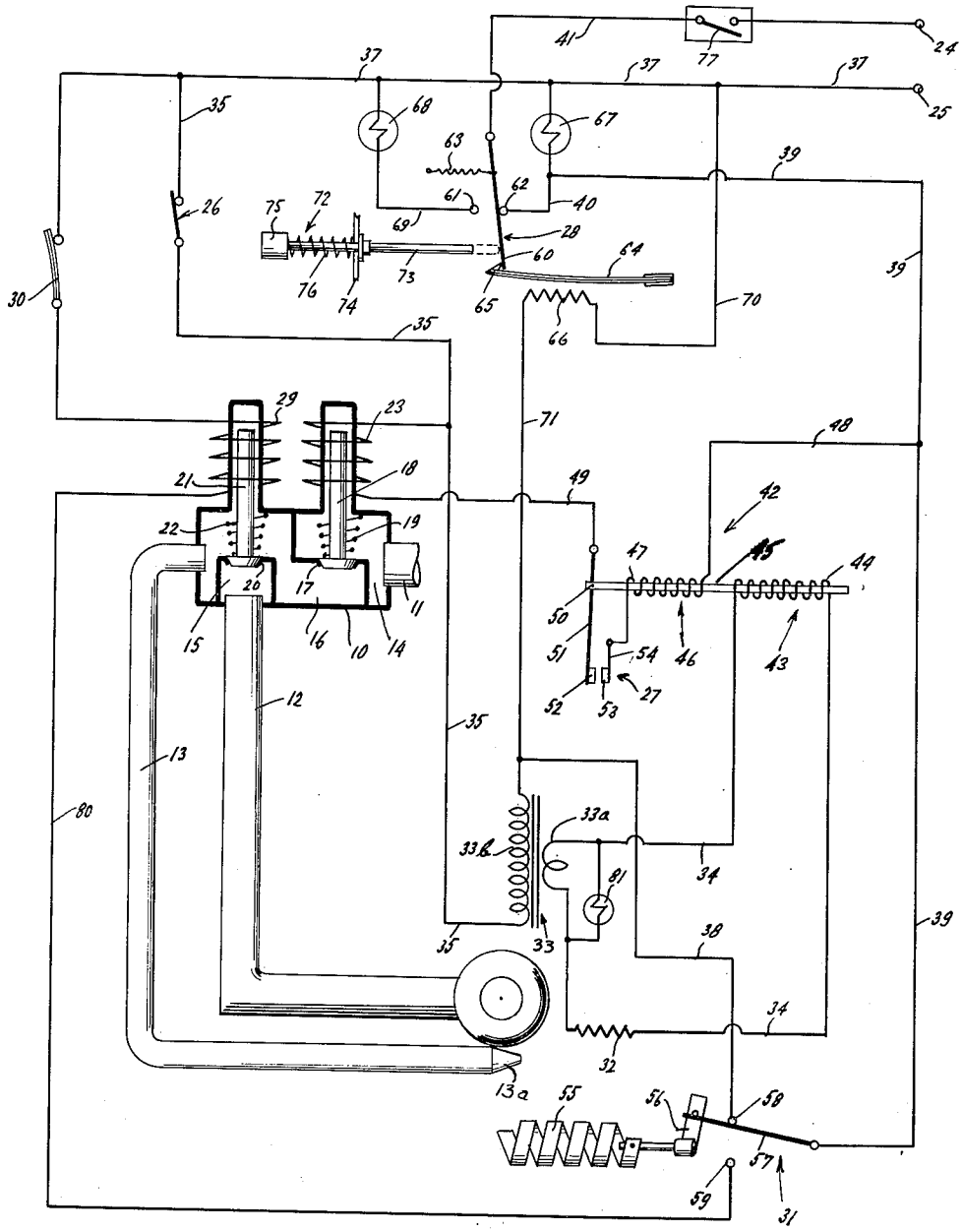
Nov. 6, 1962 C. MILLER ET AL 3,062,276

ELECTRICAL CONTROL SYSTEM FOR GAS BURNER ASSEMBLIES

Filed Aug. 4, 1958



INVENTORS
CHARLES MILLER
PAT ROMANELLI

BY

Amster & Levy
ATTORNEYS

United States Patent Office 3,062,276 Patented Nov. 6, 1962

3,062,276

ELECTRICAL CONTROL SYSTEM FOR GAS BURNER ASSEMBLIES

Charles Miller and Pat Romanelli, Bronx, N.Y., assignors to Ram Domestic Products Company, Englewood, N.J., a partnership

Filed Aug. 4, 1958, Ser. No. 752,892
9 Claims. (Cl. 158—124)

This invention relates to improvements in electrical control systems and in particular to an electrical control system for gas burner assemblies, especially such assemblies as are used in laundry drying machines.

The invention is particularly adapted for use in a gas burner system including a main gas burner ignitable by a pilot burner, the gas fed to said burners being controlled by individual solenoid valves and the pilot burner having associated therewith an electrical ignition coil for firing the same. In such gas burner assemblies, the lack of suitable safety controls often produce dangerous conditions either in normal operation or in malfunctioning of the burner parts, resulting from unignited gas being fed from the main burner or pilot burner, or both, for extended periods of time.

It is the principal object of the present invention to provide an improved electrical control system for a gas burner assembly of the type described which provides a positive, non-spillage gas system wherein no gas is permitted to flow through either the main burner or the pilot burner unless all of the parts of the drying machine are functioning properly.

Another object of the invention is the provision of an electrical control system of the character described in which the actuating solenoid for the pilot burner valve is connected in the same energizing circuit as the ignition coil, so that no gas is permitted to flow if the ignition coil or any of its atached parts are broken or become disconnected.

A further object of the invention is the provision of an electrical control system of the character described in which means are provided for de-energizing the operating circuit and display a warning signal if the pilot burner does not ignite within a short time after gas is fed thereto.

In accordance with the invention there is provided a normally open safety switch having a control relay including an actuating coil, a holding coil and an armature adapted to close the switch upon energization of either of the coils. The actuating coil is connected to the secondary circuit of a transformer, the primary of which is connected through a door switch and a heat responsive, pilot-burner controlled switch to an energizing circuit. The holding coil is connected in series with the contacts of the safety switch so as to hold the switch closed after the actuating coil has been deenergized. The heat-responsive switch has a normally closed contact which connects the transformer primary in circuit for energization of the actuating coil and ignition coil, and a normally open contact which is closed when the pilot burner is ignited for energizing the main burner valve solenoid. The control system also includes a normally closed heat-responsive switch controlled by a heater element connected to the transformer primary and adapted to interrupt the entire circuit if the heater element is not deenergized after a short period.

A further object of the invention is the provision of a control circuit of the character described in which the heat-responsive switch is effective to interrupt the operating circuit of the control system and shut off the supply of gas to the pilot and main burners if the pilot valve fails to ignite after a short time interval.

Additional objects and advantages of the invention

will become apparent during the course of the following specification when taken in connection with the accompanying drawing, which illustrates schematically and diagrammatically a gas feed system and electrical control system made and arranged in accordance with the present invention.

Referring in detail to the drawing, there is shown diagrammatically an air heater assembly of the type used in household and commercial laundry driers, and including a gas valve housing and junction box 10 fed by a gas feed pipe 11 and supplying both a main burner 12 and a pilot burner 13. As is the usual practice, the valve housing 10 is partitioned to form a gas inlet chamber 14, a main burner burner chamber 15 and a pilot burner chamber 16. The gas inlet chamber 14 is in communication with the gas feed pipe 11 and has an opening 17 communicating with the pilot burner chamber 16, which opening 17 is normally closed by a pilot valve 18 of the solenoid type which is biased to its closure position by a spring 19. In a similar fashion, the pilot burner chamber 16 has an opening 20 communicating with the main burner chamber 15, which opening 20 is normally closed by a main valve 21 of the solenoid type which is biased to its closure position by a spring 22. The pilot burner chamber 16 communicates with the pilot burner 13 while the main burner chamber 15 communicates with the main burner 12.

It will be observed that gas fed by the feed pipe 11 enters the gas inlet chamber 14, but cannot be fed to either the pilot burner chamber 16 or main burner chamber 15 unless the pilot valve 18 is lifted to uncover the opening 17. When the pilot valve 18 is lifted, by electrical energization of its solenoid as will presently be described, the gas will enter the pilot burner chamber 16 and flow through the pilot burner 13, but will not enter the main burner chamber 15 because its valve 21 is closed. When main valve 21 is opened, gas will flow through the opening 20 into the main burner chamber 15 and to the main burner 12. It will also be observed that gas must flow through the pilot burner chamber 16 to reach the main burner chamber 15 and main burner 12, and that if pilot valve 18 is closed, no gas will be supplied to the main burner 12 even if its main valve 21 is open.

The gas feeding system described above is conventional and well-known and has been illustrated and described only in sufficient detail to afford an understanding of the invention herein. The invention resides in the novel electrical system for opening and closing the valves and for igniting the burners, which includes a number of safety features and which is illustrated schematically in the drawing.

The solenoid of pilot valve 18 includes an actuator coil 23 which, when energized, will lift the pilot valve 18 from its opening 17 and thus permit gas to flow through the pilot burner 13. The coil 23 is connected for energization to the terminals 24 and 25 of a power source, through a door switch 26, a safety switch 27, and a second safety switch 28.

The door switch 26 is set within the door of the laundry drier in such a manner as to be closed when the door is closed and opened by opening the door. Thus, when the user opens the door of the appliance, the door switch 26 opens, breaking the circuit to the coil 23 and permitting spring 19 to close the pilot valve 18. This cuts off the flow of gas to both the pilot burner 13 and main burner 12 so long as the appliance door is open.

The solenoid of main valve 21 includes an actuator coil 29 which when energized will lift the main valve 21 from its opening 20 and thus permit gas to flow to the main burner 12. The coil 29 is connected for energization to the power source terminals 24 and 25 through a thermo-

stat switch 30, a pilot-light controlled switch 31 and the second safety switch 28, in a manner which will be presently described.

The pilot burner 13 is ignited by an electrical ignition coil 32 which is located in proximity thereto and is initially energized so as to glow during normal functioning of the electrical circuit. For convenience of illustration in the drawing, the nozzle 13*a* of the pilot burner 13 is shown remote from the outlet end 12*a* of the main burner 12, but it to be understood that in actual practice the pilot burner nozzle 13*a* is located close to the main burner outlet end 12*a* so that the flame of the ignited pilot burner will ignite the main burner.

The ignition coil 32 is energized by a step down transformer 33, the secondary 33*a* of which is connected to a circuit 34 which includes the ignition coil 32. One end of the transformer primary 33*b* is connected through lead 35, switch 26 and lead 37 to the power source terminal 25. The other end of the transformer primary 33*b* is connected through lead 38, switch 31, leads 39 and 40, switch 28 and lead 41 to the other power source terminal 24.

Operation of the pilot valve 18 is controlled through a relay arrangement designated generally by the reference numeral 42, which relay arrangement actuates the switch 27. The relay arrangement 42 constitutes a first actuating relay 43 comprising an actuating coil 44 and an armature 45, and a second holding relay 46 comprising a holding coil 47 and the armature 45. The actuating coil 44 is connected in series with the secondary circuit 34 of the transformer 33 for energization by the transformer secondary 33*a*. The holding coil 47 is connected at one end by lead 48 to lead 39 and thence through lead 40, switch 28 and lead 41 to the power source terminal 24. The other end of the holding coil 47 is connected through switch 27, lead 49, pilot coil 23, lead 35, switch 26 and lead 37 to the other power source terminal 25.

The armature 45 is physically connected at 50 to the movable arm 51 of the switch 27 having a contact 52. The switch 27 also includes a fixed arm 54 carrying a fixed contact 53. The armature 45 is drawn to the right, as viewed in the drawing, when the actuating coil 44 is energized, moving the movable arm 51 to the right and closing the contacts 52, 53 of the switch 27. When switch 27 is closed, the circuit through holding coil 47 is completed and the energization of holding coil 47 maintains the switch 27 closed independently of the actuating coil 44, which can now be de-energized.

While in the drawings, the two relays 43 and 46 are shown as having a single, integral armature, it is to be understood that this arrangement is shown for convenience of illustration and that in actual practice the relays 43 and 46 may be separate relays having individual armatures, both of which armatures would be coupled to the switch arm 51 for independent and individual actuation of said switch arm. Thus, either relay armature would be independently capable of moving the switch arm 51 to its closed position.

Operation of the main valve 21 is controlled by the switch 31, which in turn is controlled by a heat-responsive element 55 located in proximity to the nozzle 13*a* of pilot burner 13. The heat-responsive element 55 is in the nature of a coiled bi-metallic strip and is described in detail in our co-pending United States patent application, Serial No. 752,757, filed August 4, 1958, now abandoned. The bimetal element 55 carries a lever arm 56 in engagement with the movable arm 57 of switch 31. The switch arm 57 is normally biased to a position in which it engages one of the switch contacts 58 and is spaced from the other switch contact 59. When the bimetal element 55 is heated by the flame from the pilot burner nozzle 13*a*, the coiled element expands and turns causing the lever arm 56 to lower the movable switch arm 57 out of engagement with the normally-closed contact 58 and into engagement with the normally open contact 59.

The second safety switch 28 includes a movable switch arm 60 connected through lead 41 to the power source terminal 24 and adapted to move between switch contacts 61 and 62. A spring 63 biases the switch arm 60 toward the contact 61, but the switch arm 60 is normally held in engagement with the other contact 62 by a heat-responsive element 64. The heat responsive element 64 is in the nature of a bi-metallic strip 64 is pre-flexed so that it normally arches upwardly as shown in the drawing, to a position in which its hook 65 engages and holds the switch arm 60 in engagement with contact 62 against tension of spring 63. A coiled wire resistor 66 is located proximate to the bi-metallic strip 64 for heating said strip. When the strip 64 is heated, it flexes downwardly, bringing the hook 65 out of engagement with the switch arm 60 and allowing the spring 63 to draw said switch arm into engagement with the contact 61.

The contact 62 is connected through lead 40 through the lead 37 to the power source terminal 25. A signal lamp 67, which is preferably of green coloration, is connected in series with the lead 40 so as to be illuminated when the switch arm 60 is in engagement with contact 62 and current is supplied to the burner circuit through leads 40 and 39.

In a similar fashion, the contact 61 is connected to the lead 37 through a signal lamp 68 by lead 69. This signal lamp 68 may be of a red coloration. When the contact arm 60 is in engagement with the contact 61, a circuit is closed directly through the lamp 68, and to no other part of the circuit; the illumination of the red signal lamp indicating to the user that the entire circuit is interrupted and that both the pilot burner and main burner have been extinguished.

The coiled wire resistor 66 is adapted to heat after a certain time interval to such an extent as to heat the bimetallic element 64 and cause the latter to flex downwardly to a position in which its hook 65 disengages from the movable contact arm 60 and permits the spring 63 to bias the movable contact arm 60 into engagement with contact 61. This will occur in the event that there is low gas pressure, excessive draft conditions, etc. so that the glow coil 32 does not ignite the pilot burner 13. In such an instance, unburned gas will escape from the pilot burner, creating a dangerous condition.

The resistor 66 is connected at one end through lead 70 to lead 37 and at its other end through a lead 71 to the lead 38. If the circuit is energized and the ignition coil 32 fails to ignite the pilot burner 13 so that unburned gas escapes from the pilot burner, the resistor 66 will be energized and heated, heating the bimetallic element 64 and causing it to release the movable switch arm 60 so that it is brought in engagement with the contact 61 and out of engagement with the contact 62, thereby interrupting the relay circuit and closing the pilot valve 18 so that no further gas escapes from the system. On the other hand, if the pilot burner 13 is ignited, it will heat the coiled bimetallic element 55 causing it to bring the movable contact arm 57 out of engagement with the contact 58 and interrupting the circuit to the resistor 66. Thus, the bimetallic element 64 acts as a safety device by means of which the entire circuit is switched off after a short time interval in the event that the pilot burner is not ignited, in a manner which will be further described in greater detail. The resistor 66 and the bimetallic element 64 are so selected that the heat of the resistor 66 will cause the bimetallic element 64 to flex downwardly within a reasonable safety period, for example, within a period of preferably two minutes.

Once the bimetallic element 64 has released the switch arm 60, the spring 63 maintains the switch arm 60 out of engagement with contact 62, and the operating circuit is de-energized until the switch arm 60 is manually reset. For this purpose, the machine is provided with a manual reset plunger 72 comprising a shaft 73 slidably mounted in a portion 74 of the machine frame with its inner end

in alignment with the switch contact arm 60. The shaft 73 has a terminal finger button 75 located exteriorly of the machine frame, and is normally biased by a compression spring 76 to a position in which its end is spaced from the contact arm 60.

After the bimetallic element has released the switch arm 60, the energizing current to the heater resistor 66 is cut off and the element 64 cools and returns to its normal, upwardly-arched position. When the reset plunger 72 is depressed, the end of shaft 73 is moved forwardly to the position shown in broken line in the drawing, moving the contact arm 60 back to its original position in engagement with contact 62. The bottom end of the contact arm 60 snaps over the hook 65 and is thereafter engaged and held by said hook.

The lead 41 connecting the power source terminal 24 to the circuit is interrupted by a main switch 77 which may be manually controlled or controlled by a timer element which regulates the operation of the drying machine. The switch 77 is shown in open position in the drawing, but energization of the circuit would be closed either manually or by the aforementioned timer. When the switch 77 is in open position, no current is fed to any portion of the circuit.

In normal operation the user shuts the door of the drying machine so that the door switch 26 is closed, and regulates the timer device so that the main switch 77 is also closed. Current is now fed to the circuit from power source terminals 24 and 25. The pilot burner coil 23 is not immediately energized to open the pilot burner valve, for the reason that the energizing circuit thereto is interrupted by the separation of the contacts 52 and 53. Current entering from the power terminal 25 will then travel through lead 37, lead 35 and door switch 26 through the primary 33*b* of the transformer 33, thence through lead 38, contact 58, movable switch arm 57, lead 39, lead 40, contact 62, movable switch arm 60, lead 41 and main switch 77 to the other power source terminal 24, thereby energizing the transformer primary 33*b*. Energization of the transformer primary energizes the transformer secondary 33*a* and its secondary circuit 34, thereby illuminating the ignition coil 32 and energizing the actuating coil 44 of the first actuating relay 43. When the actuating coil 44 is energized it draws the armature 45 toward the right as viewed in the drawing, the armature 45 moving the movable switch arm 51 so that contact 52 engages contact 53.

Engagement of contacts 52 and 53 energizes the holding coil 47 of the second holding relay 46 so that the holding coil 47 maintains the armature 45 in a position in which the contacts 52 and 53 are maintained closed. In addition, engagement of the contacts 52 and 53 energizes the pilot valve actuator coil 23, current from power source terminal 25 flowing through leads 37 and 35, through the pilot valve actuator coil 23, thence through lead 49, contact arm 51, contacts 52 and 53, holding coil 47, leads 48, 39 and 40, contact 62, movable contact arm 60, lead 41 and main switch 77 to the other power source terminal 24. The pilot valve 18 is thereby opened by the actuator coil 23, permitting gas to flow from the gas feed pipe 11 through the gas inlet chamber 14, opening 17, pilot burner chamber 16 and thence out through pilot burner 13 and its nozzle 13*a*. The gas emitted by nozzle 13*a* coming in contact with the glowing ignition coil 32 is ignited and begins to heat the coiled bimetallic element 55 causing said element to turn lever arm 56 and lower the movable switch arm 57 out of engagement with contact 58 and into engagement with contact 59.

Movement of the switch arm 57 of switch 31 out of engagement with the contact 58, opens the circuit through the transformer primary 33*b* and therefore the transformer secondary circuit is de-energized along with its ignition coil 32 and actuating coil 44. Even though the actuating coil 44 is de-energized, however, the holding coil 47 is still energized and still keeps the armature 45 in its operative position in which the contacts 52 and 53 are closed, so that the pilot valve actuator coil 23 is maintained energized and the pilot valve is maintained in its open position. When the movable switch arm 57 comes into engagement with the contact 59, a circuit is completed through the main valve actuator coil 29. The current from power source terminal 25 travelling through lead 37 energizes the actuator coil 29 through the a normally-closed thermostat switch 30, thence flows through a lead 80 to the contact 59, thence through the contact arm 57, leads 39 and 40, contact 62, contact arm 60 and lead 41 to the other power source terminal 24. The main burner valve 21 is thus lifted, uncovering the opening 20 and permitting gas to flow into the main burner chamber 15 and out through the main burner 12. The gas flowing from the main burner 12 is ignited by the flame at the pilot burner nozzle 13*a*, and produces the heat for the drying machine.

The system shown herein provides a positive, non-spillage gas system by which no gas is permitted to flow through either the main burner or the pilot burner unless all of the parts of the drying machine are functioning properly.

A neon glow lamp 81 is connected in parallel across the transformer secondary 33*a*. If the glow coil 32 or its circuit breaks during operation of the machine, the glow coil no longer draws all of the current of the secondary circuit 34 and the lamp 81 is ignited as a warning signal. Illumination of the lamp 81 indicates to the user that gas is not flowing, although the drying machine mechanical parts may be turning. If the glow coil 32 breaks or burns out, or if any of its connecting wires break or become disconnected, gas in conventional drying machines would ordinarily continue to flow through the pilot burner until a warp switch went into operation after three or four minutes. In the circuit of the present invention, as soon as the glow coil 32 is broken out of circuit, the actuating relay 43 is disconnected, so that contacts 52 and 53 cannot be closed and the pilot valve actuator coil 23 cannot be energized to open the pilot valve 18. Thus, even if the main switch 77 and door switch 26 are closed, no gas can flow through the pilot burner 13. Since the pilot valve 18 remains closed, no gas can flow through the main burner 12 even though the main burner valve 21 may have remained open.

The user of the drying machine may frequently open its door during the operating cycle to examine the laundry being dried. In this event, the door switch 26 is opened, breaking the circuit of the holding relay 46 and opening contacts 52 and 53. The pilot valve 18 is then immediately closed so that no gas flows within the machine. If the door is then quickly closed, the arm 57 of switch 31 may still be in engagement with contact 59 so that the main coil 29 is energized and the main valve 21 open. No gas will flow through the main burner, however, since the pilot valve 18 is closed. The pilot valve 18 will not open until the bimetallic coil 55 permits the switch arm 57 to engage contact 58, energizing the transformer primary 33*b* and thereby energizing the actuating relay 43 and the ignition coil 32.

The thermostat switch 30 is normally closed and is contained within a pre-set thermostat within the machine in such a manner as to open if the temperature within the machine becomes too high. In such an event, the opening of thermostat switch 30 will cause the main valve 21 to close but will not affect the pilot valve 18; the latter remaining open and the pilot burner remaining lit.

While a preferred embodiment of our invention has been shown and described herein, it is obvious that numerous additions, changes and omissions may be made in such illustrative embodiment without departing from the spirit and scope of the invention.

We claim:

1. In a gas heater assembly including a main burner, a pilot burner, a gas supply for said burners, first electrical-

ly controlled valve means in said gas supply and operable to supply gas to said pilot burner, second electrically controlled valve means receiving its gas supply through said first valve means and operable to supply gas to said main burner; an electrical control system comprising electrical ignition means for said pilot burner, a normally open valve energization circuit for said first valve means, an ignition energization circuit for said ignition means, relay means for completing the valve energization circuit and including an actuating relay in said ignition energization circuit in series with said ignition means and effective to complete the valve energization circuit and open said first valve means when the ignition energization circuit is energized and a holding relay in said valve energization circuit and operable in response to energization of said actuating relay for maintaining said first valve means open independently of said ignition energization circuit, heat responsive means in proximity to said pilot burner and operable after a prescribed ignition period of said pilot burner to deenergize said ignition energization circuit, and actuating means for said second valve means controlled by said heat responsive means for opening said second valve means after said prescribed ignition period.

2. An electrical control system according to claim 1 in which said relay means includes a normally open switch in said valve energization circuit and having a movable arm, the actuating relay and holding relay having a common physical connection to said movable arm whereby each relay is independently capable of holding said arm closing said switch to complete the valve energization circuit.

3. An electrical control system according to claim 1 in which a door switch is located in said valve energization circuit for interrupting the latter when said door switch is opened, whereby said holding relay is deenergized and said pilot valve is closed.

4. In a gas heater assembly including a main burner, a pilot burner, a gas supply for said burners, first electrically controlled valve means in said gas supply and operable to supply gas to said pilot burner, second electrically-controlled valve means receiving its gas supply through said first valve means and operable to supply gas to said main burner; an electrical control system comprising a pair of electrical power terminals, a valve energization circuit for said first valve means connected across said power terminals and including a normally-open safety switch, an ignition element for said pilot burner, an ignition energization circuit including a primary transformer circuit connected to said power terminals, and a secondary transformer circuit, an actuating relay coupled to said safety switch for closing the latter to complete the valve energization circuit upon energization of said actuating relay, said ignition element and actuating relay being in series in said secondary circuit whereby said actuating relay is maintained inactive and said safety switch remains open to maintain said pilot valve closed upon interruption of said secondary circuit including said ignition element.

5. In a gas heater assembly including a main burner, a pilot burner, a gas supply for said burners, first electrically controlled valve means in said gas supply and operable to supply gas to said pilot burner, second electrically-controlled valve means receiving its gas supply through said first valve means and operable to supply gas to said main burner; an electrical control system comprising a pair of electrical power terminals, a valve energization circuit for said first valve means connected across said power terminals and including a normally-open safety switch, an iginition element for said pilot burner, an ignition energization circuit including a primary transformer circuit in parallel with said valve energization circuit, and a secondary transformer circuit, an actuating relay coupled to said safety switch for closing the latter upon energization of said actuating relay, said ignition element and actuating relay being in series in said secondary circuit whereby said actuating relay is maintained inactive and said safety switch remains open to maintain said pilot valve closed upon interruption of said secondary circuit including said ignition element, said valve energization circuit also including a holding relay for said safety switch in series with the latter.

6. In a gas heater assembly including a main burner, a pilot burner, a gas supply for said burners, first electrically controlled valve means in said gas supply and operable to supply gas to said pilot burner, second electrically controlled valve means receiving its gas supply through said first valve means and operable to supply gas to said main burner; an electrical control system comprising electrical ignition means for said pilot burner, a normally open valve energization circuit for said first valve means, an ignition energization circuit for said ignition means, relay means for completing the valve energization circuit and including an actuating relay in said ignition energization circuit in series wth said ignition means and effective to complete the valve energization circuit and open said first valve means when the ignition energization circuit is energized and a holding relay in said valve energization circuit and operable in response to energization of said actuating relay for maintaining said first valve means open independently of said ignition energization circuit, heat responsive means in proximity to said pilot burner and operable after a prescribed ignition period of said pilot burner to deenergize said ignition energization circuit, actuating means for said second valve means controlled by said heat responsive means for opening said second valve means after said prescribed ignition period, a normally closed, thermally-responsive safety switch in series with both the ignition energization circuit and valve energization circuit, and a heater element in proximity to said safety switch for opening the latter only after the ignition energization circuit remains energized for a selected period in excess of said prescribed ignition period, the heater element being connected in series with said heat responsive means for deenergization upon operation of said heat-responsive means, said heater element being also in series with said safety switch for deenergization upon opening of said safety switch.

7. An assembly according to claim 6 in which said safety switch includes a movable contact arm, means biasing said arm to a position to open said safety switch, and a heat-responsive element normally engaging said arm, said heater element being in proximity to said heat responsive element for heating the latter and thereby causing the heat-responsive element to move out of holding engagement with said arm.

8. In a gas heater assembly, a main burner, a pilot burner, a gas supply for said burners, first electrically controlled valve means in said gas supply and operable to supply gas to said pilot burner, second electrically controlled valve means receiving its gas supply through said first valve means and operable to supply gas to said main burner, electrical ignition means for said pilot burner, an ignition energization circuit for said ignition means, a valve energization circuit for said first valve means, normally-open switch means in said valve energization circuit, switch actuating means in series with said ignition means in said ignition energization circuit for closing said switch means to open said first valve means upon energization of said ignition circuit, holding means operable in response to energization of said actuating means for maintaining said first valve means open independently of said ignition energization circuit, heat responsive means in proximity to said pilot burner and operable after a prescribed ignition period of said pilot burner to de-energize said ignition energization circuit, and actuating means for said second valve means controlled by said heat responsive means for opening said second valve means after said prescribed ignition period.

9. In a gas heater assembly, a main burner, a pilot

burner, a gas supply for said burners, first electrically controlled valve means in said gas supply and operable to supply gas to said pilot burner, second electrically controlled valve means receiving its gas supply through said first valve means and operable to supply gas to said main burner, electrical ignition means for said pilot burner, an ignition energization circuit for said ignition means, a valve energization circuit for said first valve means, normally-open switch means in said valve energization circuit, switch actuating means in series with said ignition means in said ignition energization circuit for closing said switch means to open said first valve means upon energization of said ignition circuit, holding means operable in response to energization of said actuating means for maintaining said first valve means open independently of said ignition energization circuit, heat responsive means in proximity to said pilot burner and operable after a prescribed ignition period of said pilot burner to de-energize said ignition energization circuit, actuating means for said second valve means controlled by said heat responsive means for opening said second valve means after said prescribed ignition period, and a heat responsive safety device energized by said ignition energization circuit for disconnecting the electrical circuit of said gas heater assembly and operable only after said ignition energization circuit remains energized for a selected period in excess of said prescribed ignition period.

References Cited in the file of this patent

UNITED STATES PATENTS

1,535,240	Morris	Apr. 28, 1925
1,575,170	Knopp	Mar. 2, 1926
1,643,859	Sauvage	Sept. 17, 1927
1,666,331	Fischer et al.	Apr. 17, 1928
2,800,176	Morrison	July 13, 1957
2,812,806	Morrison	Nov. 12, 1957