June 12, 1962 J. A. SLOAN ETAL 3,038,347

FLUSH VALVE OPERATORS

Filed Nov. 9, 1959

Fig. 1

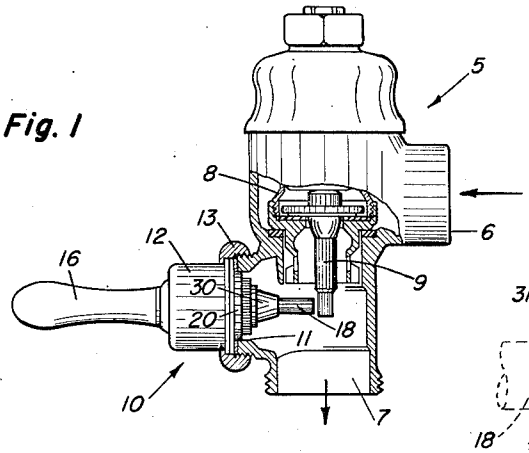


Fig. 3

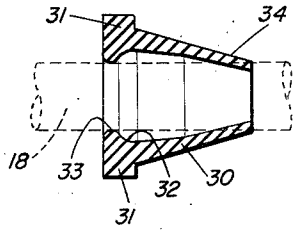


Fig. 2

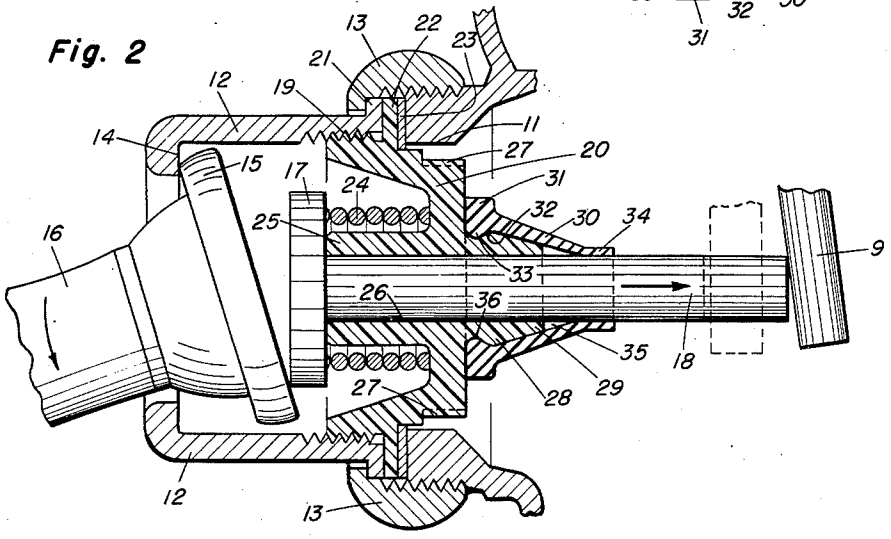


Fig. 4

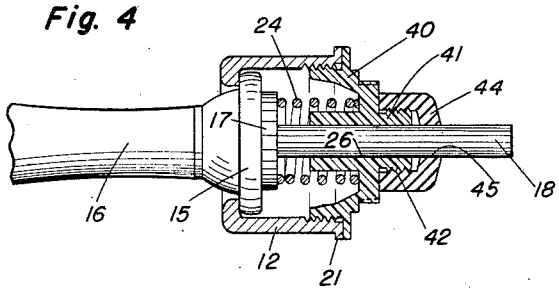
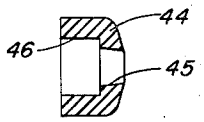


Fig. 5



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United States Patent Office 3,038,347 Patented June 12, 1962

3,038,347

FLUSH VALVE OPERATORS

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Filed Nov. 9, 1959, Ser. No. 851,850
6 Claims. (Cl. 74—18.2)

This invention relates in general to flush valves for plumbing fixtures and the principal object of the invention is to design a new and improved operating handle assembly for actuating a flush valve.

Another object is to design a new and improved operating handle unit for flush valves having novel means for preventing leakage of water outward through the handle unit.

Another object is to provide a novel sealing unit for the operating handle of a flush valve which will not stick in its operated position particularly after an extended period of non-use, and in which less frictional resistance of the sealing means is encountered by the operating plunger of the handle.

Other objects are to provide a sealing unit which is streamlined in shape to present the least amount of obstruction to the free flow of water through the flush valve, and in which the water flow over the sealing unit also assists in making it leak-proof.

Still other objects of the invention are to provide a new and improved flush valve operating unit comprising few parts, which is easy to assemble, and is economical to manufacture.

Another object is to design a leak-proof operating handle in which the parts are constructed of materials tending to eliminate corrosive action caused by impure water passing over said parts, and in which the parts have less frictional resistance with respect to one another, thereby reducing the tendency to stick and wear.

With the foregoing and other objects in view, the invention consists in certain novel features of construction, operation and arrangement of parts which will hereinafter be more fully pointed out and described, claimed, and illustrated in the accompanying drawings in which;

FIG. 1 is a partial cross-sectional view of a conventional flush valve showing the novel flush valve handle unit of the invention;

FIG. 2 is an enlarged cross-sectional view showing the handle unit in operated position;

FIG. 3 is a cross-section of the sealing unit only;

FIG. 4 shows a cross-section of a modified form of the handle unit; while

FIG. 5 is a cross-section of the sealing unit of the modification FIG. 4.

Referring now particularly to FIG. 1 of the drawings, the invention is illustrated in its preferred application in connection with a flush valve such as is commonly provided in plumbing installations for flushing a water closet or urinal. Reference character 5 indicates generally such a flush valve having the usual water supply inlet 6 and the discharge outlet 7 leading into the plumbing fixture. The flush valve 5 is provided with a piston 8 and a relief valve having an operating stem 9 adapted to be actuated by the handle operating unit indicated generally at 10, to initiate the operation of the flush valve 5. The handle unit 10 is mounted in the opening 11 in the side of the flush valve by a cup-shaped coupling member 12 and coupling nut 13. The coupling member 12 has an opening in its left-hand end with a shoulder 14 formed on the inner side thereof against which a flanged part 15 of the manually operated handle 16 normally abuts. The handle flange 15 is also normally in pressing engagement with the head 17 of an operating plunger 18, which plunger is adapted

to be projected forwardly whenever handle 16 is tilted or depressed to trip and engage the stem 9 of the relief valve, as shown in FIG. 2.

Coupling member 12 is internally threaded at 19 to accommodate an annular bushing 20 which is screwed into the member 12 for supporting the same therein. A knurled edge 27 on bushing 20 facilitates this assembly. Annular flanges 21 and 22 formed on the periphery of coupling member 12 and bushing 20, are clamped together by coupling nut 13 against the side of the opening 11 in the flush valve for securely supporting these elements in position on the flush valve. A sealing gasket 23 may be interposed with these elements and also clamped around the opening 11 to seal it. A restoring spring 24 is arranged around a sleeve portion 25 formed on bushing 20 and extends between the underside of head 17 of plunger 18 and a recess formed in one side of bushing 20. The plunger 18 is guided by and extends through an axial opening 26 in bushing 20 for reciprocal movement therein. At the front end of bushing 20, there is formed a protruding tapered portion 29 having an annular rib 28 thereon and which also surrounds the plunger 18 and assists in guiding the same at the forward end of the bushing 20.

The sealing unit for preventing leakage of water from the interior of the flush valve and outward between the plunger 18 and the axial opening 26 of bushing 20, comprises a conical-shaped hollow flexible member 30 which is tapered from a large flanged end 31 down to a smaller thin end 34. An inner annular recess 32 is formed in the flexible member 30 which is adapted to engage the bushing annular rib 28, while the outer internal end 33 of the member engages an annular groove 36 formed between the rib 28 and the side of bushing 20. The purpose of this arrangement is to enable the flexible member 30 to be grasped by the thick flange 31 and the unit then stretched over the annular rib 28 and snapped in place in groove 36 to hold the member in firm leakproof engagement on the forward end 29 of the bushing 20. The internal diameter of the hollow flexible member 30 is such that considerable stretching of the flange 31 is required to snap the unit in place, but only sufficient so that it can readily be pulled or removed from the bushing rib 28, if necessary, for replacement.

The forward thin end 34 of flexible member 30 is made with an internal diameter somewhat smaller than the diameter of plunger 18, as diagrammatically illustrated in FIG. 3 where the plunger 18 is shown in dotted lines. In the assembly of the unit, the plunger 18 is pushed through the hole 26 of bushing 20 and through the thin end opening 34 of the flexible member which is thereby stretched to closely embrace the plunger but still be in slidable engagement therewith as shown in FIG. 2. The amount of tension exerted by the flexible end 34 upon plunger 18 is such that this thin end is not elongated horizontally from its union with the main portion of flexible member 30 as the plunger is reciprocated therein. Since the forward end of the plunger 18, as well as member 30, is in contact with the path of water flow through the flush valve, the thin end 34 tends to be lubricated for easy slidability therebetween. The tension of the thin end 34 is such that no water can leak outward between the end 34 and the plunger 18 each time water flow takes place. The water pressure engaging the thin end 34, presses the end closer into engagement with the plunger 18 to further assist in preventing leakage. The small amount of clearance indicated at 35 at the end 29 of the bushing 20 enables this action to be taken advantage of. The small thin end 34 and the tapered portion of sealing member 30 being formed somewhat streamlined in shape, present no appreciable restric-

tion or obstruction to the free flow of water past this member.

The operated position of the handle unit is shown in FIG. 2 with the handle 16 being manually depressed, resulting in the plunger 18 being projected forward into operative contact with the relief valve stem 9 to cause the operation of the flush valve 5. The restoring spring 24 is also compressed, while the thin end 34 of flexible sealing member 30 closely embraces and is in slidable contact with the plunger 18, preventing leakage. When the handle 16 is released, spring 24 is effective to restore all of the parts to normal and also hold the handle in the horizontal position by virtue of the spring being slightly compressed in the normal position of the assembled unit. With the construction of the present leak-proof sealing arrangement, there is very little resistance to the ease with which the handle 16 may be operated. Therefore, children and feeble persons are not apt to neglect a flushing operation due to inability to actuate a stiffly operating handle.

Considerable trouble has been experienced in the past with the former types of handle packing, because after periods of long disuse of the flush valves as during school vacation, the packing dried up and became stiff and unpliable. As a result, when the handle 16 was operated and the plunger 18 projected forwardly to operate the flush valve, plunger 18 remained stuck in the forward position after the handle was released. This also resulted in leakage between the parts. The spring 24 was unable to restore the plunger 18 due to the friction presented by the dried up packing material. To overcome this problem the present invention provides for the use of synthetic rubber material such as "Buna" for the construction of the flexible member 30, and stainless steel for the plunger 18. These materials, it has been found, present minimum frictional resistance to one another, and the stainless steel plunger further presents a smooth hard surface in slidable contact with the "Buna" member 30. This hard surface does not become grooved or nicked by continuous contact with the "Buna" member and the parts do not become stuck to one another when idle for long periods. Ordinary rubber on the contrary, has a natural tendency to vulcanize and stick to any material such as brass when in contact therewith for extended periods and in a moist environment.

In order to further insure that the plunger 18 does not become stuck in its forward position, due to the friction presented by the surface oxidization which often takes place in the hole 26 in bushing 20 and on the plunger 18, the bushing 20 is constructed of a plastic material such as acetal resin, sold under the trade name of "Delrin," and made by the Du Pont Company. This material, it has been found, exhibits great strength, low coefficient of expansion, abrasion resistance, and is self-lubricating so that when used with the stainless steel plunger 18, the tendency to stick thereto is entirely eliminated. There is always a smooth polished surface present between these two parts which cannot become corroded after long periods of idleness.

A further advantage derived from the use of "Delrin" for the bushing 20, and stainless steel for the plunger 18, is that these materials when used in conjunction with the brass relief valve stem 9 and the brass flush valve body 5, greatly reduce the corrosive and electrolytic action which often takes place on the valve parts when the flush valves are flushed with salt water, or other corrosive and dirty waters.

Referring now to the modification of the invention illustrated in FIGS. 4 and 5, the principal elements of the handle assembly are similar to that of FIG. 2, except that the bushing 40 is provided on its forward end with a projection 41 having threads 42 formed thereon. Engaging the projection 41 is a cup-shaped flexible sealing member 44 which has a bottom opening 45 through which the plunger 18 projects. The inner wall 46 of flexible member 44 is made somewhat smaller in diameter than the diameter of the threaded projection 41, so that it can be stretched over the same and the threads 42 are thereby imbedded into the flexible wall 46 to firmly hold the flexible member in position on the side of bushing 40. As shown in FIG. 5, the flexible member 44 is provided with the opening 45 which is made smaller in diameter at the outer end than it is on the inner end of the opening. This outer end is also smaller than the diameter of the plunger 18, so that when the plunger is pushed through the flexible member, the sides of the opening 45 are stretched to closely embrace the plunger. The gripping of the flexible member 44 upon plunger 18 is such that no possible leakage can occur outward between these two parts, but still will enable the plunger to reciprocate freely and easily through the opening 45 without binding or sticking. The materials of which the bushing 40, flexible member 44, and plunger 18, are made are preferably the same as those described in FIG. 2.

What is claimed is:

1. In a sealing unit for the operating handle of a flush valve, a bushing arranged in an opening in said flush valve, an operating plunger for said flush valve extending axially of said bushing and being guided thereby for reciprocal movement therein, a sealing unit for preventing leakage of water outward from said flush valve and between said bushing and said plunger, said sealing unit comprising a flexible hollow member tapered down from a relatively thick flanged end to a thin smaller end, said smaller end having a relatively wide inner surface portion flexed around said plunger to closely embrace the same, said flexible hollow member gripping the plunger sufficiently tight to form a water tight seal between the plunger and the flexible hollow member but sufficiently loose to prevent bodily extension and retraction of said flexible hollow member when the plunger reciprocates therein, an annular rib formed on one end of said bushing, the flanged end of said flexible member abutting the end of said bushing and having an internal recess therein flexed around said bushing rib to removably hold said flexible member in position by snapping the same off or on said bushing rib, said bushing rib having an extension formed thereon providing an internal support along a portion of the inner length of said flexible member except where the thin smaller end embraces said plunger, and a plunger restoring spring arranged between said bushing and said plunger.

2. In a sealing unit for the operating handle of a flush valve, a bushing arranged in an opening of said flush valve, an operating plunger for said flush valve extending axially of said bushing and being guided thereby for reciprocal movement therein, a sealing unit for preventing leakage outward from said flush valve between said bushing and said plunger, said sealing unit comprising a flexible hollow member tapered down from a relatively thick flanged end to a thin smaller end, said smaller end having a relatively wide inner surface portion stretched around said plunger to closely embrace the same, said flexible hollow member gripping the plunger sufficiently tight to form a water tight seal between the plunger and the flexible hollow member but sufficiently loose to prevent bodily extension and retraction of said flexible hollow member when the plunger reciprocates therein, and cooperative means between said bushing and the flanged end of said flexible member for removably supporting said flexible member on one side of said bushing, said bushing having an extension formed on the one side thereof providing an internal support along a substantial portion of the inner length of said flexible member except where the thin smaller end embraces said plunger, the tapered streamlined shape of said flexible member presenting minimum restriction in the path of water flow through said flush valve, water flow around the thin smaller end of said flexible member assisting in embracing the same more closely around said plunger in leak-proof engagement therewith.

3. In a sealing unit for the operating handle of a flush

valve, a bushing, means for holding said bushing in an opening in the side of said flush valve, an operating plunger extending axially of said bushing and being in slidable engagement therewith, a sealing unit for preventing leakage of water between said plunger and said bushing outward of said flush valve, said sealing unit comprising a cup member having an opening at the bottom through which said plunger extends, the opening in said cup member being smaller in diameter than said plunger diameter and being stretched to closely embrace the plunger, the wall of said opening at the plunger opening junction being tapered so that the outer edge thereof grips the plunger sufficiently tight to form a water tight seal between the plunger and the cup member but sufficiently loose to prevent bodily extension and retraction of said cup member when the plunger reciprocates therein, said bushing having a projection formed thereon around said plunger with the inner wall of said cup member engaging said bushing projection, and means formed on said bushing projection and the wall of said cup member for removably holding said cup member on said bushing.

4. A sealing assembly for a valve unit of the type in which a plunger is mounted for reciprocable movement through an aperture in the housing of the unit, said sealing assembly being effective to prevent leakage from the interior to the exterior of the valve unit along the plunger, said sealing assembly including, in combination,

a plunger receiving and guiding member overlying an opening in the housing of the valve unit, said member having an aperture therein receiving a valve actuating plunger which reciprocates in the aperture, and

a sealing member secured to the interior side of the plunger receiving and guiding member and extending into the interior of the valve unit,

said sealing member being composed of a bodily resilient material and having a bore therein through which the plunger reciprocates,

the innermost end of the sealing member bore being in sliding frictional engagement with the plunger,

said sealing member gripping the plunger sufficiently tight to form a water tight seal between the plunger and the sealing member but sufficiently loosely to prevent bodily extension and retraction of said sealing member when the plunger reciprocates therein,

the plunger receiving and guiding member including a projection on its interior side extending inwardly into the interior of the valve unit a distance less than the length of the sealing member, said projection having a bore therein,

and further characterized in that the sealing member is secured, at its outer end, to the projection,

the bore in the projection being axially aligned with the bore in the sealing member,

said plunger being reciprocable in the aligned bores.

5. The sealing assembly of claim 4 further characterized in that the thickness of the walls of the sealing member generally decreases in an interior direction, the wall thickness at the interior end of the sealing member being sufficiently thin to slidably engage the plunger for a substantial distance.

6. The sealing assembly of claim 5 further characterized in that the projection terminates short of that portion of the interior end of the sealing member which engages the plunger to thereby form a void between the interior end of the projection and that portion of the sealing member engaging the plunger whereby water pressure within the valve tends to force the unsupported part of the sealing member overlying the void into water tight engagement with the plunger.

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