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THERMOSTATIC SAFETY VALVE CONTROL
MECHANISM FOR FUEL BURNERS
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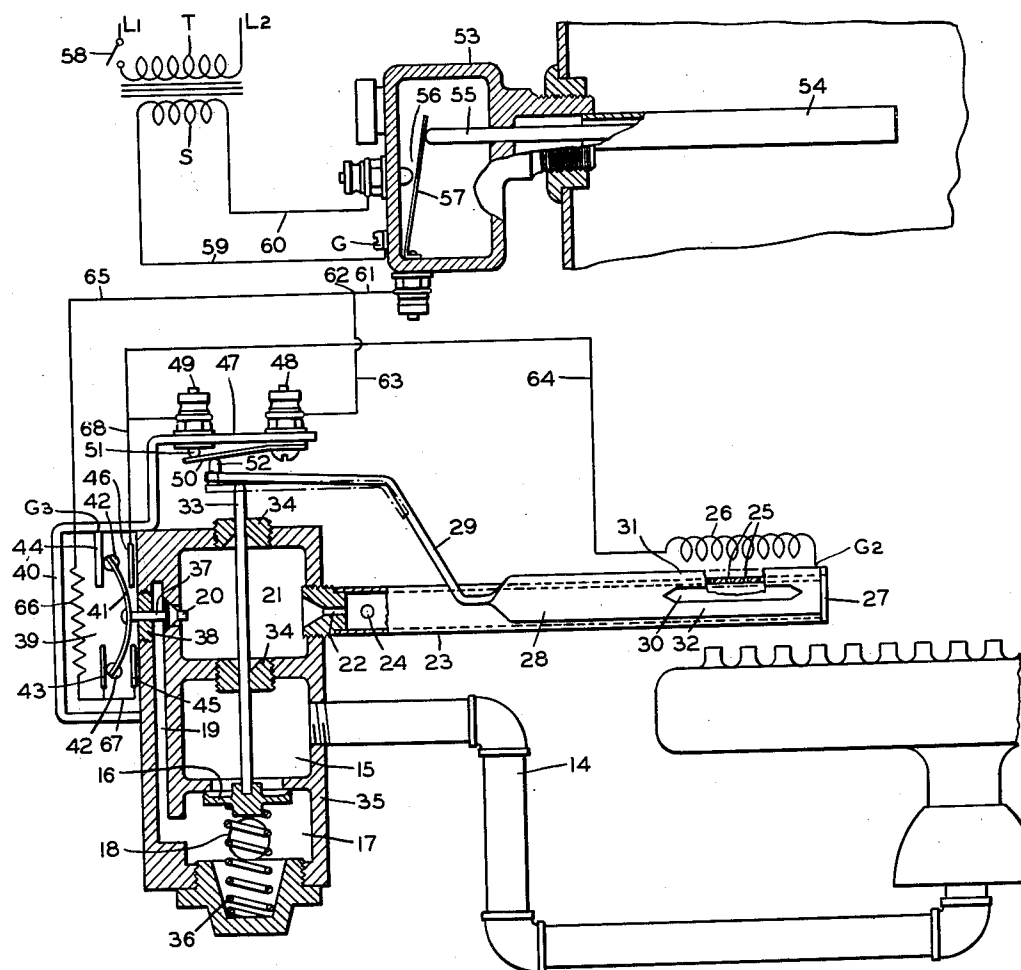


FIG. 1

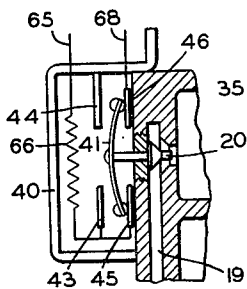


FIG. 2

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THERMOSTATIC SAFETY VALVE CONTROL
MECHANISM FOR FUEL BURNERSGeorge A. Short, Cleveland, Ohio, assignor to The
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This invention relates to thermostatic valve control mechanism, such as is used for automatic control of the fuel supply to an automatic gas burning storage water heater.

One object of the invention is to provide improved control mechanism which dispenses with any necessity for maintaining continuously either flame or the flow of gas at the pilot burner, but only at moments or during the period when heat or more heat is required or demanded.

Another object is to provide improved control mechanism of the character described, which is automatic or self-starting, requiring neither open flame or manual attention to cause or prepare it for action.

Still another object is to provide improved self-starting valve control mechanism of the character described, which is entirely safe because the fuel supply to the pilot burner as well as to the main burner is always shut off under emergency conditions.

Another object is to provide improved control mechanism which may be built in small and compact form, which requires no gas flow lines to or near the water temperature thermostat, which is reliable, safe and efficient in operation, and in which the failure of any part shuts off the supply of fuel to all burners, thus leaving the entire unit safe and inactive.

Further objects of the invention in part are obvious and in part will appear more in detail hereinafter.

In the drawings, Fig. 1 represents, somewhat diagrammatically, one form of mechanism embodying the invention, all parts being shown in the idle or inactive position; and

Fig. 2 is a detail view, illustrating another position of one of the switches and the valve connected thereto.

While the invention may be utilized for controlling the application of heat of any place or thing to be heated, the drawings, solely for purposes of illustration, and in no sense of limitation, show the invention applied for control of the gas supply to the burner of an ordinary storage water heater. 10 indicates the storage tank for holding the supply of water, 11, 12 indicates the main burner for heating the water, and 13 indicates the pilot burner located near to the main burner, as is usual.

Gas is supplied to the main burner through a conduit 14 communicating with a chamber 15 on the outlet side of the main valve 16, the supply chamber 17 on the other side of which is provided with an inlet opening 18, to which the usual gas

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supply pipe (not shown) may be connected. The supply chamber 17 also communicates, by way of passage 19 and pilot valve 20, with chamber 21, from which a small quantity of gas is supplied, through orifice 22, to one end of the pilot burner tube 23 provided with the usual air inlet opening 24. The pilot flame forms at one or a series of small openings 25 in the pilot burner tube, adjacent to which is an ignition coil 26, to be later referred to. The outer end of the pilot burner tube is closed, as by end wall 27, to which is rigidly secured one end of a bifurcated thermostatic member 28. This is of known form having an operating arm 29 extending upwardly and slotted at 30 to provide two parallel arms 31, 32 of which as 31, is close to the burner ports or openings 25 and therefore in contact with the pilot flame. The thermostat is not affected by the general surrounding or ambient temperature, but when the pilot flame is burning, arm 31 becomes hotter than arm 32 and therefore elongates, flexing the operating arm 29 downwardly in Fig. 1, as will be readily understood.

Main valve 16 is provided with a stem 33 slidable in guides 34 and extending to the outside of the valve casing 35, where its free end lies adjacent to thermostat arm 29, for operation thereby. This valve is biased toward closed position by compression spring 36.

The pilot valve 20 is provided with a stem 37 working in a guide 38 and extending into a sealed chamber 39 within a housing 40 attached to or forming part of the valve casing. In said chamber 39 stem 37 supports a snap disc 41, of known form, usually bimetallic, and bulged or otherwise deformed at its center, in such manner that when it is cold, or, its temperature is below a critical value, it bulges or is convex in one direction, as in Fig. 1, and when hot, or above the critical value it bulges or is convex in the other direction, as in Fig. 2. The disc is suitably insulated from the stem and forms a current conducting switch blade, contact knobs 42 on the disc cooperating with contacts 43, 44, 45, 46, later to be referred to.

On an arm or support 47 carried by the valve casing are mounted two terminals 48, 49, to one of which, 48, is secured a resilient switch blade 50 cooperating with a contact 51 carried by the other terminal. This switch blade, by its own resiliency is biased toward open position, but the blade lies adjacent an insulated button 52 on arm 29 by means of which the arm is able to move the switch to closed position, when thermostat 28 cools below a critical value.

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53 represents, conventionally, any suitable form of thermostat, bimetallic, tube and rod, bulb and bellows, or any other variety, having its heat sensitive portion, indicated at 54, immersed in the water or otherwise sensitive to variations in its temperature, and its operating member 55 arranged to actuate a switch 56, closing said switch upon a demand for heat and permitting it to open under its own bias, as by the effect of spring 57, when the demand for heat has been satisfied, in the usual manner of heat control.

Operation

Fig. 1 illustrates all parts in the inactive or inoperative position, such as when all circuits are deenergized. Switch 56 is closed, both valves are closed, and the water to be heated is cold, or at least below the desired critical temperature. Thus there is a demand for heat.

Upon closing of the main switch 58, the entire system is put in operation. Current flows from the leads L₁, L₂, through switch 58 and energizes the step down transformer T, the secondary S of which supplies current, e. g., at 24 volts, from ground, at G, by wire 59, secondary S, wire 60, contact 56a of switch 56 (now closed), switch blade 57, wire 61 to the point 62. Here the circuit branches.

One branch extends from the point 62 by wire 63 to terminal 48, switch blade 50 (now closed by the operating arm 29), contact 51, terminal 49, wire 64, and ignition coil 26 to ground, at G₂. The effect of this branch is to heat the coil 26 to incandescence.

The second branch extends from the point 62 by wire 65, heating coil 66, contact 43, snap switch disc 41, contact 44, and to ground on the valve casing at G₃. This branch produces heat (without incandescence) at the coil 66, the effect of which is to cause disc 41 to bend and snap to its second position, shown in Fig. 2, thus opening the pilot valve 20.

Gas then flows to the pilot burner and the jet or jets issuing from the burner openings 25 are ignited. The heat thereby produced is effective to expand and elongate the upper arm 31 of the thermostat, flexing its operating arm downwardly to the dotted line position, Fig. 1 and opening the main valve 16. Thus gas is supplied to the main burner where it is ignited by the pilot burner, heating the water in the tank in the usual manner.

The same motion of arm 29 permits switch blade 50 to move to open position. Since switch 41 is in its second position, a circuit is established as follows: from ground at G, by secondary S, switch 56, and wire 61 to the point 62, then by wire 65, heating coil 66, bridge 67, contact 45, snap switch disc 41 (now in its second position), contact 46, wire 68, wire 64, and coil 26 to ground. The two coils 26, 66 are therefore now in series. The current flow is insufficient to cause glow of coil 26, but coil 66 remains hot enough to maintain the snap switch disc 41 in its second position, with the pilot valve open.

These established conditions are maintained so long as the immersion thermostat 53 continues to demand heat. When the demand is satisfied, and the water temperature slightly exceeds the desired critical temperature, the system responds as follows:

At thermostat 53 the switch 56 opens, cutting off all current flow. Immediately coil 66 cools sufficiently so that snap switch disc 41 flexes to

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its original form, permitting pilot valve 20 to close.

In the absence of pilot flame, the hot arm 31 of the thermostat cools and contracts, flexing its operating arm 29 upwardly, and returning it to its original position, thus permitting the main valve 16 to close. All flow of gas is now cut off. The system remains in this condition, awaiting another demand for heat, when the cycle is repeated, as before.

In operation, therefore, each demand for heat first causes incandescence at coil 26 and heat at coil 66, opens pilot valve 20, ignites the pilot flame, heats thermostat 28, opens the main valve, and ignites the main burner flame. When the demand is satisfied both valves close and both coils are deenergized.

Should both the main and pilot burner flames be extinguished during a demand for heat, on account of a back draft blowout or a sudden low drop in gas pressure, or for any reason, thermostat 28 immediately cools and closes the main valve, supplying current to coils 26 and 66 in parallel and causing incandescence of coil 26, and maintaining the pilot valve open, ready to ignite the pilot flame and restore operation, when normal conditions are resumed.

Should the coil 26 burn out, the pilot valve pulsates slowly, first opening and then closing, by reason of the fact that the path through coil 66 to the second ground at G₃ is intermittently opened and closed by the effect of coil 26 upon snap disc 41.

The system as a whole is of relatively simple form, requiring no expensive parts, and is entirely automatic in operation after the main switch is first closed. It requires no manual attention for starting and the failure of any part cuts off the gas supply, leaving the unit safe and inactive.

Other advantages will be apparent to those skilled in the art.

What I claim is:

1. Thermostatic valve control mechanism of the character described, comprising a main burner for supplying heat to a body to maintain it at a desired temperature, a main burner valve, a pilot burner for the main burner, a pilot burner valve, an electrical igniter for the pilot burner, a heater, three thermostats, one sensitive to variations in the temperature of said body, the second sensitive to the presence or absence of pilot flame, and the third sensitive to said heater, three switches, each actuated by a corresponding one of said thermostats, means operated by the first thermostat for actuating the first switch, means operated by the second thermostat for actuating the second switch and the main valve, means operated by the third thermostat for actuating the third switch and the pilot valve, and an electric circuit having a conductor including the first switch and also two parallel branches one including the second switch and igniter and the other the third switch and heater.

2. Burner control mechanism, comprising an electric circuit including heater and igniter members connected in multiple, a control switch therefor, valve mechanism actuated by said heater, a burner controlled by said valve mechanism and upon which the igniter is effective, and thermally controlled means including one device sensitive to said heater and another device sensitive to heat produced by said burner for chang-

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ing the connection between said members from multiple to serial.

3. Burner control mechanism, comprising an electric circuit including heater and igniter members connected in multiple, a control switch therefor, valve mechanism actuated by said heater, a burner controlled by said valve mechanism and upon which the igniter is effective, and thermally controlled means including one device sensitive to said heater and another device sensitive to heat produced by said burner for changing the connection between said members from multiple to serial, and a second valve actuated by said first named device.

4. Burner control mechanism, comprising an igniting coil, a heating coil, a burner, a fuel valve for said burner, an electric circuit including a control switch and arranged upon closure of said switch to energize said igniter and heater in parallel with each other, means actuated by one of said coils for operating said valve, and thermal switch means including one switch device ef-

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fective upon ignition of the fuel and another switch device sensitive to said heating coil for establishing serial connection of said heater and igniter with each other and with said control switch.

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