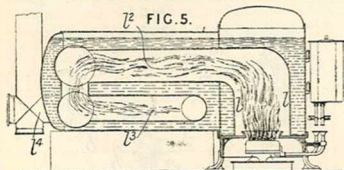


tubes in each section. The outer tubes may be exposed to flame or heated gases, or to steam or heated vapour.

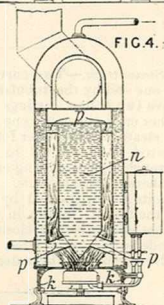
1358. Goddard, F., and Massey, E.
April 14. *Drawings to Specification.*

Heating water.—The fire chamber of an air-heating furnace is surrounded by a water jacket which may be used as a circulating boiler for heating greenhouses &c.

1380. Jacquet, F. A. April 15.



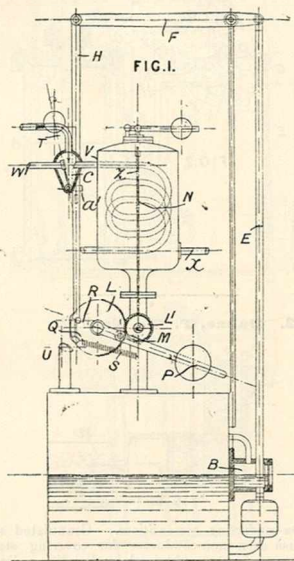
Heating water for circulation in apartments, conservatories, &c. Fig. 4 shows one form of boiler heated by liquid fuel. The firebox is fitted with a water chamber *n* connected at the top and bottom with the main water space by pipes *p*. The casing *k* of the burner supports the boiler. In the boiler shown in Fig. 5, the products of combustion pass through the flues *l²*, *l³* to the chimney *l¹*.



1462. Johnson, J. H., [Wertheim, J.]
April 21.

Heating water.—The water is supplied automatically, and the level regulated in a steam boiler or similar receptacle by the expansion and contraction of a tube *E* heated and cooled alternately by steam and water, the motion causing the opening or closing of the supply valve *M*, situated in a pipe connecting the boiler with a reservoir *N* above. The water is heated by exhaust steam circulated through a coil *V* in the reservoir. The lower end of the tube *E* enters a vessel *B*, which is connected with the steam and water spaces of the boiler, as far as the lowest water level, while the upper end is connected to one arm of a lever *F*. The other arm of the lever *F* carries a rod *H*

hooked at the lower end for engaging a stud *R*, on a wheel *L* gearing with a wheel *L¹* fitted on the supply cock *M*. In the normal condition of the apparatus, the tube *E* is kept filled with water by



the pressure of steam in the boiler. When the level falls, the tube *E* is emptied of water and filled with steam, which causes expansion, whereby motion is transmitted through the lever *F* and rod *H* to the gearing *L*, *L¹*, and the cock *M* is opened. When the cock opens, steam enters a small pipe *z* and allows the water to pass from the reservoir *N* to the boiler. The tube *E* again becomes filled with water and contracts, causing the rod *H* to move upwards, and allow the weighted lever *P* to close the cock *M*. A rapid closing of the cock is effected by disengaging the rod *H* and stud *R* by means of a catch *Q* on the rod *H* engaging a spring catch *U*, which yields downwards and allows the bar to pass until the lowest position is reached, when it again rises. In the upward motion of the bar, the catch *Q* slides on the lower edge of the catch *U* and disconnects the rod and stud. A spring *S* again brings the rod into the normal position. The downward motion of the rod *H* also actuates tappets *a¹* of a lever *T* working in connection with an arm *c* for closing the inlet of steam to the coil *V*. The steam is then discharged through a pipe *W¹*. The upward motion of the rod again actuates the tappets, and moves the arm *c* into the position shown. The vacuum formed

in the reservoir by the discharge of the water and cooling of the steam causes water to be drawn in through a pipe *x* from a well or other source. An escape valve at the top of the reservoir allows the expansion of the water, and the escape of air. In some cases, the apparatus is used to open and close a valve in the suction pipe of the feed pump, the reservoir being omitted.

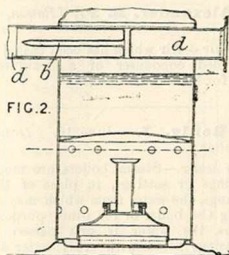
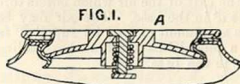
1516. Spurrier, W. J. April 24. [*Provisional protection only.*]

Heating air for ventilating buildings, carriages, and ships. A cast-iron or other vessel, preferably flat, is placed in the bottom of an ordinary fireplace, and is heated by gas or other flames. It is perforated at one end to admit air and has a pipe at the other through which the heated air is drawn by a fan and distributed.

1576. Hargreaves, J., and Robinson, T. April 29. *Drawings to Specification.*

Non-conducting coverings.—The filling-necks of the converting-chambers used in alkali manufacture are prolonged above the top covering-plate of the chambers, and the spaces between the necks are filled with ashes to prevent radiation from the tops of the chambers.

1652. Harper, J. R. May 4.



Heating air.—Relates to apparatus of the kind described in Specification No. 3277, A.D. 1872, for generating vapours and heating air for medicated and other baths. The lid of the generator, Fig. 2, is fitted with a safety-valve A as shown in Fig. 1. An air pipe *d*, passing through the generator, is fitted internally with a jet pipe *b* which communicates with the interior of the generator by means of a cross-tube as shown. The projecting part of

the pipe *d* is fitted with a universal joint so that it can be turned in any direction. The handle of the generator may be attached to a block of wood or other non-conductor sliding or fitting in a socket fixed on the side of the apparatus. The oil or spirit lamp employed is provided with a tubular handle which serves as a vent for the reservoir of the lamp to prevent accumulation of vapour therein.

1685. Leadbetter, H. May 6.

Non-conducting compositions.—Wood fibre is employed in combination with plastic and binding substances for covering steam generators, pipes, and other surfaces. One composition described consists of wood fibre with cow-dung, clay, and animal or vegetable fibrous substances or wool or hair. Soot may also be added and the clay or dung may be replaced by slate dust. The animal or vegetable substances may be cotton waste, shoddy, flock, or other waste, or chopped hay and straw. The ingredients are mixed with water and applied with a trowel. When the coating is dry, it may be painted over with a protective layer of a solution of alum and quicklime in water; it is stated that tallow or other fatty materials may be substituted for the alum.

1760. Montgomery, R. May 11. [*Provisional protection only.*]

Steam traps.—A valve and its seating are carried by separate tubes of different metals, the expansibilities of which are such that the valve is pressed on to its seating when the tubes are surrounded by steam, but when condensation water collects round the tubes, the valve leaves its seating and allows the water to escape.

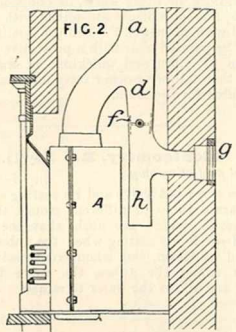
1886. Walker, A. B. May 22. *Drawings to Specification.*

Heating liquids; boiling-pans.—Relates to the application of a hollow worm or screw to brewing apparatus &c. for heating water, wort, &c. The worm is constructed of a series of tubes joined together side by side to form a screw-thread round a shaft or axle; or one or more flattened tubes or groups of tubes radiating from the centre and with provision for the circulation of a heating-agent through them may be employed. The steam or other heating-agent enters the hollow end of the shaft and passes thence to the tubes. Two separate worms, which thread into each other and are rotated in opposite directions, are also sometimes used. In another construction of the apparatus, a series of tubes are fixed in discs provided with airtight covers and mounted on a central shaft. The heating-agent, in this case also, passes from the shaft into the tubes, finally escaping at the other end of the shaft. Divisions may be placed in the discs to divert the stream of the heating-agent. The worms may be stationary or may be

rotated by means of suitable gearing on the end of the axle. Such screws or worms are placed in the tank or cistern containing the water or in the boiling-pan or copper in which the wort is boiled with the hops. The boiling-pan is preferably fitted with a perforated false bottom to facilitate the separation of the hops from the wort. Similar apparatus is used for heating the feedwater for boilers &c., and in paper-making, bleaching, and calico printing.

Heating air.—Air is heated by passing it through a worm or screw of the kind described above, which is exposed to the action of fire or highly-superheated steam. The heated air may be used for drying brewers' grains, spent hops, &c., or for regulating the temperature of the fermenting vats &c. The apparatus is also stated to be used for heating or regulating the temperature of rooms.

1970. Shorland, G. L. May 29.

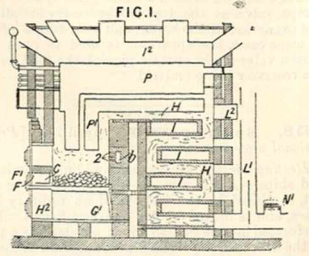


Heating air.—Air which has been heated in the grate back A, described in Specification No. 1169, A.D. 1872, has its temperature reduced, when necessary, by fresh air supplied by a pipe *d* fitted with a damper *f* and a grid *g*. A pocket *h* serves to collect the dust &c. In modifications, the pipe *a* is curved over the sides of the fireplace, and is built into the chimney breast or outside it; the upper ends of the pipes *a* are fitted with perforated caps, and may be connected to flues leading to the rooms above; and the pipes *d* extend downwards to a point near the floor, and are supplied with air as described above, or by other means.

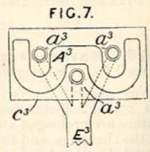
2061. Bull, W. June 4. [*Provisional protection only.*]

Thermostats.—A pyrometer rod placed in the furnace of an evaporating-pan is fitted with mechanism by which it is caused to open and close a valve for admitting cold air to the furnace as required when the temperature rises unduly.

2083. Hughes, E. T., [Smith, S., and Bates, G. A.]. June 5.



Heating water; heating buildings; heating air.—Relates to a cylindrical boiler placed over an air-heating furnace. The boiler is supported by horizontal flanges resting on extensions of the inner walls of the furnace, and has a vertical extension P¹ into the furnace. It may be traversed by a central flue as shown or by several smaller flues. A corrugated radiator A³, Fig. 7, heated by steam or water is set on a base and enclosed in a casing c³ with perforations near the top for the exit of the air which enters through the apertures a³ in the base. The air may be drawn from the apartment or may be supplied from outside by a pipe E³ having branches leading to the apertures in the base.



2154. Alexander, E. P., [Rowan, W. R.]. June 12.

Heating air.—Air which has been passed through the air-cooled condenser of a steam engine is employed for heating buildings.

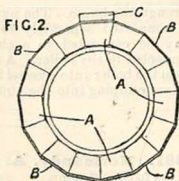
2213. Reilly, J. June 16. [*Drawings to Specification.*]

Heating water.—Steam boilers are mounted in water casings or settings, in place of the usual brick settings, the water from which may be used for feeding the boiler or for other purposes. In some cases, the water is first passed through annular casings fitted with cross water tubes, or through drums having smoke tubes, placed in the flues leading to the chimney.

2360. Mewburn, J. C., [Gay, C.]. June 29.

Non-conducting coverings.—A non-conducting covering suitable for steam pipes &c. is composed of bars A of wood or other suitable material, pasted, nailed, or screwed on a foundation B of cloth

or thin metal. The jacket may be secured by means of a lath C attached to the foundation B and overlapping one of the bars A, to which it is fastened by screws, hooks, or wires. The bars may be connected together by hinges or wire hooks, and the cloth foundation may be either outside or inside, or replaced by ribbons or bands or strips of metal.



2406. Lyttle, W. A. July 3. [*Provisional protection only.*]

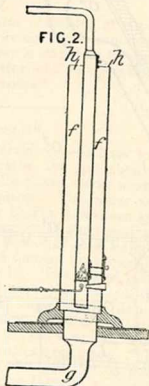
Thermostats.—When the vertical blast furnace described in Specification No. 105, A.D. 1875, [*Abridgment Class Furnaces &c.*], is used for the manufacture of animal or bone charcoal, a pyrometer bar is passed through the hottest zone of the reducing-shaft, and the elongation of this bar may actuate, through suitable mechanism, a valve for regulating the air blast to the gas producers.

2474. Clark, J. July 9. *Drawings to Specification.*

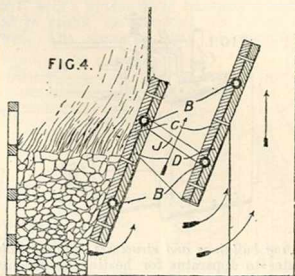
Heating water.—The air-heating tubes of steam-generator furnaces are continued outside the brick-work setting of the furnace and are enclosed by a chamber or surmounted by a plate for the purpose of heating vessels of water &c.

2487. Rigby, J., and Rigby, J. July 10.

Heating air.—Fig. 2 shows an air-heating arrangement in which a gas jet is used. Other heating-means may, however, be substituted. Air, entering by the pipe *g*, is heated in the space *f* and escapes at *h*. The pipe *g* may draw foul air from the upper part of a room, the air being discharged into the atmosphere at *h*, or it may draw in fresh air from the outside, and supply it to the room in a heated condition. Instead of the arrangement shown, a length of tubing may be used heated at one point by passing through an ordinary fireplace or otherwise.



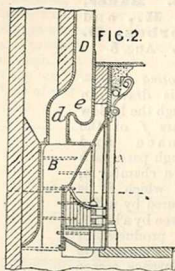
2554. Sykes, B. C. July 16.



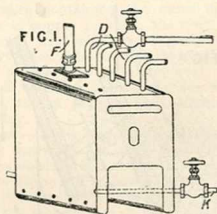
Heating water.—A boiler consists of a curved copper or other metal tube enclosed in a cast-iron or other plate or between a pair of cast-iron or other plates. Fig. 4 shows boilers or heaters such as described placed at the back of an ordinary open fireplace, but they may be arranged and heated in other ways. The pipes *B* are placed between grooved cast-iron plates *C*, *D*, riveted together. The two heaters are coupled by a pipe *J*.

2566. Shorland, G. L. July 19.

Heating air.—At the back of a fireplace is an air-heating chamber *B*, which may be constructed as described in Specification No. 3999, A.D. 1874. The chimney breasts and mantelpiece are made to project about 9 inches further than usual to accommodate the two outlet pipes *d* from the heating-chamber. These pipes may terminate in gratings in the top of the mantelpiece, or may lead the hot air into pipes *D* of \square -section which terminate near the ceiling. Or, as shown, the pipes *D* may lead the hot air into an upper apartment. These pipes may be placed in the chimney breast. Dust pockets *e* may be provided in the pipes *d*, and also valves to control the supply of air. Fresh cold air may be supplied to the pipes *d* in the manner described in Specification No. 1970, A.D. 1875.



2577. **Gray, W.** July 20.



Heating buildings and structures; heating water.
—Relates to apparatus for heating greenhouses, vineries, and other structures, which is especially adapted for use in connection with two or more houses. The heating-system in each house is connected by a flow pipe D and a return pipe K with the boiler. The flow and return pipes are connected near each house by a pipe in which there is a valve for regulating the flow of hot water

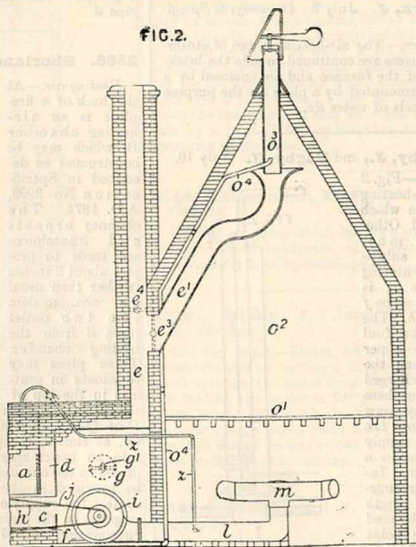
through the house. The pipes D and K are shown as connected separately to the boiler, but they may be connected to a chamber which again is connected to the boiler. A pipe F leads the steam from the boiler into a vessel in which it is expanded before escaping into the atmosphere.

2581. **Normandy, A. L.** July 20. *Drawings to Specification.*

Steam traps.—A float placed in the casing of a steam trap applied to steam-condensing apparatus is guided vertically by means of a stem moving in a guide and by a plug at the bottom of the casing moving in the bush through which the water escapes. The bush is formed with a horizontal annular recess communicating through several holes with the internal socket in which the plug works. When the float and plug rise, the water escapes through these holes and the recess to the interior of the outlet. This arrangement prevents the plug from being pressed by the steam against one side of the bush. A cock for the escape of air is provided in the top of the casing.

2766. **Baker, T. H., and Forbes, D.**
W. Aug. 5.

Heating air.—Air is drawn in through the hollow firebars *f* of the furnace and through passages *h* into a chamber *g*, from which it is delivered by a fan *i* driven by a belt *j*. The products of combustion from the furnace escape by passages *c*, *d* into a chimney *e*. The chamber *g* can be entered through a manhole *g'*.

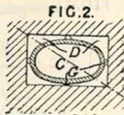


2800. Brierley, S. Aug. 9. *Drawings to Specification.*

Heating water.—The waste gases from a kiln or oven for burning lime or other material are conveyed to the furnace of a water-heating apparatus, and are ignited or consumed.

2832. Livesay, A. F. Aug. 11.

Heating air.—Relates to the apparatus described in Specification No. 2522, A.D. 1857. A metal or earthenware pipe, preferably of oval section, is placed in the usual wall flue. Spaces D are thus left which form downcast air flues. The air is heated by contact with the pipes.



2854. Riley, W. H. Aug. 13. [*Provisional protection only.*]

Heating liquids.—Vessels in which liquids are heated are fitted with a horizontal tube which is so arranged that, when the water level falls too low, an indicating or alarm apparatus is actuated, the feed apparatus is operated, or the fires are extinguished. The tube is fixed at its ends and is placed in the vessel so that the water or other liquid acts on one surface and the gases or other heating agency on the other. Thus, when the tube becomes partially uncovered through the water level falling, expansion takes place and the alarm or other apparatus is operated.

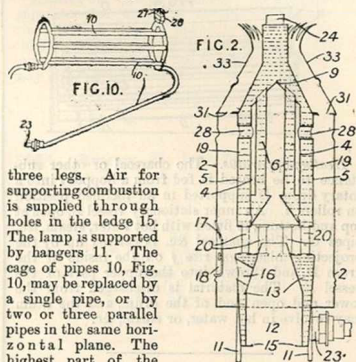
2872. Stephens, J. Aug. 14. [*Provisional protection only.*]

Heating air.—An apparatus consisting of a partitioned casing with revolving cowls containing blades or archimedean screws is stated to be applicable for "ventilating, heating, and refrigerating," and for "other similar purposes."

2907. Gadsby, J. Aug. 18.

Heating water; heating buildings.—Relates to a boiler and heating-apparatus for greenhouses, vineries, shops, entrance halls, offices, saddle rooms, and other apartments or places. The boiler consists of an annular chamber 19, Fig. 2, between two casings 4, 5, and a lower chamber 13 surrounding a chamber 12 containing the burner of an oil, spirit, or gas lamp. Water tubes 6 connect the upper and lower parts of the chamber 19. The heated gases &c. rise from the chamber 12 into the casing 4, the conical top 9 of which deflects them downwards and through the radiating passages 28 into the outer casing 2, whence they pass through a ring of holes 31 into a loose crown 33 with an open top. The heated water rises through the pipes 20 between the chambers 13, 19, and flows through a pipe 24 to an arrangement of hot-water pipes such as that shown in Fig. 10, returning through a pipe 23 to

the chamber 13, Fig. 2. A sight hole 16 and a door 17 with a window 18 of transparent horn are fitted to enable the flame of the burner to be viewed. The apparatus may be supported on

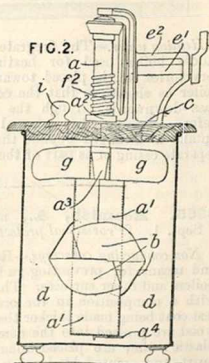


2968. Lumby, E. C. Aug. 24. [*Provisional protection only.*]

Heating water for warming buildings and for like uses. Saddle boilers, with one or more cross and longitudinal waterways connecting the side or end water spaces, are provided with a central passage or flue within each waterway, and, when desirable, these waterway and flue tubes may be placed obliquely to admit of a direct feed for fuel from the top of the boiler.

2991. Vall, T. de. Aug. 26.

Heating liquids.—In order to regulate the temperature of milk when churning it, the churu is provided with a hollow fluted spindle a^1 into which hot water may be introduced through a hole closed by a stopper a^2 .

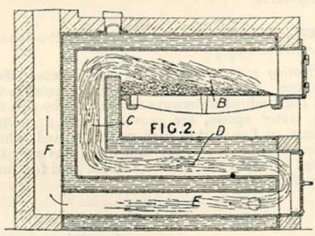


3030. Clark, A. M., [Gandolfo, J., and Jarboe, J. W.]. Aug. 28.



Heating-apparatus.—The charcoal or other substance to be heated is fed from a hopper *l* into a rotary drum *D* supported in an inclined position on rollers *h*. An inner stationary vessel *E*, open at top and bottom, is fitted with hot water, steam, &c. pipes *G*. The charcoal &c. is carried up by the projecting blades or ribs *j* on the inside of the drum *D*, and thrown into the upper part of the vessel *E*. The material is discharged from the lower and open end of the drum, and the drum may revolve in hot water, or steam, &c.

3041. McLaren, A. Aug. 30.



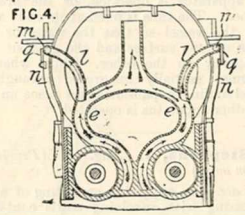
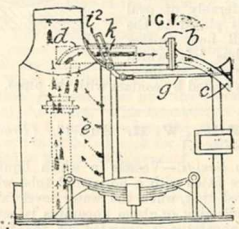
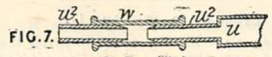
Heating water.—The firegrate or furnace *B* of a saddle boiler used for heating furnaces, conservatories, &c. is placed towards the top of the boiler as shown, so that the combustion products pass downwards through the flues *C*, *D* and *E* before reaching the external uptake *F*. The uptake is arranged outside the boiler, either as a separate casing or as part of the boiler.

3065. Beamish, A., and Mason, C. Sept. 1. [Provisional protection only.]

Non-conducting coverings.—Relates to a mode of and means for preventing radiation from steam boilers and other surfaces. The surface is covered with a composition in the ordinary manner, the last coat being made thicker than usual. Laths of wood are pressed into the composition while still plastic; they are placed about their own width apart and secured by lagging hoops. A volute

spring is placed between the bracket, stay, or lug, and the nut securing each lagging hoop, to allow for expansion and contraction.

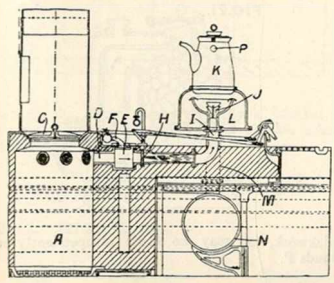
3097. Brown, E. Sept. 3.



Footwarmers.—Part of the furnace gases from the blast pipe *e*, Fig. 1, are led by a sliding plate or valve *d* into a chamber *b* and thence by pipes *c* on both sides of the train into flat metallic boxes placed beneath or forming the floors of the railway carriages. In a modification, shown in Fig. 4, the exhaust steam is used alone. The plate or valve *d*, Fig. 1, is operated by the engineer through a rod *g*, which, when screwed forwards, causes the slotted arm *i* to bear against the stud *k* on the plate *d*. Receptacles for the dust from the smoke-box are fitted on the lower parts of the pipe *c*. In the modification shown in Fig. 4, the pipes *l*, projecting a short distance into the exhaust pipes *e*, are connected by screw valves *m* to the side pipes *n*. The vessels may receive a preliminary heating by pipes and valves connecting the pipes *n* with the steam space of the boiler. The valves *m* are operated by levers *q* connected by links and levers to hand-wheels in the cab of the engine. The flat metallic boxes beneath the train are connected by sleeves *w*, Fig. 7, of vulcanized india-rubber, fitting on tubes *u*² projecting from the

ends of the boxes *u*. Two tubes *u*² are fitted at each end of each box, or they may be replaced by a flat metallic connection *x*, Fig. 9, which is connected to one of the boxes *u* by a flange or socket *x*² secured by pins and slots, the slots in the socket *x*² being large enough to permit a little lateral motion of the coupling-piece *x*. The boxes *u* are provided with receptacles in which condensed water is collected. When tubes are used instead of the chambers *u*, they are fitted with pendent drain pipes.

3164. Spence, W., [Lefebvre, T., Lefebvre-Desormont, P., and Lefebvre, H. G.]. Sept. 9.



Heating liquids.—The apparatus is designed for melting gums and for heating materials in the manufacture of oils, varnishes, and driers. The central furnace *A* has a cover *C*, and the products of combustion pass into pipes *D* fitted with valves *F* in boxes *E*. The cover *C* is raised to charge the furnace with fuel; if all the valves *F* are closed, it lifts to allow the gases to pass up the chimney. A steam injector *H* forces the gases along each of the pipes *I*, and causes them to impinge against the deflector *J*, which distributes them over the bottom of the heating-vessel *K*. The gases pass from the chamber *L*, which encloses the base of the vessel *K*, down the pipe *M* to the pipe *N*. The pipe *N* collects all the gases from the furnace and enables them to be used for steam generation, heating oil &c. The vessel *K* is mounted on trunnions *P*, one of which is made hollow to allow the escape of vapours given off under the influence of heat.

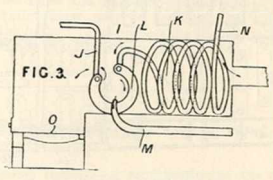
3198. Buckley, W. Sept. 13. [Provisional protection only.]

Heating water.—The exhaust steam from engines or hammers is utilized for heating water, which is contained in a vessel placed in or in connection with the exhaust pipe or pipes.

3282. Crampton, T. R. Sept. 18. Drawings to Specification.

Heating air.—In an arrangement of furnaces or apparatus for obtaining metals direct from the ore, a coil of pipes is placed in the base of the chimney to heat the furnace air supply. According to the Provisional Specification, the heated air may be otherwise utilized.

3284. Amory, J. Sept. 20.

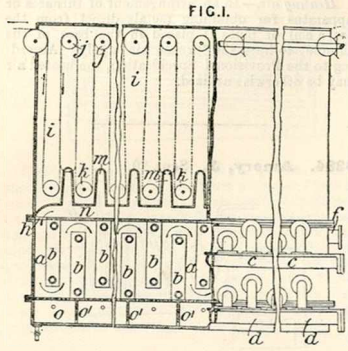


Heating water for circulation in apartments and railway carriages. The boiler consists of a coil *K* in combination with an annular water-chamber *L* forming a combustion chamber *I* similar to the chambers described in Specifications No. 12,003, A.D. 1847, and No. 812, A.D. 1859, [Abridgment Class Furnaces &c.]. The heated gases from the fireplace *O* circulate through this chamber and mix with air supplied by one or more pipes *M*. The water is supplied to the boiler by a pipe *J*. When applied for warming railway carriages, the boiler is made smaller and is suspended from the underframing between the wheels. The pipe *N* or branches from the pipe are led through the floors of the compartments to supply the circulating-pipes. In place of the grate *O*, the boiler may be heated by a lamp burning petroleum or other liquid.

3328. Knowles, S., and Kay, J. Sept. 23.

Heating air.—Relates to apparatus for heating air for drying and otherwise treating yarns, fibres and woven fabrics, and consists of additions to the apparatus described in Specification No. 3636, A.D. 1874. A lower chamber *a*, Fig. 1, is heated by steam chests *b* supplied by a pipe *c*, water of condensation being carried off by a pipe *d*. Air is forced or drawn in at an opening *f* and is heated in its passage through the chamber *a*, whence it issues by an opening *h* into a passage *n* under a chamber *i* provided with upper and lower rollers *j*, *k*. The passage *n* may be fitted with nozzles *m*, through which the heated air is forced into the chamber *i*. Steam is also mixed with the air by means of a steam box *o* provided with partitions *o*¹ and having a perforated top; the air and steam may

be discharged into the chamber *i* through a perforated plate instead of the nozzle *m*.



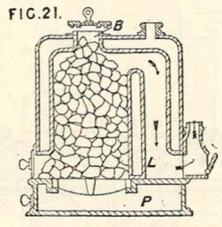
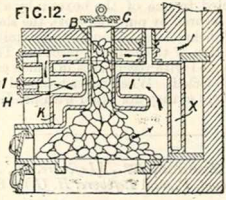
3338. Lessware, J. N. Sept. 24. [*Provisional protection only.*]

Heating liquids.—In the manufacture of glucose, infusions, or extracts, and in the washing of malt in brewing and the extraction of colours for dyeing purposes, the substances which act upon one another are discharged from a closed receptacle, in which they may be agitated, into a conical hopper or “converter” underneath, and are there heated by means of a steam coil. A circulating-pump draws the mixture from the bottom of the hopper and discharges it back again at the top, thereby causing the two substances to be intimately brought together. The charge may otherwise be fed into the hopper by the pump, so that any necessary pressure may be employed.

3511. Hartley, J., and Sugden, Z. Oct. 9.

Heating water.—Boilers for heating water for heating buildings are constructed with openings in the upper parts through which fuel is fed to the grates beneath. Fig. 12 shows a boiler with a back waterway X, a front waterway K, a return-flue I, and a water jacket H surrounding the vertical fuel-feeding opening B. Modifications are described without the front waterway K, and with the flue I recessed at the front end to enter the external flues on each side. Ordinary saddle boilers, with or without water chambers or bridges X connecting the lower parts of the sides, may be constructed with a feed opening B. The external flues may be divided by a horizontal midfeather attached to the boiler on each side. Fig. 21 shows a vertical boiler, having an oval, square, or oblong horizontal section,

constructed with a downraught flue L and fitted with a fuel opening B. It may be set in



brickwork, or may be fitted independently on stands P.

3547. Fuller, T. Oct. 13. [*Provisional protection only.*]

Heating water.—In order to warm the water used for syringing or watering plants, a coil of lead piping, which is connected at one end to the supply and at the other to a hose pipe, is enclosed within a tube or chamber having connections with the circulating pipes of a conservatory boiler. Or instead of passing through a coil, the water may pass through the annular space between two concentric vessels, of which the inner one communicates with the boiler. Or the water may pass through a series of tubes running through a chamber containing hot water, or through a jacket surrounding any ordinary stove.

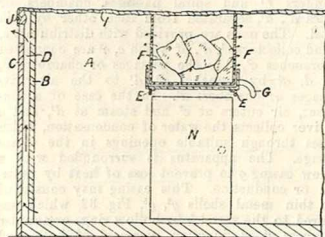
3593. Brown, A. B. Oct. 16. [*Drawings to Specification.*]

Heating buildings.—For heating a theatre, the exhaust steam from an engine used for pumping water to obtain hydraulic power for working the scenery, is led through a pipe passed through the building.

3594. Pate, W., [Cattell, L. C.] Oct. 16.

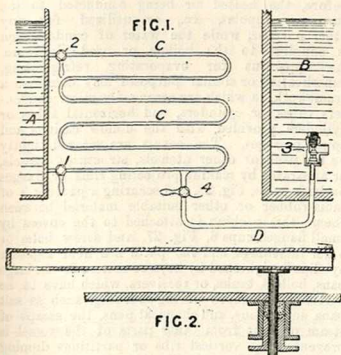
Heating buildings; heating air.—The Figure shows a method of cooling which can be adapted for heating and ventilating buildings by replacing

the ice cage F by a heated surface. The chamber A has an outer wall C and an inner wall B, between which is a space D, through which air circulates in the manner shown by the arrows. The



top of the chamber is covered by a blanket I, through which air can pass. The blanket is held in place by a cord J.

3648. Moy, T. Oct. 21.



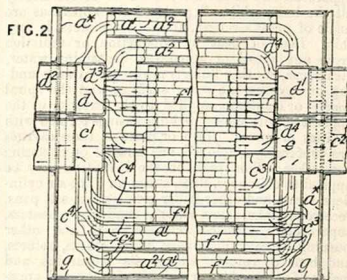
Heating water.—Comprises a self-acting or automatic apparatus for heating and supplying feed-water to steam and other boilers. A vessel or coil is fed with water from a cistern and arranged to be heated by waste gases so that steam may be generated and the water thereby forced into the boiler. Fig. 1 shows a coil C arranged between the boiler B and a main cistern A. The coil is fitted with slide or other valves or cocks 1, 2 and the branch D, leading to the boiler, with a valve or cock 4 and a non-return valve 3. When there

is sufficient water in the boiler, the cock 4 is closed and the cocks 1, 2 opened to allow water to circulate through the coil from the cistern A. When the water level falls, the valves or cocks are automatically operated through floats and levers &c., 1 and 2 being closed and 4 opened. The water in the coil C is heated until steam is generated, the pressure of which forces the water into the boiler. When the water level has been raised, the cocks are reversed. The valves and cocks may be operated through a hollow or tubular lever, as shown in Fig. 2, pivoted so that when the water level falls the tube becomes emptied and assumes an inclined position, and when the water level rises it again becomes filled and assumes a horizontal position. The hollow lever may be arranged inside or outside the boiler. The firebars may be made tubular and arranged to form part of the coil C.

3698. Matthews, J. Oct. 25. [*Provisional protection only.*]

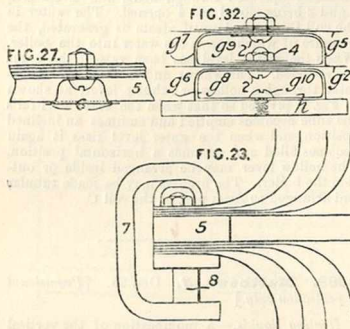
Heating liquids.—A modification of the vertical steam boiler described in Specification No. 3586, A.D. 1874, [*Abridgment Class Steam generators*], is used as an open boiler for heating liquids. The boiler consists of a vertical casing, open at the top and provided with a central firebox, from the crown of which a water pocket depends over the fire. Smoke tubes or flues rise from the crown of the firebox into a central tube which rises from the bottom of the pocket. Bent water tubes connect the main water space with the pocket.

3699. Maw, E. Oct. 25.



Heating liquids and gases; heating-apparatus; non-conducting coverings; boiling-pans.—To prevent the waste or loss of heat in processes and apparatus wherein heat is generated or utilized, air is heated by being drawn or forced through spiral passages

and other spaces or chambers enclosed in, encasing or surrounding the apparatus, such as chimneys, flues, blast pipes, evaporators, boilers, receivers, steam and gas condensers, heaters, superheaters,



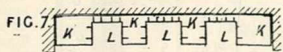
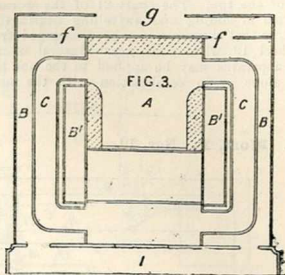
pipes, tubes, conduits, and similar apparatus. Cold air also is used in the same way for condensing, cooling, and refrigerating purposes, and the heat absorbed by it is used for heating water and other fluids for boilers, superheating steam, evaporating, warming, burning, calcining, drying, and raising the temperature of air and gases in the furnaces of steam and other boilers, evaporating-pans, furnaces, cupolas, kilns, ovens, stoves, retorts, and other fireplaces and apparatus. In all cases, there is a continuous circulation of the steam, water, gas, or other fluid to be cooled or heated, preferably in a direction opposite to that of the air. The cooling and heating surfaces are made of sufficient extent to condense steam or gas produced or used in any apparatus, and to permit the air to absorb nearly all the heat, while all parts of the apparatus are made of great strength, although the metal is very thin. Loss of heat by conduction or radiation from any vessel or apparatus, containing water, steam, gas, or other fluid, is prevented by surrounding or encasing the outer surfaces, and the spiral spaces or chambers applied to the exterior of the apparatus, with closed metallic casings formed with cavities or spaces. Two or more of these cavities are preferably employed, one outside or enclosing the other. This part of the invention may be applied to chimneys, flues, steam and hot-air cylinders, steam and other boiler evaporators, salt pans, receivers, tanks, steam and gas condensers, heaters, superheaters, furnaces, cupolas, coke and other burning or calcining ovens, kilns, stoves, retorts, and beds of retorts, and similar apparatus, and mains or other pipes or tubes, conduits, and apparatus for conducting or containing water, steam, gas, or other fluids. In like manner, heat can be excluded from apparatus for producing cold. A vacuum or partial vacuum is produced in steam cylinders and evaporators by the action of cold air surrounding and circulating through condensers connected with them, and the heat absorbed is

utilized for heating water and other fluids, or for other purposes. In applying the invention to a condenser, a heater for the warm water of condensation, or a superheater, the body of the apparatus, Fig. 2, is formed of a series of concentric cylinders f^1 and spiral passages, chambers, or spaces a^1, a^2 , separated from each other by thin metal. The ends are provided with distributors c, d , and collectors c^1, d^1 , of which c, c^1 are connected by branches c^2, c^4 to the passages or chambers a^1 , and d, d^1 by branches d^2, d^4 to the alternate passages or chambers a^2 . In the case of a condenser, air enters at c^2 and steam at d^2 , and a receiver collects the water of condensation, which passes through suitable openings in the steam passage. The apparatus is surrounded with a hollow casing g to prevent loss of heat by radiation or conduction. This casing may consist of two thin metal shells g^1, g^2 , Fig. 32, which are secured to the vessel h by hollow rings or annular chambers g^3, g^4 , junction pieces g^5, g^6 , bolts and nuts 2, 4, and screws g^7 , in conjunction with washers having keyhole slots. The inner portion of the apparatus, Fig. 2, is made separate from the outer portion, to allow it to be readily removed. In a modification, a blast pipe or tube, with or without spiral passages, passes through the centre of the apparatus for heating the air of the blast, condensing the exhaust steam of the engine, and increasing the combustion of furnaces, cupolas, &c.; the steam heats the blast, and is cooled and condensed by the action of the air, as before, the heated air being conducted to the furnaces, cupolas, &c., or utilized for any other purpose, while the water of condensation is supplied to the boilers or used elsewhere. An apparatus for evaporating, refrigerating, superheating or similar purposes may comprise a framework, in which are arranged vertical condensers, tubes, or cylinders, and horizontal tubes or cylinders provided with the hollow casings and spiral passages. The covers are secured tightly on the pans or other utensils, structures, vessels, or apparatus by making projecting rims or flanges on both parts, Fig. 23, and securing a packing 5 of india-rubber or other suitable material between them; this packing is attached to the covers by small flanged cups 6, Fig. 27, and screw bolts or other fastenings, and the parts are held together by clips 7, tightened by keys or cottars 8. In large pans, boilers, tanks, or receivers, which have to be partially uncovered during working, such as salt pans, sugar pans, and chemical pans, the escape of steam or heat from other parts of the vessel is prevented by vertical ribs or partitions dipping into the liquid, and all the compartments or divisions of the pan are connected by vertical pipes with two horizontal main pipes above the apparatus.

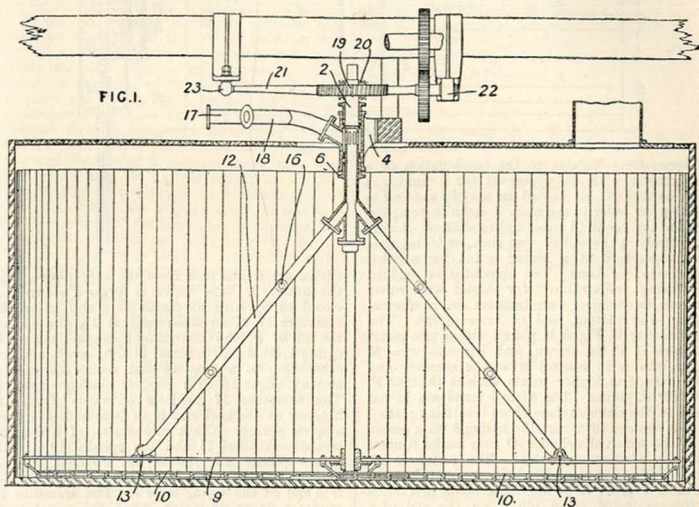
3732. Waller, T. Oct. 27.

Heating air.—A fireplace or cooking-stove is fitted with air-heating chambers for heating air for ventilation. Fig. 3 shows a section of a stove with air-heating chambers B heated by flues C descending from the fireplace A. Air is supplied to the

chamber B and passes through the openings *f* to a regulator fixed over the opening *g* before being led off to the room to be heated. To prevent overheating, cold air from a chamber at the back of the stove can be mixed with the heated air by the regulator. The products of combustion escape by flues at the back or may be conveyed under the stove by a flue I. The chambers B' pass through the stove and are fitted with gratings at the front and back. Fig. 7 shows an air-heating chamber heated by the waste heat passing through the flue L of a cooking-range. It is fitted with projecting plates to obtain a greater heating-surface.



3855. Wilson, J. Nov. 5.



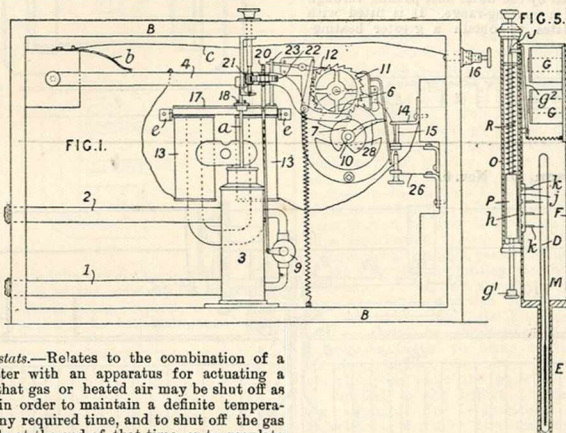
Heating liquids.—The mash tun in which the wort for distilling purposes is made from maize or rice is provided with a partially hollow vertical shaft 2 through which steam, air, water, &c., is introduced into the tun for the purpose of agitating, heating, or cooling the wort. The hollow part 2 of the shaft works in a box or casing 4 on the top of the tun, and carries two inclined pipes 12 which are furnished with bent nozzles 13 and are supported by two iron bars 9 extending from the lower end of the shaft. A pipe 17 with two branches 18

serves to supply steam, air, or water to the interior of the box 4 between its upper and lower stuffing-glands 6 and to the pipes 12. Valves are placed over the nozzles 13 to prevent the grain from passing into and choking them. The shaft 2, pipes 12, bars 9, and chains 10 revolve by the action of the steam &c. and agitate the grain and liquid. In order to agitate the liquid when no steam &c. is being introduced, gearing terminating in a worm 20, which may be engaged with a wheel 19 on the shaft 2, is provided above the

cover of the tun. The shaft 21 of the worm is supported in sliding and swivelling bearings 23 and 22, so that the worm may be disengaged from the wheel 19 when necessary. Several of the above apparatus may be applied to the one tun, either alone or in combination with the usual

stirring apparatus. Additional nozzles 16 and branch pipes may be provided on the pipes 12 and shaft 2. According to the Provisional Specification, the inclined pipes 12 may be replaced by diametrically opposite horizontal branch pipes at the bottom.

3904. Mori, F. Nov. 10.



Thermostats.—Relates to the combination of a thermometer with an apparatus for actuating a valve, so that gas or heated air may be shut off as required in order to maintain a definite temperature for any required time, and to shut off the gas &c. entirely at the end of that time, or to regulate the temperature at a higher point for another fixed period of time. The apparatus is used in vulcanizing india-rubber for dental and other purposes, in chemical manufactures &c., in electro-gilding and plating, and in brewing &c. The thermometer D, Fig. 5, is placed within two metal cylinders E, F, as shown, and has one wire M sealed into it in contact with the mercury and other wires *k* at higher points, such as the 280° F. and 320° F. points. The wires *k* terminate in flat heads on the outer surface of an insulating plate *j*, so that the end of a metallic spring *h* on a piston P in the external cylinder O may make contact with any of them as desired. The piston is adjusted by the nut *g'*, and is held down against the action of a spring R by the engagement, in a notch in the piston-rod, of a pin J on the end of a hinged or pivoted bar *g'*. This bar is the armature of an electromagnet G and is held out of contact with the magnet by a light spring. A pointer attached to the piston P moves over a thermometer scale corresponding with the position of the wires *k*. Of three binding-screws on the top of the cylinder F, the centre one is connected to one end of the coil G, another to the wire M, and the third to the cylinder F and so to the other end of the coil G. In the other part of the apparatus, a spring lift-valve is contained in a case 3 in a box B, and, when lifted by its spring,

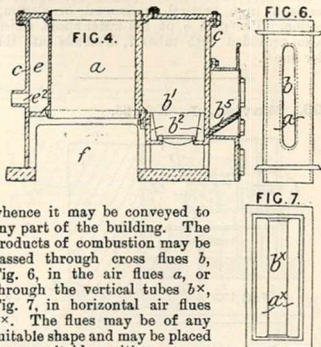
allows gas &c. to pass from the supply-pipe 1 to the outlet 2. The valve is pressed down and closed as required by means of a clip 18 on the armature 17 of an electromagnet 13, one end of the coil of which is connected through the lever 4, spring *b*, &c. to an external binding-screw, and the other end to a stop 14 and thence through a moving finger 15 with another binding-screw 16. The armature 17 projects outwards from its hinges *c* at the back and is in general held up by a spiral spring. Clock mechanism, of which the escapement-wheel 11 and the spindle 10 of the centre pinion are shown, is provided with a notched wheel 7 upon which bears a pin 6 on the free end of the spring-lever 4. The armature 17 carries a finger 23 which, when the armature is pulled down, raises a flat spring 12 from contact with pins on the wheel 11, so that the clock is then set in motion. In order to obtain a definite temperature for any desired time with the complete shutting-off of the gas &c. at the end of that time, the wire *c* is connected to the cylinder F, Fig. 5, and a battery or thermopile to the wire M and to the binding-screw 16, Fig. 1. When the temperature rises sufficiently, connection is made by one of the wires *k*, Fig. 5, and an electric current flows through the circuit, thus causing the armature 17, Fig. 1, to fall and close the gas valve.

A pilot valve 9, set previously by means of wheels 21 and 22 and a screw-rod 20, allows a small quantity of gas to pass to the heating-burner, so that, when the temperature falls again and the gas valve is opened, the heating is continued. The spring 12 having been lifted on the first downward movement of the armature 17, the clock is set in motion and rotates the wheel 7. At the end of the desired period of heating, the pin 6 falls into the notch of the wheel 7 and the lever 4 is pulled down. In falling, the lever 4 presses down the valve-rod *a* and the rod 20, so that both the gas valve and the pilot valve are closed. When a higher temperature is desired for a second definite period of time, an electric connection is made between the centre binding-screw of the thermometer and a third binding-screw on the box B, in connection with a contact piece 26. A finger 28 is attached to a tightly-fitting boss on the spindle 10, so that it is carried round with the spindle 10 and wheel 7 but may be set relatively to the wheel 7 as desired, pointers moving over an external dial being for this purpose provided on the spindle 10 and the boss of the finger 28. When the spindle 10 in its rotation has carried the finger 28 to the correct position, the finger 15 is pressed down into contact with the contact-piece 26. The electric current is then diverted, on the rising of the mercury into contact with the lower wire *k*, Fig. 5, through the coil of the electromagnet G, so that the armature *g* is withdrawn from engagement with the rod of the piston P. The piston rises as far as the nut *g*¹ allows and the spring *h* makes contact with the higher wire *k*. On the further revolution of the finger 28, Fig. 1, the finger 15 is released and makes contact with the stop 14 again, so that the previous working of the apparatus is reverted to, the temperature maintained being however higher. When the apparatus is used in connection with dental apparatus for vulcanizing india-rubber, the electric battery may be replaced by a thermopile placed in the vulcanizer. A valve which may be used for regulating the supply of gas &c. consists of an iron ball placed under the lower orifice of an iron tube which acts as the gas-supply pipe and also as the inner core of a cylindrical electromagnet. When an electric current is sent through the coil of the magnet by means of a thermostatic arrangement, the ball is lifted and closes the supply pipe. In a modification of the valve, the ball is replaced by an iron plate faced with india-rubber and guided by a pin working in guides in the central tube.

4029. Wright, T., and Saul, G. Nov. 20.

Heating air.—An apparatus for heating air for warming public and other buildings, such as churches, theatres, railway stations, dwellings, factories, and warehouses, and for drying-kilns for chicory, malt, &c., consists of a series of flattened air flues *a* heated by the products of combustion from the furnace *b* passing between and around them to the receiver *c*, and thence to an exit flue *c*¹. The iron casing *c* is surrounded by brickwork, an air

space being formed between the casing and brickwork. The air is heated as it passes through the air space, and through the flues *a* from the chamber *f*, and is collected in a chamber above,

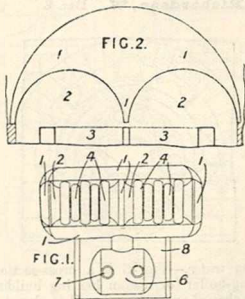


whence it may be conveyed to any part of the building. The products of combustion may be passed through cross flues *b*, Fig. 6, in the air flues *a*, or through the vertical tubes *b*^x, Fig. 7, in horizontal air flues *a*^x. The flues may be of any suitable shape and may be placed in any suitable position.

4063. Hyatt, T. Nov. 23. *Drawings to Specification.*

Heating buildings.—A building is heated by means of a series of Russian zig-zag chimney pipes arranged in recesses formed in the main walls, a tier being placed on each floor and suitably connected with each other; the fire is arranged in the basement. The zig-zag flues may be concealed by means of fretwork panels forming portions of the walls.

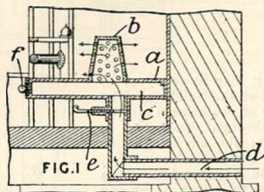
4091. Wilson, J. Nov. 25.



Heating water by means of waste gases from steam boilers, for feeding boilers or for other

analogous purposes. The heating apparatus is constructed with a capacious water space 1 into which project cavities or recesses 2, and it is set against the rear end of the boiler flues 3. Conical or cylindrical tubes 4 are passed through the recesses 2 in a vertical, horizontal, or slanting direction. The part 6 of the water space, which is also provided with tubes 7, descends into the under flue 8.

4106. Wavish, J. Nov. 26.

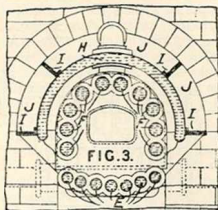


Heating air.—Air for ventilating rooms, hospitals, &c. is heated in a chamber *c* beneath a tube *a*, which is described in Specification No. 39, A.D. 1875, [Abridgment Class Stoves &c.].

4200. Bull, W. Dec. 4. [Provisional protection only.]

Thermostats.—A pyrometer rod placed in the furnace of an evaporating-pan is fitted with mechanism by which it is caused to open and close a valve for admitting cold air to the furnace as required when the temperature rises unduly.

4252. Richardson, W. Dec. 8.



Heating water.—Fig. 3 is a cross-section of a circulating-boiler for use in heating buildings &c. A saddle-shaped water chamber *H* is placed over a sectional boiler, consisting of water tubes *F*, *E*. The furnace is placed inside, the tubes *E* forming

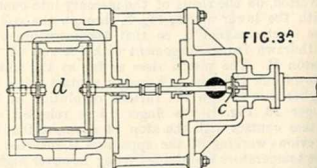
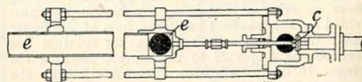
the firebars. The space between the chamber *H*, and the setting is divided by partitions *I* into flow and return flues.

4257. Kidd, J. Dec. 8. [Provisional protection only.]

Heating buildings &c. by steam circulation. The radiators and pipes are so arranged that the condensed water returns to the boiler by gravity. The radiators are made of non-oxidizable metal, such as zinc or copper, and are provided at the top with an adjustable air opening to prevent the formation of a vacuum.

4316. Holt, H. P. Dec. 13.

FIG. 3.



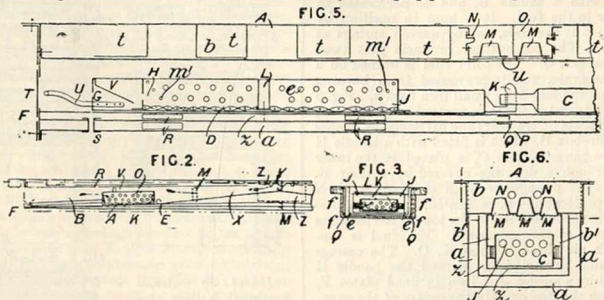
Thermostats.—In a compressed-air engine in which the air supply is heated by the admixture of steam, the supply of steam is controlled by the temperature of the exhaust from the air engine by connecting the stem of the steam-supply valve *c*, Fig. 3, with the exhaust pipe *e* which is arranged so that its expansion or contraction closes or opens the valve. In a modification, shown in Fig. 3^A, the valve stem is connected to a chamber *d* surrounded by the exhaust air and containing an expansive fluid.

4318. Bonneville, H. A., [Grandjean, P.]. Dec. 13.

Footwarmers; heating air.—Part of the flooring of a railway or tramway vehicle is removed and replaced by the upper plate of a rectangular box, which is heated by hot air from casings containing removable fireboxes. Two fireboxes *C*, Fig. 5, with wire grates *D*, are placed in the box or casing *a* in the box *a*, and are connected together at their ends by a hook *K*. Air for supporting combustion enters through holes *e* in the sides of the boxes *C*, and also through holes *F* in the doors *T*, and passes through holes *G*, *H* to the fuel, which is

prevented from clogging the holes H, J by inclined rows of wires *m'*. A deflecting plate V is fitted in the box between the holes G, H. Small squares L separate the pieces of fuel. The combustion

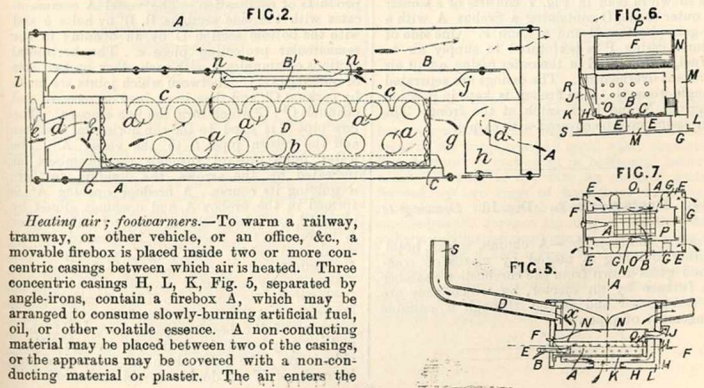
products pass off through chimneys M. Air enters by the pipe *s*, and is heated between the casings *a*, *z*, and after heating the plate A, passes away through pipes N. A plate covers the tops



of the casings *a*, *z* and forms with the upper part A a chamber *b*, in which are placed angle-irons *t* to separate the plates and to transmit the heat to the plate A. The casings are separated by squares R, and the air spaces in the outer casings are divided by angle-irons P, Q. The currents of combustion products from the boxes C are kept separate by a curved plate *u* and by a partition O. The chimneys M, N are placed in a chamber with sides of copper wire gauze. Handles U are fitted to the boxes C, which are kept from the sides of the casing *z* by springs *b'*, Fig. 6. In a modification, two fireboxes A, Figs. 2 and 3, fitted with handles B, are placed in a chamber consisting of three casings V, L, Q, Fig. 3, which are surrounded by felt and a wooden or zinc casing *f*. The

fuel is placed on a wire-gauze surface K, Fig. 2, and air is supplied to it through holes F in the door, which is fitted with a baffle, and through holes O in the boxes A. An iron plate R is placed above each firebox to deflect the heated gases &c., which are deflected upwards by inclined plates X. The combustion products escape through holes in the upper part of the inner casing V and through chimneys Y, passing thence through chambers formed on the sides of the apparatus by covering-plates Z, shown by dotted lines. The casings are separated by angle-irons M, and the fireboxes are kept in position by springs J, Fig. 2, E, Fig. 2. Air is introduced between the casings L, V to prevent radiation.

4319. Bonneville, H. A., [Grandjean, P.]. Dec. 13.



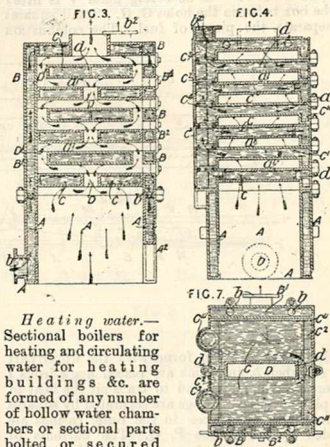
Heating air; footcarmers.—To warm a railway, tramway, or other vehicle, or an office, &c., a movable firebox is placed inside two or more concentric casings between which air is heated. Three concentric casings H, L, K, Fig. 5, separated by angle-irons, contain a firebox A, which may be arranged to consume slowly-burning artificial fuel, oil, or other volatile essence. A non-conducting material may be placed between two of the casings, or the apparatus may be covered with a non-conducting material or plaster. The air enters the

space between the casings L, K, flows into the heating-chamber N, and is conducted thence into the carriage through cased or felt-lined pipes D fitted with regulating valves S. The firebox A is fitted with a handle B, and is perforated to supply air to the fuel. It is kept in position by springs J, F at the ends, and by curved springs at the sides. The combustion products pass away through an exit Q. The solid fuel is burned on a wire-gauze grate, and is prevented from burning the ends of the box A by small iron bars *x*. Fig. 6 shows an apparatus which is secured to the flooring under the seats of trams and carriages by flanges S. The firebox B, which is fitted with a handle H and a wire-gauze bottom C, is placed in the inner casing through a doorway covered by a door R. Air enters the passages between the casings M, N through perforations L, is heated, and flows into the vehicle through holes in the tops of the passages and the ends of the apparatus. The fuel is supplied with air through holes K, O. The casings are separated by angle-irons E, and the handle H is secured by a spring J. Two inclined plates F, rising from the firebox B in the centre of the apparatus to the ends of the top plates P, are stated to facilitate the flow of the heated air. Two portable forms of the apparatus for heating carriages, rooms, and offices, are convertible into footwarmers by diverting the heated air, gases, &c., from the carriage, apartment, &c., into the atmosphere. The firebox D, Fig. 2, is placed on guides C on the bottom of a casing A, the section of which is oval in form. The central part of the inner plate B is open and is fitted with a plate B' forming passages *n* through which the combustion products pass into the chamber between the plate B and the top of the casing A, and thence into the atmosphere through perforations in the end plates. Holes *a* and notches *c* in the firebox D, and passages *d*, leading into air chambers *f*, *g*, supply air to the fuel. A curved plate *h* acts as a baffle. The firebox is secured by springs *i*, *j*, and is fitted with a wire-gauze bottom *b* and knob *e*. The apparatus shown in plan in Fig. 7 consists of a similar oval outer casing O containing a firebox A with a wire-gauze bottom B and a knob F. One side of the inner casing P is perforated to supply air to the fuel, and holes E in the outer casing admit air to prevent overheating. The casings are separated by angle-irons G. The firebox is kept in position by springs N and by a catch at the front. The outer casing may be covered with carpet.

4324. Preiswerk, L. Dec. 13. *Drawings to Specification.*

Heating buildings &c.—A church, school, hotel or other building is heated by means of compressed gases drawn from the combustion chamber of a furnace by an ejector, by which they are also compressed and forced through a suitable arrangement of pipes.

4419. Wright, W. Dec. 21.



Heating water.—Sectional boilers for heating and circulating water for heating buildings &c. are formed of any number of hollow water chambers or sectional parts bolted or secured together. Fig. 3 shows a vertical water heating and circulating boiler for horticultural and other heating purposes, the body of which is of rectangular shape. The lower portion A, or firebox, is formed of a rectangular vessel having hollow sides, upon two of which are bolted vertical water chambers B, B'. A number of horizontal rectangular water chambers or sections C, C' are secured between the vertical side chambers B, B', these chambers being provided alternately with central apertures D, and side apertures D' to give a zig-zag path to the products of combustion. The vessel A communicates with the side sections B, B' by holes *b* and with the bottom section C by an opening in the semicircular projecting piece *c*. The horizontal sections communicate with each other by two sets of openings C³, C¹¹¹, between which joints are made by packing C⁴, and they have deep or recessed end channels C¹¹, C² which form the flue spaces *a*¹. The flow pipe *b*¹ is fixed to the top horizontal chamber and the return pipe *b* to the vessel A. The water flows upward through the chambers, as indicated by the arrows, the dividing feathers *d* guiding its course. A firedoor opening A² is formed in the firebox A, and openings, closed by plugs B², are formed through the vertical chamber B to enable the flues *a*¹ to be cleaned. Small openings closed by screw plugs are also provided for cleaning out the chambers. The lower part or firebox A may be formed in sections, and the projection *c* may be carried down to form a bottom connection. A combustion chamber may be formed in a part of the heating space above the firebox, and air may be admitted thereto through adjustable doors. The water chambers or sections may be made of T or double L section to form the

flues a^1 when placed together, and they may have a number of vertical holes or flues in place of the side and central openings. Instead of the chambers being flat, they may be angle-shaped or of segmental or arched form. The boilers are preferably formed of cast iron, but they may be made of boiler plate, copper, sheet steel or malleable metal. The Provisional Specification describes numerous modifications and arrangements. The water chambers may be made square, conical, circular, or of V, W, or other angular form, or they may be fitted with tubes of various forms through which the water or fire gases may be passed. Or annular tubes may be used, through which both water or fire gases are circulated. The tubes or water chambers may also be applied to horizontal boilers, the firebox space being at one end and open below to the ashpit, or arranged like a Cornish or internally-fueled boiler; the water spaces are vertical or inclined. Double tubes may be taken through the firebox casing and connected outside with T-pipes &c. communicating with the boiler, so as to promote water circulation. The boiler and its furnace may also be made or combined with a coke oven, or with an iron or other furnace and coke oven, so that the coal may be coked and the gases utilized by forcing them into the ashpit and through the firebars by compressed air &c.

a bottom chamber h and thence rise through tubes d^1 to a superheating chamber h^1 placed above the boiler and at the foot of the chimney k . This chamber may be connected directly to the firebox

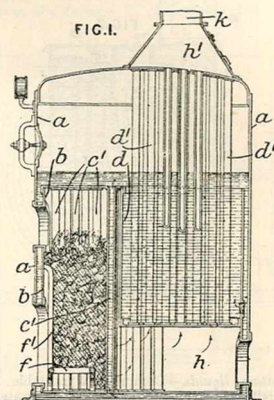
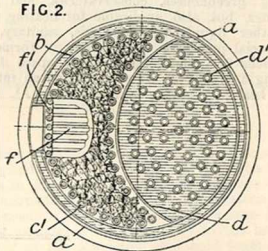
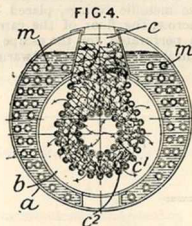


FIG. 2.



4491. **Bordone, J. P. T.** Dec. 24.

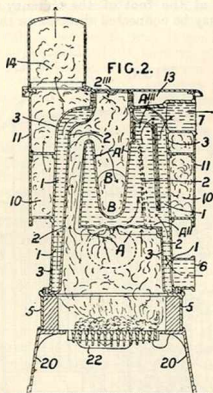


Heating water.—Vertical and horizontal boilers, for generating steam and for hot-water and domestic heating apparatus, are constructed with internal fireboxes formed by arrangements of water tubes, the combustion products being compelled to pass through the fire to consume smoke. Figs. 1 and 2 show a vertical boiler formed of an outer shell a and a smaller inner shell b divided by the curved partition d and containing the firebox, which is crescent-shaped and outlined with rows of vertical water tubes c^1 communicating with the water spaces at the top and bottom of the firebox. The grate is formed of horse-shoe shaped water tubes f from which rise vertical water tubes f^1 , all communicating with the boiler. Or it may be formed of a number of horse-shoe shaped tubes of gradually-decreasing size. The products of combustion pass through the fire into

by a tube provided with a register, which is opened when the fire is first lighted. The inner shell b has an opening which, together with the arrangement of the tubes, causes a rapid water circulation. Fig. 4 shows a section of a horizontal boiler in which the fuel is fed into an annular grate c formed by two rings of horizontal water tubes c^1, c^2 running through the internal flue b . Air is supplied to the furnace through a horizontal tube, and the combustion products pass through the fire into the flue b and thence to a front chamber, whence they pass through tubes m to the smokebox. In another arrangement, the grate bars are formed of transverse water tubes alternately inclined in opposite directions.



4506. Keith, J. Dec. 27.



Heating liquids.—Comprises a portable boiler especially applicable for circulating water for heating greenhouses, conservatories, and other buildings, but also applicable for heating water and other liquids for domestic, sanitary, and commercial purposes. The boiler is formed of two shells 2, 3 enclosing a water space 1 and forming a firebox in which is fitted an internal water heater A having a central flue A¹. The

heater is connected to the water space 1 by connections at A¹¹, A¹¹, and its outer surface is provided with ribs to increase the heating-surface. The shells 2, 3 rest on a ring 5 which is supported on an ashpit or ashpit 20. The combustion products ascend the firebox and encircle the heater; they then descend the central flue A¹ and pass through a lateral opening B into two or more flues 10, 13 formed in an outer casing 11 communicating with the chimney 14. The flow and return pipes are connected to the boiler at 7 and 6 respectively. The arrangement of the heater within the firebox causes a free circulation of the water. A door 2¹¹ is formed above the flue A¹ and doors are also formed in the casing 11 for cleaning the flues 10, 13. The boiler may be formed of cast iron, wrought iron, or steel, and the outer shell may be corrugated and of oval, oblong, rectangular, or square form, with a circular, domed, or flat top. When cast iron is used, the parts are secured and jointed by being bored and screw pinned and then rusted with very fine flour iron rust. The flues in the casing 11 may be dispensed with and the inner shell may be provided with ribs. The flue A¹ in the heater may be dispensed with, the heater being hung from the centre of the dome of the boiler.

4510. Bonneville, H. A., [Grandjean, P.].
Dec. 28. [Provisional protection only.]

Footwarmers.—Fixed or movable boxes, in which artificial fuel is burned, are placed inside a number of concentric metallic casings, placed on, or in a recess cut across, the floor of the carriage. The top plate is perforated, for the escape of the hot air, and the heater is used as a footwarmer.

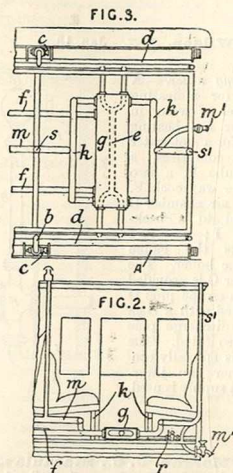
A.D. 1876.

25. Johnson, J. H., [Guitard, E. E.].
Jan. 3.

Footwarmers.—Railway carriages and tramscars propelled by steam motors are heated by vessels *g* containing water into which boiler steam is injected by the perforated tubes *e*, Fig. 3. Steam is supplied from the pipes *A* to the curved pipes *d* by

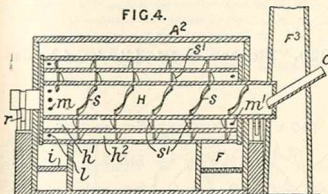
pipes *b* fitted with valves *c*. The pipes *d* are connected to the pipes *e* as shown. The vessels *g* throughout the carriage are connected by pipes *f*, and also by pipes *m*, *k* which are placed at a higher level to conduct the steam from the vessels *g* into the pipes *s* and into the open air. The apparatus is fitted with air cocks *m*¹ to enable the pipes and vessels to be filled through the pipes *s*¹. A cock *r*,

Fig. 2, is fitted to enable the water to be withdrawn. The inlet *b*, Fig. 3, for the steam is arranged at a level higher than that of the water



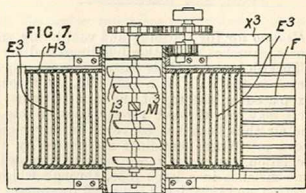
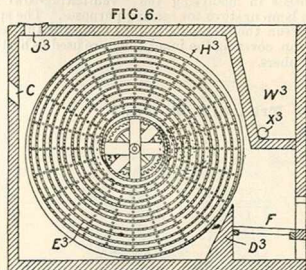
in the apparatus to prevent the water from flowing into the steam pipes A. The pipes are connected between the carriages by elastic or flexible unions.

75. Barlow, C., [Cook, T.]. Jan. 7.



Heating-apparatus.—Relates to apparatus applicable for heating and drying sand, pulverized stone, earth, fine coal, minerals, and other granular substances. In the heater shown in Fig. 4, the material is fed through the shoot *c* to the central cylinder H, along which it is passed by the internal screw threads *s* to the opposite end to pass through holes *m* to the annular space *h*¹. Screws *s*¹ pass the material back and through holes *m*¹ to the annular space *h*², from which the material passes through

holes *l* to the inclined floor *i* and is conveyed to suitable receptacles. The heater is carried on friction rollers *r*, and mounted to rotate in the chamber A². Hot air, or the products of combustion from the furnace F, pass round the outer

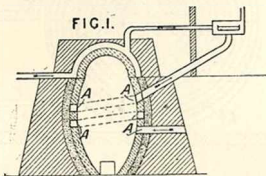


cylinder and through the holes *l*, *m*¹, *m*, spaces *h*², *h*¹, and cylinder H, to the chimney F³. The heater shown in Figs. 6 and 7 is described as applied to the manufacture of concrete, paving-material, &c., and consists of a sheet-metal scroll E³ open to the central cylinder at one end, and to the heating-chamber at the other end, and held together by perforated heads H³. The materials are fed through the shoot C to the heating-chamber, and are picked up by the mouth of the scroll, and conveyed as the scroll rotates, to the central cylinder, in which it may be mixed with asphalt or other substances by means of arms L³ on the shaft M³, which is rotated in the opposite direction to the scroll by means of spur gearing. The asphalt or tar is melted in the chamber W³, and conveyed to the central cylinder by the pipe X³, the mixture being discharged by the arms L³. The materials may be passed from the centre to the outside of the scroll. The bridge D³ prevents the ashes of the furnace F from mixing with the material to be heated. The products of combustion pass around the scroll and escape through the opening J³, or may be drawn through the scroll and escape through the central cylinder. The central cylinder is extended beyond the heads to form the journals of the scroll, and rollers are placed in the bearings to reduce the friction.

80. **Landau, M. I.** Jan. 7. [*Provisional protection only.*]

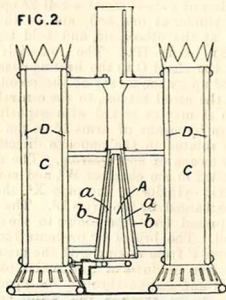
Heating-apparatus.—Relates to improvements on the apparatus described in Specification No. 1674, A.D. 1875, [*Abridgment Class Chimneys &c.*], and consists in modifying the "ventilating-cowl" of the lamp or stove for heating-purposes. The space between the inner and outer tubes, and the dome, or cap, covering the inner tube, are used as heating-chambers.

85. **Trench, J. T.** Jan. 7.



Heating air for warming and ventilating green-houses, churches, and other buildings, and for use in Turkish baths. Air is passed through pipes or flues A in the walls of a lime kiln, and through a box placed on the top of the kiln. The hot products may pass through zig-zag flues in this box. The air thus heated is conveyed in any required direction. Where buildings are heated by water circulation, the water pipes may be enclosed for some distance in a large pipe, through which air is passed, and in which it is heated by contact with the water pipes.

98. **Moore, J.** Jan. 8.

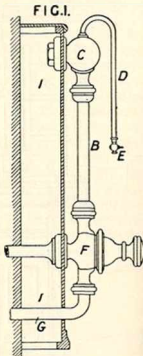


Heating air.—Fig. 2 shows a vertical section of a stove, burning gas or oil. The jets heat a boiler A, consisting of two annular conical chambers

communicating with one another, and with annular chambers D surrounding flues C through which the air passes.

140. **Wilson, J. J.** Jan. 13.

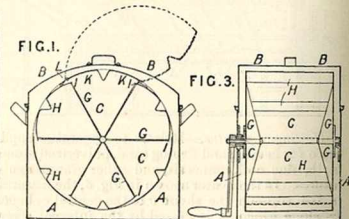
Heating water.—A gauge for indicating the level of water in a boiler for heating water for a hot-water supply comprises a glass tube B, a two or three way cock F, and an air chamber C attached to a back-plate I; a pipe connects the gauge with the boiler. The chamber C is provided with an escape pipe D furnished with a cock E. A discharge pipe G is also fitted. The gauge is specially useful where an intermittent supply is used.



178. **Morgan, J. C., Macaulay, H., and Waide, F. W.** Jan. 17. [*Provisional protection only.*]

Heating air.—Relates to stoves in which the firebasket or grate can be drawn forwards when the fire is well alight. An air-heating space is provided at the back, from which the air is admitted into the room. The back of the stove may be tiled, and provided with gills to increase the heating-surface.

220. **Morton, J. W., [Preston, A.]** Jan. 19.



Boiling-pans.—In a combined boiler and machine for washing clothes and similar articles, a rotating

cylinder C, Figs. 1 and 3, is mounted within a boiler A, and provided with radial projections G on its ends, and with ribs H on its curved surface. In operation, the boiler is partly filled with water, and set over a fire, or gas jets; the clothes are then introduced into the cylinder, and the cylinder rotated, the water and steam passing through the openings I to the cylinder, and the clothes being dashed against the ribs. The cylinder and boiler are provided with doors K, B, respectively.

230. Liddicott, P. Jan. 20. [*Provisional protection only.*]

Heating water.—In a combined food-warmer and plate and dish warmer, one of the compartments forms a tank for hot water and may be used for supplying hot water for table use. The apparatus is heated by a lamp or gas burner placed beneath it.

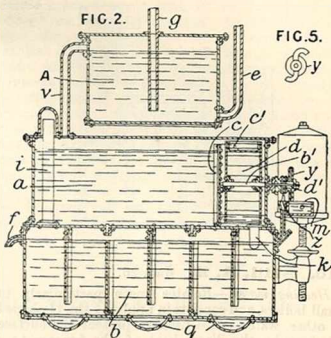
262. Lake, W. R., [*Gill, J. P.*]. Jan. 22. [*Provisional protection only.*]

Heating air.—A furnace fired with hydrogen gas is used for heating air for ventilation, and for generating and superheating steam for moistening the air. An air space surrounds the sides and top of the furnace, and above the fire space are pipes for generating and superheating steam. These pipes are maintained at a red heat. A pipe from the superheater passes from the front to the back of the upper air space and is perforated with small holes to allow a suitable amount of steam to mix with the air. A flue leading from the furnace passes through the air chamber. The cold air from the outside of the building is conducted by pipes to the bottom of the air chamber. Water is admitted to the superheater through a siphon pipe, which acts as a safety-valve and is fitted with a regulating-valve. If steam is available, it may be admitted direct to the superheater. The fireplace is so constructed that the gas pipes can be removed and solid or liquid fuel used instead of or in combination with the gas.

273. Johnson, J. H., [*Nolden, M.*]. Jan. 24.

Heating water.—The water-purifying apparatus described in Specification No. 1552, A.D. 1873 is provided with an additional tank A, into which the impure water is supplied from a pipe e. The water, when heated by the waste steam entering the tank A through the pipe g, passes through a pipe v into the tank a of the apparatus described in the prior Specification. By the use of the tank A, the steam used for heating the water is condensed and is treated along with the water, the oil and other impurities in it being afterwards

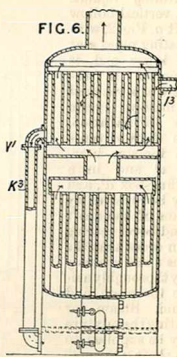
removed by the chemical agents used. Any steam which is uncondensed in the tanks A and a escapes



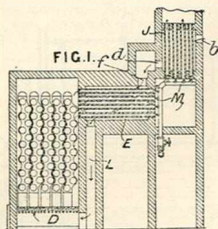
with the water through a pipe f, being led to the tank b by a pipe i.

303. Newton, A. V., [*Babbitt, B. T.*]. Jan. 25.

Heating air.—Air for combustion in steam-generator furnaces or for other purposes is heated, in the arrangement shown in Fig. 1, by circulating it in two chambers E, J containing tubes through which the waste gases from the furnace are passed. After circulating through the upper chamber, the air, which enters through an opening b, passes through openings d, f to the lower chamber, and thence downwards through a vertical passage L to the ashpit D. The tubes may be cleaned or blown out by steam jets from a pipe M. In another arrangement, the air is passed downwards through tubes placed in the annular flue of a specially-constructed vertical boiler, or air-heating apparatus, consisting of a series of tubes through which the waste gases



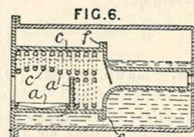
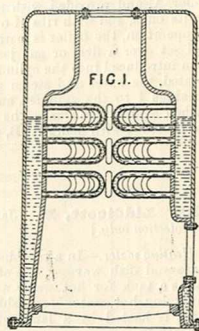
are passed, may be arranged inside the upper part of the boiler, as shown in Fig. 6.



310. Shill, R. E. Jan. 26.

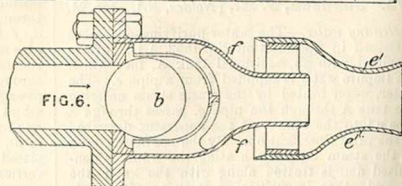
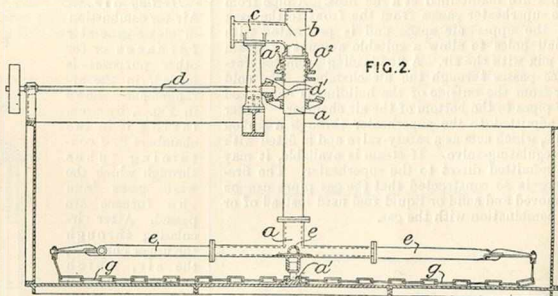
Heating water.—Relates more particularly to small boilers, and consists in applying the U-shaped or other water tubes used to protect the surface acted on by the direct heat of the furnace to a plate or plates capable of ready removal and replacement for repairs &c. For this purpose, the internal flue is connected to the outer shell by flanges and bolts or other suitable connections, and the plate or plates carrying the tubes is or are connected to the surrounding parts by bolts or the like. Fig. 1 shows the arrangement applied to

a vertical boiler, the firebox being bolted to the outer shell. In Fig. 6, the flue is shown made in two parts, which are bolted together and connected to the outer shell by flanges *f* and bolts. In another arrangement, the ends of the flue or firebox are connected to the outer shell by packed socket-joints. Gaseous or solid fuel may be used. In the latter case, the firebars may be made tubular and laid transversely in order to communicate with the side water spaces; in addition, the bars may be inclined in one direction only, or some in one direction and some in the other.



509. Brodie, D. Feb. 8.

Heating liquids.—A vertical hollow shaft *a*, Fig. 2, with radiating pipes *e* at the lower end, is supported in the centre of a vat used in mashing grain for distillation. The shaft *a* turns in a footstep bearing *a'* and in a stuffing-box *a''*, and may be revolved by means of the shaft *d* and bevel gearing *d'* in order that the arms *e* and chains *g* may thoroughly agitate the grain and liquid. Steam for heating the mixture may be supplied to the shaft *a* through the pipe *b*, and issues into the vat through nozzles at the ends of the arms *e* and bent at right-angles to them. The escaping steam assists in



the agitation of the contents of the vat. In order to prevent noise and vibration by reason of the escape of the steam in this case or in other cases in which liquids are heated in this manner, the nozzles *f*, Fig. 6, are each provided with a shield or guard *e* which screws upon an open frame surrounding the nozzle. A rapid current of liquid is drawn through the frame and under the shield by the rush of steam from the nozzle. In some cases a ball-valve *b* to prevent the back-rush of the liquid into the steam pipe is provided. Nozzles of this kind are provided on steam pipes leading into the brewing tank or into auxiliary vessels attached to them in order to heat the water used in the brewing operations.

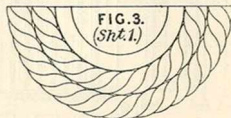
586. Wilson, T. E. Feb. 12. [*Provisional protection only.*]

Heating buildings; heating air.—An apparatus which is stated to be applicable for heating buildings and for other purposes consists of a spiral chamber made of sheet metal or other material and heated by steam or hot water. The chamber is made in one piece, or in sections, or otherwise, and the air to be heated is supplied “to the space “between the spiral coils of the chamber,” either from the centre or from the outside circumference, by a fan or other apparatus, or by exhaustion. The ends of the apparatus consist of fixed or movable side plates; when movable, spiral flanges are applied to the side plates corresponding to the shape of the spiral chamber, “so that when drawn out the “width of the apparatus is increased.”

656. Kunkler, E. Feb. 17. *Drawings to Specification.*

Thermostats.—In an apparatus for regulating the temperature of a mixture of hot air and dry steam supplied by a stove, the expansion of a metal rod actuates a system of levers which open and close valves controlling the admission of cold air.

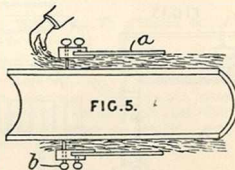
664. Walker, A. B. Feb. 17.



Heating liquids; boiling-pans; heating air.—The hollow screws or worms described in Specification No. 1886, A.D. 1875, for heating liquids in brewing, dyeing, bleaching, &c., by means of steam or hot air passed through the worms, also applicable for heating, cooling, and regulating the temperature of rooms, have the tubes of which they

are composed, corrugated, twisted, “cable,” chequered, or otherwise treated to increase the surface. Fig. 3 shows the tubes as “cabled.” Diaphragms of wire gauze, or perforated, waved, corrugated, or goffered metal may be inserted. Or the worm or screw may be constructed of “alternate longitudinal diaphragms of tube and gauze, or perforated metals.” “Baffle boxes” may be inserted at intervals to divert the currents passing through the tubes, and the tubes may be bent and crossed in various ways. Small tubular or other teeth may project from the threads of the screw to increase the agitating-effect. Instead of making the screw equal in length to the containing vessel, it may be comparatively short, and be moved up and down, or to and fro, in the vessel. The apparatus can also be used for soap-boiling and for treating liquid and plastic substances generally.

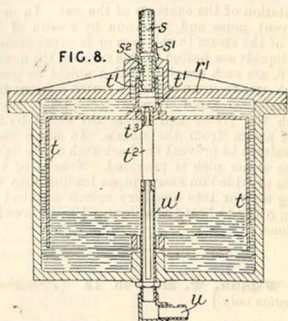
732. Stewart, R. Feb. 22. [*Provisional protection only.*]



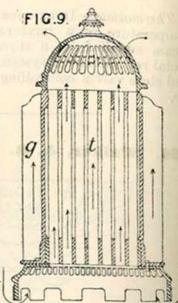
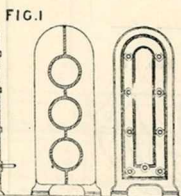
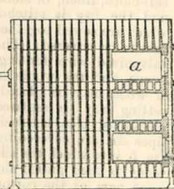
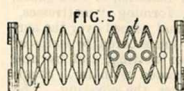
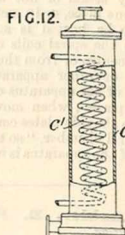
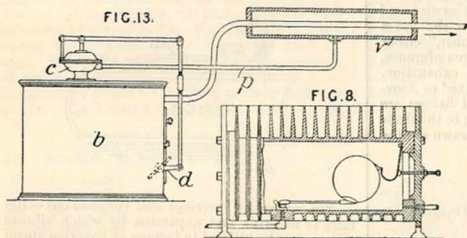
Non-conducting coverings and compositions.—Relates to methods and apparatus by which silicate cotton may be utilized in lagging or covering steam boilers, chests, and pipes, and hot-blast pipes, ice-houses, refrigerators, fireproof rooms, safes, water and gas pipes, for preventing the transmission of heat, or for arresting the spread of fire. The silicate cotton is filled into a long bag made of canvas, sail-cloth, linen, or similar material, or wire gauze, and the bag is stitched, forming “mattresses,” which are sewed together and placed over the surface to be covered. They are secured by strips of galvanized wire fencing or netting, and by iron hoops, and the whole is coated with tar. Strips of wood may be placed over the covering. The netting may be replaced by perforated sheets of galvanized iron secured by iron bands. Small pipes &c. are covered by using a tubular casing *a*, Fig. 5, into which the silicate cotton is filled. The casing is then pulled along the pipe, and the exposed part of the cotton is covered with canvas and tied with iron wire. The whole is then tarred. The casing *a* is cut open on one side to allow it to be placed on the pipe, and is kept at a uniform distance from the pipe by brass screws *b*.

749. Wood, E. Feb. 23.

Steam traps.—Siphon-boxes for removing the water of condensation from the cylinders and other parts of steam engines, and from steam pipes, are formed with a float *t*, having at the top a bush *t'* to slide over the end of another bush *s'*, which is screwed into the lid *r'* of the box and provided with a side opening *s''*. Within the bush *t'* is a spindle *t''*, the lower end of which fits in a tube *u'* fixed to the bottom of the box, and the top end is provided with an air valve *t'*. The steam and water are admitted through the pipe *u*, and, when the condensation of steam allows the float to fall, the water passes through the opening *s''* into the discharge pipe *s*. The float is prevented from collapsing by forcing into it air or other fluid lighter than water, at a pressure proportionate to the pressure of steam.



822. Weems, W. Feb. 28.

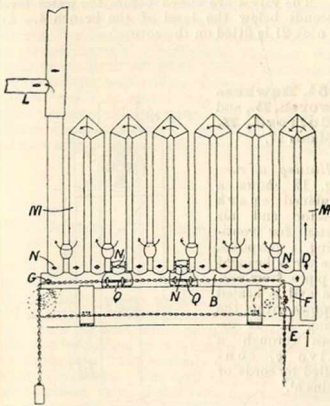


Heating buildings; heating air; heating water; steam traps; thermostats.—Water is circulated or heated in gilled and similar vessels to warm the air in or entering the buildings, such as hospitals, asylums, workhouses, and public institutions, in which they are situated. Fig. 1 shows an elevation,

cross section, and an end view of an apparatus with three tubes or pipes *a* surrounded by gills. Similar apparatus is constructed with two pipes or one. Fig. 5 shows a plan of a water-heated "stove" with a corrugated heating-surface. The vertical air tubes *t* may be omitted. Fig. 8 shows

a steam-heated "stove" containing a valve with a float and lever and expansion tube or rod for removing the air and the condensed water. Fig. 9 shows a "stove" consisting of an outer casing, with or without gills *g*, containing a number of tubes *t*. Steam or hot water is introduced into the casing, and the heated air rises in the tubes. The air in the apartment is thus circulated, or a current of fresh air may be admitted to the lower part of the apparatus. Another apparatus consists of a cylindrical casing *c*, Fig. 12, containing a number of tubes or a coil *c'* through which steam is passed to heat the water in the casing. The hot-water pipes of the building are connected to the inlet and outlet of the coil &c. The water may be passed through the tubes or coil *c*, the steam being led into the casing *c'*. The temperature of the heated water is regulated automatically by the apparatus shown in Fig. 13. The chamber *c* is fitted with an elastic or rubber diaphragm, and the space below the diaphragm is connected by a pipe *p* with a vessel *v* containing water heated by the water from the boiler *b*. When the temperature of the water rises, the diaphragm is lifted, and the motion is caused to move a damper *d* in the boiler flue.

864. Clark, A. M., [Angell, E. C.]
March 1.



Heating buildings &c.—The Figure shows a radiator through which the hot gases from a stove or furnace are passed. In starting the fire, the damper *D* may be closed so that a free draught is caused through the flue *B* to the discharge pipe *L*. By opening or closing the dampers *N*, any required

number of the pipes *M* can be utilized for heating-purposes. Scrapers *Q* are manipulated by a chain to draw the soot to the discharge pipe *F*. The dampers *E* and *G* are slotted for the passage of the chain.

896. Sawkins, J. N. March 2. [Letters
Patent void for want of Final Specification.]

Heating water.—A portable vessel which may be used for heating water, food, &c. is provided with a cover which, when inverted and placed under the vessel, serves as a container for the spirits used to heat the vessel. The vessel is preferably of a truncated conical form with the largest diameter at the mouth; the cover is provided with internal feet upon which the vessel rests when being heated. An annular projection on the cover serves as a support for it when reversed, and forms a recess in which a ring, bale, or handle is placed.

999. Solvay, E. March 8. Drawings to
Specification.

Thermostats.—In an apparatus for regulating the temperature of hot air employed for drying sodium bicarbonate, the hot air passes through a water reservoir containing a float, the rise and fall of which actuates a damper controlling the admission of cold air.

1049. Barnett, J. March 10.

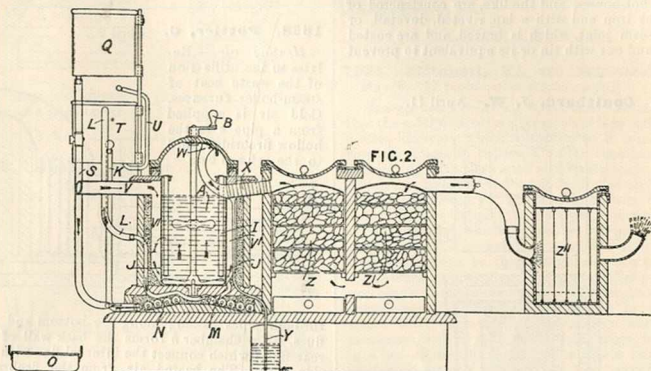
Non-conducting compositions.—In order to prevent the conduction of heat through the brickwork of a furnace, earthy matter saturated with a saturated solution of salt is inserted between the thicknesses of brickwork, or is applied to the outside of the brickwork. The material is also used for filling the interstices of the brickwork of locomotive fireboxes, and for coating the upper side of the bricks. An iron arch coated with the material may be substituted for the brickwork.

1093. Chaloner, W., Chaloner, J., and
Chaloner, T. March 13.

Steam traps.—The valves of a steam trap are opened by weights, and also, it is stated, by the pressure of the water and steam, and are closed by the weight of a float, which is made with only just sufficient buoyancy to enable it to float. The shell *A*, Fig. 1, of the trap is made with an inlet *a* and an outlet *a'* for the water, and a valve-box *b* is fitted in the outlet. The equilibrium valve *c* is operated by the lever *g*, which enters a slot in the spindle *d*, or is attached to it in any other

or medicating the air of hospitals and sick-rooms, but the apparatus is applicable also for heating the air. When the apparatus is used for heating a room, boiling water or boiling salts and water

are placed in the refrigerating-well A, instead of a frigorific salt, and kept hot by a spirit or other lamp. The air is forced by a pump or other air-propeller through the liquid by way of an inlet



pipe V and an outer channel V' provided at the bottom with a fine strainer J. The heated air passes off through an outlet pipe W, which is provided with a frame X fitted with divisions of wire or other gauze for arresting moisture and delivering it through a pipe to a receiver Y. It then passes through a partitioned chamber, the compartments Z, Z' of which contain perforated trays for holding respectively calcium chloride and pieces of quick or slaked lime or similar substances; calcium chloride in addition to absorbing moisture destroys miasm or germs of infection, and lime owing to its great affinity for carbonic-acid

gas and moisture completes the purification of the air. The air may also be passed through a chamber Z', containing one or more frames of flannel or the like supplied with water from above or below. This chamber may also be supplied with perfumes for odorizing the air, or with sulphurous or carbonic acid or other substance for medicating it. The air-propeller preferably consists of an oscillating cylinder, with piston fitting the cylinder sufficiently near to propel the air and loose enough to prevent friction by rubbing. In some cases, the air-propeller may be dispensed with.

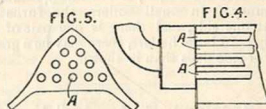
1214. Conlong, J. March 22. [*Provisional protection only.*]

Steam traps.—In a steam trap for steam pipes, drying-cylinders, heating-apparatus, &c., a hollow metal float surrounds an upright pipe in a cistern, provided with an overflow pipe. Water flows from the pipe into the float, which is thereby depressed, so that a valve-seating on it is drawn away from a valve on the pipe. The contents of the float then flow into the cistern. The float may also control an air admission valve, or this valve may be opened by a spring, and closed by the steam or water pressure.

1380. Gibbs, W. A. March 30.

Heating air.—Steam or the combustion products from a boiler or furnace are passed through

pipes A, Figs. 4 and 5, fixed in the air duct of an apparatus for drying grass, hay, or other substances. Air is forced into the air duct and is

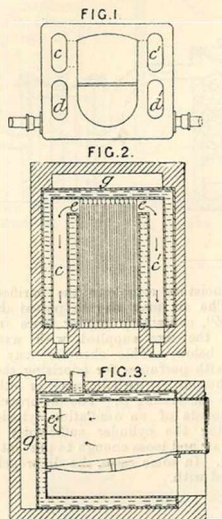


heated, passing thence to the drying-trough. The steam or other heating-agent passes away from the box by a chimney.

1511. **Mitchell, T.** April 10. [*Provisional protection only.*]

Heating buildings, metal pipes for. Steam pipes, for heating mills and other buildings, conservatories, hot-houses, and the like, are constructed of wrought iron and with a lap, riveted, dovetail, or other seam joint, which is brazed, and are coated inside and out with tin or its equivalent to prevent rusting.

1526. **Coulthard, J. W.** April 11.



Heating water.—Figs. 1, 2, and 3 show a boiler for heating greenhouses, buildings, &c. From the furnace the gases pass through openings *e* into the upper side flues *c, c'*, and thence back through the lower side flues *d, d'*, to the flue *g*, leading to the chimney. In small boilers, the furnace is placed at one side, and there is one pair of side flues only. In large boilers, there may be a greater number of side flues than is shown.

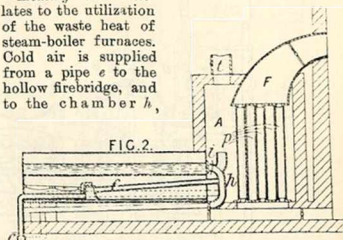
1602. **Shorland, G. L.** April 15. [*Provisional protection not allowed.*]

Heating buildings.—In order to assist in the conveyance of the sounds of the human voice &c. in churches, lecture halls, and similar places, currents of air issuing from openings and flowing past the speaker &c. are arranged to flow towards the distant parts of the building. The air so introduced may be used to increase or decrease the

temperature of the building and to assist in the ventilation, being for the latter purpose withdrawn through openings formed in the floor and communicating with an uptake or flue.

1658. **Pottier, C.** April 20.

Heating air.—Relates to the utilization of the waste heat of steam-boiler furnaces. Cold air is supplied from a pipe *e* to the hollow firebridge, and to the chamber *h*,



through pipes passing along the bottom and side flues. The chamber *h* forms the back wall of the rear flue *i* which connect the internal flue with the side flues. The heated air from the firebridge passes by a pipe *f* into the chamber *h*. From this chamber the heated air flows into a large compartment *A*, whence it passes by a pipe *t* to the place required. The compartment *A* is traversed by pipes *p*, through which the furnace gases pass from the bottom flue to the flue *F*, leading to the chimney. Cold air may be admitted to the compartment *A* through an opening in the side wall.

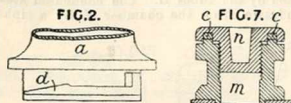
1750. **Noad, J.** April 26. [*Provisional protection only.*]

Non-conducting coverings and compositions.—Wood fibre or wood pulp is mixed with fusel oil or mineral or other solvent oil or oils in combination with gummy or resinous and other substances; in some cases, siliceous or silicious compounds, as, for example, any argillaceous, argillo-calcareous, or argillo-arenaceous matter, may be mixed with the wood fibre or pulp. The mass produced may be rolled into sheets or other forms and may be combined with canvas or other textile fabric or material as a backing or as a layer or strengthener. The invention is applicable, among other purposes, to the manufacture of non-conducting coatings or coverings for metal and other surfaces.

1825. **Watkinson, R., and Stafford, T.** May 1.

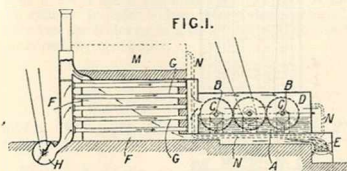
Footwarmers.—A stopper for a footwarmer or other receptacle consists of a screwed plug *n*, Fig. 7, holding in a recess an elastic ring *c*, which is compressed on screwing down the plug. The plug is made with a hole in which a carriage or other key is placed to turn it, or is milled on its edges. The joint may be made by an external screw, or by

forming projections *d*, Fig. 2, shown as applied to a pipe joint, on the plug. The projections engage



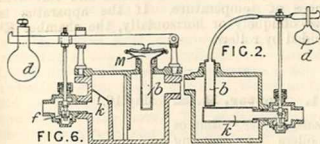
with other projections on the bush *m*, Fig. 7, and compress a packing-ring.

1849. Healey, B. May 2.



Heating air.—Air for use in the evaporation of water from saccharine and other solutions is forced by a fan *H* through pipes *G* to the evaporating pan *A*, and is heated in its passage through the pipes *G* by the waste heat from the combustion products which are used to heat the pan *A*. These combustion products, whether from the fire *E* or from separate furnaces, pass into the chamber *F*, which may be provided with baffles or partitions, and pass to the chimney after heating the pipes *G*.

1923. Barff, A., and Bradshaw, A. May 8.



Steam traps.—Relates to Hawes' and other traps in which the outlet valve is controlled by a vessel containing alcohol or other spirit, and consists in preventing damage to the vessel containing the spirit, and preventing the disarrangement of the apparatus by dirt entering with the steam or water. Fig. 6 shows a trap in which the valve *f* is controlled by a lever, actuated by a diaphragm *M* at the upper end of a strong copper vessel *b*. Dirt is arrested by diaphragms, attached to the casing and cover, and by a sieve *k*. Fig. 2 shows a trap in which the valve is controlled by a bent tube forming an extension of a strong copper vessel *b*.

A movable weight *d* is employed to adjust the movements of the valve. In another modification, a rotary valve, or plug, is used instead of a lift-valve. The valve shown in Fig. 2 is protected from dirt by a cylindrical sieve *k*, but other forms of sieve may be used.

1924. Mitchell, T., and Mitchell, M. May 8. [Provisional protection only.]

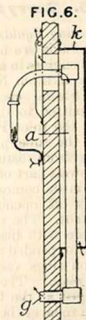
Heating water.—In an apparatus for ensuring that the safety-valve on a boiler shall blow off at the desired pressure, which is applicable in a modified form to domestic boilers, a water chamber, communicating with the steam and water space of the boiler, is connected at the top with a small cistern containing mercury. From the bottom of the cistern a pipe is carried upwards, opening into an enlargement which is open to the atmosphere and is at such a height that a column of mercury from the cistern to the enlargement corresponds to the working pressure. When the boiler pressure exceeds this, the mercury rises further, enters the enlargement, and unseals the mouth of a tube which leaves the side of the cistern and communicates with an india-rubber diaphragm working in a box containing water. The steam raises the diaphragm, which is connected by a spindle with the lever of the safety-valve.

1928. Wirth, F., [Stark, A.] May 8. Drawings to Specification.

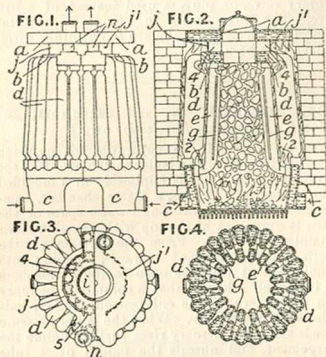
Non-conducting compositions.—In the cooking-apparatus described, a cooking-utensil is placed within a wooden box, which is lined with a non-conducting composition consisting, according to the Provisional Specification, of ash and soluble glass.

1940. Ritchie, C. May 9.

Heating air.—Relates to improvements on the apparatus described in Specification No. 3227, A.D. 1873, and consists in means for treating the products from gas and oil lamps, so that they can be discharged into the room, without deleterious effect. Fig. 6 shows an apparatus in which the products are conveyed down through a condensing-pipe *a* outside the building, and are discharged into the room at *g*. The pipe *a* is enclosed in a pipe *k*, in which an upward fresh-air current is induced. The air is heated and passes through an opening in the wall, covered by a perforated rosette.



1964. Metcalf, J. May 10.

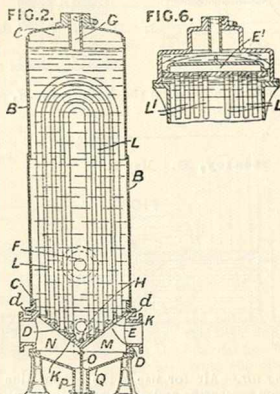


Heating water.—Figs. 1, 2, 3, and 4 show a circulating-boiler consisting of three annular water chambers, connected by vertical pipes. The upper chamber *a* is connected by pipes *n* to the chamber *b*, which is connected to the lower chamber by two rings of pipes *d, e*. The pipes *d, e* are of the cross-section shown in Fig. 4, except at the ends, where they are circular. Ribs *g*, cast on the sides of the pipes *e*, are in contact, and prevent the passage of the hot gases. In the space between the chambers *a* and *b* is a metal ring, and two pieces *j, j'* to form flues 4. The fuel is fed down through the passage way *i*, which is closed above by a dome. The gases pass up round the tubes *d*, and through the opening 5 into the flues 4.

1966. Berryman, R. May 10.

Heating liquids; heating gases.—Water, air, or other fluids are heated by the exhaust steam from steam engines in apparatus similar to that described in Specification No. 2218, A. D. 1871, [*Abridgment Class Steam generators*]. The water to be heated is admitted to the wrought-iron cylinder *B*, Fig. 2, by the inlet *F*, which is placed at a distance from the tube plate *D* in order to prevent the inflow from disturbing the sediment collecting on the lowest part of the tube plate. The tube plate *D* is made conical or concave, and is fitted with a blow-off opening *H* for the expulsion of the sediment. The upper surface of the tube plate is made with bosses *K*, and the ends of the tubes *L* are expanded into recesses in the bosses, and rest on rings cast on the lower surface of the tube plate. The outlet *G* for the hot water is arranged at the top so as to form an air space *c* which relieves the strain on the mechanism. The chamber *E* into which the exhaust steam is

admitted is cast with the tube plate *D*, and is divided by a partition *O* into two parts *M* and *N*, connected by the tubes *L*. The condensed steam is withdrawn from the chamber *E* by a siphon



pipe *P*, fitted to or formed on the bottom plate *Q*, and divided by the partition *O*. A separate pipe may be fitted to each part of the chamber *E*. The flange *C* of the cylinder *B* and the flange of the chamber *E* are constructed so as to leave a recess *d*, with a wedge-shaped section, for the reception of a rubber or other packing-ring. When used for heating air, the cold air is passed through the tubes *L*, and exhaust steam is conducted through the cylinder *B*. In a modification, the curved tubes are replaced by straight tubes *L, L'*, Fig. 6, supporting on their upper ends a chamber *E'*, which is free to rise and fall with changes of temperature. If the apparatus is placed obliquely or horizontally, the chamber *E'* is guided by rollers.

2111. Potter, H. A. May 18.

Heating water.—Relates to boilers for heating water for domestic or conservatory purposes. The firebox communicates, by one or more vertical passages, with a horizontal or inclined flue running from the front to the back of the boiler. Fig. 5 shows a vertical boiler, but the invention is equally applicable to horizontal boilers. The products pass through a flue *e* to a horizontal flue *f*, which has a cleaning-door in front. Pipes



for heating a conservatory or room may be connected to the inflow and outflow pipes *g, h*.

2159. Haddan, H. J., [*Goodwyn, S. T.*].
May 22. [*Provisional protection only.*]

Boiling-pans.—Relates to "steam culinary vessels", and consists in providing a cylinder round an ordinary cooking-vessel in order to retain heat round it. An ordinary boiler is provided with a projecting rim or rims to which the external cylinder is attached. When the boiler is placed upon a fire or stove, the heat rises between it and the cylinder in order to heat the material which is placed in the boiler or in a case suspended in water contained by the boiler.

2244. Wise, W. L., [*Susemihl, W.*]. May 27.
Drawings to Specification.

Heating buildings &c.—The exhaust from a steam engine is divided into two portions, of which the first is used for heating a large manufactory or other useful purpose, under a considerable pressure additional to that of the atmosphere, while the second is discharged with less resistance directly into the atmosphere.

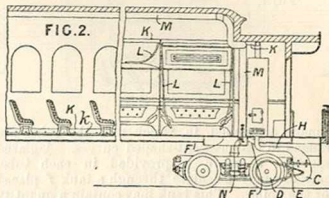
2472. Blamires, T. H. June 14. [*Provisional protection only.*]

Thermostats.—A valve, for controlling the flow of hot or cold water or other liquids, air, or gas in a conservatory or other building, or for extinguishing fires, is automatically operated by means of mercury, water, oil, alcohol, or other non-compressible fluid contained in a reservoir terminating at one end in a cylinder. As the fluid expands under a change of temperature, it acts on an elastic or other metal disc or a Bourdon tube fixed to the cylinder and connected by one or more levers to the valve. The apparatus may be connected to a ventilator in a similar manner.

2488. Alexander, E. P., [*Jenison, E. S.*].
June 15.

Heating buildings &c.—Relates to a method of warming public and private buildings by means of hot air. The invention is described as applied to a railway carriage. A pressure fan C enclosed within a casing and worked by a belt E from the axle of the driving-wheels D is fixed underneath and at one end of the platform of the carriage. A supply pipe F extending upwards from one side of

the fan casing to the centre of the carriage terminates in a box F¹, the lower and open end of which is covered by a screen to prevent the passage of dust and cinders. An air pipe H extends upwards from the upper side of the casing to a

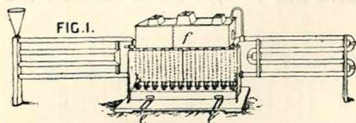


heater from which a pipe K extends along each side of the carriage. The pipe K is provided, at each seat or sleeping-berth, with small flexible pipes L within easy reach of the occupants of the seats or berths, so that each occupant can direct the current of air upon any portion of his person. The pipes L, when not in use, hang downwards, and the air currents impinge on the floor so that the lower portion of the room is thoroughly warmed and receives an abundant supply of pure air. The whole or a part of the air supply, instead of being taken from the external atmosphere, may be drawn from the upper part of the compartments, where the air is comparatively pure, and returned after being passed through the heater. For this purpose, a pipe M is led from the upper part of the interior of the car to the air-supply pipe F, so that the fan can draw the air from the upper part of the carriage. By means of a valve N at the junction of the pipes F, M, either pipe may be wholly or partially shut off from the fan. A chamber on one side of the supply pipe F communicates with the fan casing and is provided at one side with a valve through which air can pass to the pipe F; when the pressure of the air in the delivery pipes exceeds a certain amount, the valve opens and allows air to escape from the fan casing. The main delivery pipe K may be placed along each side of the car near the floor and be provided with small openings *k*.

2580. Wenn, J. B., and Dashwood, A.
June 22.

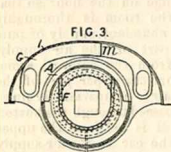
Heating water.—Relates to apparatus for heating greenhouses, forcing pits and frames, churches, schools, &c., also applicable for Turkish and other baths. Fig. 1 shows an arrangement in which oil burners are used as a source of heat, but gas jets may equally well be used. The boiler is rectangular, and has a number of tapered vertical tubes, the lower ends of which project, and enclose the oil burners. A part of each tube is cut away, and a corresponding part is secured to the burner.

The burners can thus be withdrawn horizontally from the tubes. To facilitate their withdrawal, the reservoir is mounted on wheels, running on rails *e*. The boiler may have concave sides, or may

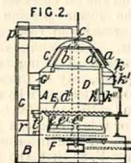


be made egg-ended, in which case the tubes are arranged in two crescent-shaped curves. A glazed inspection aperture is provided in each tube. The water may circulate through a tank *f* placed over the boiler. This tank may contain a quantity of water sufficient for a bath. When a round or oval boiler is used, the tank *f* is made mushroom-shaped.

2634. McAvoy, H. L. June 26.

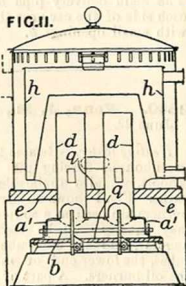


Heating air.—Figs. 2 and 3 show a cylindrical closed stove, the back part of which is enclosed by a casing *I*. Air is admitted to this casing by a passage *r*, and is conveyed by pipes to the upper apartments for heating and ventilating purposes.



2813. Rippin-gille, E. A.
July 11.

Heating water.—Fig. 11 shows a boiler for heating water for baths &c. by means of a lamp stove. The boiler *h* is of Π -section, and encloses the chimneys.



2901. Stainton, W. July 15. *Amended.*

Heating by liquid circulation.—By using liquids having low freezing points and high boiling points, such as a solution of calcium chloride or similar salt, or a mixture of glycerine and water, or both combined, the formation of ice in hot-water apparatus is prevented, and the apparatus may be heated to a temperature greater than 212° F.

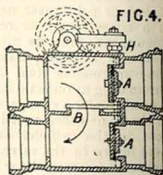
2949. Liddicott, P. July 19. [*Provisional protection only.*]

Heating water.—Relates to an apparatus for use by butlers, and others, for supplying hot water, and warming plates, pastry, &c. A box or case, mounted on a stand or otherwise, is lined with sheet metal, and is divided into four compartments, one of which serves as a tank for hot water. A second compartment is fitted with removable fluted fillets to hold the plates or other articles to be warmed. A third shallow compartment serves as a strainer for plates, and a fourth compartment arranged beneath the last-named shallow compartment is fitted with a door and forms a hot-closet. Between the second and third compartment is a double partition, at the top of which is hinged a rack free to be turned to cover either of these compartments and to serve as a strainer or plate rack. Pipes lead from the several compartments, and are fitted with taps to draw off the contents. The apparatus is heated by a lamp, or by gas.

2994. Messenger, T. G. July 25.

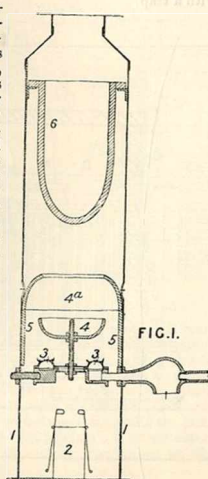
Heating by water circulation.—Relates to valve-boxes for controlling the circulation of hot-water. Fig. 4 shows one form.

Two valves *A* are carried by the same spindle *H* operated by worm and quadrant gear. A third valve in the partition *B* is actuated at the same time, so that when the valves *A* are closed, the valve in the partition *B* is opened, and *vice versa*. In cases where there is not a third valve, the valves *A* are so arranged that one is opened while the other is closed. The box is fitted with lids to allow of access to the valves for cleaning or repairs. A second chamber on which pipe sockets or flanges are cast may be used in combination with the valve box.



3033. Newton, W. E., [Felix, J., and Moulin, F.]. July 27.

Heating air.—Relates to apparatus for destroying noxious gases in sewers, drains, hospitals, schools or colleges, law courts, and other places, the apparatus being stated to be applicable also for warming such buildings or places. A copper or other metal cylinder 1 communicates with a flue or chimney, and has at the base an inlet 2 fitted with pivoted valves opening inwardly. An annular gas burner 3 is fitted above the inlet and provided with a dished deflector 4 of fireclay or the like, by which a high temperature is maintained in the interior, and a fireclay cylinder or lining 5 supports a curved cap or dome 4^a. An inverted conical vessel 6, made of fireclay, porous earthenware, &c., and filled with sand or powdered chalk, is supported by lugs in the upper part of the casing to prevent the heat from passing off too rapidly and also to prevent draught. Holes are also made in the sides of the cylinder to promote the draught.



3091. Hunt, B., [Brock, A. D.]. Aug. 2.
Drawings to Specification.

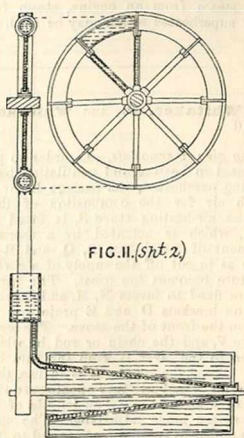
Heating buildings &c., radiators for. A pipe, bent into a double coil from the centre outwards in opposite directions and having the ends brought out on opposite sides, is used for radiating heat.

3118. Oosterwyck, J. B. van. Aug. 5.

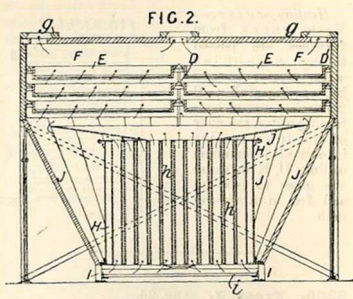
Heating-apparatus.—Fig. 11 shows “apparatus for obtaining heat mechanically.” No further description is given.

(For Figure see next column.)

3118.



3119. Thomson, W. R. M., [Mackenzie, F. W.]. Aug. 5.



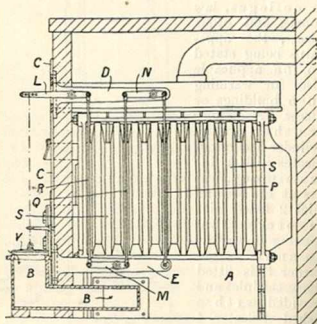
Heating air in apparatus for drying tea. A cylindrical chest H, Fig. 2, fitted with a number of steam-heated tubes h, is mounted upon an open rectangular frame I fitted with a sliding tray i over which the air passes to the tubes h. Steam is admitted to the lower front part of each chest H by a pipe fitted with a regulating tap, the steam coming into contact with the outer surfaces of the tubes. A conical baffle-plate j distributes the heated air under the whole of the drying trays E.

The air current is regulated by the slides *g*. Exhaust steam from an engine, steam from a boiler, or superheated steam may be used. Each

vessel is provided with a pipe for the escape of condensed steam to a main pipe which is fitted with a trap.

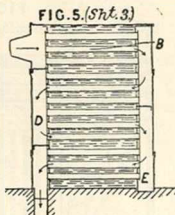
3166. Whitaker, T., and Whitaker, W.
Aug. 10.

Heating air; thermostats.—In order to prevent the air used in heating and ventilating buildings from being overheated, the passage *B*, by means of which air for the combustion of the fuel enters the air-heating stove *S*, is fitted with a valve *V*, which is actuated by a thermostatic arrangement of metal bars *P*, *Q*, and *R* in the stove, so as to cut off the supply of air when the temperature becomes too great. The bars *P*, *Q*, and *R* are fixed to levers *N*, *M*, and *L*, which are pivoted on brackets *D* and *E* projecting from a plate *C* on the front of the stove. The weight of the valve *V*, and the chain or rod by which it is connected to the lever *L*, keep the bars *P* &c. in tension. When the apparatus is in use, the doors of the stove are closed. The lengths of the bars and levers are made adjustable. The apparatus may be applied to ventilating-flues and to furnaces.



3289. Charpentier, P. Aug. 22.

Heating water.—Waste gases from furnaces are passed through a tubular water heater formed by passing tubes *B* through a vessel containing water, the ends of the tubes opening into divided chambers or flues *D*, *E* to cause the gases to pass to and fro in a zig-zag path.



3365. Frost, J. Aug. 26.

Heating water.—In order to purify water containing magnesium and calcium sulphates for use in boilers, barium hydrate is added to the water and the magnesium and calcium hydrates formed are converted into insoluble carbonates by exposure to the air or by the addition of sodium carbonate, soda ash, or "crystal." In another method, barium sulphide is added to the water and iron perchloride is then added to convert any soluble calcium sulphide produced into iron sulphide and calcium chloride. The water is

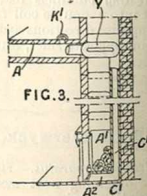
allowed to stand so that the iron salt may settle and may oxidize if any of the iron salt is dissolved.

3370. Redfern, G. F., [Sack, O., and Reunert, J.] Aug. 28. *Drawings to Specification.*

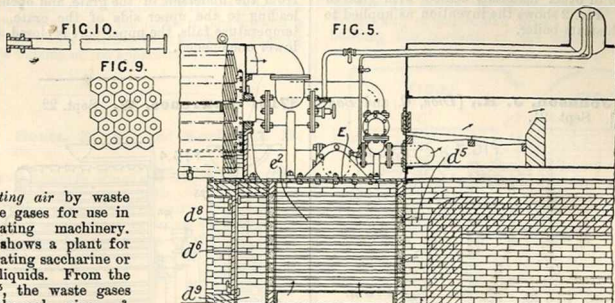
Heating air.—Air for use in a gas-producer is heated by passing it through a jacket surrounding the exhaust pipe of a gas engine.

3451. Johnson, J. H., [Beauumont, E. H. de la Bonnière, Vicomte de]. Sept. 1.

Heating air.—A pipe *C* rising from a box *A*² below the fireplace *A*¹, conveys heated air into a hollow block *A* from which it passes into the room of the floor above, by an outlet *K*¹. The pipe *C* is bent at *Y* so as not to obstruct the chimney.



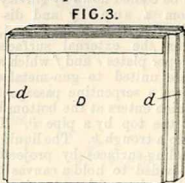
3539. Murdoch, H. H., [Kirkpatrick, R. S.]. Sept. 8.



Heating air by waste furnace gases for use in evaporating machinery. Fig. 5 shows a plant for evaporating saccharine or saline liquids. From the flue d^5 , the waste gases pass through pipes e^2 , traversing the air-heating chamber E, into a flue d^8 , and thence by a flue d^8 to the chimney. A man-hole cover d^9 allows access to the tubes for cleaning purposes &c. The pipes e^2 are cast with a pair of square or hexagonal flanges at each end, as shown in Figs. 9 and 10. Thus when the tubes are placed in position, continuous walls are formed, as shown in Fig. 9. The spaces between the walls are filled with sand to make airtight joints. The air enters below, and passes up among the tubes to the delivery pipe.

3584. Smith, E. B. Sept. 13.

Non-conducting coverings.—In a refrigerator, the preserving chamber is lined with air-cells formed in sections D. The cells are formed of water-proof paper secured to division frames, the joints being airtight. Tongues d are formed on each section for securing the sections to one another and to corner pieces.

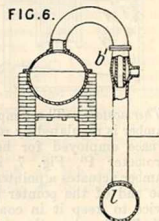


3594. Carré, F. P. E., and Jullien, E. Sept. 13. Drawings to Specification.

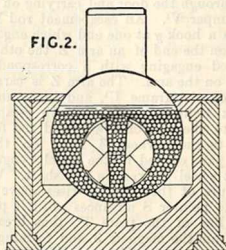
Non-conducting coverings for the walls of refrigerating-chambers. To prevent subsidence of non-conducting materials, such as wool, flocks, &c., they are cemented to the walls by quick-drying oil varnish; or bundles of straw, cut even at their ends, may be placed upright one above another; or carded wool is surrounded by woven fabrics and held by cappadines passing through the layer, the fabrics thus formed being nailed or cemented to the walls.

3645. Smith, J. Y. Sept. 18.

Digesters.—Fig. 6 shows a closed vessel for treating offal or vegetable or other refuse, or for boiling bones or soap, or in other operations in which noxious fumes are generated. By means of an ejector or jet pump b^1 , of special construction, the fumes or vapours are discharged into a drain or sewer l .



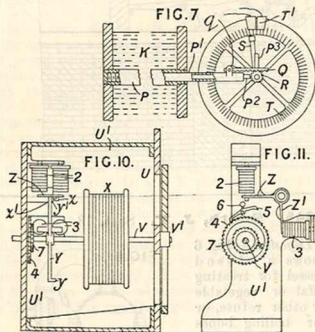
3649. Hirsch, H. Sept. 18.



Heating water.—Boilers are filled nearly to the water level with small balls or particles of glass or

other vitreous, non-oxidizable, or non-soluble materials, or of other materials coated with glass or the like. Fig. 2 shows the invention as applied to a Cornish steam-boiler.

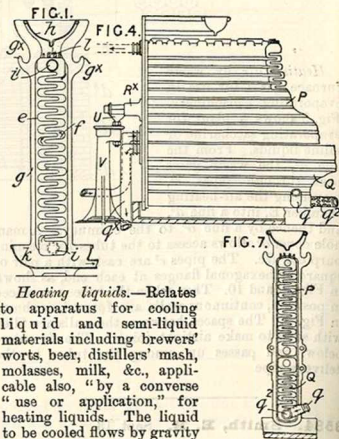
3706. Johnson, J. H., [Dion, C., and Baylis, J.]. Sept. 21.



Thermostats.—The temperature of a tempering-chamber is regulated by regulating the blast to the furnace employed for heating the chamber. A pyrometer P^1 , Fig. 7, in connection with the chamber actuates a pointer S moving over a dial T . The end of the pointer is formed with a suitable device to keep it in contact with the face of a plate T^1 placed on the circumference of the dial. The plate is isolated from the dial, and is divided into two parts separated by non-conducting material. The inner end of the pointer S is connected to the negative poles of two electromagnets 2, 3, Figs. 10 and 11, and the two parts of the plate T^1 to the positive poles. A frame U^1 secured to the door U of the blasts carries a shaft V , passing through the door and carrying on its inner end a damper V^1 . An escapement rod Y on the shaft has a hook y at one end which engages with a hook z on the end of an arm Z , the other end y^1 of the rod engaging with a corresponding projection z^1 on the arm. The arm Z is carried by a support on the frame U^1 , and turns an arm Z^1 nearly at right-angles to it. An escapement 5 pivoted to the end of a weighted rod 6 engages with a toothed wheel 4 loose on the shaft V , and a pawl carried by the wheel 4 engages with a ratchet-wheel 7 fixed on the shaft. When the temperature of the chamber rises above a certain point, the pointer S advances until it passes the division line of the plate T^1 , thus breaking the current from the magnets 3, and forming a circuit with the magnets 2. The arm Z is then attracted by the magnets 2. The projections y^1 , z^1 are disengaged, and the rod Y revolved by the action of a drum X on the shaft V , until the hooks y , z

engage. The damper V^1 thus cuts off the blast from the underside of the grate, and opens a port leading to the upper side of the grate. If the temperature falls, the upper port is closed and the lower one opened.

3713. Lawrence, W. Sept. 22.



Heating liquids.—Relates to apparatus for cooling liquid and semi-liquid materials including brewers' worts, beer, distillers' mash, molasses, milk, &c., applicable also, "by a converse use or application," for heating liquids. The liquid to be cooled flows by gravity from a supply and distributing trough h , Fig. 1, over the external surfaces of two corrugated copper plates e and f which are soldered and otherwise united to gun-metal end-plates g so as to form a serpentine passage for the cooling-liquid which enters at the bottom by a pipe i and escapes at the top by a pipe l . The liquid is distributed over the cooling-surfaces by projections l . Hooks g^x are provided to hold a canvas or india-rubber screen when the refrigerator is in use. Fig. 4 shows another arrangement of the apparatus, the cooling-chamber being carried on trunnions R^x turning in vertically-adjusted bearings U on pillars V , so that the apparatus may be used in an inclined position, or turned over, or placed in any position for cleaning and washing out. The liquid to be cooled flows successively over the surfaces of two sets of serpentine passages P and Q , Fig. 7, through which two refrigerating liquids at different temperatures are simultaneously circulated. The single apparatus may also be mounted on trunnions. The cooling water enters by a pipe q which is connected with a perforated pipe q^1 for the better distribution of the liquid. The water escape pipes q^x may be led to the cold-water tank. Milk may be first heated in the upper compartment P , and then cooled in the lower compartment Q , the object of the process being to purify the milk by "arresting

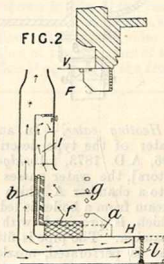
"decomposition;" for the same purpose, water is treated by passing it continuously from the bottom and upwards through the inside of the apparatus to heat the water, which is then cooled by running over the outside of the apparatus.

3773. Scott, H. P., and Zerbe, B. H. Sept. 28.

Non-conducting coverings and compositions.—Mica is pulverized and mixed with cotton, hemp, or other fibrous material. The mixture is used as a non-conducting packing or covering for steam engines, safes, boilers, steam or hot-air pipes, roofs, &c.

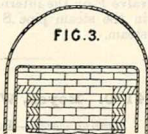
3790. Dalziel, T. B. Sept. 29.

Heating air.—The air entering an apartment is warmed by contact with a hollow hearth H of a fireplace. The hearth H is supported above a hearthstone by legs l, thus forming a chamber communicating with the outer air by a hole in the wall behind the fireplace.

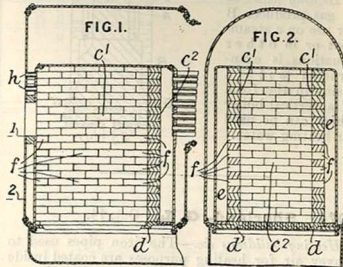


3893. Lane, T. Oct. 7.

Heating water and other liquids.—The firebox of the boiler is provided with a chamber of fireclay or other suitable refractory material enclosing the fire for the purpose of retaining the smoke &c. until it is completely consumed. The smoke &c. rises to the top of the chamber, descends again, and then passes through openings at the sides. The arrangement is described in connection with a locomotive firebox but is also applicable to apparatus for boiling or heating liquids. Figs. 1 and 2 show sections of the arrangement taken at right-angles to one another. The top and front of the chamber are formed by the crown and front of the firebox, and the remaining walls c^1 , c^2 are supported on a plate d surrounding the firebars, a tight joint being made to prevent the entrance of air. The side



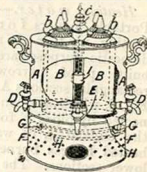
openings f lead into the side spaces e of the firebox and are formed by leaving open spaces in the brickwork; or perforated bricks may be used in building the portions of the walls between the



lines 1, 2. Air is admitted to the chamber through hollow stay h fitted at the upper part of the front of the firebox, and also through perforations in the firedoor. In some cases, small apertures are formed through the brick walls, so that if any unconsumed gases pass through the side openings f with the draught, they will be consumed by heated air passing through the small apertures. Firebricks or the like form distance-pieces in the side spaces e outside the chamber, and hoop iron may be worked into and among the firebricks to strengthen the walls. In Fig. 3, the side walls terminate below the top of the firebox, thus exposing nearly the whole of the crown-plate to the fire.

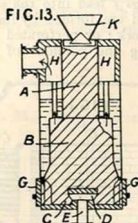
3917. Meinen, J. C. Oct. 10.

Heating water and other liquids.—In a combined apparatus or urn for supplying hot water and various hot beverages, the cylindrical or other receptacles B which contain tea, coffee, milk, or other beverages, dip into the cylindrical vessel A which is closed at the top. The receptacles B are provided with removable covers b and with taps D. The vessel A which contains water is also provided with a tap E and a cover c. A rod attached to the float I passes through guides in the cover c and is raised a short distance by the water in the vessel A, but falls when the water level descends below a certain point. The urn is supported on the hollow base F by rollers G which run on a flange H fixed inside the base. Within the latter is a ring of gas jets for heating the water &c. The urn is provided with handles for lifting and turning it.



3949. Brook, E., and Wilson, A. Oct. 12.

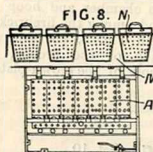
Heating water.—A gas producer B for use on a steam-boat or in other situations is constructed with a casing in the form of a vertical boiler which can be used for heating water.



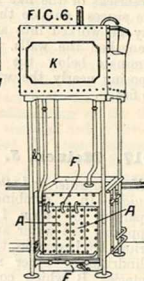
3974. Shorland, G. L. Oct. 14.

Heating buildings &c.—The iron pipes used to convey air for heating purposes are coated inside and outside with glass enamel, to give them a smooth surface which will not retain dust &c. The openings of the pipes may be coloured to harmonize with the decorations of the building.

4106. Leoni, S. Oct. 24.



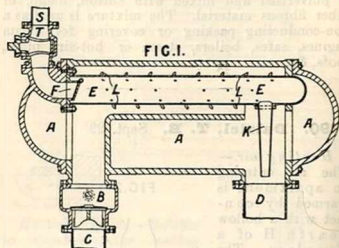
Heating water.—Portable boilers for heating water for domestic purposes are built up of narrow rectangular sections A, Fig. 6, which are connected by pipes F for the circulation of water through them and are heated by gas burners E placed underneath the lower sections. The plates on the ends of each section are provided with handholes and project beyond the sides, top, and bottom of the sections so that flues for the passage of the hot gases are formed between the sections. The whole arrangement may be enclosed in an outer case and may be fitted with an overhead water tank K or with a hot-air closet or with a steam-chamber M, Fig. 8, into which steam cooking-vessels N are inserted. Another form of section which may be used consists of two of the rectangular sections connected at the back by a transverse section so that a central space for the passage of the hot gases is formed when the front cover is attached.



4122. Grout, J. Oct. 24. *Drawings to Specification.*

Non-conducting coverings.—A food-warmer is covered with a non-conducting covering of flannel, or of thick hair felt round which successive layers of brown paper and baize, wood, or thin metal are wrapped.

4130. Sambrook, W. Oct. 25.

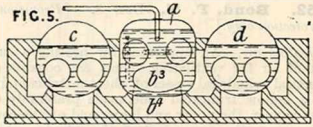
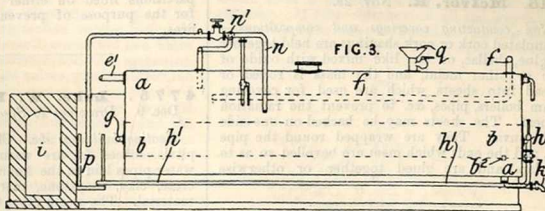


Heating water.—In an apparatus for heating water of the type described in Specification No. 596, A.D. 1873, [Abridgment Class Steam generators], the water passes by a non-return valve B into a chamber A which has a delivery pipe D. Steam from a boiler is led into an internal pipe E, which is provided with a cock T outside the chamber. The pipe is fitted with a drain pipe K and is perforated, nozzles L being fitted on the perforations. The chamber may be provided with a diaphragm and an internal pipe through which the internal steam pipe passes, so that the water comes into more direct contact with the steam. The steam intermingles with the water, a non-return valve F on the internal pipe preventing concussion in the steam pipe S due to condensation of the steam.

4180. Boyes, W. Oct. 28.

Heating water.—For purifying and heating river or other water for steam boiler-feed and for other purposes, the water is treated in a boiler-shaped vessel a, Fig. 3, placed at the side of one or more steam boilers, the heating being effected partly by the circulation of waste gases from the boilers, and partly by the exhaust or other waste steam from steam engines or from other sources. An outer flue i passing round the vessel a, communicates with the boiler flues, dampers being fitted to cut off the flue i when required. The river or other water enters by the pipe e', and the hot-well water enters by the pipe n which is connected by a branch n' with a pipe leading in the condensing water of the engine. The exhaust steam enters by

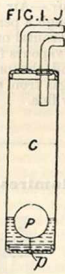
the pipe *f*. The vessel is provided with two flues *b*, and the water passes through an opening into one flue *b* and circulates through a pipe *g* into the other flue, and then passes to the discharge pipe *h* which is fitted with a thermometer, and a valve, to shut off the water which passes through the pipe *h* to a pump at *p*. The circulating-liquid deposits its impurities at the bottom of the vessel and in the flues. A blow-off mud-cock *k* is provided at the front of the vessel, and plugs *b'* are fitted to each flue *b* to run the sediment into the vessel *a*. A hopper *g* is provided for mixing the chemicals used for preventing incrustation or precipitating impurities. In a modification, shown in Fig. 5, the vessel *a* is made square-shaped as shown or otherwise, and is fixed between two boilers *c* and *d*, the sides of the vessel forming a portion of the side flues of the boilers which unite in a flue *b'* opening at the front



into a smoke flue *b'* leading to the chimney. When steam is generated in the closed vessel *a*, it may be utilized for drying or for other purposes.

4271. **Wise, W. L.**, [Herreshoff, J. B., and Herreshoff, J. B.]. Nov. 4.

Steam traps.—The receiver *C*, into which the generated steam and remaining water are passed from a coiled water-tube boiler, is fitted with a steam trap, formed of a float *P* and valve *p*, for discharging the water.

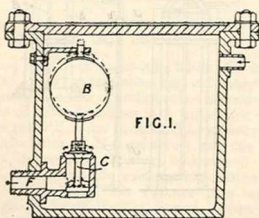


vessels containing or conveying steam. The stem of the valve *C* is fitted with a float *B*, made of wood or other light material, or consisting of a hollow copper ball, which is lifted by the accumulating water so as to open the valve *C* and discharge the water through the opening *F*.

4488. **Quick, R.** Nov. 20. [Provisional protection only.]

Heating water.—Relates to the heating of baths by means of gas jets under the bath. The burners are surrounded by a rim or flange to confine the hot gases, which pass to one end of the bath along a passage or flue at the bottom and return along a similar flue to an outlet outside the rim or flange. The aperture through which access is had to the burner is closed by a door or slide of perforated metal, which admits air freely. A metal tray containing sand is placed below the burners.

4373. **Hamer, W.** Nov. 11.



4612. **Tongue, J. G.**, [Montgomery, A.]. Nov. 29. *Drawings to Specification.* [Provisional protection only.]

Non-conducting coverings.—Relates to the use of a vacuum chamber or a vessel surrounded by a vacuum chamber for keeping the contents of the chamber or vessel either warm or cold or at a uniform temperature, and is stated to be applicable to ice-houses, refrigerators, steam boilers, engines, &c.

Steam traps for steam pipes, cylinders, and other

4616. McIvor, R. Nov. 29.

Non conducting coverings and compositions.—Granulated cork or cork shavings are held together by glue, shellac, or the like mixed with oxide of zinc or other metal, and the mass is rolled or spread into sheets which are used for covering steam boilers, pipes, &c. to prevent the radiation of heat. The sheets may be backed on one side with canvas. They are wrapped round the pipe &c., and the ends which meet are bevelled so as to overlap, and are glued together or otherwise connected.

4752. Bond, F. T. Dec. 8. [*Provisional protection only.*]

Heating air.—An apparatus for heating a current of air for ventilating rooms &c. consists of a vertical cylindrical vessel of sheet metal containing a hollow truncated cone, made preferably of sheet copper, the upper and larger end of the cone fitting upon the upper end of the cylinder, while the lower end is connected by a tube to a source of fresh air. The air passing through the conical vessel into the room is heated by burning jets of gas issuing from a tube surrounding the vessel, or by one or more circular wicks burning benzoline or other hydrocarbon. The cylinder is supported on small feet attached to its lower edges. The combustion products pass away through a pipe connected to a hole in the upper part of the side of the cylinder. To reduce the temperature of the combustion products, they may be led through a number of smaller pipes which cool them as they pass from the upper parts of the cylinder to a circular chamber surrounding the base of the cylinder, to which chamber the chimney is attached.

4762. Windhausen, F. Dec. 8. *Drawings to Specification.*

Heating air.—Air for heating and drying purposes and for ventilation is heated by compressing it in a piston pump. The air at atmospheric pressure is drawn into a cylinder by the movement of a piston, is expanded and cooled by closing the inlet early in the stroke, and is forced through a cooling-chamber in which it is warmed slightly by the heat given up by the substances therein. The air is drawn from this chamber by another piston pump and is compressed back to the atmospheric pressure, becoming hot in the operation. The piston-rods of the two pumps are connected by a beam and operated by a crank or other means.

4768. McKenzie, G. R. Dec. 9.

Compositions, non-conductors of heat.—A mixture of ground crystals of sodium carbonate and saw-dust is filled in between the floors and ceilings of buildings and also in the internal spaces of wall

partitions lined on either side with thin wood, for the purpose of preventing the spreading of fires.

4775. Lake, W. R., [*Linsley, J. S.*]
Dec. 9. *Drawings to Specification.*

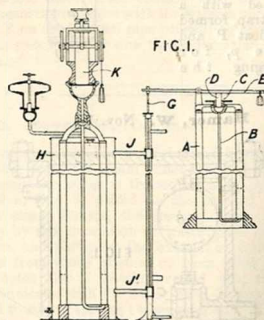
Heating buildings &c.—Churches, schools, hospitals, offices, &c. are warmed by steam or hot water pipes laid in the floors under slabs of concrete, clay, soapstone, marble, or other suitable material. The steam pipes are laid in an inclined position to allow condensed water to run off. The slabs may be supported by perforated concrete slabs, if desired.

Heating air.—Air for the ventilation of the buildings mentioned above is heated by passing over steam or hot-water pipes or other heat-radiating apparatus placed over the apertures of horizontal flues leading into a large air reservoir in the lower part of the building.

4807. Ritchie, C. Dec. 13. *Drawings to Specification.*

Heating air.—Air for ventilation is heated by passing through a perforated casing surrounding a series of horizontal or vertical pipes used for condensing the vapours from a gas lamp; or the casing may surround the pipe for conveying the smoke and heated gas from a gas stove or a fireplace to the chimney flue.

4816. Blamires, T. H. Dec. 13.



Thermostats.—Liquid contained in a closed annular vessel A has an outlet by the tube B into

a cup C closed by a diaphragm. As the liquid expands or contracts, the diaphragm is raised or depressed, thereby giving motion to the piston D which bears upon the lever E connected to a valve rod G, or direct to ventilator and like apparatus. The valve rod G operates valves which control the flow to the vessel H of hot water by the branch J and cold water by the branch J'. The vessel H contains a vessel similar to the vessel A, and the variations of the liquid which it contains gives motion to the piston K. From this, power is taken by rope and pulley, rack and pinion, or bell-crank gear. The piston may be packed by means of a cup-leather, instead of using a diaphragm, or the piston may be dispensed with, a Bourdon gauge tube being employed. The lever E may be operated by an electromagnet, the circuit of which is closed by the expansion of a mercury column. The apparatus is stated to be applicable for controlling the flow of hot or cold water, steam, gas, &c. through pipes, and for regulating the temperature of rooms, buildings, baths, dyers' and brewers' vats, and for regulating chemical operations or other purposes which can be effected by the opening or closing of valves, ventilators, &c.

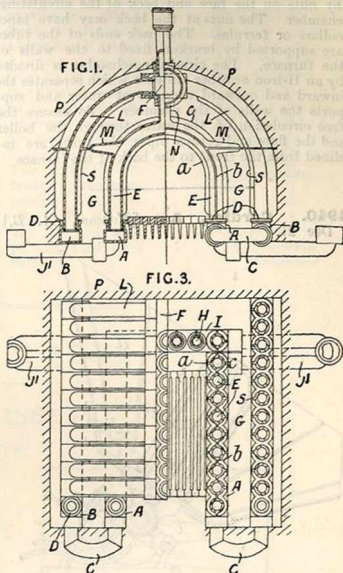
4817. Gray, D. Dec. 13. [*Provisional protection only.*]

Steam traps.—An apparatus used for separating water from the compressed air employed for working coal-cutting machines but also applicable for separating water from steam or other compressed fluids is provided with a trap for the escape of the separated water. The casing in which the water accumulates is provided with a float connected by a lever to a hollow cylindrical piston valve, which is acted upon by the pressure at each end. When water requires to be discharged, the float rises and moves the valve so that holes in the inner side of the valve shell, through the valve, and through the outer side of the valve shell and of the main casing are brought into line, the water being then discharged by the internal pressure. When used with steam, one connection only between the apparatus and the steam pipe is necessary, and the steam need not be passed through the apparatus.

4879. Seward, A. Dec. 18.

Heating water.—A water-tube boiler for heating water for conservatories, churches, and other buildings consists of a row of arched tubes E surmounted by a row of tubes L and set in a brickwork casing P. The tubes E, L are connected by sockets D to rectangular tubes A, B respectively, and the tubes A, B are connected at the front by bends C. The tubes E, L lead into the rectangular outflow pipe F. The gases from the furnace pass through the screen of tubes H, Fig. 3, and return from the combustion chamber at the back by the flues G, N, then passing over the pockets M, Fig. 1,

which form a partition, along the flue G to the chimney. If the chimney is at the front, the gases are led from the combustion chamber along the flues G also. Each of the tubes E carries



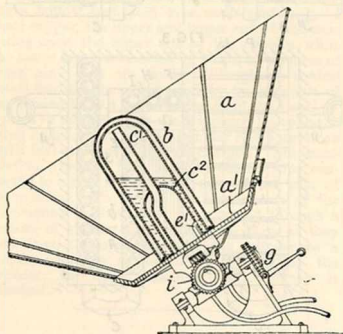
flanges a, c, serving as baffles, and two flanges b which separate the flues G, from the furnace chamber. The tubes L have flanges s serving as baffles. The vertical tubes H, Fig. 3, at the back of the furnace are formed with or are attached to an arched tube similar to the tubes E, and at their lower ends are attached to a rectangular tube L, which is connected by bends J' to the longitudinal tubes A so as to maintain the circulation in the tubes H. The outer set of tubes L may be omitted, and two or more screens of tubes H may be used.

4899. Rivers, E. G. Dec. 19. [*Provisional protection only.*]

Heating water.—A tubular boiler for heating water for warming conservatories, greenhouses, and other horticultural &c. buildings is constructed with pairs of wrought-iron or other suitable tubes set horizontally above the firebars and screwed

into and passing through a saddle-shaped circulating-chamber forming the front of the boiler, the screwed parts of the tubes being perforated to allow the water to circulate between the chamber and the tubes. The tubes are secured by nuts on the face and back of the circulating-chamber. The nuts at the back may have taper collars or ferrules. The back ends of the tubes are supported by brackets fixed to the walls of the furnace. The circulating-chamber is divided by an H-iron or other stiffener which separates the inward and outward currents of water and supports the walls of the chamber. To ensure the free circulation of the water through the boiler and the flow and return pipes, the tubes are inclined from the front to the back of the furnace.

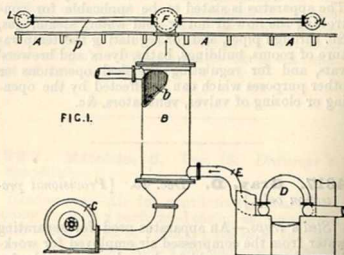
4940. Cordier, A., [Mouchot, A. B.].
Dec. 21.



Solar heat, utilizing.—Relates to a method of and apparatus for utilizing the sun's rays for generating steam, boiling and distilling liquids, cooking, desiccating various materials, melting ores and metals, and for sugar-making and other purposes. The Figure shows the apparatus for generating steam. A reflector *a*, shaped as a truncated cone, is mounted on a frame driven by clockwork *g* so that its axis is kept perpendicular to the sun's disc. By means of suitable gearing *i* it is also adjusted in correspondence with the inclination of the earth's axis. The smaller base of the truncated cone is closed by a plate *a'*, in the centre of which is set a boiler composed of two concentric shells of copper *c*, *c'* provided with rounded tops. The liquid under treatment is contained in the space between the two shells and the boiler is fitted with the usual safety and other appliances connected to pipes *e*. It is blackened on the outside, and covered with a glass cover *b*. For large apparatus, the reflector may be formed of a series of blades fitted on a frame, as shown, and for small ones the reflectors may be made to fold up like a fan. Two or

more pieces of apparatus may be arranged in series, in which case the generated steam is collected in a separate boiler and heated again before it is used, and the regulating apparatus is arranged to adjust all the reflectors simultaneously. For sugar-making and other operations where a high temperature is not required, the boiler may be made of iron, clay, glass, or other material, and the cover *b* may be of coloured glass or porcelain, or it may be dispensed with. To increase the heating-surface of the boiler, it may have a ribbed surface, or it may be composed of straight or heliocoidal pipes.

4961. Hoynes, J. F. Dec. 22.



Heating air.—In a method of heating air for use in disinfecting, and drying manures and other substances, the air is forced by a fan *C* into a vertical cylindrical jacket *B* containing a cluster of tubes *b* supplied with superheated steam from a superheater *D* by a pipe *E*. Or the steam may circulate round the tubes, and the air pass through the tubes. The heated air passes from the chamber *B* by a pipe *F* to the drying-apparatus. The condensed steam may be drawn off through an ordinary waste pipe, which may convey it to another superheater.

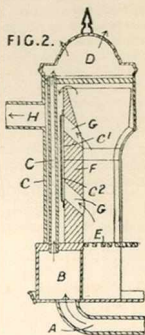
5016. Imray, J., [Brüll, A., and Besson, P.].
Dec. 28.

Non-conducting coverings and compositions.—Relates to the manufacture of a material compounded of cork and fibrous pulp, for use as a non-conducting casing for boilers, pipes, and the like, and for other purposes. The pulverized cork is intimately mixed with the paper pulp in excess of water, and the mixture kept agitated to promote the felting of the pulp fibres. Pulp rags of good quality, or pulp from the waste of linen or hemp thread, or from old ropes, is preferred. Soft wood may be substituted for a portion of the pulp. The materials are mixed together in a rag engine. The rags or other fibre may be first reduced to pulp in the engine, and the cork afterwards added. The mixture is run into a vat together with the water,

and is afterwards made into sheets, or moulded into blocks. The material is treated either in the ordinary frames used for hand-made paper, or in the ordinary continuous paper-making machine, when it is desired to produce sheets. The hand-frames are dipped into the vat so as to take up the material, the water draining off through the wire gauze, and the frame being shaken so as to equalize the pulp. The cover is then applied and pressed down, and the sheet couched upon a sheet of felt, alternate sheets of the material and the felt being thus piled one over the other to a sufficient height for charging into the press. The sheets are pressed in a hydraulic or other press, then placed in a drying-room, and afterwards calendered. When moulding the compound, the moulds are filled with the mixture, and, after allowing the water to drain off, the pulp is pressed, and then removed from the mould and dried. The moulds are made of several pieces of porous material such as plaster, perforated metal, wire gauze, &c.

5037. **Oake-shott, R. S.**
Dec. 29.

Heating air for ventilation. The fresh air entering a chamber B under a stove by the inlet A is heated in tubes C leading to the chamber D, whence the heated air flows into the apartment &c. The tubes C are heated by the gases passing from the grate E to the flue H, and are protected by a baffle c^2 .

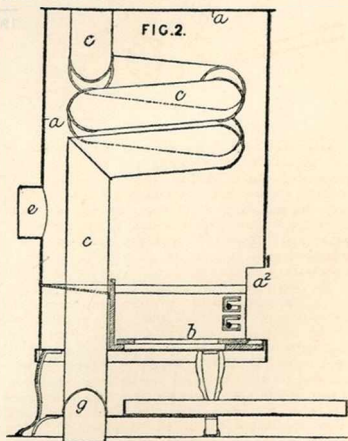


APPENDIX.

A.D. 1867.

2853. **George, R.** Oct. 11.

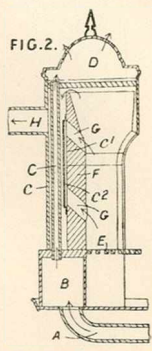
Heating air.—An air-heating pipe c , with coils or convolutions as shown, is fitted within a large casing a , in which the products of combustion from the fire on the grate b circulate before passing off by the flue e , which is controlled by a damper. Air from outside the building passes through the coil c into the room &c. to be heated and ventilated. A separate chamber may be formed in the upper part of the casing a , into which the air from the pipe c is admitted before passing into the room. The outer casing may be covered with wirework. The coil and air chamber are so arranged that the burning fuel does not come into contact with them. Sliding doors are fitted over the opening a^2 .



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5037. Oakeshott, R. S.
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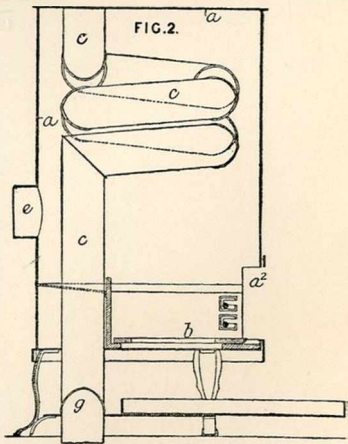


APPENDIX.

A.D. 1867.

2853. George, R. Oct. 11.

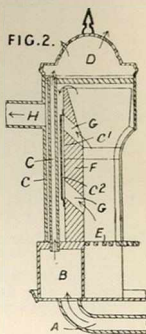
Heating air.—An air-heating pipe c, with coils or convolutions as shown, is fitted within a large casing a, in which the products of combustion from the fire on the grate b circulate before passing off by the flue e, which is controlled by a damper. Air from outside the building passes through the coil c into the room &c. to be heated and ventilated. A separate chamber may be formed in the upper part of the casing a, into which the air from the pipe c is admitted before passing into the room. The outer casing may be covered with wirework. The coil and air chamber are so arranged that the burning fuel does not come into contact with them. Sliding doors are fitted over the opening a'.



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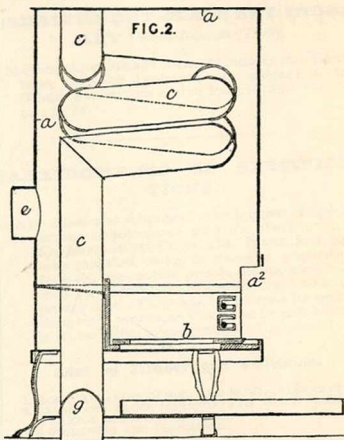


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1895

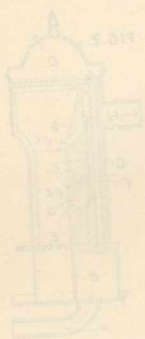


FIG. 2
 A vertical boiler component with various parts labeled with letters A through H. The drawing shows a cylindrical body with a conical top and a base. A central vertical pipe runs through the middle. Various fittings and valves are shown on the sides.

and afterwards into a space or chamber...
 The material is heated either in the...
 ordinary furnace used for heating pipes or in...
 the ordinary continuous paper-making furnace...
 when it is heated to a temperature of 200°...
 tanks are dipped into the vat so as to take up...
 the material, the water heating off through the...
 wire gauze, and the tanks being shaken so as to...
 expel the pulp. The cover is then applied and...
 pressure blown, and the sheet conveyed over a short...
 to left, the elastic bands of the material and the...
 of the sheet being pulled over the roller to a...
 that might be operating into the space. The...
 sheet are pressed in a hydraulic or other power...
 a frame in a driving-room, and afterwards...
 calculated which would be the component...
 which are fitted with the rollers, and they...
 the rollers to draw off the pulp in a...
 and then remove from the hands and the...
 which are made of several pieces...
 material such as glass, perforated metal, etc.

APPENDIX

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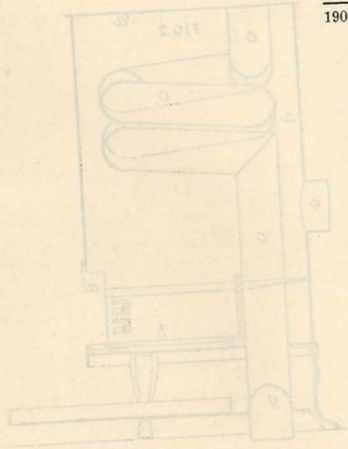


FIG. 3
 A horizontal boiler component with various parts labeled with letters A through H. The drawing shows a cylindrical body with a flat top and a base. A central horizontal pipe runs through the middle. Various fittings and valves are shown on the sides.



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