Aug. 9, 1938. J. H. THORNBERY ET AL 2,126,587

THERMOELECTRIC SAFETY VALVE

Original Filed Sept. 10, 1934

Fig. 1.

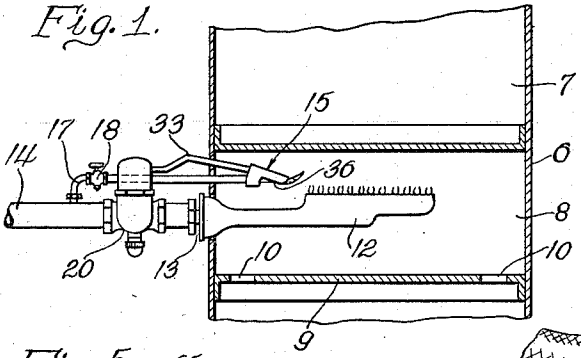


Fig. 2.

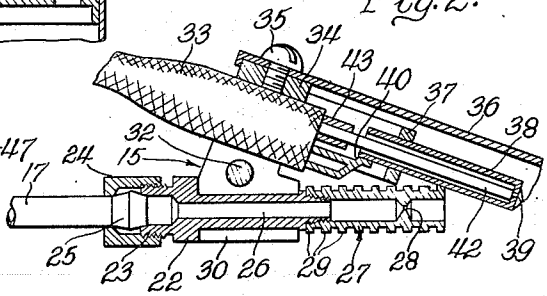


Fig. 5.

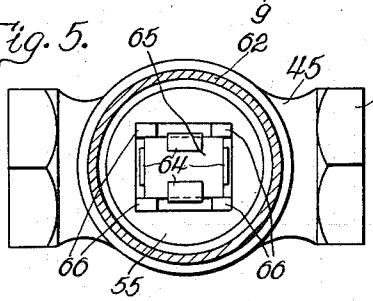


Fig. 3.

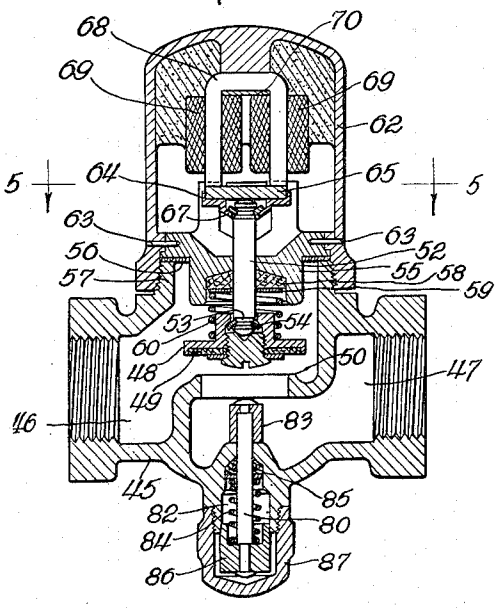
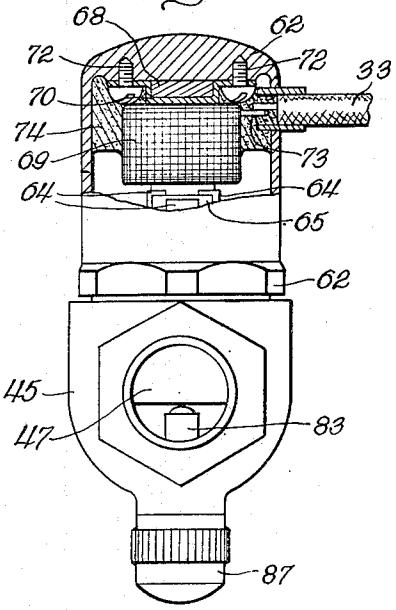


Fig. 4.



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THERMOELECTRIC SAFETY VALVE

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Original application September 10, 1934, Serial No. 743,382. Divided and this application December 4, 1936, Serial No. 114,188

1 Claim. (Cl. 175—336)

This invention relates to a thermo-electric safety valve, and more particularly is directed to a safety valve which is electrically actuated by a thermally responsive member positioned adjacent a remotely disposed pilot burner or igniter, and which is adapted to shut off the fuel supply to a main burner or the like upon accidental extinguishment of the pilot flame.

The present application is a division of our copending application, Serial No. 743,382, filed September 10, 1934.

The primary object of the present invention is to provide a safety valve of this type so designed as to produce a positive shut-off for the gas supply to a gas burner when the burner pilot igniting means is extinguished. In its preferred embodiment, the present invention comprises a valve structure including a valve member mounted upon a reciprocally movable valve stem, the upper end of the valve stem being sealed from the valve chamber and being provided with a universally supported armature, which is adapted to be held in attracted position by magnetic means controlled by actuation of a remotely disposed thermocouple. The valve is capable of being held in open position as long as the pilot burner heats the thermocouple junction, but spring means are provided for closing the valve upon deenergization of the thermocouple. The magnet means is not sufficiently energized by the thermocouple to allow automatic opening of the valve, and the particular mechanism herein shown and described is provided with manually operable means for moving the valve into open position when the thermocouple is actuated.

One of the features of the present invention is the provision of a safety valve structure which, when once closed due to accidental extinguishment of the pilot burner, cannot be opened without the actuation of manually operable mechanism at the valve, and cannot be maintained in open position unless the pilot burner is ignited. This requires that the operator manually reset the valve in open position, and insures that the valve cannot be opened to allow a flow of fuel to the main burner unless it is first manually opened and held open while the pilot burner is re-ignited. This insures that no fuel will be admitted to the main burner except during such times as the pilot burner is ignited.

Another advantage secured by the present invention resides in the valve construction, providing a ball and socket connection between the valve stem and the valve seating member, and a similar connection between the valve stem and the magnetic armature which holds the valve in open position when the electromagnet is energized.

Other objects and advantages of the present invention, such as the use of an enclosed sealing hood for the electrical actuating means for the valve, and other various features of the valve construction, will be more fully apparent from the following detailed description which, taken in conjunction with the accompanying drawing, will disclose to those skilled in the art the particular construction and operation of a preferred form of our invention.

In the drawing:

Figure 1 is a diagrammatic view showing the positioning of the pilot burner and safety valve for use in a heater or burner construction;

Figure 2 is a detail vertical sectional view of the pilot burner construction and thermocouple junction;

Figure 3 is a vertical sectional view through the safety valve member;

Figure 4 is a partial sectional view through the valve member, showing the manner in which the thermocouple conductors are led into the valve hood; and

Figure 5 is a sectional view of the magnetic armature cradle, taken substantially on the line 5—5 of Figure 3.

Referring now in detail to the drawing, a hot water heater is indicated generally at 6, and comprises a tank portion 7 adapted to contain the water to be heated, a burner compartment 8, and a flanged lower wall 9 having port 10 therein for supplying air to the burner 12 disposed within the burner compartment 8 and adapted, when ignited, to heat the water in the tank 7.

The burner 12 is connected through a suitable air and gas admixture chamber, indicated at 13, with a fuel supply line 14, conveying the fuel to the burner.

A pilot burner head is indicated generally at 15, and is supported by the lighter tube 17 having an adjustable valve cock 18 therein for controlling the flow of fuel to the burner head 15. The tube 17 is tapped into the fuel supply line 14 at any convenient point, either anterior or posterior to the valve, as is well known in the art.

The safety valve of the present invention is indicated generally at 20, and is interposed between the fuel supply conduit 14 and the gas and air admixture chamber 13 for the burner 12.

Considering the pilot burner head structure 15 in detail, the lighter tube 17 is adapted to carry, upon the free end thereof, the pilot head 22, which pilot head is provided with a recessed end

portion 23 which is exteriorly threaded to receive a compression nut 24 extending over and bearing against a compression sleeve 25 formed upon the end of the tube 17. The pilot head 22 is provided with an axial passageway indicated at 26, and at its opposite end is threaded to receive a pilot tip 27 having a restricted orifice 28 therein from which the pilot flame is projected during normal operation of the pilot burner.

The pilot tip 27 is provided with radially extending fins or flanges 29 which prevent the temperature of the tip from rising sufficiently high to cause cracking or decomposition of the gases in the orifice 28 or in passageway 26. Thus, even with the use of gases having low cracking temperatures, decomposition of the gas will not occur due to the heat adjacent the pilot tip.

Mounted upon the pilot head 22 is a suitable supporting bracket 30 which is secured in fixed position upon the head 22 by means of the clamping nut 32 which is adapted to support the outer end of a braided cable 33 carrying the two conductors leading to the thermocouple. The bracket 30 is also provided with a boss portion 34 which is threaded to receive the set screw 35, the set screw 35 serving to secure a shielding member 36 in predetermined position with respect thereto over the pilot flame port.

The bracket 30 is also provided with an offset supporting portion 37 which is adapted to receive the outer enclosing member 38 of the thermocouple junction indicated at 39. The member 38 is connected, through the terminal lug 40, to one of the conductors carried within the cable 33. Extending within and spaced from the inner periphery of the member 38 is the second thermocouple member, indicated at 42, which is suitably welded, at its free end, as at 39, to the member 38 to form a thermocouple junction which is disposed substantially in the path of the pilot flame. The member 42 is connected through terminal lug 43 to the other of the conductors carried in the braided cable 33.

Preferably, the pilot tip 27 is formed of aluminum or any similar metal which is a good conductor of heat, for the purposes hereinbefore described. The thermocouple members 38 and 42 are formed of dissimilar metals, such as iron and constantan, "Chromel" and "Copel", or any of numerous other well known combinations, and, when the welded junction 39 thereof is heated, an electrical potential is generated at the hot junction which causes a flow of electric current from the hot junction through the conductors connected to the thermocouple element by the terminal lugs 40 and 43.

Referring now in detail to the switch structure shown in Figures 3, 4 and 5, this switch structure is mounted upon the valve body 45, which valve body is provided with an inlet chamber 46 connected to the fuel supply conduit 14 and an outlet chamber 47 leading to the burner. The passageway between the chambers 46 and 47 is controlled by a valve member indicated generally at 48, which is provided with a valve seating surface 49 adapted to engage the valve seat 50 formed in the partition wall dividing the chambers 46 and 47. The valve member 48 is adapted to be suspended from the lower end of a valve stem 52, which valve stem is provided with an annular grooe 53 adjacent its lower end, the groove being adapted to receive a split collar member 54 for mounting the valve member 48 for limited universal movement with respect to the stem 52.

The valve stem 52 extends upwardly through the packing gland member 55, which member is seated, by means of gasket 56, upon the upstanding threaded boss portion 57 of the valve body 45. The gland member 55 is provided with a recess adapted to receive packing, indicated at 58, which packing is compressed by means of a washer 59 bearing thereagainst and under the influence of spring pressure exerted by one end of a spring member 60. The opposite end of the spring member 60 is biased about an annular boss portion of the valve seating member 48, and normally tends to urge the valve member 48 downwardly toward the valve seat 50.

A hood member 62 is threaded over the upstanding boss portion 57 of the valve body 45, and is non-rotatably secured to the member 55 by dowel locking pins 63 which extend through the hood member into the packing gland member 55 for non-rotatably securing the two members together.

The valve stem 52 is adapted to carry, by means of the armature cradle 64, the magnet armature 65 which is supported upon the cradle 64, and which is guided for reciprocatory movement within the guiding lugs 66 formed integral with and extending normally upwardly from the packing gland member 55. The cradle member 64 engages in an annular groove formed in the upper end of the valve stem 52, and is held in position by means of a split clamping ring 67 which provides for limited universal movement of the cradle 64 and its associated armature 65 with respect to the upper end of the valve stem 52.

The armature 65 is adapted to have engagement with the end portions of a U-shaped magnet 68, which magnet is provided, about each extending leg thereof, with an electromagnetic coil 69. The magnet frame 68 is rigidly held to the hood 62 by means of the bracket 70 which is secured thereto by means of screws 72.

The flexible leads carried by the cable 33 are connected to the coils 69 of the magnet frame 68 through the terminal lugs indicated at 73. The hood is then filled with sealing compound, indicated at 74, for holding the parts in position and for sealing the hood against gas leaks occasioned by leakage past the valve stem 52.

As shown in detail in Figure 5, the armature 65 is securely engaged by the cradle member 64, and is so positioned as to have reciprocal movement with respect to the guiding lugs 66 of the gland member 55, so that upon upward movement of the valve stem 52 against the pressure of spring 60 the armature is adapted to have seating engagement across the ends of the magnet frame 68.

The current generated at the thermocouple junction 39, and flowing through the flexible conductors in the cable 33, is sufficient to hold the valve stem in raised position against the pressure of spring 60 only when the magnetic armature 65 is in engagement with the ends of the magnet frame 68. Thus, when the pilot flame is extinguished, this current is correspondingly reduced, and the spring pressure therefore forces the armature 65 away from the frame 68 and snaps the valve member 48 downwardly to effect valve closing engagement between the boss valve seating member 49, which preferably is formed of leather or fiber, and the valve seat 50. When the valve has once been closed, reignition

of the pilot flame will not result in opening of the valve, since the magnetic attraction of the magnet **68** is insufficient to draw the armature **65** upwardly against the pressure of spring **60**. It is thus nesessary to provide a manual resetting mechanism. This is illustrated in detail in Figure 3.

The resetting mechanism comprises a plunger member **80** which extends through a suitable recess **82** formed in the lower portion of the valve body **45**, and at its upper end is provided with a cap member **83** which limits downward movement of the member **80** under the influence of the spring **84** and is adapted, upon upward movement of the plunger **80**, to engage the valve member **48** for forcing the same upwardly against the pressure of spring **60** to force the armature **65** into engagement with the ends of the magnet frame **68**. Suitable packing, indicated at **85**, is disposed in the recess **82** for sealing the same against gas leakage, and the lower end of the plunger **80** is provided with a resetting button **86** secured thereto and recessed to provide seating engagement for one end of the spring **84**. Upon actuation of the button **86**, the plunger is reciprocated within the recess **82** and effects opening of the valve. In order to prevent unwarranted actuation of the plunger member **80** to effect resetting of the valve, a closure member or knurled cap **87** is provided, which is threaded over an extending portion of the valve body **45** and completely encloses the reset button **86** and lower end of the plunger **80**. It is necessary to remove the cap **87** in order to effect resetting of the valve.

Due to the fact that the magnet frame **68** and the armature **65** are formed of "Permaloy", "Hypernic", or a similar alloy of extremely low magnetic reluctance, the relatively weak current generated by the thermocouple junction generates a magnetic field in the magnet frame **68** and the armature **65** of sufficient strength so that when the magnet armature is placed in contact with the frame by pushing the reset button **86**, the magnetic attraction between the magnet frame and armature holds the two together with a force greater than the force exerted by the spring **60**, thereby holding the valve member **48**, through its mechanical connection to the armature **65**, in open position as long as the pilot flame heats the welded junction of the thermocouple.

Upon accidental blowing out or extinguishment of the pilot flame from any cause, the welded junction of the thermocouple immediately cools, resulting in a fall of electrical potential at this junction. This decreases the amount of current flowing through the coils **69** and produces a corresponding collapse in the magnetic field in the magnet frame **68** and armature **65**. As the magnetic field decreases, the attraction between the frame and the armature decreases to a point where the spring **60** exerts a greater force, thereby drawing the armature away from the frame and snapping valve member **48** into closed position. This shuts off the fuel supply to the burner **12**, so that if, for any reason, the pilot flame is extinguished, the fuel supply to the burner is automatically cut off. The burner cannot be relighted until the pilot flame has been reignited and the safety valve member **20** has been reset.

It is apparent that we have provided positive means for cutting off the fuel supply to a main burner upon accidental extinguishment of the pilot flame, whereby the fuel supply to the burner can only be reestablished upon manual resetting of the safety valve and reignition of the pilot flame. It is thus apparent that the central valve for the burner can never be opened and maintained in open position unless the pilot flame is ignited.

It is obvious that various changes and modifications may be made in certain details of the structure shown and described in connection with the present invention, and we do not intend to be limited to the exact structure herein shown but only as defined by the scope and spirit of the appended claim.

We claim:

In combination, a control device comprising a first housing having an opening therein, a cup-shaped housing secured to said first housing over said opening, a magnet member secured inside said cup-shaped housing and having pole means, electromagnetic coil means wound about the pole means of said magnet member, a reciprocatory plunger disposed substantially concentrically of said cup-shaped housing and having an armature having relative movement thereon for accommodating itself to the pole means of the magnet member, said armature being adapted to be held in attracted position by said magnet member, control means in said first housing and cooperating with said plunger, means closing the open end of said cup-shaped housing and guiding the plunger in the movement of the armature toward and away from the pole means of said magnet member, spring means substantially coaxial with said plunger and disposed within said first housing and normally urging said armature to retracted position away from said magnet member, and a push button substantially coaxial with respect to said plunger and adapted to be pushed manually to overcome said spring means and to return said armature to the position in which it is held by said magnet member.

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