

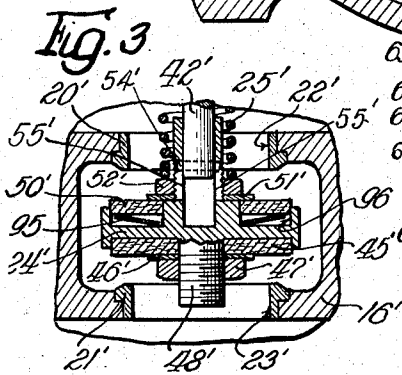
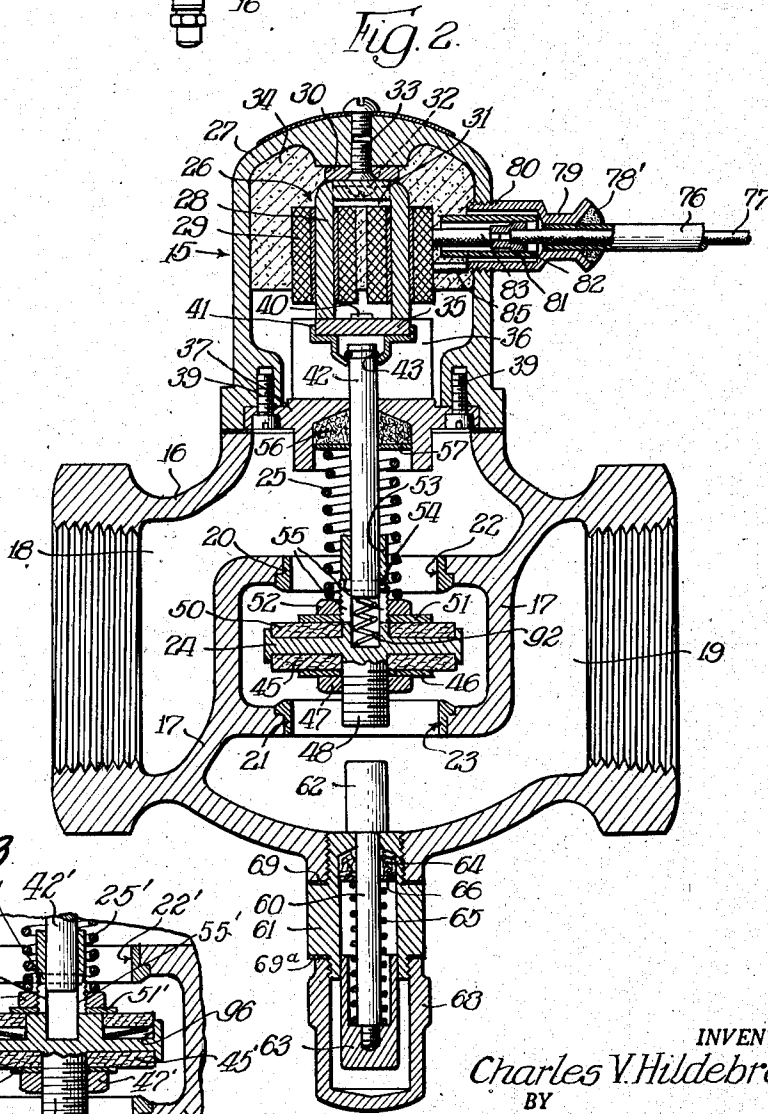
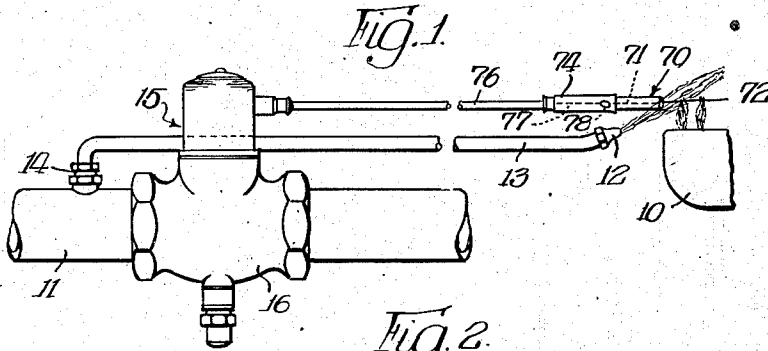
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THERMOELECTRIC SAFETY DEVICE AND THE LIKE

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THERMOELECTRIC SAFETY DEVICE AND
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This invention relates to an improvement in thermoelectric safety devices and the like.

Thermoelectric safety devices which depend upon the small E. M. F. that can be produced by the heat of a flame upon a thermocouple or other thermoelectric generator for maintaining the desired flow of fuel, for example, for a main burner, and which operates to shut off the flow of fuel upon extinction, for example, of a pilot flame, usually require reset means for resetting the device. These reset devices usually move an armature to attracted position and, simultaneously, the shutoff valve member to the position in which it is held by the armature when the armature is held attracted to the electromagnet by the energization thereof. If the valve member or other control device is operated to set up the supply of fuel whenever the reset device is operated and irrespective of whether the pilot burner is lighted, fuel may pass, for example, to the main burner and escape and collect unburned. This unburned gas presents the danger of asphyxiation and possible explosion when a flame is applied to light the pilot burner.

One of the main objects of the present invention is to provide means which will permit resetting the armature to attracted position without setting up the desired supply of fuel to the burner, and, particularly, means which will permit resetting and holding the armature in attracted position without setting up the desired supply of fuel to the burner until the pilot flame has been relighted and a thermoelectric current set up to hold the armature in attracted position.

In its more specific aspects, the present invention utilizes the shutoff valve member as the means for shutting off the supply of fuel for the main burner during the resetting operation, thereby rendering unnecessary a second valve member or other device for accomplishing this result.

Still more specifically, the shutoff valve member of the present invention is in the form of a double faced valve member operating between two valve seats. As long as the thermoelectric generator is heated by the pilot light or other flame, the resulting energization of the electromagnet holds the armature in attracted position and the shutoff valve member in open position between the two valve seats for the supply of fuel to the main burner. Upon extinction of the pilot light the shutoff valve member moves to position seating upon one of the valve seats to shut off the supply of fuel to the burner. In resetting the device the shutoff valve member is moved to position seating

upon the other valve seat to shut off the supply of fuel to the burner during the resetting operation and until the pilot flame has been relighted and a thermoelectric current set up to hold the armature in attracted position, whereupon the shutoff valve member is adapted to move to open position between the two valve seats upon release of the reset means, and is held in that position by the attraction of the armature to the electromagnet.

Further objects 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 fragmentary and more or less diagrammatic view showing an embodiment of the present invention in a pilot burner and main burner gas supply system;

Figure 2 is a vertical section through the thermoelectric safety valve shown in Figure 1; and Figure 3 is a fragmentary detail section of a modification showing means for permitting continued movement of the armature toward the magnet frame after the valve is closed in the resetting operation.

Referring to the drawing, the burner 10 is any suitable or preferred main burner, and the conduit 11 is the fuel supply conduit therefor.

Associated with the main burner 10 is the usual or any suitable or preferred pilot burner, indicated more or less diagrammatically at 12, which pilot burner is intended to remain lighted for the purpose of relighting the main burner upon extinction thereof. This pilot burner 12 is supplied with gaseous fuel by a tube 13 connected, for example, at 14 to the conduit 11.

The thermoelectric safety valve, designated in its entirety at 15, comprises a valve casing 16 connected into the conduit 11. In the illustrated embodiment of the invention, the valve casing 16 is shown connected into the conduit 11 posterior to the pilot burner connection 14, but this may vary within the broader aspects of the present invention.

The interior of the valve casing 16 is divided by a partition wall 17 into an inlet chamber 18 and an outlet chamber 19. A pair of annular valve seat members 20 and 21, suitably secured in the wall 17, define a pair of valve openings 22 and 23 through which the inlet chamber 18 is adapted to be placed in communication with the outlet chamber 19. The valve member 24 is resiliently pressed against the upper end of the valve seat member 21 by compression spring 25 to shut off the flow of fuel to the burner 10 when

the electromagnet, indicated in its entirety at 26, is deenergized.

The electromagnet 26 is disposed within the hood 27 which may be secured, as by means of screws (not shown), to the top of the valve casing 16. The electromagnet 26 comprises a generally U-shaped magnet frame 28 provided about each of its legs with a coil 29. The magnet frame 28 is held rigidly to a magnet mounting plate 30 by means of a bracket 31 which is secured to the plate 30 by screws 32. The plate 30 is, in turn, secured to the hood 27 by a screw 33.

The magnet armature 35 is adapted to have engagement with the pole faces at the ends of the legs of the U-shaped magnet 28. This armature 35 is guided for reciprocatory movement within upright guide lugs 36 on an armature guide 37 which is secured to the hood 27 by screws 39. The armature 35 has attached thereto by upwardly extending bent-over portions 40 a cradle 41 which, in turn, is connected to the upper end of the valve stem 42 by means of a generally U-shaped retainer 43 engaging in a groove in the upper end of the stem 42 and co-operating with the inturned lower end of the cradle 41. A limited universal connection is thus provided between the armature 35 and the upper end of the stem 42.

The under surface of the valve disc member 24 has a gasket or yielding facing 45 clamped in a recess in the valve disc and between the disc and a washer 46 by a nut 47 threaded upon the stud 48 integral with and depending from the valve disc. The upper surface of the valve disc member 24 has a gasket or yielding facing 50 clamped in a recess in the valve disc and between the disc and a washer 51 by a nut 52 threaded upon a hollow stem 53 integral with and extending upwardly from the valve disc member 24. The lower end of the valve stem 42 extends downwardly into the hollow stem 53 and carries a diametrical pin 54 the ends of which extend into diametrically opposite elongated slots 55 in the hollow stem 53, thus providing a lost motion connection between the valve member 24 and the valve stem 42 and, at the same time, a limited universal connection for permitting the valve member 24 to accommodate itself to its valve seats.

The valve stem 42 has axial reciprocatory movement through the armature guide 37, and the opening through the guide 37 is preferably sealed, for example, by packing, as indicated at 56. A packing washer may be provided at 57, and the coiled spring 25 is interposed between the packing washer and the nut 52. The armature, electromagnet and circuit connections are thus sealed from the fuel which passes through the valve casing 16.

The reset means comprises a reset stem 60 extending downwardly, as the device is viewed in the drawing, through a reset housing 61 threaded into an opening in the valve casing 16. The inner end of the reset stem 60 has a head 62 which limits outward movement of the reset stem, and when the reset stem is pressed inwardly, cooperates with the stud 48 to reset the device. The stem 60 has fixed on its outer end a reset button 63 secured to the stem, for example, by threading it upon the outer end of the stem. Packing may be provided at 64 for sealing the inner end of the reset housing 61 against the escape of gas from the valve casing 16. A coiled spring 65, confined endwise between the button

63 and a packing washer 66, normally maintains the reset stem in its outwardly projected position and returns the same to that position following release of the button 63 upon completion of the resetting operation. The spring 65 also holds the packing 64 tightly about the stem 60 and the opening at the inner end of the reset housing 61.

In order to prevent unwarranted actuation of the button 63 a closure cap 68 is threaded upon the lower end of the reset housing 61, and when in place completely encloses the button 63. This cap 68 is removed to reset the device. Gaskets are preferably provided at 69 and 69a.

The thermoelectric generator is illustrated in the form of a thermocouple comprising an outer tubular thermocouple element 70 which, at one end, is welded or joined to the inner element 71 to provide a "hot" junction 72 between the two elements. The thermocouple is disposed with the "hot" junction 72 in position to be heated by the pilot flame as shown more or less diagrammatically in Figure 1 so as to be responsive to the heat of the pilot flame. The outer tubular thermocouple element 70 is joined at its opposite end, as by means of welding or the like, to a tubular couple connector 74. The opposite end of the tubular connector, which may be formed of copper or other suitable metal, is joined as by welding or the like to the adjacent end of a tubular lead conductor 76. Extending through the tubular lead conductor 76 is a lead conductor or wire 77 which may be an insulated wire and which, within the connector 74, is joined at 78 to the inner thermocouple element 71. The outer and inner thermocouple elements 70 and 71, respectively, are formed of dissimilar metals, such as "constantan" and "chromel," "chromel" and "copel," or any other dissimilar metals which when heated at the junction therebetween are adapted to produce a thermoelectric current.

The outer tubular lead conductor 76, which may be formed of copper, extends to the thermoelectric valve and is secured as by means of a welded joint at 78' within a reduced portion 79 of a connector 80 which is threaded into and electrically contacts the hood. Within the connector 80 is provided an insulating sleeve 81 disposed about the adjacent end of the conductor 77 and enclosing the connector 82 between the conductor 77 and the terminal conductor 83 of one of the coils 29. The other coil terminal is connected to the connector 80 as shown at 85. Thus a circuit is completed through the coils 29 about the legs of the magnet frame 28 and the conductors 76 and 77 leading to the thermojunction 72.

After the connections are made between the electromagnet and the lead tube 76 and conductor 77, and between the electromagnet and the connector 80, the space between the electromagnet and the upper portion of the hood 27 is preferably filled with the sealing compound 34 for holding the parts in position and sealing the same in place. This compound also seals the hood against the leakage of any gas which may leak out into the hood past the packing at 56 or around the armature guide 37.

In Figure 2 I have shown a coiled spring 92 interposed between the valve disc member 24 and the adjacent end of the stem 42 for permitting continued movement of the valve disc member 24 into seating engagement with the valve seat member 20 after the armature 35 is in engage-

ment with the magnet frame 28. This assures proper engagement of the armature 35 with the pole faces of the magnet frame and prevents any possible interference therewith by the seating of the valve member 24 on the valve seat member 20.

In Figure 3 I have shown, more or less diagrammatically, spring means in the form of a spring washer 95 between the yielding valve facing 50' and the valve disc member 24' for permitting continued movement of the armature into engagement with the magnet frame after the valve disc member 24', and particularly the spring-pressed facing 50' thereof, is seated upon the valve seat member 20'. The valve facing 50' is shown as having sliding action in the annular recess 96 in the valve disc member 24'. In Figure 3, the armature is moved to attracted position by engagement of the valve disc member 24' at the lower ends of the slots 55' directly with the cross pin 54', whereas in Figure 2 the armature is moved to attracted position through the coiled spring 92. The parts shown in Figure 3, which correspond with parts shown in Figure 2, have primed reference characters corresponding with the reference characters used in Figure 2.

The operation of the device is as follows:

When the pilot flame is burning, the heat of the pilot flame upon the junction 72 of the thermocouple produces a thermoelectric current in the coils 29 of the electromagnet 26. The magnet frame 28 and armature 35 are preferably formed of "permaloy," "hypermnic," or a similar alloy of relatively low magnetic reluctance, and, as a result, the relatively weak thermoelectric current produces a magnetic field in the magnet frame and armature of sufficient strength so that when the magnet armature is placed in contact with the ends of the magnet frame by pushing the reset button 63 inwardly, the magnetic attraction between the magnet frame and the armature holds the armature in attracted position against the magnet frame with a force greater than the force exerted by the spring 25, thereby holding the valve 24 in open position between the valve seats 20 and 21 as shown in Figure 2 of the drawing. It will be noted that with the armature 35 in attracted position the valve member 24 is adapted to be moved inwardly into engagement with the valve seat 20. When the armature is held in attracted position and the reset button is released, as will presently appear, the spring 25 moves the valve member 24 away from the valve seat 20 to its open position between the valve seats, and the cross pin 54 limits the movement of the valve member 24 toward the valve seat 21 with the armature in attracted position.

If the pilot flame goes out, the thermoelectric current through the electromagnet ceases, and the spring 25 moves the valve member 24 to closed position against the valve seat 21. The spring 25 also assures detachment of the armature from the electromagnet upon deenergization of same and notwithstanding any residual magnetization therein. The closing of the valve 24 against the valve seat 21 shuts off the supply of gas to the main burner 10.

The E. M. F. produced by the heat of the pilot light on the junction 72 of the thermocouple is not sufficient to energize the electromagnet sufficiently to draw the armature upwardly from its retracted position, and therefore the valve is reset by removing the cap 68 and pushing the button 63 inwardly to raise the armature into con-

tact with the magnet frame 28. As the reset stem is pushed inwardly in the resetting operation, the head 62 thereof abuts the stud 48 which, by the inward movement of the stem, shifts the valve member 24 from seating engagement with the valve seat 21 into seating engagement with the valve seat 20. The seating of the valve member 24 upon the valve seat 20 shuts off the flow of fuel to the main burner during the resetting operation. It will be noted that in resetting the device the armature 35 is first moved into good contact with the pole faces at the ends of the magnet frame 28, and the lost motion connection provided by the cross pin 54 and the slots 55 permits continued movement of the valve member 24 into seating engagement with the valve seat 20 after the armature is in attracted position. This assures proper positioning of the armature in attracted position and against any improper positioning of the armature by reason of the valve member 24 engaging its valve seat 20 first and preventing continued resetting operation of the armature.

If the pilot burner is lighted and sets up a thermoelectric current to hold the armature 35 in contact with the pole faces of the electromagnet, the valve stem 42 will be held in the position shown in Figure 2 of the drawing. Then when the reset button 63 is released, the spring 25 will move the valve member 24 away from the valve seat 20 to open position between this valve seat 20 and the valve seat 21 as shown in Figure 2 of the drawing. As previously pointed out, the cross pin 54 limits the movement of the valve member 24 toward the valve seat 21 with the armature 35 in attracted position so that the valve member 24 will be maintained in proper open position between the respective valve seats. If, on the other hand, the pilot burner is not lighted to produce the thermoelectric current for holding the valve 24 in open position, this valve will move to closed position against the valve seat 21 upon release of the button 63, and in this manner a single shutoff valve member operates to prevent the passage of fuel to the main burner until the pilot burner is lighted and a thermoelectric current set up to hold the armature in contact with the pole faces of the electromagnet. After resetting the device and releasing the resetting button 63, the cap 68 may be replaced.

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

I claim:

1. In a safety control valve of the character described, a valve casing having an inlet chamber and an outlet chamber with a valve chamber therebetween provided with an inlet port and an outlet port respectively opening into said inlet and outlet chambers for establishing communication therebetween, a valve stem, said inlet and outlet ports and said valve stem being coaxial, a valve member mounted on said stem for limited relative movement lengthwise thereof disposed within said valve chamber between and controlling said ports, an armature attached to said valve stem, means yieldingly urging said stem and valve member toward a released position with said valve member seating over the outlet port, an electromagnet effective when energized for holding said armature and said valve stem in attracted position with said

valve member disposed between and spaced from said ports but incapable of moving said armature and stem from released to attracted position, and reset means for moving said armature and stem from released to attracted position and moving said valve member from released position to a resetting position seating over said inlet port.

2. In a safety control valve of the character described, a valve casing having an inlet chamber and an outlet chamber with a valve chamber therebetween provided with an inlet port and an outlet port respectively opening into said inlet and outlet chambers for establishing communication therebetween, an abutment member, a valve stem slidable through said member, said inlet and outlet ports and said valve stem being coaxial, a valve member mounted on said stem for limited movement lengthwise thereof disposed within said valve chamber between and controlling said ports, an armature attached to said valve stem, a compression spring disposed about said valve stem confined between said abutment member and said valve member yieldingly urging the latter and said stem toward a released position with said valve member seating over said outlet port, an electromagnet effective when energized for holding said armature and said valve stem in attracted position with said valve member disposed between and spaced from said ports but incapable of moving said armature and stem from released to attracted position, and reset means for moving said armature and stem from released to attracted position and moving said valve member from released position to a resetting position seating over said inlet port.

3. In a safety control valve of the character described, a valve casing having an inlet chamber and an outlet chamber with a valve chamber therebetween provided with an inlet port and an outlet port respectively opening into said inlet and outlet chambers for establishing communication therebetween, a valve stem, said inlet and outlet ports and said valve stem being coaxial, a valve member mounted on said stem for limited relative movement lengthwise thereof disposed within said valve chamber between and controlling said ports, an armature attached to said valve stem, means yieldingly urging said stem and valve mem-

ber toward a released position with said valve member seating over the outlet port, an electromagnet effective when energized for holding said armature and said valve stem in attracted position with said valve member disposed between and spaced from said ports but incapable of moving said armature and stem from released to attracted position, reset means for moving said armature and stem from released to attracted position and moving said valve member from released position to a resetting position seating over said inlet port, and means supplementary to said yielding means yieldingly urging said valve member outward of said stem permitting relative movement between said valve member and said stem toward said electromagnet in the resetting operation.

4. In a safety control valve of the character described, a valve casing having an inlet chamber and an outlet chamber with a valve chamber therebetween provided with an inlet port and an outlet port respectively opening into said inlet and outlet chambers for establishing communication therebetween, a valve stem, said inlet and outlet ports and said valve stem being coaxial, a valve member mounted on said stem for limited relative movement lengthwise thereof disposed within said valve chamber between and controlling said ports, an armature attached to said valve stem, means yieldingly urging said stem and valve member toward a released position with said valve member seating over the outlet port, an electromagnet effective when energized for holding said armature and said valve stem in attracted position with said valve member disposed between and spaced from said ports but incapable of moving said armature and stem from released to attracted position, reset means for moving said armature and stem from released to attracted position and moving said valve member from released position to a resetting position seating over said inlet port, and a compression spring confined between said stem and said valve member urging the latter outward of said stem and permitting relative movement between said valve member and said stem toward said electromagnet in the resetting operation.

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