H. S. HUMPHREY.

WATER HEATER.

APPLICATION FILED SEPT. 21, 1907.

903,862. Patented Nov. 17, 1908.

3 SHEETS-SHEET 1.

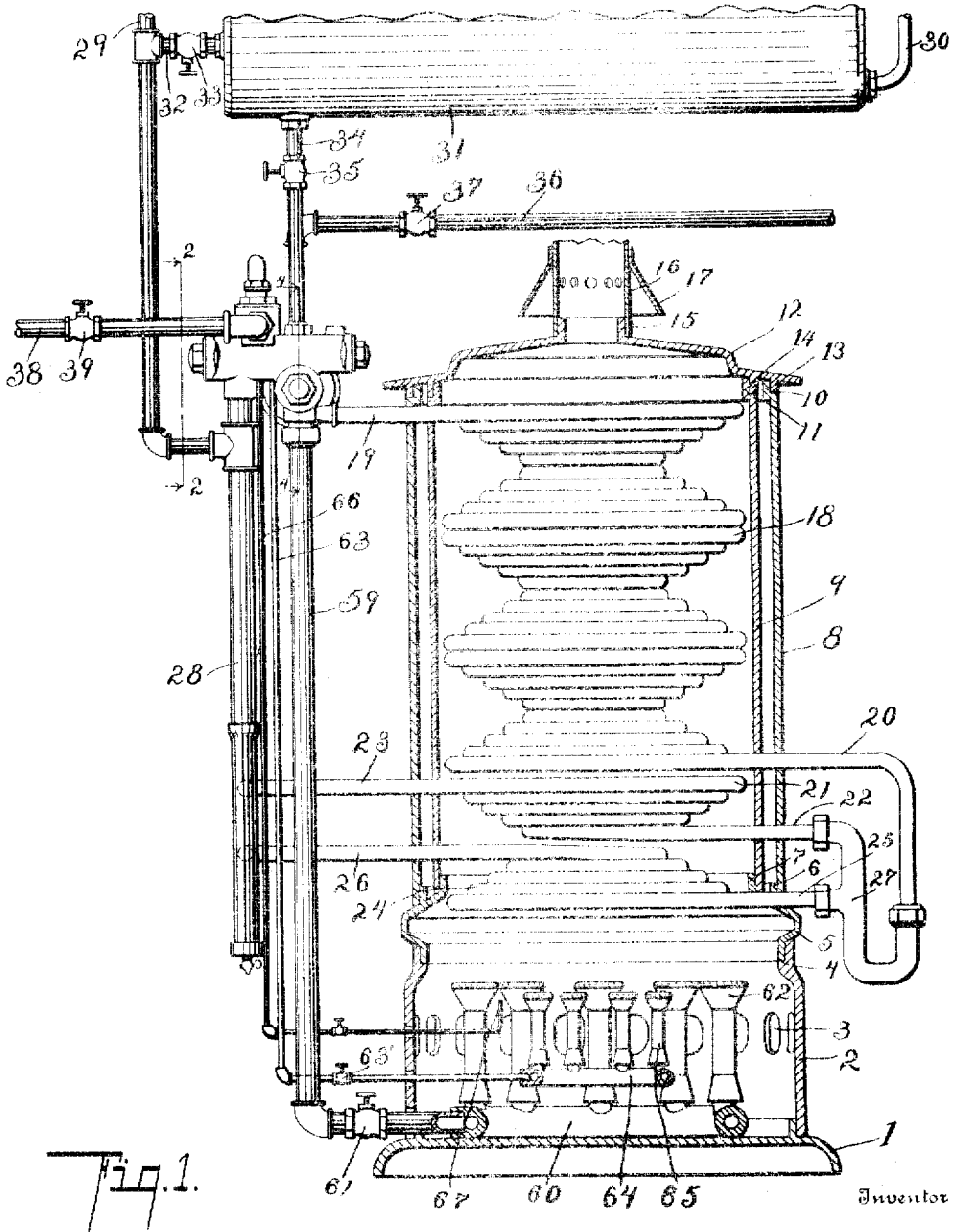


Fig. 1.

Inventor

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Witnesses

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WATER HEATER.

APPLICATION FILED SEPT. 12, 1907.

903,862.

Patented Nov. 17, 1908.

2 SHEETS—SHEET 2.

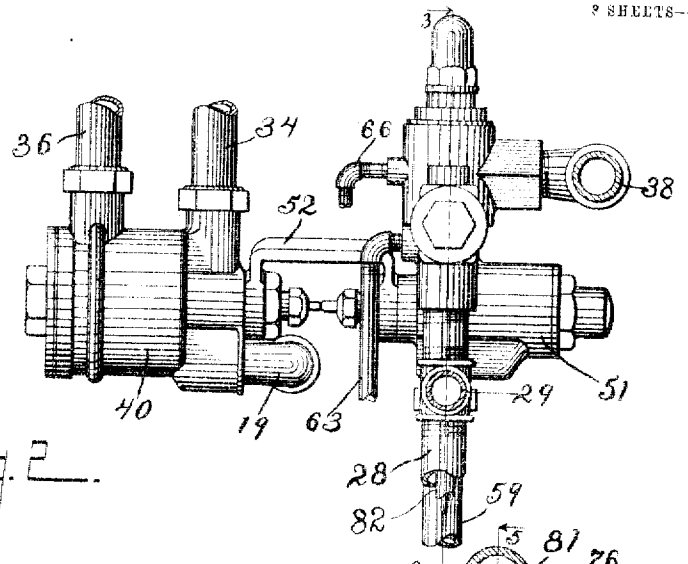


Fig. 2.

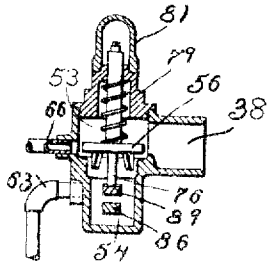


Fig. 5.

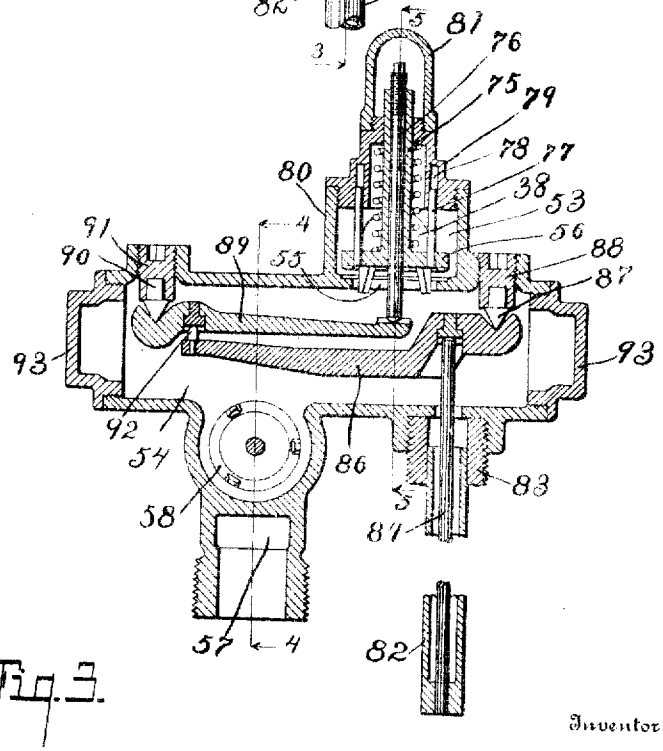


Fig. 3.

Inventor

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APPLICATION FILED SEPT. 12, 1907.

903,862.

Patented Nov. 17, 1908

3 SHEETS—SHEET 3.

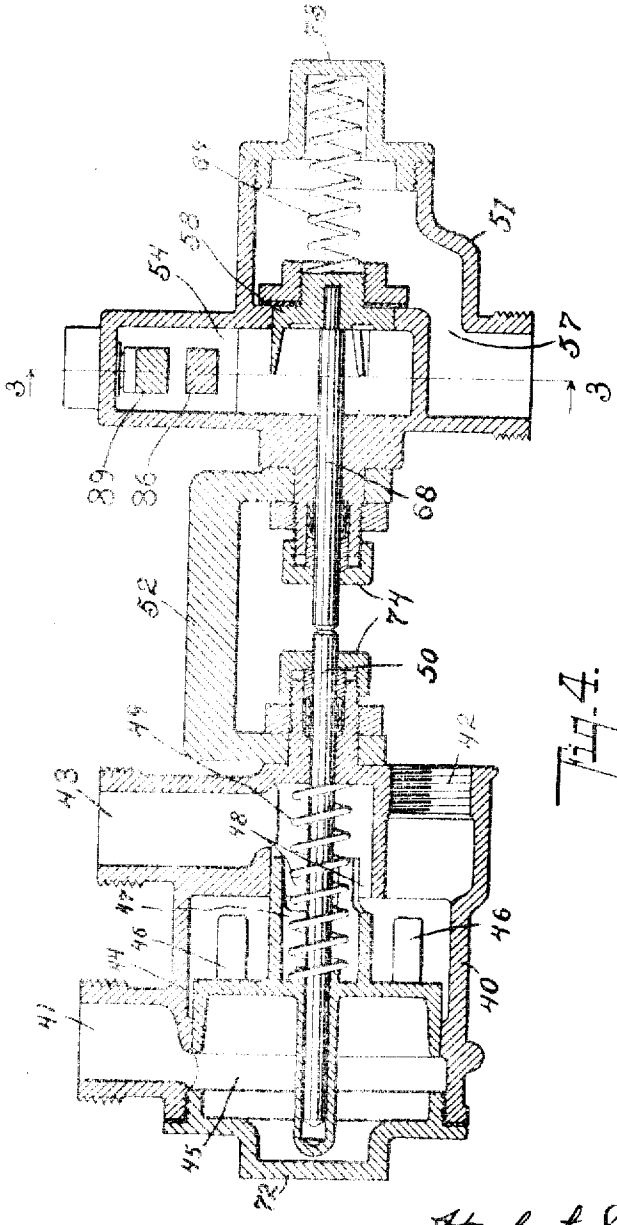


Fig. 4.

Witnesses

Inventor

Herbert S. Humphrey

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UNITED STATES PATENT OFFICE.

HERBERT S. HUMPHREY, OF KALAMAZOO, MICHIGAN.

WATER-HEATER.

No. 903,662. Specification of Letters Patent. Patented Nov. 17, 1908.

Application filed September 12, 1907. Serial No. 392,595.

To all whom it may concern:

Be it known that I, HERBERT S. HUMPHREY, a citizen of the United States, residing at the city and county of Kalamazoo, State of Michigan, have invented certain new and useful Improvements in Water-Heaters, of which the following as a specification.

This invention relates to improvements in water heaters.

The main objects of this invention are, first, to provide an improved water heater adapted to automatically maintain the water in the system, or in the storage tank, at a predetermined temperature, and to permit the drawing of large quantities of water from the system or tank without materially reducing the temperature thereof. Second, to provide in a water heater an improved valve mechanism whereby the supply of gas to the heater burners is automatically controlled both thermostatically and by the drawing off of water. Third, to provide an improved water heater which is of very large capacity and at the same time economical in its use of gas. Fourth, to provide an improved water heater in which the water circulates very freely through the heater.

Further objects, and objects relating to details of construction, will definitely appear from the detailed description to follow.

I accomplish the objects of my invention by the devices and means described in the following specification.

The invention is clearly defined and pointed out in the claims.

A structure embodying the features of my invention is clearly illustrated in the accompanying drawing, forming a part of this specification, in which,

Figure 1 is a detail side elevation of my improved water heater, the heater casing being shown in vertical section. Fig. 2 is an enlarged detail vertical section taken on a line corresponding to line 2—2 of Fig. 1, showing details of the valve mechanism. Fig. 3 is a detail vertical section taken on a line corresponding to line 3—3 of Figs. 2 and 4. Fig. 4 is an enlarged section taken on a line corresponding to line 4—4 of Figs. 1 and 3, showing further details of the valve mechanism, the valve casing being disconnected from the pipes. Fig. 5 is an enlarged detail taken on a line corresponding to the line 5—5 of Fig. 3.

In the drawing, the sectional views are taken looking in the direction of the little arrows at the ends of the section lines, and similar numerals of reference refer to similar parts throughout the several views.

Referring to the drawing, the casing of my improved heater preferably consists of the base 1, having an upwardly-projecting annular flange thereon adapted to receive the burner casing 2. The burner casing 2 is provided with air inlet openings 3, and with a shoulder 4 at its upper end adapted to receive the lower end of the burner casing ring 5. The burner casing ring is provided with a pair of upwardly-projecting flanges 6 and 7, adapted to receive the outer and inner casing walls 8 and 9, supporting them and retaining them in spaced relation to each other to form a suitable air chamber between them.

The walls 8 and 9 are provided with shoulders 10 and 11, respectively, at their upper ends, adapted to receive the downwardly-projecting flanges 13 and 14 of the casing top 12. The casing top 12 is provided with a central opening about which is an upwardly-projecting flange 15 for the vent pipe 16. The vent pipe 16 is provided with suitable air inlets and with a downwardly-flaring hood 17 about the same, the vent pipe thus being adapted to serve as a ventilator, as well as a means for carrying away the products of combustion from the heater burners.

Within the casing, I provide the heating coils 18, 21 and 24. The coil 18 is made up of a plurality of helical coils, the inlet pipe 19 thereof—which is at its upper end—being connected to the water valve casing; and the discharge pipe 20 at its lower end being connected to the header 27, to which the inlet pipes 22 and 25, respectively, of the heating coils 21 and 24 are connected. The discharge pipes 23 and 26 of these heating coils are connected to the delivery pipe 28. The coils 21 and 24 are preferably single helical coils, the upper coil being inverted.

The delivery pipe 28 is connected to the supply pipe 29 of the house system, of which 30 represents the return pipe. When the house system includes a storage tank

as 31, the return pipe 30 is connected thereto. The tank 31 is also preferably connected to the supply pipe 29 of the house system by the pipe 32, which is provided with a suitable valve, as 33. The tank is connected by the pipe 34 to the circulation passage 43 of the water valve. The pipe 34 is preferably provided with a suitable valve, as 35. In systems where no storage tank is provided, the return pipe is connected directly to the circulation passage 34 of the valve. The pipe 36 represents the cold water supply, and this pipe is preferably provided with a valve, as 37.

38 represents the gas supply pipe, which is provided with a suitable valve, as 39.

The valve mechanism preferably consists of the water valve casing 40 (see Fig. 4) having the supply passage 41 to which the cold water supply pipe 36 is connected, the circulation passage 43 to which the pipe 34 is connected, and the discharge passage 42 to which the inlet pipe 19 of the heating coil is connected. These passages in the valve casing are controlled by the inlet valve 44 which is preferably of the piston type, it being arranged in the chamber 45 of the casing. The chamber 45 of the valve casing is enlarged so that when the valve is moved inwardly the valve is opened.

The valve is guided by suitable ribs 46, so that it moves freely in the casing. On the inner end of the valve 44 is a valve 47 adapted to control the circulation passage 43. The valve 47 is provided with ports 48 which are arranged to be open when the piston valve is in its closed position, and closed when the piston valve is open, thus opening the circulation passage when the water inlet valve is closed and closing the same when the water inlet valve is opened. This allows the water to circulate through the heater for maintaining the temperature in the tank or in the system at a predetermined point; but, as soon as the pressure in the system is released, by the drawing off of water, the inlet valve 44 is automatically opened, allowing the water to pass from the supply pipe into the heating coils. The opening of the inlet valve closes the circulation valve so that it is impossible for the water, owing to the pressure in the supply pipe, to pass into the tank system without first passing through the heater. When the drawing of the water from the system ceases, the water inlet valve is closed by means of the return spring 49. The valve 44 is provided with a suitable stem, as 50, which is arranged through the inner end of the valve casing.

The gas supply pipe 39 is connected to the inlet chamber 53 in the gas valve casing 51. This chamber is connected by the port 55 to a gas delivery chamber 54, the connecting port being controlled by the valve 56. The chamber 54 is in turn provided with a delivery passage 57, which is controlled by the valve 58. The passage 57 is connected by the pipe 59 to the gas delivery ring 60, to which the burners 62 are connected. The pipe 59 is preferably provided with a valve 61. The valve chamber 54 is connected by the pipe 63 to the gas delivery ring 64, to which the burners 65 are connected, the burners thus being divided into two groups supplied by independent connections of valve. The pipe 63 is preferably provided with a valve 63′ so that the delivery of the gas to either the burners 62 or 65 may be cut off entirely, if desired by means of these valves 61 and 63′.

The pilot burner 67 is connected by the pipe 66 to the valve chamber 53; see Fig. 5. This mechanism is adapted to control the delivery of the gas through these pipes 59 and 63 so that either of the groups of burners may be supplied or both of them cut off, as may be required. The delivery of the gas to the gas delivery pipe 59 is controlled by the valve 58, and this valve is controlled by the water inlet valve 44. This I preferably accomplish by providing the valve 58 with a stem 68, which is arranged through the inner end of the valve casing 51 and adapted to be engaged by the stem 50 of the water inlet valve, so that, when the water inlet valve is opened, it opens the gas valve 58. The gas valve is held normally in its seat by the return spring 69. By this arrangement, the group of burners 62 is only in use when the water inlet valve is opened, as occurs when water is being drawn from the system, as above explained.

The valve casings 40 and 51 are preferably connected by a suitable yoke, as 52.

To provide a convenient means for assembling the parts, the water and gas valve casings are provided with caps 72 and 73, respectively, which may be readily taken off and the valves removed from the casing. The valve stems are provided with suitable packing glands, as 74.

The gas valve 56 for controlling the connecting port 55 (see Fig. 3) for the gas inlet chamber 53 and the gas discharge chamber 54 of the valve casing is provided with a tubular stem 75, having a rod 76 adjustably threaded therein. The rod 76 of the valve stem projects into the chamber 54 to be controlled by the thermostat, as will fully appear as the description proceeds.

The valve 56 is guided in its movement by means of the pins 77, which reciprocate in suitable holes 78 provided therefor in the cap 79 for the inlet chamber 53. The gas inlet valve chamber 53 is formed in the cap 80 of the valve casing. The valve stem 75 of the valve 56 reciprocates through the top of the cap 79 and is inclosed by the cap 81, so that it is easily accessible for purposes of

adjustment, and thereby regulates the action of the thermostat on the valve. The thermostat preferably consists of the fixed expansion tube 82 arranged in the water delivery pipe 28, the upper end of the tube being secured by the coupling member 83 to the valve casing. Secured to the lower end of the tube is a rod 84, the upper end of which engages the lever 86. The lever 86 is fulcrumed on a suitable bearing 87 provided therefor. The bearing 87 is carried by an adjustable plug 88 arranged through the valve casing; see Fig. 3. The lever 86 is arranged to engage the lever 89 which is fulcrumed on a suitable bearing 90. This bearing is carried by the adjustable plug 91 arranged through the top of the valve casing. The lever 89 engages the lower end of the rod 76 of the stem of the valve 56. The thermostat lever 86 is provided with a suitable bearing point 92 for the lever 89. Thus arranged, hot water in the discharge tube acts upon the expansion tube 82 expanding the same and thereby closing the valve 56.

The valve casing 51 is provided with suitable caps 93, at each end, so that it may be readily opened, and thereby render the parts of the thermostat fully accessible.

When the temperature of the water passing through the delivery pipe 28 reaches the predetermined point, the valve 56 is closed, thereby cutting off the supply of gas to the delivery chamber 54 of the valve casing. However, as soon as the temperature of the water falls, the valve 56 is opened and gas is supplied to both groups of burners in the event that the water inlet valve is open, or to the burners 65 only should the inlet valve be closed.

In the event that it is desired to use only the automatic water controlled gas valve, the valve 63′ in the gas delivery pipe 63 may be closed; or, in case it should be desired to control by means of the thermostat only—cutting out the burners 62—the valve 61 may be closed. In use, the temperature in the system and in the tank, if a tank be used, is automatically maintained by means of the thermostat, the gas to the group of burners 65 being controlled thereby, as stated.

As the water of the system is free to circulate through the heater, it is obvious that an even temperature is maintained. As soon, however, as the pressure in the system is reduced, as by the drawing off of hot water, the water inlet valve is opened, at the same time opening the gas valve 58 and allowing the gas to pass to the group of burners 62. This, of course, increases the heating capacity of the heater, the burners remaining lighted until the pressure is equalized in the system, and thereby closing the water inlet valve, or until the temperature increases beyond the predetermined point, thereby cutting off the supply of gas to both groups of burners by means of the thermostat described. I am thus enabled to not only maintain the temperature of the water in the system at a uniform point, but am enabled to draw off a large volume of water of an approximately uniform temperature.

As stated, by arranging the heating coils as I have illustrated and described, I am enabled to secure a very free and rapid circulation through the same. My improved heater is very effective in its utilization of heat units, and is therefore economical of the gas consumed. Also, it is obvious that, as the gas is cut off when the temperature reaches a predetermined point, the same is not wasted by the water in the system becoming overheated.

The parts are readily assembled and may be easily disassembled should occasion require.

I have illustrated and described my improved water heater in detail in the form preferred by me on account of its structural simplicity and economy and durability in use, I am, however, aware that it is capable of very great variation in details of construction without departing from my invention, and I desire to be understood as claiming the same broadly, as well as specifically, as illustrated.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. The combination with a water heater, of a plurality of gas burners therefor arranged in two groups; a circulation system comprising a delivery and a return pipe; a cold water inlet or supply pipe; a water valve casing having an inlet passage, a discharge passage, and a circulation passage therein, said water supply pipe being connected to said inlet passage, said return pipe of said circulation system being connected to said circulation passage and said discharge passage being connected to said water heater; a water inlet valve; a circulation valve adapted to close said circulation passage controlled by said water inlet valve; a gas valve casing having an inlet chamber and a discharge chamber therein, said discharge chamber having two discharge passages; pipes connecting said discharge passages to said groups of burners; valves in said connecting pipes; a gas inlet valve for controlling the connecting passage for said inlet and discharge chambers; a thermostat arranged to control said gas inlet valve; a discharge valve for controlling one of said discharge passages of said discharge chamber; connections for said discharge valve to said water inlet valve whereby said discharge valve is opened by said water valve; and a pilot burner connected to said gas inlet chamber, for the purpose specified.

2. The combination with a water heater,

of a plurality of gas burners therefor arranged in two groups; a circulation system comprising a delivery and a return pipe; a cold water inlet or supply pipe; a water valve casing having an inlet passage, a discharge passage and a circulation passage therein, said water supply pipe being connected to said inlet passage, said return pipe of said circulation system being connected to said circulation passage and said discharge passage being connected to said water heater; a water inlet valve; a circulation valve adapted to close said circulation passage controlled by said water inlet valve; a gas valve casing having an inlet chamber and a discharge chamber therein, said discharge chamber having two discharge passages; pipes connecting said discharge passages to said groups of burners; valves in said connecting pipes; a gas inlet valve for controlling the connecting passage for said inlet and discharge chambers; a thermostat arranged to control said gas inlet valve; a discharge valve for controlling one of said discharge passages of said discharge chamber; and connections for said discharge valve to said water inlet valve whereby said discharge valve is opened by said water valve, for the purpose specified.

3. The combination with a water heater, of a plurality of gas burners therefor arranged in two groups; a circulation system comprising a delivery and a return pipe; a cold water inlet or supply pipe; a water valve casing having an inlet passage, a discharge passage, and a circulation passage therein, said water supply pipe being connected to said inlet passage, said return pipe of said circulation system being connected to said circulation passage and said discharge passage being connected to said water heater; a water inlet valve; a circulation valve adapted to close said circulation passage controlled by said water inlet valve; a gas valve casing having an inlet chamber and a discharge chamber therein, said discharge chamber having two discharge passages; pipes connecting said discharge passages to said groups of burners; a gas inlet valve for controlling the connecting passage for said inlet and discharge chambers; a thermostat arranged to control said gas inlet valve; a discharge valve for controlling one of said discharge passages of said discharge chamber; connections for said discharge valve to said water inlet valve whereby said discharge valve is opened by said water valve; and a pilot burner connected to said gas inlet chamber, for the purpose specified.

4. The combination with a water heater, of a plurality of gas burners therefor arranged in two groups; a circulation system comprising a delivery and a return pipe; a cold water inlet or supply pipe; a water valve casing having an inlet passage, a discharge passage, and a circulation passage therein, said water supply pipe being connected to said inlet passage, said return pipe of said circulation system being connected to said circulation passage and said discharge passage being connected to said water heater; a water inlet valve; a circulation valve adapted to close said circulation passage controlled by said water inlet valve; a gas valve casing having an inlet chamber and a discharge chamber therein, said discharge chamber having two discharge passages; pipes connecting said discharge passages to said groups of burners; a gas inlet valve for controlling the connecting passage for said inlet and discharge chambers; a thermostat arranged to control said gas inlet valve; a discharge valve for controlling one of said discharge passages of said discharge chamber; and connections for said discharge valve to said water inlet valve whereby said discharge valve is opened by said water valve, for the purpose specified.

5. The combination with a water heater, of a plurality of gas burners therefor; a circulation system comprising a delivery and a return pipe; a cold water inlet or supply pipe; a water valve casing having an inlet passage, a discharge passage and a circulation passage therein, said water supply pipe being connected to said inlet passage, said return pipe of said circulation system being connected to said circulation passage and said discharge passage being connected to said water heater; a water inlet valve; a circulation valve adapted to close said circulation passage controlled by said water inlet valve; a gas valve casing having two discharge passages; valved connections for said discharge passages to said gas burners; a gas inlet valve; a thermostat adapted to control said gas inlet valve; a discharge valve for controlling one of said discharge passages of said discharge chamber; connections for said discharge valve to said water inlet valve whereby said discharge valve is opened by said water valve; and a pilot burner, for the purpose specified.

6. The combination with a water heater, of a plurality of gas burners therefor; a circulation system comprising a delivery and a return pipe; a cold water inlet or supply pipe; a water valve casing having an inlet passage, a discharge passage, and a circulation passage therein, said water supply pipe being connected to said inlet passage, said return pipe of said circulation system being connected to said circulation passage and said discharge passage being connected to said water heater; a water inlet valve; a circulation valve adapted to close said circulation passage controlled by said water inlet valve; a gas valve casing having two discharge passages; connections for said discharge passages to said gas burners; a gas

inlet valve; a thermostat adapted to control said gas inlet valve; a discharge valve for controlling one of said discharge passages of said discharge chamber; connections for said discharge valve to said water inlet valve whereby said discharge valve is opened by said water valve; and a pilot burner, for the purpose specified.

7. The combination with a water heater, of a plurality of gas burners therefor; a circulation system; a cold water inlet valve; a circulation valve adapted to control the return pipe of said circulation system arranged to be controlled by said water inlet valve; a gas valve casing having an inlet chamber and a discharge chamber therein, said discharge chamber having two discharge passages; valved connections for said discharge passages to said heater burners; a gas inlet valve for controlling the connecting passage of said inlet and discharge chambers; a thermostat arranged to control said gas inlet valve; a discharge valve for controlling one of the said discharge passages of said discharge chamber; connections for said discharge valve to said water inlet valve, whereby said discharge valve is opened by said water inlet valve; and a pilot burner connected to said gas inlet chamber, for the purpose specified.

8. The combination with a water heater, of a plurality of gas burners therefor; a circulation system, a cold water inlet valve; a circulation valve adapted to control the return pipe of said circulation system arranged to be controlled by said water inlet valve; a gas valve casing having an inlet chamber and a discharge chamber therein, said discharge chamber having two discharge passages; valved connections for said discharge passages to said heater burners; a gas inlet valve for controlling the connecting passage of said inlet and discharge chambers; a thermostat arranged to control said gas inlet valve; a discharge valve for controlling one of the said discharge passages of said discharge chamber; connections for said discharge valve to said water inlet valve, whereby said discharge valve is opened by said water inlet valve; and a pilot burner, for the purpose specified.

9. The combination with a water heater, of a plurality of gas burners therefor; a circulation system; a cold water inlet valve; a circulation valve adapted to control the return pipe of said circulation system arranged to be controlled by said water inlet valve; a gas valve casing having an inlet chamber and a discharge chamber therein, said discharge chamber having two discharge passages; connections for said discharge passages to said heaters; a gas inlet valve for controlling the connecting passages of said inlet and discharge chambers; a thermostat arranged to control said gas inlet valve; a discharge valve for controlling one of the said discharge passages of said discharge chamber; connections for said discharge valve to said water inlet valve, whereby said discharge valve is opened by said water inlet valve; and a pilot burner connected to said gas inlet chamber, for the purpose specified.

10. The combination with a water heater, of a plurality of gas burners therefor; a circulation system; a cold water inlet valve; a circulation valve adapted to control the return pipe of said circulation system arranged to be controlled by said water inlet valve; a gas valve casing having an inlet chamber and a discharge chamber therein, said discharge chamber having two discharge passages; connections for said discharge passages to said heater burners; a gas inlet valve for controlling the connecting passage of said inlet and discharge chambers; a thermostat arranged to control said gas inlet valve; a discharge valve for controlling one of the said discharge passages of said discharge chamber; connections for said discharge valve to said inlet valve, whereby said discharge valve is opened by said water inlet valve; and a pilot burner, for the purpose specified.

11. The combination with a water heater, of a plurality of gas burners therefor; a circulation system comprising a delivery and a return pipe; a water inlet valve; a circulation valve adapted to control said return pipe of said circulation system arranged to be controlled by said water inlet valve; a gas valve casing having two discharge passages; valved connections for said discharge passages to said heater burners; a gas inlet valve; a thermostat adapted to control said gas inlet valve; a discharge valve for controlling one of said discharge passages of said gas valve casing; connections for said discharge valve to said water inlet valve whereby said discharge valve is opened by said water inlet valve; and a pilot burner, for the purpose specified.

12. The combination with a water heater, of a plurality of gas burners therefor; a circulation system comprising a delivery and a return pipe; a water inlet valve; a circulation valve adapted to control said return pipe of said circulation system arranged to be controlled by said water inlet valve; a gas valve casing having two discharge passages; connections for said discharge passages to said heater burners; a gas inlet valve; a thermostat adapted to control said gas inlet valve; a discharge valve for controlling one of said discharge passages of said gas valve casing; connections for said discharge valve to said water inlet valve whereby said discharge valve is opened by said water inlet valve; and a pilot burner, for the purpose specified.

13. The combination with a water heater, of a plurality of burners therefor; a water inlet valve; a gas valve casing having two discharge passages; valved connections for said discharge passages to said heater burners; a gas inlet valve; a thermostat adapted to control said gas inlet valve; a discharge valve for controlling one of said discharge passages of said gas valve casing; connections for said discharge valve to said water inlet valve whereby said discharge valve is opened by said water inlet valve; and a pilot burner, for the purpose specified.

14. The combination with a water heater, of a plurality of gas burners therefor; a water inlet valve; a gas valve casing having two discharge passages; connections for said discharge passages to said heater burners; a gas inlet valve; a thermostat adapted to control said gas inlet valve; a discharge valve for controlling one of said discharge passages of said gas valve casing; connections for said discharge valve to said water inlet valve whereby said discharge valve is opened by said water inlet valve; and a pilot burner, for the purpose specified.

15. The combination with a water heater, of a plurality of gas burners therefor; a circulation system comprising a delivery and a return pipe; a cold water inlet or supply pipe; a water valve casing having an inlet passage, a discharge passage, and a circulation passage therein, said water supply pipe being connected to said inlet passage, said return pipe of said circulation system being connected to said circulation passage and said discharge passage being connected to said water heater; a water inlet valve; a circulation valve adapted to control said circulation passage, controlled by said water inlet valve; a thermostat arranged to be controlled by the water in the delivery pipe of said circulation system; a pair of gas valves for controlling said burners one of which is adapted to be controlled by said thermostat and the other by said water inlet valve, the valve controlled by said thermostat being arranged to control the delivery of gas to the valve controlled by said water inlet valve; and a pilot burner.

16. The combination with a water heater, of a plurality of gas burners therefor; a circulation system comprising a delivery and a return pipe; a cold water inlet or supply pipe; a water valve casing having an inlet passage, a discharge passage, and a circulation passage therein, said water supply pipe being connected to said inlet passage, said return pipe of said circulation system being connected to said circulation passage and said discharge passage being connected to said water heater; a water inlet valve; a circulation valve adapted to control said circulation passage, controlled by said water inlet valve; a thermostat arranged to be controlled by the water in the delivery pipe of said circulation system; a pair of gas valves for controlling said burners, one of which is adapted to be controlled by said thermostat and the other by said water inlet valve; and a pilot burner.

17. The combination with a water heater, of a plurality of gas burners therefor; a circulation system; a water inlet valve; a circulation valve adapted to control said return pipe of said circulation system arranged to be controlled by said water inlet valve; a thermostat; a pair of gas valves for controlling said burners, one of which is adapted to be controlled by said thermostat and the other by said water inlet valve, the valve controlled by said thermostat being arranged to control the delivery of gas to the valve controlled by said water inlet valve; a pilot burner; and valves for cutting off the delivery of gas to said burners from either of said gas valves.

18. The combination with a water heater, of a plurality of gas burners therefor; a circulation system; a water inlet valve; a circulation valve adapted to control said return pipe of said circulation system arranged to be controlled by said water inlet valve; a thermostat; a pair of gas valves for controlling said burners, one of which is adapted to be controlled by said thermostat and the other by said water inlet valve; a pilot burner; and valves for cutting off the delivery of gas to said burners from either of said gas valves.

19. The combination with a water heater, of a plurality of gas burners therefor; a water inlet valve; a thermostat; a pair of gas valves for controlling said burners, one of which is adapted to be controlled by said thermostat and the other by said water inlet valve, the valve controlled by said thermostat being arranged to control the delivery of gas to the valve controlled by said water inlet valve; a pilot burner; and valves for cutting off the delivery of gas to said burners from either of said gas valves.

20. The combination with a water heater, of a plurality of gas burners therefor; a water inlet valve; a thermostat; a pair of gas valves for controlling said burners, one of which is adapted to be controlled by said thermostat and the other by said water inlet valve; a pilot burner; and valves for cutting off the delivery of gas to said burners from either of said gas valves.

21. The combination with a water heater, of a plurality of gas burners therefor; a circulation system; a water inlet valve; a circulation valve adapted to control said return pipe of said circulation system arranged to be controlled by said water inlet valve; a thermostat; a pair of gas valves for controlling said burners, one of which is adapted to be controlled by said thermostat and the

other by said inlet water valve, the valve controlled by said thermostat being arranged to control the delivery of gas to the valve controlled by said water inlet valve; and a pilot burner.

22. The combination with a water heater, of a plurality of gas burners therefor; a circulation system; a water inlet valve; a circulation valve adapted to control said return pipe of said circulation system arranged to be controlled by said water inlet valve; a thermostat; a pair of gas valves for controlling said burners, one of which is adapted to be controlled by said thermostat and the other by said water inlet valve; and a pilot burner.

23. The combination with a water heater, of a plurality of gas burners therefor; a water inlet valve; a thermostat; a pair of gas valves for controlling said burners, one of which is adapted to be controlled by said thermostat and the other by said water inlet valve, the valve controlled by said thermostat being arranged to control the delivery of gas to the valve controlled by said water inlet valve; and a pilot burner.

24. The combination with a water heater, of a plurality of gas burners therefor; a water inlet valve; a thermostat; a pair of gas valves for controlling said burners, one of which is adapted to be controlled by said thermostat and the other by said water inlet valve; and a pilot burner.

25. The combination with a water heater of a plurality of gas burners therefor; a water inlet valve; a thermostat; a pair of gas valves for controlling the said burners, one of which is adapted to be controlled by said thermostat and the other by said water inlet valve, said thermostat being also adapted to control the delivery of gas to said gas valve controlled by said water inlet valve.

26. The combination with a water heater, of a gas burner therefor; a gas valve for said burner; a thermostat connected to said water heater adapted to control said gas valve; an automatic water inlet valve; and a circulation valve controlled by said water inlet valve, said circulation valve being adapted, when open, to permit the water to circulate through the heater and thermostat.

27. The combination with a water heater, of a gas burner therefor; a gas valve for said burner; a thermostat connected to said water heater adapted to control said gas valve; and an automatically controlled circulation valve, said circulation valve being adapted, when open, to permit the water to circulate through the heater and thermostat.

28. The combination with a water heater, of a thermostat connected thereto; an automatic water inlet valve; and a circulation valve controlled by said water inlet valve, said circulation valve being adapted, when open, to permit the water to circulate through the water heater and thermostat.

29. The combination with a water heater of a thermostat connected thereto; a water inlet; and an automatically controlled circulation valve adapted to be closed when the water inlet is opened, said circulation valve being arranged to normally permit the water to circulate through the heater and thermostat.

30. The combination with a water heater, of a water outlet; a gas burner for said heater; a valve for said gas burner; a thermostat connected to said water heater adapted to control said gas valve; and a circulation valve adapted to automatically close when the said water outlet is opened and to automatically open when the said water outlet is closed, said valve being adapted, when open, to permit the water to circulate through the heater and thermostat.

In witness whereof, I have hereunto set my hand and seal in the presence of two witnesses.

HERBERT S. HUMPHREY. [L. S.]

Witnesses:
LULU GREENFIELD,
GERTRUDE TALLMAN.