Sept. 22, 1936. R. E. NEWELL 2,055,133

VALVE

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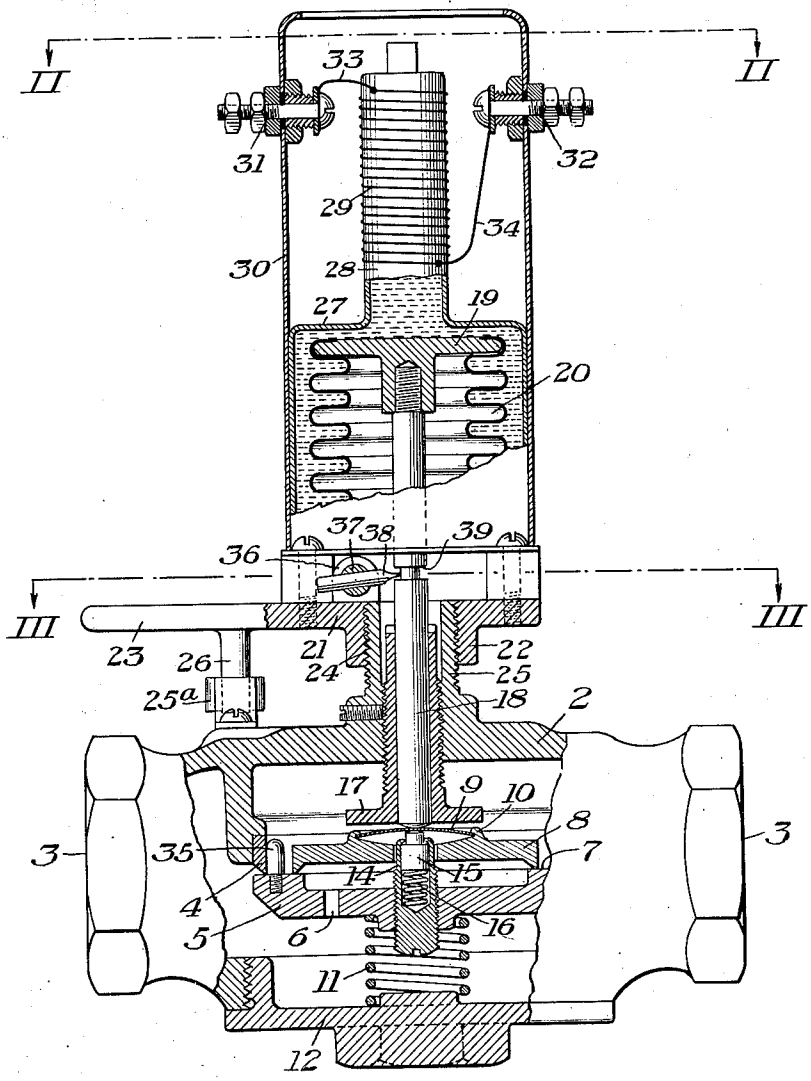
Fig. 1.



INVENTOR

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VALVE

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Fig. 2.

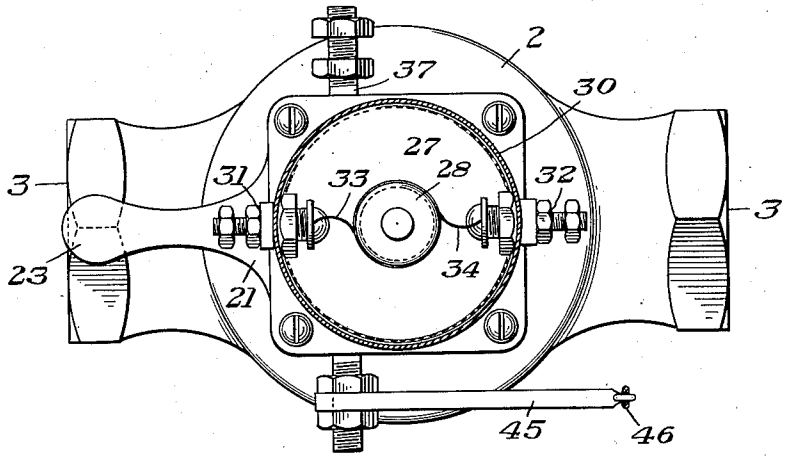


Fig. 3.

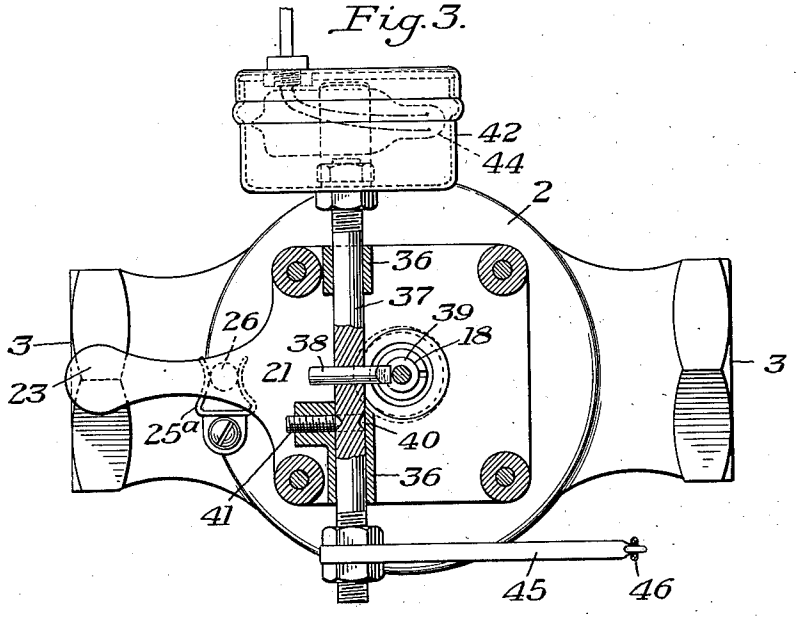
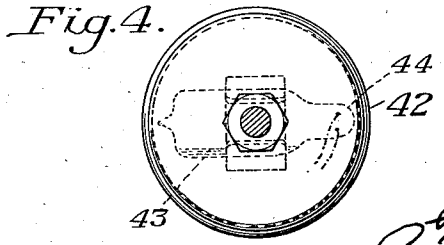


Fig. 4.



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Patented Sept. 22, 1936 2,055,133

UNITED STATES PATENT OFFICE

2,055,133

VALVE

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Application September 19, 1930, Serial No. 482,939

12 Claims. (Cl. 137—139)

The present invention relates broadly to the art of fluid distribution, and more particularly to an improved valve structure preferably of the electrically operated type and combining certain advantages both of the so-called snap valve and of the so-called throttle valve.

In my co-pending application Serial No. 471,723, filed July 30, 1930, I have disclosed and claimed a combined snap-throttle valve of the general construction herein disclosed. Such a valve is characterized by a combination of valve elements, one of which has imparted thereto a snap operation and the other of which a slow moving operation. In this manner, the combined advantages both of the snap valve and of the throttling type valve are obtained without the limitations incident to either type of structure.

The present invention has for one of its objects the provision of such a valve in combination with improved operating means therefor whereby a delayed operation of the valves is obtained, the length of which delay is under the control of the designer.

Another object of the present invention is to provide a combined valve and operating mechanism adapted to be moved concomitantly therewith and effective for controlling an outside operation, such as a separate valve, damper, switch or the like.

Still another object of the invention is to provide a valve of such construction that it may be operated either electrically or manually in the event of current failure.

In the accompanying drawings, I have shown by way of illustration only, a preferred embodiment of my invention.

In the drawings:

Figure 1 is a view partly in vertical section, partly in elevation, and partly broken away, illustrating a valve constructed in accordance with the present invention;

Figure 2 is a transverse sectional view on the line II—II of Figure 1, looking in the direction of the arrows;

Figure 3 is a transverse sectional view on the line III—III of Figure 1; and

Figure 4 is a partial conventional view of the switch mechanism illustrated in Figure 3.

In accordance with the present invention, there may be provided a valve body 2 of any desired construction having portions 3 adapted to be used interchangeably as either inlet or outlet connections. Suitably carried by the valve body is a seat 4 with which cooperates a valve 5, which valve will hereinafter be referred to as the throttling valve. Formed in the throttling valve and extending completely therethrough is any desired number and arrangement of openings 6, the number of openings and the size thereof determining, at least to a large extent, the snap capacity of the valve, as will be hereinafter more fully apparent.

The throttling valve is of such construction as to provide an upper seat 7 adapted to cooperate with and form a seating surface for a snap valve 8. The snap valve is illustrated as carrying a flexible disc or so-called "click spring" 9 of the character disclosed in my co-pending application referred to. This flexible element is conveniently secured to the snap valve by means of a flange or bead 10 of such diameter as to receive the flexible element therein, the bead subsequently being spun over the edge of the disc whereby it is effective for frictionally maintaining the same in the desired cooperative relation to the snap valve without interfering with free flexing thereof.

In the illustrated embodiment of my invention, the throttling valve 5 is shown as urged toward its seat by a spring 11 abutting at one end against the under side of the valve, and at its opposite end against a cap or closure 12. This spring, or equivalent means provided at the will of the designer, is effective for normally maintaining the valve in such position as to prevent the passage of fluid through the valve body. Extending through the throttling valve is a stop pin casing 14 within which is carried a stop pin 15 normally maintained in the position illustrated in the drawings by a spring 16.

Adjustably carried by the valve body is a stop disc 17 overlying the snap valve 8, and forming an abutment adapted to be engaged by the bead 10 for thereby limiting the opening movement of the snap valve under the influence of the flexible element 9. By suitably adjusting the disc 17, the extent of opening movement of the snap valve, and consequently the snap capacity of the valve within the limit of the openings 6 may be varied.

Extending through the disc 17 and in axial alignment with the pin 15 is a valve operating stem 18, the lower end of the stem being in engagement with the flexible element 9, while its upper end is threaded into a cap 19, constituting a closure for a power device 20, herein illustrated as being of the bellows type. The entire power device is secured in any desired manner to a handle nut 21 comprising a hub 22 and an operating handle 23. The hub 22 has a threaded engagement 24 with a boss 25 projecting upwardly from the valve body. For normally maintaining the handle nut in predetermined position, and preventing rotative movement between the same and the valve body, the valve body is illustrated as having secured thereto a retaining clip 25a adapted to receive a projection 26 on the handle 23.

The power device 20 is conveniently enclosed by a suitable casing 27 having its lower portion of such dimensions as to form a housing for the

bellows, and having an upward extension 28 adapted to receive therearound a resistance winding 29. The entire power device, casing and resistance winding may be enclosed by a protective housing 30 carrying contacts 31 and 32 connected respectively to the terminals 33 and 34 of the resistance winding.

By reason of the construction thus far described, it will be apparent that if the valves 5 and 8 are in the position illustrated, and the circuit including the resistance wire winding 29 is energized, the fluid within the casing 27 will be heated and expanded. The expansive effect of this fluid will be effective for collapsing the bellows 20, and thereby moving the valve operating stem 18 downwardly. This initial downward movement will be effective against the center of the flexible element 9, and in opposition to the pin 15 and the spring 16, for depressing the center portion of the flexible element. After such depressing operation has continued to a certain extent, the flexible element will snap or click in the opposite direction, the upward movement of the periphery of the element being effective for raising the snap valve out of engagement with the throttling valve 5. At this time, the valve structure will be effective for passing an amount of fluid corresponding to its snap capacity, this capacity in turn being determined by the opening movement of the snap valve, or by the openings 6, as before described.

Continued movement of the valve operating stem 18 in the same direction will be effective for moving the throttling valve 5 in opposition to the spring 11 away from the seat 4, whereby the desired throttling capacity of the valve is brought into play. During its opening and closing movements, the throttling valve may be guided by suitable pins 35 projecting from its upper surface and cooperating with the seat 4.

In the event of current failure, it will be apparent that manual operation of the valve may be obtained by rotation of the handle nut 21, the threaded engagement between the handle nut and the boss producing a movement of the stem 18 comparable to that obtained by the contraction or expansion of the bellows 20. There is thus provided a valve which may be either electrically or manually operated.

It not infrequently happens that it is desired to effect the control of some outside element or circuit concomitantly with the operation of the valve. In accordance with the present invention, this may be accomplished by forming the handle nut 21 with suitable bearings 36 adapted to receive a rocker pin 37. This pin is preferably of such length that the opposite ends thereof project a suitable distance beyond the sides of the valve body to facilitate the attachment thereto of chains, cables, switches or the like. Rotative movement is imparted to the rocker pin by providing the same with a finger 38 cooperating with a groove 39 in the valve operating stem 18, whereby longitudinal movement of the stem 18 will impart rotative movement to the rocker pin 37. Axial movement of the rocker pin may be prevented by providing the same with a groove 40 with which cooperates a stop pin 41 carried by one of the bearings 36.

For purposes of illustrating the utility of my invention, I have shown the rocker pin in Figure 3 as carrying a mercury switch 42 on one end thereof, the mercury switch being illustrated in greater detail in Figure 4. This switch is of such construction that upon rotation in one direction, the mercury 43 therein will be caused to flow into the end 44 of the switch and thereby close the circuit, while rotative movement in the opposite direction will break the circuit, as understood in the art.

I have found that a structure of the general character herein described, while being useful for the control of a large number of different pieces of apparatus, has particular advantage when utilized with a mercury switch of the general character disclosed, in conjunction with the control of a gas-fired warm air furnace. It has heretofore been the usual practice with such furnaces to install a thermostat in the "bonnet" or dome of the furnace, which thermostat is adapted to close the circuit and start the circulating fan at a predetermined temperature condition within the dome. Such fan, however, by speeding up the air circulation, quickly causes a drop of temperature in the bonnet which, of course, causes the thermostat to break the circuit and stop the fan. As the air circulation slows down, the dome temperature rises, causing the closing of the circuit and the starting of the fan. There is thus obtained a more or less intermittent operation which is not only annoying, but which interferes with proper temperature control.

In an effort to obviate the disadvantages of such an intermittent system, controls have been provided in which the fan is started simultaneously and automatically at the same instant, and generally by the same motor which operates the fuel valve for gas, or the draft doors for coal fired furnaces. Such motor is in turn usually controlled by remote room temperature, and is not affected by the bonnet temperature of the furnace. While this method is practical for coal fired furnaces (where considerable stored heat is always present) it is impractical for gas fired furnaces for the reason that if such a furnace has been out for an hour or so, it becomes quite cold. If the fan is started with the furnace cold, and at the same instant that the gas turned on, the fan will force cold air into the rooms being heated, as an appreciable time interval will be required to heat the furnace to such a temperature as to permit the furnishing of warm air thereby.

The present invention obviates the objections incident to controls of this character since, by properly designing the resistance coil and properly regulating the current flow thereto, I may insure a delay of any desired length of time between the closing of the resistance circuit and the complete opening of the valve. If the factors are so controlled as to insure a delay of three to four minutes between the time of closing the resistance circuit and the time of opening of the throttling valve, the furnace in the meantime has had an opportunity to come at least partly up to temperature by the gas passed by the snap valve. It will be apparent that one of the characteristics of a snap valve, and of the comparatively light springs utilized in connection therewith, is the ability to open or close quickly under small temperature changes, while the throttling valve, by reason of its heavier springs, is usually more sluggish. With the present invention, therefore, utilized in connection with a gas fired furnace, it is possible to close the resistance circuit, open the snap disc, start the furnace in operation, and thereafter move the stem 18 a sufficient distance to close the circuit controlled by the mercury switch. At the time of closing, which may be, for example, two or three minutes after the time of closing

the resistance circuit, the furnace will be up to such temperature that the fan will deliver warm air to the rooms being heated. By so adjusting the mercury switch that the circuit is not closed by the switch until the valve stem has almost completed its full stroke, such a desired time interval or delay period is easily obtainable.

The present invention also lends itself to control by a suitable thermostat independently either of the power operating means or of the manual means. This may be accomplished by securing to one end of the rocker pin a lever 45 to which is connected a chain or rod 46 operated by a suitable temperature or pressure regulator, not shown. In this manner, a limit control consisting, for example, of a bellows type of regulator, may be utilized for operating the valve stem independently either of the electrical or manual control so that, for instance, when the furnace has reached a predetermined temperature, the limit control will be effective for moving the valve stem upwardly even in advance of the period of time at which the electric thermostat becomes effective. Such a combination is particularly desirable in steam boiler installations.

Certain advantages of the present invention arise from the combination of a valve structure, particularly of the dual type, with a slow moving power device, whereby such a time interval or delay period is obtainable that advantage may be taken thereof for the control of an outside operation.

Further advantages arise from a provision of a combination of the character referred to and especially when the dual valve structure is of such nature that operation of the valves themselves occurs at spaced intervals.

Still further advantages arise from the provision of a control of the general character described embodying a delay period during which a fan or other means may be automatically started.

Additional advantages of the invention result from the provision of a valve adapted to be controlled in any one of a plurality of different manners, and particularly from the provision of manually controlled means effective in case of failure of the automatic controls provided.

While I have herein disclosed and described a preferred embodiment of the invention, and have set forth the operation thereof by way of example in connection with a gas fired furnace, it will be apparent that changes in the construction and operation of the parts may be made without departing from the spirit of the present invention or scope of the appended claims, and that the utility of the invention is not limited with respect to the particular system in which it is employed.

I claim:

1. In a valve, a dual valve structure including a snap valve and a throttling valve, a slow moving power means effective for operating said valve structure, and control means having a mechanical operating connection with said valve structure.

2. A valve comprising a plurality of valves operable in sequence, a slow moving power device for effecting operation of the valves in sequence and including a flexible member for imparting a snap action to one of the valves, and control means operable with said valve structure.

3. A valve structure, comprising a throttling valve, a snap valve, a slow moving power device for effecting opening of the snap valve in advance of the throttling valve, and control means operated by said power device.

4. The combination with a valve comprising a snap valve and a slow moving valve, of operating means therefor including a valve stem and flexible member, and control means operated by said valve stem only after sufficient movement thereof to actuate the snap valve.

5. The combination with a valve having an opening therethrough, and a snap valve cooperating with said opening, of operating means for said valves including a valve stem, control means operated by the movement of said valve stem, said control means including a rocker pin operatively connected to said stem, and means connected to said rocker pin for manually operating said valves.

6. The combination with a valve body having a valve therein, of power means carried by said body for effecting operation of said valve, and manual operating means supporting said power means and effective for manual operation of said valve.

7. The combination with a single valve body, of a plurality of valves within said body and comprising a throttling valve and a snap acting valve including a click spring, power means for effecting operation of said valves in sequence, and manual means for effecting similar operation of said valves.

8. The combination with a valve body, of a plurality of valves therein, power means for effecting operation of said valves in sequence, and manual means for effecting similar operation of said valves, said power means comprising a bellows and electrically operated means for controlling the expansion and contraction thereof.

9. A valve, an electrically heated bellows element for the control of said valve, and means for producing bodily relative shifting movement of said bellows element and valve to obtain an independent control thereof for use in event of current failing.

10. The combination with a valve body, of a plurality of valves therein, power means for effecting operation of said valves in sequence, and manual means for effecting similar operation of said valves, said power means comprising a bellows and electrically operated means for controlling the expansion and contraction thereof, and said manual means including a rotatable mounting for said bellows.

11. The combination with a valve having an opening therethrough, and a snap valve cooperating with said opening, of a valve stem for operating said valves, a rocker pin operatively connected to said valve stem, and means connected to said rocker pin for manually operating said valves.

12. The combination with a valve having an opening therethrough, and a snap valve cooperating with said opening, of a valve stem for operating said valves, a rocker pin operatively connected to said valve stem, said rocker pin having a circuit controlling switch secured thereto, and means connected to said rocker pin for manually operating said valves.

ROBERT E. NEWELL.