

July 16, 1963

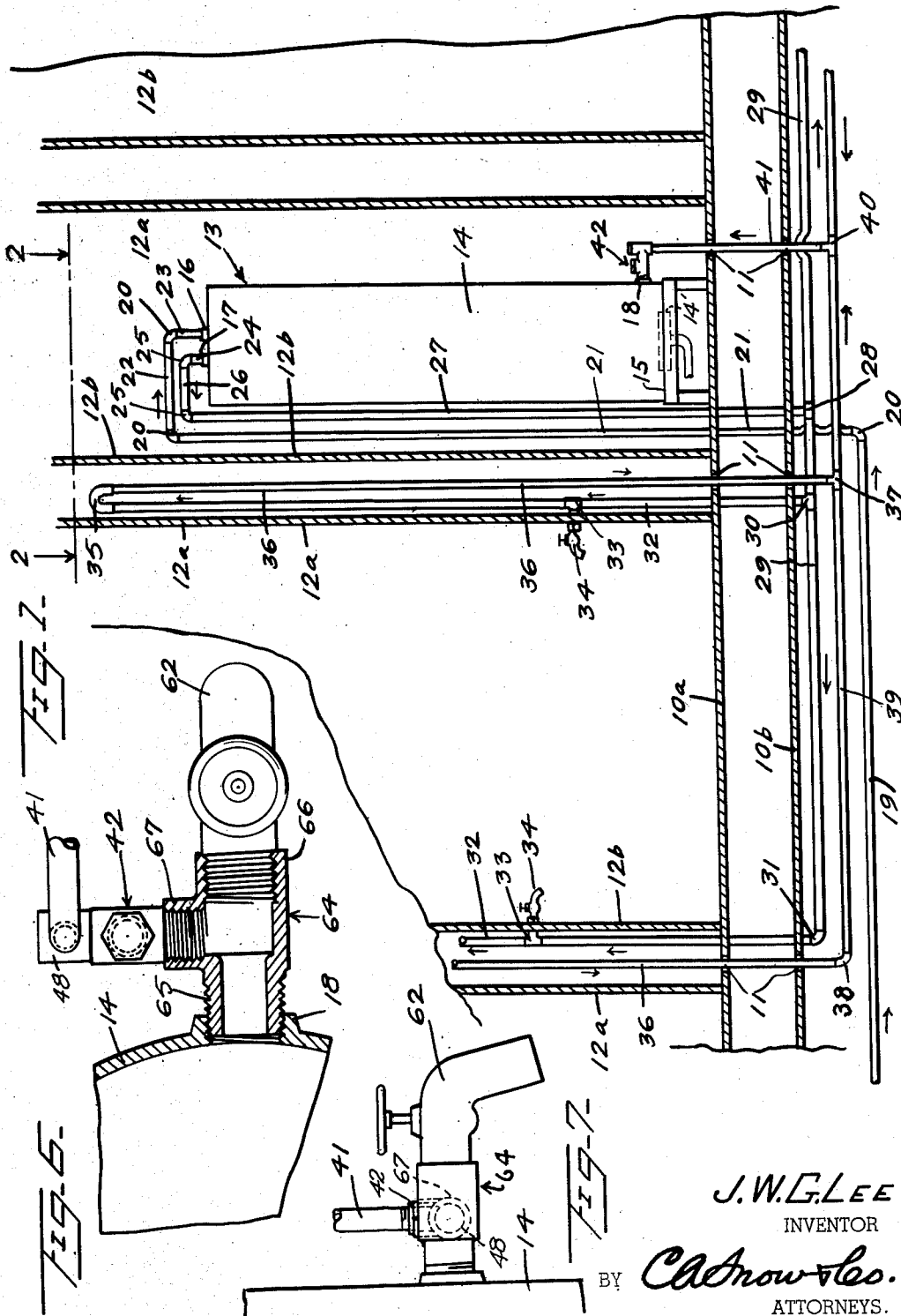
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3,097,661

INSTANT HOT WATER SYSTEM

Filed Sept. 20, 1960

2 Sheets-Sheet 1



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Fig. 2.

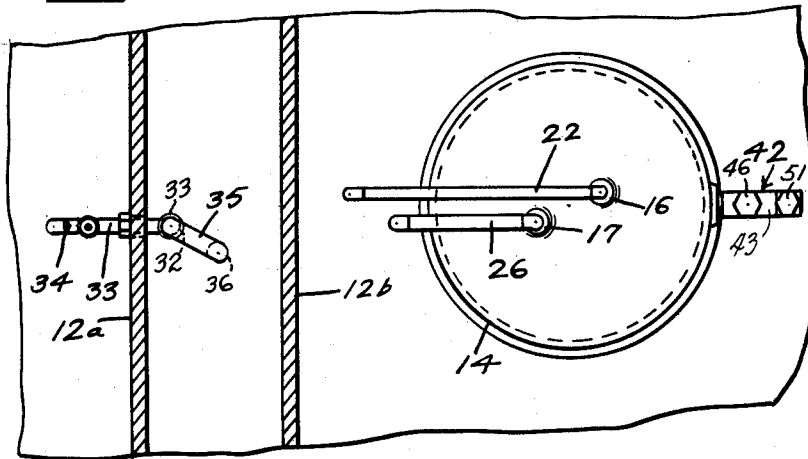


Fig. 3.

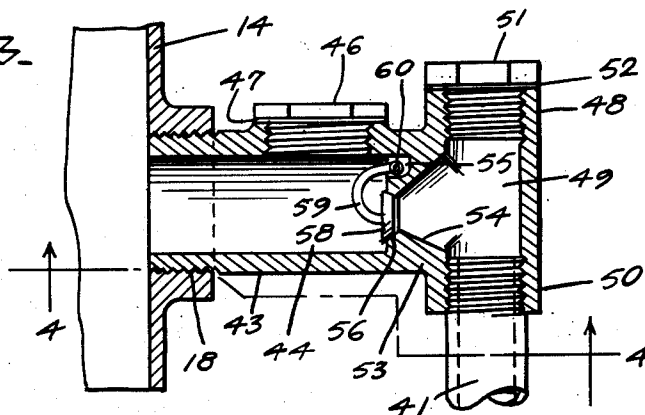
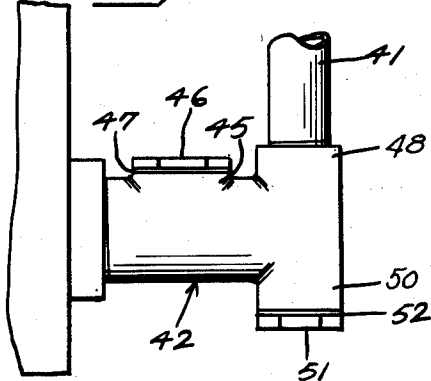
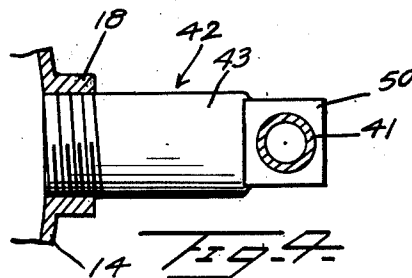


Fig. 5.



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INSTANT HOT WATER SYSTEM

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2 Claims. (Cl. 137—335)

This invention relates to a system for heating and circulating hot water.

The hot water circulating system according to the present invention operates on two principles. As to the heater itself, when heat is applied to an upright portion of a closed system, such as the tank of a hot water heater, it will cause a circulation of the water in the closed system due to convection currents.

In the closed system as a whole, when the water is heated, it expands in volume as the temperature increases and the pressure goes up accordingly. In the expansion of the water, the heated water decreases in density and moves to the top of the tank. The expansion in volume increases the pressure in pounds per square inch in direct proportion to each degree rise in temperature; conversely, as the water cools, the decrease in volume reduces the pressure in pounds per square inch in direct proportion to each degree fall in temperature.

An object of the present invention is to provide a system for heating and circulating hot water in which the circulation of the latter is improved through the provision of a return bend between the hot water supply and return lines positioned at a level above the heater.

Another object of the present invention is to provide a system for heating and circulating hot water in which there is provided a check valve between the return line and the hot water heater to prevent back flow from the heater into the return line and so that hot water can be drawn through the conventional faucets in the system without the intermixture of cold water from the return line.

Another object of the present invention is to provide a system for heating and circulating hot water in which the circulation is facilitated through a pressure differential developed by the hot water supply line being larger than the return line.

A still further object of the present invention is to provide a system for heating and circulating hot water in which a pressure is created through a heat differential developed by the return line being devoid of heat insulation for a substantial part of its extent between the last outlet connection and the heater.

Still other objects, advantages and improvements will become apparent from the following specification, taken in connection with the accompanying drawings in which:

FIGURE 1 is a vertical sectional view through the walls of a house, or other structure, showing the arrangement of the hot water and return lines in the hot water heating and circulating system according to the present invention;

FIG. 2 is a top horizontal sectional view, taken on the section line 2—2 of FIG. 1 and looking in the direction of the arrows, showing the return bend between the hot water supply and the return line;

FIG. 3 is an enlarged vertical sectional view through the horizontal check valve which is connected to the return line and adjacent the hot water heater;

FIG. 4 is a horizontal sectional view taken on the section line 4—4 of FIG. 3 and looking in the direction of the arrows;

FIG. 5 is a side elevational view of the horizontal check valve showing the return line entering the same from above as would be necessary in those cases where the heater tank is positioned beneath the return line.

FIG. 6 is a partial horizontal sectional view and a partial top plan view, showing a faucet at the bottom of the

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tank connected to the latter through an adapter and the return line connected to the tank from above through the adapter ahead of the faucet; and,

FIG. 7 is a side elevational view of the arrangement according to FIG. 6.

Referring now to the drawings in detail and to FIG. 1 in particular, the hot water heating and circulating system according to the present invention is here shown as installed in a one-story house or other building structure. It will be understood that this system could, with slight changes, be applied to a multi-story house. The floor of the house is shown at 10a and below the floor there is the ceiling 10b of the basement. As is well known in building construction, the floor and the ceiling are secured to joists (not shown) positioned between same. The interior of the house is divided by walls 12a—12a, into rooms. In a manner also well known in building construction, these walls are secured to studding (also not shown), positioned between same, and the studding is secured to the joists.

A hot water heater, which is designated generally by the reference numeral 13, is located in one of the rooms, usually the kitchen, or in the basement. As is well known, a hot water heater may be of several types. A gas burner 14' is here shown at the bottom of tank 14 for supplying the heat. Electrical resistance coils may also be used. In some localities where there is no gas service available, or where the gas rate is too high, coiled heat interchange pipes are provided in the fire box of a coal fired heater, or furnace, and connected to the tank, which then becomes only a storage tank. The principal component of the hot water heater is the tank 14, which is supported by a base 15, adapted to rest on the floor 10a. The tank 14 has internally screw threaded bosses 16 and 17 in its top and an internally screw threaded boss 18 in its side wall adjacent the bottom.

A cold water supply line is comprised by a horizontal run line 19 and a riser 21. This riser 21 passes through suitable holes (not shown) in the ceiling 10b and the floor 10a and is connected to the tank through a horizontal section 22 and a vertical section 23, the latter being received in the internally threaded boss 16 in the top of the tank 14. The horizontal run line 19 is connected to the riser 21, the latter to the horizontal section 22 and the latter to the vertical section 23 by suitable L's 20.

The hot water supply line is comprised by a vertical section 24, which is received in the internally threaded boss 17 in the top of the tank 14, a horizontal section 26, which is connected to the vertical section 24 and to the downcomer 27 by suitable L's 25; the downcomer 27 is connected to a horizontal run line 29 by a T 28. At various places along the horizontal run line 29, in alignment with the walls 12a—12b, risers 32 are connected to the horizontal run section by suitable T's 30 and, in the case of an end wall and the end of the horizontal run line, by an L 31. The risers 32 extend upwardly through suitable holes (not shown) in the ceiling 10b and the floor 10a and between the walls 12a—12b. At suitable places faucets 34 are connected to the raisers 32 by T's 33. These faucets are located in the usual places, at the kitchen sink, the wash stand, or shower, in the bath room, a wash stand in the powder room, and the laundry tubs in the basement.

The return lines are comprised by downcomers 36, which are likewise positioned between the walls 12a—12b, and extend downwardly through suitable holes 11 in the floor 10a and the ceiling 10b. The downcomers 36 between the intermediate walls of the building structure are connected to a horizontal run line 39, forming part of the return line, by T's 37; the downcomers between the walls are connected to the horizontal run section by L's 38.

The risers 32 of the hot water supply line are connected

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respectively to the downcomers 36 of the return lines between the walls 12a--12b, by inverted U-shaped return bends 35. These return bends are positioned at a level at least a foot and a half above the top of the tank 14.

The horizontal run line 39 of the return line is connected by a T 40 to a short riser 41, which extends upwardly through suitable holes 11 in the ceiling 10b and the floor 10a, and is connected to the bottom of the tank through a check valve 42, to be later described, mounted in the internally screw-threaded boss 18 in the lower side wall of the latter. The return line, including the downcomers 36, the horizontal run line 39, and the short riser 41 are preferably of smaller diameter, at least one-eighth ($\frac{1}{8}$ "), than the hot water supply line comprised by the downcomer 27, horizontal run line 29, and the risers 32. The inverted U-shaped return bends 35 will accordingly be internally threaded on one leg for pipe of the larger and on the other leg for pipe of the smaller diameter. Also, the hot water supply line comprised by the downcomer 27, the horizontal run line 29, and the risers 32, is preferably covered by a heat insulating medium, such as asbestos composition material; the same is true of the return line, including the downcomers 36 and horizontal run line 39, except that the heat insulating medium is omitted on the short riser 41 and the horizontal run line 39, for a total length of six or eight feet just ahead of the tank 14.

The riser 41 is connected to the bottom of the tank 14 by a horizontally positioned swinging gate check valve, which is generally designated by the reference numeral 42. This check valve is shown in detail in FIG. 3. It is comprised in part by a cylindrical main body section 43, having an axial bore 44 through same. At one end the main body section is externally screw threaded for reception in the internally threaded boss 18 on the side wall of the tank. At its outer end the main body section 43 merges with a pair of square oppositely directed right angle bosses 48 and 50, positioned symmetrically with respect to a line at right angles to the axis of the main body section 43. The bosses 48 and 50 have a bore 49 therethrough which has its axis along the line at right angles to the axis of the main body section 43. The bore 49 is internally screw threaded through the bosses 48 and 50. In the screw threaded end of the bore 49 through the boss 48 there is mounted a screw threaded plug 51 having a hexagonal head, a gasket 52 being positioned under the head of this plug and against the outer face of the boss 48. The riser 41, from the horizontal run section 39 of the return line, is connected in the opposite screw threaded end of the bore 49 through the boss 50. It is to be understood that the riser 41 will be connected to the check valve 42 from below as seen in FIGURES 1, 3 and 4 in those cases where the horizontal run line 39 is beneath the floor in which the tank 14 is supported as shown for example in FIGURE 1. The purpose of the special T shape of the check valve 42 is to allow a convenient connection of the riser 41 from above as shown in FIGURES 5-7 in those instances when the tank 14 is positioned in the basement of a building or otherwise positioned beneath the horizontal run line 39.

The bore 44 through the main body section 43 and the bore 49 through the bosses 48 and 50 are positioned at right angles to each other and are separated by a wall 53, which is plane on the face forming one end of the bore 44 and positioned at right angles to the axis of the latter bore. On its other face the wall 53 is formed with a frusto-conical recess 54, which intersects the bore 49 through the bosses 48 and 50 on its larger base. A frusto-conical counterbore 56 is formed in the plane face of the wall 53, this counterbore having its smaller base co-planar with the smaller base of the frusto-conical recess 54. This frusto-conical counterbore 56 forms a seat for a valve member 58. The valve member 58 is also frusto-conical in shape and one end of a U-shaped arm 59 is secured to the center of same; the other end

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of the U-shaped arm 59 is pivotally mounted by a pin 60, which is positioned in a recess 55 in the wall 53 and transversely of the main body section 43. A boss 45 is formed on the main body section 43 and this boss is bored and internally screw threaded. The bore through the boss 45 is closed by a screw plug 46 having a hexagonal head, a gasket 47 being placed under the head of the screw plug and against the face of the boss 45. Access to the valve member 58 is provided through the bore in the boss 45.

In some cases it is desired to draw hot water directly from the tank 14, such as for scrubbing. A faucet 62 may be provided in the lower internally threaded boss 18 on the tank for such purpose. The check valve 42 is then connected between the faucet 62 and the tank 14, as shown in FIGS. 6 and 7. This check valve serves to prevent backflow from the heater into the return line so that hot water can be drawn through the conventional faucets without intermixture of cold water from the return line.

Hot water heaters having gas burners, or heat interchange coils built into a heater and connected to the tank 14, as the heating elements, usually have the internally threaded boss 18 in the side wall of the tank 14 adjacent the bottom of the latter for connection of the return line, as shown in FIGS. 3 and 6. The electrical heaters, where resistance coils comprise the heating elements, sometimes have externally threaded bosses for connection of the return line. In order to adapt the invention to both types of heaters a T-shaped adapter, which is designated generally by the reference numeral 64, is provided, as shown in FIGS. 6 and 7. This adapter has an externally threaded inlet end 65, an aligned internally threaded outlet end 66, and an internally threaded side inlet through a boss 67. In the case where the hot water heater has the internally threaded boss 18, as shown, the adapter 64 is received with its externally threaded end 65 in the boss and the faucet 62 is received in the internally threaded end 66; when, however, the hot water heater has an externally threaded boss (not shown), the internally threaded end 66 is mounted on the boss and the faucet 62 is connected to the externally threaded end 65 by a coupling (not shown). In both cases the check valve 42 is connected to the adapter 64 through the internally threaded side boss 67, with its main body section 43 in the horizontal position.

As stated, the present system operates on the convection principle. The water in the tank 14 is heated by the gas burner 14', or by equivalent electrical coils, or heat interchange coils in the fire box of a coal fired heater, or furnace. As the water in the tank 14 is heated, the volume of water around the burner 14' becomes less dense and this volume of lesser density rises to the top of the tank. The expanded and less dense hot water exerts a pressure against the top of the tank, which pressure in pounds per square inch is directly proportional to each degree of difference in temperature between the hotter and cooler volumes of water in the tank. Conversely the cooler water being more dense seeks the lowest level in the system.

The system according to the present invention is comprised by a closed circuit. When the water is heated in the tank 14, the expanded less dense hot water, being at a higher pressure, seeks the highest point in the system. It will accordingly flow through the downcomer 27, the horizontal run line 29, upward through the risers 32 and the return bends 35. The latter are, as previously noted, positioned at least a foot and a half above the top level of the tank 14. As the water cools in the return bends 35 and in the return lines comprised by the downcomers 36 and horizontal run line 39, it seeks the lowest level in the closed circuit, which is the lower ends of the downcomers, the horizontal run line, and the riser 41 and bottom of the tank 14.

An important factor that aids the circulation of the

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water in the closed circuit is that the hot water line, comprised by the downcomer 27, horizontal run line 29, and the risers 32, is smaller in area than the tank 14, and the return line, comprised by the downcomers 36 and the horizontal run line 39, is smaller in area than the hot water line. The greater the volume of the water passing through a given cross sectional area, the greater the pressure exerted. The hot water in the top of the tank 14 exerts a pressure on the hot water line, and the hot water in the latter line exerts a pressure on the smaller return line, which pressures accelerate the circulation of the water in the closed circuit and through the check valve 42 and into the bottom of the tank. This circulation, once set in motion by the heating of the water, will continue at a constant rate until all of the water in the closed circuit cools and reaches the same temperature.

Having now fully described my invention, what I claim as new and useful and desire to secure by Letters Patent of the United States is:

1. A water heating and circulating system for a building having double walls comprising a hot water heater, a hot water supply line connected to the top of said heater and including a horizontal run section, risers in the walls connected to the horizontal run section and extending to a level above the heater, outlets on said risers, a return line including downcomers in the walls extending to a level above the heater, return bends connecting the upper ends of said risers to the upper ends of said downcomers, a horizontal run section to which the lower ends of said downcomers are connected, and a riser connecting the last mentioned horizontal run section adjacent the bottom of said heater, a check valve in said last mentioned

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riser immediately before its connection to said heater, said check valve allowing flow from said return line into said heater and preventing flow from said heater into said return line, said return line having a smaller cross sectional area than said hot water supply line and said risers and said hot water supply line and a major portion of said return line being insulated against heat dissipation, a minor portion of said return line including part of said last mentioned horizontal run section and said last mentioned riser being free from insulation.

2. A water heating and circulating system in accordance with claim 1 further including a T fitting having an inlet opening and an outlet opening and being mounted in said heater adjacent the bottom thereof, a faucet connected in said outlet opening of said T fitting, and said check valve connected in said inlet opening of said T fitting, said check valve being connected to said last mentioned riser to prevent back flow from said heater into said riser.

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