

March 17, 1942.

H. F. ALFERY
THERMO-ELECTRIC SAFETY SHUT-OFF VALVE AND
THERMALLY OPERATED CONTROL THEREFOR
Filed Jan. 26, 1938

2,276,909

3 Sheets-Sheet 1

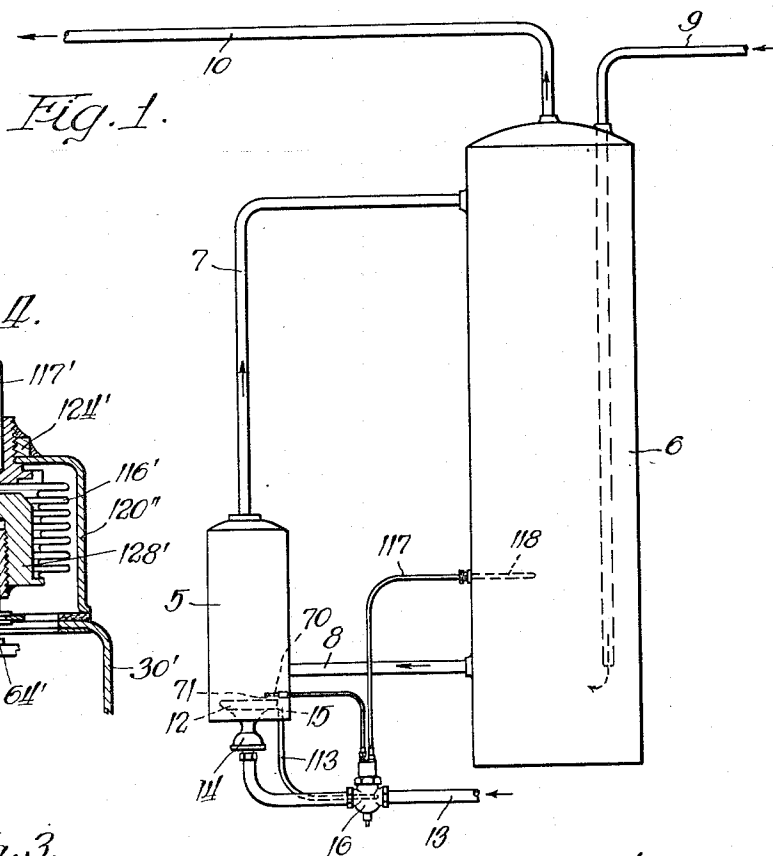


Fig. 1.

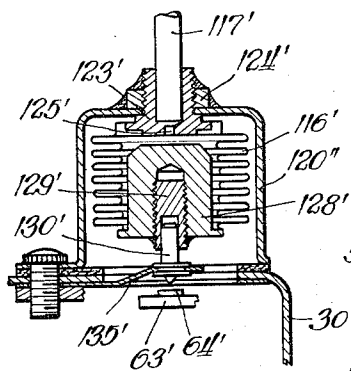


Fig. 4.

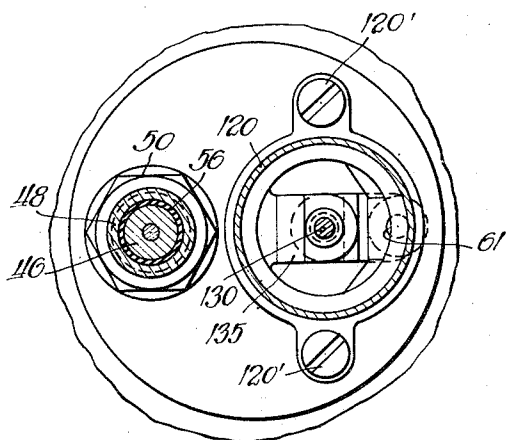


Fig. 3.

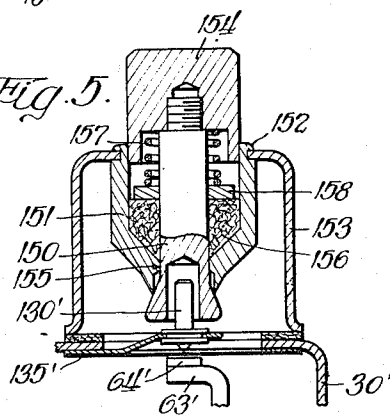


Fig. 5.

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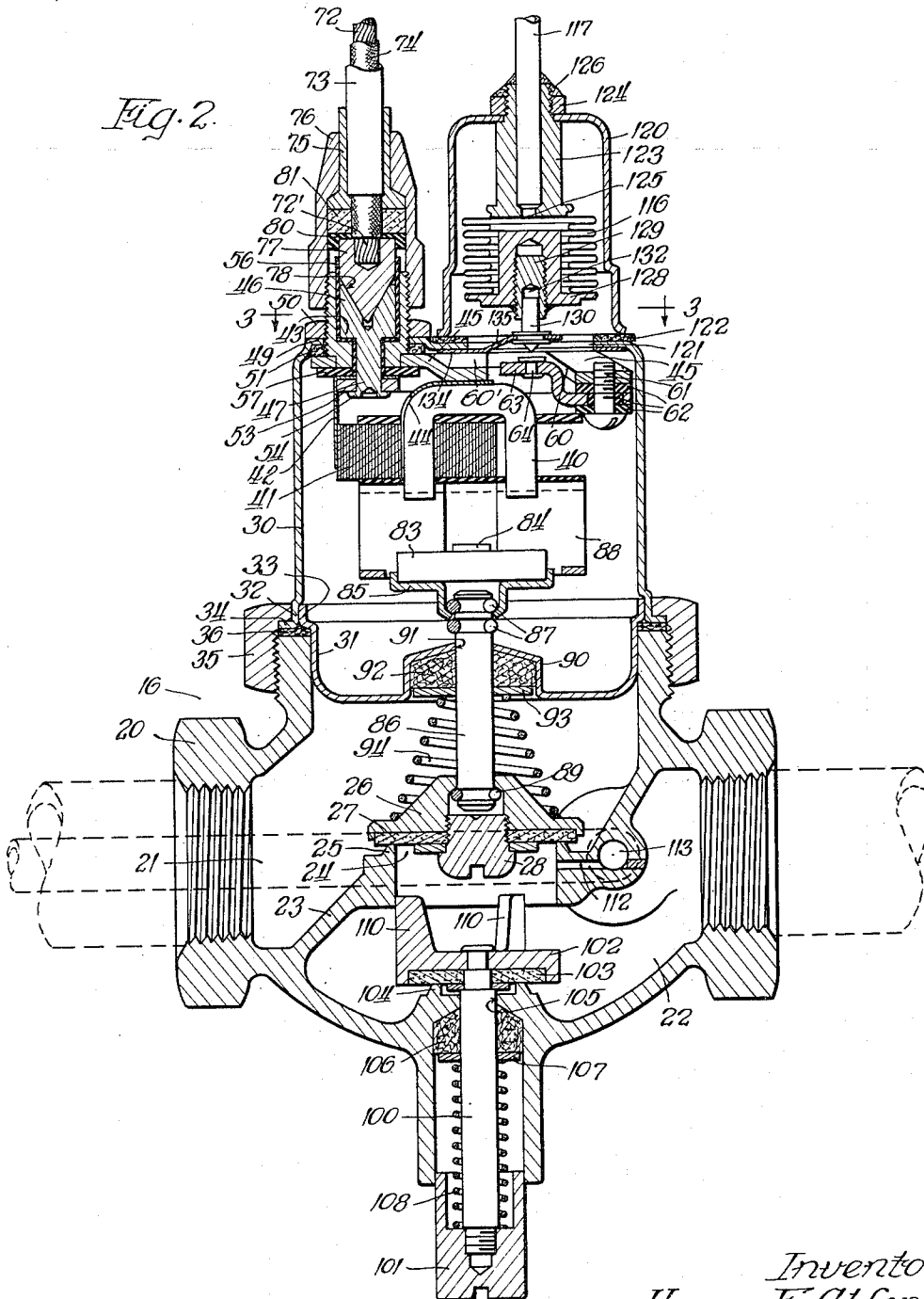
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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

Fig. 6.

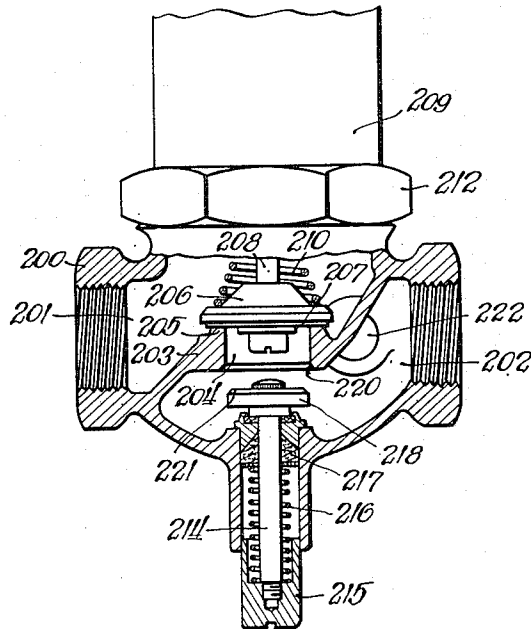
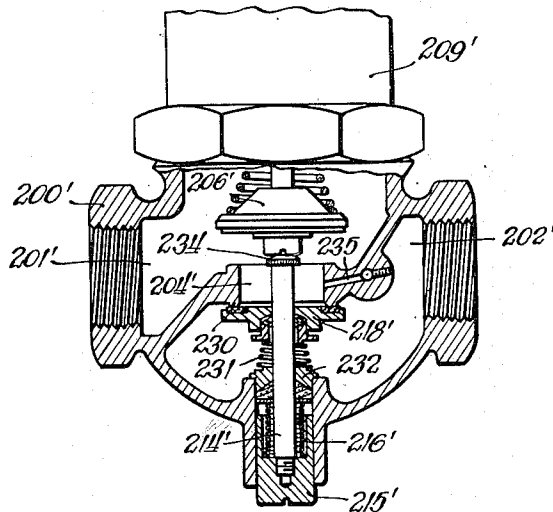


Fig. 7.



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UNITED STATES PATENT OFFICE

2,276,909

THERMOELECTRIC SAFETY SHUTOFF
VALVE AND THERMALLY OPERATED
CONTROL THEREFORHenry F. Alfery, Milwaukee, Wis., assignor to
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Application January 26, 1938, Serial No. 186,967

8 Claims. (Cl. 175—335)

This invention relates to a thermo-electric safety shut-off valve and thermally operated control therefor.

While the particular device which I shall describe hereinafter in connection with the drawings is a thermo-electric safety shut-off valve and thermally operated control adapted for use with water heaters and the like, it is to be understood that the invention is not limited to this particular use but may be employed in all equivalent or similar work, or elsewhere as suitable or desired.

One of the main objects of the invention is to provide a thermo-electric safety shut-off valve for shutting off the supply of gaseous fuel to the main burner for the water heater when the pilot burner for said main burner is extinguished, and thermally operated means for rendering the thermo-electric means ineffective to hold the thermo-electric valve open by the heat of the pilot flame when the water is heated to the temperature at which said thermally operated means is operable.

It is also an object of the invention to provide means for shutting off, or substantially shutting off, the supply of gaseous fuel to the main burner during resetting of the armature of the thermo-electric device into contact with the pole faces of the magnetic frame and the thermo-electric valve to open position, and means for by-passing gaseous fuel for the pilot burner to said pilot burner while the means for shutting off, or substantially shutting off, the supply of gaseous fuel to the main burner is operable during the resetting operation and wherein, at the same time, the thermo-electric valve operates to shut off not only the supply of gaseous fuel to the main burner but also the supply of gaseous fuel to the pilot burner when the pilot burner is extinguished.

Another object of the invention is to provide means for manually rendering the thermo-electric means ineffective to hold the thermo-electric valve open by the heat of the pilot flame.

Further objects and advantages of the invention will be apparent from the following detailed description taken in connection with the accompanying drawings, in which:

Figure 1 is a side elevational view of a water heater system, showing an embodiment of the present invention in connection therewith;

Figure 2 is a vertical section through the thermo-electric safety shut-off valve and thermally operated control therefor;

Figure 3 is a fragmentary horizontal section taken on the line 3—3 of Figure 2;

Figure 4 is a fragmentary vertical detail sec-

tion showing a more compact arrangement of the Sylphon or corrugated bellows which operates to render the thermo-electric means ineffective to hold the thermo-electric valve open by the heat of the pilot flame, and a more compact hood of reduced height therefor;

Figure 5 is a fragmentary vertical section similar to Figure 4, showing manual means for rendering the thermo-electric means ineffective to hold the thermo-electric valve open by the heat of the pilot flame;

Figure 6 is a vertical section through another form of valve and reset means therefor; and

Figure 7 is a vertical section similar to Figure 6 showing another form of valve and reset means therefor.

Referring to the drawings, the water heater system shown in Figure 1 may be of any existing or other suitable or preferred type. The particular system shown comprises a heating coil, indicated at 5, and a hot water tank 6. The top of the coil 5 is connected to the tank 6 near the top thereof by a pipe 7 which delivers the hot water from the coil 5 to the tank 6. The tank 6 is connected near the bottom with the lower portion of the coil 5 by a pipe 8 which delivers the cold water from the tank 6 to the coil 5. The tank 6 has a cold water inlet pipe 9 for delivering cold water to the tank 6, and a hot water outlet pipe 10 extends from the top of the tank 6 for delivering the hot water therefrom.

Underlying the bottom of the coil 5 to heat the water in this coil is a main burner 12. The gas supply pipe for supplying gaseous fuel to the burner 12 is indicated at 13. The gaseous fuel supply line has connection to the burner 12 through a feed pipe, having at its outer end a mixing chamber 14, to the outer end of which air is admitted, as well understood in the art. The main burner 12 is provided with a pilot burner 15 located in proximity thereto for maintaining a pilot flame in proximity to the main burner to ignite the same in case it is accidentally extinguished. This pilot burner assures that the main burner is ignited so long as there is a supply of gaseous fuel thereto.

A thermo-electric valve device, indicated at 16, is provided in the gaseous fuel supply line 13 for shutting off the supply of gaseous fuel to the main burner 12 when the pilot burner 15 is extinguished. This thermo-electric valve device 16 has thermally operated means connected thereto for rendering the thermo-electric means of the device 16 ineffective to hold the thermo-electric valve open by the heat of the pilot flame when

the water is heated to the temperature at which the thermally operated device is operable.

The thermo-electric valve device 16 comprises a valve body 20 provided with an inlet chamber 21 and with an outlet chamber 22. The partition 23, intermediate these chambers 21 and 22, has a valve opening 24 provided on the inlet side with a surrounding valve seat 25. The flow of gaseous fuel through the valve opening 24 is controlled by a valve member 26 provided with a leather or other suitable valve seating member 27 which engages the valve seat 25 when the valve is closed. The seating member 27 is secured to the valve member 26 by a screw 28.

Mounted upon the top of the valve body 20 is a housing comprising a downwardly opening cup-shaped bell 30, and an upwardly opening cup-shaped shell 31. The shell 30 has an enlarged lower end 32 fitting telescopically over the enlarged upper end 33 of the shell 31. The lower end of the shell 30 has an outwardly extending annular flange 34, and the two shells are clamped in place to the top of the valve body 20 by a nut member 35, a suitable sealing gasket being preferably provided as indicated at 36.

A generally U-shaped magnetic frame member 40 is mounted in the shell or hood member 30, and this magnetic frame member 40 is provided with an electromagnetic coil indicated at 41. The coil 41 surrounds one of the legs of the magnetic frame member 40, and one terminal of the coil is connected to a terminal stud 43. The other terminal of the coil 41 is connected at 44 to a metallic terminal plate 45. The stud 43 has an enlarged upper end 46 and a reduced stem 47 depending therefrom. This stud fits in a correspondingly formed bushing member 48, which bushing member is externally threaded and clamped in place in an opening 49 in the top of the shell 30 by nut members 50 and 51.

The lower end of the bushing 48, which constitutes a terminal bushing, is reduced, and this reduced lower end of the bushing fits in an opening in the plate member 45. A second terminal plate 53 underlies the plate 45 and is secured with the plate 45 to the bushing 48 by extending the reduced lower end of the stud 43 through an opening in the plate 53 and heading the lower end of the stud over, as indicated at 54, or otherwise as desired. The stud 43 is insulated from the bushing 48, and the plate members 45 and 53 are insulated from each other by insulation indicated at 56 and 57. The terminal of the coil 41, which is connected to the terminal stud 43, is clamped in place between the insulation at 57 and the plate member 53.

The plate member 45 has an opening 60 and is depressed at 60' to provide a support for the magnetic frame 40 which is secured thereto in any suitable or desired manner. The plate member 53 is depressed and secured to the plate member 45 by a screw 61, the plate members 45 and 53 being insulated from each other and from the screw 61 by insulation indicated at 62. The plate 53 also has a lug 63 struck up therefrom into the opening 60 in the plate 45 but out of contact with said plate 45. This lug 63 has a contact member 64 for a purpose which will presently appear.

The thermocouple, indicated at 70, may be of any existing or other suitable or preferred form—for example, of the general type more fully disclosed in Oscar J. Leins Patent No. 2,126,564, issued August 9, 1938, or in the copending ap-

plication of John H. Thornbery, Serial No. 37,276, filed August 22, 1935. The hot junction 71 of the thermocouple is disposed in proximity to the pilot burner 15 so as to be responsive to the heat of the pilot flame for the main burner 12 at all times. The internal element of the thermocouple is suitably joined to the lead wire 72 (Figure 2) which constitutes one part of the lead connection between the coil 41 and the thermocouple. The other part of this lead connection comprises a metallic tube 73 suitably connected to the external element of the thermocouple. The lead tube 73 is insulated from the lead wire 72 by the insulation on this wire as indicated at 74.

At its opposite end the metallic tube 73 enters and is connected at 75 to a metallic thimble member 76 having threaded engagement on the outer externally threaded end of the terminal bushing 48. The adjacent end of the lead wire 72 has metallic connection at 72' to a terminal member 77. This terminal member 77 has a conical end 78 which seats in a recess of corresponding conical form in the outer end of the terminal stud 43 and forms the metallic contact between the member 77 and the stud 43. The terminal member 77 may be held centered in the thimble member 76 at its outer end by a centering member 80 fitting within the thimble and engaging the upper end of the member 77 as shown. Suitable insulation is provided as indicated at 81, and the conical end of the terminal 77 is clamped in contact with the conical recessed surface of the stud 43 by the thimble 76.

From the foregoing description and the drawings, it will now be apparent that the internal element of the thermocouple 70 is connected through lead wire 72, terminal member 77, stud 43, and connection 42, to one terminal of the coil 41, and that the external element of the thermocouple is connected through the thimble 76, terminal bushing 48, metallic terminal plate 45, and connection 44 to the other terminal of the coil 41.

The free ends of the magnetic frame member 40 constitute pole faces, and the magnet armature 83 is held against these pole faces by the magnetic field produced in the frame 40 by the thermo-electric current set up in the coil 41 due to the action of the heat of the pilot flame on the hot junction 71 of the thermocouple when the pilot flame is burning. The armature 83 has attached thereto, by upwardly extending bent-over portions 84, a cradle 85 which, in turn, is connected to the upper end of the valve stem 86, preferably for limited universal movement, by means of U-shaped retainers 87 engaging in grooves in the upper end of the stem 86. The armature 83 is guided for reciprocating movement by an armature guide 88, and the valve member 26 is connected to the lower end of the stem 86, preferably for limited universal movement with respect to the stem, by means of a retainer 89 engaging in a groove in the valve stem.

The bottom wall of the shell 31 is depressed at 90 and provided with an opening 91 in which the stem 86 has reciprocating movement. The opening 91 is sealed against the leakage of gas from the valve body 20 and into the enclosure formed by the shells 30 and 31 by suitable packing indicated at 92. A washer is provided at 93, and surrounding the valve stem 86 and interposed between the washer 93 and the valve member 26 is a generally conically coiled spring 94. This spring 94 compresses the packing 92, and when

the coil 41 is deenergized, the spring 94 moves the valve member 26 to closed position against the seat 25 to shut off the supply of gaseous fuel to the main burner 12 and pilot burner 15.

For the purpose of resetting the device after the coil 41 is deenergized and the valve 26 closed, a resetting stem 100 is mounted for sliding movement in the valve body 20 in axial alignment with the valve member 26. Secured upon the lower end of the stem 100 is a resetting button 101, and fixed upon the upper end of the stem is a valve member 102. The valve member 102 has a valve seating surface 103 which engages an annular valve seat 104 to prevent leakage of gas through the opening 105 in which the stem 100 operates. This opening 105 is additionally sealed against the leakage of gas by suitable packing indicated at 106. A washer is provided at 107, and surrounding the stem 100 and interposed between the washer 107 and the resetting button 101 is a coiled spring 108 which holds the valve member 102 against the seat 104 and the button 101 in the position shown.

The valve member 102 has upstanding lugs 110 which, in the resetting operation, engage the valve member 26 and force the same to open position away from its seat 25 and the armature 83 into engagement with the pole faces of the magnetic frame 40 against the tension of the spring 94. The lugs 110 may have sliding movement in the valve opening 24 for the purpose of guiding the valve member 102 and resetting stem 100. When the resetting stem has been pressed upwardly sufficiently to bring the armature 83 into contact with the magnetic frame 40, the valve member 102 preferably shuts off, or substantially shuts off, the flow of gaseous fuel through the valve opening 24. This eliminates the flow of gaseous fuel from the main burner 12 until the pilot burner is ignited and the coil 41 is energized to hold the armature 83 against the magnetic frame 40 and the valve 26 in open position.

The valve body 20 has a passageway 112 connected to a tube or gas supply line 113 for delivering gaseous fuel to the pilot burner 15. This passageway 112 by-passes the valve member 102 to provide a supply of gaseous fuel to the pilot burner 15 when the valve 102 is in raised position, shutting off, or substantially shutting off, the flow of gaseous fuel to the main burner 12 during the resetting operation. At the same time this passageway 112 is so disposed that the valve member 26 operates to shut off not only the supply of gaseous fuel to the main burner 12, but also the supply of gaseous fuel to the pilot burner 15 when the valve member 26 is closed against its seat 25.

The thermally operated control for the thermo-electric shut-off valve comprises a corrugated metallic bellows 116 connected by a tube 117 with a bulb or chamber 118. The bellows 116, tube 117 and bulb 118 contain a sensitive fluid, preferably a liquid, the expansion and contraction of which, whether by evaporation and condensation or otherwise, results in expansion and contraction of the bellows 116.

The bulb or chamber 118 is disposed where it is subject to the temperature of the hot water—for example, in the tank 6 as shown in Figure 1. The bellows 116 is located in a hood 120 mounted over an opening 121 in the top of the shell 30, with a gasket 122 interposed therebetween. The upper end of the bellows 116 has fluid-tight connection with the lower end of a sleeve member 123, the upper reduced and threaded end of which

extends through an opening in the top wall of the hood 120 and is clamped thereto by a nut 124. The adjacent end of the tube 117 extends into the sleeve 123 and has communication with the interior of the bellows 116 through an opening 125, and a suitable wiping or other means at 126 seals the joint between the tube 117 and the sleeve 123.

The lower end of the bellows 116 has fluid tight connection with the outwardly extending flange on the thimble member 128. This thimble member 128 has an internally threaded recess in which a stud 129 has threaded engagement, and the stud 129 has an axial recess in which is mounted a contact pin 130, the lower end of which, in the specific use of the device herein described, is adapted to be forced into engagement with the contact 64 by the expansion which results in the bellows 116 when the water in the tank 6 reaches the temperature at which the thermally operated control is set to operate. The particular temperature at which the contact 130 engages the contact 64 may be adjusted by adjusting the stud 129 in the thimble 128, or otherwise as desired, there being some lost motion between the stud 129 and the contact stem 130 as shown at 132 in the particular setting illustrated.

An annular resilient sheet metal member 134 is clamped in place between the undersurface of the top of the shell 30 and the metallic plate 45. This member 134 has a resilient ear 135 in which the contact pin 130 is mounted. As the bellows 116 expands, the thimble 128 moves downwardly and carries with it the stud 129 which slides upon the pin 130 until the lost motion at 132 is taken up and the stud 129 engages the upper end of the contact pin 130. The contact 130 is then moved downwardly, depressing the ear 135 with it, and when the water in the tank 6 reaches the temperature at which it is desired to render the thermo-electric device ineffective to hold the valve member 26 open by the heat of the pilot flame, the contact 130 engages the contact 64. This short-circuits the thermo-electric current before it reaches the coil 41, i. e., from the lead tube 73 of the thermocouple through thimble 76, bushing 48, shell 30, metallic plate 45, member 134, contacts 130 and 64, and metallic plate 53, to the stud 43 and through terminal member 77 to the lead wire 72.

This short-circuiting of the thermo-electric current before it reaches the coil 41 deenergizes this coil, and the spring 94 moves the valve member 26 to closed position and the armature 83 downwardly away from the magnetic frame 40 to the position shown in Figure 2. When the temperature of the water drops, the flexible metallic bellows 116 contracts, and the ear 135, by its inherent resiliency, moves the contact 130 upwardly out of engagement with the contact 64.

It is to be understood that the fluid fill within the bellows 116, tube 117, and bulb 118 may work the other way, i. e., it may contract and break contact thereby instead of expanding to make contact as described. In other words, the fill may operate to expand the bellows, or it may operate to contract or produce a contraction of the same.

Where the fill operates to expand the bellows, such bellows may be contracted by its inherent resilience or by means of a spring, or a combination thereof, and where the fill operates to contract or produce a contraction of the bellows, such bellows may be expanded by its inherent resilience or by means of a spring, or a combina-

tion thereof. In other words, the bellows may be worked either way by the fill, and it may work either by its inherent resilience or by a spring, or by its inherent resilience with the aid of a spring.

The operation of the device is as follows:

When it is desired to ignite or reignite the main burner 12 with the parts positioned as shown in Figure 2, the resetting button 101 is manually pushed upwardly. This moves the valve member 26 upwardly away from its seat 25 and the armature 83 into contact with the magnetic frame 40 where it is held by holding the button 101 in raised position. In this raised position of the resetting stem 100, the valve 102 shuts off, or substantially shuts off, the flow of gaseous fuel to the main burner 12 to prevent the escape of gaseous fuel from the main burner during the resetting operation.

The valve member 26 is open, however, at this time, and the passageway 112 by-passing the valve 102 sets up the desired supply of gaseous fuel to the pilot burner 15 where it can be ignited as it issues from the pilot burner by applying a match or otherwise as desired. The resulting pilot flame energizes the thermocouple 70, creating a thermo-electric current which energizes the coil 41 and causes the armature 83 to be held against the magnetic frame 40 and the valve 26 to be held in open position against the tension of the spring 94. When the coil is so energized to hold the valve 26 open, the resetting button 101 is released and the spring 108 moves the resetting stem 100 downwardly to the position shown in Figure 2, and with it the valve 102 to open position.

The gaseous fuel then flows through the valve opening 24 and out through the fuel supply line to the feed pipe to which air is admitted, and the gaseous mixture enters the main burner 12 where it is ignited by the pilot burner 15 as it issues from the ports of the main burner. In case the main burner 12 is accidentally extinguished, the pilot burner 15 will reignite the same, and thereby assures that the main burner is lighted so long as the valve 26 is open.

If the pilot burner is extinguished, the thermo-electric current through the coil 41 diminishes to such a degree that the armature is released, whereupon the spring 94 forces the valve member 26 into engagement with the valve seat 25, thereby shutting off the flow of fuel to the main burner 12 and to the pilot burner 15.

If, on the other hand, with the pilot burner 15 ignited and the valve 26 held open by the thermo-electric current developed by the pilot burner, the water in the tank 6 is heated to the temperature at which the thermally operated control is operable, the expansion of the metallic bellows 116 engages the contact 130 with the contact 64, and thereby short-circuits the thermo-electric current before it reaches the coil 41. The coil is thus deenergized and the spring 94 forces the valve 26 to closed position.

While the fluid type thermostat, with its bulb in the tank 6 and the connected corrugated bellows at the thermo-electric shut-off device as indicated in the drawings, is preferred, it is understood that the thermostat or thermally operated control for the thermo-electric shut-off valve may be of any other suitable or desired type, such as the bimetallic or rod and tube type thermostats well known in the art.

The corrugated metallic bellows arrangement shown in Figure 4 is similar to the corrugated

metallic bellows arrangement shown in Figure 2 except that the supporting sleeve 123' and the hood 120' are shortened to provide a more compact arrangement. The other parts are designated by primed reference characters corresponding to the reference characters used in Figure 2.

The manually operable device shown in Figure 5 for rendering the thermo-electric device ineffective to hold the thermo-electric valve open by the heat of the pilot burner comprises a plunger 150 recessed to engage over the contact pin 130'. The plunger is mounted for sliding movement in a sleeve member 151 secured at 152 in the top of the hood 153, and the outer end of the plunger has a button 154 fixed thereon. The opening 155 in which the plunger 150 has sliding movement is sealed by suitable packing 156, and this packing is compressed by a coiled spring 157 which is interposed between the washer 158 and the button 154 and holds the button in its upper projected position.

In this embodiment of the invention, by manually pressing the button 154 downwardly, the contact 130' is engaged with the contact 64' to short circuit the thermo-electric current ahead of the coil 41 at will. This short-circuiting of the thermo-electric current ahead of the coil 41 deenergizes this coil, and the spring 94 moves the valve 26 to closed position as before.

The valve body 200 shown in Figure 6 has an inlet chamber 201, an outlet chamber 202, and an intermediate partition 203 provided with a valve opening 204. On the inlet side, the valve opening 204 has a surrounding valve seat 205. The flow of fuel through the valve opening 204 is controlled by a valve member 206 provided with a leather or other suitable valve seating member 207 which engages the valve seat 205 when the valve is closed. The valve member 206 is connected to valve stem 208 which, in turn, is connected at its upper end to an armature which, as in Figure 2, when held attracted to an electromagnet within the shell 209, holds the valve member 206 open. When the pilot burner is extinguished the thermo-electric current which passes through the coil means of the electromagnet diminishes to such degree that the armature is released and the spring 210 moves the valve member 206 to closed position. The nut member 212 corresponds with the nut member 35 in Figure 2.

The resetting stem 214 and its button 215, as well as the spring 216 and packing 217, are similar to corresponding parts in Figure 2. The valve member 218, instead of being formed and provided with upstanding lugs as shown in Figure 2, is formed to enter the valve opening 204 when the resetting stem is projected upwardly in the resetting operation. To guide the valve member 218 into the opening 204, the bottom of the valve opening is preferably chamfered at 220 and the top of the valve member 218 is similarly chamfered at 221.

The valve member 218 preferably fits relatively loosely in the opening 204 so that when it is positioned in the opening 204 upon projecting the resetting stem upwardly to move the armature into attracted position and the valve member 206 to open position, a restricted supply of fuel for maintaining the pilot flame may flow past the valve member 218. The pilot connection for delivery of this restricted supply of fuel to the pilot burner is shown more or less diagrammatically at 222. It is to be understood that the pilot connection shown is diagrammatic and that

the connection for delivering the restricted supply of gas which passes the valve 218 when it is positioned in the valve opening 204 may be of any suitable or preferred form.

In Figure 7 the valve member 218', which shuts off the supply of fuel to the main burner during the resetting operation, seats upwardly against a valve seat 230 on the outlet side of the valve opening 204'. The valve member 218', instead of being fixed upon the resetting stem 214' as in the preceding embodiments of the invention, is loose on the resetting stem 214' so that the stem may slide upwardly therethrough in the resetting operation. A spring 231, interposed between the valve member 218' and the gland member 232, moves the valve member 218' yieldingly to closed position when the stem 214' is projected upwardly to reset the armature to attracted position and the valve member 206' to open position.

Upon completion of the resetting operation and release of the button 215', the spring 216' returns the resetting stem to its downwardly projected position, and in so doing, the head 234 at the upper end of the stem 214', by engagement with the valve member 218', moves this valve member to open position against the tension of the spring 231, the spring 216' being sufficiently stronger than the spring 231 to provide this action.

When the valve member 218' is closed, a passageway 235 by-passes the valve member 218' to provide a restricted supply of fuel for the pilot burner. This by-pass passageway 235, instead of being formed in the partition 203' of the valve body 200', may open through the valve member 218', or may be arranged otherwise as suitable and desired.

I do not intend to be limited to the precise details shown or described.

I claim:

1. In a device of the class described, in combination, a thermoelectric generator, a hood, a first conducting member disposed within said hood and connected in circuit with one side of said thermoelectric generator, a second conducting member disposed within said hood and insulated from said first conducting member and connected in circuit with the other side of said thermoelectric generator, an electromagnet disposed within said hood and having a magnet frame supported by said first conducting member, and a coil for said magnet frame, said coil having its terminals connected in circuit with the opposite sides of said thermoelectric generator, a contact on one of said conducting members, a resiliently supported contact connected, within said hood, in circuit with the other conducting member, and means for moving said resiliently supported contact into engagement with the other contact for closing the thermoelectric circuit ahead of said electromagnet to short circuit the electromagnet.

2. In a device of the class described, in combination, a thermoelectric generator, a hood having an end wall, a first conducting plate disposed within said hood adjacent the end wall thereof and connected in circuit with one side of said thermoelectric generator, a second conducting plate disposed within said hood adjacent said first plate and insulated from said first plate and connected in circuit with the other side of said thermoelectric generator, an electromagnet disposed within said hood and having a magnet frame supported by said first conducting plate, and a coil for said magnet frame, said coil having

its terminals connected in circuit with the opposite sides of said thermoelectric generator, a first contact on one of said conducting plates, a spring contact arm clamped between the other conducting plate and the end wall of the hood and in circuit with said other conducting plate, a second contact carried by said spring arm and normally held yieldingly out of engagement with said first contact, and means operable through the end wall of said hood for moving said second contact into engagement with said first contact for closing the thermoelectric circuit ahead of said electromagnet to short circuit the electromagnet.

3. In a device of the class described, in combination, a thermoelectric generator, a hood having an end wall provided with an opening, a first conducting plate disposed within said hood adjacent the end wall thereof and connected in circuit with one side of said thermoelectric generator, a second conducting plate disposed within said hood adjacent said first plate and insulated from said first plate and connected in circuit with the other side of said thermoelectric generator, an electromagnet disposed within said hood and having a magnet frame supported by said first conducting plate, and a coil for said magnet frame, said coil having its terminals connected in circuit with the opposite sides of said thermoelectric generator, a first contact on one of said conducting plates, a spring contact arm clamped between the other conducting plate and the end wall of the hood and in circuit with said other conducting plate, a supplemental hood attached to the end wall of said first hood over the opening therein, a thermostat bellows disposed within said supplemental hood, a tube opening into said bellows at one end and extending to a temperature sensitive bulb, a thimble member having fluid tight connection with the opposite end of said bellows and disposed within said supplemental hood, and a second contact carried by said spring arm adjacent the opening in the end wall of said hood, said second contact being normally held yieldingly out of engagement with said first contact and cooperable with said thimble member to be moved by said thimble member upon expansion of said bellows into engagement with said first contact for closing the thermoelectric circuit ahead of said electromagnet to short circuit the electromagnet.

4. In a device of the class described, in combination, a thermoelectric generator, a hood having an end wall provided with an opening, a first conducting plate disposed within said hood adjacent the end wall thereof and connected in circuit with one side of said thermoelectric generator, a second conducting plate disposed within said hood adjacent said first plate and insulated from said first plate and connected in circuit with the other side of said thermoelectric generator, a first contact on one of said conducting plates, a spring contact arm clamped between the other conducting plate and the end wall of the hood and in circuit with said other conducting plate, a supplemental hood attached to the end wall of said first hood over the opening therein, a thermostat bellows disposed within said supplemental hood, a tube opening into said bellows at one end and extending to a temperature sensitive bulb, a thimble member having fluid tight connection with the opposite end of said bellows and disposed within said supplemental hood, a second contact carried by said spring arm adjacent the opening in the end wall of said hood and nor-

mally held yieldingly out of engagement with said first contact, and a stud having threaded engagement with said thimble member and cooperable with said second contact for moving said second contact into engagement with said first contact for closing the thermoelectric circuit ahead of said electromagnet to short circuit the electromagnet upon expansion of said bellows.

5. In a device of the class described, in combination, a thermoelectric generator, a hood, a first conducting member disposed within said hood and connected in circuit with one side of said thermoelectric generator, a second conducting member disposed within said hood and insulated from said first conducting member and connected in circuit with the other side of said thermoelectric generator, an electromagnet disposed within said hood and having a magnet frame supported by said first conducting member, and a coil for said magnet frame, said coil having its terminals connected in circuit with the opposite sides of said thermoelectric generator, a first contact on one of said conducting members, a second contact connected within said hood with the other conducting member and normally held yieldingly out of engagement with said first contact, and means for moving said second contact relative to said first contact to disable the thermoelectric circuit.

6. In a device of the class described, in combination, a thermoelectric generator, a hood having an end wall, a first conducting plate disposed within said hood adjacent the end wall thereof and connected in circuit with one side of said thermoelectric generator, a second conducting plate disposed within said hood adjacent said first plate and insulated from said first plate and connected in circuit with the other side of said thermoelectric generator, an electromagnet disposed within said hood and having a magnet frame supported by said first conducting plate, and a coil for said magnet frame, said coil having its terminals connected in circuit with the opposite sides of said thermoelectric generator, a first contact on one of said conducting plates, a second contact connected within said hood with the other conducting plate and normally held yieldingly out of engagement with said first contact, and means operable through the end wall of said hood for moving said second contact

relative to said first contact to disable the thermoelectric circuit.

7. In a device of the class described, in combination, a thermoelectric generator, a hood, a first tubular terminal member mounted in the wall of said hood, a second terminal member mounted in said first terminal member, said second terminal member being insulated from said first terminal member and extending at its inner end into the hood inwardly from said first terminal member, a first conducting plate mounted on said first terminal member in position within the hood, a second conducting plate mounted on the inwardly extending end of said second terminal member in position within the hood and insulated from said first plate, an electromagnet disposed within said hood and having a magnet frame supported by said first conducting plate, and a coil for said magnet frame, said coil having its terminals connected in circuit with the opposite sides of said thermoelectric generator, a first contact on one of said conducting plates, a resiliently supported contact connected within said hood in circuit with the other conducting plate, and means for moving said resiliently supported contact into engagement with said first contact to disable the thermoelectric circuit.

8. In a device of the class described, in combination, a hood, a first tubular terminal member mounted in the wall of said hood, a second terminal member mounted in said first terminal member, said second terminal member being insulated from said first terminal member and extending at its inner end into the hood inwardly from said first terminal member, a first conducting plate mounted on said first terminal member in position within the hood, a second conducting plate mounted on the inwardly extending end of said second terminal member in position within the hood and insulated from said first plate, an electromagnet disposed within said hood and having a magnet frame supported by said first conducting plate, a coil for said magnet frame, a first contact on one of said conducting plates, a resiliently supported contact connected within said hood in circuit with the other conducting plate, and means for moving said resiliently supported contact into engagement with said first contact.

HENRY F. ALFERY.