

FIG. 4.—Locomotive Type Boiler (sectional views).  
 F.B., fire-box; O.S., outer shell or barrel; S.B., smoke-box; F.D., fire-door; T., tubes; B., fire-bars; D., damper; C., chimney; S.P., steam pipe; S.P., feed pipe; F.P., feed pump; I., injector; W.G., water gauge; S.B.D., smoke-box door; A.P., ashpan; F.B.R.S., fire-box roof stays; M.H., manhole; M.H.C., manhole cover; S.S.V., spring safety-valve; L.S.V., lever safety-valve; S.V., stop-valve; P.G., pressure-gauge; M.P., mud-plug; A.P.P., anti-priming pipe; E., escape pipe from lever safety-valve to chimney.

flues. In one variety, called the double-ended boiler, there are furnaces at both ends of the shell, each pair generally leading to a common combustion chamber, though in some boilers there are separate combustion chambers with a water space between. A single-ended marine boiler is prac-

the funnel, immediately above the highest row of tubes, is a superheater (not shown in the figure), consisting of 168 waved tubes, through which the steam passes on its way from the boilers to the engine, entering at the top and leaving at the bottom, and being superheated by the hot gases from

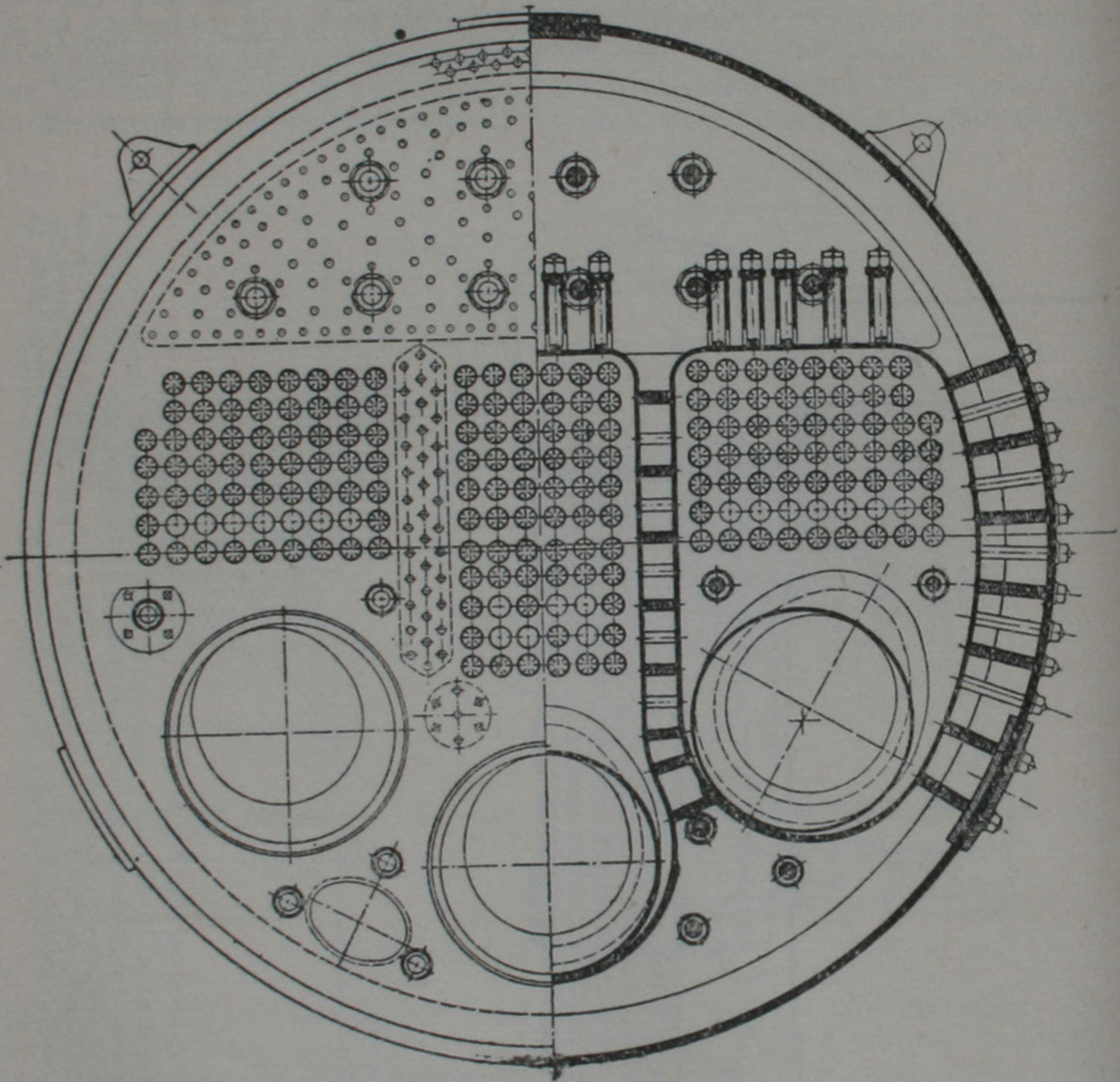


FIG. 5.—*Marine Boiler (end elevation and section).*

tically half a double-ended boiler. Figs. 5 and 6 show one of two single-ended steel return-tube marine boilers. These boilers were designed to supply steam at a pressure of 267 lbs. per sq. in., and superheated to a temperature approaching 500° F., to a set of five-cylinder quadruple expansion engines. In the uptake leading to

the boiler. When the gases leave the top of the superheater they flow up through nests of vertical pipes to a fan, by which they are aspirated and forced into the funnel. These vertical pipes heat the air which is drawn into the furnaces by the fans, the air entering through openings in the casings and flowing downwards among

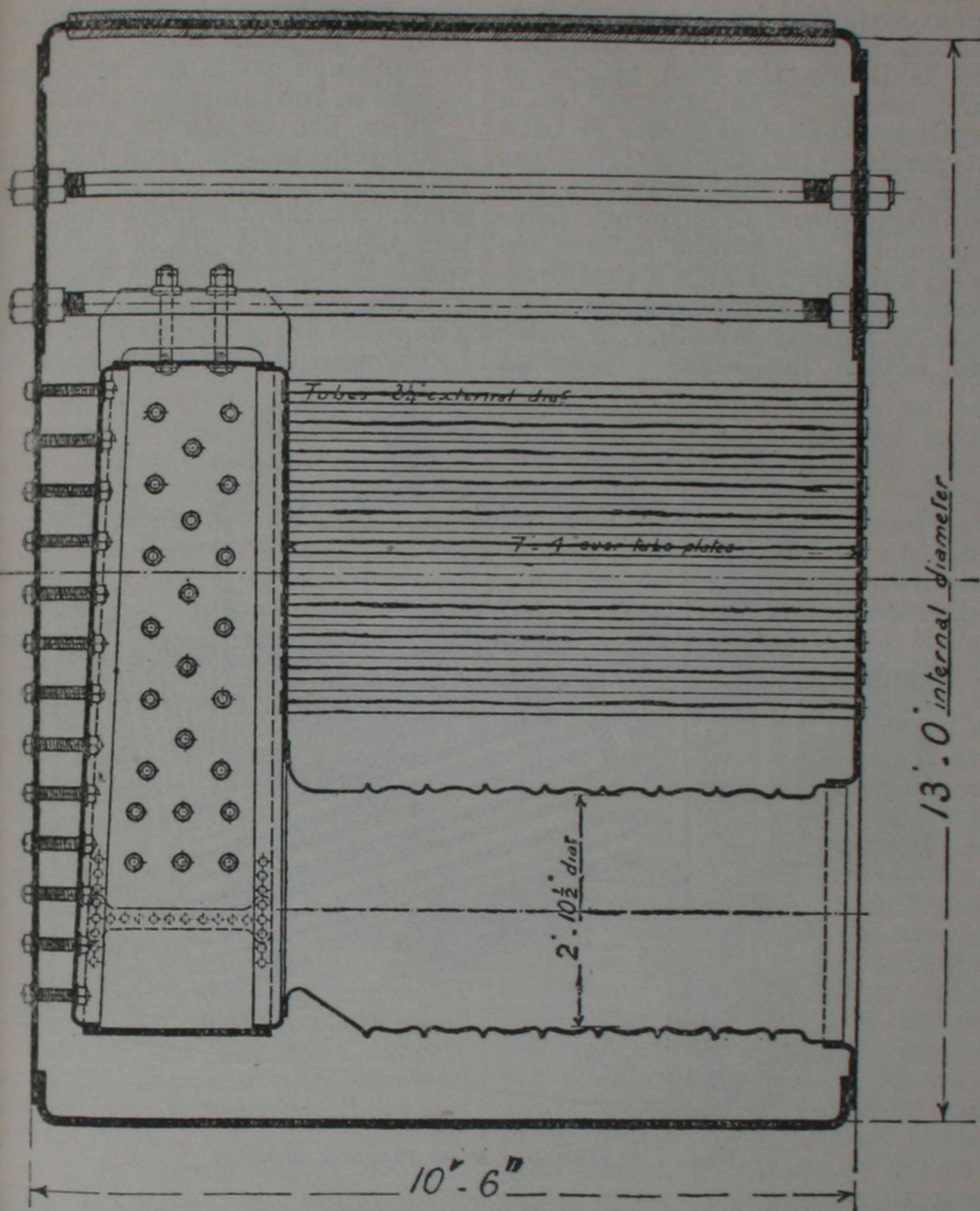


FIG. 6.—*Marine Boiler (longitudinal section).*

the pipes, and thence to the ash-pits. By the use of superheated steam there is a great saving of fuel: with the above boilers and engine on an extended trial, the consumption of Welsh coal was at the unprecedentedly small rate of '97 lb. per I.H.P. per hour.

*Water-tube Boilers.*—In boilers of this type the steam is generated from water contained in

thin tubes of small diameter, by heat applied to the outside of the tubes. Circulation in water-tube boilers is mainly produced by the difference in density of the ascending and descending currents of water. In this type of boiler a small quantity of water covers a large area of heating surface, and a rapid circulation is necessary to carry off the

heat absorbed by the generating tubes, which should be arranged to facilitate the free escape of the steam. The strength of a cylindrical-shaped boiler or tube depends on its diameter: the less the diameter the greater is the resisting power to bursting. Consequently water-tube boilers are very suitable for high steam pressures, towards which modern practice is rapidly trending in order to obtain the highest possible

very quickly, and these boilers permit the maximum power to be obtained with the minimum weight in the minimum space.

There are numerous forms of water-tube boilers used for both stationary and marine engine work. In the Babcock and Wilcox boiler (Fig. 7) a series of tubes is placed over a fire-grate and inclined at an angle of 1 in 4. The tubes are joined at their ends by wrought-steel connecting boxes

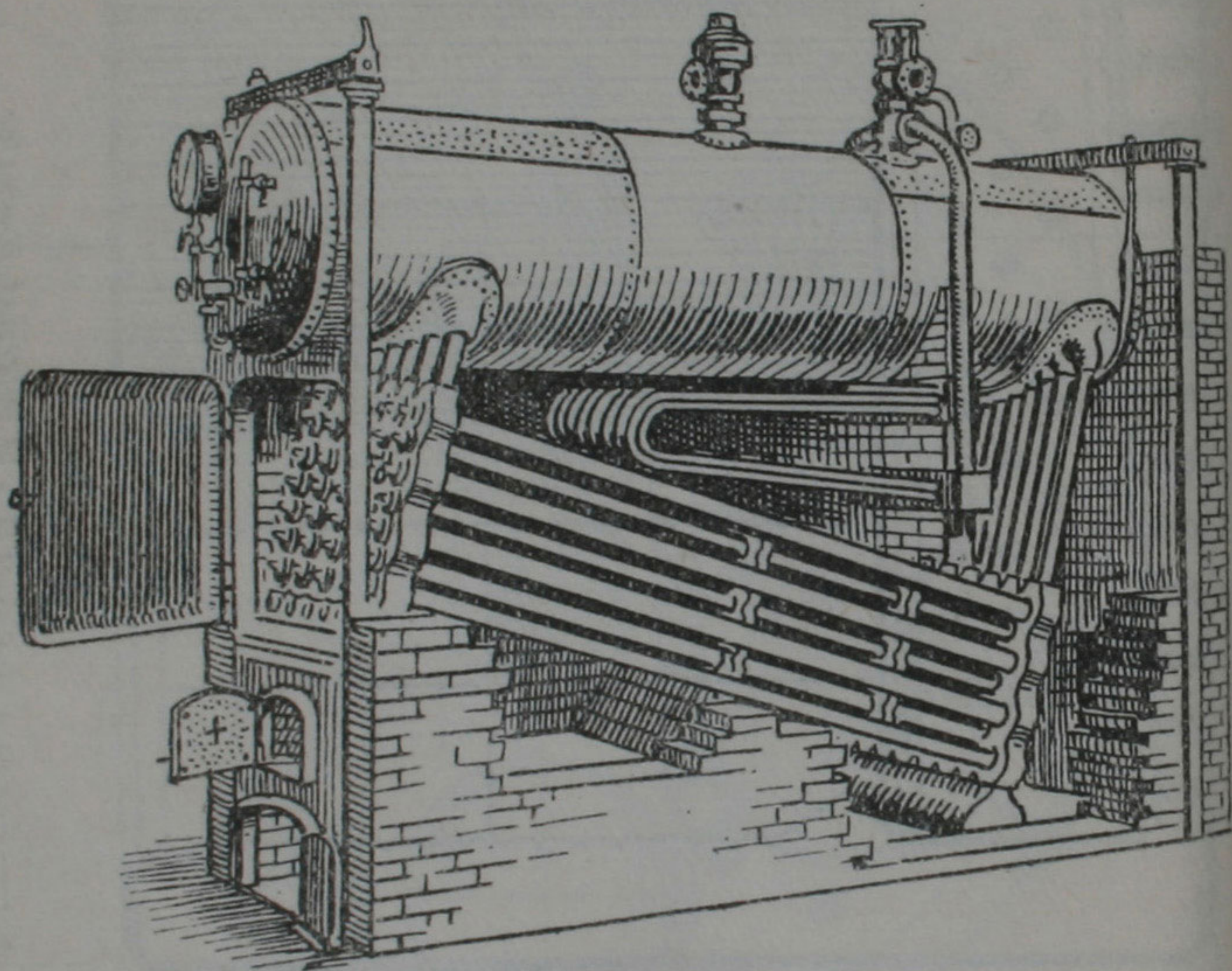


FIG. 7.—*Babcock and Wilcox Boiler.*

efficiency. They are sometimes called safety boilers. The quantity of water contained in them is very small as compared with the contents of an ordinary cylindrical boiler of the same power, and the danger of explosion is generally limited to a single tube. As a rule, water-tube boilers are easy to repair; and as the component parts are not large, they are easily transported, and can be conveyed through narrow openings of buildings. Steam can be raised

or headers to one another, and also to a horizontal drum or receiver on the top; the tubes are 'staggered,' or so placed that each horizontal row comes over the spaces in the previous row. The steam and water rise from the generating tubes through the upper headers into the receiver where the steam separates from the water, which returns down the pipes at the back into the back headers, thus completing the circulation. A continuous and rapid

circulation is thus kept up, and a nearly uniform temperature is maintained throughout the boiler. A mud-collector is fixed at the lowest point of the inclined tubes, to receive any impurities from the water. The openings for cleaning opposite the end of each tube are closed by hand-hole plates, which are held in place by wrought-steel clamps and bolts. In the illustration of this boiler a superheater is shown immediately above the inclined tubes. It consists of a number of solid drawn steel tubes bent into U-shape, and is connected at the ends with boxes—the upper one receiving the natural steam from the boiler, the lower one collecting the superheated steam after it has traversed the superheater tubes and delivering it to a valve placed above the boiler. Steam, when superheated, has a higher temperature than the water from which it was evaporated. Water cannot exist in the presence of superheated steam; it robs the steam of its extra heat, and is itself evaporated into steam. By superheating the steam the loss due to condensation, not only in the pipes, but in the engine cylinder, is greatly diminished. The Babcock and Wilcox boiler has been largely employed for land purposes, and particularly for electric light and power work.

In the marine boiler of this type, which has been adopted for the British mercantile marine and the British navy, with very satisfactory results, freedom of circulation and economy when forcing are being specially allowed for. The side sections are continued down to the level of the grate, the tubes being replaced by forged steel boxes of 6-inch square section at the furnace sides. These boxes are located one above the other on the same angle as the tubes, take the place of tubes, ensure a cool casing,

and prevent the adherence of clinkers. They are of sufficient thickness to withstand the wear and tear of the pie-tools.

In the Stirling boiler (Fig. 8) the heating surface is almost wholly supplied by water tubes with an external diameter of  $3\frac{1}{4}$  in. The main tubes connect three steam drums above with two water drums below, though the number of the drums, both at top and bottom, may vary according to the power to be developed. The sides and back and front of the boiler are composed of brickwork, in which suitable doors are provided for cleaning, etc. In addition to the main tubes there are short cross tubes, lying more or less horizontally, which connect the three steam drums with one another, and the two water drums with one another. Above the middle steam drum is a dome with an anti-priming pipe, through which the steam is taken from the boiler. There are no brickwork supports under the lower drums, which hang from the upper drums by the tubes, so that the whole boiler is free to expand without disturbing the brickwork. The feed-water is introduced below the water-level in the backmost top drum; it then finds its way down the bank of tubes to the lower water drum. The water then passes, by means of the inclined tubes, to the upper drums, or, by means of the short tubes connecting the two lower drums, to the front water drum, and next to the bank of tubes nearest the fire. By means of suitable baffles, the furnace gases are compelled to pass up and down the various banks of tubes until they reach the flue. On account of the very large combustion chamber, the walls of which are made of firebrick, and are maintained at a very high temperature, the combustion of the fuel is excep-

tionally good. The Stirling boiler has been applied in a modified form to steamships.

The Belleville boiler (Fig. 9), which has been adopted to a large extent in the British and other navies, consists of a series of sets of tubes or elements, *b*, placed side by side over the fire.

to the horizontal, and connected at the ends by junction caps, *B*. Water entering one end of an element from the lower feed collector has to traverse each of the tubes in succession before it is delivered as steam from the topmost tube. The circulation of the water in the boiler is caused

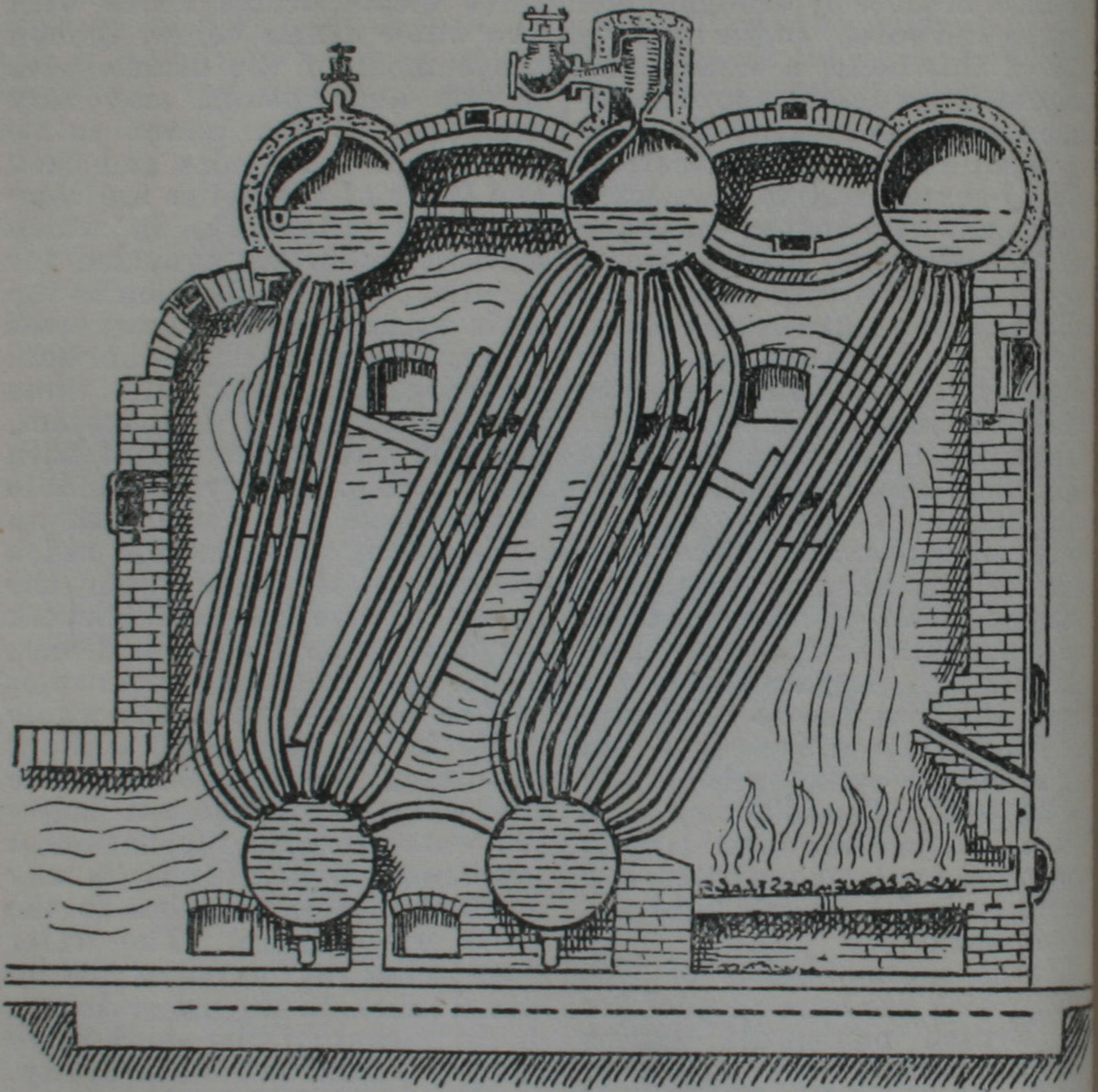


FIG. 8.—*Stirling Boiler.*

Each element is connected at the top with a common steam reservoir, *L*, and at the bottom with a common horizontal feed-distributor, which supplies the feed-water to each of the different elements. Each element is in the form of a flattened spiral, and consists of straight tubes slightly inclined

by the difference of density between the water in the downcast pipes and the mixture of steam and water in the element tubes. Above the row of elements forming the boiler proper is placed an 'economizer,' which consists of a number of elements composed of tubes, *b*<sub>1</sub>, smaller than those of the

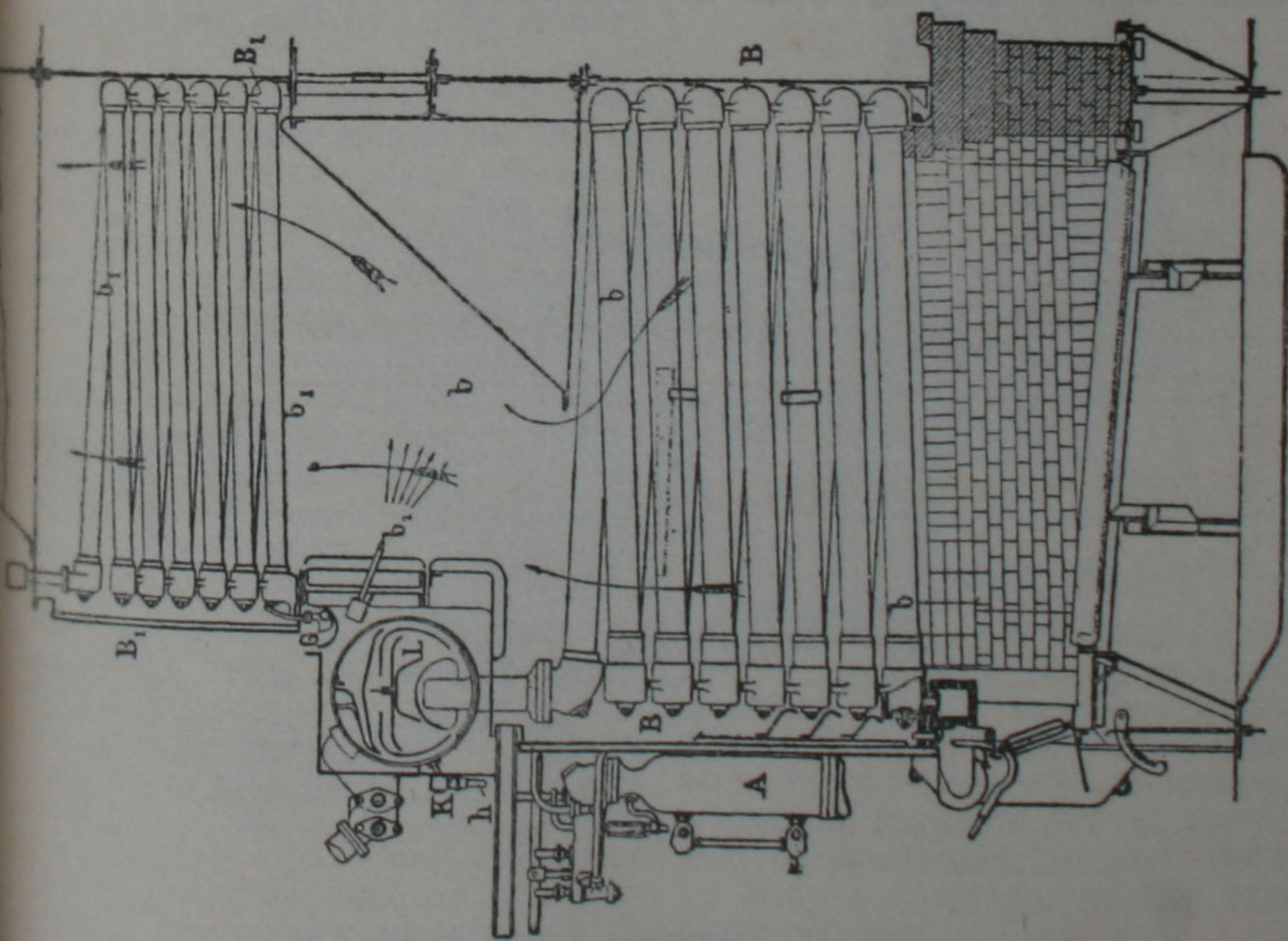


FIG. 9.—Belleville Boiler.

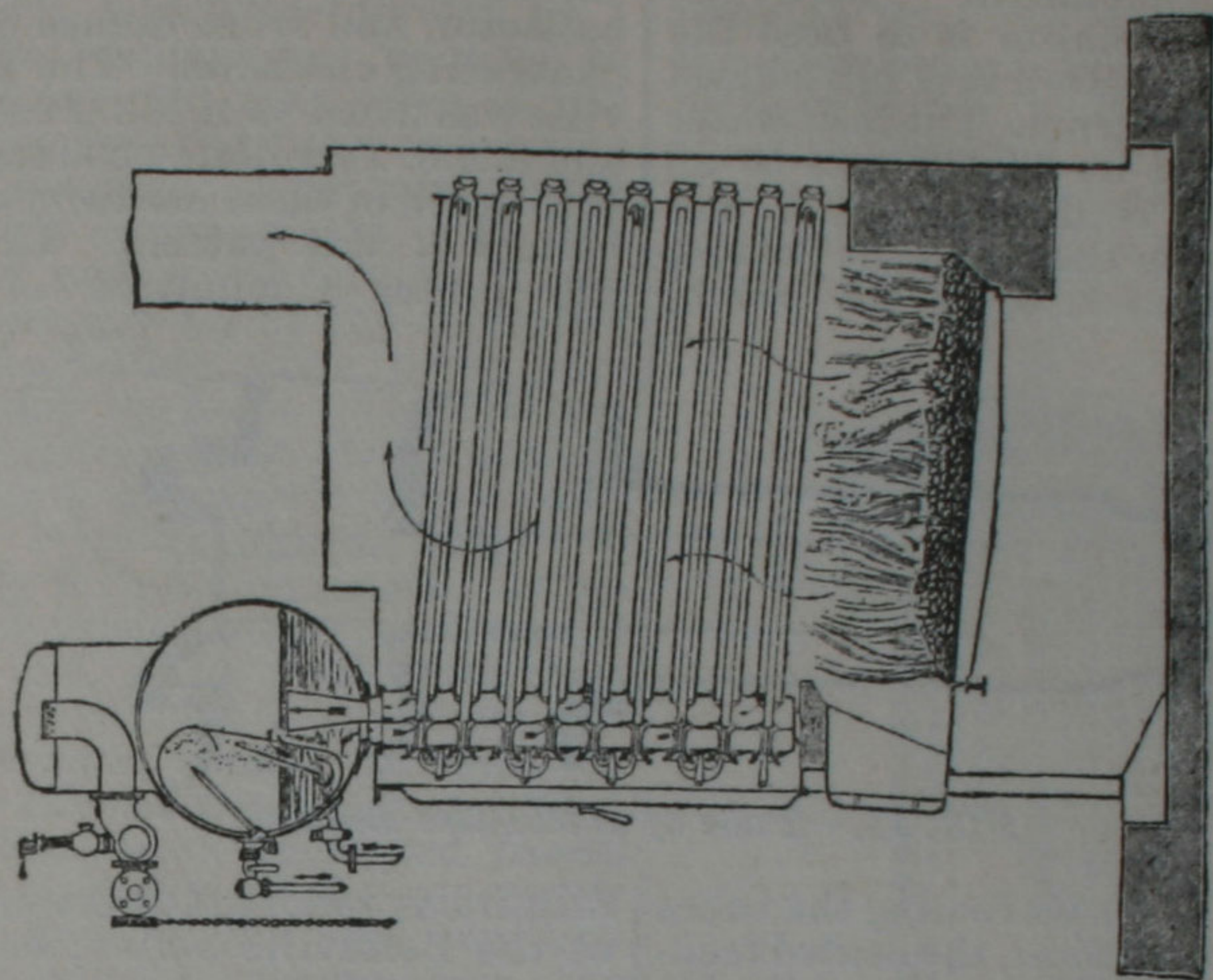


FIG. 10.—Niclausse Boiler.

generator elements. The object of the economizer is to heat the feed-water before it is introduced into the top drum. The feed-water is supplied by feed-pumps to an automatic feed-regulator, A, and passes from thence to the bottom feed-collector, G, of the econo-

the bottom to the bottom feed-collector, and from thence to the generating elements. The Belleville was fitted to H.M.S. *Powerful* and H.M.S. *Terrible* (14,200 tons) in 1895; each of these has forty-eight boilers of this pattern. In 1901 the Boiler Committee of the

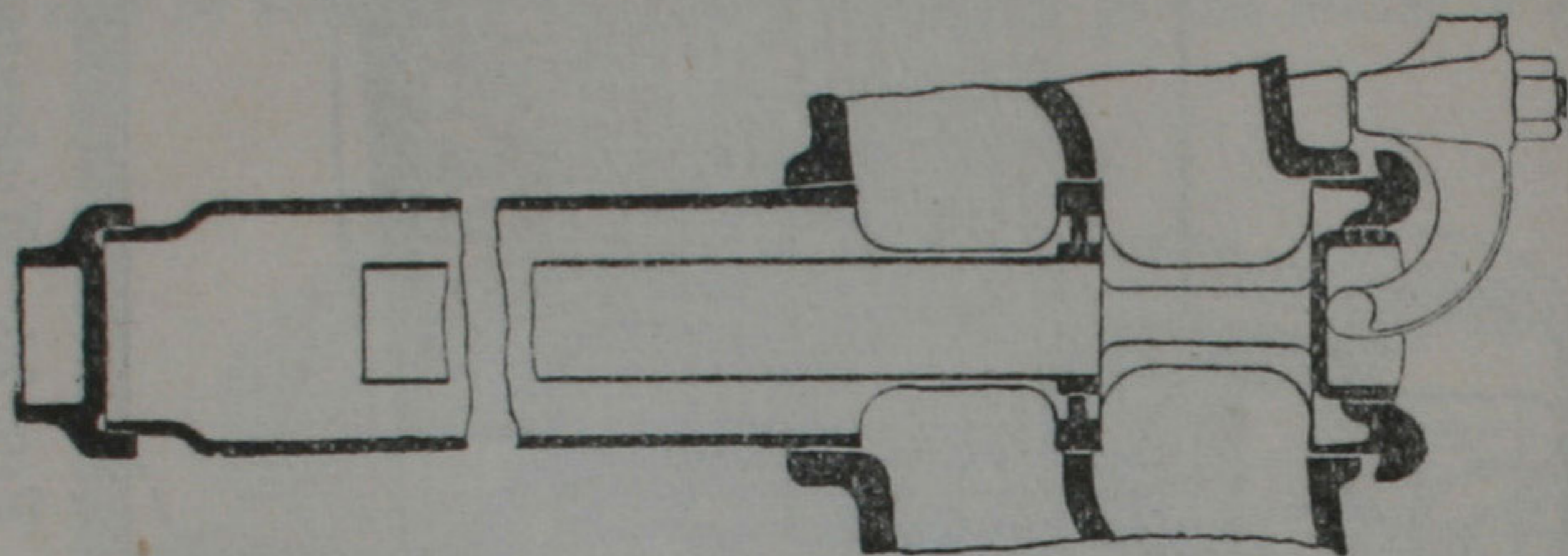


FIG. 11.—*Tube of Niclausse Boiler.*

mizer. After traversing the tubes of the economizer, the heated feed-water passes into another collector communicating with the top of the economizer elements, and is then led into the steam drum L. From the steam drum the feed-water passes down an external down-comer with a settling drum at

Admiralty reported unfavourably of the Belleville boiler; but the question of the best type of marine tubular boiler can hardly be regarded as being definitively settled.

The Niclausse boiler (Fig. 10) consists of a number of compound tubes slightly inclined, and con-

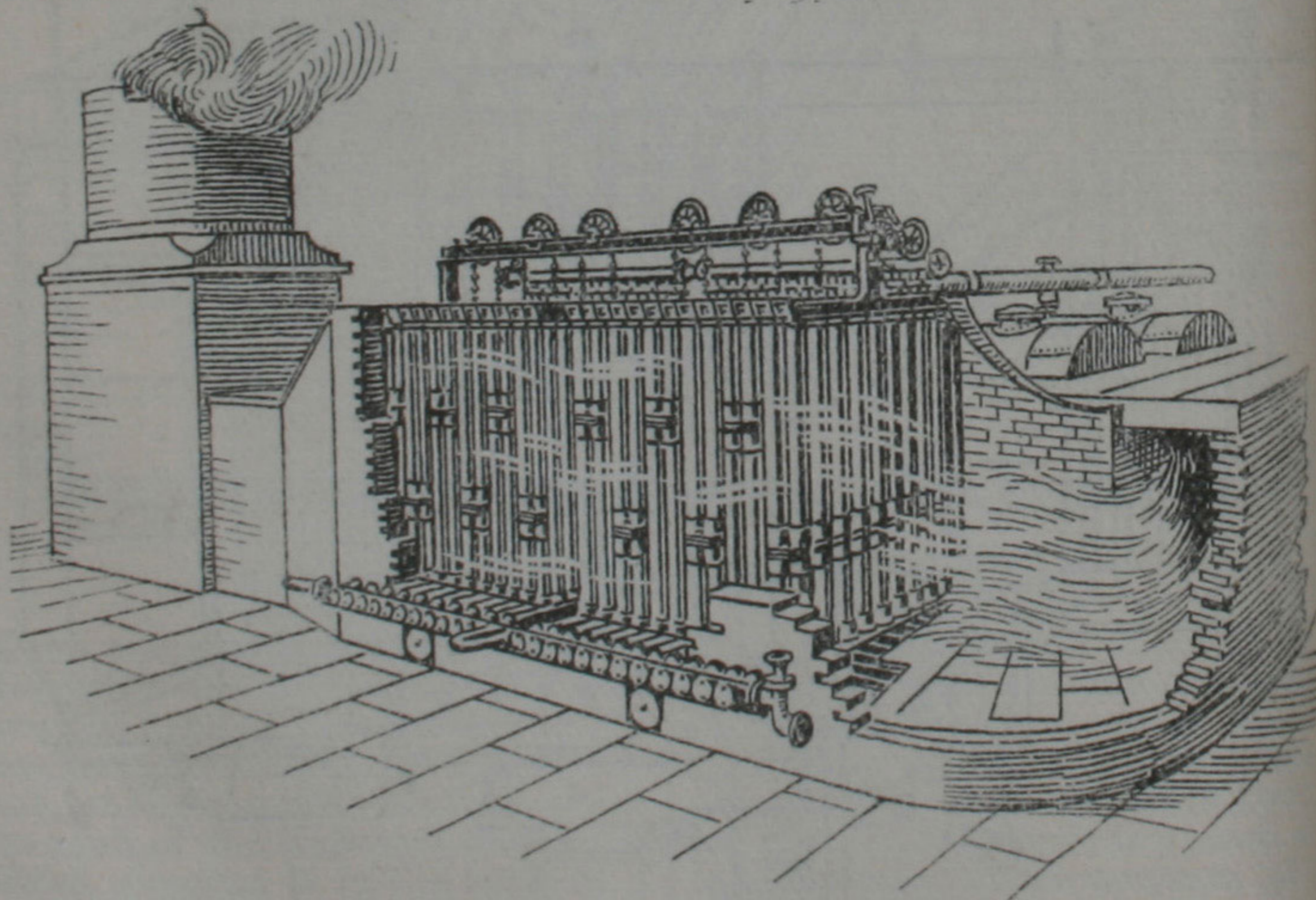


FIG. 12.—*Green's Economizer.*



nected at the ends to vertical headers, which are divided by a vertical diaphragm, parallel to the front and rear faces of the header, into a front and a rear compartment. The tops of the headers communicate with the steam and water drum. These headers are all at the front end of the boiler, none being provided at the back. The inclined heating tubes (Fig. 11) are double, having a concentric inner water tube running down them for nearly their whole length, the external tubes being closed at the rear end. The feed-water goes down the front compartment of the header, passes through the inner tube of the compound tube, and the steam generated passes on the outside of the concentric tube, and up the rear compartment of the header into the steam drum. The circulation of the water and steam is shown by the arrows in Fig. 10.

(The illustrations of Belleville and Niclausse boilers have been taken by permission from *Water-tube Boilers*, 1901, by Leslie Robertson.)

*Feed-water Heaters.*—One of the most important means for the increase of boiler-plant efficiency consists in heating the feed-water as much as possible before its entry into the boiler. This is best done by utilizing some of the heat of the products of combustion which would otherwise escape up the chimney. One of the best known forms of apparatus for this purpose is Green's economizer (Fig. 12), which consists of a number of vertical cast-iron pipes about 4 in. diameter and 9 ft. long, connected at the top and bottom by longitudinal headers, termed boxes. These boxes are connected by top and bottom branch pipes, placed lengthways on opposite sides of the economizer, and on the outside of the brickwork with which

it is encased. The feed-water is pumped into the economizer at the lower branch-pipe nearest the point of exit of the flue gases, and emerges from the upper branch-pipe nearest the point where the flue gases enter. The economizer is situated in a by-pass in the

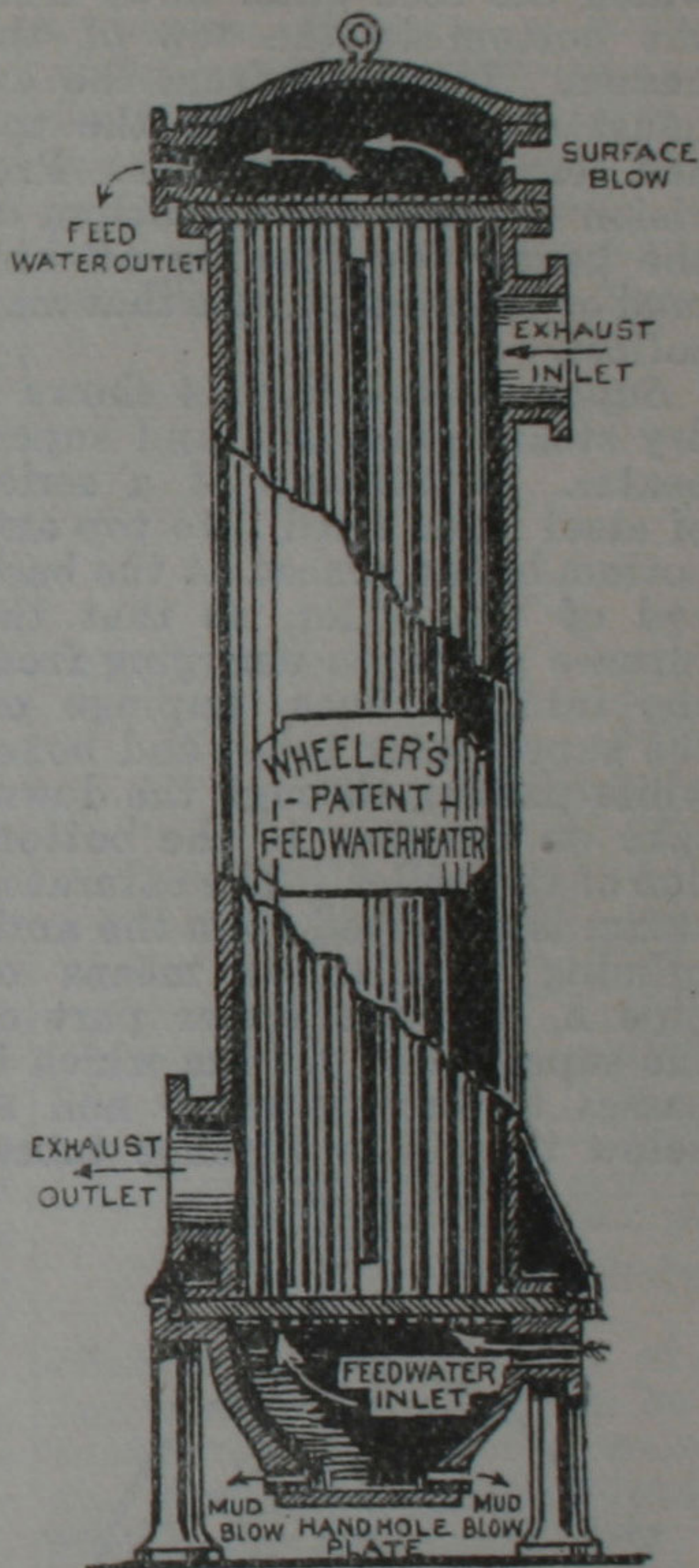
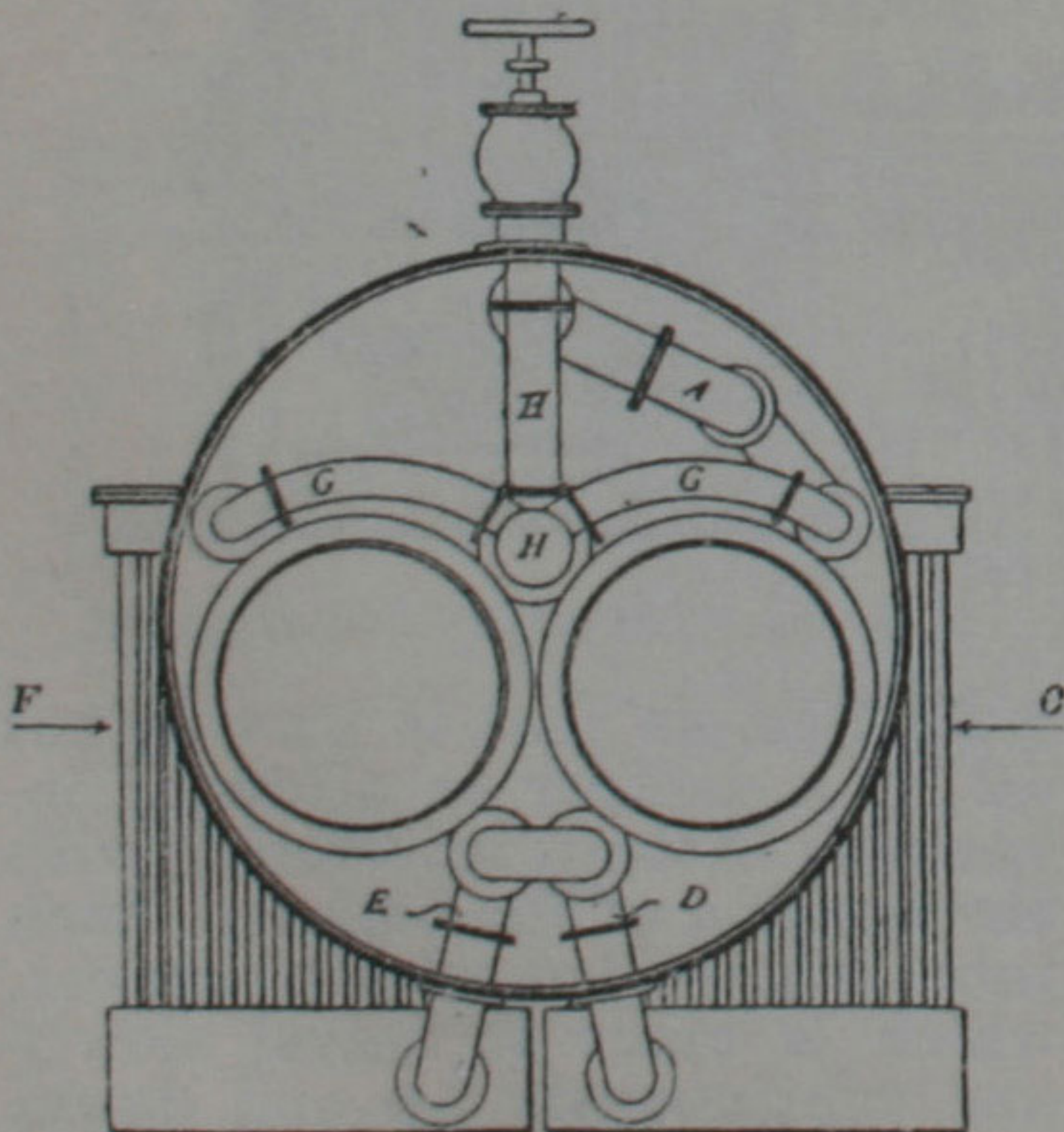


FIG. 13.—*Feed-water Heater.*

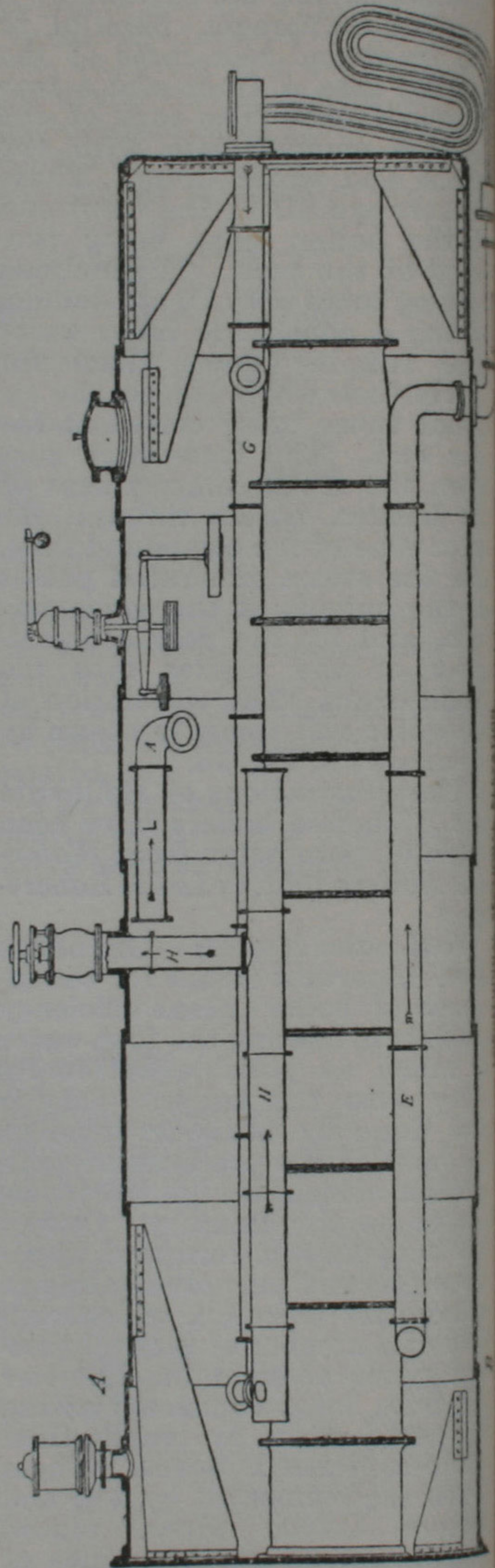
main flue, so that it may be cut off by a damper to allow of inspection without interfering with the working of the boilers. Each tube is provided with a scraper, which is made to travel slowly and continuously up and down, to keep the surface of the tube clear of soot.

There are many forms of feed-water heaters in which the feed-water is heated by means of the exhaust steam from an engine. Wheeler's feed-water heater (Fig. 13), which may be taken as an example, consists of a large number of brass tubes through which the feed-water flows from the bottom to the top of the heater. The heat from the exhaust steam enters at the top and leaves at the bottom. Provision is made at the bottom of the heater for drawing off any mud or other impurities that may collect.

*Superheaters.*—Fig. 14 shows a dry steam generator and superheater. It consists of a series of steel tubes fixed into top and bottom boxes, placed at the back end of the boiler, so that the furnace gases, on emerging from the internal flues, impinge on the superheater tubes and boxes while passing through the down-take on the way to the bottom flue of the boiler. The saturated steam is conveyed from the anti-priming pipe L, by means of pipe A, into the upper part of the superheater C, from which it passes through pipes D and E, below the boiler furnace tubes,



SECTIONAL ELEVATION AT A B



to the lower part of the superheater F, whence it is conducted by the pipes G and H through the steam space to the stop-valve. In this way the superheated steam gives up some of its surcharged heat to the water and steam in the boiler, thus increasing its evaporative capacity, and finally leaving the boiler with a certain amount of superheat. When highly-superheated steam is required, a direct-fired superheater is generally used, consisting of a battery of tubes heated by a special furnace. As a rule, steam with a considerable amount of superheat requires engines of special design.

*Mechanical Stokers.*—Many appliances have been devised for the mechanical supply of coal to boiler furnaces, and there is no doubt that better results are obtained by the use of mechanical stokers, provided there is a steady load on the engines, and therefore on the boilers. There are two kinds of mechanical stokers, termed 'coking' and 'sprinkling.' A coking stoker pushes the coal on to a moving fire-grate, at the front of which a fire is formed from 8 to 12 in. thick, which burns gradually thinner as it moves to the end of the fire-bars. A sprinkling stoker spreads the coal in thin layers evenly over the surface of a fire from 3 to 4 in. thick.

An interesting form of coking stoker is shown in Fig. 15, as applied to a Lancashire boiler (part of the view is in section). A coal-hopper, H, communicates with a conveyor pipe or trough, T, placed longitudinally under the fire-grate F, which is highest at the centre. The coal, as it is fed into the trough from the hopper, is forced to rise evenly and continuously throughout the length of the furnace by means of a tapered conveyor screw or worm, which is driven independently by

a small steam motor contained in a casing, A. The upper edge of the fuel magazine is surrounded by tuyère sectional blocks, which are provided with openings for the discharge of air both inwardly and outwardly. The air is supplied at a low pressure (from  $\frac{1}{2}$  to  $1\frac{1}{2}$  in. of water) by means of a blower, through a pipe, P, which communicates with an air-chamber, E. The tuyères are angular in section, and act as fire-bars; they practically overlap each other, and prevent any ash from falling into the air-

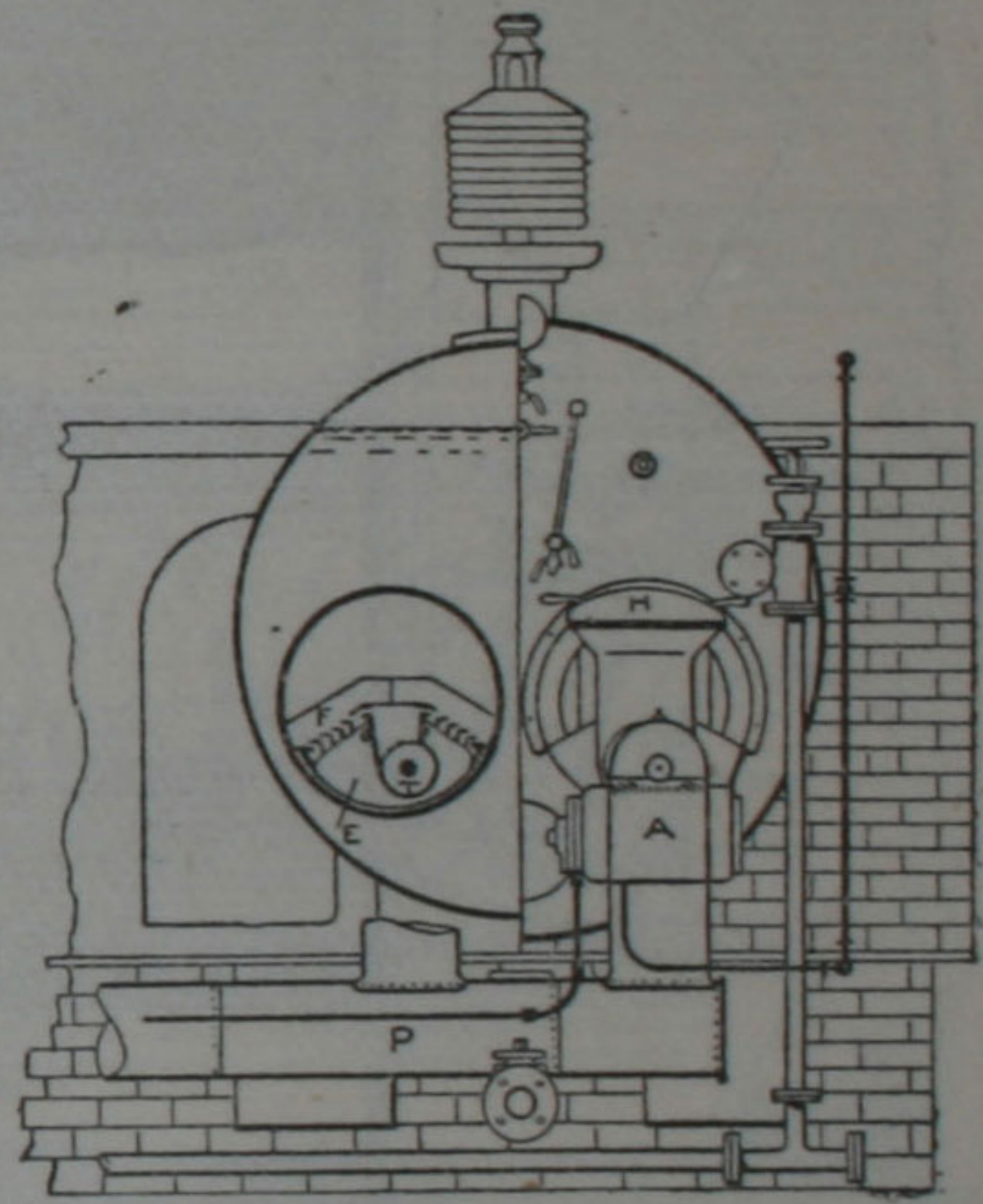


FIG. 15.—*Mechanical Stoker.*

chamber. The quantity of fuel fed into the furnace can be regulated by varying the speed of the steam motor; the supply of air is also under control. The coal, as it rises in the magazine, becomes heated, and the more volatile products are driven off; these become mixed with air, and are completely consumed by the incandescent fuel on the upper part of the grate, the coal becoming gradually converted into coke as it reaches the fire-level. The under-feed stokers can be applied to any type of boiler.

Procter's mechanical stoker (Fig. 16) is of the sprinkling type. Coal from a hopper, 1, falls into a box, 2, from which a charge is forced from time to time by a ram, 5, and deposited in front of a radially-acting shovel, 4. The shovel is fixed to a shaft controlled by a tension spring, which exerts sufficient force to propel the fuel on to

justable throw crank, slotted lever, C, and rocking shaft, B. The bars are protected from being burned at the back by a bearer, F, through which steam is allowed to circulate.

*Forced Draught.*—The Meldrum furnace (Fig. 17) is specially designed for consuming cheap, low-class fuel, such as coal dust, coke dust, etc., which can only be

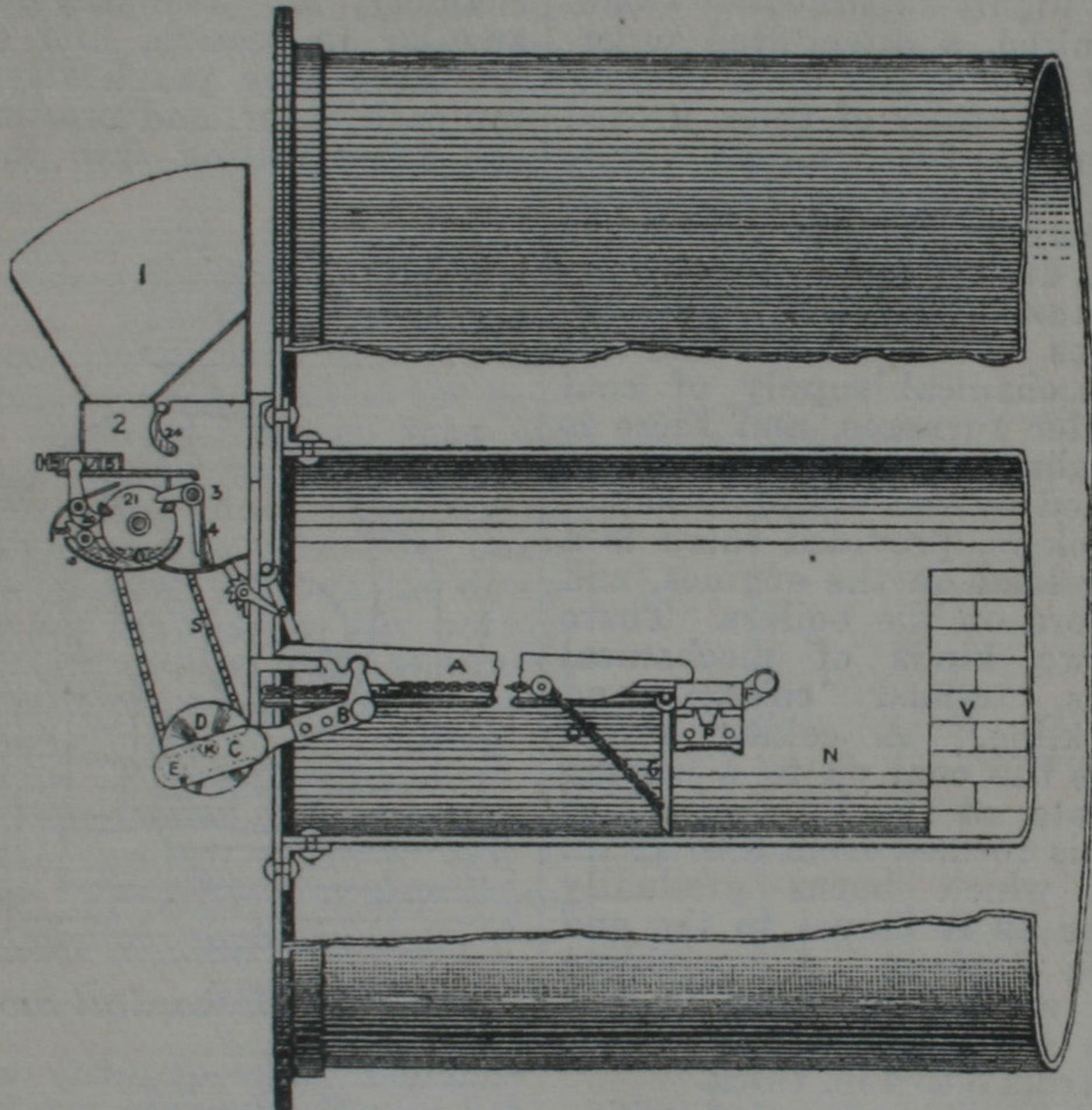


FIG. 16.—Procter's Mechanical Stoker.

the grate, when a projecting piece at the back of the shovel is released from contact with a tappet on the face of a wheel, 21. The above tappet wheel, which receives its motion through gearing from a countershaft, actuates the ram as well as draws back the shovel against the action of the spring. The bars are made to move backward and forward alternately by means of an ad-

burned with good results when the fire-bars are close together and the air is supplied at considerable pressure, much beyond the power of ordinary chimney draught. The system of forced draught as used in this furnace is the one generally adopted for land boilers of all types. Two steam-jet blowers, J, are fixed on the front of a closed ashpit, and project under the fire-grate of

the furnace. The blowers are tubes, which extend to about one-third the length of the fire-grate, with enlarged trumpet-shaped inner ends, and are provided at the outer ends with steam nozzles or injectors. The steam for actuating the blowers is first superheated by being passed through a superheater, S, shown partly in section. The whole air-supply is under control, so

of a flap-valve, and can be raised slightly by moving a lever, L; a thin stream of air is thus allowed to pass immediately over the fuel, supplying the necessary air to complete the combustion of the distilled gases: when distillation ceases the valve is closed. The above arrangement is introduced for the purpose of preventing the formation of dense black smoke, to which some fuels

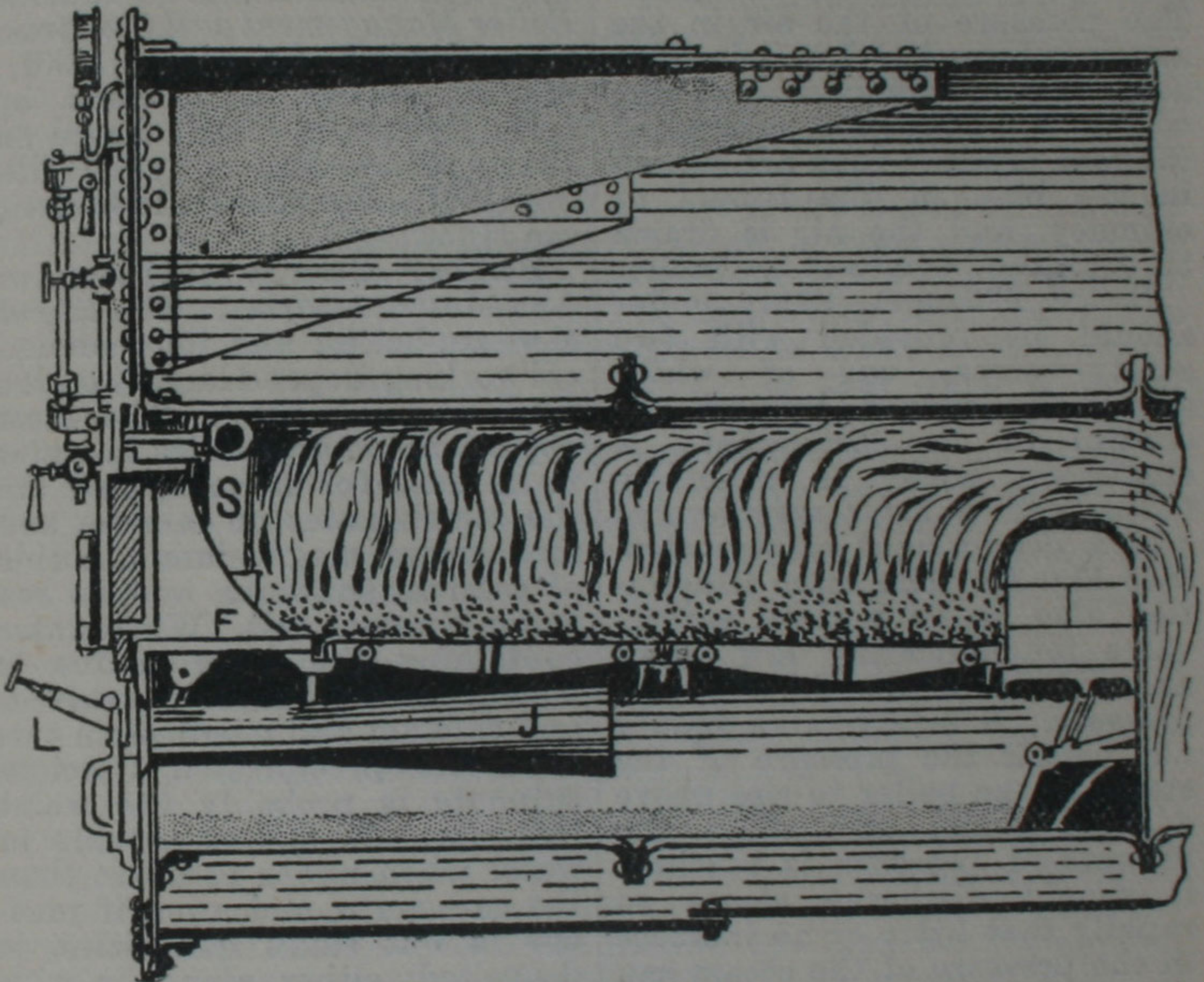


FIG. 17.—*Meldrum Furnace.*

that the fire may be forced or slackened at will. The fire-bars are made interlocking to prevent displacement, and are spaced about one-sixteenth of an inch apart, so as to prevent anything but the finest dust from falling through. The action of the steam and air on the bars prevents clinker adhering, and thus prolongs their life. The front part of the dead plate F is in the form

are liable. Numerous tests have shown that the evaporative power of boilers fitted with forced draught on the Meldrum system has been increased fifty per cent. as compared with the results obtained in an ordinary furnace when using the same fuel, and without any loss of efficiency. Mechanical stokers are now adapted to Meldrum's furnaces with very satisfactory results.

Forced draught on Howden's principle is applied to most of the boilers in the British navy, and to many boilers in the mercantile marine service. In Howden's system the air to the furnace is heated by being passed through a series of tubes placed in the path of the escaping products of combustion; the ashpit is closed, and the hot air is supplied to the fire both above and below the fire-grate. The pressure of the air in the ashpit is from  $\frac{3}{4}$  to 1 in. of water, according to the nature of the coal used. In certain systems of *induced* draught fans are placed in the base of the funnel or chimney, and the air is drawn through the furnace of the boiler.

*Boiler Fittings.*—Every boiler should be provided with two safety-valves, one of which should be placed beyond the control of the attendant. A stationary boiler is generally fitted with a lever safety-valve and a dead-weight safety-valve. (See Fig. 1.) The same illustration also shows a third safety-valve for indicating low water as well as a too high steam pressure. A safety-valve should not permit the pressure of the steam in the boiler to rise above a fixed limit; and when the blowing-off pressure is reached, it should discharge steam so rapidly that little or no increase in the pressure of the steam can take place however rapidly the steam may be generated. For locomotives and marine boilers spring-loaded safety-valves are used.

A reliable gauge to indicate the steam pressure is also a necessary adjunct to a boiler; it should be removed from the boiler at regular intervals and tested, for gauges are liable to get out of order when in constant use. A boiler should have two water gauges, one being a check on the other, and a convenience in case of accident to

one gauge. The bottom portion of the gauge should be fixed so that when the water is in sight in the glass there should be sufficient water above the furnace crown, generally from 4 to 6 in.

Most boilers are provided with an injector for feeding them with water, and many have a feed-pump in addition. See *Water-tube Boilers*, by Leslie S. Robertson (1901); *Steam-Boiler Construction*, by W. S. Hutton (1891); *Marine Boiler Management and Construction*, by C. E. Stromeyer (1901); *Marine Boilers*, Eng. trans. by L. S. Robertson (1905), based on Bertin; *Steam-Boilers*, by G. Halliday (1897). For household boilers, see HEATING.

**Boiler Compositions, or ANTI-INCRUSTATORS.** The life of a steam-boiler, and its economical working, depend largely on the kind of water used. The most objectionable impurities in water to be used for steam-raising are the bicarbonates of calcium and magnesium, magnesium chloride of calcium sulphate, and, in sea water, common salt. When water containing the bicarbonates is boiled, carbon dioxide is evolved, and calcium and magnesium carbonates are precipitated. Calcium sulphate is probably the worst impurity. It is less soluble in water when under pressure than the carbonate, and, even if present in but small quantities, is deposited, either alone or with the carbonates, as a very hard, coherent scale. Magnesium chloride is decomposed on boiling, with deposition of magnesium hydroxide and liberation of free hydrochloric acid. If carbonates are present, the acid will combine with them, but forms chlorides; if not, it will corrode the steam-pipes and the boiler plates above the water-line. In low-pressure boilers salt water is sometimes used, but as it becomes concentrated the salt is deposited. The

degree of saturation is tested by the specific gravity. With high-pressure and tubular boilers, however, salt water cannot be used, and a distilling apparatus or evaporator is necessary. Peaty waters contain organic acids which destroy the boiler plates, usually at the water-line. The addition of a small quantity of chalk, or the mixture with a proportion of hard water, obviates this difficulty.

A large number of patented anti-incrustation compounds are advertised, the basis of the majority being some form of alkali; but they should never be used unless their composition is known, as also that of the water. The bicarbonates are readily removed by heating the feed-water, whereby the carbonates are deposited in the heater; or the water may be softened by the addition of lime (Clarke's process). Caustic soda is often introduced into boilers; it combines with the carbonic acid of the bicarbonates, giving sodium carbonate, and precipitates the calcium and magnesium carbonates. The sodium carbonate then reacts on the calcium sulphate, forming sulphate of soda and carbonate of lime. If carbonates are not present in the water, washing soda may be used. These substances are, as a rule, very effective if used judiciously; but if added in excess, they cause the boiler to prime. Their presence prevents corrosion of the plates, and produces a deposit which has little tendency to adhere. Sal ammoniac is sometimes used with success, but its cost is almost prohibitive. One of the most successful of anti-incrustators is tri-basic phosphate of soda, sold under the name of 'tripsa.' It precipitates the calcium and magnesium salts in the water as a slimy mud which does not stick to the plates. It is best introduced in small quantities by

an injector with the feed-water; and the sludge is blown off by the mud-cock once a week. Besides the above saline anti-incrustators, organic substances, such as fats and oils, tannin, paraffin oil, etc., are also used; but with the exception of the last-named substance, which seems to act mechanically, such bodies should be regarded with suspicion.

**Boiler Explosions Acts, 1882 and 1890.** Under these Acts (which do not apply to a boiler used exclusively for domestic purposes or in the government service) notice of a boiler explosion must be sent to the Board of Trade by the owner or user within twenty-four hours, giving full particulars. The Board may then appoint an engineer to make a preliminary inquiry, or may order a formal investigation by two or more commissioners—one an engineer and one a lawyer—as to the cause of the explosion. The commissioners have the powers of a court of summary jurisdiction, and other special powers. Explosions in ships and mines are usually investigated under the Merchant Shipping and Mines Regulations Acts.

**Boiling and BOILING-POINT.** The act of boiling consists in the brisk transformation of a liquid into its vapour form. During the process the heat that is applied to effect the transformation is wholly used up in effecting the change, and the temperature of the liquid remains steady at what is called the boiling-point. Experiment shows that a liquid of definite constitution has the same boiling-point when the pressure is the same, but that with changing pressure the boiling-point changes. Thus, water which boils at 212° F. or 100° C. at normal atmospheric pressure, boils at 40° C. (104° F.) when the pressure is .027 atmosphere, and at 160° C. (320° F.) when the pressure is 6.12

atmospheres. It is possible to reduce the pressure so low as to bring the boiling-point of water almost to the same value as its freezing-point. This is the principle of Leslie's famous experiment, in which water is made to freeze by rapid evaporation in an exhausted receiver. An important practical application of the relation of boiling-point and pressure is the hypsometric thermometer, which enables a traveller with fair accuracy to determine his altitude. By observing the temperature at which water boils he knows at once the pressure of the atmosphere at the station, and from it can estimate the height at which the observation is made to a degree of accuracy determined by a knowledge of the value of the pressure at the sea-level. The relation between pressure and boiling-point in the case of a pure liquid substance is a particular case of the more general proposition, that the maximum pressure of vapour in presence of its liquid is determined by the temperature of the liquid surface. When this pressure of vapour equals the pressure of the atmosphere the liquid boils.

When a liquid contains other substances in solution the boiling-point is generally raised. Thus, it is necessary to raise brine to a higher temperature than 100° C. before it boils; but the steam given off has nevertheless the temperature corresponding to the boiling-point of the pure liquid. When anhydrous calcium chloride is mixed with sufficient water at ordinary temperatures, a chemical solution is formed with considerable evolution of heat, and the solution on cooling crystallizes out. This substance when heated melts, and has a boiling-point which is regulated by the concentration of the solution. During heating, evaporation takes place; so that if more water is not added,

the boiling-point of a particular solution rises appreciably after repeated heatings. It is possible to reach a temperature of 180° by means of a strong solution of calcium chloride.

**Boiling.** See COOKERY.

**Bois-Brûlés**, a race of people in N. America, the descendants of Canadian Frenchmen and Indian women; also known as half-breeds, and numbering about 35,000.

**Bois Colombes**, comm., Seine dep., France, to the N.W. of Paris. Pop. 15,000.

**Bois de Boulogne**, public park, France (2,158 ac.), ceded by Napoleon III. in 1853 to Paris.

**Boise**, city, Idaho, U.S.A., the co. seat of Ada co. and cap. of the state; situated on the Boise R., 50 m. above its junction with the Snake R., at an alt. of 2,880 ft. The principal industry is mining. Pop. 6,000.

**Boisgobey**, FORTUNÉ DU (1824-91), French novelist of the school of Gaboriau, born at Granville in Normandy. For some time paymaster in the Algerian army, he devoted himself from 1868 to the writing of sensational detective novels. As feuilletons for newspapers, several obtained an extraordinary success, especially *L'Homme sans Nom* (1872), *Les Mystères de Nouveau Paris* (1876), and *Le Crime de l'Opéra* (1880).

**Bois-le-Duc**, tn., Netherlands. See HERTOGENBOSCH, 's.

**Boisserée**, SULPICE (1783-1854), German writer on art, born at Cologne; became professor of archæology at Bonn in 1838. With his brother Melchior (1786-1851) he formed (1803-19) at Stuttgart a collection of over two hundred old German pictures, now in the Pinakothek at Munich. His chief works are *Geschichte des Doms von Köln* (1823-32), and *Die Denkmale der Baukunst vom 7 bis 13 Jahrhundert am Niederrhein* (1831-3). See his *Selbstbiographie* (1862), edited by his widow.



**Boissier**, MARIE LOUIS GASTON (1823-1908), French writer, born at Nîmes; professor of rhetoric at Angoulême (1846-56); became professor of Latin elocution in the Collège de France in 1861, and perpetual secretary of the French Academy in 1895. His works include *Etude sur Terentius Varron* (1861), *Cicéron et ses Amis* (1865; 12th ed. 1902), *L'Opposition sous les Césars* (1875; 4th ed. 1900), *La Religion Romaine d'Auguste aux Antonins* (1874; 5th ed. 1901), *L'Afrique Romaine* (1895); and biographies of Madame de Sévigné (1885; 5th ed. 1901) and of Saint-Simon (1892).

**Boissonade**, JEAN FRANÇOIS (1774-1857), French classicist, born at Paris; became professor of Greek at Paris (1812), and in the Collège de France (1828). His chief works were *Anecdota Græca* (1829-33), *Anecdota Nova* (1844), and editions of the less known classical writers. His papers were published (2 vols. 1863), with biography, by Naudet.

**Boissy d'Anglas**, FRANÇOIS ANTOINE, COMTE DE (1756-1826), French statesman, born at St. Jean le Chambre, in Ardèche. He was elected a deputy of the States-general, became a member of the Convention, opposed the execution of the king, and helped to overthrow Robespierre in 1794. He became secretary to the National Convention in the same year, and was afterwards a member of the Committee of Public Safety, and president of the Council of Five Hundred. He was created a senator (1805) by Napoleon, and a noble by Louis XVIII. He wrote *Recherches sur la Vie.....de Malesherbes* (1819-21), and *Etudes Littéraires et Poétiques d'un Vieillard* (1826).

**Boito**, ARRIGO (1842), Italian composer and poet, was born at Padua. After receiving a musical education at Milan, Boito, with a fellow-pupil, Faccio, composed a

cantata, *Le Sorelle d'Italia* (1862), which achieved enormous success. After a period spent in travel, Boito in 1868 produced the opera *Mefistofele*, which, though first received with coldness, has since established itself as a favourite in Italy and elsewhere. Boito writes his own librettos, and has done the same for other composers (*Gioconda* for Ponchielli, *Otello* and *Falstaff* for Verdi, etc.). As a poet he uses the *nom de plume* of Tobia Gorrio, and has written a *Libro dei Versi* remarkable for its realism. He is also the author of an epic (*Re Orso*, 1877) and of some weird tales, and is highly esteemed as a musical critic. Two later operas of Boito, *Ero e Leandro* and *Nerone*, have not been produced.

**Bojador**, CAPE, on the W. coast of Africa, in 26° 7' N. lat.

**Bojan**, tn., Bukowina, Austria, 8 m. E. of Czernowitz. Pop. 6,700.

**Bojano**, tn. and episc. see, Italy, in prov. of and 11 m. S.W. of Campobasso. Pop. 6,500.

**Boke**, a fortified station of W. Africa, in French Guinea, on the Nunez R., about 50 m. from its mouth, and at the head of navigation (on a high tide).

**Bokelmann**, CHRISTIAN LUDWIG (1844-94), German painter; born at St. Jürgen, near Bremen; began to paint after spending ten years in business. His canvases display realistic conception, a fine eye for character, and telling arrangement. In 1893 he was appointed professor at the Academy, Berlin. Among his best known works are *In the Pawnshop* (1875), in the National Gallery at Stuttgart; *An Itinerant Stall before Christmas* (1878); *The Emigrants* (1882), in the Museum at Dresden; *The Gaming Tables at Monte Carlo* (1884); *The Opening of the Will* (1879), in the National Gallery at Berlin; and *The Arrest* (1881), in the Museum at Hanover.

**Bokhara, or BUKHARA. (1.)** The khanate of, a vassal state of Russia in Central Asia, with an area of about 83,000 sq. m., and a population estimated at about 1,250,000, mostly congregated in the oases (Bokhara, Shaar, Karshi, Khuzar, and along the Oxus). Uzbeks are most numerous, and to them the reigning house belongs; next come the Tajiks and Galchas, Persians, Hindus, Afghans, Kirghiz, Turcomans, etc., with a small but increasing colony of Russians along the line of the Transcaspian Railway. The khanate is bordered on the N. by the Russian provinces of Amu Daria, Samarkand, Fergana; on the E. by Russian Pamir; on the S. by Afghanistan; and on the W. by the Russian Transcaspian province and the vassal khanate of Khiva. Ten per cent. of the area is cultivable, the plain of Zerafshan is very rich, and in the mountainous E. there are signs of valuable mineral deposits. Hissar, in the centre, and Karategin and Darvaz, in the E., are the chief subdivisions. Camels, horses, and sheep form the principal wealth of the state; corn, tobacco, fruit, and cotton are extensively raised. The import of tea, indigo, muslins, etc., from India is considerable, but excessive import duties greatly restrict trade. The Oxus, which runs along the whole S. border, and the Transcaspian Railway, which crosses from S.W. to N.E., are the chief means of communication; the rest of the country is served by caravan routes. The only towns worth mentioning besides Bokhara are Karshi, Kermineh, Charjui, Hissar, Shahr-i-Zabz, and Khuzar. The Uzbeks, from the steppe between the Ural and the Volga, ruled Bokhara and Samarkand after 1505, when Baber, the last Samarkand Timurid, was expelled. In 1868 Bokhara fell under Russian

domination, and by the treaty of 1873 Russia now represents Bokhara in all foreign relations. Prior to the Russian conquest the khanate was more than twice its present size, and, both politically and religiously, was regarded as the leading native state of Central Asia. It was the scene of a destructive earthquake in Jan. 1911. See CENTRAL ASIA (RUSSIAN). (2.) Capital of the above, lies in the lower valley of the Zerafshan, in the midst of trees, gardens, and orchards. It is surrounded by a wall twenty feet high, pierced by twelve gates. The waters of the Zerafshan are distributed by canals, and the city contains well-built bazaars, colleges for Mohammedan students, and many mosques. Tajiks, most of whom are artisans, form three-fourths of the population; the rest are Uzbeks, Jews, Hindus, Kalmucks, and Afghans. Bokhara was a centre of Moslem civilization in the 9th and 10th centuries, and became an Asiatic capital under the Uzbek khans. Pop. est. at 80,000. Most of the Russian colonists and merchants are settled at New Bokhara, on the Transcaspian Railway, 10 m. S.E., and to which there is a short railway. Pop. 2,000. See Vambéry's *Travels in Central Asia* (1864), *Sketches of Central Asia* (1867), and *History of Bokhara* (1873); Veniukov's *Frontières Russes en Asie* (1873); Yavorsky's *Reise in Afghanistan und Bukhara in 1877-9* (2 vols. 1885); Bonvalot's *En Asie Centrale* (1885); Moser's *A travers l'Asie Centrale* (1885); Lansdell's *Russian Central Asia* (1885); Curzon's *Russia in Central Asia* (1889); Galkin's *Boukhara* — military study (1890); Le Mesurier's *From London to Bokhara* (1889); and O'Donovan's *The Merv Oasis* (1889).

**Boksburg, tn.,** Transvaal, S. Africa, 15 m. E. of Johannes-

burg; an important coal and gold mining centre. Pop. 30,000 (8,000 Europeans).

**Bol**, FERDINAND (1616-80), Dutch painter; born at Dordrecht; the most distinguished of Rembrandt's pupils. He first painted portraits after Rembrandt, and later came under the influence of the Flemish historical painters. Some of his pictures are at the Hermitage, St. Petersburg. His chief work is *The Regents of the Leprosy Hospital* (Amsterdam, 1649). Of other pieces, Amsterdam possesses a portrait of Admiral Ruyter; the National Gallery, London, has the *Portrait of an Astronomer*; the Liverpool Institute, the Wallace Collection, the Louvre and many other continental galleries (especially Dresden) possess Scriptural and allegorical pictures. See Cole's *Old Dutch and Flemish Masters* (1895).

**Bolama**, isl., W. Africa, one of the Bissagos Archipelago; belongs to Portugal. Pop. 4,000. Its largest town, Bolama, is the capital of Portuguese Guinea.

**Bolan Pass**, a narrow gorge, hemmed in by steep cliffs, leading in a N.W. direction from the plains of Karachi (Kutch Gandawa) across the Hala Mts. to the highlands of Sarawan, Baluchistan. The pass is about 60 m. long, and its summit is 5,900 ft. above sea-level. It is traversed by a military road which repeatedly crosses the Bolan R., and since 1886 by the railway (cogged in parts) between Sibi and Quetta.

**Bolaram**, military cantonment, 11 m. N. of Haidarabad, Nizam's Dominions, India. Alt. 1,890 ft. Health resort for Haidarabad and Secunderabad. Pop. about 10,000.

**Bolas**, a hunting instrument used in Mexico and S. America. It consists of a raw-hide rope, to the end of which are attached by separate thongs three heavy balls covered with leather. The weapon

is thrown at a running animal so as to entangle its feet and thus bring it down.

**Bolbec**, tn., dep. Seine-Inférieure, France, 20 m. by rail N.N.E. of Havre, with cotton and wool spinning, weaving, dyeing and bleaching, paper-making, and tanning. Pop. 11,500.

**Boldrewood**, ROLF, the pseudonym of THOMAS ALEXANDER BROWNE, Anglo-Australian novelist, who was born in London in 1826. He settled in Victoria as a squatter in 1844, and became a police magistrate and warden of the New South Wales gold fields, a post which he held till 1895. His first and best work of fiction was *Robbery under Arms* (1888). His other works include *The Miners' Right* (1890), *The Squatter's Dream* (1895), *Plain Living* (1898), *The Babes in the Bush* (1900), *The Last Chance* (1905), and *A Tale of the Golden West* (1906). In *Old Melbourne Memories* (1895) he has given a vivid account of his early experiences as a squatter.

**Bole**, an earthy, finely pulverulent mineral, mostly brown, but in some varieties red or yellow, found in the cavities of basaltic igneous rocks. It is employed chiefly as a pigment, and was formerly used in medicine. It is found in the Greek island of Lemnos, in Sicily, Armenia, Silesia, and S. America.

**Bolero**, a Spanish national dance in three-four time for two persons, danced to the accompaniment of castanets. It dates from the end of the 18th century.

**Boletus**, a genus of mushroom-like fungi, including many species of various colours. Most of the species are edible, though the flesh of the cap only is eaten; but a few are poisonous.

**Boleyn**, ANNE (1507-36), second wife of Henry VIII. and mother of Queen Elizabeth, was the daughter of Sir Thomas Boleyn and his wife, Lady Elizabeth Howard,

daughter of the Duke of Norfolk. She was a comely brunette, with long black hair and beautiful eyes. Henry VIII., in order that he might marry her, took steps to procure a divorce from Catherine of Aragon, and privately married Anne on Jan. 25, 1533. The new queen was crowned in June, and in the following September gave birth to a daughter, Elizabeth. But the king was disappointed that she did not bring him a male heir. In May 1536 Anne was committed to the Tower, on a charge of treason and adultery. Her alleged accomplices, who were all apprehended and executed, were her brother, Lord Rochford, Sir Henry Norris, Smeaton, a musician, and Brereton and Weston, gentlemen of the bedchamber. Anne was doubtless guilty of indecorous conduct, but the more serious charge against her was not really proved. She was beheaded on May 19, 1536, on Tower Green. See Strickland's *Lives of the Queens of England* (1875-80); Froude's *Hist. of Eng.* (1871); Hepworth Dixon's *Hist. of Two Queens* (1873-4); Friedmann's *Anne Boleyn* (1884). Round's *Early Life of Anne Boleyn* (1886).

**Bolgary**, BOLGHAR, or BOLGARA, vil., Kazan gov., Russia, on the r. bk. of the Volga, 60 m. s. of Kazan, on the site of the ancient capital of the old Bulgarians. The town was destroyed by Tamerlane in the 14th century. Here, during excavations begun in 1722, many ancient coins and inscriptions were found. The Bulgarians of Bolgary were converted to Islam about 920, and were subsequently visited by Moslem travelers, especially Ibn Batuta, about 1335. During these ages Bolgary was an entrepôt of trade between Scandinavians, Russians, and other Europeans to the w. and n.w., and Khazars and Moslems to the s. and s.e.

**Bolgrad**, tn., Bessarabia, Russia, 25 m. n. of Ismail. Pop. 12,000.

**Boli**, tn., Turkey in Asia, vilayet Kastamuni, 86 m. n.w. of Angora; warm springs. Pop. 10,000.

**Bolingbroke**, HENRY ST. JOHN, VISCOUNT (1678-1751), English statesman, entered Parliament as member for Wootton-Basset in 1701, where he soon acquired an important position on the Tory side. In 1704 he became Secretary for War in the Godolphin ministry, retiring from office three years later with Harley. On Harley's return to power, as Chancellor of the Exchequer, in 1710, St. John became Secretary of State, with the management of foreign affairs. In 1713 he concluded the unpopular treaty of Utrecht. He had been created Viscount Bolingbroke in 1712. To counteract the close connection between the Whigs and the Hanoverian court, he intrigued with the Pretender; but it is probable that his real object was to be in a position, on the death of Anne, to dictate terms to either party. The queen's sudden death frustrated his schemes; he was dismissed from his offices, and in the following year was impeached and attainted (1715). He had already fled to France. For a brief period he was secretary of state to the Pretender; but he protested against the rising of 1715, and was soon afterwards dismissed. During his exile he wrote *Reflections upon Exile* (1716), and the *Letters to Sir W. Windham* (1717), an interesting piece of autobiography. In 1723 he procured a pardon from George I., and in 1725 his estates were restored. He settled at Dawley, near Uxbridge, where he attacked the ministry in a series of letters in the *Craftsman*, reprinted (1735) as a *Dissertation on Parties*. In 1735 he retired to France, and employed

his leisure in writing a *Letter on the True Use of Retirement*, and *Letters on the Study and Use of History*. The *Letters on the Spirit of Patriotism* and *The Idea of a Patriot King* were written in 1738. He died in England. Bolingbroke, unsurpassed as an orator, was handsome in person and of polished manners and cultured wit. His knowledge of foreign affairs, his capacity, and his ready eloquence would have qualified him to be a great statesman, but for his insincerity and love of intrigue. His collected works were published in 1754, in 1778, and again in 1809. See *Life* by Goldsmith (1770) and by Thomas Mac-knight (1863); *Bolingbroke: an Historical Study*, by J. Churton Collins (1886); *Life of Viscount Bolingbroke*, by Arthur Hassall (1888), in the 'Statesman Series;' and *Life* by W. Sichel (1901-2).

**Bolintineanu, DIMITRIE** (1826-72), Roumanian poet, born at Bolintin, near Bucharest. He founded the *Dimbovitza* (1861), in which he vigorously sustained the popular cause against the boyars, and was minister of education in 1864, when Prince Cuza introduced his popular reforms. Bolintineanu's works, which include some of the best poetry in the language, are the collections *Cantece si Plangeri*; *Legendele Nationale*; *Basmele*; *Florile Bosforului*, etc. They were collected and published in 1877 in 2 vols. A French translation, under the title *Brises d'Orient*, appeared at Paris in 1866.

**Bolivar.** (1.) State of Venezuela, extending along the s. bank of the Orinoco and Apure. The products are chiefly those of the Orinoco forests—*e.g.* copaiva balsam, india-rubber, and tonka beans; other products are tobacco, coffee, and cinchona. Cattle are herded on the llanos. Cap. Ciudad Bolivar. (2.) Province of Ecuador, S. America; largely un-

developed and densely covered with forests. Pop. 43,000. Cap. Guaranda.

**Bolivar, SIMON** (1783-1830), 'the Liberator,' was born at Carácas, in the Spanish colony of New Granada, S. America, of a noble Spanish family. He was educated at Madrid. After a visit to the United States in 1809, he threw himself with ardour into the movement for making the colony independent of the mother country. After the abortive insurrection of Carácas in 1810 he proceeded to London; but the British government decided to maintain a neutral policy. Bolivar's party having issued a Declaration of Independence in 1811, a long struggle for the mastery ensued between Spain and her recalcitrant colonists. In 1819 the Congress of Angostura having invested Bolivar with the chief command, he fought the decisive battles of Tunja and Boyaca, and proclaimed the new 'republic of Colombia,' which term embraced the whole territory subsequently (1832) divided into the republics of Venezuela, the United States of Colombia, and Ecuador. The war, however, continued until 1821, when it practically concluded with Bolivar's victory at Carabobo. On August 30, 1821, the constitution of Colombia was adopted, and Bolivar was elected president. He next proceeded to effect the independence of Peru, of which country he was chosen (1824) dictator, as he was also of Bolivia, likewise freed in 1825. The closing years of Bolivar's life were marked by the unworthy suspicions and intrigues of his co-republicans. Ultimately, however, he was no longer spoken of as a Napoleon, but as a Washington, who had spent his energies and his wealth to secure the liberties of his countrymen. See the *Mémoires de Bolivar*, by Ducoudray-Holstein (1830); Rojas's *Life*, in

Spanish (1883); De Schrijver's *Esquisse de la Vie de S. Bolivar* (1899); and Loraine Petre's *Bolivar* (1910).

**Bolivia** (named after Bolivar), republic in S. America, bounded on the E. and N. by Brazil, on the W. by Peru and Chile, and on the S. by the Argentine Republic. It has an estimated area of between 500,000 and 600,000 sq. m. The W. part of the republic is a table-land (10,000 to 12,000 ft.) lying between the cordilleras of the Andes, while the E. part consists of low plains sloping down to the rivers Madeira, Guapore, and Paraguay, and crossed by a few conspicuous mountain ranges. The table-land is drained into Lakes Titicaca and Poopo, and the centre and north belong to the basin of the Amazon. The S. section lies in the Paraguay basin, and is drained chiefly by the Bermejo and the Pilcomayo. The plateau region is cold, dry, and healthy. La Paz, in an upland valley of the Andes, has a mean annual temperature of 52° F., the mean extremes being 64° and 36°. The average rainfall is about 24 in., most of it falling during summer. The S. part of the plateau, receiving much less rain, is very arid, and is subject to frequent sandstorms. The E. slopes of the Andes have a tropical climate and abundant rainfall. Farther N., in the Beni department, are vast pasturages (the Mojos llanos), where large numbers of cattle are grazed. Agriculture thrives in the Yungas ('hot valleys'), the E. slopes of the Andes, and in the S. Coca, coffee, and cinchona are the chief crops; india-rubber is collected in the plains of the Amazon; and wheat, barley, and potatoes are grown on the plateau. The llama, alpaca, vicuña, viscacha, fox, and chinchilla are the principal mammals. On the E. side of the Andes the fauna is that of the Brazilian sub-region.

As a silver-mining country Bolivia formerly held a high place, but the output, chiefly from the Huanchaca mine, is at present small. Copper mines extend from Lipez, in the extreme S., through the Potosi department, Oruro, and Corocoro. The districts of Oruro, Potosi, and La Paz are rich in tin—the most important article of export (over £2,000,000 annually)—and bismuth. The gold-bearing regions are along the western border, the region of Atacama, and the N.E. portion of the country near the Peruvian border. About three-fourths of the inhabitants of Bolivia are Indians and half-breeds (Cholos). Their occupations are mining, agriculture, and grazing; manufacturing industry is little developed.

In 1879 Chile took possession of the Bolivian coast lands, and the country has now no ports. Its exports are carried to Mollendo (Peru), Arica, and Antofagasta, at which places Bolivian customs agents reside. A river port was opened at Puerto Alonso (now Acré) on the Acré in 1899 (since ceded to Brazil), and it is proposed to form another (Puerto Quijarro) on the Gaiba lagoon, and connect it by a railway (380 m. long) with Santa Cruz. The principal railway is that from Antofagasta to Oruro (298 m. in Bolivia). There are also lines from Oruro to La Paz and Oruro to Potosi, and other lines are under construction and projected. Much of the traffic is by mules and llamas, and in the N. by means of the rivers. Most of the india-rubber is carried down the Acré and Madeira, the total production of which is valued at £700,000 annually. The value of the total exports is about £4,500,000, and of the imports about £3,000,000. Formerly Peru and Chile secured a large proportion of the trade through special exemptions from duties, but these

privileges were put an end to by the commercial treaty of July 1, 1906. The government consists of a president and two vice-presidents (elected for a term of four years), a senate of sixteen members, and sixty-nine deputies. The country is divided into the Territorio de las Colonias and eight departments. The supreme court sits at Sucre, the usual seat of government, though sometimes it meets at La Paz. The foreign debt has been taken over by Chile. The Roman Catholic religion is alone recognized by the state. Pop. estimated at over 2,000,000.

After the battle of Ayacucho, in 1824, Bolivia gained its independence. The Colombian general Bolívar made his entrance into La Paz in 1825, and under his auspices the first constitution was drawn up in 1826. Since then the chief event in the history of Bolivia has been the loss to Chile of the coast province of Antofagasta, with its valuable nitrate deposits (1879-84). The boundary dispute with Brazil as to the territory of Acre was settled in November 1903, when, in return for Upper Acre, Upper Purus, and Upper Jurua as far as 11° s., comprising about 74,000 sq. m., Bolivia acquired territory on the frontier of Matto Grosso and the river Madeira (1,220 sq. m.), together with a compensation of £2,000,000 and commercial facilities. See M. V. Ballivian and E. Idiaquez, *Diccionario Geografico de la Republica de Bolivia* (1890); F. Blanco, *Diccionario Geografico de Bolivia* (1901); Sir M. Conway, *The Bolivian Andes* (1901); Matzenauer, *Bolivia* (1897); Payne and Wilson, *Pioneering in Bolivia* (1905); Suarez, *Notes on Bolivia* (1902); and Marie Wright, *Bolivia* (1907).

**Bolkhov**, tn., Orel gov., Russia, 37 m. N. of Orel; important tanneries; trade in agricultural produce. Pop. 22,000.

**Boll**, a measure of capacity for grain, etc., used in Scotland and the north of England, containing in the former generally six imperial bushels, but in the latter varying locally from the 'old boll' of six bushels to the 'new boll' of two bushels. For its local values, see *Old Country and Farming Words* (English Dialect Society, 1880), p. 168. As a weight, a boll represents 140 lbs. avoirdupois. By an act which came into operation on Jan. 1, 1879, these and all other local weights and measures were abolished, imperial weights and measures taking their place. The A.S. *boll*, *bolle* = any round vessel, is our 'bowl.'

**Bollandists**. See ACTA SANCTORUM.

**Bollene**, tn., Vaucluse dep., France, 25 m. N. of Avignon; with silk industries. Pop. 5,700.

**Bollington**, eccles. par. (1,291 ac.) and tn., 2 m. N.N.E. of Macclesfield, E. Cheshire, England; has cotton manufactures and calico printing. Pop. 5,300.

**Bollulos par del Condado**, tn., Spain, prov. of and 20 m. E.N.E. of Huelva. Pop. 8,000.

**Bologna**. (1.) Province (area, 1,448 sq. m.), Italy, lying between middle Apennines and lower Po. To s. of Via Æmilia, on which stands the cap. Bologna, are the slopes and valleys of the Apennines, and N. of it is the fertile, well-watered valley of the Po. Its chief manufactures and industries are those of the city. Wheat and maize are largely grown. Pop. 545,000. (2.) Anc. *Bononia*, cap. prov. Bologna, Italy, and an archiepiscopal see, at the foot of the Apennines, 135 m. s.E. of Milan. All the railways of that part of Italy converge on Bologna, which stands on the ancient Via Æmilia, and consequently in a strategical position necessitating fortification (since 1860). The city has fine broad streets, the older central parts containing many churches,

towers, and palatial dwellings. In the centre is the square of Victor Emmanuel, with communal palace and palace of the podestà, both dating from the 13th to the 16th century. In the Neptune Square are the Italian Gothic church of San Petronio (1390-1659) and the cathedral of St. Peter (founded 910, and rebuilt 1605). The leaning towers—Torre Asinelli and Torre Garisenda—belong to the 12th century. In the E. of the city are the university (founded in 1200, and attended by 1,700 students) and the Academy of Fine Art, containing works by Guido Reni, Domenichino, Francesco Albani, the Carracci, and Guercino (founders of the Bolognese school). Outside the city stand the Certosa (1335) and the pilgrimage church of the Madonna of St. Luke. The surrounding district is fertile. Trade and manufactures are both very active, the principal productions being hams, sausages, perfumery, soap, lace, artificial flowers, macaroni, liqueurs, preserved fruits, silks, cloth, hemp textures, glass, tobacco, and hats. Pop. 165,000. Bologna is the birthplace of the painters already named, and of Francia, Galvani, and Rossini.

Bologna, originally an Umbrian town (*Felsina*), was conquered by the Boii, and called Bononia. In 189 B.C. it was made a Roman colony, and became the residence of the Roman emperors. In the middle ages the university was famous as a school of jurisprudence, and as early as the 14th century women were permitted to teach in its schools. In 1506 Pope Julius II. incorporated the city in the Papal Estates, and in 1860 it became part of the modern kingdom of Italy. See Burton's *Etruscan Bologna* (1876), Hare's *Cities of Italy* (1884), and Edith Coulson-James's *Bologna* (1909).

**Bologna**, GIOVANNI or GIAN (1524-1608), sculptor of the Ital-

ian renaissance, called IL FIAMMINGO, from his birthplace in Flanders; went early (1551) to Florence to study the work of his contemporary Michael Angelo, and worked there for three years under the goldsmith Vecchietti. His statues are characterized by classic simplicity and nobility of form; the chief are the bronze *Mercury*, in the Bargello at Florence; the *Rape of the Sabines*, in the Loggia dei Lanzi at Florence; and the equestrian statue of Cosimo I. (1594), grand-duke of Florence. He also designed the fountain of Neptune at Bologna, and the bronze gates for the Pisa cathedral (1595). His colossal group of *Samson Killing the Philistines* is at Hovingham Hall, Yorkshire. See C. C. Perkins's *Historical Handbook of Italian Sculpture* (1883), and Desjardins's *La Vie et l'Œuvre de Jean Bologna* (1884).

**Bologna Stone**, known also as BOLOGNA PHOSPHORUS. At Monte Paterno, near Bologna, are found certain concretions of barytes which, after being heated in a crucible with charcoal, phosphoresce upon exposure to light. This mineral, ground to fine powder, mixed with gum, and heated, yields a paint which is employed on account of this property. Celestine (sulphate of strontium) gives similar results.

**Bologoi**, tn., Novgorod, Russia; important railway junction between St. Petersburg and Moscow, and 200 m. N.W. of the latter.

**Bolometer** ('ray-measure'), an instrument invented by Professor Langley of Washington for the detailed measurement of radiant heat. The principle of its construction is the change of electrical resistance which is produced in metallic conductors by variations of temperature. Thus, the exposure to heat of a platinum filament forming one of the arms of a Wheatstone bridge disturbs



the electrical balance; a current is set up, and the galvanometer needle is deflected. By this means Langley discovered, from the summit of Mount Whitney in 1883, an invisible range of heat rays octupling the extent of the visible solar spectrum, and including nearly three-fourths of the energy that reached the earth from the sun. In his improved apparatus, erected at the Smithsonian Astrophysical Observatory in 1892, all the movements are automatic. The sun's rays, collected by a large siderostat, are transmitted through a rock-salt prism, and the infra-red part of the spectrum thus formed is made to travel by means of clockwork in front of a bolometric strip one-twentieth of a millimetre wide and one-thousandth of a millimetre thick. The ensuing electrical effects record themselves through the movements of a speck of light which is thrown from a mirror attached to the galvanometer upon sensitized paper shifted at a steady rate. The curves traced as the outcome of the process are termed 'bolographs'; they show, by their heights and hollows, the alternations of temperature due to absorption. From the materials furnished by them Langley has mapped about 750 lines below the red, mostly of telluric origin (*Annals of the Smithsonian Observatory*, vol. i., 1900). His perfected bolometer records differences of temperature not exceeding one ten-millionth of a degree centigrade.

**Bolor-tagh**, mt. range of Central Asia, reaching altitudes of 24,000-26,000 ft. See PAMIRS.

**Bolsena**. (1.) Small tn., prov. Rome, Italy; stands on the N.E. shore of the Lake of Bolsena, 9 m. S.W. of Orvieto; has remains of the ancient *Volsinii Novi*. (See ORVIETO.) Here occurred the so-called 'miracle of Bolsena' (1263),

an appearance of blood on the Host which had just been consecrated by a Bohemian priest, an unbeliever in transubstantiation. Pop. 3,300. (2.) Lake, Italy, about 55 m. N.W. of Rome, the centre of a volcanic district, but probably not itself an extinct crater, 1,000 ft. above sea-level, 480 ft. deep, about 10 m. long and 8 m. broad. Its eels are mentioned in Dante's *Purgatorio*, xxiv. 24.

**Bolsover**, par. and tn., 6 m. E. of Chesterfield, Derbyshire, England; has coal mines and magnesian limestone quarries which supplied the stone for the Houses of Parliament. Pop. 7,000.

**Bolsward**, tn., prov. Friesland, Netherlands, 15 m. by rail S.W. of Leeuwarden; has trade in cheese and butter. Pop. (comm.) 6,500.

**Bolt**, any metal pin which unites parts of structures or machines. Temporary bolts are fixed to doors, windows, etc., and are operated by a key or the hand. Permanent bolts take various shapes, according to their use: in shape they may be round, square, hook-and-eye, etc. According to their use they may be foundation, rail, tyre, shackle, and so forth. The commonest form of bolt has a head and a screw-thread towards the end; it is fastened up with a loose nut. In shipbuilding, bolts which completely penetrate a structure are *through* bolts, and those which only partly do so are *blunt* bolts. Eye bolts have a hole in the projecting end; a ring through this hole turns the eye bolt into a ring bolt. The Lewis bolt is an eye bolt with a barbed shank fixed into a socket on the deck.

**Bolt Head**, cape, S. Devonshire, England, at W. side of mouth of riv. Salcombe. Here is a government wireless telegraphy station.

**Bolton**, or BOLTON-LE-MOORS, par., tn. (incorporated 1838), parl., munic., and co. bor., Lancashire,

England, 11 m. N.W. of Manchester. It is one of the chief centres of the cotton industry, and is especially noted for fine yarns. There are also manufactures of muslins and fine calicoes. Bolton has foundries, iron works, bleaching, paper, and saw mills, and chemical works. In the vicinity are extensive coal fields. In 1337 the Flemings introduced the woollen trade; this was stimulated by further immigrants in 1567, and by French Huguenots in 1685. Arkwright, long a resident in Bolton, and Crompton, a native of the town, invented the spinning-frame and the mule respectively. The chief buildings are the public library, the town hall (1873), the technical school, and the mechanics' institute. The water of the town is obtained from Entwisle Moor, 5 m. distant. Bolton is represented by two M.P.'s. Pop. of parl. bor. 190,000.

**Bolton Abbey**, eccles. par. and township. on the Wharfe, 6 m. E. of Skipton, W. Riding, Yorkshire, England (ac. 2,071). There was a priory for Augustinian canons, founded at Embsay about 1121, but it was moved here in 1151. It is now a picturesque ruin; the nave serves as a parish church. The entrance hall of the Duke of Devonshire's shooting-box, Bolton Hall, was the gateway of the priory. Wordsworth's *White Doe of Rylstone* was founded on a tradition connected with the priory. Pop. 750.

**Boma**, or M'BOMA, formerly known as EMBOMMA or LOMBI, cap. of the Belgian Congo, W. Africa, on the r. bk. of the Congo, about 45 m. from its mouth; harbour formed by Congo and I. of Nkete (1 m. wide; depth from 20 to 66 ft.).

**Bomarsund**, ancient Russian fortress on E. coast of Åland I., Baltic Sea, at entrance to G. of Bothnia. On Aug. 16, 1854, after a six days' siege, it was taken by

the allied fleets of Britain and France. Russia, by the treaty of Paris, undertook not to rebuild it.

**Bomb**, in geology. Bombs are large, round, porous masses of igneous rock ejected by active volcanoes, and are found mixed with other varieties of volcanic ash. The blocks are often pear-shaped or flattened, owing to their having been in rapid rotation while hot and viscous during their journey through the air. They are simply a large form of the *lapilli* of which the ash beds principally consist. Masses nine feet in diameter have been thrown a distance of several miles. When such materials have, in course of time, been compacted into firm rock, they are known as volcanic agglomerate. Bombs are sometimes hollow, owing to the expansion of the steam in the molten igneous rock, aided, no doubt, by centrifugal force. See J. Phillip's *Vesuvius* (1869), and other works on volcanoes.

**Bomb**. See AMMUNITION; EXPLOSIVES; DYNAMITE.

**Bomba, KING**. See FERDINAND II., king of the Two Sicilies.

**Bombala**, tn., New South Wales, co. Wellesley, 40 m. N.W. of Twofold Bay, 250 m. S.W. of Sydney. Pop. of tn. 1,000; dist. 4,500.

**Bombardier**, originally an artilleryman who was skilled in the use of *bombards*; but the term has come to be applied to the lowest grade in the non-commissioned ranks of the royal artillery, and is equivalent to that of corporal in other branches of the army. An acting bombardier corresponds to a lance-corporal in an infantry regiment. The establishment of bombardiers in a battery is four, five, or six in peace, and eleven in war.

**Bombardier Beetles** (*Brachinus*), interesting insects which receive their name from the remarkable habit of emitting a

discharge from the posterior end of the body when alarmed. The discharge is like a tiny puff of smoke, and is accompanied by an evil odour. The common European form is *B. crepitans*. All the bombardier beetles resemble the common garden carabids in general appearance, and are allied to them.

**Bombardment.** The object of a bombardment may be either to destroy military stores, arsenals, or dockyards, or to bring about the surrender of a place. It is more often a naval than a military operation. Its effect is too uncertain for it to be relied upon for the latter purpose unless it is combined with a rigorous blockade, or with the operations of a regular siege. The bombardment of a fortress or defensive position prior to an assault being delivered is absolutely essential to success. A place surrounded by sufficiently advanced fortifications is safe against bombardment. In the Franco-German war the distance of the detached forts from the cities or towns they surrounded was so small that on sixteen occasions a very slight bombardment (generally from field guns merely) proved sufficient to bring about surrender. History has shown that the effects of bombardment on the civil population is usually small—about one per cent. only being killed. The Brussels Conference (1874) drew up rules (Arts. 15-18) for the restriction of bombardment to fortified places and towns which actively opposed the enemy. See BELLIGERENTS, RIGHTS AND DUTIES OF.

The most terrible bombardment of history was that of Port Arthur during the Russo-Japanese war. On Sept. 1, 1904, the Japanese began the reduction of the fortress by engineering methods—i.e. by 'sapping' and 'mining,' supported by a terrific artillery

fire. Some three hundred guns were trained against the place, and all the infantry assaults were preceded by bombardments. The Japanese used regular siege guns of from 5 to 6 in. calibre, naval guns (4.7 to 6 in.), ordinary field ordnance, and, above all, 11 in. mortars weighing 8 tons apiece without the carriage. These mortars were originally designed for coast defence. They had a bore of 11 in.; their shells, which weighed 500 lbs., were loaded with a high explosive (invented by Dr. Shimose), and burst on contact. Each shell cost £40, and the cost of each discharge was about £100. During heavy bombardments each gun was fired once every eight minutes, and the grand bombardments were kept up about four hours. The mortars had a maximum range of seven or eight miles, but none of them were more than three miles distant from the town. They were fired at angles as great as 60°, 'the huge shells hurtling high into the heavens, passing over two ranges of hills, and falling like thunderbolts out of the blue sky vertically upon the devoted city.' On the whole, the bombardments were conducted with care and humanity. The *Times* correspondent, writing after the fall of the fortress, reported that practically no damage had been inflicted on the many large buildings, the attack being directed mainly to the defences, the storehouses, and the warships in the harbour. It is said that 11,000 of the besieged were killed, but the number of casualties directly traceable to the bombardment is not known. See article by Richard Barry, 'An American Correspondent in Port Arthur,' *Fortnightly Review*, March 1905, p. 459 *et seq.*

**Bombardon.** See SAXHORN.

**Bombay,** cap. of the presidency of the same name, is an island in

the Arabian Sea, situated close to the w. shore of India (with which it is connected by three causeways). The mails to and from the West for all India are embarked at and disembarked from this port, which is called 'the Gate of India.' Three main lines of railway have terminal stations in Bombay: by two of these the port is in direct communication with Calcutta, either through the Central Provinces or through Rajputana; the third line runs s.e., *via* the Nizam's Dominions, to Madras. Bombay is the second seaport of India; about one-fourth of all the commerce of the country passes over its quays. The value of the imports and exports (merchandise only) in 1909 amounted to £55,000,000. The commodious and picturesque harbour is dotted with islands. Opposite the anchorage are the fort, and the docks and places of business. The native town lies to the N. On Kolaba, the narrow s. extremity, is the European garrison. A shallow sheet of water on the farther side of Kolaba, called Back Bay, is encircled on the w. by a hilly promontory (Malabar Hill), terraced with houses—the residential quarter.

The climate is humid and enervating. Hindus and Mohammedans are the most numerous of the inhabitants, and include not only natives of India, but also Afghans, Arabs, Malays, and Africans. There are also influential communities of Parsees, Jews, Europeans, and Americans. There are large cotton mills, tanneries, dyeworks, and shops for metalwork.

Bombay is the headquarters of the government of the presidency, over which a high court exercises supreme jurisdiction. Besides a university (over 1,100 students), there are the Government Elphinstone College, three art colleges, the Grant Medical College, two

missionary colleges, a technical institute, and a law school. Numerous high schools and orphanages, initiated by the efforts of Christian bodies, have been extended by the native merchant princes; and several hospitals, including one for lepers, are maintained by its citizens. In municipal enterprise Bombay holds its own with the foremost cities of Europe. Since 1897 annual visitations of bubonic plague have devastated the city, but an extensive scheme of sanitary improvement has been instituted.

Bombay came into the possession of the British crown in June 1661, as part of the dowry of Catherine of Braganza, on her marriage with Charles II. Pop. (1911) 972,892. See Forrest's *Cities of India* (1903).

**Bombay Presidency** is that portion of India which lies between Baluchistan and the Punjab in the N. and Mysore in the s. The Arabian Sea marks its w. boundary, and on the E. are the native states of Rajputana and the Nizam's Dominions. Its area is nearly 188,800 sq. m., of which about 123,000 are British territory. Pop. about 25,000,000. Two important mountain ranges run through the presidency: the Sahyadri, or Western Ghâts, follow the coast-line from the s. and converge on the Aravali Hills, which are spread over Gujarat; in the extreme N. the Hala Mountains form the dividing line between Sindh and Baluchistan. The three principal rivers are the Indus (which traverses Sindh and enters the Arabian Sea in a wide delta), the Narbada, and the Tapti, both in Gujarat. The Manchar Lake, on the Indus, has, under inundation, covered an area of 180 sq. m. The Rann of Kutch, an inland lake, becomes, when in flood, an arm of the sea. The country generally is fertile. In Sindh, where there are stretches

of sandy desert, irrigation has brought large tracts under cultivation. Forests are scattered along the mountain ranges, and cover extensive areas on the banks of the Indus. During the fair weather traffic along the coast-line is brisk, but the only harbours are Karachi, Bombay, and Karwar; and native craft cease to ply during the prevalence of the s.w. monsoon. The chief industries are the manufacture of cotton and salt. The volume of trade in cotton, wheat, and oil-seeds, grown in the presidency and gathered from the inland provinces for export to Europe, is considerable; and the export to China of opium and coarser cotton cloths is also important. Three main lines of railway from Bombay tap the Nizam's Dominions, the Central Provinces, and Rajputana; the cotton-growing province of Kathiawar is being covered with a network of lines. A military line from Karachi leads to the northern frontier, and this port is in railway communication with the Punjab and Rajputana. The post office and telegraphs are controlled by the imperial government both in British territory and in native states.

The executive government is vested in a governor and two councillors. For administrative purposes the presidency proper is divided into nineteen districts. Local self-government is in its infancy, but municipalities have been established in the larger towns; and for legislative purposes the executive government is assisted by a council of Europeans and natives.

Of the territories under native rule the most important is Baroda, which is practically under the direct control of the imperial government. In all the native states the British government is represented by political officers. The chiefs have surrendered the

right to manufacture opium, salt, and native intoxicating drinks (*abkari* dues), and the jurisdiction over railway lands. They are responsible for the safety of mails in transit through their territories. The chiefs of Kolhapur, Kutch, and a few in Kathiawar, possess plenary powers.

The inhabitants comprise numerous races, who profess divers creeds. The majority (75 per cent.) are Hindus—a term used to comprehend pure Brahmanism, as well as the worship of Vishnu and Siva under various systems; a small but influential body are Parsees; and the proselytizing faiths are represented by Buddhists, Mohammedans (20 per cent.), and Christians. The languages principally spoken are Marathi (50 per cent.), Gujarati (20 per cent.), and Sindhi (15 per cent.). See Drew's *Bombay and its Feudatories* (1892).

**Bombay, Baroda, and Central India Railway.** The first portion of this railway (Amroli to Surat), 36½ m. in length, was opened in 1860. It was on the (then) standard Indian gauge of 5 ft. 6 in. At the end of 1905, the railway was purchased by the Indian government. At this date the system consisted of 465 m. of 5 ft. 6 in. gauge railway, 252 m. of which was double track; and 1,816¾ m. of metre gauge, 39¼ m. of which had been converted from broad gauge. At this date the Bombay, Baroda, and Central India Ry. also worked for the government 141 m. of 5 ft. 6 in. gauge railway, as well as 222¼ m. of 5 ft. 6 in. gauge, 271½ m. of metre gauge, and 131¾ m. of 2 ft. 6 in. gauge for various native states and private companies. The capital of the company when purchased by the Indian government was £11,007,098, of which £138,838 had been advanced by the Indian Secretary of State.

Since the Indian government

acquired the line, it has been worked for the government by a new Bombay, Baroda, and Central India Ry. Co. with a capital of £2,000,000, increased in Oct. 1908 by the issue of £1,000,000 3½ per cent. debenture stock. The government guarantees interest at the rate of 3 per cent. per annum, and the surplus profit is divided between the government and the railway company, the latter receiving one-tenth up to the sum necessary to pay an additional ½ per cent. interest on the company's capital, and one-fifteenth of any further surplus. For the year 1909 the surplus provided the additional ½ per cent. with £30. At Dec. 31, 1909, the total mileage (including worked lines) was—5 ft. 6 in. gauge, 831·95 m.; metre gauge, 2,710·38 m.; and 2 ft. 6 in. gauge, 131·84 m. The working expenses in 1905—the last year as a private line—were 42·94 per cent. of the gross earnings; for 1909 they amounted to 52·14 per cent.

**Bombay Duck**, or BUMMALOTI, the name given to a fish called *Harpodon nehereus*, in the dried or salted condition in which it is exported from Bombay and the coast of Malabar. It belongs to the family Scopelidæ, to which many deep-sea fish belong, and is itself probably a deep-water form coming periodically to the surface. The body is much elongated, with delicate scales and soft bones.

**Bombazine**, a twilled or corded cloth, manufactured in England as early as the reign of Elizabeth, and composed of silk and worsted. Norwich was the chief seat of the manufacture from about 1816. It is also made in N. Italy.

**Bombetoka**, BAY OF, on N.W. coast of Madagascar, about lat. 16° S. On it stands the seaport of Mojanka.

**Bombinator**, a genus of toads, including the common fire-toad (*B. igneus*) of Central Europe. It

is a small animal (length about 1½ in.), with a dark protectively-coloured back and splashes of orange-red on the under side of the abdomen. When alarmed it adopts a remarkable attitude which serves to display this bright under surface. In the south and west of Europe another species (*B. pachypus*) occurs, in which the under surface is yellow instead of red.

**Bombyx**. See SILK.

**Bommel**, or ZALT-BOMMEL, tn., prov. Gelderland, Netherlands, on the l. bk. of the Waal, 10 m. N. by w. of 's Hertogenbosch. Pop. of commune, 4,000.

**Bommelö**, isl., Norway, off the w. coast between Stavanger and Bergen.

**Bommelwaard**, isl., Gelderland prov., Netherlands, formed by the Waal and the Meuse. It contains the town of Zalt-Bommel and numerous villages.

**Bomvanaland**, native dist. in Tembuland, Cape of Good Hope, lying on the E. coast between the Bashee R. and Umtata R.

**Bon**, CAPE, or RAS ADDAR, northernmost point of Africa, 58 m. N.E. of Tunis.

**Bona** (Fr. *Bône*), fort. seapt. tn., prov. of Constantine, Algeria, in fertile plain 85 m. N.E. of Constantine, on Sebus R.; it has a fine harbour. The exports include phosphates, iron, zinc, lead, copper, cork-wood, and briar roots. Bona was occupied by the French in 1832. To the S. are the ruins of Hippo Regius, the see of Augustine, who died here in 430. Pop. 42,000 (Europeans 30,000).

**Bona Dea** ('the good goddess'), a Roman divinity, sister, wife, or daughter of Faunus, and named Fauna, Fatua, or Oma. Her worship was exclusively confined to women, and she was revered as a chaste and prophetic deity. Her sanctuary was a grotto on the Aventine Hill. On May 1 of every year her festival was held in the

house of the consul or prætor. Also, on the night of Dec. 3-4, a distinct rite was celebrated by women only in the house of either the consul or prætor. This rite degenerated after Clodius's sacrilege in 62 B.C. See Cicero's *Epist. ad Atticum*, i. 12; Warde Fowlers's *Roman Festivals*; Tyrrell's *Correspondence of Cicero* (1879-1901); and Purser's ed. of Cicero's *Epist. ad Atticum* (1903).

**Bona Fides** (Lat. 'good faith,' as opposed to *mala fides*, 'bad faith'), a term used in civil law, chiefly in regard to sale and contract. If a person acquired possession of anything *bona fide* (i.e. without notice of any defect in title) and *ex justa causa* (i.e. by one of the usual means of acquiring property, such as purchase), and retained it for three years in the case of movables, and in the case of land for ten years if the parties were present, and twenty if they were not, he became by Roman law owner of the thing even against the real owner. The ownership of stolen goods, however, could not be acquired in this way. In England *bona fide* possession is no defence to an action by the true owner, except in the case of negotiable instruments or goods bought in market overt, or where the true owner is estopped by some act of his own from setting up his title, or in cases of prescription. To make a contract void on the ground of *mala fides*, it must amount to a fraud, unless the parties stand in a fiduciary relation to each other.

**Bonai**, the most southerly of the feudatory states of Chota Nagpur, Bengal, India; consists of a valley, surrounded by the Bonai Hills. Area, 1,349 sq. m.

**Bonaire**, isl., W. Indies. See CURAÇAO.

**Bonald**, LOUIS GABRIEL AMBROISE, VICOMTE DE (1753-1840), French philosopher and statesman, born at Mouna (Aveyron).

He retired with other royalist *émigrés* to Heidelberg in 1791, and there wrote *Théorie du Pouvoir Politique et Religieux dans la Société Civile* (3 vols. 1796). At the Restoration he became a member of the Council of Public Instruction, minister of state (1822), and was ennobled (1823). His principal works were *Législation Primitive* (1802); *Recherches Philosophiques* (1818), *Mélanges Littéraires* (1819). His *Œuvres* were collected in 3 vols. by Migne (1859). See Damiron, *Phil. en France au XIX<sup>e</sup> Siècle* (3rd ed. 1834); and *Life in French* by Bonald's son VICTOR (1853). Another son, LOUIS JACQUES MAURICE (1787-1870), became bishop of Puy (1823), archbishop of Lyons (1839), and a cardinal (1841).

**Bonanza** (Lat. *bonus*, through the Spanish), a miner's term in the United States for the discovery of a rich vein of ore. The 'Big Bonanza,' one of ten in the Comstock Lode, was struck in 1876. By analogy the term expresses any stroke of good luck.

**Bonanza Creek**, in the Yukon dist., Canada, joins the Klondyke R. 2 m. from Dawson. It has rich placer-gold deposits.

**Bonapartes**, THE. The surname Bonaparte or Buonaparte was borne by various Italian families during the middle ages, and it occurs in Corsica in the 10th century. Their name was entered in the 'Golden Book' at Treviso as of noble rank.

BONAPARTE, CHARLES, or CARLO BUONAPARTE (1746-85), was a Corsican lawyer, and an adherent of the patriot Paoli. In 1767 he married Maria Letitia Ramolini, a strong-minded and accomplished patrician lady. On the failure (1768) of Paoli's rebellion, Charles Bonaparte accepted the French rule; and in 1773 he was appointed royal counsellor and assessor of the town and province of Ajaccio. In 1793 Napoleon's

mother went to Marseilles; but on Napoleon becoming first consul she removed to Paris. She was styled 'Madame Mère' after his coronation in 1804. She accompanied Napoleon to Elba, and after Waterloo she resided with her step-brother, Cardinal Fesch, at Rome, where she died in 1833. See *Madame Mère*, by Larry (1892). Among her children were:—

(1.) BONAPARTE, JOSEPH (1768-1844). Expelled from Corsica by the partisans of Paoli, he emigrated to Marseilles; and later, when his illustrious brother rose into power, he was appointed commissary-general, and in 1797 was sent as ambassador to the Pope. He negotiated the treaties of Lunéville (1801) and Amiens (1802). In 1806, much against his will, he accepted the throne of Naples; and in 1808 his brother made him king of Spain. He tried in vain to abdicate; but Wellington's triumph at Vitoria in 1813 at length put an end to his mock sovereignty. He was a mild and reasonable man, of a statesman-like mind, but a poor soldier. On the final fall of his brother he emigrated to the United States. He returned to Europe in 1832, and died in Florence. See Du Casse's *Mémoires du Roi Joseph* (1853-4).

(2.) BONAPARTE, NAPOLEON. See NAPOLEON I.

(3.) BONAPARTE, LUCIEN (1775-1840). In 1798 he was elected to the Council of the Five Hundred, where, as president, he rendered great service to Napoleon on the 18th Brumaire. He was subsequently minister of the interior, and in 1800 was sent as ambassador to Spain. Having married Madame Jouberton against the wishes of his brother, he went into retirement in Italy, where he was created Prince of Canino by the Pope. Napoleon's displeasure obliged him in 1810 to leave Rome, and he embarked

for the United States, but was captured by the British, who detained him until 1814. Becoming reconciled to his brother, he stood by him during the struggle of the Hundred Days; and it was by his advice that the emperor abdicated in favour of his son. When Louis XVIII. ascended the throne, Lucien Bonaparte retired with his family to Italy, where he died. See Jung's *Lucien Bonaparte et ses Mémoires* (1882-3).

Prince Lucien Bonaparte left five sons and two daughters. The eldest son, CHARLES LUCIEN JULES LAURENT BONAPARTE (1803-57), married his cousin Zénaïde, the daughter of Joseph Bonaparte, in 1822, and emigrated to the United States, where he became a distinguished naturalist. He produced his *American Ornithology*, a valuable work, in 1825-33; *Iconografia della Fauna Italica* in 1832-41; *Conspectus Generum Avium*, in 1850-65; besides other books. He succeeded to his father's title in 1840. Returning to Europe, he mingled for a time in politics on the republican side, but in 1849 settled quietly in Paris. One of his sons, Lucien, became (1858) a cardinal in the Church of Rome.—PAUL MARIE BONAPARTE (1808-27), second son, took part in the Greek war of liberation, fighting on Lord Cochrane's ship. LOUIS LUCIEN BONAPARTE (1813-91), the third son, became an eminent philologist, and an authority upon the Basque (*Langue Basque*, 1862) and Celtic languages. The Catalogue of his works (1858-88) includes no fewer than 222 books written either by himself or under his supervision. He ultimately settled in England, and was awarded a pension of £250 from the British civil list.—PIERRE NAPOLEON BONAPARTE (1815-81), the fourth son and the black sheep of the family, spent the early years of his erratic career in Italy, Belgium, and America. Re-



turning to France in 1848, his conduct caused great annoyance to his cousin, Napoleon III. In 1870 he shot dead Victor Noir, the journalist, with whom he was to fight a duel. Brought to trial, he was acquitted of murder, but was ordered to pay £1,000 to the Noir family. His remaining years were spent in England.

(4.) BONAPARTE, MARIE ANNE ELISA (1777-1820), married (1797) a captain in the French army, named Felice Bacciochi. She was a clever woman, and when, in 1805, Napoleon erected Lucca and Piombino into a principality, he conferred upon her the government. She became Grand-duchess of Tuscany in 1809. See Turquan's *Les Sœurs de Napoléon* (1896).

(5.) BONAPARTE, LOUIS (1778-1846), king of Holland, was in his brother's Italian and Egyptian campaigns. In 1802, in deference to the wishes of Napoleon, he married Hortense (1783-1837), daughter of General Beauharnais by his wife Josephine, afterwards empress of the French. The union was very unhappy, and the pair spent most of their married life apart. In 1806 Louis was made king of Holland; but declining to carry out Napoleon's tyrannical policy, he retired in 1810 in favour of his son, and Holland was annexed to France in the same year. He was the author of *Documents Historiques, etc., sur le Gouvernement de la Hollande* (1821); *Histoire du Parlement Anglais* (1820); *Réponse à Sir W. Scott* (1829); and a critique upon Norvins's *Histoire de Napoléon* (1834). After the final defeat of Napoleon, Hortense Bonaparte settled in Switzerland. She was the authoress of *La Reine Hortense en Italie, en France, et en Angleterre* (1833), and of a number of songs, including the popular *Partant pour la Syrie*. The third son of Louis and Hortense Bona-

parte was CHARLES LOUIS NAPOLEON. See NAPOLEON III.

(6.) BONAPARTE, MARIE PAULINE (1780-1825), also called CARLOTTA, was Napoleon's favourite sister, and, with her mother, shared his exile at Elba. She was married first (1797) to General Leclerc, afterwards (1803) to Prince Borghese. Canova immortalized her beauty as Venus Victrix.

(7.) BONAPARTE, CAROLINE MARIE ANNONCIATA (1782-1839), married Murat, king of Naples, in 1809, and shared in all his vicissitudes.

(8.) BONAPARTE, JEROME (1784-1860), king of Westphalia, the youngest brother of Napoleon I., was born at Ajaccio, and served as naval lieutenant in the Hayti expedition (1801). In 1806 he fought in the war against Prussia, and in 1807 was made king of Westphalia. He took part in the Russian expedition of 1812, commanded a division at Waterloo, and thereafter settled in Florence. On his return to France in 1848 he was appointed governor of the Invalides, and in 1850 was created a marshal of France. His third son by his second wife was NAPOLEON JOSEPH CHARLES PAUL BONAPARTE, known as PRINCE JEROME NAPOLEON (1822-91), and nicknamed 'Plon-Plon.' He was banished from France in 1845, on account of his republican tendencies. In 1848 he was elected to the National Assembly, and served with the army in the Crimean war. He married, in 1850, Princess Clotilde, daughter of Victor Emmanuel; and their eldest son, PRINCE VICTOR NAPOLEON (1862), is now the head of the Bonaparte family.

See NAPOLEON; Du Casse's *Mémoires et Correspondance du Roi Joseph* (1853-4); Bingham's *Marriages of the Bonapartes* (1881); *Mémoires Secrets de Lucien Bonaparte* (1819); *Mémoires de la Cour de Louis Napoléon*; Wouter's *Les*

*Bonapartes depuis 1815* (1841); Du Casse's *Mémoires du Roi Jérôme* (1861-6); and Martinet's *Jérôme Napoléon, Roi de Westphalie* (1902).

**Bonar**, HORATIUS (1808-89), Scottish divine and hymn-writer; born and educated at Edinburgh; appointed minister of Kelso in 1837. He seceded with the Free Church at the Disruption in 1843, and became minister of Chalmers' Memorial Church, Edinburgh, in 1866. He was editor of various religious journals, and published numerous religious works, notably *Hymns of Faith and Hope* (1857-66; new ed. 1886), eighteen of which are in the *Scottish Hymnary*. See *Horatius Bonar, D.D.: a Memorial* (1889).

**Bonasa**, the genus to which belongs the ruffed grouse (*B. umbellus*) of N. America. It is peculiar in having the lower part of the legs as well as the toes devoid of feathers, and in possessing frilled ruffles of black feathers on each side of the neck. See GROUSE.

**Bonaventura**, co. of Quebec, Canada, bordering on the Baie de Chaleurs and New Brunswick. Pop. 25,000.

**Bonaventura**, or BUONAVENTURA, ST. (1221-74), scholastic theologian and mystic, surnamed 'the Seraphic Doctor,' was born at Bagnorea in Tuscany. In 1238 he became a Franciscan friar. He received his doctor's degree at Paris after a great controversy, and in 1257 became minister-general of the Franciscans. He accepted the bishopric of Albano, and in 1273 was created a cardinal. He accompanied Gregory X. to the Council of Lyons, during the session of which he died (1274). Dante placed him among the saints in canto xii. of the *Paradiso*; and in 1482 he was canonized by Sixtus IV. His principal works are the *Breviloquium*, the *Itinerarium Mentis in Deum*, *De Re-*

*ductione Artium ad Theologiam*, and the *Biblia Pauperum*. His works were collected in 8 vols. folio (Rome, 1588-96) and 10 vols. quarto (1882-92). Works upon his life, character, and writings have been written by Hollenberg (1862), Vicenza (1874), Richard (1873), Borgognoni (1874), and De Chévancé (1899).

**Bona Vista**, bay, cape, dist., and tn., Northern Newfoundland. The numerous rocks and islands in the bay make its navigation both dangerous and intricate. The town, 75 m. N. by W. of St. John's, is a port of entry. Pop. 3,600. The cape is in 48° 40' N. lat.

**Bonchamps**, CHARLES MELCHIOR ARTHUR, MARQUIS DE (1760-93), Vendean general, born at Jouverteuil in Anjou. He resigned his captaincy in the army at the Revolution, and was appointed a leader by the Vendéans. He frequently defeated the republican troops, but was mortally wounded before Cholet in 1793. His last act was to ensure the safety of 5,000 republican prisoners on whom the insurgents were about to wreak their vengeance. See *Life* by Chauveau and Dussieux (1817), and Blachet's *Bonchamp et l'Insurrection Vendéenne* (1902).

**Bond**, in English law, a document under seal by which one person promises to pay another a specified sum. It is often employed when it is sought to secure under penalty—in a money bond usually double the sum actually due—the performance of something, either the payment of money or the doing of some act; in such cases the promise is to become void on the happening of the particular event. At common law, on failure of the condition named in the bond, the full penal sum became payable; but the law now only permits the obligee to receive the amount of his actual loss.

**Bond**, a term used in bricklaying and masonry to indicate the arrangement of the bricks or the stones. See BRICKLAYING.

**Bond**, AFRIKANDER. See AFRIKANDER.

**Bond**, SIR EDWARD AUGUSTUS (1815-98), chief librarian of the British Museum, was born at Hanwell, near London, and entered the British Museum as a palæographer in 1838, becoming keeper of the MSS. (1866) and chief librarian (1878). With Sir E. Maunde Thompson he founded the Palæographical Society (1873). He was created C.B. (1885) and K.C.B. (1898). He edited *Speeches in the Trial of Warren Hastings* (4 vols. 1859-61), *Chronica Abbatie de Melsa* (Rolls Series, 1858), *Statutes of the University of Oxford* (1853), and a complete *Catalogue of the MS. Collections in the British Museum* (1870-5).

**Bond**, SIR ROBERT (1857), premier and colonial secretary of Newfoundland, was born in Newfoundland, and educated at Queen's College, Taunton, England. Having studied for the bar, he was elected to the Newfoundland Assembly (1880), appointed Speaker (1884), executive councillor and colonial secretary (1889-97), and premier (1900). He was a delegate to England relative to the French treaties question (1890), and was mainly instrumental in carrying through the Bond-Blaine convention (1890). He was also a delegate on the Newfoundland fisheries question (1892), and chairman of the Ottawa conference (1895). He was made a K.C.M.G. in 1901, and a P.C. in 1902.

**Bond**, WILLIAM CRANCH (1789-1859), American astronomer, born in Portland, Maine; became director of the observatory at Harvard University in 1840. He discovered the eighth satellite of Saturn (Sept. 19, 1848), invented the chronograph (1850), and was

one of the first (1848) to photograph celestial bodies.

**Bonde** (pl. *bönder*), originally, in the Scandinavian north, a peasant freeholder (odal owner). The term is now, however, synonymous with peasant as ordinarily understood.

**Bonded Warehouse**, a warehouse used for storing bonded goods—*i.e.*, goods subject to inland revenue duty, but on which the duty has not been paid. Such goods are warehoused under government supervision. When removed for sale within the country the duty is paid; when removed for exportation no duty is paid. The system of bonding goods in a warehouse was authorized by an act passed in 1802.

**Bondeno**, tn., prov. Ferrara, Italy, 11 m. by rail N.W. of Ferrara, on the Panaro. Rice and hemp are grown in the neighbourhood. Pop. comm. 16,000.

**Bondi**, CLEMENTE (1742-1821), Italian poet and Jesuit, born at Mezzano in Parma. After the suppression of his order he devoted himself to literature, and became (1797) librarian to the Archduke Ferdinand at Brünn, and in 1815 professor of history and literature at Vienna, where he died. His poems, including his most famous work, *Giornata Villereccia*, as well as French translations of Virgil and Ovid, were published in 3 vols. (1808).

**Bonds**. See AMERICAN RAILS.

**Bondu**, a native Fulbe kingdom of W. Africa, in the French colony of Senegal, between the middle Gambia and the Faleme; is well watered and fertile, and produces iron and gold, cotton, indigo, tobacco, and the usual W. African products. Pop. 500,000. It became French in 1858.

**Bonduku**, tn., West Africa, in the French colony of the Ivory Coast, close to the W. boundary of Ashanti, and in about 8° N. lat.

**Bondy**, comm., Seine dep., France, 6 m. S.E. of St. Denis; has chemical industries and breweries. Pop. 5,000.

**Bône**, Algeria. See BONA.

**Bone** is one of the hardest structures of the animal body, and possesses also a certain degree of toughness and elasticity. It serves as the framework or skeleton of the body, supporting the softer structures, forming the joints, and protecting the viscera. It is composed of earthy and animal matter in the proportion of 67 per cent. of the former and 33 per cent. of the latter. Of the earthy matter 56 per cent. is calcium phosphate, the rest being calcium carbonate, calcium fluoride, and magnesium phosphate. Rickets, mollities ossium, and caries are associated with deficiency of the earthy matters. The organic substance is chiefly collagen—a substance which is converted into gelatin by boiling. A section of bone is seen to be composed of two kinds of tissue—one external, hard like ivory, a compact and dense tissue; the other internal, a spongy or cancellous tissue resembling a lattice-work. The shaft of a long bone consists of compact bone surrounding a central canal or 'medullary cavity,' so called from its containing the medulla or marrow. Bones are enclosed in a fibrous membrane, the 'periosteum,' by means of which many of the blood-vessels reach the hard tissue. When the periosteum is stripped from the surface of a living bone, the small bleeding points which are seen mark the entrance of the periosteal vessels; the long bones are supplied also by a nutrient artery which enters at the 'nutrient foramen' in the shaft, reaches the medullary cavity, and breaks up into branches, from which small vessels are distributed to the interior of the bone for the supply of the marrow. Veins

emerge from the long bones in various places. Examined with a lens of low power, a section of bone is seen to be divided into a number of circular areas, each of which consists of a central hole surrounded by a number of concentric rings. These areas are called Haversian systems. The central hole is a Haversian canal. The average diameter of the Haversian canals is one five-hundredth of an inch; they contain blood-vessels, and the minute canaliculi and lacunae convey the lymph which is exuded from the blood-vessels to the substance of the bone which they traverse. The lacunae are occupied by branched cells, called bone cells or bone corpuscles, each of which is a little mass of protoplasm, and serves for the nutrition of the bone immediately surrounding it. One lacunar corpuscle communicates with another, with its surrounding area, and with the blood-vessels of the canals, by means of the minute streams of nutrient lymph which occupy the canaliculi.

Bone grows in girth by the deposition of layers under the periosteum, like successive rings under the bark of a growing tree. Duhamel placed silver rings round the bones of young pigeons, and when these were killed the rings were found completely covered in by bone; in the animals killed last they were found in the central cavity. John Hunter fed pigs alternately on ordinary food and on food dyed by the red pigment madder. The rings of bone deposited during the madder period were red, and easily distinguished from the others.

Diseases of bone may be classified as follows: *Bacterial diseases*—pyogenic, tuberculous, syphilitic. *Parasitic diseases*—actinomycosis, mycetoma, hydatid cysts. *Trophic diseases*—rickets, scurvy—

rickets, osteomalacia, osteitis deformans, leontiasis ossea, fragilitas ossium. *Tumours and cysts.*

Pyogenic disease of bone results from infection with pus-forming organisms, and occurs chiefly before the growth of the skeleton is completed. The *staphylococcus aureus* is the cause of various forms of osteomyelitis and periostitis, of chronic abscess of bone, and of necrosis, with or without suppuration. Other organisms causing bone disease are *pneumococcus* and the typhoid bacillus. Pyogenic diseases of bone also arise from direct infection through a wound or other breach of surface, as in amputations, in compound fractures, and in diseases of adjacent soft parts. Tuberculous disease of bone occurs very frequently as the result of the infection of the marrow and periosteum by tubercle bacilli, which have been conveyed to those tissues through the arteries. Syphilitic disease of bone is caused through infection by the syphilitic virus as a consequence of the general disease.

Bones are frequently the seat of tumours, both primary and secondary. Examples of primary tumours are osteoma, chondroma, sarcoma, and fibroma; and of secondary tumours, carcinoma. For the morphology of bones, see SKELETON.

**Bone, HENRY** (1755–1834), English painter, was born at Truro. He went to London in 1778, and was employed in enamelling watches and fans, and in enamel painting. His chief works are a series of historical portraits of the time of Elizabeth, *Bacchus and Ariadne*, and the *Cavaliers Distinguished in the Civil War*. He was appointed enamel painter to the king in 1801, and a R.A. in 1811. See Sandby's *Hist. of the Royal Academy* (1862).

**Bone, MUIRHEAD**, Scottish etcher, born in Glasgow (1876),

member of New English Art Club and the Society of Twelve. His works are as highly prized as those of any living etcher. He is especially successful with city scenes and weather impressions.

**Bone Ash**, or BONE EARTH, the residue obtained by calcining bones in the presence of air until they are white, consists chiefly of calcium phosphate, together with some carbonate. It is used in the manufacture of cupels for assaying, in the preparation of phosphoric acid and phosphorus, and is the basis of several artificial fertilizers.

**Bone-beds**, beds of rock containing fossil bones of animals in great abundance—*e.g.* the Ludlow bone-bed, near the top of the Silurian system in Shropshire and Herefordshire, where the bones, scales, teeth, and plates are principally those of fishes. Another occurs at Aust, in Gloucestershire, and is in places from two to three feet thick. Many beds of the Jurassic are so full of bones of reptiles, with coprolites and other phosphatic materials, as to be used for the manufacture of manures. Many bone-beds exist in western N. America, and yield remarkable fossils belonging to extinct races; the 'big bone lick' of Kentucky is another celebrated example. In caves a red earth is often found containing many bones of animals which lived there, or had been dragged thither by beasts of prey; this is generally known as bone earth. See PHOSPHATES; COPROLITES; Hutchinson's *Extinct Monsters* (1892), and *Creatures of Other Days* (1894); Boyd Dawkins's *Cave Hunting* (1874).

**Bone-black**, or ANIMAL CHARCOAL, is obtained by heating bones, from which the fat has been removed by a solvent or by boiling, in retorts from which air is excluded. The bone-black contains phosphate and carbonate of

lime, with about 10 per cent. of carbon, in a state of very fine division. Its principal use is in sugar-refining, a solution of raw sugar filtered through it being completely decolourized.

**Bone Manure.** It is chiefly for the phosphates which they contain that bones are valuable as manure; but they contain also about 4 per cent. of nitrogen, when employed in the raw state. According to the degree of fineness to which the bones are ground or crushed, they are spoken of as half-inch bones, quarter-inch bones, and bone meal. The more finely divided forms are quicker in action and less lasting in effects. The half-inch bone is said to require about seven years for complete disintegration in the soil. Raw bone contains from 43 to 49 per cent. of phosphate of lime. Bone is usually applied to pastures at the rate of about half a ton per acre. By a process of fermentation, effected by mixing them with clay and urine, bones are rendered more immediately valuable as manure, through the partial conversion of insoluble into soluble phosphate. Boiled and steamed bones are those from which the gelatin, and consequently much of the nitrogen, has been extracted by heat. They are much more quickly decomposed in the soil than is the case with raw bones. So-called dissolved bones, or bone superphosphate, is the form of bone manure in which the phosphate has been converted into soluble superphosphate by treatment with sulphuric acid. To make bone superphosphate, place a ton of ground bones in a wooden tank, add about fifty gallons of water, and then add about an equal volume of oil of vitriol mixed with its own bulk of water. In a few days add enough ashes or peat to absorb any excess of fluid. This may be applied at the rate

of about a quarter of a ton per acre. Bone ash (the residue left from burnt bones) is largely used as a phosphatic manure, and contains about 75 per cent. of phosphate. It is chiefly imported from S. America, and is employed in the preparation of bone ash superphosphate. The phosphates are essential to nearly every plant's growth, but their effects are most noticeable in the case of turnips and allied species.

**Bone Oil, ANIMAL OIL, DIPPEL'S OIL, or OIL OF HARTSHORN,** distilled from the retorts in the preparation of bone-black, is a dark brown, evil-smelling liquid containing ammonia, sulphuretted hydrogen, and a number of organic bases, particularly the closed-chain compounds, pyrrol, pyridine, and their derivatives.

**Boner, CHARLES** (1815-70), English poet and traveller, born at Bath; lived on the Continent from 1840, and was, after 1865, correspondent at Vienna and other places of the *Daily News*; died at Munich. He published *Chamois Hunting in the Mountains of Bavaria and in the Tyrol* (1853; new ed. 1860); *Verses* (1858); *Forest Creatures* (1861)—i.e. the game of Germany; *Transylvania: its Products and its People* (1865). He also translated several of Hans Andersen's fairy tales—*A Danish Story-book* (1846), *Nightingale* (1846), *The Shoes of Fortune* (1883). See *Memoir and Letters of Charles Boner* (2 vols. 1871), and *Memorials* (2 vols. 1875).

**Boner, ULRICH**, writer of fables, a native of Bern, flourished in the second quarter of the 14th century. He compiled the oldest book of fables in German, his *Edelstein*, to serve as a 'talismán' against the evils and errors of the world. There are a hundred fables, taken from the Latin col-

lections of Avianus and the *Anonymus Neveleti*; they are told in simple language, not without grace, and each has its moral, often far-fetched, and in some cases even incongruous. There is a critical edition by Pfeiffer (1844), and some modernized selections have been prepared by Oberbreyer (1880) and Pannier (1895).

**Bo'ness.** See BORROWSTOUNNESS.

**Bonfire** ('bone-fire,' 'fire of bones'), probably originating in the funeral pyre. Bonfires were lighted in early times to avert plagues or evil spirits, and became connected with ceremonial observances (*cf.* the lighting of fires on Midsummer Eve). The burning of effigies in such fires may be a relic of propitiatory sacrifices. Firmly rooted in the pagan mind, they were adopted and consecrated by the church: thus, in the Catholic Church the new fire is blessed at Easter, and in the Orthodox Greek Church lighted tapers are carried at that festival. Modern bonfires are lighted on occasions of public rejoicing, as at the jubilee, the King's accession, etc. The signalling by bonfires at the time of the Spanish Armada, and the bonfires still lighted on Guy Fawkes Day (November 5), deserve mention. See BEACON; BELTANE.

**Bonga**, tn., Abyssinia, cap. of Kaffa, 400 m. w.s.w. of Harar; trades chiefly with the Galla countries.

**Bongar**, a name sometimes applied to certain poisonous snakes of the genus *Bungarus*, one of which is the deadly *krait* or *krait* of India. The snakes of this genus are closely allied to the cobra. The *krait* (*B. candidus*) is dark brown or bluish black above, with bands or spots of white or yellow, and uniform white below. The length does not exceed 4 ft. It is very com-

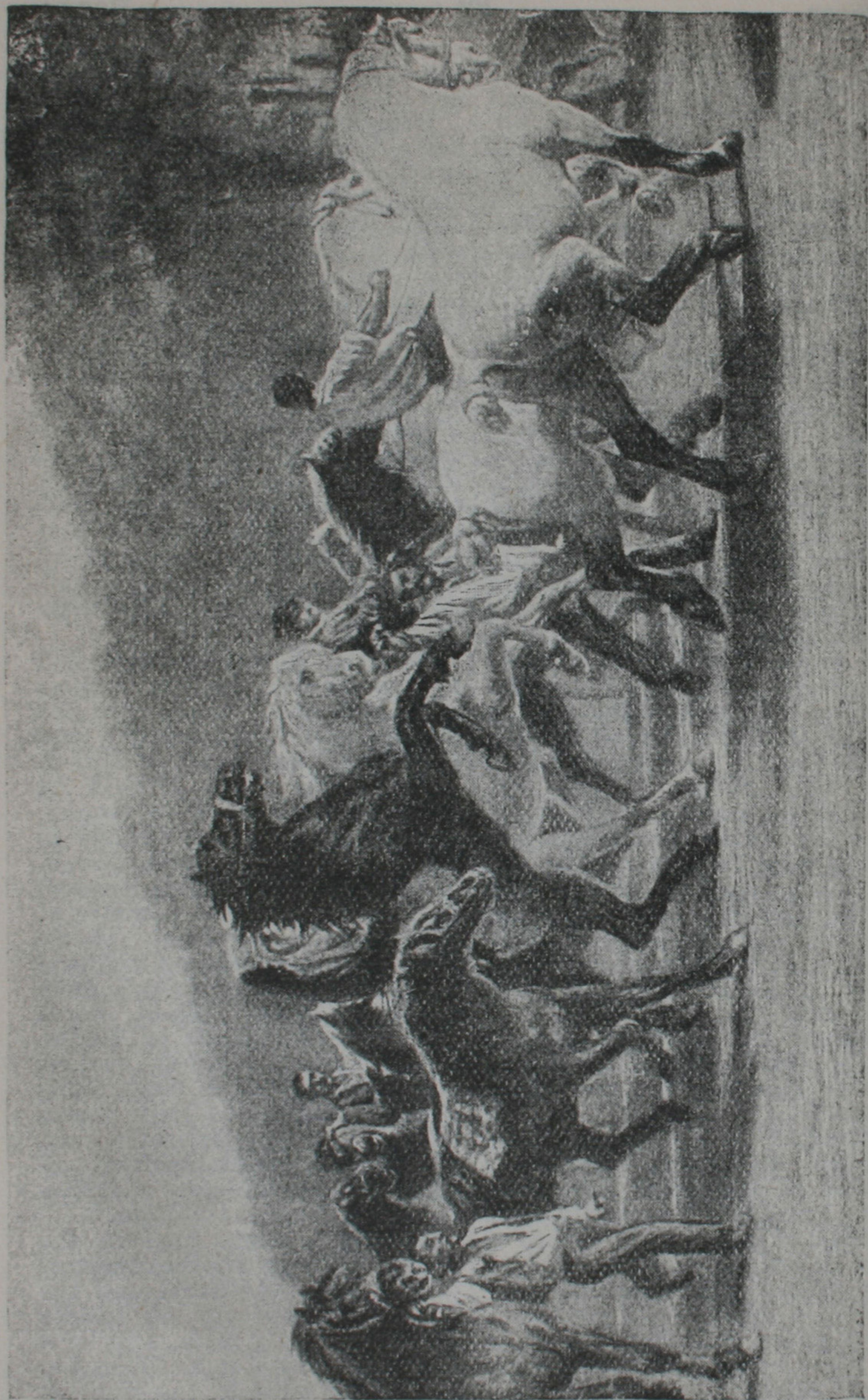
mon in Bengal and S. India, and is said to cause more deaths than any other Indian snake.

**Bongardia**, a genus of the barberry family. One species only is known, *B. Rauwolfii*, a small, stemless plant, found in Greece, Syria, Persia, and Afghanistan, with a tuberous underground root-stock. The Persians roast or boil the tubers for food; the leaves are eaten like sorrel.

**Bon Gaultier Ballads**, parodies of modern poetry written by Professor W. E. Aytoun and Sir Theodore Martin (1840-4). They were reprinted from *Blackwood's Magazine*, and went through thirteen editions between 1855 and 1857. The pseudonym 'Bon Gaultier' was that adopted by Martin when he wrote in *Fraser's Magazine* and *Tait's Edinburgh Magazine*.

**Bonghi**, RUGGERO (1826-95), Italian scholar, political writer, and statesman, was born at Naples, and took an active part in the political events of 1847-9. Between the years 1859-77 he held various chairs of philosophy, classics, and ancient history at Pavia, Turin, Florence, Milan, and Rome. In 1860 he entered Parliament, and was minister of education from 1874-6. Thereafter he devoted himself to literature. His numerous works include *Storia di Roma* (1884-6), *Storia dell' Europa durante la Rivoluzione Francese* (1890-4), various biographies (*Vita di Gesù*, 1890; *Arnaldo da Brescia*, 1884), translations of Plato, Aristotle, etc., and essays on contemporary politics. He was a regular contributor to the *Nuova Antologia*.

**Bongo**, a negro race in the Sudan, between the head-waters of the Bahr el Ghazal and the Ubangi. They are of middle stature, strongly made, and have a reddish-brown skin. They exhibit some skill in the working of iron.



*The Horse Fair (central portion). By Rosa Bonheur.*



**Bonham**, co. seat of Fannin co., Texas, U.S.A., 75 m. N.N.E. of Dallas. Has cotton-seed oil and flour mills and machine shops. Pop. 5,000.

**Bonheur**, ROSALIE or ROSA (1822-99), French painter of animals, was born at Bordeaux, but early moved (1830) to Paris. Her habit was to study animals not only in their anatomy, but also in their passions. With this object she frequented markets and slaughter-houses. She was eighteen when her first picture was exhibited at the Salon, and in 1848 she painted her famous *Attelage Nivernais*, now in the Luxembourg. After the exhibition of 1855 she rarely exhibited. The *Horse Fair* was painted in 1853; the original is in the New York Museum, and a replica in the London National Gallery. In 1855 the cross of the Legion of Honour was conferred on her by the Emperor Napoleon III. She painted in Spain and Scotland, but her usual residence was near Fontainebleau. Many of her pictures are in England, four being in the Wallace Collection. See her *Reminiscences*, ed. by Theodore Stanton (1910), and Roger-Milès's *Rosa Bonheur* (1900).

**Bonhill**, par. and tn., Dumbar-tonshire, Scotland, on the Leven, adjoining Alexandria. Has calico printing and bleaching. Smollett was a native. Pop. par. 15,000; tn. 3,500.

**Boni**. (1.) GULF OF, in the Dutch E. Indies, separates the two southern peninsulas of Celebes. (2.) Native state, situated on E. side of the s.w. peninsula of Celebes (w. of Gulf of Boni); yields cassia, rice, and sago. The people are Buginese, and are skilful workers in gold and iron. The capital is Boni, on the coast. Pop. of state, 200,000.

**Boniface**, the name of nine popes. BONIFACE I., bishop of Rome (418-422), was a contem-

porary of St. Augustine, who dedicated to him his *Quatuor Libri contra Duas Epistolas Pelagianorum*.—BONIFACE III. was consecrated Pope in February 607, and died in October of the same year. He obtained from the Emperor Phocas recognition of the headship of the church at Rome.—BONIFACE V. (619-625) enacted a decree by which churches became places of refuge for criminals. He did much for the Christianizing of England, and four of his letters relative thereto are reproduced in Bede's *Eccles. Hist.*—BONIFACE VIII., BENEDICT CAJETAN (1294-1303), born at Anagni, was a man of great ability. He strongly upheld the temporal as well as the spiritual power of Rome, and was involved in disputes with the Colonnas and Philip the Fair of France, whom he excommunicated. He was proceeding to interdict the whole of France when he was made prisoner at Anagni, and although released almost immediately by the populace, the shock proved fatal.—BONIFACE IX., PIETRO TOMACELLI (1389-1404), quarrelled with Richard II. of England regarding the collation of benefices. During his reign Clement VII. asserted his right to the Popedom, and held his court at Avignon.

**Boniface**, ST. (680-755), the monastic name of Winfried, archbishop, and the great 'Apostle of Germany,' a native of Crediton, Devonshire. Trained in Benedictine monasteries at Exeter and later at Nursling, he was ordained priest. In 718 he went to Rome, where he was commissioned by Gregory II. to the heathen nations of Germany, and laboured as missionary for thirty years. He was consecrated to the bishopric in 723, and founded four cathedrals—Erfurt, Buraburg (near Fritzlar), Eichstätt, and Würzburg—and established episcopal sees at Freising, Passau,

and Regensburg. Gregory III. appointed Boniface archbishop and primate of all Germany; he was chosen archbishop of Mainz in 746, but resigned the see in 754, in order to devote himself more fully to the evangelization of the heathen. During an open-air confirmation service in Friesland in 755, Boniface and his converts were massacred by the populace. His remains were finally buried at Fulda, where he had founded the celebrated monastery. There is a *Life of Boniface* by Willibald (in *Monumenta Germanicæ Scriptorum*, vol. ii. 1829), and his *Letters* have been edited by Giles (1844) and Jaffé (1866). See also Mabillon's *Life of him* (1708); Dunham's *Hist. of the Germanic Empire*, vol. ii. (1835); and C. Merivale's *Conversion of the West* (1878).

**Bonifacio.** (1.) STRAIT OF, narrow, rocky passage, difficult of navigation, 7 m. wide, between Corsica and Sardinia. (2.) Town, s. coast, Corsica, 16 m. s.s.w. of Porto Vecchio. It has a coasting trade and coral fisheries. Pop. 3,800.

**Bonington, RICHARD PARKES** (1801-28), an English artist whose youth was spent in Paris, was a romantic painter in the days of classical influences, a friend of Delacroix, and deeply influenced by his great contemporary Constable. His landscapes (especially in water colour) and his historical paintings are famous for their brilliancy of colouring. Bonington also drew sketches for lithography, and sometimes drew on the stone. The National Gallery, London, has one painting; the South Kensington Museum, two landscapes in oil and seven drawings; the Wallace Collection has thirty-four oils and water colours—a very representative series of his historical and landscape work. See Muther's *History of Modern Painting* (1895-6), and Chesneau's *Eng. School of Painting* (1884).

**Bonin Islands**, Japanese volcanic group, Magellan Archipelago, N. Pacific, about 24° N. and 142° E., divided into four clusters—viz. Coffin Is., Beechey Is. (principal, Peel I., with Port Lloyd, which has a good anchorage), Kater I. and adjacent rocks; and Parry Is. The European and Polynesian half-breeds, and the Japanese colonists who inhabit the group, catch turtle and sharks (for their fins and oil). The Japanese used these islands as a penal settlement from 1593 to 1725, and in 1876 took definite possession of them.

**Bonito** (*Thynnus pelamys*), a fish allied to the Mediterranean tunny, found abundantly in temperate and tropical seas. Like its ally the mackerel, it is an active, predaceous animal, its chief food being flying-fish.

**Bonivard, FRANÇOIS DE** (1493-1570), the original of Lord Byron's *Prisoner of Chillon*, was born at Seyssel of an ancient Savoyard family, and in 1510 succeeded his uncle as prior of the Cluniac monastery at Geneva. Owing to his hostility to the Duke of Savoy, he was seized in 1530, and spent six years in the castle of Chillon, during four of which he was underground. Released by the Bernese in 1536, when they wrested Vaud from Savoy, he returned to Geneva, and became a Protestant. In 1542 the city commissioned him to compile its history, a task which he completed in 1550. But Calvin found both style and matter wanting, so that the *Chroniques de Genève* were never printed till 1831 (best ed. 1867, by Revilliod). The work is uncritical, diffuse, and partial.

**Bonjem**, small oasis, hinterland of Tripoli, N. Africa, on direct track between that town and Sokna, 210 m. s.e. of Tripoli. Contains Roman buildings in excellent repair. Visited by Edward Dobson (1901).

**Bonn**, tn., prov. Rhineland, Prussia; has a charming situation on the l. bk. of the Rhine, 21 m. S.S.E. of Cologne by rail. It is the seat of a university, with 3,600 students. The most conspicuous building is the minster, an example of late Romanesque architecture, completely restored since 1875. Other noteworthy structures and institutions are the university (1818); the provincial (Rhenish) museum, built 1889-93; the museum of the Academy of Arts; the municipal museum; the castle of Poppelsdorf, which contains the natural history collections of the university; Beethoven's house, since 1889 a museum; the house of Arndt; and the bridge across the Rhine, 1,417 ft. long, built in 1896-8. Behind the town rises the hill Kreuzberg (410 ft.), crowned by a famous pilgrimage church. Bonn has an agricultural high school and a botanic garden. It is an episcopal see of the Old Catholics. Bonn is the *Castra Bonnensia* of Tacitus, one of the chief Roman camps on the Rhine. It was almost destroyed by the Elector Frederick III. of Brandenburg in 1689, and was besieged by Marlborough in the war of the Spanish Succession. Its fortifications were demolished in 1717. Pop. 85,000.

**Bonnat**, LÉON JOSEPH FLORENTIN (b. 1833), a celebrated French painter. He began to exhibit in the Salon in 1857, and his genius declared itself in the *Pilgrims at the Foot of the Statue of St. Peter* (1864). His *Assumption* (1869) is at Bayonne, his *St. Vincent de Paul taking the Place of a Galley Slave* (1866) in St. Nicholas des Champs, his *Christ on the Cross* (1874) in the Palais de Justice, Paris, and his *Martyrdom of St. Denis* in the Pantheon. But his fame rests chiefly on his portraits, remarkable for energy and keen insight. Among his subjects

have been Victor Hugo, Thiers (Louvre), Puvis de Chavannes, Pasteur, Dumas, Renan, Ferry, Grévy, and Cardinal Lavigerie (Luxembourg). See Van Dyke's *Modern French Masters* (1896); Brownell's *French Art* (1902).

**Bonner**, EDMUND (?1500-69), bishop of London, who, through the patronage of Cardinal Wolsey, came to be of great service to Henry VIII. in his controversy with the Pope (1532-4). In 1539 he was elected bishop of London. Under Henry he maintained the principle of royal supremacy; but under Edward VI. he resisted the claim of the Privy Council to uncontrolled authority in church and state, and was confined in the Marshalsea prison from 1549 to 1553. On the accession of Queen Mary he was restored to his bishopric. Refusing to take the oath of supremacy (1559) to Elizabeth, he was again sent to the Marshalsea, where he died. See Burnet's *Reformation* (1679-1715).

**Bonnet**. (1.) A headdress for men and boys, usually soft, and distinguished from the *hat* by the absence of brim. The bonnet has been retained in Scotland in three forms—the 'braid' or Lowland bonnet, made of milled woollen, without seam or lining; the glengarry, or Highland bonnet, which rises to a point in front (till recently the undress cap of the army and volunteers); and the Balmoral, flat, and resembling the Lowland bonnet. Local magnates of Scotland who wore the 'braid bonnet' were dubbed 'bonnet lairds.' (2.) A headdress of women worn out of doors, distinguished from a hat mainly by the want of a brim, and by its covering no part of the forehead. The earliest head gear of the women of Britain was a felt or woollen cap called *hæt*, worn by the higher class of Anglo-Saxons. This was superseded by a hood or

veil, which lasted till the reign of Edward III., when hats first became general; but with the accession of Richard II. they were discarded in favour of coloured hoods. Velvet headdresses were usual in the reign of Henry VIII.; French caps were fashionable in the reign of Elizabeth, who introduced the ermine bonnet, which was 'forbidden to all but gentlewomen born.' Since that time changes in the style of hats and bonnets have been innumerable. See article 'Headdress' in Fairholt's *Costume in England* (1885).

**Bonnet, CHARLES DE** (1720-93), naturalist, was son of a French family settled at Geneva. His first work was the *Traité d'Insectologie* (1745), which was permeated by the philosophical idea, then so powerful at Geneva, of the interdependence of all parts of the universe, physical and moral. In 1754 appeared his *Recherches sur l'Usage des Feuilles dans les Plantes*, a treatise on vegetable physiology, followed later by *Considérations sur les Corps Organisés* (1762). In his *Essai de Psychologie* (1755) he sought to show the links between the moral and the physical world. His teaching is most perfectly summed up in his *Contemplation de la Nature* (1764)—of which it has been said that it might have been called the *Esprit de la Nature*—and in his *Palingénésie Philosophique* (1769-70), dealing with the immortality of all men and animals. He was strongly opposed to Voltaire and Rousseau. See *Mémoire* by Trembley (1794), and *Sa Vie et sa Ouvres* by the Duc de Caraman (1859).

**Bonneval, CLAUDE ALEXANDRE, COMTE DE** (1675-1747), French soldier, descended from a noble family in Limousin. Having received a commission (1706) in the Austrian army, he fought against France (1706-12), and under Prince Eugene against

Turkey (1716-17). Exiled for insulting the Marquis de Prié (1724), he became an officer (Ahmed Pasha) in the Ottoman army. Once more he made enemies, who procured his banishment to Chio (1738); but he was recalled, and died at Constantinople. His supposed autobiography (Lond. 1806) is not genuine. See Prince de Ligny's *Mémoire sur le Comte de Bonneval* (1817), and Vandal's *Le Pacha Bonneval* (1885).

**Bonneville Lake**, a former great inland sea of the United States of America, covering portions of Nevada, Utah, Oregon, and California, of which the Great Salt Lake is a remnant. It was over 350 m. in length and 1,000 ft. deep.

**Bonney, THOMAS GEORGE** (1833), English geologist, born at Rugeley; emeritus professor of geology in University College, London; was educated at St. John's College, Cambridge. He was president of the Geological Society (1884-6); Hulsean (1884), Boyle (1890-2), Rede (1892) lecturer, and president of the British Association (1910). He is an honorary canon of Manchester. Among his works are *The Alpine Regions* (1868), *The Story of our Planet* (1893), *Charles Lyell and Modern Geology* (1895), *Ice Work* (1896), *Volcanoes* (1898), and 4 vols. of *Sermons*.

**Bonny.** (1.) Town, W. Africa, on the S. coast of the colony of S. Nigeria, 80 m. E. of the mouth of the Niger. It exports palm oil. Pop. about 7,000. (2.) River, one of the E. mouths of the Niger, falling into the Bight of Biafra; formerly a notorious haunt of slave traders.

**Bonomi, JOSEPH** (1739-1808). British architect, was born of Italian parents in Rome. In 1789 he was elected A.R.A. His designs were chiefly in the style of Grecian architecture. His

most celebrated buildings are the Italian villa at Roseneath in Dumbartonshire, Langford Hall in Shropshire, and Dale Park in Sussex.

**Bonomi**, JOSEPH, the younger (1796-1878), draughtsman and sculptor, was the son of the above. His hieroglyphic drawings are second only to those of Wilkinson. He illustrated the important Egyptological works of Wilkinson, Birch, Hay, and Sharpe. He also published a book on Nineveh, and wrote valuable papers on obelisks and other Egyptian monuments.

**Bononia**. (1.) Now Bologna, Italy. (2.) Now Boulogne, in the N.W. of France; anciently the chief port of departure for Britain. (3.) The Latin name for Widdin, a town of Bulgaria.

**Bonorva**, tn., Sardinia, 25 m. S.S.E. of Sassari; with medicinal springs. Pop. 6,000.

**Bonpland**, AIMÉ (1773-1858), French naturalist, born at La Rochelle; travelled with Alexander von Humboldt in America (1799-1804), and was director of the gardens of Josephine at Malmaison (1805-14). Appointed professor of natural history at Buenos Ayres in 1818, he was seized by Francia, dictator of Paraguay, while engaged on scientific work on the Paraná, and kept a prisoner (1821). After his release (1829) he devoted himself to agriculture, first in Brazil, and later in Argentina. His works include *Plantes Equinoxiales* (1805-18, with 140 plates) and *Monographie des Mélastomacées* (2 vols. 1806-23, with 120 plates). See Brunel's *A. Bonpland* (3rd ed. 1872).

**Bonsignori**, or BUONSIGNORI, FRANCESCO (1455-1519), Italian painter of the Veronese school; called the 'modern Zeuxis,' from the lifelikeness of his work. Many of his pictures from the Mantuan collection belonged,

after the catastrophe of Mantua in 1630, to Charles I. Other important works are Madonnas with saints in the Pinacotheca at Verona (1488), and in S. Fermo at Verona; a portrait of a man in Pitti Gallery, Florence (attributed to Giacomo Francia); portrait of Elizabeth, wife of Gonzaga, Duke of Mantua, in Uffizi Gallery, Florence (ascribed to Mantegna); the Venetian Senator in the National Gallery, London, etc. See Vasari's *Lives of Italian Painters* (1895).

**Bonstetten**, ALBERT VON (c. 1441-1504), a monk of the great Benedictine monastery of Einsiedeln in Switzerland (elected dean in 1470), who in 1479 wrote (in Latin and German) the first *Description of Switzerland* (first ed. 1836; best ed. that of Büchi, 1893, together with his letters and other writings). He also wrote a treatise on the *Banishment of Justice and other Virtues* (1470), an account of Charles the Bold's wars (1477), various works relating to Einsiedeln and its patron saint Meinrad, and a history of the house of Austria (1491). See *Life* by Büchi (1889).

**Bonstetten**, KARL VICTOR VON (1745-1832), Swiss littérateur, a scion of one of the great patrician families of Bern, was profoundly influenced by Rousseau. Later he visited England, and was a friend of the poet Gray. In 1768 he entered political life at Bern. Named in 1779 governor of Saanen (Gessenay), he wrote *Lettres Pastorales sur une Contrée de la Suisse*, describing this charming region. In 1787 he was transferred to Nyon, but showed himself too liberal on the outbreak of the French revolution, and retired in 1792. From 1795 to 1797 he ruled (for the Confederation) the Italian bailiwicks of Lugano, Locarno, and Val Maggia, of which he wrote a pleasing description (1797). Re-

tiring once more into private life, he spent three years (1799-1801) in Scandinavia with his friend Frederica Brun, with whom he later (1802-3) made a long journey in Italy. In 1803 he settled at Geneva, where he associated with Madame de Staël and the historians of Switzerland, Johannes von Müller and Zschokke. His most famous work is *L'Homme du Midi et l'Homme du Nord* (1824), one of the earliest treatises on the influence of climate on the characters of various peoples—the south, in his view, being far inferior to the north. He also wrote his *Souvenirs* (1831). See *Lives* by Steinlen (1860, in French), Morel (1861, in German), and R. Willy (1900).

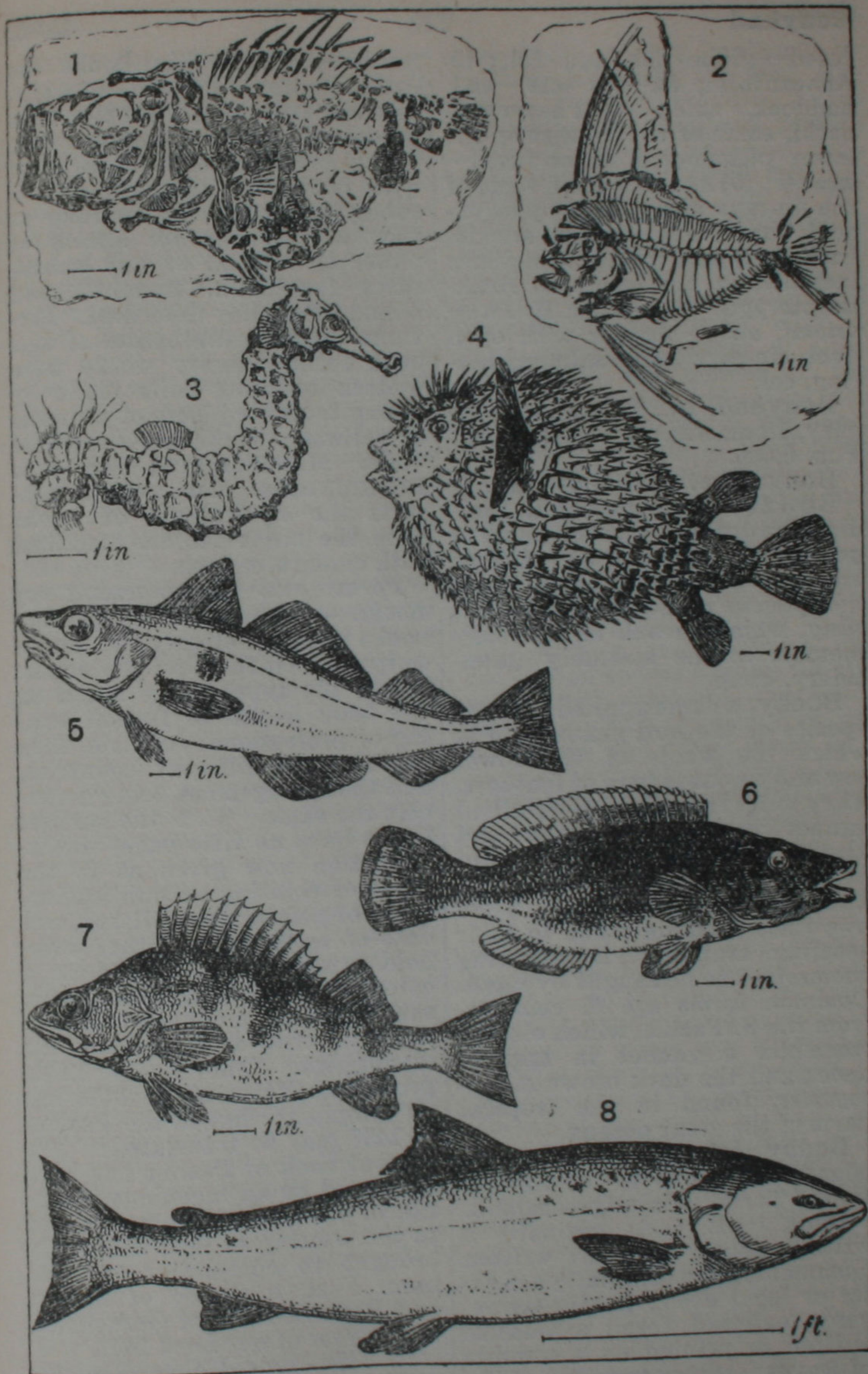
**Bonus**, sum paid to proprietors of shares as supplementary to the regular dividend. Bonuses usually arise out of the undivided profits of former years, or are occasioned by exceptional transactions; in such cases the directors are unwilling to create a precedent by raising the nominal dividend. For the question whether a bonus belongs to the liferenter of the shares or to the person ultimately entitled to them, see *Bouch v. Sproule* (12; Appeal Cases, 385). The bonus given by an insurance company is an addition made to the amount insured for under a life policy. The amount is determined by the profits of the company as ascertained by periodical valuation.

**Bonvalot**, PIERRE GABRIEL (1853), French traveller, born at Epagne, Aube. He explored Central Asia in 1882, Persia and the Pamirs (1885-7), Siberia to Tongking with Prince Henri of Orleans (1889-90), Ethiopia in 1897, and Central Asia again in 1900-1. His chief works are *En Asie Centrale: I. De Moscou en Bactriane* (1884), and *II. Du Kohistan à la Caspienne* (1885); *De*

*Paris au Tonkin* (1892); *L'Asie inconnue* (1896).

**Bonvin**, FRANÇOIS SAINT (1817-87), French painter and etcher. His earliest successes were achieved with portraits. He treated lamplight effects with great success, notably in *A Woman Eating* (1848), *The Etcher* (1873), and in the water-colour drawing *The Woman Watching* (1877). His subjects are interiors, still life, and figures, studied with great refinement and realism. Most of his work belongs to private owners, but the museums of Rodez, Niort, and Arras have fine examples; also in the Luxembourg at Paris, *The Servant at the Fountain* and *The Refectory*. See Brownell's *French Art* (1902).

**Bony Fishes**, or TELEOSTEANS, an important order of fishes, including the vast majority of living forms. Since their first appearance, apparently in Jurassic times, they have increased in numbers, until at the close of the Secondary epoch they acquired the numerical superiority which they have never since lost. Ganoids and teleosteans are very closely related, and it is believed that the bony pike is the nearest living representative of the stock from which the latter arose. As special teleostean characters, are to be noted the soft scales, the completely bony skeleton, the usually homocercal or even-lobed tail, the swim-bladder, the absence of a spiral valve in the intestine, the existence of an anus instead of a common opening for food-canal and urino-genital organs, together with some less obvious anatomical peculiarities. The classification is a matter of difficulty; the following is based on that of Günther:—Sub-order A. *Physoclysti* (duct of swim-bladder closed): (1) Lophobranchii, with tufted gills—e.g. sea-horse, pipe-fish; (2) Plectognathi, bones of upper jaw



*Bony Fishes.*

1. *Hoplopteryx Lewesiensis* (fossil). 2. *Semiophorus velifer* (fossil). 3. Sea-horse. 4. Globe fish. 5. Haddock. 6. Cook wrasse. 7. Perch. 8. Salmon.

fused—globe-fish, sun-fish; (3) Anacanthini, fin-rays soft—cod, haddock, sole; (4) Pharyngognathi, some of the fin-rays spiny, lower pharyngeal bones fused—wrasse; (5) Acanthopteri, some of the fin-rays spiny, lower pharyngeal bones free—perch, stickleback. (4) and (5) are sometimes included in one group as Acanthopterygii. Sub-order B. *Physostomi*, swim-bladder with open duct, fin-rays soft—salmon, herring, eel.

**Bonyhad**, tn., Tolna co., Hungary, 18 m. N.E. of Fünfkirchen. Pop. 6,000.

**Bony Pike.** See GAR-PIKE.

**Bonze**, a member of a Buddhist fraternity; but the name is generally applied to any Asiatic monk or priest. It comes from a Japanese pronunciation of *fan sūng*, which means an ordinary member of the assembly (monastery, etc.).

**Booby**, a name applied to those species of the bird genus *Sula* in which the whole of the lower jaw and throat is bare of feathers. They differ from the closely-allied gannet in this character, and also in breeding in trees instead of upon rocks, and in being confined to warm climates. They owe their common name to their seeming stupidity in allowing themselves to be caught by hand. Common forms are *S. cyanops*, from the S. Pacific, which closely resembles a gannet in appearance; and the dark brown *S. leucogaster*, found in the tropical parts of the great oceans.

**Booby Island**, small, rocky island, dangerous to the navigation of Torres Strait, Queensland.

**Book** (O.E. *boc*), originally a writing-tablet; then any written document, more especially a charter or legal deed; finally (as regards external form) a treatise written or printed on a number of leaves fastened together at the back and in some kind of binding

(without which thin books are called pamphlets); and, by transference, the literary matter thus preserved. Literary manuscripts, which are sometimes contrasted with books, are properly only a subdivision of them, so long as they are written on sheets of paper or vellum, or any substitutes for them, fastened and bound as already described. Previous to the introduction of this book form, literary works were written on long rolls made by gluing together pieces of papyrus or vellum. These are described under MANUSCRIPTS; see also BOOKBINDING. In ancient Assyria the equivalents of books were the stone tablets inscribed with cuneiform texts.

*Form and Arrangement of Books.*—The earliest printed books imitated closely the manuscripts which they quickly superseded, the types being based on the book-hands, or formal writing of professional copyists, then prevalent in different countries, and the arrangement being generally the same. Thus the earliest books have no title page, the information now given as to the place of printing or publication, name of printer or publisher, and date of issue, being either withheld altogether or placed in a colophon or crowning paragraph, such as author or copyist had been wont to write at the end of his manuscript. The Latin Bible printed at Mainz about 1455 has no colophon; that in the Psalter of 1457 may be translated: 'The present book of Psalms has been fashioned by an ingenious invention of printing and stamping, and to the worship of God diligently brought to completion, by Johann Fust, a citizen of Mainz, and Peter Schöffer of Gernsheim, in the year of our Lord 1457.'

In 1470 Arnold ther Hoernen at Cologne printed on a separate leaf a nine-line paragraph con-



taining the title of a Latin sermon and its date, and by about fifteen years later title pages had become common, though the two earliest English examples, that of *A Passing gode lityll boke necessarye and behovefull agenst the Pestilens*, printed at Machlinia, and of *The Chastysynge of Goddes Chyldern*, issued from Caxton's office probably after his death, both date from about 1490-1. For more than a century after this the colophon struggled with the title page for the right of giving the fullest information about the book. Both colophons and (when they came into use) title pages were frequently decorated with the mark or device of the printer, and subsequently of the publisher. The earliest printer's device is the two shields of Fust and Schöffer in the Mainz Bible of 1462; but the use of such devices spread less quickly in Germany than in Italy and France, in both of which countries they attained great beauty, the Italian designs being mostly conventional, while the French often introduce the figure of the printer's patron saint, the arms of the town, or the sign of his house. English devices were in many cases copied from the French. In the 16th century the printer's device became less important than that of the publisher, and gradually both died out, until the revival of English printing in the second half of the 19th century restored them both to occasional use. When not decorated by a device, title pages in the 16th century often displayed a woodcut illustration, and in the 17th the entire title page was frequently engraved on copper.

In most early books the leaves are left unnumbered, leaf numeration being first used by Arnold ther Hoernen at Cologne in 1471, making its way gradually,

and being slowly replaced by pagination during the 16th century. The preliminary leaves containing the author's preface or introduction, dedication, etc., were for a long time left unnumbered, and the use of Roman numerals for preliminaries and Arabic for the text is quite modern. To facilitate the work of the binder, the writers of manuscripts had been wont to mark successive sheets of their books with the letters of the alphabet, further indicating the order of the leaves in the sheet by numbering some or all of those in the left-hand half of the sheet. The use of these signatures was introduced into printed books by John Koelhoff at Cologne in 1473, and has continued to the present time—the letters J and U, which had no separate existence in the 15th century, and W, which was not recognized in Roman founts, being still omitted. In early Italian books a summary of the signatures was often given in a register at the end of the book.

Very elaborate printed capitals in the proper sense of the word—*i.e.* large initial letters at the beginnings of chapters or sections of a book—were used in Fust and Schöffer's Psalter of 1457; but throughout the 15th century spaces were frequently left blank for them to be filled in by hand, a small letter being sometimes printed to guide the rubricator. The *De Regimine Principum* of Ægidius Columna, printed by G. Zainer at Augsburg in 1473, has not only printed capitals, large and small, but also headlines, chapter headings, and paragraph marks, all of which were frequently left to be added by hand in much later books. Decorative capitals became usual about 1490, and held their place in large books for rather over a century. The illustration of books forms the subject of a separate article.

The first printer of these was Albrecht Pfister at Bamberg, in 1461; and after 1470 they became common in Germany, and in another ten years in other countries also.

*Size of Books.*—This is determined primarily by the number of times the sheets of paper used in a book are folded, and secondarily by the trade names of the sizes of paper used. In a folio the sheet is folded only once, to form two leaves; in a quarto twice, to form four; in an octavo four times, to form eight. Other recognized sizes are duodecimo (12mo), sextodecimo (16mo), octodecimo (18mo, a French size), vigesimo - quarto (24mo), trigesimo - secundo (32mo), etc. When hand-made papers are used, the true size of a book, even when cut down in binding, can be told by the position of the wider water-lines—those in folios, octavos, 24mos, and 32mos being perpendicular; those in quartos, 12mos, and 16mos horizontal.

In the 15th century books were mostly published in large or small folio or quarto. In 1501 Aldus popularized octavos by beginning a series of editions of the classics in his newly-invented italics; in 1532 Sebastian Gryphius brought sextodecimos into fashion with a similar series of classics in smaller type; while a still smaller size, the 24mo, came into vogue at the end of the century. The duodecimo was a popular English size in the 18th century. The great majority of English books are now in octavo. See H. Bouchot's *The Book* (trans. 1890); C. T. Jacobi's *Some Notes on Books and Printing* (1902); A. W. Pollard's *Last Words on the Hist. of the Title Page* (1891), and *Early Illustrated Books* (1893); W. Roberts's *Printers' Marks* (1893); *The Localization of Books by their Bindings* (Biblio. Soc. Trans. viii., 1907);

and C. Davenport's *The Book* (1907). See also *Cambridge Hist. of Eng. Lit.*, ch. xviii., vol. iv. (1909).

**Bookbinding.** HISTORY.—Binding begins when the sheet of parchment or paper, instead of being rolled, is folded so as to form leaves of uniform size, the uncut sheet consisting of two, four, eight, twelve, or more leaves, according to the number of folds. Threads are then passed through each sheet where the folds come, and fastened at the back, strips of leather, string, or tape being attached to them, and glued on to the boards which form the covering of the book. The earliest English bindings which have come down to us date from about the 10th century, the boards being made of wood and covered with deerskin or other leather, on which numerous small stamps, from half an inch to an inch in size, containing figures of animals or conventional designs, have been impressed. By arranging these small stamps in circles, rectangles, and other patterns, the binders of Winchester, Durham, Oxford, and London, in the 11th and 12th centuries, produced excellent effects, and the English binders of this period were the best in Europe. Large panel stamps were subsequently used in France and the Low Countries, and were introduced into England in the 15th century. They are found on numerous books of the time of Henry VIII., some of them bearing the royal arms, others figures of saints or conventional designs. In the 12th and 14th centuries the boards of very valuable books, more especially copies of the gospels for use in church, were covered with carved ivory or metal, and frequently studded with gems. The famous 'Lindau Gospels' thus ornamented in gold and jewels, belonging to the Earl of Ashburnham, was sold to

Mr. J. Pierpont Morgan in 1901 for £10,000. Towards the end of the 15th century the use of gold leaf in the decoration of bindings was introduced into Venice from the East; and under the patronage of Jean Grolier (who became treasurer of the duchy of Milan in 1510), Tommaso Maioli, and other wealthy book-lovers, many beautifully decorated bindings were produced in Italy in the first half of the 16th century. On the return of Grolier to France the French school of binding speedily attained excellence, and, by the work of such artists as Nicolas and Clovis Eve (fl. 1560-90), Le Gascon (c. 1620), Du Seuil, Monnier, and the successive members of the families of Padeloup and Derôme, continued pre-eminent till nearly the end of the 18th century. In Germany, where many good bindings in white pigskin were executed in the 16th century, gold-tooling arrived late, and never developed any originality. In Holland, Le Gascon found imitators in Poncyn and Magnus of Amsterdam. In England, with the assistance of Italian workmen, Thomas Berthelet, printer and bookbinder to Henry VIII., turned out some excellent bindings; and, under the patronage of Archbishop Parker, the workmen of John Day established a heavy and dignified English style, well suited to large folio volumes. Under both the Tudor and the Stuart kings various styles of embroidery were applied to bindings, the gaudy little prayer books in embroidered satin of the reign of Charles I. being quite inaccurately associated with the work done in the religious house maintained by John Ferrar and the Collets at Little Gidding. No embroidered bindings can be traced to this establishment, the books bound there being decorated with ordinary binders' tools

(mostly obtained from Buck of Cambridge), stamped sometimes on velvet, sometimes on leather. Under Charles II. the royal binder, Samuel Mearne, freely copied Le Gascon, his designs being often excellent. Their general effect is pleasing, especially when the tooling is combined with inlays of different coloured leathers. From the frequent use of a design, the top and bottom of which dimly resemble a roof, the bindings of Mearne and his successors are often spoken of as forming the 'cottage' style. In the first half of the 18th century many handsome bindings in red morocco, with a centre ornament in gold tooling, were executed for Robert Harley, Earl of Oxford. At the end of the century the work of Roger Payne combined, for the first time in England, originality, fine taste, and consummate workmanship. During the 19th century binding all over Europe suffered from the slavish imitation of old designs, varied by occasional attempts to introduce a larger style of decoration suitable for ornamenting the cloth cases of popular books.

**MODERN INDUSTRY.**—The requirements of modern publishing have made cheaper and speedier methods necessary, and practically every operation may now be performed by machinery. Modern bookbinders divide their work into the following sections:—(1) Folding the sheets into 'signatures,' gathering and collating these, sewing or stitching, endpapering, and trimming; (2) making the case or cover; (3) blocking or decorating the case or cover, also called 'finishing;' (4) gluing, rounding, and backing the book, and putting on the case or cover: these processes are included under the term 'forwarding.' *Folding* of small quantities is still done by hand. The printed sheets are cut into a convenient

size and folded once, twice, thrice, or four times, according to the number of pages in the sheet. The hand folder uses no tool except a small piece of wood or bone, like a paper-knife. Before a fold is made care is taken that the pages are placed exactly opposite each other, or 'in register.' The section of a book folded in each sheet is commonly known as a signature, and the usual signature contains sixteen pages; for thin papers, thirty-two pages. The technical name of each size of book is determined by the number of folds. (See article BOOK above.) Folding machines are now devised to make one fold (for a sheet of four pages), two folds (for eight pages), three folds (for sixteen pages), four folds (for thirty-two pages), and also to do the more unusual folds for twenty-four pages, forty-eight pages, etc. The simplest type of machine for ordinary bookwork makes three folds, and produces a folded signature of sixteen pages. To secure correct 'register,' the sheets are fed by the operator so that the edges are in contact with 'guides' at the front and side, or are 'pointed'—*i.e.* tiny holes, perforated in the sheet in the process of printing, are placed over steel points on the feeding-board of the folding machine. The feeding may also be done by an automatic attachment to the folding machine. The most efficient of all bookfolding machines is the quadruple (an American invention), which folds a sheet of sixty-four pages, cutting it into four sections of sixteen pages, each of which is delivered into a separate trough at the rate of from forty to forty-five large sheets per minute.

*Gathering.*—The folded signatures must next be gathered in complete books. This operation is done either by hand or by gathering machines, which have long rows of boxes for the signa-

tures, and moving fingers which take out one signature at a time. They deposit these in proper order on a moving band, and forty complete books can thus be gathered in a minute. Gathered books must next be *collated*—*i.e.* looked over to see that the sections are in their proper order.

*Sewing and Stitching.*—Hand-sewing is done in frames across which are stretched in a vertical position the cords or tapes on which the books are to be sewn. Small holes are sawn in the backs of the signatures, and through these the sewer passes the needle in and out round the cords or tapes. It would be impossible to explain or illustrate all classes of book-sewing machines, but it will suffice to mention the two most commonly used. The first is the machine generally used for bookwork. The operator feeds the signatures on a radial arm which carries them into the machine, where they are firmly sewed. The second machine is a wire-stitcher which cuts off from a reel a small piece of wire, forms it into a staple, forces it through the paper, and turns over the ends of the wire. These ingenious machines can wire-stitch a book one inch in thickness.

*End-papering.*—At the front and back of the book a strong paper, called 'end-paper' or 'waste-paper,' is now fixed. By this the book will afterwards be pasted to its cover.

*Trimming.*—After sewing, the books have their edges trimmed (unless bound with uncut edges) on a guillotine. The simplest form of guillotine is a metal table with guides to place the books in proper position, a press (platen) to hold them firmly, and a descending knife to cut the edges. In this form of machine books must be inserted three times to get their 'heads,' 'tails,' and 'fore-edge' cut. Other forms

have been devised with either one or two knives in which the books are placed on turn-tables, all three edges being cut consecutively, without moving the books.

*Gluing.*—The trimmed books are now glued on the back with a brush, to harden them and make them more solid.

*Rounding and Backing.*—When the glue is dry, the books are ready for the next two operations—viz. rounding the backs, a term which explains itself; and ‘backing’—*i.e.* making the little projections at the side against which the cover opens as on a hinge. These operations are done in small binderies by hammering the glued backs roughly into a curve, then fixing them in a vice and passing a roller over the backs. In large binderies the two operations are performed at once by a rounding and backing machine.

*Linings.*—The next operation is the pasting on of mull or paper, or both, to the rounded back to give additional strength to the book. When this is done the book is ready for *casing*.

*Case-making.*—In binding ordinary cloth books, the covers or ‘cases’ are made before they are attached to the books. The materials required are coloured cloth, straw boards for the sides, and thick paper to stiffen the back. All these are cut to the exact size required. The cloth is glued with a brush, the boards and stiff paper are laid on by gauges, and then the edges of the cloth are turned over, a piece being cut off each corner to prevent a thick fold. Case-making is now done in large binderies by machines. The operator feeds the cloth to guides. The machine glues it, places the boards and stiff paper in position, and completes the case.

*Finishing the Case.*—Modern cloth books must receive some

ornament on the covers, and this is done either by the hand work already described or by machine-‘blocking.’ By this latter method metal stamps, on which the design for the back and sides is cut, either emboss the cover or print it with ink or gold. In the gold process, known as ‘gold blocking,’ leaves of very thin gold are laid on the covers at the spots where a gilt design is required; the design is then stamped in with a hot metal stamp, and the surplus gold leaf not impressed by the stamp is brushed off the cover.

*Casing.*—The book being now ready for its cover, and the cover being prepared for the book, there remains only the operation of pasting the two together. After being pressed for a few hours, the book is ready for delivery.

It would be impossible to describe in detail the progress of many other classes of work which pass through binders’ hands. A few words may, however, be added about some distinctive features of other work with which every reader is familiar.

*Edges.*—Ordinary cloth work has plain edges either trimmed, as already described, or ‘deckle-edged’—*i.e.* rough and uncut—when an antique paper has been used. Very often, however, trimmed edges are dyed with red or some other colour, or ‘sprinkled’ with spots of mixed colours. These coloured edges, again, may be either dull or ‘burnished’ by hand.

Many fine books are bound with gilt edges or gilt tops. The books, after trimming, are fastened in a press; the edges are scraped smooth, and sized; gold leaf is then laid on, and when dry is burnished with a tool by hand till it shines brightly. In Bibles, etc., a colour is washed over the edges before gilding, producing the beautiful ‘red under gold’ edges.

*Leather Binding.*—In the finest

work, or when great strength is required, a leather cover is not completed separately from, but, as it were, built up round the book, and finished when attached to it. In recent years, however, leather bindings have become so common that most of the leather covers are now made and finished separately like cloth cases. In the old-fashioned way the leather cover adhered to the back of the book, but was made so supple that the book opened freely. In the more modern style of leather binding, as in ordinary cloth work, the back of the book and the back of the cover are not fixed together, and when the book is opened they curve in opposite directions and a hollow appears between them; hence the expression 'hollow back.' The cheapest leathers in use for bookbinding are split sheepskins (commonly known as 'skivers'). Next come sheepskins of the full thickness of the hide; then persians—the skins of Persian goats; and lastly fine moroccos. The persians, moroccos, and other fine leathers have beautiful natural grains, but the same appearance is given to both fine and common leathers by stamping them in a machine with a metal plate. See LEATHER.

Leather bindings may be roughly divided into (1) full leather or 'bound' books, in which the whole cover is leather; (2) 'half-bound' books, with leather back and corners, the rest of the cover being paper or cloth; and (3) 'limp' books. In the two first classes the basis of the cover is a stiff board; in the third the cover is made as flexible as possible. Bound and half-bound books are generally made with 'hollow backs,' but in limp leather bindings, which have recently become very popular in Dent's Temple Classics, Nelson's New Century Library, etc., the

covers are always pasted to the backs of the books.

*Loose-leaf Binding.*—Within comparatively recent date a new and ingenious method of binding has been adopted—the 'loose-leaf' system—whereby leaves may be added or removed by a simple mechanical arrangement. The device is chiefly valuable in works of reference like encyclopædias, where it is important to keep the matter perpetually up to date. Probably the best example of the loose-leaf binding is Nelson's comprehensive bibliography entitled *Standard Books* (1910).

*Bibles.*—A very large proportion of leather binding is done for Bibles and Prayer Books. For an example of fine leather bindings done in large quantities at cheap prices, nothing is more wonderful than the beautiful flexible Bible work of Eyre and Spottiswoode and other Bible firms. Nearly all Bible work comes under the class of cased work, and the two prevalent styles are known as 'limp' (*i.e.* soft leather covers without flaps) and 'divinity circuit' or 'yapp' (*i.e.* soft covers with a projecting flap turned over to preserve the book). 'Bible work,' and especially Prayer Books, give great scope to the binder for introducing round corners, pretty gold lines, and ornaments both inside and outside the cover, and tasteful linings of paper or leather for the inside of the covers.

*Stationer's Binding,* or the manufacture of account books, etc., is a distinct branch. These books must be specially strong, and the covers are securely fastened to the books at an early stage, and completed while fixed to the books themselves.

A bibliography of works on binding is printed at the end of Miss S. T. Prideaux's *Historical Sketch of Bookbinding* (1893), itself an excellent work. Other good

books are H. P. Horne's *The Binding of Books* (1894); W. Y. Fletcher's *Bookbinding in England and France* (1896); C. J. Davenport's *Royal English Bookbindings* (1896); and *English Embroidered Bookbinding* (1899). The best collections of coloured illustrations of bindings are the *Catalogue of the Exhibition of Bookbindings at the Burlington Fine Arts Club* (1891); *Examples of Bookbindings* (1894); Fletcher's *English Bookbindings in the British Museum* (1895), and *Foreign Bookbindings in the British Museum* (1896). The technical processes of bookbinding are briefly described in Mr. Horne's book quoted above, and more fully in J. W. Zaehnsdorf's *The Art of Bookbinding* (1890), Douglas Cockerell's *Bookbinding and the Care of Books* (1901), also in Stephen's *Commercial Bookbinding* (1910).

**Book Clubs.** Before the growth of circulating libraries clubs were formed in many country towns and districts for the purchase of the best popular books of the day, and their distribution among the members in rotation. At the end of the year the books purchased were mostly put up to auction at a meeting of the club, and the sum realized carried forward to the next year's purchases. Some famous clubs, not for the circulation but for the printing of books (*e.g.* the Roxburghe, Maitland, Abbotsford, and Bannatyne), were formed at the beginning of the 19th century. In 1905 the *Times* founded a book club for the gratuitous distribution of books to subscribers to the paper. What is known as the 'Book War,' which was waged by authors, publishers, and public alike for a couple of years, arose owing to the '*Times* Book Club' selling surplus new books at greatly reduced prices. The most notable instance was

that of *The Life of Lord Randolph Churchill*, which was sold at one-fifth of its published price. The protestations of the booksellers resulted in the rule formulated by the Publishers' Association in conjunction with the Booksellers' Association that *net* books could not be sold to the public below the full price until after the lapse of six months, and then only if secondhand. The 'Book War' was satisfactorily terminated in 1908.

**Book Collecting.** Books are acquired by collectors for their rarity, because they are first editions, or because they are finely printed, bound, or illustrated. Save in the case of the very rarest books, only copies which are perfect, clean, and with their margins uncropped, have any value. The collector's spirit may be traced in the *Philobiblon* of Richard de Bury (d. 1345), and in the 16th century in the zeal with which Archbishop Parker and Sir Robert Cotton secured what they could of the wreckage of the English monastic libraries. During the 17th century interest began to be taken in early specimens of printing. The introduction from Holland in 1676 of the practice of selling old books by auction (the first English library thus sold was that of Dr. Lazarus Seaman) greatly increased collecting, which steadily grew throughout the 18th century, and for a short time at the beginning of the 19th was a fashionable and aristocratic pastime. First editions of the Greek and Latin classics and the finer specimens of 15th-century printing were chiefly sought after by the collectors of that day. The early classics, together with the Aldine and Elzevir editions, declined in value during the century; but all finely illustrated books (more especially illuminated manuscripts and French and Italian early printed editions), specimens of early

printing, first editions of English classics, and books relating to the early history of America, steadily increased, the rise during the twelve years 1891-1902 being especially rapid. Among the most famous English sales of the 19th century were those of the libraries of the Duke of Roxburghe, 1812 (£23,397); Richard Heber, 1834-6 (£56,774); Earl of Sunderland, 1881-3 (£56,581); Wm. Beckford, 1882-3 (£73,551); and Earl of Ashburnham, 1897-8 (printed books, £62,712, exclusive of the MSS. which were sold privately). The Gutenberg Bible (c. 1455) on vellum rose in price from £504 (Nicol's sale, 1825) to £4,000 (Ashburnham, 1897); on paper from £199, 10s. (Sykes, 1824) to £3,900 (Thorold, 1884); and in the case of a copy privately sold by Quaritch, to £5,000; the Latin Psalter printed at Mainz in 1459, from £136, 10s. (Sykes, 1824) to £4,950 (Thorold, 1884); the folio Shakespeare of 1623, from £121, 16s. paid by Mr. Grenville in 1818 to the £1,720 paid at Christie's in 1901. Of the rise in value of books printed by Caxton, the most remarkable instance is that of the Royal Book, of which a splendid copy sold in 1815 for £85, and subsequently in 1819 for £73, 10s., and in 1829 for £61, 19s. In 1901 one copy fetched £1,550; in 1902 another, £2,250. At the Scott of Halkhill sale (March 1905) Caxton's *Chronicles of England* brought £102, in comparison with £45 fifteen years ago. The Kilmarnock edition of Burns has also risen steadily in value, reaching the record price (£1,000) paid for the copy sold privately by Mr. Veitch of Paisley, and secured by the Burns' Cottage Trustees at Ayr (1903), the previous record being that of £572, 5s. paid for the Lamb copy (1898). See the annual volumes of Slater's *Book Prices Current*, Dauze's *Repertoire des Ventés*

(1894), Livingston's *American Book Prices Current* (1895), and Mr. H. B. Wheatley's comprehensive work, *Prices of Books* (1898). On collectors and collecting the best works are Elton's *Great Book Collectors* (1893), Quaritch's *Contributions towards a Dict. of English Book Collectors* (1892-9), Fletcher's *English Book Collectors* (1902), Hazlitt's *Book Collector* (1904), and Pollard's *Books in the House* (1907).

**Book Illustration.** See ILLUSTRATION OF BOOKS.

**Bookkeeping.** Bookkeeping is a method of recording business transactions in such a way that from these records a person may readily ascertain the financial position of a business undertaking or any department of it. A good system of bookkeeping will show the state of any account, whether of ordinary trade debtors and creditors, of goods or property, or of the expenses connected with a business, and will enable a qualified person to make up a statement at any time showing the gain or loss involved, or determine the solvency or insolvency of the business. Correct bookkeeping is essential to enable a merchant to understand his position and the extent of his obligations and resources, and many bankruptcies can be traced to careless or inefficient bookkeeping.

The art of bookkeeping in one form or another must be as old as civilized trading, but its present form can be traced back only to about the end of the 15th century, when it was in use among the merchants of Venice and other commercial cities of Italy; hence the system of double entry was known as the Italian system. In the succeeding century it seems to have gained a footing in England.

There are two systems of bookkeeping used, single entry and



double entry—the former being only a part of the latter, and so incomplete.

*Single Entry.*—In this system only the personal accounts—*i.e.* those dealing with persons, not with property, goods, etc.—are dealt with, and a transaction is only entered once; whereas in double entry each transaction is entered in one account as a debit, and in another as a credit. The single system is much used by small traders, as its simplicity and minimum of trouble recommend it; but its disadvantages far outweigh its advantages in all but the smallest businesses. Some of these disadvantages are, that there is no check against fraud nor against errors and omissions in posting; there is no

The books necessary for single entry are: (1) day-book, in which the sales and purchases are entered; (2) cash-book, in which all cash transactions appear; and (3) the ledger, in which an account is opened for each person to whom goods are sold, or from whom goods are purchased, on credit.

When single entry is used, a proper balance sheet and profit and loss account should be made up once a year, by an accountant, in double-entry form. This, in a rough way, is possible by incorporating information derived from other sources than the ledger.

*Double Entry.*—This is in practice the only satisfactory system of bookkeeping, and well repays the extra trouble entailed in its

SINGLE ENTRY BALANCE SHEET.

<i>Liabilities.</i>		£	s.	d.
1900.				
Jan. 1.	Capital.....	1450	0	0
Dec. 31.	Due to creditors.....	840	0	0
	Balance, being profit...	350	0	0
		<hr/>		
		2640	0	0

<i>Assets.</i>		£	s.	d.
1900.				
Dec. 31.	Due by debtors. ....	1360	0	0
	Goods, etc., on hand....	1140	0	0
	Cash in bank. ....	130	0	0
	„ on hand.....	10	0	0
		<hr/>		
		2640	0	0

means of showing from what department or class of goods the profit or loss has arisen, and, as a consequence, unprofitable business may be nursed, while profitable business may be dropped, with dire future results; nor are the expenses shown in such a way as to enable a comparison to be made between these expenses and the turnover, so that any increased or decreased ratio may be discovered. A balance is simply made up by taking the capital at the beginning of the period, adding to that the present liabilities (if any), and comparing the total with the assets possessed at the end of the period in cash, goods, sums due, etc. The difference between the totals is profit if the latter be the greater, loss if it be smaller.

working. The basis on which it rests is that every debtor (Dr.) must have a corresponding creditor (Cr.), every buyer implying a seller. If A buys goods from B, A must in his ledger give B credit for their value (*i.e.* Cr. B); and as goods are received, the goods account must be charged with the value (*i.e.* Dr. goods).

The account or person receiving anything is always debited, and the account or person parting with anything is always credited. A person is thus *debtor* for what he *gets*, and *creditor* for what he *gives*. The total of the debits and credits in a ledger should thus always be equal, if the posting has been correctly done.

The contraction Dr. is used in practice for debtor or debit, and

similarly Cr. is used for creditor or credit.

The following examples and explanations of the various books will outline the methods of double entry.

*Day-book or Sales-book.*—This is the book into which sales are entered in detail; they are then posted to the debit of the buyer's account in the ledger; and periodically—say monthly—the total of the sales is posted to the credit of goods account, the goods having been parted with.

The *Invoice or Purchase book* is used to record goods bought, and is entered up in the same way as the day-book, substituting 'By' for 'To.' The sums are posted to the credit of the person's account from whom the goods are

are three columns on each side, for discount, bank, and cash; this form shows the state of the bank account at a glance. A cash-book with several columns on each side is useful in saving clerks' time, the receipts and payments being at once classified by entering into the proper columns.

The transactions have been as follows:—On Jan. 11, A. Thomson paid £95 by cheque, and was allowed £5 of discount; on Jan. 13, R. Smith paid £30 in cash, and was allowed £2 of discount; on Jan. 16, G. Park was paid £75 by cheque, and allowed me £11 discount; and on Jan. 17, W. Inglis was paid £5 in cash. Note that all cheques received must be banked in full.

The *Ledger* is the most impor-

DAY-BOOK.

	£	s.	d.	Folio	£	s.	d.
Jan. 10. J. Bruce and Co.							
To goods (give details).....	10	0	0	in			
"      "      "      ".....	10	0	0	Ledger.			
				7	20	0	0
„ 15. R. Simpson and Son.							
To goods (detail).....	..			25	65	0	0
„ 31. J. Robertson.							
To goods (detail).....	..			83	33	0	0
Sales for month: By goods account, folio 50.....					118	0	0

purchased, and periodically to the debit of the goods account.

In the foregoing books the totals have been posted to the goods account, but in practice this account is subdivided into special accounts, and the day-book and invoice-books would be adapted for this object by having several money columns in place of the two shown.

*Cash-book.*—The book into which all cash, cheques, etc., are entered—what is received on the debit side, and what is paid on the credit side: e.g. if B pays an account to you, cash is received; therefore cash must be debited, and B credited with the amount, which is done in posting to B's account. An excellent form of cash-book is one in which there

tant book in bookkeeping. It is not a book of original entry, but to it the entries in all the other books are posted. In it all the recorded transactions are classified. An account is opened for each debtor and creditor of the business (called Personal Accounts); for goods, property, etc. (called Real Accounts); and for such accounts as wages, rent, profit and loss account, etc. (called Nominal Accounts). A ledger account would appear as on page 122.

In large businesses it is convenient to have more than one ledger in use—e.g. Town Ledger and Country Ledger, A-L Ledger, M-Z Ledger, Debit and Credit Ledgers, and so on.

*Bill-book.*—This is generally purchased ready ruled and printed

CASH-BOOK.

Fol.	Discount	Bank.	Cash.	Fol.	Discount	Bank.	Cash.
Jan. 11. To A. Thomson . . . . .	£ s. d. 5 0 0	£ s. d. 95 0 0	£ s. d. ..	Jan. 16. By G. Park . . . . .	£ s. d. 11 0 0	£ s. d. 75 0 0	£ s. d. 5 0 0
" 13. " R. Smith . . . . .	2 0 0	..	30 0 0	" 17. " W. Inglis . . . . .	..	..	..
" " Balance (of dis- count received posted to the Dr. of discount account in ledger) . . . . .	4 0 0	..	..	" " Balance, cash on hand, car- ried forward..	..	..	25 0 0
Feb. 1. To Balances brought forward . . . . .	11 0 0	95 0 0	30 0 0	" " Balance in bank, carried for- ward . . . . .	..	20 0 0	..
	..	20 0 0	25 0 0		11 0 0	95 0 0	30 0 0

from the stationers. It is usually in two sections—one for bills receivable, the other for bills payable; and in it the particulars of each bill are entered—date, currency, when due, amount, etc. The individual bills are posted from it to the Dr. and Cr. of the Personal Accounts, and the totals periodically to Bills Receivable and Bills Payable Accounts in the ledger.

*Journal.*—This book is very useful in double-entry bookkeeping for opening and closing entries, transfers from one ledger account to another, etc.; but by many bookkeepers it is used to quite an unnecessary extent. Its use is mainly to explain why certain accounts are debited and credited—i.e. to preserve a proper record of the transfer. In the following instances the journal would be used: (1.) A begins business with £1,000, which is deposited in bank. (2.) An error is made in posting £20 to the credit of B instead of C. (3.) In balancing the books, goods on hand are valued at £500, and this amount is to be carried forward to begin the new goods account. The Drs. and Crs. in this book are thus always equal.

*Subsidiary Books,* as Wages Book, Petty Cash-book, etc., are necessary in most businesses, and the uses of these are obvious.

*Trial Balance.*—This is simply a statement in two columns of the balances, Dr. and Cr. respectively, on each account in the ledger; and the totals of these columns, if equal in amount, show that the ledger balances; and the presumption is that the books are correct. Cash in hand must be added in to the Dr. column.

*Profit and Loss Account.*—This account, made up from the ledger, shows the gain or loss on the business for the period it includes.

*Balance Sheet.*—This is a statement showing the financial position of the business at a given date.

*Card or Separate Sheet Ledger.*  
—Instead of having the ledger as a bound volume, each account in this system is kept on a separate loose sheet or card, and these are arranged alphabetically. Its use is favoured in America by merchants, insurance offices (cards generally), and other companies, and has several distinct advan-

quently used in business transactions:—  
*Bills, Acceptances, and Promissory Notes* are written agreements, on stamped paper, to pay a sum of money at a particular future date, say one month, three months, and so on. Three days' 'grace' is given before the bill is legally due—*e.g.* if a bill at one

LEDGER ACCOUNT. A. BROWN AND Co.

*Dr.*

Jan. 3. To goods (sold to them)...	£	s.	d.
.. 10. " " " ..	50	0	0
.. 17. " " " ..	20	0	0
	10	0	0
	<hr/>		
	80	0	0
Feb. To balance brought forward.....	10	0	0

*Cr.*

Jan. 25. By cash (received).....	£	s.	d.
Discount (allowed).....	47	0	0
.. 28. " cash.....	3	0	0
Discount.....	18	0	0
.. Balance carried forward .....	2	0	0
	10	0	0
	<hr/>		
	80	0	0

tages. Thus, accounts which are closed, or sheets completed, may be removed, leaving only the active accounts in view. Accounts can be classified or grouped to suit the convenience of the business, and can be apportioned among several clerks; there is also a saving of time in indexing, and especially in doing away with the opening of new ledgers. Against

month is dated February 3, the due date would be March 6. No days of grace are allowed on bills payable 'on demand' or 'at sight.'  
A *Cheque* is a written request to your banker to pay over to 'Bearer' or 'Order' (*i.e.* to the order of the person named therein) the definite sum of money stated on the cheque.

JOURNAL.

Jan. 1. Bank.....	<i>Dr.</i>	£	s.	d.	£	s.	d.
To A, being the capital with which A begins business.....	<i>Cr.</i>	1000	0	0	..	..	..
May 10. B.....	<i>Dr.</i>	..	..	..	1000	0	0
To C, for item posted in error to B .....	<i>Cr.</i>	20	0	0	..	..	..
Dec. 31. Goods new account.....	<i>Dr.</i>	..	..	..	20	0	0
To goods old account, for value of goods on hand..	<i>Cr.</i>	500	0	0	..	..	..
		..	..	..	500	0	0
		<hr/>			<hr/>		
		1520	0	0	1520	0	0

this, of course, must be set the risk of loose sheets getting lost if carelessly kept. Similarly, original entries may be made on cards or slips, and these passed on from one clerk to another to enter from the original record, thus forming a check on the entries and saving much time.

*Capital.*—This is the excess of assets over liabilities, and theoretically is a debt due by the business to the owner thereof. Similarly, in a limited company the capital subscribed by the public—*i.e.* the cash paid by them for shares—is a debt due by the company to the individual shareholders. In the event of a wind-

The following are terms fre-

ing up, all other debts take precedence of this one; and when they are paid, the balance, if any, remains to satisfy the owners or shareholders. Capital may consist of cash, goods, property, etc.

*Partnership* is an arrangement between two or more persons for business purposes. A deed of partnership should be drawn up,

count on the amount of the bill, but also discount on discount: thus, the banker's discount, say at 5 per cent. per annum, on a bill at three months for £400, would amount to £5—*i.e.* £5 is being paid for the use of £395 for three months = £5, 1s. 3d. per cent.

*Goodwill.*—In purchasing a business as a going concern, a sum

PROFIT AND LOSS ACCOUNT.

<i>Dr.</i>			<i>Cr.</i>		
	£	s. d.		£	s. d.
Jan. 1. Office expenses.....	300	0 0	Dec. 31. Goods account (being the balance on this account after allowing for value of the goods on hand).....	1750	0 0
Salaries.....	400	0 0	Discount account (being the excess of discount received over discount allowed).....	50	0 0
Rent and taxes.....	160	0 0			
Bad debts.....	40	0 0			
	900	0 0			
Profit (this added to capital account).....	900	0 0			
	<u>1800</u>	<u>0 0</u>		<u>1800</u>	<u>0 0</u>

defining each person's rights and share in the profits, assets, etc., of the business.

*Depreciation.*—A deduction corresponding with the estimated depreciation of value, through use or otherwise, is made—usually as a percentage each year—from the value of assets such as machinery, office furniture, stock, etc.

varying with the clear annual profit and other circumstances has to be paid for goodwill—*i.e.* for the value of the firm's name and established connection acquired by the purchaser.

The books on the subject of bookkeeping are very numerous, not only on the art generally, but on many special branches of it, as

BALANCE SHEET AT 31ST DECEMBER.

<i>Liabilities.</i>			<i>Assets.</i>		
	£	s. d.		£	s. d.
Sundry creditors.....	1130	0 0	Sundry debtors.....	1200	0 0
Rent accrued, not yet paid.....	30	0 0	Cash in bank.....	200	0 0
Bills payable.....	560	0 0	Cash on hand.....	10	0 0
Capital— <i>i.e.</i> the sum due to the partners of the business.....	2780	0 0	Goods on hand.....	2290	0 0
	<u>4500</u>	<u>0 0</u>	Machinery.....	650	0 0
			Office furniture.....	150	0 0
				<u>4500</u>	<u>0 0</u>

*Discount.*—This is either (1) an allowance, say for prompt cash, made to a buyer, or received from a seller of goods; or (2) a charge for interest and risk made by a banker when a bill is handed to him for collection at its due date, and the amount of which is to be placed to the credit of the customer's account. In bill transactions it includes not only dis-

merchants', shopkeepers', solicitors', stockbrokers', bankers', insurance, etc., bookkeeping. See E. T. Jones's *Bookkeeping by Single and Double Entry*; Carter's *Practical Bookkeeping*; Thornton's *Manual of Bookkeeping*; Pixley and Wilson's *Bookkeeping*; Sarll's *Double-Entry Bookkeeping*; J. W. Heaps's *Antiquity of Bookkeeping*; Pitman and Sons' *Ad-*