F. L. O. WADSWORTH.

WATER HEATER CONSTRUCTION.

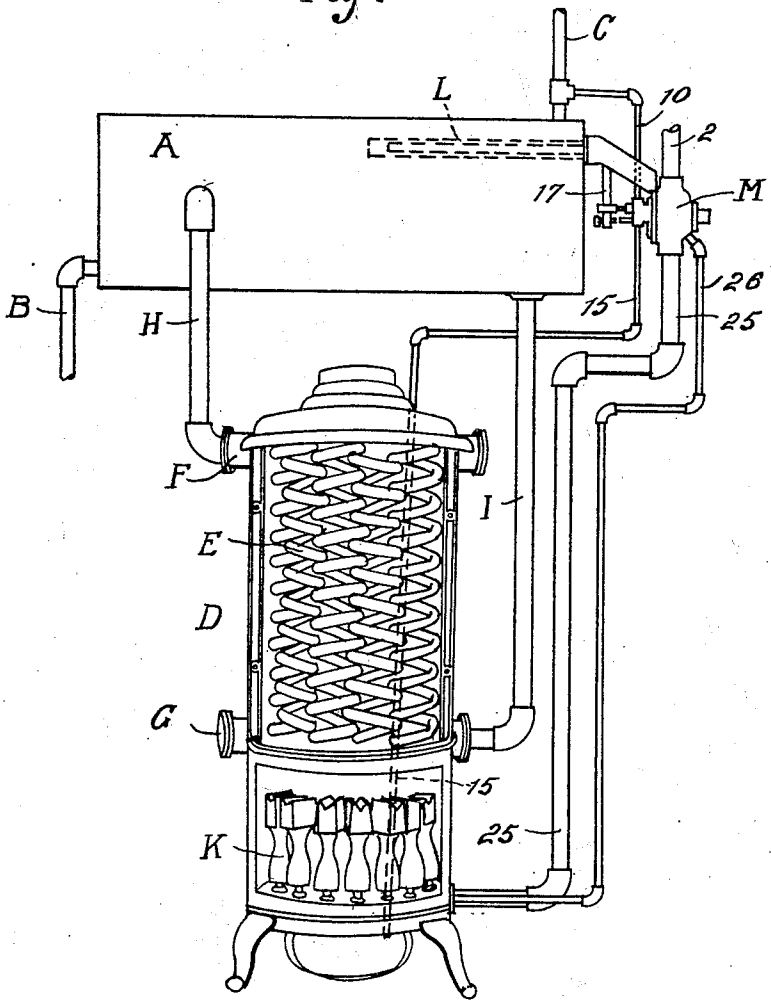
APPLICATION FILED OCT. 3, 1911.

1,131,020.

Patented Mar. 9, 1915.

3 SHEETS—SHEET 1.

Fig 1



WITNESSES

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3 SHEETS—SHEET 2.

Fig. 2

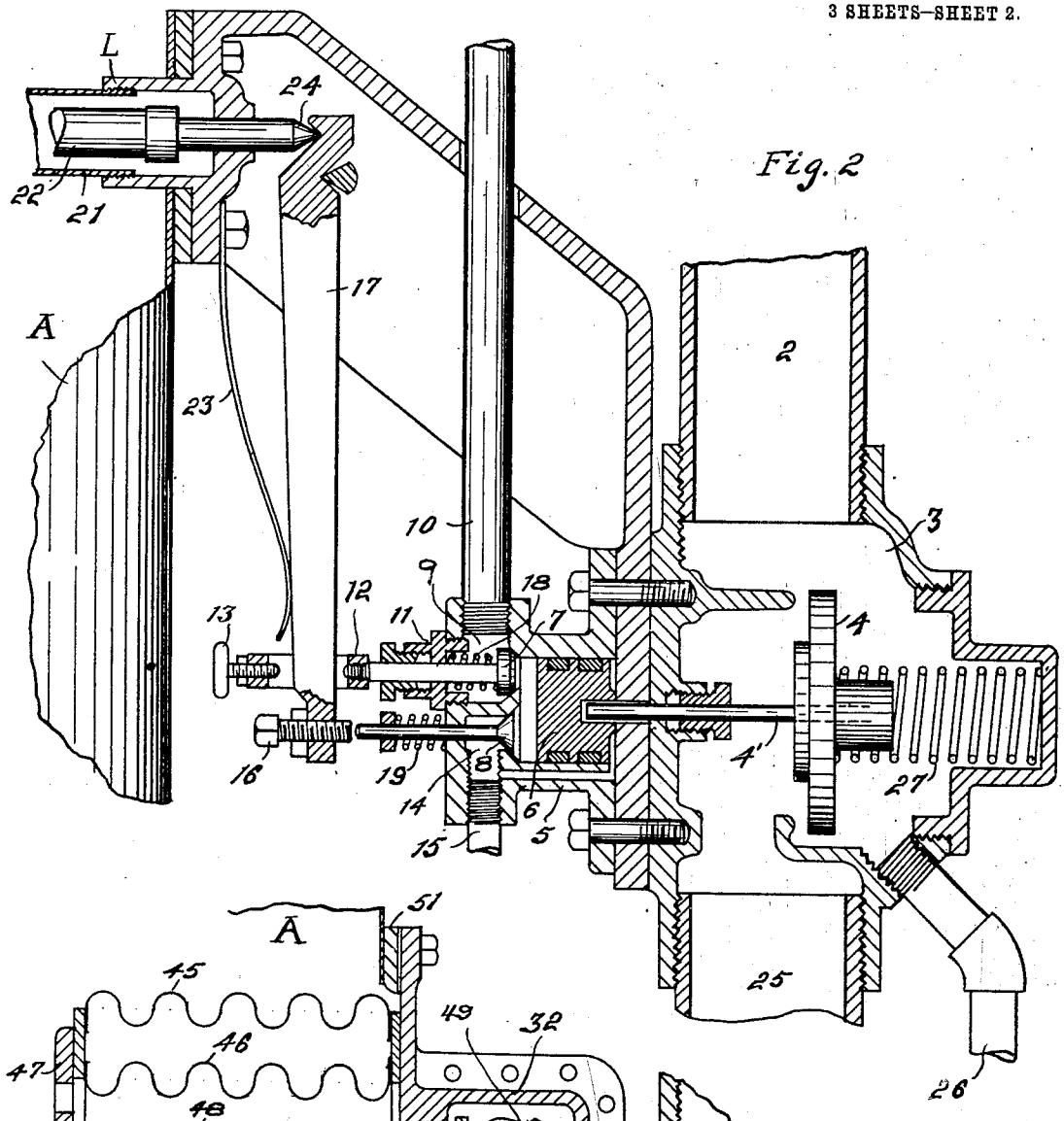
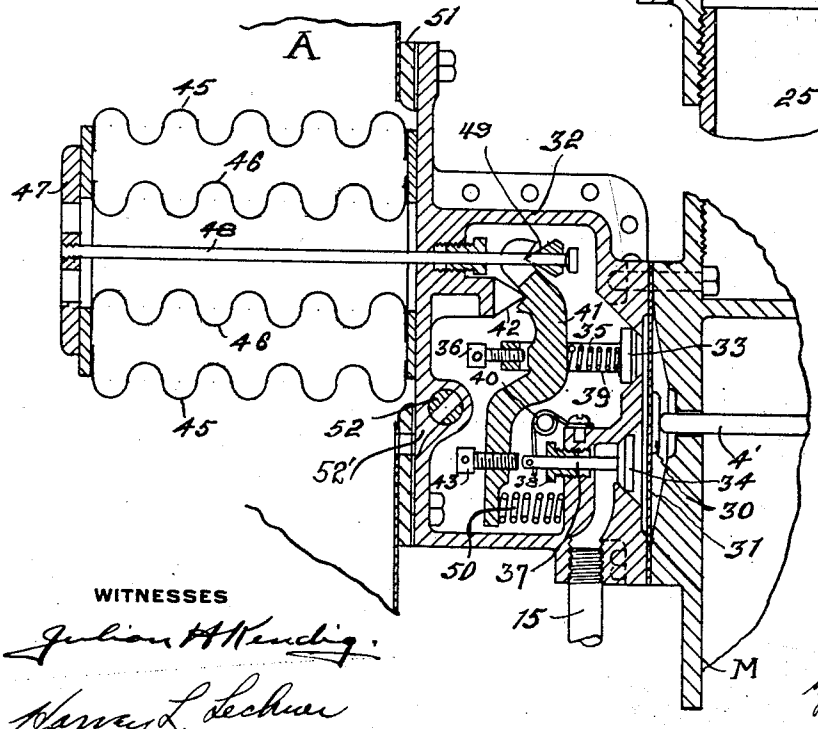


Fig. 3



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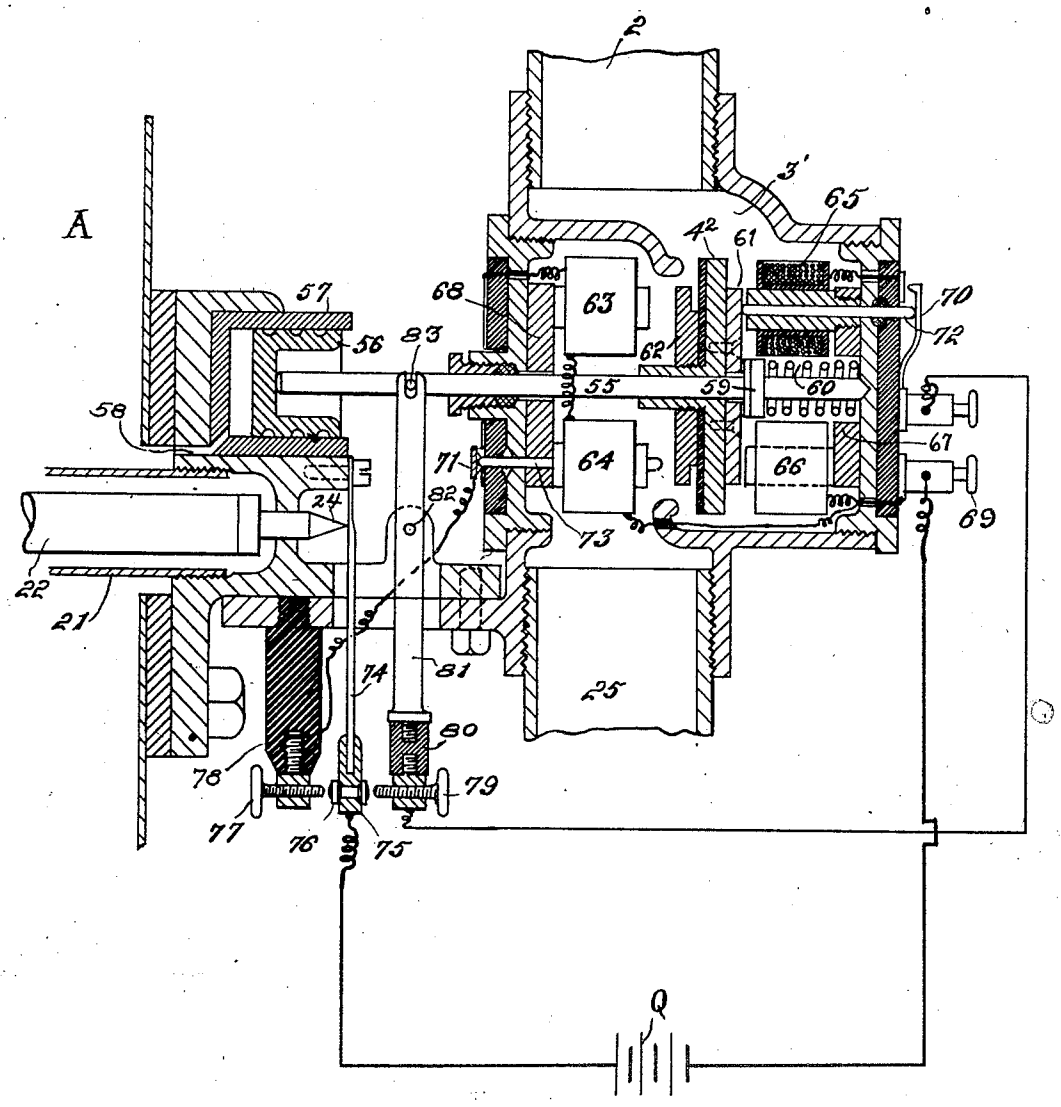
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3 SHEETS—SHEET 3.

Fig. 4



WITNESSES

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WATER-HEATER CONSTRUCTION.

1,131,020. Specification of Letters Patent. Patented Mar. 9, 1915.

Application filed October 3, 1911. Serial No. 652,578.

To all whom it may concern:

Be it known that I, F. L. O. WADSWORTH, a citizen of the United States, residing at Sewickley, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Water-Heater Construction, of which the following is a specification.

The invention relates to improvements in water heater construction, and particularly to water heaters wherein the supply of gas is automatically controlled by means of a thermostat acted upon by the water of the heater. The primary objects of the invention are; the provision of an improved arrangement whereby the fuel valve will be fully opened when the water reaches a certain predetermined temperature and will remain fully opened until the water in the heater reaches a second predetermined temperature at which time it will rapidly and completely close; the provision of a heater construction in which the thermostatic means actuates easily operable pilot means which in turn brings into operation a power means for moving the gas valve, thus relieving the thermostat of the work incident to the direct operation of the gas valve; and the provision of mechanism in which the fuel valve is automatically closed when the water pressure in the system is released, so that no gas can be turned on when the heating system is emptied. Several embodiments of my invention are illustrated in the accompanying drawings, wherein:—

Figure 1 is a front elevation of one form of heating system with my improved controlling mechanism applied thereto; Fig. 2 is a vertical section through the controlling mechanism; and Figs. 3 and 4 are vertical sections through modified forms of the invention.

Referring first to the general arrangement of parts as illustrated in Fig. 1, A is a storage tank or reservoir having a cold water inlet pipe B leading from the main and a hot water outlet pipe C leading to the house fixtures; D is the casing of the heater, which heater may be of any approved type; E are the heater coils leading at their upper ends into a header F and at their lower ends into a header G; H is the hot water riser leading from the header F to the reservoir A; I is the return pipe leading from the reservoir to the lower header G; K are the gas burners which are located beneath the coils of the heater and may be of any approved type; L is the thermostatic controlling mechanism for governing the supply of gas to the burners K; and M is the casing containing the gas valve and certain of the parts for controlling the operation of such gas valve.

Referring now to Fig. 2 of the drawings, which discloses in enlarged cross section the controlling means in which my invention particularly resides; 2 indicates a fuel supply pipe leading from the gas main or other supply of gaseous or liquid fuel, to a valve chamber 3 in which is located the automatic controlled fuel supply valve 4. Secured to one side of the valve casing is a box 5 bored to receive a small piston 6. At the rear end of the cylinder containing the piston 6 are two puppet valves 7 and 8, the first arranged to open away from the piston 6 and the latter arranged to open toward the said piston. The puppet valve 7 is seated in a chamber 9, which is in communication through the pipe 10 with the water or liquid in the tank A. The stem of this puppet valve 7 projects through a stuffing box 11, and is secured to a link 12, which has at its outer end an adjustable screw 13. The puppet valve 8 is seated in a chamber 14, which is in free communication with the air and is provided with a drain pipe 15 which leads to some point where water can be conveniently discharged into a sink or drain pan. The stem of the puppet valve 8 projects through the rear wall of this chamber and terminates opposite an adjustable screw 16 mounted in the end of the thermostat lever 17. The valves 7 and 8 are normally kept closed by means of the springs 18 and 19. The thermostat lever 17 is moved by means of a thermostat L located at some convenient point in the tank A, this thermostat being of any desired construction. In the form shown in the figure it is composed of the ordinary positive and negative elements, the former being composed of a tube 21 of zinc, copper or some other metal having a high coefficient of expansion, and the latter being composed of a rod 22 of porcelain, carbon, nickel, steel, or "invar" metal, which is secured at its inner end to the adjacent part of the tube 21, and terminates at its outer end in the knife edge 24 bearing against the short arm of the thermostat lever 17. The spring 23 keeps the thermostat lever 17 in engagement with the thermostat parts, and also serves

to move the latter to the right as the positive element 21 of the thermostat expands.

The operation of this mechanism is as follows: When the system is filled with cold water the thermostat lever 17 is forced to the left against the pressure of the spring 23 until it contacts with the end of the screw 13 and lifts the valve 7 from its seat against the pressure of the spring 18, thereby admitting water to the rear end of the cylinder containing the piston 6, forcing this piston to the right and opening the gas valve 4. Gas from the pipe 2 will then flow past this valve to the pipe 25 which leads to the main burners provided for the heating of the liquid, and the gas will be ignited at these burners by means of an ordinary pilot light which is supplied with fuel through a pipe 26. As the temperature of the liquid in the tank A rises, the positive element 21 of the thermostat expands, allowing the thermostat lever 17 to move to the right under the pressure of the spring 23, and when the temperature has reached a certain point, the end of the screw 16 engages with the stem of the valve 8 opening that valve and allowing the water back of the piston 6 to escape through the pipe 15. The valve 4 will then be closed by the pressure of the spring 27, shutting off the fuel supply from the main burners. The same result will follow if the system is emptied of water, or if sufficient liquid is withdrawn to remove the main line pressure from the water in the pipe 10. It will therefore be impossible to turn on the gas when there is no liquid in the heating receptacle, and it will therefore be impossible to burn out the heater coils or other parts of the system under such circumstances. In the normal operation of the mechanism, the parts may be adjusted by means of the screws 13 and 16, so that the gas can be turned off or on at any desired temperature. It will be noted moreover that an exceedingly small motion of the thermostat lever 17 is required to operate either of the puppet valves 7 or 8, and that consequently the range of temperature required to operate the fuel valve at the cut-off and turn-on points is extremely small.

In the modification shown in Fig. 3, the construction and arrangement of the fuel valve box M, the fuel valve 4, the spring 27, and the connections to 25 and 26 is the same as in Fig. 2, and this part of the mechanism is not therefore illustrated. In Fig. 2, the stem 4′ passes freely through the front wall of the valve box chamber 3, and bears against a washer 30 at the center of the diaphragm 31 clamped between the front wall of the valve box chamber 3 and the flanged face of a rectangular chamber 32 which contains the thermostatically actuated control mechanism. The opening back of the diaphragm 31 is provided with two ports which are closed respectively by the puppet valves 33 and 34, the former opening away from the diaphragm and the latter opening toward the diaphragm, the construction and arrangement of these valves being similar to that shown in Fig. 1. The valve 33 is provided with a yoke 35 which carries at its outer end an adjustable screw 36; while the valve 34 is mounted on a stem 37 passing through a stuffing box 38. The two valves are normally held closed by the springs 39 and 40. The controlling thermostat lever 41 is mounted on a knife edge 42, passes through the yoke 35 and carries at its lower end an adjusting screw 43, which is in alinement with the end of the stem 37. The thermostat lever is actuated in this case by a liquid thermostat element which is composed of two concentric corrugated tubes 45 and 46 mounted at one end on the side of the box 32 and engaging at the other end with the bar 47 which is connected by a rod 48 with a knife edge 49 bearing against the thermostat lever 41. The thermostat parts are kept in actuating engagement by means of a spring 50. The box 32 carrying the thermostat element just described is secured to a flange 51 on the wall of the tank A, the thermostat element being immersed in the liquid filling the tank. A boss is formed on the inner side of the box 32 to receive a plug valve 52 which is used to establish or shut off the passage 52′ between the tank A and the interior of the box 32. The object of using this valve, instead of leaving a constantly open communication between the interior of the tank and the interior of the box 32 (as might be done in some cases by leaving a free opening at the point where the stem 48 passes into the box 32) is to permit of the box 32 being opened—by taking off one of its sides—at any time that it is desired to adjust the parts of the control mechanism.

The operation of the mechanism shown in Fig. 3 is the same as that of the mechanism shown in Fig. 2. When the tank is filled with cold water, the contraction of the liquid in the thermostat box permits the rod 48 to move to the right and allows the thermostat lever 41 to engage with the screw 36, thus lifting the valve 33 and admitting water from the tank A and chamber 32 to the space back of the diaphragm 31. This will force the diaphragm forward opening the fuel valve 4 and admitting gas to the main burners of the heating system. As the water in the tank becomes hotter, the liquid in the thermostat expands moving the bar 47, rod 48 and knife edge 49 to the left against the pressure of the spring 50, and the continuance of this movement will bring the screw 43 into engagement with the stem 37 of the valve 34 thereby opening the latter and allowing the water back of the diaphragm to

escape through the drain pipe 15. The relief of the water pressure on the back of this diaphragm allows the gas valve 4 to be closed as before by a spring 27 thus shutting off the fuel supply to the main burners. The design of parts is such that the closing movement is performed more rapidly than the opening movement, this being in general desirable in order to admit the gas somewhat more slowly than it is shut off. As in the previous mechanism the withdrawal of the water from the tank below the level of the thermostat, or the shutting of the water from the chamber 32 renders the thermostatic controlled mechanism inoperative, thereby absolutely prevents the opening of the fuel valve, and the admission of gas to the main burners when there is no water in the tank.

In the construction illustrated in Figure 4, A indicates as before the storage tank containing the liquid to be heated, 2′ the fuel supply pipe leading to the gas valve chamber 3′, and 4^2 the automatically controlled fuel supply valve which regulates the flow of gas through the valve box to the main burners of the heater. This fuel supply valve 4^2 is mounted so as to slide freely on the stem 55, which passes through a stuffing box in the front wall of the gas valve chamber, and bears at its outer end against the piston 56, which slides in a cylinder 57 whose rear end is in communication through the port 58 with the water in the tank A.

The inner end of the stem 55 carries a leather faced collar 59, and interposed between this collar and the adjacent head of the gas valve chamber is a compression spring 60, which tends to force the stem and its connected parts to the left. Secured to the opposite faces of the gas valve 4^2 are two soft iron disks 61 and 62; and mounted on each head or end of the gas valve box 3′ are copper coils 63, 64, 65 and 66, provided with soft iron cores and yokes 67 and 68, the coils being connected in series so as to form together with the cores and yokes two opposing electromagnets. The current is led to the coils through a binding post 69 connected in parallel to the coils 64 and 66, and through the spring switches 70 and 71, the contact terminals of which are connected respectively to the coils 65 and 63, the binding post 69 being connected to one terminal of the battery Q. The spring switches are normally closed but can be opened by the rods 72 and 73, which pass through the centers of the coils 64 and 65 and terminate at their inner ends opposite the faces of the soft iron disks 61 and 62. The controlling thermostat is of the same construction as that shown in Fig. 2 and carries a terminal knife edge 24 which bears against a spring 74. The spring 74 is provided at its lower end with a block of insulating material 75 in which is mounted a metallic terminal 76 connected to one side of the battery Q. An adjusting contact screw 77 is mounted on an insulating block 78 and is electrically connected to the open terminal of the spring switch 71. On the opposite side of the terminal 76 is a second adjustable screw 79, which is mounted on an insulating block 80 secured to the end of a lever 81. The screw 79 is electrically connected to the open terminal of the switch 70. The lever 81 is pivotally mounted at 82 and forked at its upper end to engage with a pin 83 on the stem 55.

The operation of the above described mechanism is as follows: When the tank is filled with water, the pressure of the liquid on the back of the piston 56 forces the latter to the right compressing the spring 60 and withdrawing the collar 59 from the back of the gas valve 4^2. The movement of the stem 55 to the right moves the lower end of the lever 81 to the left. If the temperature of the liquid in the tank is less than that for which the thermostat may be set, this movement will bring the screw 79 into contact with the part 75, and thus close the electric circuit through the coils 65 and 66, the current flowing, for example, from the battery terminal connected with the block 76 through the contact 79 to the switch 70, the coils 65 and 66, and out at the terminal 69 to the other side of the battery. This flow of current will magnetize the cores and yokes 67, and will—by the action of these parts on the soft iron disk 61—draw the gas valve 4′ away from its seat to the left, thus allowing the fuel to flow from the pipe 2 to the outlet pipe 25 which is connected to the main burners of the heater. During this movement, the face of the disk will come into contact with the end of the rod 72 and will thus open the switch 70 breaking the circuit, just before the movement of the gas valve is completed. The latter is held in its open position by the frictional contact between it and the stem 55 on which it slides, and also by the residual magnetism of the right hand set of electromagnets. As the temperature of the water in the tank A rises, the positive element 21 of the thermostat expands, moving the knife edge 24 to the left and allowing the spring arm 74 to likewise move to the left, thus ultimately bringing the terminal 76 into contact with the screw 77, and closing the electrical circuit through the left hand set of coils 63 and 64—the current now flowing for example, from the battery terminal 76 to the contact 77, and switch connection 71 through the coils 63 and 64 and out through the terminal 69 back to the battery. This flow of current will magnetize the left hand set of core pieces and yoke 68 and the gas valve 4^2 will be moved to the left by the action of these

parts on the soft iron disk 62, thus closing the gas valve and shutting off the flow of fuel to the main burners of the heater. The electrical connection through the coils 63 and 64 will be broken just before the valve has completed its left hand movement by the engagement of the disk 62 with the rod 73, and the consequent opening of the switch connection 71. The gas valve is held in its closed position by the frictional contact between it and the stem 55, by the residual magnetism in the core pieces and yoke 68; and by the pressure of the gas on the back of the valve. The gas valve will remain closed until the temperature of the water in the heater has fallen sufficiently to move the spring arm 74 and the contact 76 far enough to the right to once more close the battery circuit through the terminal 79 and switch 70. This will again open the gas valve 4^2 in the manner previously described. These controlling operations of the thermostat will continue as long as the tank A remains filled with water, but as soon as the latter is emptied, the pressure on the rear end of the piston 56 will be relieved, allowing the spring 60 to close the gas valve 4^2, while the simultaneous movement of the lever 81 will carry the contact screw 79 out of range of movement with the contact 76 and thereby prevents the reopening of the gas valve by the closing of the electrical circuit through the coils 65 and 66.

It will be noted in the operation of this device that the current is only on while the gas valve is being moved from one position to the other. In consequence of this, the consumption of the electric current will be exceedingly small, and the device may therefore be operated by connecting up the terminals 69 and 75 with the same battery that is used to operate the call bell system of the house.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent is the following:—

1. In combination in a water heater system, a burner, a valve for controlling the supply of gas thereto, means for closing the gas valve when the pressure is released from the system and operating automatically upon the release of such pressure, a thermostat controlled by the water in the system, power means for opening the gas valve, and a pilot mechanism operated by the thermostat throwing on such power means to give a quick opening of the valve when the temperature of the water in the heater reaches a predetermined point.

2. In combination in a water heater system, a burner, a valve for controlling the supply of gas thereto normally maintained yieldingly in closed position, an element operated by the water pressure in the system for opening the gas valve and permitting the automatic closure of the gas valve when the water pressure in the system is released, thermostatic means operated by the water of the system, and means operated by the thermostatic means for permitting the application of the pressure in the system to the said element to secure the opening of the gas valve when the temperature of the water in the system drops below a predetermined point.

3. In combination in a water heater system, a burner, a valve for controlling the supply of gas thereto normally maintained yieldingly in closed position, an element operated by the water pressure in the system for opening the gas valve and permitting the automatic closure of the gas valve when the water pressure in the system is released but cut off from the application of such pressure when the temperature of the water in the system is above a predetermined point, thermostatic means operated by the water of the system, and means operated by the thermostatic means for permitting the application of the pressure in the system to the said element to secure the opening of the gas valve when the temperature of the water in the system drops below a predetermined point.

4. In combination in a water heater system, a burner, a valve for controlling the supply of gas thereto normally maintained yieldingly in closed position, an element adapted to be operated by the water pressure in the system for opening the gas valve and permitting the closure of such valve when the pressure in the system is released, a pilot valve for controlling the application of pressure from the system to the element, and thermostatic means controlled by the water of the heater for opening the pilot valve when the temperature of the water in the system drops below a predetermined point.

5. In combination in a water heater system, a burner, a valve for controlling the supply of gas thereto normally maintained yieldingly in closed position, an element adapted to be operated by the water pressure in the system for opening the gas valve and permitting the closure of such valve when the pressure in the system is released, a pilot valve for controlling the application of pressure from the system to the element, and thermostatic means controlled by the water of the heater for opening the pilot valve when the temperature of the water in the system drops below a predetermined point and for closing the pilot valve when the temperature of the water in the system rises above a second predetermined point.

6. In combination in a water heater system, a burner, a valve for controlling the supply of gas thereto normally maintained

yieldingly in closed position, an element adapted to be operated by the water pressure in the system for opening the gas valve, a pilot valve for controlling the application of pressure from the system to the element, a second valve for permitting the exhaust of the water supplied for operating the element, and thermostatic means controlled by the water of the heater for opening the pilot valve and closing the second valve when the temperature of the water in the system drops below a predetermined point and for closing the pilot valve and opening the second valve when the temperature of the water in the system rises above a second predetermined point.

In testimony whereof I have hereunto signed my name in the presence of the two subscribed witnesses.

FRANK L. O. WADSWORTH.

Witnesses:
LETITIA A. MYERS,
DOERING BELLINGER.