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2,108,770

PREIGNITION OIL BURNER SYSTEM

Filed May 21, 1934

2 Sheets-Sheet 1

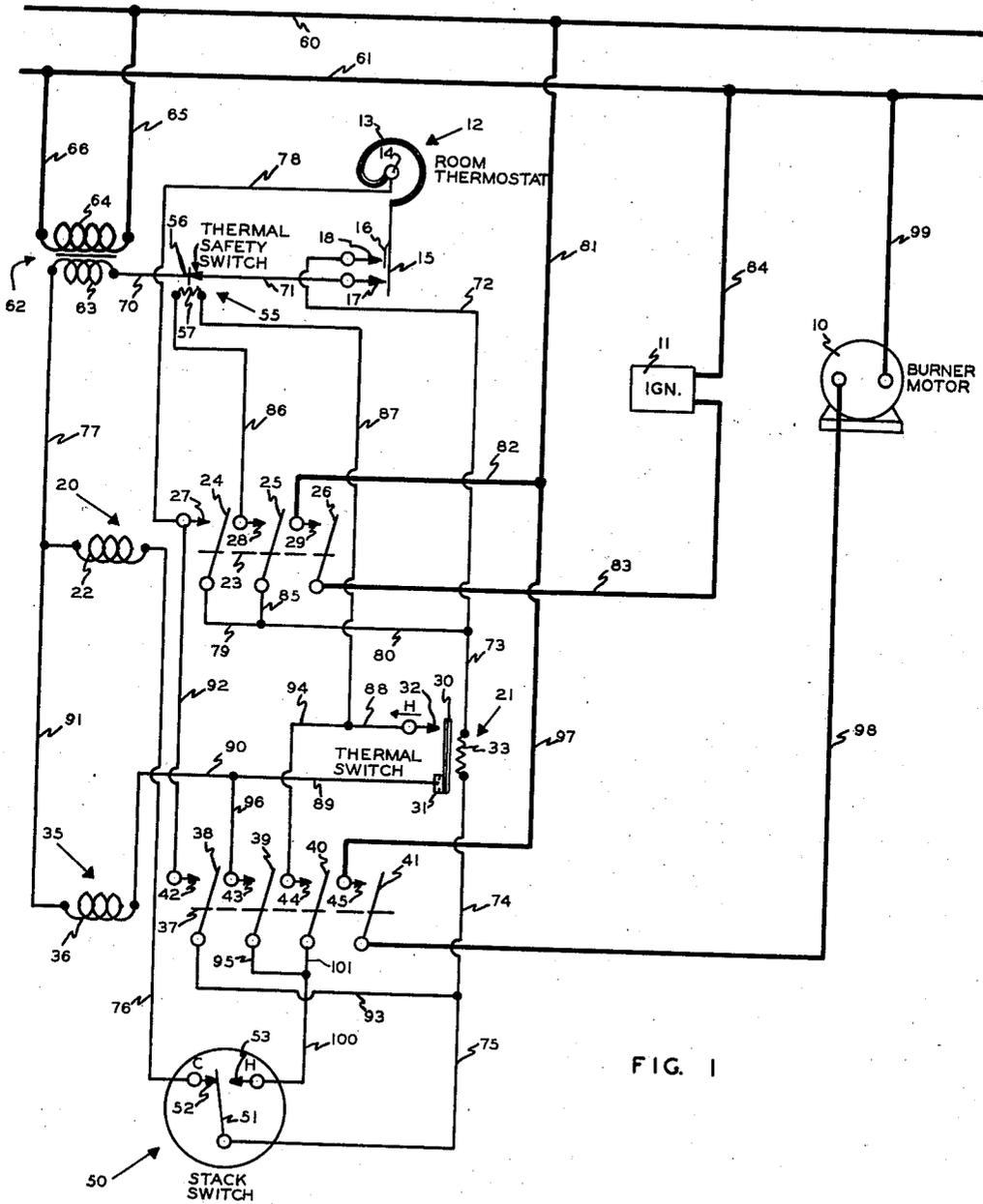


FIG. 1

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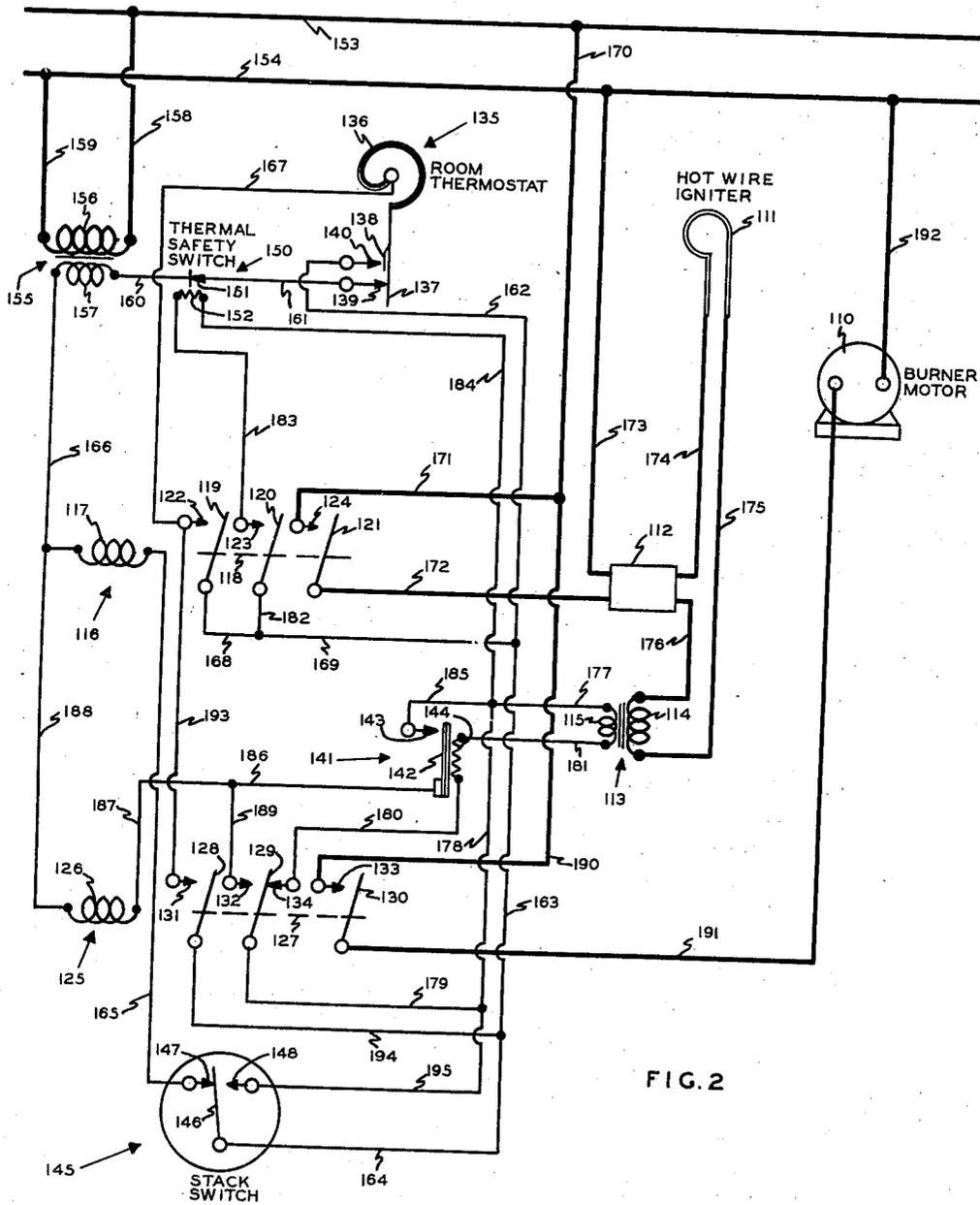


FIG. 2

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# UNITED STATES PATENT OFFICE

2,108,770

## PREIGNITION OIL BURNER SYSTEM

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3 Claims. (Cl. 158—28)

The present invention relates to improved control systems for fuel burners, such as the well-known oil burner, by which the ignition means is rendered operative for a timed period prior to the supplying of fuel to the burners.

One of the objects of the present invention is the provision of a fuel burner control system in which the ignition means is rendered operative prior to the supplying of fuel, the system being so arranged as to provide all of the usual safety features such as a safety shut-down upon a failure of combustion to be properly established and a recycling upon a momentary power failure or flame failure only after the interposition of a timed delay whereby the unburned vapors may have time to dissipate.

Other objects of the invention include the specific arrangements to be hereinafter shown and described and covered by the appended claims.

For a better understanding of the invention, reference may be had to the following detailed description and accompanying drawings, in which:

Fig. 1 is a schematic showing of one form of the invention, and

Fig. 2 is a schematic showing of another form of the invention.

Referring first to Fig. 1, the system includes an electrically operable fuel supply controlling means herein shown in the form of a burner motor and indicated at 10. The fuel supplied by the burner motor 10 is adapted to be ignited by ignition means of any suitable type indicated at 11. Operation of burner motor 10 and ignition means 11 is normally controlled by a main control switch herein shown as comprising a room thermostat generally indicated at 12.

The room thermostat 12 includes a bimetallic element 13, having one of its ends secured as to a post 14. The other end of bimetallic element 13 carries a pair of contact blades 15 and 16 which, upon a fall in the room temperature, are adapted to engage sequentially relatively stationary contacts 17 and 18 in the order named. Upon a rise in room temperature, contact blade 16 first disengages contact 18 and upon a further rise in such temperature of say 2° F., the contact blade 15 disengages contact 17. This room thermostat may well take the form shown in Frederick S. Denison Patent No. 1,818,697 issued August 11, 1931. The room thermostat 12 controls a first or ignition relay generally indicated at 20 and a thermal time switch generally indicated at 21.

The relay 20 comprises a relay coil 22 which,

when energized, is adapted to attract an armature 23 that in turn moves switch arms 24, 25 and 26 respectively into engagement with contacts 27, 28 and 29. Upon deenergization of the relay coil 22, the armature 23 and switch arms 24, 25 and 26 fall by gravity to the position shown in Fig. 1 of the drawings.

The thermal time switch 21 comprises a bimetallic element 30, having one of its ends secured as indicated at 31, its free end being adapted to engage a stationary contact 32 when the bimetallic element 30 is heated to a predetermined extent. An electrical heating coil shown at 33 is closely associated with the bimetallic element 30 and is adapted to heat the same to cause such movement of its free end into engagement with the cooperating contact 32.

The room thermostat 12 and thermal time switch 21 cooperate in the control of a second or burner motor relay generally indicated at 35. This relay 35 includes a relay coil 36 which, upon energization, is adapted to attract an armature 37. When armature 37 is attracted it moves switch arms 38, 39, 40 and 41 into respective engagement with contacts 42, 43, 44 and 45. Upon deenergization of relay coil 36, the armature 37 and the associated switch arms 38, 39, 40 and 41 move by gravity to the position shown in Fig. 1 of the drawings.

The operation of the complete system is further controlled by a stack switch mechanism generally indicated at 50. This stack switch mechanism is diagrammatically shown as comprising a switch arm 51 that engages a cold contact 52 during the absence of combustion and engages a hot contact 53 upon the establishment of combustion. This stack switch mechanism is of the usual slip friction type which responds to reversals in stack temperature rather than to definite stack temperatures and the arrangement further is such that switch arm 51 engages hot contact 53 prior to disengaging cold contact 52 upon the establishment of combustion and first disengages hot contact 53 and then engages cold contact 52 after a delayed interval upon the cessation of combustion. Such stack switch mechanisms are now well-known in the art and no further description thereof is thought to be necessary at this time. For the details of construction of such a stack switch mechanism, reference may be had, if desired, to Daniel G. Taylor Patent No. 1,941,502 which issued January 2nd, 1934.

The operation of the system as a whole is completely dominated by a thermal safety switch generally indicated at 55. This thermal safety

switch includes a switch 56 that is operated by a thermal element (not shown), the arrangement being such that upon heating of the element to a predetermined degree, the switch 56 opens and is latched in open position, thereby requiring manual resetting before the system can again be placed in operation. An electrical heating element 57 serves to actuate the thermal element for the switch 56. Such manually resettable thermal safety switches are well-known in the art and the thermal safety switch 55 can, for instance, take the form shown in Frederick S. Denison Patent No. 1,958,081 which issued May 11th, 1934.

Line voltage electrical power is furnished by line wires 60 and 61. Low voltage electrical power is furnished by a step-down transformer generally indicated at 62 which includes a low voltage secondary 63 and a high voltage primary 64. Primary 64 of transformer 62 is connected to line wires 60 and 61 by means of wires 65 and 66. The remaining circuit connections will be described in connection with the operation of the system of Fig. 1.

#### Operation of the system of Fig. 1

With the parts in the position shown, the room temperature is at or above the desired value so that the relays 20 and 35 are both deenergized. As a result, burner motor 10 and ignition means 11 are both inoperative. Furthermore, the system has been inoperative for a reasonable length of time inasmuch as the contact arm 51 of the stack switch mechanism 50 is engaged with cold contact 52 and is disengaged from hot contact 53.

The room temperature will soon begin to decrease since no heat is being furnished thereto and such decrease in room temperature will first bring contact blade 15 into engagement with contact 17 and thereafter bring contact blade 16 into engagement with contact 18 to energize the electrical heating element 33 of time switch 21 and the relay coil 22 of relay 20, in series, as follows: secondary 63 of transformer 62, wire 70, safety switch 56, wire 71, contact 17, contact blades 15 and 16, contact 18, wire 72, wire 73, time switch heating element 33, wire 74, wire 75, contact arm 51 and cold contact 52 of stack switch 50, wire 76, relay coil 22 and wire 77 to the other side of secondary 63. Energization of relay coil 22 moves switch arms 24, 25 and 26 into engagement with their respective contacts 27, 28 and 29. Engagement of switch arm 24 with contact 27 establishes a series holding circuit for time switch heating element 33 and relay coil 22 which is independent of contact blade 16 and contact 18 of the room thermostat 12. This holding circuit is as follows: secondary 63, wire 70, safety switch 56, wire 71, contact 17, contact blade 15, bimetallic element 13, wire 78, contact 27, switch arm 24, wire 79, wire 80, wire 73, time switch heating element 33, wire 74, wire 75, switch arm 51, cold contact 52, wire 76, relay coil 22 and wire 77 to the other side of secondary 63. Engagement of switch arm 26 with contact 29 energizes ignition means 11 as follows: line 60, wire 81, wire 82, contact 29, switch arm 26, wire 83, ignition means 11 and wire 84 to line 61. Engagement of switch arm 25 with contact 28 conditions an energizing circuit for relay coil 36 for completion as will hereinafter become apparent.

Ignition means 11 is therefore in operation and at the same time the heating element 33 of time switch 21 is generating heat which is trans-

mitted to the bimetallic element 30 thereof. After a timed period, bimetallic element 30 will be heated sufficiently so that its free end moves into engagement with contact 32 whereupon an energizing circuit for relay coil 36 and safety switch heating element 57, in series, is established as follows: secondary 63, wire 70, safety switch 56, wire 71, contact 17, contact blade 15, bimetallic element 13, wire 78, contact 27, switch arm 24, wire 79, wire 85, switch arm 25, contact 28, wire 86, safety switch heating element 57, wire 87, wire 88, contact 32 and bimetallic element 30 of time switch 21, wire 89, wire 90, relay coil 36, wire 91 and wire 77 to the other side of secondary 63. Energization of relay coil 36 moves switch arms 38, 39, 40 and 41 into engagement with their respective contacts 42, 43, 44 and 45. Engagement of switch arm 38 with contact 42 establishes a second holding circuit for relay coil 22 which is independent of time switch heating element 33 as well as being independent of contact blade 16 and contact 18 of room thermostat 12, this second holding circuit being as follows: secondary 63, wire 70, safety switch 56, wire 71, contact 17, contact blade 15, bimetallic element 13, wire 78, wire 92, contact 42, switch arm 38, wire 93, wire 75, switch arm 51, cold contact 52, wire 76, relay coil 22 and wire 77 to the other side of secondary 63. Engagement of switch arms 39 and 40 with contacts 43 and 44 establishes a holding circuit for relay coil 36 and safety switch heating element 57, in series, which is independent of contact 32 and bimetallic element 30 of time switch 21, this holding circuit for relay coil 36 being as follows: secondary 63, wire 70, contact 56, wire 71, contact 17, contact blade 15, bimetallic element 13, wire 78, contact 27, switch arm 34, wire 79, wire 85, switch arm 25, contact 28, wire 86, safety switch heating element 57, wire 87, wire 94, contact 44, switch arm 40, wire 101, wire 95, switch arm 39, contact 43, wire 96, wire 90, relay coil 36, wire 91 and wire 77 to the other side of secondary 63. Engagement of switch arm 41 with contact 45 establishes an energizing circuit for burner motor 10 as follows: line 60, wire 81, wire 97, contact 45, switch arm 41, wire 98, burner motor 10 and wire 99 to line 61.

The burner motor 10 is now operating and the safety switch heating element 57 is heating its associated thermal element (not shown) so as to institute a trial ignition period. In the event combustion is not established, the thermal safety switch 55 will open in the usual manner well-known in the art so as to interrupt all of the low voltage circuits from transformer secondary 63 whereupon the system is rendered inoperative until manual intervention.

Assuming that combustion is properly established within the timed period allowed by safety switch 55, the switch arm 51 of stack switch 50 will move into engagement with hot contact 53 thereof to establish a maintaining circuit for relay coil 36 which is as follows: secondary 63, wire 70, safety switch 56, wire 71, contact 17, contact blade 15, bimetallic element 13, wire 78, wire 92, contact 42, switch arm 38, wire 93, wire 75, switch arm 51, hot contact 53, wire 100, wire 95, switch arm 39, contact 43, wire 96, wire 90, relay coil 36, wire 91 and wire 77 to the other side of secondary 63. It will be noted that this maintaining circuit is independent of time switch 21 as well as all of the switches controlled by relay coil 22. It will also be noted that this circuit is

independent of the safety switch heating element 57 and short circuits the former circuits therefor. As the temperature of combustion continues to rise, switch arm 51 will disengage cold contact 52 whereby to interrupt all of the circuits for relay coil 22. The system is now operating normally and upon restoration of the room temperature so as to move contact blade 16 from engagement with contact 18 and then separate contact blade 15 from contact 17, the system will be shut down and after a timed delay, the parts will return to the position shown in Fig. 1 of the drawings.

In the event there should be a failure of flame during normal operation of the system, switch arm 51 will move from engagement with hot contact 53 of stack switch 50 whereupon the maintaining circuit for relay coil 36 will be interrupted and the burner motor 10 will become deenergized by movement of switch arm 41 from engagement with contact 45. As heretofore pointed out, upon fall in stack temperature, contact arm 51 disengages hot contact 53 a timed period before it re-engages cold contact 52. It will therefore be impossible for the system to again establish ignition and fuel feeding until there has been a predetermined standby period as measured by changes in the temperature of combustion. At the end of this standby period, switch arm 51 will engage cold contact 52 whereupon the cycle of operations above described, including the pre-ignition and trial ignition periods, will be repeated, whereupon the system will either be shut down until manual intervention because of a failure to establish combustion properly or will again be placed in normal operation.

In the event of a momentary failure of power while the system is in normal operation, relay coils 22 and 36 will both be deenergized. If the power returns prior to the time switch arm 51 moves from engagement with contact 53 as the result of discontinuance of combustion, it will be impossible for either relay coils 22 or 36 or time switch heating element 33 to be energized since the initial energizing circuit for relay coil 22 goes through the cold contact 52 and the initial energizing circuit for relay coil 36 must go through the time switch 21. The temperature of combustion will therefore continue to fall and after a time period switch arm 51 will engage cold contact 52 at which time the system will recycle in the same manner as upon a failure of flame, if the power supply has returned in the meantime. Otherwise, the system will remain inoperative until the supply of power is returned whereupon the controls will recycle in a new attempt to establish combustion.

Turning now to Fig. 2 of the drawings, a slightly modified system is shown by which the same general results are accomplished as are accomplished by the system of Fig. 1. The system of Fig. 2 includes a burner motor 110 and an igniter means 111 shown in the form of a hot wire igniter. The flow of current to hot wire igniter 111 is controlled by a constant current transformer 112, having a low voltage secondary and a line voltage primary, the secondary being adapted constantly to supply approximately 80 amperes. The constant current transformer 112 also supplies power to a current transformer 113 having a primary 114 and a secondary 115 which delivers a constant current supply of approximately  $\frac{1}{2}$  ampere.

The flow of power to the constant current transformer 112 is controlled by a relay generally

indicated at 116 which comprises a relay coil 117 that controls an armature 118. Upon energization of relay coil 117, armature 118 moves switch arms 119, 120 and 121 into engagement with respective contacts 122, 123 and 124. The flow of current to the burner motor 110 is controlled by a similar relay generally indicated at 125. This relay 125 includes a relay coil 126 which, upon energization, attracts an armature 127 and moves switch arms 128, 129 and 130 into engagement with contacts 131, 132 and 133 respectively. Armature 127, when attracted by energization of relay coil 126, further moves the switch arm 129 from engagement with a contact 134.

Energization of relay coil 117 is primarily controlled by a room thermostat, generally indicated at 135, which includes a bimetallic element 136 and a pair of contact blades 137 and 138. Upon temperature fall, contact blade 137 first engages a contact 139 and upon a further temperature fall of about 2° F., contact blade 138 engages a similar contact 140. Relay 125 is controlled both by the room thermostat 135 and by a time switch generally indicated at 141. Time switch 141 includes a bimetallic element 142 which is secured at one end, the free end thereof being adapted to engage a contact 143 when the bimetallic element 142 has been heated to a predetermined extent. The time switch 141 is provided with an electrical heating element 144.

The system further includes a stack switch generally indicated at 145 which functions in the same manner as the stack switch 50 of Fig. 1. This stack switch 145 includes a switch arm 146 and cooperating cold and hot contacts 147 and 148. The arrangement of stack switch 145 is such that upon the establishment of combustion, switch arm 146 first engages hot contact 148 and thereafter disengages cold contact 147 whereas, upon cessation of combustion, switch arm 146 first disengages hot contact 148 and, after a timed period, reengages cold contact 147. The system is additionally controlled by a thermal safety switch 150 which includes a safety switch 151 that is adapted to be controlled by a thermostatic element (not shown) and an electrical heating element 152. The thermal safety switch 150 of Fig. 2 takes the same general form as the thermal safety switch 55 of Fig. 1.

High voltage power is supplied to the system of Fig. 2 by line wires 153 and 154. Low voltage power is supplied thereto by means of a step down transformer 155 having a high voltage primary 156 and a low voltage secondary 157. The high voltage primary 156 is connected to line wires 153 and 154 by means of wires 158 and 159. The remaining circuit connections will be described in detail under the heading "operation".

#### Operation of the system of Fig. 2

With the parts in the position shown, the room temperature is at or above the desired value so that both relays 116 and 125 are deenergized and the igniter 111 and burner motor 110 are inoperative. Furthermore, the burner motor 110 has been inoperative for a timed period inasmuch as switch arm 146 of stack switch 145 is in engagement with the cold contact 147 thereof. As a result, the room temperature will soon begin to fall and bring contact blade 137 into engagement with contact 139 and thereafter will bring contact blade 138 into engagement with contact 140 whereupon an energizing circuit for relay coil 117 is established as follows: secondary 157, 75

wire 160, safety switch 151, wire 161, contact 139, contact blades 137 and 138, contact 140, wire 162, wire 163, wire 164, switch arm 146, cold contact 147, wire 165, relay coil 117 and wire 166 to the other side of secondary 157. Energization of relay coil 117 moves switch arms 119, 120 and 121 into engagement with their respective contacts 122, 123 and 124. Engagement of switch arm 119 with contact 122 establishes a holding circuit for relay coil 117 which is independent of contact blade 138 and contact 140. This holding circuit is as follows. secondary 157, wire 160, safety switch 151, wire 161, contact 139, contact blade 137, bimetallic element 136, wire 167, contact 122, switch arm 119, wire 168, wire 169, wire 163, wire 164, switch arm 146, contact 147, wire 165, relay coil 117 and wire 166 to the other side of secondary 157. Engagement of switch arm 120 with contact 123 conditions an energizing circuit for relay coil 126 for completion by the time switch 141 as will hereinafter become apparent.

Engagement of switch arm 121 with contact 124 energizes the constant current transformer 112 as follows: line wire 153, wire 170, wire 171, contact 124, switch arm 121, wire 172, constant current transformer 112 and wire 173 to line wire 154. Energization of constant current transformer 112 energizes the hot wire igniter 111 and the current transformer 113, in series, as follows: constant current transformer 112, wire 174, hot wire igniter 111, wire 175, primary 114 of transformer 113 and wire 176 back to the constant current transformer 112. Energization of transformer 113 results in energization of heating element 144 of time switch 141 by a circuit which is as follows: secondary 115 of transformer 113, wire 177, wire 178, wire 179, switch arm 129 and contact 134 of relay 125, wire 180, heating element 144 and wire 181 to the other side of secondary 115.

The igniter 111 and the thermal timer switch 141 are in this manner energized upon closure of the room thermostat 135 in the event the stack switch 145 is in its cold position. The use of constant current transformer 112 insures that the hot wire igniter will be supplied with a proper amount of current to cause the same to become incandescent. By having this same constant current transformer control the flow of current to the current transformer 113 which in turn energizes the time switch heating element 144, the timing period of this time switch will also be quite constant. After a timed period during which the hot wire igniter 111 is heated sufficiently to become incandescent, the heat generated by time switch heating element 144 will become sufficient to cause bimetallic element 142 to move its free end into engagement with contact 143. When this occurs, the heating element 152 of thermal safety switch 150 and the relay coil 126, in series, are energized as follows: secondary 157, wire 160, safety switch 151, wire 161, contact 139, contact blade 137, bimetallic element 136, wire 167, contact 122, switch arm 119, wire 168, wire 182, switch arm 120, contact 123, wire 183, safety switch heating element 152, wire 184, wire 185, contact 143, bimetallic element 142, wire 185, wire 187, relay coil 126, wire 188 and wire 166 to the other side of secondary 157. Energization of relay coil 126 moves switch arm 129 from engagement with contact 134 and into engagement with contact 132 and also moves switch arms 128 and 130 into engagement with contacts 131 and 133 respectively. The arrange-

ment is such that switch arm 129 engages contact 132 prior to disengaging contact 134, such overlapping "in" and "out" contacts on relays being well-known in the art. Disengagement of switch arm 129 from contact 134 deenergizes the circuit for time switch heating element 144 whereas engagement of switch arm 129 with contact 132 establishes a holding circuit for relay coil 126 which is independent of contact 143 and bimetallic element 142 of thermal time switch 141. This holding circuit is as follows: secondary 157, wire 160, safety switch 151, wire 161, contact 139, contact blade 137, bimetallic element 136, wire 167, contact 122, switch arm 119, wire 168, wire 182, switch arm 120, contact 123, wire 183, safety switch heating element 152, wire 184, wire 178, wire 179, arm 129, contact 132, wire 189, wire 187, relay coil 126, wire 188 and wire 166 to the other side of secondary 157. Engagement of switch arm 130 with contact 133 energizes burner motor 110 as follows: line wire 153, wire 170, wire 190, contact 133, switch arm 130, wire 191, burner motor 110 and wire 192 to line wire 154. Energization of burner motor 110 causes the feeding of fuel which should be ignited by the hot wire igniter 111. In the event ignition of this fuel is not successful, then, after a timed period, safety switch 151 will open as is well-known in the art and render the system inoperative until manual intervention.

Assuming that combustion is successfully established however, switch arm 146 of stack switch 145 will move into engagement with hot contact 148 to establish a maintaining circuit for relay coil 126 as follows: secondary 157, wire 160, safety switch 151, wire 161, contact 139, contact blade 137, bimetallic element 136, wire 167, wire 193, contact 131, switch arm 128, wire 194, wire 164, switch arm 146, hot contact 148, wire 195, wire 179, switch arm 129, contact 132, wire 189, wire 187, relay coil 126, wire 188 and wire 166 to the other side of secondary 157. It will be noted that this maintaining circuit for relay coil 126 shunts the initial energizing and holding circuits therefor and the heating element 152 of safety switch 150 whereby the safety switch 150 is operatively deenergized. Upon further increase in the temperature of combustion, switch arm 146 of stack switch 145 will disengage cold contact 147, whereupon all circuits for relay coil 117 and all but the maintaining circuit for relay coil 126 are interrupted. The system is now operating normally and will continue to so operate until the room thermostat becomes satisfied so as to disengage both contact blades 138 and 137 from their respective contacts 140 and 139 unless there should be a flame failure or a failure of electrical power.

In the event of a flame failure or in the event of a failure of electrical power, the system will recycle after a standby period measured by the time required for switch arm 146 to engage cold contact 147 after disengagement of hot contact 148 in the same manner as heretofore explained in connection with the system of Fig. 1.

From the foregoing, it will be seen that the systems of the present invention provide for a predetermined preignition period which is timed by a thermal timer in an oil burning system having all of the usual safety features including delayed recycling upon a flame failure or momentary power failure and a recycling upon a power failure of longer duration together with the safety shut down in the event of a failure to establish combustion during any trial ignition period whether it be an initial trial ignition period or 75

one resulting from a recycling of the system. Furthermore, it will be noted that the delayed recycling upon a flame failure or momentary power failure is obtained entirely by the action of the stack switch mechanism and independently of the thermal time switch that measures the pre-ignition period. Furthermore, it will be noted that the thermal timers by which the pre-ignition period is measured are rendered inoperative as soon as the pre-ignition period has expired whereby the thermal timers are only energized during the actual measuring of the pre-ignition period. Also, in one embodiment of the invention, each relay coil is arranged in series with one of the heating elements for the thermal safety switch or for the thermal timer whereby the particular relay cannot be energized unless its series-connected electrical heating coil is operative. Furthermore, in another one of the modifications, the timing of the thermal time switch that measures the pre-ignition period is rendered quite accurate by the use of a constant current transformer which also supplies the ignition means with electrical current.

It will be apparent that many detailed changes can be made by those skilled in the art without departing from the spirit of the invention and I therefore intend to be limited only by the scope of the appended claims.

I claim:

1. In combination, a fuel control device, a first relay in control thereof, an igniter, a second relay in control of said igniter, a thermal timer including a thermal actuating element and an associated electrical heater, a timer switch closed by the timer thermal actuating element when heated to a predetermined degree by its associated heater, hot and cold combustion responsive switches arranged to close the cold switch a delayed interval after opening of said hot switch upon combustion failure, said hot switch being closed before opening of said cold switch upon establishment of combustion, a main switch, circuit connections for energizing the actuator of said igniter relay and the heater of said thermal timer controlled by said main switch and cold switch, circuit connections for energizing the actuator of said fuel control device relay controlled by said timer switch and said main switch, and a maintaining circuit for the actuator of said fuel control device relay controlled by said main switch and said hot switch, whereby opening of said hot switch as a result of a failure of flame during normal operation deenergizes said fuel control device relay and the subsequent reclosing of said cold switch causes the system to repeat its normal cycle of operations.

2. In a fuel burning system, in combination, a

first relay including an operator and a load switch controlled thereby, combustion responsive switching means having cold and hot positions, a main switch, a circuit for the operator of the first relay controlled by the main switch and the combustion responsive switching means when in its cold position, a constant current transformer, a circuit for the constant current transformer controlled by the load switch of said first relay, a hot wire igniter, a thermal timer including a thermal actuating element and an associated electrical heater, means including circuit connections associating the igniter and timer heater with the constant current transformer for energization thereby, a timer switch moved to circuit closed position by said timer actuating element when the same has been heated to a predetermined extent by its associated heater, a second relay including an actuator and a load switch, a thermal safety switch including a controlling thermal element and an associated electrical heating element and arranged to render the system inoperative if the thermal element thereof is heated to a predetermined extent by its heating element, an energizing circuit for the actuator of said second relay and the safety switch heating element, in series, controlled by said timer switch, a fuel controller, a circuit therefor controlled by the load switch of the second relay, and connections controlled by the combustion responsive switching means when in its hot position for maintaining energization only of the actuator of the second relay if combustion is successfully established before the thermal element of the safety switch has been heated to said predetermined extent.

3. In combination, ignition means, a thermal timer, a constant current transformer to supply current to the thermal timer and ignition means, a main control switch, cold and hot combustion responsive switches overlappingly controlled upon temperature rise only, circuit connection controlled by said main control switch and cold switch to energize said thermal timer and ignition means from the constant current transformer, a timer switch operated by the thermal timer, a solenoid, a circuit for the solenoid controlled by the thermal timer, a fuel control device controlled by the solenoid, a maintaining circuit for the solenoid controlled by the hot switch, and means to deenergize the timer prior to the deenergizing of said ignition means, opening of said hot switch during normal operation deenergizing the solenoid and subsequent closing of the cold switch initiating a new cycle of operation of the system.

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