Feb. 28, 1956 R. F. RAFENSTEIN 2,736,371

BURNER CONTROL SYSTEM

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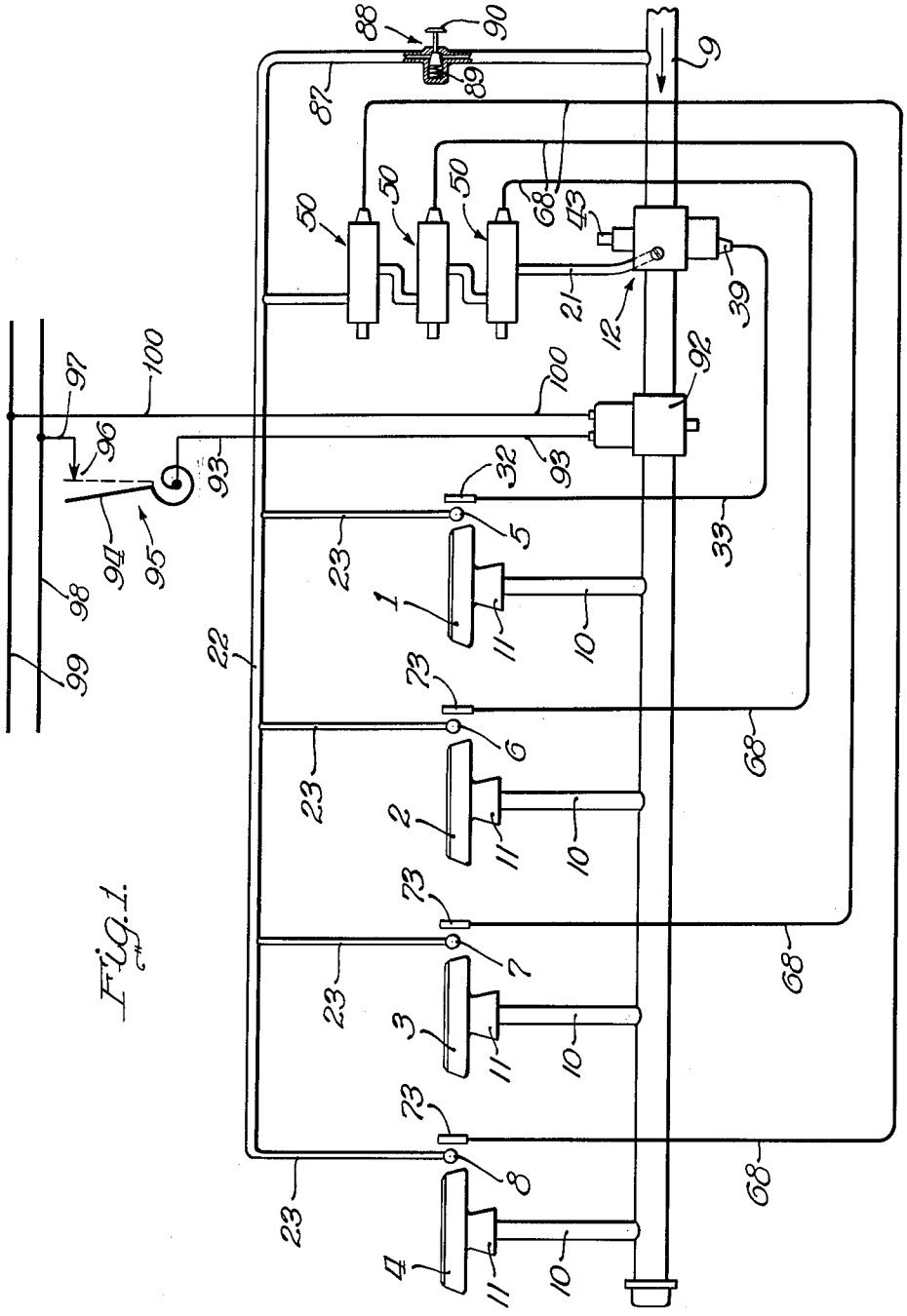


Fig. 1.

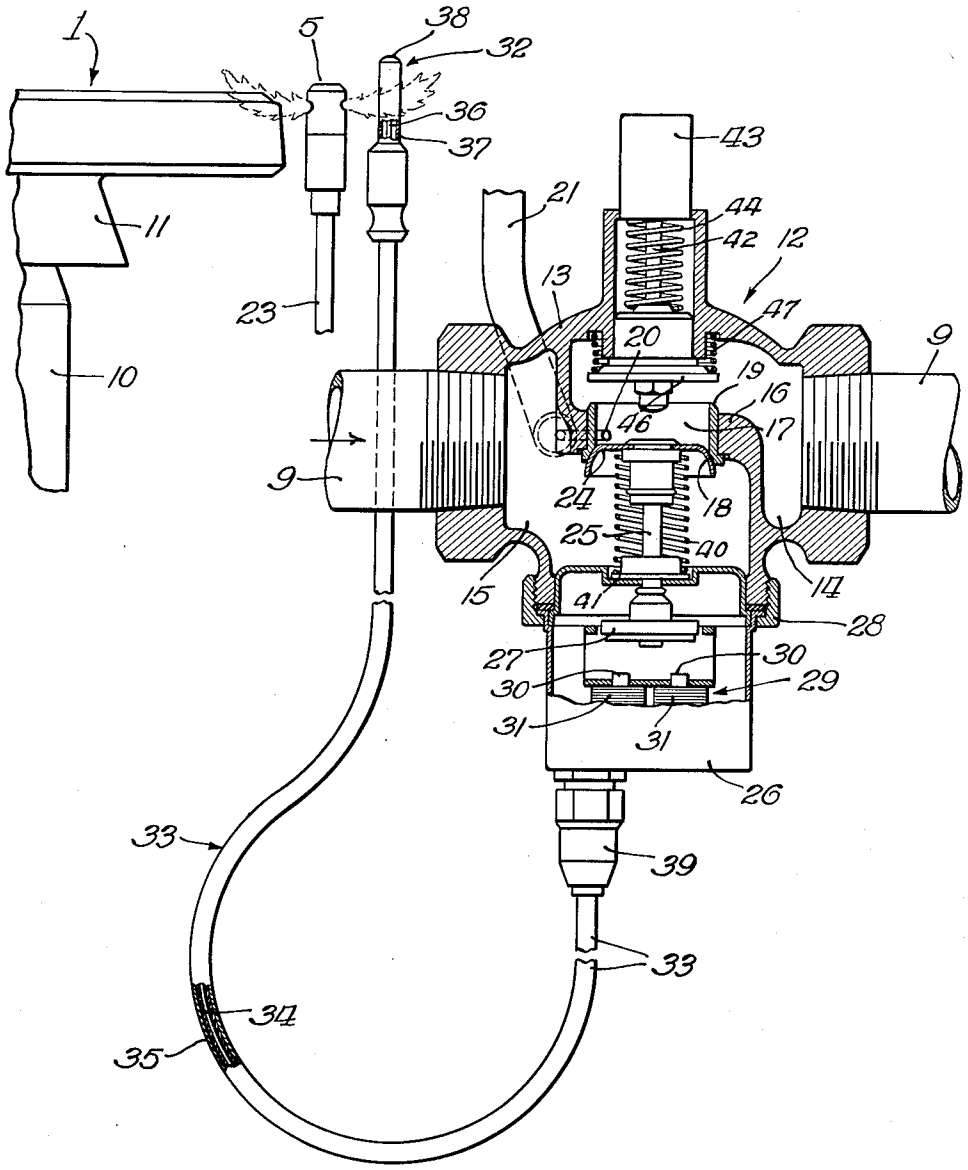
INVENTOR.
Roy F. Rafenstein
BY
Brown, Jackson, Boettcher & Dienner
Attys.

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BURNER CONTROL SYSTEM

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Fig. 2.



INVENTOR.

Roy F. Rafenstein

BY

Brown, Jackson, Boettcher & Dienner

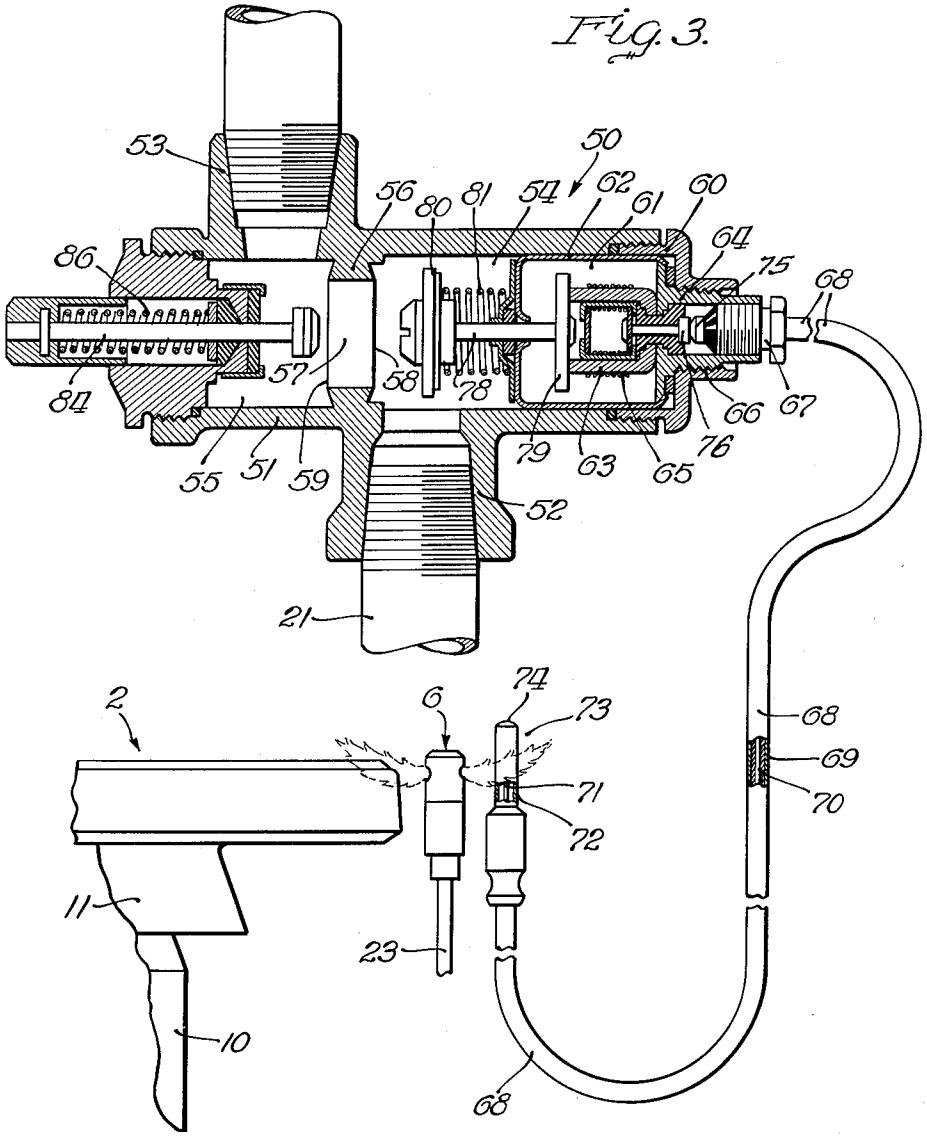
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BURNER CONTROL SYSTEM

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Fig. 3.



INVENTOR.

Roy F. Rafenstein

BY

Brown, Jackson, Boettcher & Dienner

Attys.

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2,736,371

BURNER CONTROL SYSTEM

Roy F. Rafenstein, Long Beach, Calif., assignor to Milwaukee Gas Specialty Company, Milwaukee, Wis., a corporation of Wisconsin

Application March 20, 1951, Serial No. 216,596

17 Claims. (Cl. 158—131)

This invention relates, in general, to a burner control system, and has particular relation to an improved thermoelectric safety shut-off apparatus for gaseous fuel burners.

The particular system which I shall describe hereinafter in connection with the drawings is a thermoelectric safety shut-off system for sectional furnaces and similar multiple burner installations, it being understood that the thermoelectric safety shut-off apparatus of the present invention may be adapted to furnaces or heaters having any desired number of furnace sections or burners.

In prior practice, it has been customary with sectional furnaces and multiple burner installations to provide thermoelectric safety switches, for example, of the type disclosed and claimed in Clarence Wantz Patent No. 2,330,461, patented September 28, 1943, one associated with each of the pilot burners for the respective main burners or furnace sections, and an electric relay valve in the fuel supply line for the pilot burners to provide 100% shut-off. The electric relay valve is intended to hold open as long as all of the thermoelectric safety switches are maintained in operating position by the heat of the pilot burner flames on their connected thermoelectric generators. If any thermoelectric safety switch opens or drops out, for example, as the result of extinguishment of the flame of its pilot burner, it breaks the series circuit which shuts off the main burner gas supply through a solenoid valve and the pilot line gas supply through the small relay type valve.

The use of a small relay type valve to obtain 100% shut-off has been a weakness in prior art systems. Any drop in line voltage or momentary interruption of the electric power will shut off all of the pilot burners, and consequently shut down the entire furnace. This trouble will occur primarily when the thermostat employed in conjunction with the system first calls for heat.

While I reserve the right to revise or supplement my theory of the difficulties with these prior art systems, it is believed that perhaps the power distribution (i. e., the electric power) fails to deliver sufficient power at all times to hold open the small electric type pilot valve. It is entirely possible with a heavy current load in the house or other place where the burner installation is employed (i. e., lights lit, electrical appliances running, and the like) that the thermostat will call for heat and start, for example, a fan motor and several electric damper motors connected to the system. If this occurs, enough power may be drawn to cause a sufficient drop in line voltage to allow the small relay type valve in the pilot line to flutter closed for an instant. If this happens, all of the pilot burners will be shut off, and the entire furnace will be shut down.

One of the main objects of the present invention is to provide an improved thermoelectric safety shut-off system which will overcome the shortcomings of prior thermoelectric safety shut-off systems.

Another and more specific object of the invention is to provide a thermoelectric safety shut-off system which does

not require external electric power or a small electric relay valve in the pilot line and which, therefore, will not shut down the system in the event sufficient external electric power is not delivered at any time.

Another object of the invention is to provide an improved thermoelectric safety shut-off system of the class described which will operate to provide 100% safety shut-off.

Another object of the invention is to provide a thermoelectric safety shut-off system wherein there is combined with a first valve for shutting off the fuel for a plurality of main burners, and, if desired, for a plurality of pilot burners—one for each of the main burners—a plurality of pilot fuel shut-off valves one for each of the plurality of pilot burners except the first pilot burner which controls the first valve, any one of which will shut off the fuel for all of the plurality of pilot burners, and a plurality of electromagnets each having a connected thermoelectric generator subject to the heat of one of said pilot burners for holding said pilot fuel shut-off valves and said first valve open only when all of the pilot burners are ignited.

Another object of the invention is to provide a by-pass connection for supplying fuel to the pilot burners when the first valve is closed, and means for manually opening the by-pass connection.

Another object of the invention is to provide apparatus of simple and inexpensive construction which is composed of few parts and adapted for convenient assembly and installation, and to operate effectively for the desired purpose.

Further features and advantages and numerous adaptations of the invention will be apparent from the following detailed description and the drawings.

In the drawings:

Figure 1 is a more or less schematic view of a burner control system embodying the present invention;

Figure 2 is a longitudinal axial section through the main shut-off valve; and

Figure 3 is a longitudinal axial section through one of the pilot burner shut-off valves.

Referring now to the drawings, the burners **1**, **2**, **3**, and **4** are the main burners of a sectional furnace or other multiple burner installation, for example, for heating a dwelling or other space, or an oven or other device.

A first pilot burner **5** is located in juxtaposition or in lighting proximity to the first burner **1**. Additional pilot burners **6**, **7**, and **8** are located in juxtaposition or in lighting proximity to the additional main burners **2**, **3**, and **4**, respectively, so that each main burner thus has a separate pilot burner. There are preferably at least two main burners and two pilot burners, but there may be more than two main burners and pilot burners as shown in the system selected for illustration. Where there are more than two main burners and two pilot burners, the number of such main burners and pilot burners in excess of two may, within the scope of the present invention, vary widely to suit different conditions.

A main fuel supply pipe or conduit **9** has branch conduits **10** leading to the main burners, **1**, **2**, **3**, and **4**, for the delivery of gaseous or other fuel thereto, for example, through mixing chambers **11**, to which air is admitted through adjustable air inlets (not shown), as well understood in the art. Interposed in the conduit **9** ahead of the main burners is a main thermoelectric safety shut-off valve **12** which, when closed, is adapted to shut off the flow of gas to all of the main burners.

As shown in detail in Figure 2, the main thermoelectric shut-off valve **12** selected for illustration comprises a valve body or casing **13** having a fuel inlet chamber **15** and a fuel outlet chamber **14**. Between the chambers **15** and **14** there is a wall or partition **16** provided with a port or opening **17**. An annular valve seat **18** surrounds

the inlet end of the port 17, and an annular valve seat 19 surrounds the outlet end of the port 17. A pilot port or tapping 20 opens from the port 17 between the valve seats 18 and 19 for supplying gaseous fuel to the pilot burners 5, 6, 7, and 8 through a pilot burner supply conduit or tube 21 which leads to the pilot burner supply conduit or manifold 22 from which branch conduits or tubes 23 lead to the respective pilot burners.

Communication between the inlet chamber 15 and the outlet chamber 14 is controlled by a valve member 24 which, when in closed or shut-off position, seats against the valve seat 18. The valve member 24 is carried on one end of a stem 25, the opposite end of which extends into an electromagnet hood 26 and carries an armature 27. The hood 26 is clamped to the valve body 13, for example, by a flanged union nut 28 preferably with a suitable gasket interposed therebetween.

Housed within the hood 26 is an electromagnet 29 which comprises a magnet frame 30 having a coil 31 wound thereon. The coil 31 is connected in circuit with a first thermoelectric generator 32 by a lead 33. The lead 33 may, for example, comprise concentric lead conductors 34 and 35 connected in circuit at one end with concentric thermoelectric generator elements 36 and 37 of the thermoelectric generator 32, as more fully disclosed and claimed in Oscar J. Leins Patent No. 2,126,564, patented August 9, 1938. The thermoelectric generator elements 36 and 37 are joined to form a hot thermojunction 38 which, in use, is positioned to be heated by the flame of the first pilot burner 5. The opposite ends of the tubular and inner lead conductors 35 and 34 are connected to the terminals of the coil 31, for example, by a detachable terminal connector 39 such as shown in John H. Thornbery Patent No. 2,328,111, patented August 31, 1943.

The heat of the flame of the pilot burner 5 on the hot junction of the thermoelectric generator 32 is adapted to energize the electromagnet 29 sufficiently to hold the armature 27 attracted against the magnet frame 30 and thereby the valve member 24 in open position as long as the thermoelectric generator is heated by the flame of the pilot burner 5. When the flame of the pilot burner 5 is extinguished, the electromagnet 29 ceases to hold the armature 27 in attracted position. A coiled spring 40 confined, for example, between the valve member 24 and a wall 41 at the inner end of the hood 26 then moves the armature 27 to retracted position and the valve member 24 to closed position for safety shut-off of the flow of fuel to both the main burners, 1, 2, 3, and 4, and the pilot burners, 5, 6, 7, and 8.

The heat of the flame of the pilot burner 5 on the hot junction of the thermoelectric generator 32 may not be capable of moving the armature 27 to attracted position and the valve member 24 to open position. Reset means is therefore provided for manually resetting or cocking the armature 27 to attracted position and the valve member 24 to open position. This reset means comprises, in general, a reset stem 42 mounted for axial movement in the valve body 13. The outer end of the reset stem 42 is provided with a reset button 43. A coiled spring 44 holds the reset stem 42 in its outwardly projected position, and returns it to such position.

When the armature 27 is retracted and the valve member 24 is closed and the reset stem 42 is pressed inwardly, the inner end of the stem engages the valve and armature assembly and moves the valve member 24 to open position and the armature 27 to attracted position. They may be held in this position until the pilot burner 5 is ignited and the flame thereof has heated the hot junction of the thermoelectric generator 32 to energize the electromagnet 29 sufficiently to hold the armature 27 in attracted position and the valve member 24 in open position. The reset button 43 may then be released, and will be returned to its outwardly projected position by the spring 44.

If desired, the reset stem 42 may be provided with a flow interrupter valve 46 for seating against the valve seat 19 to shut off the flow of fuel to the main burners during the resetting operation and until the armature 27 is held in attracted position and the valve member 24 in open position by the energization of the electromagnet 29. The flow interrupter valve may, for example, be of the character more fully disclosed and claimed in Charles V. Hildebrecht Patent No. 2,114,446, patented April 19, 1938. Suffice it to state that when the reset stem 42 is pressed inwardly, a coiled spring 47 moves the flow interrupter valve 46 to closed position and the coiled spring 44, in returning the reset stem 42 to its outwardly projected position, moves the valve member 46 to open position against the action of the spring 47.

During the time the flow interrupter valve 46 is seated against its seat, the flow of gaseous fuel to all of the main burners 1, 2, 3, and 4 is shut off, but the valve 24 being open, fuel may flow out through the pilot port 20 to the conduit 21 for delivery to the pilot burners, as will presently appear. Interposed in the pilot fuel supply conduit 20 beyond the main shut-off valve 12 are a plurality of thermoelectric shut-off valves 50, one for each of the additional pilot burners 6, 7, and 8.

Each valve 50 comprises, as shown in detail in Figure 3, a valve body or casing 51 having a fuel inlet 52 and a fuel outlet 53. The inlet 52 opens into an inlet chamber 54, and the outlet 53 opens from an outlet chamber 55. Between the chambers 54 and 55 there is a wall or partition 56 provided with a port or opening 57. An annular valve seat 58 surrounds the inlet end of the port 57, and an annular valve seat 59 surrounds the outlet end of the port 57.

Screwed or otherwise secured in the valve body 51 coaxial with the valve seats 58 and 59 is a magnet mounting nut 60. An electromagnet 61 is enclosed within an inner shell 62 and comprises a magnet frame 63 secured, for example, to a terminal bushing 64. A coil 65 is wound around the legs of the U-shaped magnet frame 63. The bushing 64 is secured in place, for example, by screwing it at 66 into the magnet mounting nut 60, and has a threaded opening for receiving an attaching nut 67 of a thermoelectric generator lead 68.

The lead 68 comprises, for example, concentric lead conductors 69 and 70 connected in circuit at one end with concentric thermoelectric generator elements 71 and 72 of a thermoelectric generator 73 as previously described. The thermoelectric generator elements 71 and 72 are joined to form a hot thermojunction 74 one of which, in use, is positioned to be heated by the flame of each of the pilot burners 6, 7 and 8. The opposite end of each lead conductor 70 has a connector cone 75 which is clamped in contact with its terminal tip 76 by the nut 67. The outer tubular lead conductor 69 is connected in circuit with one side of its coil 65 through the bushing 64, and the other side of the coil 65 is connected to the inner lead conductor 70 through the terminal tip 76.

A stem 78 extends through the wall at the inner end of the shell 62, and has an armature 79 attached thereto within the shell 62 and preferably in a manner to permit self-accommodation of the armature to the pole ends of the magnet frame 63. A safety shut-off valve 80 is attached to the opposite end of the stem 78 within the inlet chamber 54, and preferably in a manner to permit self-accommodation of this valve member to its seat 58.

The heat of the flames of the pilot burners 6, 7, and 8 on their respective thermoelectric generators 73 is adapted to energize the electromagnets 61 sufficiently to hold the armature 79 in attracted position and the valve members 80 in open position as long as the thermoelectric generators are heated by the flames of the pilot burners. When any one of the pilot burners 6, 7, or 8 is extinguished, its related armature 79 ceases to be held in attracted position by the electromagnet 61, and the valve

member 80 is moved by a coiled spring 81 into closed position engaging the valve seat 58 to shut off the flow of gaseous fuel to all of the pilot burners 5, 6, 7, and 8.

A reset stem 84 is provided for manually moving the armature 79 to attracted position and the valve member 80 to open position where they may be held until the thermoelectric generator 73 is heated by the flame of its pilot burner and has energized the electromagnet 61 sufficiently to hold the armature 79 in attracted position and the valve member 80 in open position as previously described in connection with the main shut-off valve 12.

The pilot shut-off valves 50 are preferably devoid of flow interrupter valve members as described in connection with the main shut-off valve, because they control only the pilot fuel supply. When a pilot valve is cocked to open position, a flame or other ignition means is applied to ignite the related pilot burner. A coiled spring 86 holds the reset stem 84 in its outwardly projected position, and returns it to such position.

For the purpose of supplying fuel to the pilot burners when the main shut-off valve member 24 is closed, a by-pass conduit or connection 87 is provided between the main fuel supply conduit 9 on the upstream or anterior side of the valve 12 and the pilot burner supply conduit 22. Interposed in the by-pass connection 87 is a valve 88 which is biased to closed position by a spring 89, and has a button 90 which is adapted to be pressed with the fingers manually to open the valve 88.

A solenoid or electroresponsive valve 92 may be interposed in the main fuel supply conduit 9 between the main shut-off valve 12 and the main burners. One terminal of the coil (not shown) of the valve 92 is connected, for example, by a conductor 93 with the bimetallic element 94 of a thermostat, limit switch or other condition responsive device 95. The fixed contact 96 of the thermostat is connected by a conductor 97 to one of the line conductors 98 leading from a suitable source of current, such, for example, as a household alternating current supply line of the type which averages about 115 volts. The other terminal of the coil of the valve 92 is connected to the other line conductor 99 by a conductor 100.

In the operation of the apparatus, if any one of the pilot burners 6, 7, or 8 is extinguished, its related pilot fuel shut-off valve 50 will close and shut off the supply of fuel to all of the pilot burners. Extinguishment of the first pilot burner 5 results in operation of the main shut-off valve 12 to closed position to shut off the supply of fuel to all of the main burners and also the supply of fuel to all of the pilot burners, thus shutting down the entire system. In one illustrative embodiment of the invention, it is contemplated that each valve 50 will close in about one minute maximum after extinguishment of its related pilot burner, and the main shut-off valve 12 will close in about two minutes maximum after extinguishment of the first pilot burner 5.

To set the system in operation, the operator manually presses the button of the valve 88 to set up a by-pass flow of fuel to the pilot burners. After they have heated their related thermoelectric generators sufficiently, the operator with one hand still on the button of the valve 88 presses the outer ends of the reset stems 84 to reset the pilot shut-off valves 50 to open position, and the reset button of the main shut-off valve 12 is also pressed inwardly to reset this valve to open position. The button of the valve 88 may be released, and the system is in operation. Thus the safety pilot set-up is entirely independent of external electric power. On gas, such as liquid petroleum gas for example, there will be sufficent capacity through various models of the valve 12 so that one will not have to worry about the pressure drop.

The embodiment of the invention shown in the drawings is for illustrative purposes only, and it is to be expressly understood that said drawings and the accompanying specification are not to be construed as a definition of the limits or scope of the invention, reference being had to the appended claims for that purpose.

It is contemplated, for example, to provide a small pilot fuel shut-off valve for each of the pilot burners 5, 6, 7, and 8 instead of only for the pilot burners 6, 7, and 8 as shown in the drawings. Any one of such small pilot fuel shut-off valves would be operable to shut off the fuel for all of the pilot burners. In such case, a thermoelectric safety switch, in general, of the character shown and described in John H. Thornbery and Harold A. Mantz Patent No. 2,132,057, patented October 4, 1938, could be employed to open, for example, the circuit 93, 100 for the electroresponsive valve 92 upon extinguishment of one of the pilot burners to the heat of which the connected thermoelectric generator of such thermoelectric safety switch could be responsive.

It is further contemplated—particularly in the arrangement referred to in the preceding paragraph—to arrange all of the reset buttons so that they could be bridged and pressed by a single reset lever when lighting the pilot burners. This would eliminate the necessity for the pilot by-pass line shown in Figure 1 as a convenience for lighting the pilots.

I claim:

1. In apparatus of the class described, in combination, a first main burner, at least one additional main burner, a first pilot burner in juxtaposition to said first main burner, an additional pilot burner in juxtaposition to said additional main burner, main fuel supply conduit for supplying fuel to said main burners, a pilot burner fuel supply conduit leading from said main fuel supply conduit for supplying fuel to said pilot burners, a first valve in said main fuel supply conduit, said first valve having closed position shutting off the flow of fuel to both said main burners and said pilot burners and open position for flow of fuel to both said main burners and said pilot burners, a first electromagnet having a connected thermoelectric generator subject to the heat of the first pilot burner for holding said first valve open when said first pilot burner is ignited, means for biasing said first valve to closed position upon extinguishment of said first pilot burner, a second valve in said pilot fuel supply conduit and having closed position for shutting off the fuel for said first and additional pilot burners and open position for flow of fuel to said first and additional pilot burners when said first valve is open, a second electromagnet having a connected thermoelectric generator subject to the heat of the additional pilot burner for holding said second valve open when said additional pilot burner is ignited, and means biasing said second valve to closed position upon extinguishment of said additional pilot burner.

2. Apparatus according to claim 1 wherein there is a by-pass connection by-passing both said first valve and said second valve for supplying fuel from said main fuel supply conduit to the first and additional pilot burners when said first and second valves are closed, and means for manually opening the by-pass connection.

3. Apparatus according to claim 1 wherein there is a by-pass connection by-passing both said first valve and said second valve for supplying fuel from said main fuel supply conduit to the first and additional pilot burners when the first valve is closed, and a valve in said by-pass connection spring biased to closed position and manually operable to open position.

4. Apparatus according to claim 1 wherein there is an electroresponsive valve in said main fuel supply conduit posterior to the first valve, condition responsive means connected in circuit with said electroresponsive valve and acting electrically to operate said valve independently of said first and second valves.

5. Apparatus according to claim 1 wherein there is an electroresponsive valve in said main fuel supply conduit posterior to the first valve, and condition-responsive means controlling said electroresponsive valve.

6. Apparatus according to claim 1 wherein there is means for manually resetting the first valve to open position.

7. Apparatus according to claim 1 wherein there is means for manually resetting the second valve to open position.

8. For use with a burner installation having a plurality of main burners, separate pilot burners one for each of the main burners, a main fuel supply conduit for the main burners and a fuel supply conduit leading from said main fuel supply conduit for supplying fuel to the pilot burners, a thermoelectric safety shut-off apparatus comprising a first shut-off valve in said main fuel supply conduit having a closed position for shutting off the fuel for both the main burners and the pilot burners and open position for flow of fuel to both said main burner and said pilot burners, a first electromagnet, a first thermoelectric generator for positioning to be heated by one pilot burner and connected in circuit with said first electromagnet to energize same sufficiently to hold said first shut-off valve in open position, means for biasing said first valve to closed position upon extinguishment of said one pilot burner, a second shut-off valve in said pilot fuel supply conduit having a closed position for shutting off the fuel for said pilot burners and open position for flow of fuel to said pilot burners when said first valve is open, a second electromagnet, a second thermoelectric generator for positioning to be heated by a pilot burner other than the one which heats said first thermoelectric generator and connected in circuit with said second electromagnet to energize same sufficiently to hold said second shut-off valve in open position, and means biasing said second valve to closed position upon extinguishment of said other pilot burner.

9. A thermoelectric safety apparatus acording to claim 8 wherein there is a by-pass valve by-passing both said first valve and said second valve and spring-biased to closed position, said by-pass valve being manually operable to open position to by-pass fuel to said pilot burners when the first shut-off valve is closed.

10. A thermoelectric safety apparatus according to claim 8 wherein there is an electroresponsive valve for connection in the fuel supply conduit for the main burners between the first shut-off valve and the main burners, and condition responsive means connected in circuit with said electroresponsive valve and acting to operate said valve independently of said first and second valves.

11. In apparatus of the class described, in combination, a first main burner, at least one additional main burner, a first pilot burner in juxtaposition to said first main burner, an additional pilot burner in juxtaposition to said additional main burner, a main fuel supply conduit for supplying fuel to said main burners, a pilot burner fuel supply conduit for supplying fuel to said pilot burners, a valve for shutting off the fuel for said main burners and said pilot burners, a first electromagnet having a connected thermoelectric generator subject to the heat of the first pilot burner for holding said first valve open when said first pilot burner is ignited, a second valve for shutting off the fuel for said first and additional pilot burners, a second electromagnet having a connected thermoelectric generator subject to the heat of the additional pilot burner for holding said second valve open when said additional pilot burner is ignited, and means for manually resetting both the first and second valves to open position.

12. In apparatus of the class described, in combination, a plurality of main burners each provided with a single pilot burner, a main fuel supply passage for supplying fuel to said main burners, a pilot burner fuel supply passage for supplying fuel to said pilot burners, a main safety shut-off valve having closed position shutting off flow of fuel to both said main burners and said pilot burners, electromagnetic means connected in circuit with a thermoelectric generator subject to the heat of one of said pilot burners and adapted when energized to hold said main safety shut-off valve in open position, said main safety shut-off valve being released for operation to closed position by deenergization of said electromagnetic means upon extinguishment of said one pilot burner, a plurality of pilot burner safety shut-off valves connected in series in said pilot burner fuel supply passage and each having electromagnetic means connected in circuit with other thermoelectric generators subject to the heat of a plurality of other pilot burners and effective when energized to hold said pilot burner safety shut-off vaives open, and means operable by a single manual operation for establishing a supply of fuel to all of said pilot burners when said main safety shut-off valve is open.

13. In a fuel flow control system, in combination, at least one main burner, a plurality of pilot burners, fuel supply means for said main and pilot burners, first control means for said fuel supply means under the direct control of one only of said pilot burners for controlling the flow of fuel to said main and pilot burners, said first control means being responsive to flame extinguishment of said one of said pilot burners to interrupt fuel flow to said main and pilot burners, and second control means for said fuel supply means under control of the other of said pilot burners for directly controlling the flow of fuel to all of said pilot burners only, said second control means being responsive to flame extinguishment of any one of said other pilot burners to directly interrupt fuel flow to all of said pilot burners.

14. In a fuel flow control system, in combination, at least one main burner, a plurality of pilot burners, a thermoelectric generator for each of said pilot burners in heating relation respectively therewith, fuel supply means for said main and pilot burners, an electromagnetic flow control device for said fuel supply means in circuit with one of said thermoelectric generators in heating relation with one of said pilot burners for controlling the flow of fuel to said main and pilot burners, said flow control device being responsive to flame extinguishment of said one of said pilot burners to interrupt fuel flow to said main and pilot burners, and an additionatl electromagnetic flow control device for said fuel supply means in circuit with each of the other of said thermoelectric generators in heating relation with the other of said pilot burners to be responsive to heat afforded by the respective pilot burners for directly controlling the flow of fuel to all of said pilot burners only, each of said additional flow control devices being responsive to flame extinguishment of its respective pilot burner to directly interrupt fuel flow to all of said pilot burners.

15. In apparatus of the class described, in combination, a first main burner, at least one additional main burner, a first pilot burner in juxtaposition to said first main burner, an additional pilot burner in juxtaposition to said additional main burner, a main burner fuel supply conduit for supplying fuel to said main burners, a pilot burner fuel supply conduit for supplying fuel to said pilot burners, shut-off means for shutting off the fuel for said main burners and said pilot burners, said shut-off means comprising first valve means and first electromagnetic means having a connected thermoelectric generator subject to the heat of the first pilot burner permitting holding of said first valve means open when said first pilot burner is ignited, and second shut-off means including second valve means for shutting off the fuel for said first and additional pilot burners and second electromagnetic means having a connected thermoelectric generator subject to the heat of the additional pilot burner for holding said second valve open when said additional pilot burner is ignited.

16. In apparatus of the class described, in combination, a first main burner, at least one additional main burner, a first pilot burner in juxtaposition to said first main burner, an additional pilot burner in juxtaposition to said additional main burner, a main burner fuel supply

conduit for supplying fuel to said main burners, a pilot burner fuel supply conduit for supplying fuel to said pilot burners, shut-off means for shutting off the fuel for said main burners and at least one of said pilot burners, said shut-off means comprising first valve means and first electromagnetic means having a continuously closed circuit for energization thereof including as a source of energy a thermoelectric generator subject to the heat of the first pilot burner permitting holding of said valve means open when said first pilot burner is ignited, and second shut-off means including second valve means for shutting off the fuel for said first and additional pilot burners and second electromagnetic means having a continuously closed circuit for energization thereof including as a source of energy a thermoelectric generator subject to the heat of the additional pilot burner for holding said second valve open when said additional pilot burner is ignited.

17. In apparatus of the class described, in combination, a first main burner, at least one additional main burner, a first pilot burner in juxtaposition to said first main burner, an additional pilot burner in juxtaposition to said additional main burner, a main burner fuel supply conduit for supplying fuel to said main burners, a pilot burner fuel supply conduit for supplying fuel to said pilot burners, shut-off means for shutting off the fuel for said main burners and at least one of said pilot burners, said shut-off means comprising first valve means and first

electromagnetic means having a continuously closed circuit for energization thereof including as a source of energy a thermoelectric generator subject to the heat of the first pilot burner permitting holding of said first valve means open when said first pilot burner is ignited, means for biasing said first valve to closed position upon extinguishment of said first pilot burner, second shut-off means including second valve means for shutting off the fuel for said first and additional pilot burners and second electromagnetic means having a continuously closed circuit for energization thereof including as a source of energy a thermoelectric generator subject to the heat of the additional pilot burner for holding said second valve open when said additional pilot burner is ignited, and means biasing said second valve to closed position upon extinguishment of said additional pilot burner.

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