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CONTROL SYSTEM FOR FLUID FUEL BURNERS

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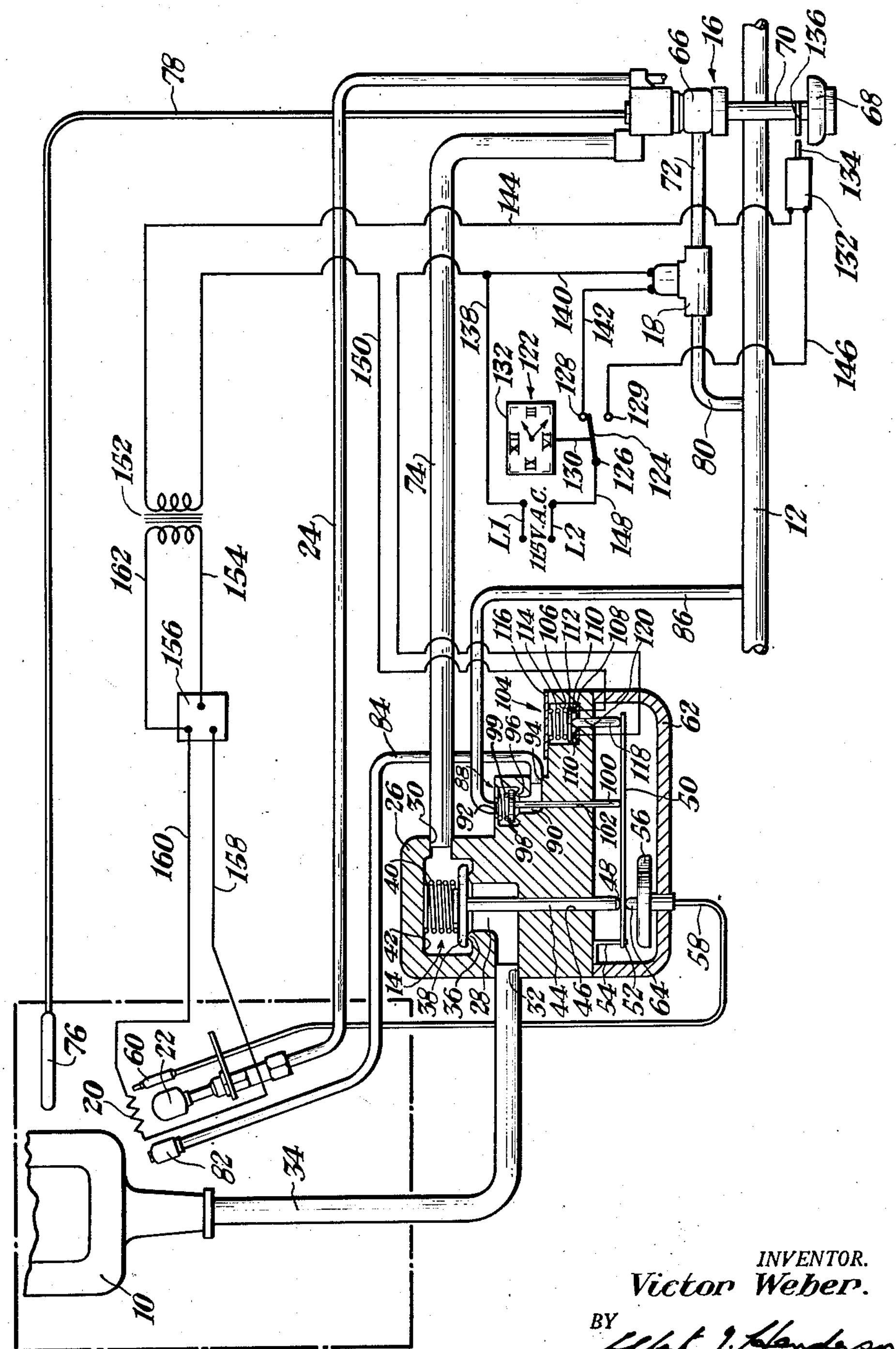

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CONTROL SYSTEM FOR FLUID FUEL BURNERS

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14 Claims. (Cl. 161—9)

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This invention relates to control systems for fluid fuel burners and more particularly to electrically operable apparatus of this type.

In fluid fuel burning apparatus it is often desirable to effect automatic operation of the burners by means of a timing mechanism. To this end, it is an object of this invention to control the admission of fuel to the burners in timed intervals.

It is a further object of this invention to control the ignition sequence of the burners at preselected intervals.

Another object of this invention is to control admission of fuel to the burners and ignition of fuel at the burners through the operation of a single simple switch.

Another object of this invention is to construct the control system with simple inexpensive parts.

Another object of this invention is to permit the operation of the burners in the event of power failure.

A preferred embodiment of the present invention comprises a main burner supplied with fuel by a conduit, the flow of fuel in which is under the control of a normally closed valve movable to an open position by a device responsive to the presence of flame at a pilot burner. Fuel flow to the normally closed valve and to the pilot burner is controlled by a manually operable valve, the supply of fuel to which is in turn controlled by a normally open electrically operable valve. An electric igniter is provided for the pilot burner and has an energizing circuit controlled by a timing device and by a switch mechanism operatively associated with the manually operable valve. The timing device also controls energization of the actuating means of the normally open electrically operable valve.

Further objects and advantages will be apparent from the accompanying specification and claims taken with the drawing which is a schematic view of a control system for a fuel burner embodying this invention, a portion thereof being shown in the section.

The control system comprising this invention is an improvement on the system disclosed and claimed in the copending application of Victor Weber, Serial No. 195,765, filed November 15, 1950.

Referring to the drawing, the control system is shown as associated with a main burner 10 which receives fuel from a supply conduit 12, flow of fuel from the supply conduit 12 to the main burner 10 being under the control of thermally responsive means 14, manually oper-

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able valve means 16, and normally open electrically operable valve means here shown as a solenoid valve 18.

An electric igniter 20 is disposed in igniting relation with a pilot burner 22 in turn disposed in igniting relation with the main burner 10. The pilot burner 22 is supplied with fuel by a conduit 24 connected therewith, flow of fuel in the conduit 24 being controlled by the manually operable valve means 16.

A casing 26 may contain the thermally responsive valve means 14 which may comprise a valve chamber 28 formed in the casing 26 and provided with an inlet opening 30 and an outlet opening 32. The outlet opening 32 communicates with a pipe 34 connected to the main burner 10. Disposed in the valve chamber 28 is a valve seat 36 cooperable with a valve element 38 to interrupt flow between the inlet 30 and the outlet 32. A coil spring 40 acts between a wall 42 of the valve chamber 28 and the valve member 38 to bias the valve member 38 into engagement with the valve seat 36.

Depending from the lower side of the valve member 38 is a valve stem 44 which extends through a bore 46 in the casing 26. The diameter of the bore 46 is sufficient to permit axial movement of the valve stem 44 therein. The free end 48 of the valve stem 44 extends beneath the casing 26 to abut a lever 50 which is pivoted at one end 52 in a bracket 54 secured to the casing 26.

The lever 50 is adapted to be moved about its pivot by a thermally responsive device which may comprise the usual expansible element 56, capillary tube 58, and bulb 60. The bulb 60 is disposed adjacent the pilot burner 22 to be heated by a flame emanating therefrom. The expansible element 56 is mounted on a cover 62 secured in fluid relation to the lower side of the casing 26 by any suitable means (not shown). Movement is transmitted from the expansible element 56 to the lever 50 by means of a thrust button 64 carried on the upper surface of the expansible element 56. It will be apparent that in the absence of a flame at the pilot burner 22 the expansible element 56 will be in its contracted condition and the spring 40 will hold the valve member 38 against the valve seat 36. It will also be apparent that a flame emanating from the pilot burner 22 will be effective to heat the bulb 60 to cause expansion of the expansible element 56, counterclockwise rotation of the lever 50 and movement of the valve member 38 against the bias of the spring 40 and away from the valve seat 36.

The manually operable means 16 may comprise a simple fuel cock (not shown) mounted in a casing 66 for rotation between fuel flow permitting and fuel flow preventing positions. Manual rotation of the cock may be effected by means of a knob 68 connected to the cock through a stem 70.

Fuel may be admitted to the casing 66 of the manually operable valve means 16 through a conduit 72 connected therewith and egress of fuel from the casing 66 may be had through a pair of outlets. One of the pair of outlets communicates with a conduit 74 which communicates with the inlet 30 of the valve chamber 28 of the thermally responsive valve means 14. The other of the pair of outlets communicates with the conduit 24 connected to the pilot burner 22. The manually operable valve means 16 thus controls the flow of fuel to both the thermally responsive valve 14 and pilot burner 22.

Flow of fuel to the thermally responsive valve means 14 may also be under the control of condition responsive valve means which may comprise a thermostatically controlled valve combined with the manually operable valve means in a manner well known in the art. The thermostatic control for the thermostatically controlled valve may include a temperature sensing element here shown as a bulb 76 exposed to the temperature of the space to be heated by the main burner 10 and connected to a valve actuating mechanism (not shown) by a capillary tube 78. Since combined fuel cocks and thermostatically controlled valves are well known in the art, further description is believed to be unnecessary.

The solenoid valve 18 is normally open and is adapted to be closed when the solenoid winding thereof is energized. The solenoid valve 18 is connected to a conduit 80 in communication with the supply conduit 12 and also to the conduit 72 which communicates with the casing 66 of the manually operable valve means 16. Thus, the solenoid valve 18 controls the flow of fuel to the manually operable valve means 16.

A stand-by pilot burner 82 is disposed in igniting relation with the main burner 10 and is connected to the supply conduit 12 by conduits 84 and 86. Flow of fuel to the stand-by pilot burner 82 is under the control of valve means 88 which may comprise a valve chamber 90 formed in the casing 26 and provided with an inlet 92 and an outlet 94. The inlet opening 92 communicates with the conduit 86 and the outlet opening 94 communicates with the conduit 84. A valve seat 96 disposed in the valve chamber 90 is cooperable with a valve member 98 to interrupt flow between the inlet opening 92 and the outlet opening 94.

A valve stem 100 is slidably carried in a bore 102 formed in the casing 26 and extends between the valve member 98 and the lever 50 of the thermally responsive actuating means. It will be apparent that rotation of the lever 50 under the influence of a flame at the pilot burner 22 will cause an upward movement of the valve stem 100 and associated valve member 98 to move the valve member 98 away from the valve seat 96. When the valve member 98 is not so moved it will be held against the valve seat 96 by the pressure of the fuel supply acting thereon and by the bias of a spring 99 interposed between the valve member 98 and the casing 26.

A standby pilot control of the type herein disclosed is disclosed and claimed in the copending application of Charles K. Strobel, Serial No. 189,584, filed October 11, 1950.

Also disposed within the casing 26 is a thermally responsive switching device 104. Secured to the bottom of a recess 106 formed in the casing 26 is an apertured element 108 formed of suitable insulating material and carrying thereon a pair of contacts 110. The contacts 110 are arranged in spaced relation and are engageable by a movable plate 112 to complete a circuit therebetween. A coil spring 114 acts between the movable plate 112 and a closure member 116 to bias the plate 112 into engagement with the contacts 110.

An operative connection is established between the movable plate 112 of the switching device 104 and the lever 50 of the thermally responsive actuating device by a push rod 118 slidably carried in a bore 120 formed in the casing 26. The push rod 118 extends through the apertured element 108 to engage the movable plate 110 and also extends beneath the casing 26 to abut the lever 50. It will be apparent that when the expansible element 56 is in its nonexpanded condition, the coil spring 114 of the switching device 104 will maintain the plate 112 in engagement with the contacts 110 and that counterclockwise rotation of the lever 50 about its pivot 52, upon expansion of the expansible element 56, will cause upward movement of the push rod 118 and the plate 112 associated therewith to disengage the plate 112 and the contacts 110.

Movement of the solenoid valve between fuel flow permitting and fuel flow preventing positions is under the control of a timing mechanism indicated generally by the reference numeral 122. This mechanism includes a double throw switch having a switch blade 124 pivoted at 126 to be alternatively movable into engagement with two fixed contacts 128, 129. The switch blade 124 is connected to a reciprocal plunger 130 of a timer here shown as a clock 132. The timer 132 may be of any suitable form and may be manually adjusted to cause axial movement of the plunger 130 at preselected times. It is understood that the timer 132 may also be manually adjusted to set and retain the plunger 130 in its retracted or extended position. As timing devices of this type are well known in the art, further description of the timer 132 is deemed unnecessary.

The switch 124—128 of the clock actuated mechanism 122 forms a part of an energizing circuit for the solenoid of the solenoid valve 18 and serves to connect the solenoid winding of the solenoid valve to a source of commercial current here shown as line wires L1 and L2. Thus, movement of the solenoid valve between fuel flow permitting and fuel flow preventing positions is under the control of the timing mechanism 122. The energizing circuit for the solenoid winding of the solenoid valve 18 may be traced as follows: line wire L1, wire 138, wire 140, solenoid winding of solenoid valve 18, wire 142, contact 128, switch blade 124, contact 126, and wire 148, to line wire L2.

Energization of the igniter 20 is under the control of the clock actuated switch 124—129 and also under the control of a switch 132 operatively associated with the manually operable valve means 16. The switch 132 forms a part of the energizing circuit of the igniter 20 and is here shown as including an actuating lever 134 engageable by a cam element 136 carried by the stem 70 of the manually operable valve means 16 to be rotatable therewith. The switch 132 is so designed that rotation of the knob 68 to close the fuel cock of the manually operable valve means 16 will open the switch 132 and rotation of the knob 68 to open the cock of the manually operable valve means 16 will close the switch 132.

The energizing circuit for the igniter 20 may be traced as follows: line wire L1, wire 138, one of the contacts 110 of the switching device 104, movable plate 112, the other of the pair of contacts 110 of the switching device 104, wire 150, lower terminal of the primary winding of a step down transformer 152, primary winding of the transformer 152, upper terminal of the primary winding of the transformer 152, wire 144, switch 132, wire 146, contact 129, switch blade 124, contact 126, and wire 148 to line wire L2. Thus, when the clock actuated switch blade 124 is in engagement with contact 129, switch 132 is closed and switching device 104 is closed, current will flow through the primary winding of the transformer 152. Energization of the primary winding of the transformer 152 will cause a current to be induced in the secondary winding thereof and such current will flow through a circuit which may be traced as follows: lower terminal of the secondary winding of the transformer 152, wire 154, ballast resistor 156, wire 158, igniter 20, wire 160, ballast resistor 156 and wire 162 to the upper terminal of the secondary winding of the transformer 152.

Operation

Assuming that the apparatus is in the condition shown in the drawing with no flame existing at any of the burners and it is desired to adjust the apparatus for automatic operation, the timer 132 is set to move the plunger 130 to move the switch blade 124 out of engagement with contact 128 and into engagement with contact 129 at a selected time and the knob 68 is rotated to move the fuel cock of the manually operable valve means 16 to an open position. Such rotation of the knob 68 will cause the cam element 136 to engage the actuating lever 134 of the switch 132 to close the switch 132 so that when the timer 132 moves the switch blade 124 into engagement with the contact 129, the previously traced energizing circuit for the igniter 20 is completed and the igniter will become energized.

When the switch blade 124 is moved out of engagement with the contact 128, the previously traced energizing circuit for the solenoid winding is broken and the solenoid valve will assume its fuel flow permitting position. Fuel will then flow from the supply conduit 12 through the conduit 80, solenoid valve 18, conduit 72, manually operable valve means 16, and conduit 24 to the pilot burner 22.

Since the bulb 60 of the thermally responsive actuating means is in its unheated condition, the mechanism in the casing 26 will be in the position shown in the drawing with the thermally responsive valve means 14 preventing flow of fuel to the main burner 10, the standby pilot valve 88 preventing flow of fuel to the standby pilot burner 82, and the plate 112 of the switching device 104 engaging the contacts 110 to complete the previously traced energizing circuit of the igniter 20. Current flowing through the igniter 20 will raise its temperature sufficiently to cause ignition of the fuel flowing from the pilot burner 22 to produce a flame directed against the bulb 60.

As the temperature of the bulb 60 increases, the expansible element 56 will expand causing an upward movement of the thrust button 64 and counterclockwise rotation of the lever 50 about its pivot 52. As hereinbefore described, such rotation of the lever 50 will cause opening of the normally closed valve means 14 and standby pilot valve 88 and movement of the plate 112 of the switching device 104 out of engagement with the contacts 110.

Thus fuel will flow from the manually operable valve means 16 through the conduit 74, inlet opening 30 of valve means 14, valve chamber 28, past valve seat 36, through the outlet opening 32 of the valve means 14, and through conduit 34 to the main burner 10 where it will be ignited by the flame at the pilot burner 22. Fuel will also flow from the supply conduit 12 through the conduit 86 to the valve chamber 90 of the standby pilot valve 88 past the valve seat 96, through the outlet opening 94 of the standby pilot valve 88, and through the conduit 84 to the standby pilot burner 82 where it will be ignited by the flame at the main burner 10.

When the plate 122 of the switching device 104 is moved out of engagement with the contacts 110, the energizing circuit for the igniter 20 is interrupted and the igniter 20 will be deenergized. The igniter 20 will remain in its deenergized condition as long as a flame exists at the pilot burner 22.

The apparatus is now in its condition for steady state operation with the flow of fuel to the main burner 10 through the conduit 74 being under the control of the thermostatically actuated valve associated with manually operable valve means 16 in accordance with the temperatures sensed by the temperature sensing element 76.

If, when the apparatus is in condition for steady state operation, the flame at the pilot burners 20, 82 should accidently be extinguished, the bulb 60 will cool causing contraction of the expansible element 56 and clockwise rotation of the lever 50 about its pivot 52 under the bias of the springs 40, 99 and 114 to position the plate 112 of the switching device 104 in engagement with the contacts 110 and once again complete the energizing circuit for the igniter 20 to effect a recycling of the system.

When the timer 132 of the clock actuated mechanism 122 acts to move the switch blade 124 out of engagement with the contact 129 and into engagement with the contact 128, the energizing circuit of the solenoid winding of the solenoid valve 18 is completed and the solenoid winding is energized. The solenoid valve 18 will then act to shut off all the flow of fuel from the supply conduit 12 through the conduit 80. Thus the fuel supply to the main burner 10 and to the pilot burner 22 will be cut off and the flames at said burners will be extinguished.

Upon extinguishment of the flame at the pilot burner 22, the bulb 60 will cool causing contraction of the expansible element 56 and clockwise rotation of the lever 50 about its pivot 52 under the bias of the springs 40 and 114. As hereinbefore set forth, such clockwise rotation of the lever 50 will permit the valve member 38 of the valve means 14 to engage its seat 36 and the valve member 98 of the standby pilot valve 88 will engage its seat 96. Thus, the fuel supply to the standby pilot burner 82 will be cut off and the flame thereat will be extinguished. The apparatus is now in the condition shown in the drawing with fuel supply to all burners prevented.

In the event of electric power failure, the solenoid winding of the solenoid valve 18 will be deenergized regardless of the position of the switch blade 124 and the solenoid valve 18 will assume its normally open position. With the solenoid valve so positioned, the system may be operated manually merely by rotating the knob 68 to move the fuel cock of the manually operable valve means 16 to open position to admit fuel to the pilot burner 22 where it may be ignited by a match or the like. After ignition of the pilot flame, the various components of the system will automatically be positioned for steady state operation in the same manner as when power is available.

It will be apparent from the foregoing that the hereindisclosed apparatus provides a control system for fluid fuel burners wherein a simple clock actuated switch is effective to control admission and ignition of fuel thereby providing for a simple economical clock control and that it accordingly accomplishes the objects of the invention.

Although a specific embodiment of the invention has been shown and described, it will be apparent that many modifications may be made by those skilled in the art. Such modifications may be in the details of construction and arrangement of parts without departing from the scope of the invention as set forth in the appended claims.

It is claimed and desired to secure by Letters Patent:

1. In a fluid fuel burner control system, manually operable valve means for controlling the supply of fuel to the burner, normally open valve means for controlling the supply of fuel to said manually operable valve means, electrically operable actuating means adapted when energized to close said normally open valve means, and timing means for controlling the energization of said actuating means at preselected intervals.

2. In a fluid fuel burner control system, manually operable valve means for controlling the supply of fuel to the burner, normally open valve means for controlling the supply of fuel to said manually operable valve means, electrically operable actuating means adapted when energized to close said normally open valve means, an electric igniter for igniting fuel flowing from the burner, and timing means for selectively energizing said actuating means and said igniter at preselected intervals.

3. The control system as claimed in claim 2 wherein thermally responsive means are provided for deenergizing said electric igniter when a flame is established at the burner.

4. In a fluid fuel burner control system, manually operable valve means for controlling the supply of fuel to the burner, normally open valve means for controlling the supply of fuel to said manually operable valve means, electrically operable actuating means adapted when energized to close said normally open valve means, an energizing circuit for said actuating means, an electric igniter for igniting fuel flowing from the burner, an energizing circuit for said igniter, switching means for selectively closing said circuits, and timing means for actuating said switching means at preselected intervals.

5. A control system as claimed in claim 4 wherein said energizing circuit for said igniter includes a switch operatively associated with said manually operable valve means to be closed when said manually operable valve means is in fuel flow permitting position and open when said manually operable valve means is in fuel flow preventing position.

6. A control system as claimed in claim 5 wherein said energizing circuit for said igniter includes a thermally responsive switch for opening said igniter energizing circuit when a flame is established at the burner.

7. In a fluid fuel burner control system having main and pilot burners, means responsive to the presence of flame at the pilot burner for controlling the supply of fuel to the main burner, manually operable valve means for controlling the supply of fuel to said last named means and the pilot burner, an electric igniter for the pilot burner, normally open valve means for controlling the supply of fuel to said manually operable valve means, electrically operable actuating means adapted when energized to close said normally open valve means, and timing means for selectively energizing said electric igniter and said actuating means at preselected intervals.

8. A control system as claimed in claim 7 wherein thermally responsive means are provided for deenergizing said electric igniter when a flame is established at the pilot burner.

9. In a fluid fuel burner control system having main and pilot burners, an electric igniter for the pilot burner, means responsive to the presence of flame at the pilot burner for controlling the supply of fuel to the main burner, condition responsive valve means for controlling the flow of fuel to said last named means, manually operable valve means for controlling the flow of fuel to said condition responsive valve means and to the pilot burner, normally open valve means for controlling the supply of fuel to said manually operable valve means, electrically operable actuating means adapted when energized to close said normally open valve means, an energizing circuit for said electric igniter, an energizing circuit for said electrically operable actuating means, switching means having a first position closing only said first named circuit and a second position closing only said last named circuit, and clock controlled means for moving said switching means between said positions.

10. A control system as claimed in claim 9 wherein said energizing circuit for said igniter includes a switch operatively associated with said manually operable valve means to be moved between open and closed positions thereby when said manually operable valve means is moved between fuel flow permitting and fuel flow preventing positions.

11. A control system as claimed in claim 10 wherein said energizing circuit for said igniter includes a thermally responsive switch for opening said igniter energizing circuit when a flame is established at the pilot burner.

12. In a fluid fuel burner control system having main and pilot burners, an electric igniter for one of the pilot burners, means responsive to the presence of flame at said one pilot burner for controlling the supply of fuel to the main burner, means responsive to the presence of flame at said one pilot burner for controlling the supply of fuel to another of the pilot burners, condition responsive valve means for controlling the flow of fuel to said first named flame responsive means, manually operable valve means for controlling the flow of fuel to said condition responsive valve means and to said one pilot burner, normally open valve means for controlling the supply of fuel to said manually operable valve means, electrically operable actuating means adapted when

energized to close said normally open valve means, an energizing circuit for said electric igniter, an energizing circuit for said electrically operable actuating means, switching means having a first position closing only said first named circuit and a second position closing only said last named circuit, and clock controlled means for moving said switching means between said positions.

13. A control system as claimed in claim 12 wherein said energizing circuit for said igniter includes a switch operatively associated with said manually operable valve means to be moved between open and closed positions thereby when said manually operable valve means is moved between fuel flow permitting and fuel flow preventing positions.

14. A control system as claimed in claim 13 wherein said energizing circuit for said igniter includes a thermally responsive switch for opening said igniter energizing circuit when a flame is established at said one pilot burner.

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No references cited.