

Sept. 22, 1942.

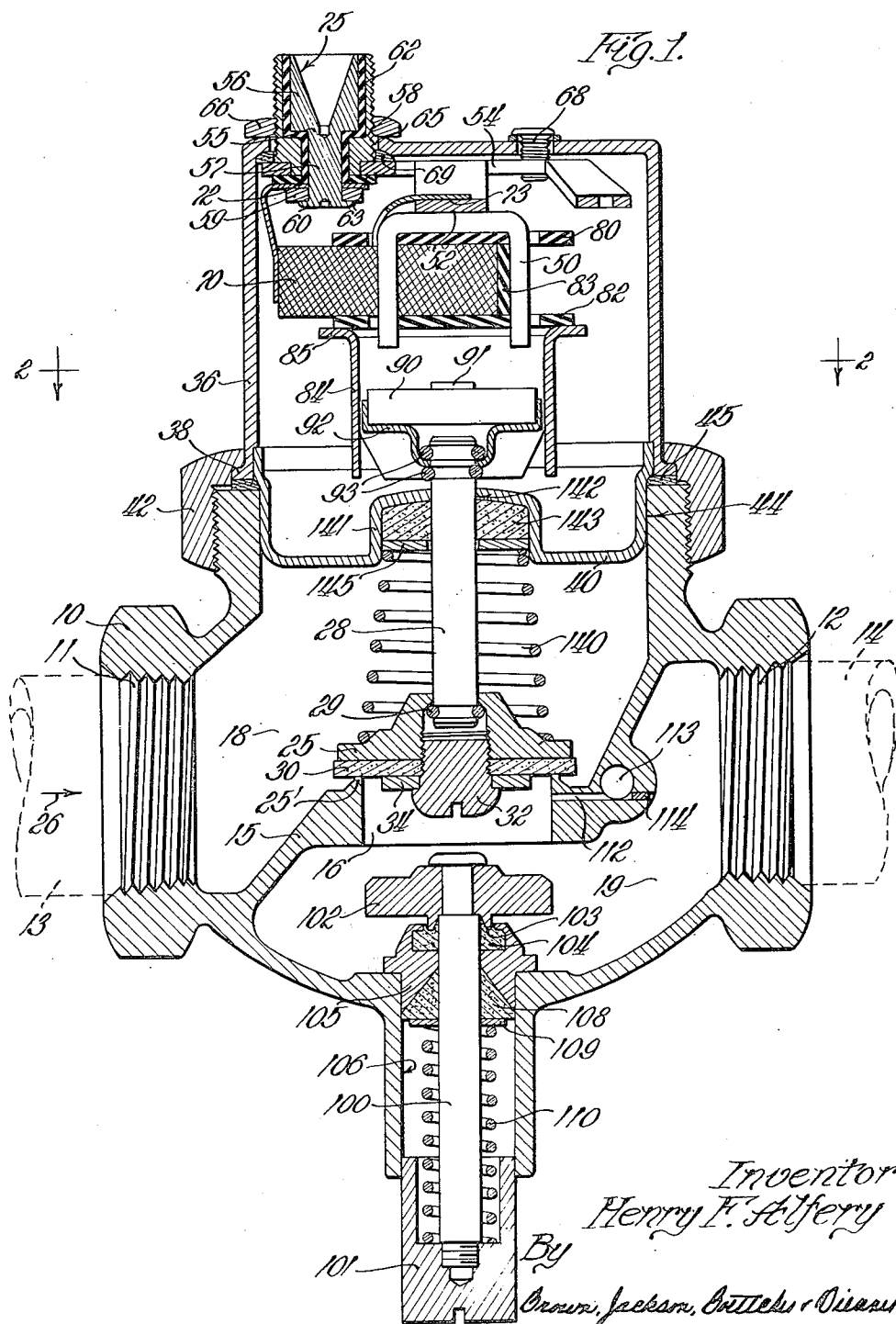
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THERMOELECTRIC SAFETY SHUTOFF DEVICE

Filed Nov. 9, 1939

2 Sheets-Sheet 1



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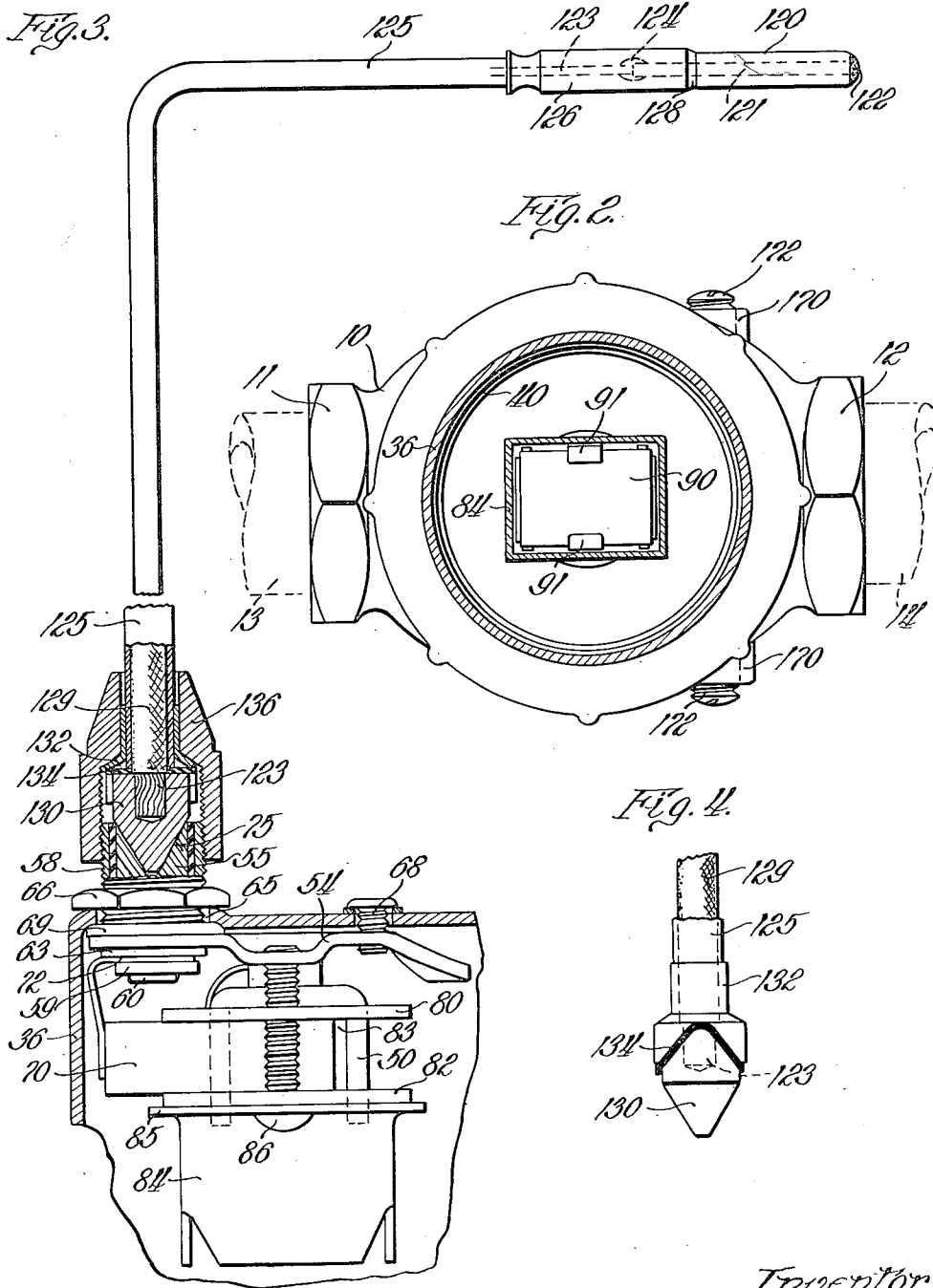
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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THERMOELECTRIC SAFETY SHUTOFF
DEVICE

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Application November 9, 1939, Serial No. 303,601

3 Claims. (Cl. 137-144)

This invention relates to safety devices for heating and other apparatus and has particular relation to an improved thermoelectric valve for automatically shutting off the fuel supply for a burner upon extinguishment of a pilot light or other flame.

The present invention is a continuation in part of my copending application Serial No. 186,967, filed January 26, 1938, and now Patent No. 2,276,909, granted Mar. 17, 1942.

The illustrated embodiment of the invention comprises generally a valve adapted to be positioned, for instance, in the fuel supply line leading to the burner, an electromagnet, an armature for the electromagnet which, when attracted, is adapted to maintain or to permit the valve to be maintained in open or operating position, and when retracted, compels closing of the valve to shut off the supply of fuel to the burner, and a thermocouple adapted to be placed in position to be heated by a pilot light or other flame and connected in circuit with the electromagnet.

One of the main objects of the present invention is to provide an improved quick detachable connection between the lead conductors for the thermocouple and the thermoelectric safety device.

It is also an object of the invention to provide means for shutting off or interrupting the flow of fuel to the main burner during the operation of resetting the armature to attracted position and the thermoelectric valve to open position—or other thermoelectric control means to operating position—and, in conjunction therewith, means for by-passing fuel, for instance, for the pilot burner while the flow of fuel for the main burner is thus interrupted during the resetting operation and wherein, at the same time, the thermoelectric valve operates to shut off not only the supply of fuel to the main burner, but also the supply of fuel for the pilot burner when the pilot burner or other flame, to the heat of which the thermocouple is subjected, is extinguished.

Another object of the invention is to provide an improved electromagnet assembly and mounting therefor, and more specifically, an improved electromagnet assembly having guide means for the armature adapted to constitute a part of such assembly and having also quick detachable connector means constituting a part of the electromagnet assembly and adapted, when the electromagnet assembly is mounted within the enclosure therefor, to project from the electromagnet enclosure for quick detachable connection with the

quick detachable connector means on the thermocouple leads.

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 vertical section through a thermoelectric valve embodying the present invention; Figure 2 is a sectional view taken on the line 2-2 of Figure 1;

Figure 3 is a fragmentary vertical section partially in elevation and showing the quick detachable connector means on the thermocouple leads connected with the quick detachable connector means on the thermoelectric valve; and

Figure 4 is a fragmentary elevational view showing the quick detachable connector means on the thermocouple leads.

The device is shown as a thermoelectric safety shutoff valve for shutting off the supply of fuel to the burner, which, for instance, may be the burner for a room, oven, or other space heater, or the burner for a water heater, conversion heater, or any other burner.

The device selected for illustration comprises a valve body 10 having a fuel inlet 11 and a fuel outlet 12 which are tapped internally to receive the inlet and outlet pipe sections 13 and 14, respectively. The inlet pipe section receives the fuel from a suitable source of fuel supply, and the outlet pipe section leads to the burner.

The valve body has an internal wall or partition 15 which has a valve opening 16 through which communication is adapted to be effected between the inlet chamber 18, which is in communication with the inlet 11, and the outlet chamber 19, which is in communication with the outlet 12. Communication between the inlet chamber 18 and the outlet chamber 19 through the opening 16 is controlled by a valve member 25 shown as adapted to seat upon the valve seat 25', preferably in a direction with the flow of gas or other fuel, the arrow 26 indicating the direction of flow of the fuel. The valve member 25 is held to the inner end of the valve stem 28, for instance, by a U-shaped fastener, snap ring, or other fastener means indicated at 29. The particular valve disc shown in the drawings has a valve disc gasket or yielding seating material 30 secured thereto by a valve disc screw 32, an intervening washer being shown at 34. These features may vary within the scope of the present invention.

The hood and cup assembly which encloses the electromagnet and armature for the thermoelec-

trically controlled valve 25 comprises a hood 36 which, in the illustrated embodiment of the invention, is of generally cylindrical and cup-shaped form provided at its inner end with an external flange 38. A metal shell or cup 40 has pressed fit or is otherwise suitably secured in the inner end of the hood 36, and encloses and seals the interior of the hood from the deleterious action of the gas or other fuel which passes through the valve body. The hood 36 is clamped to the valve body 10 by a union nut 42, with the hood and cup assembly closing the opening 44 in the valve body. A union gasket may be provided at 45.

The electromagnet, which is sealed within the hood and cup assembly comprises a magnet frame 50 shown in the drawings as of U-shaped form, although this may vary widely. The magnet frame 50 is secured at 52, and is supported by a metallic plate 54. A metallic terminal stud 55 having an enlarged outer end at 56 and a reduced stem 57 extending inwardly therefrom fits in a correspondingly formed metallic bushing 58. A metallic washer 59 underlies the adjacent portion of the plate 54 and is secured with the plate 54 to the bushing 58 and stud 55, for instance, by extending the reduced inner end of the stud 55 through the washer 59 and heading the inner end of the stud over as indicated at 60, or otherwise as desired. The stud, which is thereby secured to the plate 54 with the bushing 58 so that these parts constitute a unitary assembly, is insulated from the bushing 58 by insulation indicated at 62. The washer 59 is insulated from the plate 54 by insulation indicated at 63.

The bushing 58, with the stud 56 secured therein as set forth, extends outwardly through an opening 65 in the outer end of the hood 36. The bushing 58 is externally threaded, and a nut 66 threaded thereon clamps the bushing and stud assembly in place in the opening 65. Screws 68 or other suitable means may be employed for additionally securing the plate 54 to the outer end of the hood 36. Packing may, if desired, be interposed between the plate 54 and the outer end wall of the hood 36 as indicated at 69. If desired, the bushing 58 may be grounded to the hood 36. One terminal of the magnet coil 70, which is shown as surrounding one of the legs of the magnet frame 50, is connected at 72 to the terminal stud 55. The other terminal of the coil 70 is connected at 73 to the plate 54, and through the plate 54 to the terminal bushing 58.

One of the terminals of the coil 70 is adapted to be connected in circuit with one of the thermocouple leads through the stud 55, and where the bushing 58 is insulated from the hood 36, the other terminal of the coil 70 is adapted to be connected in circuit with the other thermocouple lead through the bushing 58. Where the bushing 58 is grounded to the hood, this side of the thermoelectric circuit is completed by grounding one side of the thermocouple and one of the terminals of the coil 70, for instance, to the hood 36. The enlarged outer end of the stud 55 has a conical recess 75.

Insulating strips are provided at 80 and 82, and an insulating strip 83 is provided between one side of the coil 70 and the adjacent leg of the magnet frame 50. The insulating strips 80 and 82 have openings through which the legs of the magnet frame extend, and underlying the insulating strip 82 is an armature guide 84 which may be formed of metal or other suitable material. The outer end of the guide 84 has a flange

85, and screws 86, one at each of the opposite sides of the electromagnet, have their heads engaging the flange 85 and their shanks extending through registering openings in the insulating strips 80 and 82 and threaded at their outer ends in the depressed portion of the plate 54. The screws 86 hold the insulating strip 82 and armature guide 84 in place so that these parts, with the magnet frame 50, coil 70, insulating strips 80 and 82, plate 54, and the stud and bushing terminal connector, constitute a unitary assembly which, upon being positioned within the cup 36 is adapted to be secured in place therein by the nut 66 and screws 68, only one of which latter screws is shown.

The armature 90 has attached thereto by upwardly extending bent-over portions 91 a cradle 92 which, in turn, is connected to the upper or outer end of the valve stem 28, preferably for limited universal movement, for instance by means of U-shaped retainers 93 engaging grooves in the upper end of the valve stem 28. The armature 90 is guided for reciprocatory movement by the armature guides 84, and the attachment of the valve member 25 to the lower end of the stem 28 preferably allows limited universal movement with respect to the stem. This limited universal movement of the armature and valve on the stem 28 permits self-accommodation of the armature to the pole ends of the magnet frame and self-accommodation of the valve member 25 to its seat 25'.

For the purpose of resetting the valve 25 to open position and the armature 90 to attracted position against the pole ends of the magnet frame 50 after the coil 70 is deenergized or after it becomes insufficiently energized to hold the armature in attracted position, a resetting stem 100 is mounted for sliding movement in the valve body 10 in axial alignment with the valve 25. Secured upon the lower end of the stem 100 is a reset button 101, and fixed upon the upper end of the stem is a valve member 102. The valve member 102 has a depending annular flange or rib 103 which engages the packing 104 and presses the same tightly around the stem 100 to prevent leakage of gas or other fuel out along the stem. The packing 104 is carried by a gland member 105 mounted in the opening 106, and this opening is sealed against the leakage of gas by suitable packing indicated at 108. A washer is provided at 109, and surrounding the stem 100 and interposed between the washer 109 and the reset button 101 is a coiled spring 110 which normally maintains the flow interrupter valve 102 in open position, as shown, and the reset button 101 in outwardly projected position.

Opening laterally from the valve opening 16 intermediate the ends thereof is a passageway 112 which is connected to a tube or fuel supply pipe 113 for delivering gaseous or other fuel to the pilot burner (not shown). The outer end of the passageway 112 may be closed at 114. This passageway 112 by-passes the flow interrupter valve 102 to provide a supply of gaseous fuel to the pilot burner when the valve 102 is in raised position closing off communication from the inlet chamber 18 to the outlet chamber 19 through the valve opening 16 during the resetting operation. At the same time, the passageway 112 is so disposed that the valve member 25 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 valve member 25 is closed against its seat 25'.

The thermocouple is shown by way of illustration and not by way of limitation as of the general character disclosed and claimed in Oscar J. Leins Patent No. 2,126,564, granted August 9, 1938. The thermocouple comprises an outer tubular metallic thermocouple member 120 and an inner metallic thermocouple member 121 joined at one end to the end of the outer thermocouple member to form the thermal junction 122 which is placed, for instance, in position to be heated by the pilot light or any other desired flame. An inner lead conductor 123 is joined to the inner thermocouple member to form an internal thermal junction 124, and an outer tubular lead conductor 125 is connected to the outer thermocouple member 120, for instance through a sleeve 126 to form a third thermal junction 128. The outer lead conductor 125 encloses the inner lead conductor 123, and with the outer thermocouple member and the sleeve 126 constitutes an enclosure about the inner thermocouple member and the inner lead conductor and the inner thermocouple junction 124. The inner lead conductor 123 is insulated from the outer lead conductor, for instance, by a wrapping of insulation on the inner lead conductor as indicated at 129.

The free end of the inner thermocouple lead 123 extends from the adjacent end of the outer lead 125 and has fixed thereon and in good conducting contact therewith a wedge member or metallic connector cone 130. The outer lead conductor 125 may have fixed thereon a metallic connector sleeve 132 in good conducting contact therewith. The sleeve 132 is insulated from the cone 130 by insulation indicated at 134. A couple lead connector nut is provided at 136, this nut having an internal shoulder which cooperates with a shoulder on the sleeve 132.

By applying the connector means on the thermocouple leads to the connector terminal means on the thermoelectric safety valve with the cone 130 positioned in the recess 75 and threading the nut 136 upon the bushing 58, the cone 130 is wedged into the recess 75, and consequently makes good positive contact with the stud 55, thereby connecting the lead 123 with one terminal of the coil 70. At the same time, the threaded engagement between the nut 136 and the bushing 58 together with the clamping of the nut 136 against the connector sleeve 132 forms a good positive connection between the adjacent end of the lead 125 and the bushing 58, thereby connecting the lead 125 to the other terminal of the coil 70. The thermocouple leads are quickly disconnected from the device by unscrewing the nut 136 from the bushing 58, and the connection is made quickly in the manner set forth.

The operation of the device is as follows:

When it is desired to ignite the main burner or other burner supplied with fuel from the outlet 12, the reset button 101 is pushed manually in an inward or upward direction. This moves the valve member 25 to open position away from the seat and the armature 90 into attracted position engaging the pole ends of the magnet frame 50. In this raised position of the reset stem 100, the flow interrupter valve 102 enters the valve opening 16 and shuts off communication between the inlet chamber 18 and the outlet chamber 19 through the opening 16 and thereby the flow of fuel to the main burner to prevent the escape of gaseous fuel from the main burner during the resetting operation.

The valve member 25 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 where it may be ignited as it issues from the pilot burner by applying a match or otherwise as desired. The thermocouple is positioned with the thermal junction 122 subject to the heat of the pilot flame and, as a result, the pilot flame energizes the thermocouple, creating a thermoelectric current which energizes the coil 70 and causes the armature 90 to be held in attracted position and the valve 25 to be held in open position against the tension of the spring 140. The reset button 101 may then be released, and the spring 110 moves the stem 100 downwardly to the position shown in Figure 1, and with it the valve 102 to open position.

The gaseous fuel then flows through the valve opening 16 and out through the fuel supply line 14 to the feed pipe to which air is admitted, and the gaseous mixture enters the main burner where it is ignited by the pilot burner as it issues from the ports of the main burner. In case the main burner is accidentally extinguished, the pilot burner will reignite the same, and thereby assures that the main burner is lighted as long as fuel is supplied thereto.

If the pilot burner is extinguished, the thermoelectric current through the coil 70 diminishes to such an extent that the armature 90 is released, whereupon the spring 140 forces the valve member 25 into engagement with the seat 25', thereby shutting off the flow of fuel to the main burner and to the pilot burner.

The bottom wall of the cup 40 is shown as depressed at 141 and provided with an opening 142 in which the stem 28 has reciprocatory movement. The opening 142 is sealed against the leakage of gas or other fuel from the body 10 into the electromagnet enclosure by suitable packing indicated at 143. A washer is provided at 145, and the spring 140 surrounds the valve stem 28 and is interposed between the washer 145 and the valve member 25. The spring 140, which is shown as of generally conical form, in addition to moving the valve 25 to closed position and the armature 90 to retracted position upon extinguishment of the flame, compresses the packing 143 tightly about the stem 28 to prevent leakage of fuel into the hood and cup assembly.

The pilot fuel supply passageway 113 extends out at 170 from opposite sides of the valve body as indicated in Figure 2, and the diametrically opposite outlets of this passageway are provided with screw plugs 172. By removing either plug 172, the pilot supply tube may be connected to either side of the valve body as 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, a valve body having an inlet and an outlet and means defining a passage between said inlet and said outlet, a pilot outlet leading from said passage, shutoff valve means operable to closed position anterior of said pilot outlet to shut off the flow through said first outlet and said pilot outlet, reset means cooperable with said shutoff valve means for actuating said shutoff valve means to open position, and a second valve actuated to closed position posterior of said pilot outlet by the resetting operation of said reset means to shut off the flow through said first outlet without shutting off the flow through the pilot outlet during the resetting operation, said second valve

having movable fit in the passage between the inlet and outlet for permitting continued resetting movement after the flow through said first outlet is shut off by said second valve.

2. In a device of the class described, a valve body having an inlet and an outlet, a partition wall disposed between said inlet and outlet and having a valve seat on one side of said wall and a valve passage opening through said wall, a shutoff valve member operable to closed position engaging said valve seat to shut off fluid flow through said outlet, a reset plunger adapted to be projected inwardly to reset said shutoff valve to open position, and a valve member fixed on said reset plunger and cooperable with the passage in said partition wall to shut off the flow through said outlet during the resetting operation and by movement in said passage permitting resetting movement after the flow through said outlet is shut off by said second valve member

and without relative movement between said second valve member and said reset plunger.

3. In a device of the class described, a valve body having an inlet and an outlet and means defining a passage between said inlet and said outlet, a shutoff valve member operable to closed position to shut off the flow through said outlet, reset means cooperable with said shutoff valve member for actuating said shutoff valve member to open position, and a second valve member actuated to closed position by the resetting operation of said reset means to shut off the flow through said outlet during the resetting operation, said second valve member having movable fit in the passage between the inlet and outlet for permitting continued resetting movement after the flow through said outlet is shut off by said second valve member.

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