July 7, 1936. A. W. WHEATON 2,046,759

SLOW CLOSING VALVE

Filed May 15, 1934

Fig. 1

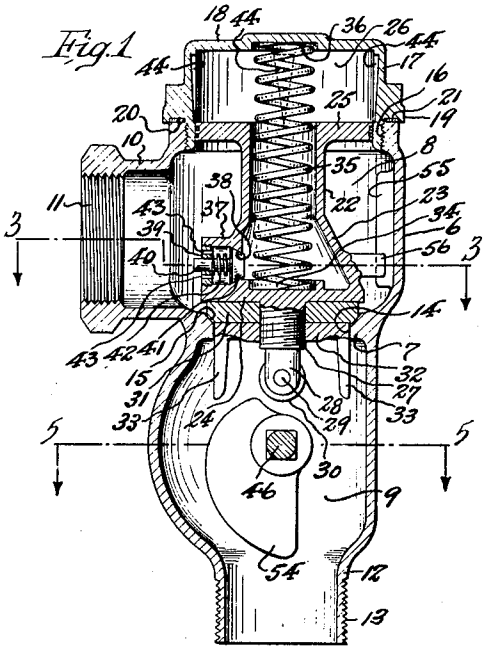


Fig. 2

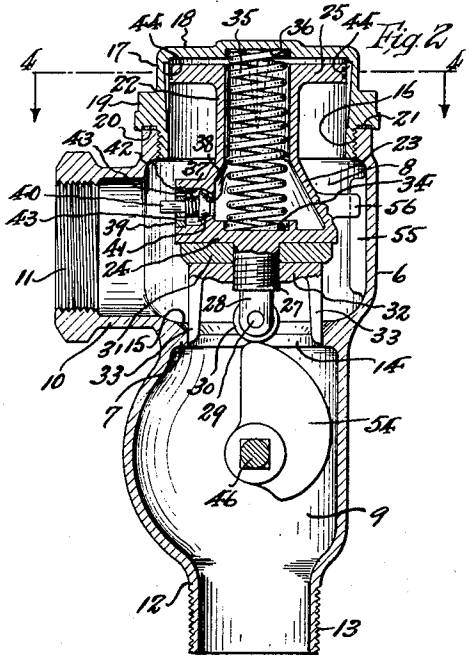


Fig. 3

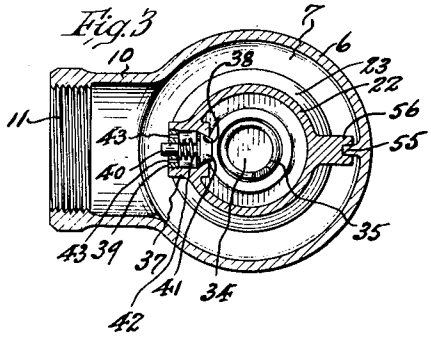


Fig. 4

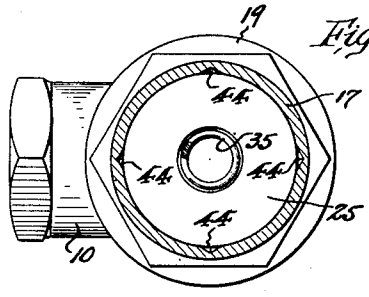
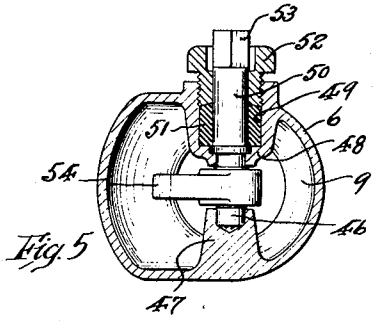


Fig. 5



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SLOW CLOSING VALVE

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Application May 15, 1934, Serial No. 725,724

1 Claim. (Cl. 251—128)

This invention relates, generally, to improvements in valves; and the invention has reference, more particularly, to a novel construction of quick opening and slower closing valve for controlling the flow of fluid in pipes and conduits, and wherein the closing movement is self-actuating and so controlled that sudden back pressure or liquid hammer is avoided, thus relieving the valve and pipe-line structure from injurious jars and strains as well as conserving the useful life of the valve facings and valve seats.

Self-actuating slow closing valves as heretofore provided have been cumbersome and bulky in design, requiring a comparatively large amount of material for their construction which considerably increased their cost. Among other objects of this invention is that of providing a form of construction for such valves, whereby the weight and bulk thereof, and consequently the cost thereof, is considerably reduced, and whereby a very compact and simple structure is attained.

Another object of the invention is to provide a valve wherein the elements thereof, which serve to control the closing operations, are of simple and effective design, and so formed as to offer a minimum of resistance to flow of fluid between the intake and outlet of the valve; wherein the valve per se, during its movements is smoothly guided against binding, sticking or vibration; wherein a minimum of resistance to valve opening movement is attained while nevertheless an effective and progressively increasing check upon closing movements of the valve is assured.

Other objects of this invention, not at this time more particularly enumerated, will be understood from the following detailed description of the same.

An illustrative embodiment of this invention is shown in the accompanying drawing, in which:

Fig. 1 is a vertical longitudinal sectional view of the valve according to this invention, with the valve means in closed condition; Fig. 2 is a similar view, with the valve means in open condition subject to slow closing movement; Fig. 3 is a transverse section, taken on line 3—3 in Fig. 1; Fig. 4 is a transverse section, taken on line 4—4 in Fig. 2; and Fig. 5 is a transverse section, taken on line 5—5 in Fig. 1.

Similar characters of reference are employed in the above described views, to indicate corresponding parts.

Referring to the drawing, the reference character 6 indicates the main body or casing of the valve which is interiorly divided between its upper and lower ends by a partition 7, thus forming within the casing interior an intake chamber 8 above said partition and an outlet chamber 9 below the latter. Formed in connection with the side of said body or casing, to communicate with said intake chamber 8, is a laterally extending intake branch 10, which is internally threaded, as at 11, to receive the end of a fluid supply pipe (not shown). Formed in connection with the lower end of said body or casing, to lead outwardly from the outlet chamber 9, is a branch 12, which, for purposes of illustration, is shown externally threaded, as at 13, to permit of coupling thereto a suitable fluid discharge pipe or conduit (not shown).

Said partition 7 is provided with a valve port opening 14, aligned with the longitudinal axis of said body or casing 6. Formed on the upper margin of said valve port opening 14 is a chamfered valve seat 15.

At its upper end, said body or casing 6 is provided with an internally threaded opening 16. The reference character 17 indicates a bonnet closed at its upper end by an exterior end wall 18 but open at its lower end. Said lower end of the bonnet is externally threaded and is sized to screw into the top opening 16 of the body or casing 6. Intermediate its upper and lower ends and integral with its body, the bonnet is provided with an external lateral flange 19, in the underside of which is provided a seat 20 to receive a sealing gasket 21. When the bonnet 17 is assembled with the body or casing 6, the flange 19 abuts the top end of said body or casing 6, so as to engage the sealing gasket 21 between these parts, to thus effect a fluid tight joint therebetween.

Disposed within said intake chamber 8 is a valve means comprising a hollow plunger 22 open at its upper end. At its lower end portion said plunger is provided with an outwardly flaring wall portion 23 which joins the marginal portions of a valve disk 24 at the lower extremity of said plunger. Extending laterally around the upper end of said plunger 22 is a retarding piston 25 which slidingly moves within the interior chamber 26 of said bonnet 17. Axially aligned with said plunger 22, and dependent from said valve disk 24 is an externally screw-threaded stud 27, which is provided at its free extremity with a bifurcate member 28 to support the journal pin 29 of an anti-friction roller 30. Mounted on the underside of said valve disk 24, around the stud 27, is a valve facing washer 31 of suitable material, the same

being cooperative with the valve seat 15. Threaded upon the stud 27 is a valve keeper disk or nut 32, the same being of a diameter to fit the valve port opening 14. Depending from the marginal portions of said keeper disk or nut 32, and spaced circumferentially about the same, are a plurality of guide fingers 33 which slidingly engage the periphery of said valve port opening 14. Disposed axially within the hollow plunger 22, with its lower end footed in a seating socket 34 with which the upper or inner surface of said valve disk 24 is provided, is a valve closing spring 35, the upper end of which projects from said hollow plunger 22 so as to engage and thrust from a seating socket 36 provided on the under or inner side of the top wall 18 of said bonnet 17. Formed in connection with the side of said plunger 22 above the valve disk 24, and preferably adjacent thereto, is a check-valve housing 37, the inner end wall of which is provided with discharge port 38, preferably having a chamfered periphery. Threaded or otherwise affixed to or within the outer end of said housing 37 is a centrally perforate guide plate 39, through which slidingly extends the stem 40 of an outwardly opening check valve 41 which normally closes said discharge port 38, being urged into closed relation thereto by a coiled compression spring 42 which is mounted on and around said valve stem 40 between the valve 41 and said guide plate 39. Said guide plate 39 is provided with outlet openings 43 communicating with the interior of said intake chamber 8. Formed in the side walls of said bonnet 17, at the interior sides thereof, are one or more fluid by-pass grooves or channels 44 over which the retarding piston 25 moves. These grooves or channels 44 are of a special conformation being of V-shape tapering downwardly from their relatively broad upper ends toward their narrow or restricted lower ends. It also preferable that these grooves or channels possess a diminishing depth toward their narrow or restricted lower ends. Such conformation of said grooves or channels provides for a diminishing fluid by-pass effect around the retarding piston 25, constantly diminishing from maximum by-passing capacity at their upper ends to minimum by-passing capacity at their lower ends. The purpose and functioning of these grooves or channels in cooperation with movements of the retarding piston in the cylinder 26 provided by the interior of the bonnet 17 will subsequently be understood from the description of the operation of the valve.

Means are provided for opening the valve by a manual operation. This means comprises a spindle 46 having its inner end journaled in an inner bearing support 47 provided within the outlet chamber 9 on one side wall thereof, while its opposite end is journaled in a bearing support 48 provided on the opposite side wall of said outlet chamber 9. Said bearing support 48 is provided with an outwardly open stuffing-box chamber 49 through which extends, for exterior projection from the body or casing 6, the stem or shank 50 of said spindle 46. Packed around said stem or shank 50 is a suitable packing material 51, which is held in place by a stuffing box nut or gland 52 which is engaged around the stem or shank 50 and which screws into the outer open end of said stuffing-box chamber 49. The outer extremity of said stem or shank 50 is provided with a squared end 53 for application thereto of a suitable wrench (not shown) by means of which said stem or shank 50 and consequently said spindle 46 may be turned. Fixed on said spindle 46, to turn therewith, is a lift-cam 54 which, on turning of the spindle, may be rotated against the anti-friction roller 30, to thereby impart an upward thrust to the stud 27 for lifting the valve disk 24, plunger 22 and retarding piston 25, to thereby open the valve port 14 to the passage of fluid through the valve.

To prevent twisting or turning of the plunger and valve device about its longitudinal axis, a longitudinal guide rib 55 is provided to project from the inner side of the wall of the body or casing 6 within the intake chamber 8. Connected with and projecting laterally from a side of the plunger 22 is a bifurcate guide lug 56, the bifurcate end of which straddles said guide rib 55 so as to slidingly engage therewith.

To open the valve, the lift-cam 54 is rotated upwardly by application of a suitable tool or wrench to the shank of its spindle. When thus turned said lift-cam 54 engages the anti-friction roller 30 of the stud 27 exerting an upward thrust thereupon whereby the plunger 22 is raised against the compression of the spring 35. The rising of the plunger lifts the valve disk and its facing from closed relation to the valve port opening 14, while at the same time the retarding piston 25 rises within the interior of the bonnet 17. The fluid within the interior 26 of the bonnet and within the interior of the hollow plunger 22 is compressed by such rising movement of the plunger and retarding piston, and the fluid pressure thus created acts upon the outwardly opening check-valve 41 so that the latter is removed from the discharge port 38, thus discharging the fluid from the interior 26 of the bonnet 17, and by reason of this quick and certain release of fluid pressure at this point the main valve port 14 is quickly opened to the flow of fluid from the intake chamber 8 therethrough to the outlet chamber 9, or in other words through the valve.

The valve is self-closing under the reaction of the spring 35 when the spindle and lift-cam are released from manipulating force. The downward movement of the plunger 22 and valve disk 24 is retarded, and a slow closing movement of the valve is effected by the following occurrences. As the plunger 22 starts downward, the outwardly opening check-valve 42 closes the discharge port 38, so that fluid can not reenter the interior of the plunger 22 and the interior of the bonnet 17 at that point, thus compelling the fluid to enter only by by-passing the retarding piston 25 through the grooves or channels 44, thus gradually filling the region of reduced pressure above the retarding piston 25 and within the plunger 22, and consequently slowing the movement of the main valve toward its closed position relative to the valve port opening 14. Owing to the diminishing cross-sectional area of the by-pass grooves or channels 44, as the retarding piston 25 travels downwardly over the same, the resistance to reentry of fluid into the area of reduced pressure is gradually increased proportionately as the main valve approaches closed relation to the valve port opening 14, thus gradually decelerating the closing movement of the valve, so that eventually the valve disk and its facing washer will seat itself upon the valve seat 15 of the valve port opening without any risk of sudden slam, and consequently without the occurrence of any chattering, sudden back pressure or liquid hammer within the valve or the fluid conduit line in which the valve is located.

From the above description it will be obvious that a very efficient and yet exceedingly compact valve of comparatively small bulk is provided for the intended purposes, and for the slow closing mode of operation. Furthermore, owing to the full enclosure of the spring means 35 within the hollow plunger, whereby the relatively smooth surfaces of the latter are alone opposed to the flow of fluid through the valve when open, the internal resistance to fluid flow is greatly reduced, and eddying and breaking of the fluid stream is reduced to a minimum, all of which is no inconsiderable advantage in a valve of the instant type.

I am aware that many changes could be made in the constructions above set forth, and many apparently widely different embodiments of this invention could be made without departing from the scope thereof; it is therefore intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

I claim:—

In a slow closing valve, a casing having a valve port therein intermediate its intake and outlet, a hollow cylinder detachably connected with said casing with its open inner end opposed to and axially aligned with said valve port, an upwardly open hollow plunger of substantially reduced diameter compared with the internal diameter of said cylinder and having at its upper end a diametrically enlarged piston to fit slidingly in said cylinder, said plunger having at its lower end an outwardly flared and closed portion forming a valve body supporting abutment, a valve body for cooperation with said valve port supported by said abutment, a vertical guide rib on the inner wall surface of said casing, said plunger having a bifurcate guide arm laterally projecting therefrom into engagement with said guide rib, spring means extending through said hollow plunger between its closed lower end and the end wall of said cylinder, means to manually raise said plunger and its piston to move said valve body to open relation to said valve portion, a quick acting outwardly opening check-valve communicating between the plunger and cylinder interior and the interior of said casing, and fluid-retarding bypass means in the wall of said cylinder and adapted to be traversed by said plunger piston.

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