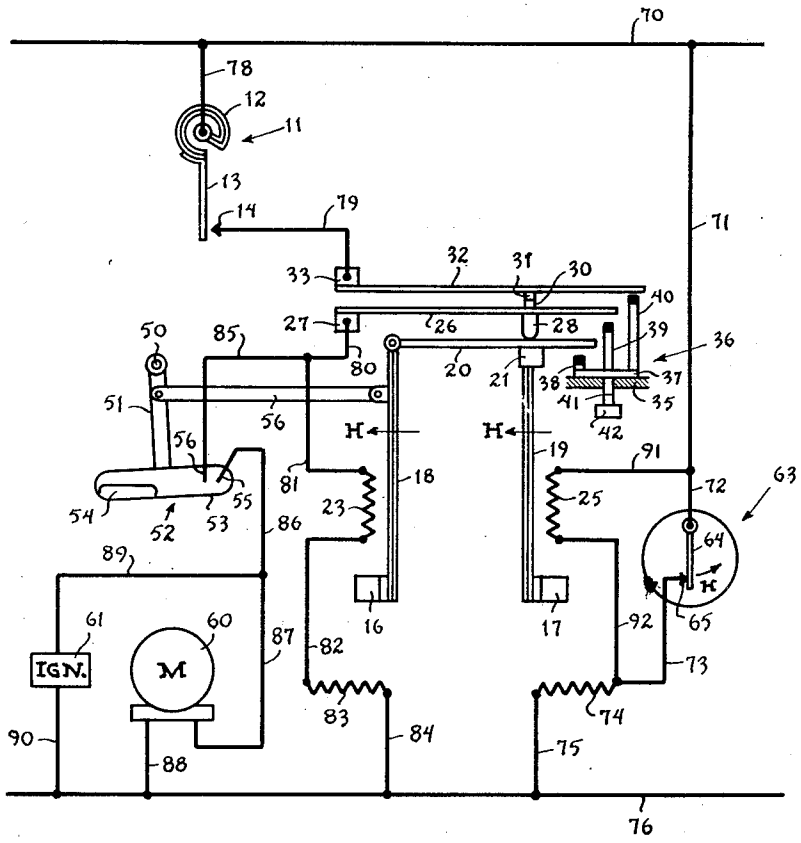
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FUEL BURNER CONTROL SYSTEM

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FUEL BURNER CONTROL SYSTEM

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This invention is directed to a simplified control system for fuel burners in which a pair of electrical timers are utilized to actuate the fuel feeding device and also to provide the proper safety features in case of flame or ignition failure.

It is an object of the present invention to provide such a system wherein the two timers maintain a predetermined relationship to each other so long as the system is operating normally, but on a flame or ignition failure this predetermined relationship is destroyed and the system goes out on safety.

A further object of the invention is to provide a system of the above type in which thermal timers are used, one being energized by a main controlling switch and the other being energized by a thermostat responding to combustion.

These and other objects will readily become apparent to those skilled in the art as the following specification is read in the light of the accompanying drawing in which the single figure shows a diagrammatic representation of my invention.

The main control device for the system of my invention is in the form of a room thermostat indicated generally at 11. The thermostat takes the form of a coiled bimetallic element 12 which is fixed at one end and at its free end carries a contact blade 13 which cooperates with a stationary contact 14. The thermostat is so arranged that on a decrease in temperature the bimetal coil will move the blade 13 into engagement with the stationary contact 14 and on an increase in temperature these contacts will be separated.

Mounted on supports 16 and 17 respectively are a pair of bimetal timers 18 and 19. The bimetal timer 18 at its free end pivotally carries a lever 20 which has depending from its lower side a block 21. When both of the timers are at substantially the same temperature the block 21 rests on the upper end of the bimetal timer 19 in the manner shown in the drawing. Closely associated with the bimetal timer 18 is an electric heating element 23 for the purpose of heating the timer to cause it to warp toward the left. A second electric heating element 25 is associated with the bimetal timer 19 and when energized causes this timer to warp toward the left, as seen in the drawing.

Spring contact blade 26 is fixedly supported at one end to the bracket 27 and has attached thereto at the lower side a supporting member 28. The blade 26 is normally biased toward the lever 20 and its position is therefore determined by this lever. On its upper side the contact blade 26 carries an electric contact 30 which cooperates with a second electric contact 31 carnied by the spring contact blade 32. The spring contact blade 32 is fixedly secured to the bracket 33 and is biased in a direction toward the lever 20 so that when the lever 20 is supported as shown in the drawing, the contacts 30 and 31 are in engagement.

Slidable within a support 35 is a reset member generally indicated at 36. This reset member comprises a plate 37 carrying three reset fingers 38, 39, and 40 each of which has an insulated tip. The stem 41 is slidably received in the support 35 and carries a knob 42 whereby the reset member may be vertically moved within the support. The purpose and function of this reset member will appear in a description of the operation of the present invention.

Pivotally mounted at 50 is an arm 51 carrying a mercury switch generally indicated at 52 and comprising a glass tube 53 and a globule of mercury 54. The mercury switch is provided with a pair of electrodes 55 and 56 which the mercury 54 is adapted to alternately bridge and unbridge. A connecting arm 56 is pivotally connected to the arm 51 and to the bimetal timer 18 in such a manner that as the bimetal timer 18 warps to the left the arm 51 will be rotated in a direction to cause the mercury 54 to bridge the electrodes 55 and 56 of the mercury switch 52.

The present control system is provided with the usual electrical fuel delivery means which in this case is in the form of an oil burner motor 60. Ignition device 61 is supplied for the purpose of igniting the fuel delivered by the motor 60.

Indicated generally at 63 is a combustion responsive switch which comprises a switch arm 64 and stationary contact 65. It will be understood that this is merely a diagrammatic representation and that the switch arm 64 is to be actuated by some means responsive to combustion which may be located within the furnace to respond to radiant heat of the flame or which may be mounted in the stack to respond to the temperature of the products of combustion. A slip friction mechanism is inserted between the combustion responsive means and the switch arm 64 in order that the switch may be actuated in response to a change in the temperature to which the combustion responsive means responds and not in accordance with any predetermined tem-

perature. Such devices are of course old and well known in the art.

In considering the operation of the present control system, let it be assumed that the room thermostat 11 is satisfied and that the switch arm 13 has been out of engagement with the contact 14 for a sufficient length of time for the bimetal timers 18 and 19 to have returned to their cold positions and for the combustion responsive contacts 64 and 65 to have moved into engagement. It will be noted that when the switch arm 64 is in engagement with contact 65, a circuit is completed from the line wire 70 through conductors 71, 72, switch arm 64, contact 65, conductor 73, protective resistance 74, and conductor 75 back to the other line wire 76. The above circuit shunts out the electric heater 25 thus permitting the bimetal timer 19 to remain in its cold position. The movement of the bimetal timer 18 to cold position moves the mercury switch 52 to its open circuit position thereby deenergizing the motor 60 and ignition means 61.

As a result of the above condition, the temperature will begin to drop at the room thermostat 11 and eventually the bimetallic element 12 will move switch arm 13 into engagement with the stationary contact 14. This closes a circuit from the line wire 70, conductor 78, bimetallic element 12, switch arm 13, contact 14, conductor 79, contact blade 32, contacts 31 and 30, contact blade 26, conductors 80 and 81, electric heater 23, conductor 82, protective resistance 83, and conductor 84 back to the line wire 76. The result of this circuit is to energize the electric heater 23 causing the bimetallic timer to warp toward the left. As the timer 18 warps towards the left, it tilts the glass tube 53 until the mercury 54 bridges the electrodes 55 and 56. This sets up a parallel circuit from the conductor 80 to conductor 85, electrode 56, mercury 54, electrode 55, conductors 86 and 87, burner motor 60, and conductor 88 back to the line wire 76. The ignition means 61 is simultaneously energized by means of conductors 89 and 90 which place the ignition means in parallel with the motor 60. The energization of motor 60 and ignition means 61 normally establishes combustion which will cause the combustion responsive device 63 to move the switch arm 64 out of engagement with the stationary contact 65. This breaks the shunt circuit about the electrical heater 25 which will now be energized by means of the following circuit: line wire 70, conductors 71 and 91, electric heating element 25, conductor 92, protective resistance 74, and conductor 75 back to the other line wire 76.

As a result of the energization of the electric heater 25, the bimetallic element 19 will warp toward the left. The relationship of the bimetallic timers 18 and 19 and the supporting block 21 is such that the bimetallic timer 18 may warp toward the left to close the mercury switch 52 resulting in the energization of the burner motor 60 and ignition means 61 to produce combustion thereby causing the combustion responsive device 63 to open the contacts 64 and 65 energizing the heater 25 before the block 21 has moved to the left far enough to drop off the end of the bimetallic timer 19. After the heater 25 has been energized, the bimetallic timer 19 moves to the left along with the block 21 so that normally the lever 20 remains in the horizontal position thereby holding the switch contacts 30 and 31 closed. This is the normal running position of the system.

After the temperature at the thermostat 11 has been sufficiently raised the bimetallic element 12 will cause the switch arm 13 to separate from the stationary contact 14 thereby deenergizing the burner motor 60, ignition means 61 and the electric heater 23. Bimetal timer 18 will therefore begin to cool and move toward the right. Combustion having ceased to exist within the furnace, the switch arm 64 will move into engagement with the contact 65 thereby shunting the electric heater 25 with the result that the bimetal timer 19 will also cool and warp toward the right along with the timer 18 and the block 21 will continue to rest on the free end of the timer 19 and maintain the switch contacts 30 and 31 in closed position. Therefore during normal operation of the system the contacts 30 and 31 will remain closed at all times.

Let us assume now that the room thermostat 11 is calling for heat and has caused the switch arm 13 to engage the contact 14 thereby energizing the electric heater 23. As a result, the bimetallic timer 18 will warp toward the left and close the mercury switch 52 energizing the burner motor 60 and ignition means 61. If for some reason combustion should not take place, the switch arm 64 would remain in engagement with the contact 65 thereby preventing energization of the electric heater 25. The bimetallic timer 19 would therefore remain stationary and after the timer 18 had warped to the left a predetermined amount the supporting block 21 for the lever 20 would drop off the end of the timer 19. The end of the lever 20 would then drop onto the arm 38 of the reset member and the spring biased contact blade 26 would drop on the arm 39 while the arm 40 would prevent the contact blade 32 from following the contact blade 26. Contacts 30 and 31 would therefore be separated breaking the circuit to the motor 60, ignition means 61 and electric heater 23. The bimetallic timer 18 would then cool and tend to warp toward the right. The parts would remain in this position until the lever 20 has been reset upon the upper end of the timer 19 thereby closing the contacts 30 and 31. This resetting operation is accomplished by means of the reset member 36 which is moved vertically upwardly by means of the knob 42. It will be noted that as the arms 38 and 39 reset the lever 20 and contact blade 26 to the positions shown in the drawing that the arm 40 will hold the contacts 30 and 31 separated until the reset 36 is released and then the contacts 30 and 31 will move into engagement only if the timers 18 and 19 are in such position that the supporting block 21 engages the free end of the timer 19. In other words, the reset member 36 provides a trip free reset action. The system is then capable of making another attempt at a normal start.

If the system should be running normally and a flame failure should occur, the combustion responsive device 63 would immediately respond and move the switch arm 64 into contact with the stationary contact 65. The result of this is to shunt the electric heater 25 causing the bimetal timer 19 to cool and warp toward the right. The electric heater 23 will remain energized due to the fact that the room thermostat 11 is still calling for heat so that the timer 18 will hold the block 21 over toward the left and as the timer 19 continues to warp toward the right the block 21 will after a predetermined length of time

drop off the end of the timer 19. This opens the switch contacts 30 and 31 which shuts down the system in the same manner as described in connection with the ignition failure. The system will remain in this condition until reset by means of the reset member 36 in the same manner as described above.

On power failure should the system be in running condition both of the electric heaters 23 and 25 will be deenergized and the timers will move together to their cold position where the system will be in condition for another normal start after the power has been resumed.

It will therefore be seen that I have provided a simplified form of oil burner control system wherein a pair of bimetal timers not only actuate the control switch for the burner motor and ignition means but also cooperate with the safety switch 30 and 31 to provide the proper features of safety in case of flame or ignition failure.

Other modifications of this invention may occur to those who are skilled in the art and I therefore wish it to be understood that I am to be limited only by the scope of the appended claims and not by the specific embodiment disclosed.

I claim as my invention:

1. 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 predetermined relative movement between said timers, and means energizing the other timer as a result of combustion to prevent said predetermined relative movement.

2. 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, said one timer upon energization closing said circuit and upon continued movement relative to said other timer breaking said circuit again, and means responsive to combustion energizing said other timer causing it to move along with said one timer and maintain said circuit closed.

3. 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, said one timer upon energization closing said circuit and upon continued movement relative to said other timer breaking said circuit again, electrical means for energizing said other timer, a switch closing a shunt circuit around said electrical means, and means responsive to combustion opening said last named switch whereby said other timer moves along with said one timer and maintains the circuit for said fuel feeding device closed.

4. A control system for fuel burners comprising in combination, an electrical fuel feeding device, a circuit therefor including a control switch and a biased open safety switch, a pair of timers, said timers holding said safety switch in closed position as long as they bear a substantially predetermined relation to each other, means energizing one of said timers to cause it to move and close said control switch for energizing said fuel feeding device, said timer upon continued movement being operative to destroy said predetermined relation, and means responsive to combustion energizing the other timer for movement in a direction to maintain said predetermined relation.

5. A control system for fuel burners comprising in combination, an electrical fuel feeding device, a circuit therefor including a control switch and a biased open safety switch, a pair of timers, said timers holding said safety switch in closed position as long as they bear a substantially predetermined relation to each other, means energizing one of said timers to cause it to move and close said control switch for energizing said fuel feeding device, said timer upon continued movement being operative to destroy said predetermined relation and trip said safety switch to open position, manual means for resetting said safety switch after said timers are in a condition to return to their predetermined relation, and means responsive to combustion energizing the other timer for maintaining said predetermined relation if it has not already been destroyed.

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 predetermined relative movement between said timers, and means energizing the other timer as a result of combustion to cause it to move in a direction to prevent said relative movement, said means deenergizing said other timer as a result of a subsequent failure of combustion to cause it to move in the opposite direction relative to said one timer and hence render said fuel feeding device inoperative.

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, said one timer upon energization closing said circuit and upon continued movement relative to said other timer breaking said circuit again, and means responsive to combustion energizing said other timer causing it to move along with said one timer and maintain said circuit closed, said means on subsequent failure of combustion deenergizing said other timer causing it to reverse its movement relative said one timer and open said circuit.

8. A control system for fuel burners comprising in combination, an electrical fuel feeding device, a circuit therefor including a control switch and a biased open safety switch, a pair of timers, said timers holding said safety switch in closed position as long as they bear a substantially predetermined relation to each other, means energizing one of said timers to close said control switch for energizing said fuel feeding device, said timer upon continued movement being operative to destroy said predetermined relation, and means responsive to combustion energizing the other timer for movement in a direction to maintain said predetermined relation, said last mentioned means on subsequent failure of combustion deenergizing said other timer causing it to reverse its movement and hence trip said safety switch to open position.

9. A control system for fuel burners comprising in combination, an electrical fuel feeding device, a circuit therefor, a pair of bimetal timers, a main switch, a heater energized by said main switch for heating one of said bimetal timers which upon initial movement closes said circuit and after a predetermined movement relative to the other of said timers reopens said circuit, a second heater, and means energizing said second heater in response to combustion

for causing said other timer to move in the same direction as said one timer thereby preventing said predetermined relative movement between them.

10. A control system for fuel burners comprising in combination, an electrical fuel feeding device, a circuit therefor, a pair of bimetal timers, a main switch, a heater energized by said main switch for heating one of said bimetal timers which upon initial movement closes said circuit and after a predetermined movement relative to the other of said timers reopens said circuit, a second heater, and means energizing said second heater in response to combustion for causing said other timer to move in the same direction as said one timer thereby preventing said predetermined relative movement between them, said means on a subsequent failure of ignition deenergizing said second heater whereupon said other timer accomplishes said predetermined movement in the opposite direction thereby opening said circuit.

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