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PUSH BUTTON FLUSH MECHANISM

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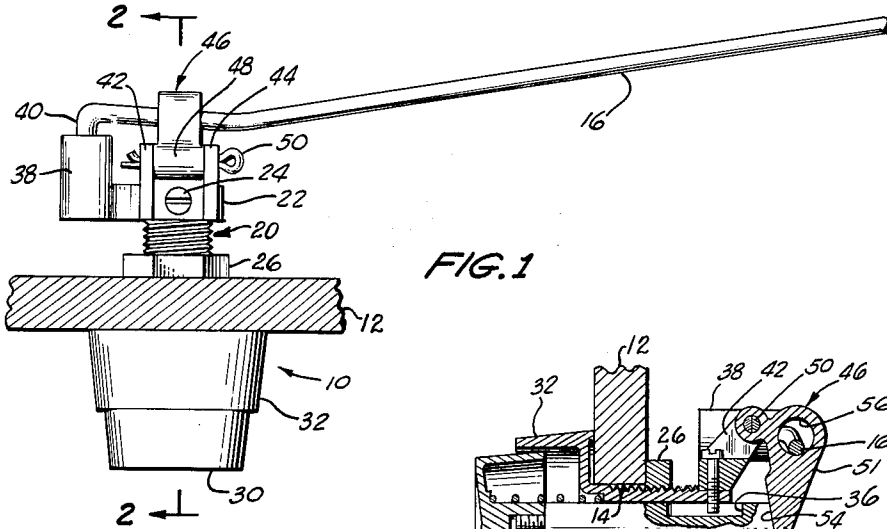


FIG. 1

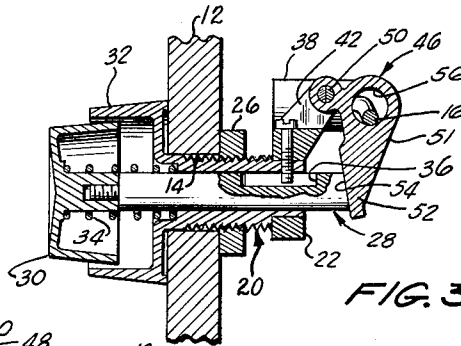


FIG. 3

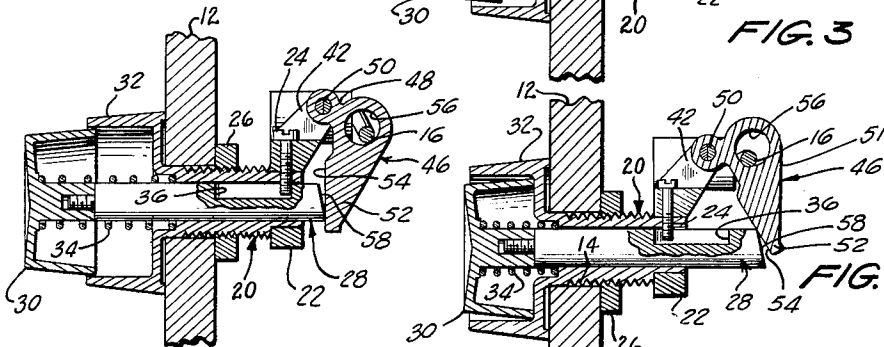


FIG. 2

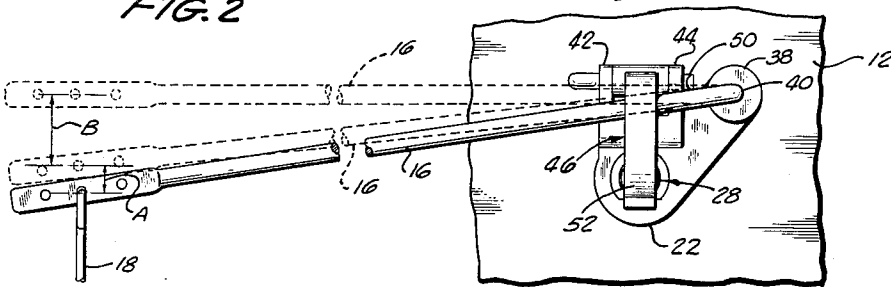


FIG. 5

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1

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PUSH BUTTON FLUSH MECHANISM

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7 Claims. (Cl. 4—67)

The present invention relates to improvements in a push button assembly or flush mechanism for actuating the discharge valve in a flush tank.

The conventional flush mechanisms now generally in use for operating flush valves employ handles, pivotally mounted, for effecting the flushing operation. These conventional constructions have proved to be satisfactory in use and to function properly over extended periods of time, at least in part, because the forces that are caused to act on various parts of the flush mechanism will normally act in the desired plane of action and there will be an absence of components of forces acting in other directions out of the desired plane of action causing bending or misalignment of parts. As can be understood, components of forces acting in directions other than in the desired plane of action will, in time, cause malfunctioning of the flush mechanisms.

There have been numerous efforts in the past to use push button flush mechanisms in place of the pivotal handle types of flush mechanisms, but such push button flush mechanisms have not been entirely successful. One of the problems encountered has been that of providing a push button flush mechanism at a competitive cost which would operate satisfactorily over a prolonged period of time. One of the difficulties encountered, centered around the requirement that the force exerted by the push button against the flush lever are essentially perpendicular to the plane of movement of the flush lever, and thus, the push button flush mechanism tended to cause misalignment of parts after usage, causing troublesome operation.

It is recognized that mechanisms can be constructed for satisfactorily converting the perpendicular forces of the push button to the vertical forces required to act on the flush lever, but those of such mechanisms which heretofore have proved to be satisfactory in operation have been excessively costly to produce, and hence, push button flush assemblies employing such mechanisms have not been competitive with the conventional flush mechanisms using pivotal handles.

It is an object of the present to provide an improved push button flush assembly which is constructed and arranged so that it can be produced at an economical cost and which will be relatively trouble-free in operation over a prolonged period of time.

It is another object of the present invention to provide an improved push button flush assembly which is constructed and arranged so that the pressure required to be exerted on the push button for effecting a flushing action is maintained within an allowable range during both the lifting of the flush valve from its seat and the subsequent elevating of the valve.

It is still another object of the present invention to provide an improved push button flush assembly of the foregoing character which is adapted to function so that when substantially uniform pressure is exerted on the push button for moving the same inwardly, a two state lifting action occurs on the flush lever, the first stage providing maximum lifting pressure thereon with a minimum rate of movement of such flush lever and the second stage providing maximum rate of movement and a corresponding lesser lift pressure on the flush lever.

2

It is still another object of the present invention to provide an improved push button flush assembly wherein a simple but effective mechanism is employed for converting forces exerted by the push button into substantially vertical forces acting on the flush lever.

It is still another object of the present invention to provide an improved push button flush assembly of the foregoing character which can be assembled in place easily and simply in the flush tank and which is characterized by its effective operation.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

In the drawings:

FIGURE 1 is a fragmentary top elevational view, partly in section, of a push button flush assembly embodying one form of the present invention;

FIGURE 2 is a fragmentary sectional view taken on the line 2—2 of FIGURE 1, showing the push button flush assembly in its normal position;

FIGURE 3 is a fragmentary sectional view similar to FIGURE 2, but showing the push button partially moved inwardly with respect to the tank;

FIGURE 4 is another fragmentary sectional view similar to FIGURE 2, but showing the push button fully moved inwardly with respect to the tank and

FIGURE 5 is a fragmentary elevational view of the push button flush assembly as viewed from within the tank and showing the flush lever in positions corresponding to the three positions of the push button shown in FIGURES 2, 3 and 4.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

Referring now to the drawing, the invention will be described in greater detail. The push button flush assembly 10 is adapted to be mounted on the side wall of the flush tank 12 through an opening 14 therein. The flush lever 16 is adapted to be connected by a link 18, FIGURE 5, to a conventional flush or discharge valve (not shown) seated in an opening in the bottom of the flush tank 12.

The push button flush assembly 10 has a sleeve-like part or spud 20 which extends through opening 14 and has a collar 22 attached to the inner end thereof by screw 24. The spud 20 is secured in place on the wall of the flush tank 12 by clamping nut 26 which is threadedly connected to spud 20 by the external threads thereon.

Extending through the spud 20 is an axially movable plunger of push button 28 which has a head 30 at its outer end. In the illustrated embodiment, the head 30 is adapted to be moved axially inwardly within an enlarged bell-shaped end 32 on the spud 20, as is shown sequentially in FIGURES 2, 3 and 4. Positioned between the spud 20 and the plunger or push button 28 is a compression coil spring 34 which is operative to urge the plunger or push button 28 outwardly to the normal position to FIGURE 2. The plunger 28 has an axially extending slot 36 into which the screw 24 extends, and the outer end of slot 36 and screw 24 cooperate to provide means for limiting the extent of axial outward movement of the plunger 28 within the spud 20, and the engagement of head 30 with

3

the inner end 32 of spud 20 limits the axial inward movement of plunger 28 with respect to spud 20.

The collar 22 has as an integral part thereof a bearing portion 38 with an axis parallel to and above the axis of the plunger 28, and the one end 40 of the flush lever is mounted in the bearing portion 38 for pivotal movement about the axis thereof. It will be observed that the one end 40 is substantially perpendicular to the longitudinal axis of flush lever 16 so that the latter can pivot in a plane that is essentially vertical.

Also formed as an integral part of the collar 22 are two arms 42 and 44 which form a pivotal support for a bell crank lever 46. The latter has a short arm 48 which is pivotally supported on arms 42 and 44 by the cotter pin 50. The other or longer arm 51 has its end 52 extending into the path of movement of plunger 28 and has a flat surface 54 adapted to be engaged by the inner end of plunger 28. Thus, movement of arm 51 by reciprocating movement of plunger 28 will cause pivotal movement of the bell crank lever 46 around the axis of cotter pin 50, as shown in FIGURES 2, 3 and 4.

The bell crank lever 46 has a relatively large opening 56 at its fulcrum through which the flush lever 16 extends. In the illustrated embodiment of the invention the opening 56 is circular in shape and of a diameter approximately twice that of the flush lever 16, which is circular in cross section. This enlarged size of the opening 56 is one of the significant features of the present invention, because it enables push button flush assembly 10 to function in a manner such that forces exerted inwardly against plunger 28 will be converted substantially entirely into vertical upward forces on flush lever 16.

Referring to the sequence of movements shown in FIGURES 2, 3 and 4, it is believed this can readily be understood. As shown in FIGURE 2, which illustrates the outermost position of plunger 28, the flush lever 16 can be seen making a line contact with the bottom wall of opening 56. In this position the line contact is only slightly to the right of center of opening 56, and thus, forces exerted by bottom wall of opening 56 on flush lever 16 will be essentially vertical. As shown in FIGURE 3, when the plunger 28 is moved approximately half the length of its stroke, the forces would be exactly vertical, and similarly, when the plunger 28 is moved its full stroke inward, as shown in FIGURE 4, the flush lever 16 is only slightly to the left of center of opening 56, and hence, the forces will still be substantially vertical. Thus, by having an enlarged opening in which the flush lever 16 can slide, the bell crank lever 46 will lift the flush lever 16 in a vertical path and there will be an absence of component forces acting out of this vertical plane of movement so that misalignment of parts is avoided.

Another important feature of the present invention is the arrangement whereby the plunger 28 can be pressed inwardly at generally a uniform rate and pressure and the flush lever 16 will initially be raised slowly with maximum lifting forces acting on flush lever 16 and thereafter, after the flush valve (not shown) has been lifted from its seat, the flush lever 16 will be raised at a more rapid rate. This feature is accomplished by the angular relationship between the surface 54 of bell crank arm 51 and the end surface 53 of the plunger 28. It will be observed that when the plunger 28 initially advances against surface 54, the length of the moment arm for pivoting the bell crank lever 46 is measured from the axis of cotter pin 50 to the bottom edge of plunger end surface 58, and this length of moment arm will remain this long essentially until the plunger has advanced to the position of FIGURE 3. Further advance of the plunger from the FIGURE 3 position to that of FIGURE 4 will result in a shortening of the moment arm which now is measured from the axis of cotter pin 50 to the top edge of plunger end surface 58. This structural relationship results in greater upward forces being exerted on flush lever 16

4

during movement from the FIGURE 2 to the FIGURE 3 position than occurs from the FIGURE 3 to the FIGURE 4 positions, because a longer moment arm exists in the first stage of movement than in the second stage of movement. Likewise, more rapid upward movement of flush lever 16 occurs in the second state of movement than in the first stage of movement.

This last described feature is significant because it allows maximum lifting force to be exerted on the link 18 and thereby on the flush valve (not shown) to break the seal between the flush valve and its valve seat, and thereafter, in the second stage, maximum speed of lifting the flush valve is realized. This can be seen diagrammatically in FIGURE 5 which shows the flush lever 16 in solid lines in its FIGURE 2 or normal position and in broken lines in its intermediate and fully lifted positions corresponding to the FIGURE 3 and FIGURE 4 positions, respectively. Note that the lift indicated by the letter A, which is that which has occurred when moving flush lever 16 to the FIGURE 3 position is considerably less than the corresponding lift B which is realized when moving the flush lever 16 to the FIGURE 4 position.

The present invention is formed by relatively few parts which can be economically produced and can be easily assembled in place in the flush tank. When assembling the push button flush assembly in place on the tank 12, the screw 24 will initially be withdrawn from the spud 20 so that the collar 22 and clamp nut 26 are separated from spud 20. The assembly can then be installed by inserting spud 20 through opening 14, turning nut 26 on spud 20 until wall 12 is clamped between end 32 and nut 26, and then fitting collar 22 onto the inner end of spud 20 and turning screw 24 until it extends into slot 36.

Having thus described my invention, I claim:

1. In a flush tank, a push button assembly for operating the flush valve through an opening in the wall of said tank, said assembly comprising a spud mounted in said opening, a plunger extending through said spud axially movable therein, means operably disposed between said plunger and said spud for urging said plunger axially outward of said tank, limited means operably positioned between said spud and said plunger for limiting the extent of axial movement of said plunger in both axial directions, a collar on the axially inner end of said spud, a flush lever pivotally mounted on said collar on a pivot having an axis parallel to the axis of said plunger and generally perpendicular to the longitudinal axis of said flush lever, a bell crank lever pivotally connected by one of its arms to said collar on an axis generally parallel to the longitudinal axis of said flush lever, the other of its arms extending into the path of axial movement of said plunger, said bell crank lever having an opening through its fulcrum through which said flush lever extends and is loosely supported therein so that when said other end is moved by inward movement of said plunger, said fulcrum will exert substantially a vertical force upward on said flush lever.

2. In a flush tank, a push button assembly for operating the flush valve through an opening in the wall of said tank, said assembly comprising a spud mounted in said opening, a plunger extending through said spud for axial movement therein, a flush lever pivotally mounted on the inner end of said spud on a pivot having an axis to one side of and parallel to the axis of said plunger and generally perpendicular to the longitudinal axis of said flush lever, a bell crank lever pivotally connected by one of its arms to the inner end of said spud on an axis generally parallel to the longitudinal axis of said flush lever and above the axis of said plunger, the other of its arms extending into the path of axial movement of said plunger, said bell crank lever having an opening at its fulcrum through which said flush lever extends and on the lower wall of which said flush lever is slidably supported, said opening having a substantially larger cross

5

sectional area than the cross sectional area of said flush lever, and the lower wall of said opening having a configuration such that when said bell crank is pivoted by movement of said plunger a force substantially in a vertical plane will be exerted by said lower wall against said flush lever throughout the pivotal movement of the bell crank.

3. In a flush tank, a push button assembly as claimed in claim 2 wherein said flush lever has a circular cross section and said opening is circular and has a diameter approximately twice the diameter of said cross section of the flush lever.

4. In a flush tank, a push button assembly for operating the flush valve through an opening in the wall of said tank, said assembly comprising a spud mounted in said opening, a plunger extending through said spud for axial movement therein, means for urging said plunger outwardly of said tank to a normal rest position, a flush lever pivotally mounted on the inner end of said spud on a pivot having an axis to one side of and parallel to the axis of said plunger and generally perpendicular to the longitudinal axis of said flush lever, a bell crank lever pivotally connected by one of its arms to the inner end of said spud on an axis generally parallel to the longitudinal axis of said flush lever and above the axis of said plunger, the other of said arms having a surface extending in its normal position in a vertical plane into the path of axial movement of said plunger, said bell crank supporting at the fulcrum said flush lever, said plunger having an inner end surface engageable by said surface of said plunger when said plunger and said bell crank lever are in their normal positions, said surfaces diverging upwardly from one another when in their normal positions so that when said plunger is initially pushed inwardly the lower edge of the plunger will engage the surface of the bell crank lever arm at a prescribed distance from the axis of pivotal movement of the bell crank lever, and after the plunger has advanced inwardly a portion of the length of its stroke the upper edge of the plunger will engage and pivotally move the bell crank lever.

5. In a flush tank, a push button assembly as claimed in claim 4 wherein said bell crank has an opening at its fulcrum through which said flush lever extends and in

6

which said flush lever is slidingly supported, said opening having a substantially larger cross sectional area than the cross sectional area of said flush lever.

6. In a flush tank, a push button assembly as claimed in claim 5 wherein said flush lever has a circular cross section and said opening is circular and has a diameter approximately twice the diameter of the flush lever cross section.

7. In a flush tank, a push button assembly for operating the flush valve through an opening in the wall of said tank, a plunger mounted in said opening for axial movement therein, a flush lever pivotally mounted within said tank adjacent to the inner end of said plunger and extending in a vertical plane normal to the path of axial movement of said plunger and terminating in an end adapted to be connected to said flush valve, a mechanism operably disposed between the inner end of said plunger and said flush lever for transmitting substantially only vertical upward forces to said flush lever in response to inward movement of said plunger, cooperating means on said plunger and said mechanism for effecting in response to uniform inward movement of said plunger (1) a maximum force acting upwardly on said flush lever and a relatively low rate of upward movement of said end of the flush lever during the first portion of the inward movement of said plunger and (2) a reduced force acting upwardly on said flush lever and a correspondingly increased rate of upward movement of said end of the flush lever during the second portion of inward movement of said plunger.

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