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BURNER CONTROL APPARATUS

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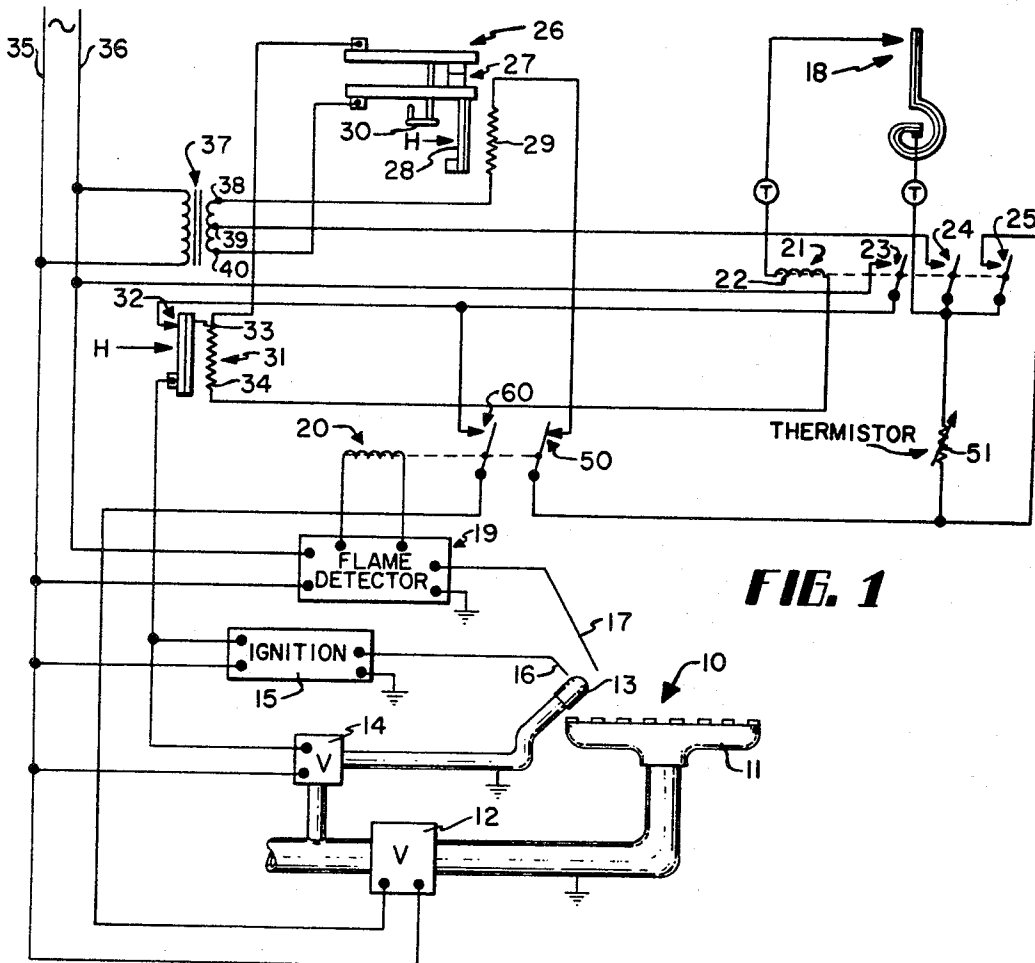


FIG. 1

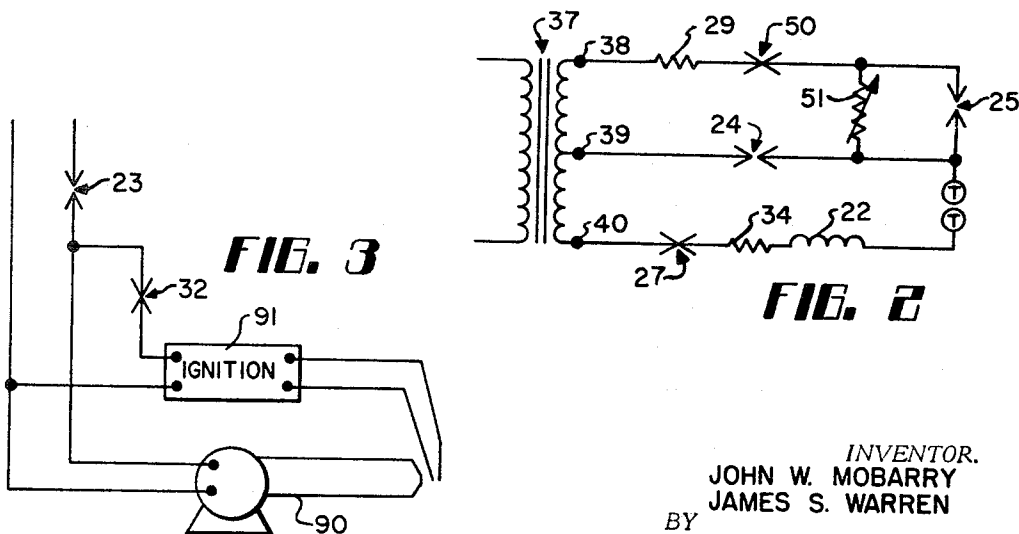


FIG. 2

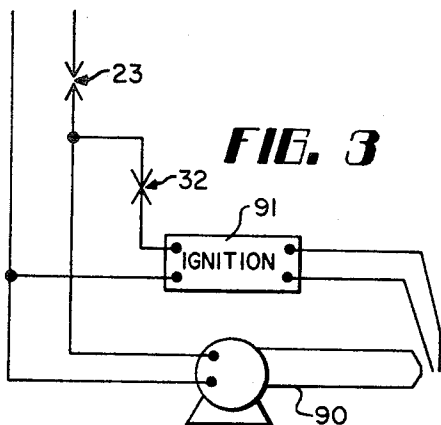


FIG. 3

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BURNER CONTROL APPARATUS

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ABSTRACT OF THE DISCLOSURE

A non-recycling, timed ignition burned control apparatus having a flame detector, a bimetal safety lockout timer, a bimetal ignition timer, and a burner control relay; in which a series circuit for energizing the safety lockout timer heater includes a normally-closed switch of the flame detector and a normally-open switch of the relay, and a series circuit for energizing the relay winding and the ignition timer heater includes the same normally-open switch of the relay.

Background of the invention

Non-recycle burner control apparatus are known, as are burner control apparatus having timed ignition utilizing a bimetal ignition timer. Our invention relates to an improvement in the field of such burner control apparatus.

Summary of the invention

Our invention provides non-recycle and timed ignition operation of a burner unit by means of electrical circuitry which includes a safety lockout timer having an actuator, a flame detector, an ignition timer having an actuator, and a burner control relay having a winding. More specifically, the initial energizing circuit for the relay winding includes in series the safety lockout actuator, a switch controlled by the flame detector, and the timer actuator. Upon energization of the relay, a single normally-open switch of the relay is effective to establish two maintaining circuits, one of which includes in a series circuit the safety lockout actuator and the switch controlled by the flame detector, and the other of which includes in a series circuit the timer actuator and the relay winding.

Brief description of the drawing

FIGURE 1 discloses a preferred embodiment of our invention, connected to control a gas burner unit,

FIGURE 2 is a partial circuit diagram of the embodiment of FIGURE 1, showing the circuit which includes the safety lockout device actuator, the ignition timing device actuator and the relay winding, and

FIGURE 3 is a partial circuit diagram showing the circuit of FIGURE 1 connected to control an oil burner unit.

Description of the preferred embodiments

Referring to FIGURE 1, reference numeral 10 identifies a burner unit having a main burner 11 with a fuel valve 12, a pilot burner 13 with a fuel valve 14, and ignition means 15 with an ignition electrode 16.

Our invention provides non-recycling control and timed ignition control of burner unit 10. Reference numeral 13 designates a controller in the form of a bimetal thermostat having a normally-open switch. Controller 18 is adapted to be located in the area to be heated by operation of burner unit 10. Upon closing of controller 18, valve 14 and ignition means 15 are energized to establish flame at pilot burner 13. The presence of flame at the pilot burner is detected by a flame detector 19, which includes a flame rod 17, causing a flame relay 20 to be energized. Energization of flame relay 20 is effective to energize main valve 12. Flame rod 17 is situated to be sub-

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jected to flame at both pilot burner 13 and main burner 11. Flame relay 20 is deenergized upon the absence of flame at the pilot burner and the main burner. Ignition means 15 is deenergized a time period after initial energization of valve 14 and ignition means 15.

Reference numeral 21 identifies a burner control relay having a winding 22, and normally open switches 23, 24 and 25. Reference numeral 26 identifies a bimetal safety lockout timer having a normally-closed switch 27, a bimetal operator 28, and an actuator in the form of heater 29. Safety lockout timer 26 provides a period of time delay from initial energization of the heater 29 to the opening of switch 27. Also, lockout timer 26 requires manual reset, as by operation of reset button 30. Reference numeral 31 identifies timing means in the form of an ignition timing means having a normally closed ignition cut-off switch 32, a bimetal operator 33, and an actuator in the form of a heater 34. Timer 31 provides a period of time delay, greater than the time delay of lockout timer 26, from initial energization of heater 34 to the opening of switch 32. Timing means 31 is held in its actuated position (switch 32 open) by continued energization of heater 34 and automatically resets upon cooling of bimetal 33.

Operating voltage for the apparatus of FIGURE 1 is derived from a source of AC voltage, not shown, to which power line conductors 35 and 36 are adapted to be connected. Conductors 35 and 36 are connected to the primary winding of step-down transformer 37. The secondary winding of transformer 37 includes terminals 38, 39 and 40. Terminals 38 and 39 constitute a first voltage source and terminals 39 and 40 constitute a second voltage source, the two voltage sources being in voltage adding or aiding relation between terminals 38 and 40.

Considering the operation of the apparatus of FIGURE 1, the apparatus is shown in the standby condition wherein controller 18 is in an open condition, indicating no need for operation of burner unit 10. Upon a need for operation of the burner unit, controller 18 closes its normally-open switch and an energizing circuit for the winding of relay 21 can be traced from terminal 38 through heater 29, normally-closed switch 50 of flame relay 20, thermistor 51, controller 18, winding 22, heater 34, and switch 27 to terminal 40. From this circuit it can be seen that the following conditions must prevail in order for relay winding 22 to be energized: heater 29 must have electrical continuity, flame relay 20 must be in a condition indicating no-flame, heater 34 must have electrical continuity.

Thermistor 51 functions to provide a short period of time delay for pull-in of relay 21. When thermistor 51 is cool, the current through the winding of relay 21 is limited to below the pull-in value. As thermistor 51 self-heats, its resistance drops and relay 21 pulls-in.

Upon pull-in of relay 21, switches 23, 24, and 25 close. The closing of switch 23 is effective to energize valve 14 and ignition means 15. The circuit can be traced from power line conductor 36 through switch 23, switch 32, and ignition means 15 and valve 14 in parallel to power line conductor 35.

The closing of switch 25 provides a shunt circuit around the now hot thermistor 51, allowing the thermistor to cool.

The closing of switch 24 completes two maintaining circuits, one for heater 29 of safety lockout device 26 until switch 50 opens, and the other for winding 22 and heater 34 of time 31 and to maintain these elements energized after switch 50 opens. The first circuit can be traced from terminal 38 through heater 29, switch 50, switch 25, and switch 24 to terminal 39. From this first circuit it can be seen that heater 29 is maintained energized until flame is detected at pilot burner 13 and switch 50 opens. The second circuit can be traced from terminal 40 through switch 27, heater 34, winding 22,

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controller 18 and switch 24 to terminal 39. From this second circuit it can be seen that heater 34 and winding 22 are maintained energized so long as there is a need for operation of the burner unit.

In accordance with the teachings of our invention, electrical continuity of heater 34 is continuously checked during the entire period of operation of the burner. Should the heater of timing means 31 malfunction by open-circuit, the winding of relay 21 is deenergized and its switches open to deenergize burner unit 10. Thus, since initial energization of relay winding 22 depends upon continuity of both heaters 29 and 34, and since continued maintaining energization of winding 22 depends upon continuity of heater 34, our invention provides a simple, low cost and reliable control providing non-recycle and timed ignition of a burner unit.

Upon establishment of flame at pilot burner 13, flame detector 19 energizes flame relay 20, actuating switches 50 and 60. The opening of switch 50 deenergizes heater 29 of safety lockout means 26, as above described. The closing of switch 60 is effective to energize valve 12 through a circuit which can be traced from power line conductor 36, switch 23, switch 60 and valve 12 to power line conductor 35. Normally, flame is established at pilot burner 13 immediately after energization of valve 14 and ignition means 15. Thus, there is a period in which both pilot flame and main flame exists. After the timing of timing means 31 is completed, switch 32 opens to deenergize valve 14 and ignition means 15.

Should a flame failure now occur at main burner 11, flame relay 20 is deenergized to open switch 60 and close switch 50. The opening of switch 60 deenergizes valve 12. The closing of switch 50 operatively energizes heater 29 of safety lockout means 26 and, after the timing period of this device has been accomplished, switch 27 opens to deenergize relay winding 22. Since lockout device 26 requires manual operation, the device is now in safety lockout condition. It is necessary to manually actuate reset button 30 to reset the control.

In FIGURE 3 we show our invention connected to control an oil burner unit having an oil burner 90 and ignition means 91. In this embodiment, relay 21 of FIGURE 1 and its switch 23 is effective to energize oil burner 90 and ignition means 91. Timer 31 of FIGURE 1 is effective, after a time period, to open switch 32 to deenergize ignition means 91. Switch 60 of flame relay 20, FIGURE 1, is eliminated, while the remaining structure of FIGURE 1 is used with the embodiment of FIGURE 3.

The embodiments of the invention in which an exclusive property or right is claimed are defined as follows:

1. Control apparatus for use with a condition changing installation having an initiating means, comprising:
 - a condition changing control relay having a winding and a first normally open switch,
 - time delayed safety lockout means having an actuator,
 - initiating means time delayed timing means having an actuator, said timing means having a period of time delay greater than the time delay of said safety lockout means,
 - condition detecting means for detecting a condition established at the condition changing installation by operation of the initiating means, said detecting means having a normally closed switch,
 - a voltage source having first, second and third terminals,
 - first circuit means connecting said lockout means actuator, said detecting means switch, and said relay switch in a series circuit from said first terminal to said second terminal,
 - and second circuit means connecting said timing means actuator, said relay winding, and said relay switch in a series circuit from said third terminal to said second terminal.

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2. The control apparatus of claim 1, for use with a fuel burner installation having ignition means, wherein said control relay is a burner control relay, wherein said timing means is an ignition timing means having a period of time delay greater than the time delay of said safety lockout means, wherein said detecting means is a flame detecting means, and including first voltage source means connected from said first terminal to said second terminal, and second voltage source means connected from said second terminal to said third terminal, said first and second voltage source means being connected in aiding relation between said first and third terminals.

3. The control apparatus of claim 2 including circuit means controlled by said relay and said ignition timing means and adapted to be connected to the ignition means to energize the ignition means for a time period beginning with initial energization of said relay winding and terminating at the end of the period of time delay of said timing means.

4. The control apparatus of claim 3, wherein said safety lockout means includes a normally closed switch connected to interrupt energization of said relay winding upon opening of said switch, and said timing means includes a normally closed switch to interrupt energization of the ignition means at the end of the period of time delay of said timing means.

5. The control apparatus of claim 3, wherein said safety lockout means includes a normally closed safety switch connected in series with said second circuit means.

6. The control apparatus of claim 5, wherein said timing means includes a normally closed ignition cut-off switch which opens at the end of the period of time delay of said timing means.

7. The control apparatus of claim 1, for use with a fuel burner installation having ignition means, and having a main valve to control the flow of fuel to a main burner; wherein said timing means is an ignition timing means, wherein said detecting means is a flame detecting means adapted to detect flame at the main burner, and including first voltage source means connected from said first terminal to said second terminal and second voltage source means connected from said second terminal to said third terminal, said first and second voltage source means being connected in aiding relation between said first and third terminals.

8. The control apparatus of claim 7, for use with a fuel burner installation wherein the ignition means includes a pilot valve to control the flow of fuel to a pilot burner and means to ignite fuel at the pilot burner, and wherein said flame detecting means is adapted to detect flame at the pilot burner and the main burner; and including circuit means controlled by said relay and said ignition timing means and adapted to be connected to the ignition means to energize the pilot valve and the means to ignite fuel at the pilot burner for a time period beginning with initial energization of said relay winding and terminating at the end of the period of time delay of said timing means, a normally closed switch controlled by said safety lockout means and connected to interrupt energization of said relay winding upon opening of said switch, and circuit means controlled by said relay and said flame detector and adapted to be connected to the main valve to energize the main valve upon detection of flame at the pilot burner.

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