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A GAS FIRED WATER HEATER

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The present invention relates to an automatic safety gas fired water heater for producing instant hot water.

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In conventional heaters, the water pressure acts on a diaphragm valve to move a valve rod, which not only actuates a microswitch to activate the sparking of an igniter, but also simultaneously moves a first valve disc to open and admit gas to the nozzle of a pilot burner, thus igniting the gas thereat. As the pilot flame is produced, a catch which is controlled by a sensor, is subsequently disengaged from a second valve disc in the gas conduit to the main burner so that the valve rod will subsequently move the second valve disc to open and admit gas to the nozzle of the main burner and burning thereat. In such heaters, if the pilot flame, or the pilot flame

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together with the main flame are blown out by the wind, the igniter will re-ignite the gas at the pilot burner, and then fire the main burner following the above-mentioned operation steps. Hence no unburned gas will flow out of the nozzles of the burners. The valve disc of the main burner will be maintained in its closed position if the pilot flame cannot be ignited. Therefore, in case the igniter fails to work, a slight amount of the unburned gas will flow out of the nozzle of the pilot burner, thus resulting in a serious problem of suffocation and explosive burning. However, if the main and pilot flames are suddenly blown out by a strong wind, and immediate re-ignition is not possible, a large amount of unburned gas will flow out of the nozzle of the main burner and cause explosive burning and suffocation. Moreover, in the event of failure of the electricity supply the valve disc cannot be automatically closed and a great deal of gas will escape from the nozzles of the main burner and pilot burner. In my U.K. Patent Application No. 8115951 (Published Specification No. 2099130), an automatic safety gas fired water heater is described to overcome the above drawbacks. In that heater, a valve rod connected to a diaphragm valve does not control the gas supply valves directly, but instead,

it merely actuates a microswitch connected in an electric control circuit. The electric control circuit, in turn, controls the on-off state of two solenoid operated valves which are connected in series. The two solenoid operated valves are so oriented that the valves move to their closed position when the electrical supply to the electric control circuit fails.

The present invention provides further improvements to the gas fired water heater described in my U.K. Patent Application No. 8115951, in that a disc valve is additionally provided thereto for controlling the supply of gas to the main burner.

According to the present invention there is provided a gas fired water heater comprising: a valve rod connected to a diaphragm valve which is actuated by pressure of the water supply; an electric control circuit; a microswitch included in the circuit and adapted to be actuated by movement of the valve rod; first and second solenoid operated valves connected in series in the circuit and provided respectively in a first gas conduit communicating with a nozzle of a pilot burner and a second gas conduit communicating with the nozzles of a main burner, the first and second solenoid operated valves being separately

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actuated by the electric control circuit; a third valve provided in the first gas conduit and located between the first solenoid operated valve and the nozzle of the pilot burner and the second solenoid operated valve, said third valve being actuated by the movement of the valve rod; an electrically operable igniter located adjacent the nozzle of the pilot burner, and included in and actuatable by the electric control circuit to ignite gas issuing from the pilot burner to provide a pilot flame; and a first electric sensor provided adjacent the nozzle of the pilot burner and included in the electric control circuit for detecting the presence of a pilot flame, whereby when the sensor detects the presence of a pilot flame, the electric control circuit generates a first electric signal to de-activate the igniter, and to operate the second solenoid operated valve to supply gas to the main burner, and in the absence of the pilot flame, the sensor induces the electric control circuit to generate a second electric signal to continue activation of the igniter, and to actuate the second solenoid operated valve to stop the supply of gas to the main burner.

In accordance with another feature of the present invention, the third valve has a valve disc

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which is urged to its open position by the valve rod against a bias.

5 In accordance with further features of the invention, a temperature detecting sensor is provided adjacent the main burner for generating a signal for an alarm device and simultaneously de-energises the electric control circuit when the temperature exceeds a predetermined value.

10 The invention will now be described by way of example with reference to the accompanying drawings in which:-

15 Figure 1 is a schematic view illustrating a preferred embodiment in its inoperative condition in which the diaphragm valve is not subjected to the water pressure;

20 Figure 2 is a schematic view as in Figure 1, but in its operative condition in which the diaphragm valve is subjected to the water pressure and the ignition of the pilot burner has been accomplished; and

Figure 3 is a schematic view as in Figure 1, but in another condition, in which the main burner is also ignited.

25 The gas fired water heater shown schematically in the accompanying drawings is shown in

Figure 1 in its inoperative condition in which the faucet (not shown) controlling the water supply is closed. The water supply passes through a diaphragm valve 1 as shown by the arrows so that when the faucet is opened the pressure of the water passing through the valve will exert pressure on an elastomeric diaphragm 2 in the valve 1 moving the diaphragm upwardly as shown in Figures 2 and 3.

The gas supply to the heater enters a first conduit as shown by the arrow, the conduit being controlled by a first solenoid operated valve 5 and communicates with a pilot flame nozzle 14 and with a second conduit which connects to the main burner nozzles 18 and is controlled by a second solenoid operated valve 8.

According to the invention a third valve 3 is located in the first gas supply conduit at a position between the first solenoid operated valve 5 and the connection of the first conduit with the supply conduits to the pilot and main burners. The third valve 3 includes a valve rod 21 connected to the diaphragm 2 of valve 1 so that the valve rod is moved upwardly against the bias of a spring 34 in response to upward deformation of the diaphragm due to water pressure in the valve 1. The valve rod 21 has a

conical portion 31 intermediate its length which actuates a microswitch 4 on upward movement of the valve rod to close a circuit connected with the control board 11 of an electrical control circuit.

5 The valve rod 21 further includes at its upper end a disc valve 32 normally engaging a valve seat 33 but which is moved upwardly from the seat 33 by the valve rod 21 to open the valve thus connecting the first gas supply conduit with the pilot nozzle 14 and second gas
10 conduit when water pressure enters the valve 1.

The first solenoid operated valve 5 is electrically connected to the board 11 of the electrical control circuit and has a magnet 25 which in its de-energised condition is urged downwardly by a
15 spring 7 to engage a valve disc 13 against a valve seat 9 so as to close the valve. Similarly, the second solenoid operated valve 6 includes a magnet 26 also connected to board 11 of the control circuit and which in its de-energised condition is urged
20 downwardly by spring 8 to engage valve disc 17 against a valve seat 10 to close the valve.

In the operation of the heater when the faucet is closed the valves 3, 5 and 6 are inoperative and in their closed positions. However, when the
25 faucet is opened, as shown in Figure 2, the

elastomeric diaphragm 2 is urged by the water pressure to drive the valve rod 21 upwardly. The upward movement of the valve rod 21 moves the disc 32 away from the valve seat 33 against the bias of spring 34, and at the same time, by means of its conical portion 31, imparts a force to actuate the microswitch 4 to its operative state. Assuming the electric control circuit has been switched on at the board 11, an igniter 12 is now activated while another signal from the electric control board 11 energises the magnet 25 of the first solenoid operated valve 5 to lift the valve disc 13 upwardly against the bias of the spring 7 to permit gas to flow through the valve and through the opened third valve 3, to pilot flame nozzle 14 at which the gas will be ignited by the sparking of the igniter 12.

As shown now in Figure 3, a sensor 16 is provided near the pilot flame nozzle 14 for detecting the presence of the pilot flame 15. In the presence of the flame 15, the impedance in the sensor 16 varies and induces the electric control circuit to generate two further signals, one for discontinuing the sparking action of the igniter 12 and the other for energising the magnet 26 of the second solenoid operated valve 6 to lift the valve disc 17 upwardly to

permit gas to flow to the nozzles of the main burner 18 at which the gas is ignited by the pilot flame 15 so as to produce the main flame 19. After use of the heater, the faucet is closed and the valve rod 21 as well as the elastomeric diaphragm 2 will revert to its original position as shown in Figure 1.

If the pilot flame 15 and the main flame 19 are extinguished undesirably e.g. by a strong wind, the sensor 16 will induce the electric control circuit to send signals to de-energise the magnet 26 thereby closing the valve 6 and at the same time to continue sparking of the igniter 12. The second solenoid operated valve 6 will not re-open until the gas from the pilot burner 14 is re-ignited. Hence, the possibility of explosive burning and suffocation can be minimized to be negligible.

Further, the event of failure of the electrical supply, the solenoid operated valves 5, 6 will automatically close. In the case of damage to the solenoid operated valves 5, 6 or the springs 7, 8 thereof, the valve discs 13, 17 will move down by gravity to abut against the valve seats 9, 10 and thereby close the valves.

The third valve 3 which is provided in the gas supply conduit up-stream of the pilot burner 14

and the main burner 18 will obviously prevent the supply of gas to the burners of the microswitch 4 is abnormally switched-on without any corresponding actuating movement of the valve rod 21.

5 A temperature detecting sensor 40 is provided in the vicinity of main burner 18 for sending a signal to the electric control board 11 to activate an alarm 41 and cut the electricity supply automatically, in case of overheating of the main
10 burner 18.

CLAIMS

1. A gas fired water heater comprising:
a valve rod connected to a diaphragm valve which is
5 actuated by pressure of the water supply; an electric
control circuit; a microswitch included in the circuit
and adapted to be actuated by movement of the valve
rod;
first and second solenoid operated valves connected in
10 series in the circuit and provided respectively in a
first gas conduit communicating with a nozzle of a
pilot burner and a second gas conduit communicating
with the nozzles of a main burner, the first and
second solenoid operated valves being separately
15 actuated by the electric control circuit;
a third valve provided in the first gas conduit and
located between the first solenoid operated valve and
the nozzle of the pilot burner and the second solenoid



operated valve, said third valve being actuated by the movement of the valve rod; an electrically operable igniter located adjacent the nozzle of the pilot burner, and included in and actuatable by the electric control circuit to ignite gas issuing from the pilot burner to provide a pilot flame; and a first electric sensor provided adjacent the nozzle of the pilot burner and included in the electric control circuit for detecting the presence of a pilot flame, whereby when the sensor detects the presence of a pilot flame, the electric control circuit generates a first electric signal to de-activate the igniter, and to operate the second solenoid operated valve to supply gas to the main burner, and in the absence of the pilot flame, the sensor induces the electric control circuit to generate a second electric signal to continue activation of the igniter, and to actuate the second solenoid operated valve to stop the supply of gas to the main burner.

2. A gas fired water heater according to claim 1, in which the third valve has a valve disc which is urged to its open position by the valve rod against a bias.

3. A gas fired water heater according to claim 1 or 2, in which the two solenoid operated valves are



so oriented that in the event of failure of the electric supply the solenoid operated valves will move to their inoperative closed positions due to the force of gravity.

5 4. A gas fired water heater according to claim 3, in which a temperature detecting sensor is provided adjacent the main burner for generating a signal for an alarm device and simultaneously de-energising the electric control circuit when the temperature exceeds
10 a predetermined value.

5. A gas fired water heater substantially as described and as shown in the accompanying drawings.

