

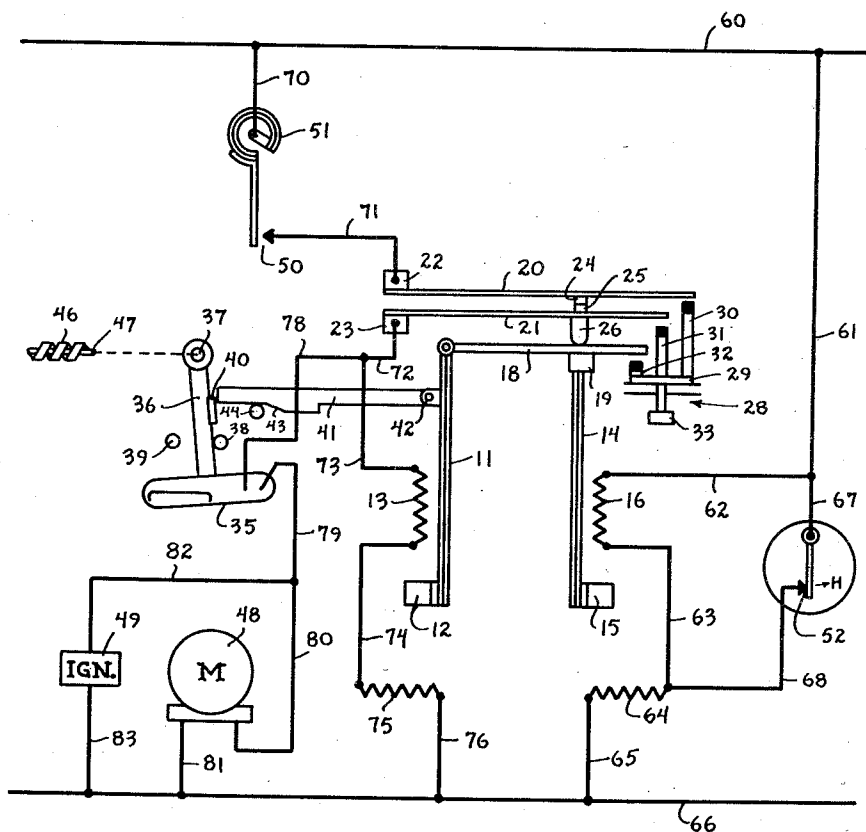
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A. H. LOCKRAE

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FUEL BURNER CONTROL SYSTEM

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Inventor

Arthur H. Lockrae

By *George H. Fisher*

Attorney

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FUEL BURNER CONTROL SYSTEM

Arthur H. Lockrae, Minneapolis, Minn., assignor
to Minneapolis-Honeywell Regulator Company,
Minneapolis, Minn., a corporation of Delaware

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This invention relates to improvements in simplified control systems for fuel burners.

Heretofore, in some instances, electric fuel feeding devices, such as oil burner motors, have been controlled by means of power devices or timers which are energized in response to a demand for heat and which, when energized, close a control switch for the burner motors. Such systems have the drawback that they will not shut down rapidly on flame failure. For example, in one case, the timer must first be deenergized in response to flame failure and then after a predetermined time interval open the circuit to the burner motor. In other cases, on flame failure, a second timer is controlled in a manner to open the safety switch after a predetermined time interval. In both of these cases the shut-down is accomplished through the medium of a timer and is therefore not immediate.

It is therefore a main object of the present invention to improve systems of the above type so that they may be shut down substantially immediately on flame failure.

A further object of the invention is to provide a power device which, upon energization, closes a control switch for a burner motor, and which then moves to a position which does not interfere with the movement of the control switch after it has been closed, so that a combustion responsive device can act directly on the control switch to open it in the event of a flame failure.

A more specific object is to improve the control system disclosed in the copending application of William J. McGoldrick, Serial No. 284,223, and filed July 13, 1939, so that the burner motor may be shut down substantially immediately on flame failure.

These and other objects will readily become apparent as the following specification is read in the light of the accompanying drawing, the single figure of which illustrates schematically a control system embodying the various features of my invention.

Numeral 11 indicates a timer or power device in the form of a bimetallic element which is fixed at its lower end to a bracket 12 and is free to move at its upper end. An electric heating element 13 is associated with the timer 11 for the purpose of heating it and causing it to warp. A second timer 14 is also made in the form of a bimetallic element which is fixed at its lower end to a bracket 15 and an electric heating element is associated with the timer in order to cause it to warp. The upper end of the timer 11 pivotally carries a latch 18 which is provided with an abutment 19 which normally rests on the free end of the timer 14. It will be seen that as long as the timers 11 and 14 move together the upper end of the timer 14 will remain beneath the

abutment 19 and therefore hold the latch 18 in its raised position.

Two resilient contact arms 20 and 21 are connected at one end to brackets 22 and 23, respectively, and carry the movable contacts 24 and 25 of a safety switch. The blade 21 is biased in a downwardly direction so that the contact 25 is biased out of engagement with the contact 24. However, the blade 21 is provided with a depending finger 26 which rests on the latch 18 and when the latch is in its raised position the blade 21 is held so that the contact 25 engages the contact 24. When the blade 14 moves a predetermined amount with respect to the blade 11, the abutment 19 drops off of the upper end of the blade 14 permitting the latch 18 to drop down and also permitting the blade 21 to move downwardly due to its bias and separate the contacts 24 and 25.

A manual reset 28 is provided for returning the contacts 24 and 25 to their closed position. This reset 28 is provided with a plate 29 carrying three fingers 30, 31, and 32. The reset is also provided with a button 33 by means of which the plate 29 may be manually raised so that the fingers 31 and 32 may raise the contact blade 21 and latch 18 to their normal positions. At the same time, it will be seen that the finger 30 engages the end of the blade 20 to maintain the contact 24 out of engagement with the contact 25 until after the latch 18 has been reset on the free end of the timer 14 and the button 33 released. This provides for a trip free reset.

A mercury switch 35 is carried by the stem 36 which is in turn rotatably mounted as shown at 37. A pair of stops 38 and 39 limit the rotation of the stem 36 in each direction. The stem 36 is provided with an abutment member 40 which is adapted to be engaged by the operating member 41 which is in turn pivotally mounted as shown at 42 to the free end of the timer 11. As the timer 11 warps to the left the operating member 41 engages the abutment 40 to swing the stem 36 toward the stop 39 thereby closing the switch 35. After the switch has been closed, the cam surface 43 on the operating member 41 rides up on the pin 44 thereby raising the operating member 41 until it clears the abutment 40 whereby the stem 36 can then be rotated back and forth without interference from the operating member 41.

A thermostatic element 46 is adapted to respond to combustion within the furnace and may be located at any suitable point but is preferably positioned in the stack. This thermostat rotates the rod 47 in response to temperature changes in the stack and this rod has a slip frictional engagement with the stem 36 so that if the stem 36 is free to rotate it will rotate with the rod 47, but if the stem 36 is prevented

from rotation by either of the stops 38 or 39 or by the operating member 41 then it will merely slip with respect to the rod 47.

An electrical fuel feeding device which may be in the form of the usual oil burner motor is indicated at 48 and an ignition device for igniting the fuel delivered to the combustion chamber by the motor 48 is indicated at 49. The main switch 50 is adapted to be opened and closed by means of a room thermostat 51. A closed cold combustion switch is indicated at 52. This switch is operated by a device responding to combustion within the furnace and, as is usual, is connected thereto by means of a slip friction connection so that it is operated in response to a change in temperature trend and not in response to any predetermined temperature. If desired, the same thermostat 46 which actuates the switch 35 may also actuate the switch 52.

The system has been shown in the drawing in the condition it will assume following a normal shut-down by means of the room thermostat 51 and after a sufficient time interval has elapsed for the timers 11 and 14 and the thermostat 46 to return to their cold positions. It will be noted at this time that the burner motor control switch 35 is in open position and the burner motor and ignition device are therefore deenergized. The electric heater 13 is also deenergized due to the fact that the main switch 50 is in open circuit position. The electric heater 16 is in a circuit which extends from supply line 60, conductors 61 and 62, electric heater 16, conductor 63, protective resistance 64, and conductor 65 back to the other supply line 66. The heater 16 is deenergized, however, due to the shunt around it which comprises conductor 67, switch 52, and conductor 68. The timer 14 is therefore cold.

On a decrease in temperature the room thermostat 51 will contract and close main switch 50 establishing the following circuit: supply line 60, conductor 70, room thermostat 51, main switch 50, conductor 71, contact blade 20, contacts 24 and 25, contact blade 21, conductors 72 and 73, electric heater 13, conductor 74, protective resistance 75, and conductor 76 back to the other supply line 66. This circuit will heat the timer 11 and cause it to warp toward the left and the burner motor control switch 35 will be moved to closed position by the coaction between the operating member 41 and the abutment member 40 on the rotatable stem 36. This will establish a circuit from supply line 60, conductor 70, room thermostat 51, main switch 50, conductor 71, contact blade 20, contacts 24 and 25, contact blade 21, conductors 72 and 78, switch 35, conductors 79 and 80, burner motor 84, and conductor 81 back to the other supply line 66. This circuit will energize the burner motor 48 and the ignition device 49 is connected in parallel with the burner motor 48 by means of conductors 82 and 83 so that the ignition device 49 will be energized at all times when the burner motor 48 is energized.

Under normal conditions, the energization of the burner motor 48 and ignition device 49 will establish combustion within the combustion chamber of the furnace and as a result the thermostat 46 will begin to heat up and expand. The expansion of the thermostat 46 will immediately cause the closed cold combustion switch 52 to open thereby breaking the shunt around the electric heater 16, which will therefore be energized to heat up the timer 14. The timers 11 and 14 are so related with respect to the size of the abutment member 19 that when combustion is established

within a predetermined time, the timer 14 will be heated in sufficient time to cause it to warp toward the left along with the timer 11 and maintain its free end beneath the abutment member 19 thereby holding the safety switch contacts 24 and 25 closed. On continued movement of the timer 11 toward the left, the operating member 41 will ride up on the pin 44 and move out of engagement with the abutment member 40. The expansion of the thermostat 46 will operate through the rod 47 and its slip friction connection with the stem 36 to rotate this stem against the stop 39 if it has not already been moved there by the operating member 41. As long as the room thermostat maintains the switch 50 closed, the timers 11 and 14 will remain hot and the switch 35 will remain closed maintaining the burner motor 48 and the ignition device 49 energized and therefore operative to supply heat.

When the room thermostat 51 has become satisfied, it will open the switch 50 thereby deenergizing the electric heater 13 and the burner motor and ignition device. As a result, the stack thermostat 46 will immediately begin to cool and return the switch 35 to its position against the stop 38. The timer 11 will begin to cool and return the operating member 41 to its original position. The thermostat 46 will also close the combustion responsive switch 52 establishing the shunt around the electric heater 16 which will deenergize it and permit the timer 14 to cool. The timers 11 and 14 will therefore warp toward the right together and maintain the safety switch contacts 24 and 25 closed. Thus the system will return to the condition shown in the drawing.

It will be clear that if there is a demand for heat by the room thermostat 51 resulting in a closure of the control switch 35 and combustion is not established, the combustion responsive switch 52 will remain closed and the electric heater 16 will not be energized. In this case, the timer 11 will continue to warp toward the left until the abutment member 19 drops off the free end of the timer 14 thereby permitting separation of the safety switch contacts 24 and 25 which will interrupt the circuit to the burner motor 48 and ignition device 49. The system will remain shut down until the trouble has been repaired and the safety switch contacts 24 and 25 reclosed by the manual reset 28.

One of the main features of this invention is that by which the system may be rapidly shut down in the event of a flame failure following the normal establishment of combustion. When combustion has been established and the timers 11 and 14 are in their hot positions the operating member 41 is raised out of engagement with the abutment member 40 and will not interfere in any way with the movement of the switch 35 by means of the combustion responsive thermostat 46. Therefore on a flame failure the thermostat 46 will contract and immediately rotate the stem 36 over against the stop 38 thereby opening the motor control switch 35 shutting down the burner motor 48 and the ignition device 49. At the same time, the combustion responsive switch 52 will be reclosed, shunting the electric heater 16 and permitting the timer 14 to cool. The timer 11 will remain heated due to the fact that the room thermostat 51 is still calling for heat and is maintaining the switch 50 closed. After a predetermined movement of the timer 14 toward the right, the abutment member 19 will drop off the free end of the timer 14

and open the safety switch contacts 24 and 25 which breaks the circuit to the heater 13 thereby permitting the timer 11 to cool. The system will remain locked out, however, until the trouble causing the flame failure has been repaired and until the safety switch contacts 24 and 25 have been reclosed by the manual reset 28.

It will thus be seen that I have provided a system in which the motor control switch is closed by means of a timer or power device and that after the switch has been so closed the timer or power device moves out of operative relationship with the switch and throws the control of the switch over to a combustion responsive thermostat whereby the burner motor may be immediately shut down in the event of a flame failure. Moreover, the system is so arranged that it will trip open a safety switch to provide for a permanent lock out after the burner motor has been deenergized in response to flame failure thereby preventing a recycle of the controls.

As certain changes and modification in this system may occur to those who are skilled in the art, I desire it to be understood that I am to be limited only by the scope of the appended claims and not by the specific embodiment of the invention herein disclosed.

I claim as my invention:

1. A fuel burner control system comprising in combination, a fuel feeding device, an ignition device for the fuel, control means having a first position in which said fuel feeding and ignition devices are inoperative and a second position in which it renders said devices operative, power means operative in response to a demand for heat for moving said control means from its first to its second position and then moving out of cooperative relation therewith, and means for positively moving said control means back to its first position in the event of a flame failure following the establishment of combustion.

2. A fuel burner control system comprising in combination, a fuel feeding device, control means having a first position in which said fuel feeding device is inoperative and a second position in which it renders said fuel feeding device operative, power means, a main switch for energizing said power means to move said control means from its first to its second position in order to establish combustion, said power means on continued energization moving to a position in which it does not interfere with the movement of said control means, and combustion responsive means having a slip friction connection with said control means for returning it to its first position when combustion ceases to exist.

3. A fuel burner control system comprising in combination, an electrical fuel feeding device, an ignition device for the fuel, a control switch therefor, a power device, an electrical energizing means therefor, a main switch closing a circuit to said electrical energizing means, said power device closing said control switch as a result of energization for rendering said electrical fuel feeding and ignition devices operative to produce combustion, said power device on continued energization moving to a position where it will not interfere with said control switch, and combustion responsive means opening said control switch when combustion ceases to exist.

4. A fuel burner control system comprising in combination, an electrical fuel feeding device, a

control switch therefor, combustion responsive device having a slip friction connection with said control switch, a power device, an electrical energizing means therefor, a main switch closing a circuit to said electrical energizing means causing said power device, as a result of energization, to close said control switch against the action of said slip friction connection in order to establish combustion, and means causing said power device, on continued energization, to move to a position where it will not interfere with the movement of said control switch, whereby said control switch is placed under the exclusive control of said combustion responsive device.

5. A fuel burner control system comprising in combination, an electrical fuel feeding device, a rotatably mounted switch means in control thereof, a combustion responsive device, a slip friction connection between said device and switch means, a power device, an operating member associated with said power device, means for causing energization of said power device, said power device, as a result of energization, causing said operating member to abut said switch means and rotate it to closed position and then move clear of said switch means so as not to interfere with its movement in either direction, whereby said switch means is placed under the exclusive control of said combustion responsive device.

6. A control system for fuel burners comprising in combination, a pair of timers, means energizing one of said timers, a fuel feeding device rendered operative by said one timer upon energization thereof and rendered inoperative again by a relative movement between said timers, means energizing the other timer as a result of combustion to prevent said predetermined relative movement, and means rendering said fuel feeding device inoperative independently of said timers upon failure of combustion.

7. A control system for fuel burners comprising in combination, a pair of electrical timers, a main switch for energizing one of said timers, an electrical fuel feeding device, a circuit therefor, a control switch in said circuit, a normally closed safety switch in said circuit, said one timer closing said control switch as a result of energization and opening said safety switch a predetermined time thereafter, combustion responsive means for energizing said other timer to prevent said one timer from opening said safety switch, said one timer moving out of cooperative relation with said control switch on continued energization, and means opening said control switch independently of said timers in response to cessation of combustion.

8. A fuel burner control system comprising in combination, an electrical fuel feeding device, a switch in control of said device, a timer which when energized moves from a first position to a second position and when deenergized returns to said first position, means operated by said timer for closing said control switch to produce combustion as said timer moves from said first position, said last named means moving out of cooperative relation with said switch as said timer moves into said second position, means for energizing said timer, and means responsive to combustion for opening said switch independently of said timer upon a flame failure following the successful establishment of combustion.

ARTHUR H. LOCKRAE.