May 11, 1943. R. K. ENGHOLDT 2,318,767

SAFETY SHUT-OFF VALVE

Filed May 20, 1940

Fig. 1.

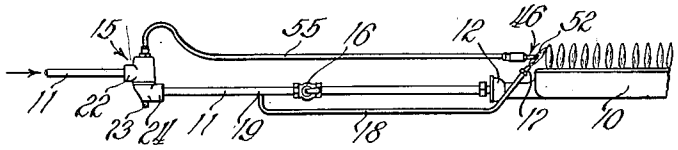


Fig. 2.

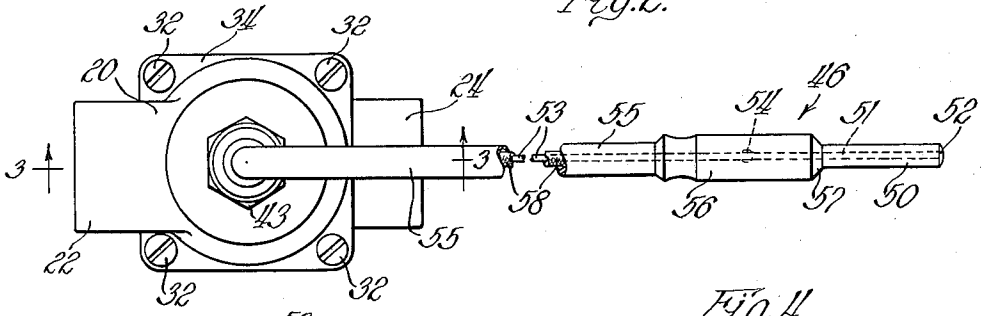


Fig. 3.

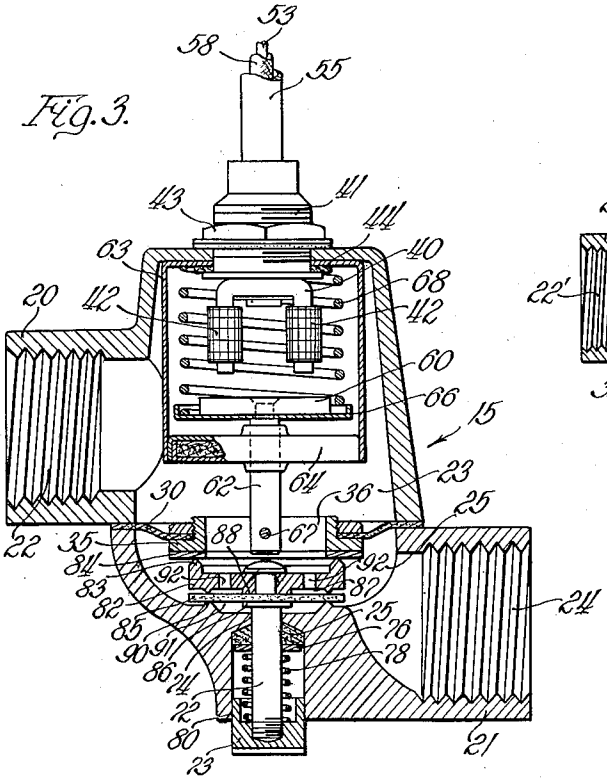
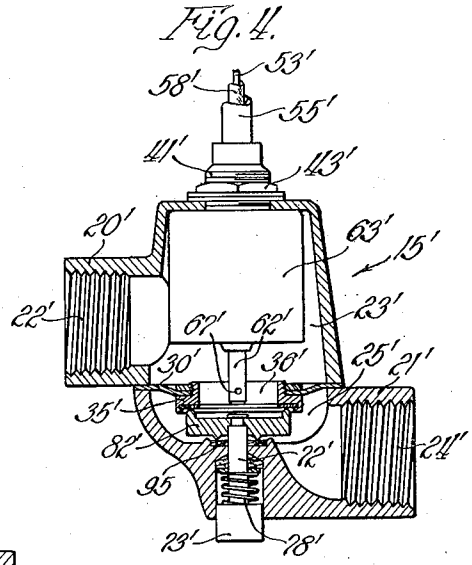


Fig. 4.



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2,318,767

SAFETY SHUTOFF VALVE

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Application May 20, 1940, Serial No. 336,144

14 Claims. (Cl. 137—139)

This invention relates to an improvement in safety shutoff valves.

Safety shutoff valves which depend upon a thermo-electric or other relatively weak current for maintaining the valve in open position and in which the valve operates to closed position to shut off the flow of fuel when a pilot light or other flame goes out require cocking means for actuating the valve to open position. These cocking devices usually move an armature to attracted position relative to an electromagnet and the valve to open position, the electromagnet, when energized, holding the armature attracted thereto and the valve in cocked position, and, when deenergized, releasing the armature for movement to retracted position and the valve for movement to closed position. If the operation of the cocking device is effective to open the valve and establish the supply of fuel irrespective of weather the pilot burner is lighted, fuel may pass, for example, to the main burner and escape unburned. This unburned gaseous or other fuel presents the danger of asphyxiation and the possibility of fire or explosion when a flame is applied to light the pilot burner.

One of the main objects of the present invention is to provide improved valve means which will permit cocking and holding same in cocked position without establishing the supply of fuel to the main burner, and, particularly improved valve means which will permit cocking and holding the same in cocked position without establishing the supply of fuel to the main burner until the pilot burner is lighted and a thermoelectric current set up to hold the armature in attracted position.

It is also an object of the invention to provide improved means which is rendered operative to establish a supply of fuel for the pilot light during the cocking operation and which is effective to shut off not only the supply of fuel for the main burner, but also the supply of fuel for the pilot light when the electromagnet is deenergized and the cocking means is in released position, thereby giving a 100% shutoff feature.

Another object of the invention is to provide, in a device of the class described, inlet and outlet sections that may be moved relative to each other and secured together in different relative positions to change the relative positions of the inlet and outlet of the device, thereby adapting the device to different positions and to different arrangements of the fuel supply pipe sections leading, for example, to the burner.

Another and more specific object is to provide a movable valve seat so mounted and correlated with respect to the movable valve member that the valve member and valve seat remain in contact to shut off the supply of fuel to the burner during actuation of the cocking means, the valve member moving away from the valve seat to open position when the armature is set in attracted position, and held attracted by energization of the electromagnet, and the cocking means is released, and the valve seat moving into contact with the valve member to shut off the supply of fuel to the main burner when the electromagnet is deenergized and the armature released. In this connection, means is also provided for shutting off the supply of fuel to the pilot burner to give the 100% shutoff feature as above referred to and as will presently appear.

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

Figure 1 is a more or less diagrammatic view showing a thermoelectric safety shutoff valve embodying the present invention in one illustrative form of safety shutoff system;

Figure 2 is a top plan view of the safety shutoff device shown in Figure 1;

Figure 3 is a section through the safety shutoff device, taken on the line 3—3 of Figure 2; and

Figure 4 is a section similar to Figure 3 showing another form of safety shutoff device embodying the present invention.

The invention can be embodied in a wide variety of forms for use with a wide variety of devices, but for purposes of illustration the invention has been shown more or less schematically as embodied in a manner automatically to close a valve in a fuel supply pipe leading to a burner when the pilot light for the burner goes out.

In Figure 1 of the drawing the burner 10 is any suitable or preferred main burner, such as the burner of a room or space heater, water heater, floor furnace, or any other burner. A fuel supply pipe 11 leads to the burner 10 for the delivery of gaseous or other fuel thereto—for example, through the mixing chamber 12 to which air is admitted in the usual way, as well understood in the art. The safety shutoff device, designated in its entirety at 15, is connected into the fuel supply pipe 11.

The fuel supply pipe 11 is provided with a gas cock 16 located between the safety shutoff device 15 and the main burner 10 and operable to shut off the flow of fuel to the main burner so that the pilot burner will get sufficient fuel for proper operation during cocking or resetting of the safety shutoff device. The pilot burner 17, which is located in juxtaposition to the main burner 10 to maintain a pilot flame for igniting the main burner, is supplied with gaseous fuel by a pilot supply pipe 18 connected at 19 to the pipe 11, the connection at 19 being located between the safety shutoff device 15 and the cock 16.

The safety shutoff device 15 comprises a pair of valve body parts 20 and 21 which may be in the

form of metal castings, or of other suitable form. The body part 20 has an inlet 22 opening into an inlet chamber 23, and the body part 21 has an outlet 24 leading from an outlet chamber 25. The inlet 22 and outlet 24 are shown as directed laterally, but this may vary. Furthermore, the inlet and outlet may be reversed, i. e., the outlet 24 may be used as the inlet and the inlet 22 may be used as the outlet.

The valve body sections or parts 20 and 21 may be turned or moved relative to each other and secured together in different relative positions to change the relative positions of the inlet and outlet, thereby adapting the device to different positions and to different arrangements of the pipe sections constituting the fuel supply pipe 11. This is an important aspect of the present invention.

The body parts 20 and 21 are secured together, with an impervious flexible member 30 clamped marginally therebetween, by screws 32 or other suitable fastening means. The screws 32 are so arranged that the body parts 20 and 21 may be clamped together in different relative positions, for instance with the outlet extending in a direction 180 degrees from the inlet 22 as shown, or with the inlet 22 or outlet 24 in a direction 90 degrees, 180 degrees, or 270 degrees from the direction shown. The particular number of relative positions in which the body parts 20 and 21 may be secured together may vary widely within the scope of the present invention. The particular construction shown is adapted for securing either body part to the other body part in any of four equi-spaced positions, but by making, for example, the attachment flanges shown at 34 (Figure 2) of suitable form and providing additional screws 32 and additional openings therefor, additional positions may be provided for as suitable or desired.

The flexible member 30 carries the movable valve seat member 35, which member 35 has the valve opening 36 through which the inlet chamber 23 is adapted to be placed in communication with the outlet chamber 25 for supplying the fuel for the main burner. The flexible member 30 may be formed of any suitable flexible material, such as the material of which the diaphragms of diaphragm valves are commonly formed, or any other material.

The electromagnet selected for illustration comprises a generally U-shaped magnet frame 40 positioned within the valve body part 20 and secured, for example, to a terminal bushing 41 in the manner more fully disclosed in my copending application Serial No. 328,923, filed April 10, 1940. The coil 42 of the electromagnet is wound around the legs of the magnet frame 40. The bushing 41 is shown as externally threaded for threaded engagement with a nut 43 by means of which the bushing is clamped in place to the outer end of the body part 20 preferably with a gasket 44 between the headed inner end of the bushing and the adjacent wall of the body part 20.

The thermocouple 46 is placed in position so that the hot junction 52 thereof will be heated by the pilot flame as long as the pilot flame is burning. The construction of the thermocouple may be similar to that more fully disclosed in Oscar J. Leins Patent No. 2,126,564, granted August 9, 1938, or the construction of the thermocouple and the leads therefor may be of any other suitable or preferred form.

For the purpose of the present description, suffice it to state that the particular thermocouple 46 selected for illustration comprises an outer tubular thermocouple member 50 and an inner metallic thermocouple member 51 joined at one end to the outer end of the thermocouple member 50 to form the thermal junction 52 which is placed in position to be heated by the pilot light at the pilot burner 17. An inner lead conductor 53 is joined to the inner thermocouple member 51 to form an internal thermal junction 54, and an outer tubular lead conductor 55 is connected to the outer thermocouple member 50, for instance, through a sleeve 56, to form a third thermal junction 57. The inner lead conductor 53 is insulated from the outer lead conductor 55, for instance, by a wrapping of insulation on the inner lead conductor 53 as indicated at 58.

A quick detachable or removable connection is preferably provided between the opposite ends of the leads 53 and 55 and the coil of the electromagnet. This removable lead connection may be of the form disclosed in my copending application above identified, or of any other suitable or preferred form. Suffice it for purposes of this description to state that the lead 53 is connected in circuit with one side or one terminal of the coil 42, and that the other lead 55 is connected in circuit with the other side or other terminal of the coil. One side of the circuit may, for example, be connected with the coil 42 directly or through the wall of the valve body part 20.

The electromagnet has an armature 60 attached to the outer end of a stem 62, if desired, in a manner to permit self-accommodation of the armature, when in attracted position, to the pole ends of the magnet frame 40. The electromagnet and armature are enclosed within a generally cup-shaped member 63, the outer end of which is secured to the outer end of the valve body part 20, for example, by the inner headed end of the terminal bushing 41. The inner end of the cup-shaped member 63 is closed by guide and closure means 64 shown as comprising a pair of telescopically engaged generally cup-shaped members having pressed fit or other suitable engagement in the inner end of the cup-shaped member 63. Suitable sealing material is provided between the cup-shaped members constituting the guide and closure means 64 and around the stem 62 to prevent the passage of dust or other foreign matter into the electromagnet and armature housing along the stem 62.

A spring seating disk 66 is also carried by the stem 62, and the inner end of the stem 62 is attached to the valve seat member 35, for example, by a pin 67. A spring 68 is coiled about the electromagnet and interposed between the disk 66 and the outer end of the cup-shaped member 63, this spring 68 being operative when the pilot light goes out and the electromagnet is deenergized to actuate the armature 60 and valve seat member 35 to their retracted positions as shown in Figure 3.

The heat of the pilot light on the thermocouple 46 energizes the electromagnet sufficiently to hold the armature 60 and the valve seat member 35 in their attracted positions when the armature 60 is engaged with the pole ends of the magnet frame, but this thermoelectric current is not capable of moving the armature to attracted position and the valve seat member to the position which it occupies when the armature is in attracted position. Cocking means is therefore provided for actuating the armature 60 to at-

tracted position and the valve seat member 35 to cocked position. This cocking means comprises a cocking or reset stem 72 coaxial with the stem 62 and extending outwardly from the valve body part 21.

The outer end of the cocking stem 72 has a cocking or reset button 73 secured thereto. The stem 72 is guided at 74 in the body part 21, and the opening through which the stem extends is sealed by suitable sealing material indicated at 75. A packing washer is provided at 76, and a cocking or reset spring 78 is coiled about the stem 72 and interposed between this packing washer and the button 73. The cocking button 73 operates slidingly in the recess 80 in the valve body part 21.

The valve member 82 is fixed on the inner end of the cocking stem 72 and has an annular raised valve seat 83 which is adapted to contact the valve gasket or yielding facing 84 of the valve seat member 35 when the valve is closed to shut off the supply of fuel to the main burner. A sealing gasket 85 is secured at 86 to the cocking stem 72 with its outer periphery normally spaced at 87 from the valve member 82, for example by an integral raised hub-like portion 88 at the center of the outer side of the valve member 82. The sealing gasket 85 cooperates with a raised annular rib 90 on the valve body part 21, which body part 21 is recessed at 91 within this rib.

The valve member 82 has pilot ports 92 which are made only sufficiently large to provide fuel for the pilot burner during the cocking or resetting operation and with the device connected as shown in Figure 1.

The operation is generally as follows:

When the pilot light is burning, the heat thereof on the thermal junction 52 produces a thermoelectric current in the coil 42. The magnet frame and armature are preferably formed of an alloy of relatively low magnetic reluctance, and, as a result, the relatively weak thermoelectric current produces a magnetic field of sufficient strength so that when the armature 60 is placed in contact with the pole ends of the magnet frame 40 by pushing the cocking stem 72 inwardly, the magnetic attraction holds the armature in attracted position against the magnet frame. At the same time the valve seat member 35 is held in the position it occupies when the armature is attracted, so that when the cocking stem 72 is released, the valve member 82 moves away from the valve seat member 35 to the position shown in Figure 3 and the fuel passes out through the valve opening 36, outlet 24, and supply pipe 11, to the main burner.

If the pilot light is extinguished, the holding action of the electromagnet ceases to be sufficient to hold the armature 60 in attracted position and the valve seat member 35 in cocked position. As a result, the valve seat member 35 is moved by the spring 68 into engagement with the seat 83 of the valve member 82, thereby shutting off the supply of fuel to the main burner. At the same time the cooperation of the sealing gasket 85 with the valve member 82 outwardly of the ports 92 shuts off the space 87 against the flow of fuel to the pilot burner.

When it is desired to cock or reset the device, the cocking button 73 is engaged with the hand or fingers and pressed inwardly. The accompanying inward movement of the stem 72 moves the valve member 82 inwardly and, by its cooperation with the valve seat member 35 and the attachment of this latter member to the stem 62, the armature 60 is moved to attracted position against the pole ends of the magnet frame.

The valve member 82 and valve seat member 35 remain in contact to shut off the supply of fuel to the main burner during the cocking operation. However, as soon as the sealing gasket 85 is released in the cocking operation, the periphery of the gasket 85 separates from the adjacent side of the valve member 82 under the pressure of the fuel admitted through the valve opening 36 and pilot ports 92. By closing the cock or valve 16 (Figure 1), fuel for the pilot burner then passes out through the ports 92, space 87, supply pipe 11, and pilot supply pipe 18, to the pilot burner 17. If the pilot burner is lighted and sets up a thermoelectric current to hold the armature in attracted position, the valve seat member 35 will remain in cocked position, and when the cocking stem is released the valve member 82 is moved away from the valve seat member, and fuel thereupon passes through the valve opening 36 to the main burner where it is lighted by the pilot burner.

If, on the other hand, the pilot burner is not lighted to produce the thermoelectric current for holding the armature and valve seat member in their cocked positions, the valve seat member will return with the valve member 82 to the position shown in Figure 3 when the cocking stem is released, thereby remaining in contact with the valve member 82 to prevent the flow of fuel to the main burner.

The device shown in Figure 4 is similar to the device shown in Figure 3 except that the valve member 82' has no pilot supply ports therethrough but, instead, is of imperforate form. A cocking stem gas seal is provided at 95. In this embodiment of the invention any suitable provision may be made for supplying fuel to the pilot burner as, for example, by a pilot supply pipe connected to the fuel supply pipe leading to the main burner anterior of the safety shutoff valve, or otherwise as desired. The other parts of the device shown in Figure 4 which correspond with the parts of the device shown in Figure 3 are designated by primed reference characters like the reference characters used in Figure 3.

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 valve body having an inlet and an outlet, first and second movable valve members one having a valve opening therethrough, said one valve member forming a partition between said inlet and outlet preventing flow therebetween except through said opening, said valve members cooperating to effect closure of said opening when they are in seating engagement with each other, means for holding said first movable valve member in position separated from said second movable valve member to permit fluid flow through the device and adapted to release said first valve member for movement into seating engagement with said second valve member to shut off the fluid flow, and cocking means for cocking said first valve member to position in which it is held by said holding means, said second valve member being carried by said cocking means for movement in seating engagement with said first valve member in the cocking operation.

2. In a device of the class described, in combination, a valve body having an inlet and an outlet, first and second movable valve members one having a valve opening therethrough, flex-

ible means carried by said valve body supporting said first movable valve member and preventing flow between said inlet and outlet except through said opening, said valve members cooperating to effect closure of said opening when they are in seating engagement with each other, means for holding said first movable valve member in position separated from said second movable valve member to permit fluid flow through the device and adapted to release said first valve member for movement into seating engagement with said second valve member to shut off the fluid flow, and cocking means for cocking said first valve member to position in which it is held by said holding means, said second movable valve member being carried by said cocking means for movement in seating engagement with said first valve member in the cocking operation.

3. In a device of the class described, in combination, a valve body having an inlet and an outlet, an armature, an electromagnet adapted when energized to hold the armature attracted thereto and, when deenergized, releasing said armature for movement to retracted position, cocking means for cocking said armature to attracted position, a pair of valve members each movable with said cocking means and in seating engagement with each other in the cocking operation, one of said movable valve members having a valve opening, means preventing flow between said inlet and outlet except through said opening, said valve members cooperating to effect closure of said opening when they are in seating engagement with each other, one of said valve members being connected to said armature, and means for separating one of said movable valve members from the other movable valve member when said armature is held in attracted position to permit fluid flow through said valve opening upon completion of the cocking operation.

4. In a device of the class described, in combination, a valve body having an inlet and an outlet, an armature, an electromagnet adapted when energized to hold the armature attracted thereto and, when deenergized, releasing said armature for movement to retracted position, cocking means for cocking said armature to attracted position, a pair of valve members each movable with said cocking means and in seating engagement with each other in the cocking operation, one of said movable valve members having a valve opening, flexible means carried by said valve body supporting said one valve member and preventing flow between said inlet and outlet except through said opening, said valve members cooperating to effect closure of said opening when they are in seating engagement with each other, one of said valve members being connected to said armature, and means for separating one of said movable valve members from the other movable valve member to permit fluid flow through said valve opening upon completion of the cocking operation and when said armature is held in attracted position.

5. In combination, a fluid supply conduit, a pair of movable valve members one cooperable with the other to shut off the supply of fluid through said conduit, an armature connected to one of said movable valve members, an electromagnet adapted, when energized, to hold said armature attracted thereto and the connected valve member in the position in which it is adapted for separation from the other valve member, and reset means connected to the other valve member for moving both valve members while in cooperation with each other in a direction to set the armature in attracted position and the valve member connected to the armature to the position in which it is held when the armature is in attracted position.

6. In combination, a fluid supply conduit, a pair of movable valve members one cooperable with the other to shut off the supply of fluid through said conduit, an armature connected to one of said movable valve members, an electromagnet adapted, when energized, to hold said armature attracted thereto and the connected valve member in the position in which it is adapted for separation from the other valve member, reset means connected to the other valve member for moving both valve members while in cooperation with each other in a direction to set the armature in attracted position and the valve member connected to the armature to the position in which it is held when the armature is in attracted position, and means for separating the valve member connected to said reset means from the other valve member for the supply of fluid through said conduit when the reset operation is completed and the armature is held in attracted position.

7. In combination, a fluid supply conduit, a pair of movable valve members one cooperable with the other to shut off the supply of fluid through said conduit, an armature connected to one of said movable valve members, an electromagnet adapted, when energized, to hold said armature attracted thereto and the connected valve member in the position in which it is adapted for separation from the other valve member, and reset means connected to the other valve member for moving both valve members while in cooperation with each other in a direction to set the armature in attracted position and the valve member connected to the armature to the position in which it is held when the armature is in attracted position, the valve member connected to the armature including a flexible supporting means for movement as described.

8. In combination, a fluid supply conduit, a pair of movable valve members one cooperable with the other to shut off the supply of fluid through said conduit, an armature connected to one of said movable valve members, an electromagnet adapted, when energized, to hold said armature attracted thereto and the connected valve member in the position in which it is adapted for separation from the other valve member, reset means connected to the other valve member for moving both valve members while in cooperation with each other in a direction to set the armature in attracted position and the valve member connected to the armature to the position in which it is held when the armature is in attracted position, and means for moving the armature to retracted position and the connected valve member into cooperation with the other valve member upon deenergization of the electromagnet.

9. In combination, a fluid supply conduit, a pair of movable valve members one cooperable with the other to shut off the supply of fluid through said conduit, an armature connected to one of said movable valve members, an electromagnet adapted, when energized, to hold said armature attracted thereto and the connected valve member in the position in which it is adapted for separation from the other valve member, reset means connected to the other valve member for moving both valve members while in cooperation with each other in

a direction to set the armature in attracted position and the valve member connected to the armature to the position in which it is held when the armature is in attracted position, and means permitting a limited flow of fluid through said valve members during the resetting operation.

10. In combination, a fluid supply conduit, a pair of movable valve members one cooperable with the other to shut off the supply of fluid through said conduit, an armature connected to one of said movable valve members, an electromagnet adapted, when energized, to hold said armature attracted thereto and the connected valve member in the position in which it is adapted for separation from the other valve member, reset means connected to the other valve member for moving both said valve members while in cooperation with each other in a direction to set the armature in attracted position and the valve member connected to the armature to the position in which it is held when the armature is in attracted position, means for separating the valve member connected to said reset means from the other valve member for the supply of fluid through said conduit when the reset operation is completed and the armature is held in attracted position, the valve member connected to the armature including a flexible supporting means for movement as described, and means for moving the armature to retracted position and the connected valve member into cooperation with the other valve member upon deenergization of the electromagnet.

11. In a device of the class described, in combination, a valve body having an inlet and an outlet, a first movable valve member having a valve opening therethrough, a second movable valve member adapted for cooperation with said first valve member to close said valve opening and shut off the flow of fluid through the device, one of said valve members being movable relative to the other valve member to position separated therefrom to establish a flow of fluid through the device, an armature connected to the other valve member, an electromagnet adapted, when energized, to hold said armature attracted thereto and the connected valve member in the position in which the other valve member is adapted for separation therefrom, and reset means connected to the other valve member for moving both valve members while in cooperation with each other in a direction to set the armature in attracted position and the valve member connected to the armature to the position in which it is held when the armature is in attracted position.

12. In a device of the class described, in combination, a valve body having an inlet and an outlet, a first movable valve member having a valve opening therethrough, a second movable valve member adapted for cooperation with said first valve member to close said valve opening and shut off the flow of fluid through the device, one of said valve members being movable relative to the other valve member to position separated therefrom to establish a flow of fluid through the device, an armature connected to the other valve member, an electromagnet adapted, when energized, to hold said armature attracted thereto and the connected valve member in the position in which the other valve member is adapted for separation therefrom, and reset means connected to the other valve member for moving both valve members while in cooperation with each other in a direction to set the armature in attracted position and the valve member connected to the armature to the position in which it is held when the armature is in attracted position, the valve member connected to the armature including a flexible supporting means for movement as described.

13. In a device of the class described, in combination, a valve body having an inlet and an outlet, a first movable valve member having a valve opening therethrough, a second movable valve member adapted for cooperation with said first valve member to close said valve opening and shut off the flow of fluid through the device, one of said valve members being movable relative to the other valve member to position separated therefrom to establish a flow of fluid through the device, an armature connected to the other valve member, an electromagnet adapted, when energized, to hold said armature attracted thereto and the connected valve member in the position in which the other valve member is adapted for separation therefrom, reset means connected to the other valve member for moving both valve members while in cooperation with each other in a direction to set the armature in attracted position and the valve member connected to the armature to the position in which it is held when the armature is in attracted position, the valve member connected to the armature including a flexible supporting means for movement as described, and means for separating the valve member connected to said reset means from the other valve member for the supply of fluid through said conduit when the reset operation is completed and the armature is held in attracted position.

14. In a device of the class described, in combination, a valve body having an inlet and an outlet, a first movable valve member having a valve opening therethrough, a second movable valve member adapted for cooperation with said first valve member to close said valve opening and shut off the flow of fluid through the device, one of said valve members being movable relative to the other valve member to position separated therefrom to establish a flow of fluid through the device, an armature connected to the other valve member, an electromagnet adapted, when energized, to hold said armature attracted thereto and the connected valve member in the position in which the other valve member is adapted for separation therefrom, reset means connected to the other valve member for moving both valve members while in cooperation with each other in a direction to set the armature in attracted position and the valve member connected to the armature to the position in which it is held when the armature is in attracted position, the valve member connected to the armature including a flexible supporting means for movement as described, means for separating the valve member connected to said reset means from the other valve member for the supply of fluid through said conduit when the reset operation is completed and the armature is held in attracted position, and means for moving the armature to retracted position and the connected valve member into cooperation with the other valve member upon deenergization of the electromagnet.

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