

B. A. SCHRODER.
WATER HEATER.
APPLICATION FILED DEC. 26, 1911.

1,060,638.

Patented May 6, 1913.

2 SHEETS-SHEET 1.

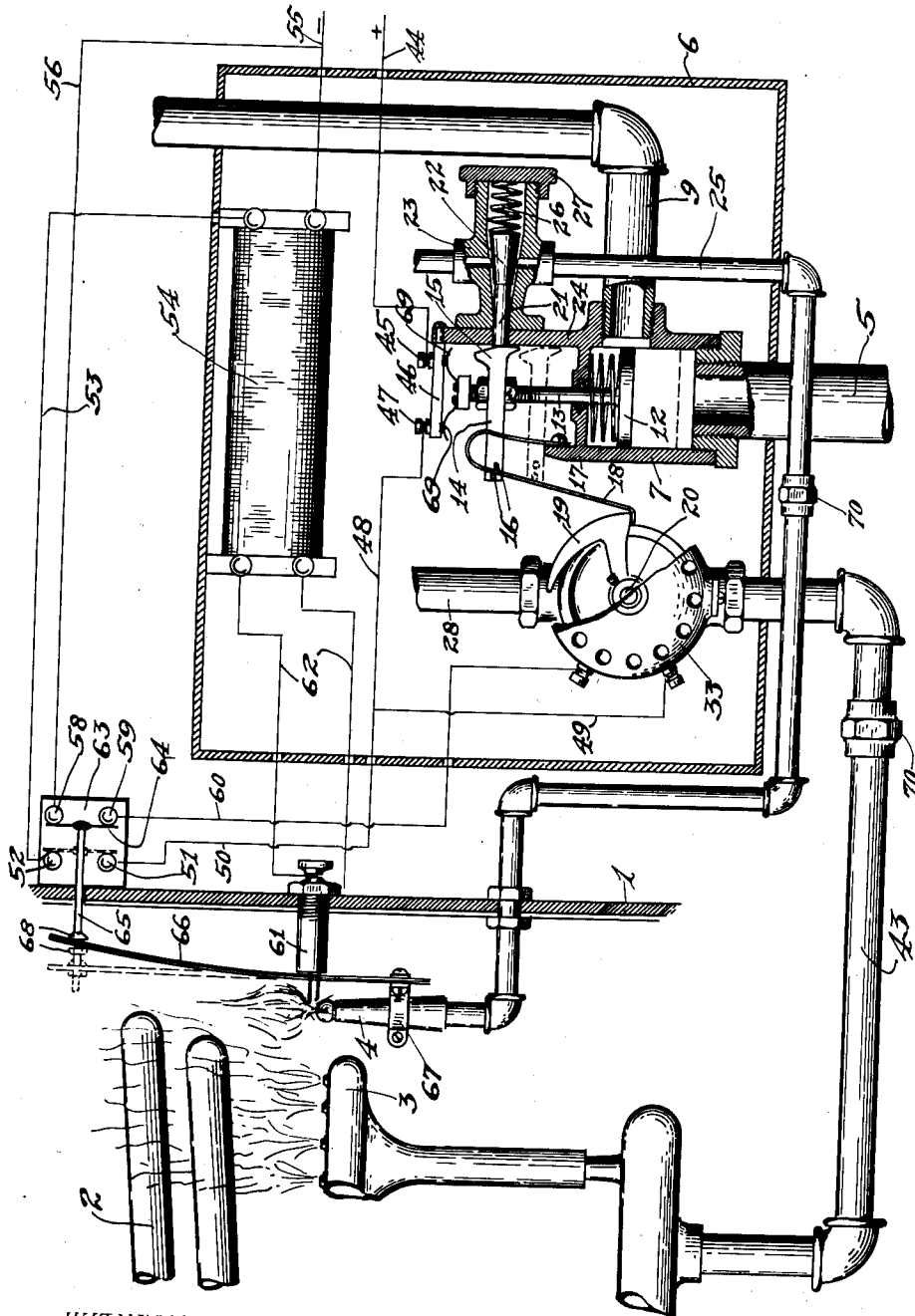


FIG. 1

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2 SHEETS—SHEET 2.

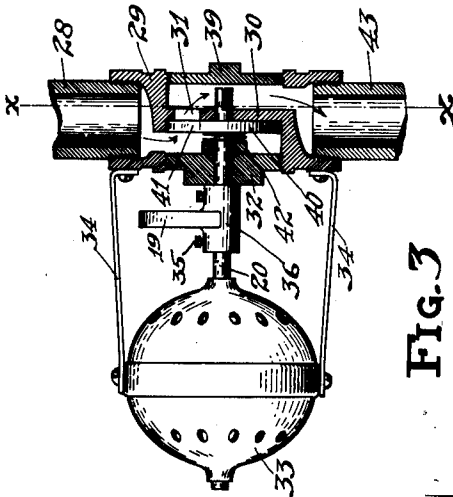


FIG. 3

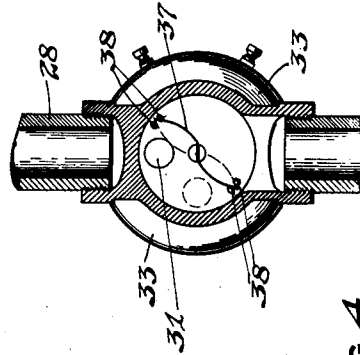


FIG. 4

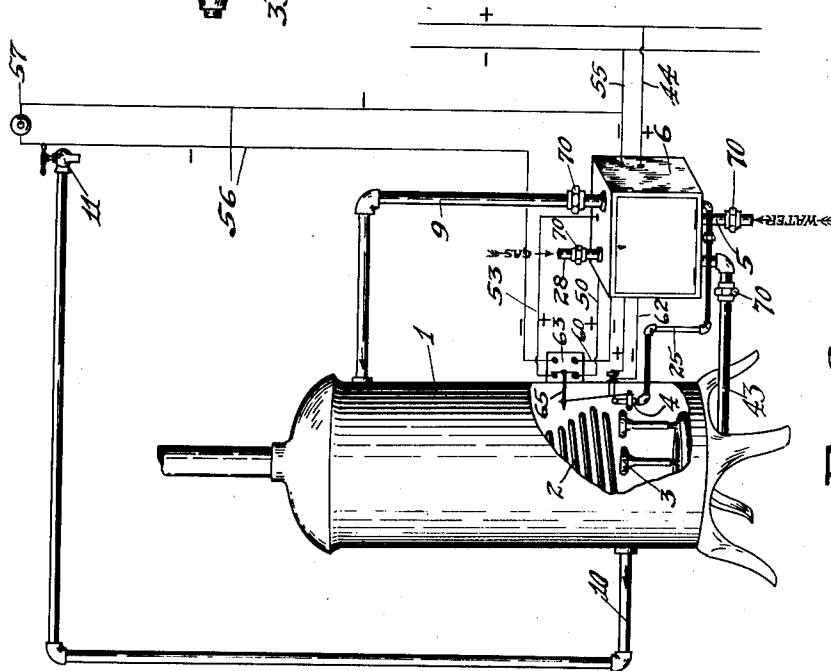


FIG. 2

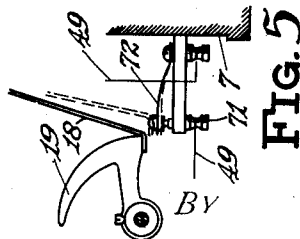


FIG. 5

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WATER-HEATER.

1,060,638.

Specification of Letters Patent.

Patented May 6, 1913.

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To all whom it may concern:

Be it known that I, BERNARD A. SCHRODER, a citizen of the United States of America, residing at Birmingham, in the county of Jefferson and State of Alabama, have invented certain new and useful Improvements in Water-Heaters, of which the following is a specification.

My invention relates to improvements in water heaters designed particularly to make it impossible for explosions to occur.

One object of my invention is to provide a thermostat responsive to the heat of the pilot flame which controls the mechanism for opening the main gas valve and positively prevents that valve opening until the pilot flame is burning sufficiently to insure the lighting of the main burners as soon as the gas is turned on. If the pilot flame, by reason of the low gas pressure, is too small to insure the lighting of the main burners, my apparatus will hold the main valve closed until the gas pressure rises and gives a normal pilot flame.

Another object of my invention is to make the whole gas controlling and igniting mechanism responsive to the drawing of water so that they cannot start the heater until water in a substantial volume is being drawn. Before the volume of water being drawn is reduced to so small a quantity that there might be a tendency to produce steam in the heating coils, the mechanism will automatically close the main gas valve and cut the heater out of service until the normal flow of water is reinstated.

My invention contemplates the use of electricity as the means for operating the main gas valve and effecting the ignition of the pilot flame.

In order to make my present system an improvement over the electric controller system shown in my Letters Patent No. 1,008,077, and to economize the consumption of electricity in the operating of my apparatus, I prefer to use a push button placed near one or each faucet and so connected up that when released it breaks the circuit to all the electro-magnetic mechanism, mechanical means being provided to hold the gas valve open as long as water is being drawn in substantial volume.

A further object of my invention is to arrange all the controller valve mechanism for the gas and water in a casing having

connections which can be readily coupled to the gas and water pipes for both house and heater, thus making it as simple as possible to readily install same and to remove it for repair or exchange, which will be of great practical advantage in the economical maintenance of the heater.

My invention further comprises various details of construction, such as the apparatus by which the valve which moves responsive to the drawing of water both opens the gas valve for the pilot and sets the catch to engage and hold the spring pressed main gas valve from closing when once opened by its operating motor; the simplicity of the main gas valve and its operating means; and the other details of construction and arrangement of parts hereinafter more particularly described in their preferred embodiment by reference to the accompanying drawings, in which:—

Figure 1 illustrates my controller mechanism shown partly in elevation and partly in section. Fig. 2 is a view showing the heater with the controlled mechanism inclosed in its casing and connected up as in use, a manual control being used to start the heater. Fig. 3 is a vertical cross-sectional view of the motor operated main gas valve. Fig. 4 is a vertical sectional view taken along the line $x-x$ of Fig. 3. Fig. 5 is a detail showing of an automatic electric cut out for the motor.

Similar reference numerals refer to similar parts throughout the drawings.

The heater 1 may be of any standard type provided with a water coil 2, main burners 3 and a pilot burner 4. The water flows to the apparatus through a water inlet pipe 5 which enters the bottom of the box 6 for the controller mechanism and is screwed into the bottom of a valve casing 7. This has a side port 8 into which the water pipe 9 is screwed, this pipe, by suitable couplings and elbows, leading through the top of the casing and connecting with the upper end of the coil 2 from which the water passes off through a pipe 10 to the faucet 11. Within the valve casing 7 is a spring pressed piston valve 12, the stem 13 of which passes up through a suitably packed opening in the top of the casing and is threaded. An actuator 14 is held on the stem by means of jam nuts which are threaded thereon and at one end the actuator is provided with

a beveled head 15 and at the other end with a pair of guide pins 16. The casting for the valve casing 7 has a shoulder 17 at one side to which is suitably fastened a bent spring catch 18 which is slidably engaged by the pins 16 and which normally stands with its hooked end caught under a segment 19 which is fixed on the stem 20 of the main gas valve. The bevel head 15 is adapted to engage the stem 21 of a cone valve 22 mounted in a valve casing 23 which is attached to a vertical extension 24 of the casing 7. The stem 21 of this valve projects through the inner wall of its casing and through the extension 24 and is adapted to be engaged by the bevel head 15 as the latter moves from dotted to full line position, Fig. 1, and to be moved thereby to open the valve, permitting gas to flow through a pipe 25 which leads to the pilot 4 to which it supplies gas. A spring 26 normally holds the valve 22 seated and the valve casing is provided with a threaded cap which is removable for the insertion and removal of the valve.

A main gas supply pipe 28 enters the casing from above and is threaded into the upper end of the main gas valve casing 29, which, as seen in Figs. 3 and 4, is circular in front elevation and provided with a diaphragm 30 having a port 31. The valve casing is provided with circular openings on opposite sides of the diaphragm, one of which is closed by a threaded cap 32 which serves as a bearing for the inner end of the valve stem 20, which at its outer end is operably connected to the movable element of an electric motor 33. The motor is shown connected to the valve casing by arms 34 and is spaced sufficiently therefrom to permit the segment 19 to be mounted on the shaft 20 and be rigidly connected thereto in any suitable manner, such as by set screws 35 which pass through the hub 36 of the segment. The cap 32 is suitably packed to prevent the escape of gas around the stem 20, which latter, at its inner end, projects through an opening in the diaphragm 30 and is transversely slotted to receive a reversely curved spring 37 (Fig. 4), the ends of which engage between the oppositely disposed pairs of pins or projections 38 carried by the diaphragm. The spring is inserted by removing the screw closure 39. A rotary disk valve 40 is fixed on the stem 20 and provided with a port 41 adapted to register with the port 31, and the valve is normally held against the diaphragm as a seat by means of a coil spring 42. The gas flows out from the valve casing 29 through a pipe 43 which leads to the main burners 3. The spring is so arranged that it is placed under the tension as the valve is moved by the motor to open port 31 and it is therefore adapted, as soon as the motor is cut out of

circuit, to instantaneously and automatically restore the valve to its closed or dotted line position, Fig. 4.

My electric controller system may be described as follows: Current from the positive line wire or battery is carried by a wire 44 to the terminal 45 which is mounted on an insulator block 46 that is suitably connected to the upper end of the extension 24. At its opposite end the block 46 carries a terminal 47 from which a wire 48 leads and is connected by a wire 49 to one terminal of the motor and by wire 50 to a contact point 51. From an opposite contact 52 the wire 53 leads to the spark coil 54 and continues therefrom as wire 55 to the negative line wire. The wire 56 branches from wire 55 and leads to the contact 58. When it is desired to make the controller system not wholly automatic but dependent on manual control before starting the heater, I interpose a push button make and break switch 57 (Fig. 2) in the wire 56. A contact 59, opposite the contact 58, is connected by a wire 60 with the other terminal of the motor. A spark plug 61 is mounted in the heater casing in position to ignite the pilot flame and is connected in a circuit 62 with the spark coil. The contacts 51, 52, 58 and 59 are mounted on a plate 63 of insulating material which is fastened to the walls of the heater or to any other suitable place, and one or the other vertically opposite a pair of said contacts is adapted to be short circuited by a spring circuit closure 64, which is mounted on a stem 65 that projects to a thermostat 66. This thermostat is composed of metals having different coefficients of expansion and is fastened at its lower end by means of a clip 67 to the pilot burner 4. The nuts 68 are threaded onto the stem 65 and serve to adjustably connect the stem and thermostat. A spring circuit closer 69 is mounted on the top of the stem 13 and is adapted to engage and close the circuit across the terminals 45, 47.

In order that the casing 6 may be easily coupled to and disconnected from the water and gas connections for house heater, I provide each pipe entering the casing with a union 70 near the casing by means of which the latter may be removed without disarranging the other pipes.

The spring 37 is reversely curved, as shown in dotted lines, Fig. 4, when not under tension, which design is desirable to permit the spring to assume the full line position necessary for the valve to have its full opening movement without being subjected to too great a strain.

The operation of my apparatus is as follows: Referring to Fig. 2, which shows the combined manual and automatic control and assuming the wire 56 broken at the push button 57, if the faucet 11 be opened, the

flow of water will raise piston 12, causing its actuator 14 to open pilot valve 22, release spring 18 (so that it will press against the curved periphery of 19) and close the circuits between wires 48 and 49. The switch 64 will close the sparking circuit across the terminals 51, 52. Gas will now flow past valve 22 to the pilot burner and become ignited by the sparking system. The circuit to the motor however remains broken until the thermostat closes the motor circuits across the terminals 58 and 59, which it does after breaking the sparking circuit. If, now, the make and break switch 57 is still open, cold water will flow through the heater and the main gas valve will not be opened nor will the heater be in service. If however there were no push button switch in the circuit, as in Fig. 1, or if such switch were closed, as in Fig. 2, the motor 33 would be energized and valve 40 rocked to the right, Fig. 4, to open the main gas valve and move the element 19 into position to be engaged by the catch 18, which holds the valve fully open. The moment the push button is released the motor circuit is broken but the gas valve 40 is held fully open by the catch until the amount of water being drawn through the faucet falls below the predetermined volume necessary for the safe operation of the heater with the gas valve fully open. When this occurs the piston 12 falls, drawing the pins 16 down with the actuator 14 until they disengage the catch from the element 19, whereupon the spring 37, which was placed under tension by the opening movement of the valve, immediately closes valve 40 and fully cuts off the gas from the burners 3, and at the same time the head 15 becomes disengaged from the pilot gas valve 22 and that is closed by spring 26.

If the pilot flame upon being ignited should prove abnormally weak, which might possibly interfere with its igniting the heater until the latter becomes filled with gas from the main burners and explodes, the thermostat 66 will not move sufficiently to cause 64 to close the motor circuit and therefore it is not possible for the main gas valve to be opened until a normal gas pressure and a normal pilot flame is obtained. Also, when the volume of water that is being drawn is abnormally small, not only are the main gas valve and the pilot gas valve held closed by their respective springs, but the circuit is broken across the terminals 45, 47, and there is no waste of current or gas in the heater which will then deliver only cold water.

By my system the heater is automatically cut out under conditions of low gas pressure or low water pressure and without the aid of thermostats responsive to conditions in the water coil or over the main burners in the heater. Further, when the heater is in service the burners are always burning at

maximum efficiency and are not adjusted to intermediate conditions by the water valve which gives me a full open or closed action only of the main gas valve. The adjustment of the actuator 14 will determine the minimum quantity of water which may be drawn while the heater is in service and as this minimum quantity is increased the temperature of the water delivered to the faucet will be lowered, the factor of heating in the heater being a constant, and the flow of water the variable factor.

To make the apparatus proof against injury in the electrical mechanism and to enable me to use a small motor, I provide in Fig. 5 an automatic circuit breaker in the motor circuit 49 which comprises insulator terminals 71 to which the wire 49 is connected, and a spring circuit closer 72 which normally breaks the circuit of 49 when the catch 18 is in dotted line position and the main gas valve closed. The moment the catch 18 snaps under the element 19 to lock the gas valve open, the switch 72 breaks the motor circuit 49 and automatically opens the circuits the motor. In the automatic apparatus shown in Fig. 1, this attachment will prevent the motor being constantly energized during the drawing of water, and in the apparatus shown in Fig. 2 would prevent the motor being energized if the button 57 should be held closed any substantial period. The possibility of such conditions would require a larger motor than I prefer to use and than is necessary for snapping the gas valve open.

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

1. The combination in a water heater, of a main gas burner, a pilot burner, a thermostat primarily responsive to the pilot flame, means controlled by the flow of water through the heater to control the supply of gas to said pilot burner, mechanism for controlling the admission of gas to the main burner, means operable by said thermostat and mechanism responsive to said means and adapted to control the supply of gas to the said main burner.

2. The combination in a water heater, of a main gas burner, a pilot burner, means to supply gas to said burners, a motor operated valve acting on the gas supplied to the main burner, a valve responsive to the flow of water through the heater for controlling the supply of gas to the pilot burner, thermostat means responsive primarily to the heat of the pilot flame and means controlled thereby and adapted in turn to control the opening of the main gas valve.

3. The combination in a water heater, of a main gas burner, a pilot burner, means to supply gas to said burners, a motor operated valve acting on the gas supplied to the main

burner, a valve responsive to the flow of water through the heater for controlling the supply of gas to the pilot burner, thermostat means responsive to the heat of the pilot flame and adapted to control the opening of the main gas valve, and means controlled by the flow of water through the heater to hold the main gas valve fully open under predetermined conditions of flow.

4. The combination with a water heater, of main gas burners, a pilot burner, a thermostat exposed to the pilot flame, motor operated mechanism for controlling the admission of gas to the main burners, valve means controlled by the drawing of water through the heater and adapted to supply gas to said pilot burners, and mechanism controlled by said thermostat which prevents said main gas valve mechanism opening until the pilot flame is burning normally.

5. In a water heater having gas burners, a pilot flame and a water coil, the combination therewith of a controller mechanism comprising a primary controller device which moves responsive and proportionally to the drawing of water, a secondary controller device which moves responsive to the intensity of heat of the pilot flame, valve mechanism for the gas flowing to the burners, and power means, responsive to the joint control of said primary and secondary controller means, which controls the operation of said valve mechanism.

6. In a gas burning water heater, a water coil, a device which moves responsive to the drawing of water through said coil, a gas burner, valve means for controlling the supply of gas to said burner, means to open and close said valve, and means to hold said valve fully open which are controlled by said device and adapted to release the gas valve when the flow of water falls below a predetermined volume.

7. In a water heater, a main gas supply valve, means to open said valve, means to hold the valve in open position, means to automatically close the valve when released by said latter means, and means responsive to the volume of the flow of water through the heater which controls the release and automatic closure of said gas valve, substantially as described.

8. The combination with a gas heater and the pipes for supplying gas and water thereto, of juxtaposed valve mechanism interposed in said pipes for controlling the flow of gas and water to the heater, a casing containing said valve mechanism, and couplings in said pipes at or near said casing and on each side thereof to permit the casing and valve mechanism to be readily disconnected, substantially as described.

9. In a water heater containing a water coil and gas burners, means to ignite the gas, a piston movable responsive to the volume of

water drawn through said coil, a valve controlling the supply of gas to said burners, means to open said valve, means tending to normally close said valve, a catch to hold the valve open, and means carried by said piston to trip the catch when the piston assumes a predetermined position responsive to the drawing of a small volume of water through the heater.

10. In combination, a water supply pipe, a valve chamber in said pipe, a heater through which said pipe passes, a piston in said water chamber adapted to be operated responsive to the volume of water flowing through said chamber, gas burners in said heater, a gas pipe leading to said burners, a gas valve in said gas pipe, means to open said valve against a resistance tending to normally close it, a spring catch adapted to engage said opening means for the valve and hold the latter open, and means controlled by said piston to release said catch and permit the gas valve to close, substantially as described.

11. In combination with a water heater having gas and water supply pipes and valves therein, a device in the water pipe which moves responsive to the drawing of water therethrough, a catch which is operable by said device, and a device movable with the gas valve which is engaged by said catch to hold the valve in predetermined open position, substantially as described.

12. In combination with a water heater having gas and water supply pipes and valves therein, a device in the water pipe which moves responsive to the drawing of water therethrough, a catch which is operable by said device, an element movable with the gas valve which is engaged by said catch to hold the valve in predetermined open position, a pilot burner, a gas pipe leading to the pilot burner, a normally closed valve in said pipe which is adapted to be engaged and opened by said device, and means to ignite the pilot burner.

13. In combination with a water heater having gas and water supply pipes and valves therein, a device in the water pipe which moves responsive to the drawing of water therethrough, a catch which is operable by said device, an element movable with the gas valve which is engaged by said catch to hold the valve in predetermined open position, a pilot burner, a gas pipe leading to the pilot burner, a normally closed valve in said pipe which is adapted to be engaged and opened by said device, and means to ignite the pilot burner comprising electric circuits and sparking means, said circuits being adapted to be closed and opened by said device, substantially as described.

14. A controller system for water heaters comprising a water supply pipe, a main gas supply pipe, valves in said pipes, a device

which moves responsive to the drawing of water, electric means to open the gas valve, means tending to automatically close the valve, a pilot flame, sparking means to ignite the pilot flame, electric circuits comprising a push button adjacent to a point of use of heated water, a circuit closer controlled by the position of said device and adapted to close the circuit when a predetermined volume of water is being drawn, and automatic means controlled by the heat of the pilot flame and adapted to automatically hold the circuits to the gas valve opening means broken until the heat of the pilot flame rises to a predetermined point.

15 15. A controller system for gas burning water heaters which comprise a pilot flame and means to ignite same, the combination therewith, of a thermostat controlled by the heat of the pilot flame, a main gas supply valve for the heater, a device movable responsive to the drawing of water through the heater, and mechanism controlled by said thermostat and said device for opening the gas valve under predetermined conditions of flow of water through the heater and flow of gas to said pilot, substantially as described.

20 16. In a controller system for gas burning water heaters, a main gas supply valve, means to ignite the gas in the heater, an electric motor for opening the valve, a catch to hold the valve open, means to close the valve when released from the catch, a circuit to supply electrical energy to said motor, and circuit breakers interposed at three points in said circuit, one being operable responsive to the heat of the pilot, another operable responsive to the drawing of water through the heater, and a third adapted to be manually operated, substantially as described.

25 17. In a gas burning water heater, a main burner, a pilot burner, ignition means for said pilot burner, and independent valve means for controlling the supply of gas to the pilot burner, means to normally hold said valve means in position to shut off gas from said pilot burner, and means which move responsive to and during the drawing of water through said heater for operating said valve means and admitting gas to said pilot burner.

30 18. In a gas burning water heater, a main burner, a pilot burner, valve means for controlling the supply of gas to said pilot burner independently of the main burner and which shut off gas therefrom when water is not being drawn through the heater, ignition means for the pilot flame, mechanism movable responsive to the drawing of water through said heater and adapted to control both said valve and ignition means to produce and ignite a pilot flame, and means responsive to the pilot flame for admitting gas to said main burner.

19. In a gas burning water heater, heating burners, a valve controlling the supply of gas to said burners, a motor adapted to move the valve to one operating position, power means to restore the valve to initial position, means to energize and deenergize the motor, a catch to prevent the power means moving the valve under certain conditions, and mechanism responsive to the drawing of water which in one position releases the catch and energizes the motor, and which in another position releases said catch, said motor having been previously deenergized, substantially as described.

20. In a gas burning water heater, a valve controlling the supply of gas to the heating burners, and mechanism responsive to the drawing of water through said heater to fully open and fully close said valve without intermediate operating positions, said mechanism comprising a motor, a spring and an adjustable catch controlled by the drawing of water.

21. In a gas burning water heater, a valve controlling the supply of gas to the heating burners, a device movable responsive to the volume of water drawn through the heater, an actuator adjustably connected to said device, means to produce a pilot flame, means to ignite it, and mechanisms respectively adapted to catch and hold the gas valve open, to cut the ignition means into and out of service, and to control the supply of gas to the pilot, which are all controlled by said actuator, substantially as described.

22. In a gas burning water heater, a gas valve for controlling the supply of gas to the heater, an arcuate member movable with the valve and having a shoulder, a spring catch adapted to ride over the arcuate surface and engage said shoulder as the valve moves to an open position, and means controlled by the flow of water through the heater to disengage said catch from the shoulder and release the valve.

23. In a gas burning water heater, a main gas valve, a pilot burner, a separate valve for the burner, an electric ignition means for the pilot flame, a thermostat exposed to the pilot flame, an electric motor for operating the main gas valve, a water motor for operating the pilot valve, a make and break switch for the ignition and motor circuits which is controlled by said water motor, a make and break switch for both said circuits which is controlled by said thermostat, and a manually controlled switch for the motor circuit, substantially as described.

24. In a gas burning water heater, a main gas valve controlling the supply of gas to the heater, an electric motor to open said valve, a pilot burner, means to electrically ignite the pilot flame, a thermostat adapted to be heated by the pilot flame, and a make and break switch in circuits leading to the

igniting means and to the electric motor and
which is operated by said thermostat to close
the ignition circuit and open the motor cir-
cuit when the thermostat is cold and when
5 the thermostat is heated to open the ignition
circuit and close the motor circuit.

25. In a gas burning water heater, a valve
controlled gas supply means, electric means
to open the gas valve, catch means to hold
10 the valve fully open against means tending

to close it, mechanism controlled by the
catch means to open circuit said electric
means when the valve is open, and means to
control the opening of the valve.

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

BERNARD A. SCHRODER.

Witnesses:

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NOMIE WELSH.