Sept. 6, 1949. T. F. VAN DENBERG ET AL 2,481,265

SAFETY VALVE MECHANISM

Filed Nov. 27, 1944 2 Sheets-Sheet 1

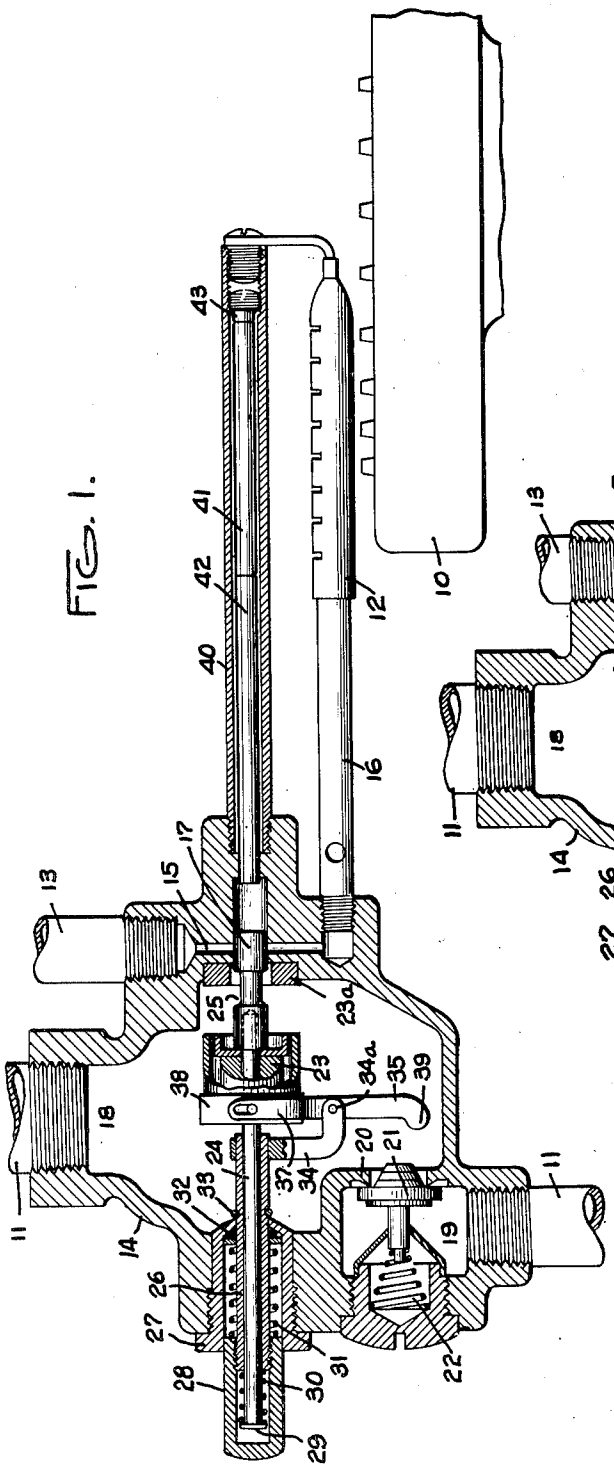


FIG. 1.

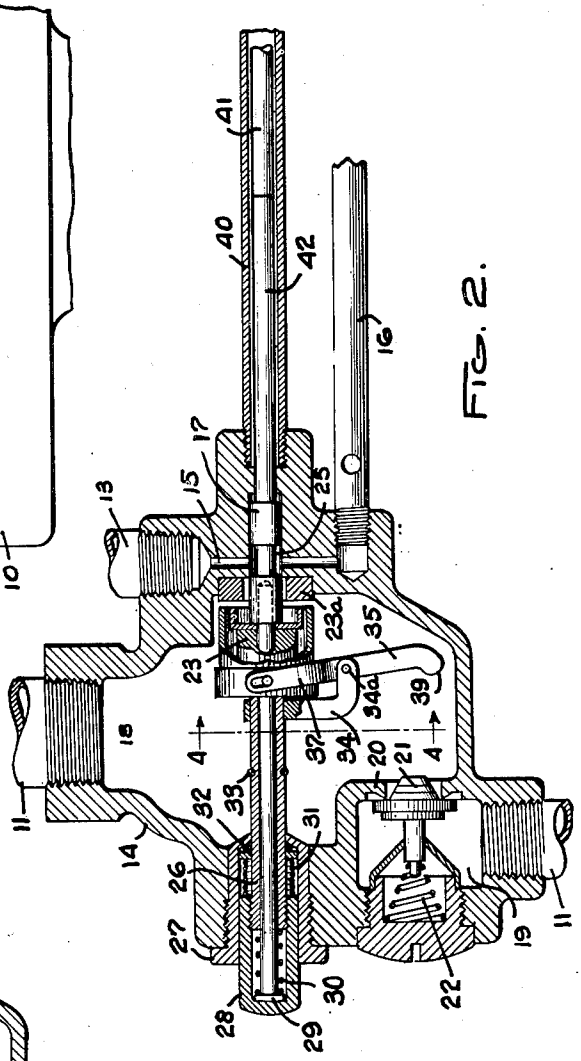


FIG. 2.

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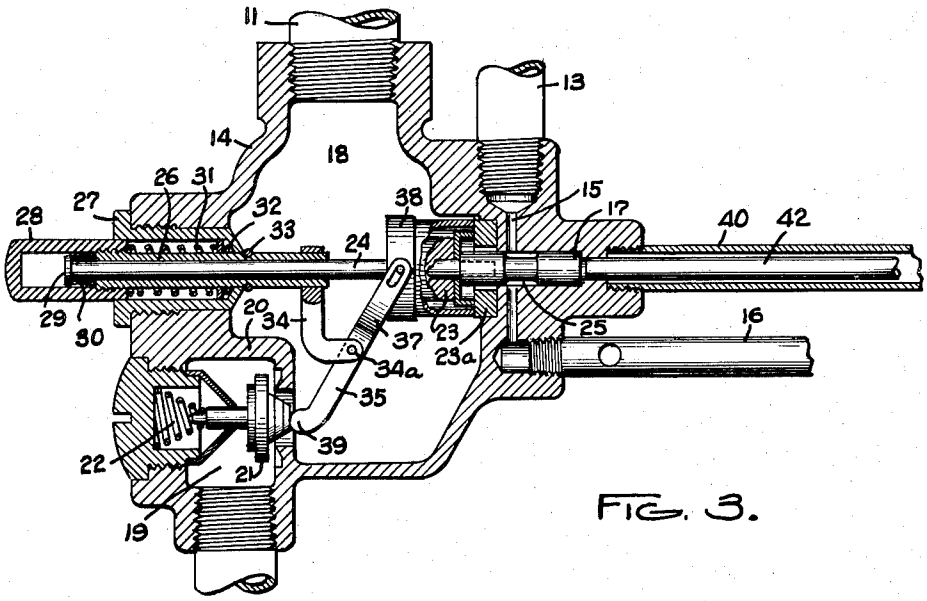



FIG. 3.

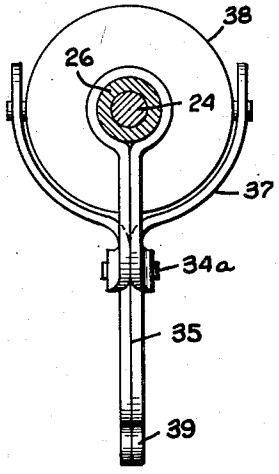



FIG. 4.

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## SAFETY VALVE MECHANISM

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Application November 27, 1944, Serial No. 565,209

4 Claims. (Cl. 137—139)

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This invention relates to safe operating mechanism for a controlling device, and more particularly for a controlling device, such as an electric switch, a valve, or the like, which normally occupies an idle position, but which may be cocked to an active position in which it is releasably held by maintaining means sensitive to a variable condition, such as temperature.

One object of the invention is to simplify and improve the operating connections between the cocking device, the maintaining means and the controlling device in such manner as to reduce the number of parts and the cost of construction, assembly and upkeep.

Another object is to secure more certain and positive results in operation.

Still another object is to provide an improved arrangement in which movement of the controlling device to active position is produced by return rather than by advance motion of the cocking device.

Another object is to provide an improved arrangement in which motion of the cocking device in one direction adjusts the maintaining devices toward maintaining relation with each other, while motion thereof in the opposite direction moves the controlling device from one of its positions to the other.

Further objects of the invention in part are obvious and in part will appear more in detail hereinafter.

In the drawings, which represent one suitable embodiment of the invention, Fig. 1 is a sectional elevation, showing the parts in normal or inoperative position;

Fig. 2 is a similar view, showing the cocking device advanced, some parts being omitted;

Fig. 3 is a similar view, showing all parts in active or operating position; and

Fig. 4 is a cross section on the line 4—4, Fig. 2.

The invention may be applied for use in the operation of any controlling device, such as an electric switch, a valve, a trigger, or the like, employed in the control or operation of other devices. For convenience, and in no sense of limitation beyond the full scope of the claims appended hereto, it has been illustrated in connection with the control of the flow of fuel, either gaseous or liquid, to a burner. The drawings show a main burner 10, to which fuel is supplied by a conduit 11, and a pilot burner 12 adjacent the main burner and supplied with fuel by way of a conduit 13.

The valve mechanism for controlling fuel flow through conduits 11, 13 usually is organized as a

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single unit, although this is not essential and separate control devices may be employed.

As illustrated, the controlling valve mechanism includes a hollow body or casing 14 provided with a pilot burner supply channel or passage 15 to one end of which the conduit 13 is connected, and to the other end of which the pilot burner tube 16 is connected. Flow through said channel is controlled by a suitable valve 17. The same hollow body is also provided with fuel supply and discharge chambers 18, 19 communicating with conduit 11, said chambers communicating with each other by way of an opening in cross wall 20 controlled by a valve 21 normally biased toward the closed or idle position shown in Fig. 1 by a compression spring 22.

Valves 17, 21 may be releasably held in their active or open positions, shown in Fig. 3, by any suitable maintaining means, such as mechanical latch devices, an electromagnet and armature controlled by a thermocouple or other current source, or any other device. The drawings show for the purpose a permanent magnet couple of the same general form and arrangement described and shown in a prior application for Safety valve mechanism, Serial No. 558,514, filed October 13, 1944, by Van Denberg and Selby, now Patent No. 2,412,235, granted Dec. 10, 1946, to which reference may be had if desirable or necessary. Said couple includes a permanent magnet member 23 firmly mounted upon a stem 24 to move therewith, and a washer form keeper or armature 23a fixedly mounted in the casing and through which the stem slides. A part of the stem 24 is provided with an annular recess 25 which forms the channel of the pilot valve 17 before referred to.

The outer end of stem 24 slides within a tube 26 slidable in a thimble 27 threaded into the casing, said tube having its outer end closed by a cap 28 which houses a head 29 on the end of the stem and a compression spring 30 surrounding the stem and lying between its head and the end of tube 26. Tube 26 is biased to move outwardly by a compression spring 31. Leakage of gas is prevented by suitable seals, such as the O ring 32, and tube 26 is provided with an external annular collar or abutment 33.

On the inner end of tube 26 is rigidly mounted a laterally extending arm 34, the free end of which carries a pin 34a operatively associated with a lever 35 having a yoke, the arms 37 of which are pivoted to a support 38 carried by stem 24, and the opposite end of which lever 35 has its end portion formed to provide an abut-

ment 39 lying opposite the central portion of the valve 21.

The inner end of stem 24 is normally spaced from but lies opposite the end of a thermostatic device for control thereby. In the arrangement shown this device is of the tube and rod variety including a tube 40 closed at its outer end and enclosing a rod 41 axially alined with stem 24. The tube and rod are made of materials having different coefficients of expansion under heat, such as brass or copper for the tube and Invar for the rod, or vice versa. These tube and rod members lie opposite the jet ports of the pilot burner and any differential in length between them, as the result of presence or absence of flame, is reflected in variation in position of the inner end of push rod 42, which is made of the same material as the tube to avoid the effect of variation in ambient temperature in the combustion chamber at points remote from the pilot flame. Rod 41, of course, is capable of endwise adjustment, during calibration, by the usual screw 43 for that purpose.

The control device described operates as follows:

Fig. 1 illustrates all parts in the normal idle or inoperative position. Valve 21 is held closed by its biasing spring 22. Tube 26 carrying the exposed cap 28 is biased outwardly to the limit of its motion in that direction as determined by the collar or abutment 30, by its spring 31. Stem 24 is also biased outwardly by its spring 30, with the support 38 against or near to the end of tube 26. Lever 35 occupies a position with its abutment end 39 free of engagement with the valve 21. Pilot valve 17 is closed, because a full-sized portion of rod 24 obstructs the channel 15. The end of stem 24 is spaced from the inner end of the push rod 42. No gas is flowing and there is no flame. To put the burner into operation, the cocking device is advanced by applying a finger to the end of the cap 28 and pushing inwardly. Any lost motion between the end of tube 26 and the support 38 is first taken up and the stem 24 and tube 26 advance together, compressing and building up the pressure of spring 31. The parts are so proportioned and adjusted that at any normal temperature in the combustion chamber around the main burner with no flame present stem 24 will engage the end of the push rod 42 and take up all lost motion just before the permanent magnet member 23 of the couple actually engages its mating armature member 23a. Indeed, at this moment there may be a clear space of the order of .020 of an inch between the couple members. But the same motion has advanced the annular valve recess 25 of stem 24 to a position opposite or in line with the pilot valve channel 15, so that the pilot valve has been opened. Gas therefore flows from the pilot valve conduit 13 through channel 15 and burner tube 16 to the pilot burner 12, where it may be ignited in any suitable manner. The pilot flame jets issuing from the ports in the pilot burner play upon the tube and rod elements 40, 41 of the thermostat, thus expanding the tube lengthwise and causing the inner end of rod 42, which is in contact with the end of stem 24, to move to the right in Fig. 1. Continued pressure of the finger upon the cocking cap 28, of course, causes stem 24 and tube 26 to follow the movement of rod 42 until, finally, the permanent magnet member of the couple actually engages its armature mate and the two parts stick together as the result of the magnetic force. Now,



the finger may be removed from the cap of the cocking device. Thereupon compression spring 31 takes effect, because it has been chosen with force preponderating that of spring 30. Accordingly, the tube 26 moves outwardly, or to the left in Fig. 2, to the position shown in Fig. 3, with two results. First, spring 30 is compressed, but its pressure does not build up to a value sufficient to separate the members of the magnet couple. Second, the lateral arm 34 carried by tube 26 applies force to lever 35, moving it in the clockwise direction, Fig. 2, to the position shown in Fig. 3, its abutment end portion 39 engaging valve 21 and moving the same to open position. This opens the conduit supplying gas to the main burner, the flame of which is promptly ignited by the already present flame of the pilot burner.

The parts remain in this position until for any reason all flames are extinguished. Thereupon the members of the thermostatic device cool down and tube 40 contracts endwise, moving the push rod 42 to the left and applying force to the right-hand end of the stem 24 sufficient to physically move the permanent magnet member to the left, freeing it from contact with its armature mate. As soon as the members of the magnet couple are separated, spring 30 takes effect and moves stem 24 and the permanent magnet to the left to the full amount permitted, thereby restoring the parts to their original positions, with both valves closed.

It will be observed that in the cocking operation, advance movement of the cocking device moves the maintaining devices, which here are the members of the permanent magnet couple, toward their maintaining positions, but actual maintaining effect is still subject to an appropriate variation in temperature at the thermostatic device sufficient to permit the members of the magnet couple to reach actual contact. But the production of maintaining condition or position of the parts is entirely independent of movement of the control device, which remains stationary, in its idle or inactive position, until maintaining relation of the maintaining parts is actually effected. Then, upon motion of the cocking device in the opposite direction, or motion of retraction thereof, the controlling device, such as the valve 21 in the arrangement illustrated, is moved to its active, in this case, its open, position.

The arrangement described is quite simple, is easily manufactured and assembled at low cost, and operates satisfactorily and effectively.

Other advantages of the invention will be apparent to those skilled in the art.

What we claim is:

1. Control apparatus, comprising a hollow body provided with a cross wall forming supply and discharge chambers communicating through an opening in said wall, an imperforate valve member in one of said chambers biased to move along a line toward closed position at said opening, and operating and control means for said valve in the other chamber and including a reset member reciprocable back and forth along a line at one side of the line of valve movement, means operatively connecting said reset member and valve member, and releasable means operated by said reset member for holding said valve member in open position.

2. Control apparatus, comprising a hollow body provided with a cross wall forming supply and discharge chambers communicating through an opening in said wall, an imperforate valve mem-

ber in one of said chambers biased to move along a line toward closed position at said opening, and operating and control means for said valve in the other chamber and including a reset member reciprocable back and forth along a line at one side of the line of valve movement, means operatively connecting said reset member and valve member, releasable means operated by said reset member for holding said valve member in open position, and an actuator for said reset member, said connecting means including a lever having a valve operating arm pivotally associated with said reset member and operated by said actuator.

3. In a device of the character described, the combination of a chambered casing enclosing a control device, a stem slidable endwise in said casing, releasable control device holding members on said stem and casing, a lever extending laterally from the stem to the control device and having a fulcrum movable with the stem, and a cocking device slidable on the stem and operatively connected to the lever.

4. In a device of the character described, in combination, a control device biased to move toward a safe position, holding means therefor including cooperating magnet and armature members, at least one thereof being movable, operating connections between the control device and movable member, manually operatable cocking means for advancing the movable member into holding contact with its cooperating member without effect upon said control device, means arranged upon retraction of said cocking means to actuate the control device to operating position without effect upon the holding means, and means sensitive to a variable condition and arranged upon variation therein to apply pressure to said one movable member for bodily separating said members to thereby release the control device for movement to its safe position.



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