

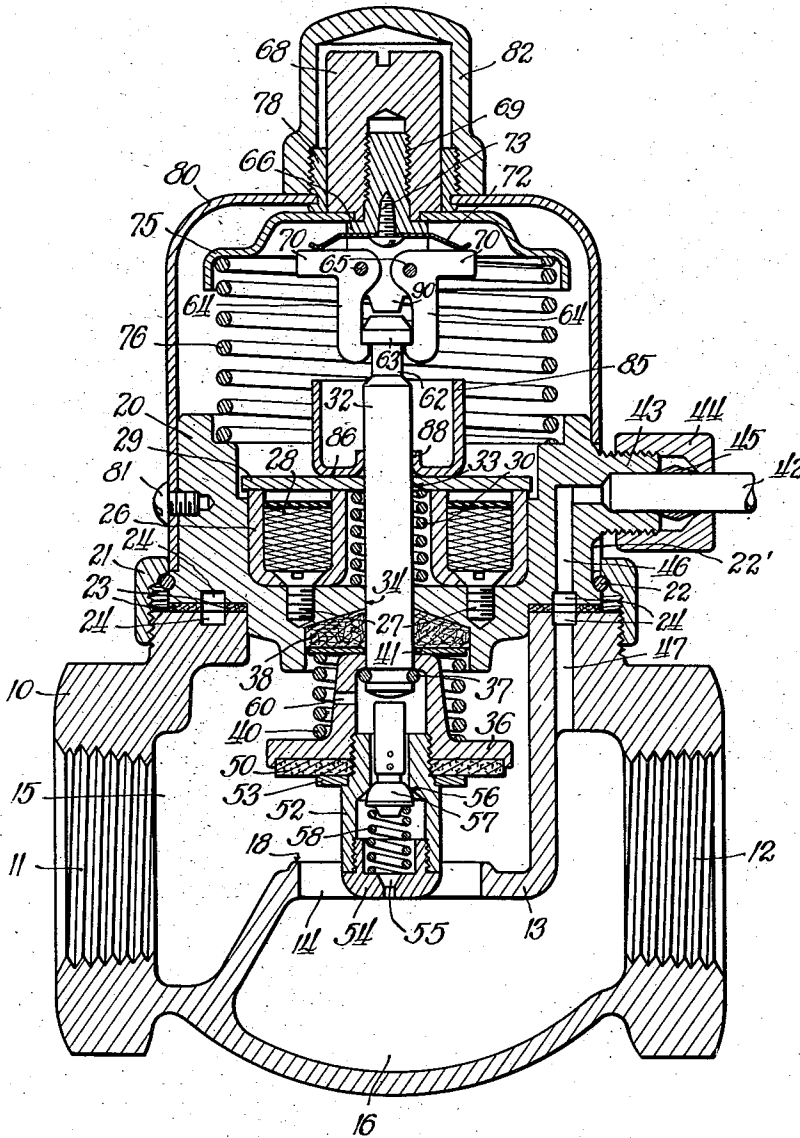
June 8, 1943.

H. A. MANTZ

2,321,095

THERMOELECTRIC SAFETY SHUT-OFF DEVICE

Filed July 24, 1939



Inventor:
Harold A. Mantz.

By

Brown, Jackson, Cuttler & Sienna

Attys.

UNITED STATES PATENT OFFICE

2,321,095

THERMOELECTRIC SAFETY SHUTOFF
DEVICE

Harold A. Mantz, Milwaukee, Wis., assignor to
Milwaukee Gas Specialty Company, Milwaukee,
Wis., a corporation of Wisconsin

Application July 24, 1939, Serial No. 286,091

19 Claims. (Cl. 137—139)

This invention relates to safety devices for heating and other apparatus, and has particular relation to an improved thermoelectric safety device for automatically shutting off the fuel supply for a burner whenever, for instance, a pilot light in juxtaposition to the burner is extinguished.

While the particular device which I shall describe in connection with the drawing is a thermoelectric valve, it is to be understood that within the broader aspects of the invention the valve member is illustrative of one form of controlling member and that the invention may be employed with any other suitable form of controlling member such as an electric switch or the like.

One of the main objects of the present invention is to provide an improved form of thermoelectric control device in which a snap action of the valve or other controlling member to safety shut-off position is secured and the inertia of the moving parts is reduced.

In the illustrated embodiment of the invention the foregoing object is attained by providing the thermoelectric device with latch means which is adapted to hold the valve or other controlling member in operative position as long as the pilot or other burner to which the device is responsive is lighted, the electromagnet of the device having an armature which is free of the valve or other controlling member and is operable upon movement to retracted position to release said latch means, whereupon the valve or controlling member is actuated to safety shut-off position with a quick snap action and without the added inertia set up by a connected armature or the like.

Another object is to provide an improved form of reset means for resetting the valve or other controlling member to operative position and the armature to attracted position.

Another object is to provide an improved form of thermoelectric control device of the general character herein set forth and which is adapted to be reset without setting the valve in open position to establish the supply of fuel to the main burner until the pilot burner has been lighted and, by the heat thereof on the thermocouple, has energized the electromagnet sufficiently to hold the armature in attracted position.

Another object is to provide in the improved form of thermoelectric control device of the general character set forth means for by-passing fuel for the pilot burner through or around the main shut-off valve while it is in closed position to supply fuel to the pilot burner during the

resetting operation and until the main shut-off valve is actuated to open position, and for continuing the supply of fuel to the pilot burner after the main burner is open.

Another object is to provide an improved form of thermoelectric valve of relatively simple and inexpensive construction, and which is effective and reliable in operation; also, a device which may be easily and quickly installed in the fuel supply pipe and connected in circuit with the thermocouple.

Further objects and advantages of the invention will be apparent from the following detailed description, taken in connection with the accompanying drawing in which the single figure is a vertical section through a thermoelectric valve embodying the present invention.

Referring to the drawing, the device selected for illustration comprises a valve body 10 having a fuel inlet 11 and a fuel outlet 12 which may be tapped internally to receive the inlet and outlet pipe sections of the fuel supply pipe leading to the main burner. The burner may be the main burner for a space or room heater, or for a water heater, or it may be an oven burner, or one or more top burners of a gas range, or any other burner. The valve body 10 has an internal wall or partition 13 which has a valve opening 14 through which communication is adapted to be effected between the inlet chamber 15, which is in communication with the inlet 11, and the outlet chamber 16, which is in communication with the outlet 12. The valve opening 14 is surrounded by a valve seat 18.

A closure member 20 is mounted upon the top of the valve body 10 as the same is viewed in the drawing and, when in place, closes the upper open end of the valve body. The member 20 is clamped to the valve body 10 by a union nut 21 which has threaded engagement with the valve body and cooperates with a removable split spring snap ring 22 which, in turn, cooperates with a shoulder on the member 20, as shown. Annular grooves 24 are provided in the member 20 and valve body 10 to assure communication of the pilot supply passageway 47 with the passageway 46 regardless of the angular position of the member 20 on the valve body. Gaskets are provided at 23. A groove is provided at 22' for insertion of a screw driver or other tool for releasing the ring 22.

The electromagnet, which is carried by the member 20, comprises an annular metallic magnet frame 26 of U-shaped section positioned coaxially with respect to the valve opening 14 and

secured to the member 20, for instance, by screws 27. The coil 28 of the electromagnet is wound between the annular legs of the magnet frame 26. The armature 29 is shown in attracted position against the outwardly directed annular pole edges of the magnet frame, and the coiled spring for actuating the armature to retracted position when the electromagnet is deenergized, or at least not sufficiently energized to hold the armature in attracted position, is interposed between the armature 29 and the member 20.

The valve stem 32 passes freely through an axial opening 33 in the armature 29, through the convolutions of the spring 30, and through an axial opening 34 in the member 20. The valve disc 36 is held upon the inner end of the valve stem 32 by a snap ring 37 which is engaged in an annular groove in the lower end of the valve stem. The valve stem has reciprocatory movement through the openings 33 and 34, and the opening 34 is sealed against leakage of gas or other fuel or other deleterious substances from the interior of the valve body by packing 38.

A coiled spring 40 is interposed between the valve disc 36 and a washer or disc 41, and serves to snap the valve to closed position, shutting off the supply of fuel when the electromagnet ceases to hold the armature 29 in attracted position, as will presently appear. The spring 40 also, through the disc 41, serves to compress the packing 38 and hold the same in tight sealing relation about the valve stem 32 and the opening 34.

The tube 42 for supplying fuel to the pilot burner (not shown) is connected to a hollow boss 43 on the member 20. The tube 42 is joined, for instance, to the boss 43 by a union nut 44, and the union is sealed by a union sleeve 45. Co-operating passageways 46 and 47 in the member 20 and valve body 10, respectively, are adapted to supply fuel from the outlet chamber 16 to the pilot supply tube 42. The outer end of the tube 42 is connected to a suitable pilot burner (not shown), which pilot burner is disposed in juxtaposition to the main burner for the purpose of lighting the main burner, as well understood in the art. The pilot burner may be of any suitable or preferred form.

The particular valve disc shown in the drawing has a valve disc gasket or yielding seating material 50 which, when the valve disc is positioned as shown, seats against the valve seat 18 and closes communication between the inlet chamber 15 and the outlet chamber 16 through the valve opening 14. The gasket or seating material 50 is secured to the valve disc 36 by a tubular valve housing 52 threaded axially into the main valve disc 36, there being a washer provided at 53. Threaded into the valve housing 52 is a valve cap 54 having an orifice 55 opening into the outlet chamber 16 of the valve body for delivering fuel for the pilot burner thereto in the resetting operation and with the main valve disc closed, as will hereinafter appear.

The interior of the valve housing 52 has a valve seat 56, and mounted in the valve housing 52 is a pilot valve plunger 57. This plunger 57 is normally seated against the seat 56 by a spring 58 to shut off the pilot supply of fuel into the outlet chamber 16 through the orifice 55. A port or opening 60 places the interior of the hollow hub part of the valve disc 56 in communication with the inlet chamber 15.

The upper or outer end of the valve stem 32 is grooved at 62 to form a head 63 which is adapted

to be engaged by latch or detent means for holding the valve 36 open against the action of the spring 40. The latch or detent means comprises a pair of latch or detent levers 64 pivoted at 65 to a stud 66, upon the shank of which a reset button 68 is threaded at 69. The latch or detent levers 64 are of generally bell crank form, with the laterally directed arms 70 at their outer ends. A leaf spring 72 secured to the stud 66, for instance by a screw 73, engages at its opposite ends with the laterally extending arms 70, yieldingly holding the latch levers in engagement with the head 63 and returning these levers to latching engagement with the head 63, as will presently appear.

A spring disc 75 is clamped to the inner end of the reset button 68 by the stud 66, and a coiled spring 76 is interposed between the spring disc 75 and the member 20 and serves to return the reset button and the latch means carried thereby to outwardly projected positions as shown, and to maintain same yieldingly in such positions. The reset button 68 has sliding or reciprocatory movement in a grommet or bushing 78 secured to the outer end of the hood 80 which encloses the latch means and other parts of the device disposed externally of the valve body 10. The hood 80 is secured at 81 to the member 20.

In order to prevent unwarranted actuation of the reset button 68 a closure cap 82 is threaded upon the bushing 78 and, when in place, encloses the button 68. This cap 82 is removed to reset the device.

A cup-shaped latch releasing member 85 is welded, brazed, or otherwise suitably secured at 86 to the armature 29. This latch releasing cup 85 has a hub portion 88 in which the valve stem 32 has free sliding movement, and the latch releasing cup also has sliding movement upon the valve stem, as will appear. The stud 66 is formed at 90 to engage the outer end of the valve stem and actuate the same inwardly to unseat the pilot valve plunger 57 in the resetting operation.

The thermocouple (not shown) and lead connection therefor may be of the general character disclosed and claimed in Oscar J. Leins Patent No. 2,126,564, granted August 9, 1938, or of any other suitable or preferred form. It is to be understood that the thermocouple is placed in position to be heated by the pilot light, and that it is connected in circuit with the coil 28 of the electromagnet in any suitable or preferred manner. The details of various connections suitable for this purpose are well understood in the art, and in that they form no part of the present invention they will not be shown or described in the present application.

The operation of the device is as follows:

With the parts of the device in the positions shown in the drawing, the latch means holds the valve disc 36 open and fuel flows from the inlet chamber 15 through the valve opening 14, outlet chamber 16 and outlet 12, to the main burner, and through the passageways 46 and 47 to the pilot burner. If, because of the greater amount of fuel outlet opening at the main burner, the passageways 46 and 47 do not supply the desired pilot supply of fuel to the pilot burner from the outlet chamber 16 when the valve 36 is open, the passageways 46, 47 may be disposed in any other suitable or preferred manner to secure the desired pilot supply of fuel to the pilot burner at this time. The showing in this respect may be considered as more or less diagrammatic.

As long as the pilot burner is lighted, the heat

thereof on the thermocouple energizes the electromagnet sufficiently to hold the armature 29 in attracted position as shown in the drawing. When the pilot burner or other flame, to the heat of which the thermocouple is subject, is extinguished however, the electromagnet is deenergized, or at least the holding action thereof ceases to be sufficient to hold the armature 29 attracted to the magnet frame 26 and the spring 30 compels or actuates the armature outwardly to retracted position. The latch releasing cup 35 moves outwardly with the armature, and, by engagement with the lateral arms 70 of the latch or detent levers 64, swings these levers about their pivots 65 in directions to release the latch or detent levers from the headed end 63 of the valve stem. Immediately the latch levers are released, the spring 40 actuates the valve 36 to closed position with a snap action, thereby shutting off the supply of fuel to the main burner, and, in the illustrated embodiment of the invention, also shutting off the supply of fuel to the pilot burner, although this may vary, at least within the broader aspects of the invention.

When it is desired to reset the device, the cap 32 is removed and the reset button 68 is pressed inwardly. Upon such operation, the latch levers 64, through the aid of spring 72, are placed in their latching or holding position with reference to head 63 of stem 32. The inner end of the stud 66 engages the outer end of the valve stem 32 and forces the same inwardly. The valve stem 32 in its inward movement engages the pilot valve plunger 57 and unseats same from the seat 56 to establish a pilot supply of fuel from the inlet chamber 15 through the port 60 and out through the orifice 55 into the chamber 16, and from this chamber to the pilot burner through the passageways 46 and 47. Continued inward movement of the reset button brings the latch arms 64 into latching engagement with the head 63 and into cooperation with the bottom of the cup 35, and, by cooperation with the bottom of this cup, forces the armature 29 to attracted position as shown in the drawing.

Upon establishing the supply of fuel to the pilot burner the pilot burner is lighted, and the heat of the pilot flame upon the thermocouple creates a thermoelectric current in the coil 28, which energizes the electromagnet and causes the armature 29 to be held positively against the outer end of the magnet frame by magnetic attraction. As a result, when the reset button 68 is released, the spring 76 moves or returns the button 68 to its outwardly projected position. The outward movement of the button 68 moves the latch means to the position shown in the drawing, and, by engagement of the latch means with the valve stem 32, the valve 36 is actuated to open position. Upon outward movement of the valve stem, the pilot valve plunger 57 is released and returns to engagement with its seat 56. However, before the pilot valve plunger seats against the seat 56, the main valve 36 is in open position, so that the desired supply of fuel for the pilot burner is set up through the valve opening 14 along with the supply of fuel for the main burner.

If, in the resetting operation, the reset button 68, after being pressed inwardly, is released before the electromagnet is energized sufficiently to hold the armature 29 in attracted position, the spring 30 will actuate the armature to retracted position and, with it, the cup 35. The movement of the cup 35 trips the latch arms 64, and

the valve stem 32 is released, whereupon the valve 36 snaps to closed position to shut off the supply of fuel until such time as the electromagnet is energized sufficiently to hold the armature in attracted position.

From the foregoing it will now be apparent that the improved form of thermoelectric control device of the present invention provides a snap action of the valve or other controlling member to safety shut-off position upon extinguishment of the pilot light and without added inertia from an armature, electromagnet, or other parts connected to the valve stem. Moreover, the device is adapted to be reset without positioning the main valve 36 in open position to set up a supply of fuel to the main burner until the pilot burner has been lighted, and, by the heat thereof on the thermocouple, has energized the electromagnet sufficiently to hold the armature in attracted position. These are important aspects of the present invention, as are the other features herein set forth.

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 controlling member, means supporting said controlling member for movement to an operative position and to a safety position, armature means mounted for movement to retracted position and to attracted position, an electromagnet which, when energized, is adapted to hold said armature means in attracted position, means for moving said armature means to retracted position upon deenergization of said electromagnet, and latch means for holding said controlling member in operative position and disposed in the path of movement of said armature means to be released by movement of said armature means to retracted position.

2. In a device of the character described, in combination, a controlling member having an operative position and a safety position, latch means for holding said controlling member in operative position, an electromagnet, an armature for said electromagnet which, by movement to retracted position, releases said latch means for movement of said controlling member to safety position, and reset means for actuating said armature to attracted position and in the actuation of the armature to attracted position being operable to move said latch means to position to pick up said controlling member for actuation thereof to operative position.

3. In combination, a fuel supply pipe, a valve member having an open position permitting fuel to flow through said pipe and a closed position shutting off the supply of fuel through said pipe, means supporting said valve member for movement to open and closed positions and comprising a valve stem connected to said valve member, armature means mounted for movement to retracted position and to attracted position along the axis of said stem, an electromagnet which, when energized, is adapted to hold said armature means in attracted position, means for moving said armature means to retracted position upon deenergization of said electromagnet, and latch means adjacent one end of said valve stem and cooperating with said valve stem to hold said valve member in open position and disposed in the path of movement of said armature means to be released by movement of said armature means to retracted position.

4. In combination, a fuel supply pipe, a valve

member having an open position permitting fuel to flow through said pipe and a closed position shutting off the supply of fuel through said pipe, a valve stem for said valve member, latch means cooperating with said valve stem for holding said valve member in open position, an electromagnet, an armature for said electromagnet which, by movement to retracted position, releases said latch means for movement of said valve member to closed position, and reset means for actuating said armature to attracted position and in the actuation of the armature to attracted position being operable to move said latch means to position to engage said valve stem and pick up said valve for actuation thereof to open position.

5. In a device of the class described, in combination, a reciprocating valve stem, a valve member on one end of said stem, latch engaging means on the opposite end of said stem, an armature surrounding said stem and movable to attracted and retracted positions, an electromagnet surrounding said stem and adapted, when energized, to hold said armature in attracted position, means for moving said armature to retracted position upon deenergization of said electromagnet, a latch releasing cup carried by and movable with said armature and opening toward the end of the valve stem having the latch engaging means thereon, and latch means cooperating with the latch engaging means on said stem to hold said valve member in open position and disposed in the path of movement of said latch releasing cup to be released by movement of said cup and armature to retracted position.

6. In a device of the class described, in combination, a controlling member having an operative position and a safety position, latch means for holding said controlling member in operative position, said last means being pivoted for swinging movement to latching position and to released position, an electromagnet, an armature for said electromagnet, and a latch releasing member actuated by movement of said armature to retracted position to swing said latch means to released position to free said controlling member for movement to safety position, said latch releasing member being operable to swing said latch means to latching position upon resetting the device and said armature being reset to attracted position through said pivoted latch means.

7. In a device of the class described, in combination, a controlling member having an operative position and a safety position, reset means; latch means carried by said reset means, an electromagnet, and an armature for said electromagnet which, when retracted, releases said latch means for movement of said controlling member to safety position, said reset means being operable to reset said armature to attracted position and to actuate said latch means to position to pick up and actuate said controlling member to operative position.

8. In a device of the class described, a control body, a closure member mounted thereon, a control stem reciprocable in said member, a control member on the inner end of said stem, an electromagnet carried by said closure member and encircling said stem, latch means cooperating with the outer end of said stem for holding said control member in operative position, and an armature encircling said control stem and, by movement to retracted position, releasing said latch means for movement of said control member to safety position.

9. In a device of the class described, in combination, a control body, a closure member mounted thereon, a control stem reciprocable in said member, a control member on the inner end of said stem, an electromagnet carried by said closure member and encircling said stem, latch means cooperating with the outer end of said stem for holding said control member in operative position, an armature encircling said control stem and, by movement to retracted position, releasing said latch means for movement of said control member to safety position, reset means supporting said latch means and adapted to actuate said armature to attracted position and said latch means to position to pick up and actuate said control member to operative position, a spring disc carried by said reset means, and a spring interposed between said disc and said closure member for yieldingly maintaining said reset means and said latch means in outwardly projected position and for returning same to said position.

10. In a device of the class described, in combination, a control body, a closure member mounted thereon, a control stem reciprocable in said member, a control member on the inner end of said stem, an electromagnet carried by said closure member and encircling said stem, latch means cooperating with the outer end of said stem for holding said control member in operative position, an armature encircling said control stem and, by movement to retracted position, releasing said latch means for movement of said control member to safety position, reset means supporting said latch means and adapted to actuate said armature to attracted position and said latch means to position to pick up and actuate said control member to operative position, a spring disc carried by said reset means, a spring interposed between said disc and said closure member for yieldingly maintaining said reset means and said latch means in outwardly projected position and for returning same to said position, a spring interposed between said armature and said closure member for actuating said armature to retracted position, and a spring between said control member and said closure member for actuating said closure member to safety position with a snap action upon release of said armature.

11. In a device of the class described, in combination, a valve body, a closure member mounted thereon, a valve stem reciprocable in said member, a valve member on the inner end of said stem, an electromagnet carried by said closure member and encircling said stem, latch means cooperating with the outer end of said stem for holding said valve member in open position, an armature encircling said valve stem, a latch releasing member actuated by movement of said armature to retracted position to release said latch means, and spring means for actuating said valve member to closed position free of said armature and electromagnet and with a snap action upon release of said latch means.

12. In a device of the class described, in combination, a controlling member having an operative position and a safety position, an electromagnet, an armature adapted to be held in attracted position by said electromagnet and for movement to retracted position, reset means for resetting said armature to attracted position, latch levers pivotally supported by said reset means and adapted to hold said controlling member in operative position, a spring carried by said

reset means and cooperating with said latch levers for yieldingly urging said levers to latching position, and means actuated by movement of said armature to retracted position for releasing said latch levers for movement of said controlling member to safety position.

13. In combination, a valve stem, a valve member disposed at one end of said stem and having open and closed positions, pivoted latch means cooperable with the opposite end of said stem to hold said valve member in open position, an electromagnet, an armature for said electromagnet, latch releasing means actuated by movement of said armature to retracted position to engage and release said pivoted latch means for movement of said valve member to closed position, and reset means for resetting the armature to attracted position and, by the same movement, resetting said latch means into latching cooperation with said valve stem.

14. In combination, a valve stem, a valve member disposed at one end of said stem and having open and closed positions, pivoted latch means cooperable with the opposite end of said stem to hold said valve member in open position, an electromagnet, an armature for said electromagnet, latch releasing means actuated by movement of said armature to retracted position to engage and release said pivoted latch means for movement of said valve member to closed position, reset means for resetting the armature to attracted position and, by the same movement, resetting said latch means into latching cooperation with said valve stem, and means for actuating said reset means, valve stem, and valve member as a unit to position the valve member in open position upon release of said reset means.

15. In combination, a valve stem, a main valve member disposed at one end of said stem and having open and closed positions, pivoted latch means cooperable with the opposite end of said stem to hold said valve member in open position, an electromagnet, an armature for said electromagnet, latch releasing means actuated by movement of said armature to retracted position to engage and release said pivoted latch means for movement of said main valve member to closed position, an auxiliary valve member, and reset means operable to open said auxiliary valve member and, by the same direction of movement, to reset the armature to attracted position and said latch means into latching cooperation with said valve stem.

16. In combination, a valve stem, a main valve member disposed at one end of said stem and having open and closed positions, pivoted latch means cooperable with the opposite end of said stem to hold said valve member in open position, an electromagnet, an armature for said electromagnet, latch releasing means actuated by movement of said armature to retracted position to

engage and release said pivoted latch means for movement of said main valve member to closed position, an auxiliary valve member, reset means operable to open said auxiliary valve member and, by the same direction of movement, to reset the armature to attracted position and said latch means into latching cooperation with said valve stem, said auxiliary valve member being carried by said main valve member, and spring means for closing said auxiliary valve member when said main valve member is open and said armature is in attracted position.

17. In combination, a valve stem, a valve member disposed at one end of said stem and having open and closed positions, pivoted latch means cooperable with the opposite end of said stem to hold said valve member in open position, an electromagnet, an armature for said electromagnet, latch releasing means actuated by movement of said armature to retracted position to engage and release said pivoted latch means for movement of said valve member to closed position, reset means for resetting the armature to attracted position and, by the same movement, resetting said latch means into latching cooperation with said valve stem, and a thermocouple subject to the heat of a flame and connected in circuit with said electromagnet.

18. In combination, a control member, a stem for said control member, latch means cooperable with said stem to hold said control member in operating position, means comprising an armature and an electromagnet effective when energized for holding said armature in attracted position but ineffective to move said armature to attracted position, said latch means being released upon release of said armature and movement of same to retracted position, and reset means for resetting said armature to attracted position and said latch means into holding cooperation with the stem for said control member, said latch means being carried by said reset means.

19. In combination, a control member, a stem for said control member, latch means cooperable with said stem to hold said control member in operating position, means comprising an armature and an electromagnet effective when energized for holding said armature in attracted position but ineffective to move said armature to attracted position, said latch means being released upon release of said armature and movement of same to retracted position, and reset means for resetting said armature to attracted position and said latch means into holding cooperation with the stem for said control member, said latch means being carried by said reset means and movable into and out of holding cooperation with said stem laterally with respect to said stem.

HAROLD A. MANTZ.