(No Model.)

I. C. RICHARDSON.

HEATING APPARATUS.

No. 405,504. Patented June 18, 1889.

Fig. 3.

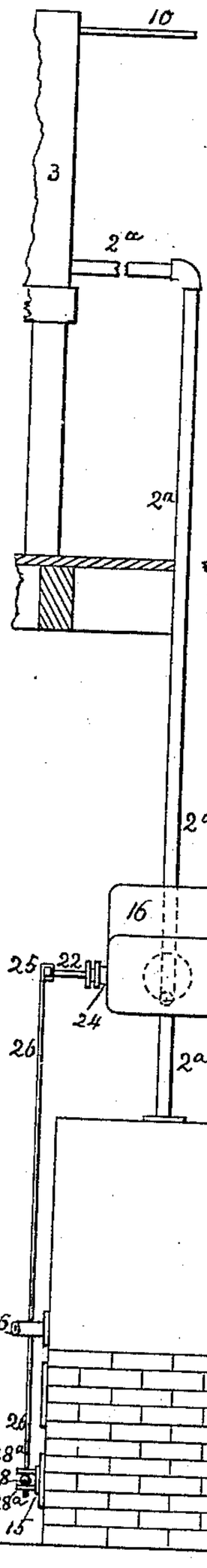


Fig. 1.

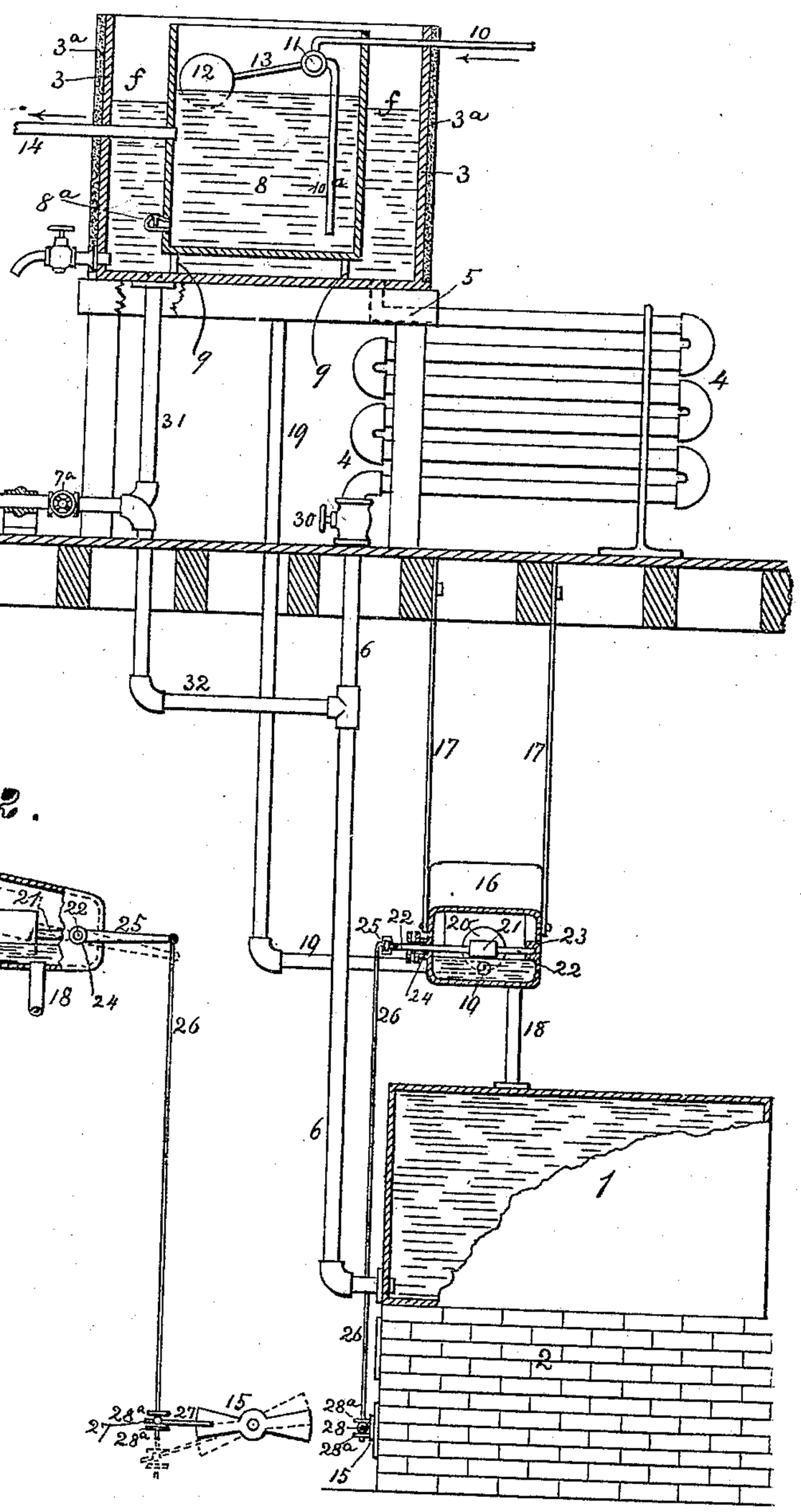
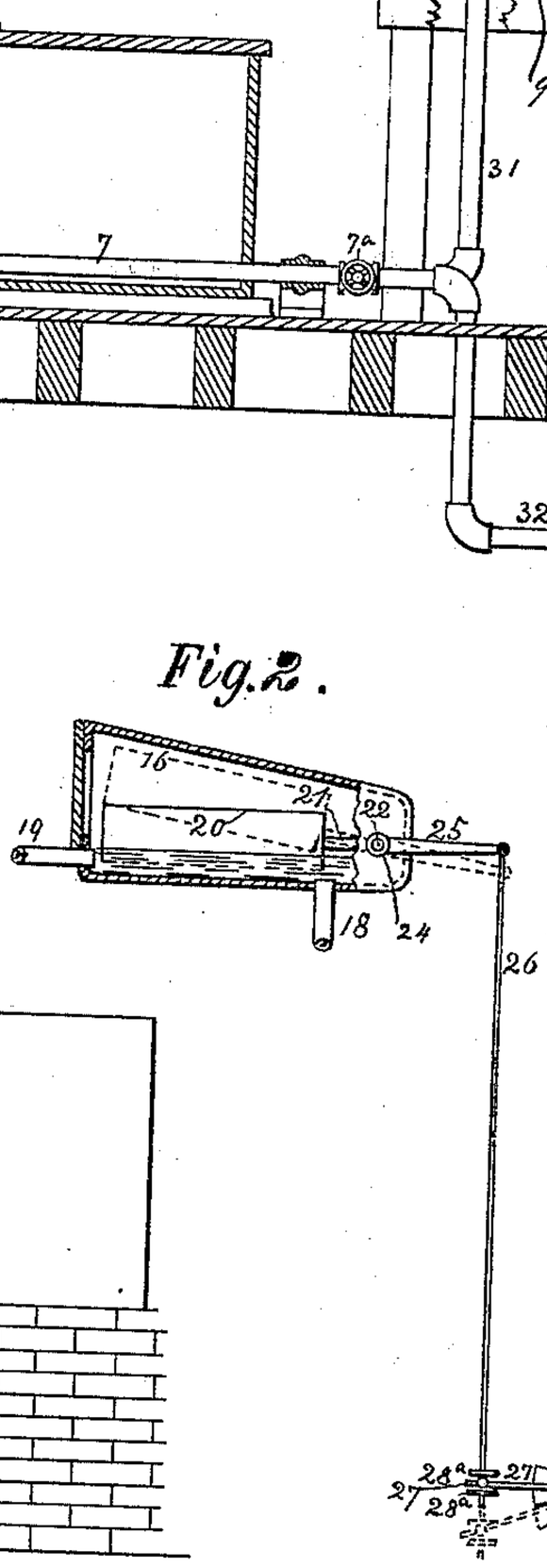


Fig. 2.



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UNITED STATES PATENT OFFICE.

ISAAC C. RICHARDSON, OF NASHUA, NEW HAMPSHIRE.

HEATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 405,504, dated June 18, 1889.

Application filed June 9, 1887. Serial No. 240,768. (No model.)

To all whom it may concern:

Be it known that I, ISAAC C. RICHARDSON, a citizen of the United States, residing at Nashua, in the county of Hillsborough and State of New Hampshire, have invented new and useful Improvements in Heating Apparatus, of which the following is a specification.

My invention relates to that class of heating apparatus in which the temperature is maintained by the circulation of a body of water through radiating pipes or coils connected with a boiler and a hot-water tank, an illustration of which is seen in Letters Patent No. 333,672, granted to me on the 5th day of January, 1886.

It is the object of my invention, which is an improvement on my aforesaid invention, to combine with the boiler-supply tank of an apparatus of this kind an auxiliary tank within the supply-tank from which a supply of hot water may be obtained at any time and at any desired point, the construction of the parts being such that perfectly clean water is heated by a surrounding body of water heated by circulating hot water from the boiler, and this clean water may at any time be obtained for general household purposes, while the contents of the boiler supply and heating and circulating tank will be maintained at the required temperature during the burning of the fire in the furnace, and for a considerable time after the said fire has been suffered to go out.

It is a further purpose of my invention to combine with a heating apparatus of this class an automatic damper-regulator, whereby the draft may be so controlled as to retain the temperature at or nearly at a given point, which is fixed by the operator to suit the requirements.

The invention consists in certain novel constructions, arrangements, and combination of parts, as will be hereinafter described and specifically claimed.

In the drawings, Figure 1 is a vertical section, partly in elevation, showing an apparatus in which my invention is embodied. Fig. 2 is a detail section of the automatic draft-regulator detached, in full lines as it appears after having closed the damper of the furnace, and in dotted lines before said operation; and Fig. 3 is a broken sectional view illustrating a modification.

In the drawings, numeral 1 indicates a boiler, of suitable form and dimensions, heated by a furnace 2. From the lower part of this boiler a pipe 6 (see Fig. 1) is extended upward, united to one or more radiator-coils 4, and connected by a continuation 5 of the same with the bottom or other suitable portion of a boiler supply and circulation tank 3, located above the boiler at any convenient point—say, in an attic or other upper portion of the house or structure in which the apparatus is placed.

The radiator (indicated by the numeral 4) may be of any suitable or preferred construction, and each coil should be provided with a shut-off valve 30. For convenience of illustration, said radiator is represented in close proximity to the circulation-tank 3; but it may be located at a more remote distance from both the boiler and the said tank. The boiler 1 is filled at the start directly from the circulation-tank through either the coils 4 and pipe 6, or all the pipes and coils when their cocks are open, and the upper circulation of the hot water from the boiler is primarily through pipe 18, chamber 16, and pipe 19, and the return through either the radiator 4 and pipe 6, or through other proper branch pipe or pipes of pipe 6, to the lower part of the boiler, as illustrated.

In Fig. 1 the numeral 7 designates a cooking-coil arranged in a suitable chamber and connected with the tank 3 and boiler 1 by branch pipes 31 and 32 of pipe 6, and provided with a suitable cock 7^a, whereby the water may be set in and out of circulation through said coil 7 when desired. Within the circulation-tank 3, which may be of any desired dimension, I place a smaller auxiliary tank 8, the same resting upon suitable brackets 9 on the bottom of the outer tank, and in tank 8 a check-valve 8^a, opening outward, is provided, so that water from tank 8 may flow into tank 3 by hydrostatic force until the height of the water in both tanks is the same, when said valve, being under balancing-pressure, closes the communication between the two tanks. Both the tanks are preferably

made of copper and cylindrical in form, and they should be of such relative sizes that a sufficient space *f*, as shown, is afforded between the two for containing the requisite quantity of water for supplying the boiler 1 and filling the pipes or coils. When the boiler, radiator, and cooking-coils and the pipes connecting the parts are properly supplied, the level of the water in the space *f* will remain a little below the tops of the two tanks, and the check-valve 8ª will be kept closed by the balancing-pressures of the water in the two tanks. The tank 8, and therefrom the tank 3, through check-valve 8ª, may be supplied in any suitable manner—as, for example, by an induction-pipe 10—should there be a water-supply on the premises having a sufficient head, and the supply might under these circumstances be rendered automatic by means of a ball-float 12 and valve 11, whereby the level of the water in both tanks can be always kept at the proper height—say a little below the top of the tanks; but the tank 8 and therefrom the tank 3 may be filled in any other way if there is not sufficient head to raise the water in the tank to the desired height, the loss by evaporation, which is comparatively small, being supplied from time to time. As the water in the tank 3 is excluded from the tank 8 so long as the balancing-pressure of the two tanks is maintained and is circulated only in the boiler and radiator, the iron rust and other impurities which may exist therein from oxidation of pipes, &c., will not have chance to affect any of the pipes through which hot water for domestic purposes circulates. The inner or auxiliary tank 8 is intended for containing only perfectly clean water, notwithstanding it serves for supplying the outer tank 3. It is fed, therefore, by a pure-water-induction pipe 10, which is brought into the tank at any convenient point, but made to discharge through a branch 10ª at or near the bottom thereof. The valve 11 has its passage constructed to remain open so long as the water is below the proper height and to close when the proper height is attained, and the valve is so arranged that by raising the float and turning the valve over, with the float-arm 13 resting upon the edge of the tank, the inflow of water may be permanently cut off.

From the auxiliary tank 8 a discharge service-pipe 14 is carried through the outer tank to such points as circumstances require, said pipe being provided with suitable cocks or faucets through which hot water may be drawn as needed. This discharge service-pipe communicates with the auxiliary tank at a point a little below the water-level, in order that the hottest portions of the water in the inner tank which are at the top may be drawn off. This pipe may, however, communicate with the tank at any other point, though I prefer the construction and arrangement shown and described.

The inlet-pipe 10, by discharging through branch 10ª, at or near the bottom of the auxiliary vessel, introduces the cold water at a point where it will normally lie until heated, leaving the hotter upper portions undisturbed and where they can be drawn off through the discharge service-pipe 14. Both the outer and inner tanks, especially the inner one, may be provided with loose covers for the exclusion of dust and other foreign matters, which would render the water in the inner tank impure and unsuited for domestic purposes. To prevent oxidation, I prefer to make the inner auxiliary tank of tinned copper or galvanized iron; but the outer tank is best made of wood lined with copper or other metal. The wood, being a non-conductor of heat, will retain the temperature of the water in both tanks for a long time after the fire under the boiler has been allowed to go out. A felt coating 3ª may be placed around the outer tank for preventing the radiation of heat.

No special form of boiler 1 is essential to this invention; but I prefer a comparatively small boiler having a large fire-surface, and I may arrange heating-tubes, which communicate with it, in the fire-chamber of the furnace. The furnace 2 is supplied with any suitable form of draft-opening, closed by any convenient form of damper, a pivotally-mounted plate 15, similar to that shown in Fig. 2, being preferred.

For regulating the draft of the furnace, I place at any suitable point near the boiler 1 a tightly-closed float chamber or casing 16, formed of cast-iron and properly suspended by means of rods or straps 17, and for connecting this chamber or casing with the tank 3 and boiler 1 a pipe 18 is extended from the top of the boiler 1 and made to enter said casing at or near its bottom, and a second pipe 19 is extended from a little above the bottom of said chamber or casing to and through the bottom of the outer or circulation tank 3.

The chamber or casing 16 is preferably made in the form shown in Fig. 2 higher at one end than at the other, in order that the elevation of the float 20 or its normal position within the chamber or casing shall be about parallel with the top of the casing, as indicated by dotted lines in Fig. 2, and thus by a very small quantity of steam entering the highest part of the chamber and driving the water therefrom, so as to leave the extreme end of the float unsupported, said float will instantly descend to the position shown in full lines and cause the damper to close when only a moderate undue amount of heat exists in the furnace. A like beneficial result is secured by the small amount of steam in the chamber condensing quickly and allowing the water to fill the chamber, raise the float to the position shown by dotted lines, and open the damper suddenly. Within the chamber or casing 16 a rod or lever 21 is arranged, and the float 20 is placed upon one end thereof. This rod is rigidly mounted

upon a shaft 22, one end of which is supported in an interior bearing 23, while the other end is extended through a wall of the chamber or casing at 24, and made to project a short distance therefrom. Upon the projecting end of said rod is rigidly mounted a crank-arm 25, to the rod of which is pivotally connected a connecting-rod 26, which hangs down in convenient proximity to the end of a pivotally-mounted damper-plate 15. Upon the latter is mounted a finger 27, having an eye 28 at or near its end. The end of the rod 26 is threaded, and passes through said eye, and upon the threaded portions adjustable nuts 28ª, forming rests, are screwed in such manner that they lie above and below the finger 27.

From Fig. 3 it will be seen that the chamber 16 of the draft-regulator may be placed on a line with the pipe 2ª instead of pipes 18 and 19, and thus occupy a position outside of the radiator, which position may in some cases be more convenient and desirable than that shown in Fig. 1; but with this arrangement the operation of the apparatus will be just the same as with the arrangement shown in Fig. 1.

The operation of the whole apparatus is as follows: The boiler, radiator-coils, circulation-pipes, and the tanks being properly supplied with water from one source through the float-valve 11 and check-valve 8ª, the pressure of the water in tank 8 will cause the check-valve 8ª to open and admit water into the space *f* between the tanks until an equilibrium is established, whereupon the valve closes, and the furnace being now started and all the cocks of parts presently mentioned opened, upward circulation of the hot water from the boiler 1 will go on through pipe 18, chamber 16, pipe 19, and tank 3, and return circulation through tank 3, coil 4, and pipe 6, also through tank 3, pipe 31, coil 7, and pipe 32, and by the upward circulation of the hot water the body of water in tank 3 will become heated to a high degree, and by its heat, conducted through walls of tank 8, the pure water in said tank will be heated to about the same high degree. The hot water in tank 3 continues its circulation, while the water in tank 8, separated practically from the water in tank 3, can be drawn off as needed through the discharge service-pipe 14 and used for domestic purposes. The return circulating-water heats the radiator coil or coils and the cooking-coil sufficiently for the purposes intended. If the radiator consists of only one coil and the valve or cock 30 should be closed and the cock 7ª of the coil 7 also closed, the circulation will go on through pipe 18, chamber 16, tank 3, and pipe 19 from and to the boiler; but if cock 7ª should remain open the circulation will also be through pipe 31, coil 7, and pipe 32; or, if more than one coil 4 is used, any one or more may be cut out of circulation by shutting a valve or valves similar to that 30 without completely obstructing the circulation in the line of the radiator 4. In case the head of water in the outer tank 3 falls below that in the inner tank 8, valve 8ª opens by reason of inequality of pressure and water flows from the inner to the outer tank until the equilibrium is restored, thereby feeding both tanks by a single automatic valve.

If during the operation the heat in the furnace rises to such a degree as to produce steam in the upper part of the boiler 1, such steam will instantly escape through the pipe 18 and pass into the chamber 16 and expel therefrom a portion of the water contained therein, forcing it up through the pipe 19 into the circulation-tank 3, whereupon, by reason of the fall of the water in this chamber, a corresponding depression or sinking of the float 20 takes place, thereby rocking the shaft 22 and closing the draft wholly or in part, according to the change in the height of the water in chamber 16. The fire being thus checked, the temperature of the furnace decreases, and, the steam within the chamber 16 becoming condensed, the water again fills said chamber, raises the float, opens the damper, and increases the draft to a proper extent. By adjusting the nuts 28ª upon the rod 26 the vibrations of the float may be caused to regulate the draft with great nicety, so as to secure any degree of heat desired. By jacketing or otherwise inclosing the circulation-pipes the heat may be retained and utilized a long time after the extinction of the fire under the boiler, and the contents of the circulation-tank and auxiliary tank will be kept at a like temperature. Thus in spring and fall and on cool days in summer, when a small fire is required at night and morning, the water in the auxiliary tank will remain hot all day, or nearly so, thereby affording a supply of warm water for general household purposes and a moderate amount of heat for warming the dwelling without requiring a constant consumption of fuel. In summer when hot water is wanted all the radiators are cut out of circulation and a small fire is kindled in the furnace, the slightest blaze sufficing to heat the water sufficiently to supply the house for twenty-four hours for all ordinary requirements.

It may be found convenient to place the furnace and boiler in the cellar, or in an outbuilding, while the circulation-tank with its accessories may be arranged elsewhere and at any distance, provided the tank is sufficiently elevated to insure the proper circulation. The radiators may also be arranged in any number and at any point or distance from both the tank and the boiler.

What I claim is—

1. In a heating apparatus, in combination, an open circulation-tank, a smaller open tank arranged within the outer circulation-tank, a pure-water-supply pipe provided with a float-valve for automatically regulating the height of the water, a water-heater, and circulation-pipes connecting the heater and circulation-

tank, substantially as and for the purpose described.

2. In a heating apparatus, in combination, an open circulation-tank, a smaller open tank for domestic supply, a pure-water-supply pipe provided with a float-valve for automatically regulating the height of the water, a water-heater, circulation-pipes, and radiating-coils connected with the outer circulation-tank and water-heater, substantially as described.

3. In a heating apparatus, in combination, a circulation-tank, a water-heater, connecting circulating-pipes, a tank arranged within the circulating-tank, a supply-pipe for the inner tank, a discharge service-pipe by which water may be drawn from the inner tank, and an automatic valve through which water may pass from the inner to the outer tank when the water in the outer tank falls below that in the inner tank, substantially as described.

4. In a heating apparatus, in combination, an outer open circulation-tank, a water-heater, an inner tank, connecting and circulation pipes between the outer tank and the heater, a supply-pipe provided with a float-valve for controlling the water-supply to said inner tank, a discharge service-pipe for withdrawing water from said inner tank, and an automatic valve through which water may pass from the inner to the outer tank when the water in the outer is lower than in the inner tank, substantially as described.

5. In a heating apparatus, in combination, a circulation water-tank, a water-heater, connecting circulation-pipes, a water-tank arranged within the circulation-tank, a pure-water-supply pipe provided with a float-valve and entering said inner tank and discharging at or near its bottom, and a discharge service-pipe emerging from the same at a point a little below the normal water-level, substantially as and for the purpose described.

6. In a heating apparatus, in combination, a water-heater, a circulation-tank, pipes connecting the said heater and tank, an automatic draft-regulator consisting of a closed chamber, pipes entering said chamber below its top and connecting said chamber, water-heater, and circulation-tank, a float within said chamber, a draft-damper, and a connection between said float and draft-damper, substantially as and for the purpose described.

7. In a heating apparatus, in combination, a water-heater, a circulation-tank, pipes connecting said heater and tank, an automatic draft-regulator consisting of a closed chamber higher at one end than at the other, circulation-pipes entering below the top of said chamber and connecting the chamber to the upper part of the water-heater and the lower part of the circulation-tank, a float within said chamber, a shaft carrying the float and having one end passed through the wall of the chamber, and a connection between the end of said shaft and a draft-damper, substantially as and for the purpose described.

In testimony whereof I affix my signature in presence of two witnesses.

ISAAC C. RICHARDSON.

Witnesses:

J. N. WOODWARD,

E. B. GOULD.