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VALVE ARRANGEMENT

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Fig. 1

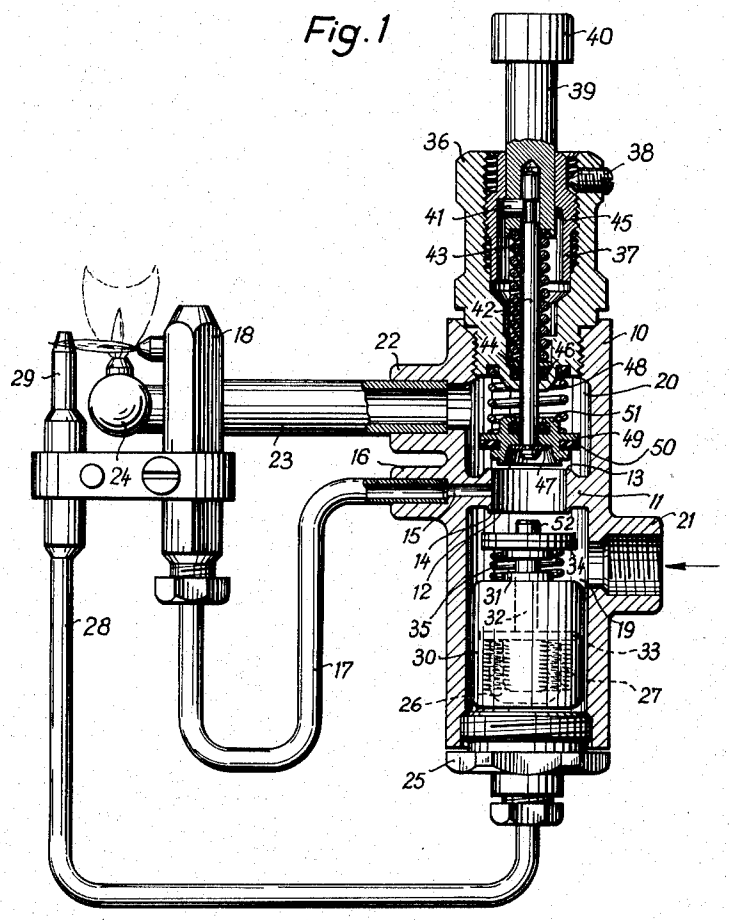
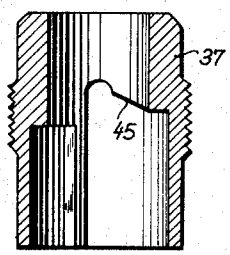


Fig. 2



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VALVE ARRANGEMENT

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The present invention relates to a valve arrangement.

More particularly, the present invention relates to an automatic safety valve by means of which the flow of a fluid medium to a burner is automatically shut off if the flame is extinguished.

There exists automatic safety valves capable of interrupting the flow of gas to a burner in the event the flame is accidentally extinguished. The known devices, however, are of the "on"-"off" type, there being no way of regulating the amount of gas supplied to the burner.

It is therefore an object of the present invention to provide an automatic safety valve which is not only capable of automatically shutting off the flow of fluid to a burner in the event the flame is extinguished, but which is also infinitely adjustable so as to be capable of controlling the precise amount of fuel supplied to the burner.

The objects of the present invention also include the provision of such an automatic safety valve which can be operated with one hand.

It is a further object of the present invention to provide an automatic safety device which is rugged, which will give long periods of trouble-free service, and which may be built at very low cost.

With the above objects in view, the present invention mainly resides in a valve arrangement which comprises a housing, gas inlet means in the housing, first gas outlet means leading to a pilot burner, second gas outlet means leading to a main burner, main valve means arranged between the gas inlet means on the one hand and the first and second gas outlet means on the other hand, first spring means permanently tending to close the main valve, holding means adapted to hold the main valve in open position, the holding means being automatically actuated when the pilot burner is lighted, auxiliary valve means arranged in sequence after the main valve means and between the first and second gas outlet means, second spring means permanently tending to move the auxiliary valve means into closed position, an operating member mounted in the housing for movement between an inoperative position in which the auxiliary valve means is held in open position by the operating member and in which the main valve means is not influenced by the operating member and an operative position in which the auxiliary valve means is released by the operating member and is moved toward its closed position by the second spring means and in which the main valve means is opened by the operating member against the action of the first spring means, and guiding means for so guiding the operating member between its inoperative and operative positions that the operating member stays in any desired intermediate position thereof between the inoperative and operative position, when moved into such position.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing, in which:

Fig. 1 is a sectional view of a valve arrangement according to the present invention; and

Fig. 2 is a sectional view of a detail, shown on an enlarged scale.

Referring now to the drawing, there is shown a valve arrangement which incorporates a valve housing **10** having a central partition **11** formed with a bore **12** therethrough. The upper face of the partition constitutes a valve seat **13** for an auxiliary valve and the lower face of the partition constitutes a valve seat **14** for a main valve means. A bore **15** which opens at a first gas outlet stud **16** is provided between the valve seats **13** and **14**, and a conduit **17** serves to connect the stud **16** to a pilot burner **18**.

The partition **11** separates the casing **10** into two chambers **19** and **20**, and a gas inlet stud **21** communicates with the chamber **19**. A second gas outlet stud **22** communicates with the chamber **20**, and another conduit **23** serves to connect this stud **22** to the main burner **24** of a gas-heated appliance.

The chamber **19** is closed by a cover **25**, the latter being firmly connected to a U-shaped electromagnet **26**. The winding **27** of the electromagnet **26** is connected by means of a line **28** to a thermocouple **29**. The solenoid **26**, **27** is encased within a sheath **30** formed with a guide ring **31** which accommodates a valve rod **32**. The lower end of the valve rod carries an armature plate **33** and the upper end carries the main valve **34** which is adapted to seat upon the valve seat **14**. A spring **35** is interposed between the sheath **30** and the main valve **34** so that the latter is constantly urged toward its closed position. In Fig. 1 the main valve **34** is shown in its open position in which it is retained against the action of the spring **35** by the holding means constituted by the solenoid **26**, **27** and the armature **33**. This condition occurs when the thermocouple **29** is exposed to the heat of a flame so that sufficient current flows through the winding **27** to enable the solenoid to hold the armature **33**, whereas when there is no flame, the main valve **34** will be moved to and held in its closed position by the spring **35**.

The chamber **20** is closed by means of a tubular closure element **36** forming part of the valve casing **10**, within which closure element a tubular mounting element **37** is threaded, a wedging screw **38** being provided for preventing rotation of the mounting element. A manually operable shaft **39** having a knob portion **40** is slidably and turnably arranged in the mounting element **37**, and an operating member such as a rod **42** which is concentric with the shaft **39** projects into a bore thereof, a transverse connecting element **41** being provided for connecting the shaft **39** and the rod **42** to each other. As is clearly shown in the Fig. 1, the inner end of the element **41** projects into a collar formed in the rod **42**, so that the shaft **39** and the rod **42** are longitudinally movable with each other whereas the shaft **39** may be turned within the element **37** without turning the rod **42**.

The element **37** is formed with a shoulder portion constituting a helical cam surface **45** (Fig. 2) which is open toward the partition **11**, and the outer end portion of the connecting element **41** abuts against this cam surface, a spring **43** being provided which is interposed between the under surface of the shaft **39** and a washer **44** which lies upon an upwardly directed face of the closure element **36**. In this way, the element **41** acts as an engaging element which is firmly pressed against the cam surface **45**.

The lower end of the closure element **36** is so shaped as to serve as a guide for the operating rod **42**, as well as a mount for a sealing ring **46**.

The rod **42** carries at its lower end an abutment disk **47**, and the main valve **49** which is slidably mounted on the rod **42** is constantly urged toward this abutment **47** by means of a spring **48** which is interposed between the

main valve 49 and the closure element 39. The main valve 49 carries on its underside a sealing element 50 which is adapted to engage the valve seat 13, and a sealing ring 51 is provided between the main valve 49 and the rod 42.

The operation of the device is as follows:

In order to ignite the burners, the knob 40 is pressed, thereby depressing the rod 42 and with it the abutment disk 47 so that the sealing ring 50 of the main valve 49 will, under the influence of the spring 48, be pressed upon the valve seat 13.The knob is then depressed further until the lower end of the rod 42 engages a projection 52 on the main valve 34, the latter occupying its closed position at the start of the operation. The rod 42 pushes the main valve 34 open against the action of the spring 35 until the armature 33 abuts the magnet 36.

After the auxiliary valve 47 has been closed and the main valve 34 opened, gas may flow from the inlet 21 through the conduit 17 to the pilot burner 18. A pilot flame is then ignited, and the heat of this flame causes the thermocouple 29 to generate sufficient current to energize the solenoid 26, 27 so that the same will exert a retaining force on the armature 33 thereby holding the main valve 34 in its open position against the action of the spring 35.

The knob 40 is then released, and the shaft 39 will, under the influence of the spring 43 be raised. As a result, the operating rod 42 together with the abutment disk 49 will likewise be raised, and this will lift the auxiliary valve 49 off the valve seat 13 against the action of the spring 48. The gas may thus flow through the outlet stud 22 and the conduit 23 to the main burner 24, and the pilot flame will ignite the main flame.

When the burner flames are extinguished for any reason, the thermocouple 29 will cease to generate enough current to enable to solenoid 26, 27 to hold the armature 33, so that the main valve 34 will be closed under the influence of the spring 35. In this way, no further gas can flow to the pilot burner or to the main burner.

According to the present invention the flow of gas through the chamber 20 and consequently the size of the main burner flame may be regulated by turning the knob 40. This will cause the element 41 to engage different portions of the helical cam surface 45 so that the shaft 39, and with it the operating rod 42 together with the abutment disk 47, will be moved longitudinally relative to the valve seat 13, and this, in turn, will permit the auxiliary valve 47 to be pressed into different positions relative to the valve seat 13 by the spring 48. However, the valve 49 will not be turned upon turning of the knob 40 inasmuch as the connection effected by the element 41 will permit free turning of the shaft 39 relative to the rod 42.

It has been found advanageous to provide the cam surface 45 with an index point or detent which corresponds to an angular position of the shaft 39 at which the auxiliary valve 49 is nearly closed but is still sufficiently open to permit just enough gas to pass through the stud 22 to sustain a flame at the main burner.

If desired, the cam surface 45 and the rod 42 can be so arranged that when the auxiliary valve 49 is in the above-described nearly-closed position, or even in a fully closed position, the rod 42 engages the projection 52 of the main valve 34 and moves the latter from the valve seat 14 to such an extent as to permit the flow of sufficient gas to enable ignition of the pilot burner. In such an arrangement the configuration of the helical cam surface should be such that when the knob 40 has been turned sufficiently to open the main valve 34, the static force with which the springs 35 and 43 press the element 41 upwardly against the cam surface 45 is insufficient to cause the shaft 39 to rotate, i.e., the cam and cam follower set constituted by the surface 45 and the element 41 should be a self-locking one incapable of being moved under the influence of the static forces of the springs 35 and 43. However, the cam and cam follower set should be so constructed as not to be self-locking when the projection 52 of the main valve 34 strikes the bottom end of the rod 42 after the solenoid 26, 27 has become incapable of holding the main valve 34 in its open position.

As a result, one-handed operation of the valve is made possible as follows:

The knob 40 is turned until the rod 42 has been moved downwardly sufficiently to engage the projection 52 and to open the main valve 34. The knob 40 may then be released without there being any possibility that release will permit rotation of the shaft 39 and consequent upward movement of the rod 42 under the influence of the springs 35 and 43. The pilot flame may then be ignited manually with the same hand which operated the knob 40, and after the pilot flame has been ignited, the same hand may then be used to press the knob 40 until the armature 33 abuts against the solenoid 26, 27. The latter will be energized due to the flame issuing from the pilot burner and will therefore hold the main valve 34 in its fully open position against the action of the spring 35, thus allowing the flow of sufficient gas to feed the main burner. The knob 40 is then released until it assumes that position which occupied before the pilot flame was ignited, i.e., that position at which the auxiliary valve 49 is in its nearly closed position so as to permit just enough gas to flow to the main burner to sustain a flame. The valve arrangement then will act as a safety valve inasmuch as the impact with which the projection 52 of the main valve 34 is capable of striking the bottom of the rod 42, under the influence of the spring 35 after deenergization of the solenoid due to extinguishing of the burner flames, will be greater than the static forces of the springs 35 and 43 and will cause the rod 42 to move upwardly with sufficient force to rotate the element 41 to a higher point on the cam surface 45. The main valve 34 will thus be able to assume its fully closed position.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of valve arrangements differing from the types described above.

While the invention has been illustrated and described as embodied in an automatic safety valve, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention. For example, the arrangement of the parts may be such that the respective paths along which the main and auxiliary valves move are inclined to each other, and/or so that the main valve is moved by a separate lever or the like connected to the manual operating means which actuate the operating member of the auxiliary valve.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. A valve arrangement comprising, in combination, a housing; gas inlet means in said housing; first gas outlet means leading to a pilot burner; second gas outlet means leading to a main burner; main valve means arranged between said gas inlet means on the one hand and said first and second gas outlet means on the other hand; first spring means permanently tending to close said main valve means; holding means adapted to hold said main valve means in open position, said holding means being

automatically actuated when said pilot burner is lighted; auxiliary valve means arranged in sequence after said main valve means and between said first and second gas outlet means; second spring means permanently tending to move said auxiliary valve means into closed position; an operating member; means mounting said member in said housing for movement between an inoperative position in which said auxiliary valve means in held in open position by said operating member and in which said main valve means is not influenced by said operating member and an operative position in which said auxiliary valve means is released by said operating member and is moved toward its closed position by said second spring means and in which said main valve means is opened by said operating member against the action of said first spring means; and said mounting means including guiding means for so guiding said operating member between its inoperative and operative positions that said operating member stays in any desired intermediate position thereof between said inoperative and operative positions, when moved into such position.

2. A valve arrangement as defined in claim 1, and third spring means permanently tending to move said operating member away from its operative position.

3. A valve arrangement as defined in claim 2, wherein said guiding means open in that direction in which said operating member moves when it moves toward its operative position.

4. A valve arrangement as defined in claim 3 wherein said mounting means mounts said operating member so as to be slidable relative to said housing between said operative and inoperative positions.

5. A valve arrangement as defined in claim 4 wherein said mounting means mounts said operating member so as to be turnable relative to said housing, and wherein said guiding means are formed with a helical cam surface adapted to be engaged by said operating member.

6. A valve arrangement as defined in claim 3, wherein said mounting means mounts said operating member for both sliding and turning movement relative to said housing, said mounting means including a tubular mounting element formed with a helical cam surface constituting said guide means and adapted to be engaged by said operating member.

7. A valve arrangement as defined in claim 6 wherein said operating member carries an engaging element adapted to engage said helical cam surface.

8. A valve arrangement as defined in claim 6, and indexing means for indexing that intermediate position of said operating member in which said auxiliary valve means is sufficiently open to permit just enough gas to pass through said second gas outlet means to sustain a flame at said main burner.

9. A valve arrangement as defined in claim 6 wherein the position of said tubular mounting element in said housing is adjustable, and means for securing said tubular mounting element in any one of its positions.

10. A valve arrangement as defined in claim 6 wherein said helical cam surface is in the form of shoulder of said tubular mounting element.

11. A valve arrangement as defined in claim 6, and manually operable means connected to said operating member for moving the same between its different positions.

12. A valve arrangement as defined in claim 6 wherein said operating member is so constructed and arranged that when it is in that position thereof in which said auxiliary valve means is sufficiently open to permit just enough gas to pass through said second gas outlet means to sustain a flame at said main burner, said operating member engages said main valve means and holds the same in a partly open position in which said main valve means permit the flow of sufficient gas to enable ignition of said pilot burner.

13. A valve arrangement as defined in claim 12 wherein the configuration of said helical cam surface is such that when said operating member is in said position thereof in which said auxiliary valve means is sufficiently open to permit just enough gas to pass through said second gas outlet means to sustain a flame at said main burner, the static force of said first and third spring means is insufficient to cause turning of said operating member so as to allow movement of said first and second valve means, whereas the impact of said main valve means upon said operating member, after said holding means have released said main valve means due to the extinguishing of said burners thus allowing said main valve means to be moved to closed position under the influence of said first spring means, is sufficient to cause turning of said operating member thereby allowing said main valve means to close under the influence of said first spring means.

14. A valve arrangement as defined in claim 11, and a coupling element for coupling said manually operable means and said operating member to each other in such a manner that the same are longitudinally movable with each but are freely turnable relative to each other.

15. An adjustable automatic safety valve, comprising, in combination, a housing having an inlet, a first outlet spaced therefrom, and a second outlet spaced downstream from said first outlet, said housing being formed with first valve seat means intermediate said inlet and said first outlet and with second valve seat means intermediate said first and second outlets, said first and second valve seat means being aligned with each other; first valve means operatively associated with said first valve seat means and including a first valve movable between open and closed positions, said first valve being so positioned that when it moves toward its closed position it moves toward said aligned first and second valve seat means, first spring means operatively associated with said first valve for constantly urging the same into said closed position, and solenoid means operatively associated with said first valve for maintaining the same, when said solenoid means are energized, in said open position against the action of said first spring means; and second valve means operatively associated with said second valve seat means and including a valve rod mounted for turning movement also for sliding movement toward and away from said aligned first and second valve seat means, second spring means interposed between said housing and said valve rod for constantly urging the latter away from said first valve seat means, said valve rod means carrying an abutment at that end thereof which is nearest said aligned first and second valve seat means, a second valve slidably arranged on said valve rod and adapted to engage said abutment thereof, and third spring means interposed between said housing and said second valve for constantly urging the latter toward said abutment, said valve rod being so constructed and arranged that when the same is moved toward said aligned first and second valve seat means against the action of said second spring means said first and second valves assume different positions, said second valve means further including adjusting means for determining the position occupied by said valve rod under the influence of said second spring means, said adjusting means including an engaging element on said valve rod and turnable and slidable therewith and a helical indexing element open toward said aligned first and second valve seat means and adapted to be engaged by said engaging element.

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