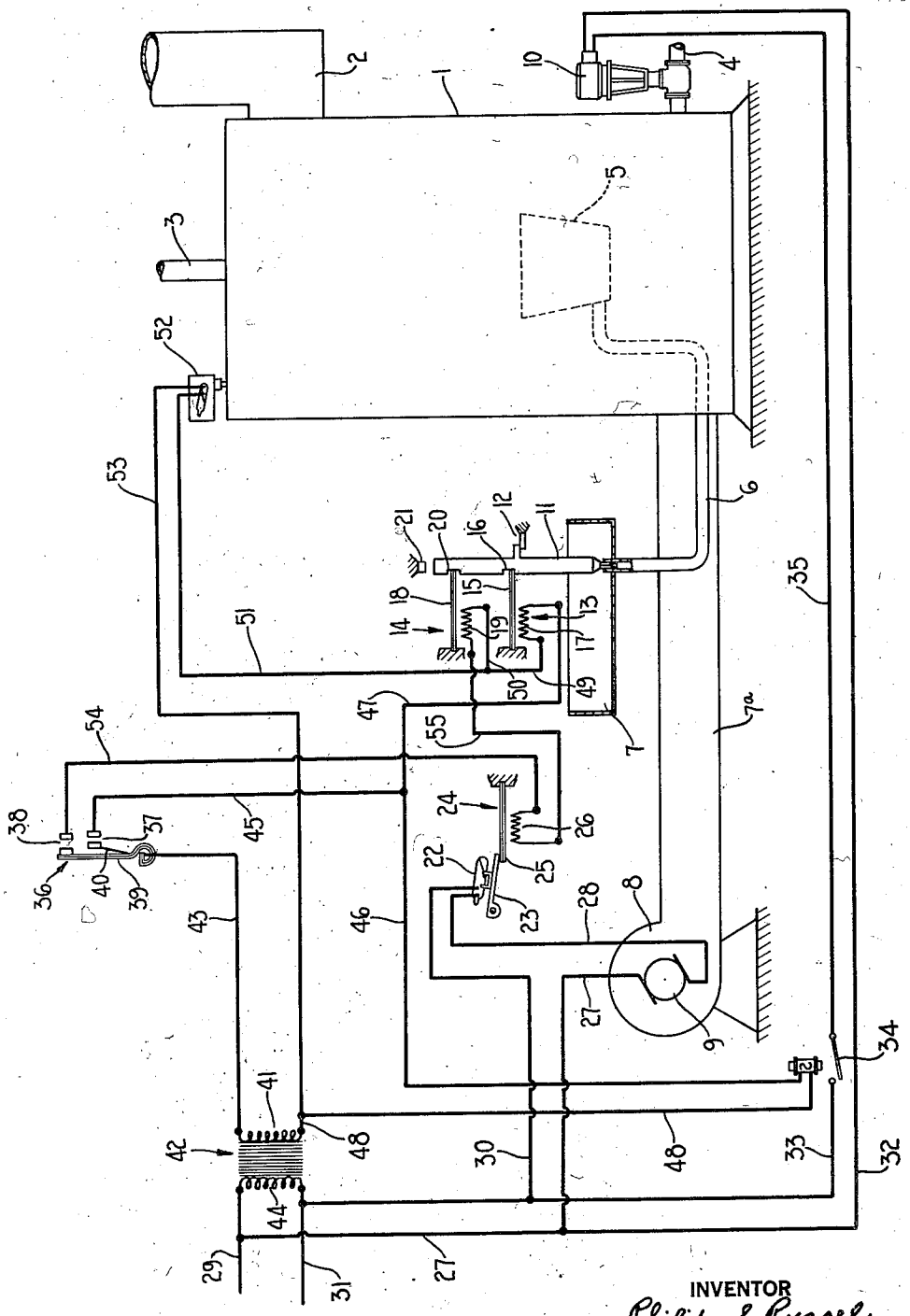
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HEATING SYSTEM

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HEATING SYSTEM

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My invention relates to new and useful improvements in heating systems and more particularly to means for controlling a medium supplied to a region or space to be heated.

An object of my invention is to provide means for regulating the operation of a burner for heating the medium.

Another object is to provide means to supply the medium irrespective of operation of the burner.

Another object is to control the operation of the burner in accordance with the temperature of the medium to be heated.

The invention consists in the novel system and the combination and relation of control elements comprising the same, to be more fully described hereinafter and the novelty of which will be particularly pointed out and distinctly claimed.

In the accompanying drawing, to be taken as a part of this specification, I have fully and clearly illustrated a preferred embodiment of my invention, in which drawing—

The figure is a diagrammatic view illustrating a heating system embodying my invention.

Referring to the drawing by characters of reference, 1 designates generally a heating apparatus which may be a hot air furnace or a water heater or boiler having an outlet flue 2 for the products of combustion, a conduit or pipe 3 for supplying to the space or region to be heated the medium such as air or water to be heated by the apparatus, and a return pipe or conduit 4 for returning the heated medium after use to the heating apparatus. The apparatus 1 contains in the combustion chamber a liquid fuel burner 5 supplied with oil through a conduit or pipe 6 leading from a constant level chamber or reservoir 7 which may be fed from any suitable source of supply and therefore the burner is of the gravity fed type and may be of the gravity fed pot type. The burner 5 is supplied with air for combustion through a duct 7 having an air supply fan or blower 8 driven by an electric motor 9. The medium to be heated is supplied to the apparatus 1 and to the space to be heated by an electrically driven circulator 10 preferably positioned in the return conduit 4. Discharge of fuel to the burner 5 and from chamber 7 is controlled by a valve means 11 which is normally positioned or held by a cooperable stop member 12 in a position to supply sufficient oil to maintain a pilot flame in the burner. The valve means 11 preferably comprises a reciprocal valve movable toward open position automatically by an electrically heated thermostatic actuator 13 which is the medium fire actuator, and also movable further toward open position automatically by an electrically heated thermostatic actuator 14 which is the high fire actuator. The actuator 13 comprises a bimetal leaf or element 15 fixed at one end and having its other end extending into a slot 16 in the stem of valve 11 for engagement of the upper end of the slot to lift or open the valve. The actuator 13 also has an electric heater or resistance element 17 for heating the bimetal element 15 to cause it to warp or bend upward at its free end for opening the valve 11. The actuator 14 comprises a bimetal strip or element 18 to be heated by an electric heater or resistance element 19. The bimetal element 18 is fixed at one end and has its other end extending into a slot 20 in the stem of valve 11 such that upon upward warping of the free end of bimetal element 18 when heated by resistance element 19 it will engage the upper end wall of slot 20 to lift valve 11 toward open position. A stop 21 which may be adjustable is provided to limit the opening movement of the valve 11 by engagement of the end of the valve therewith. The motor 9 is controlled by a switch 22 which may be of the mercury tube type carried by a lever 23 which is tiltable to close the motor circuit by an electrically heated thermostatic actuator 24. This actuator 24 comprises a bimetal strip or element 25 fixed at one end and having its free end engageable with the lever 23, the strip being heated by an electric heater or resistance element 26. Connected to the terminals of the motor 9 are lead wires 27, 28 of which wire 27 is connected to a main line wire 29 and wire 28 is connected to one terminal of the switch 22. From the other terminal of the switch 22 a lead wire 30 extends and is connected to the other main line wire 31. Connected to the lead wires 27 and 30 are branch lead wires 32, 33 respectively of which wire 32 is connected to one terminal of the circulator 10 and the wire 33 is connected to one terminal of a normally open relay switch 34, the other terminal of the relay switch being connected by a lead wire 35 to the remaining terminal of the circulator 10.

Positioned in the space or region to be heated there is a temperature responsive switch means 36 having electric switches 37, 38 operated by and preferably carried by a thermostatic bimetal actuator 39. One of the terminals of switch 37 is supported from the actuator 39 by a leaf spring 40 so that upon closure of switch 37 the actuator 39 can have continued movement before closing switch 38. The movable terminals of switches

37, 38 are electrically connected to one terminal of the secondary 41 of a transformer 42 as by a lead wire 43 connected to the actuator 39. The primary 44 of transformer 42 is electrically connected to the main line wires 29 and 31. Extending from the fixed contact of switch 37 is a lead wire 45 having branch wires 46, 47 leading respectively to the coil of the relay switch 34 and to one end of the medium fire resistance element 17. The other terminal of the relay switch coil is connected by a lead wire 48 to the remaining terminal of the transformer secondary 41. Extending from the remaining terminal of resistance element 17 and from one terminal of the high fire resistance element 19 are lead wires 49, 50 respectively which are joined to a common lead wire 51. Responsive to the temperature of the medium heated by burner 5 there is a thermostatic switch 52 which is in closed circuit position at all temperatures below a predetermined desired high temperature which, for example, may be 200° F., the lead wire 51 being connected to one terminal of this switch 52. The other terminal of switch 52 is connected by a lead wire 53 connected to and through the lead wire 48 and to the transformer secondary 41. The fixed contact of the thermostatic switch 38 is connected by a lead wire 54 to one terminal of the resistance element 26 which has its other terminal connected by a lead wire 55 to the remaining terminal of the high fire resistance element 19.

The operation of the system is as follows: The stop member 12 is adjusted to position valve 11 to maintain a pilot flame in burner 5 and may be such that when the medium to be heated is water, the pilot flame will be sufficiently high to maintain the water hot enough for heating of a domestic hot water supply. Such a pilot flame will also maintain a reserve supply of hot water or of heated air for immediate discharge upon operation of the circulator 10 so that heated medium will be immediately supplied to the space to be heated upon a demand for heat. With the burner operating at pilot flame and the transformer primary 44 energized, then if the temperature in the space to be heated drops to a predetermined temperature, say 70° F., the thermostatic actuator 39 will operate to close switch 37 which will complete the transformer secondary circuit, with current flowing from the secondary 41 through lead wire 43, switch 37, lead wires 45 and 46 to the coil of relay switch 34 and thence via lead wire 48 back to the transformer secondary 41. The relay switch 34 will therefore be closed and start operation of the circulator 10. Closure of switch 37 will also, if the medium responsive switch 52 is closed, close the circuit through lead wires 45 and 47 to the medium fire heating element 17 from which current flows via lead wires 49 and 51 to switch 52 and thence via lead wires 53 and 48 back to the transformer secondary 41. Heat imparted to the bimetal element 15 by resistance element 17 will cause the element 15 to warp or bend upward, thereby lifting the valve 11 to an intermediate open position which will supply sufficient fuel through pipe 6 to the burner 5 to provide for a medium fire. Should the temperature of the heated medium rise above the temperature at which switch 52 is set to operate, then the circuit to resistance element 17 will be broken at switch 52 without affecting continued operation of the circulator 10 which is under the sole control of the thermostatic switch 37. If the temperature in the space to be heated continues to fall irrespective of medium fire operation such that the actuator 39 closes switch 38, say at 68° F., then the resistance elements 26 and 19 will be energized provided the temperature of the medium to be heated has not risen sufficiently to open switch 52. The elements 26 and 19 are in a series circuit which may be traced as follows: from the transformer secondary 41 through lead wire 43, actuator 39, switch 38, lead wire 54 to element 26, lead wire 55 to element 19 and via lead wires 50 and 51 to switch 52 and from switch 52 via lead wires 53 and 48 back to the transformer secondary 41. The bimetal switch actuator 25 and the bimetal valve actuator 18 will be simultaneously heated but due to the lost motion of actuator 18 before it engages the end wall of slot 20 to further open valve 11, the switch 22 will be closed, thereby closing the circuit to motor 9 and starting operation of fan 8 to supply combustion air to the burner 5. The actuator 18 will continue to bend or warp upward after engagement with the end wall slot of 20 and will move the valve to further open position until it engages maximum limit stop member 21 which determines the maximum open position of vlave 11 and the maximum high fire at the burner 5. As the temperature in the space to be heated warms up, the actuator 39 will first open switch 38 when the temperature exceeds say 68° F., thereby deenergizing the resistance elements of the heat motor actuators 24 and 14. Cooling of the actuator 24 will open switch 22, thereby breaking the circuit to the motor 9 and stopping operation of fan 8. Cooling of the actuator 14 will permit valve 11 to move downward until it is supported by the bimetal element 15 in intermediate open position so that the burner 5 will continue operation with a medium flame or fire. When the temperature responsive means 36 becomes completely satisfied, say at 70° F., the actuator 39 will open switch 37, thereby deenergizing the relay switch 34 to stop the circulator 10 and also deenergizing the medium fire heating element 17 so that bimetal element 15 will cool and permit valve 11 to move downward until stop members 12 are in engagement providing for pilot fire operation of the burner 5.

From the foregoing it will be noted that I have provided a system in which safety means in the form of switch 52 is provided for controlling operation of the burner and stopping regulation of the burner by the space responsive means while permitting control by the space responsive means of the supply of heated medium to the space to be heated.

What I claim and desire to secure by Letters Patent of the United States is:

1. A heating system comprising a heating apparatus having a gravity type liquid fuel burner, controllable means for supplying fuel to said burner, electrically controlled means for operating said controllable means to supply fuel for a medium fire, means to supply air to said burner for said medium fire, electrically controlled means for operating said controllable means to supply fuel for a high fire, means responsive to temperature in a space to be heated by said apparatus and operable upon a predetermined low temperature to energize said first-named controlled means, and electrically operated means to increase the supply of combustion air through said supply means to said burner for said high fire, said responsive means acting upon occurrence of a temperature below said low tempera-

ture to energize said second-named controlled means and said electrically operated air supply means, said last-named electrically operated air supply means being so constructed and arranged relative to said second-named controlled means that said air supply means is energized and supplies said increased air prior to supply of fuel for the high fire by said second-named controlled means.

2. A heating system comprising a heating apparatus having a liquid fuel burner, a constant level chamber for supplying fuel to said burner, a valve controlling the discharge of fuel from said chamber and normally in a position to supply fuel for pilot flame operation, an electrically heated thermostatic actuator operable to move said valve to supply fuel for a medium fire, an electrically heated thermostatic actuator to move said valve to supply fuel for a high fire, electrically operated means to supply combustion air to said burner, electrically operated means to supply the medium heated by said burner to the space to be heated, means responsive to the temperature of the heated medium and operable upon occurrence of a high temperature to break the circuits of said first-named and said second-named thermostatic actuator and ineffective to control said second-named electrically operated means, and means responsive to temperature in the space heated by the heated medium and controlling the circuits of said first-named and said second-named thermostatic actuator and of said first-named and said second-named electrically operated means.

3. A heating system comprising a heating apparatus having a liquid fuel burner, a constant level chamber to supply fuel to said burner, a valve controlling the discharge of fuel from said chamber, an electrically heated thermostatic actuator operable to move said valve to supply fuel for a medium fire, an electrically heated thermostatic actuator operable to move said valve to supply fuel for a high fire, a thermostatic switch responsive to the temperature of the medium heated by said burner and operable upon occurrence of a high temperature to break the circuits of said actuators, an electrically driven fan for supplying combustion air to said burner, a thermostatic switch controlling the circuit of said fan, an electric heater for said last-named switch, electrically operated means to supply the heated medium to a space to be heated, an electric switch controlling the circuit of said first-named actuator and of said electrically operated medium supply means, an electric switch controlling the circuit of said second-named actuator and of said electric heater, and thermostatic means responsive to temperature in the space heated by the medium and operable at a predetermined low temperature to close said first-named electric switch and at a temperature below said predetermined temperature to close said second-named electric switch.

4. A heating system comprising a heating apparatus having a gravity type liquid fuel burner, controllable means for supplying fuel to said burner, electrically controlled means for operating said controllable means to supply fuel for a medium fire, electrically controlled means for operating said controllable means to supply fuel for a high fire, lost motion means interconnecting said last-named means and said controllable means, means responsive to temperature in a space to be heated by said apparatus and operable upon a predetermined low temperature to energize said first-named controlled means, and electrically operated means to supply combustion air to said burner, said responsive means acting upon occurrence of a temperature below said low temperature to energize said second-named controlled means and said electrically operated air supply means, said lost motion means being operable to provide a time delay thereby to insure that said air supply means supplies said high fire air to said burner prior to the supply of fuel for the high fire by said second-named controlled means.

5. A heating system comprising a heating apparatus having a liquid fuel burner, means controlling the flow of fuel to said burner, means normally supplying fuel for pilot flame operation of the apparatus, an electrically heated thermostatic actuator operable to move said controlling means to supply fuel for a medium fire, an electrically heated thermostatic actuator to move said controlling means to supply fuel for a high fire, electrically operated means to supply combustion air to said burner, electrically operated means to supply the medium heated by said burner to the space to be heated, means responsive to the temperature of the heated medium and operable upon occurrence of a high temperature to break the circuits of said first-named and said second-named thermostatic actuator and ineffective to control said second-named electrically operated means, and means responsive to temperature in the space heated by the heated medium and controlling the circuits of said first-named and said second-named thermostatic actuator and of said first-named and said second-named electrically operated means.

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