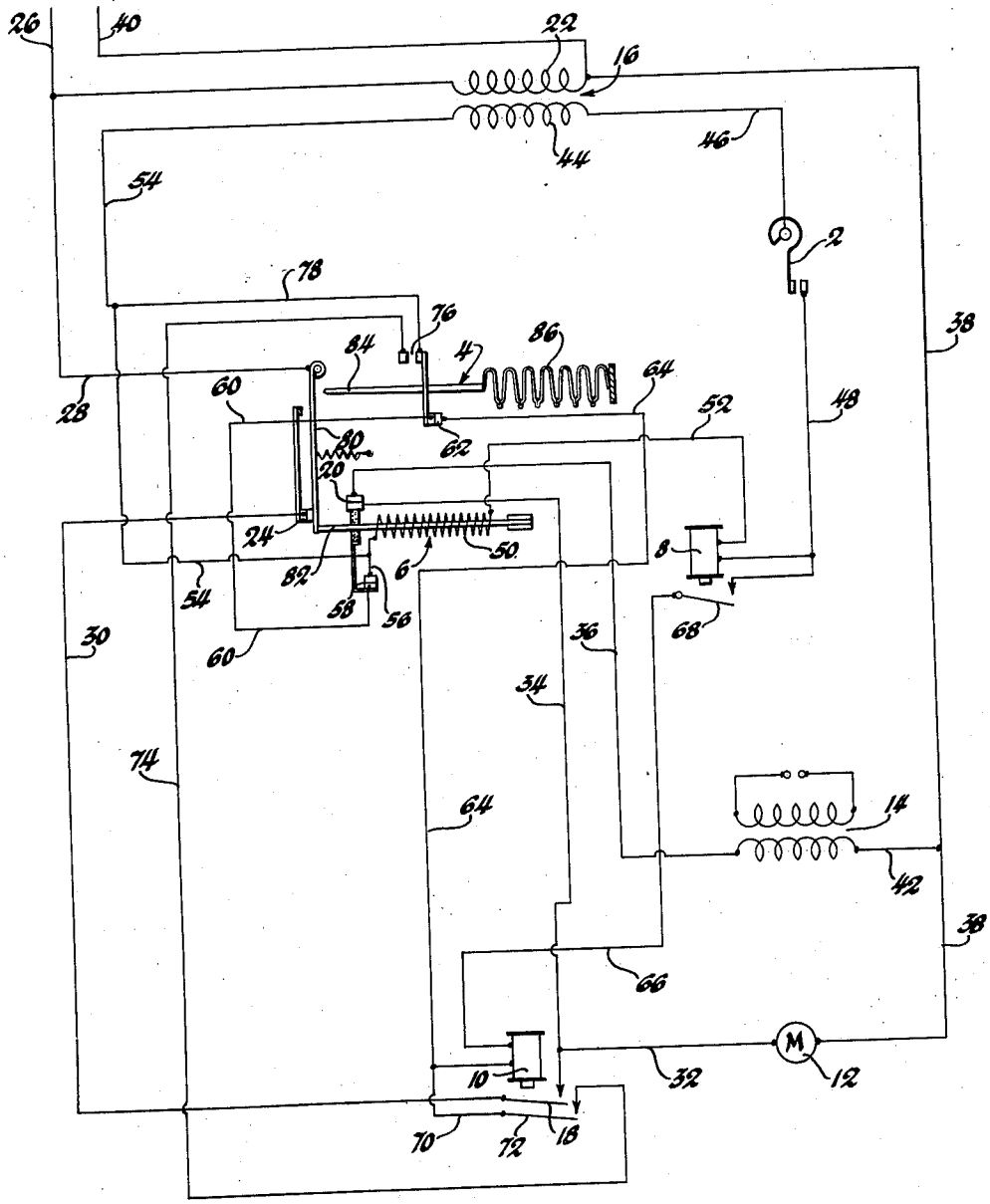
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OIL BURNER CONTROL-PROGRAM TYPE

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OIL BURNER CONTROL—PROGRAM TYPE

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4 Claims. (Cl. 158—28)

Our invention pertains to control apparatus and more particularly to automatic controlling means for fluid fuel burners for heating and is related to our copending application Ser. No. 138,688 filed April 24, 1937.

In the usual construction of either mechanism for burning oil or gas or other fluid fuel, it is necessary to provide some automatic means for controlling the periods of actuation of the burner and the regulation of the temperature in the space to be heated, the primary function of course being to actuate the burner as the temperature falls below a predetermined point and to cause it to cease operating as the temperature rises back up to the set point. There are however, over and above these normal variations, safety precautions which must be provided in case the burner does not operate in the usual manner; for example, if the burner does not start to provide heat when actuated or if there is a flame failure or current failure when the burner is operating normally, means must be provided for shutting down the whole system to prevent an explosion or destruction of a portion of the apparatus.

It is therefore an object of our invention to provide a simple system for so controlling a burner as to provide the necessary safety features as above pointed out.

With this and other objects in view, the embodiments of our invention are disclosed in the following specification and claims and illustrated in the accompanying drawing, in which the figure illustrates a schematic wiring diagram of our invention.

The essential parts of our control apparatus are a room thermostat 2, a stack thermostat 4 operated by the combustion temperature within the furnace, an electrically heated safety switch 6, a pair of control relays 8 and 10, a motor 12 for projecting fuel into the combustion chamber, an ignition transformer 14 and a main control transformer 16.

The system may be roughly divided into two classes:—the high voltage and the low voltage side. In the high voltage portion there is connected the motor 12, the ignition transformer 14, the main motor switch 18, an ignition switch 20, primary coil 22 of the transformer 16 and safety switch 24 whose contacts are under normal conditions closed. These devices are connected in the line in the following manner:—from the main supply line 26 is connected a line 28 to the safety switch 24 from which extends a line 30 to the motor switch 18. From the motor switch 18 one line 32 extends to one terminal of the motor and a second line 34 extends to the ignition switch 20. From the other terminal of the ignition switch 20 is a line 36 extending to the transformer 14 and from the opposite side of the motor 12 a line 38 extends back to the other supply line 40 and to this line 38 is connected the opposite side of the ignition transformer 14 by a line 42.

The primary 22 of the main transformer is connected directly across the incoming line 26 and 40. The secondary 44 of the transformer 16 supplies energy for operating the main control apparatus and one side of said secondary is connected by line 46 to the room thermostat 2 and from the room thermostat 2 extends a line 48 which is connected to one of the control relays 8 which is connected in series with the heating coil 50 of the warp switch 6 by line 52. From the opposite terminal of the heating coil 50 extends a line 54 which is connected back to the opposite terminal of the secondary 44. It will thus be seen that when the room thermostat calls for heat the relay 8 and heating coil 50 are energized directly by the secondary and are in series.

Also extending from the opposite end of the heating coil 50 is a line 56 to which is connected a switch 58, the opposite point of the switch being connected by line 60 to a switch 62 operated by stack switch 4 and being normally closed when the combustion chamber is cold and open when the combustion chamber is heated. A line 64 extends from the stack switch to the other control relay 10, the opposite terminal of which is connected by line 66 to switch 68, the opposite portion of the switch being connected back to line 48 which extends from the room thermostat.

Extending from the line 64 is an additional line 70 which connects to a switch 72 the opposite terminal of which is connected by line 74 to a second stack switch 76 which is normally open when the combustion chamber is cold and closed when the latter is heated, said opposite terminal of the stack switch 76 being connected by line 78 to line 54. The switch 72 is adapted to be actuated by the relay 10 and may be termed the holding contacts.

The safety switch 24 is composed of one stationary terminal and one movable terminal, the latter being mounted on a pivoted arm 80 which is spring biased away from the stationary contact and it is held in position as shown by a bimetallic arm 82 but as will be seen when the bimetallic arm warps downwardly, as shown in the drawing, it will move out of contact with the end

of the arm 80 and allow the same to spring to the right opening the safety switch. However the rod 84 actuated by the bimetallic stack element 86 is adapted to project into the path of the pivoted arm 80 and to prevent its movement in case the combustion chamber has heated so that if the thermal element moves out of the way the stack arm will act as an interlock and prevent the safety switch from opening if the burner operates normally.

The operation of my circuit will now be described. When the room thermostat 2 calls for heat it closes its contacts and the following circuit is completed to energize the relay 8 and the heating coil 50. From transformer secondary 44, line 46, room thermostat 2, line 48, relay 8, line 52, heating coil, 50, line 54, back to secondary 44. This energizes the heating coil which starts to heat the bimetallic arm 82 which will cause the latter to warp out of its stop position. At the same time the relay 8 is energized and it closes contacts 68 thereby energizing relay 10 through the following circuit: Secondary 44, line 46, room thermostat 2, line 48, switch 68, line 66, relay 10, line 64, stack switch 62, closed when cold, line 60, switch 58 (closed when 50 is cold), line 56, line 54 back to the secondary.

It will be evident from the above that in the initial energizing circuit for the relay 10 there are two switches in series, namely 62, operated by the stack switch, and 58, operated by the warp switch, to insure that both of these members are in their normal cold or deenergized position before the burner may be started. If either one is open the system will not start.

Upon the energization of the relay 10 the switch 18 in the main motor circuit is closed thereby energizing the motor through the following circuit: Line 26, line 28, safety switch 24, line 30, switch 18, line 32, motor 12, line 38 back to incoming line 40. At the same time the ignition transformer will be energized through the same line as far as switch 18 and from there through line 34, ignition switch 20, line 36, ignition transformer 14 to line 38 back to the incoming line. This will start the motor and ignition in operation and under normal conditions the burner will commence operation.

As the bimetallic arm 82 heats, it will warp in a downward direction as shown which will break the ignition switch 20 after a certain set time which will cut off the ignition and it will also break the contacts in switch 58 which would ordinarily break the circuit for relay 10. However when relay 10 closed it also closed switch 72 which acts as a holding circuit for the relay since by this time switch 76 operated by the stack has closed to complete the by-pass or holding circuit for the relay 10 and insuring heat before the holding circuit is complete. If the stack has not heated up by the time that switch 58 or switch 62 opens, the relay 10 will be deenergized. It might be mentioned at this piont that the switches 62 and 76 are of the overlapping type in one direction, namely to the left or from 62 to 76, so that switch 76 makes before switch 62 breaks. Also, if the burner does not heat when the warp switch plate 82 passes beyond the end of the spring bias arm 80, the latter will fly to the right and open the safety switch if the rod 84 has not been thermally positioned into contact with the lever to act as a stop.

If the burner is operating normally and a flame failure occurs, the bimetallic element 86 of the stack switch will contract and rod 84 will move out of position allowing the safety switch 24 to open which requires a manual reset. If there is a current failure during normal operation, holding switch 72 will open deenergizing relay 10 which operates the motor switch and the motor will be stopped. The energizing circuit for relay 10 cannot again be closed due to the fact that switch 58 is open and therefore as the combustion chamber cools down rod 84 will again allow the safety switch 24 to open.

We claim:

1. In a system for controlling fluid fuel burners, a burner circuit, a safety switch in said circuit having an actuator with a heating element for opening said switch when said actuator is heated by said heating element, means operative on establishment of combustion to mechanically engage said safety switch and prevent the opening thereof, electrically operated means to control said burner circuit, a control circuit for said electrically operated means, a thermostat with said heating element in series therewith to energize said control circuit, a normally closed stack switch in said control circuit adapted to be opened in response to combustion temperature, and a normally closed timer switch in series with said stack switch and adapted to be opened by said safety switch actuator when heated.

2. In a system for controlling fluid fuel burners, a burner circuit, a safety switch in said circuit having an actuator with a heating element for opening said switch when said actuator is heated by said heating element, means operative on establishment of combustion to mechanically engage said safety switch and prevent the opening thereof, electrically operated means to control said burner circuit, a control circuit for said electrically operated means, a thermostat with said heating element in series therewith to energize said control circuit, a normally closed stack switch in said control circuit adapted to be opened in response to combustion temperature, a normally closed timer switch in series with said stack switch and adapted to be opened by said safety switch actuator when heated, and a holding circuit for said electrically operated means having a second stack switch which is normally open and adapted to be closed in response to combustion temperature prior to opening of said first-mentioned stack switch.

3. In a system for controlling fluid fuel burners, a burner circuit, an ignition circuit, a safety switch controlling said circuits having an actuator with a heating element for opening said switch when said actuator is heated by said heating element, means operative on establishment of combustion to mechanically engage said safety switch and prevent the opening thereof, electrically operated means to control said burner and ignition circuit, a control circuit for said electrically operated means, a thermostat with said heating element in series therewith to energize said control circuit, a normally closed stack switch in said control circuit adapted to be opened in response to combustion temperature, a normally closed timer switch in series with said stack switch in said control circuit and a normally closed timer switch in said ignition circuit, both of said timer switches adapted to be opened by said safety switch actuator when heated.

4. In a system for controlling fluid fuel burners, a burner circuit, an ignition circuit, a safety switch controlling said circuits having an actuator with a heating element for opening said switch when said actuator is heated by said heat-

ing element, means operative on establishment of combustion to mechanically engage said safety switch and prevent the opening thereof, electrically operated means to control said burner and ignition circuits, a control circuit for said electrically operated means, a thermostat with said heating element in series therewith to energize said control circuit, a normally closed stack switch in said control circuit adapted to be opened in response to combustion temperature, a normally closed timer switch in series with said stack switch in said control circut, a normally closed timer switch in said ignition circuit, both of said timer switches adapted to be opened by said safety switch actuator when heated, and a holding circuit for said electrically operated means having a second stack switch which is normally open and adapted to be closed in response to combustion temperature prior to opening of said first-mentioned stack switch.

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