Sept. 25, 1951 J. C. OWENS 2,569,017

FLUSH TANK CONTROL VALVE

Filed Aug. 27, 1946 2 Sheets-Sheet 1

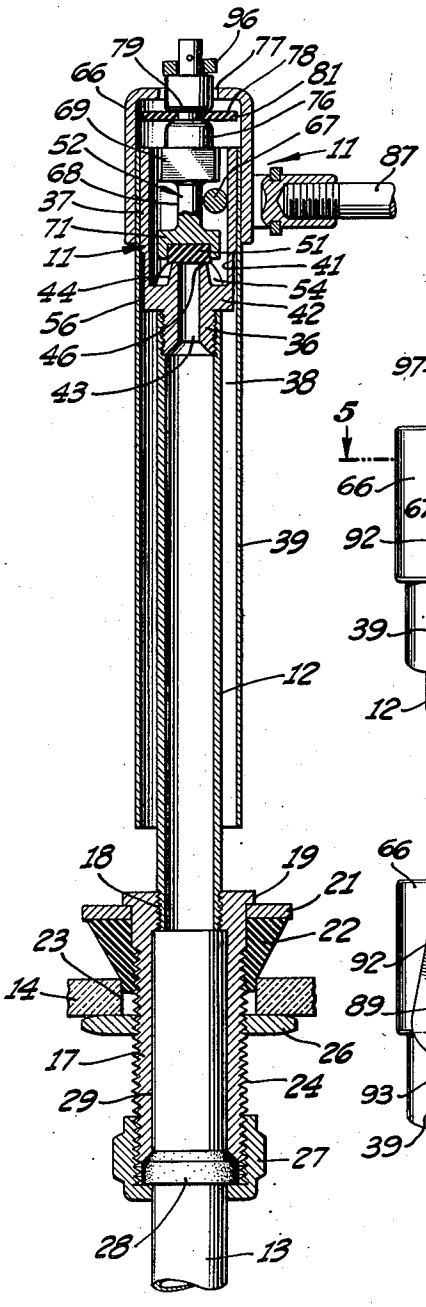


Fig. 2.

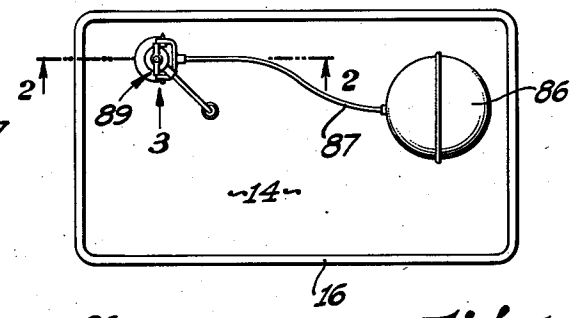


Fig. 1.

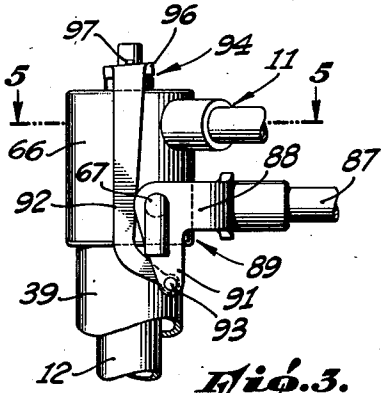


Fig. 3.

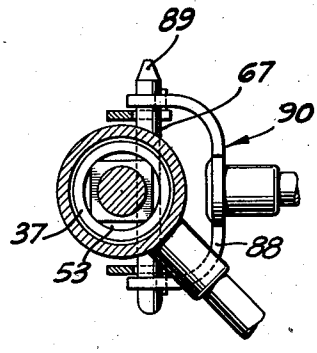


Fig. 5.

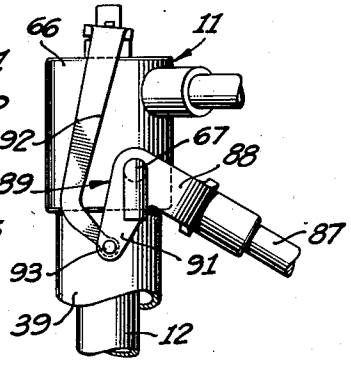


Fig. 4.

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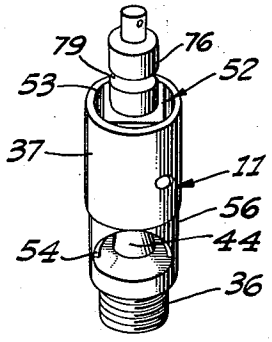


Fig. 6.

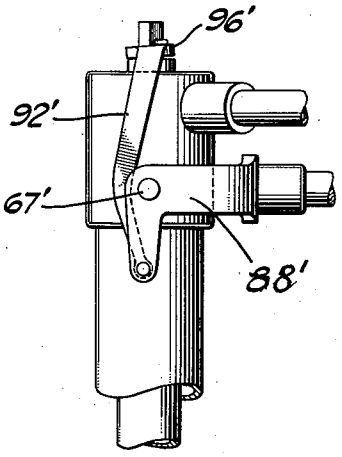


Fig. 7.

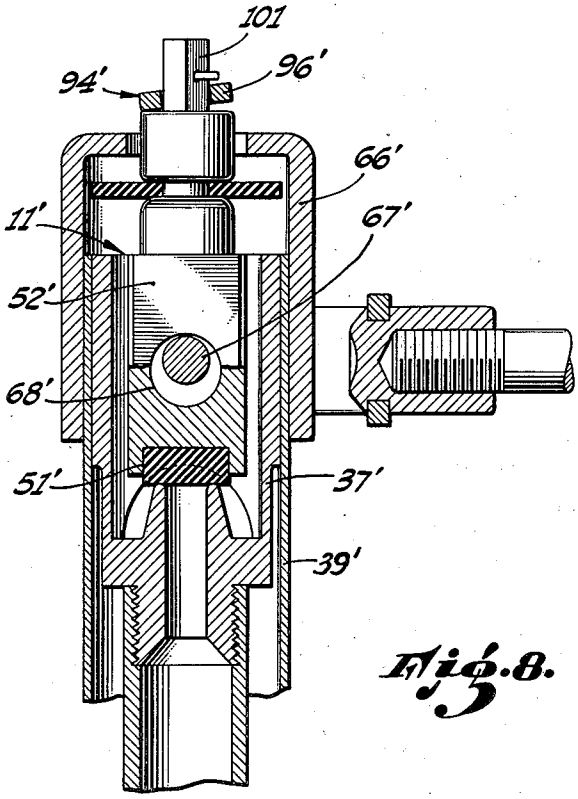


Fig. 8.

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FLUSH TANK CONTROL VALVE

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Application August 27, 1946, Serial No. 693,373

2 Claims. (Cl. 137—104)

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This invention relates to float valves of the type commonly employed to control the supply of water to toilet flush tanks.

An object of my present invention is to provide a control valve of the character indicated, which is distinguished by a novel type of construction which adapts it to be produced entirely from screw machine products, i. e., which does not require any castings or forgings, and which, accordingly, is of an unusually simple and inexpensive construction, requiring only a minimum of space within a flush tank and also characterized by unusual facility of assembly and minimum liability of its getting out of order, and yet which is highly efficient and positive in operation.

Another object of the invention is to provide a novel type of interconnection between the valve and the float by which it is actuated, which interconnection is substantially irreversible to the extent that when the valve is in its fully closed position, fluid pressures far in excess of those for which my control is designed cannot lift the valve from its seat, thus providing greater assurance against any leakage from the water supply into an already filled flush tank until the level of the water stored within the flush tank has been suitably lowered.

A further object of the present invention is to provide, in a toilet flush tank supply valve of the general character described, highly efficient and unusually simple anti-siphonic construction for the positive prevent of the drainage of contaminated water from the flush tank or from the toilet fixture associated therewith, back into the water supply system, which might otherwise occur if and when the supply of water fails and a partial vacuum develops in the supply pipe leading to the storage tank.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of the preferred forms of my invention which are illustrated in the drawings accompanying and forming part of the specification. It is to be understood that I do not limit myself to the showing made by the said drawings and description, as I may adopt variations of the preferred forms within the scope of my invention as set forth in the claims.

Referring to the drawings:

Figure 1 is a top plan view of a conventional toilet fixture flush tank with a control valve incorporating the principles of the present invention operably installed therein.

Figure 2 is an enlarged view in vertical, medial section taken through the control valve of Figure 1, the plane of section being indicated by the line 2—2 of that figure and the direction of view by the arrows.

Figure 3 is a view in side elevation of the upper portion of the control valve of Figure 2, the direction of view being indicated by the arrow 3

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of Figure 1. This figure shows the valve-actuating mechanism in the position which it occupies when the flush tank is properly filled and the float at its upper extreme of movement.

Figure 4 is a view similar to Figure 3, but with the parts in the respective positions assumed thereby when the tank is empty and the float in its lowermost position.

Figure 5 is a horizontal sectional view taken upon the line 5—5 of Figure 3, with the direction of view as indicated.

Figure 6 is a perspective view of the valve and valve housing of Figure 2 removed from the other portions of the structure.

Figure 7 is a view similar to Figure 3, but showing a slightly modified form of control valve incorporating the principles of the present invention.

Figure 8 is a more highly enlarged view in vertical, medial section of the valve in Figure 7.

Referring first to that modifiation of my invention which is illustrated in Figures 1 to 6 inclusive, my improved control valve comprises a valve housing 11 of substantially tubular form and mounted upon the upper end of an inlet tube 12 which is adapted to be secured to a suitable source of water under pressure such as a supply pipe 13. The inlet tube 12 is mounted rigidly upon the bottom wall 14 of a conventional toilet flush tank 16 as by means of a nipple 17 to the upper end of which the lower end of the supply tube 12 is attached by threads 18. A flange 19 at the upper end of the nipple 17 bears against the upper face of a washer 21 below which a preferably conical, resilient sealing gasket 22 is disposed. This gasket 22 establishes a fluid-tight seal with the bottom wall 14 around the opening 23 through which the nipple 17 extends; and the exterior surface of the nipple 17 is provided with a relatively long running thread 24 for the reception of a nut 26 adapted to be tightened against the under surface of the bottom wall 14 so as to crowd the gasket 22 against the edges of the opening 23 and thereby establish a suitable fluid-tight seal preventing escape of water from the tank 16 through the opening 23. A gland nut 27, also engaged upon the thread 24, is adapted to compress a packing 28 around the water supply pipe 13 which extends upwards into the enlarged lower portion of the bore 29 of the nipple 17 and thereby establish a suitably strong mechanical interconnection as well as a fluid-tight seal between the supply pipe 13 and the nipple 17.

The construction of the valve housing 11 is best illustrated in Figure 2 and 6. This housing 11 is rigidly mounted upon the upper end of the inlet tube 12 by a short, exteriorally threaded nipple 36 fitted into the interior of the inlet tube 12 which is sufficiently smaller in diameter than the body portion 37 of the housing 11 to provide ample space 38 of annular cross-sectional form

between the exterior surface of the inlet tube 12 and the bore of a discharge tube 39 within the upper end of which the body portion 37 of the housing 11 is fitted. The body portion 37 is provided with a valve chamber 41 open at its upper end and closed at its lower end by a head 42 from the under surface of which the nipple 36 extends. A passage 43 preferably in the form of an axial bore extends through the nipple 36 and head 42, as well as through a preferably conical tubular extension 44 on the upper, or inner, surface of the head 42. The extreme upper edge of this tubular extension 44 serves as an annular valve seat 46 encircling the upper end of the passage or bore 43. A valve 51 preferably in the form of a disc of suitably resilient material is carried at the lower end of a valve plunger 52 in position to engage upon the valve seat 46 when the plunger 52 is in its lowermost position and thereby close the passage 43 which otherwise establishes communication between the inlet tube 12 and the valve chamber 41 within the housing 11. As a convenient means for guiding the plunger 52 for reciprocatory movement within the valve chamber 41, it is formed of square cross-section and of such size that a diagonal of its square is only slightly less than the inside diameter of the valve chamber 41, with the result that although the plunger 52 fits nicely within the valve chamber, ample passageways 53 are left between the flat sides of the plunger 52 and the interior surface of the body portion 37 of the valve housing, so that when the valve 51 is lifted from the valve seat 46, water entering the valve chamber 41 can flow upwards past the plunger 52 as well as downwards through openings 54 in the body portion 37 of the valve housing just above the lower head 42. A portion 56 of reduced diameter is provided upon the exterior surface of the body portion 42 at its lower end so as to permit water flowing through the outlet openings 54 to pass into the discharge tube 39, the upper end of which is fitted upon the body portion 37. Water passing the valve 51 is therefore delivered by the discharge tube 39 to the interior of the tank 16. The upper end of the valve housing 11 is closed by a cap 66 of cylindrical form removably received upon the upper end of the discharge tube 39 and is retained in operative position thereupon by means of a transversely extending pin 67 which extends through suitably aligned holes in the body portion 37 of the valve housing, the upper end of the discharge tube 39 and the cylindrical wall of the cap 66. In this modification the pin 67 is offset laterally from the center of these members through which it passes and in order to establish clearance between the vertically movable valve plunger 52 and the pin 67, the central portion of the valve plunger 52 is relieved to provide a portion 68 of considerably reduced diameter as compared with the upper and lower square ends 69 and 71 of the plunger, as is clearly shown in Figure 2. In the modification illustrated in Figures 7 and 8, however, the pin 67' by means of which the cap 66' is retained in position upon the upper end of the discharge tube 39' and the body portion 37' of the valve housing 11' is disposed centrally of these members; and to provide clearance between the pin 67' and the valve plunger 52' a transversely extending hole 68' is provided in the valve plunger 52', this hole 68' being sufficiently larger than the pin 67' to permit the necessary vertical movement of the plunger 52' without interference from the transverse pin 67'.

Referring again to the modification of Figures 1 to 6, inclusive, the plunger 52 is provided with an extension 76, preferably of reduced diameter above the upper square section 69, extending through an opening 77 in the top of the cap 66, which opening is sufficiently larger than the portion 76 of the plunger to establish communication between the ambient atmosphere and the interior of the valve chamber 41 and thereby insure the maintenance of pressure at least as great as atmospheric within the valve chamber. The purpose of this feature is to prevent the development of siphonic conditions which otherwise might cause contaminated water to be drawn upward through the discharge tube 39 into the valve chamber 41 and thence into the water supply tube 13 if and when interruption should occur in the supply of water under pressure in the water supply system. However, in order to prevent escape of water under pressure through the opening 77 when the valve 51 is lifted from its seat and thus insure that all water entering the valve chamber 41 flows to the tank 16 through the discharge tube 39, I provide a disc 78 of suitably flexible, resilient material seated within a groove 79 in the cylindrical portion 76 of the plunger 52 just below the interior surface of the top of the cap 66. When the valve 51 is first lifted from its seat 46, even though it is mechanically lifted only a slight distance, water entering the valve chamber 41 will flow upward through the passageways 53 past the valve plunger 52, and when it engages the under surface of the disc 78, will deflect the disc upwards until it engages the under surface of the top of the cap. Thus it may be seen that the disc 78 operates to close the opening 77 against escape of water from the valve chamber when water is flowing past the valve 51 into the valve chamber, and to open the opening in the absence of pressure within the valve chamber. It should be observed that the diameter of the disc 78 is sufficiently less than the inside diameter of the cap 66 to provide an annular clearance space 81 through which air entering the valve chamber through the opening 77 can pass the disc and thus insure pressure at least as great as atmospheric within the valve chamber 41 below the disc 78.

Means are provided for raising the valve 51 from its seat 46 when the level of water stored within the tank 16 is lowered. The float 86 is connected as by a rigid arm 87 to a bell crank lever 90 which preferably is bifurcated to provide two horizontally extending arms 88 embracing the cap 66 so as to make it possible to pivotally mount both of these two arms 88 upon the extended ends 89 of the transversely extending pin 67 to which reference has already been made. This pin 67 therefore serves the double function of releasably retaining the cap 66 upon the upper end of the valve assembly and also to pivotally mount the float 86 in operative position within the tank. Each of the horizontal arms 88 is preferably the horizontal portion of a bell crank lever 90 which also includes a downwardly extending arm 91 to the lower end of which a link 92 is pivoted as by a pin 93. Preferably each of these links 92 is the downwardly extending portion of a yoke 94 since the upper ends of the two links 92 are joined by a horizontally extending portion 96 which preferably is integral with both of the two links 92. The extreme upper end of the valve plunger 52 extends relatively loosely through the horizontal portion 96 of the yoke 94; and a pin 97 extending transversely through this

upper end of the plunger **52** above the yoke **94** insures lifting the plunger **52** and its valve **51** when the yoke **94** is lifted, with the result that when the float **86** is lowered, as when the quantity of water stored within the tank **16** is reduced, thus causing the bell crank **89** to rotate in a clockwise direction as viewed in Figures 3 and 4, the yoke **94** will open the valve **51**.

The lower ends of the two links **92** are deflected laterally so as to curve around the pivot pin **67** sufficiently to dispose the pins **93** connecting the links **92** to the downwardly extending arms **91**, substantially in a dead-center position with respect to the fulcrum of the bell crank **89** and the pin **97** which serves as the pivotal connection between the links **92** and the plunger **52**. Because of this arrangement, the rotary motion of the bell crank **89** about the axis of its fulcrum which results from lowering of the ball **86** when the level of the water within the tank **16** is lowered, causes only a very slight vertical movement of the yoke **94** and the valve plunger **52**. Accordingly, a relatively great mechanical advantage is developed which causes the valve **51** to be pressed with great force against the seat **46** when the float **86** rises to its upper extreme of movement, thereby providing greater security against leakage past the valve **51** when the tank **16** is properly filled.

The modification in Figures 7 and 8 differs from that of Figures 1 to 6, inclusive, not only in respect to the positioning of the fulcrum for the float valve's ball crank which has been described hereinabove, but also in respect to the extent to which the lower ends of the links **92'** are deflected around the axis of the pin **67'** which serves as the fulcrum for the bell crank lever **89'**. Since the links **92'** in this modification are deflected less than in the first described modification, the mechanism approaches but does not quite attain a dead-center position. So closely does the mechanism approach the dead-center position, however, that substantially the same mechanical advantage is derived and yet a slightly greater lift of the valve **51'** from its seat is attained when the float is in its most widely open position. Another point of differentiation between the two modifications is that the extreme upper end of the valve plunger **52'** instead of being round, as illustrated in the first described modification, is square, as indicated at **101**. This type of construction has been found advantageous in some instances in that it minimizes any tendency for binding between the horizontal portion **96'** of the yoke **94'** of which the links **92'** form a part.

Thus it may be seen that I have provided a float valve construction which does not include any castings or forgings as constituent parts thereof, but which can be produced almost entirely by an assembly of parts adapted for rapid and economical manufacture by automatic screw machines. Both the inlet and discharge tubes **12** and **39**, respectively, can be constructed most advantageously from conventional, standard sizes of tubing, while the valve housing **11** and valve plunger **52** can be produced at a high rate of speed from standard brass rod by automatic screw machines. The yoke **94** and bifurcated bell crank lever **90** can be formed by a stamping process from sheet stock of standard thickness and the fulcrum pin **67** can be produced from standard size metal rod. In this manner, the valve of the present invention is peculiarly adapted for quantity production at minimum cost and yet has been found to operate very positively to prevent leakage into the flush tank when the valve is closed and yet to permit refilling the tank rapidly and quietly when the float **86** is lowered.

I claim:

1. In a flush tank valve mechanism, a valve housing comprising a body portion having a valve chamber therein, means defining a valve seat within said chamber, a plunger reciprocable within said body portion, a valve carried by the lower end of said plunger in position to engage said valve seat when said plunger moves downward, a cap carried by said housing to define the upper end of said chamber and having an opening in the top thereof through which said plunger extends with sufficient clearance to permit flow through said opening around the associated portion of said plunger, a resiliently flexible disc carried by said plunger and extending radially outwards therefrom far enough to be flexed by fluid moving within said chamber and with respect to said disc, whereby seating of said disc against the top of said cap in position to close said opening around said plunger is assured when said plunger is adjacent the upper extreme of its movement but without requiring precise location of said plunger in said upper position, and means for moving said plunger within said housing.

2. In a flush tank valve mechanism, a valve housing comprising a cylindrical body portion having a valve chamber therein of circular cross section, means defining a valve seat within said chamber adjacent the bottom thereof, a plunger comprising a non-circular portion guided reciprocably within said circular valve chamber of said body portion, a valve carried by the lower end of said plunger in position to engage said valve seat when said plunger moves downward, a cap carried by said housing to define the upper end of said chamber and having an opening in the top thereof through which said plunger extends with sufficient clearance to establish communication between the exterior of said housing and said valve chamber around the associated portion of said plunger and means operably connected to the upper end of said plunger exteriorly of said housing for moving said plunger.

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