

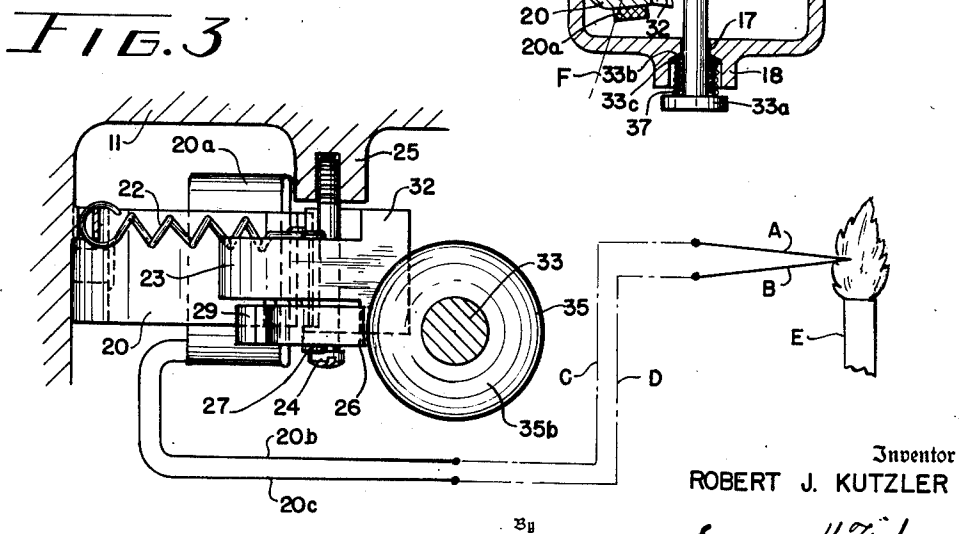
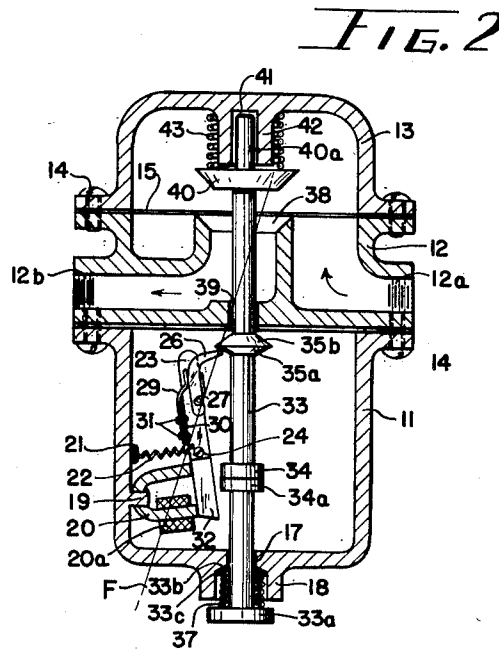
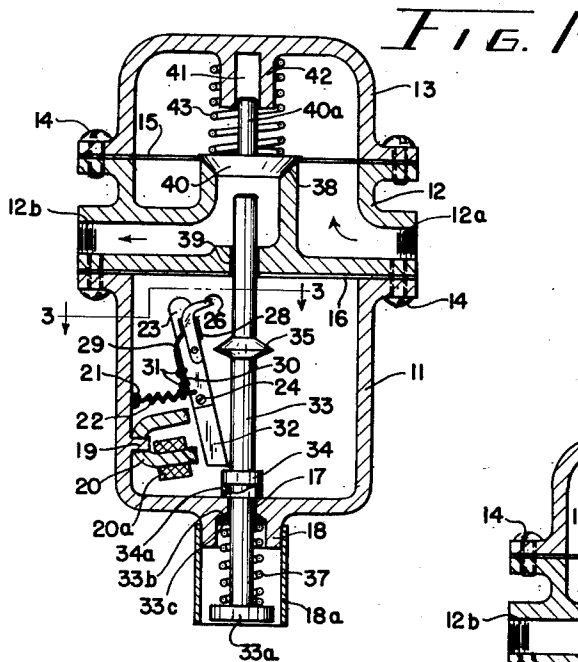
Sept. 15, 1953

R. J. KUTZLER

2,652,065

SAFETY DEVICE

Filed Jan. 19, 1950



Inventor
ROBERT J. KUTZLER

George H. Fisher

Attorney

UNITED STATES PATENT OFFICE

2,652,065

SAFETY DEVICE

Robert J. Kutzler, Minneapolis, Minn., assignor
to Minneapolis-Honeywell Regulator Company,
Minneapolis, Minn., a corporation of Delaware

Application January 19, 1950, Serial No. 139,518

14 Claims. (Cl. 137—66)

1

This invention relates to safety devices generally and, more specifically, to a manually resettable safety valve.

In heating systems, which use gas as a fuel, it is customary to provide a pilot burner which burns continuously for the purpose of igniting a main burner whenever there is a demand for heat from the heating system. It is also customary to provide, in a heating system of this type, a safety valve which will interrupt the flow of gas to a main burner in the event the pilot burner becomes extinguished and will maintain said gas supply cut off until the pilot has been reignited and the safety valve manually reset. While various types of means may be used to maintain the safety valve in its open position in response to a pilot flame, the type of means most generally used comprises a thermoelectric generator in the form of a thermocouple, which supplies current to the coil of an electromagnet positioned in the valve. An armature in the valve so cooperates with the electromagnet that it maintains the valve in its open position when the coil is energized but moves to permit the valve to close when the coil becomes deenergized through flame failure. It is an improved design of a valve of the last mentioned type that forms the subject matter of this application.

One object of the invention is to provide a safety valve having manual reset means which cannot be actuated in a resetting direction unless the condition responsive means, the electromagnet, and armature are in their condition and position, respectively, indicating a safe operating condition for the valve.

Another object of the invention is to provide an inexpensive, simple and reliable safety valve of the class described above.

Another object of the invention is to provide a safety valve employing a latching mechanism for holding the valve in its open position, but operating, when an unsafe condition exists, to release the valve to its closed position and to prevent further opening of said valve until the unsafe condition has been removed.

A still further object of the invention is to provide a safety valve latching mechanism which is so delicately balanced that only a very small force is necessary to actuate the mechanism between its different operating positions.

A still further object of the invention is to provide a manually resettable safety valve having a pivoted latching mechanism cooperable with abutments on a manually operable reset plunger which permits operation of the manual

2

reset means only if a safe condition exists in the heating system in which the valve is installed.

Other objects of the invention will become apparent upon reading the following detailed description of the invention in conjunction with the accompanying drawing wherein:

Figure 1 is a vertical sectional view through the safety valve showing the elements thereof in the positions they would assume in a shutdown condition of the valve;

Figure 2 is a vertical sectional view of the safety valve showing the elements thereof in the positions they assume when the valve is in its normal open condition, with a safe condition existing in the heating system in which it is installed; and

Figure 3 is an enlarged fragmentary view taken along the lines 3—3 of Figure 1.

The body of the valve comprises a lower casting 11, an intermediate casting 12 and an upper casting 13 secured together by means of screws 14 extending through holes in flanges on the castings with suitable gaskets and/or cement therebetween. The bolts 14 pass freely through holes in one of the flanges and is screw-threaded into the opposed holes in the cooperative flange on the adjoining casting.

The lower casting 11 is of general cup-shape and has a centrally disposed bore 17 extending through the bottom thereof. A cylindrical portion 18, of larger internal diameter than the bore 17, extends downwardly or outwardly from the bottom surface of the casting 11 coaxially with the bore 17. A stud 19, formed on a lower portion of the side wall of said casting 11, extends through a hole in the curved portion of a U-shaped electromagnetic core 20. The core member is held on said stud by staking the inner end of the stud 19 over the inner surface of the U-shaped portion of the electromagnetic core. A low voltage coil 20a surrounds one of the legs of the core and is connected to a thermocouple A—B, heated by the flame of a pilot burner E, by leads 20b and 20c and external wires C and D. A conventional terminal block (not shown) extends through a wall of casting 11 and connects the wires C and D to the leads 20b and 20c.

Formed on the side wall of casting 11, a short distance above the stud 19, is an apertured lug 21 which provides means for anchoring one end of a tension spring 22.

The tension spring 22 is of very light construction and is anchored at its other end to a pivoted lever 23 which is pivoted to a side wall of the lower casting 11 by means of a bolt 24 extending

through said lever and screwthreaded into a boss 25 formed on said side wall. It will be noted that the spring 22 is anchored to said lever 23 at a point which is spaced only a very small distance from the pivot bolt 24. Due to this positioning of the spring and the light construction of the spring, only a very small moment of force is imparted to said lever by the spring.

An L-shaped lever 26 is secured to the lever 23 by means of pivot pin 27 at a point which is substantially half way between the pivot bolt 24 and the upper end of the lever 23. The lever 26 is resiliently urged by a leaf spring 29 into abutting relationship with a laterally extending ear 28 formed on the lever 23. The spring 29 is secured to another laterally extending ear 30 by means of rivets 31. It is thus seen that the L-shaped lever 26 is normally held in the position shown in Figure 1 but is movable counterclockwise on the pivot 27 against the bias of spring 29, if a sufficient force is applied thereto in that direction.

The lower portion of the pivoted lever 23 has an enlarged head 32 which is of such size that it substantially balances the other end of the lever 23 and the elements carried thereby. This means that the electromagnet 20—20a will only have to overcome the friction between the lever 23 and its pivot bolt 24 and the very slight force imparted to lever 23 by the spring 22, to pivot the lever 23 into engagement with the ends of the core 20.

It is to be understood however that the spring 22 may be eliminated by merely positioning the pivot bolt 24 in such a manner as to cause the upper portion of the lever 23 to overbalance the lower portion just enough to rotate the lever counterclockwise.

Extending through the bore 17 in the bottom of the casting 11 is a manually operable plunger 33 having a collar-shaped abutment 34, formed thereon just below the lower end of the enlarged head 32 on lever 23, and a rotary cutter-shaped abutment 35 formed thereon a short distance below the free end of the lever 26. A sealing washer 34a of any well-known suitable material is positioned between the abutment 34 and the inner surface of the bottom of casting 11. Positioned around the plunger 33 and against the outer surface of the casting 11 is a packing washer 33b which is held tightly against the casting by means of a metallic washer 33c and a compression spring 37 positioned between said metallic washer 33c and a knob 33a screwthreaded or otherwise secured to the outer end of the plunger 33. A removable protective sleeve 18a may be provided to frictionally fit over the outer surface of the portion 18 to protect the plunger 33 from damaging blows accidentally imparted externally to the valve.

As can be seen in Figure 1, a spring 37 normally holds the plunger 33 in a position which causes the washer 34a to seal the plunger 33 with respect to the casting 11 and thus provide an additional gas seal to the seal formed by the packing washer 33b. In this position, the abutment 34 is positioned only slightly below the lower end of the lever head 32. Thus, due to the normal tendency of the lever 23 to rotate counterclockwise, the head 32 acts as a latch means to prevent upward movement of the plunger 33.

The abutment 35 is positioned a substantial distance below the free end of L-shaped lever 26 and has a lower annular flat surface 35a which

is inclined outwardly and upwardly, and an annular flat surface 35b which is inclined outwardly and downwardly to meet the lower surface. With the electromagnet energized and the armature head 32 in engagement therewith, it will be noted that the abutment 35 overlaps the lever 26 to such an extent that upward movement of the plunger 33 will cause the upper surface 35b to engage the end of the lever 26 and cam said lever 26 in a counterclockwise direction against the bias of spring 29 to permit continued upward movement of the plunger 33, for a purpose to be hereinafter described. The strength of leaf spring 29 is such that a camming action of surface 35b will not cause disengagement of the armature head 32 from the electromagnet when the lever 26 is moved counterclockwise as above described, it being well known that the holding power of the magnet is much greater than its attracting power. Return movement of the plunger 33 under the bias of spring 37 will cause the surface 35a to bear against the upper edge of lever 26 in such a manner as to cause said lever 26 to act as a latch and prevent return movement of the plunger 33.

It will be noted in Figure 2 that the surface 35a of abutment 35 acts on the end of latch lever 26 along the line F. It will be further noted that the force line F passes between the pivot pin 27 and the pivot bolt 24. This means that the force acting on the latch lever 26 tends to rotate said lever 26 clockwise about the pivot 27 and into engagement with the abutment ear 28 and tends to rotate the lever 23 counterclockwise to tend to move the armature head 32 out of engagement with the electromagnet. Thus, if the electromagnet is deenergized, the forces acting on plunger 33 will cause the lever 26 to move out from under the abutment 35 and permit the plunger to return to its normal position, as shown in Figure 1.

The intermediate casting 12 has a threaded inlet 12a and a threaded outlet 12b, a valve seat 36 is positioned concentrically with a reset plunger 33. An opening 39 through the bottom of the casting 12 has the upper end of the reset plunger 33 extending therethrough to a point slightly below the valve seat 38.

Cooperating with the valve seat 38 is a valve 40 having a valve stem 40a extending upwardly therefrom and extending into a guide bore 41 formed in a boss 42 on the upper wall of the casting 13. A strong spring 43 surrounds the boss 42 and bears against the upper surface of the valve 40 to normally urge said valve into seating engagement with the valve seat 38.

Operation

With the valve installed in a heating system of the type hereinbefore described, with the inlet 12a connected to a source of fuel supply, the outlet 12b connected to a main burner of the system, and the electromagnetic coil 29a connected to thermocouple A—B being heated by pilot burner E for the above-mentioned burner, the enlarged armature head 32 will be drawn into engagement with the ends of the core 20. The elements mounted on the lever 23 will be in the positions shown in Figure 2, but the plunger will be in its lowered position, as illustrated in Figure 1. Inward movement of the reset button 33a and plunger 33 will thus be permitted inasmuch as the lower end of the head 32 has been moved away from the plunger 33 and out of alignment with the abutment 34. By pressing

5

inwardly on the button 33a, against the bias of spring 37, the abutment 34 will move past the lower end of the head 32 and the beveled surface 35b will engage the latch lever 26 and deflect it counterclockwise about the pivot 27 against the bias of spring 29. This movement of plunger 33 causes the upper end of the plunger to engage the bottom surface of the valve 49 and lift it slightly beyond the normal open position thereof to permit the spring 29 to force the latch lever 26 back against ear 28. A very slight return movement of the plunger 33 will cause the lower surface 35a of the abutment 35 to engage the latch lever 26 and thus hold the valve in its open position. The combined forces of the spring 43 and the spring 37 are not sufficient to rotate the lever 23 about pivot 24 against the pull of the electromagnet on the armature head of the lever 23. These forces are sufficient to pull the armature away from the electromagnet when the pilot flame becomes extinguished or becomes so low that it does not provide enough heat to generate electricity to the extent necessary to energize the electromagnet sufficiently to hold the armature. In either event, upon the armature leaving the electromagnet, the latch lever 36 will move out from under the abutment 35, about pivot 24, and thereby release the plunger 33.

It will be noted that in the return movement of the plunger 33, after the abutment 35 has passed latch lever 26, the abutment 34 will momentarily engage the side of the armature head 32 and deflect it toward the electromagnet sufficiently to permit the abutment 34 to pass the lower end of the head 32. After it has reached the last mentioned position, the very small unbalancing force acting on the lever 23, due to the unbalance weights on opposite sides of the pivot 24 or, if used, due to the bias of light spring 22, the lower right hand end of the latch lever 23 will swing into engagement with the plunger 33 immediately above the abutment 34, to thus latch the plunger 33 in its retracted or outer position.

From the above description of the device and the operation thereof, it is seen that the device comprises a mechanism which operates to latch the control device, in either its operating position or safety position depending upon the condition of, or the presence or absence of, the pilot flame.

While the preferred embodiment of the invention has been described above, it will be readily apparent to those skilled in the art that other modifications may be made therein without departing from the spirit of the invention. Therefore, it is to be expressly understood that the scope of the invention is to be determined solely from the appended claims.

I claim as my invention:

1. A safety device comprising means for controlling the flow of fuel through said device, means biasing said controlling means to its closed position, reset means for moving said controlling means to its open position, a first abutment on said reset means intermediate its ends, a second abutment on said reset means spaced from said first abutment, a first latch means normally biased into alignment with said first abutment to prevent opening movement of said reset means, condition responsive means for holding said latch means out of alignment with said first abutment when a safe condition exists to free said reset means for movement, and second latch means, carried by said first latch means and resiliently

6

biased into alignment with said second abutment when said safe condition exists for holding said reset means in its operating position.

2. A safety device comprising means for controlling the flow of fuel through said device, means biasing said controlling means to its closed position, reset means for moving said controlling means to its open position, a first abutment on said reset means intermediate its ends, a second abutment on said reset means spaced from said first abutment, a first latch means normally biased into alignment with said first abutment to prevent opening movement of said reset means, condition responsive means for holding said latch means out of alignment with said first abutment when a safe condition exists to free said reset means for movement, and second latch means on said first latch means and positioned to be in alignment with said second abutment when said safe condition exists for holding said reset means in its operating position but movable out of alignment with said second abutment to free said controlling means when said condition ceases to exist.

3. In a safety device for use in a fuel burning system, the combination comprising means for controlling the flow of fuel through said device, means biasing said controlling means to its closed position, reset means for moving said controlling means to its open position, a first abutment on said reset means intermediate its ends, a second abutment on said reset means spaced from said first abutment, a first latch means pivoted intermediate its ends on said device and normally biased into alignment with said first abutment to prevent opening movement of said reset means, electromagnetic means for attracting and holding said first latch means out of alignment with said first abutment when a pilot burner in said system is burning fuel satisfactorily to free said reset means for movement, and second latch means pivoted at one of its ends on said first latch means and resiliently biased into alignment with said second abutment when said flame exists for holding said reset means in its operating position, said second abutment reacting on said second latch means along a line passing between the pivots for said second latch means and said first latch means.

4. A safety device comprising means for controlling the flow of fluid, means biasing said controlling means to a first position which prevents fluid flow, reset means for moving said controlling means to a second position which permits fluid flow, a first abutment on said reset means intermediate its ends, a second abutment on said reset means spaced from said first abutment, a first latch means normally biased into alignment with said first abutment to prevent movement of said reset means, condition responsive means for moving and holding said latch means out of alignment with said first abutment when a safe condition exists to free said reset means for movement, and second latch means movable into alignment with said second abutment by said first latch means when said safe condition exists for holding said reset means in its second position.

5. A safety valve mechanism comprising a biased closed valve, a coaxial reset plunger extending through a wall of said valve mechanism for actuating said valve, transverse abutment means on said plunger near said wall, inclined abutment means on said plunger between said transverse abutment means and the inner end

7

of said plunger, a lever positioned generally parallel to said plunger and pivoted intermediate its ends in the safety valve, means biasing the outer end of said lever normally against said plunger adjacent the inner surface of said transverse abutment, a low voltage electromagnet spaced a short distance from the outer portion of said lever for attracting said portion when the electromagnet is energized, and an L-shaped latch member pivoted at the end of one of its legs to said lever near the inner end thereof, the outer end of the other leg of said member being biased toward said plunger and positioned to engage said inclined abutment to hold said valve in its open position when said electromagnet is energized and said plunger is in its valve-open position.

6. A safety valve mechanism comprising a biased closed valve, a coaxial reset plunger extending through a wall of said valve mechanism for actuating said valve, transverse abutment means on said plunger near said wall, inclined abutment means on said plunger between said transverse abutment means and the inner end of said plunger, a lever positioned generally parallel to said plunger and pivoted intermediate its ends to a wall of the safety valve, means biasing the outer end of said lever normally toward said plunger adjacent the inner surface of said transverse abutment, a low voltage electromagnet spaced a short distance from the outer portion of said lever for attracting said portion when the electromagnet is energized, and a latch member pivoted at one of its ends to said lever near the inner end thereof, the outer end of said member being biased toward said plunger and positioned to engage said inclined abutment to hold said valve in its open position when said electromagnet is energized and said plunger is in its valve-open position, said inclined abutment acting on said outer end of said member along a line of force passing between said lever's and latch member's pivots.

7. A safety device comprising control means biased to an inoperative position, a coaxial reset plunger extending through a wall of said device for actuating said control means, transverse abutment means on said plunger near said wall, inclined abutment means on said plunger between said transverse abutment means and the inner end of said plunger, a lever positioned generally parallel to said plunger and pivoted intermediate its ends in the safety device, means biasing the outer end of said lever toward said plunger adjacent the inner surface of said transverse abutment and into the path of movement thereof, a low voltage electromagnet spaced a short distance from the outer portion of said lever for attracting said portion when the electromagnet is energized, an L-shaped latch member pivoted at the end of one of its legs to said lever near the inner end thereof, the outer end of the other leg of said member being biased toward said plunger and positioned to engage said inclined abutment to hold said control means in its operating position when said electromagnet is energized.

8. A safety device comprising a controller normally biased to a first inoperative position, a reset plunger extending through a wall of said device for actuating said controller, transverse abutment means on said plunger near said wall, inclined abutment means on said plunger between said transverse abutment means and the inner end of said plunger, a lever positioned gen-

8

erally parallel to said plunger and pivoted intermediate its ends in the safety device, the arrangement of said lever being such that the outer end of said lever is biased toward said plunger adjacent the inner surface of said transverse abutment to prevent inward movement of said plunger, a thermocouple energizable electromagnet spaced a short distance from the lower portion of said lever for attracting said portion when the electromagnet is energized to move said lower portion from the path of said transverse abutment, a latch member pivoted at one of its ends to said lever near the inner end thereof, the other end of said latch member being biased toward said plunger and positioned by a stop on said lever to engage said inclined abutment to hold said controller in a second operative position when said electromagnet is energized.

9. In a control device of the type described, the combination comprising control means having an operative position and an inoperative position, means biasing said control means toward its inoperative position, means for actuating said control means to its operative position and having spaced abutments thereon, and means responsive to a condition and having spaced latch means for cooperating with said abutments on said actuating means to prevent movement of said actuating means when said condition does not exist and to move with respect to said actuating means to permit said actuating means to move said control means to its operative position when said condition exists and to hold said control means in its operative position only as long as said condition exists.

10. In a control device of the type described, the combination comprising control means having an operative position and an inoperative position, means biasing said control means toward its inoperative position, manually engageable and operable means for actuating said control means to its operative position and having a pair of abutments thereon, and a double latch means responsive to the presence or absence of a flame and cooperating with said pair of abutments on said actuating means to prevent movement of said actuating means when said flame does not exist and to move with respect to said actuating means to permit said actuating means to move said control means to its operative position when said flame exists and to hold said control means in its operative position only as long as said flame exists.

11. A device of the class described, comprising, in combination, a valve biased to closed position, means manually operable to move said valve to open position against its bias, two-position latch means biased to a first position and operable when in said first position to prevent opening of said valve by said manual means and operable when in a second position to permit opening of said valve by said manual means and after said valve has been opened by said manual means to thereafter maintain said valve open so long as said latch means remains in its second position, and power means associated with said latch means for moving said latch means from its first position to its second position upon the supply of power to said power means, the bias of said valve when said valve is maintained open by said latch means reacting on said latch means to additionally bias said latch means to its first position.

12. A device of the class described, comprising, in combination, a valve biased to closed position, means manually operable to move said valve to

open position against its bias and having spaced abutments thereon, two-position latch means biased to a first position operable when in said first position to engage one of said abutments and to prevent opening of said valve by said manual means and operable when in a second position to engage the other of said abutments to permit opening of said valve by said manual means and after said valve has been opened by said manual means to thereafter maintain said valve open so long as said latch means remains in its second position, and electromagnetic means including an electromagnet element and an armature element, one of said elements being stationary and the other being connected to said latch means, said elements being separated when said latch means is in its first position, energization of said electromagnet element causing movement of said elements toward each other and consequent movement of said latch means to its second position.

13. A device of the class described, comprising, in combination, a control device having first and second controlling positions, means manually operable to move said control device from its first to its second controlling position, mechanical latch means biased to a first position in which it prevents moving of said control device from its first to its second controlling position by said manual means, an electromagnet element having a low resistance winding adapted to be energized by a thermocouple means heated by a burner flame, an armature element separated from said electromagnet element, one of said elements being stationary and the other element being connected to said latch means, the bias of said latch means and the spacing between said electromagnet and armature elements being so related that energization of said electromagnet element causes said elements to move toward each other and move said latch means from its first position to a second position, said control device being movable to its second controlling position by said manual means when said latch means is in its second position and being maintained in its second position by said latch means upon release of said manual means, and means biasing said controlling device to its first position and exerting an additional force on said latch means tending to move said

latch means from its second position to its first position when said control device is held in its second position by said latch means.

14. A device of the class described, comprising, in combination, a control device having first and second controlling positions, actuating means to move said control device from its first to its second controlling position and having spaced abutments thereon, mechanical latch means biased to a first position in which it engages one of said abutments and prevents moving of said control device from its first to its second controlling position by said actuating means, an electromagnet element having a low resistance winding adapted to be energized by a thermocouple heated by a burner flame, an armature element separated from said electromagnet element, one of said elements being stationary and the other element being connected to said latch means, the bias of said latch means and the spacing between said electromagnet and armature elements being so related that energization of said electromagnet element causes said elements to move toward each other and move said latch means from its first position to a second position, said control device being movable to its second controlling position by said actuating means when said latch means is in its second position and being maintained in its second position by engagement of the other of said abutments by said latch means, and means biasing said controlling device to its first position and exerting an additional force on said latch means tending to move said latch means from its second position to its first position when said control device is held in its second position by said latch means.

ROBERT J. KUTZLER.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
Re. 20,210	Knowles	Dec. 22, 1936
1,637,154	Mark	July 26, 1927
2,035,711	Lowndes	Mar. 31, 1936
2,213,844	Mantz	Sept. 3, 1940
2,236,227	Wantz	Mar. 25, 1941
2,245,834	Sparrow	June 17, 1941
2,333,370	Graham	Nov. 2, 1943