Feb. 8, 1955 G. F. CARLSON ET AL 2,701,581

FLOW CONTROL VALVE

Filed April 13, 1951 2 Sheets-Sheet 1

Fig. 1.

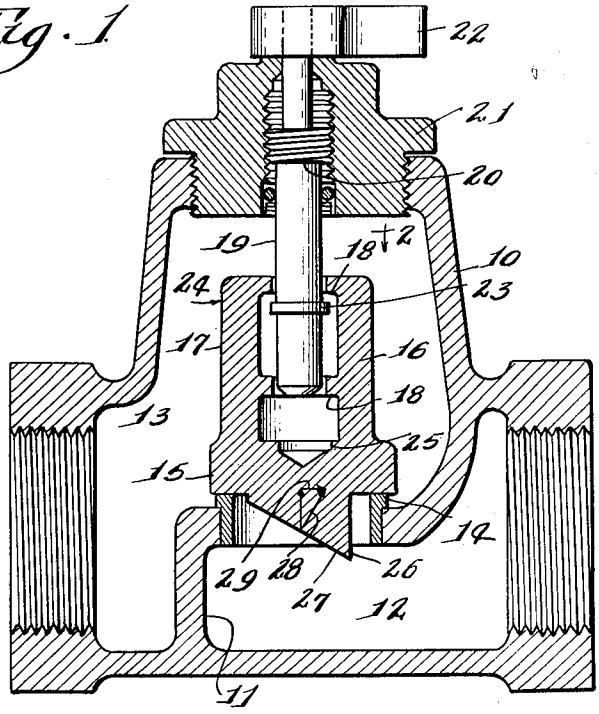


Fig. 2.

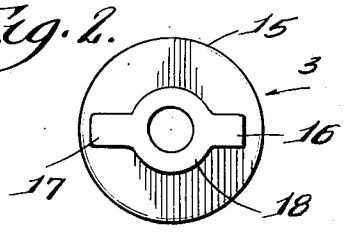


Fig. 3.

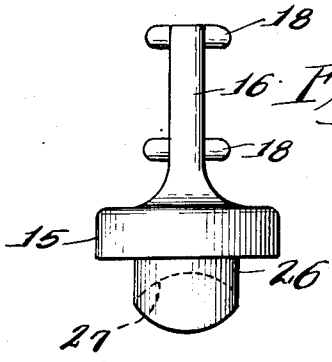
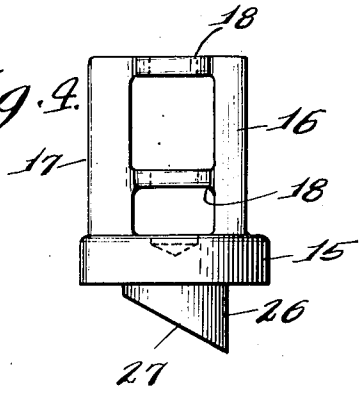


Fig. 4.



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Feb. 8, 1955 G. F. CARLSON ET AL 2,701,581

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Filed April 13, 1951 2 Sheets-Sheet 2

Fig. 5.

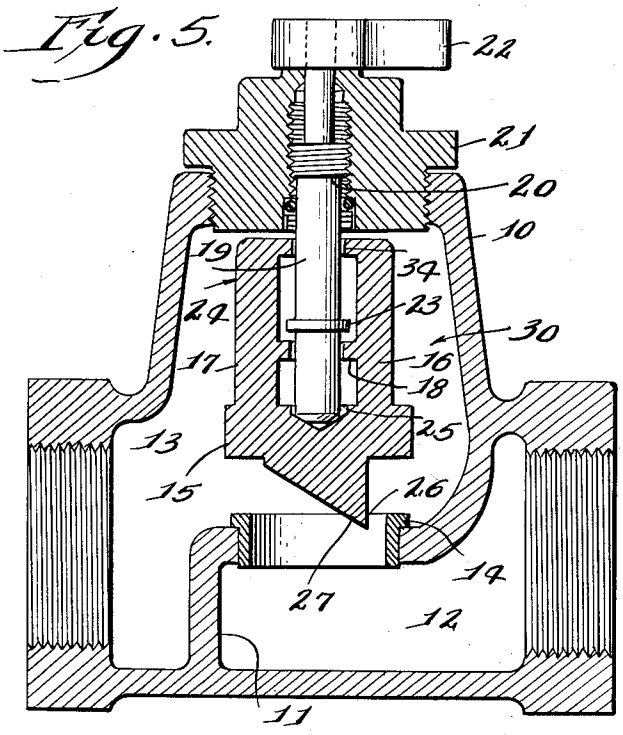
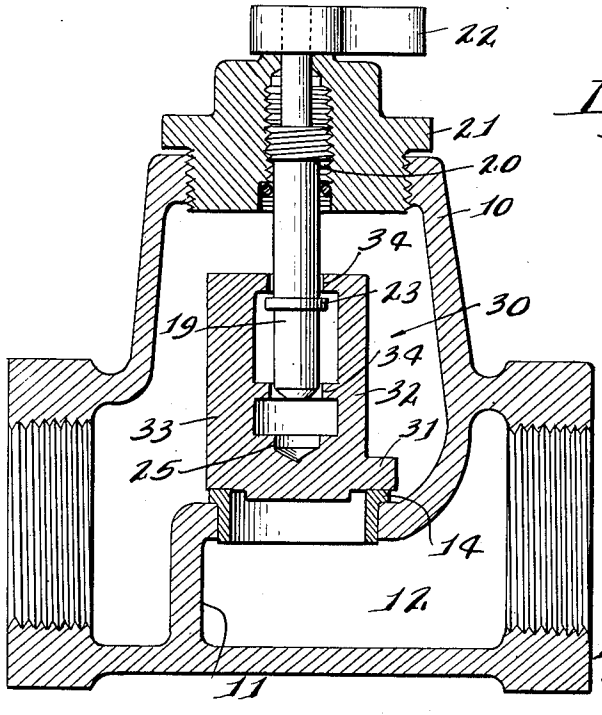


Fig. 6.



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FLOW CONTROL VALVE

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3 Claims. (Cl. 137—533.27)

Our invention relates to flow control valves which are pressure operated in an opening direction and is concerned more particularly with that type which is vertically reciprocable between opened and closed positions.

A characteristic form of this valve includes a valve member slidably mounted for vertical movements on a stem, the member being raised in an opening direction by fluid pressure and gravity moved to closure when the pressure is removed. A typical application of the valve occurs in forcibly circulated, hot water heating systems wherein the valve opens in response to the operation of a thermostatically controlled pump to permit circulation through the radiating part of the system and closes when the pump stops, i. e., when the demand of the space being heated is satisfied. Sufficient clearance must be provided between the valve member and its stem to insure its free gravity movement to closure, but this condition sets up a chattering action when the pump starts running and the noise thus created is transmitted through the associated piping and is objectionable, particularly in domestic installations.

It is therefore one object of the invention to provide a flow control valve in which the valve member is constructed in relation to the opening pressure so that the member is tilted or rocked into non-chattering contact with the valve stem during the opening movement of the member.

A further object is to construct and arrange the valve member so that pump pressure applies a constant lateral force thereto sufficient to tilt the member into contact with the stem.

A further object is to provide a valve member having a surface against which the pump pressure acts and arranged so that a component of this pressure produces the tilting movement.

These and further objects of the invention will be set forth in the following specification, reference being had to the accompanying drawings and the novel means by which said objects are effectuated will be definitely pointed out in the claims.

In the drawings:

Fig. 1 is a sectional elevation of the valve with the valve member in closed position.

Fig. 2 is a plan view of the member looking in the direction of the arrow 2 in Fig. 1.

Fig. 3 is a view of the member looking in the direction of the arrow 3 in Fig. 2.

Fig. 4 is an elevation of the valve member.

Fig. 5 is a view similar to Fig. 1, but showing the valve member in open position.

Fig. 6 is a sectional elevation showing a modified form of the valve with the valve member in closed position.

Referring to Figs. 1 to 5 of the drawings, the numeral 10 designates a hollow valve body which is divided interiorly by a wall 11 into inlet and outlet chambers 12 and 13, respectively. The wall 11 is apertured to receive a sleeve valve seat 14 whose axis is vertical and whose upper surface sealingly coacts with a valve disk 15 in the usual way. In effect, therefore, the valve seat 14 forms a part of the wall 11. Extending upwardly from the disk 15 are spaced, parallel legs 16 and 17 which are connected above the disk by vertically spaced, annular ribs 18—18 that are apertured for sliding engagement with the lower end of a vertical stem 19 whose vertical axis is aligned with the axis of the valve seat 14, the legs and ribs accordingly formed a skeleton structure for

guidably mounting the disk 15 on the stem 19. The upper end of this stem includes an enlargement 20 threaded in a closure cap 21 demountably secured to the body 10 and the stem extends exteriorly of the cap 21 for attachment to a handle 22. Below the upper rib 18, the stem 19 is provided with an annular shoulder 23 which is spaced from the upper rib 18 when the disk 15 engages the seat 14.

When the handle 22 is rotated in the proper direction, the shoulder 23 will engage the upper rib 18 to manually open the valve disk 15, or with the parts in the positions shown in Fig. 1, the valve disk will move upwardly whenever an adequate pressure exists in the inlet chamber 12, such as when an associated pump starts operating and will drop by gravity to a closing position when the pressure is removed. Under the latter condition, the valve member, generally designated by the numeral 24 and including the disk 15, legs 16 and 17, and ribs 18, is guided on the stem 19 whose lower end bottoms in a pocket 25 formed in the top side of the disk 15 when the latter is raised.

So far as described, the foregoing structure follows accepted practice in flow control valves, but it is characterized by a tendency of the valve member to chatter when an opening pressure is established in the chamber 12 and this chatter sets up a noisy condition which is transmitted through the associated piping. This noise is particularly objectionable in domestic hot water heating systems.

The sliding fit of the valve member 24 on the stem 19 is of the order of .020" to .032", it being necessary to insure that the member will move freely in both directions without too sloppy a fit. It is believed that this sliding clearance, though small, is the cause of this chatter which is eliminated by the following instrumentalities.

A truncated, cylindrical projection 26 depends from the valve disk 15 in clearance relation to the interior of the sleeve seat 14 and the lower end of the projection includes a face 27 that is inclined to the longitudinal axis of the valve member 24. There is nothing critical in the shape of the projection 26 other than that the inclination of the face 27 shall be such that an adequate lateral component of the applied pressure will be available to act on the face and that the latter shall be exposed to pressure in the inlet chamber 12. In the arrangement shown, the surface 27 makes an angle of about 60° with the vertical axis of the member 24.

When pressure is present in this chamber, the total force thereof acts normally against the face 27 and may be represented by a vector 28. One component of this total force may be represented by a vector 29 which is normal to the longitudinal axis of the valve member 24 and hence tilts the member towards the left, as viewed in Fig. 1, so that the upper and lower ribs 18, respectively, bear oppositely against the stem 19. Accordingly, the member 24 is held snugly against the stem 19 during upward movement to thereby eliminate any chattering. When the pressure in the chamber 12 is cut off, the pressure component, represented by the vector 29, is no longer present and the member 24 drops freely by gravity to seating position.

Since the center of gravity of the projection 26 lies to the right of the longitudinal axis of the member 24 which would locate the center of gravity of the member including the projection to the right of the same axis, this distribution of mass of the member 24 would oppose the rocking action of the pressure component 29 and lessen its effect. To correct this situation, the member 24 is counterbalanced by sufficiently increasing the mass of the leg 17, i. e., the leg which is on the opposite side of the member from the longest vertical dimension of the projection 26. This arrangement places the center of gravity of the member 24, including the projection 26, on the longitudinal axis of the member so that the pressure component 29 is utilized to the fullest extent in rocking the member.

In Fig. 6 is illustrated a modified form of the valve wherein a different type of valve member is employed to secure the non-chattering action, the remainder of the construction being identical with that shown in Fig. 1. Like parts in Figs. 1 and 6 are identified by the same numerals.

In Fig. 6, the valve member, generally indicated by the numeral 30, comprises a valve disk 31 which sealingly coacts with the valve seat 14 and extending upwardly from the disk 31 are spaced, parallel legs 32 and 33 which are connected above the disk by vertically spaced, annular ribs 34—34 that are apertured for sliding engagement with the lower end of the stem 19. As shown, the leg 33 includes a greater mass than that of the leg 32 so that the center of gravity of the member 30 lies to the left of the axis of the stem 19. In plan view, the appearance of the member 30 is substantially identical with the valve member 24 as shown in Fig. 2.

Assuming that the valve member 30 is closed, then when pressure is established in the inlet chamber 12, it operates uniformly against the exposed portion of the under side of the disk 31 and, due to the unbalanced construction of the member 30, this pressure tilts or rocks the member to the left and thus causes the upper and lower ribs 34, respectively, to bear oppositely against the stem 19. This snug holding of the member 30 against the stem 19 during the opening movement prevents chattering of the member on the stem.

We claim:

1. A flow control valve comprising a hollow body having an apertured interior wall including a valve seat and defining with the body inlet and outlet chambers, a stem mounted within the body coaxial with the seat, and a valve member freely slidable and slightly rockable on the stem for coaction with the seat and adapted to be moved in an opening direction by pressure in the inlet chamber, the member having a projection generally offset from and including a face angularly related to the longitudinal axis of the member and the face being exposed to pressure in the inlet chamber whereby a component of the applied pressure rocks the member into snug contact with the stem.

2. A flow control valve comprising a hollow body having an apertured interior wall including a valve seat and defining with the body inlet and outlet chambers, a vertical stem mounted within the body coaxial with the seat, a valve member freely slidable on the stem for coaction with the seat and adapted to be moved in an opening direction by pressure in the inlet chamber and gravity biased to closure, the member having a depending projection generally offset from and including a face angularly related to the longitudinal axis of the member and the face being exposed to pressure in the inlet chamber whereby a component of the applied pressure rocks the member into snug contact with the stem, and a counterbalance formation on the member positioned in relation to the projection to locate the center of gravity of the member on said axis.

3. A flow control valve comprising a hollow body having an apertured interior wall including a valve seat and defining with the body inlet and outlet chambers, a vertical stem mounted within the body coaxial with the seat, a valve member operably related to the seat and adapted to be moved in an opening direction by pressure in the inlet chamber and gravity biased to closure, the member having an upwardly extending skeleton structure including a pair of opposed legs and a pair of vertically spaced, guide elements carried by the valve member and slidable freely along the stem, one of the legs having a greater mass than the other, and a projection depending from the member in counterbalance relation to the leg having the greater mass to locate the center of gravity of the member on the longitudinal axis thereof, the projection including a face angularly related to the longitudinal axis of the member and exposed to pressure in the inlet chamber whereby a component of the applied pressure rocks the member into snug contact with the stem.

References Cited in the file of this patent

UNITED STATES PATENTS

199,814	Fifield	Jan. 29, 1878
345,197	Wade	July 6, 1886
913,491	Greenlee	Feb. 23, 1909
963,836	Varlie	July 12, 1910
993,742	Wardlaw	May 30, 1911
1,001,111	Wood	Aug. 22, 1911
1,834,276	Hallett	Dec. 1, 1931
2,271,274	Donnell	Jan. 27, 1942