Aug. 31, 1954 J. H. THORNBERY 2,687,738

COMBINED CONTROL AND SAFETY SHUTOFF VALVE

Filed April 11, 1950 3 Sheets-Sheet 1

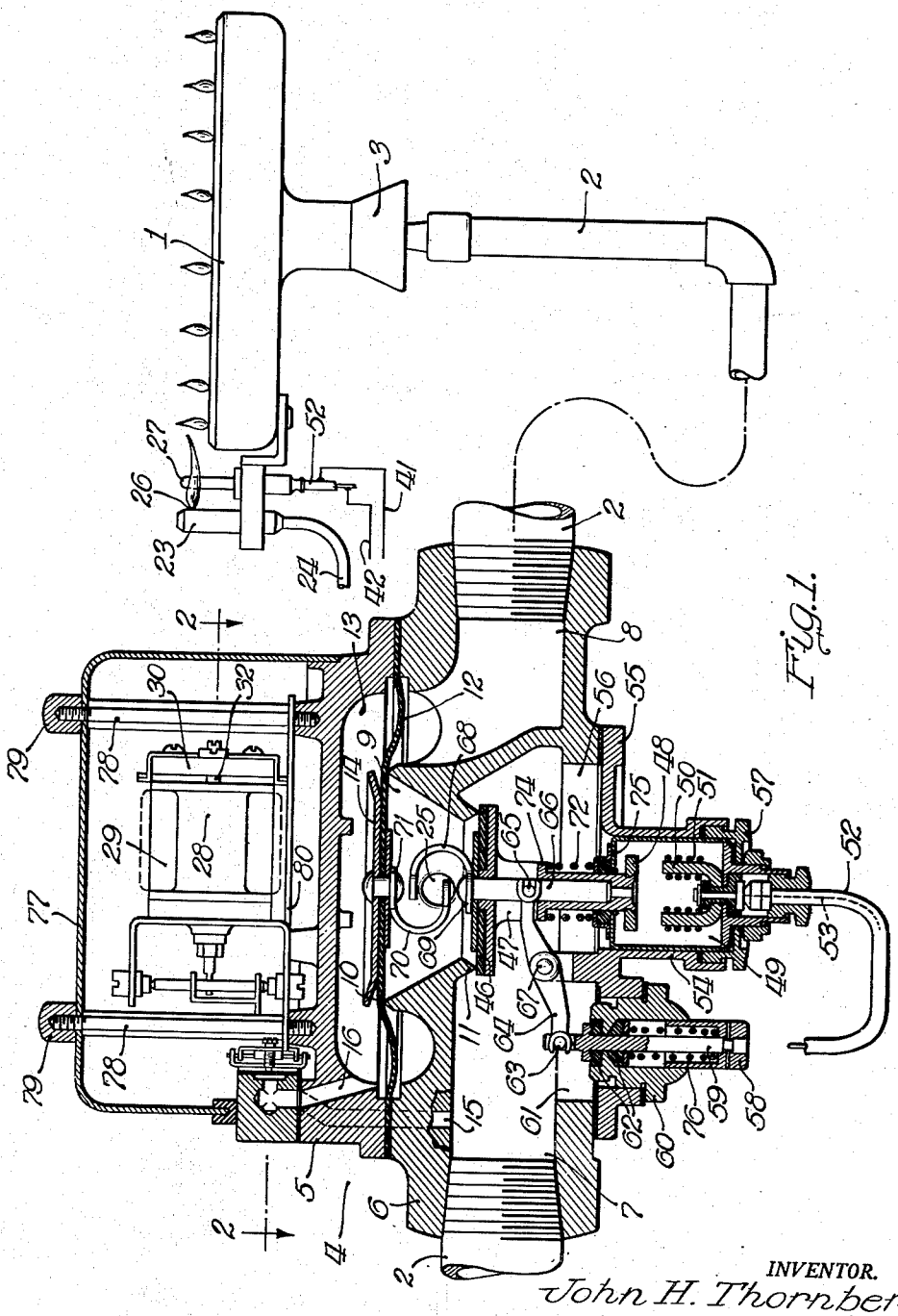


Fig. 1.

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COMBINED CONTROL AND SAFETY SHUTOFF VALVE

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Fig. 2.

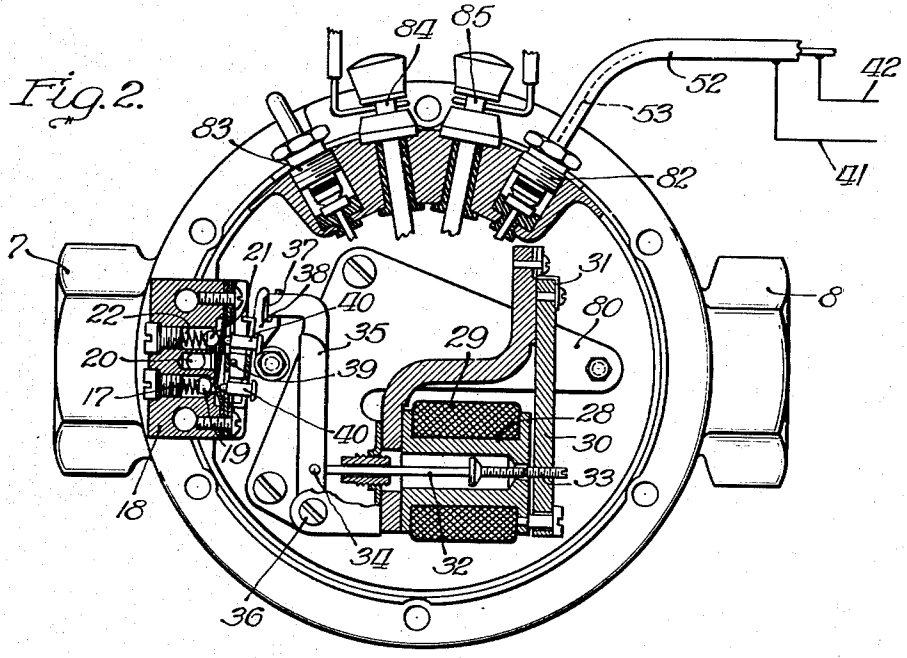
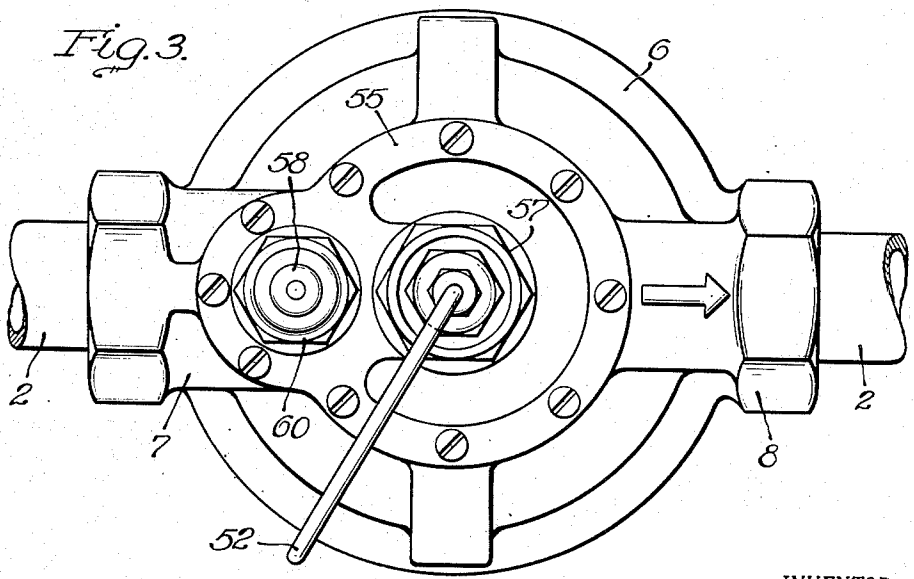


Fig. 3.



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COMBINED CONTROL AND SAFETY SHUTOFF VALVE

Filed April 11, 1950 3 Sheets-Sheet 3

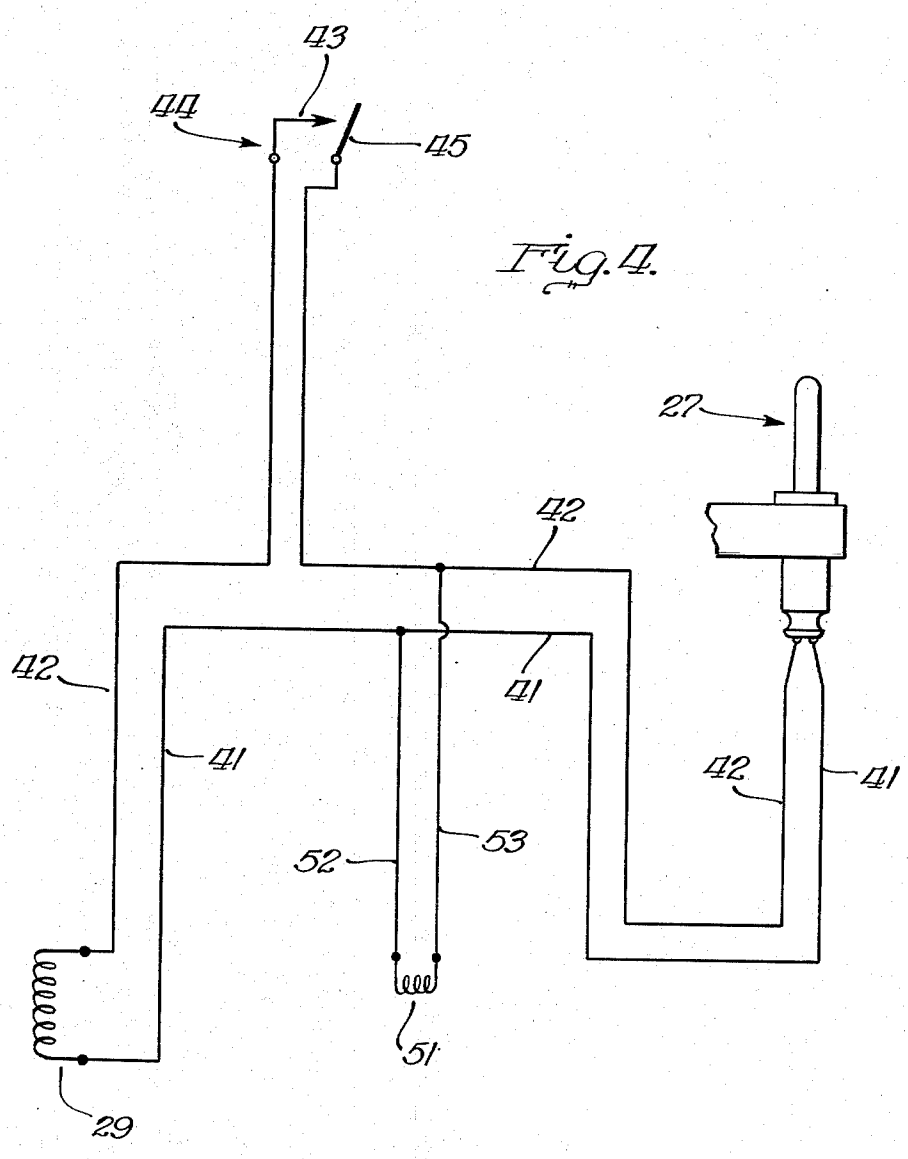


Fig. 4.

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UNITED STATES PATENT OFFICE

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COMBINED CONTROL AND SAFETY SHUTOFF VALVE

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Application April 11, 1950, Serial No. 155,251

24 Claims. (Cl. 137—66)

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This invention relates, in general, to burner control and safety shut-off valves, and is particularly concerned with a combined control and safety shut-off valve which, under the control of fluid pressure and thermoelectric power, controls the flow of gaseous fuel to a main burner, and when, for example, a pilot burner is extinguished, operates to shut off the flow of gaseous fuel both to the main burner and to the pilot burner.

While I shall hereinafter, in connection with the drawings, describe certain particular combined control and safety shut-off valves embodying the present invention in relation to a particular burner system, it is to be understood that this invention is not in its broader aspects limited to the particular embodiments selected for illustration, nor to use with the particular burner system shown and described.

In prior control and safety shut-off systems of the type with which this invention is concerned there has been interposed in the fuel supply pipe leading to the main burner a diaphragm valve under control of a thermoelectric generator positioned to be heated by a pilot burner for the main burner in conjunction with another and separate valve also in the fuel supply pipe leading to the main burner and which is operable to shut off the supply of fuel both to the main burner and to the pilot burner when the pilot burner is extinguished.

One of the main objects of the present invention is to provide a valve of the class described wherein all of the elements for accomplishing the control and safety shut-off functions are combined into one compact unit to simplify and reduce the cost of manufacture, installation, and service.

Another object of the invention is to provide a valve that will fail safe under all conditions and which will provide 100% shut-off of the burner and pilot burner gas.

Another object of the invention is to provide for safety shut-off in case the pilot burner becomes extinguished for any reason.

Another object of the invention is to provide a valve of the class described wherein the valve member under control of fluid pressure and thermoelectric power for controlling the flow of gaseous fuel to the main burner also acts as a flow interrupter for shutting off the flow of fuel to the main burner while the pilot burner is being ignited.

Another object of the invention is to provide in conjunction with a diaphragm valve for controlling the flow of gaseous fuel to the main burner a thermoelectric safety shut-off valve for shutting off the flow of gaseous fuel both to the main burner and the pilot burner, and means for closing and holding closed the diaphragm valve during resetting of the thermoelectric safety shut-off valve and while the pilot burner is being ignited.

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Another object of the invention is to provide in a valve of the class described an intermediate passage between the valve inlet and the valve outlet, valve seats at opposite ends of said passage, a diaphragm valve movable into and out of seating engagement with one valve seat under the control of fluid pressure and thermoelectric power, a safety shut-off valve movable into and out of seating engagement with the other valve seat, said safety shut-off valve being held open by thermoelectric power and moving to closed position when the thermoelectric power ceases to be sufficient to hold it open, a pilot outlet opening from the intermediate passage between the valve seats, and means for resetting the safety shut-off valve to open position, which means acts also to close and hold closed the diaphragm valve during the resetting operation.

Further objects and advantages of the invention will appear from the following detailed description, taken in connection with the accompanying drawings which show the construction and operation of certain illustrative embodiments of the invention.

In the drawings:

Figure 1 is a sectional view taken in a longitudinal axial plane of a combined control and safety shut-off valve embodying the present invention, and showing the same embodied in an illustrative form of burner system which is shown more or less schematically and on a reduced scale;

Figure 2 is a horizontal section taken generally along the line 2—2 of Figure 1, and with the upper cover of the valve removed;

Figure 3 is a bottom plan view of the valve shown in Figures 1 and 2; and

Figure 4 is a diagram showing more or less schematically one illustrative thermoelectric circuit for thermoelectrically energizing the electromagnet of the safety shut-off valve and the electromagnet for controlling the application of fluid energy to the diaphragm valve, and wherein the latter electromagnet is under the control of a thermostat.

Referring now to the drawings, and first to Figure 1 which shows one form of valve embody-

ing the present invention with the basic elements of a burner system illustrated on reduced scale, the burner shown at 1 is the main burner. It may be the main burner, for example, for a room or space heater, or it may be the main burner for a water heater, or for a floor furnace, an oven burner or any other burner, and of any suitable construction.

A fuel supply pipe 2 leads to the burner 1 for the delivery of gaseous or other fuel thereto, for example, through a mixing chamber 3 to which air is admitted through adjustable air inlets (not shown) as well understood in the art. The flow of gas through the conduit 2 is controlled by a main valve 4 shown in the form of a diaphragm valve.

The diaphragm valve 4 is shown in Figures 1, 2, and 3 as comprising a pair of valve body parts 5 and 6. The valve body part 6 has a gas inlet 7, a gas outlet 8, and an intermediate passage 9 between the inlet 7 and the outlet 8. Contiguous sections of conduit 2 are connected to inlet 7 and outlet 8. The passage 9 has a valve seat 10 at one end and a valve seat 11 at its opposite end. The passage 9 is preferably of flaring or spreading form to give passage 9 larger cross-sectional area at the seat 10 than at the seat 11 for a purpose which will hereinafter appear.

A diaphragm 12 is secured marginally between the valve body parts 5 and 6 and separates the main flow of gas from inlet 7 to outlet 8 from the diaphragm chamber 13 on the opposite side of the diaphragm. The diaphragm 12 carries a main valve member 14 which is adapted to seat upon valve seat 10 to shut off the flow of fuel to the main burner 1 and for movement to position away from valve seat 10 for flow of fuel to the main burner.

The valve body parts 5 and 6 have pasasge means 15 for receiving fuel from the inlet side of the valve 4, and the valve body part 5 has a passage 16 which, when in communication with passage means 15, receives the gaseous fuel from passage means 15 and applies the pressure or energy thereof into diaphragm chamber 13 and thereby to diaphragm 12 to close the valve member 14. The upper end of passage means 15 opens into a passage 17 in auxiliary valve body 18 as best shown in Figure 2. Passage 17 communicates, when, for example, first auxiliary valve means 19 is open, with a passage 20 which communicates with passage 16 for delivering the gas into the diaphragm chamber 13.

Second auxiliary valve means 21, when open, places the interior of the diaphragm chamber 13 in communication with a vent or bleed passage 22 which may lead to atmosphere, or through a conduit into the furnace chamber, or into proximity to the pilot burner 23. The auxiliary valve means 19 is closed when the auxiliary valve means 21 is open, and when the auxiliary valve means 21 is closed the auxiliary valve means 19 is open.

The pilot burner 23 is located in juxtaposition to the main burner 1 to maintain a pilot flame for igniting the main burner. The pilot burner 23 receives its pilot burner supply of gas through a conduit 24 which leads at 25 from the passage 9 between the valve seats 10 and 11 at opposite ends thereof. The pilot burner 23 may be in the form shown and described in the copending application of Stephen L. Kile, Serial No. 693,927, now abandoned, filed August 30, 1946, or in the copending application of Charles E. Hajny, Serial No. 39,339, filed July 1, 1948, or in the copending application of Eugene E. Meusy, Serial No. 146,686, filed February 28, 1950, or of any other suitable form.

Suffice it to state that the pilot burner 23 has one or more orifices at 26 for maintaining one or more flames for igniting the main burner 1 and for heating the one or more hot junctions of a thermoelectric generator 27 which may be in the form of a thermocouple of concentric character as shown and described in Oscar J. Leins Patent No. 2,126,564, issued August 9, 1938, or other form, or in the form of a thermopile.

The form of auxiliary valve means 19 and 21 for controlling entry of gas into diaphragm chamber 13 and venting of gas from this chamber as shown in the drawings, is merely illustrative and, per se, forms no part of the present invention. Mechanisms of this sort are known in the art and the particular form of the mechanism may vary widely within the scope of the present invention.

The thermoelectromagnetic actuator for the valve means 19 and 21 also, per se, forms no part of the present invention. Such thermoelectromagnetic actuators are well known in the art, for example, in general, in Lourdes V. McCarty Patent No. 2,349,443, issued May 23, 1944. Suffice it, therefore, to state that the actuator shown in the drawings is in the form of a magnetic frame comprising a core or coil spool 28 and a coil 29. The electromagnet has an armature 30 which swings to attracted position upon energization of the core 29 by the thermoelectric generator 27. Upon deenergization of the electromagnet the armature 30 swings to retracted position, for example, under the action of spring means 31.

A stem 32, connected to the armature at 33, is reciprocated within the core 28 by swinging movement of armature 30. The opposite end of the stem 32 is pivotally connected at 34 to an actuating arm 35 pivoted at 36. The free end of this arm 35 cooperates at 37 with a member 38 which rocks on a pivot 39. The member 38 carries pins 40, one of which acts to open one valve means 19 when the member 38 is rocked in one direction, with accompanying closing of the other valve means 21. When the member 38 is rocked in the other direction, the other pin 40 opens the other valve means 21 with accompanying closing of the valve means 19.

In Figure 4, one end of the coil 29 is shown connected by a lead conductor 41 to one side of the thermoelectric generator 27. One section of a lead conductor 42 connects the opposite end of coil 29 to one of the contacts 43 of a thermostat 44 or other condition responsive device. The other section of lead conductor 42 is shown connected at one end to the other terminal 45 of the thermostat 44 or other condition responsive device, and as extending and connected at its opposite end to the other side of the thermoelectric generator.

A safety shut-off valve member 46 is adapted to seat, for example, upon valve seat 11 at the adjacent end of passage 9 to shut off the flow of gas both to the main burner through the outlet 8 and to pilot burner 23 through pilot burner outlet 25. The valve member 46 is secured to one end of a carrier member 47, and an armature 48 is secured to the opposite end of the carrier 47.

An electromagnet 49, having a magnet frame 50 and a coil 51, is adapted for holding the armature 48 in attracted position and thereby the valve member 46 open when the thermoelectric generator 27 is heated by the pilot burner flame.

In Figure 4, one end of the coil 51 is shown connected by a lead conductor 52 to lead conductor 41, and the other end of the coil 51 is shown connected by a lead conductor 53 to the adjacent lead conductor section 42. The electromagnet 49 is shown enclosed within a tubular housing 54 having a closure and mounting plate 55 secured by screws as shown in Figure 3, or otherwise as desired, and sealed to valve body part 6 over an opening 56 therein. The outer end of the tubular housing 54 may be closed, for example, by a removable closure and electromagnet mounting cap 57.

A reset button 58 is adapted to be pressed inwardly to move the armature 48 to attracted position and valve member 46 to open position. The reset button 58 and its stem 59 have sliding movement in a member 60 detachably secured and sealed in an opening 61 in the mounting plate 55. The opening through which stem 59 reciprocates may be sealed against gas leakage by suitable packing 62. The inner end of reset stem 59 is connected at 63 to one end of a lever 64 in a manner to permit rocking of the lever relative to the reset stem. The opposite end of the lever 64 is connected at 65 to a pin 66 which pin has sliding movement in carrier member 47. The connection at 65 permits rocking movement of lever 64 relative to pin 66. Between the connections 63 and 65 the lever 64 is pivoted at 67 on a pivot carried, for example, by plate 55.

The pin 66 projects inwardly through valve member 46 and has one leg of a formed or generally U-shaped leaf spring 68 riveted or otherwise secured to it at 69. A similarly formed or generally U-shaped leaf spring 70 has one leg riveted or otherwise secured to the main or diaphragm valve member 14 at 71. The free leg of leaf spring 70 straddles the free leg of leaf spring 68 and has interlocking relation relative thereto. A coiled spring 72, interposed between a flange 74 on carrier member 47 and the inner end of magnet housing 75, moves the valve member 46 to closed position when the energization of the electromagnet 49, by the thermoelectric generator 27, ceases to be sufficient to hold armature 48 in attracted position. A coiled spring 76 moves reset button 58 to its outwardly projecting position when it is released.

The electromagnet comprising core 28 and coil 29 and the related actuating mechanism for valve means 19 and 21 may be enclosed within a cup-shaped cover 77 secured to valve body part 5, for example, by posts 78 and nuts 79. The electromagnet and pivot pin 36 may be supported on mounting plate 80 secured in place between abutments on valve body part 5 and shoulders on posts 78. In Figure 2, circuit connector means is shown at 82 for connecting the electromagnet 49 in circuit with the thermoelectric generator 27, for example, as shown in Figure 5, by lead conductors of coaxial form as shown in the Oscar J. Leins patent previously identified herein. The coaxial conductors are designated by reference characters 52 and 53 which are the same as the reference characters applied to the corresponding lead conductors in Figure 5. A similar circuit connector is shown at 83, and terminal connectors are shown at 84 and 85 for completing the thermoelectric circuits for coil 29, coil 51, thermoelectric generator 27, and for the contacts or terminals 43 and 45 of the thermostat or other condition responsive device.

When the pilot burner 23 is extinguished, the electromagnet having coil 29 and the electromagnet 49 are deenergized. As a result the safety shut-off valve member 46 is in closed position shutting off the flow of gas both to the main burner 1 and pilot burner 26. The valve means 19 and 21 is in position shutting off venting of gas from diaphragm chamber 13 and permitting entry of gas into the diaphragm chamber 13 from the inlet side of the valve 4 through passages 15 and 16. As a result, the diaphragm valve 14 is also in closed position.

With the parts in the foregoing relation, the following sequence is followed to start the system:

The reset button 58 is engaged with the fingers and pressed inwardly. This swings lever 64 in a clockwise direction which moves pin 66 downwardly as the device is viewed in Figure 1. This movement of pin 66 moves the carrier 47 with it, and thus moves armature 48 to attracted position and valve member 46 to open position. Gas thereupon passes through outlet 25 to pilot burner 23, which is then ignited.

Upon ignition of the pilot burner 23 the flame thereof, by heating the one or more hot junctions of the thermoelectric generator 27, energizes the electromagnet 49 to hold the safety shut-off valve 46 in open position. Assuming that the thermostat 44 is calling for heat, its switch is closed and the thermoelectric generator 27 then energizes the electromagnet having coil 29 sufficiently to move valve means 19 and 21 to positions wherein the entry of gas into diaphragm chamber 13 through passages 15 and 16 is shut off and where the diaphragm chamber 13 is vented through vent or bleed passage 22. However, as long as the resetting operation continues (i. e., as long as the reset button 58 is depressed) the leg of spring 68 engages the leg of spring 70, thus holding the diaphragm valve 14 in closed position and preventing flow of gas to the main burner 1 until the resetting operation is completed and the reset button is released. The diaphragm valve 14 is thus utilized to interrupt the flow of gas to the main burner during the resetting operation.

When the electromagnet 49 is energized sufficiently to hold armature 48 in attracted position and safety shut-off valve member 46 in open position, the reset button 58 may be released. Springs 72 and 76 then return reset button 58 to its outwardly projecting position, and pin 66 slides upwardly as the device is viewed in Figure 1, carrying with it the spring 68 so as to release this spring from the spring 70. In this position the gas acts upwardly through the passage 9 from the smaller cross-sectional end thereof, and its energy or pressure on the diaphragm 12 moves the diaphragm valve 14 to open position for the flow of gas to the main burner 1 which is ignited by the pilot burner 26.

If after the system is started the thermostat operates to position where further heat is not desired, it opens the thermoelectric circuit for the electromagnet having the coil 29. As a result the valve means 19 and 21 operates to position shutting off the venting of the diaphragm chamber 13 and permitting entry of gas into the diaphragm chamber 13 from the inlet side of valve 4 through passages 15 and 16. The diaphragm valve 14 then closes to shut off the supply of gas to the main burner, notwithstanding that the electromagnet 49 continues to be energized as long as the thermoelectric generator 27 is heated by the pilot burner flame, whereby the safety shut-off valve 46 is held open for continuing supply of

gas to the pilot burner through the pilot burner outlet 25.

If the pilot burner 23 is extinguished, the safety shut-off valve member 46 closes and thereby shuts off not only the flow of gas to the main burner but also the flow of gas to the pilot burner. This provides 100% safety shut-off for the system.

With the safety shut-off valve 46 open and the pilot burner lighted the thermostat or other condition responsive means is operable automatically to open and close the diaphragm valve 14 independently of the safety shut-off valve 46 which continues open as long as the pilot burner 23 is ignited and electromagnet 49 energized sufficiently to hold armature 48 in attracted position and safety shut-off valve 46 in open position.

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.

I claim:

1. In a burner control valve of the class described, in combination, a valve body having therein a main valve opening, a main valve member operable in the valve body to control the flow of gas through said opening, means operable to open said main valve and to apply the energy of gaseous fuel from the inlet side of the valve to close said main valve member, a safety shut-off valve operable to closed and open positions in said valve body, means for maintaining the safety shut-off valve in open position, means for moving said safety shut-off valve to closed position, means for resetting said safety shut-off valve to open position, and means for holding said main valve closed to interrupt the flow of gas through said main valve opening during resetting of said safety shut-off valve.

2. A burner control valve according to claim 1 wherein there is a first electromagnet for controlling the application of the energy of the gaseous fuel from the inlet side of the valve to close the main valve member, said electromagnet being adapted to be connected in electric circuit with a thermoelectric generator adapted to be subject to the heat of a pilot burner, and a second electromagnet on said valve body and connected in parallel circuit relation with the thermoelectric generator circuit for said first electromagnet and of a character when energized to hold the safety shut-off valve in open position.

3. A burner control valve according to claim 1 wherein the means in the valve body for holding the main valve closed to interrupt the flow of gas through the main valve opening during resetting of the safety shut-off valve comprises a first interlocking member connected to the main valve member and a second interlocking member connected to the resetting means for movement into engagement with said first interlocking member to hold the main valve member closed during operation of the resetting means, and means for unlocking said second interlocking member from said first interlocking member upon completion of the resetting operation.

4. A burner control valve according to claim 1 wherein the means in the valve body for holding the main valve closed to interrupt the flow of gas through the main valve opening during resetting of the safety shut-off valve comprises a first interlocking member connected to the main valve member and a second interlocking member connected to the resetting means for movement into engagement with said first interlocking member to hold the main valve member closed during operation of the resetting means, and wherein the connection between said second interlocking member and the reset means is of a character to free the main valve member for operation to open and closed positions upon completion of the resetting operation of the safety shut-off valve.

5. A burner control valve according to claim 1 wherein the means in the valve body for holding the main valve closed to interrupt the flow of gas through the main valve opening during resetting of the safety shut-off valve comprises a first interlocking member connected to the main valve member and a second interlocking member connected to the resetting means for movement into engagement with said first interlocking member to hold the main valve member closed during operation of the resetting means, and wherein the connection between said second interlocking member and said reset means is of a character to free the main valve member for operation to open and closed positions upon completion of the resetting operation of the safety shut-off valve, and an electromagnet adapted to be energized by a thermoelectric generator to hold the safety shut-off valve in open position.

6. In a control valve, in combination, a pair of valve body parts having a diaphragm secured therebetween, one of said valve body parts having a main fluid inlet, a main fluid outlet, and an intermediate passage therebetween, valve seats at opposite ends of said intermediate passage, a main valve member carried by said diaphragm and movable into and out of engagement with the valve seat at one end of said intermediate passage, a safety shut-off valve movable into and out of engagement with the valve seat at the opposite end of said intermediate passage, reset means for resetting said safety shut-off valve to open position, and interconnecting means between said reset means and said main valve member for holding said main valve member closed during the resetting operation, said interconnecting means being unlocked by release of said reset means.

7. A control valve according to claim 6 wherein the intermediate passage has an intermediate outlet opening therefrom between the valve seats at opposite ends of said passage.

8. A control valve according to claim 6 wherein the safety shut-off valve is carried by a carrier having an armature thereon, and wherein the reset means for said safety shut-off valve comprises a pin having sliding movement in said carrier in at least one direction.

9. A control valve according to claim 6 wherein the safety shut-off valve is carried by a carrier having an armature thereon, and wherein the reset means for resetting the safety shut-off valve comprises a pin having sliding movement in said carrier, and an electromagnet for holding said armature in attracted position and the safety shut-off valve in open position, said shut-off valve and armature having movement to open and attracted positions respectively with the movement of the pin in one direction and the pin having movement relative to the safety shut-off valve and armature in the opposite direction.

10. In a control valve having an inlet and an outlet, in combination, means defining a pas-

sage having valve seats at its opposite ends, a main valve means for effecting movement of said main valve into and out of engagement with one valve seat, a safety shut-off valve movable into and out of engagement with the other valve seat, a pin having sliding movement in said safety shut-off valve in one direction and moving said safety shut-off valve with it to open position upon movement of the pin in the opposite direction, a first interlocking member connected to the main valve member, means for actuating said pin in a direction to open said safety shut-off valve and a second interlocking member connected to said pin for movement into engagement with said first interlocking member to hold the main valve member closed upon such actuation of said pin.

11. A control valve according to claim 10 wherein there is an electromagnet for holding the safety shut-off valve in open position, and means for moving said pin relative to the safety shut-off valve to release the second interlocking member from the first interlocking member for operation of the main valve to open and closed positions upon release and movement of the pin in a direction opposite the direction of movement of the pin which moves the safety shut-off valve with it to open position.

12. A control valve according to claim 10 wherein the means for actuating said pin in a direction to open said safety shut-off valve comprises a reciprocatory reset member, and a pivoted lever connected to said reset member and to the pin.

13. In a valve of the class described, in combination, a valve body having a valve opening, a first valve seat at one end of said opening, a second valve seat at the opposite end of said opening, a first valve member, a second valve member, means for effecting movement of said first valve member to closed position against said first seat and to open position separated from said first seat, means for moving said second valve member to closed position against said second seat, actuating means for moving said second valve member to open position separated from said second seat and for holding said second valve member in open position, and cooperating means on said first valve member and said actuating means and operable to hold said first valve member closed against its seat when said actuating means is in position holding said second valve member in open position separated from its seat.

14. A valve according to claim 13 wherein the cooperating means for holding the first valve member closed against its seat when the actuating means is in position holding the second valve member in open position comprises cooperating generally U-shaped leaf springs disposed in the valve opening.

15. A valve according to claim 13 wherein the first valve member is carried by a diaphragm with the valve opening side of the valve on one side of the diaphragm and separated by the diaphragm from a chamber on the opposite side of the diaphragm; the means for effecting movement of the first valve member to its closed and open positions comprising condition responsive means for passing fuel into the chamber on the opposite side of the diaphragm and for venting the fuel from said chamber.

16. A valve according to claim 13 wherein the valve opening is of flaring form to provide larger cross-sectional area at the first valve seat than at the second valve seat.

17. In combination, an armature, a first valve member connected to said armature, an electromagnet adapted to be energized by heating of a thermoelectric generator and, when energized, to hold said armature in attracted position and said first valve member in open position, said first valve member being movable to closed position and said armature being movable to retracted position upon deenergization of said electromagnet, reset means for resetting said armature to attracted position and said first valve member to open position, a condition-responsive valve, valve seat means for said first valve member and said condition-responsive valve, and interconnecting means between said reset means and said condition-responsive valve and operable to hold said condition-responsive valve closed during the resetting operation of said rest means.

18. In a valve of the class described, in combination, a valve body having an opening provided with a valve seat, a valve member, a pin slidable in said valve member in one direction and having an abutment engageable with said valve member to open the same upon movement of said pin in the opposite direction, first means for holding said valve member in open position, second means for moving said pin in a direction to move said valve to open position and into holding cooperation with said holding means, and third means for moving said valve member to closed position against said seat but only upon release of said first and second means.

19. In a diaphragm valve of the type having a diaphragm operatively associated with a valve member controlling a flow of fluid and electromagnetic means powered by a source of small electric energy for controlling the pressure condition to which one side of said diaphragm is subjected, safety shut-off means operable to shut off said flow of fluid upon extinguishment of a flame, cocking means for cocking said safety shut-off means to fluid flow permitting position, and means operable by the cocking operation of said cocking means to close the valve member operatively associated with said diaphragm and to hold same closed independently of fluid pressure whereby to interrupt said flow of fluid during the cocking operation.

20. In a diaphragm valve of the type having a diaphragm operatively associated with a valve controlling a flow of fluid and electromagnetic means powered by a thermoelectric generator subject to the heat of a flame for controlling the pressure condition to which one side of the diaphragm is subjected, safety shut-off means operable to shut off said flow of fluid upon extinguishment of a flame including an armature and an electromagnet operatively associated with said armature, said electromagnet being powered by said thermoelectric generator and connected in parallel circuit relation with respect to said electromagnetic means, cocking means for cocking said safety shut-off means to fluid flow permitting position, and means operable by the cocking operation of said cocking means to close the valve member operatively associated with said diaphragm and to hold same closed independently of fluid pressure during the cocking operation.

21. Apparatus for controlling a flow of fluid comprising, in combination, a fluid pressure operated valve and a safety shut-off valve both in the same path of fluid flow, first electromagnetic means powered by a source of small electric energy for varying the pressure condition to which one side of said fluid pressure operated valve is

subjected for operation of said fluid pressure operated valve to flow permitting position upon occurrence of one condition and to flow preventing position upon occurrence of another condition, second electromagnetic means adapted when energized to hold said safety shut-off valve in flow permitting position, said safety shut-off valve being biased to flow preventing position to interrupt said flow of fluid when said second electromagnetic means is deenergized, cocking means for cocking said safety shut-off valve to flow permitting position, and means operable by the cocking operation of said cocking means to close said fluid pressure operated valve and to hold same closed independently of fluid pressure whereby to interrupt said flow of fluid during said cocking operation.

22. Apparatus according to claim 21 wherein said second electromagnetic means is powered by the same source of small electric energy which powers said first electromagnetic means.

23. Apparatus for controlling flow of fuel to fluid fuel burning apparatus having a main burner and an ignition burner comprising, in combination, means defining a first fuel supply passage and a second fuel supply passage, a safety shut-off valve having closed position shutting off flow of fuel through both said first fuel supply passage and said second fuel supply passage, a diaphragm valve including a diaphragm operatively associated with a main valve having closed position shutting off only the flow of fuel through said first fuel supply passage and open position permitting supply of fuel through said first fuel supply passage when said safety shut-off valve is open, said safety shut-off valve having open position permitting supply of fuel through said second fuel supply passage irrespective of whether said diaphragm valve is open or closed, first electromagnetic means powered by a source of small electric energy for controlling the pressure condition to which one side of said diaphragm is subjected, second electromagnetic means adapted when energized to hold said safety shut-off valve in open position, cocking means for cocking said safety shut-off valve to open position, and means operable by the cocking operation of said cocking means to close said main valve associated with said diaphragm and to hold same closed independently of fluid pressure during said cocking operation.

24. Apparatus according to claim 23 wherein there is a condition responsive means in circuit with and controlling said first electromagnetic means.

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