Oct. 12, 1965 H. R. BILLETER ETAL 3,211,416

FLUSH VALVES

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Fig. 1

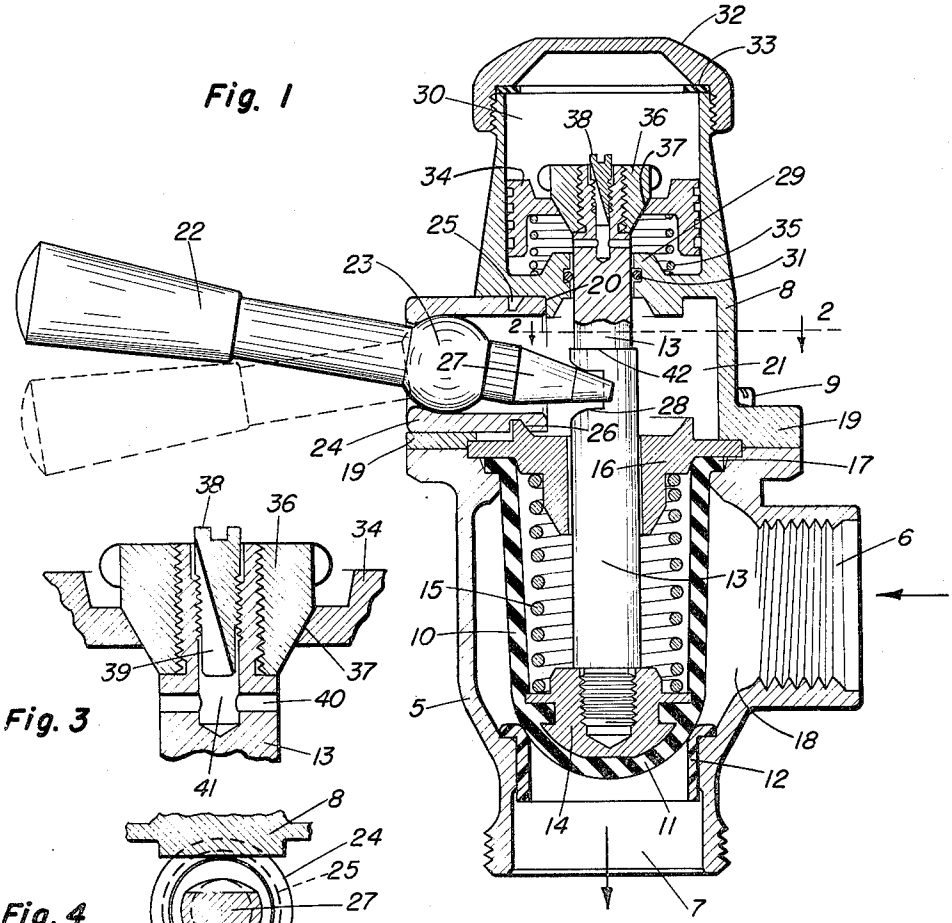


Fig. 3

Fig. 4

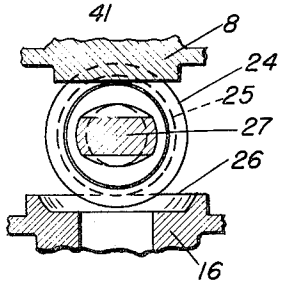
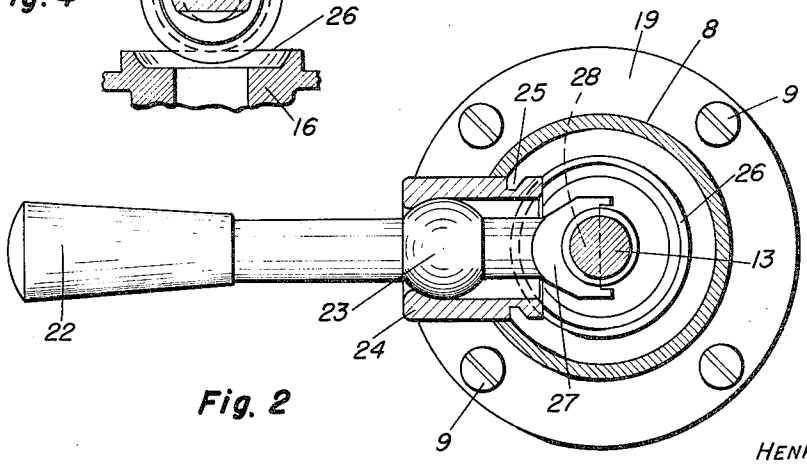


Fig. 2



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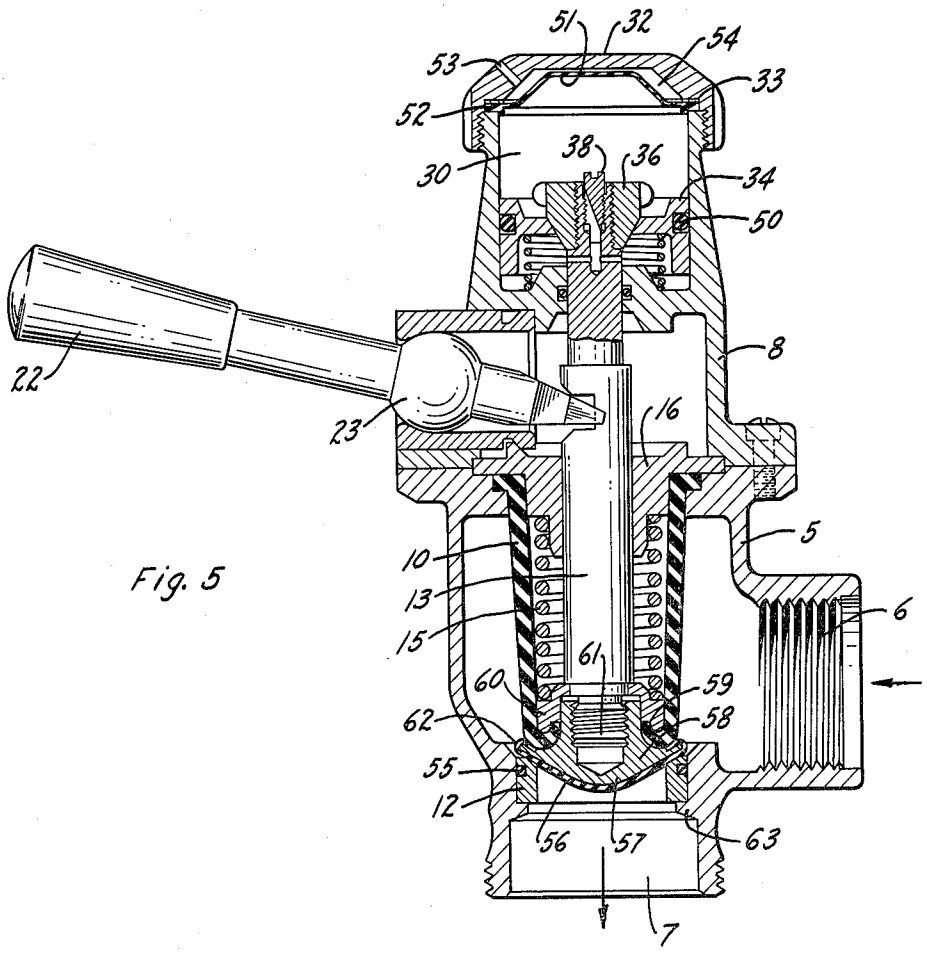


Fig. 5

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United States Patent Office 3,211,416 Patented Oct. 12, 1965

3,211,416

FLUSH VALVES

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Filed Sept. 27, 1963, Ser. No. 312,140
7 Claims. (Cl. 251—54)

The present application is a continuation-in-part of original application Serial No. 242,989, filed December 7, 1962, now abandoned.

The present invention relates in general to flush valves but more particularly to an improved flush valve for flushing water closets and other plumbing fixtures.

An object of the invention is to design a new and improved flush valve particularly for use with corrosive or salt waters, and in which the valve operating parts are all sealed or isolated from direct contact with such impure waters.

Another object is to design a new and improved flush valve in which the operation is not controlled or affected by water pressures or flow in any manner.

A further object is to provide an improved flush valve having a manual positive valve opening means and a timing means independent of water pressures for regulating the amount of water flushed by the valve.

A further object is to provide a novel flush valve which is simple and compact, has few operating parts, and in which the parts are all made rugged to withstand rough usage and wear.

It is a further object of the invention to provide a new and improved flush valve in which all the operating and control parts are completely out of contact with the water, thereby greatly lengthening the life of such parts, reducing the possibility of leakage, and enabling the elements to be easily assembled or inspected.

Flushing water for carrying away wastes from plumbing fixtures is often secured from sources containing impurities including corrosive materials and debris, as well as sea water from harbors which is commonly used for flushing purposes on shore installations, and for ships at sea. The common type of flush valves formerly used are provided with small by-passes or metering orifices in the piston or diaphragm to control the valve closing operation. These orifices regularly become clogged and render the flush valves inoperative when subjected to the action of the impure or corrosive waters. The metal operating parts of these prior flush valves are also attacked by the destructive effect of corrosive waters and are quickly rendered inoperative.

The present invention obviates all the foregoing objections by providing a novel flush valve in which all the operating parts are effectively sealed or isolated from contact with the corrosive water, so that the operating parts will endure indefinitely without repair or replacement. Furthermore, sediment, sea weed or debris cannot clog and interfere with the reliable operation of the valve since the actuating elements are all completely sealed therefrom.

Other objects and features of construction, operation, and combination of elements of the invention not particularly pointed out, are set forth in the following description which taken together with the accompanying drawings forming a part thereof, depicts a preferred form of the invention.

Referring now particularly to the drawings:

FIGURE 1 is a cross-sectional side elevation of a flush valve embodying the invention;

FIGURE 2 is a top view taken along the line 2—2 of FIGURE 1;

FIGURE 3 is an enlarged cross-section of a portion of the timing adjustment;

FIGURE 4 is a fragmentary cross-section through the front part of the operating handle looking from the left-hand side of the stem of FIGURE 1; while

FIGURE 5 is a cross-sectional elevation of a variant form of flush valve embodying the invention.

The flush valve according to the present invention has a body or casing 5 preferably made of brass having an inlet water supply connection 6 and an outlet connection 7 which may lead into a plumbing fixture such as a water closet or urinal. A top enclosing casing 8 for the body 5 has a lower flange portion 19 fastened by screws 9 directly on the top opening of the valve body 5, as seen in FIGURE 2. Arranged within the valve body is a flexible rubber valve member 10 having its lower end nose portion 11 normally closing off the inserted valve seat 12 in the valve body and arranged to open the same to permit water flow through the valve Flexible valve member 10 has a hollow interior through which the operating stem 13 extends. The lower end of stem 13 is threaded into a plug 14 which is molded into the bottom of valve member 10 so that upward movement of the stem 13 will cause the valve member nose portion 11 to be withdrawn from its seat 12. To restore the valve member 10 upon its seat 12 and normally hold it in that position, there is provided a compression spring 15 encircling the stem 13 with the lower end pressing upon the plug 14 and the upper end engaging the bottom of a bushing 16. Spring 15 is of a diameter to closely approach the inner walls of flexible valve member 10 to prevent inward collapse or bending of the valve member 10 when high water pressures are encountered at the inlet 6. The valve nose part 11 will remain seated under such conditions. The flexible valve member 10 in its seated position is slightly stretched by the spring 15.

At the top of the casing 5 there is arranged a bushing 16 having a central opening through which the stem 13 extends and is guided thereby. The bushing 16 encloses the top of the valve member 10 and is clamped at its outer edges between the top of valve body 5 and the flange 19 of casing 8. The top edge of flexible member 10 is also provided with a flanged portion 17 clamped in position between the top of the valve body 5 and bushing 16. The flanged portion 17 serves as a gasket and prevents leakage from the valve chamber 18 into the interior of the valve member 10 as well as outward between the flange 19 and body 5.

The lower portion of casing 8 provides a chamber 21 for the accommodation of the operating handle 22 which has a ball type pivot 23 riding within the socket member 24. The ball 23 enables the handle 22 to be pivoted with an up and down movement to cause operation of the flush valve, as will be pointed out. The cylindrical-shaped socket 24 at its inner end has a groove 25 formed around it which engages a circular ridge 26 formed on top of bushing 16. The socket 24 is thereby locked in position when the casing 8 is clamped on top of the body 5. In order to provide a suitable guide and support for the socket 24, the lower portion is recessed into the top of flange 19 and the inner end of the socket 24 abuts a flat portion 20 of a circular ridge formed in the top of chamber 21.

The operating connection between the inner end of handle 22 and stem 13 comprises a forked portion 27 straddling a notch 28 cut part way into stem 13. The fork 27 is arranged so that movement of the handle 22 can only take place in a vertical direction. With this arrangement, the operating handle 22 is held locked in position between the notch 28 in stem 13 and the left-hand end of socket 24 so the ball pivot 23 will ride in the position as shown.

At the upper end of casing 8 and separated from chamber 21 by the partition 29, is a dash-pot or timing cham-

ber 30. The upper end of stem 13 extends through an opening in the partition 29 into chamber 30, and an O-ring 31 in the partition 29 seals the chamber 30 from the lower chamber 21. A closing cover 32 is screwed on top of casing 8 with a sealing gasket 33 therebetween. Reciprocal within the dash-pot chamber 30 is a piston 34 which is normally urged upwardly by the light compression spring 35 located around the stem 13 and extending between the partition 29 and the bottom of the piston 34. An auxiliary valve member 36 is threaded on the end of stem 13 in chamber 30 and is adapted to normally seat upon an annular valve seat 37 formed in top of piston 34.

The timing adjustment for the dash-pot, as seen in FIGURE 3, comprises a regulating screw 38 threaded into the top of valve member 36 having a diagonal slot 39 cut lengthwise of the screw to determine the setting desired. A vertical opening 41 below the screw 38 and horizontal side openings 40 through the stem 13 permit passage of fluid from one side of the piston 34 to the other through slot 39. The chamber 30 above and below the piston 34 is filled with suitable hydraulic fluid up to the level of the gasket 33 when the cover 32 is off.

In the normal position of the flush valve the compression spring 15 forces the lower end 11 of flexible valve member 10 tightly against valve seat 12 to shut off the water flow from the inlet 6. When the plumbing fixture to which the flush valve is attached is to be flushed, the operating handle is pressed downward and pivoted about ball 23. This action tilts up the forked end 27 of the handle in notch 28 to lift the stem 13 upwardly until its shoulder 42, near the top end of the stem, contacts the bottom of partition 29 to halt the upward movement. The lower end 11 of flexible valve member 10 is thereby lifted off its seat 12 and restoring spring 15 compressed. Since the opening of the valve from its seat is entirely under direct manual control by the user operating the handle 22, it is apparent water flow will take place even on very low pressures. It will also be apparent that as long as the handle 22 is held down or operated the water will continue to flow through the valve. Furthermore, should a short flush be desired, the handle may be only partially depressed and then let go.

At the upper end of the stem 13 the auxiliary valve member 36 move upwardly into dash-pot chamber 30 gradually placing the hydraulic fluid therein under pressure together with the small air pocket which normally exists above the level of fluid in cover 32. The light spring 35 forces up the piston 34 in the chamber 30 as valve member 36 moves upward and tends to follow the same. However, due to the pressure exerted against the hydraulic fluid by the valve 36 as the piston 34 moves up, the piston is forced to move away from the valve 36 and open its valve seat 37. This action exposes a large opening around valve seat 37 for the fluid to pass through from above the piston 34 to the chamber below it. The valve 10 is thereby quickly and easily opened without restraint. When the valve member 36 stops its movement at the top of the stroke, piston 34 catches up with it and valve seat 37 is thereby closed again. The foregoing action takes place whether the handle 22 is quickly depressed or held and then slowly moved downward. All or about all of the fluid in chamber 30 has now passed into the chamber below the piston 34.

When the handle 22 is released, the stored up energy in restoring spring 15 forces the lower end 11 of valve member 10 back upon its seat 12 to shut off the water flow. However, because of the action of the dash-pot and timing arrangement, the closing of the valve member upon its seat is retarded. This enables a sufficient volume of water to pass through the flush valve to properly flush the plumbing fixture. The rate of the retarding or timing action is controlled by the adjusting screw 38 threaded into the top of the piston 34. Turning the screw 38 down reduces the by-pass opening in slot 39, so that on the downward restoring movement of the stem 13 and auxiliary valve member 36, the fluid below the piston 36 is forced upward through the small by-pass opening 39 from openings 40 and 41 into the upper part of chamber 30. Since the by-pass opening 39 is much smaller than the opening around valve seat 37, when the piston 34 moves upwardly, the return movement of the piston 34, stem 13, and valve member 10, towards valve seat 12, is greatly slowed down. Turning the adjusting screw 38 outward will cause a faster closing movement.

It is noted that the piston 34 does not employ packing where it slides along the chamber 30 walls and is unnecessary because of the small clearance therebetween. Also any slight leakage which may occur would have no effect on the action of the timing arrangement.

From the foregoing arrangement and construction of the various parts of the flush valve, it will be apparent that the valve includes three separate chambers: chamber 18 through which all water flow takes place and which contains the flexible rubber valve member 10 to completely shield all the operating mechanism from corrosive waters; chamber 21 which contains the handle operating mechanism; and chamber 30 defining the timing mechanism. The various operating parts are all compactly arranged within their respective chambers and readily assembled into position. Debris, sea weed, and other water borne sediment cannot clog the operating mechanism because only the outside of the rubber valve member is exposed to this condition and the rubber nose 11 readily closes upon its seat 12 or the foreign material is quickly washed off the seat.

The operating handle 22 and casing 8 may be arranged on top of the flush valve body 5 in four different angular positions, with respect to the inlet connection 6, thereby reducing the number of different types of flush valves required for different plumbing installations. The four screws 9 in the casing flange 19 are simply removed and the casing 8, together with the attached valve member 10, handle 22 and other parts, are lifted out of body 5 and rotated to the position where the handle 22 will be accessible for operation, from either the left side, right side, or front, as desired. The groove 25 in socket 24 is accommodated in any handle position by the ridge 26 around bushing 16.

Referring now particularly to the modification in FIGURE 5 the body 5 and casing 8 as well as other parts, not specifically pointed out, are substantially the same as those shown in FIGURE 1. The dash-pot piston 34 is provided with an O-ring seal 50 for better sealing against the cylinder walls. A thin disc-shaped flexible diaphragm or membrane 51 is arranged to close the top end of the dash-pot chamber 30 and has a thick, peripheral edge portion 52 which serves as a sealing gasket when the cover 32 is screwed down on top of casing 8. A slip friction washer 33 prevents distortion of the diaphragm 51 when the cover is screwed on. The cover 32 is pierced with an opening 53 so that the top side of the diaphragm 51 and chamber 54 are exposed to atmospheric pressure at all times.

The purpose of the diaphragm 51 is to insure that atmospheric pressures will prevail at all times within the dash-pot chamber 30 so as not to affect the reliable operation of the valve. As the piston 34 and relief valve 36 are reciprocated in chamber 30 the volume of the fluid therein is changed with consequent pressure changes. The diaphragm 51 follows these changes by expanding and contacting within the chambers 30 and 54 and since it is exposed to atmospheric pressure on its top side, substantially the same pressures are present inside the dash-pot chamber 30. Consequently, the constant reliable operation of the valve in its opening and closing movements, is unaffected.

In addition, when the cover 32 is removed to add or replenish the supply of fluid in the chamber 30 different size air pockets will not be formed on top of the fluid

which might affect the operation of the valve. This would be also true when the cover and diaphragm are removed, so that adjustments to the adjusting screw can be made. Furthermore, the diaphragm serves to prevent spillage or leakage of the fluid from the dash-pot chamber **30** during shipment or storage.

The valve seating member **12** is provided with an O-ring **55** to prevent leakage between the member and the valve body outlet. The member **12** preferably rests upon a shoulder **63** formed in the outlet **7** to provide a good support.

The valve seating portion of the flexible sleeve member **10** is advantageously made into two sections, the nose portion **56** being molded at **57** to the bushing **58**, while the lower portion of the sleeve member **10** is made with a turned in portion **59**. A clamping washer **60** engages the turned in portion **59** and tightly presses the same against the top side of bushing **58** when the lower threaded end **61** of stem **13** is threaded into bushing **58**. The outer edge **62** of nose portion **56** is curled around the edge of bushing **58** as shown, and the two sections are thereby tightly sealed together. It is preferred that the sleeve member **10** together with its lower portion **59** be made of a relatively flexible material, stiff enough however not to be distorted by varying water pressures, while the nose portion **56** is preferably made of a softer material to provide good seating qualities. A synthetic rubber material such as Buna-N may be used which is sold under the trade name Hycar. This material is extremely resistant to corrosive waters and not affected in case the fluid from the dash-pot leaks into the interior of the sleeve **10**.

It is to be noted that the diameter of the flexible sleeve **10** at its lower end in the valve seating position is substantially of equal diameter or area as the seated portion **56** resting on valve seat **12**. This provides a pressure balance so that minimum effort is required to raise the valve member **10** from its seated position. The edge portion **62** of the valve seating nose **56** protrudes slightly outward from the bottom end of the sleeve member **10** in order that the valve member **56** may be more readily closed upon its seat under low water pressure conditions.

While two practical embodiments of the invention have been illustrated and described, it will be clear that certain variations of the same could be produced without departing materially from the spirit of the invention, and it is therefore desired that the invention be not limited to the precise disclosure but only to the extent of the appended claims.

What is claimed is:

1. In a flush valve, a valve body having a water supply inlet and an outlet with a valve seat therein, a flexible hollow valve member in said body controlling water flow therethrough, said valve member having a closed lower end seated normally on said valve seat and an open upper end supporting said valve member in said body, a casing mounted directly on top of said valve body, a bushing clamped between said casing and said body and supporting the upper end of said valve member in position, a valve stem extending inside said hollow valve member having the lower end attached to the closed lower end of said valve member and the upper end extending slidably through said casing and said bushing, a restoring spring in said hollow valve member around said valve stem and extending between the lower end of said valve member and said bushing, said casing having two chambers therein, one chamber being located directly on top of said bushing and having a side opening therein, an operating handle pivoted in said side opening having one end arranged in operating relationship to said valve stem for raising the same and thereby opening said valve member from its seat, said second chamber being arranged directly on top of said first chamber and being opened on the top end thereof, said second chamber having a partition across the lower end thereof, the upper end of said valve stem extending into said second chamber and through said partition, a timing arrangement in said second chamber for retarding the closing of said valve member upon its seat, an enclosing cover for said second chamber on top of said second chamber, said operating handle and said first chamber being located between said second chamber and said valve body.

2. In a flush valve, a body having a water supply inlet and an outlet with a valve seat therein, a flexible hollow valve member in said body for controlling water flow therethrough, said valve member having a closed lower end seated upon said valve seat and an open upper end, a top casing clamping the upper end of said valve member to said body, a stem extending through said casing into said valve member and having its lower end attached to the lower seated end of said valve member, a restoring spring around said stem in said valve member, an operating handle extending outward from between said casing and said body and having its inner end connected to said stem, said connection including a forked end on said handle engaging a slot in said stem, a ball and socket pivoting arrangement in said casing for said operating handle, and cooperating locking means on said socket and said body for holding said handle forked end against said stem and said socket in place regardless of the radial position in which said handle is mounted around said valve body.

3. In a flush valve, a body having an inlet and an outlet with a valve seat around said outlet, a flexible hollow valve member in said body having a nose portion closing said valve seat and an open upper portion, said valve member controlling fluid flow through said body, a casing supported on top of said body and clamping said valve member in seal tight position on said body, a valve stem attached at its lower end to the nose portion of said valve member and extending through said valve member into said casing, a restoring spring in said valve member normally holding said valve member seated, an operating handle extending outward from a position between said body and said casing and having its inner end connected to said stem, said connection including a forked end on said handle engaging a groove on said stem in a manner to prevent axial rotation of said handle while permitting up and down movement to actuate said stem, a ball and socket pivot for said handle, and means for locking said handle in position between said body and said casing, said locking means including cooperating means on said socket, said casing, and said body for holding said handle forked end in said stem groove and said socket in place in any radial position around said valve body from which said handle extends.

4. In a flush valve as defined in claim **3** in which there are means in said casing attached to said stem for retarding the closing action of said valve member.

5. In a flush valve as defined in claim **3** in which the valve stem, operating handle and connection therebetween are all isolated and sealed from contact with the fluid on the outside of said valve member in said body.

6. In a flush valve, a body having an inlet and an outlet connection with a valve seat in said outlet connection, a flexible valve member in said body for controlling fluid flow therethrough, a valve stem attached to said valve member for operating the same, an enclosing casing on top of said body holding said valve member in said position, a restoring spring for said valve member normally holding said valve member seated, an operating handle in said casing having an operating connection with said valve stem, a ball and socket pivoting means for said handle in said casing, a bushing in said body having a circular ridge thereon, said socket having an annular groove therein registering with said circular ridge to hold said socket in position within said body, said annular groove adapted to register with said circular ridge in any angular position that said operating handle may be positioned in said casing.

7. In a flush valve, a valve body having an inlet and an outlet with a valve seat in said outlet, a flexible valve member in said body for controlling fluid flow therethrough, a valve stem attached at its lower end to said valve member, an enclosing casing supported on top of said body, a restoring spring for said valve member normally holding said valve member closed upon its seat, an operating handle pivoted in said casing and having an operating connection with said stem whereby the operation of said handle causes said valve member to be lifted from its seat to permit water flow through said body, and means for retarding the closing movement of said valve member, said retarding means including a fluid filled chamber in said enclosing casing having a piston slidable therein, said piston having an axial opening with a valve seat therein, an auxiliary valve member attached to the upper end of said stem and seated on said piston valve seat, a spring in said casing normally holding said piston closed on its valve seat, the operation of said handle causing said auxiliary valve member to move upwardly in said fluid chamber to tend to compress the fluid whereby said piston valve seat is opened from said auxiliary valve member against said spring and the fluid is forced from the top to the bottom of said piston in said chamber, the piston spring causing said piston to follow said auxiliary valve member upwardly until the operating movement of said handle is stopped, whereby said piston valve seat is closed again, and restricted by-pass means in said auxiliary valve member and said stem for effectively retarding the return movement of said stem and thereby the closing of said main valve seat by said flexible valve member.

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