This invention relates to vaporizing oil burners and particularly to provision of a reliable electric ignition system for such burners. The scope of this invention encompasses the provision of the controls used in operation of the burner.

An object of this invention is to provide a simple, reliable, electrically ignited oil burner of the vaporizing type.

Another object is to provide a vaporizing type oil burner with a novel electric igniter.

Still another object is to control oil flow to an electrically ignited, vaporizing type oil burner to prevent pooling the burner.

The invention also contemplates a combination oil control and electric ignition for a vaporizing oil burner wherein the same mechanism controls the oil flow into the burner and controls the energization of the electric ignition element whenever the fire in the burner is extinguished and the room thermostat calls for heat. This latter arrangement is particularly efficient in operation because it permits the burner to burn over extended periods during which the thermostat intermittently calls for heat but without energizing the electric ignition element until the fire in the burner is extinguished and the thermostat thereafter calls for heat.

Other objects and advantages will be pointed out, or be apparent from the specification and claims, as will obvious modifications of the two embodiments shown in the drawings, in which:

Fig. 1 is a schematic showing of a vaporizing oil burner furnace heating unit provided with the instant ignition and fuel control;

Fig. 2 is a cross-section along the lines 2—2 of Fig. 1;

Fig. 3 is a partial sectional view of the burner showing the control bulb and igniter;

Fig. 4 is a vertical cross-section of a combined oil and ignition control unit; and

Fig. 5, similar to Fig. 4, shows a modified control structure.

Referring to the drawings in detail, conventional furnace 10 is provided with vaporizing pot type oil burner 12 which is adapted to receive oil through conduit 14 from a constant oil level control in casing 16. Flow into reservoir 18 in casing 16 through inlet 20 is regulated by needle valve 22. Float 24 is fixed on arm 26 pivoted at 28 to act on the needle valve collar 30 to close the valve against the force of compressed spring 32 as the oil level reaches the desired maximum. Outlet valve 34 controls flow through outlet port 36 and is urged toward its open position by compressed spring 38 in the conventional manner. The lower end of the outlet valve is provided with slot 40 which is raised and lowered to increase or decrease flow through conduit 14 to pot 12.

When room thermostat 42 calls for heat, contacts 44, 46 close a circuit including secondary coil 52 of transformer 54 to energize heater 48 on bimetal 50. Bimetal 50 is anchored at 56 and extends over the upper end of outlet valve 34. When heater 48 is energized, bimetal 50 warps upwardly to allow the outlet valve to open under influence of spring 38 to increase fuel flow to pot 12 to the high fire rate. Upon satisfaction of the heat demand, thermostat 42 opens and bimetal 50 warps downwardly until it rests on upper end 58 of lower bimetal 59 which is anchored at 62 and rests on adjustable stop 64 when heater 66 is not energized. When heater 66 is not energized, bimetal 50 can close outlet valve 34 to the low pilot position. Under these conditions the control cycles between high fire and low pilot. When desired, manually operable switch 68 on room thermostat 42 may be closed to energize heater 66 and warp lower bimetal 60 upwardly until it strikes stop 70. This movement causes upper bimetal 50 to be raised to increase the valve opening to low fire. With manually operable switch 68 closed, the control cycles between high fire and low fire thus insuring a steady flow of heat into the heated space to avoid the condition known as "cold 00."

The device as thus far described may be said to be more or less conventional. In order to adapt the oil control to operation with electric ignition it is, of course, necessary to add further controls. Thus the control in Fig. 4 is provided with mercury switch 12 having clips 74, 76, respectively pivoted to the free end of upper bimetal 60 as at 78 and to the free end of lever 80 as at 82. Lever 80 is pivoted to the control housing at 84 and rests on embossed center 86 of flexible bellows 88. Bellows 88 is connected to feeler bulb 90 by means of tube 92. Bulb 90 is mounted in heat transmitting relationship to igniter 94 which is an insulated resistance heater element or coil enclosed in a metal sheath or tube. This element comprises a resistance coil 96 surrounded by an insulating material such as mica, for example, and enclosed in a metal sheath which can reach incandescence and will not foul. As may be seen in Figs. 2 and 3, U-shaped igniter 94 projects downwardly through the side of pot 12 and is formed so that the lower end thereof substantially rests on or near the bottom of the
pot with feeler bulb 90 nested within the curve of the U. The igniter is supplied with current from secondary coil 98 of transformer 54 when mercury switch 72 is closed to complete the circuit through lines 169, 162, 104. The mercury switch can be closed only when the room thermostat calls for heat.

Assuming a cold start, mercury switch 72 will be closed when room thermostat 42 calls for heat and warps valve operating bimetal 50 upwardly to open the outlet valve and tilt the mercury switch about its pivotal connections. When the switch is closed, the igniter is energized. When the igniter reaches incandescence, feeler bulb 90 becomes hot enough to expand bellows 88 and raise lever 93 a small amount which is not sufficient to open the mercury switch but is sufficient to relieve the upper end of inlet valve 22 of the pressure of lever 60, to allow the inlet valve to open. This establishes flow into the casing and, since the outlet valve is already open, to pot 12. When oil flows into the pot and strikes the incandescent igniter, it bursts into flame and ignition is established. The radiant heat of the oil flame heats feeler bulb 90 to a still higher temperature to cause bellows 88 to expand further and open mercury switch 72 to deenergize the igniter.

It will be noted that link 105 is pivotally connected to the free end of upper bimetal 50 and the free end of lever 105 which is pivoted on the housing at 110. Lever 105 is provided with adjustable push pin 112 depending from the lever through cooperating aperture 114 in lever 80 to act on the end of the inlet valve stem. The push pin is adjusted so that it will close the needle valve when the outlet valve is in its low position. When the outlet valve is in its low fire position or in the high fire position, push pin 112 is withdrawn sufficiently to permit normal operation of the needle valve.

Upon satisfaction of the thermostat heat demand and assuming pilot selector switch 68 on the room thermostat has been set to the low pilot position, the outlet valve is returned to low pilot by means of valve operating bimetal 50. This movement of bimetal 50 pulls lever 105 downwardly by means of link 103 until push pin 112 closes needle valve 22. Thus flow into the casing is interrupted upon return of the fire to low pilot. When the amount of oil in reservoir 10 is sufficient to maintain the fire at low pilot for approximately thirty minutes. Therefore, if the thermostat does not call for heat within this period the fire will go out. It is to be noted that the heat in the pot normally is not sufficient to expand bellows 88 sufficiently to keep needle valve 22 open when the unit is operating at low pilot. Therefore, upon return of the fire to low pilot, bulb 90 would cool until bellows 88 collapsed to close needle valve 22. The provision of push pin 112 merely insures against poor adjustment of the low pilot flow causing the heat to be sufficient to prevent collapse of bellows 88. It is desirable that the fire continue at low pilot for a predetermined time interval only and to completely interrupt flow if the interval is exceeded to thereby prevent sotting the pot as a result of continued operation at low pilot.

It will be appreciated that push pin 112 can be backed off the needle valve stem so as to render the push pin inoperative. With the push pin thus adjusted the fire will continue at low pilot for a predetermined time only, assuming the low pilot to be properly adjusted. Thus upon satisfaction of the heat demand and return of the outlet to low pilot, bulb 90 will cool to allow bellows 88 to collapse and permit lever 93 to act on the needle valve stem to close the inlet. Flow through outlet 17 will continue until the supply in the reservoir is exhausted.

When the thermostat again calls for heat, the igniter will be energized if bellows 88 has collapsed. If, at the time of the call for heat, the reservoir has been emptied, the start of the new cycle is the same as the cold start described above. If the residual oil in the reservoir is still flowing when the thermostat calls for heat, combustion will take place immediately. If the amount of oil remaining in the reservoir is sufficient, bulb 90 will be heated to expand bellows 88 and open needle valve 22 before the supply in the reservoir is exhausted. If the supply in the reservoir should be insufficient to cause ignition in this manner the igniter circuit will remain closed to cycle as if from a cold start.

It should be noted that it is substantially impossible to flood the burner with this control. The greatest quantity of oil that can enter the pot without being ignited is that quantity contained in reservoir 18. This quantity is hardly enough to more than wet the floor of the pot. If the igniter should fail, inlet needle valve 22 cannot open and no flow to the pot can take place. If the igniter should reach incandescence but for some reason fail to ignite the oil, the incoming oil flooding about the igniter would displace the heat so rapidly as to cause the needle valve to close due to the collapse of bellows 88. The igniter when thus flooded preferably does not have sufficient capacity to heat the contents of a flooded pot. Therefore, if the pot should somehow become flooded the igniter would not function and no further oil could flow into the pot until the flooded condition had been eliminated. The flooded pot preferably would have to be ignited by other means. Even when ignited the control will prevent flow into the pot until the pot has been burned off since the control bulb cannot be heated sufficiently when covered with oil.

As pointed out above, when the oil flow is reduced to the low pilot rate, the control will interrupt all flow in the event that the thermostat should not call for heat within a predetermined time. If pilot selector switch 68 on the thermostat 42 is closed to cycle the fire between high fire and low fire, flow will continue at all times since the heat of the low fire flame is sufficient to keep bellows 88 expanded. Since the flame at the low fire rate is a clean flame, there is no objection to continuing operation at this level.

The control illustrated in Fig. 5 is basically the same as that illustrated in Fig. 4. However, instead of using a mercury switch for completing the igniter circuit "micro" or snap switch 116 is employed. The "micro" switch is mounted on the casing with the usual plunger actuator 118 projecting upwardly and lever 123 pivoted on pin 122. The left-hand end of lever 120 is connected to the free end of bimetal 50 by means of spring 132 and adjustable screw 126. When the bimetal warps upwardly, lever 120 is moved about pin 122 to depress switch plunger 118 and close the igniter circuit. Adjustable screw 123 on the free end of lever 80 will contact the right-hand end of lever 120 and cock the lever counterclockwise about its pivot to permit the switch plunger 118 to rise and break the igniter circuit after combustion takes place in the burner.
will be appreciated that screw 128 should be adjusted so that it will not open the igniter circuit upon the igniter reaching incandescence but only upon combustion taking place in the burner. This sequence of operation is the same as in the case of the mercury switch in the modification of Fig. 4.

The other change in Fig. 5 over the modification of Fig. 4 resides in interconnecting bimetallic 50 and lever 168 by merely extending the end of bimetallic 50 to overlap lever 168. This will permit the bimetallic to move lower 100 downwardly when bimetallic heater 43 is deenergized. As in the case of Fig. 4, movement of the outlet valve to its low pilot position is operable to close inlet nozzle valve 22 by means of plunger 112 depending from lever 108 and acting on the nozzle valve stem through aperture 114 in lever 88. Lever 108 and pin 112 are not necessary if the low pilot flow is properly adjusted. Pin 112 is provided merely to insure against faulty operation due to improper setting of the low pilot rate of flow.

The operation of the modification in Fig. 5 is the same as that described with respect to Fig. 4 except that the igniter circuit switch is a "micro" or snap switch which operates as described above.

The practical and advantageous aspects of this invention should be apparent. When necessary, the igniter is energized. During the time required for the igniter to reach the ignition temperature the only possible oil flow to the burner is any residual oil in the constant level valve reservoir. At most, this is a very small quantity. When the igniter reaches incandescence, oil flow automatically starts. When combustion is established, the igniter is deenergized. Upon satisfaction of the thermostat the fire is reduced to low pilot or low flow. If reduced to low pilot the flow will stop in absence of a new demand with a predetermined period of time whether or not push pin 112 is employed. If flow stops, the igniter operates to re-establish combustion. If flow continues, the igniter is not needed and is not operated. The placement of the igniter and the associated controls prevents flooding the pot. Any time the pot tends to flood, the bulb is cooled and the inlet valve closes. The heat left in the valve cannot be re-opened until the pool is dissipated.

The use of an insulated and metal clad resistance core for an igniter prevents fouling or oxidation of the resistance element while permitting the igniter to be positioned in the burner where it comes into direct contact with the oil. The metal sheath makes the igniter rugged and capable of considerable abuse while being installed.

It will be appreciated that modifications beyond those here illustrated will occur to persons skilled in the art. The scope of this invention is, therefore, to be limited only by the scope of the claims.

We claim:

1. An ignition and oil control for an oil burning system comprising in combination, a vaporizer type oil burner, an electric resistance igniter adapted when energized to ignite the oil in the burner, a fuel reservoir, means including a valve for controlling flow of fuel from said reservoir to said burner, an electric circuit including said igniter and a switch for supplying current to said igniter, an electrically operated heat motor operatively connected to said switch and valve, said heat motor when energized causing said valve to open and said switch to close whereby the igniter is energized and ignites the oil flowing into the burner from said reservoir by said valve, an electrical circuit including said heat motor and a thermostatic switch for controlling energization of said heat motor, and a second heat motor in heat exchange relation with said igniter and operatively connected to said switch to bias said switch toward off position when the igniter is energized.

2. The combination claimed in claim 1 including, a second valve for controlling the flow of fuel into said reservoir, an operative connection between said second heat motor and said valve tending to open said valve when the second heat motor is energized.

3. The combination claimed in claim 2 including an electric heater for supplying heat to said first heat motor, a thermostatic switch in circuit with said heater for controlling the flow of current through said heater in response to the temperature of the space being heated by said burner.

4. An oil burner system comprising, a vaporizer type oil burner, an electric igniter in the burner, a room thermostat, a fuel reservoir having an inlet and an outlet, an inlet valve, and outlet valve, means including an electrically operated heat motor acting on said outlet valve to increase fuel flow when the thermostat calls for heat and decrease flow when the demand for heat is satisfied, an electric circuit including a switch and said igniter, said heat motor being operatively connected to said switch to close the switch and energize said igniter when the thermostat calls for heat, means adapted to prevent opening of said inlet valve, means responsive to the combustion temperature of said igniter for opposing the last named means and allowing said inlet valve to open, float means for regulating movement of said inlet valve when the valve is free to open, and means responsive to the combustion temperature in said burner to open said switch and to prevent switch closure.

5. A control according to claim 4 in which means are provided for closing said inlet valve when the rate of flow through the outlet is decreased upon satisfaction of the heat demand.

6. A control according to claim 5 in which the last named means include lever means operable by said heat motor and acting on said inlet valve.

7. An oil burner system comprising, a vaporizer type oil burner, an electric resistance igniter in the burner, a constant level oil reservoir having an inlet adapted for connection to an oil supply and an outlet connected to the burner, a valve for controlling flow through the inlet, a spring urging the inlet valve open, a valve having a pilot fire position for regulating flow through said outlet to the burner, a bimetal arm operatively connected to said outlet valve and operative to close the outlet valve to its pilot position when cool and to open the outlet valve to its high fire position when heated, a room thermostat, an electric circuit including a heater on said bimetal arm and energized when said thermostat calls for heat to warp the bimetal arm and open the outlet valve, an electric circuit including said igniter and a switch, said switch being operatively connected to an electric arm to close when said bimetal arm is heated, means responsive to holding said inlet valve closed, means responsive to ignition temperature of said igniter to oppose said last mentioned means and permit said inlet valve to open, float means operable on said inlet valve when the inlet valve is free to open to regulate inlet valve movement to...
maintain a constant level in the reservoir, said temperature responsive means being operatively connected to said switch and being responsive to the temperature of combustion in the burner at a rate greater than pilot position to open said switch to deenergize said igniter.

8. A control according to claim 7 in which means are provided for forcibly closing said inlet valve when the outlet valve is moved to its pilot position.

9. An ignition and oil control for an oil burning system comprising, a vaporizer type oil burner, an electric igniter in said burner and adapted to ignite oil in the burner, a room thermostat, a constant level fuel reservoir having an inlet and an outlet connected to said burner, a valve for the inlet and a valve for the outlet, a float in said reservoir for regulating said inlet valve in accordance with the reservoir level, a heat motor in series circuit with said room thermostat for regulating said outlet valve, an electric circuit including a switch for supplying current to said igniter, operative connections between the motor and said switch and between the motor and said outlet valve, said heat motor being operative to open said outlet valve when said thermostat calls for heat, means for holding said inlet valve closed and for allowing the inlet valve to open when said igniter reaches ignition temperature, and means for opening said switch in response to the heat of combustion in said burner.

10. An ignition and oil control for an oil burning system comprising in combination, a vaporizer type oil burner, an electric resistance igniter adapted when energized to ignite the oil in the burner, a fuel reservoir, means including a valve for controlling flow of fuel from said reservoir to said burner, an electric circuit including said igniter and a switch for supplying current to said igniter, an electrically operated heat motor operatively connected to said switch and valve, said heat motor when energized causing said valve to open and said switch to close whereby the igniter is energized and ignites the oil flowing into the burner from said reservoir through said valve, an electrical circuit including said heat motor and a thermostatic switch for controlling energization of said heat motor, a second heat motor in heat exchange relation with said igniter, a second valve for controlling the flow of fuel into said reservoir, and an operative connection between said second heat motor and said second valve whereby said second valve opens when the second heat motor is heated by said igniter.

11. The combination defined in claim 10 wherein said second heat motor is also in heat exchange relation with said burner, and an operative connection between said second heat motor and said switch whereby said second heat motor responds to the burner heat when the burner is operating at or above low fire to open said switch and deenergize said igniter, said second valve closing when said second heat motor is cooled.

12. An ignition and oil control for an oil burning system comprising in combination a vaporizer type oil burner, an electric igniter positioned in said burner and adapted when energized to ignite the oil in the burner, an electric circuit including a switch for supplying current to said igniter, a heat responsive motor when energized tending to move said switch toward closed position whereby current flows through said circuit and igniter, a second heat motor responsive to the heat of the burning fuel in said burner and responding when heated to move said switch to open position, said second heat motor comprising a bulb positioned in the burner, a bellows positioned without the burner, a tube connecting said bellows and bulb, and an expandable gas in said tube, bulb and bellows, the said bellows having an operative connection with the switch, an oil reservoir having an inlet and an outlet, a valve controlling the inlet, a valve controlling the outlet, the second heat motor being responsive to the heat of said igniter when energized and tending to move the inlet valve toward open position, said first heat responsive motor when energized tending to move said outlet valve toward open position.

13. An oil burner system comprising, a burner, a room thermostat, a fuel reservoir having an outlet connected to said burner, a valve having a pilot fire position, a high fire position, and an intermediate fire positions and for regulating flow through said outlet means including a heat motor controlled by said thermostat and operating to move said valve opening when said thermostat calls for heat and closing to its pilot position when the thermostatic heat demand is satisfied, and a second means operable in absence of thermostatic heat demand by said thermostat for a predetermined period of time to interrupt flow to the burner, an electric igniter in said burner, and a third means operable to energize said igniter when said thermostat calls for heat after the second means has operated to interrupt fuel flow to the burner.

14. A control according to claim 13 including means operative upon said igniter reaching ignition temperature to re-establish fuel flow to the burner.

15. A control according to claim 14 including, manually operable means for modifying operation of said heat motor to position said valve in a high pilot position when the thermostatic demand for heat has been satisfied, said second means being operative when the operation of the heat motor has been modified by said manually operable means.

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