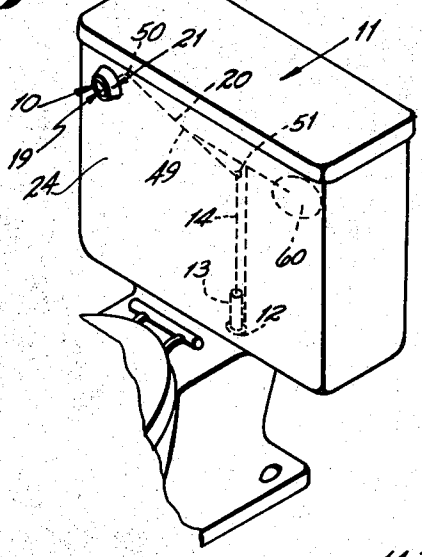
Feb. 9, 1971 C. T. MOORE 3,561,015

PUSH BUTTON OPERATED FLUSH MECHANISM

Filed April 23, 1969

Fig. 1



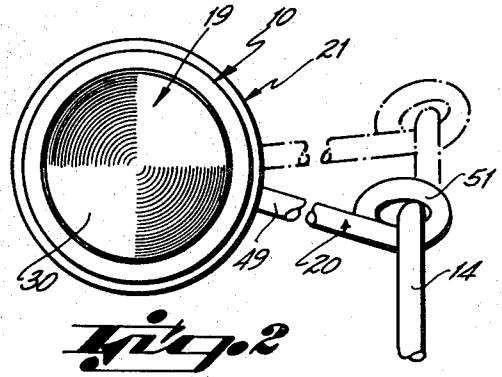


Fig. 2

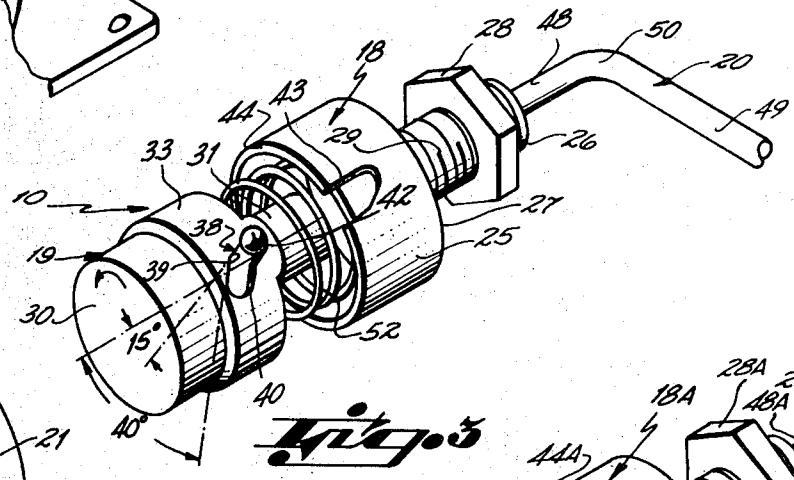
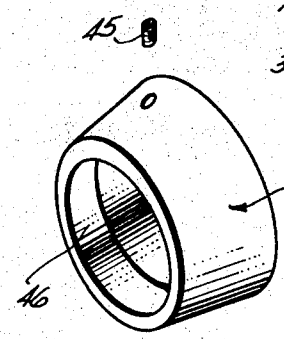


Fig. 3



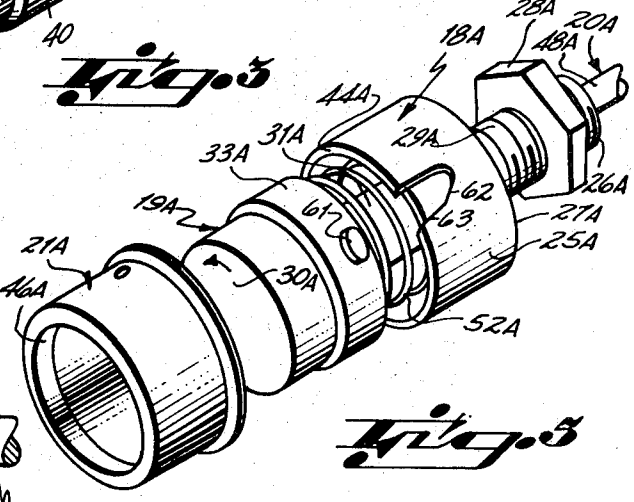


Fig. 5

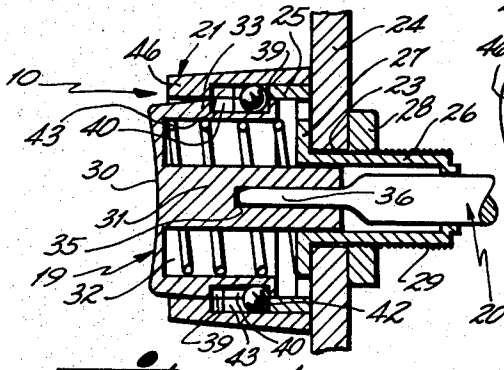


Fig. 4

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United States Patent Office 3,561,015 Patented Feb. 9, 1971

3,561,015

PUSH BUTTON OPERATED FLUSH MECHANISM

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Filed Apr. 23, 1969, Ser. No. 818,535
Int. Cl. E03d 1/34
U.S. Cl. 4—67 16 Claims

ABSTRACT OF THE DISCLOSURE

A push button operator for controlling opening and closing movements of a flush valve in a flush tank.

This invention relates to a flush valve assembly for controlling the flow of water from a flush tank.

Most flush valve operators now in use for controlling the flushing of flush tanks employ pivotally mounted handles for actuating the valve. Over the years, these handle actuated flush valve operators have proven very satisfactory from both a cost and a maintenance standpoint. In fact, they have been so satisfactory that there has been very little agitation for improvement upon them. However, there has always been a demand for something more aesthetically appealing than the crank or handle on the front of a flush tank. Consequently, attempts have been made to depart from conventional crank handle operated flush operators.

More recently, one of the departure attempts has been in the nature of a push button actuated mechanism for operating a flush valve. At least one such mechanism is now available commercially and is in competition with the old-fashioned handle type mechanism. The push button style operator though which is available is more expensive than a handle type operator and is subject to more frequent breakage or failure because it contains more moving parts.

It has therefore been one objective of this invention to provide an improved push button operated flush operator which contains a minimal number of parts or components so that it is both inexpensive to manufacture and relatively trouble free.

The principal problem encountered in the construction of a push button operated flush mechanism is that of minimizing the force required to actuate the push button. This force must be relatively small while at the same time a large force is required to lift the connected flush valve out of engagement with the valve seat in the bottom of a flush tank. Once the valve is unseated, water rushes beneath it so that continuing opening movement is easy to maintain with a very minimal force. To minimize the initial push button force, prior attempts at push button operated flush mechanisms have involved relatively complex structures for achieving a high mechanical advantage from a short push button stroke. Inevitably though, the result is that the structure which generates the high mechanical advantage has a large number of mechanical components which also give rise to a high incidence of breakdown and failure.

The push button flush operator of this invention which overcomes these problems and undesirable characteristics is a very simple structure. It consists of a sleeve within which a push button plunger is slidable. For appearance sake, a finished shroud or skirt preferably surrounds the sleeve. A lever extends rearwardly and laterally from the plunger and is connected at its outer end to a vertical flush valve control rod. For decorative purposes, that portion of the sleeve which is located on the outside of the flush tank wall is preferably surrounded by a decorative shroud fixedly secured to the sleeve. With this construction, the sleeve need not have a polished or decorative finish.

The primary advantage of the push button flush operator heretofore described resides in its simplicity and its low cost of manufacture. These factors enable this push button flush operator to be manufactured and sold in price competition with the old-fashioned crank handle type of flush operator.

These and other objects and advantages of this invention will be more readily apparent from the following description of the drawings in which:

FIG. 1 is a perspective view of a flush tank having the flush valve operator of this invention applied thereto and showing the flush valve in phantom,

FIG. 2 is a front elevational view of the push button flush operator,

FIG. 3 is an exploded perspective view of the push button flush operator of FIG. 1,

FIG. 4 is a cross-sectional view through the push button flush operator, and

FIG. 5 is an exploded perspective view of a second modification of the push button flush operator.

Referring first to FIG. 1, the push button flush operator **10** is illustrated as applied to a conventional flush tank **11** having a valve seat **12** surrounding a water outlet in the bottom wall. A conventional vertically movable valve or closure **13** controls opening and closing of the discharge outlet. Connecting the valve **13** to the operator **10** is a flush valve control rod **14** which extends vertically upwardly from the flush valve or closure **13** and is pivotally secured at its upper end to the push button flush operator **10**.

The push button flush operator **10** generally comprises a sleeve **18**, a plunger **19**, a flush lever **20** and a decorative shroud or skirt **21**. The sleeve **18** is fixedly mounted within a circular aperture **23** which extends through a vertical wall **24** of the flush tank **11**. It has an outer large diameter section **25** and a smaller diameter section **26** interconnected by a vertical wall **27**. The smaller diameter section **26** extends through the aperture **23** in the flush tank wall. A nut **28** is threaded over external threads **29** on the sleeve and holds the sleeve in the vertical wall **24** of the tank.

The plunger **19** consists of a large diameter outer end or push button **30** from which a cylindrical shaft **31** extends inwardly. There is an annular cavity **32** in the plunger located between the central shaft **31** and a surrounding push button flange or skirt **33**.

The cylindrical shaft **31** is slidably mounted within the smaller diameter section **26** of the sleeve. At its inner end it has a transverse slot similar to a screw driver slot **35** extending diametrically therethrough. The flattened inner end **36** of the flush rod **20** fits within the slot **35** so that the flattened end **36** of the lever and the slot **35** act as a key and keyway to transmit rotational movement of the plunger to the flush lever.

To effect rotation of the plunger upon axial movement thereof, there is a cooperating cam and cam follower assembly in the plunger **19** and the sleeve **18**. The cam consists of a pair of opposed angulated trackways **38** machined into the outside surface of the plunger skirt **33**. Each of these trackways has a first inner section **39** extending at an angle of approximately fifteen degrees to the direction of axial movement of the plunger and a second outer section **40** extending at an angle of about forty degrees to the axial direction of movement of the plunger. The slots **38** thus slope outwardly at a slight angle and then at a greater angle.

The cam follower consists of a pair of ball bearings **42** slidable within the cam tracks **38**. Each of these balls has a radius approximately equal to the depth of the re-

cess **38** so that the outermost portion of the ball is always located outside the recess **38**.

A pair of diametrically opposed slots **43** are machined from the large diameter section **25** of the sleeve **18**. These slots extend inwardly from the outermost wall **44** parallel to the axis of the sleeve.

The outermost half of each of the ball bearings **42** rides within one of the slots **43**. Consequently, as the plunger **19** is pushed inwardly, the balls **42** riding in the slots **43** and the cam groves **38** cause the plunger to rotate in a counterclockwise direction as viewed in FIG. 3.

Preferably, a decorative shroud **21** surrounds the large diameter section **25** of the sleeve and is fixedly secured thereto by a setscrew **45**. The outermost end section **46** of the shroud is only slightly larger in diameter than the flange **33** of the plunger so that this section **46** of the shroud also serves as a guide for the plunger. The shroud also serves to maintain or hold the balls **42** in assembled relation within the slots **43**.

The flush lever **20** has one end section **48** which extends rearwardly from the flattened end section **36** in a direction generally parallel to the axis of the plunger. The lever is bent at approximately a ninety degree angle and extends laterally in a generally horizontal direction from the ninety degree bend **50**. The outermost end of the laterally extending section **49** is bent in the form of a circular loop **51**. This loop **51** receives the upper end of the flush valve control rod **14**.

When the push button flush operator **10** is mounted within the aperture **23** of the tank, the sleeve **18** is held in a fixed relation relative to the vertical wall **24** by the nut **28** threaded over the sleeve. Consequently, upon the plunger **19** being pushed inwardly against the bias of a compression spring **52** sandwiched between the vertical wall **27** of the sleeve and the outer wall **30** of the push button, the plunger **19** is forced to rotate by the spherical balls **42** tracking within the cam slot **38**. Since the innermost section of the slot is angulated only slightly relative to the direction of movement of the plunger in the sleeve **18**, the plunger rotates through a very small angle during the first half of its axial travel in the sleeve. This small angular movement however, is sufficient to move the flush lever **20** upwardly a distance sufficient to break the seal of the flush valve **13** with the seat **12** so that water rushes from the tank through the discharge opening or seat **12**. During the last half of the axial inward movement of the plunger **19**, the plunger rotates through an arc approximately twice as great as the arc through which it rotated during the first half of its axial inward travel. At this time though, opening movement of the closure is assisted by the water pressure so that the force required to push the plunger inwardly and move the plunger through this arc is not increased in spite of the increased angle of inclination of the cam slot.

After the push button **30** has been pushed all the way in and is released, it is forced outwardly by the compression spring **52**. This outward travel is limited by the spherical balls **42** seated within the cam grooves **38** and the slot **43**. The rate at which the plunger moves outwardly though is controlled by the level of water in the flush tank **11** through a conventional float valve **60**.

Referring now to FIG. 5, there is illustrated a second modification of the push button operator heretofore described. This modification is generally similar to the modification of FIGS. 1–4 and therefore identical parts have been given identical numerals. Those parts which function similarly but differ structurally have been given the same numerical designations as their counterparts in the first modification but followed by a suffix A.

The modification of FIG. 5 differs from the modification of FIGS. 1–4 only with respect to the cam and cam follower assembly for effecting rotational movement of the plunger relative to the sleeve upon axial movement of the plunger. In this modification the cam follower

comprises a pair of diametrically opposed rollers **61** rotatably journaled upon the outer ends of a pair of radially extending posts (not shown). These rollers **61** are normally biased into engagement with the sloping cam walls **62, 63** of the slot.

The outermost portion of the wall **61** slopes at only a slight angle, as for example an angle of about fifteen degrees relative to the axial direction of movement of the plunger. The innermost extent **62** of the wall **61** slopes at a greater angle as for example an angle of about forty degrees relative to the axial direction of movement of the plunger. Thus, during the initial inward movement of the plunger, the roller **61** moves in a counterclockwise direction as viewed in FIG. 5 as the rollers **61** track on the outermost portion **63** of the cam wall. Subsequently, during the last half of the inward travel of the plunger, the slope of the innermost section **62** of the cam wall increases and the plunger rotates through an angle approximately twice that through which it rotates during the first half of its inward travel.

In the second modification of FIG. 5 the force required to move the plunger inwardly remains relatively constant even though the rate of inward axial movement of the plunger remains fixed. Similarly, the force required to push the plunger inwardly remains relatively fixed in spite of the increased rate of vertical upward movement of the valve closure **13**. The inward force on the plunger required to break the seal between the closure and the valve seat **12** is minimized by the relatively slow angular movement of the plunger and thus of the attached flush lever.

The structure heretofore described in both embodiments of the push button flush operator is very inexpensive to manufacture because of the simplicity and small number of parts. It also has the advantage of not being subject to breakage or failure because of the simplicity of the construction.

While I have described only a single preferred modification of my invention those persons skilled in the arts to which this invention pertains will readily appreciate numerous changes and modifications which may be made without departing from the spirit of my invention. Therefore, I do not intend to be limited except by the scope of the appended claims.

Having described my invention, I claim:

1. For use in combination with a flush tank having a flush valve therein for controlling the flow of water from said tank, a flush valve actuating assembly comprising

a sleeve adapted to be fixedly mounted in an aperture in a vertical wall of said tank,

a push button actuated plunger slideably mounted in said sleeve,

a flush lever extending rearwardly and laterally from said plunger, said lever having one end nonrotatably keyed to said plunger so that rotation of said plunger effects rotation of said one end of said lever, the other end of said lever being pivotly connected to the upper end of a vertical flush valve control rod, and

cooperating cam and cam follower means on said sleeve and plunger for causing rotational movement of said plunger and said one end of said flush lever in response to axial movement of said plunger relative to said sleeve, said rotational movement of said one end of said flush lever being operative to effect vertical movement of said other end of said flush lever and thereby control vertical movement of said flush valve control rod.

2. The flush valve actuating assembly of claim **1** which further includes a compression spring located between a flanged outer end of said plunger and said sleeve and operable to bias said plunger forwardly relative to said sleeve.

3. The flush valve assembly of claim 2 wherein said cam and cam follower means cooperate to limit the extent of forward movement of said plunger relative to said sleeve.

4. The flush valve actuating assembly of claim 1 wherein said plunger has a large diameter outer end slidable within a large diameter section of said sleeve,

an annular decorative shroud surrounding said large diameter section of said sleeve and fixedly secured thereto.

5. The flush valve actuating assembly of claim 4 wherein said annular shroud is operative to partially guide the axial movement of the large diameter outer end of said plunger.

6. The flush valve actuating assembly of claim 1 wherein said sleeve comprises a first large diameter section and a second smaller diameter section interconnected by a vertical shouldered section, said large diameter section being located on the forward side of said vertical wall of said tank and said shouldered section of said wall abutting against said vertical wall of said tank, said small diameter section of said sleeve extending through said aperture in said vertical wall of said tank and having threads machined on the outside surface thereof, and

a nut threaded over the threaded small diameter section of said sleeve to fixedly secure said sleeve in said vertical wall of said tank.

7. The flush valve actuating assembly of claim 1 wherein said cooperating cam and cam follower means comprises a cam slot in said plunger angulated relative to the axial direction of movement of said plunger in said sleeve, and

said cam follower means comprises a ball bearing movable in a groove in said sleeve.

8. The flush valve actuating assembly of claim 1 wherein said cooperating cam and cam follower means comprises at least one roller rotatably secured to said plunger and rotatable about an axis which is radial to the axis of said plunger and

a cam slot in said sleeve having a roller engageable surface angulated relative to the axial direction of movement of said plunger in said sleeve.

9. In combination, a flush valve and a flush valve actuating assembly,

said flush valve including a closure element cooperable with a valve seat in a flush tank to control the flow of water from the bottom of the tank,

a vertical flush valve control rod extending upwardly from the closure element to control opening and closing movement of said element,

a sleeve adapted to be fixedly mounted in an aperture in a vertical wall of said tank,

a pushbutton actuated plunger sidably mounted in said sleeve,

a flush lever having one end section nonrotatably keyed to said plunger and extending rearwardly therefrom so that rotation of said plunger effects rotation of said one end section of said lever, said lever having a bend therein and second section extending laterally in a generally horizontal plane, said second section of said lever having an outer end pivotally connected to the upper end of said vertical flush valve control rod, and

cooperating cam and cam follower means on said sleeve and plunger for causing rotational movement of said plunger and said one end section of said flush lever in response to axial movement of said plunger relative to said sleeve, said rotational movement of said one end section of said flush lever being operative to effect vertical movement of said outer end of said flush lever and thereby control vertical movement of said flush valve control rod.

10. The combination of claim 9 which further includes a compression spring located between a flanged outer end of said plunger and said sleeve and operable to bias said plunger forwardly relative to said sleeve.

11. The combination of claim 10 wherein said cam and cam follower means cooperate to limit the extent of forward movement of said plunger relative to said sleeve.

12. The combination of claim 9 wherein said plunger has a large diameter outer end slidable within a large diameter section of said sleeve, and

an annular decorative shroud surrounding said large diameter section of said sleeve and fixedly secured thereto.

13. The combination of claim 12 wherein said annular shroud is operative to partially guide the axial movement of the large diameter outer end of said plunger.

14. The combination of claim 9 wherein said sleeve comprises a first large diameter section and a second smaller diameter section interconnected by a vertical shouldered section, said large diameter section being located on the forward side of said vertical wall of said tank and said shouldered section of said wall abutting against said vertical wall of said tank, said small diameter section of said sleeve extending through said aperture in said vertical wall of said tank and having threads machined on the outside surface thereof, and

a nut threaded over the threaded small diameter section of said sleeve to fixedly secure said sleeve in said vertical wall of said tank.

15. The combination of claim 9 wherein said cooperating cam and cam follower means comprises a cam slot in said plunger angulated relative to the axial direction of movement of said plunger in said sleeve, and

said cam follower means comprise a ball bearing movable in a groove in said sleeve.

16. The combination of claim 9 wherein said cooperating cam and cam follower means comprises at least one roller rotatably secured to said plunger and rotatable about an axis which is radial to the axis of said plunger and

a cam slot in said sleeve having a roller engageable surface angulated relative to the axial direction of movement of said plunger in said sleeve.

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