July 26, 1949. R. W. MUELLER 2,477,078

THERMOCOUPLE BURNER CONTROL DEVICE

Filed Oct. 30, 1944 2 Sheets-Sheet 1

Fig. 1.

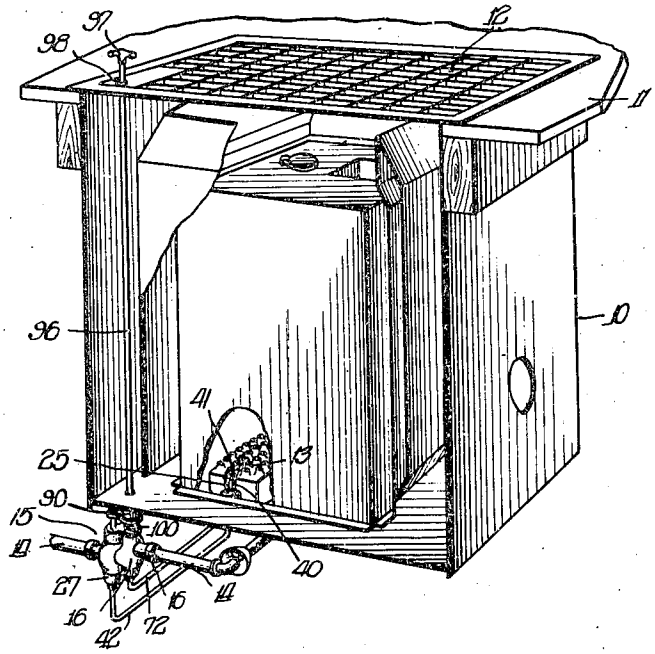


Fig. 2.

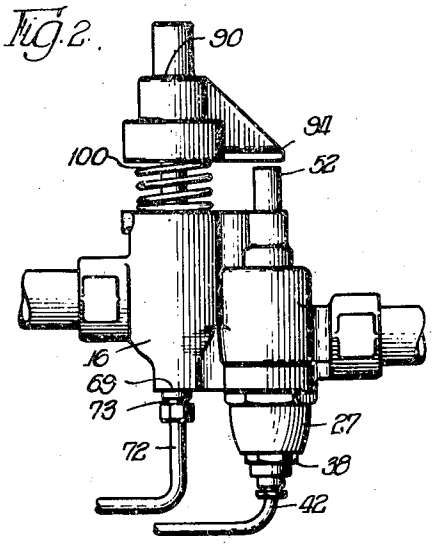


Fig. 4.

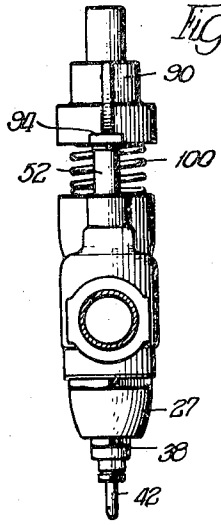
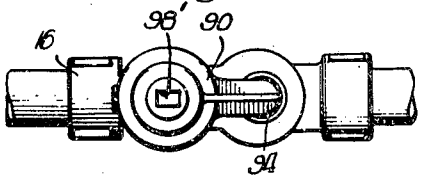


Fig. 3.



INVENTOR.
Robert W. Mueller,
BY
Brown, Jackson, Boettcher & Dienner
Attys

July 26, 1949. R. W. MUELLER 2,477,078

THERMOCOUPLE BURNER CONTROL DEVICE

Filed Oct. 30, 1944 2 Sheets-Sheet 2

Fig. 5.

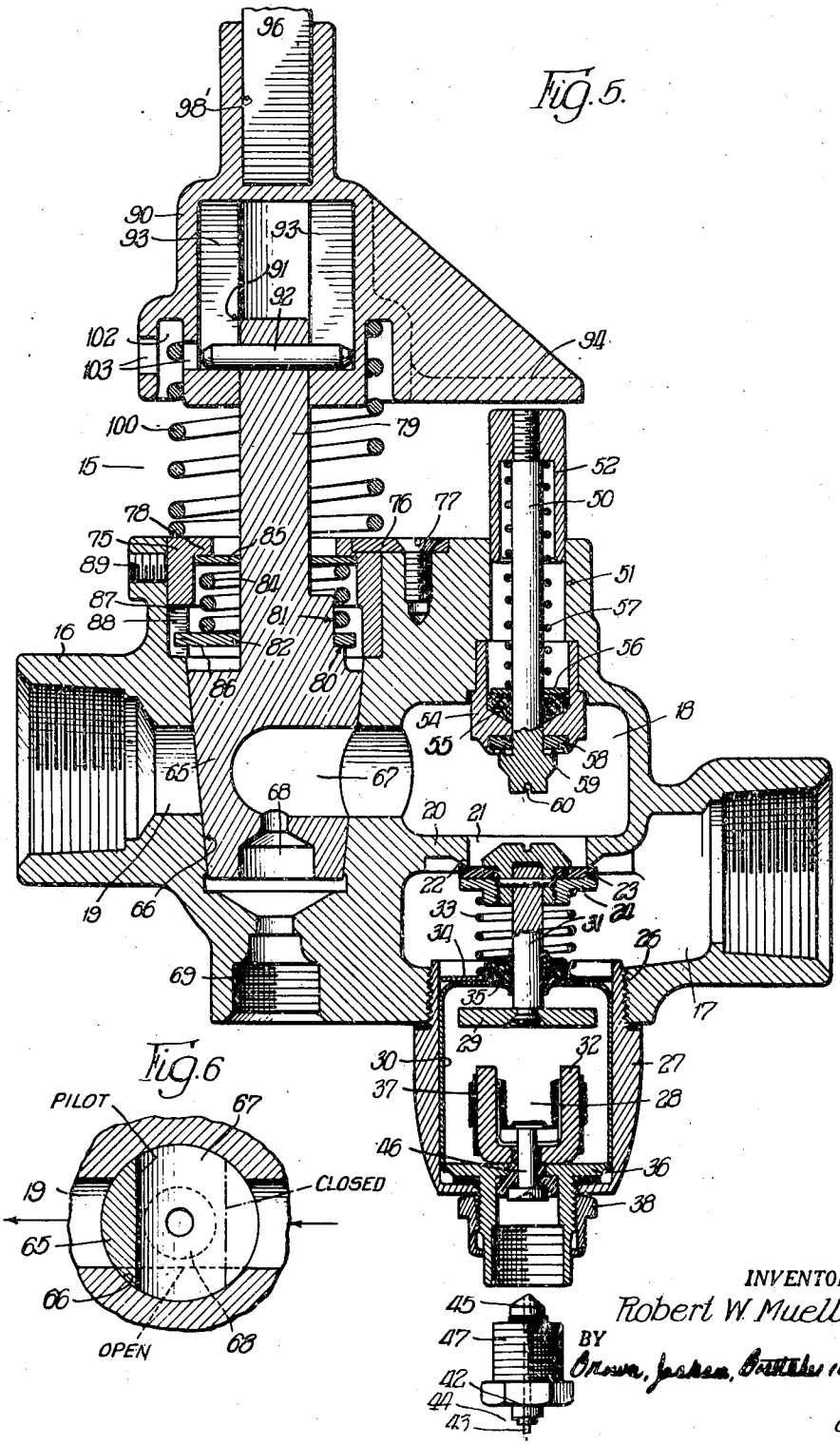


Fig. 6

INVENTOR.
Robert W. Mueller,
BY
Brown, Jackson, Boettcher & Dinn
attys

Patented July 26, 1949

2,477,078

UNITED STATES PATENT OFFICE

2,477,078

THERMOCOUPLE BURNER CONTROL DEVICE

Robert W. Mueller, Milwaukee, Wis., assignor to Milwaukee Gas Specialty Company, Milwaukee, Wis., a corporation of Wisconsin

Application October 30, 1944, Serial No. 561,082

5 Claims. (Cl. 137—144)

1

This invention relates, in general, to a burner control device, and has particular relation to a thermocouple burner control device for fluid fuel burners, which device is operable to shut down the main burner upon failure of the pilot flame.

The device which I shall describe hereinafter in connection with the drawings is particularly adapted for use with gas-fired floor furnaces of the type that are constructed to be set into the floor, and have a register disposed, for example, at the floor level through which the heated air enters the room. It is to be understood, however, that the device of the present invention is not limited to this particular use but may be employed for other purposes as suitable and desired.

It is known to provide floor furnaces and like apparatus with a combined shutoff valve and thermocouple safety device. In general, however, in prior devices of this sort two control rods have been required to operate the shutoff valve, reset the thermocouple safety device, and operate the pilot valve. As a result, the operation of the device has been more difficult and its cost has been higher.

One of the main objects of the present invention is to provide an improved form of thermocouple burner control device that may be manipulated very expeditiously from position above the floor.

Another object of the invention is to provide a device of the class described in which the shutoff valve is moved to open, closed, and pilot positions, and in which the thermocouple safety means is adapted to be reset when the shutoff valve is in pilot position; all by means of a single rod connected to the shutoff valve and the thermocouple safety device and extending to position to be operated, for example, from above the floor.

Another object of the invention is to provide, in a device of the class described, an operating member attached to the valve plug to turn the plug to open, closed, and pilot positions and having longitudinal movement relative to the plug for resetting the thermocouple safety device when the plug is in pilot position; the operating member being clear of the thermocouple safety device for longitudinal movement relative to the valve plug and free of the thermocouple safety device when the valve plug is out of pilot position.

Another object of the invention is to provide a device of this character having various features of novelty and advantages, and which is particularly characterized by its simplicity in construction, its economy in manufacture, its effectiveness in use, and the presence of only one operating rod for accomplishing the results set forth.

2

Further objects and advantages of the invention will appear from the following detailed description, taken in connection with the accompanying drawings which illustrate the manner of constructing and operating one form of device embodying the present invention.

In the drawings:

Figure 1 is an isometric sectional view of a conventional floor furnace illustrating a thermocouple burner control device embodying the present invention applied thereto;

Figure 2 is a side elevational view of the thermocouple burner control device;

Figure 3 is a top plan view of the device shown in Figure 2;

Figure 4 is an end view of the device taken from the right as the device is viewed in Figure 2;

Figure 5 is an enlarged sectional view taken on the line 5—5 of Figure 3; and

Figure 6 is a fragmentary cross sectional view through the valve plug showing the pilot, open, and closed positions of the plug.

Referring now to the drawings, the invention is shown for purposes of illustration applied to a floor furnace which is designated in its entirety at 10. The furnace 10, which may be of conventional or any suitable construction, is set into the floor 11, and has a register 12 disposed, for example, at the floor level through which the heated air enters the room.

For purposes of the present description, suffice it to state that the furnace 10 has a main burner 13 which is supplied with gaseous fuel by a fuel supply pipe 14 and that the thermocouple burner control device, designated in its entirety at 15, is interposed in the fuel supply pipe 14. The construction of the floor furnace 10 per se forms no part of the present invention, and therefore it will not be described in further detail.

The thermocouple burner control device 15 comprises a valve body or housing 16 having an inlet chamber 17, an intermediate chamber 18, and an outlet passage 19. Contiguous sections of the fuel supply pipe 14 are connected to the inlet chamber 17 and outlet passage 19.

A wall or a partition 20 separates the inlet chamber 17 from the intermediate chamber 18. This wall 20 has a valve opening 21. An annular valve seat 22 is provided about the valve opening 21, upon which valve seat 22 the yielding facing 23 of the thermocouple safety valve 24 is adapted to seat to shut off communication between the inlet and intermediate chambers 17 and 18 and

thereby the supply of fuel for the main burner 13; also the supply of fuel for a pilot burner 25, which pilot burner is positioned in proximity to the main burner 13 as shown in Figure 1.

Screwed or otherwise secured at 26 in the valve body 16 axially relative to the valve opening 21 is an electromagnet housing 27. The electromagnet 28 and armature 29 are disposed within the housing 27, and are preferably enclosed by an inner shell 30. A stem 31 has one end extending into the inlet chamber 17 and attached to the thermocouple safety valve 24, preferably in a manner to permit self-accommodation of this valve 24 to its seat 22. The opposite end of the stem 31 extends through the adjacent end of the shell 30 and is attached to the armature 29, also preferably in a manner to permit self-accommodation of the armature to the pole ends of the magnet frame 32.

A coiled spring 33, interposed between the valve 24 and a spring abutment member 34, tends yieldingly to close the valve 24 and to hold it in closed position. Suitable sealing material 35 is preferably placed around the stem 31 and between the member 34 and the adjacent end of the inner shell 30 to prevent the passage of dust or other foreign matter into the armature and electromagnet housing along the stem 31.

The magnet frame 32 is secured, for example, to a terminal bushing 36 in the manner more fully disclosed in Henry F. Alfery Patent No. 2,318,136, May 4, 1943. The coil 37 of the electromagnet is wound around the legs of the magnet frame 32. The bushing 36 is shown as externally threaded for threaded engagement with a nut 38, by means of which nut the bushing 36 is clamped to the outer end of the electromagnet housing 27.

A thermocouple, indicated at 40, is placed in position so that the hot junction 41 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, August 9, 1938, or the construction of the thermocouple and leads therefor may be of any other suitable or preferred form.

The thermocouple lead comprises an outer tubular lead conductor 42 joined, for example, to the outer tubular thermocouple element and an inner lead conductor 43 joined to the inner thermocouple element as shown and described in the Leins patent above identified. The inner lead conductor 43 is insulated from the outer lead conductor 42 by a wrapping of insulation 44 on the inner lead conductor.

A quick detachable or removable connection is preferably provided between the ends of the leads 42 and 43 opposite the ends which are connected to the thermocouple elements. This removable lead connection may be in the form disclosed in the Henry F. Alfery patent above identified, and is illustrated in that form, it being understood that this connection may be of any other suitable or preferred form. Suffice it, for purposes of this description, to state that the inner lead 43 has a connector cone 45 which seats in the correspondingly recessed outer end of the terminal tip 46 and is clamped in contact therewith by a connector sleeve 47. The adjacent end of the outer tubular lead conductor 42 is connected in circuit with one side of the coil 37 through the bushing 36, and the other side of the coil is connected to the inner lead conductor 43 through the terminal tip 46.

The heat of the pilot light on the thermocouple 40 energizes the electromagnet 28 sufficiently to hold the armature 29 in attracted position against the pole ends of the magnet frame 32 and the thermocouple safety valve 24 in open position, but this thermoelectric current is not capable of moving the armature 29 to attracted position and the valve 24 to open position. Reset means is therefore provided for resetting or cocking the armature 29 to attracted position and the valve 24 to open position.

The reset means comprises a reset stem mounted for rectilinear movement in an opening 51 in the valve body 16. The axis of the reset stem 50 is in alignment with the axis of the valve and armature stem 31. A reset button 52 is secured to the outer end of the stem 50, for example by screwing the same thereon, as shown. The reset button 52 operates slidingly in the opening 51 in the valve body.

A guide member 54 is secured in the valve body 16 at the inner end of the opening 51. The inner end of the stem 50 extends through the guide 54 into the intermediate chamber 18 and is guided by the guide member 54. The opening in the guide 54 through which the stem 50 extends is sealed by suitable packing 55. A packing washer is provided at 56, and a coiled reset spring 57, interposed between the washer 56 and reset button 52, yieldingly holds the reset stem in the position shown in Figure 5, and returns the stem to this position upon release thereof, as will presently appear.

A gasket, or additional packing, may be provided at 58, and the inner headed end of the reset stem 50 may have rib means at 59 which cooperates with the gasket or packing 58 to press the same tightly about the stem additionally to prevent the escape of gas when the reset stem is in the position shown in Figure 5. A kerf or slot 60 may be provided in the inner end of the stem 50 for screwing the stem into the button 52.

The shutoff or control valve is in the form of a truncated conical plug 65 seated in a conical bore 66 in the valve body 16 to turn to open, closed, and pilot positions, as shown in Figure 6; also to intermediate open and closed positions. The plug 65 is disposed laterally of the intermediate chamber 18 with its axis parallel with the axis of the valve and armature stem 31, and has laterally opening port means 67 for cooperation with the outlet passage 19; also an outlet 68 opening from its inner end for supplying fuel to a pilot outlet 69 in the valve body 16 when the valve plug 65 is in the position shown in Figure 5. By reference to Figure 6 it will be apparent that turning of the plug 65 a quarter of a turn, or 90°, counterclockwise from the position shown will place the port means 67 in position to open the passage 19 for the supply of fuel to the main burner. Another quarter or 90° turn of the valve plug 67 in the same direction will shut off all fuel to both the main burner and the pilot burner.

A pilot tube 72, connected to the pilot outlet 69 by suitable connection means 73, leads to the pilot burner 25 for the purpose of supplying fuel thereto when the valve plug 65 is in pilot position as shown in Figure 5.

A sleeve 75 is mounted in a cylindrical opening in the valve body 16 at the outer end of the conical bore 66. This sleeve 75 is held against outward displacement from the valve body by a plate 76 secured to the valve body, for example, by a screw 77. The outer end of the sleeve 75 has an inturned annular flange 78.

The valve plug 65 has a stem 79 which extends outwardly from the valve body 16. The valve plug 65 has an abutment 80, and adjacent this abutment 80 the valve stem 79 has an enlargement which is splayed at 81. A combined abutment and stop member 82 has an opening which fits over the enlarged inner end of the stem 79 and is shaped to cooperate with the splayed portion 81 thereof to prevent rotation of the combined abutment and stop member 82 relative to the valve stem 79. A coiled spring 84, interposed between the abutment and stop member 82 and abutment disc 85 which seats against the inturned annular flange 78, maintains the conical surface of the plug 65 resiliently and, at the same time, tightly seated in the bore 66.

Rotation of the valve plug 65 in a counterclockwise direction (Figure 6) is stopped when the valve plug is in full closed position, and rotation of the plug in the opposite direction is stopped when it reaches full pilot position by cooperation of a radially extending finger 86 on the abutment and stop member 82, with stops 87 formed by the ends of an opening 88 in the sleeve 75. A set screw 89 holds sleeve 75 in position.

Turning of the valve plug 65 and resetting of the armature 29 to attracted position and valve 24 to open position is accomplished by means of an operating head 90. The operating head 90 has a bore 91 which fits slidingly over the adjacent end of the stem 79. The head 90 is connected to turn the stem 79, and thereby the valve plug 65, with turning movement of the operating head by means of the cavity in the head 90 which is mated to the stem 79 to connect stem 79 and thereby valve plug 65 for turning movement with head 90. A cross pin 92 fixed in the stem 79 limits the outward movement of head 90 relative to stem 79.

A finger 94, which extends laterally from the operating head 90, is adapted to register with the reset button 52 when the valve plug 65 is in pilot position as shown in Figure 5. In the illustrated embodiment of the invention the finger 94 is out of register with the reset button 52 in the other positions of the valve plug 65, namely, when the valve plug is in open and closed positions. The longitudinal slots 93 permit longitudinal movement of the operating head 90 relative to the valve plug 65 inwardly from the position shown in Figure 5.

With the finger 94 in register with the reset button 52 in the pilot position of the valve plug 65 the finger 94 engages the reset button 52 in the inward longitudinal movement of the operating head 90, and imparts inward rectilinear movement to the reset stem 50 which, by engagement of its inner end with the valve means at 24, actuates the valve 24 to open position and the armature 29 to attracted position.

When the valve plug 65 is turned out of pilot position, for example, to open or closed positions, or to positions intermediate open and closed positions, the finger 94 is moved out of register with the reset button 52. Any inward longitudinal movement of the operating head 90 with the finger 94 out of register with the button 52 is free or clear of the reset button and, as a result, no resetting operation is imparted to the reset means.

Turning and longitudinal movement are imparted to the operating head 90 by an operating rod 96 which extends up from the burner control device 15 to the floor level. The rod 96 is provided at its upper end with an actuating handle 97, and may be guided at 98 in a hole in the floor register, or otherwise as desired. The lower end of the rod 96 is attached to the head 90 to turn same therewith and to impart the desired longitudinal movement to the head, for example, by securing the oblong or polygonal lower end of the rod 96 in a correspondingly shaped socket 98 in the head 90.

A coiled spring 100, interposed between the operating head 90 and the valve body 16, maintains the operating head 90 and rod 96 yieldingly in extended position as shown in Figure 5, and returns same to such position after the operating head 90 is depressed to reset the thermoelectric safety means. The operating head 90 may be provided with an annular recess 102 for receiving the adjacent end of the spring 100. The head 90 preferably has openings 103 to permit insertion and removal of the cross pin 92.

To start the operation of the system shown in the drawings, the following sequence is followed:

With the valve plug 65 in pilot position as shown in Figure 5, the operating head 90 is pressed inwardly by means of the handle 97, and the finger 94 actuates the reset button 52 to move the valve 24 to open position and the armature 29 to attracted position. This sets up a flow of fuel to the pilot burner 25 through inlet chamber 17, valve opening 21, intermediate chamber 18, the inner end of passageway 19, port 67, pilot outlet 69, and pilot tube 72.

Upon ignition of the pilot burner 25 for example, by applying a lighted match or otherwise as desired, the pilot flame, by heating the hot junction 41 of the thermocouple 40, energizes the electromagnet 28 sufficiently to hold the armature 29 in attracted position and the valve 24 open. When the inward pressure on the handle 97 is released the operating head 90 and rod 96 are returned to the positions shown in Figure 5 by the spring 100. The spring 57 returns the reset stem 50 to its outwardly projected position.

After the pilot has been ignited and the thermocouple operates to hold the thermoelectric safety valve 24 in open position, gas will flow to the main burner 13 if the manual valve 65 is turned 90° to open position as shown in Figure 6. Further 90° rotation of the valve plug 65 to closed position, as shown in Figure 6, will shut off all gas to both the main burner and the pilot burner, and the thermoelectric safety valve 24 will then, of course, close.

In order to place the unit in operation, the valve plug 65 is turned counterclockwise from its closed position (Figure 6) to pilot position and the described procedure is repeated. Intermediate positions of the valve plug 65 between open and closed positions will, of course, provide intermediate supplies of fuel to the main burner.

The embodiment of the invention shown in the drawings is for illustrative purposes only, and it is to be expressly understood that the drawings 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 device of the class described, in combination, a fuel supply pipe, a controlling member, controlling the supply of fuel through said pipe, an electromagnet provided with an armature connected to said controlling member and adapted, when energized and said armature has been moved to attracted position to hold said member in operating position permitting the flow of fuel

to said pipe, and, when deenergized, to release said member for movement to safety position, shutting off the flow of fuel through said pipe, means normally biasing said member and the associated armature to safety position, reset means operable to reset said armature to attracted position and said controlling member to operating position, a valve body having passages therein, a valve plug mounted to be turned in cooperation with said valve body passages to open, closed, and pilot positions, an operating member attached to said valve plug and having turning movement for turning the valve plug to different positions by turning movement of the operating member, said operating member being free for longitudinal movement relative to said valve plug in all of the positions into which said valve plug is adapted to be turned, and means on said operating member for registration with said reset means only when the valve plug is in pilot position and out of registration with said reset means in the other positions of said valve plug said reset means being so constructed and arranged that when the means on said operating member is in register with the reset means the reset means may be actuated to attracted position whereby said reset means is actuated by longitudinal movement of said operating member only when said valve plug is in pilot position and is not actuated by longitudinal movement of said operating member relative to said valve plug in the other positions of said valve plug.

2. In a device of the class described, in combination, a control body having passages therein, a valve plug member rotatable in said body in cooperation with said control body passages to open, closed and pilot positions, a reset member mounted for reciprocatory movement in said body in position spaced laterally from the axis of said valve plug member, means requiring resetting and adapted to be reset by actuation of said reset member, an operating member connected to turn the valve plug member by turning movement of said operating member and free for longitudinal movement relative to the valve plug member in all of the positions into which said valve plug member is adapted to be turned, and abutment means integral with and extending laterally from said operating member, said abutment means registering with said reset member to actuate the reset member by longitudinal movement of the operating member relative to the valve plug member when said valve plug member is in pilot position and of a width along the path of turning movement of the operating member to be out of register with said reset member in all positions of said valve plug member except its pilot position, whereby longitudinal movement of said operating member relative to said valve plug member in positions other than pilot position will not actuate said reset member.

3. In a device of the class described, in combination, an electromagnet having a magnet frame and a coil, a thermoelectric generator connected in circuit with the coil of said electromagnet, an armature held attracted to said magnet frame by energization of said electromagnet by the heat of a flame on said thermoelectric generator and movable to retracted position upon extinguishment of the flame, a controlling member connected to said armature and held in operating position by said armature when the armature has been moved to attracted position and the electromagnet is energized by said thermoelectric generator, means normally biasing said controlling member and the associated armature to safety position, a valve body having passages therein, a valve member mounted to be moved in cooperation with said valve body passages to open, closed and pilot positions, an operating member connected to said valve member and having movement for moving said valve member to its different positions by movement of said operating member, a reset member operable to reset said armature to attracted position and said controlling member to operating position, said operating member being movable longitudinally relative to said valve member in all positions of said valve member, and means on said operating member for engagement with said reset member only in pilot position of said valve member to reset said armature to attracted position and said controlling member to operating position by longitudinal movement of the operating member relative to the valve member in pilot position thereof.

4. In a device of the class described, in combination, an electromagnet having a magnet frame and a coil, a thermoelectric generator connected in circuit with the coil of said electromagnet, an armature held attracted to said magnet frame by energization of said electro-magnet by the heat of a flame on said thermoelectric generator and movable to retracted position upon extinguishment of the flame, a controlling member connected to said armature and held in operating position by said armature when the armature has been moved to attracted position and the electromagnet is energized by said thermoelectric generator, means normally biasing said controlling member and the associated armature to safety position, a valve body having passages therein, a valve plug mounted for rotation in cooperation with said valve body passages to open, closed and pilot positions, an operating member connected to said valve plug and having movement for moving said valve plug to its different positions by movement of said operating member, a reset member operable to reset said armature to attracted position and said controlling member to operating position, said operating member being movable longitudinally relative to said valve plug in all positions of said valve plug, and means on said operating member for engagement with said reset member only in pilot position of said valve plug to reset said armature to attracted position and said controlling member to operating position by longitudinal movement of the operating member relative to the valve plug in pilot position thereof, said reset member having reciprocatory movement along a path parallel with and spaced laterally from the axis of said valve plug.

5. In a device of the class described, in combination, an electromagnet having a magnet frame and a coil, a thermoelectric generator connected in circuit with the coil of said electromagnet, an armature held attracted to said magnet frame by energization of said electromagnet by the heat of a flame on said thermoelectric generator and movable to retracted position upon extinguishment of the flame, a controlling member connected to said armature and held in operating position by said armature when the armature has been moved to attracted position and the electromagnet is energized by said thermoelectric generator, means normally biasing said controlling member and the associated armature to safety position, a valve body having passages therein, a valve plug mounted for rotation

in cooperation with said valve body passages to open, closed and pilot positions, an operating member connected to said valve plug and having rotary movement for moving said valve plug to its different positions by movement of said operating member, a reset member operable to reset said armature to attracted position and said controlling member to operating position, said operating member being movable longitudinally relative to said valve plug in all positions of said valve plug, means on said operating member for engagement with said reset member only in pilot position of said valve plug to reset said armature to attracted position and said controlling member to operating position by longitudinal movement of the operating member relative to the valve plug in pilot position thereof, and an extended operating rod adapted for operation from remote position and connected to said operating

member to impart turning and longitudinal movement to said operating member.

ROBERT W. MUELLER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
857,915	Woody	June 25, 1907
1,898,952	Gray	Feb. 21, 1933
2,226,313	Little	Dec. 25, 1940
2,257,024	Ray	Sept. 23, 1941
2,268,953	McGee	Jan. 6, 1942
2,299,649	Paille	Oct. 20, 1942
2,318,136	Alfery	May 4, 1943
2,318,823	Wantz	May 11, 1943
2,324,862	Martin	July 20, 1943
2,353,759	Ray	July 18, 1944