ULTIMHEAT®
VIRTUAL MUSEUM

PATENTS FOR INVENTIONS

ABRIDGMENTS OF SPECIFICATIONS

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flame-heated. 159,036. 162,144. 172,207. 173,141. 202,375. 204,736. 209,922. 216,510. 225,571. 227,565. 240,179. 242,160.

other than flame-heated. 163,918. 172,207. 190,528. 225,571.

pressure gauges. *See* Barometric &c. gauges, [*Class* 106 (ii)].

pressure-relieving devices for fluids. *See* Pressure-relieving devices &c., [*Class* 135].

pumps, heating liquid during passage through. *See* Pumps, Reciprocating, &c., [*Class* 102 (i)].

pumps modified for. *See* Pumps, Reciprocating, &c., [*Class* 102 (i)].

regulating heating, thermostats for. *See* Thermostats &c., [*Class* 64 (ii)].

safety arrangements, (*other than* safety-valves *and* pressure-relieving devices for fluids). 234,016.

fusible plugs. *See* Steam generators, [*Class* 123 (ii)].

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Heating water &c.—*cont.*

safety-valves. *See* Valves &c., [*Class* 135].

spray-producers and liquid-distributing nozzles, construction of. *See* Spray-producers &c., [*Class* 69 (iii)].

stove fittings for heating. *See* Stoves &c., [*Class* 126].

stoves and fireplaces, not solely for heating liquids, arrangement and disposition of boilers in. *See* Stoves &c., [*Class* 126].

stuffing-boxes. *See* Stuffing-boxes &c., [*Class* 122 (v)].

submersible heaters. 178,312. 189,633. 193,726. 206,303. 228,926.

surface-apparatus for effecting transfer of heat otherwise than from combustion products, construction of. *See* Surface-apparatus &c., [*Class* 64 (iii)].

tanks and cisterns, of interest apart from heating water, construction of. *See* Tanks &c., [*Class* 69 (i)].

thermostats. *See* Thermostats &c., [*Class* 64 (ii)].

vacuum pans. *See* Distilling &c. liquids, [*Class* 32].

valves and cocks, arrangement and disposition of. *See* water supply &c. *below*.

valves and cocks, construction of. *See* Valves &c., [*Class* 135].

waste heat, utilizing. *See* feedwater &c., heating, (misc.) *above;* Heating systems &c., [*Class* 64 (ii)].

water-circulation, promoting in systems. *See* general arrangement &c. *above*.

water-circulation, utilizing for motive-power purposes. *See* Turbines &c., [*Class* 110 (iii)].

water, purifying and softening. *See* Water &c., Purifying &c., [*Class* 46].

water supply and delivery, (*including* arrangements of valves and cocks for). 158,595. 159,259. 168,713. 172,207. 174,970. 175,272. 186,703. 191,187. 192,432. 193,429. 194,088. 195,325. 198,775. 199,061 [*Appx*]. 199,086 [*Appx*]. 211,930. 213,066. 213,766. 223,223. 233,839. 234,289. 238,510.

interconnecting gas and water valve mechanically. *See* Valves &c., [*Class* 135].

valves, construction and actuation of. *See* Valves &c., [*Class* 135].

wheeled water-heaters for field, camp, and like use. *See* Cooking-apparatus, Field &c., [*Class* 28 (i)].

Washing-boilers and setpans.

Excepting Cauldrons, Asphalt, snow-melting, gravel-heating, and like, (*including* Plant for making tar macadam). [*Class* 107].

alloys for. *See* Alloys, [*Class* 82 (i)].

baths, modified for use as. *See* Baths, [*Class* 26].

burners for heating. *See* Burners &c., [*Class* 75 (i)].

chimneys and flues not forming part of boiler or pan settings. *See* Chimneys &c., [*Class* 25].

Washing-boilers &c.—*cont.*

circulation, promoting. 162,911. 167,993. 174,288. 175,476. 176,473. 176,899. 185,619. 206,600. 208,231. 210,852. 211,046. 214,996. 215,921. 228,031. 228,032. 229,081. 229,755. 243,064.

coverings and compositions, nonconductors of heat. *See* Nonconducting coverings &c., [*Class* 64 (ii)]; Plastic compositions, [*Class* 70].

electroplating. *See* Electrolysis &c., [*Class* 41].

frothing, preventing, (*other than* circulation, promoting). [*No cases.*]

furnaces for. *See* Furnaces &c., Combustion apparatus of, [*Class* 51 (i)].

gas supply for heating, controlling, arrangements and applications of valves for. *See* Burners &c., [*Class* 75 (i)].

heating by electricity. *See* Heating by electricity, [*Class* 39 (iii)].

heating liquids by direct contact with steam and other gases. *See* Heating water &c.; kinds &c. *below*.

heating-surface, modifications of, (*including* structural alterations to bottoms of pans). 163,558. 177,230. 204,736. 204,997. 222,959. 228,032. 229,081. 243,064. 243,172. 243,875.

hinges for lids. *See* Hinges &c., [*Class* 65 (ii)].

incrustation and corrosion, preventing and minimizing. *See* Incrustation &c., Preventing &c., [*Class* 123 (i)].

kinds or types—

fire-heated. 185,619. 207,049. 210,852. 211,353. 226,890. 228,031. 228,714. 229,755. 243,064. 243,172.

gas and oil heated. 177,230. 179,367. 194,037. 198,880. 204,736. 204,997. 206,600. 208,600. 209,363. 209,612. 212,844. 213,150. 222,938. 228,032. 232,694. 243,568. 243,875.

injection of steam, heated by. 175,476. 177,264. 204,736. 209,363.

internal tubes and chambers, heated by. 183,039. 219,617.

jacketed, steam and like, (*other than* water-bath and like indirectly-heated pans). 164,834. 166,531. 196,412. 231,662.

water-bath and like indirectly-heated pans. 164,597. 165,610. 218,575.

lids specially modified and adapted for. 156,703. 162,911. 174,288. 204,997. 207,049. 208,600. 211,353. 222,938. 228,032. 229,755. 243,568.

condensers for vapours. *See* vapours, consuming &c. *below*.

lids not specially modified for. *See* Hollow-ware, [*Class* 66].

liners, baskets, and like arrangements for holding goods treated—

fixed. 177,230. 218,402.

removable. 162,911. 163,573. 164,834. 167,993. 176,473. 187,007. 206,600. 207,049. 210,852. 211,046. 218,402. 228,031. 228,714. 229,755.

liquid supply and delivery. 159,259. 162,911. 163,573. 166,531. 167,993. 209,363. 226,890. 229,755. 231,662. 235,775.

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Washing-boilers &c.—*cont.*

making by electrodeposition. *See* Electrolysis &c., [*Class* 41].

making by operations of interest apart from washing-boilers and setpans. *See separate headings, such as* Casting metals, [*Class* 83 (i)].

materials of pans. [*No cases.*]

miscellaneous—

compartments in pans. 213,150.

scum, removing. 162,911.

with internal handles to facilitate removal. 234,975.

with steam-generating coil in firebox. 177,264.

with strainers for exit pipes. 204,736.

mixing and agitating appliances. *See* Mixing and agitating machines &c., [*Class* 86].

plastic compositions for. *See* Plastic compositions, [*Class* 70].

preserving-pans, feeding. *See* Jam &c., [*Class* 49].

pyrometers for. *See* Thermometers &c., [*Class* 97 (iii)].

Washing-boilers &c.—*cont.*

riveted joints for. *See* Riveted joints, [*Class* 83 (iv)].

settings and supports—

flues, arrangement of. 194,037. 212,844.

other than arrangement of flues, and rims and like supports. 156,703. 163,573. 165,610. 171,042. 175,476. 184,124. 188,572. 203,181. 204,997. 209,612. 211,353. 213,150. 213,167. 227,334. 228,032.

rims and like supports. 179,367. 184,124. 194,037. 208,600. 232,694.

stirrers or agitators for laundry articles. *See* Washing, Domestic &c., [*Class* 138 (ii)].

stoves for. *See* Stoves &c., [*Class* 126].

valves and cocks, construction of. *See* Valves &c., [*Class* 135].

vapours, consuming and trapping. 156,703. 162,911. 163,573. 164,597. 164,834. 179,367. 184,124. 194,037. 198,880. 204,997. 208,600. 209,363. 211,046. 219,764. 228,032. 232,694.

water-level indicators. *See* Water &c. levels, Regulating &c., [*Class* 123 (i)].

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NAME INDEX

The names in *italics* are those of persons by whom inventions have been communicated to the applicants for Letters Patent.

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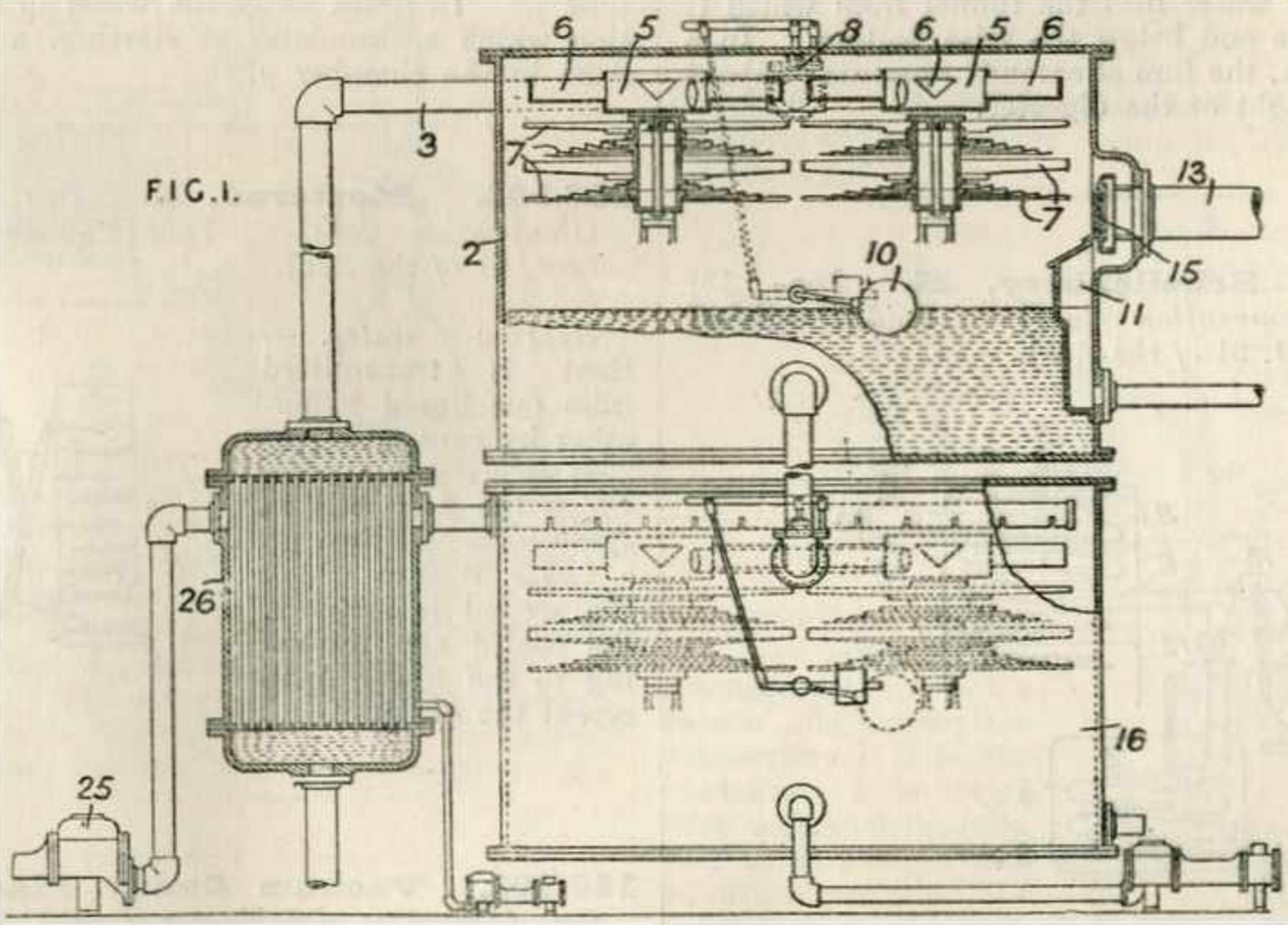
CLASS 64(i)

HEATING LIQUIDS AND GASES

Patents have been granted in all cases, unless otherwise stated. Drawings accompany the Specification where the abridgment is illustrated, and also where the words *Drawings to Specification* follow the date.

PERIOD 1921—25

155,864. Elliott, W. S. July 17, 1919.



Feed-water, heating.—Water to be heated is passed into a chamber 2 by a pipe 3 communicating with pans 5; from these, the water flows into spraying-troughs 6 which discharge on to distributors 7 comprising alternate shallow pans having a central opening and plates having stepped surfaces. Steam enters the chamber 2 by a pipe 13 and impinges against a cap 15 having a number of ribs and against which particles of oil are driven and collect in a chamber 11 below; this chamber also serves as an overflow for excess water, which however is intended to be maintained at a constant level by means of an interconnected float 10 and valve 8.

500. Wt. 108A/348. 7/24. C.P.Leam. Ps 2071.

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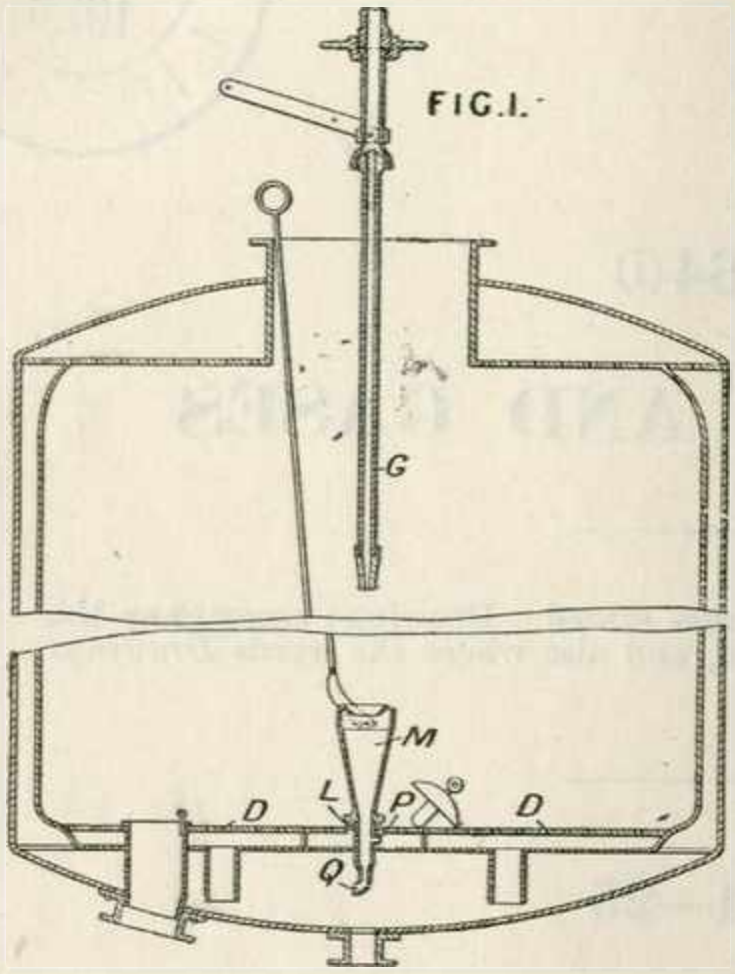
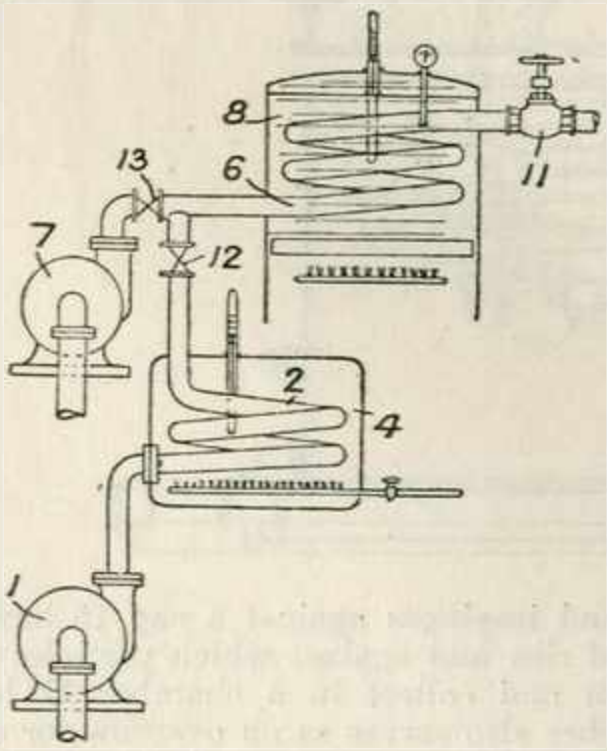
156,025. Wallace, W. M. March 10, 1920.



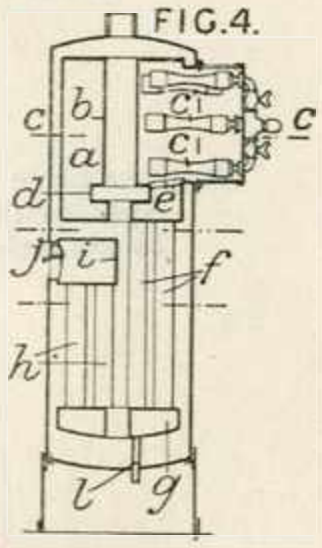
Digesters.—Means for cleaning out digesters comprise a funnel M with one or more outlets P, Q adapted to fit into a closable hole L in the perforated bottom D and a pipe G for directing a stream of water into the funnel from which it passes above and below the false bottom. In a modification, the funnel extends upwards to about half the height of the digester.

156,264. Schellenberg, H. June 13, 1917, [*Convention date*]. *Void* [*Published under Sect.* 91 *of the Act*].



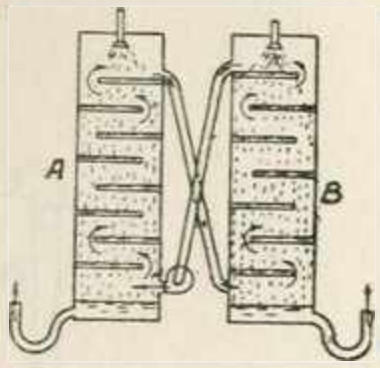
Digesters. — Liquids, solids, or gases which react at high temperatures under pressure are introduced, separately or together, into heated pipes wherein the reaction takes place. The figure shows one form of apparatus in which the reacting materials are respectively forced by pumps 1, 7 into the connected pipes 2, 6, which are provided with valves 12, 13 and are heated in the tank 4 and metal bath 8. The outlet of the product is controlled by the valve 11.

156,432. Cantais, G. Feb. 25, 1920.



Internally-fired boilers. — In a gas-heated boiler for water or steam, the horizontal burners *c* are inserted into the combustion chamber *a* at the upper end of the boiler so that the flames come in contact with the surface next to the hottest water. A flattened conical water chamber *b* in the heating-chamber *a* has an enlargement *d*, forming a cross chamber, on the side of which rests a baffle *e*. The products of combustion circulate around the chamber *b*, down the tubes *f*, into the chamber *g*, and up the tubes *h* to the outlet chamber *i*, escaping through the outlet tube *j*. To drain away the water of condensation which accumulates at starting, a tube *l* is fixed in the chamber *g*.

156,595. Morterud, E. Nov. 7, 1917, [*Convention date*]. *Void* [*Published under Sect.* 91 *of the Act*].



Heating water. — Heat is transmitted from one liquid to another by causing air to pass up a tower A down which the first falls in spray form and then up a tower B into which the second is sprayed, the cooled air returning to the tower A to repeat the cycle.

156,703. Vacuum Candy Machinery Co., (Assignees of *Schlueter, P. H.*). Sept. 5, 1913, [*Convention date*]. *Void* [*Published under Sect.* 91 *of the Act*].

Boiling-pans; digesters.—A furnace 10 and pan 14 can be lowered from or raised to a tight hood 15 by a screw-mounted support 30. The hood 15 communicates with a direct-contact condenser

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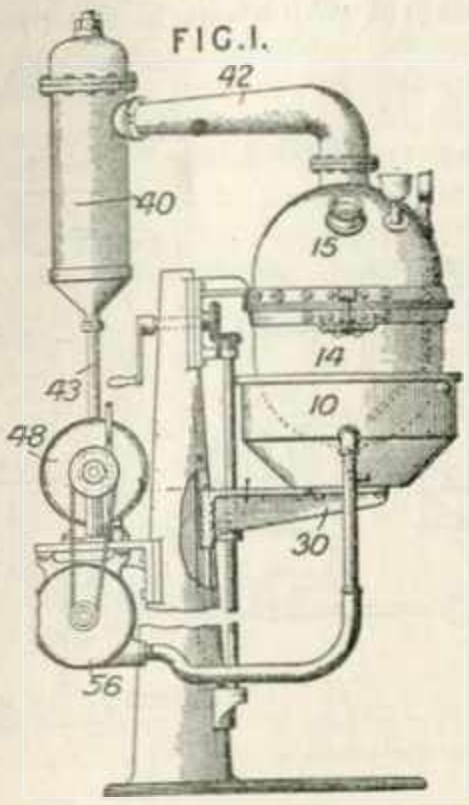
40 by a tube 42. A motor 48 drives a pump connected by a tube 43 to the condenser and may

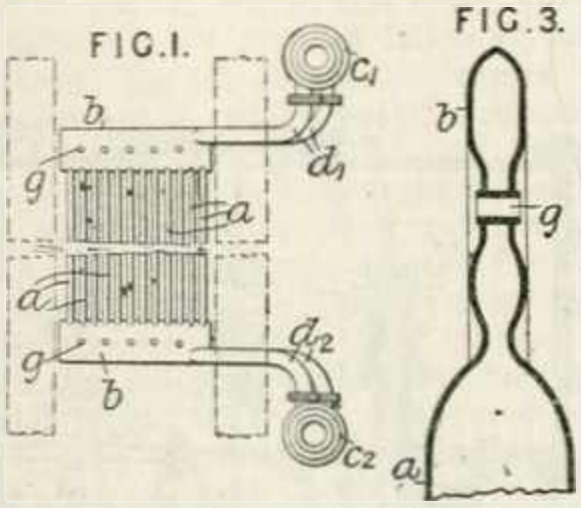
FIG. 1.



drive a fan 56 supplying air to the gas burner in the furnace 10.

157,307. Sulzer Frères, Soc. Anon. April 6, 1918, [*Convention date*]. *Void* [*Published under Sect.* 91 *of the Act*].

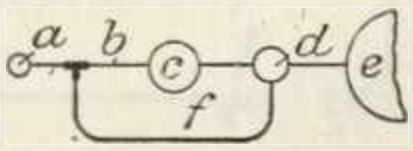
FIG. 1. FIG. 3.



Feed-water, heating.—A heat exchanger is constructed from a series of elements each comprising flat headers *b* connected at their edges by tubes *a*, which may be of elliptical cross-section. The walls of the headers are stayed by tubular rivets *g*. The elements are separately connected by connections d_1, d_2 with outlet and inlet conduits c_1, c_2. The outer heat exchanging medium may flow in a direction parallel to the tubes, entering and leaving the bank between the headers.

157,690. Rushen, P. C., (*Knorr-Bremse Akt.-Ges.*). June 26, 1920.

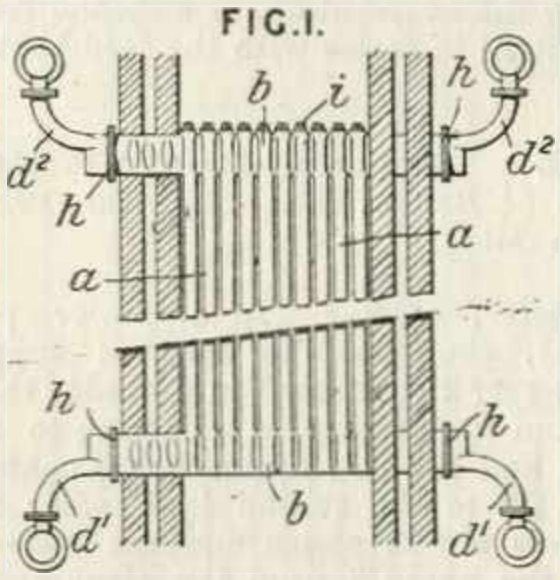
Feed-water, heating.—In an arrangement for feeding a locomotive boiler *e* by means of a piston feed-



pump *c*, the steam supply to the preheater *d*, fitted in the feed-pump delivery circuit, is taken from the steam-pipe *b*, between the stop valve *a* and the pump. If the preheater *d* is not fitted, the pipe *f* opens directly into the feed delivery.

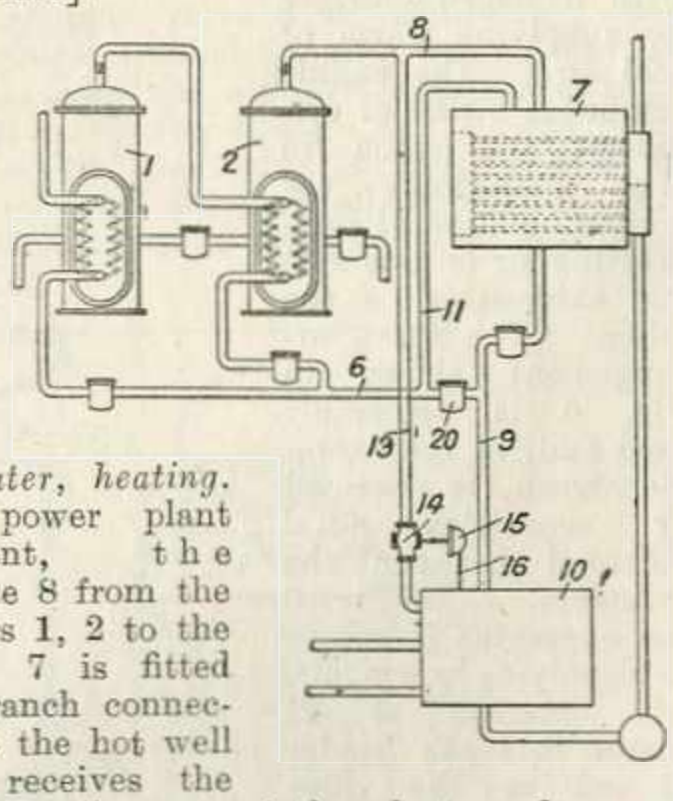
157,901. Sulzer Frères, Soc. Anon. July 30, 1918, [*Convention date*]. *Addition to* 157,307. *Void* [*Published under Sect.* 91 *of the Act*].

FIG. 1.



Feed-water, heating. — Heat-exchangers constructed as described in the parent Specification are provided with closable openings *i* in the headers *b* for the introduction of cleaning devices. The tubes *a* are of circular cross section, and the connecting pipes d^2 have flanged joints *h* with the headers *b*.

158,219. Griscom-Russell Co., (Assignees of *Brown, S.*). Jan. 26, 1920, [*Convention date*].



Feed-water, heating.—In a power plant arrangement, the vapour line 8 from the evaporators 1, 2 to the condenser 7 is fitted with a branch connection 13 to the hot well 10 which receives the exhaust from the rest of the plant, and means are provided, controlled by the temperature of the hot well, for regulating the quantity of vapour delivered thereto. As shown, the condenser 7 functions as a feed-heater, and the branch pipe 13 is provided with an automatic back pressure valve 14, controlled by a diaphragm 15 fitted with a pipe connection to the hot well 10. The tem-

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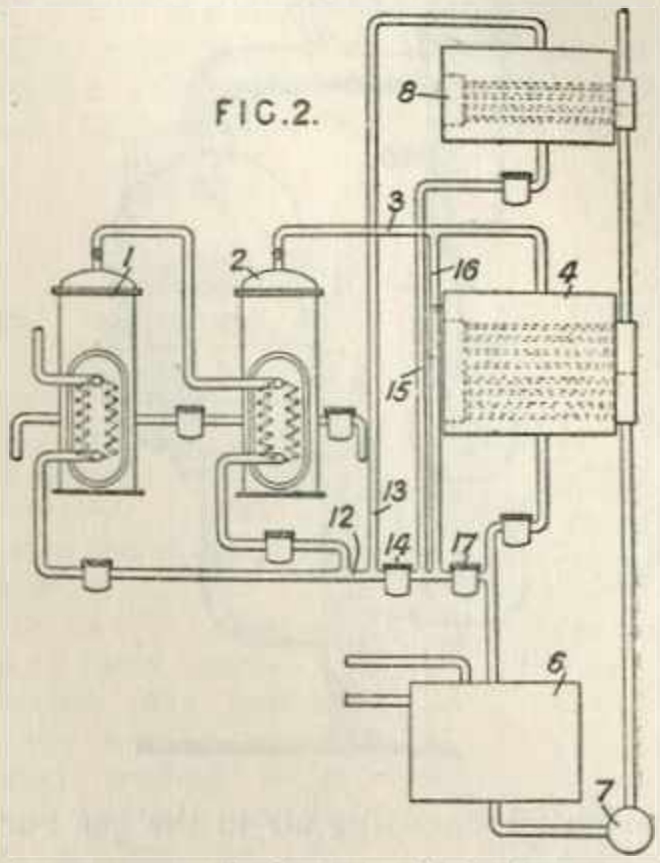
perature of the open heater 20 is maintained at atmospheric boiling point with a consequent minimum size of feed-heater or condenser. The feed-heater 7 has a drain connection 9 to the open heater, the evaporator coil drains being connected to this pipe by the pipe 6. A riser 11 leads from the pipe 6 to the feed-heater 7 so that any excess in temperature of the drains over the feed-heater temperature results in the "flashing" of a portion of the fluid into vapour which passes to the heater as described in Specification 158,220. A part of the vapour in the pipe 8 may be used in a feed-heater for the evaporators, or a second feed-heater may be fitted in series with the feed-heater 7.

158,220. Griscom-Russell Co., (Assignees of *Brown, S.*). Jan. 26, 1920, [*Convention date*].

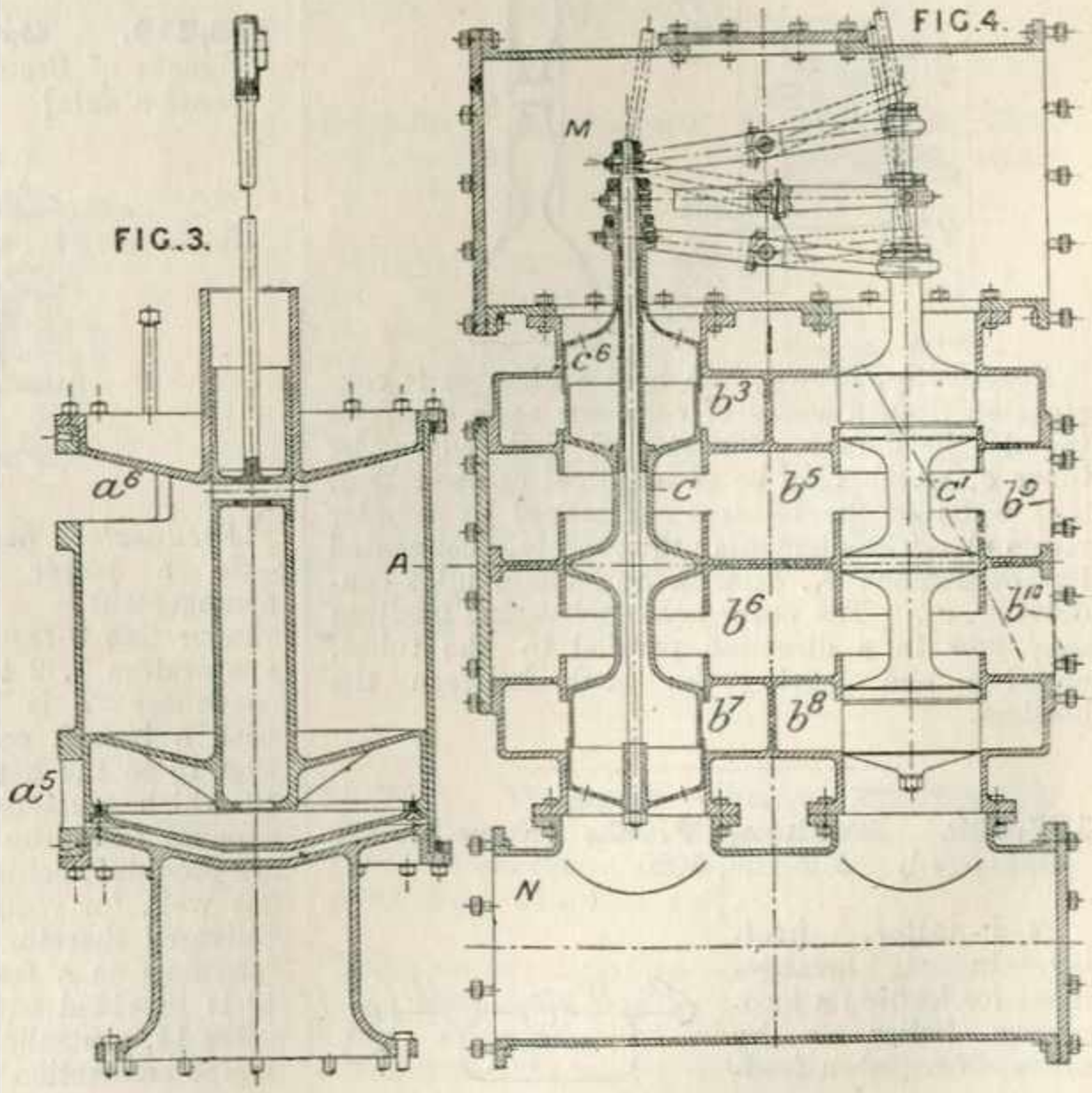
Feed-water, heating.—In a power plant arrangement, the make-up feed is supplied by evaporators 1, 2 connected in cascade, the vapour pipe 3 from the evaporator 2 passing to the feed-heater 4, and the coil drains being connected by pipes 12, 13 to the second feed-heater 8. The feed-heaters are in series and the water is supplied by the pump 7 from the plant open-heater 6 which receives the exhaust from all the main and auxiliary engines. The heater 8 drains to the pipe 12 and a riser 16 is fitted so that if this drain is at a higher temperature than the heater 4 a portion of the liquid "flashes" into vapour and passes as steam to the heater 4, traps 14, 17 being fitted, as shown. The pipe 12 joins the drain from the heater 4 which passes the open-heater 6.



In a modification, both the coil drains are simply connected by separate leads to the heater 8, which drains to the heater 4, the vapour from the evaporator 2 all passing to the heater 4, which is drained to the open heater 6.

158,305. Lanchester, F. W. Oct. 15, 1919.

Heating air.—A thermodynamic engine is used in conjunction with a heat-exchanger for supplying warm or cold air. The engine comprises a pair of cylinders, the piston in each performing the double function of compressing air on one side and exhausting on the other. The valve arrangement shown in Fig. 4 is preferably used and, in the example shown, is operated by eccentrics and mounted between the cylinders. In Fig. 6 the apparatus is shown as supplying warm air. Air entering at P^1 passes into the header M and into the valve chest b^3, Fig. 4, for example, by way of the valve C. Thence it flows through cylinder port a^6, Fig. 3, into the cylinder A above the piston. At the bottom of the stroke



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the air which has been slightly expanded and cooled due to the action of the cut-off sleeve c^6, Fig. 4, is passed back into the valve chest b^3, which is now open to the compartment b^5, and passing to the heat exchanger Q by way of the port b^9 is restored to normal temperature, by water, for instance, returning through the port b^{10} to the compartment b^6. At this time the valve C^1 allows communication between this space and the space b^8 whereas the lower element of the valve C closes the aperture between b^6 and b^7, so that the returned air passes through b^8 to the lower cylinder port a^5 to the space beneath the piston being drawn in by the up stroke. At

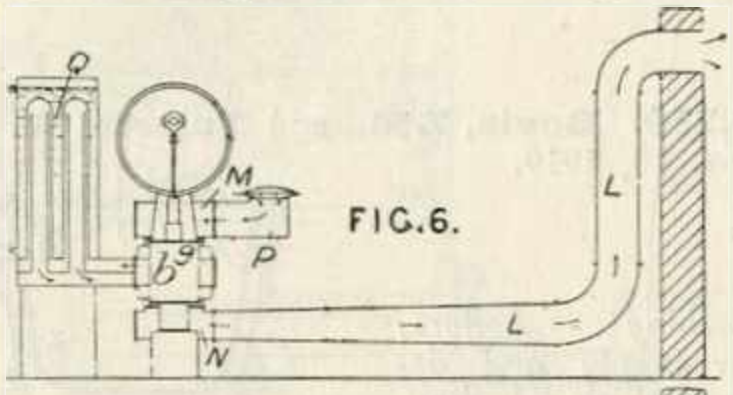

FIG. 6.

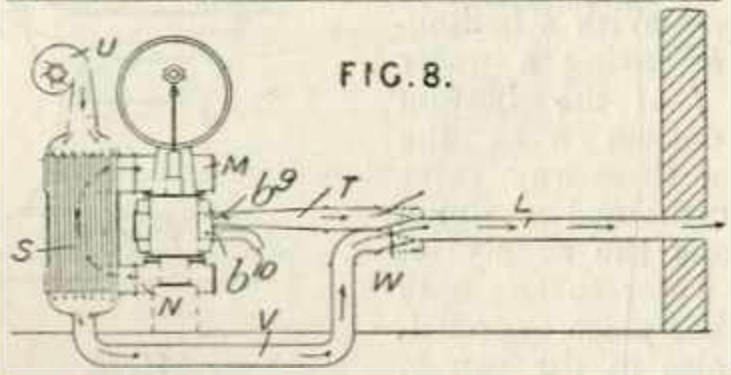

FIG. 8.

the end of the up stroke the lower cut off sleeve of the valve C^1 has not yet fallen so that on the down stroke the air is re-compressed to atmospheric pressure at which point communication is opened between the chest b^8 and the header N and the warmed air is discharged through the ventilating conduit L. The other cylinder is working similarly but in opposite phase. In the modification shown in Fig. 8 the cycle is inverted, air being first compressed, cooled by heat exchange with atmospheric air supplied by the fan U in the exchanger S and ultimately delivered cool by the trunk T. The warmed air from the exchange passes by the conduit V, and a valve arrangement W permits any desired mixture to be supplied.

158,595. Filbar Electric Heater, Ltd. and **Kratt, C.** Sept. 5, 1919.

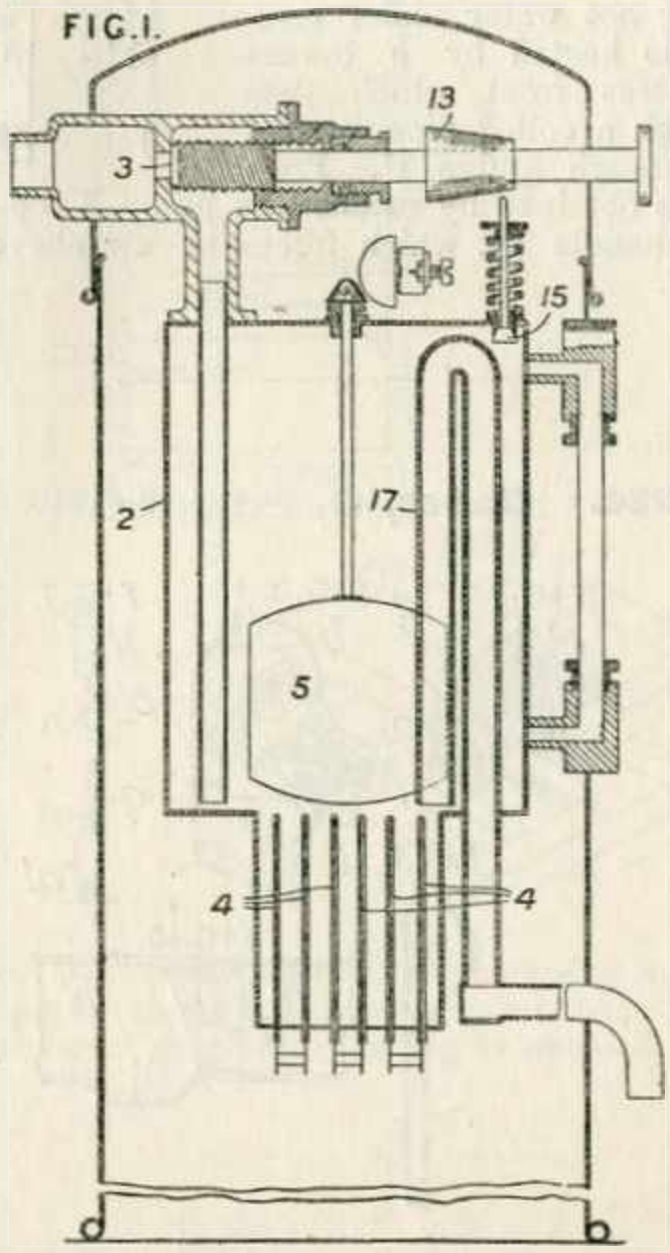

FIG. 1.

Water supply and delivery.—An air release 15 in a container 2 is kept open by a cone 13, while the water-supply valve 3 is admitting water. When a predetermined quantity has entered, the valve 3 is closed and a float 5 rises and switches on current to electric heaters 4. On the generation of steam, the valve 15 being closed the water is delivered automatically through a siphon 17, and the current is interrupted by the falling of the float.

158,800. Smith, D. V. H. March 18, 1920. *Addition to* 144,783.

Water-tube boilers.—In a boiler of the kind described in the parent Specification, the sinuous tubes a^1 are placed closely together and with their bends meeting at the middle of the boiler, thus forming two side flues h^1. The gases flow forwardly through the sides flues and then pass to the outlet at the back of the boiler through an upper flue h^2. The tubes f arranged at the back and bottom of the boiler open into an upper header b^2 in communication with the drum d. The bottom of the drum is connected to the lower ends of the tubes by downcomers o^1.

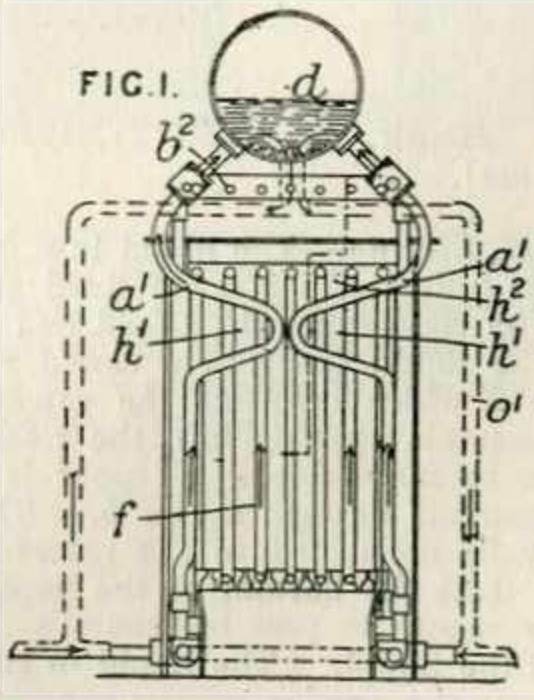

FIG. 1.

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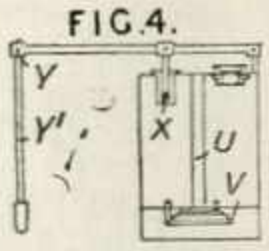
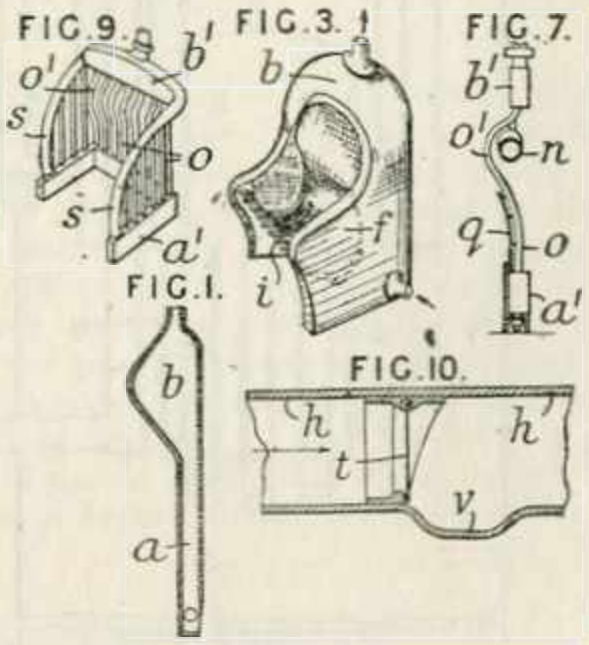
159,036. Squire, R. Nov. 26, 1919.



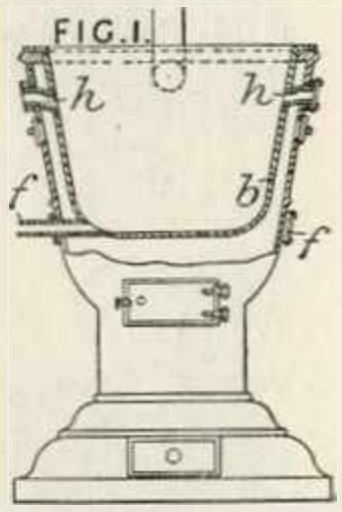
Portable and small liquid-heaters. — Apparatus for supplying hot water under pressure is heated by a burner the gases from which pass through a coiled pipe V and up through a flue U. Pressure is obtained by means of a pump X, operated by a handle Y¹, which forces in air above the liquid.

159,234. Gabet, G. Aug. 6, 1919.

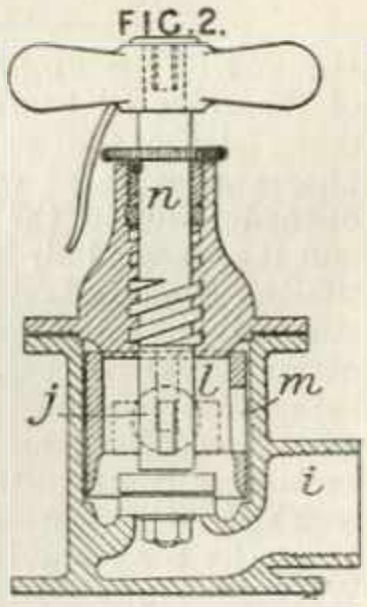


Block or slab form boilers.—The front face or wall of a boiler for domestic and like heating-systems is formed at its upper end with an arcuate or bulged portion arranged at such a height as to form practically no obstruction to the passage of gases &c. to the flue. Figs. 1 and 3 show constructions of boilers of block form comprising a lower part *a* and an upper bulged part *b*, hollow side cheeks *f* on each side of a hearth *i* being incorporated in the latter construction. In the construction shown in Fig. 7, the boiler comprises upper and lower headers a^1, b^1 arranged in vertical line and connected by a series of vertical tubes *o* having bulged portions o^1 at their upper ends. One or more horizontal tubes *n* connecting the outer tubes may be on the inside of the bulges, and a guard *q* may be added to prevent direct contact of the flames with the tubes. The lower header a^1 may be extended as shown in Fig. 9 to form side cheeks, the ends of which are connected to the upper header b^1 by curved tubes *s*. A light non-return flap valve *t*, Fig. 10, may be located in the inlet tube *h* to the boiler adjacent to an enlargement *v* in the tube.

159,259. Bovis, Ltd., and **Tullett, W. E.** Nov. 13, 1919.

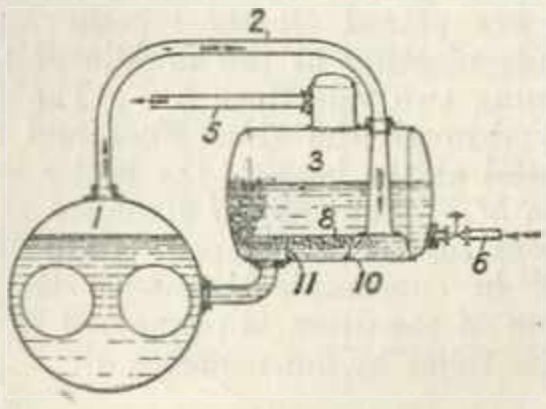


Washing - boilers; water supply and delivery.—With a boiling-pan *b* having a water inlet *f* at the bottom and outlets *h* at the top, a three-way valve is combined which controls the supply of cold water to the bath or other place supplied, and also to the pan *b*. Water entering at *i* is directed through one of two opposite outlets *j*, by a hole *m* in a sleeve *l* rotating with the valve stem *n*. In one position of the valve cold water passes direct to the bath, in the other the cold water entering the pan *b* causes hot water to flow to the bath by the outlets *h*.



159,498. Haag, J. Feb. 21, 1920, [*Convention date*].

Feed-water, heating.—The liquid in a steam or other vapour generator 1 is maintained at a constant level by connecting the liquid and vapour spaces to the liquid space in a closed reservoir 3 the pipe 2 which connects the vapour space with the reservoir opening into the reservoir at the level to be maintained. Vapour is led off from the reservoir through a pipe 5. The feed-pipe 6 may be connected to the reservoir. A baffle plate 8 at the bottom of the vapour pipe compels the vapour to pass horizontally through the body of the liquid. The liquid in the reservoir condenses the surplus vapour generated, the store of heated liquid thus produced being fed to the generator when the vapour demand rises. The



reservoir may be arranged within or around the generator.

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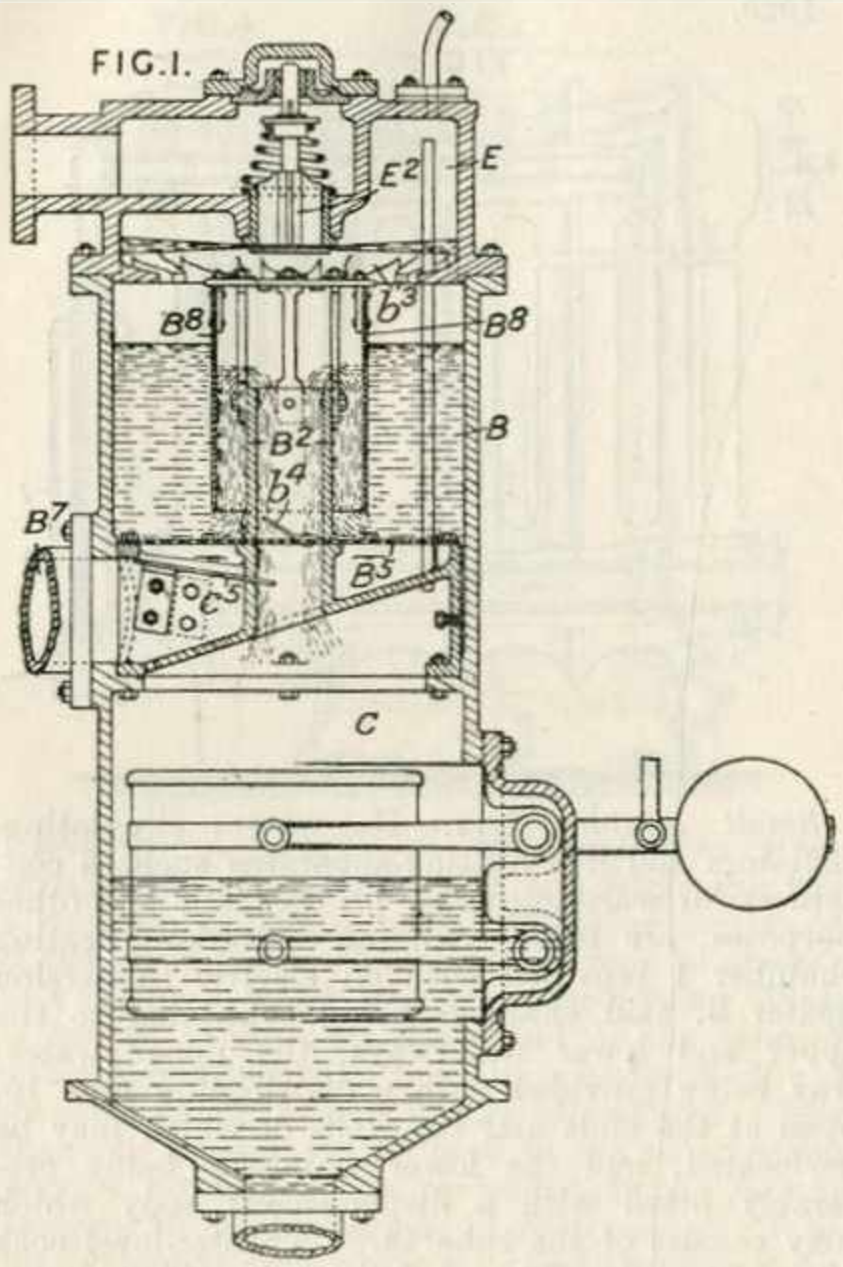
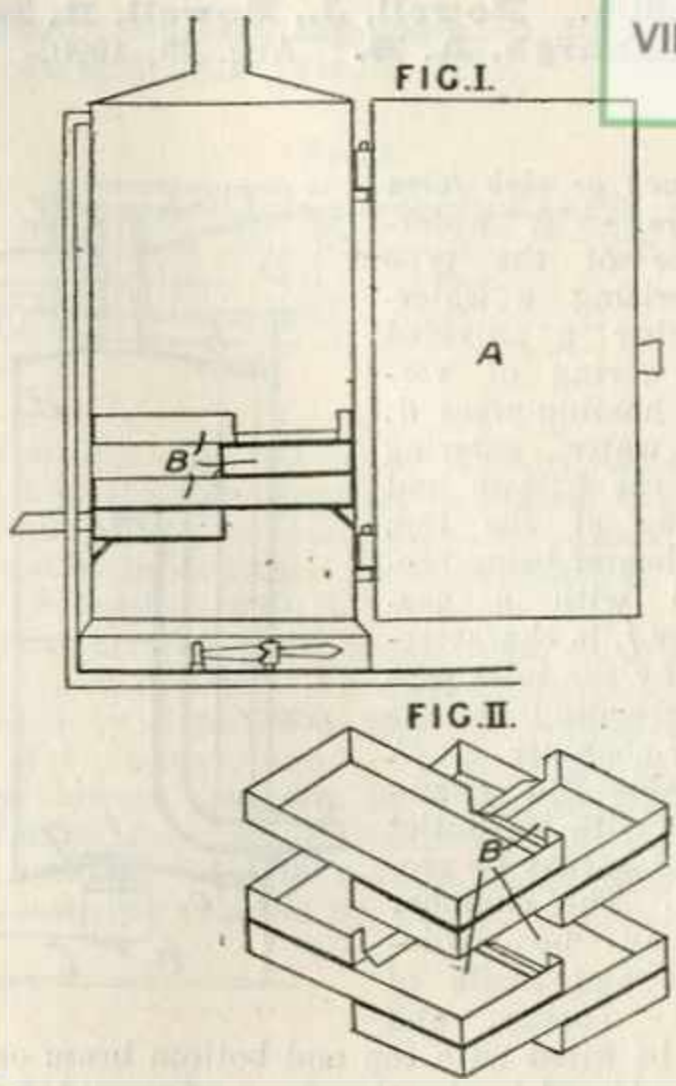
159,700. MacDonald, J. Dec. 29, 1919.



Feed-water, heating.—Water enters the chamber E through a spring-controlled valve E^2 in a circular sheet form and, striking against the wall and the projections b^3, falls into the chamber B, where it gathers over a perforated plate B^5 through which steam entering at B^7 passes, finally flowing under a bell B^8 over the edge of a funnel B^2 into the collecting chamber C. Baffles C^5 and b^4 assist respectively in distributing the steam and giving the water in B a gyratory motion. Specification 3306/74 is referred to.

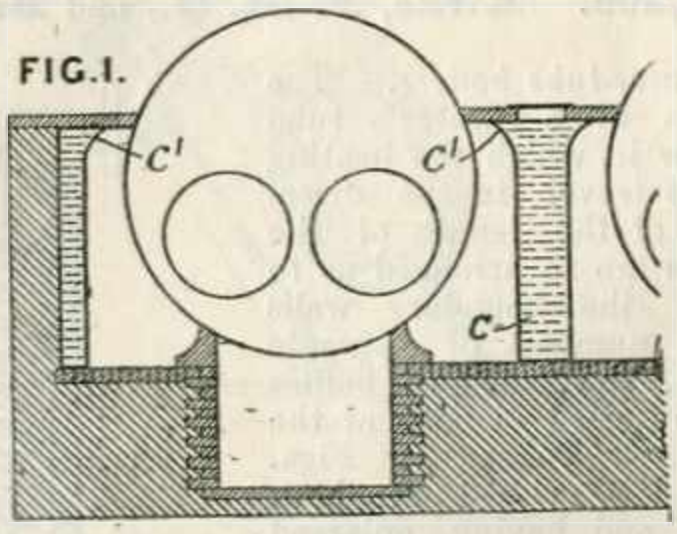
159,751. Page, J. H. Feb. 3, 1920.

Instantaneous water-heaters.—In an instantaneous water-heater, water is caused to flow downwards in a helical path over a series of trays B, Figs. I and II, arranged in a casing. Each tray occupies half of the cross-section of the casing, and the tray below also occupies half, but in a direction at right-angles to the tray above. The edge of the tray is partly cut away as shown in Fig. II., to allow the water to overflow, but sufficient of the side wall is left to retain some water in the bottom of the tray and prevent damage by overheating. The water is heated by a gas-burner below, and the combustion products pass upwards under and over the trays.



A door A occupies one side of the casing and must be opened to light the burner, so that an accumulation of gas in the casing is avoided.

159,765. Addyman, W. P. March 17, 1920.



Feed-water, heating. — Feed-water heating tanks C in the side flues of a Cornish or like boiler have vertical parallel sides curved or flared outwards at the top c^1, the outer surfaces of the tanks thus conforming to the surfaces of the walls which they replace.

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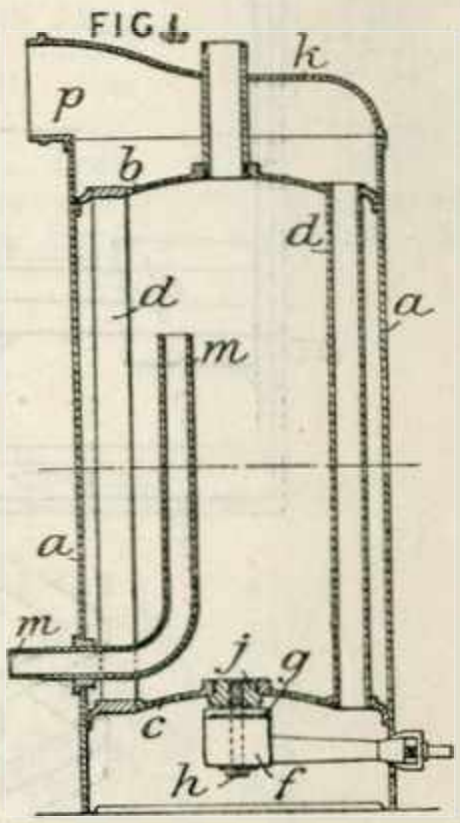
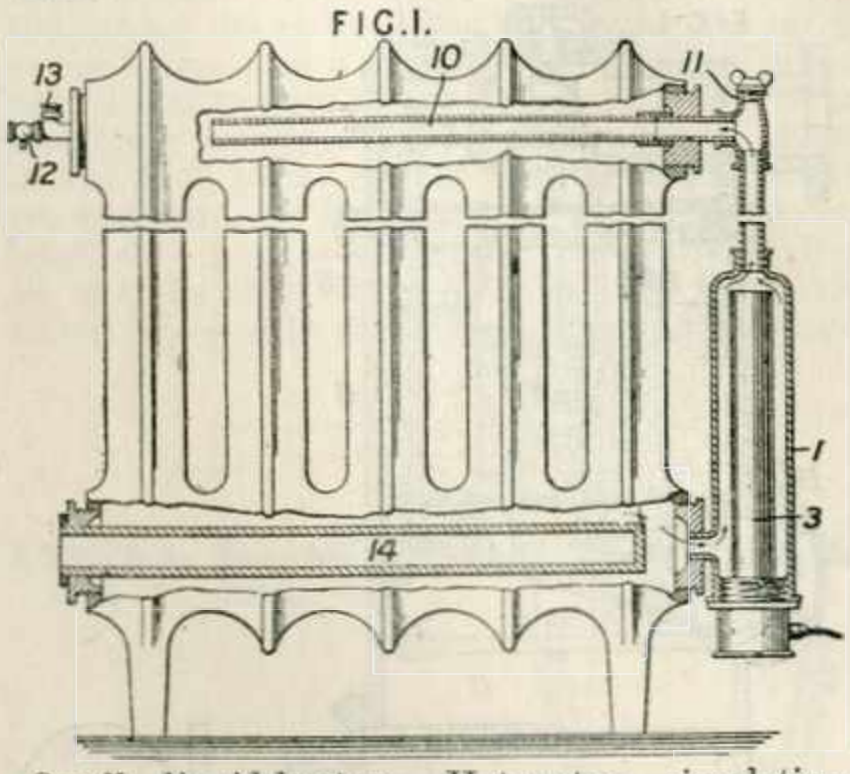
159,854. Rowell, J., Rowell, R. H., and **Roxburgh, A. B.** Aug. 23, 1920.

Block or slab form boilers. — A water-heater of the type comprising a water-chamber *a* provided with a ring of vertical heating-pipes *d*, the water entering near the bottom and leaving at the top, said heater being provided with a gas-burner *f*, is characterized by the inlet pipe *m* extending up the water-chamber. A rotatable flue chamber *k* with an outlet nozzle *p*, may be provided. The chamber *a* may be cylindrical and made of sheet copper, and may be fitted with top and bottom brass castings *b*, *c* soldered to the chamber and provided with a ring of vertical copper pipes. The burner *f* is supported by a bolt *h* carried by the plug *j*, and is fitted with a deflecting plate *g*, the pitch circle of the tubes being so chosen that it agrees with the annular flame produced by the burner. The heater is primarily intended for domestic purposes, but it may be fitted in series with the boiler situated at the back of the kitchen fire.



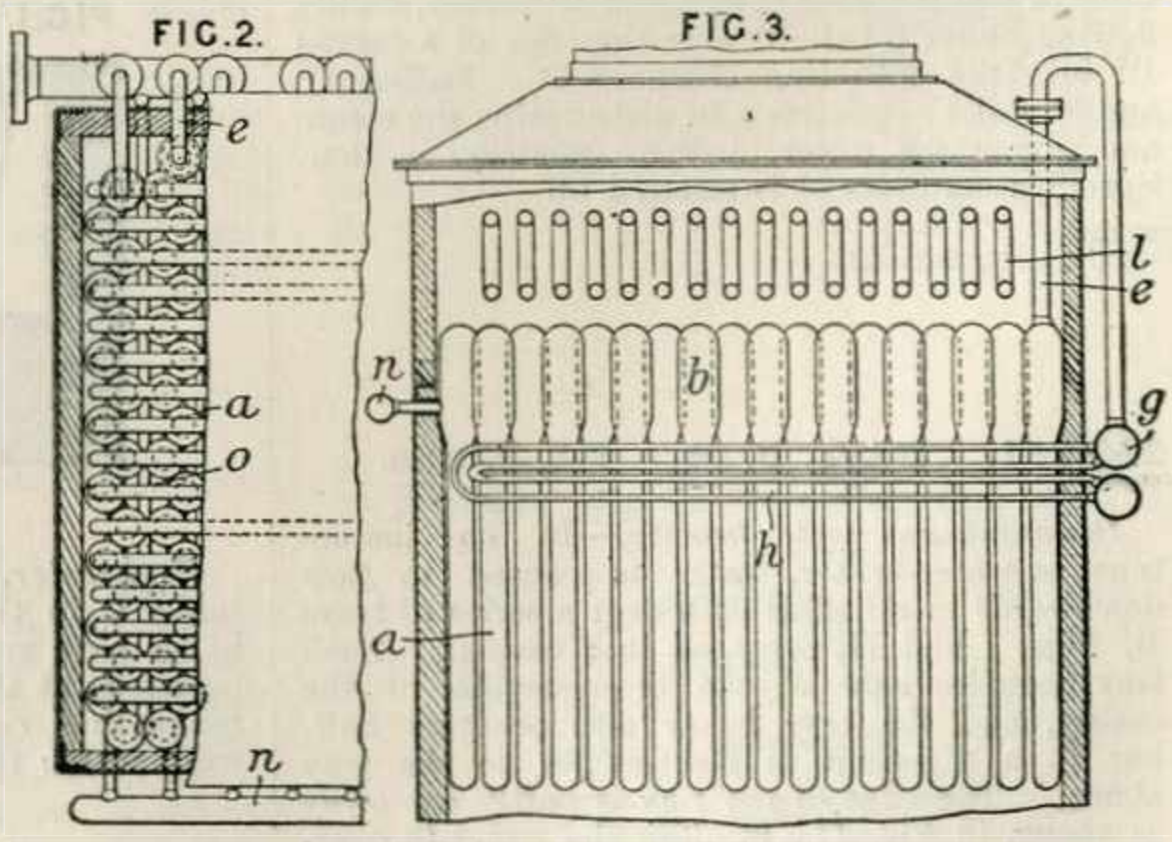
160,111. Norris, F. A., (*trading as* Norris & Co., F. A.), and **Dutton, H. W.** July 5, 1920.



Small liquid-heaters.—Hot-water circulating-radiators and like heating-apparatus such as containers for warming water for domestic and other purposes, are fitted with an exterior heating chamber 1 provided with an electric immersion heater 3, said chamber being connected to the upper and lower waterways, the upper waterway being provided with a distributing pipe 10, open at the ends and the walls of which may be perforated, and the lower waterway being preferably fitted with a displacement body which may consist of the tube 14. A water-level cock 12, safety-valve 13 and filling plug 11 are provided. The whole apparatus constitutes a complete and independent hot-water radiator.

160,205. Kirke, P. St. G., and **Bristol Aeroplane Co., Ltd.** Oct. 17, 1919.

Water-tube boilers. —The tubes of a water-tube boiler in which the heating gases travel in the direction of the length of the tubes are so arranged as to form the boundary walls of a number of separate flues, and cores or baffles are inserted in each of the flues. Tubes *a*, Figs. 2 and 3, closed at both ends and having enlarged heads *b* formed with flat faces are so arranged and welded together at their flat faces as to enclose separate flue spaces *o*. The heads are placed in communication with one another through perforation in their welded faces. The feed-water flows from the collector of a feed-heater *l* into a main *n* supplying rows of tubes. Helical baffles or cylindrical cores are inserted in the flues. In a modification, tubes of the same diameter throughout and connected to upper and lower cross tubes are so arranged as to enclose separate flues. The flue may be separately heated.



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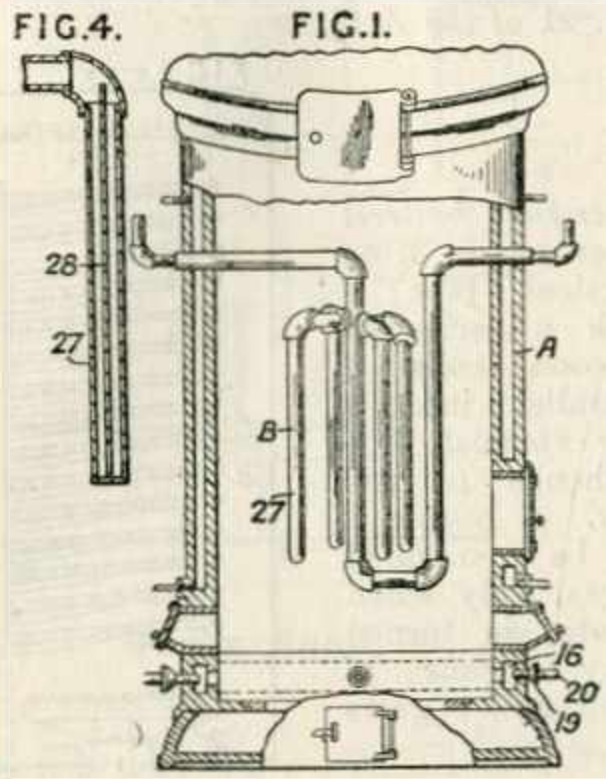
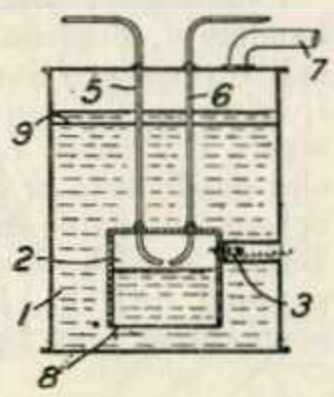
160,516. Murphy, R. N. Dec. 16, 1919.



Boilers.—A cluster of inter-connected tubes, each closed at its lower end and diverging from a common centre, is used for heating liquids. As shown in Fig. 1, such a cluster B may be enclosed in a casing A which may be water-holding. Water is caused to circulate down and up the tubes 27 under the influence of heat, by a baffle 28, Fig. 4, which extends nearly to the closed end. More than one cluster can be used in the outer casing. Air for combustion is preheated in an annular passage 16 at the bottom of the casing. When liquid fuel is used, it is supplied through a pipe 20 opening into a flared pipe 19 which delivers into the annular passage 16.

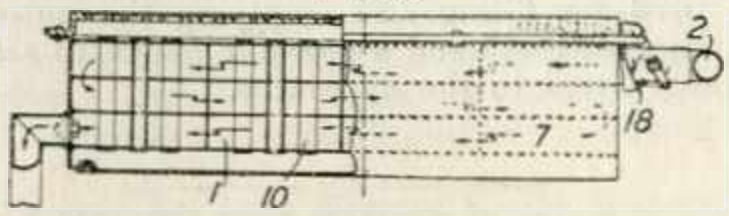
Reference has been directed by the Comptroller to Specification 149,026.

160,517. Kay, H. Dec. 17, 1919. *No Patent granted (Sealing fee not paid).*



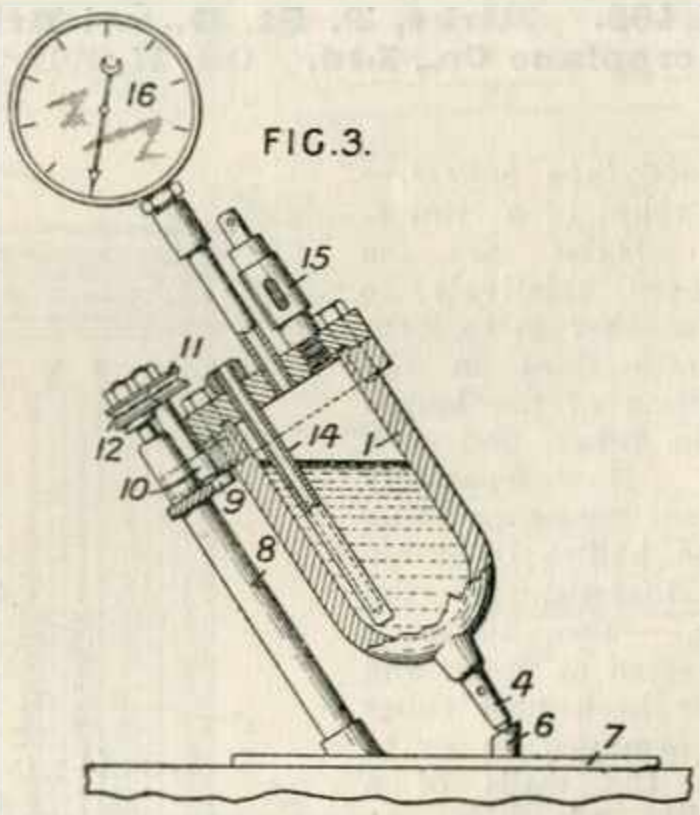
Heating liquids.—Relates to hot water apparatus of the kind in which a combustion chamber is immersed in and open to the water for direct contact of the heating medium with the water and consists in providing a gauge screen for preventing flames from passing above the water level. The generator 1 has a combustion chamber 2 adapted to be supplied with fluid fuel and air or oxygen through pipes 5, 6 and having a sparking plug 3 in a side passage. Screens 8 or 9 are provided to prevent flames passing above the water level. One or more baffles may be arranged in the boiler. The chamber 2 may be placed centrally or out of centre.

160,968. Mann, Egerton, & Co., Ltd. and Jay, S. A. Jan. 9, 1920.



Heating air.—An air heater primarily-intended for motor-vehicles comprises a central chamber 1 through which, for example, engine gases pass, traversed by tubes 10 and enclosed within an outer casing 7 finished with a perforated top. The interspace is filled with loosely packed asbestos wool or silica cotton. Air entering through holes controlled by flaps 18 is filtered in passing between the casings, and is heated in passing upward through the tubes 10. Longitudinal and cross baffles may prolong the path of the exhaust gases, and the flaps 18 may be inter-connected with a butterfly valve in the exhaust pipe 2.

161,269. Edenborough, H. Jan. 5, 1920.



Digesters.—A high-pressure digester or autoclave is provided with means whereby it may be rotated with its axis inclined 30° to the vertical, and is fitted with stirring means, preferably consisting of a tube 14, with a blind end, fixed eccentrically within and rotating with the autoclave. In the preferred form, the autoclave 1 is fitted at the bottom with a screwed pivot 4, engaging a phosphor-bronze bearing 6 secured to the base-plate 7. The base-plate is provided with an inclined pillar 8 fitted with an arc-shaped plate 9 carrying friction rollers 10, against which the flange of the autoclave rests. The friction rollers are rotated, for example, at 60-80 revolutions per minute, by means of a belt passing around pulleys 11 mounted on the same spindles,

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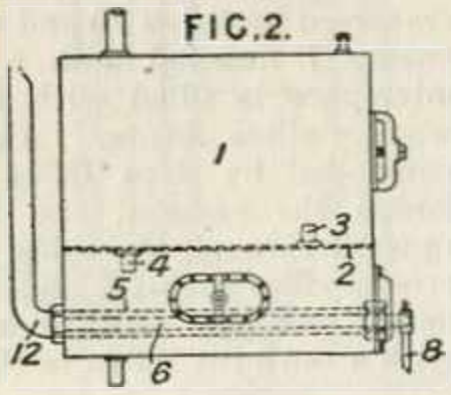
and an intermediate pulley 12 carried by the pillar 8. The tube 14 may be fitted with a thermometer, and may be removable from the outside so that the hole through which it is fitted may be used for filling and emptying the autoclave. A relief valve 15 and a pressure gauge 16 are preferably fitted to the apparatus.

161,424. Lyne, F. T., Banks, W., and **Stephenson, A.** March 18, 1920.

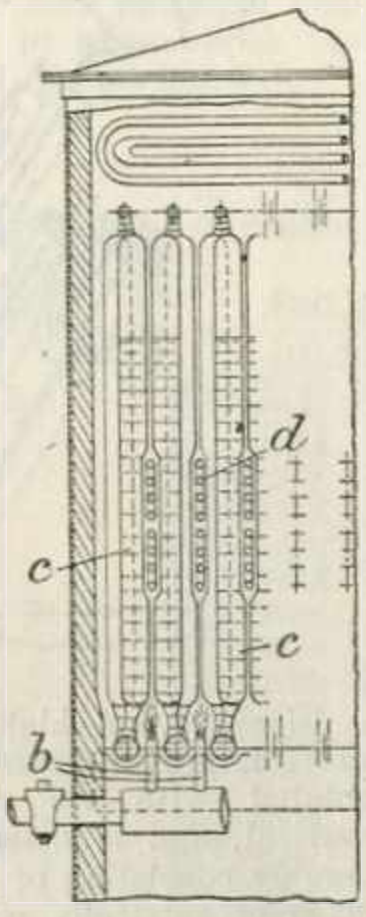
Block form boilers. — A tank 1 has a transverse partition 2 carrying up-cast and down-flow tubes 3, 4, horizontal flue pipes 5 connected at one end to a flue 12, and gas-burners 6 extending through the flue pipes 5 supplied with gas from a pipe 8.

FIG. 2.



161,486. Kirke, P. St. G., and **Bristol Aeroplane Co., Ltd.** Oct. 17, 1919.

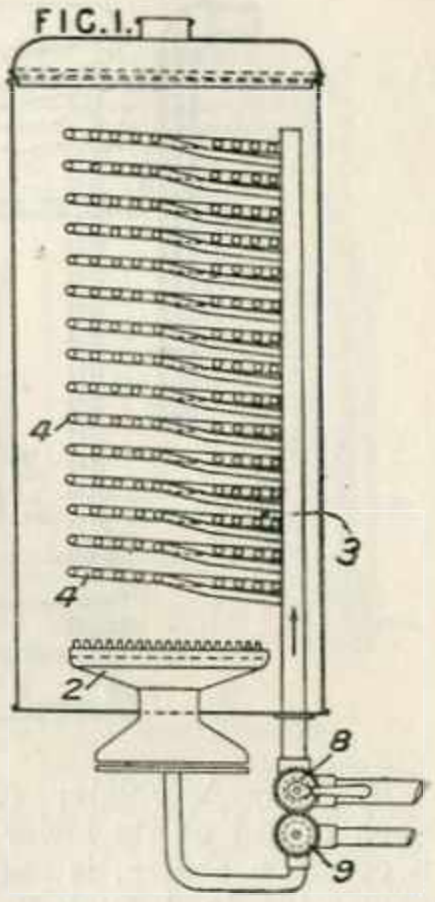
Water-tube boilers.—The tubes of a water-tube boiler are so arranged relatively to one another as to form separate flues in the direction of the length of the tubes, and each flue is separately heated. Screw or other shape baffles or cores are inserted in the flues. The tubes c connected at upper and lower horizontal tubes and arranged so as to form the walls of a number of flues, as described in Specification 160,205, are heated by liquid fuel burners *b* projecting into each flue.



161,528. Vandevelde, A. April 8, 1920, [*Convention date*]. *Void* [*Published under Sect.* 91 *of the Act*].

Water-tube boilers. —Water passes from a vertical pipe 3 through a series of superposed coils 4 in parallel into a similar vertical pipe and thence to the outflow. A burner 2 may be supplied with gas, only when the water is turned on, by means of interlocking gears 8, 9.

FIG. 1.



161,879. Martin, J. July 2, 1920.

FIG. 4.

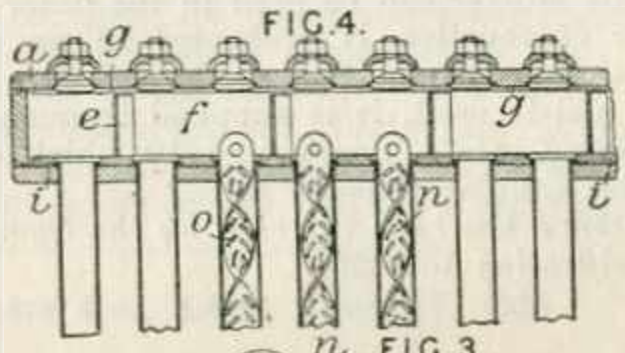
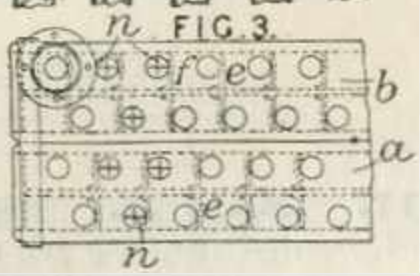


FIG. 3.



Feed-water, heating.—The partitions in the headers *a*, *b* of an economizer comprise separate cell frames *e*, *f* inserted from the ends. A plate *i*, lying on the bottom of each header, perforated where the tubes open, enables each frame to be slid easily into or out of the heater and clearance spaces *g* enable the gases liberated to escape. Baffles *n* with slots *o* may be fitted in the tubes exposed to the highest temperature and the economizer may be made of wrought iron.

162,079. Maddocks, J. I. N. Jan. 22, 1920.

Heating water; boilers.—A hot-water system comprises two interconnected boiler chambers D^1, D^2, one for each of two houses each heated by a separate fireplace, two storage cisterns J, J^1, and a single cold-water supply conduit K leading to one cistern. The two boiler chambers are so connected by side extensions that they constitute a single boiler which may be square in plan with a vertical flue E communicating with horizontal flues from the two fire-places.

(*For Figure see next page.*)

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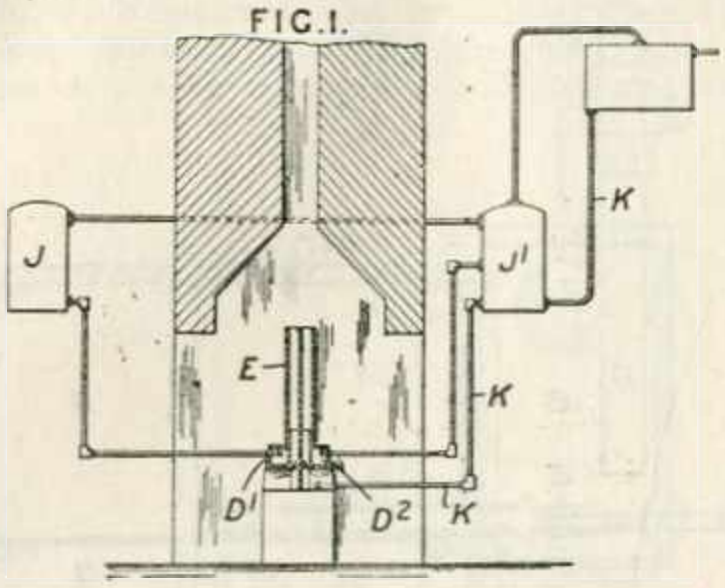
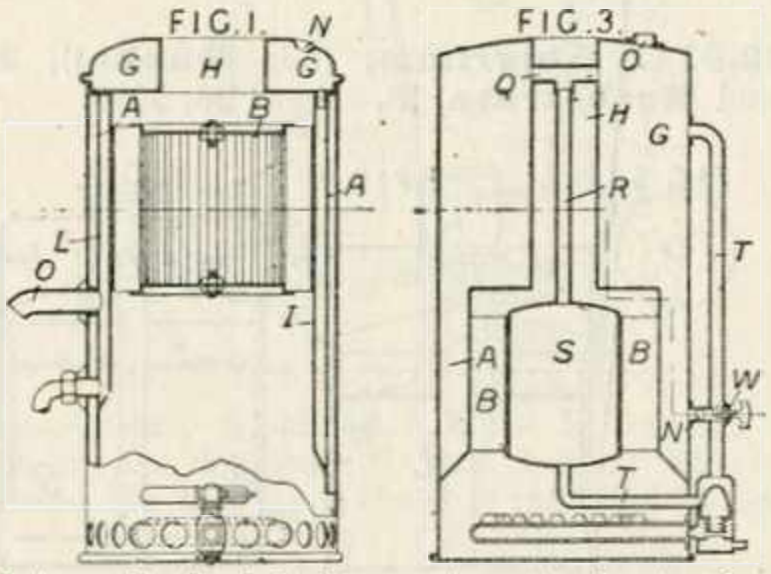
162,079.

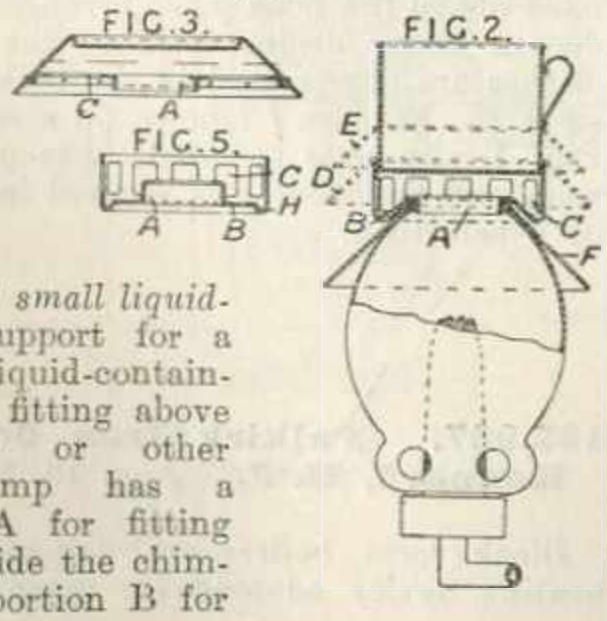


162,121. Winterflood, B. W. Feb. 9, 1920.



Internally-fired boilers.—A water-heater has a water jacket A surrounding a series of radial conduction plates B in the central heating-space and an upper chamber G with a central flue H. In one form, Fig. 1, the water enters at N passed down the tube I to the bottom of the jacket and is delivered from the top of the jacket by the tubes L, O. In the form shown in Fig. 3, a central water chamber S is provided, and a valve W is so fitted that when it is closed only a small part of the water in the chamber G circulates through the chamber S and pipes R, Q, T, thus becoming quickly heated. On opening the valve W, the whole of the water can circulate.

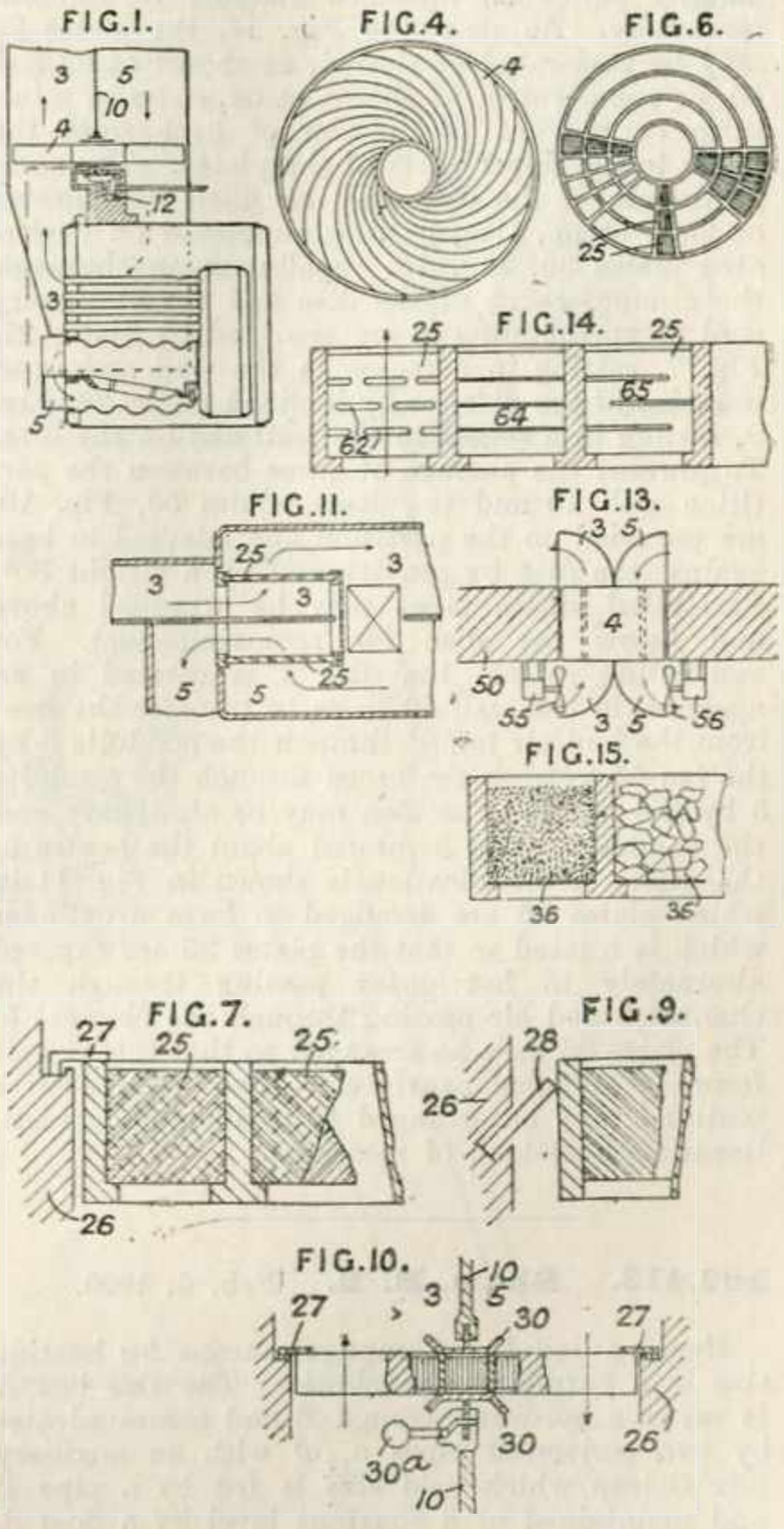
162,144. Price, A. L. March 1, 1920. *No Patent granted (Sealing fee not paid).*



Portable and small liquid-heaters.—A support for a cup or other liquid-containing vessel for fitting above a gas-burner or other illuminating-lamp has a locating-ring A for fitting within or outside the chimney, a hood portion B for preventing overflowing liquid from entering the chimney, and is pierced with holes C for the escape of the products of combustion. An additional hood may be provided as at D, E, or F. Modifications are shown in Figs. 3 and 5, the latter of which has a gutter H for catching any overflow. The holes C may be omitted at one point to prevent overheating of the handle of the cup.

Reference has been directed by the Comptroller to Specifications 9477/85, 12863/88, and 13298/01, [all in *Class* 126, Stoves &c.].

162,250. Aktiebolaget Ljungströms Angturbin. April 23, 1920, [*Convention date*].



Heating air and gases; heating liquids.—Relates to apparatus for transferring heat from one gas or liquid to another as from furnace gases

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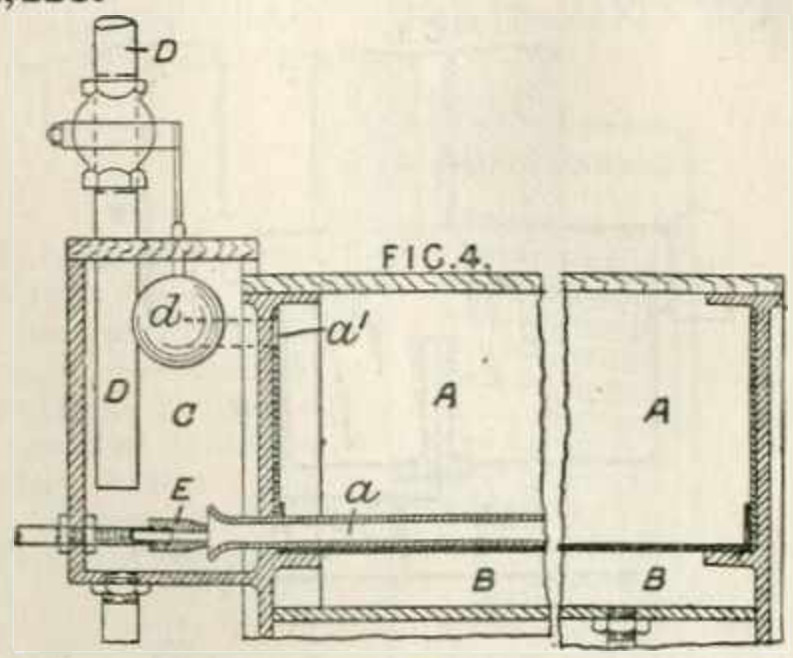
to air for combustion, from the foul air of a room to fresh air for ventilation, or from warm to cold water when changing the water in swimming-baths, in which the two fluids are passed alternately through the same passages in a movable mass of regenerative material. The apparatus consists, in one form, of a rotating open-work or permeable disc 4, Fig. 1, arranged in the path of the furnace gases escaping from a boiler through the uptake 3 and of the air for combustion passing to the furnace through the conduit 5, separated from the uptake by a partition 10. The disc is rotated by gearing 12 and is filled with plates, ribbed or corrugated, forming passages for the air and gases. Preferably the plates are arranged parallel to one another, but they may be radial, or curved as shown in Fig. 4. The disc may be divided into compartments by radial and circular ribs, as shown in Fig. 6, the compartments being provided with parallel plates 25 arranged radially or circumferentially. As shown in Fig. 14, the plates 25 may be perforated or slotted, as shown at 62 and 65, or sub-divided, as shown at 64, so as to minimize or prevent conduction of heat from the lower to the upper parts of the plates. The compartments of the disc may be filled with gravel or loose stone, slag, or tiles supported on perforated plates 36, Fig. 15. Sealing-means between the circumference of the disc and the stationary wall 26 surrounding it are provided by plates 27, Fig. 7, resting in a recess in the wall and upon the edge of the disc, or by inclined plates 28, Fig. 9, resting in a recess in the wall and on the disc. To prevent the passage of gases between the partition wall 10 and the discs, slides 30, Fig. 10, are provided on the partition and adapted to bear against the disc by gravity and by a weight 30^a. Perforated steam pipes may be arranged above and below the disc for removing soot. For ventilating rooms, the disc 4 is rotated in an aperture in the wall 50 so as to transfer the heat from the foul air forced through the conduits 3 by the fan 55 to fresh air forced through the conduits 5 by the fan 56. The disc may be stationary and the conduits 3 and 5 rotated about the centre of the disc. A modification is shown in Fig. 11 in which plates 25 are arranged to form a cylinder which is rotated so that the plates 25 are exposed alternately to hot gases passing through the channel 3 and air passing through the channel 5. The plates 25 may be arranged so that their edges form a conical surface. The regenerative material may be arranged to oscillate in a rectilinear path instead of rotating.

162,413. Shaw, E. E. Feb. 4, 1920.

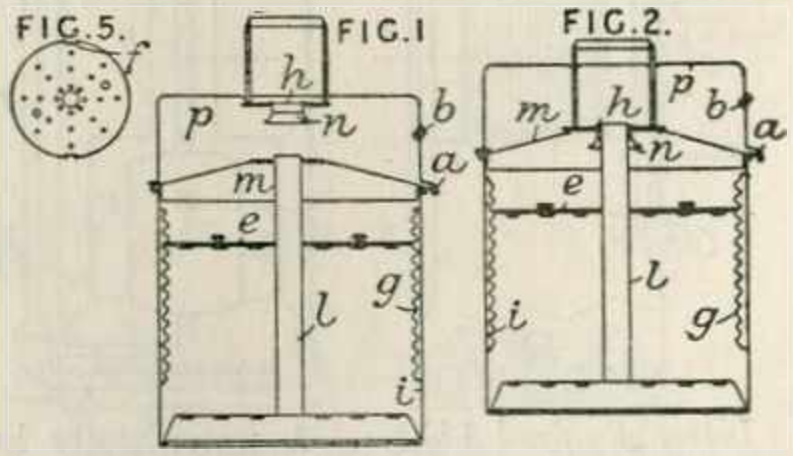
Heating liquids.—Comprises means for heating size in a yarn-sizing machine. The size box A is set in a hot-water trough B and communicates by two horizontal pipes a, a^1 with an auxiliary box C into which cold size is fed by a pipe D and maintained at a constant level by a float d. A steam jet E applied to the lower pipe a heats the size and circulates it through the two boxes.

(*For Figure see next column.*)

162,413.



162,911. Ahlgrimm, (*née* **Gunkel**), **H.,** and **Hochstrate, P.** April 26, 1920.



Washing-boilers.—The top of the boiler i is closed by a deep hood p, forming a steam chamber, which is separated from the boiler by a partition m having a central hole through which circulating tube l protrudes. An externally-operated plate h, which has an extension piece n for the insertion of tube l, can be lowered, as in Fig. 2, to close the hole in partition m so as to divert the normal circulation over the clothes, to the upper side of partition m and thence to discharge spout a. The discharge spout may be of the swivel type, the end when vertical being higher than the edge of the hole in plate m, thus preventing discharge of liquid. Steam vents b may discharge to atmosphere or to a condenser fixed above the hood p, so arranged that the condensed water drains back to the boiler. The clothes are compressed in the boiler by means of sieve e. Notches f (shown on a reduced scale in Fig. 5) slip over serrated racks g on the boiler wall, and the sieve e is secured in the serrations by a part turn.

162,987. Falkirk Iron Co., Ltd., and **Kennard, H. J.** Aug. 19, 1920.

Block form boilers.—A self-contained water-heating device adapted for association with an

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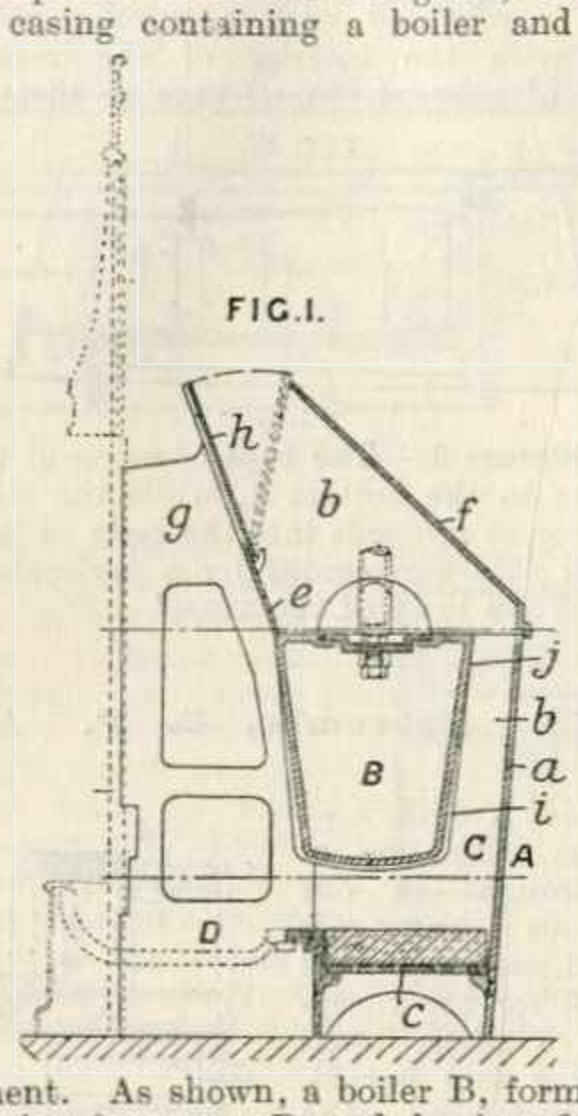
Interior, Register Grate, or Mantel Register, is entirely separate from the fire-grate, and comprises a casing containing a boiler and a flue

FIG. 1.

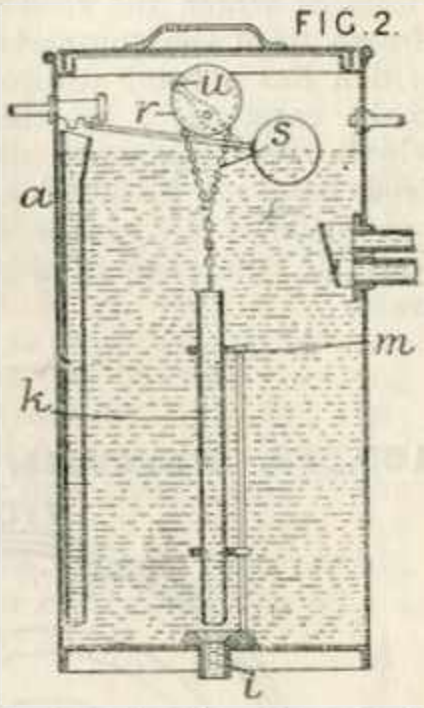


arrangement. As shown, a boiler B, forming the back of the fire-space D and having fins *i* to increase the heating surface, is mounted in openings *j* in the sides *b* of a casing A which has back *a*, base *c*, and inclined upper walls *e*, *f*. Forwardly diverging wings *g* are formed integral with the wall *e* which also carries a damper *k* adapted to control the boiler flue C. The boiler B may be connected to a hot water reservoir or to a circulating arrangement.

163,120. Coleman, A. B. Feb. 12, 1920.

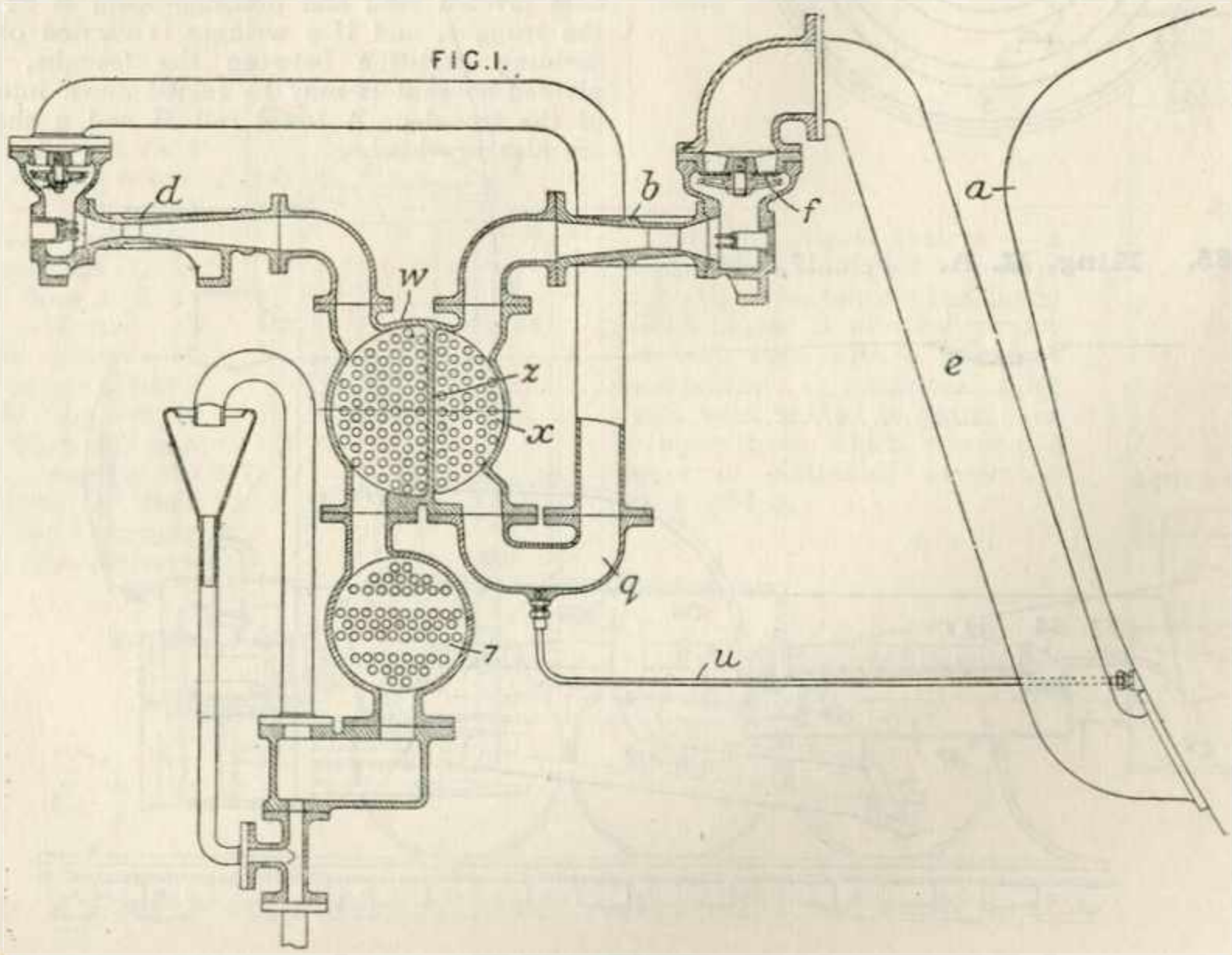
Heating water.—To enable a small quantity of the water in a tank *a* to be heated quickly, the return pipe to the boiler has an extension *k* sliding in guides *m* which can be lowered at will so as to fit into a socket in the return pipe connection *i*. The movement of the extension may be effected by a chain *s* and eccentric *r* operated by a handle *u* or by any other means. A crank mechanism is also described. Specification 106,683 is referred to.

FIG. 2.



163,224. Weir, Ltd., G. & J., and **Lang, C. R.** June 23, 1920.

FIG. 1.



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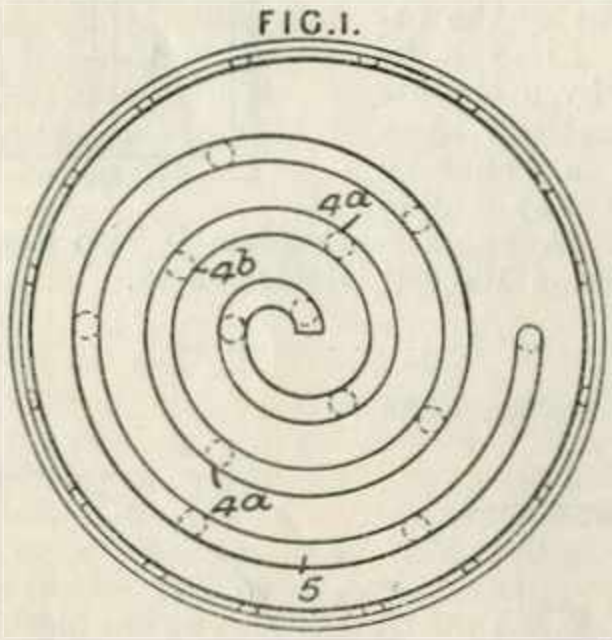
Feed-water, heating.—In apparatus for condensing steam and heating feed-water of the kind described in Specification 126,014 which is combined with a two-stage ejector having a condenser between the stages as described in Specification 163,214, [*Class* 71, Injectors &c.], the interstage condenser *x* is formed in the feed heater *w* by a partition *z* which divides the steam space. The first-stage ejector *b* draws air from the main condenser *a* by a pipe *e* through a stabilizing or anti-fluctuating valve *f*, and discharges to the compartment *x* of the feed heater *w*, through the tubes of which the feed-water passes. The air is drawn from the compartment *x* through a pipe *q*, which has a small drainage pipe *u* leading to the main condenser, by the second-stage ejector *d* which discharge into one compartment of the feed heater. Residual steam is condensed in a condenser 7 by water from any source, which may, in the case of a ship installation, be sea-water.

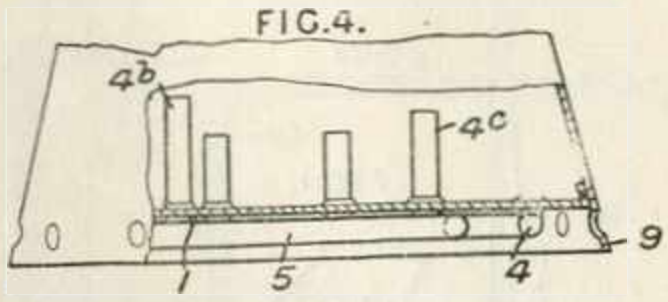
163,558. Parncutt, A. E. March 29, 1920.

FIG.1.



Boilers; washing-boilers.—The bottom 1 of a kettle, boiler, copper, or other vessel for heating liquids is provided with a tubular coil 5 connected with the interior of the vessel by a number of tubes 4, 4^a, 4^b passing through holes

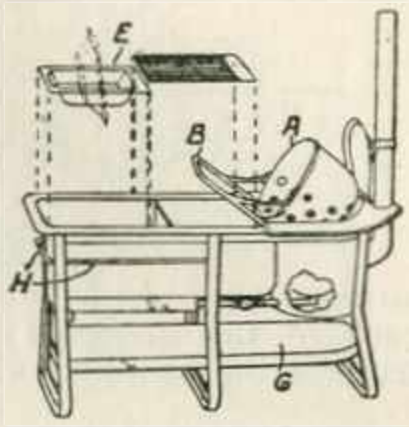
FIG.4.



in the bottom 1. The tops of some of the tubes are close to the bottom 1, while the rest of the tubes project upwards into the body of the vessel. The coil 5 is surrounded by a perforated extension 9 of the body of the vessel.

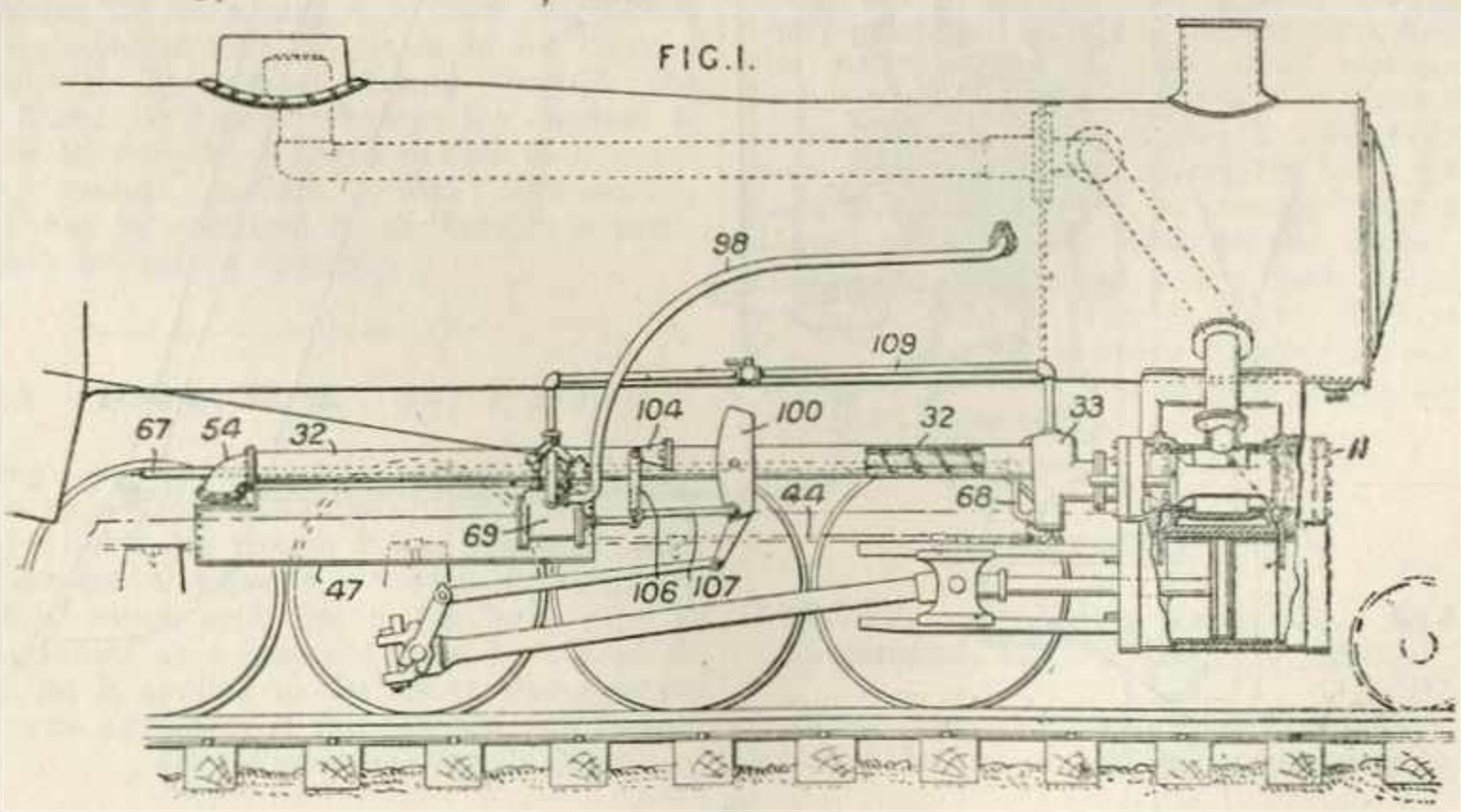
163,573. Seccombe, C. P. April 20, 1920.

Washing - boilers. — A boiler with one or more troughs in one continuous frame is provided with a pivoted cradle A for the reception of clothes, operated by a trip bar B, for transferring the contents without handling. A single waste-pipe drains the boiler and the troughs, and may be provided with a draw-off tap for supplying hot water. A removable pivoted sink and draining-board E fit over the troughs, and if a wringer is carried on the dividing partition between the troughs, it is pivoted so that it may be folded down into one of the troughs. A towel rail H and a shelf G are also provided.



163,765. King, H. A. Feb. 17, 1920.

FIG.1.



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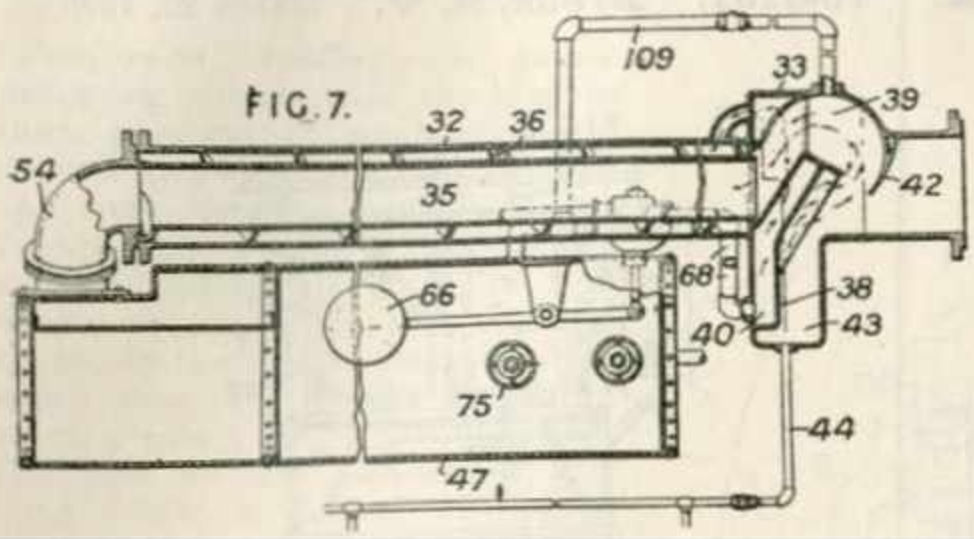
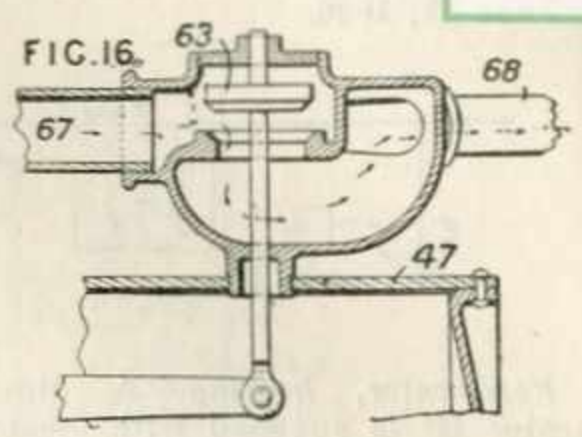
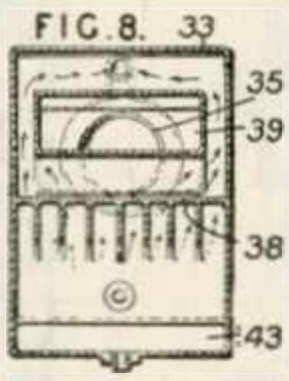
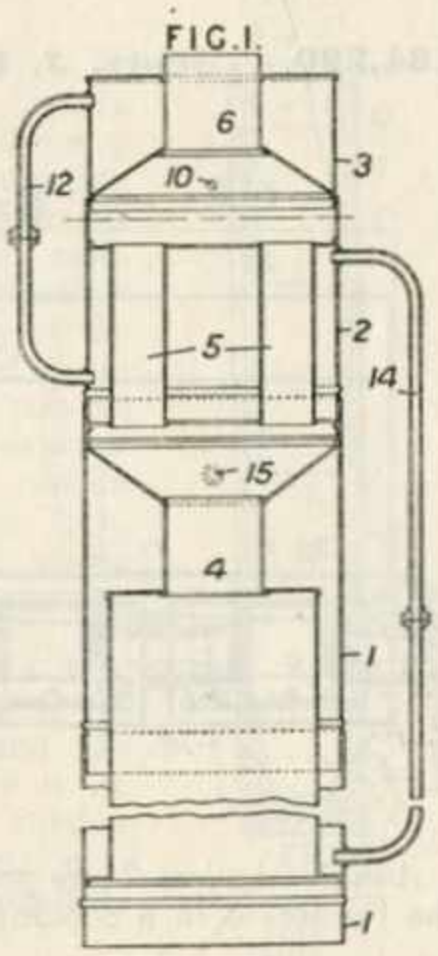






Feed-water, heating.—Feed-water heaters 32 take the whole of the exhaust steam from a locomotive the resulting hot water collecting in a central reservoir 47 from which pumps 69 actuated from the link motion supply the boiler through the pipes 98. Exhaust steam from the valve chest passes to the receiving chamber 33 at the forward end of the combined condensers and feed-heaters 32, Fig. 7. A baffle 42 directs the steam against a ribbed partition 38, separated oil collecting in the sump 43 whence it may be led by the pipes 44 to the axle boxes. Steam passes through an aperture 39 into the inner concentric tube 35 of the heater 32. Cold feed from the tender is supplied through the pipes 67, 68 to the base 40 of the receiving chambers 33, through a valve 63, Fig. 16, controlled by a float 66 in the reservoir 47. The annulus between the inner and outer tubes of the feed heater has a baffle 36 which directs the water around the inner tube towards the junction 54 at which point the water mixes with the steam and passes to the reservoir 47.

163,871. Webb, G. W. April 1, 1920.



Internally-fired boilers.—A water-heater comprises separable superimposed sections 1, 2, 3, with flues 4, 5, 6. Water admitted at 10 flows upwards in each section being conveyed by pipes 12, 14 from the top of each section to the bottom of that next below, passing out by the delivery 15.

163,918. Martin, J. Walter-. June 2, 1920.

Portable liquid-heaters.—A copper tube 1 adapted to receive a bottle 2 containing the liquid to be heated is provided at one or both ends with a burner 4 comprising a container filled with wick soaked in petrol, the vapours from which traverse a layer of platinated amianthus on a grid 5.

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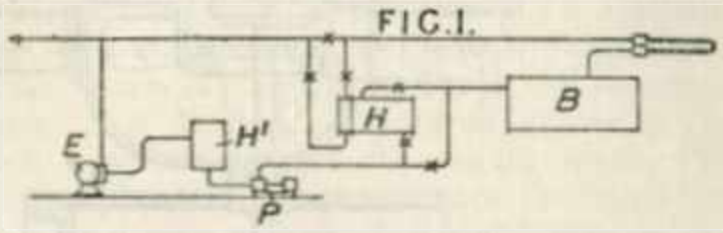
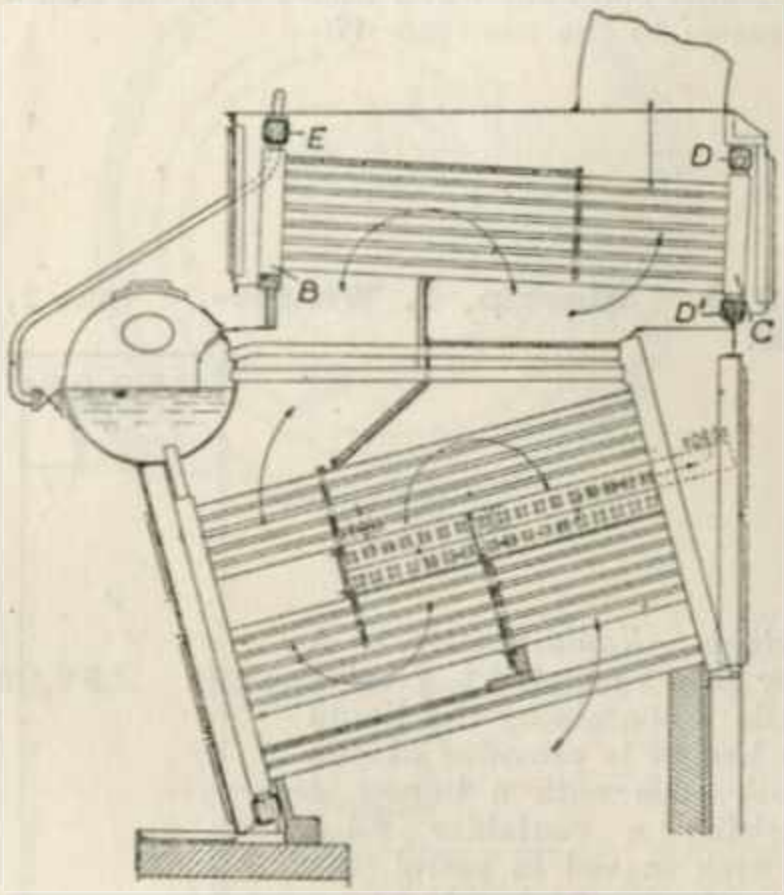
163,926. Codd, T. J., and **Johnson, H.** June 21, 1920.



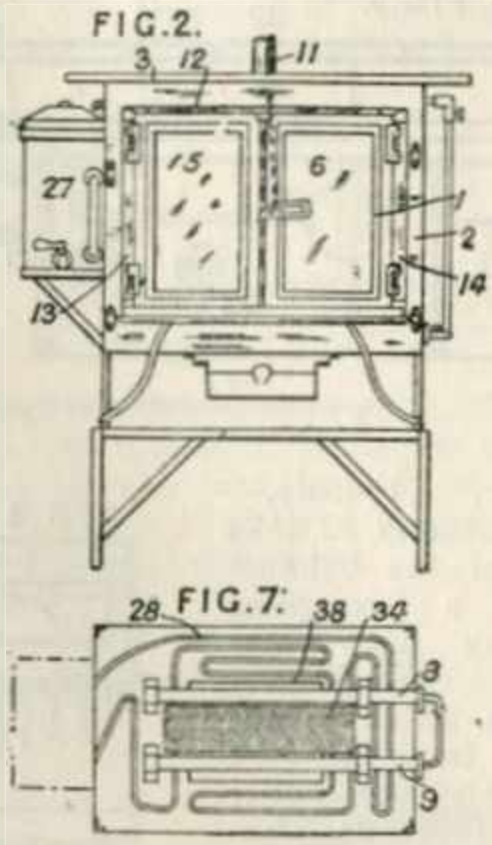
Feed-water, heating.—A direct-contact preheater H^1 is supplied with steam, for example, exhausted from an engine E, the water then passing through the pump P to a convection heater H supplied with superheated live or exhaust steam before entering the boiler B.

164,181. Babcock & Wilcox, Ltd., and **Innes, W.** March 24, 1920.



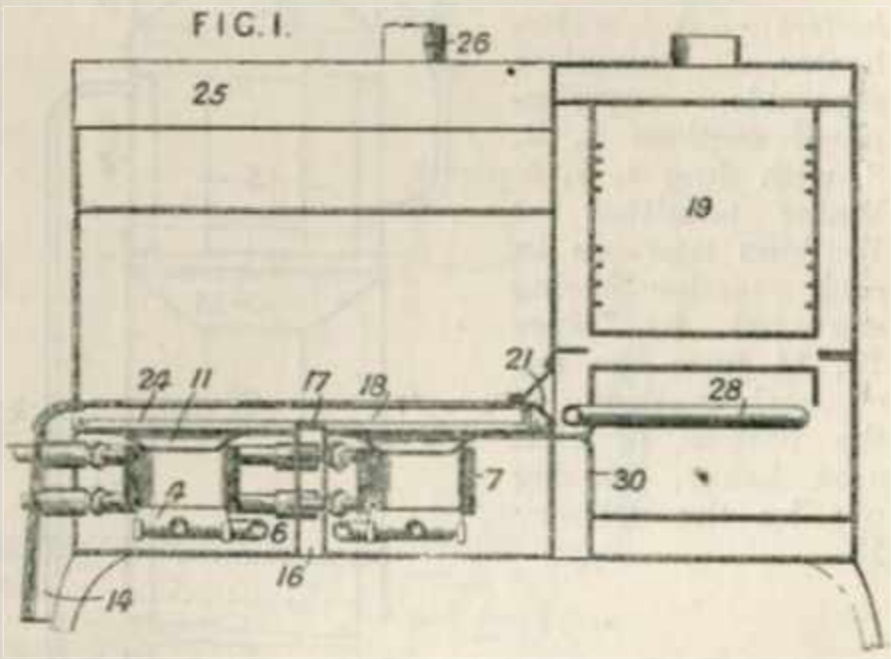
Feed-water, heating.—In a feed-water heater arranged above a Babcock & Wilcox boiler, the cold feed is supplied to the series of headers C at one end from an upper box D and is delivered from the series of headers B at the other end into an upper box E, a bottom blown-down box D^1 not directly in the path of the water circulation being provided for the collection and removal of sediment.

164,191. Brook, S. V. March 26, 1920.



Water-tube boilers.—In a cooking-stove, water is heated in zig-zag pipes 28 beneath the burners 8, 9 connected to a tank 27. The gas burners may be replaced by oil burners, a coal fire or by an electric heater.

164,220. Scott, J. G. May 12, 1920.



Annular boilers 7 are arranged as shown above the burners 4 in a cooking-stove.

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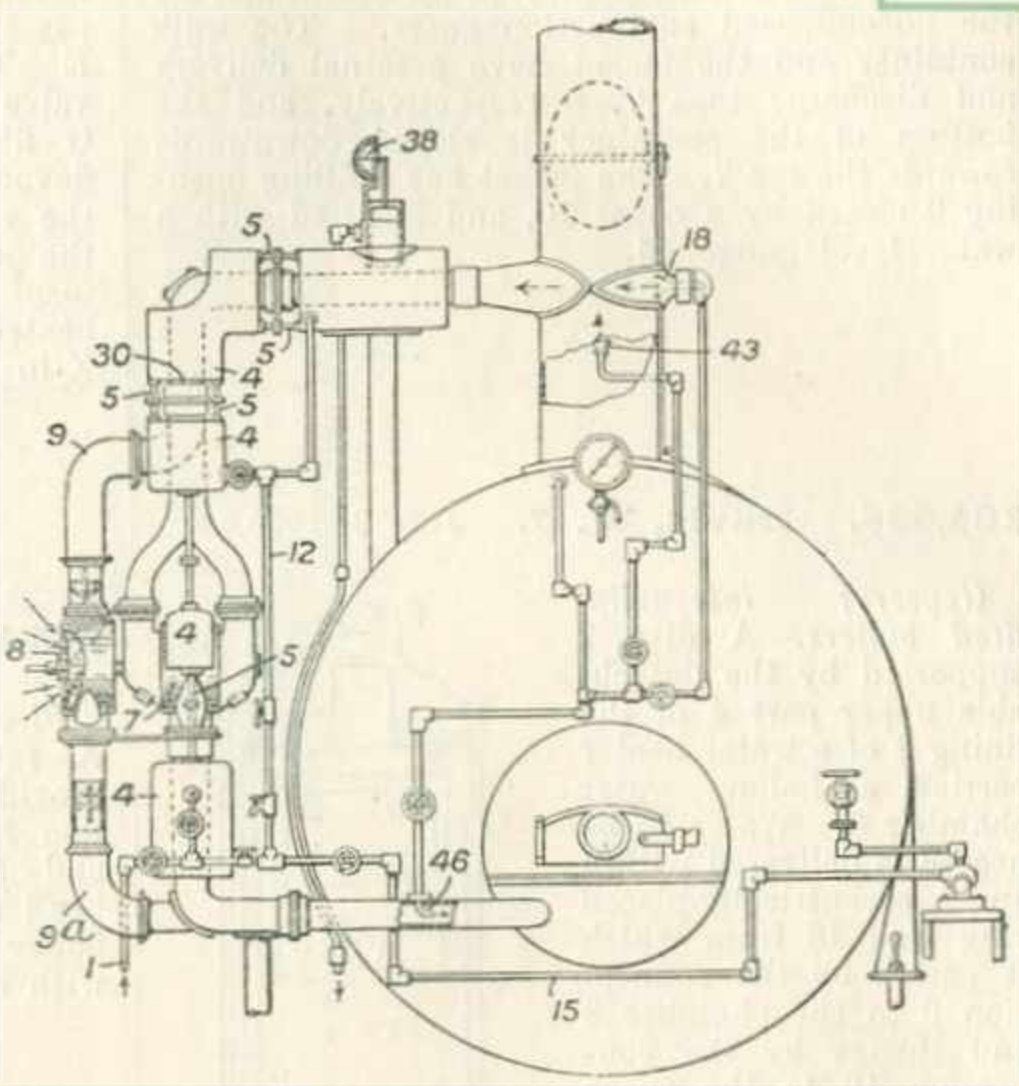
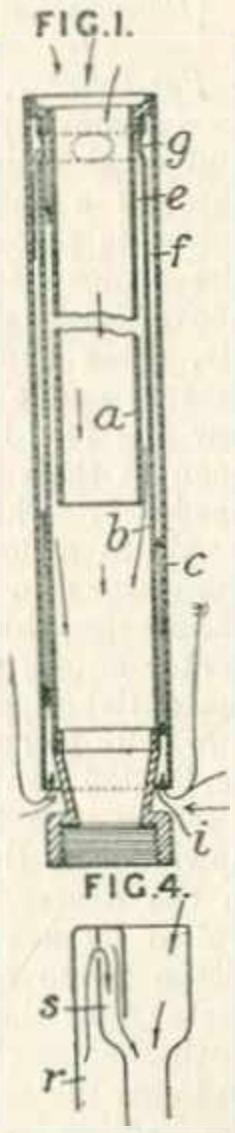
164,279. Tugwood, R. J., (*Watterson, W. A.*). Oct. 27, 1920.

Feed-water, heating.—In smoke consuming apparatus of the kind in which products of combustion are directed by a steam jet into a return pipe from the smoke-stack to the furnace this pipe is water-jacketed and an auxiliary blower is provided. A steam-jet 18 ejects the smoke, &c. across the stack into the return pipe 30, in the length of which a rotary fan 7 is interposed. The pipe 30 and fan 7 are provided with a series of water-jackets 4 connected by pipes 5 and supplied with cold water by a pipe 1. Hot water is drawn from the uppermost jacket, which has a water-level indicator 38, by pipes 12, 15 delivering through a pump or injector to the boiler, a connection with the pipe 1 providing for the supply of cold water to the boiler. An auxiliary blower 8 and steam jets 43, 46 provide for increased draught to the smoke stack and furnaces. Suitable cocks are provided for controlling the steam and water pipes. Specification 123,575, [*Class* 51 (i), Furnaces and kilns, Combustion apparatus of], is referred to.

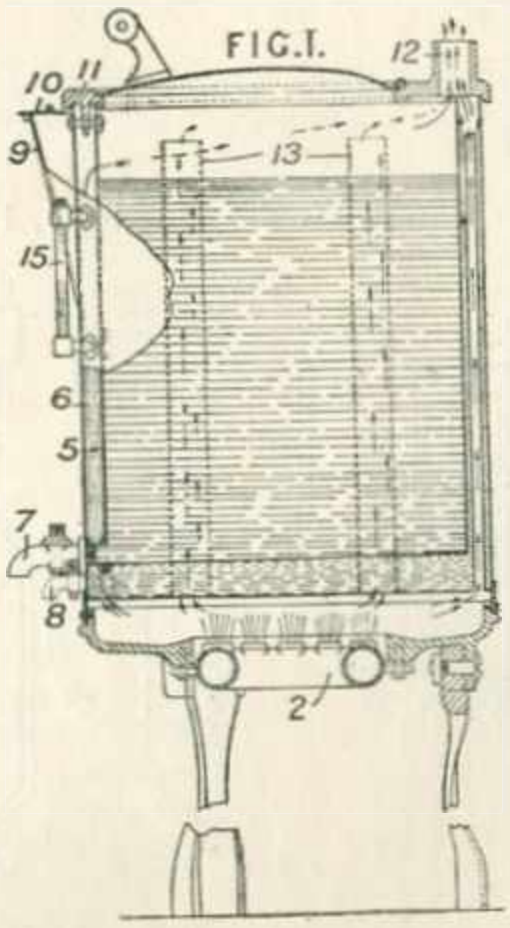


164,287. Watson, A. R. Jan. 7, 1921.

Heating water.—The return pipe to the boiler in a hot water cylinder is extended by a fitting *b* to the top of the cylinder. Perforations *g* thereat communicate with a concentric tube *c* which is open only at the bottom. Already warmed water from the top of the tank passing to the boiler by a short depending tube *a* entrains a certain proportion of cold water from the base of the tank which passes by the opening *i* annulus *f*, apertures *g* and space *e*. In the modification shown in Fig. 4, the innermost tube *a* is replaced by a partition and the passage *r* for cold water is on one side only. In a further modification, the passages *r*, *s* are constituted by a separate bent tube of ∩-shape.



164,597. Forte, D. May 10, 1920.



Set-pans.—A milk boiler comprises a milk container 5 surrounded by a water jacket 6 through which pass tubes 13 carrying the products of combustion from the burner 2. The tubes terminate below the upper end of the jacket, permitting the products of combustion to be partly condensed in

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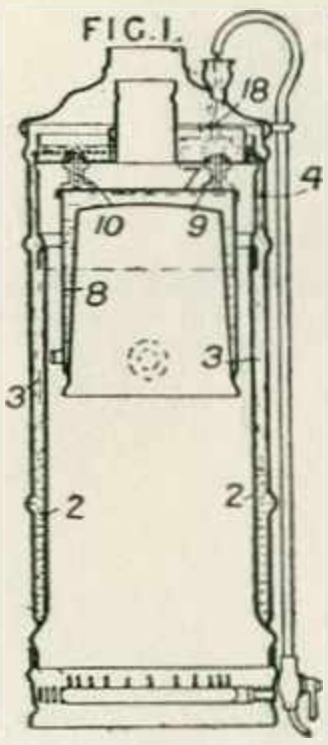
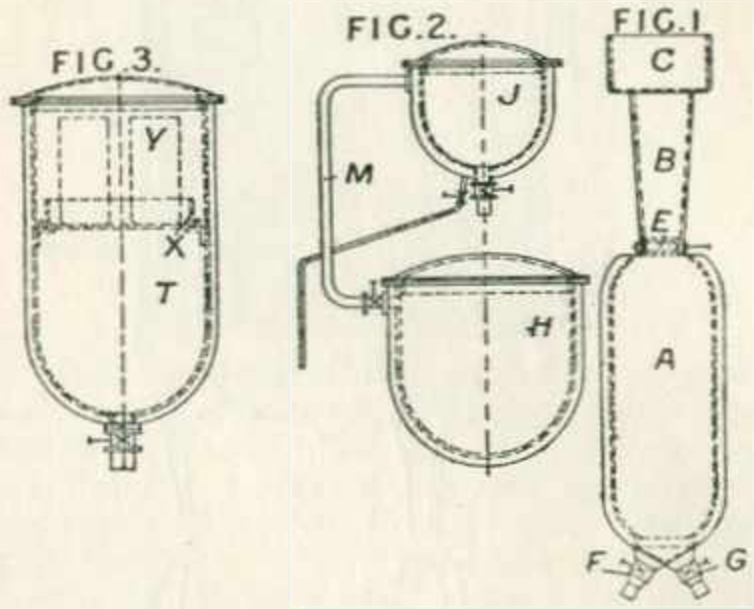
the jacket. The jacket has a removable cover 11 in which is a discharge pipe 12 for steam and for the uncondensed combustion gases. The milk container and the jacket have external delivery and discharge taps 7, 8 respectively, and the bottom of the container is sloped downwards towards the tap 7. The jacket has a filling opening 9 closed by a cover 10, and is fitted with a water level gauge 15.

164,626. Davis, W. J. July 2, 1920.

Geysers; internally-fired boilers.—A disc 7 supported by the detachable upper part 4 of the lining 2 of a water heater carries a hollow water chamber 8. Water to be heated is delivered within an eccentrically-placed ring wall 18 from which it passes by the connection 9 to the chamber 8 and thence by the connection 10 to the space above the disc 7, and through holes in the surrounding wall to the annular jacket space 3.



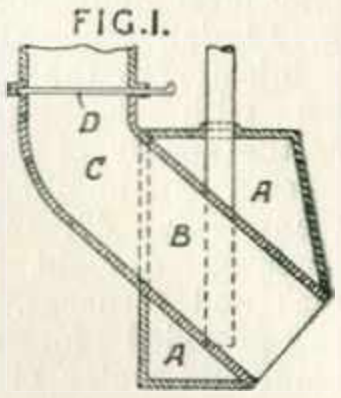
164,834. Hall, J. I. March 13, 1920.



Boiling-pans.—In making jam and the like the vapours arising from the boiling fruit &c. are utilised for preheating the material. Three forms of apparatus for this purpose are shown. Fig. 1 shows a steam-jacketed container A surmounted by a cooler vessel B and a reservoir C. Vapours rising from the container A pass through a valve E formed of gauze into the vessel B and heat the material therein, which can be passed into the container A by opening the valve E The completed preserve is drawn off by a valve F, while liquor can be drawn off by a valve G fitted with a gauze strainer, and used for flavouring. Fig. 2 shows a jacketed vessel H the vapour from which passes by a pipe M into the jacket of the preheating vessel J. In the form shown in Fig. 3 the substance to be preheated is placed in vessels Y standing in a tray X in the upper part of the jacketed vessel T.

164,854. Saxon, J. March 16, 1920.

Block-form boilers.—A range boiler A is provided with a central flue B leading upward and backward into a bend C formed on the boiler and provided with a damper D.



165,053. Soc. l'Auxiliare des Chemin de Fer et de l'Industrie. June 14, 1920, [*Convention date*].

Feed-water, heating.—The water space of a feed heater for use in locomotive and other boilers and of the kind in which the water is passed through a chamber containing horizontal steam tubes, is placed in constant communication with the atmosphere through an overflow extending above the level of the feed-tanks, thus permitting air, gases and steam given off by the water to escape, and allowing the heater to be placed below the feed-tank. The steam tubes 6, Fig. 1, open at their inner ends into a freely supported header 9. The steam passes backwards and forwards in a downward course through the tubes, the water of condensation escaping through a pipe 12, passing through a stuffing box on the casing 1. Water enters through a bottom opening 22 near the outlet pipe from the steam tubes and passes upwardly to an offtake near the steam inlet. The perforated vent pipe 13, Fig. 5, is surrounded by a larger pipe 33 which collects the water forced upwards in the vent pipe by steam entrapped in the heater. The admission of steam is controlled by a valve 24, Fig. 6, so operated by a piston 27 so acted upon by the pressure in the heater that the valve is closed when the pressure in the heater rises above a certain limit. The top and side plates of the heater may be held against the framing by readily removable bolts.

(*For Figures see next page.*)

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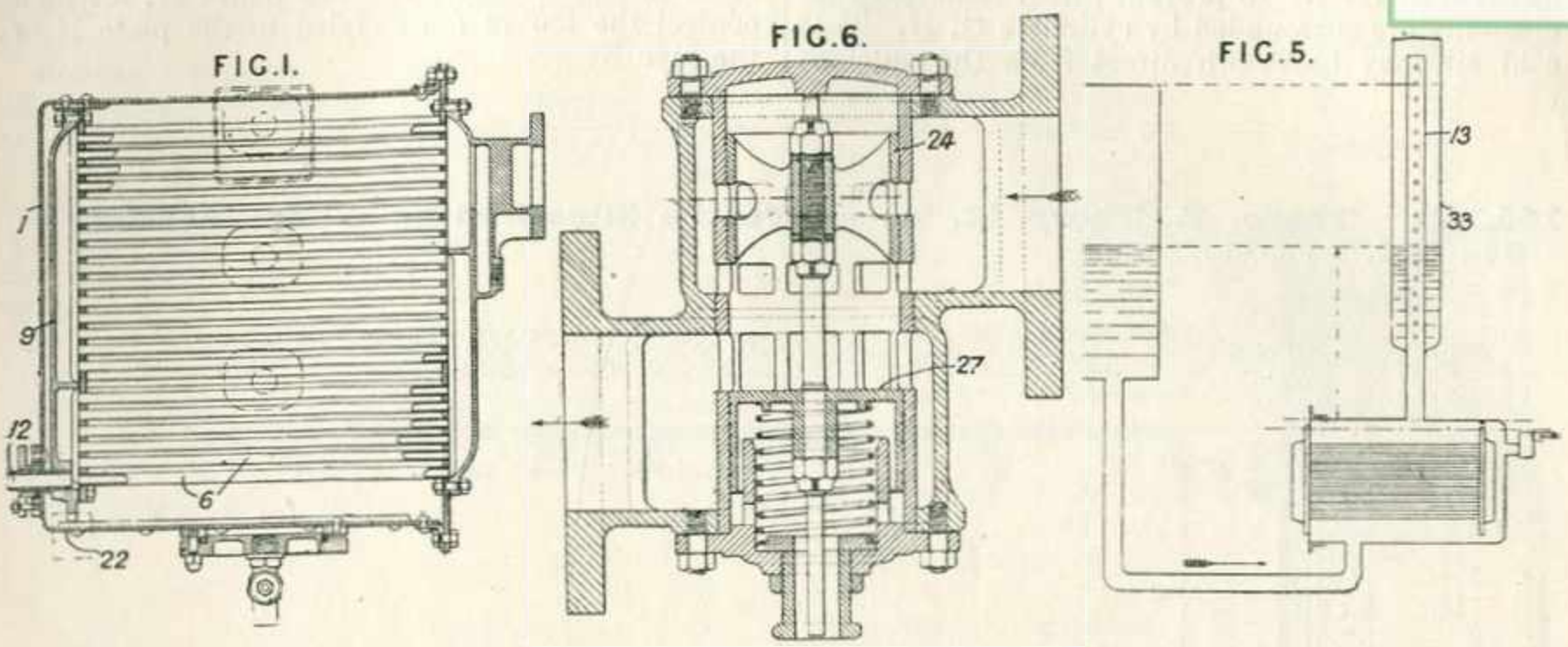
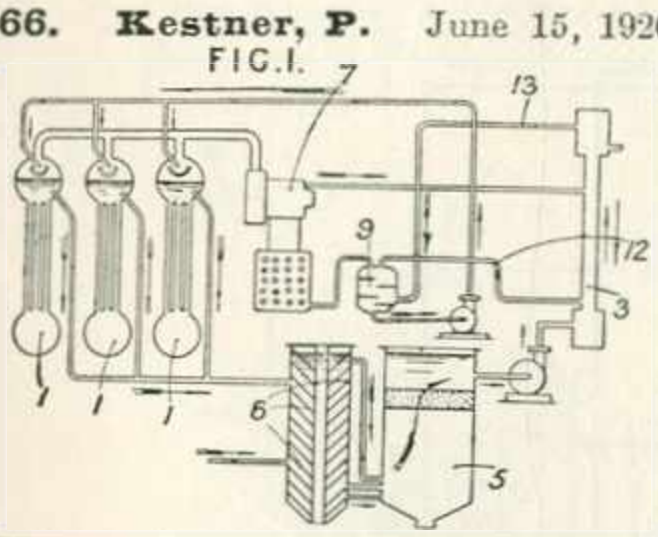
165,053.



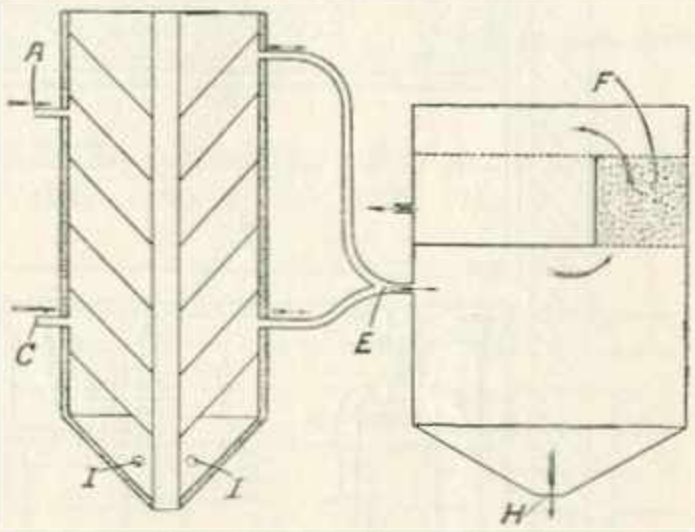
165,066. Kestner, P. June 15, 1920.



Feed-water, heating.—The make-up water of boilers fed with distilled water is heated and purified by water continuously blown down from the boilers and then evaporated. Blown down water from the boilers 1 heats the fresh feed in a heater 6, the mixture of the two waters being passed through a decanting chamber 5 and fed to an evaporator 3 and, after distillation, supplied to the boilers. The evaporator may be heated by steam from a turbine 7 supplied with steam from the boiler. The water of condensation from the evaporator is led by a pipe 12 to a chamber 9, and mixed therein with the evaporated water entering through a pipe 13, and with water of condensation from the turbine condenser. In a modification, the steam-heated evaporator is replaced by a boiler. The steam from the boiler passes into the supply pipe of the turbine, feed-water being drawn directly from the turbine condenser.

165,068. Kestner, P. June 12, 1920, [*Convention date*].

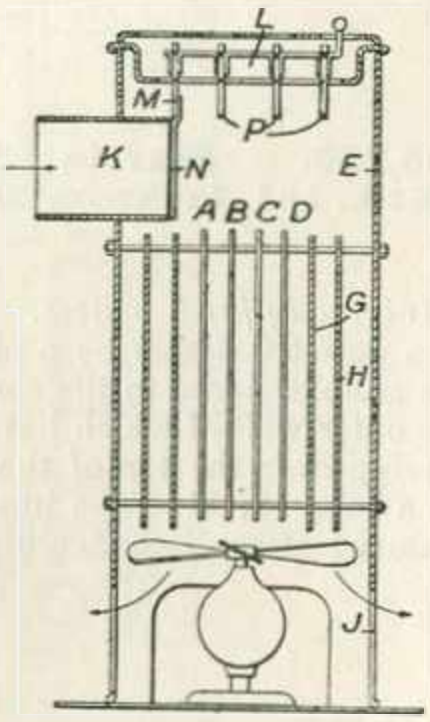
Feed-water, heating.—In apparatus for purifying boiler feed-water, fresh feed and blow-down water entering a heater through inlets C, A, respectively, flow in opposite directions through separate helical passages formed by plates. The two waters enter a decanting chamber through a



common pipe E and pass through a filter F at the top of the chamber. Openings I, H are formed in the bottom of the heater and of the chamber for the removal of sediment.

165,129. Mower, G. A. Oct. 12, 1920.

Heating air. — In heating and ventilating apparatus comprising hot elements enclosed in a casing and having means whereby air is drawn down through the casing, insulating means are interposed between the elements and the casing. Four electric heating - elements A, B, C, D are arranged vertically on the casing E, and a fan is placed at the bottom for drawing air downwardly through the casing



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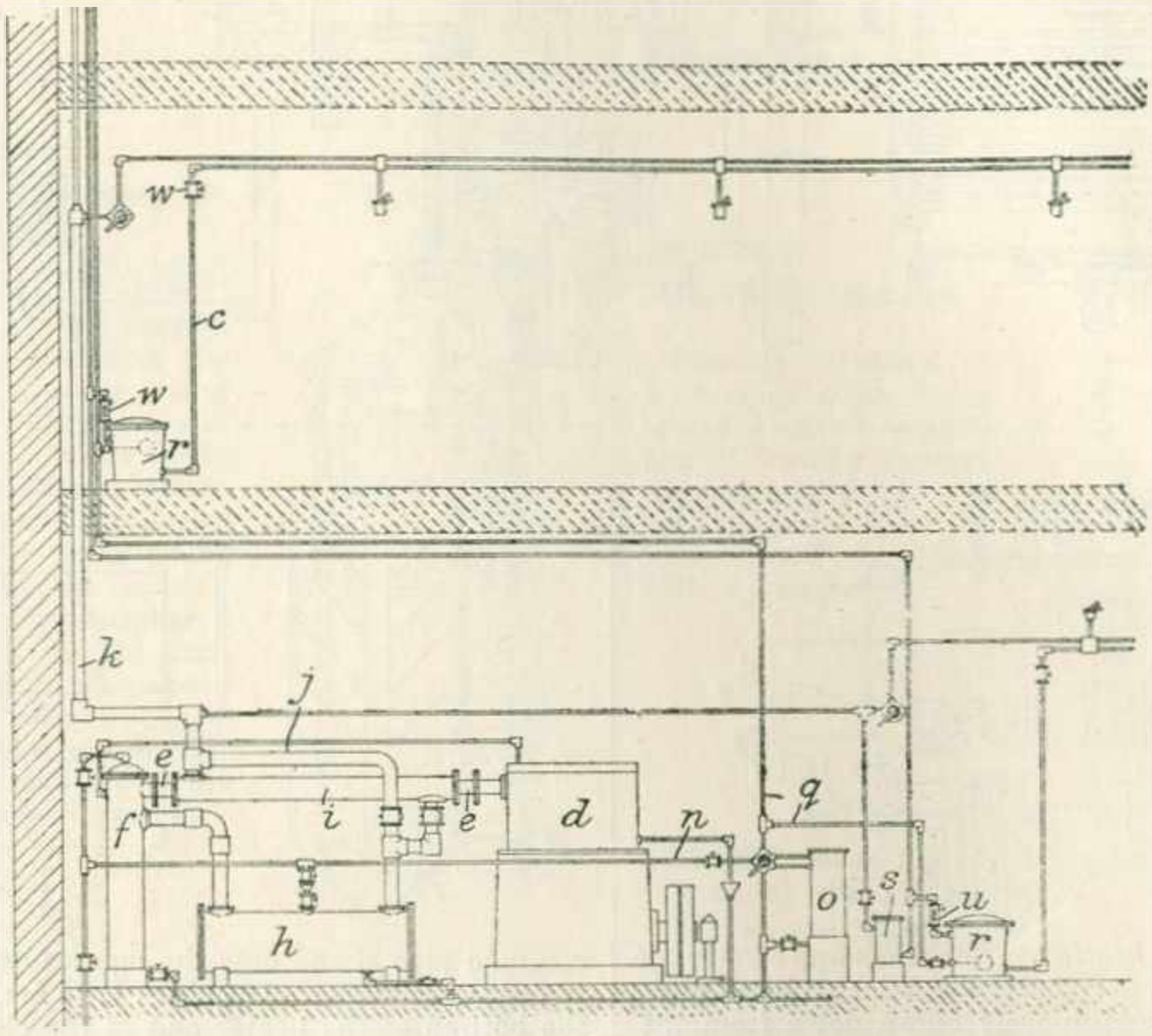
the heated air through openings J at the floor level. To prevent direct radiation the elements are surrounded by cylinders G, H. The cold air may be drawn direct from the outside through the pipe K, or from the upper part of the room through a louvre L. The plates M, P which control the louvre are coupled to the plate N of the pipe K.

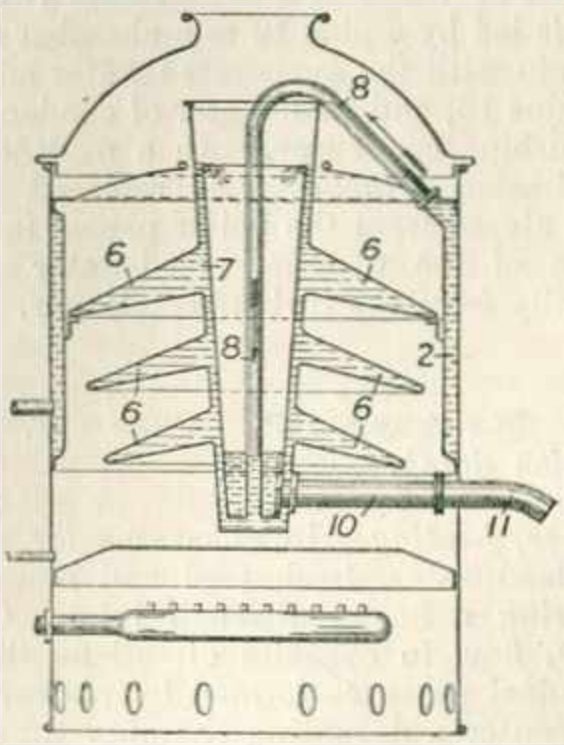
165,145. Thorp, F., Thorp, H. T., and **Textile Illuminating & Engineering Co., Ltd.** Feb. 19, 1920.



Heating air.—In humidifying systems of the kind in which liquid is atomized by compressed air, the air is delivered from the compressor *d* through a pipe *e* to a cooler *f* and from thence to the filter *h*. The filtered air passes through a re-heater *i* which is a jacket around the hot air delivery pipe *e*. If re-heating is not required the re-heater may be by-passed and the air delivered directly by the pipe *j* to the main *k*.

165,268. Martin Engineering Co., Ltd., and **Jackson, E.** April 19, 1920.

Internally-fired boilers.—Cold water admitted to a jacket 2 passes by a pipe 8 to the bottom of the annular space in the central heating-chamber, the outer wall of which has hollow discs 6, finally passing over the top of the inner wall 7 and out by a tube 10, 11. The inner wall can be readily removed after disconnecting the outflow pipe 10.



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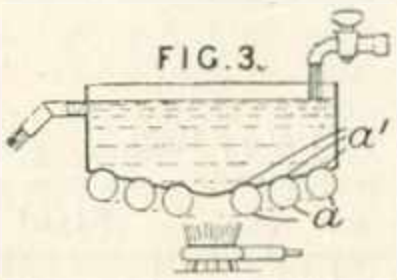
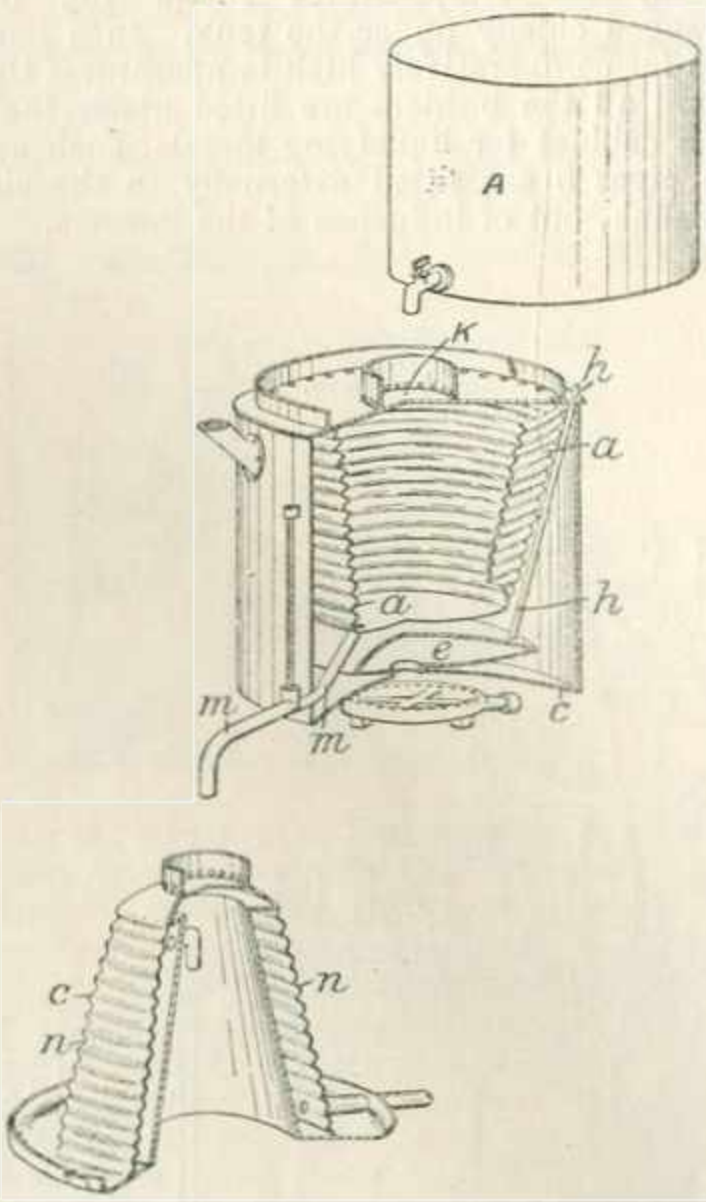
165,299. Simpson, W. M. May 19, 1920.

Boilers; geysers. — A receptacle for heating water is provided with one or more openly wound helices *a* of copper &c., wire, secured by soldering &c., in grooves or shallow depressions *a*' in the bottom of the vessel. Where more than one helix is employed, as shown, the helices are formed of different pitches, the ones of coarser pitch being situated nearer to the source of heat. The helices may be of circular or other section.

FIG. 3.



165,329. Nunn, T. E., and **Froggatt, W. C.** June 22, 1920.

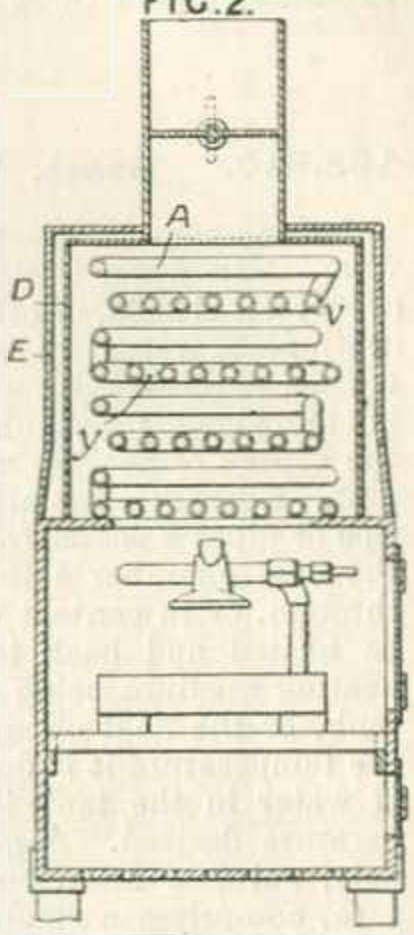


Heating liquids.—In a heater primarily for sterilizing, milk flows from a container A to the distributor K and down the inside of the vessel *a* before passing by the pipe *m* to a cooling surface *n*. The heater is provided with a water jacket heated by a gas burner and has a dished bottom *c* and an inner heating chamber *e* with a vent-pipe *h*.

165,526. MacLennan, A. March 27, 1920.

Water-tube boilers.—Water is heated in sinuous tubes A arranged in horizontal rows, the elements *v* in any one row being at right-angles to those in the adjacent rows, and vertically over the spaces *y* between the elements in the lower alternate rows. The tubes are enclosed by a thin metal casing D and by a covering E, and are preferably heated by the vapour burner described in Specification 145,928, [*Class* 75(i), Burners &c.] Water is passed downwardly through the tubes.

FIG. 2.



165,533. Smith, P. A., and **Rutter, J. M.** March 30, 1920.

FIG. 4.

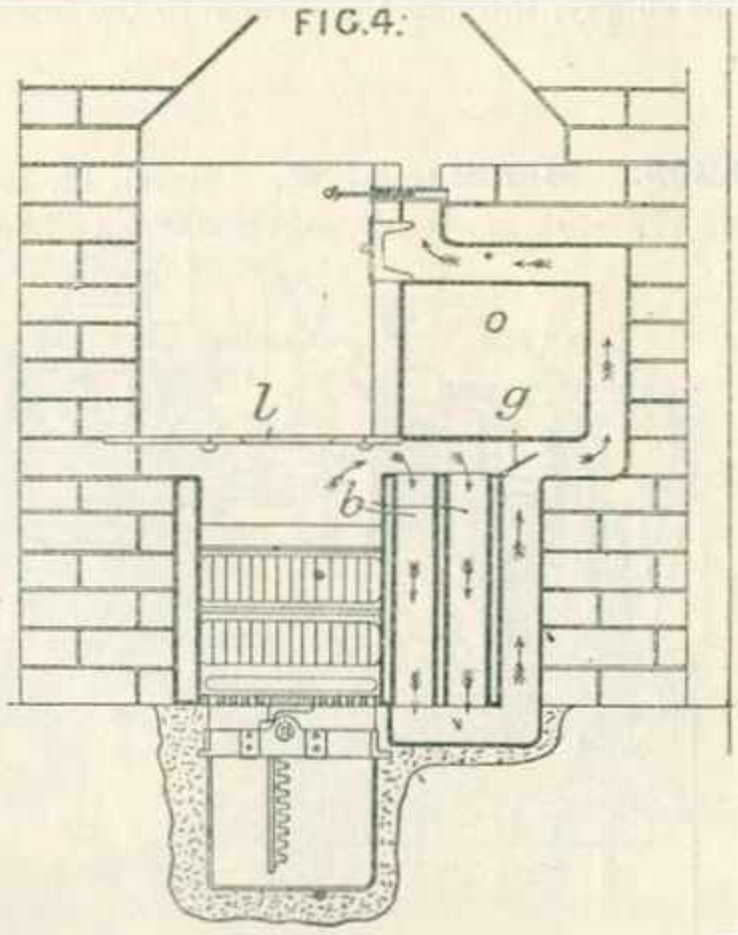
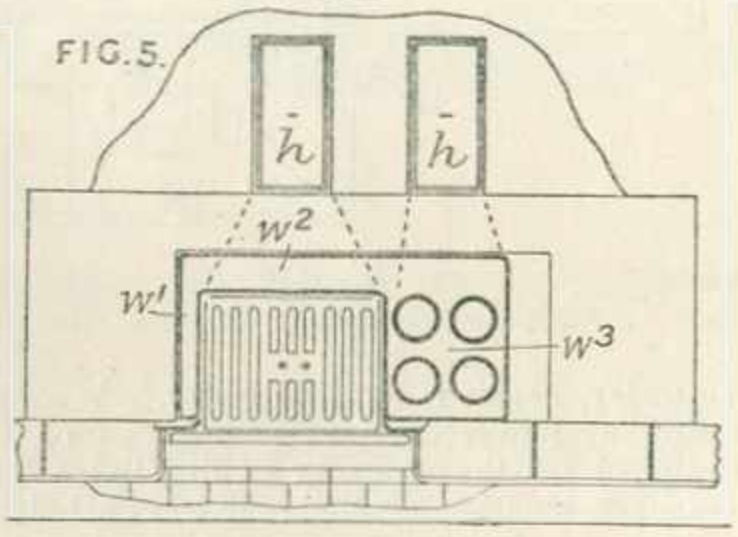


FIG. 5.



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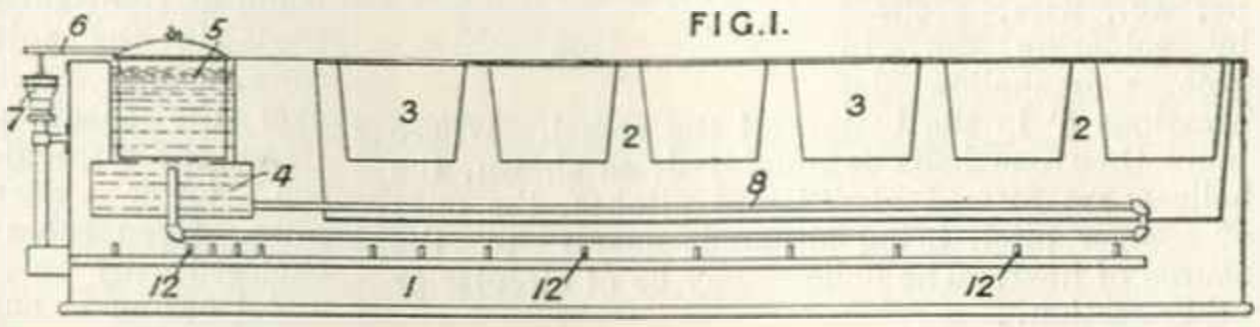
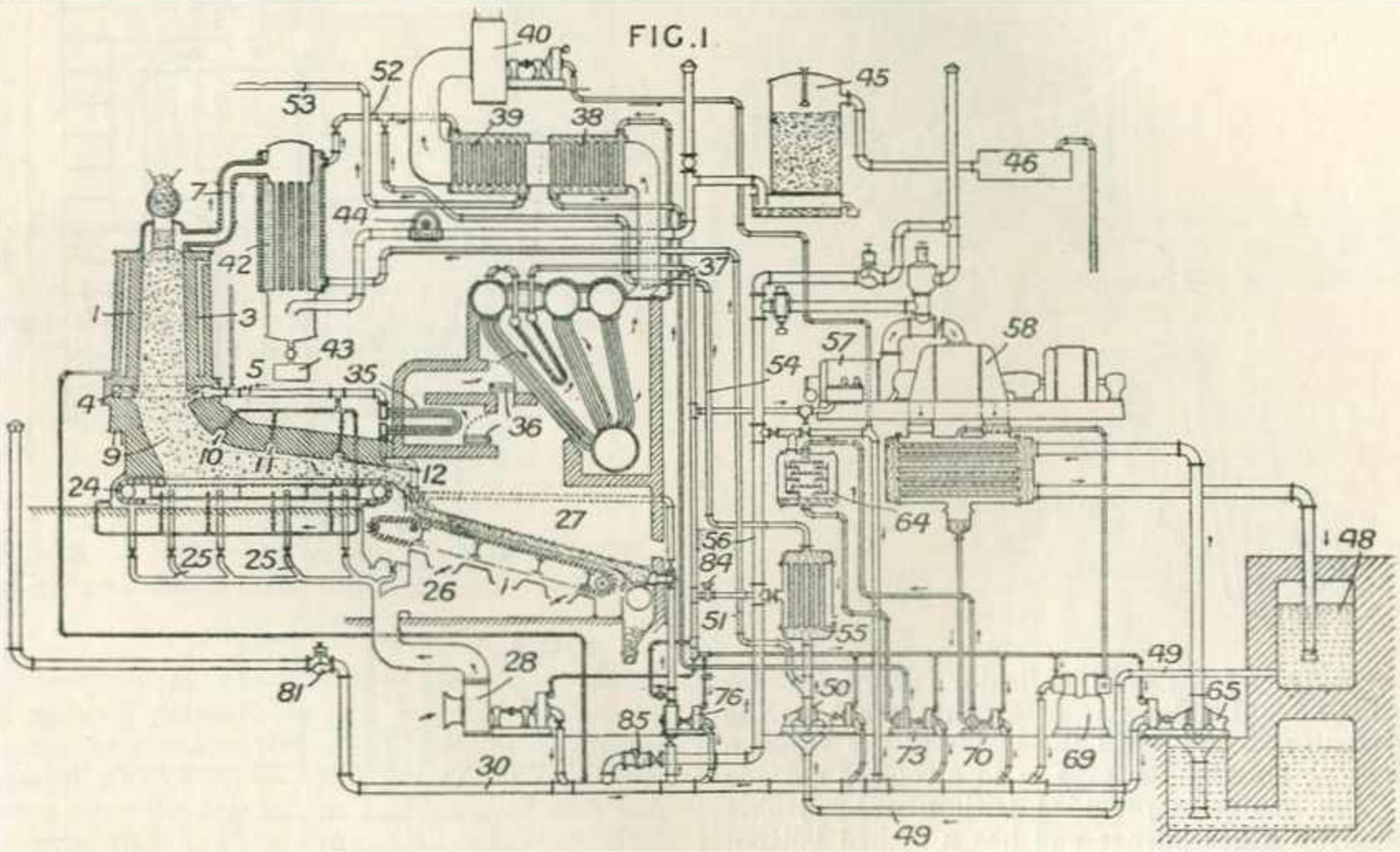
Stoves or slab form boilers.—A boiler for a cooking-range comprises water spaces W^1, W^2, W^3 extending round three sides of the fire space and having vertical flues *b* through one or both of the side water-spaces.

165,610. Stott, V. H., and **Schofield, L.** May 7, 1920.



Boiling-pans and the like. — In water-heaters, ovens, hot closets, or other heating-apparatus wherein a float or inverted cup 5 is employed to regulate the supply of heating medium, a water circulating pipe or pipes 8 passes from the float chamber 4 into, through, or in contact with the tank or oven 2 to be heated and back to the float chamber, the heating medium being positioned under or in the tank, or the float chamber, or both, according to the temperature it is desired to maintain. The use of water in the tank is determined by the temperature desired. A gas-heated cabinet for glue pots, suitable for a comparatively low temperature, comprises a chamber 1 containing the tank 2, with glue pots 3, and the float chamber 4 containing the float 5 which operates the spring-controlled valve 7, controlling the gas, steam, or vapour supply, through the lever 6 to the burners 12 grouped under the float chamber and spaced under the tank, or the burners under the tank may be omitted if a very low temperature is desired. The tank is heated by the circulating water assisted by the spaced burners. An arrangement for medium temperatures shows the burners arranged chiefly under the tank. In a modification for comparatively high temperatures the pipe 8 and all the burners are fitted under the tank. In a cabinet for liquefying metals, such as lead, the pipes 8 are fitted externally to the sides of the tank, out of influence of the burners.

166,209. Bennis, A. W. March 12, 1919.



Feed-water, heating; heating water.—A power-generating system comprises coke-ovens or the like designed for the recovery of distillates and wherein carbonization of the fuel is effected, in combination with conveyers, gas-sealing appliances, mechanical stokers, fans, boilers, superheaters, turbo-generators, pumps, condensers, heaters, economizers, &c. The boiler flue 37 is

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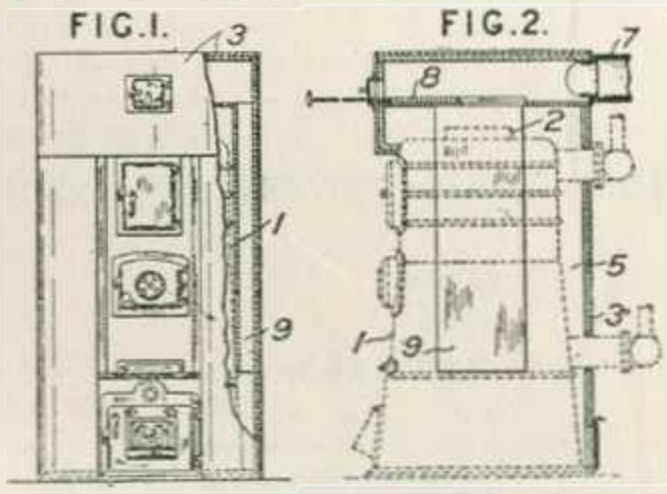
connected to a boiler feed-water economizer 38 and a service hot-water economizer 39. An exhauster 40 withdraws the flue gases. The distillates &c. pass into a combined condenser and charge sump 48 is led by pipe 49, pump 58, pipe cooler 42 having a sump 43. Water from the discharge sump 48 is led by a pipe 49, pump 58, pipe 51 through the apparatus 42, and passes by pipe 52 to an economizer 39 and a hot water service main 53 which is also fed from a pipe 54 connected to a heater 55 heated by bleed steam from an intermediate stage in the main motor 57, 58. The circulating pump 65, air pump 69, hot-well pump 70 which supplies the feed-water heater 64, the boiler feed pump 73 which passes the water from the heater 64 to the economizer 38, the hot-water service pump 50, the circulator 76, fan 28 and exhauster 44 are driven by noncondensing steam turbines which exhaust into pipe 30. Excess steam may pass a valve 81 to the atmosphere. An emergency steam connection is provided between the high pressure main steam supply and auxiliary exhaust main 30 through a reducing valve 84. An automatic valve 85 is arranged between the main 30 and the bleed steam main 56.

166,342. La Fay, A. J. April 12, 1920.



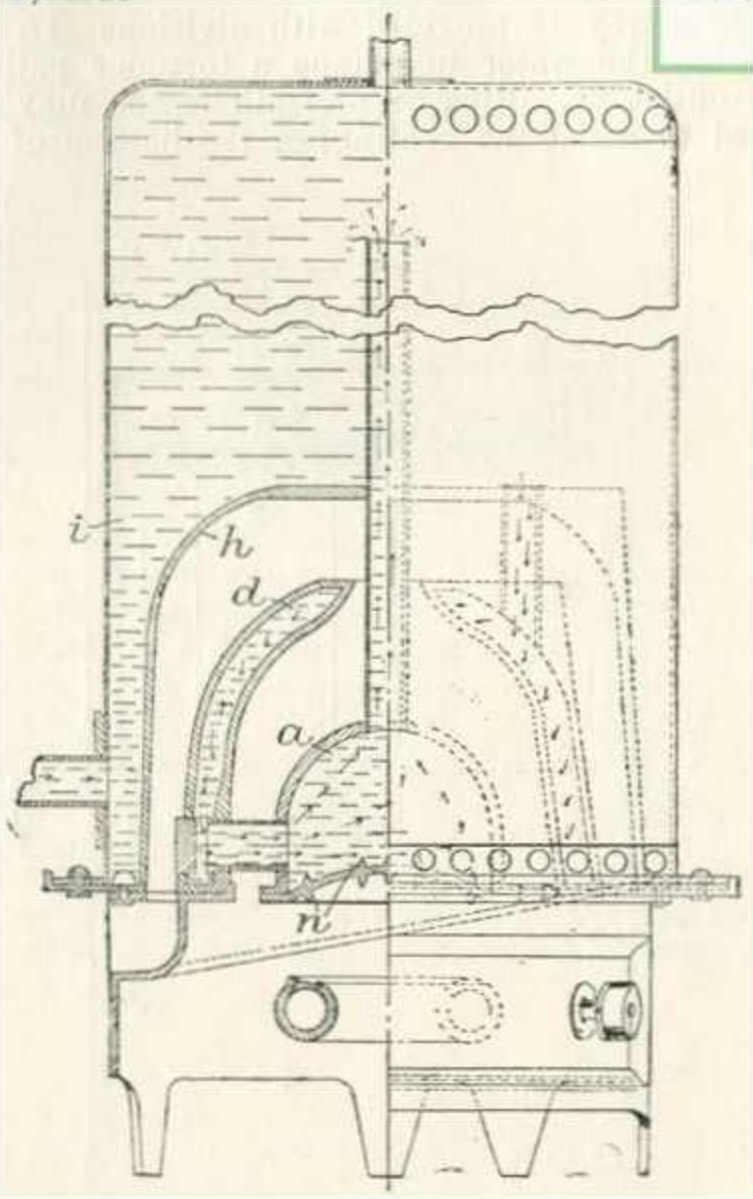
Boilers.—A boiler 1 is enclosed in a refractory casing 3 which is fitted with one or more flues 9 such that combustion products emerging from the internal flue at 2 flow over the exterior surface of the boiler, in the space 5 before passing to the outlet 7 by the flue 9. A damper 8 can be withdrawn to allow the gases to pass direct to the outlet at starting. A modification is described applying the invention to horizontally flued boilers.

166,455. Stimson, E. F., and **Stimex Gas Stove Co., Ltd.** July 24, 1920.

Internally-fired boilers.—A combined storage tank and hot-water circulator comprises a boiler *a* and a jacket feed-water-heating chamber *d* enclosed within a domed space *h* in the bottom of the tank *i*. The bottom of the boiler may be provided with projections *n*. Specification 868/15 is referred to.

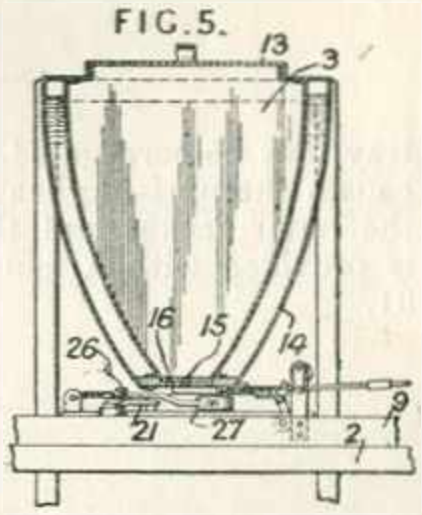
(*For Figure see next column.*)

166,455.



166,531. Onofrio, L. d'. July 17, 1920, [*Convention date*].

Boiling-pans and the like. — A syrup or sugar boiler, for use in confectionery making, is provided with a bottom having a transverse line of perforations 15 the delivery of liquid through which is controlled by registering perforations in a transversely sliding plate 16, and also with an adjusting screw which abuts against the end of the plate 16, the movement of which is limited by a spring. The boiler is provided with a lid 13 and is heated by a steam or hot-water jacket 14 having a drain cock.



166,792. St. Leger, A., and **Richmond Gas Stove & Meter Co., Ltd.** June 2, 1920.

Geysers; internally-fired boilers.—Water is directed on to the shallow cover 4 of the heating-space of a geyser, thence passing to the annulus

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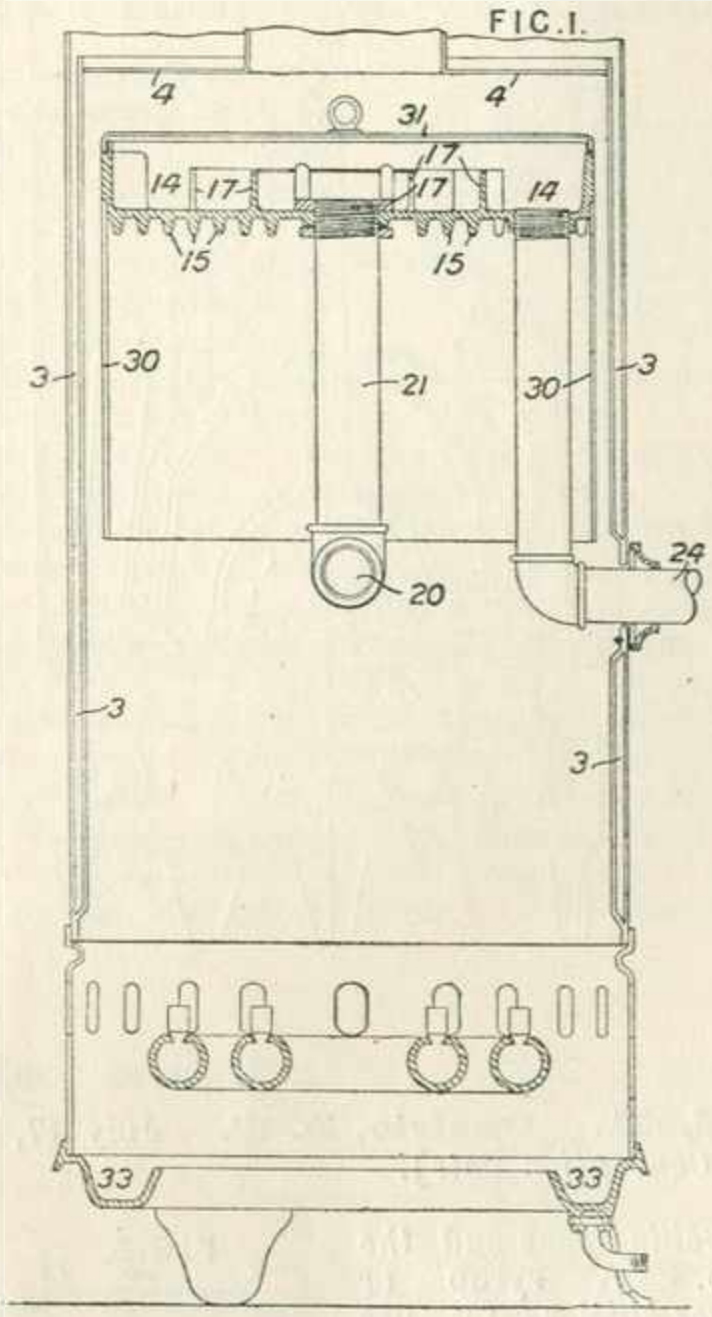
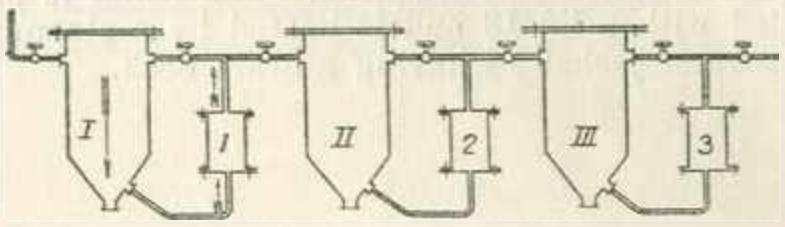
through cross pipes 20 and vertical pipes 21 to a tray 14 provided with divisions 17 for causing the water to pursue a tortuous path to the outlet 24. Ribs or projections 15 may be fitted to assist the heating, or the bottom of the



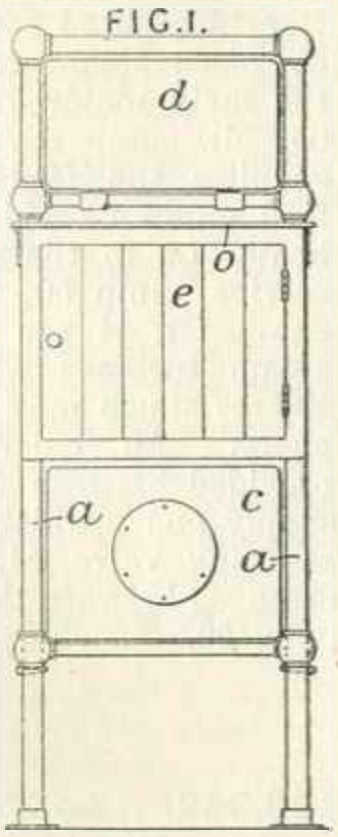
tray may be corrugated. A depending curtain 30 causes the uprising heating gases to pass close to the outer jacket and the drip-collecting rim 33 is provided with a flange joint for the exit pipe 31.

166,896. Collard, C. July, 24, 1920, [*Convention date*].



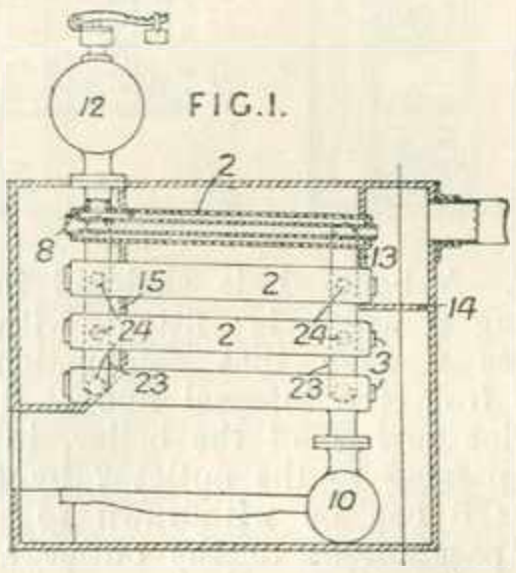
Digesters.—A series of digesters I., II., III., charged with ossein and heated by external circulatory heaters 1, 2, 3 is operated so that the extract from the first after heating until the gelationmeter shows 2 per cent, is passed by stages through the other digesters, each time meeting ossein which has had one fewer treatment until the juice is concentrated by treatment in the last digester in which it meets fresh ossein.

166,955. Mitchell, F. April 23, 1920.



Heating water — A portable hot-water system for prises hot and cold water tank *c*, *d* and a hot-water chamber *e*, all supported in a tubular stand *a* which can readily be taken to pieces for transport. A collapsable shelf *o* may be provided over the hot-air chamber.

167,105. Davis, W. K. Sept. 22, 1920.



Water-tube boilers.—A boiler comprises upper and lower transverse drums 12, 10 and vertical rows of water-tubes 2 transversed by smoke-tubes 3. The rows of tubes are connected by branch pipes 24 to vertical headers 23. Baffles 13, 14, 15 direct the gases forwards through the smoke-tubes in the lower water-tubes and backwards through the smoke-tubes in the upper water-tubes. The smoke-tubes have enlarged ends 8.

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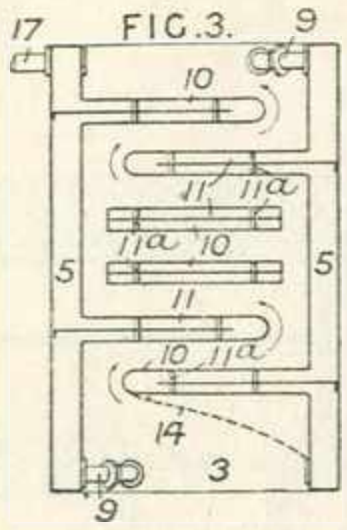
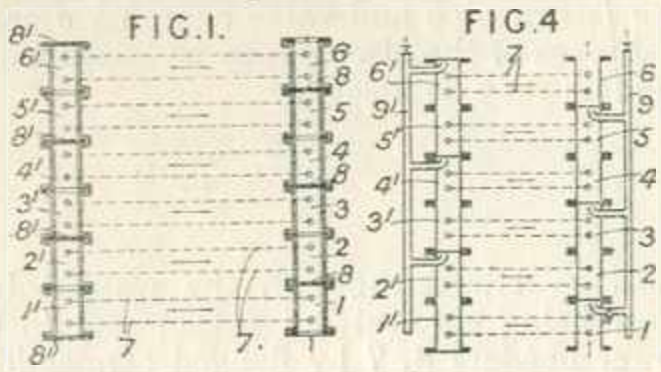
167,106. Long, S. J. T. Sept. 27, 1920.



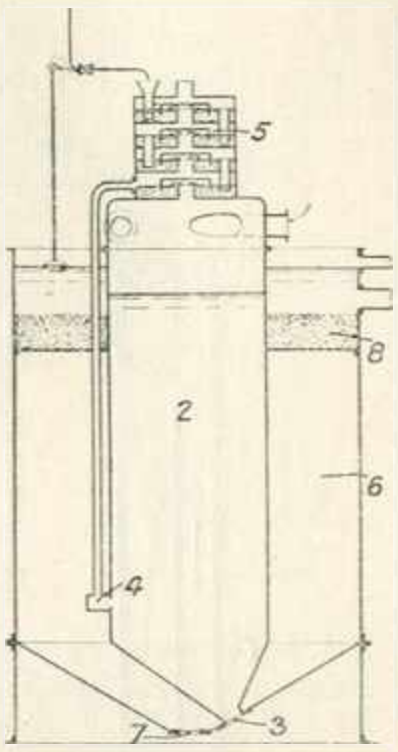
Internally - fired boilers.—A water-heater formed with separate sides, back and front, containing water spaces 5, and enclosing a combustion chamber 3, is fitted with couplings 9 across the interior corners of the chamber which provide communication between the water spaces. Horizontal water-chambers 10, fitted with baffles 11 and baffle spacers 11[a] and preferably trapezoidal in plan, project from the water spaces into the combustion chamber. Detachable securing-clips are fitted to the corners of the heater, which rests in a base provided with a channel for collecting any condensed water. The heater is fitted over a gas burner and provided at the top with an uptake for the products of combustion. The slower chambers 10 are shielded from the burner by a perforated baffle 14. The water enters at the top of the heater by the pipe 17 and after passing through the spaces in series leaves at the top, the coupling between the first and last water space being a blank fitting. Extra blank couplings or stays may be fitted. In a modified construction for the basement of a building, each chamber is replaced by a number of tubes, secured to the water spaces by nuts and provided with baffles comprising a series of fingers. In this construction the sides, back, and front are bolted together by corner-pieces.

167,140. Dieterlen, H. July 29, 1920, [*Convention date*].



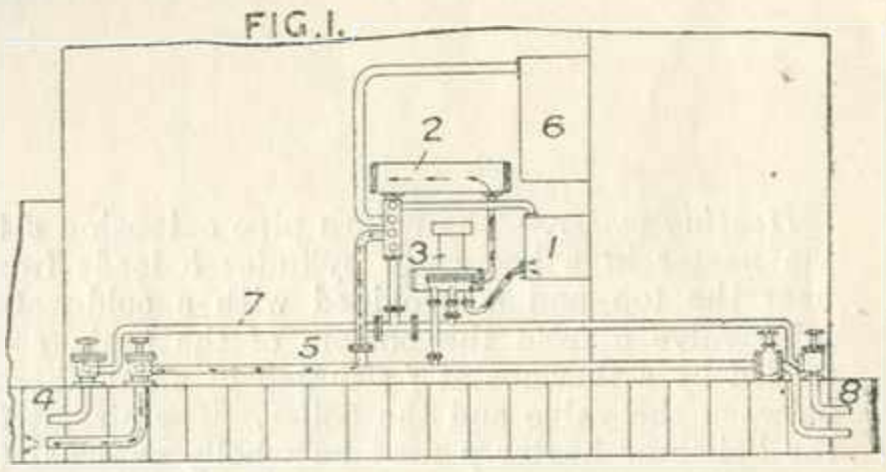
Feed-water, heating.—Feed-water is heated in curved tubes 7 connected to headers in sections 1 - - 6, 1[1] - - 6[1]. The headers are arranged in consecutive corners of a smoke flue. Baffles 8, 8[1], inserted between sections may direct the flow of water through any number of banks of tubes. At the top of each division of the header steam and gas relief pipes may connect with tubes 9, 9[1] as shown in Fig. 4. These relief pipes may lead from one division to the next above it or from division to division zig-zag across the heater.

167,142. Kestner, P. July 27, 1920, [*Convention date*].



Feed-water, heating.—In apparatus for heating feed-water by water blown down from the boiler and then decanting it, blown-down water flows downwardly through a vessel 2 surrounded by an annular decanting chamber 6. Fresh feed previously heated in a heater 5 by the steam given off by the blow-down water is supplied to the bottom of the vessel through a pipe 4. The mixed waters flow upwardly through the annular chamber and through a filter 8. Sediment is removed through mud-cocks 3, 7.

167,207. Manson, P. March 5, 1920.



Heating liquids.—Oil fuel &c., which is semi-fluid when cold, is discharged from receptacles by heating the liquid at the outlet pipe of the tank, withdrawing the liquefied portion, passing it through a heating apparatus, and returning a portion of the heated liquid to the tank to liquefy another portion. Apparatus for carrying out the process comprises an auxiliary tank 1 containing heated fuel which is forced by a pump 3 through a heater 2 and pipe 5 to the fuel-tank 4, where it liquefies the fuel near the pipe 5. The pump is then reversed to withdraw the liquefied fuel and force it through the heater 2, from which a portion of it is returned to the tank 4 through the pipe 7, the remainder passing to the storage tank 6. A second tank 8 may be discharged by extending the pipes 5, 7.

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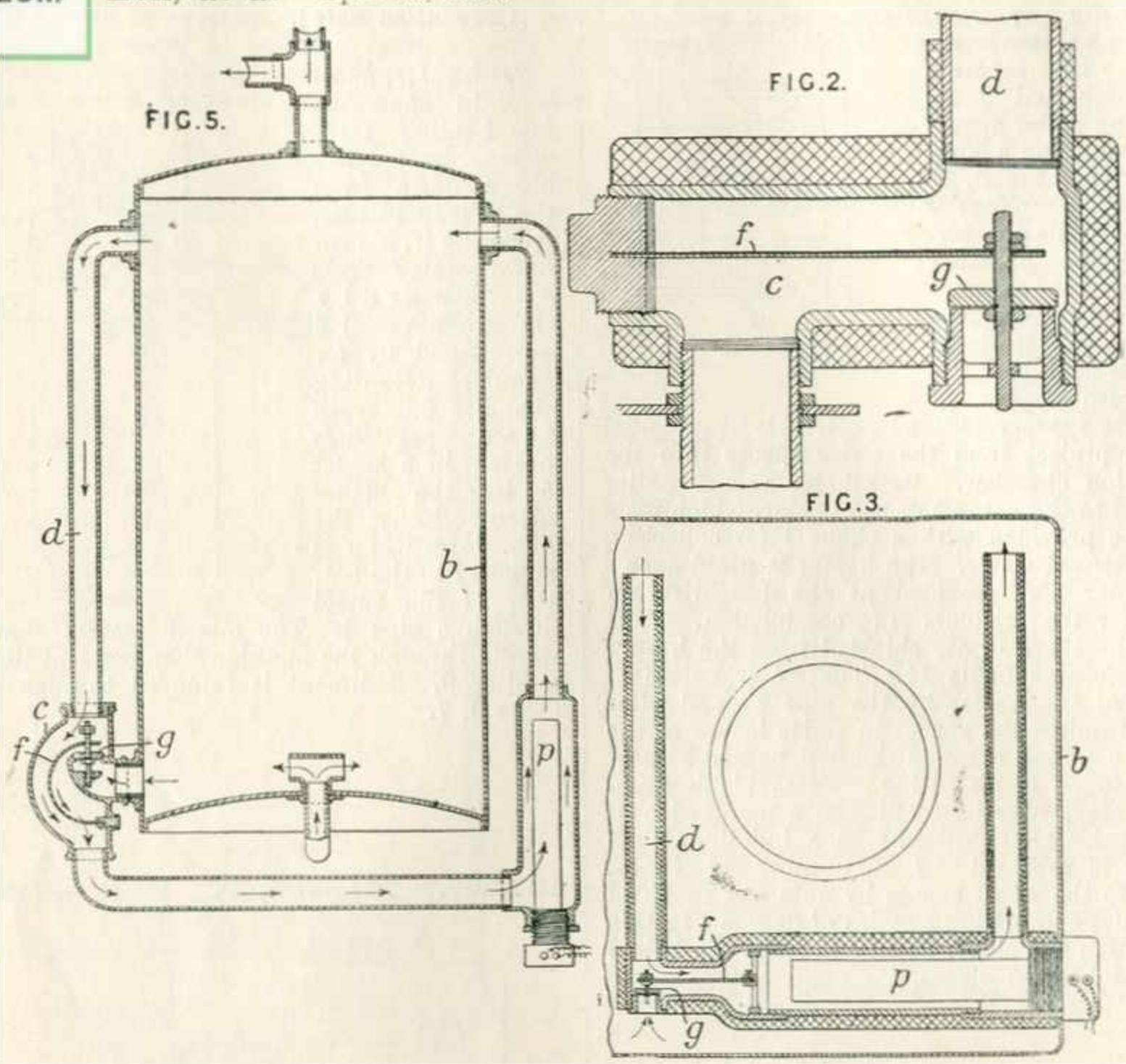
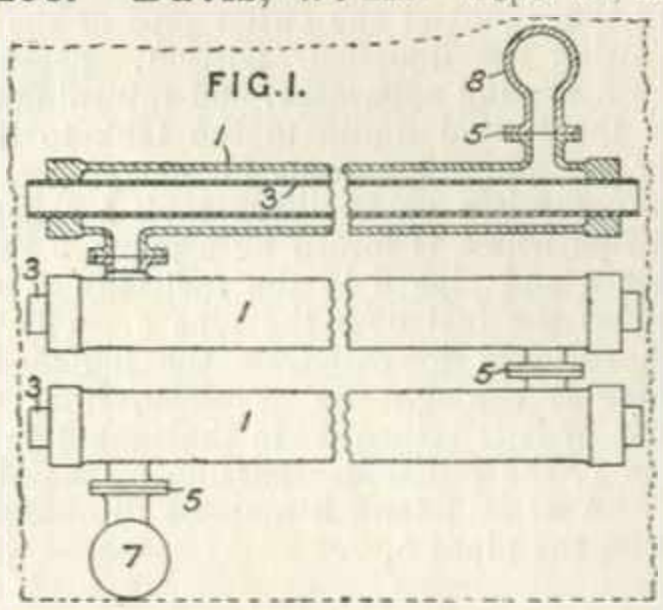
167,230. Bell, G. G. April 28, 1920.



Heating water.—The return pipe extension *d* to the heater in a hot-water cylinder *b* leads from near the top and is provided with a cold-water inlet valve *g* from the bottom of the tank, controlled by a thermostat *f* situated in a chamber *c* between the valve and the boiler. The circuit to the boiler or heater *p* may be wholly external to the cylinder as shown in Fig. 5 or wholly internal as shown in Fig. 3, or the return pipe extension and valve chamber only may be within the tank *b*. The return pipe and valve chamber *c* and any internal pipes of the circuit may be heat insulated. The heaters may be electric.

167,406. Davis, W. K. Sept. 13, 1920.



Feed-water, heating.—A fuel-economizer consists of vertical rows of horizontal water-tubes 1 traversed by smoke-tubes 3, the water-tubes in each row being connected together and to upper and lower headers 8, 7 by flanged connections 5. The ends of the smoke-tubes may be enlarged, or may be cast integral with the water tubes, as described in Specification 167,105.

167,498. Soc. Anon. Radiolux, (Assignees of *Boizard, R., and Biclet, E.*). Aug. 7, 1920, [*Convention date*].

Small heaters.—The heat from an illuminating lamp which is placed on a platform F is utilized to circulate water through a radiator G from the top downwards for warming a room. The heating coil B delivers an emulsion of steam and water into an expansion tank A carried by a shade E. Other forms of heater are described comprising

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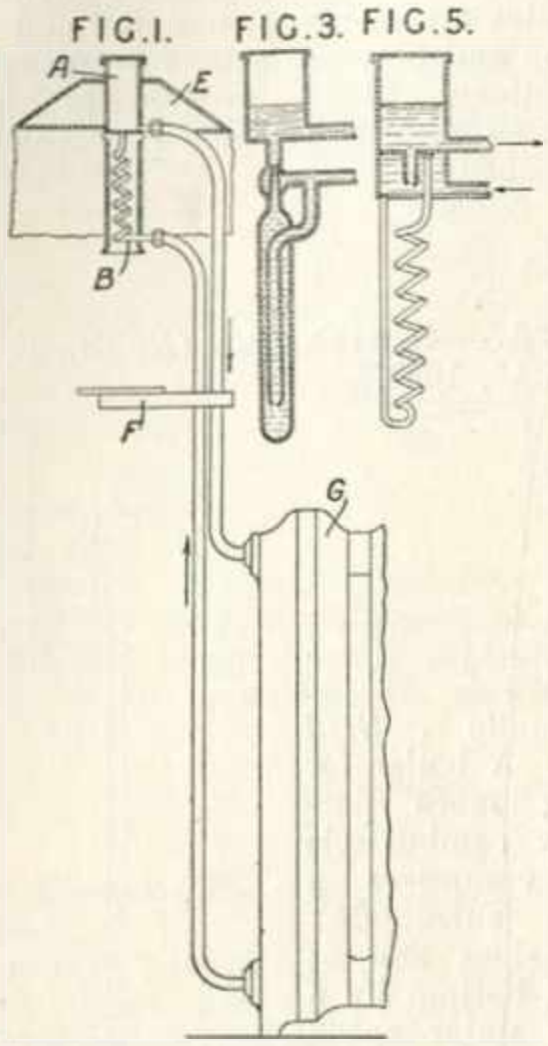
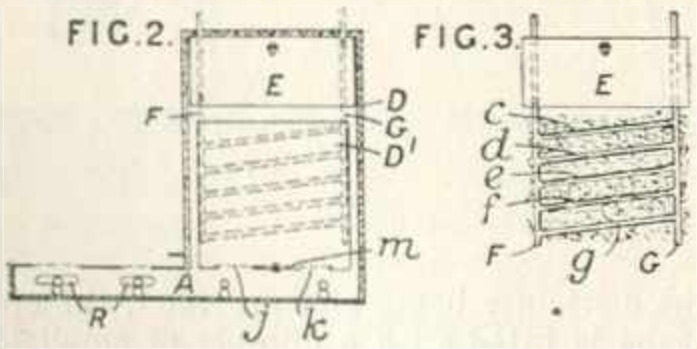
single and double Field tubes, an injector apparatus as shown in Fig. 3, coiled tubes with coils in



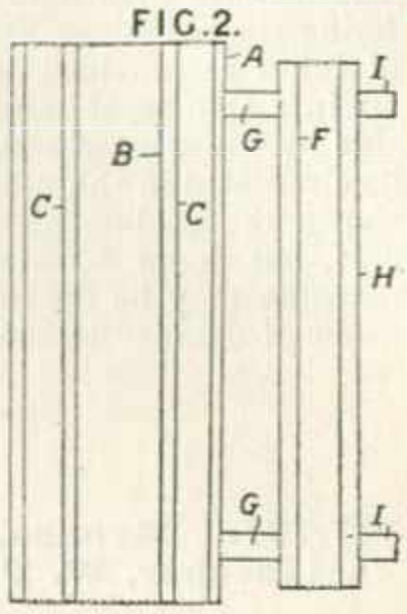
a lower compartment of the expansion tank to effect a preliminary warming and a heater shown in Fig. 5 stated to circulate by pulsation.

167,524. Bohar, V. April 6, 1920.



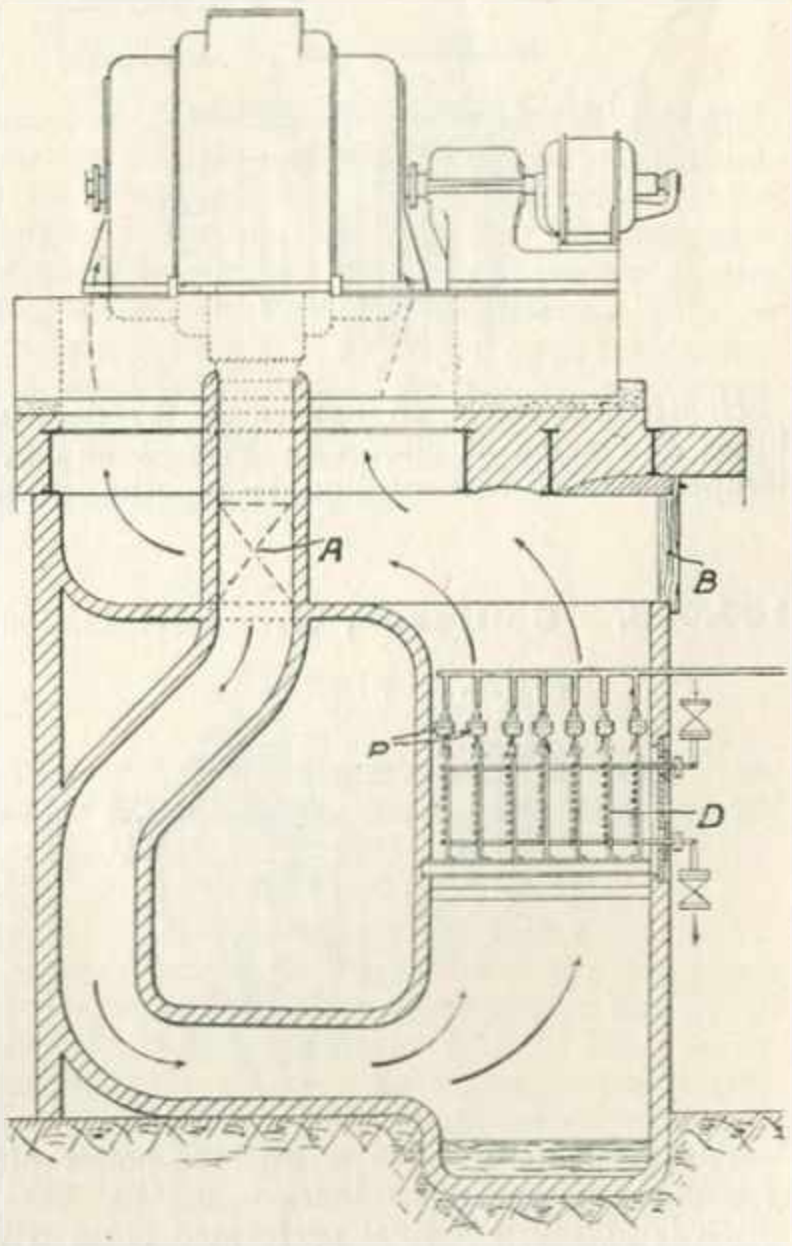
Water-tube boilers. — A hot-water system arranged in the oven flues of a cooking-stove comprises a water-tank E in the top flue connected to circulating-pipes F, G, with a number of inclined connecting pipes *c*, *d*, *e*, *f*, *g* arranged in the back flue. A coil may be substituted for the inclined pipes, and the flue space around the pipes is preferably packed with heat conducting and absorbing material such as metal shavings, wire, or gauze.

167,619. Soc. Anon. la Générale, and Delferrière, A. May 21, 1920.



Annular and block form boilers.—A boiler adapted to be inserted in a stove or the like for the production of hot water or steam for central heating comprises one or more thin-walled tubes of steel, copper, or other material in which fit internal tubes forming flues and around which free circulation of water or steam takes place. The two tubes A, H, comprising the boiler are connected by circulating-tubes G, and are placed in the uptake and downtake flue respectively. The boiler is provided with flue tubes B, C, F and supply and delivery connections I. The combustion gases pass upwardly through the tubes B, C as well as around the tube A and down through the tube F. In a modification, the boiler may comprise only one tube A and its internal tubes, or it may comprise an external and internal annular water space connected by cross circulating-tubes.

167,750. Pourcel, M. L. Aug. 11, 1920, [*Convention date*].



Heating by hot air.—In a method of cooling

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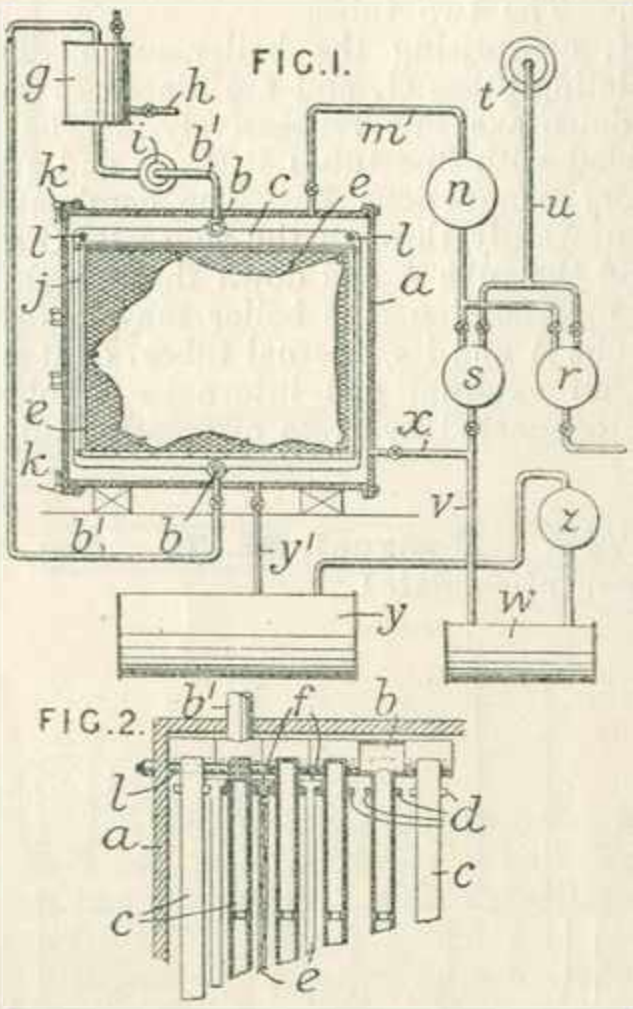
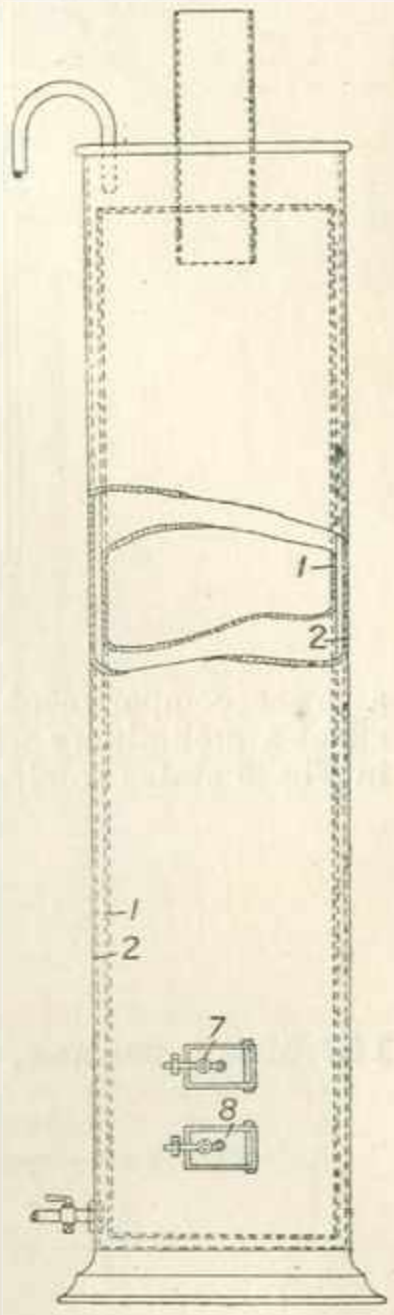
alternating-curernt generators the cooling air is scrubbed and its heat given out by being brought into contact with finely divided water before entering the machine. The air is passed over a set of tubes D provided with fins which divide the air into thin layers and are sprinkled on the outside by a stream of water troughs P. Water may be circulated in the tubes D. In the arrangement shown the cooling air circulates in a closed circuit, but doors A, B are provided by which the machine may be operated on open circuit in the event of damage to the tubes D.

167,787. Krouse, C. C., Davis, E. H., and **Beeber, W. P.** Feb. 16, 1920.



Heating liquids.—In apparatus for degreasing hides and skins as shown in Figs. 1 and 2, the temperature of solvent liquid in the treating chamber *a* is regulated by water heated in a tank *g* by steam from a pipe *h* and circulated by a pump *i*, through hollow plates *c* in the chamber. The plates *c* are strung on rods *l* and are formed with top and bottom headers *b* arranged in abutting sections. Flanges or runways *d* between the plates *c* support wire frames *e* to which the hides are attached.

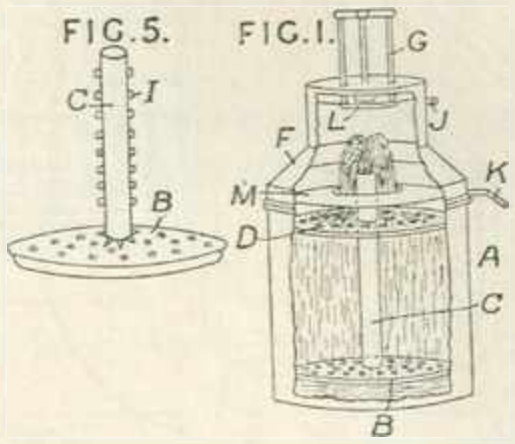
167,974. Smith, A., (*Holden & Co., Ltd.*). Sept. 15, 1920.



Internally - fired boilers.—A boiler for burning more particularly combustible refuse comprises a firebox surrounded on all sides and at top and bottom by a shallow water space between walls 1, 2. No firebars are fitted, but doors 7, 8 provide for firing and the admission of air.

Reference has been directed by the Comptroller to Specifications 3841/87 *and* 103,899.

167,993. Collinson, G. Nov. 22, 1920.



Washing-boilers. — In a washing-boiler of the type comprising a container A in the base of which is placed a conical perforated plate B with a central circulating-tube C, discharging-means for the container being also provided, the circulating-tube is fitted with a number of small jets I, Fig. 5, for producing additional circulation through the clothes at various angles. The loose sieve D for retaining the clothes has notches in a central hole disposed to agree with the position of the jets, so that the sieve can be locked on the tube in the desired position. The washer is self-regulated by the bevelled plate M in the cover F, any excess water draining away by the outlet K and the volume of water retained depending on the size of the central hole in the plate M. The boiler is discharged by lowering the handle G until the plate L covers the hole in the plate M, the outlet K being turned into a downward position when discharging and regulating. A steam safety outlet J is provided in the cover.

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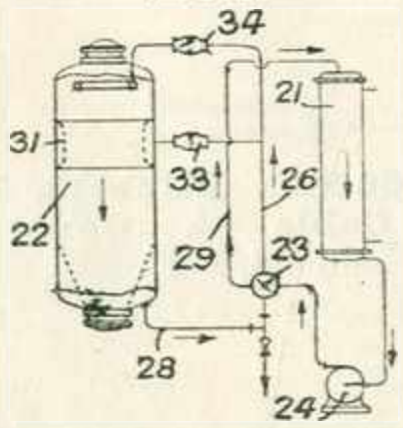
168,304. Akt.-Ges. der Maschinenfabriken Escher, Wyss, et Cie. Aug. 21, 1920, [*Convention date*].

Digesters.—In a process and apparatus for alternating the flow of liquid in passing between the heater 21 and pump 24, and the digester, either enters the top of the digester by way of the cross-over valve 23, pipe 26 and non-return valve 34, returning through pipes 28, 29 as shown, or, with the valve 23 moved through 90° enters the digester at the bottom through the pipe 28 and leaves at a point just above the half height through a strainer 31, non-return valve 33, cross-over 23, and pipe 29 to the heater 21.

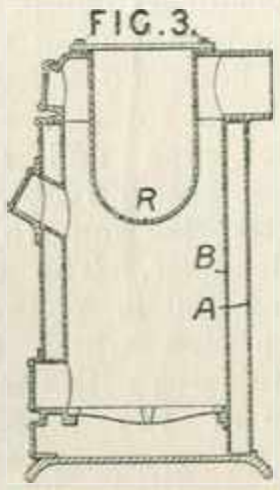
FIG. 2.



168,519. Green, H. Aug. 19, 1920.

Heating water; boilers. — A combined boiler has an annular water-holding shell A, B, and a second independent block boiler R mounted above and extending into the outer shell both heated by the same fire. The outer boiler may heat water or provide steam for a radiator system and the inner boiler heat water for domestic purposes. The two systems may be inter-connected by means of suitable cocks.

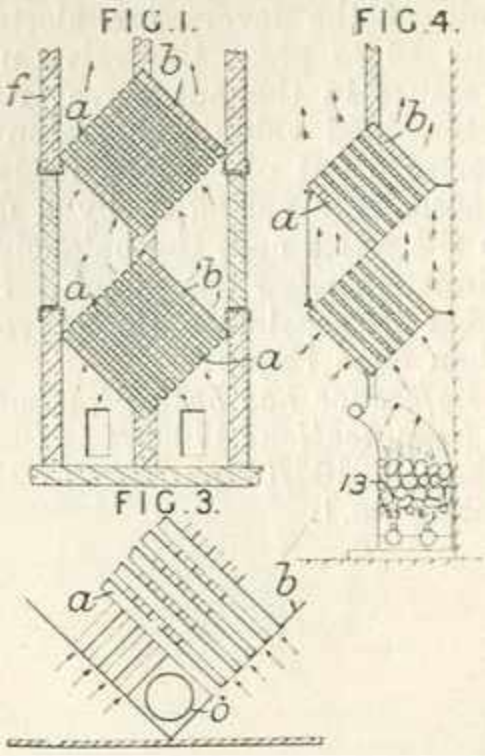
FIG. 3.



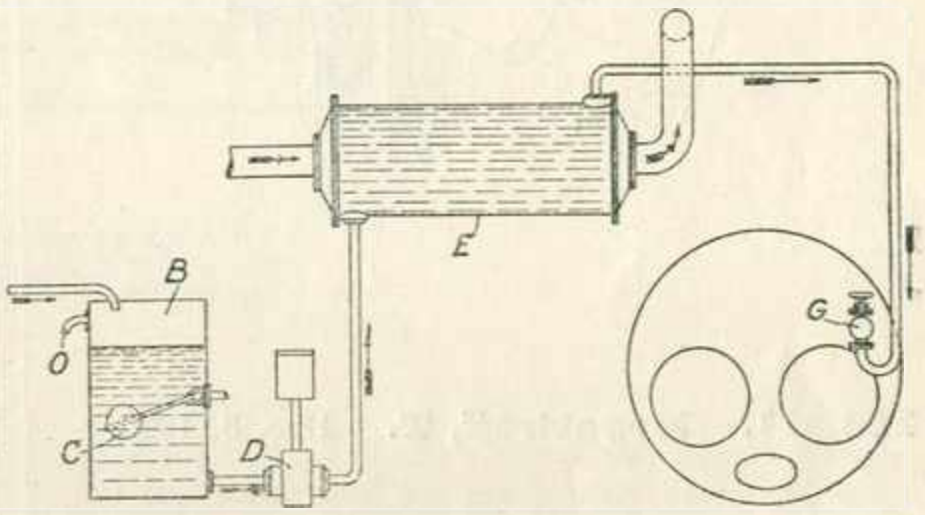
168,609. Pease, E. L. March 2, 1920.

Heating air; heating liquids. — Two or more tanks *b* provided with separate crossed sets of inclined tubes *a* are filled with water or sand, metal filings, &c. and mounted in an outer structure *f* in such a manner that fluid passing through one set of tubes in the lower tank then passes through an oppositely inclined set in the next tank. The apparatus may be used for heating or cooling air or water. An application to heating the air of rooms by the heat of a stove 13 is illustrated in Fig. 4. The tubes *a* may extend beyond the tube plates in each unit. In the modification shown in Fig. 3, additional heat may be applied to the heat-transmitting medium contained in the tank *b* through a duct or passage way *o*. In a further modification, in which the series of tanks are arranged vertically, sets of tubes alternately inclined in opposite directions are divided by partitions, heating-gases passing up through the tubes in a central space while air to be heated passes up through the tubes in the outer spaces.

FIG. 1. FIG. 4.



168,705. Wilkinson, G. June 22, 1920.



Feed-water, heating. — In a mixed internal-combustion engine and steam engine or turbine plant the cooling water of the internal-combustion engine is further heated by the exhaust gases and used as boiler feed water. As shown in the Figure, the cooling water is discharged into a tank B from which it is delivered by a feed pump D to a calorifier E heated by the exhaust gases and through a check valve G to the boiler. A ball cock C supplies water to the tank if the supply of cooling water fails.

168,713. Westinghouse Brake & Saxby Signal Co., Ltd., and **Barty, T.** June 24, 1920.

Heating water; water supply and delivery. — Cold water is supplied through the annular space 15 to a lavatory basin by depressing a handle 28 thus causing a bell-crank lever 24 to lift a valve 6 from its seat. Further actuation of the handle causes the crank-lever to lift a valve 5 whereby steam passes through the central pipe 2 to the drain 21, heating the water passing through the annulus.

(*For Figure see next page.*)

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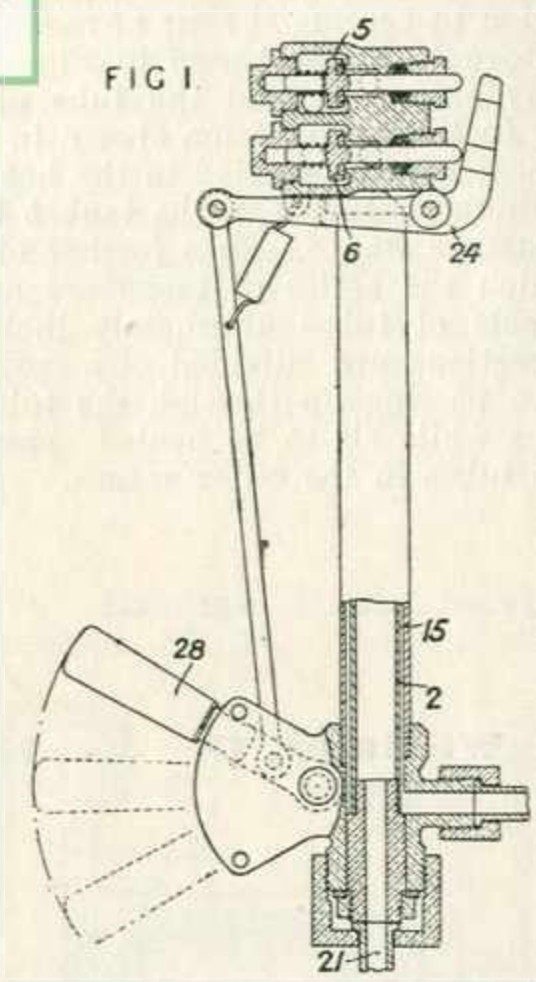
FIG 1



168,811. Bogatireff, T. Dec. 3, 1920.

FIG.1.

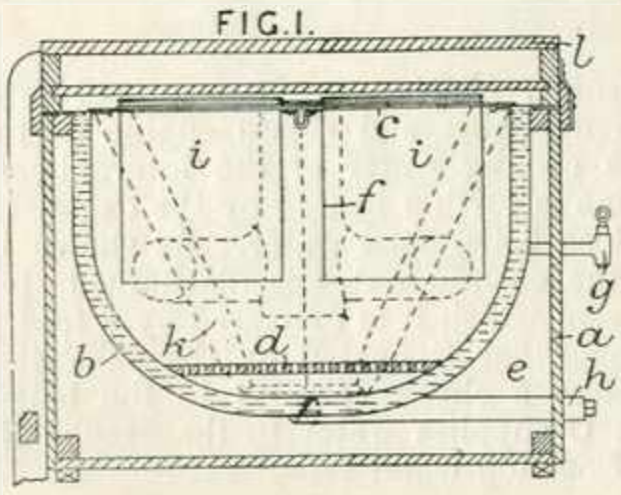
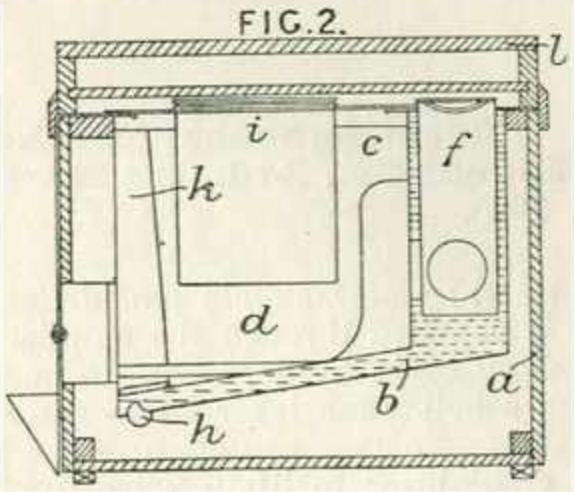


FIG.2.



Internally-fired boilers.—In a cooking-apparatus the fire chamber is arranged in a water-jacket *b* containing the grate *d*. The combustion gases pass out through a flue *f* in the rear part of the jacket. A draw-off cock *g* and a sediment pipe *h* are provided.

168,920. Hibbert, J. I., and **Callender's Cable & Construction Co., Ltd.** March 5, 1920.

FIG.1.

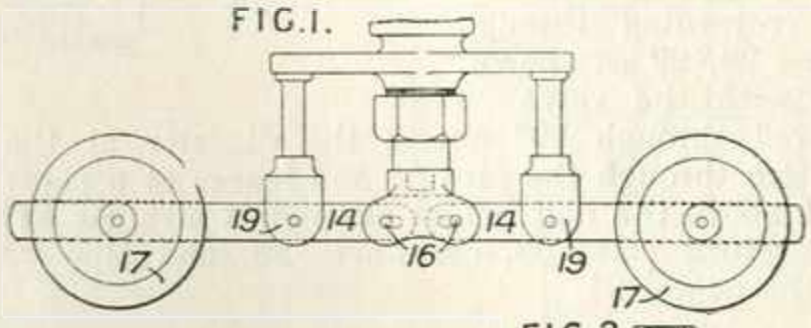
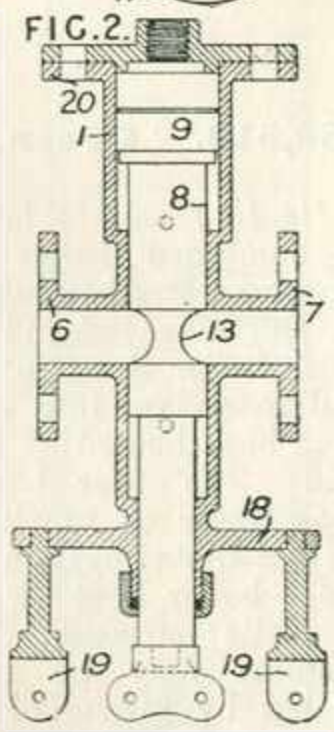


FIG.2.



Digesters. — A valve for controlling steam or gas pressure in autoclaves and especially vulcanizers comprises a four-way casting 1 having flanges 6, 7 for connection to the steam inlet pipe and outlet pipe respectively, the latter leading to the vulcanizer. The upper flange 20 is connected to a pipe which communicates with the portion of the autoclave whose pressure is to be controlled. The piston valve 8 is provided with an enlarged portion 9 on which the pressure in the autoclave acts, and with a reduced portion 13 for the passage of steam. The lower part of the valve casting is provided with a flange 18 having members 19 which form pivots for levers 14 carrying weights 17. The inner ends of the levers are slotted, and coact with pins 16 to press the valve upwards. When the pressure in the autoclave rises above a predetermined value, the piston 8 is depressed and steam is cut off. The loaded lever may be replaced by a spring or by a direct-acting weight. In the latter case the balancing steam pressure is admitted below the piston. Springs may be provided to accelerate the movement of the piston when once begun.

Reference has been directed by the Comptroller to Specifications 17938/95 [*Class* 51, Furnaces and kilns], 23105/07 *and* 5291/09 [*both in Class* 135, Valves &c.].

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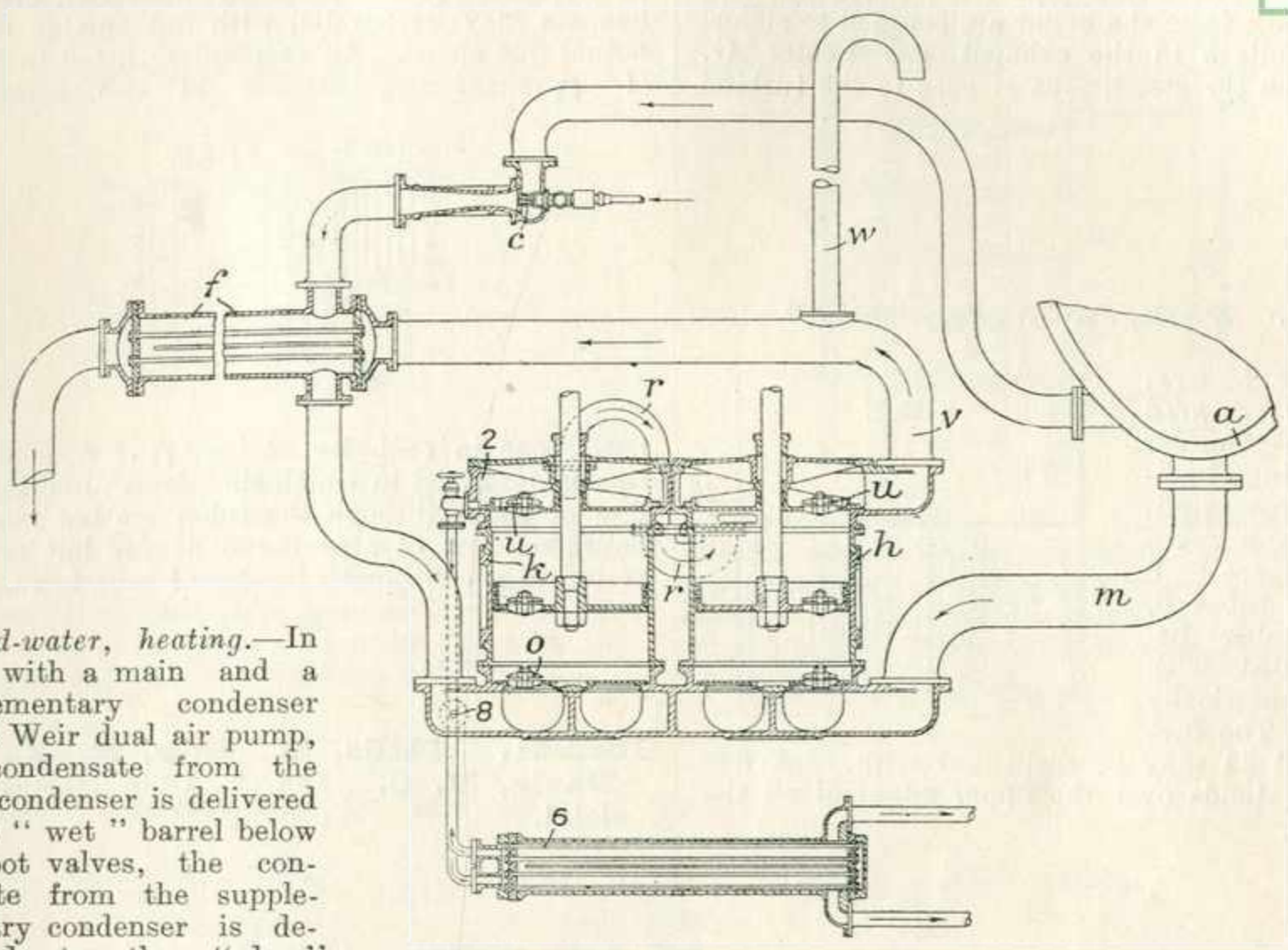
169,084. Weir, Ltd., G. & J., and **Lang, C. R.** Aug. 12, 1920.



Feed-water, heating.—In plant with a main and a supplementary condenser and a Weir dual air pump, the condensate from the main condenser is delivered to the "wet" barrel below the foot valves, the condensate from the supplementary condenser is delivered to the "dry" barrel beneath the foot valves and the feed water is passed to the supplementary condenser as condensing water by the "wet" barrel. Air is drawn from the main condenser *a* by an ejector *c* to the supplementary condenser *f* and passes to the space beneath the foot valves *o* of the "dry" barrel *r* of the dual air pump. The condensate from the main condenser flows through the pipe *m* beneath the valves *o* of the "wet barrel" *h*. The discharge from the "dry" barrel below the head valves *u*, and the water and air are jointly passed through these valves to the pipe *v*, the air escapes by the pipe *w* and the feed water proceeds to take up heat from the supplementary condenser *f* and thence goes to the feed water plant. When the feed to the "dry" barrel is not sufficiently cool, water from the space 2 may be passed through a cooler 6 and returned to the barrel at 8.

169,275. Schmidt, W. June 22, 1920.

FIG. 2.

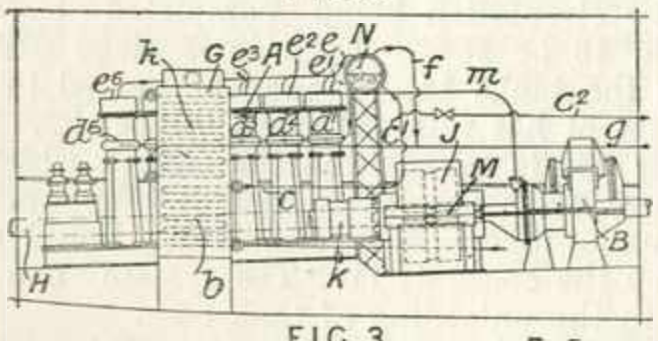
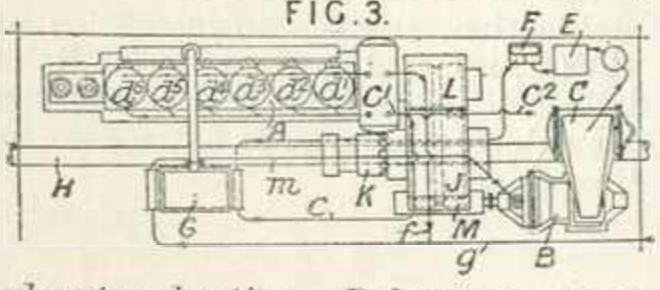


FIG. 3.



Feed-water, heating.—Relates to cruising plant for warships and consists in using an internal combustion engine and steam engine wherein at low speeds the steam for the engine is obtained from the exhaust and water cooling systems of the reciprocating engine, which steam is progressively supplemented by boiler steam as the speed is increased. The cylinder jackets are connected to a common collecting drum from which the steam is drawn for the engine. The plant comprises a propeller shaft H on which is freely mounted a pinion J with claw coupling K, Figs. 2, 3, the pinion J being driven by an internal combustion engine A through a wheel L and by a turbine B through a wheel M. A feed pump F draws from a feed water tank E which is supplied from the condenser C and delivers the feed water to a coil *b* in the exhaust gas heater G, from which the water goes by the pipe *c* to the drum N by the pipe c^1 or by the pipe c^2 to the boiler. From the vessel H the water passes to, the bottom of the water jackets d^1 - - d^6 up through the jackets,

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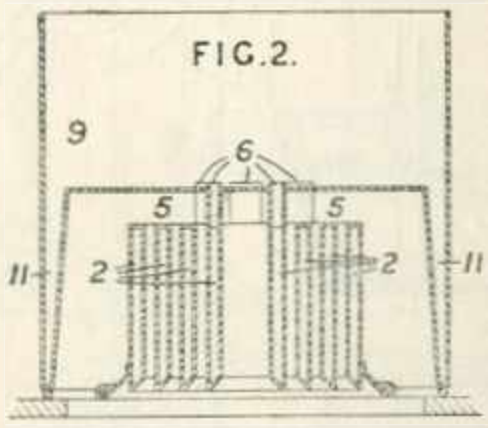
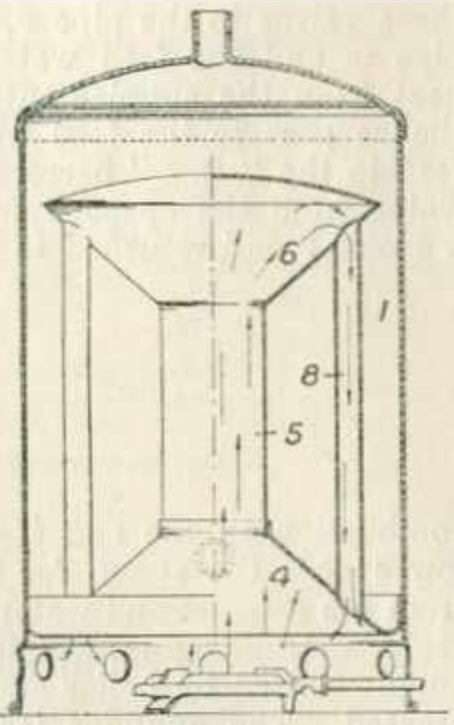
steam pipes c - - c^6 to the top of the drum N. The steam pipe from the drum and steam pipe g from the boiler are coupled to superheating coils k in the exhaust gas heater G, from which the steam pipe m goes to the turbine B.

169,355. Park, A. J. July 30, 1920.



Annular boilers; internally - fired boilers. — Annular waterholding chambers 2 communicate with a main water space 9 above by tubes 6, each chamber being provided with two, diametrically opposed. The firebox jacket 11 may be dispensed with. A flue space 5 extends over the upper edges of all the chambers.

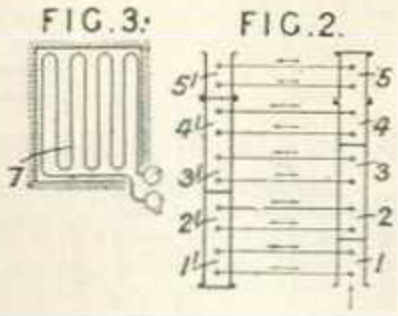
169,375. Hosler, R. Sept. 3, 1920.



Internally - fired boilers.—A main flue 5 of a boiler 1 has a flared portion 4, 6 at each end, the lower forming a firebox and the upper a combustion chamber in the water-space. The two flared parts are connected by a series of tubes 8.

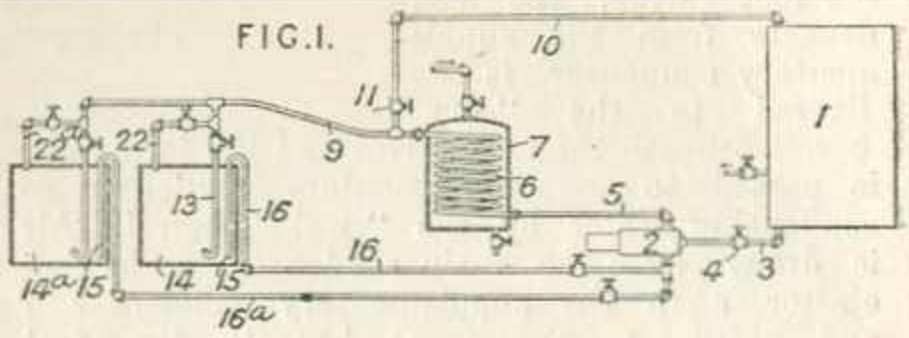
169,679. Dieterlen, H. Sept. 27, 1920, [*Convention date*]. *Addition to* 167,140.

Feed-water, heating.—The feed-water heater described in the parent Specification is adapted so as to permit the adding of sections such as 5, 5^1 with appropriate connecting-tubes to economizer sections 1 - - 4, 1^1 - - 1^1 already existing. The connecting-tubes 7 may be of serpentine form as shown in Fig. 3, and the headers may lie parallel with but outside of the actual flue space. An economizer fitted in a flue of ∩-shape may be made in two connected



parts, one in each leg of the ∩. A modification is described in which the plates directing the flow of water through the tubes are not inserted between units of a sectional header but are inserted in a continuous header of tube form.

169,961. Mills, B., Row, R. R., and **Davis, H. C.** Oct. 7, 1920, [*Convention date*].



Heating liquids.—Viscous substances, such as congealed or thickened liquids, e.g. heavy oils, asphalt, molasses, &c., in storage tanks 14, 14^a are heated so as to render them more mobile by circulating in the first instance a certain amount contained in a smaller tank 1 by means of a pump 2 through a coil 6 surrounded by steam in a jacket 7 by way of pipes 3, 5, 10. When this amount is fluid, by adjustment of cocks, a proportion of the hot fluid is introduced through pipes 9, 13 into any or all of the main storage tanks the circulation being completed by the pipes 15, 16 or 16^a. At a later stage distant parts of the tanks 14, 14^a may be heated by introduction of hot fluid through pipes 22, 22^a. Fluid for use is taken from the tank 1 which is kept warm when the installation is fully working by a small proportion of circulating liquid controlled by the cocks 4, 11. The system can be applied to the unloading of tank cars.

The Specification, as open to inspection under Sect. 91 (3) (a), referred to the use of a liquid in the small tank different from that in the storage tank. This subject-matter does not appear in the Specification as accepted.

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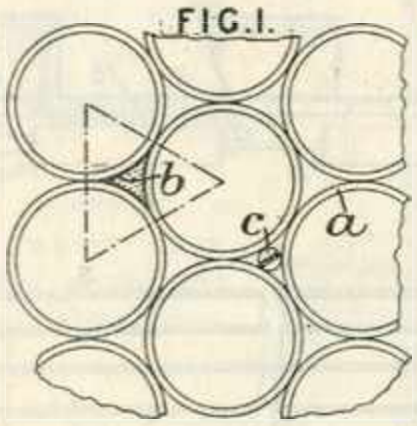
170,069. Kirke, P. St. G., and **Bristol Aeroplane Co., Ltd.** July 7, 1920.

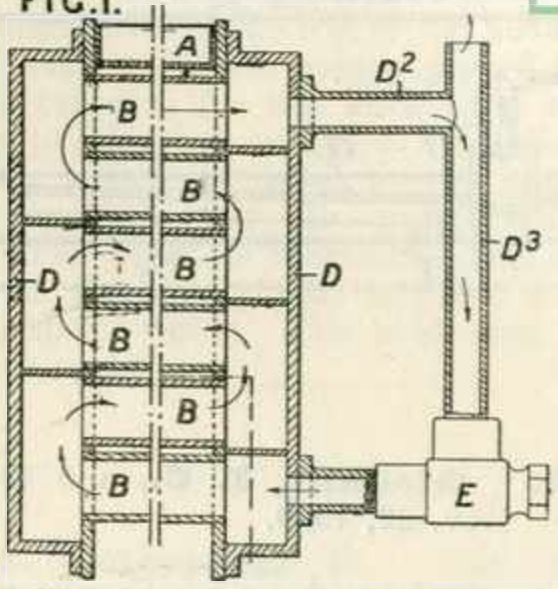
FIG. 1.



Water-tube boilers.—A water heater in which the furnace gases travel along water-tubes arranged to form the sides of flue passages, as described in Specifications 161,486 and 160,205, has its tubes *a* arranged in rows, the centres of the tubes in adjacent rows being at the corners of triangles. Helical cores *c* may be fitted in the flues as described in Specification 160,205.

170,210. Phillips, F. G. Nov. 16, 1920.

FIG. 1.



Heating liquids. — Milk is heated by passing from a distributor A over the outer surface of superimposed tubes B connected at their ends to headers D. Through the tubes and the connecting-pipes D^2, D^3 liquid is circulated and heated by a steam injector E.

170,326. Trevithick, F. H. June 9, 1920.

FIG. 14.

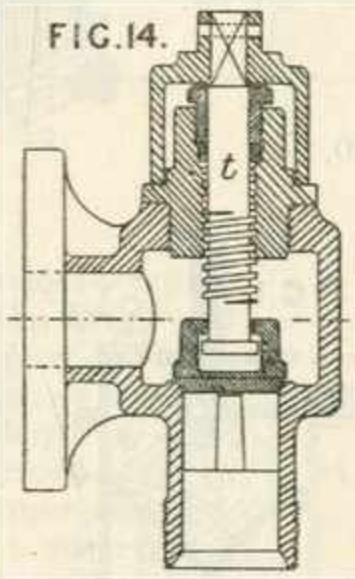
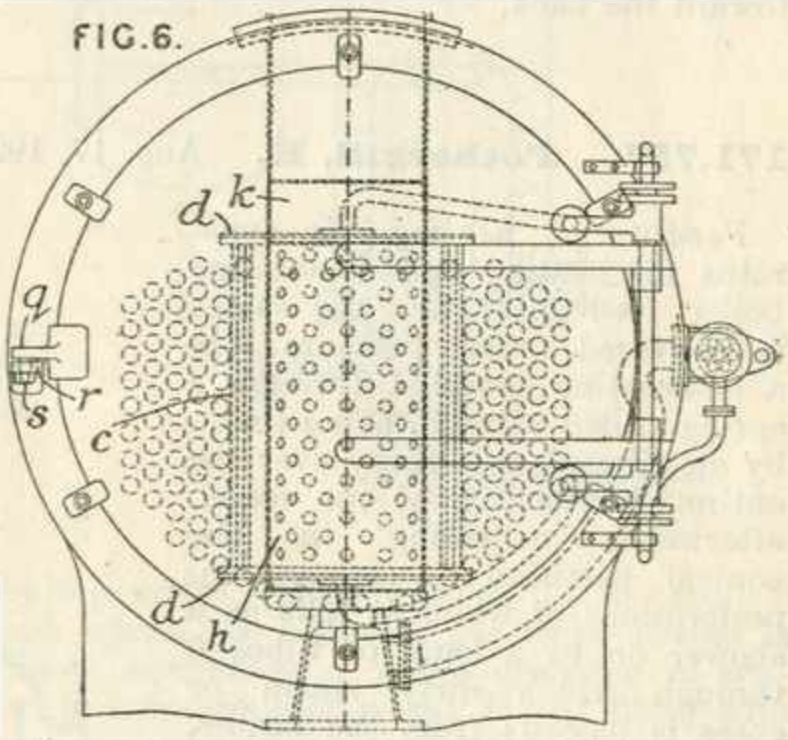


FIG. 6.



Feed-water, heating. — A feed-heater fitted in a locomotive smoke-box and serving as a spark-arrester is provided with means for ensuring even distribution of the water through the heater. In a heater consisting of rings of vertical water-tubes *c*, Fig. 6, connected to annular headers *d* and placed between the blast pipe and the chimney, the inlet header is fitted with a disc having perforations opposite the ends of the water-tubes. The gases are distributed equally over the heater by a liner *h* having equally spaced perforations of a combined area equal to that of the chimney. The heater may be mounted on the smoke-box door. When the door is closed, a lug *q* on it rests upon a bolt *s* screwed through a lug on the door frame. The boiler check valve, Fig. 14, may be maintained in a raised position by means of a screwed spindle *t* in order to blow through the heater when emptying. The feed-water may also be heated in an exhaust steam heater arranged below the smoke-box or at the side of the boiler. The heated water may pass from the smoke-box heater through a heater traversed by smoke-tubes opening into the fire-box and smoke-box. Alternatively, the water may pass through a live-steam heater at the side of the boiler.

170,617. Thermal Industrial & Chemical (T.I.C.). Research Co., Ltd., Duckham, Sir A. M., and **Morgan, J. S.** May 26, 1920.

Heating liquids. — Liquids, such as tar, are heated or evaporated by introducing them below the surface of molten lead or other metal or alloy through a hood *g* formed with vertical slots at its lower edge. The hood is fitted over a filling *l* in order that the supply of liquid shall be in a thin, rapid stream. Inclined corrugated plates *d* along the lower side of which the liquid travels may be attached to the hoods. Open tubes *f* are secured in the plates *d* to promote the circulation of the molten metal.

(*For Figure see next page.*)

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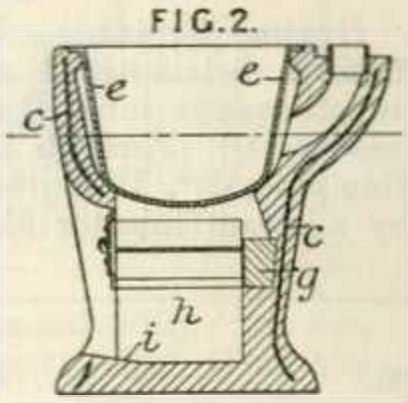
171,317.

FIG.4.

171,042. Gledhill, J. C., and **Gledhill, A. E.** Nov. 22, 1920.

Boiling - pans. — A setting for a boiling-pan *e* constructed of concrete reinforced by rods and wire netting *c* has a fire-box lined with fire-bricks *g* at the back and sides. The floor *i* of the ash-pit *h* slopes inwards to throw falling cinders toward the back.

FIG.2.



171,353. Rumery, C. C., and **Spates, F. G.** Nov. 11, 1920, [*Convention date*].

FIG.1.

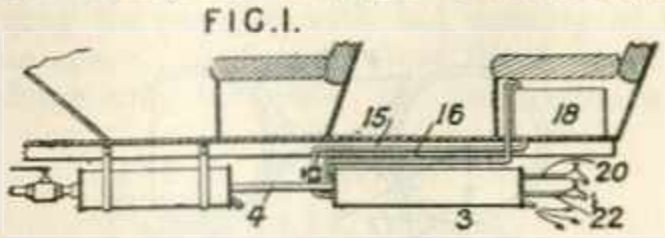
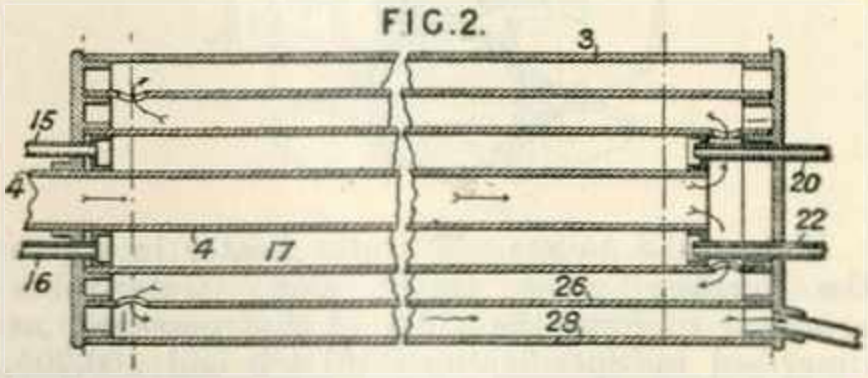


FIG.2.



Heating water.—An arrangement for supplying hot water &c. for use on motor-vehicles comprises a heater 3 connected by circulating-pipes 15, 16 to a supply tank 18. Exhaust gases from the engine are directed when desired through the pipe 4 into the annular chambers 26, 28 and thence allowed to escape. Water fills the annulus 17 and is drawn off through the pipes 20, 22.

171,757. Fothergill, H. Aug. 17, 1920.

Feed-water, heating.—In apparatus for heating and de-aerating boiler feed-water &c. the latter is delivered under pressure into a de-aerating vessel 1 through a spring-loaded valve 3, being thereby distributed as a spray over the entire cross-section of the vessel, afterwards collecting in the conical partition 4 through the perforations of which it falls as a shower on to a bank of tubes 6 through which dirty steam or gases is passed; from the heater, surplus steam escapes at an outlet 7a, while condensate is discharged through a branch 20. The de-aerated and heated water leaves by a sealed outlet at the lower part of the vessel 1, and a connection may be provided between the outlet pipe and a point below the partition 4 for permitting the escape of vapour collecting in the pipe. A ship's feed-water system, embodying the heater, is illustrated in Fig. 3. Water is taken from the filter and feed tank 11 and delivered by a pump 12 to the de-aerator and heater 1, and the de-aerated and heated water is collected in a reserve tank 16 or is supplied to a feed pump 15 and delivered from there to a surface heater 17; the latter may, however, be cut out by means of a bye-pass 18 and valves 19. The heater is supplied with steam from the auxiliary exhaust-steam system, condensate and surplus steam being passed to the feed tank 11.

FIG.1.

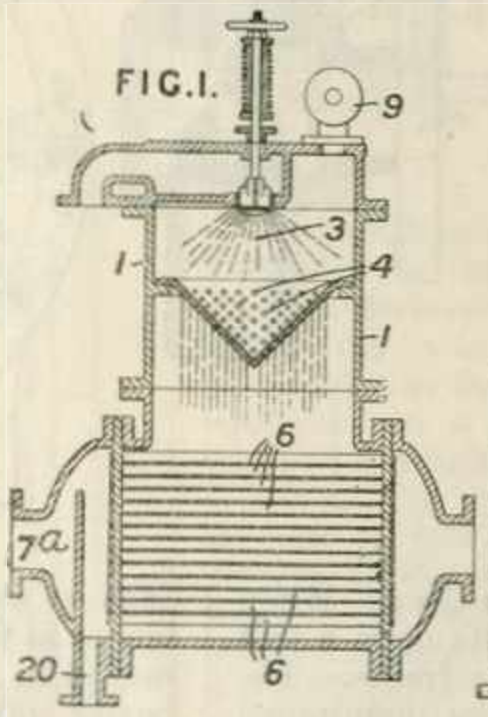
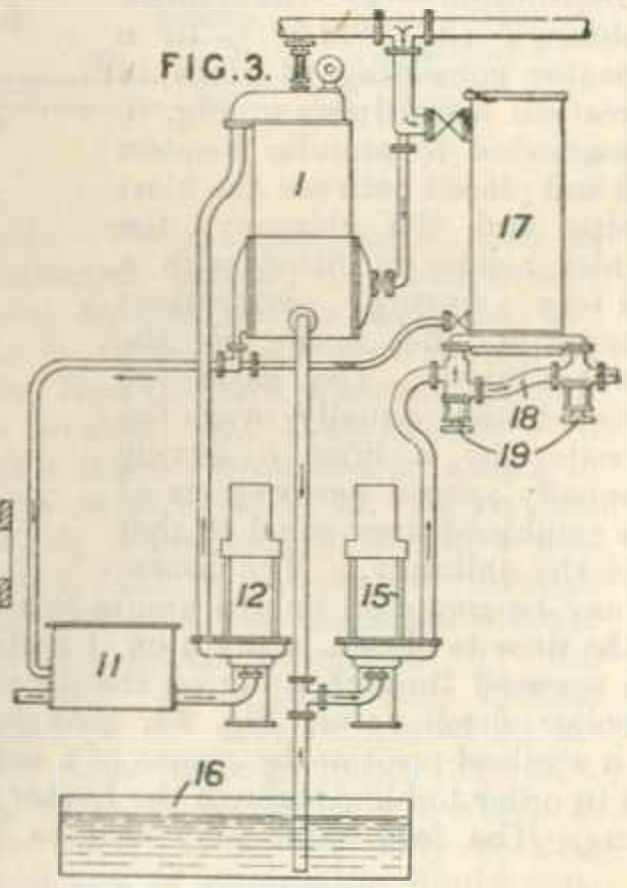


FIG.3.



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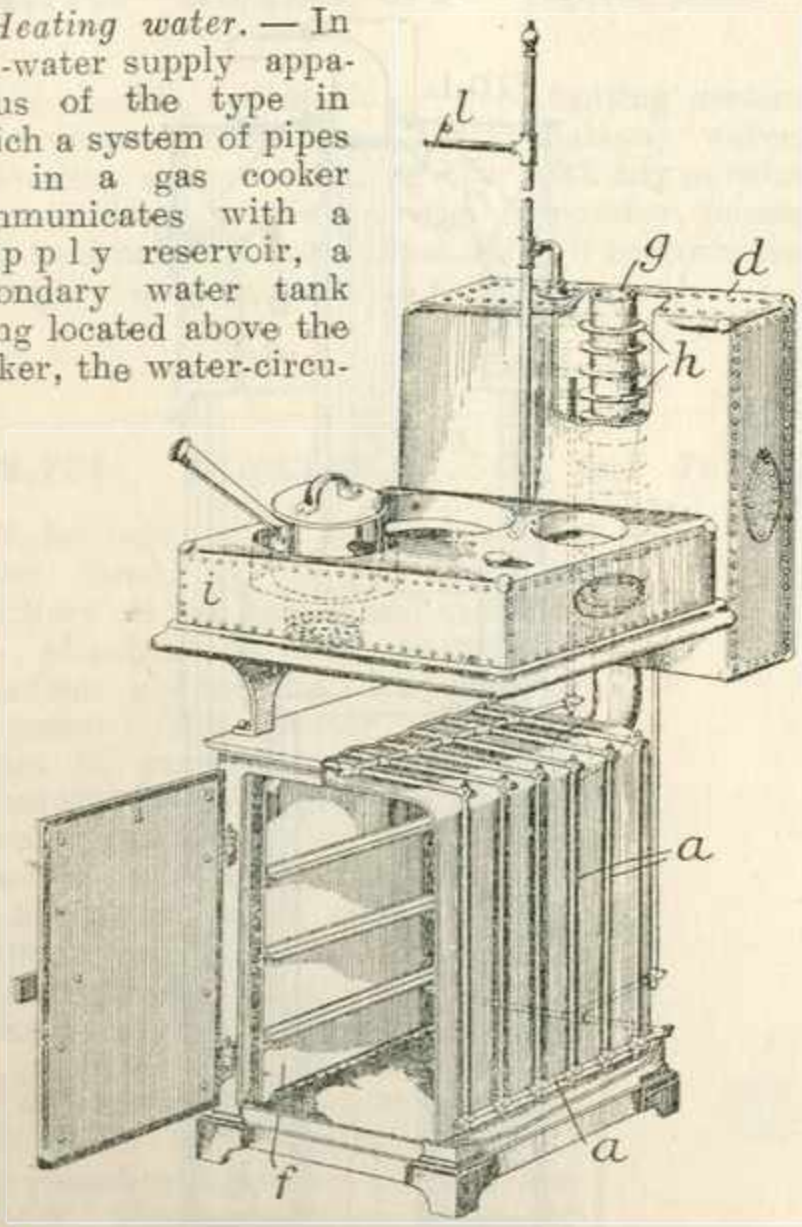
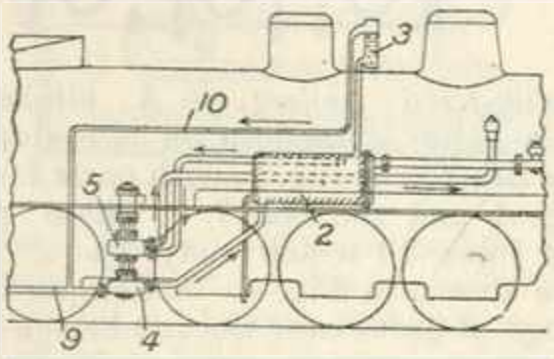
171,761. Clarke, W. E. Aug. 18, 1920.

Heating water. — In hot-water supply apparatus of the type in which a system of pipes &c. in a gas cooker communicates with a supply reservoir, a secondary water tank being located above the cooker, the water-circu-



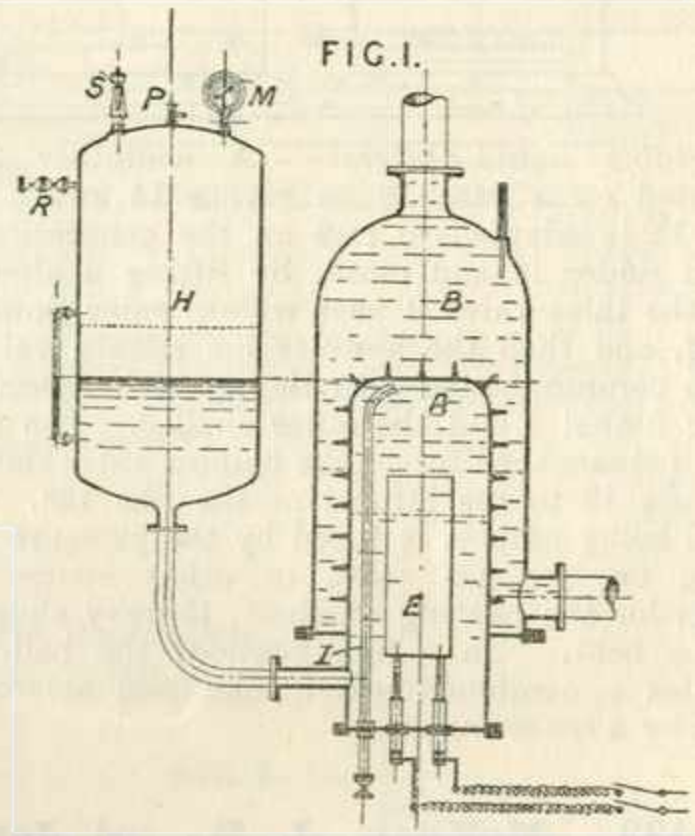
lating system is located in an enclosed space surrounding or partly surrounding the oven, and the tank located above the cooker is provided with apertures or recesses for the reception of cooking utensils. In the arrangement shown a pipe system *a* is arranged in the space formed between the outer walls of the oven and an inner casing *f*. The pipe system *a* is connected to a reservoir *d* through which the flue pipe *g* carrying gills *h* may pass in order to use the heat in the waste gases. A second tank *i* is located above the cooker having apertures for the cooking utensils and being connected to the tank *d* and to the hot-water supply-pipe *l*.

171,966. L'Auxiliaire des Chemins de Fer et de l'Industrie. Nov. 23, 1920, [*Convention date*].



Feed-water, heating.—Feed-water is supplied to a heater 2 by a pump 4 in tandem with the pump 5 that withdraws the water from the heater and forces it into the boiler, an open expansion vessel 3 being connected to the top of the heater and to the feed tank or to the supply pipe 9 to ensure sufficient pressure for the working of the pump 5 and to provide for over flow from the heater. The pump supplying water to the heater is of greater capacity than the pump withdrawing water. The pipe 10 connecting the expansion vessel with the supply pipe is flared at its connection with the vessel. The water may be heated by exhaust steam.

172,001. Bergeon, P. Nov. 25, 1920, [*Convention date*]. *Void* [*Published under Sect. 91 of the Act*].



Heating water; heating gases. — A vessel B through which the water or gas to be heated is circulated surrounds a water chamber A connected to a compensating-tank H and fitted with electrodes comprising non-oxidable plates E insulated from each other and consolidated together, and an air outlet pipe I. The tank H is fitted with a safety-valve S, a blow-off cock P, a pressure gauge M, and a filling cock R. If steam is generated in the chamber A, the water therein is forced back into the tank H and the electrodes are not completely immersed, so that the current supply is automatically regulated to maintain a certain temperature according to the pressure in the chamber A. The pressure in the chamber A may be varied by raising or lowering the tank H, or by increasing the pressure or by producing a vacuum therein. For heating gases, the heat-transmitting surface is increased by means of ribs or tubes.

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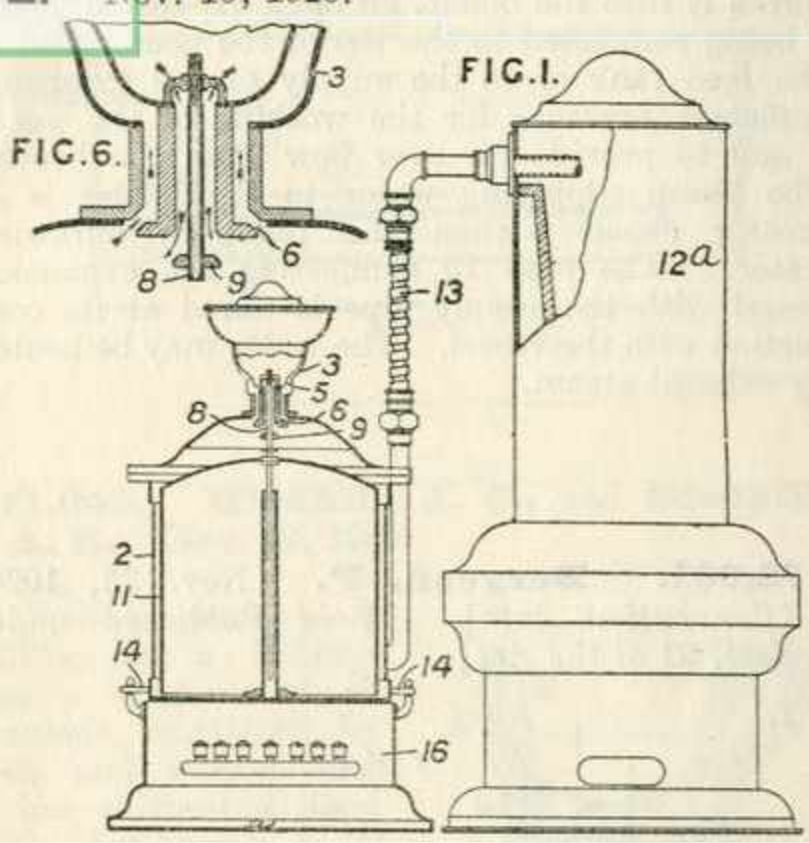
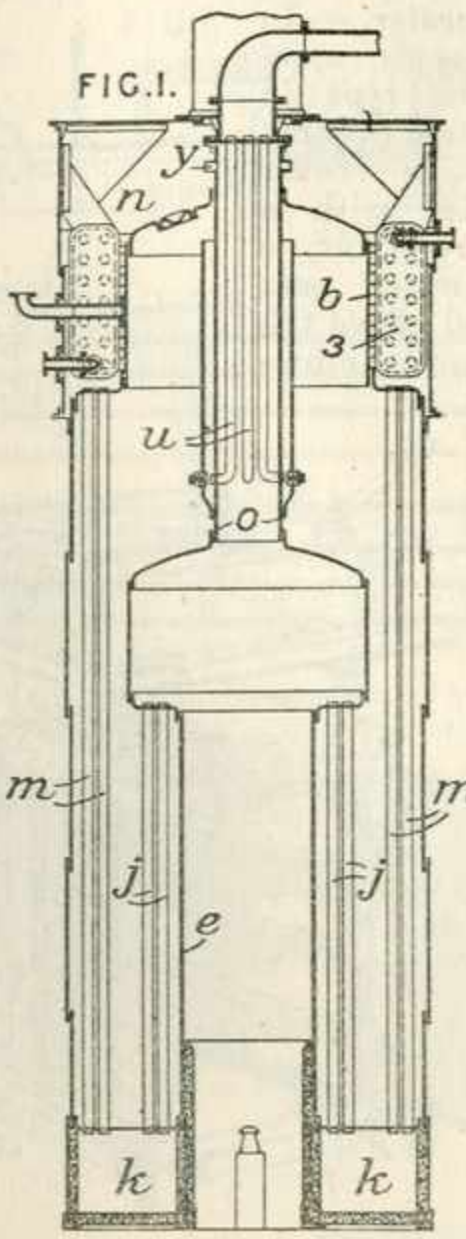
172,207. Stott, V. H., and **Schofield, L.** Nov. 15, 1920.



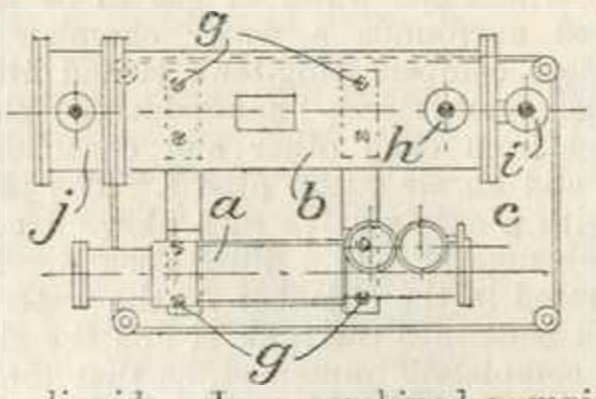
Portable liquid-heaters. — A container 2 is mounted on a base 16 on pivots 14 and a bell float 11 is adapted to rise on the generation of steam under it and close, by lifting a stem 8, first the inlet valve 9 past which water flows on filling, and then the annular air release valve 6 which commnuicates with the space between the filling funnel 5 and the outer shell 3. The pressure of steam then forces the boiling water through the tube 13 to the infuser or the like 12a. The vessel being empty, is tilted by the pressure of a spring on the gas valve or other controlling-means for the heating medium, thereby shutting off the heat. In a modification, the bell-float actuates a combined water inlet and air outlet valve by a rocker arm.

172,339. Cruse, H. May 25, 1920.



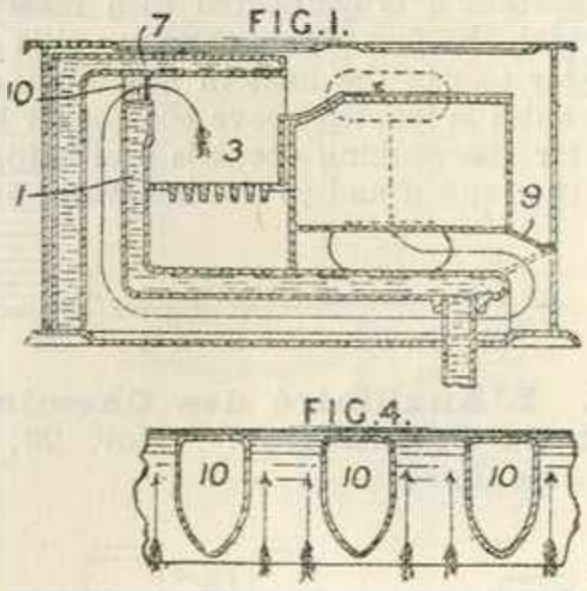
Feed-water, heating.—In a vertical boiled fired by oil, gas, or pulverulent fuel, feed-heating tubes 3 are arranged in the smoke chamber *n* around the steam dome *b*.

172,423. McKean, J. G., and **Jones, R. F.** Sept. 13, 1920.



Heating liquids.—In a combined pumping and heating apparatus for supplying liquid fuel to burners &c., the feet of the pump *a* and heater *b* are secured to the bed plates *c* by similar bolts *g* arranged in positions equidistant from and symmetrically disposed in respect to the longitudinal vertical centre planes of the pump and heater so that the pump and heater may be transposed to form a right or left-handed unit. The fuel inlet *h*, steam inlet *j* and fuel outlet *i* are arranged in the vertical centre plane of the heated. The bed plate froms a drip-tray for the complete unit.

172,556. Petterson, P. O. Feb. 16, 1921.



Internally-fired boilers. — A kitchen range includes a boiler extending on two sides of and under the fire-box 3, Fig. 1, with parts forming the fire-bridge 1 and the hob 7. These parts are joined by tubes 10 which may be of elongated section as shown in Fig. 4. A damper 9 controls the passage of gases over the fire-bridge 1.

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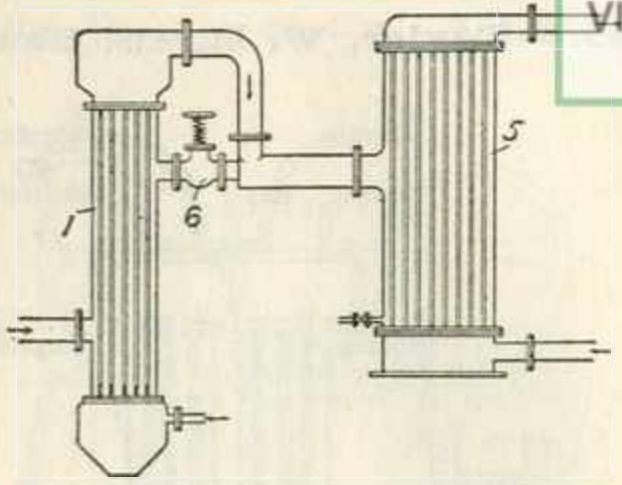
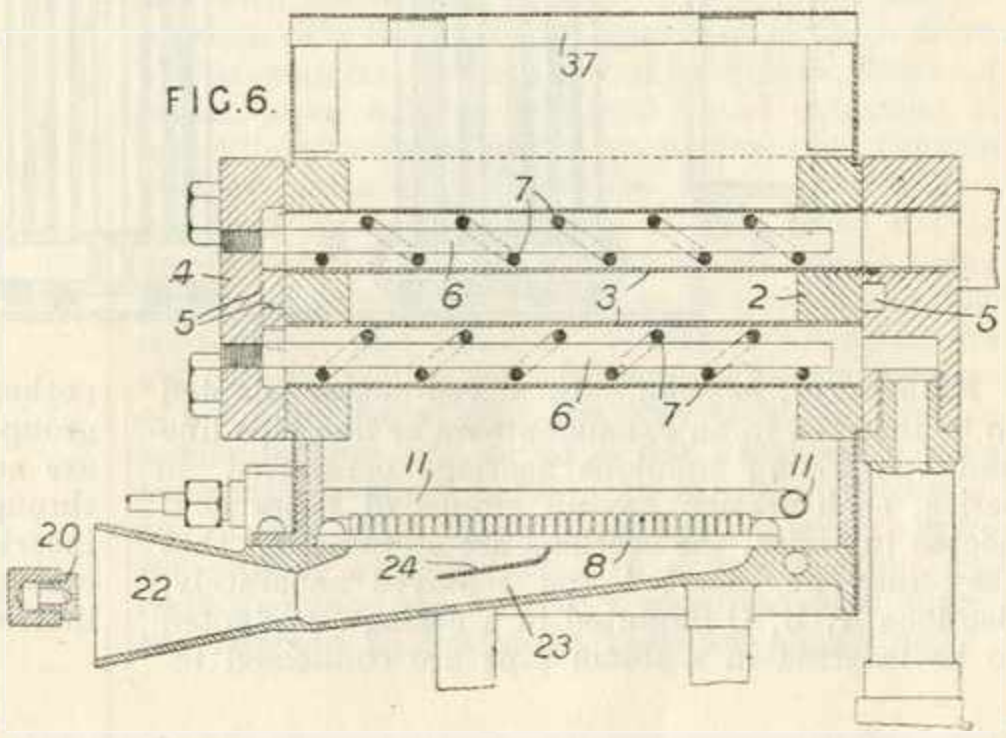
172,713. Higgins, C. F. Sept. 8, 1920.



Feed-water, heating. — A feed-heating system comprises an evaporator 1 for make-up water, generating steam which, together with any surplus exhaust steam supplied to the evaporator, passes to a feed-heater 5. A loaded valve 6 controls the passage of surplus steam to the heater.

172,721. McKean, J. G., and **Jones, R. F.** Sept. 11, 1920.

FIG.6.



Water-tube boilers. — For a steam boiler fired by liquid fuel, an auxiliary oil fuel heater and atomizer are attached to the permanent atomizer connections for starting purposes. The heater comprises plates 2, carrying tubes 3 which communicate with passages in end plates 4 the oil flowing through the tubes in series. The tubes are preferably fitted with retarders consisting of rods 6 on which wires 7 are wound spirally. Below the tubes is arranged a vapour burner consisting of vaporizer tube 11 fitted at its delivery end with a needle valve and a nozzle 20 and deliverying vapour to a chamber 23 below a slotted flame plate 8. The heater is provided with handles, inspection and ignition doors, and a hood or ventilator 37. In an alternative arrangement the tubes 3 are heated by blow lamps.

172,894. Babcock & Wilcox, Ltd., (*Soc. Française des Constructions Babcock et Wilcox*). March 1, 1921.

FIG.4.

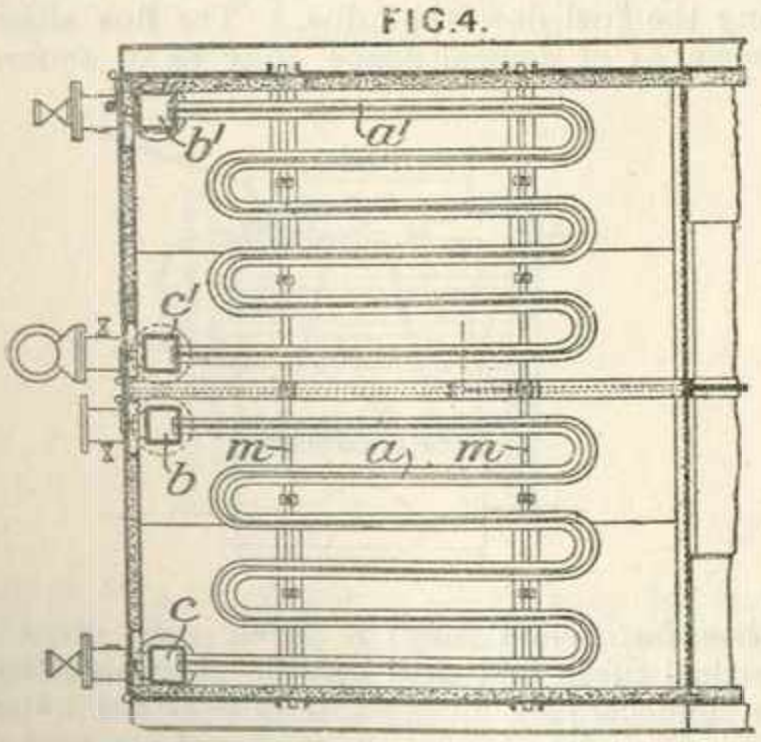
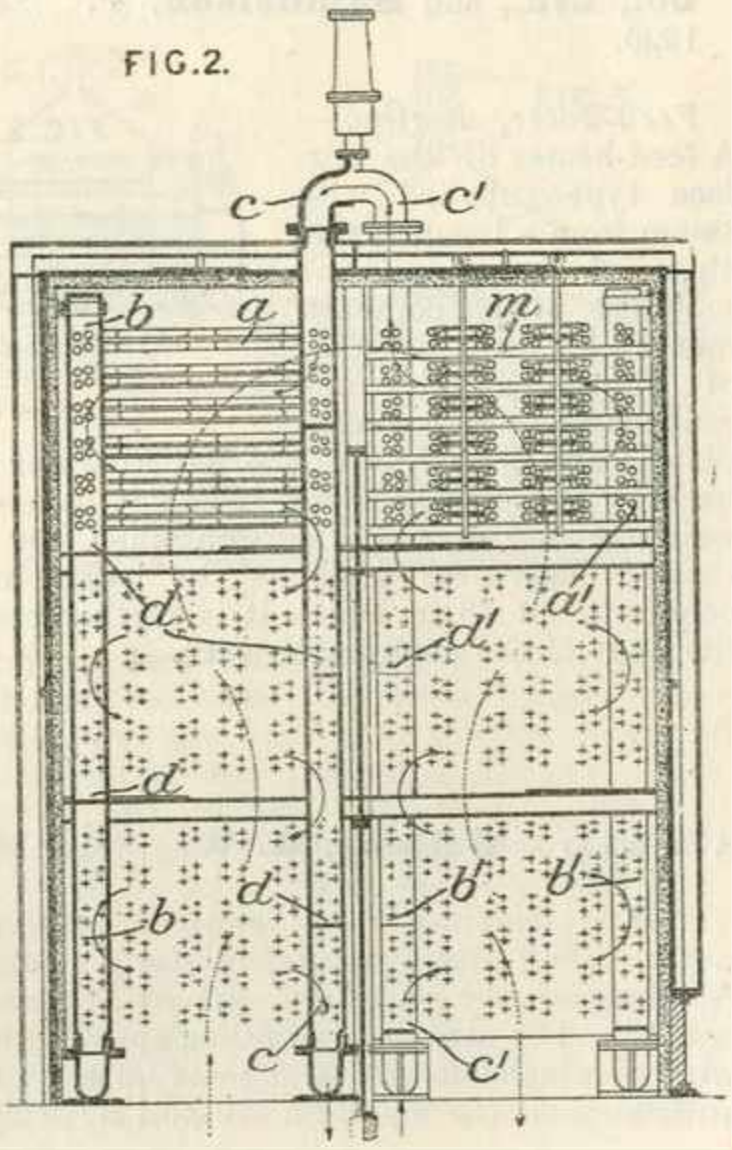


FIG.2.



Feed-water, heating.—An economizer comprises jointless headers b, b^1, c, c^1 with partitions d, d^1, tubes a arranged in clusters, and bars m each supporting a group of tubes, the ends of each cluster of tubes being accessible on removal of a single cover.

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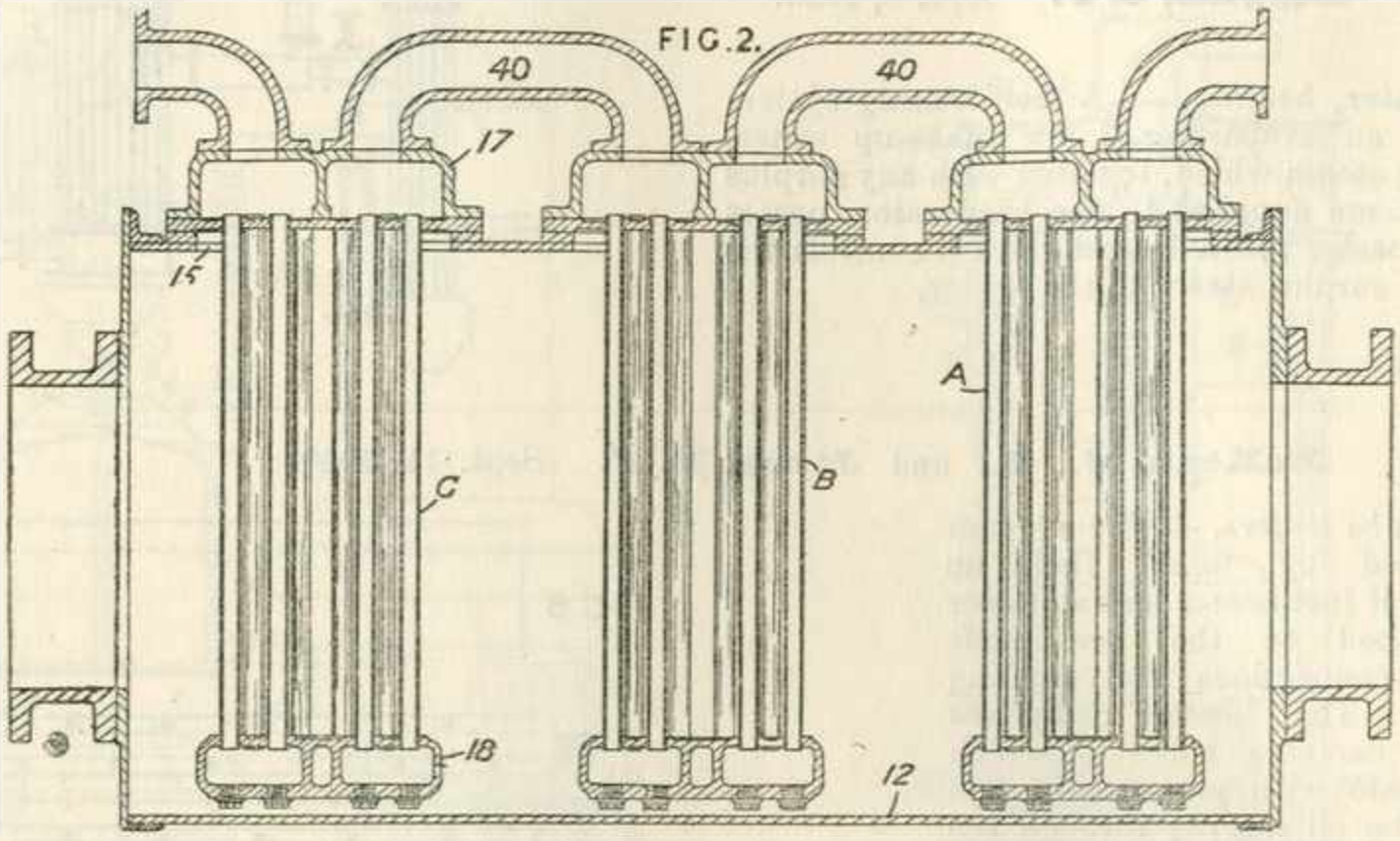
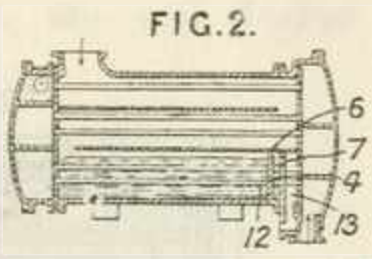
172,991. Taylor, W. H., and **Shaw, C.** Feb. 21, 1921.



Feed-water, heating.—In a feed-heater adapted to be inserted in an exhaust steam or like pipe line and comprising tubulous sections connected in series, each section having groups of tubes connected in series, the sections are so mounted that they may be inserted and removed separately. Sections A, B, C mounted in a casing 12 adapted to be inserted in a steam pipe are connected together by external pipes 40. Each section has six groups of tubes opening into headers 17, 18, which are so divided internally as to direct the water through the groups in series. The sections are inserted through openings 15 in the top of the casing, the top headers being secured against reinforcing rings around the edges of the openings.

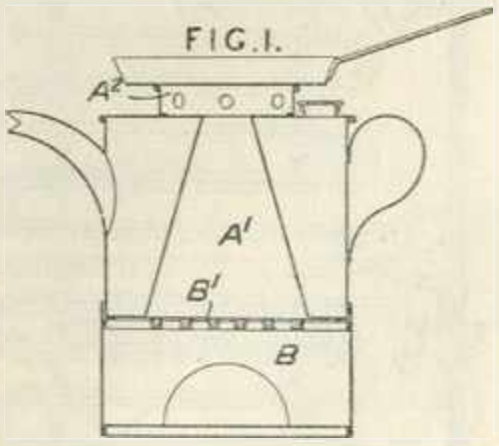
173,068. British Thomson - Houston Co., Ltd., and **Samuelson, F.** Sept. 23, 1920.



Feed-water, heating.—A feed-heater of the surface type supplied with steam from a low-pressure stage of a turbine and provided with compartments for the cooling of contained air and condensate, has a baffle-plate 4 and weir 7. Condensation water is held back by the plate 4 under which it passes to the weir 7 and the outlet. Contained air passes through apertures 6 above the baffle into the compartment 13 in which it is further cooled by the ends of the cooling-tubes 12.

173,141. Willans, K. W. Nov. 18, 1920.

Portable liquid-heaters; annular boilers. — A water-boiling kettle or utensil has a central flue A^1 surmounted by a hollow support A^2 for a frying pan &c. The utensil has a filling opening provided with a detachable cap, and rests upon a grate B^1 situated near the top of an ash pan B. Clips may be provided to secure the kettle to the ash pan. The ash pan may have an apertured rotary sleeve damper turning on an apertured tube communicating with the interior. Fuel is supplied to the grate by removing the frying-pan &c. and dropping the fuel down the flue. The flue although shown as of conical shape, may be of square or



other form, and may be fitted with cross and vertical tubes and with baffles. The utensil may be connected by pipes so as to heat the water in an independent vessel, or it may form part of a hot-water circulating system or be used to keep motor car radiators warm.

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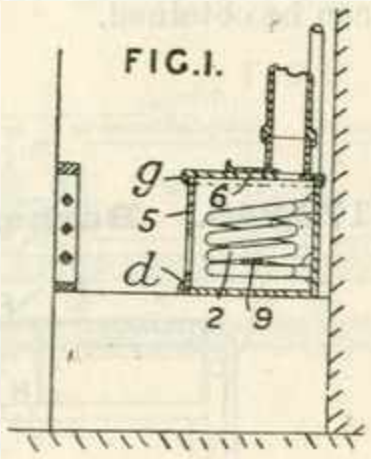
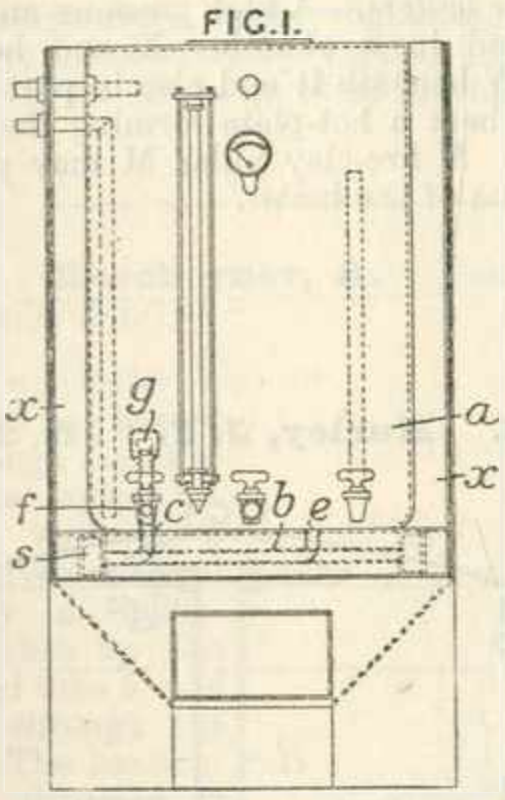
173,263. Wilson, I. May 19, 1921.

Water-tube boilers.—A coil-tube boiler 2 is enclosed within a metal casing adapted to be walled into the brickwork at the back of a fire-place, the inlet and outlet pipes extending on one side through the brick work. The perforated removable front 5 is held in position by a rim *d* on the bottom plate and a rim *g* on the detachable top plate 6. The coil 2 is supported by a cross-bar 9.

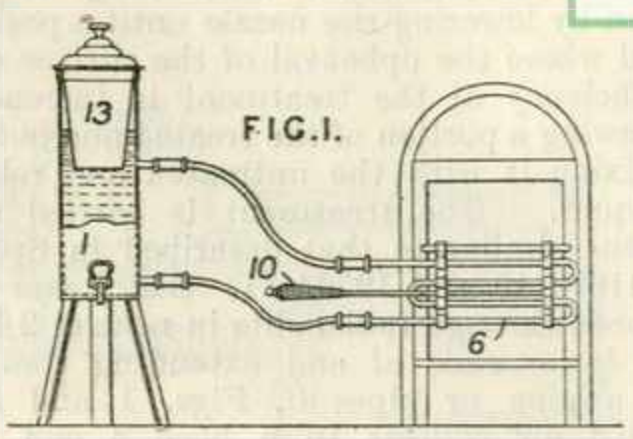


173,287. Fraser, W. Sept. 21, 1920.



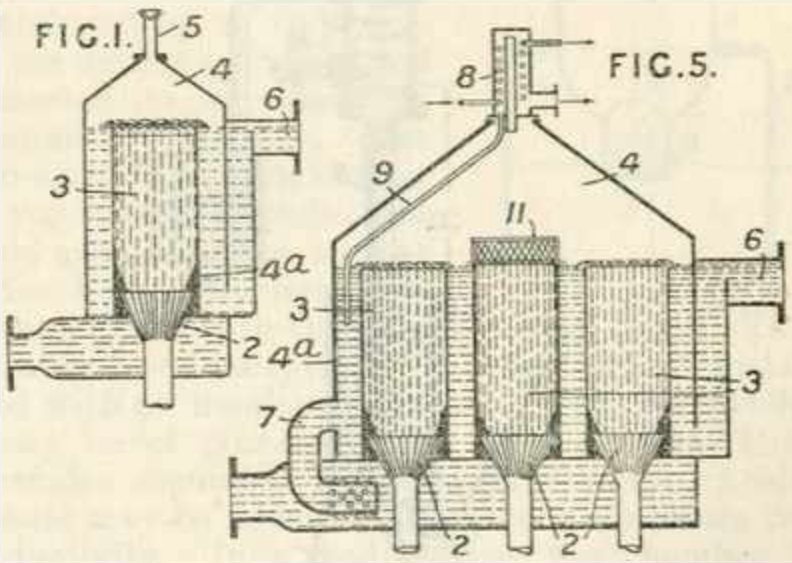
Boilers.—A container *a* which may be surrounded by flues *x* has a tubular grid below it, in communication through tubes *e*, *c*, the latter having a loaded valve *g* and a draw-off tap *f*. The grid comprises tubes *b* connected to compartments in headers *s* fitted with covers *u*.

173,417. Bacon, J. Dec. 9, 1920.



Portable liquid-heaters.—A portable heater for use with fire-grates, or gas, oil, or other stoves, consists of a flat boiler 6 supported close in front of the grate &c. and connected by flexible flow and return pipes with an adjacent liquid container 1, which may have an inner compartment to contain food or plates &c. The boiler is provided with a non-heat conducting handle 10 and when not in use is hooked on to the container, the whole being thus readily movable by means of a handle on the container. The boiler is provided with hooks for attachment to the grate &c. and as shown consists of a tubular metal grid, but may be in the form of a tubular flat coil or of a flat chamber with a horizontal internal baffle. In the form shown in Fig. 1, the inner vessel 13 of the container serves for cooking porridge &c. In a modification, the container is in the form of a water jacketed chamber adapted to contain a rack for plates &c.

173,534. Morison, D. B. June 24, 1920.



Heating liquids.—To heat and de-aerate liquids such as boiler feed-water, the liquid is passed into a pipe-like structure, and into the lower end of the column are upwardly injected films of steam at a velocity and pressure such as will impart to the liquid an upward velocity approximating to that of a bubble of air rising freely through the liquid, whereby there is induced in the column of liquid stream-lines of upward unconfused flow. The desired conditions are attained by locating the nozzle through which the steam is introduced, at the correct depth beneath the surface of the liquid; the position can be determined according to the

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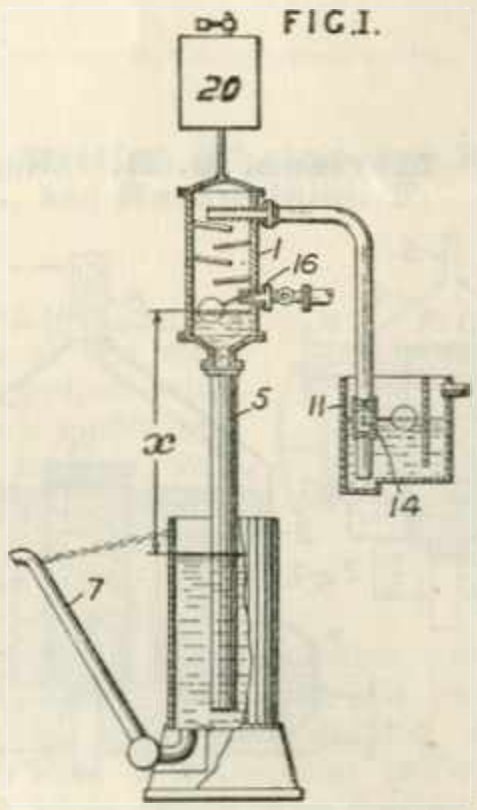
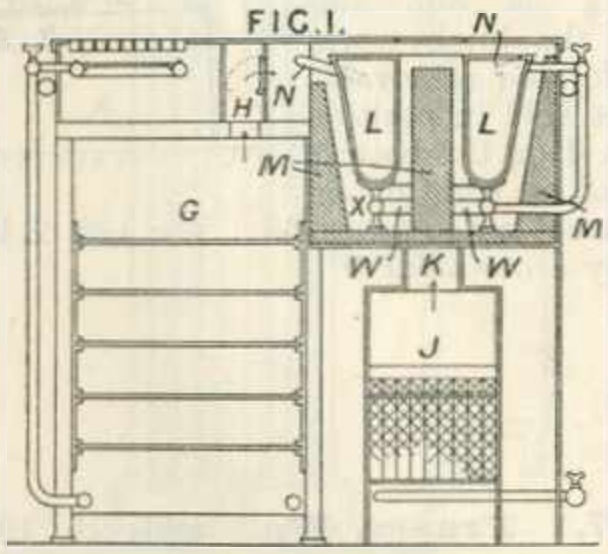
values of the pressure and the velocity of the steam, but in practice a satisfactory result is obtained by lowering the nozzle until a position is reached where the upheaval of the surface ceases. The efficiency of the treatment is increased by withdrawing a portion of the treated and hot liquid and mixing it with the untreated and relatively cold liquid. The treatment is carried out in apparatus similar to that described in Specifications 11690/10 and 19564/11, the steam being introduced through radial slits in nozzles 2 located at the lower ends of and extending completely across a pipe or pipes 3, Figs. 1 and 5; the separated air collects in a hood 4 and is discharged through a pipe 5, and the de-aerated and heated water flows downwardly through an extension 4^a and then upwardly to a discharge pipe 6. In Fig. 5, some of the de-aerated and hot water is returned through a pipe 7 to the inlet end of the pipes 3 for re-treatment; and in this construction the liberated air escapes through a condenser 8, condensed water being returned through a pipe 9. The de-aerator may be placed at a considerable height above the feed-pump, in which case the temperature of the water may reach 212° F. or higher, a loaded valve being then provided for the escape of air from the de-aerator.

173,709. Mauss, W. March 8, 1921.



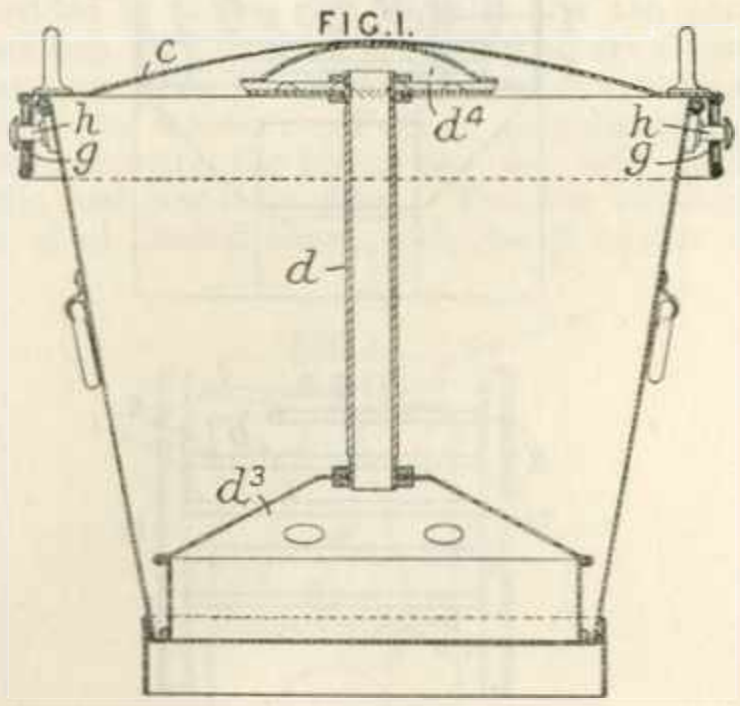
Heating liquids.—Sugar juice or other liquid is heated by direct contact with steam and the temperature regulated by the pressure of a head of liquid. Fig. 1 shows apparatus for heating under a pressure less than atmospheric. Juice is syphoned into the heating-chamber 1 from a vessel 11, the rate of flow being regulated by a float-controlled butterfly valve 14. Steam is admitted by a float-controlled valve 16, the pressure being regulated by the height x of the column of liquid in the pipe 5 which can be regulated by a swivel overflow pipe 7. A vacuum chamber 20 draws off non-condensable gases. By curving the pipe 5 upwards, a pressure above atmospheric can be obtained.

173,846. Barker, L. S. Oct. 5, 1920.



Annular boilers.—A high pressure annular boiler is mounted in a chamber X and heated by a burner W beneath it and also in part by burners N which heat a hot-plate forming the top of the chamber. A fire-clay pillar M may pass up the central flue of the boiler.

174,288. Hurley, J. J. Jan. 25, 1921.



Washing-boilers.—The lid c of a washing-boiler fitted with a central circulating-tube d opening into a hollow base d^3 and into a hollow crown d^4, is detachably secured by fastenings between the depending rim g and the sides of the boiler. Pins h projecting from the boiler engage inclined slots in the rim of the cover. The circulating member is held in position by contact with the cover. The central tube is attached to the base and crown portions by screwed nuts, which, after the parts are secured, are immersed in a tinning-bath.

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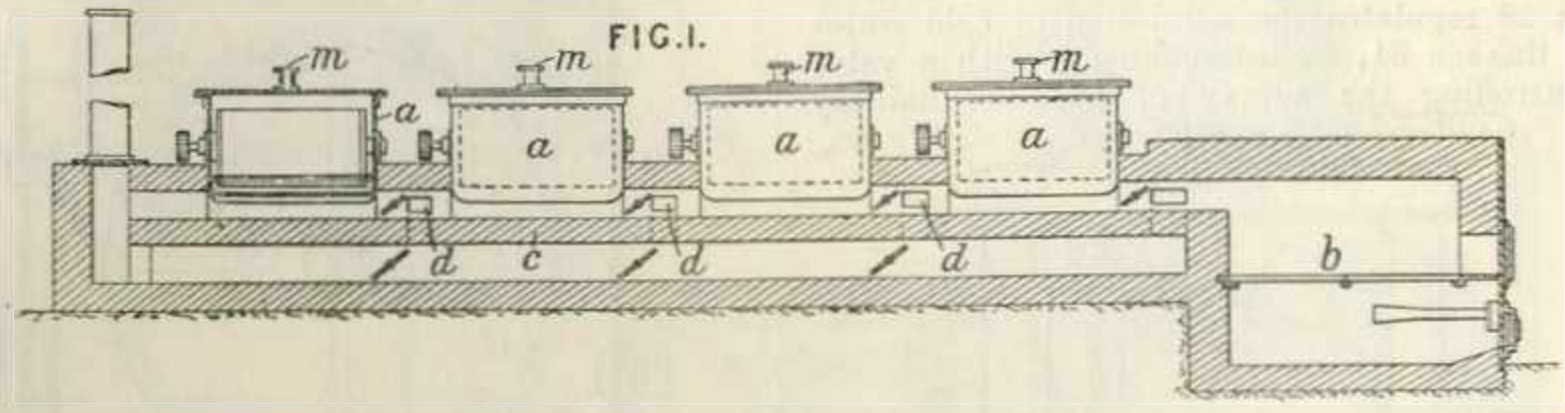
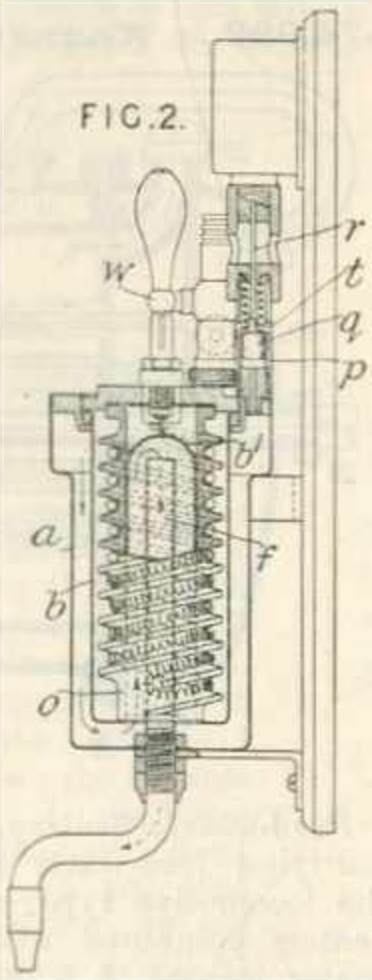
174,690. Thermal Industrial & Chemical (T.I.C.) Research Co., Ltd., Duckham, Sir A. M., and Morgan, J. S. Oct. 20, 1920.



Heating liquids.—In heating solids or liquids by immersion in a molten metal, either by carrying the material through the metal by contact with a moving drum or other surface as described in Specification 174,974 or, in the case of a liquid, by causing it to travel against a stationary inclined surface submerged in the metal as described in Specification 170,617, the material is submitted to successive different temperatures either by passing it in succession through a series of baths of different temperature, or by regulating the time of successive immersions by varying the speed of movement of the drum or other surface or by varying the inclination or length of the submerged inclined surface. The material may be permitted to cool between the successive immersions. In the fractional distillation of tar oil, the oil is passed in succession through a series of stills *a* of the kind described in Specification 174,974 heated by gases from a furnace *b*, passing along a flue above a horizontal partition *c*. Portions of hot gases may be passed through by-pass flues *d* to a lower flue so as to regulate the temperature of the stills. The vapours generated in each still pass through outlets *m*. The process is applicable to the destructive distillation of wood.

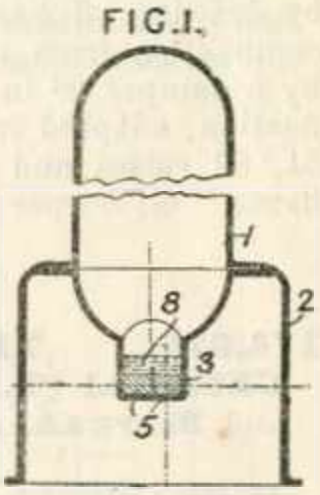
174,895. Beschorner, A. Feb. 1, 1921, [*Convention date*].

Heating water.—Liquid to be heated enters through a cock *w* the annular space between the walls *a*, *b* and it is given a spiral motion by a baffle. Thence it rises up the close-topped tube b^1 and flows out through the tube *f*. The heating-means is disposed in the space between the walls *b*, b^1 and is shown as an electric resistance wire wound in a double spiral in grooves in an insulating-body *o*. Any heating means may be used. A spring-pressed piston *q* working in a cylinder *p* is subjected on its underside to the pressure on the liquid in the apparatus and its movements are indicated on a dial by means of a rod *r* and a rack and pinion. If the heat input is constant and the outlet is of fixed size, the dial will indicate simultaneously the quantity flowing in a given time and the temperature. Should the pressure become excessive, ports *t* are uncovered and the pressure relieved.



174,937. Topp, W. B. Feb. 5, 1921, [*Convention date*].

Heating water. — An electrical heating apparatus comprises a closed chamber 1 and an attached or integral receptacle 3 at the lower end thereof containing electrides 5 separated by an imperforate insulating partition and connected to a source of alternating current, the receptacle containing a vaporizable conducting liquid such as water, so that as the liquid vaporizes, the current varies with the volume of the liquid. The chamber 1 and receptacle 3 may be made of metal lined with an insulating enamel, or the receptacle 3 may be of porcelain and may contain four electrodes separated by three partitions. Acids or salts may be added to the water to increase its conductivity. In a modification, the chamber 1 is surrounded by a water jacket with an inlet and outlet so as to form a water heater.



The Specification, as open to inspection under Sect. 91 (3) (a), states that mercury may be used as the vaporizable liquid. This subject-matter does not appear in the Specification as accepted.

174,970. Crompton, R. E. B. Aug. 31, 1920.

Heating liquids; water supply and delivery.—A jacketed and insulated container 1 has mounted below it a continuously-burning burner 18 pro-

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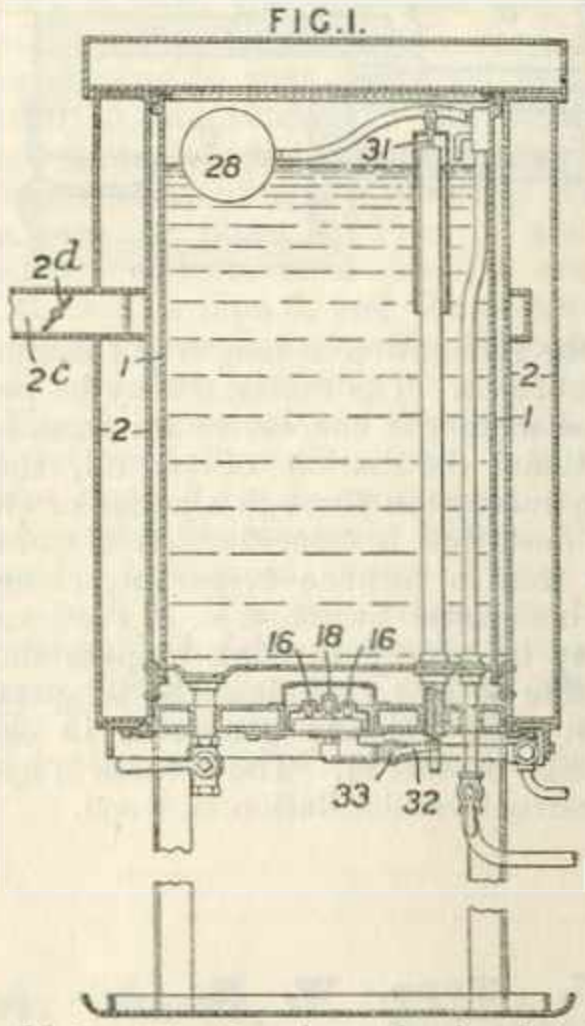
tioned so as to maintain the temperature of the water or other liquid at about 100° in excess of that of the cold supply. A valve controlled by a float 28 regulates the admission of cold water and a linkage 31, 32 interconnects with a valve 33 controlling the supply of gas to auxiliary

FIG. 1.



burners 16 to open it when the level is lowered by drawing off water. The escape of products of combustion from the jacket 2 may be controlled by a damper 2^d in the smoke pipe 2^c. In a modification, adapted for use with oil fuel, the linkage 31, 32 raises and lowers the wick of a "blue-flame" oil burner to regulate the heating.

174,974. Thermal Industrial & Chemical (T.I.C.) Research Co., Ltd., and **Morgan, J. S.** Sept. 7, 1920.

Heating liquids.—Material, such as liquid or subdivided solid, is subjected to heat treatment in contact with molten metal, and is carried into the molten metal as a film or layer by means of a travelling surface such as a rotating drum or endless band. A still for dehydrating tar or oil comprises a closed vessel *a* containing molten lead *e* and having a rotating drum *d* partly immersed in the metal. The hydrated tar enters by a pipe *f* and floats on the surface, while it is gradually brought into contact with the drum *d* and carried into the metal. The dehydrated tar leaves by the pipe *g*, and vapour by the pipe *c*. A scraper *h* may be provided to remove tar from the surface of the drum. In a modification, Fig. 3, which is particularly applicable for distilling carbonaceous material such as sawdust, the material is carried into the molten metal by an endless band *o*. Other applications mentioned are the drying of powders or crystals such as chalk or sodium bicarbonate, the distillation of calcium acetate, and the evaporation of liquids.

FIG. 2.

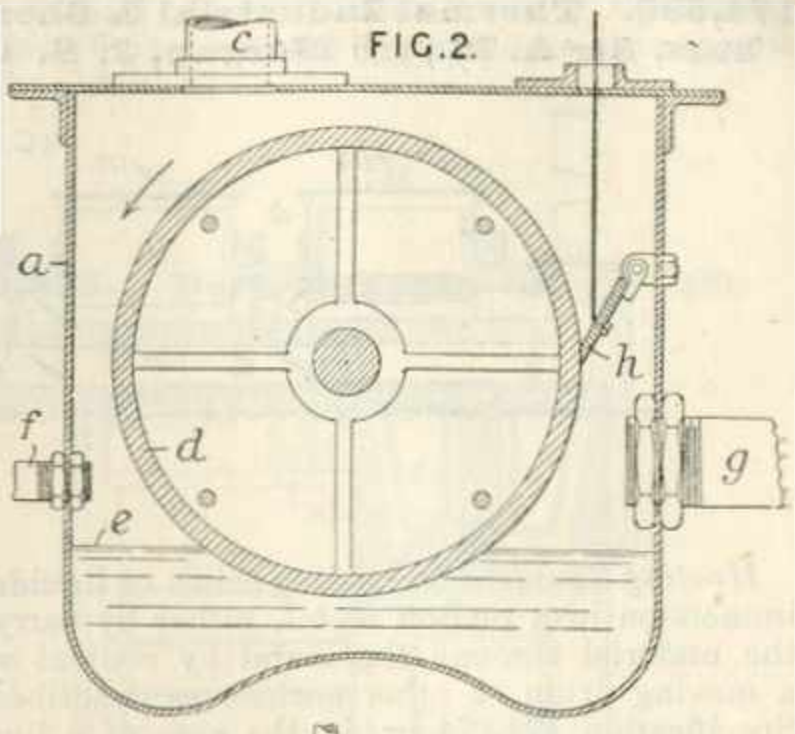
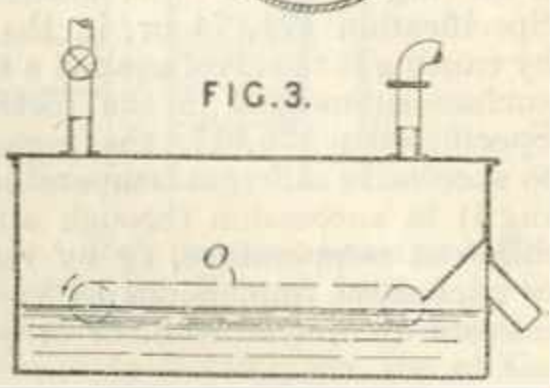


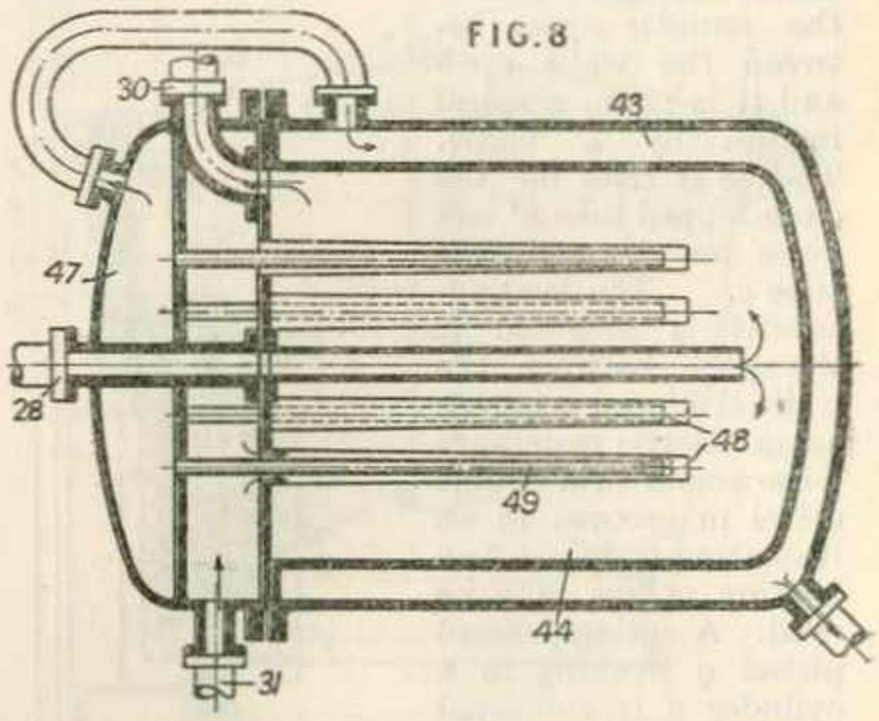
FIG. 3.



Specifications 14617/95, [*Class* 55, Gas manufacture], 19305/11, [*Class* 51 (ii), Furnaces and kilns for applying &c.], and 25698/12, [*Class* 55 (i), Coking &c.], are referred to.

174,998. Wagner, F. Oct. 27, 1920

FIG. 8



Feed-water, heating.—A plant for heating and purifying feed-water for boilers, particularly of the locomotive type, comprises a series of pre-heaters combined with a direct contact steam heater located in a dome on the boiler. Feed-water is supplied to a series of jets in a ring-pipe 7, Figs. 1 and 6, in the dome 4 and, passing over the plate 10, Fig. 1, and funnel member 15, is conducted through channels 17, 19^a on each side of the boiler to the bottom. Wire brushes 11 serve to assist in the mixing of the water spray and the steam in the dome 4. The upward flow

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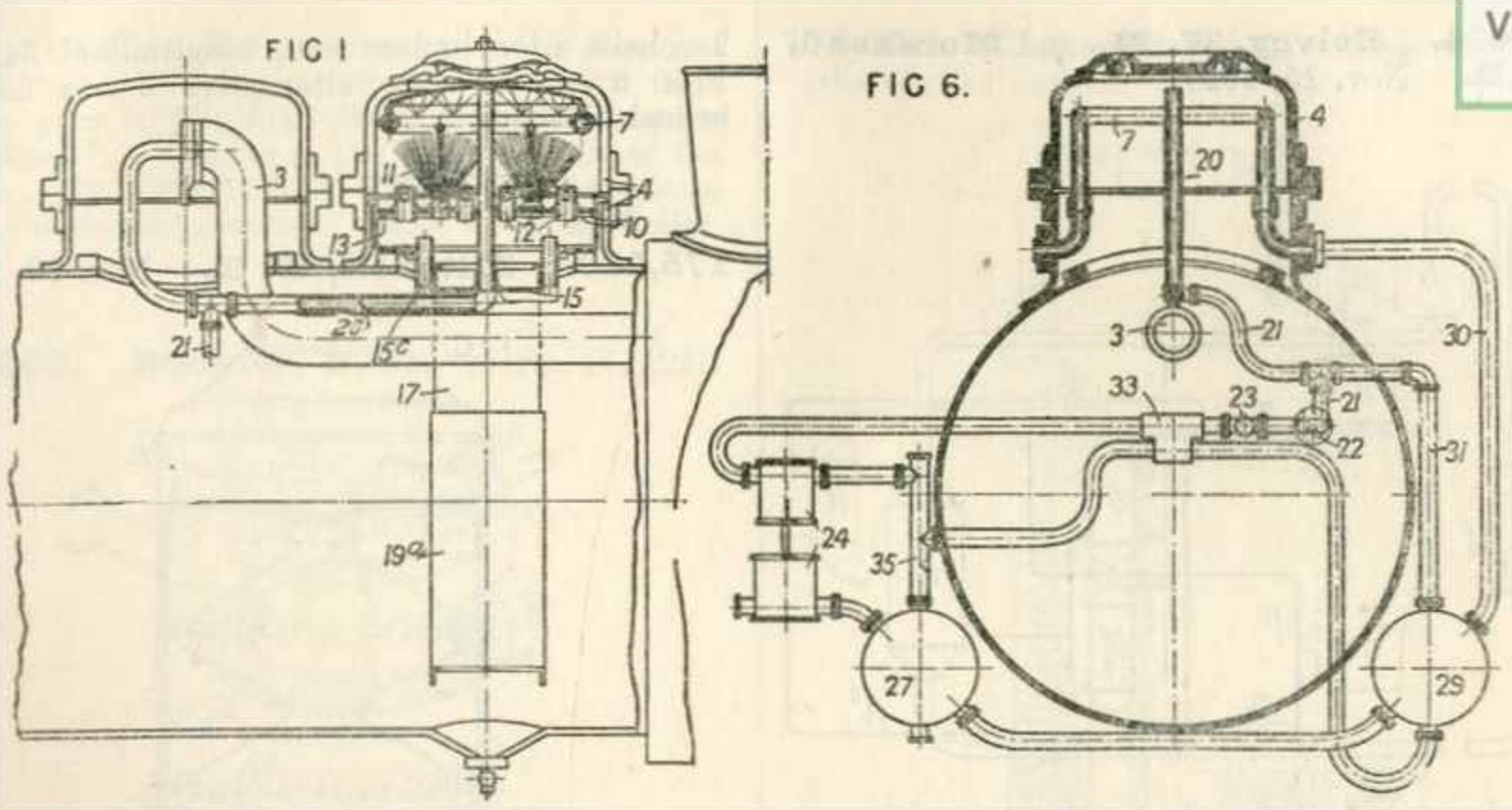
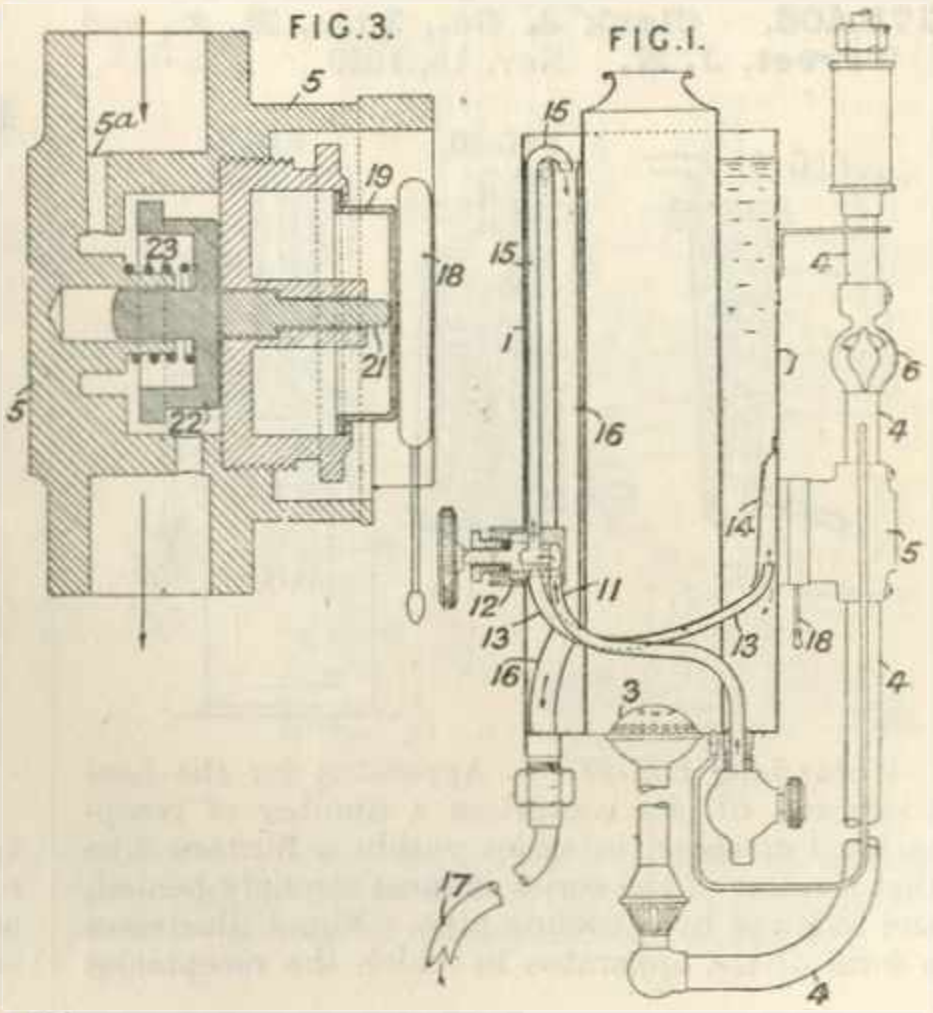


of boiler steam into the dome, through the openings and tubes 15c of the funnel 15 and the tubes 12 and openings 13 of the plate 10, is assisted by suction through the pipe 20 the outer end of which opens opposite the mouth of the steam-supply pipe 3 to the engine. One or more purifiers 29, Fig. 6, may be interposed on the feed-supply pipe between the preheater 27 and the dome purifier to collect the impurities thrown down at temperatures below that attained in the final heater. These preheaters and purifiers may be of the construction shown in Fig. 8, in which feed-water entering the chamber 44 by the pipe 28 issues by the pipe 30 being heated by steam which enters at 31 and traverses the double tubes 48, 49, the header 47 and the casing 43. The steam supplied to the preheaters and also to the feed-pump 24, Fig. 6, may be obtained from the suction pipe 20 through a branch 21, and the steam passing to the pump may be superheated before use by traversing a looped pipe 22 in an enlarged fire-tube. By the action of a valve device 33, steam only passes through the purifier 29 when, by opening the stop valve 23, steam is supplied to actuate the pump 24 to deliver water through the series of heaters to the boiler. The preheater 27 is supplied with exhaust steam from the engines and pump by the pipe 35. In a modification, one purifier may be located in the smoke-box to be heated by furnace gases.

175,272. Maladry, H. J. Feb. 9, 1921, [*Convention date*].

Heating water; annular boilers; water supply and delivery. — An apparatus for heating water comprises an annular chamber 1 with an open-topped overflow tube 16 connected to the outlet 17. A burner 3 is supplied with gas from a tube 4 through a thermostatic regulator 5 and a cock 6. Cold water supplied through the tube 11 passes to a three-way cock 12 and is delivered either direct to the outflow 16, 17 through the pipe 15 or through a pipe 13 to that point at the side of the chamber 1 under a baffle 14, against which the capsule 18 of the thermostat is fitted. In the latter case, water heated in the chamber 1 flows to the outlet by way of the tube 16. The thermostat 5 comprises the capsule 18 and a guided member 19 bearing on a rod 21 which presses the valve 22 against the pressure of a spring 23 on to its seat, thereby closing the gas passage 5a.

Reference has been directed by the Comptroller to Specifications 223/08 *and* 11072/08.



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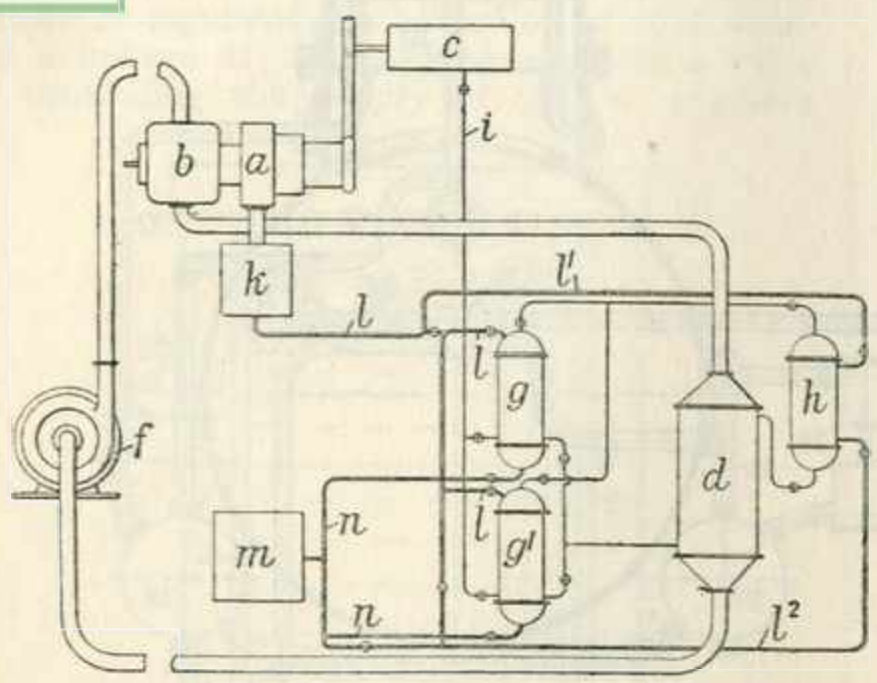
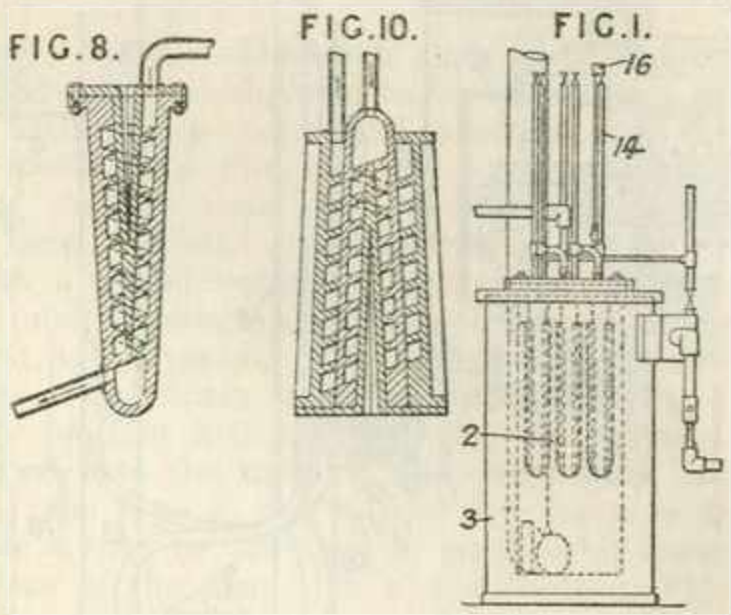
175,404. Selvey, W. M., and **Morshead, L. R.** Nov. 15, 1920.



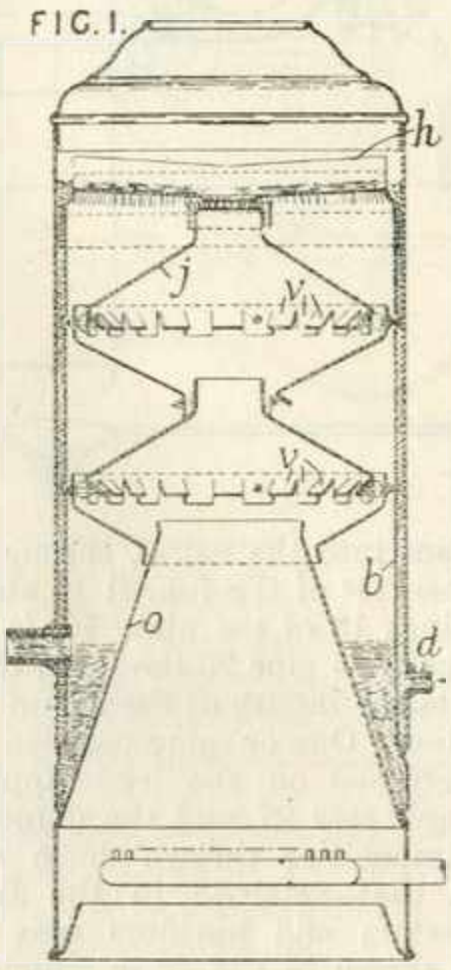
Feed-water, heating.—In a plant comprising an air-cooled dynamo *b*, a main steam engine *a*, and an auxiliary steam engine *c*, the exhaust steam of the auxiliary engine being employed in an absorption refrigerating apparatus cooling the air for the dynamo, the condensate of the condenser of the main engine may be warmed by heat from the refrigerating-apparatus. In the form shown, by means of pipes l, l^1, l^2, n, some or all of the turbine condensate from the condenser k may be led to cooling coils in the absorbing vessels g, g^1 or in the condensing vessel h, either in series or in parallel, or directly through the vessel h to the feed-water heater m. Water or air coolers may be employed in the air system between the dynamo and the vessel d. Specification 174,693, [*Class* 35, Dynamo-electric generators &c.], is referred to.

175,406. Clark & Co., Ltd., R. I., and **Tervet, J. N.** Nov. 15, 1920.



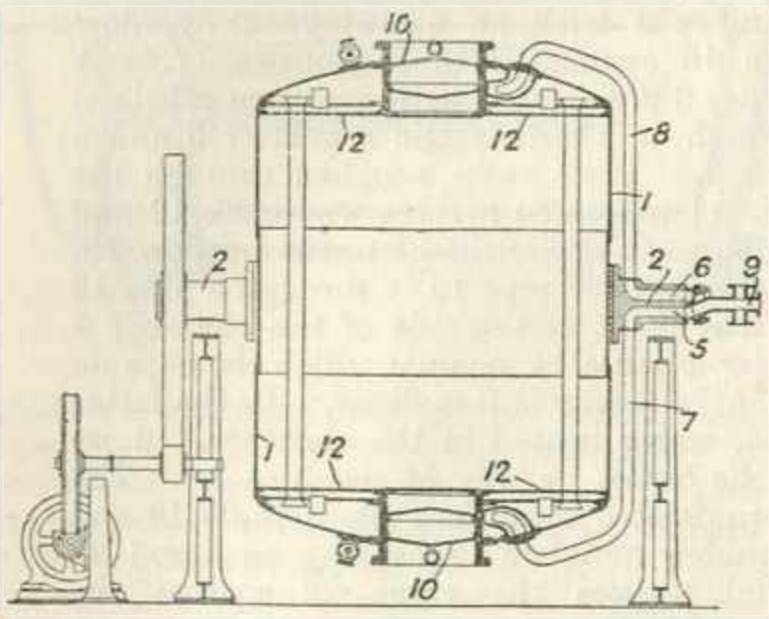
Water-tube boilers. — Apparatus for the heat treatment of oils comprises a number of receptacles 2 arranged in series within a furnace 3 so that the last of the series is most strongly heated, and followed by a cooling pipe. Fig. 1 illustrates a form of the apparatus in which the receptacles 2 consist of cylinders with longitudinal flanges. Figs. 8 and 10 show alternative forms having helical passages.

175,430. Mitchell, W. T. Nov. 20, 1920.



Heating water; geysers. — In a geyser, water entering at d flows up in the annular casing b and along a trough h over the closed top baffle j and thence over others, alternately inverted, down to a collecting-cone o. The lower edge of each baffle is serrated and tongues v thus formed are bent alternately in opposite directions.

175,476. Happer, J. R. Dec. 10, 1920.



Digesters; boiling-pans.—A boiler of the Sinclair type, such as is described in Specification 6441/93, for use in paper making has exactly similar ends and is so mounted that it may be revolved on a transverse axis. Ports 5, 6 in one of the trun-

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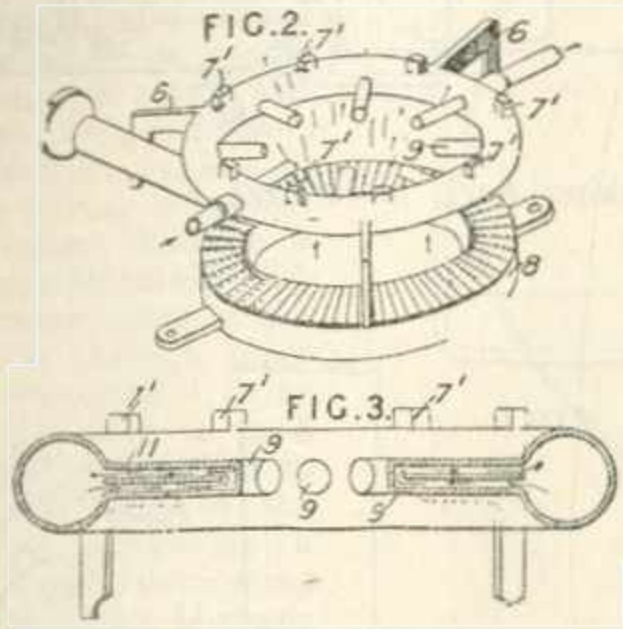
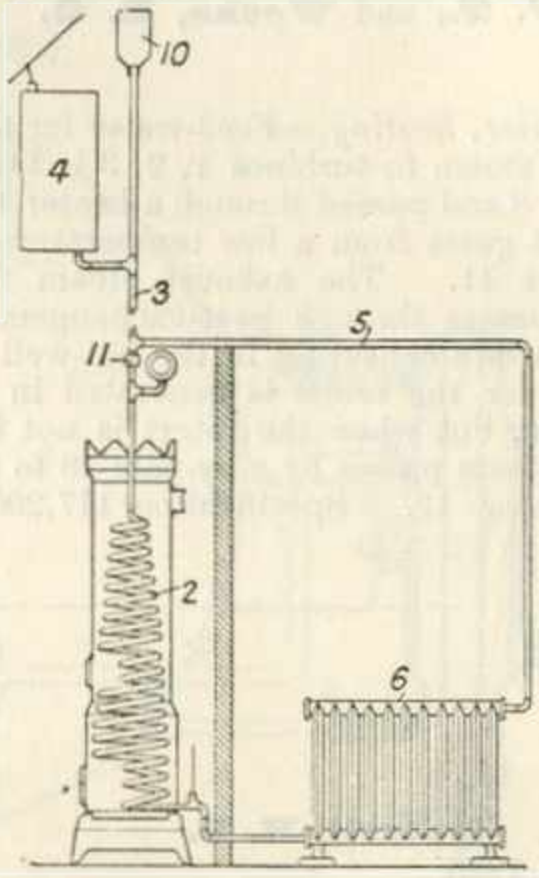
nions 2 on the boiler 1 communicate in turn, as the boiler is revolved, with the steam or fluid supply pipe 9. The fluid flows through the ports into pipes 7, 8 leading to the opposite ends of the boiler. The doors 10 have inner perforated plates in line with the perforated plates 12 of the boiler.

175,908. Meister, D. J. March 16, 1921.



Annular boilers; water-tube boilers.—An annular boiler, adapted to be supported by legs 6 over the burner 8 in conjunction with which it is used, has radial tubes 9 closed at their inner ends and provided with divisions 11 extending nearly to their ends to assist the circulation. Projections 7¹ support any utensil which it is desired to heat. A series of these boilers may be used each over a burner in a gas-range and connected with an adjacent hot-water reservoir.

175,956. Johansson, C. Feb. 19, 1921, [*Convention date*].

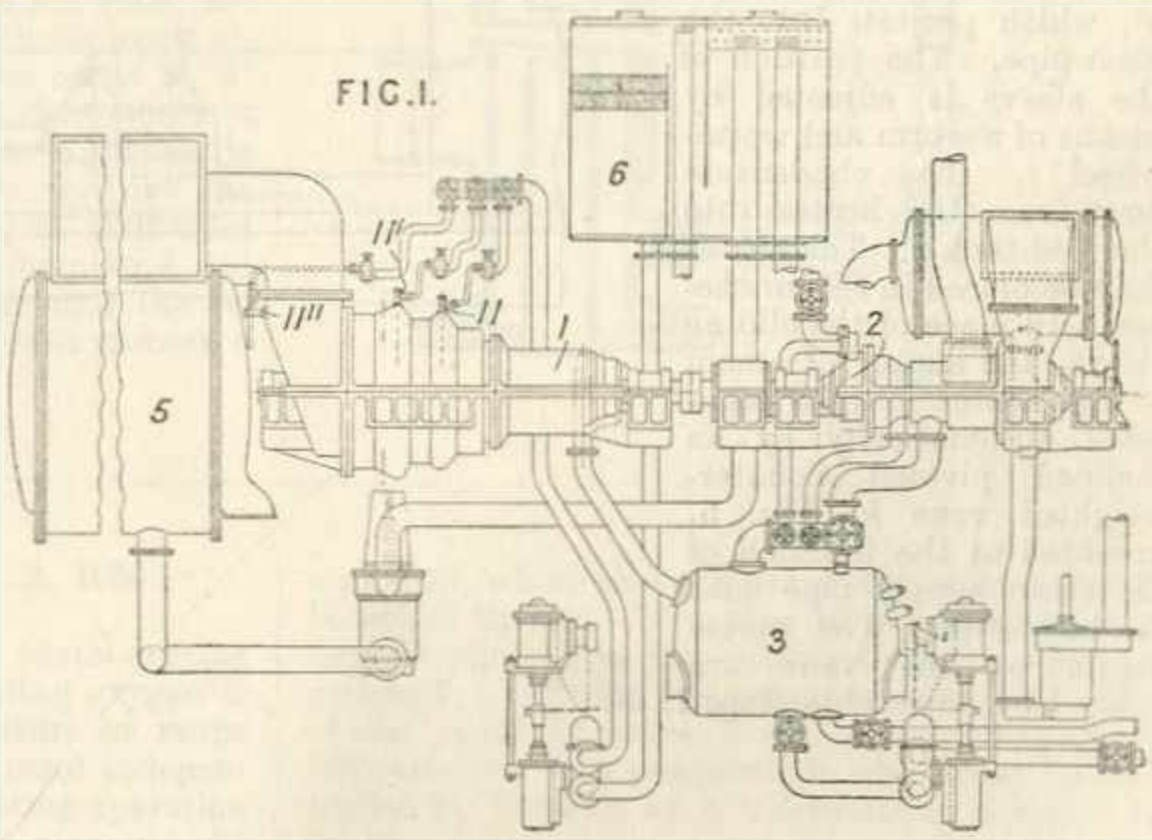


Heating water.—The rising pipe 3 from a boiler 2 is extended to a tank 10 above the level of the ordinary expansion tank 4. The water and steam rising from the boiler in pulsations due to over-firing, pass directly to the tank 10.

According to the Specification, as open to inspection under Sect. 91 (3) (a), a non-return valve 11 may be fitted on the pipe 3 below the branch 5 which supplies the radiator 6. This subject-matter does not appear in the Specification as accepted.

176,009. Vianello, E. Feb. 25, 1921, [*Convention date*].

Feed - water, heating.—Relates to steam engines or turbines which are made to work on a Carnot cycle by taking a portion of the exhaust steam from the condenser and adiabatically compressing it, together with water, to the boiler pressure, the compressed fluid passing to the boiler. According to the invention a centrifugal compressor, fed with steam from the condenser and with water from the hot well injected near the suction end, discharges into a receiver which is provided with means for discharging any air. An auxiliary turbine 2 drives a multistage compressor 1 which take a portion of the exhaust steam from a main condenser 5, and compresses it to boiler pressure, water from a hot well 6 being injected through atomizers 11, 11¹, 11¹¹ at various stages of the compressor so as to reduce the fluid practically to liquid at boiler pressure. The fluid is led to a receiver 3 and the water fed to the boiler, any steam or air being used in a stage of the auxiliary turbine 2.



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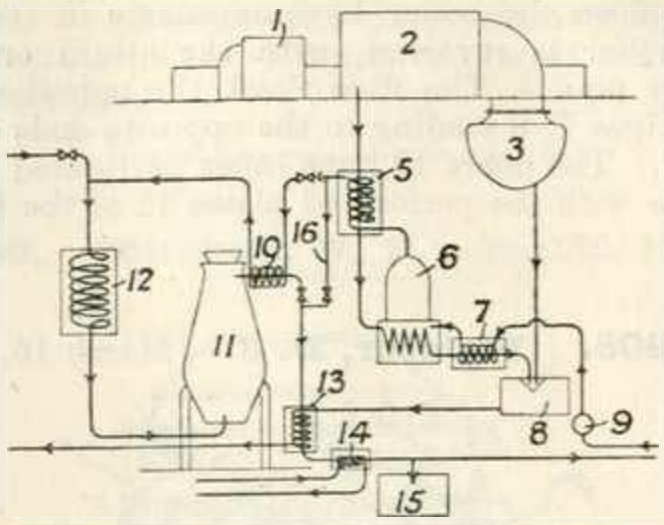
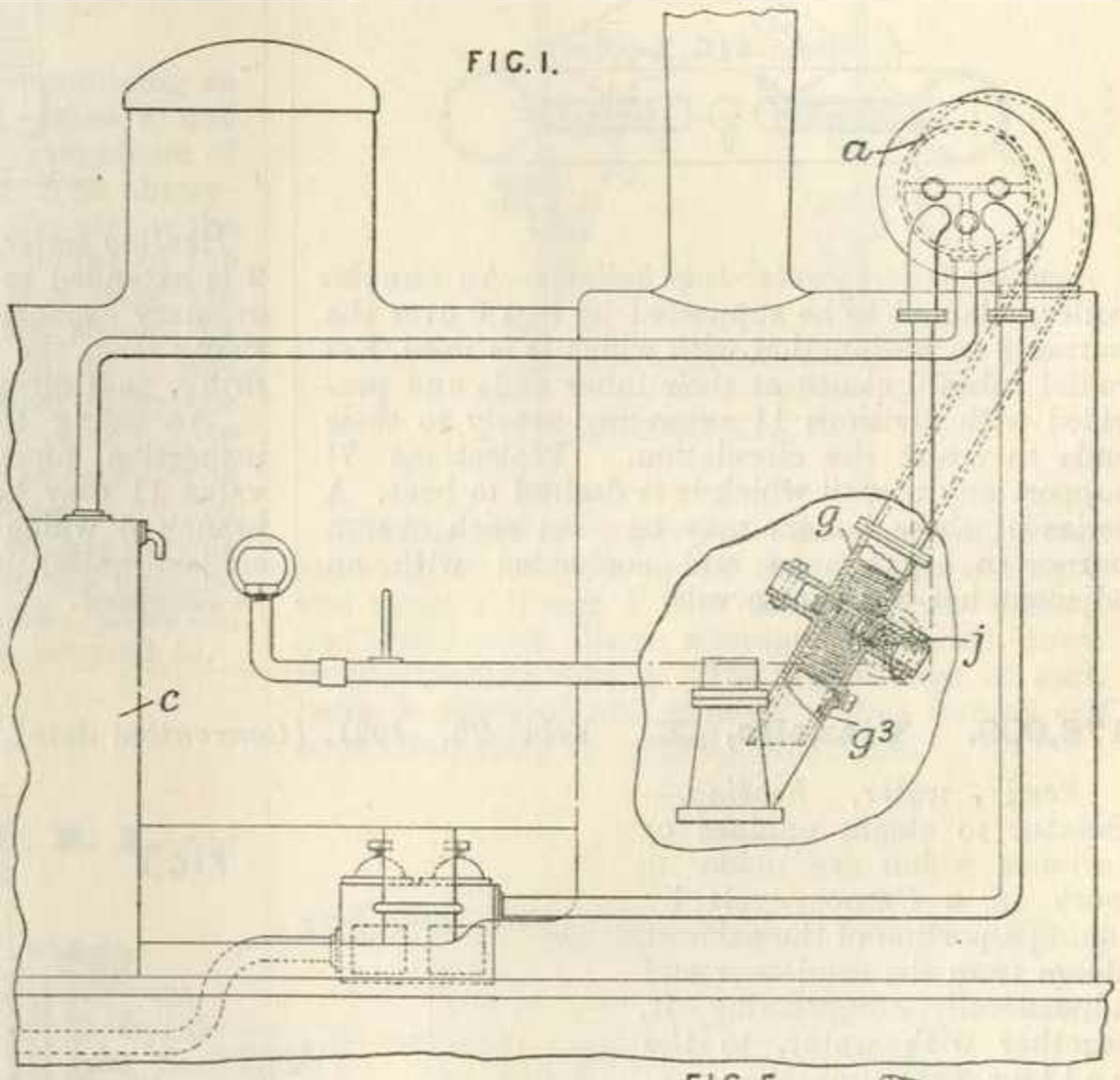
176,149. Merz, C. H., and **McLellan, W.,** (*trading as* Merz & McLellan), **Bottomley, W. T.,** and **Weeks, E. G.** Dec. 3, 1920.

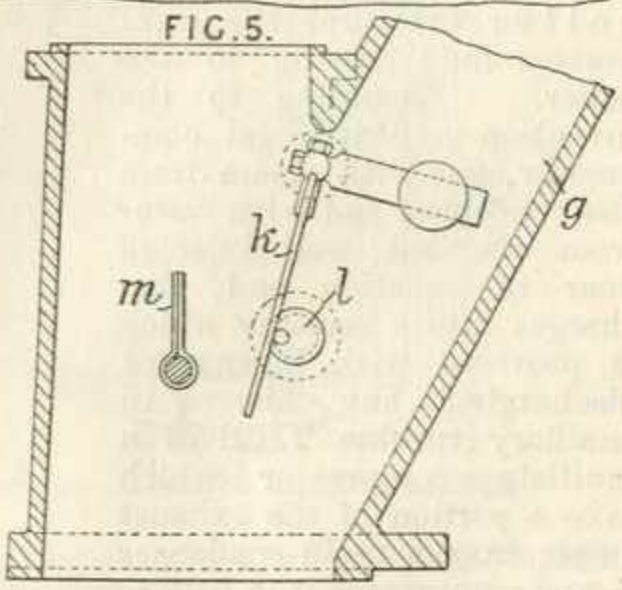


Feed-water, heating.—Feed-water for the boiler supplying steam to turbines 1, 2, 3 is taken from a hot-well 8 and passed through a heater 13 heated by the hot gases from a low temperature distillation retort 11. The exhaust steam from the turbines passes through heat-exchangers 5, 6, 7, the condensate collecting in the hot-well 8. Make up steam for the retort is generated in the heat exchangers, but when the retort is not in operation this steam passes by a by-pass 16 to the feed-water heater 13. Specification 117,290, [*Class* 55 (i), Coking &c.], is referred to.

176,439. Dalzell, H. E. Nov. 3, 1920.



Feed-water, heating.—Feed-water for a steam locomotive is heated by exhaust steam diverted from the blast-pipe in adjustable quantities. The condensate from the heater is conducted to the boiler feed-tank. Exhaust steam is led into the feed-heater *a*, Fig. 1, arranged above the boiler smoke-box through an inclined pipe *g* having at its lower end an internal sleeve g^3, which projects into the blast-pipe. The position of the sleeve is adjusted by means of a worm and worm-wheel *j*. The condensate flows from the heater into the feed-tank *c*. The heater may be placed in the smoke-box. In place of the sliding sleeve, the supply of steam to the heater may be regulated automatically by an inclined pivoted counter-weighted vane *k*, Fig. 5, mounted at the junction of the steam-supply pipe with the blast-pipe. The movements of the vane are limited by adjustable stops *l*, *m*.



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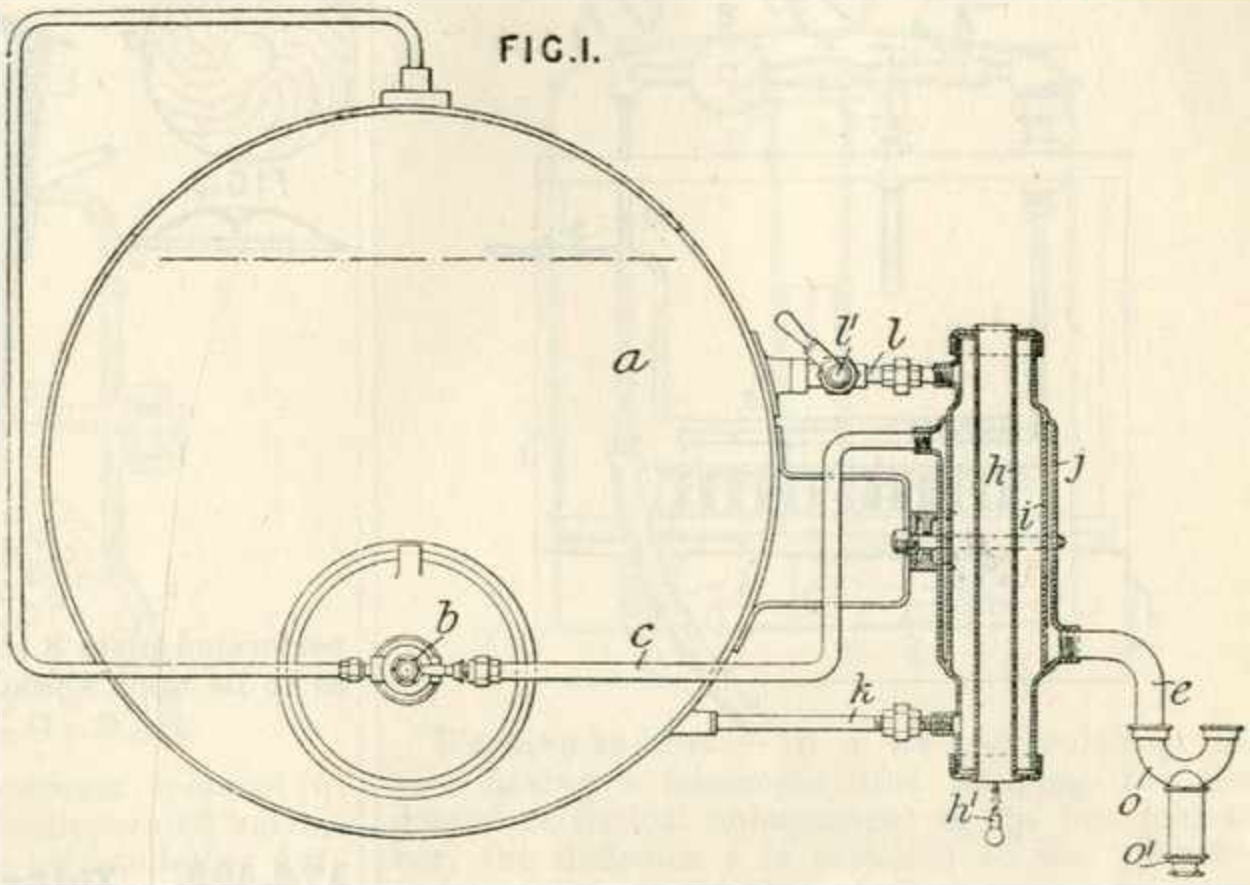
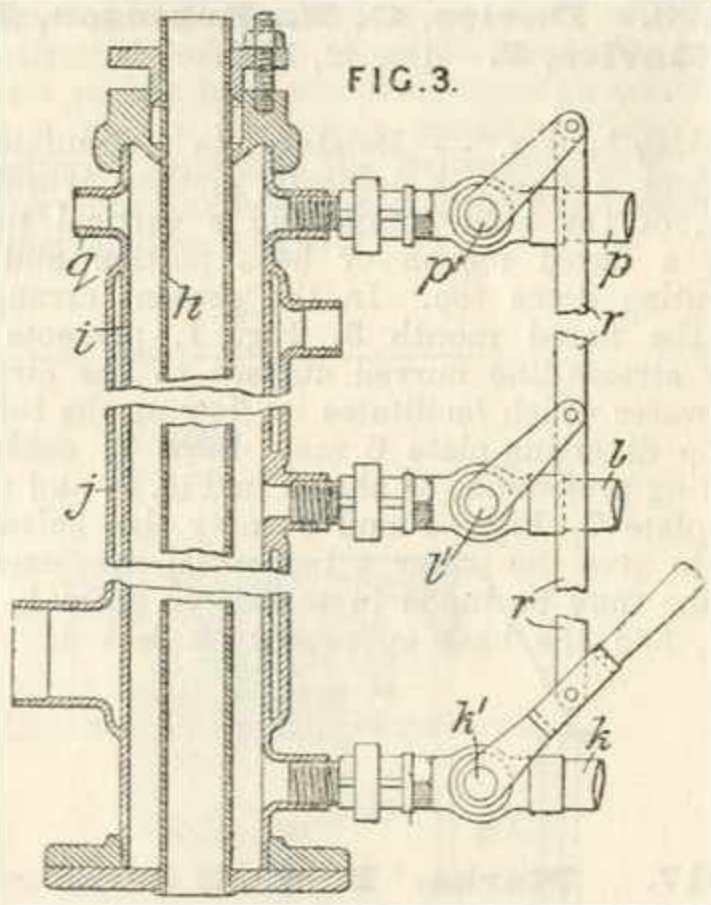
176,454. Kirke, P. St. G. Nov. 25, 1920.

Heating liquids. — Apparatus for heating oil supplied to the burner *b* of a steam-boiler *a* comprises a water chamber or auxiliary boiler *i* provided with an internal fire tube *h*, at the lower end of which is located a burner h^1, and surrounded by a chamber *j* in which the oil supply to the burner is heated. The water chamber is in communication with the water space of the boiler *a* through pipes *l*, *k*, the pipe *l* being provided with a cock l^1. Oil is supplied to the lower end of the chamber *j* through a pipe *e* communicating by means of a **U**-shape pipe *o* provided with a sludge-cock o^1 with the supply tank. A pipe *c* leads the oil from the chamber *j* to the burner *b*. When steam has been raised in the main boiler, the burner h^1 is put out of action, and by opening the cock l^1 water from the main boiler is circulated through the chamber *i* to effect the heating of the oil. In the modified form of heater shown in Fig. 3, the upper part of the chamber *i* forms a steam space communicating with the steam space of the main boiler through a pipe *p* provided with a cock p^1, and, if desired, with the burner of the main boiler through a pipe connected to the chamber *i* at *q*. Cocks k^1, l^1 in the pipes *k*, *l*, communicating with the water space of the main boiler are inter-connected through a link *r* with the cock p^1. Upon the cock p^1 being opened the cocks l^1, k^1 are closed and vice versa so that either steam or water may be led to the chamber *i* which is provided with a suitable discharge cock at the bottom. In a further modification, an additional chamber communicating with the chamber *i* and forming a steam chamber may surround the oil chamber and may supply steam to the burner *b* for atomizing the oil.





176,472. Godfrey, A. Dec. 2, 1920.

Heating gases. — In an oxygen metal-cutting apparatus, a separate stream of cutting oxygen is heated to a predetermined temperature or range of temperature by means under control independent of the heat produced by the cutting operation and the preheating flame. In the arrangement shown in Fig. 1, the cutting oxygen passes through a pipe 3 and a coil 5 arranged in an electrically or gas-heated oven 1. From the coil 5, the oxygen passes through a cock 6 and reducing valve 8 to a pipe 10, which passes through the oven and may be coiled therein. The pipe 10 is connected by a flexible pipe 11 to the cutting burner. Pressure gauges 7, 9 indicate the gas pressure on both sides of the reducing valve 8 and a thermometer 12 indicates the oven temperature which may be controlled by hand or by a thermostatic device. In another arrangement a gas jet supplied from the fuel gas pipe or the fuel gas and oxygen pipes heats a chamber fixed to the burner supply pipes.

(*For Figure see next page.*)

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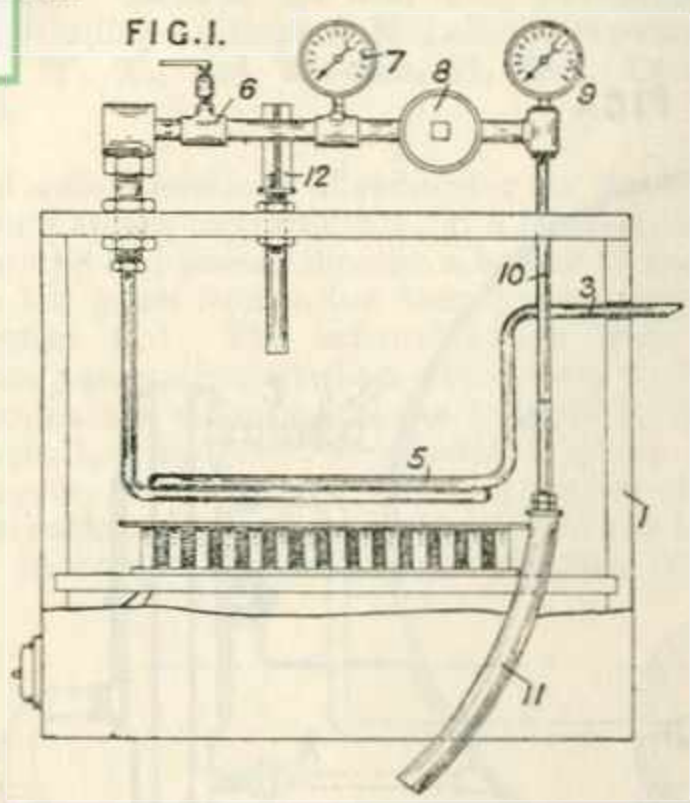
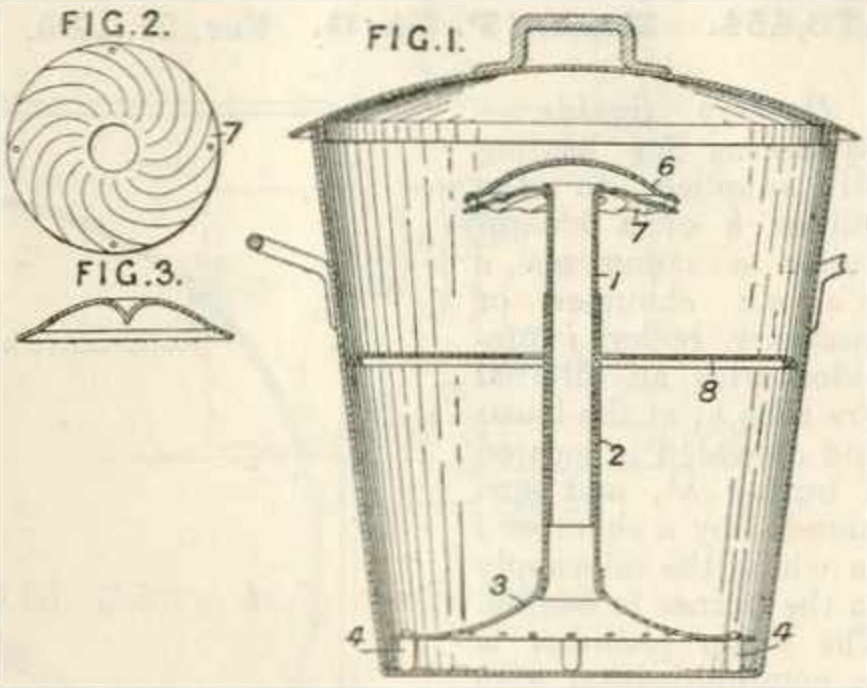
176,472.



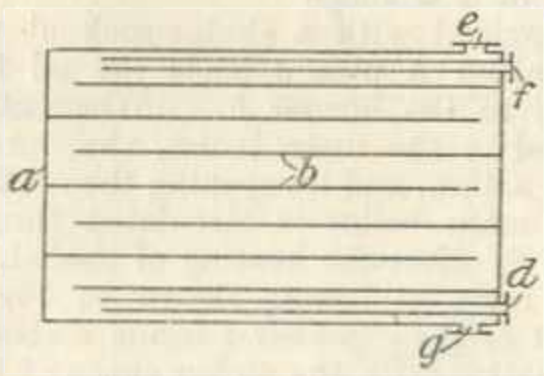


perforated plate 8 may be disposed on the tube so as to lie upon the clothes.

176,473. Davies, G. N., Robinson, H., and **Davies, C.** Dec. 2, 1920.

Washing-boilers. — Relates to circulatory appliances, for use in domestic clothes, washing boilers, of the kind comprising a vertical tube having a flared mouth or base portion and a distributing dome top. In the present arrangement the flared mouth 3, Fig. 1, presents a convex stream-line curved surface to the circulating water which facilitates its flow up the tube. The top diverting-plate 6 may have a central depending projection, as shown in Fig. 3, and the lower plate 7, Figs. 1 and 2, may be spirally fluted to give the water a tangential movement The tube may be made in telescopic parts 1, 2, Fig. 1, and the base supported on feet 4. A

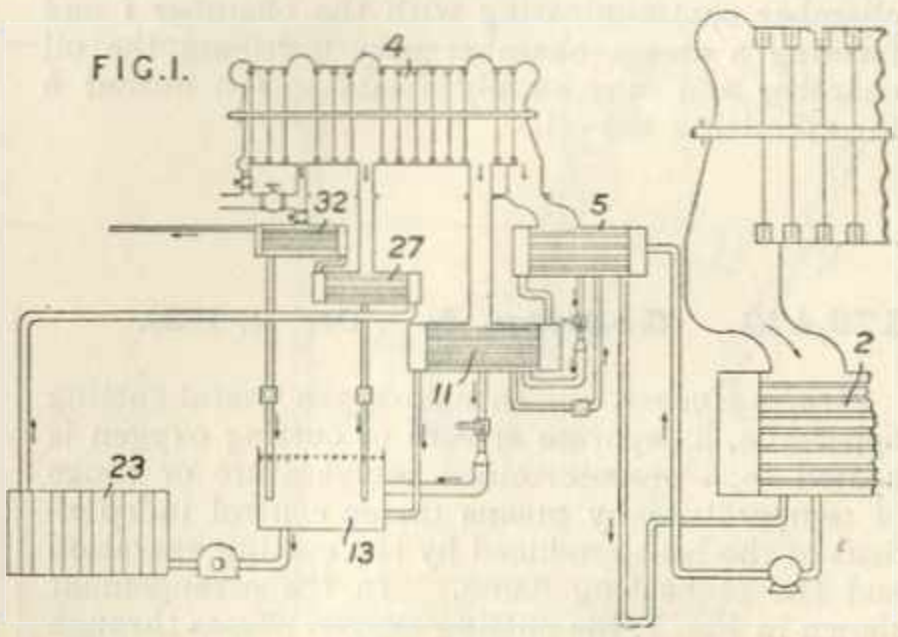
176,499. Ibing, H. Dec. 7, 1920.



Heating liquids.—Heat is exchanged between two immiscible liquids of different densities by passing them in superposed layers in opposite directions. The heavier flows downwards through a receptacle *a* over a series of partitions *b* from the opening to the exit *g*. The lighter liquid enters at *d* and passes upwards to the exit *e*.

176,817. Marks, E. C. R., (*Ingersoll-Rand Co.*). Sept. 7, 1920.

Feed-water, heating.—Condensate from the main condenser 2 is pumped through the condenser 5 of an auxiliary turbine 4, and a re-heater 11 heated by steam from a lower stage of the auxiliary turbine to the hot-well 13. Thence it is pumped through an economizer 23 and is further heated in heaters 27, 32 supplied with steam from higher-pressure stages of the turbine 4 before delivery to the boilers. Air-extracting devices are employed in the heaters operating below atmospheric pressure.



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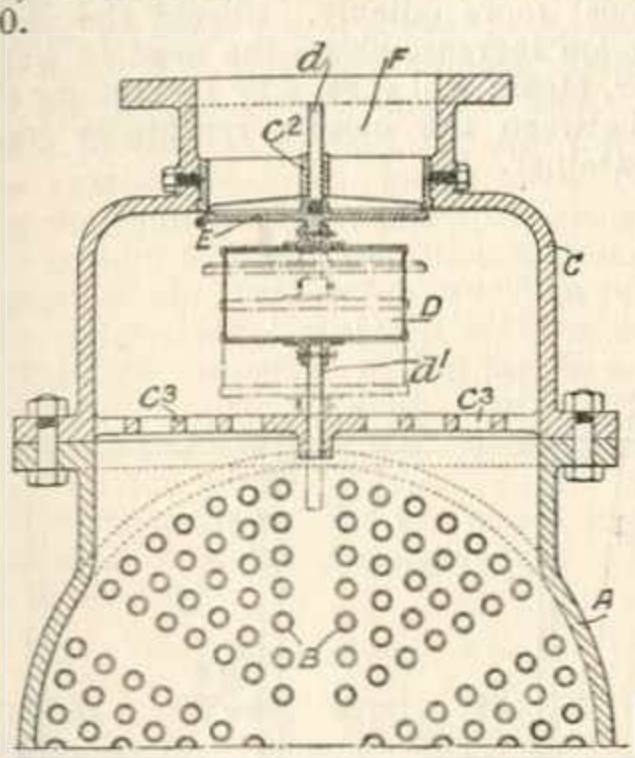
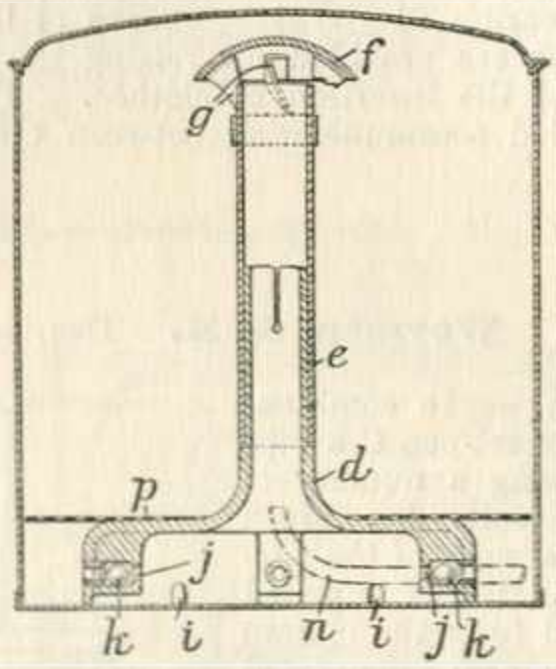
176,872. Swan, Hunter, & W. Richardson, Ltd., and **Yates, S. R.** Dec. 11, 1920.



Feed-water, heating. — The steam inlet of a feed-heater is controlled by a float-operated valve, the valve being closed on water accumulating due to breaking or bursting of the water-tubes. The heater A has feedwater circulating-tubes B and carries a casing C, which contains a float D directly connected to a valve E controlling the steam connection F. The float and valve are guided by stems d, d^1 moving in guides c^2 in the valve-seat casting and in a plate c^3. When the valve E is closed, the accumulated water blows out at the safety-valve and so gives warning of tube breakage.

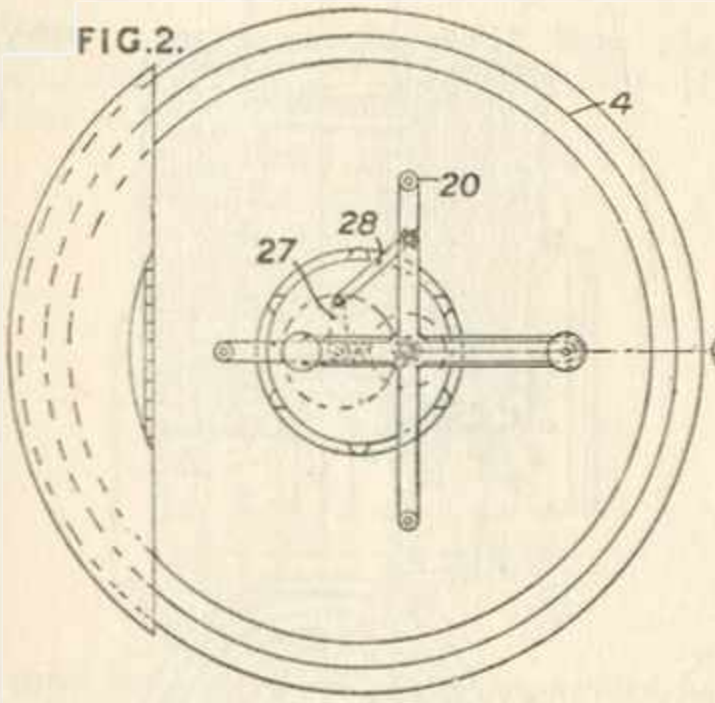
176,899. Crockford, A. H. Dec. 11, 1920.

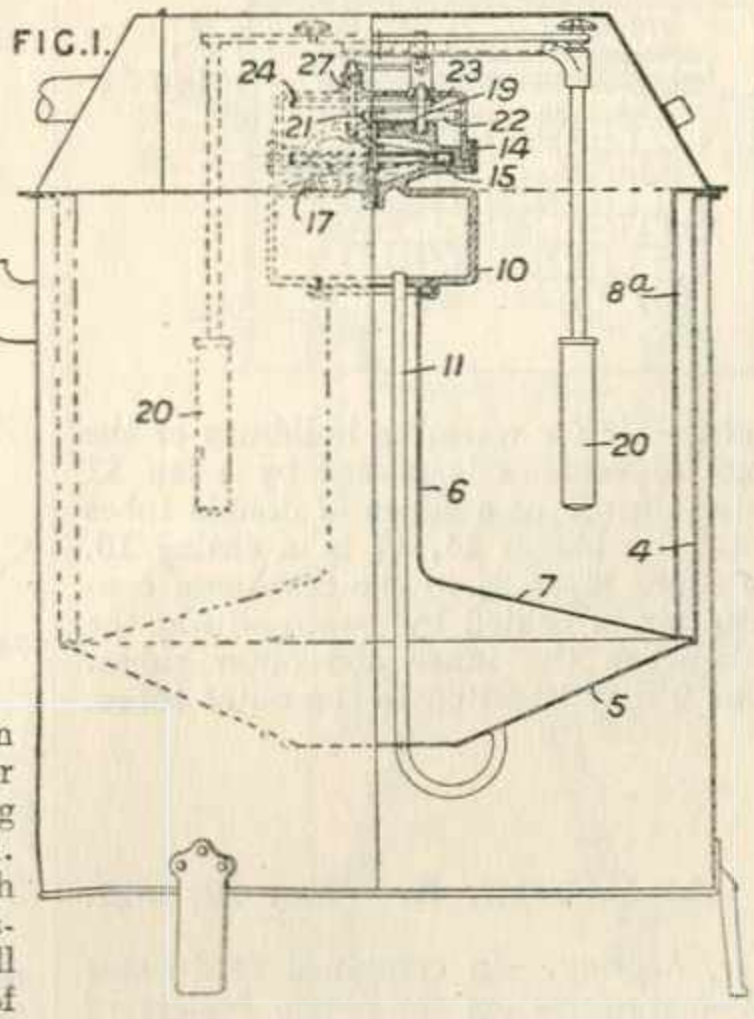


Washing-boilers. — In a water-circulating device having a telescopic tube merging into the domed or conical enlargement of the base chamber, the deflector f is attached to the tube by webs g so arranged that a spiral motion is given to the liquid. The base chamber has holes j containing double-seated valves k in addition to unrestricted holes i. A perforated false bottom p rests on the base chamber, through which may pass a pipe n to supply steam or liquid from an exterior source to the delivery tube d, e.

Reference has been directed by the Comptroller to Specification 176,473.

177,230. Statham, A. E., and **Collett, A.** Dec. 18, 1920.





Washing-boilers. — Relates to machines in which the clothes are cleansed by boiling-water agitated by stirrers, and consists in the driving of the stirrers by means of the steam produced. In the upper part of the water-container 4, which has a dished bottom 5, is an annular clothes-receptacle perforated on its inner and lower wall 6, 7. A turbine 14 is driven by the projection of steam against its blades 15 by nozzles 17 in the

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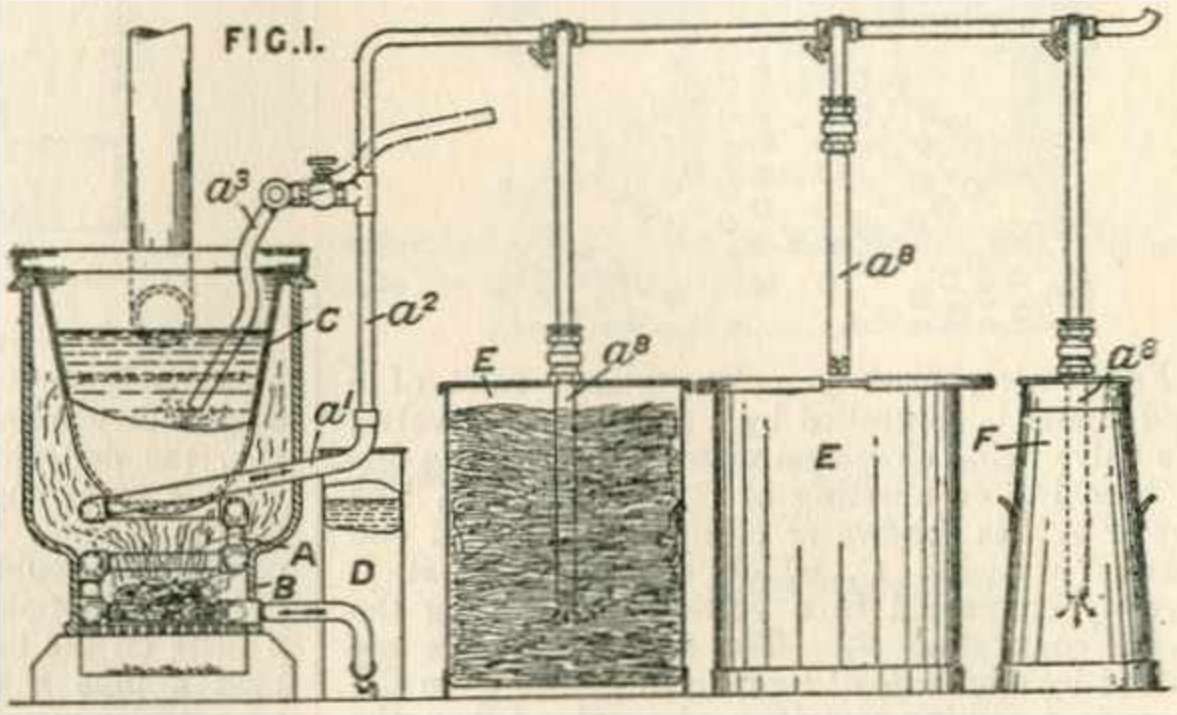
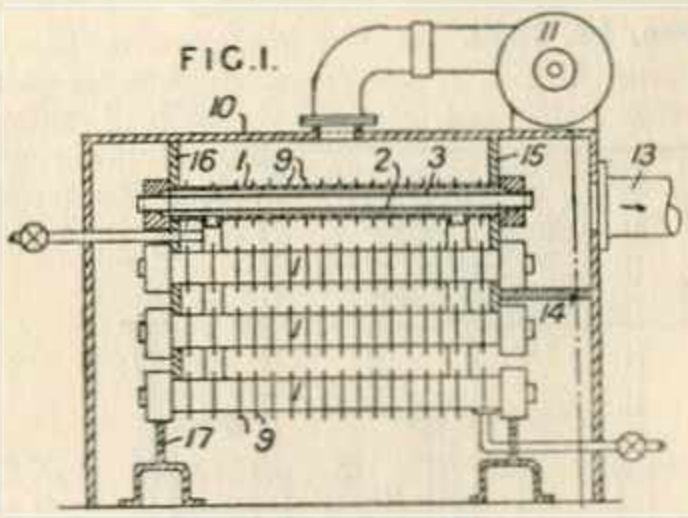
top of a steam chest 10 fixed above the member 6. The spindle 19 of the turbine oscillates four stirrers 20 mounted on a cruciform member through gearing 21 - - 24 by means of links 27, 28. Means are provided for raising the stirrers to allow of the insertion of clothes. Pipes 11 are provided communicating between the steam chest and the dished bottom 5 so that water therein is heated first and steam passes into the steam chest more quickly. Should the pressure of the steam increase above the head of water in the boiler, steam will escape by an annular chamber 8^a between the clothes receptacle and the water-container.

177,264. Weymes, G. R. Dec. 24, 1920.

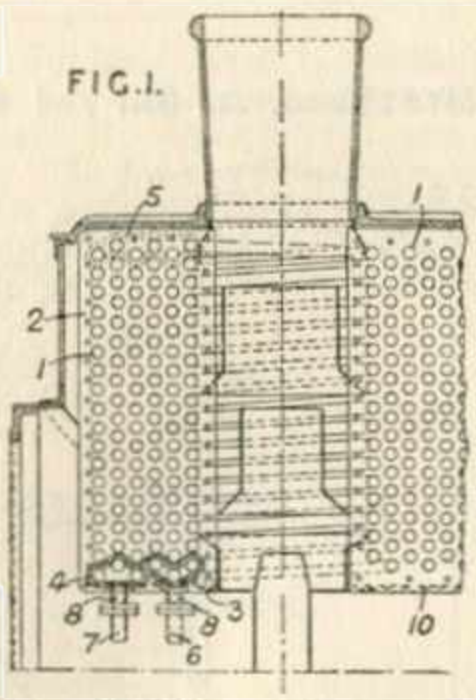
Set-pans. — In combination with a set-pan C a pipe A comprising a number of **U**-shaped coils is spaced around the walls of the fire-box B. Water is supplied to one end from the cistern D and steam generated passes by the other end a^1 to a pipe line a^2 from which it is delivered to a series of telescopic tubes a^8 for steaming milk-churns F or fodder &c. contained in vessels E. A hinged pipe a^3 may deliver steam to assist the heating of the contents of the pan C.

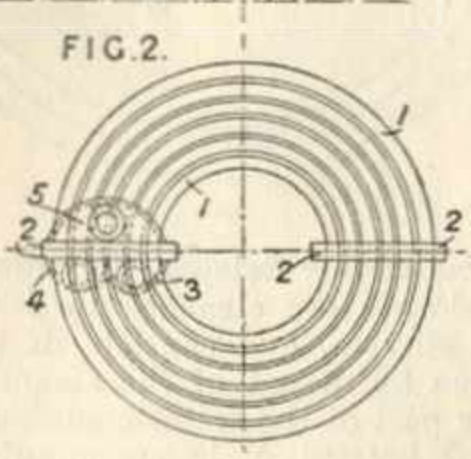


177,279. Davis, W. K. Jan. 3, 1921.



Heating air.—Air for warming buildings or the compartments of vehicles is passed by a fan 11 over the outer surface of a series of double tubes 1 and directed by baffles 14, 17 in a casing 10, through the inner pipes 2, to the discharge conduit 13. The air is heated by steam within the annulus 3 between the inner and outer tubes. Radiating-fins 9 may be fitted to the outer tubes.





177,435. Anderberg, A. May 20, 1921.

Feed-water, heating.—In combined feed-water heaters and spark-arresters for steam boilers of the type in which groups of curved pipes 1 are arranged in the smoke-box concentric with the smoke-stack, the pipes are affixed at their ends to tube-plates 2 detachably connected with each

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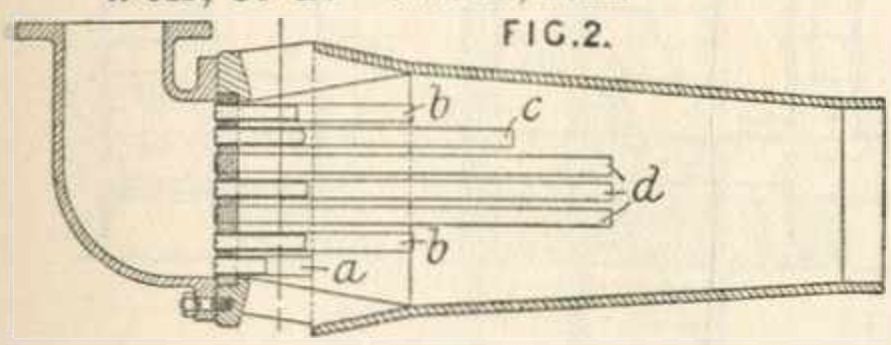
other in pairs and connecting the curved pipes in such a way that they form a number of helical conduits so that the system of pipes can be taken apart for cleaning purposes. The rows of pipes are displaced vertically and horizontally in relation to each other, causing the flue gases to strike against the pipes several times before entering the funnel. The inner coils are connected at the bottom with a water-chest 3 provided with an inlet for the feed-water, and the outer ones with a water-chest 4 provided with an outlet. All the pipes are connected at the top to a common water-chest 5. For blowing through the pipes, cocks or plugs 8 are provided on the water chests 3, 4 or on the outlet pipes 6, 7. The sheets 10 provided for carrying the flue gases towards the circumference of the apparatus are hinged at their inner edges.

177,625. Weir, Ltd., G. & J., and **Weir, J. G.** Jan. 11, 1921.

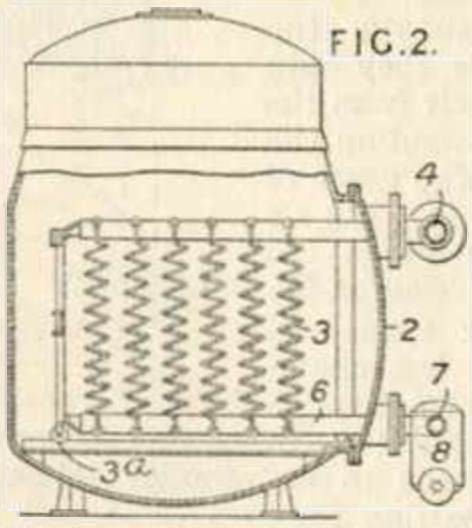
FIG.2.



Feed-water, heating; heating water. — Nozzles for the injection of heating-steam into feed or other water comprise jets *a* - - *d* of three or more different lengths in parallel, the internal diameters of the nozzles not exceeding three-quarters of an inch. In the preferred arrangement the longer nozzles are in the centre and the others grouped round them.

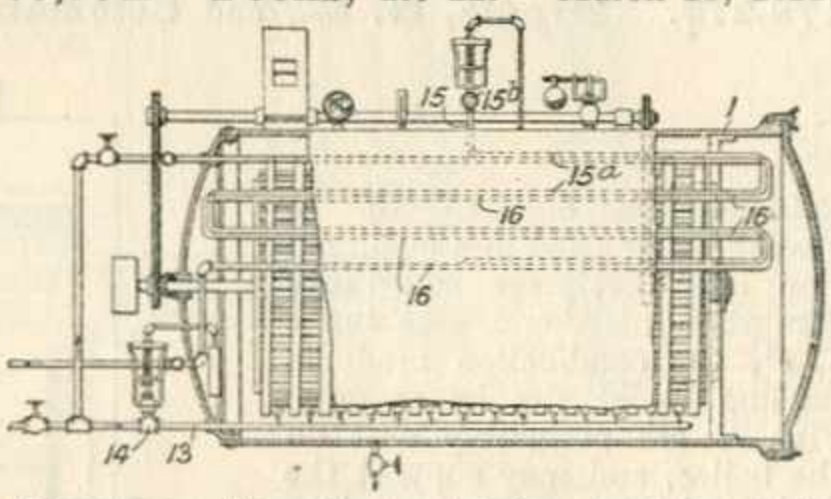
177,760. Griscom-Russell Co., (Assignees of *Jones, R. C.*). March 31, 1921, [*Convention date*].

FIG.2.



Heating water.—In an heater, described as an evaporator particularly for use on board ship, for obtaining distilled water for boiler feed, drinking, &c., which is heated by steam coils 3 passing between inlet headers 4 and lower headers 6, the outlets 7 of the lower headers are connected directly to a chamber 8 which receives the drainage from the coils. The chamber has a valved outlet near its lower side, through which the condensed water passes to the hot-well and valves at the top and bottom for allowing escape periodically of air and sediment. The heating-coils are carried by a door 2 on supporting-rollers 3a and rollers on the front of the door which enable the coils to be withdrawn from the evaporator. In a small installation a bracket for carrying a front supporting-roller may be cast on the base of the chamber 8.

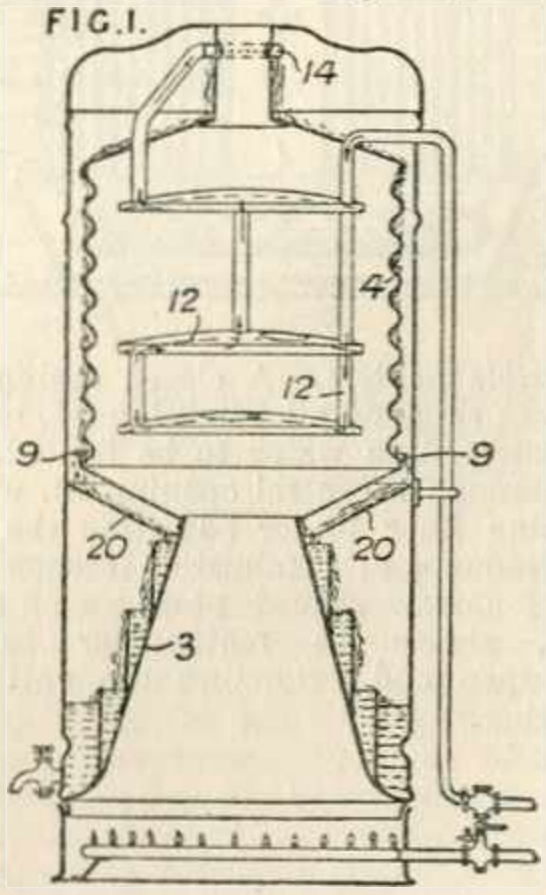
177,974. Fooks, N. H. March 10, 1921.



Digesters.—Tins &c. containing food &c. to be heated are passed through a vessel containing air or other gas saturated with the vapour of water or other liquid at a pressure above that of the atmosphere and a temperature above the normal boiling-point of the liquid, means being provided for passing the tins through the vessel while maintaining the temperature and pressure. For this purpose the vessel 1 may be provided with rotary air locks and a conveyer similar to those described in Specification 141,343, [*Class* 49, Food &c.], a steam inlet pipe 13 with a thermostatically-operated valve 14, an air-inlet pipe 15 with an automatic pressure-regulating valve 15b, and heating coils 16. The pipe 15 may be continued as at 15a adjacent to the coils 16, so that the air is heated before it escapes into the vessel 1. Specification 156,994, [*Class* 49, Food &c.], is referred to.

178,042. Vincent, W. P., Barrow, P. E., Vincent, G. T., and **Wayne, P. F. W. Pictor-.** Aug. 27, 1921.

FIG.1.



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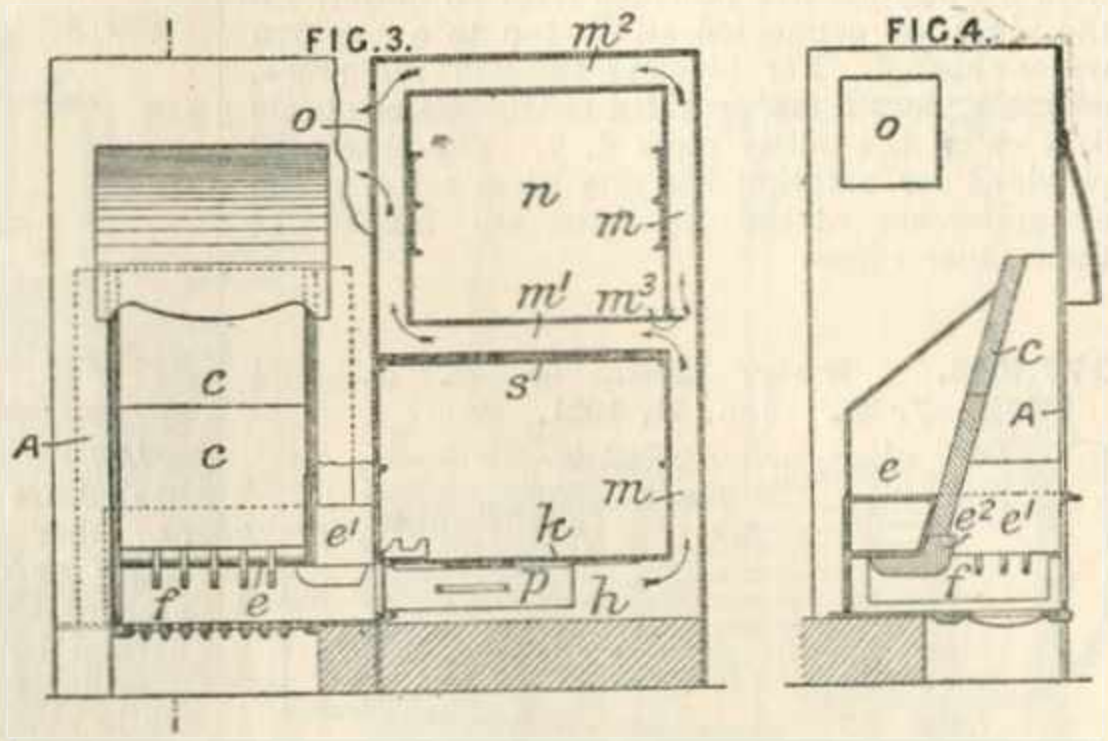
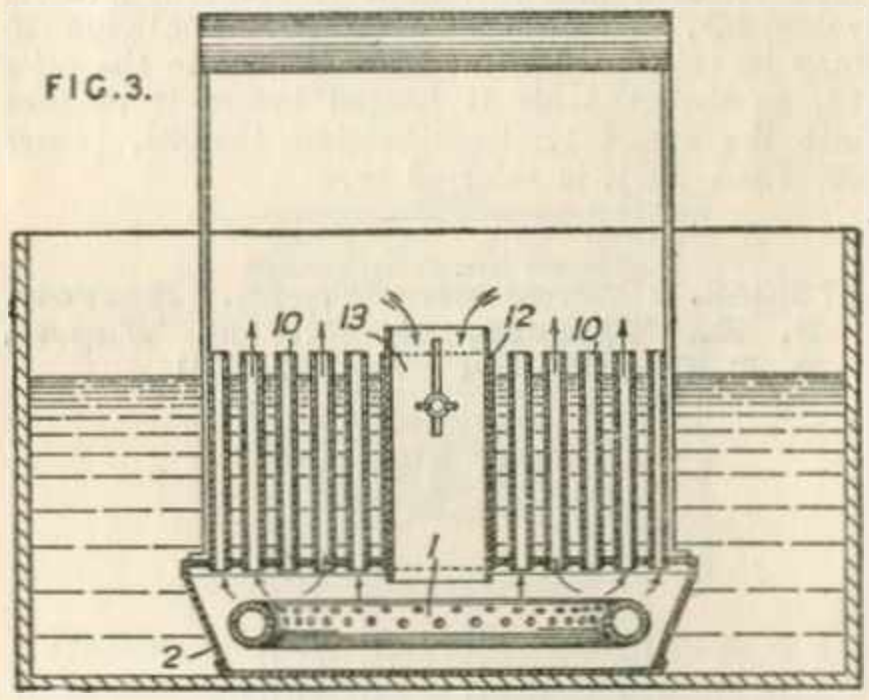
Geysers.—In a geyser of the type described in Specification 139,896, the conical base of the corrugated cylindrical flue 4 is arranged to fit tightly over the conical flue 3, so as to isolate the heated water from the gases of combustion. Water flows upward through hollow baffles 12 and thence through the sprayer-ring 14 and over the flue 4 and a conical flange 20. The joint of the cylindrical flue and its base is protected by water in a lip 9.

178,279. Brodie, G. G., and **Coleman, A. B.** March 7, 1921.



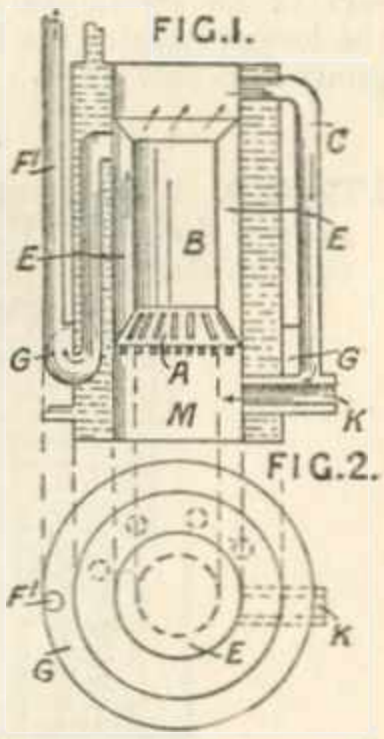
Block-form boilers.—An **L**-shaped boiler used in a combination open fire-place and range comprises back and side limbs e, e^1, the combustion products passing under the latter only. Fins e^2 are preferably cast on the boiler, and may support the firebrick back c of the stove. The boiler may have a limb similar to e^1 on the other side, the combustion products passing under both.

178,312. Chappell, E. April 8, 1921.



Submersible heaters.—A closed casing 2, containing a gas ring and pilot lighting jet, is adapted to be submerged in water to be heated. Air is supplied through a central opening 12, which has a telescoping liner 13 for adjusting the draught of air. Products of combustion escape through a series of narrow spaced passages of any conformation, shown as rectangular tubes 10, mounted upon and extending the entire width of the casing.

178,440. Vermeyen, E. J. April 11, 1921, [*Convention date*].



Internally - fired boilers.—The internally-fired boiler shown comprises a combustion chamber A, a fuel-distillation chamber B, and a conduit C leading the gases to the space M beneath the grate, where they are mixed with air from the inlet K surrounding the gas inlet. The gases of combustion pass through openings in the conical wall A to the annular space E surrounding the chamber B, thence through vertical conduits in the water-space to an annular collector G, and finally to the flue F^1.

According to the Specification as open to inspection under Sect. 91 (3) (a), the conical wall A may be formed of water tubes connected to the boiler. This subject-matter does not appear in the Specification as accepted.

178,543. Rouse, E. E. Jan. 15, 1921.

Internally-fired boilers. — In a water-heater having a central water column c inside an annular water chamber a, a cylindrical float i is

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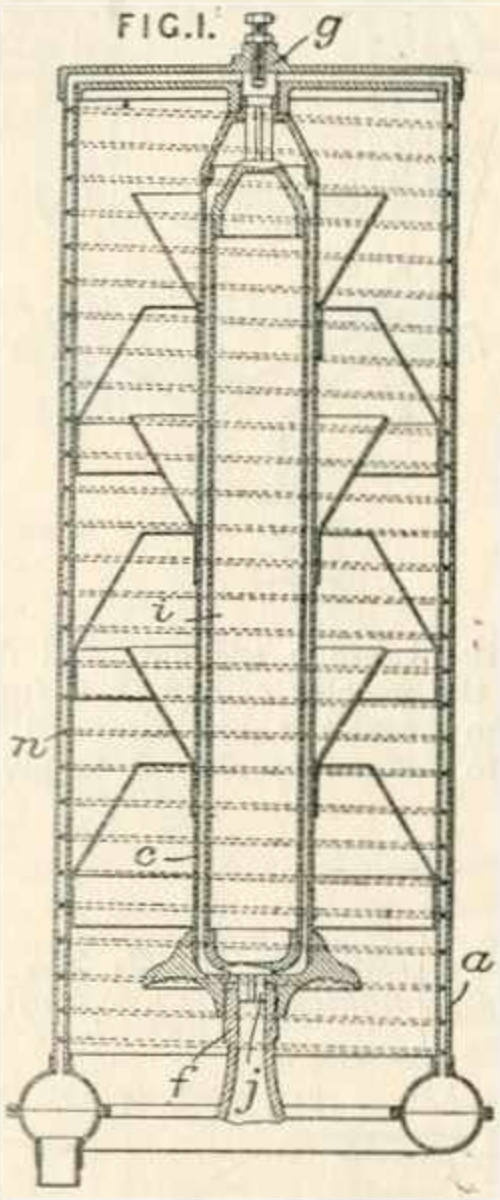
placed in the water column for the purpose of causing the water to ascend through the column as a film and regulating the water supply. A valve *j* at the bottom of the float seats upon the top of the inlet pipe *f*. The upward movement of the float is limited by an adjustable stop *g*. A helical coil of wire or metal strip *n* in the

FIG.1.



annular water chamber is spaced slightly from the inner wall of the chamber. The helical coil or strip may be replaced by a helical groove formed in the outer wall of the chamber. Specifications 140,253 and 178,886 are referred to in Provisional Specification 178,543.

178,843. Castiaux, R. April 16, 1921, [*Convention date*].

Internally-fired boilers.—A boiler for heating water or generating steam has a central fire-box 1 the gases from which pass by conduits 9 to a down-draft flue 4, or flues within the side members of sections constituting the boiler, to a collector 11. A sectional boiler is shown in Fig. 2, there being a water space encircling the fire-box and water walls 14, 15, at front and back. A grate 5 composed of tubes closed at one end is supported at the front on bars 5^1. In the form shown in Fig. 4, the boiler is cylindrical and the ports 9 lead to an annular flue 4 and a collector 11 below. Fittings 8^2, 12^1 connect the water-spaces on each side of the annular flue.

(*For Figs. see next column.*)

178,843.

FIG.2.

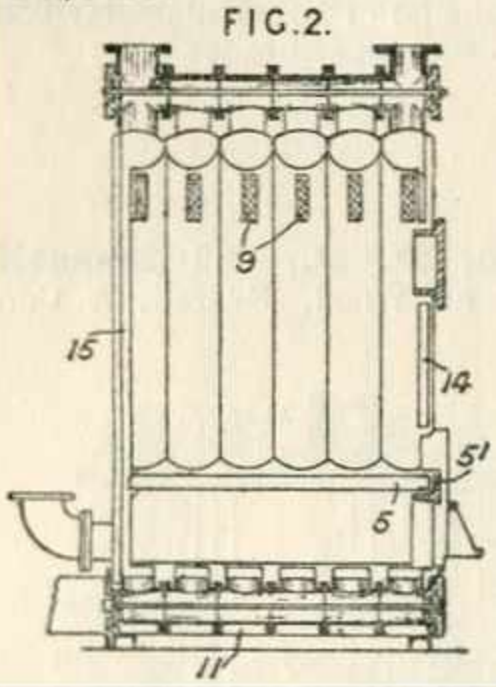
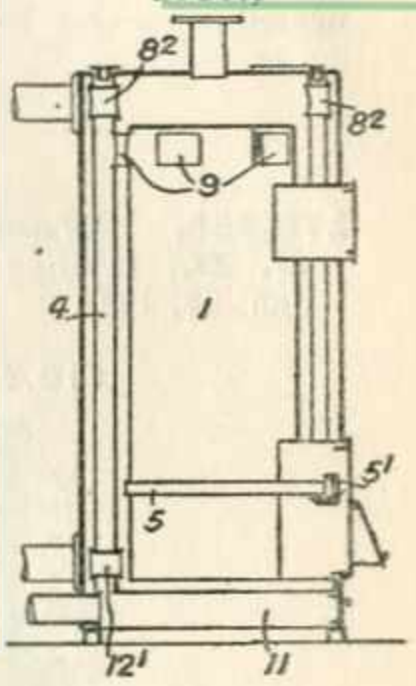
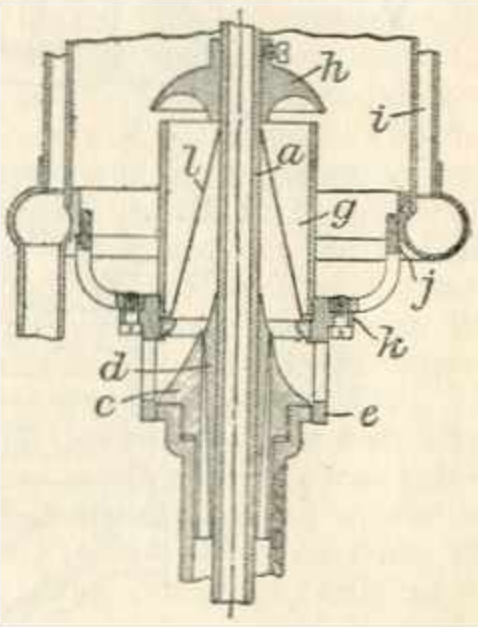


FIG.4.



178,886. Rouse, E. E. Dec. 20, 1920. *No Patent granted (Sealing fee not paid).*

Boilers. — In a water-heater in which water passes up a control tube *a* to an annular chamber *i*, the annular chamber is carried by brackets *j* on a flange *k* formed near the upper end of a perforated ring *e* which forms part of the mixing-chamber of a gas burner surrounding the central tube *a*.



178,934. Gabet, G. Jan. 24, 1921. *Addition to* 159,234.

FIG.2.

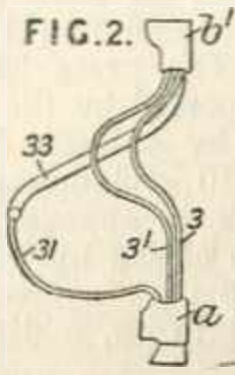
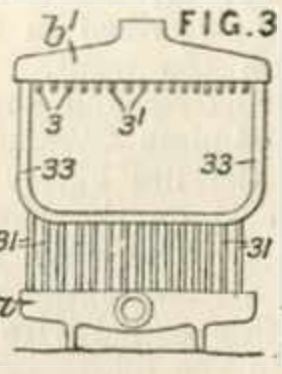


FIG.3



Water-tube boilers.—The boiler described in the parent Specification is modified in that the headers *a*, b^1 are connected by two or more rows 3, 3^1 of vertically-disposed bulged tubes arranged in staggered relation and having bulged portions of different curvatures. The rear tubes 3 are of larger diameter than the front tubes 3^1. In addition, a further row of bent tubes 3 may be provided projecting forwardly from the header *a* so

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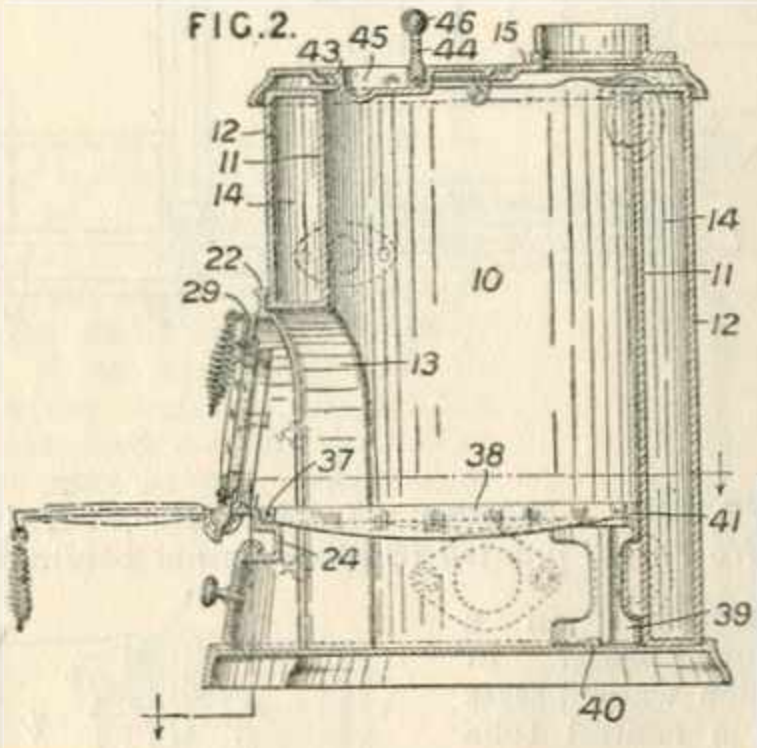
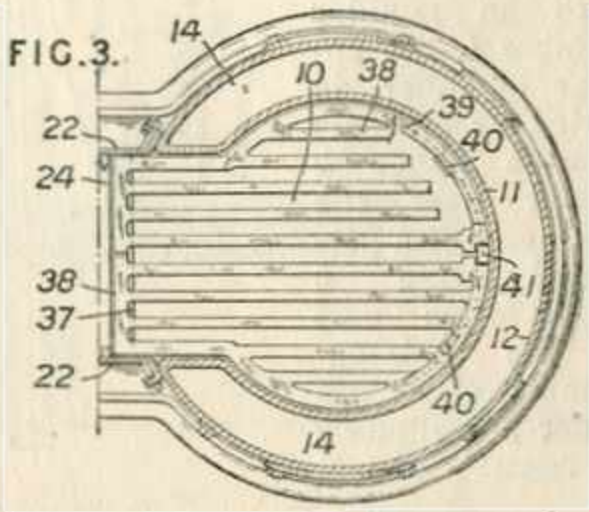
as to form a grate, and communicating at their upper ends with a tube 33 of larger diameter connected at its ends to the upper header b^1.

178,955. Wood, P. N., and Russell, G. D., (*trading as* Wood, Russell, & Co.). Jan. 28, 1921.

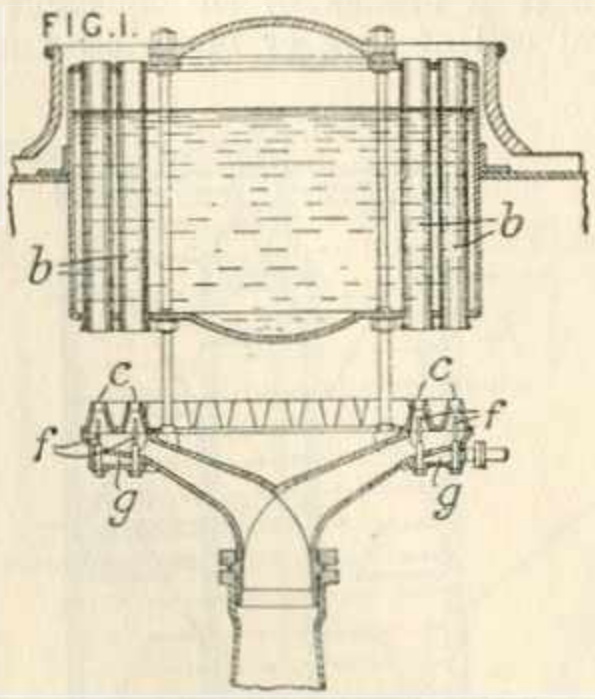




Annular boilers.—The fire cavity 10 of a domestic stove or boiler is formed in the interior of the inner of two concentric cylinders 11, 12, between which is a space 14 for water to be heated. A front 22 is fitted over an arch 13 formed in the cylinders 11, 12, and a door 29 preferably constructed as described in Specification 179,121 is provided on the front. The grate 38 is constructed in halves and supported by the ledge 37 on the dead-plate 24 and by a block 39 fitting loosely in the fire cavity 10 and engaging lugs 40. A lug 41 on the block 39 engages a recess in the grate. The stove is closed by a hot-plate 15 having a charging-lid 43 with a pivoted handle 44, with a coiled wire grip 46, folding into a recess 45 in the lid.

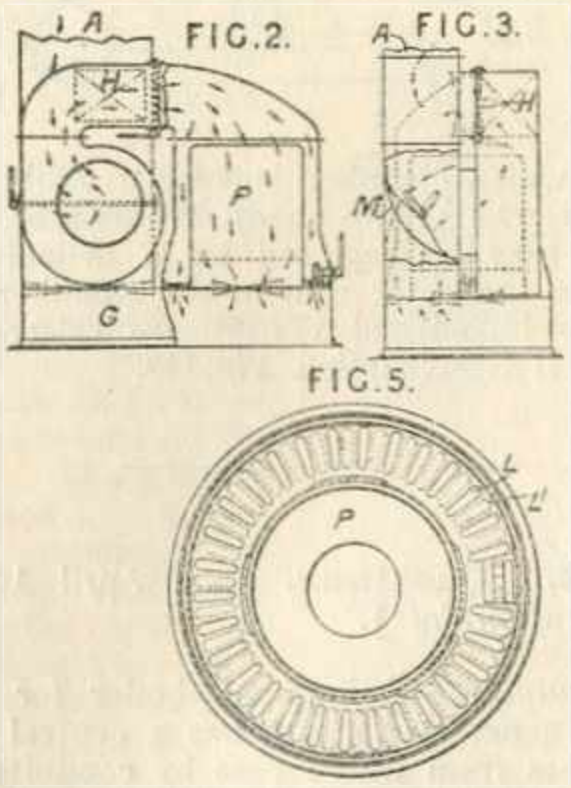
179,068. Meister, A. April 25, 1921.

Feed-water, heating.—A water container traversed by tubes *b* is fitted in the smoke-box of a locomotive or like boiler. A ring of jets *c* is secured to the upper end of the blast-pipe so as to register with the tubes and thus induce a flow of furnace gases through them. Live steam may be supplied through an annular header *q* and smaller concentric jets *f*. In a modification the



ends of the tubes *b* are extended downward to embrace the nozzles *c*, and in a further modification the nozzles *c* are extended through the tubes *b* to extensions shaped to give an ejector effect.

179,072. Marks, E. C. R., (*Soc. Anon. Italiana G. Ansaldo & Co.*). April 29, 1921.



Heating air.—In heating and ventilating apparatus for use on board ships, of the type in which the heating-apparatus, fan, and control valves constitute a self-contained unit, and two valves only are necessary for changing over from a supply to an exhaust system, the temperature of the air is controlled by means of a rotatable annular louver valve which allows a part of the air to pass outside the heater. In the apparatus shown, air is drawn in through the conduit A and delivered by the fan past the valve H to the heater P, which is surrounded by a valve

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comprising fixed and rotatable annular plates having louver openings L, L¹; by adjusting the movable plate the proportion of air passing outside the heater may be varied. To change over to an exhaust system the heater is shut off from the fan by the valve H, and the segmental valve M is moved to the position shown in dotted lines in Fig. 3; air is then drawn from the apartment through an opening G below the fan and delivered through the conduit A.

179,367. Aird, K., and Wortley, G. W. March 4, 1921.

FIG.9.

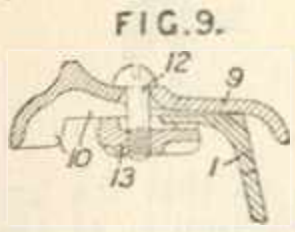
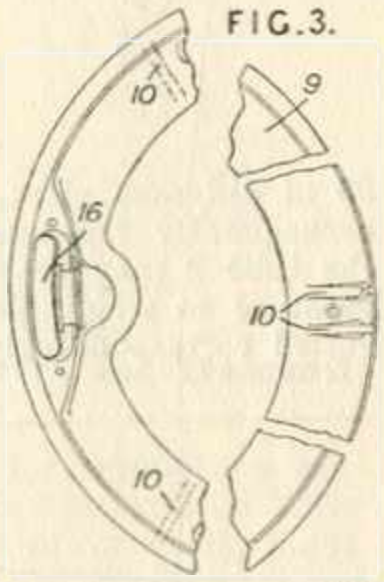
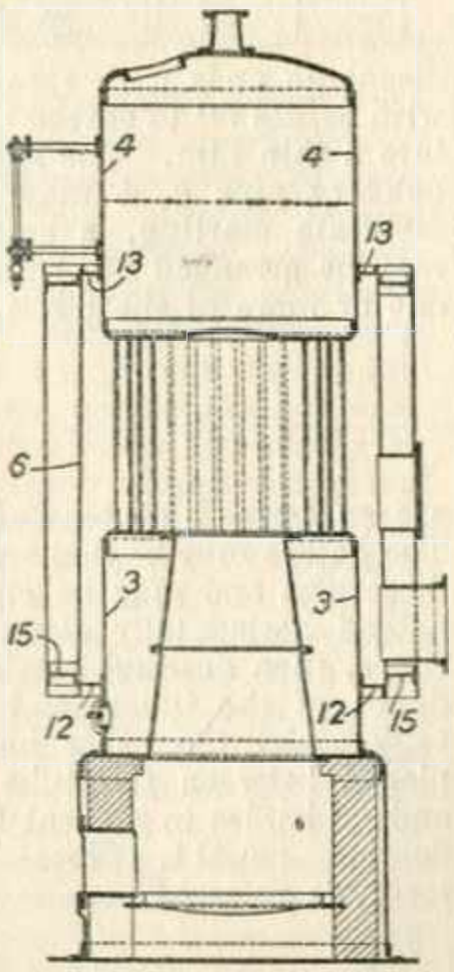


FIG.3.



Washing-boilers.—A standard pan 1 is secured to a ring hob 9 fitting on the usual outer casing of a portable wash-boiler by clamps 13 and screws 12 which hold the pan against projections 10 on the under side of the hob. By adjustment the flue opening 16, the hob can be brought into proper relation to the flue, and a draw-off pipe in the pan can be made to register with an opening in the outer casing. The flue opening is so shaped as to allow of the passage of vapours from the pan to the flue.

179,714. Hudson, T. Feb. 24, 1921. *Addition to* 134,002.



Feed-water, heating. — The casing around the boiler described in the parent Specification is water-jacketed, the jacket serving as a feed-water heater. The inner wall 6 of the jacket tapers upwardly and is secured to the upper and lower water chambers 4, 3 by channel-section members 13, 12. The outer wall of the jacket is secured to the inner wall by channel-section members 15.

180,025. Allgemeine Elektricitäts-Ges., and Münzinger, F. Feb. 14, 1921.

FIG.1. FIG.3. FIG.7.

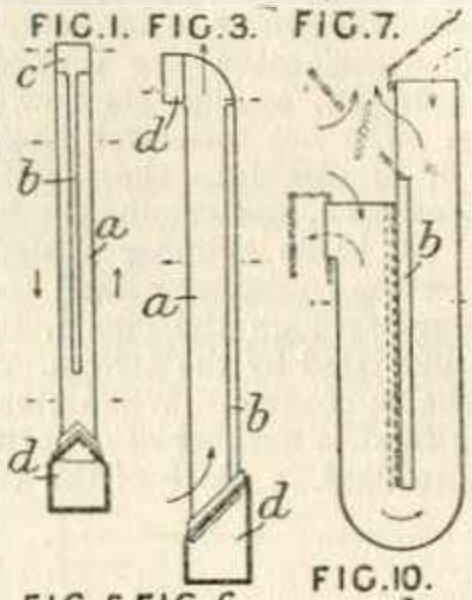
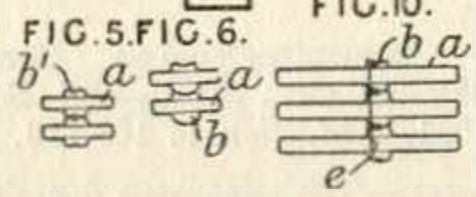


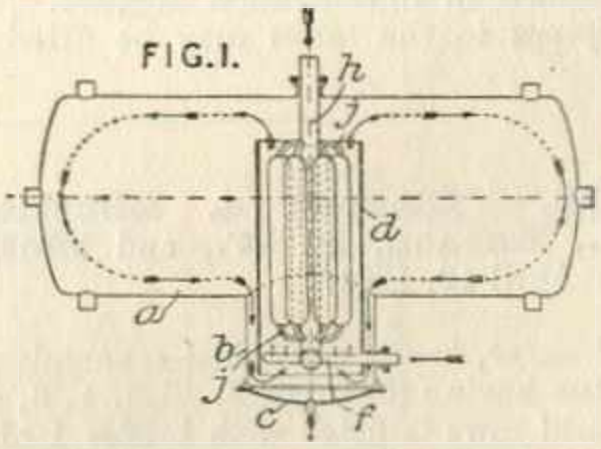
FIG.5. FIG.6. FIG.10.



Heating air.—Apparatus for heating air and other gases by the waste heat of combustion products comprises flat sheet metal bodies *a* which have stamped on their lateral faces projecting areas *b* which serve when the units are in position to form partition walls. These pressed-out parts may have longitudinal hollow grooves b^1, Fig. 5, for the reception of packing material, or may be alternately convex and concave, as shown in Fig. 6. Fig. 1 shows one arrangement, the pressed-out portion being full width at *c* and leaving a plain walled part at the foot above the header *d*. In the form shown in Fig. 3, the pressed-out parts *b* are at the back and a gap is arranged at the top to form an exit for the heating gases. In another arrangement in Fig. 7, the passages for the air are of **U**-form and the pressed-out parts *b* are arranged to cause the heating-gases to pass down and up in opposite directions to the air. Fig. 10 shows a plan of such an arrangement. The dividing partition *e* is in this instance shown as being held in position by the spring in the bent edges.

180,303. Mertens, G. May 19, 1921, [*Convention date*].

FIG.1.



Heating water.—In a boiler or like water-heater the horizontal cylindrical container *a* is fitted with a multi-tubular vertical heating-coil surrounded by a cylindrical baffle, the lower end of the coil and baffle extending down into a de-

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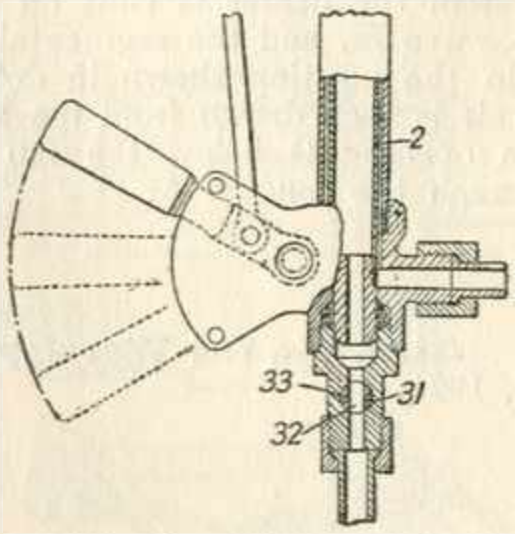
ing pocket *b* on the container. The heating fluid, which is steam or hot water, flows down the heater coils, and the water to be heated is introduced through a perforated pipe immediately below the heating-coils, so that its flow is upward past the coils. The hot water for heating enters at the pipe *h*, divides into the vertical tubes through connections *j*, and rejoins the bottom discharge pipe. A baffle cylinder *d* depends into the pocket *b* on the container *a*, and the water to be heated enters through the pipe *f*, the circulation being as indicated by the arrows. The pocket *b* has a detachable cover *c*. When steam is used as the heating fluid, a number of concentric annular passages are used in place of the tubes.

180,429. Westinghouse Brake & Saxby Signal Co., Ltd., and **Barty, T.** Feb. 22, 1921. *Addition to* 168,713.

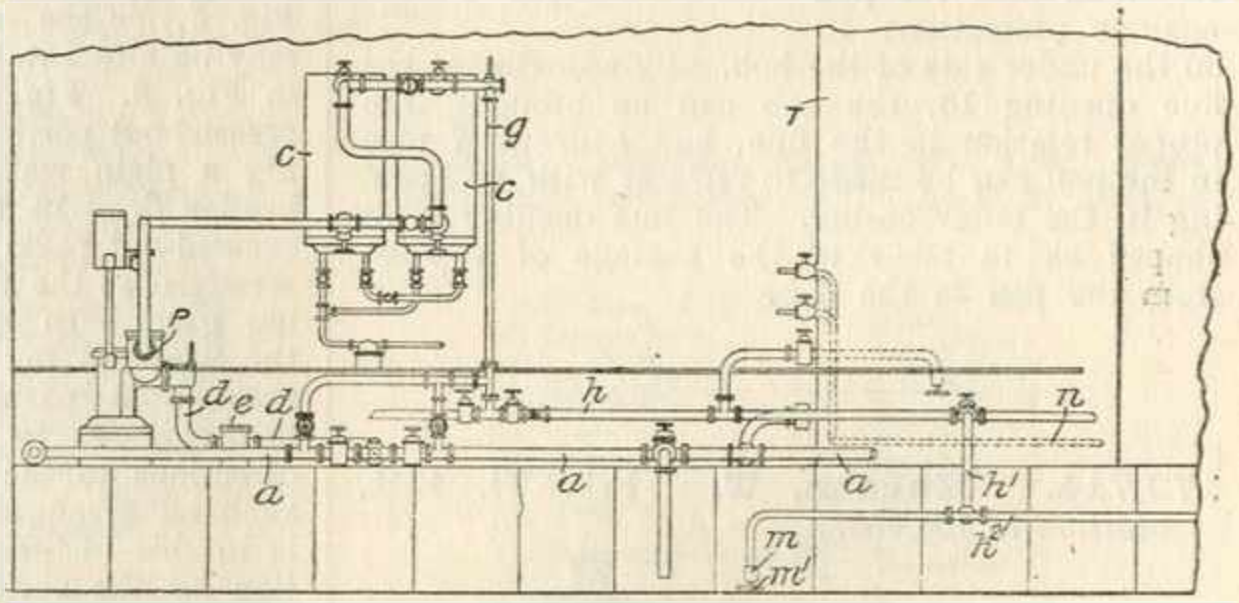
Heating water.—The apparatus described in the parent Specification for heating water by passing it through a tube containing an inner tube through which steam is passed is provided with a manually-operated valve 31 in the steam outlet. The valve is provided with two or more passages 32,



33 of different sizes, so that the pressure, and consequently the temperature, of the steam in the tube 2 may be varied in stages. The temperature to which the water is heated is thus varied correspondingly.

180,471. White, W. A. March 18, 1921.

Heating liquids.—Oil for use in oil-burning furnaces is drawn by pumps from the bottom of the oil tank or tanks, and after passing through one or more heaters is returned to the oil tanks or delivered to separate tanks from which it is supplied to the furnaces. In the arrangement illustrated, oil from a tank T is drawn by a pump P through a main suction pipe *a*, and after being passed through heaters *c* is delivered through a pipe *g* to a main discharge pipe *h* which is connected by valve-controlled branch pipes h^1, h^2 to the various storage tanks. The pipe *a* is connected to the pump P by a pipe *d* fitted with a strainer *e*. The oil heaters may be constructed as described in Specification 158,483. The delivery pipes to the tanks may be fitted at their



discharge ends with spraying nozzles *m* provided with baffles m^1 to spread the oil entering the tanks into a thin film. The suction pipes *a*, *d* and the delivery pipe *g*, *h* may be steam heated. To facilitate starting, a small steam-heated grid *n* may be arranged at or near the suction orifice of one or more of the tanks.

180,512. Clayton & Shuttleworth, Ltd., Robson, P. W., and **McGregor, R.** April 13, 1921.

Feed-water, heating.—A fuel-economizer or like apparatus having its tubes 2, Figs. 1, 3, arranged in vertical rows is fitted with baffles 1 of a width substantially equal to the vertical spaces between the rows of tubes and so placed within the spaces as to cross the rows of tubes, thus laterally deflecting the gases around the tubes. The baffles may be supported by lateral end extensions resting against the tubes. End-extensions 3, Fig. 9, are so formed as to wedge between the tubes. The baffles may be inclined alternately in opposite directions and may be curved. Each baffle may extend horizontally along half the length of the tubes, then descend vertically through the whole depth of the tubes, and finally extend horizontally under the other half. Covers 4 may be placed between the tube plates and the upper ends of baffles to prevent lodgment of soot. Specification 180,511, [*Class* 123 (ii), Steam generators], is referred to.

(*For Figs. see next page.*)