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WATER HEATER CONTROL SYSTEM

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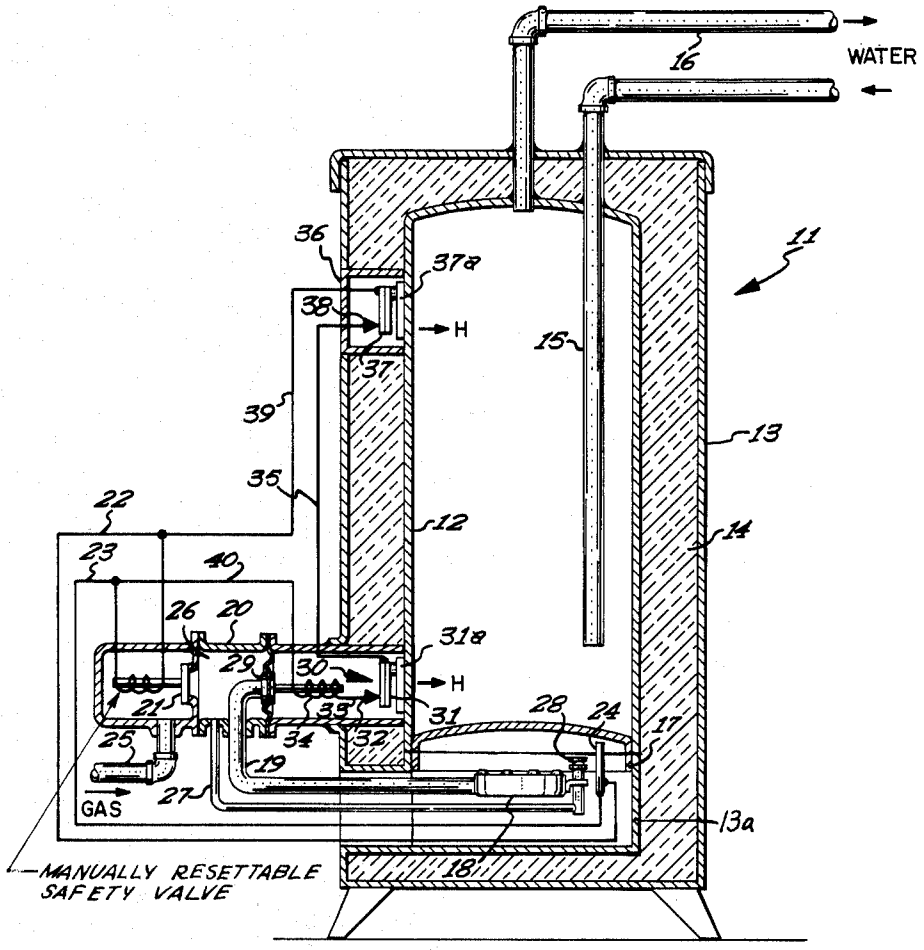

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WATER HEATER CONTROL SYSTEM

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1 Claim. (Cl. 236—21)

This invention relates to a water heater control system and the apparatus thereof and, more particularly, to such a system for controlling the supply of gas to the water heater to maintain a desired amount of hot water for domestic use thereof. The water heater industry is a highly competitive one in which the various manufacturers of the heaters are constantly striving to reduce the cost and increase the life of the heaters. Some of the ways to reduce the cost are to reduce the number of controls used in the heaters or to decrease the cost of installation of the controls or to increase the life of the heater for the same cost.

One of the objects of this invention is to provide a water heater control system and apparatus which will combine the above-mentioned methods of reducing the cost of a water heater.

Another object of the invention is to reduce the cost of the water heater by controlling it with a fewer number of parts requiring a lesser amount of work for the installation thereof.

A further object of the invention is to make a combined gas valve and a switch type of thermostatic unit for controlling it so as to eliminate some of the external wiring that would be necessary except for the elements being combined.

Another object of the invention is to provide a control system for a water heater which provides a better control thereof in that it reduces the variation in the temperature of the water.

A still further object of the invention is to provide control apparatus for a water heater which provides an automatically recycling limit switch which will prevent the water from overheating and which will make it unnecessary for a householder to manually reset the safety switch every time that the safety switch senses an unsafe condition of the water.

A still further object of the invention is to provide a self-contained control system for a water heater which will require a minimum amount of attention from a householder yet provide completely safe operation thereof.

Still further objects of the invention will become apparent upon reading the following detailed description of the invention in conjunction with the accompanying drawing wherein the only figure of the drawing is a schematic showing of a water heater in vertical cross-section showing the general arrangement of the components of the control apparatus and the electrical wiring thereof.

The water heater is generally designated by the reference numeral **11** and comprises a water containing tank **12** surrounded by a spaced outer jacket **13** with insulation **14** therebetween. Water is admitted to the tank through a supply pipe **15** and is taken from the tank through an outlet pipe **16**. The tank is supported in the outer jacket **13** by means of an annular ring **17** mounted on an inwardly spaced wall **13***a* of the jacket **13** positioned below the water tank.

The water is adapted to be heated by a main burner **18** positioned below the water tank and supplied with gas through a pipe **19** extending therefrom to a main gas valve **20**. The main valve is mounted in the water heater so as to extend through an opening in the outer jacket **13** and bear against the outer surface of the water tank **12**. This main valve, which is shown schematically,

comprises an auxiliary safety valve **21** which is of a conventional manually resettable electromagnet type energizable by the current supplied by a thermoelectric generator. This type of safety valve is shown, for example, in U.S. Patent 2,746,472, issued to Melvin G. Sogge on May 22, 1956, and assigned to the assignee of the present invention. This safety valve is electrically connected through leads **22** and **23** to a thermoelectric generator **24**. The valve **21** is supplied gas through a supply pipe **25** and has an outlet chamber **26** which communicates with a pilot gas supply pipe **27** which, in turn, is connected to a pilot burner **28** positioned adjacent the main burner **18**. The pilot burner is adapted to provide an igniting flame for the main burner as well as a flame for heating the thermoelectric generator **24**.

The apparatus so far described is conventional in the water heater art and only the apparatus now to be described in combination with the previously described apparatus constitutes the invention of this application. While the main valve **20** which includes a main gas control valve **29** is illustrated as being one which is directly actuated by a solenoid actuator, with a diaphragm seal between the valve and the actuator, it is to be understood that the valve **29** may be of the diaphragm type wherein the gas supply pressure is used to actuate the diaphgram in response to the control of a conventional electrically controlled diaphragm controller valve. Mounted in the valve **20** is a thermostatically operated switch **30** which may be of the bimetal type having a sensing plate or heat pickup shoe **31***a* shaped and arranged to be held firmly against the water tank **12** or may be of the rod and tube type (not shown) that is adapted to be inserted through an opening (not shown) in the water tank for controlling the opening and closing of contacts **31** and **32**. **31** is illustrated as being a movable bimetal contact arm while **32** is illustrated as being a fixed contact. The fixed contact **32** is connected through a short lead wire **33** to the coil **34** of the electrical controller for the valve **29** while the movable contact **31** is electrically connected through a lead wire **35** to a second thermostatic switch **36** positioned near the top of the water tank **12**. The switch **36** is similar to the thermostatic switch **30** only that it is calibrated for opening and closing its movable contact **37** and fixed contact **38** at a higher temperature setting. The switch **36** also has a heat pickup shoe **37***a* similar to a heat pickup shoe **31***a* in the switch **30**. The movable contact arm **37** is connected through a lead wire **39** to the lead wire **22** to electrically connect it to the thermoelectric generator **24**. The other end of the coil **34** of the main valve is connected through lead wire **40** to the lead wire **23** to connect it to the thermoelectric generator also. It is thus seen that a circuit is completed from the thermoelectric generator through the coil **34** and the switches **30** and **36** in series to provide for the operation of the main valve and that a parallel circuit is completed from the generator **24** to the coil of the safety valve **21** with no switching means in the circuit. This means that whenever there is a pilot flame that is adapted to ignite the main burner and is heating the generator, the safety valve will be retained in its open position, provided it has been manually opened, whereas the main valve will be opened and held open only if both of the switches **30** and **36** are in a contacts closed condition.

Operation

The apparatus is shown in its shutdown condition. That is, the safety valve is closed and the main valve is closed and both of the thermostats have their contacts closed indicating that there is a call for heat from the main burner. To place the heater into operation, it is necessary to manually open the safety valve

21 to provide for the flow of gas to the pilot burner and then to ignite the pilot burner. After a sufficient time delay to allow for the heating of the generator 24 to energize the coil of the safety valve, the manually resetting mechanism, which incidentally is of the conventional safe light type, may be released to permit the flow of gas through the safety valve to the main valve. The heating of the generator 24 also causes the development of sufficient current to cause the operation of the main valve to its open position so that upon the release of the manual resetting mechanism of the safety valve, gas will flow past the main valve to the main burner whereupon it will be ignited by the flame from the pilot burner.

The water in the tank 12 will be heated until such time that the water surrounding the thermostat 30 has reached a desired temperature level whereupon the contact arm 31 will separate from the fixed contact 32 to break the circuit to the main valve and thus cause its closing. This thermostat 30 will cycle in response to changes in the water temperature at the thermostat and will maintain a desired amount of hot water in the tank.

If for any reason the water in the tank should become dangerously hot in the upper portion of the tank, the thermostat 36 will operate by having the movable arm 37 separate from the contact 38 and break the circuit to the main valve. However, upon the dissipation of the unsafe condition of the water at the top of the tank, the thermostat 36 will operate to close the contacts 37–38 and re-establish a control circuit from the generator to the thermostat 30 to return the main burner to the normal control of the thermostat 30. This automatic recycling of the safety switch 36 will make it unnecessary for the householder to go to the water heater to manually reset the controls thereof to place the water heater back into operation following an unsafe condition occurring in the water heater, as is the case with water heaters on the market now. Currently water heaters have a safety switch in series with the coil of the safety valve so that when an unsafe condition arises causing closing of the safety valve, the householder must manually reset the safety valve to place the heater back into operation.

The functioning of the safety switch 36 in the above described manner also helps to prevent excessive temperature commonly called "stacking" of the water in the water heater and by thus reducing "stacking," extends the life of the tank.

Should there be a pilot flame failure, the safety valve will become de-energized and close so as to prevent the supply of gas to both the main burner and the pilot burner in the conventional manner. While we have disclosed the preferred embodiment of the invention in the drawing and the specification above, it is obvious that modifications may be made in the components thereof without departing from the spirit of the invention. Therefore, the scope of the invention should be determined from the appended claim.

We claim:

Control apparatus for a water heater comprising: an electrically operable main gas valve; an electrically operable safety valve for controlling the flow of gas to said main valve; a first automatically recycling thermostatic switch adapted to be mounted on the water heater in a position to sense the temperature of water at the lower portion of a water tank in the heater and to operate when the water therein reaches a first predetermined temperature; a second automatically recycling thermostatic switch adapted to be mounted on the water heater in a position to sense the temperature of water in the upper portion of the water tank in the heater and to operate when the water therein reaches a second predetermined temperature; which is greater than said first predetermined temperature so that said second switch operates as a safety switch; a thermoelectric generator adapted to be heated by a pilot burner; first circuit means electrically connecting said first and second thermostatic switches and said main gas valve electrically in series circuit with said thermoelectric generator; so that cycling of said first switch normally controls operation of said main valve and said second switch operates only in response to an abnormally high temperature at the upper portion of the water tank to interrupt said first circuit means and de-energize said main valve; and second circuit means electrically connecting said safety valve across said thermoelectric generator in parallel circuit with said first and second thermostatic switches and said main gas valve.

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