July 14, 1953 A. B. BOYD 2,644,952

FLUSH VALVE

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FIG. 7.

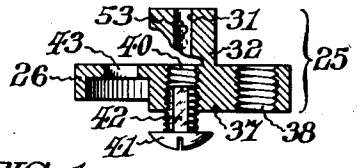


FIG. 8.

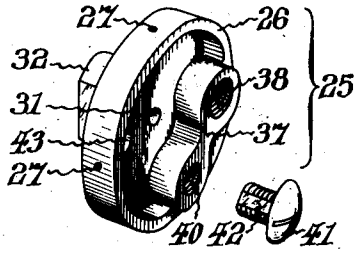


FIG. 1.

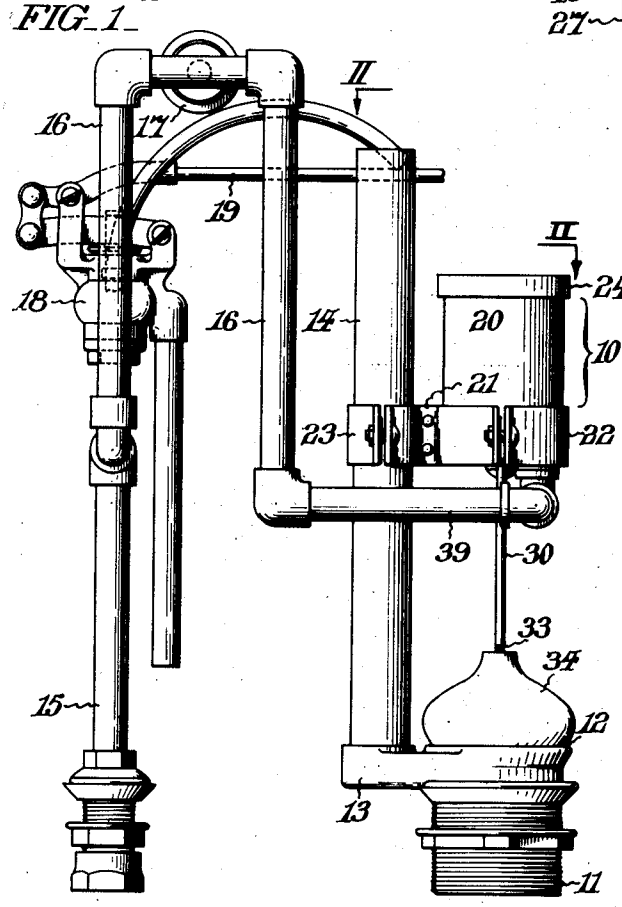


FIG. 2.

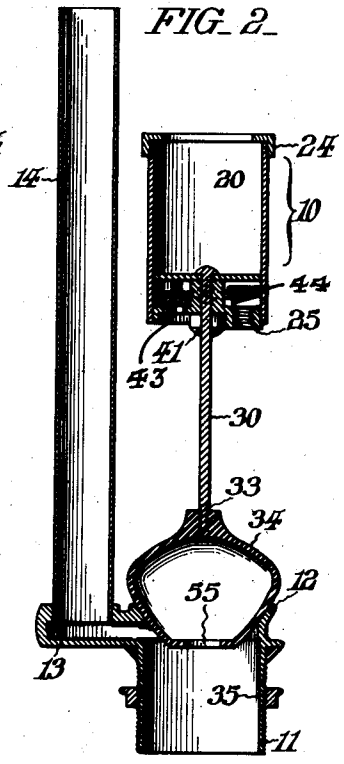


FIG. 9.

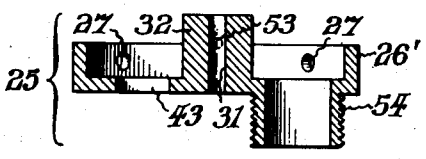
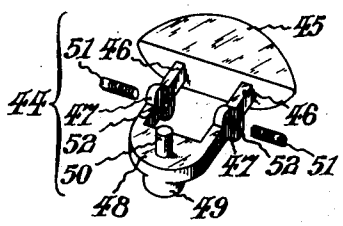


FIG. 6.



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FIG. 3

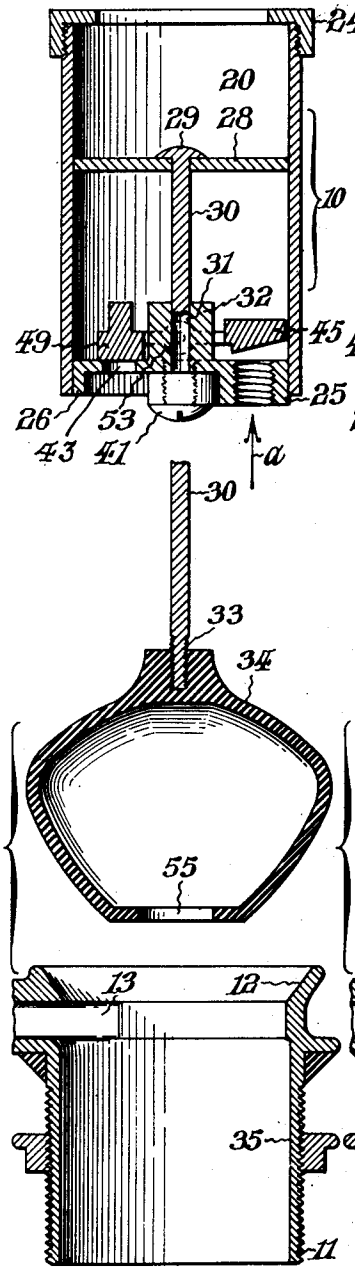


FIG. 4

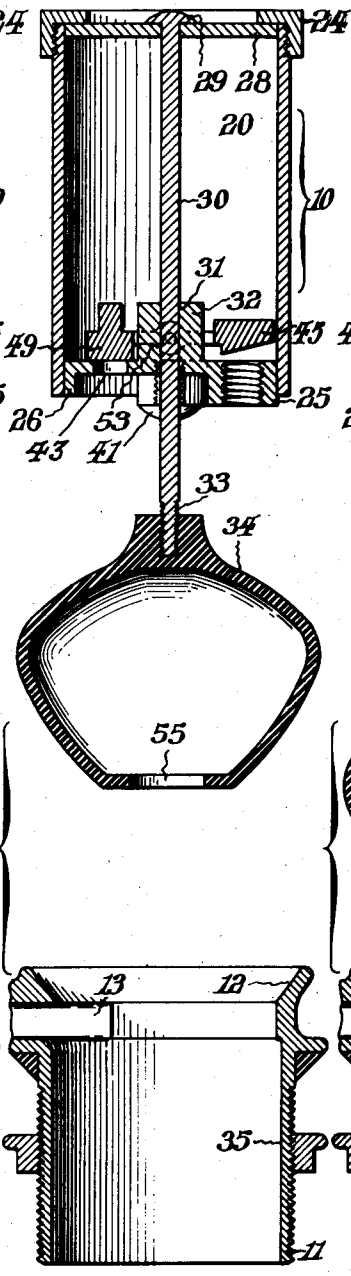
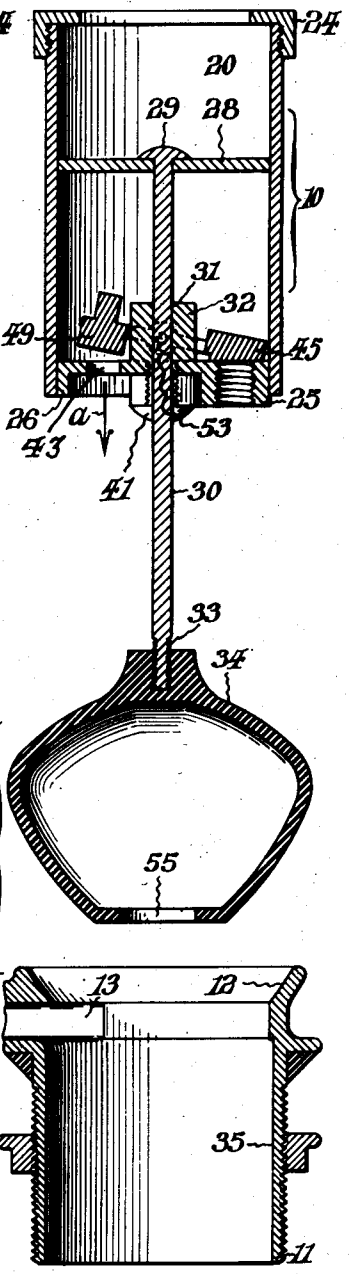


FIG. 5



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FLUSH VALVE

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Application September 15, 1950, Serial No. 184,988

10 Claims. (Cl. 4—67)

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This invention has general reference to flush valves and more particularly relates to the species or form thereof associated with the flush tanks of toilets and which close automatically after each flushing operation.

Conventional types of automatically closing flush valves usually include a ball-float and lower lifting-rod, a guide for the latter, an upper lifting-rod and operating lever with a handle, exterior of the flush tank, for lifting the valve. Such devices while measurably satisfactory are objectionable owing to the loosely connected metal parts and, in addition, they are invariably noisy and inefficient due to the unavoidable swinging of the ball-float with incidental jamming of the lower lifting-rod in its guide which causes imperfect seating of the valve and leakage or running of water therethrough into the toilet bowl. As a result much wastage of water takes place until the valve is re-seated by "jogging" the operating lever, or by removing the cover from off the flush tank, and manually seating said valve, both of which operations are tedious and annoying.

The general object of my invention is to overcome the above noted disadvantages in a simple and practical manner with a substantial reduction, if not complete elimination, of the noise incidental to the flushing operation.

With the just stated general object and other subsidiary ones, as well as ancillary advantages in view, my invention essentially consists in the provision of a novel flushing control or device that is motivated by power derived from the water supply to open a valve which smoothly, efficiently and positively re-seats itself.

My invention further consists in certain structural features and combinations of parts, hereinafter disclosed and illustrated by the accompanying two sheets of drawings, wherein like characters of reference are applied to corresponding parts in all the views; whereas the subjoined claims more succinctly define the features of novelty over the prior art.

In the drawings:

Fig. 1 is an elevation of my novel flush controlling device as adapted to conventional toilet fixtures.

Fig. 2 is a vertical section taken within the confines of the direction pointing arrows II—II in Fig. 1, and showing the flush controlling valve in closed position.

Fig. 3 is a broken vertical section through the device with the associated flush controlling valve in course of elevation, drawn to a larger scale for

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clarification of details, or incidental to the flushing operation.

Fig. 4 is a substantially similar view to the preceding but showing the valve at maximum elevation or fully open.

Fig. 5 is a corresponding view to Fig. 4, but illustrating the flush controlling valve proximately approaching the closed position of Fig. 2.

Fig. 6 is an exploded perspective view of a combined check-and-relief device, hereinafter fully described.

Fig. 7 is a sectional detail of the closure for the lower end of the flush-valve actuating means, with a fragmentary part broken out for clarity in illustration.

Fig. 8 is an exploded perspective view of the closure means shown in Fig. 7; and

Fig. 9 is a diametric section, similar to Fig. 7, of a slightly modified form of the closure.

In describing the embodiment of my invention exemplified by the drawings herewith, specific terms will be employed for the sake of clarity, but it is to be understood the scope of said invention is not thereby limited; each term being intended to embrace all reasonable equivalents which perform the same function for an analogous purpose.

Referring more in detail to the drawings the reference character 10 comprehensively indicates one specific example of the novel flush-valve operating-device. The device 10 is rigidly mounted, in axial alignment relative to a conventional toilet-bowl nipple 11 and the associated bowl-shaped valve seat 12, said seat embodying a branch 13 to which the customary overflow 14 is secured, in accordance with known practice. The number 15 designates a service connection from the source of water supply said connection preferably including an inverted U-shaped portion 16 with a self-closing push-button-valve 17, for example only, interposed in the bend thereof; inasmuch as said valve may be of the lever or other operable type; or a non-automatic manually opened and closed valve will serve equally well. The valve 17 is conveniently located in advance, or ahead, of the pressure water supply automatic float-operated ball-cock 18, or it may be otherwise mounted to the flush tank. The number 19 designates a portion of the customary lever connection intermediate said ball-cock 18 and the float, not shown.

Referring now more particularly to my novel flush-valve operating device 10, as best shown in Figs. 3, 4 and 5, the same comprises an actuator cylinder 20 that is conveniently mounted on the

overflow 14, by aid of a split-clamp device 21, see Fig. 1, the major portion or loop 22 whereof encircles and is secured to the cylinder 20 by any appropriate securing means. The minor portion or loop 23 is clamped to the overflow 14 by similar securing means, as readily understood by those conversant with the plumbing art. The upper end of the cylinder 20 is suitably equipped with an angle-section annulus 24 which is serviceable both as a stop and a vent. The opposed or lower end of the cylinder 20 is fitted with a novel or special closure cap or base 25, which may be tightly engaged within said cylinder end as shown to best advantage in Figs. 3–5; or such base 25 may embody a surrounding flange 26', see Fig. 9, for socket reception of the cylinder end, and be rigidly held in place by stud-screws (not shown) engaged in circumferentially spaced holes 27, in an obvious manner. Movable lengthwise within the actuator cylinder 20 is a circular plate or piston disc 28 to which is rigidly attached the upper or headed end 29 of a rod 30, the stem portion whereof is afforded slidable guidance through the bore 31 of a central boss 32, forming a part of the closure cap or base 25. The free end of said rod 30 is screw-threaded at 33 for secure application thereto of a preferably hollow rubber-ball, or bulbous-shaped flush-controlling valve 34 that controls flow communication into the bore 35 of the nipple-connection 11 aforesaid.

The closure cap or base 25, as best understood from Figs. 7 and 8, is conveniently although not essentially formed as a unit to include, in addition to the central boss 32, a substantially surrounding lip 26 with circumferentially spaced holes 27, as aforesaid and for a purpose hereinbefore noted. It also embodies a tangentially-related opposed projection or solid portion 37 having a screw-threaded bore 38 therethrough for attachment of one end of a service conduit 39, Fig. 1, the other end of which is suitably coupled to one leg of the inverted U-shaped portion 16 of the pressure-water service connection 15. The other leg of said U-shaped portion 16 is, preferably, coupled to the service connection 15 below the float-operated ball-cock 18. In addition the tangential projection 37 is provided with a relatively smaller threaded orifice 40 for reception of an adjuster element or screw 41 embodying a lengthwise segmental reduction or reductions 42, the purpose whereof is hereinafter set forth. Still further the closure cap or base 25 is provided with an eccentrically related relief-orifice 43 under control of a combined and overbalanced check-and-relief device, comprehensively designated 44 in Fig. 6. This combined and overbalanced check-and-relief device 44, is preferably of somewhat stirrup-shape and embodies a relatively heavier segmental solid foot-piece 45 with spaced portions 46 including opposed bearing sections 47, and a second segmental portion, or lighter weight head-section 48; said foot-piece 45 serving to seat over the hereinbefore referred to service supply bore 38 when the piston-disc is nearing closure of the flush-controlling valve 34, see Fig. 5. The head-section 48 of the device 44 also includes a lower embossment or circular check-stopper 49 and a concentrically related upper pin-projection 50; the check-stopper 49 serving to seat over and close the relief orifice 43, whereas the pin-projection 50 is pressed down by the piston-disc 28 as it approaches its lowermost level to effect active seating of the check-stopper 49 over said relief orifice 43 in opposition to the heavier foot-piece 45. The projection 50 also serves to assist the

initial elevation of the piston disc 28. The combined check-and-relief device 44 is pivotally mounted to the central boss 32, before described, by aid of pins or screws 51, for example, passed through axially aligned holes 52 in the spaced bearing portions 47 and rigidly engaged in similar socket holes, indicated by the dotted circles 53, in the central boss portion 32 of the closure cap or base 25, see Figs. 3, 4, 5, 7 and 9.

In the modified closure cap or base 25 of Fig. 9 it is to be noted the over-all diameter thereof is increased so that the surrounding flange 26' may be frictionally engaged around the related end of the actuator cylinder 20 and thereby ensure a tighter juncture thereat; while the threaded bore 38, aforesaid, is omitted and an exteriorly male-screw threaded-nipple 54 substituted for connection of the service conduit 39.

In the operation of the device, when the self-closing push-button valve 17 is moved inwardly or opened, the service water under pressure will flow through the inverted U-shaped portion or conduit 16 into the bore 38 against the underside of the heavier portion 45 of the combined check-and-release device 44. Such pressure action will, obviously, raise the heavier portion 45 and cause the device 44 to rock or turn counter-clockwise on the pivot pins 51 and simultaneously lower the lighter end 48 until the check-stopper 49 seats over the relief orifice or discharge passage 43, and when the service water now commencing to fill the actuator cylinder 20 contacts the confronting surface of the piston disc 28, said disc as well as the rod 30 will be forced upwardly toward the angle-section annulus or stop 24, as indicated by the arrow *a* in Fig. 3. Such movement of the parts 28, 30 concurrently lifts or pulls the flush-controlling valve 34 away from engagement in the bowl seat 12. Incidental to lifting the valve 34, the piston disc 28 elevates until it engages or abuts the angle-section annulus or stop 24—see Figs. 5 and 4, respectively. Said valve 34 will remain open until the self-closing push-button valve 17 is released for automatic closure, thereby discontinuing the flow of the pressure service water to the underside of the foot-piece or heavier portion 45 of the device 44, whereupon the said portion 44 will descend clockwise and simultaneously raise the relatively lighter headpiece 48 and pad 49 out of seating contact over the relief discharge orifice 43, whereby the pressure water content of the actuator cylinder 10 will discharge, with concurrent automatic descent of the piston-disc 28, rod 30, and attached flush-controlling valve 34, until the latter impacts the bowl-seat 12. Incidentally it will be clearly apparent that concurrent with the lowering of the parts 28, 30 and 34, emptying of the flush tank takes place until the hollow rubber valve 34 positively engages the seat 12. Such positive engagement of the hollow rubber valve 34 is materially aided by the volume of water entrained therein incidental to entry of the orificed end 55 thereof as it downwardly approaches and enters the bowl-shaped seat 12, by functioning with a suction action; while said positive engagement is furthermore materially aided by mounting the flush valve control device 10 so that sufficient tolerance between the opposing surfaces of the piston-disc 28 and the central boss 32, of the closure base 25, may compensate the elasticity of the hollow rubber valve 34 positively engaged in the valve seat 12. Furthermore, the above described raising and lowering of the piston disc 28, within the actuator cylinder 20, rod 30 and flush-controlling valve

34 is noiselessly and smoothly effected, upon manipulation of the self closing push-button valve 17, and in a hydraulically-cushioned manner whether the operating device 10 be submerged in, or out of, the water contained in the flush tank. Furthermore the flush-controlling valve 34 will directly elevate and correspondingly descend relative to the bowl-seat 12 without any tendency to lateral movement or sticking of the rod 30 due to positive guidance of said rod through the central bore 31 of the closure cap or base 25, aided by similar action of the piston disc 28 within the actuator cylinder 20. Furthermore, it is to be particularly noted that, in addition to provision of the open angle-section annulus 24, and the normal leakage around the piston disc 28, as well as about the rod 30 and the confronting surface of the guide bore 31 therefor, the combined check-and-relief device 44 materially assists rapid descent of the piston disc 28, attached rod 30 and valve 34, by provision of the eccentric outlet orifice 43 for discharge of the pressure water from the cylinder 20, in addition to the normal leakage around the said disc edge and the bore of the said cylinder, as well as about the rod 30 and the confronting surface of the guide bore 31. Still further, the action just explained assists in maintaining the volumetric pressure of the water against the under surface of the piston disc 28, during its lift movement by the effective seating of the pad portion 49, of the combined check-and-relief device 44, over the relief orifice 43 in the closure 25.

In order to make provision for the accommodation of my novel flush valve operating device 10 to different or varying pressure in the service water, I preferably equip the closure cap or base 25 with an adjuster-screw 41, see Figs. 7 and 8 to best advantage, for engagement in the threaded bore 40 of the tangential projection 37. This screw 41 is conveniently provided with opposed flats 42 lengthwise of the shank; and it will be readily understood that, when threaded fully home, no discharge of the volumetric pressure water from below the piston disc 28 takes place, except by way of the valve controlled relief orifice 43. It is also obvious that, for the higher ranges of supply water pressure, such greater pressure under the piston disc 28 holds said disc up against the angle-section annular stop 24, while the greater pressure upon the lighter segmental portion 48 of the check-and-relief valve 44 aids in holding the pad 49 over the relief discharge orifice 43, when the push-button valve 17 is moved inwardly or opened. It is further apparent that when the push-button valve 17 is released and closed, discontinuance of water pressure supply under the heavier segmental section 45, of check-and-relief valve 44, there will be a related reduction of pressure under the piston disc 28 and upon lighter segmental portion 48, when the adjuster screw 41 is variably retracted, with resultant assurance, that said pad 49 of lighter segmental section 48 will become unseated and lifted off the relief discharge orifice 43 by the gravity pull of the opposedly related heavier segmental section 45 of said check-and-relief device 44; whereby the volumetric pressure below the piston-disc 28 is diminished which aids the gravity descent thereof, and thus positively ensures automatic and smooth working of the device 10, under all normal conditions of service.

The manner of mounting and application of my invention to a self-closing flush-valve having been fully disclosed, it will be readily appreciated

that said invention is also applicable to numerous types of flush-valves, other than the one herein selected for illustration and that various changes may be made in the form of the device and its manner of application. Accordingly the foregoing description is not to be considered as limitive, otherwise than the terms of the following claims and the prior art permit.

Having thus described my invention, I claim:

1. A flush-valve operating device comprising an actuator cylinder having one end substantially open, a closure for the opposed end with provision for attachment thereto of a pressure fluid supply conduit; a self-closing valve in said conduit located above the level of the cylinder open end; an apertured boss, forming part of the closure, affording guidance for the rod of a disc-piston movable within the cylinder, and having secured to its free end the flush-controlling valve; a relief orifice in the cylinder closure; and an overbalanced valve, pivotally mounted to the closure boss, normally effective to tilt when the supply of pressure fluid to the actuator cylinder is shut off by the closure of the self-closing valve with simultaneous opening of the relief orifice and, contrariwise, automatically closing the relief orifice when the self-closing valve is moved to initiate the flushing operation.

2. The invention of claim 1, wherein the actuator cylinder closure further includes a screw-threaded hole; wherein a correspondingly threaded adjuster-screw is engaged in said hole with capacity to close said hole; and wherein the shank of said screw is provided with diametrically opposed lengthwise flats, whereby provision is made for variably reducing the pressure below the piston disc to ensure smooth working thereof, in the actuator cylinder.

3. The invention of claim 1, wherein the actuator cylinder includes a relatively lateral flange portion which projects inwardly of the cylinder bore to define a stop limiting movement of the disc-piston toward said cylinder open end.

4. The invention of claim 1, wherein the closure for the one end of the actuator cylinder embodies a surrounding lip for engagement and fixture within the cylinder end; wherein said closure includes a concentric axially-bored boss affording guidance for the disc piston-rod; and wherein said closure also includes diametrically opposed borings, one of which serves for attachment of a pressure water connection while the other serves as a relief orifice under automatic control of the overbalanced valve, for the purpose specified.

5. The invention of claim 1, wherein the pressure fluid supply conduit includes an inverted U-shaped portion; wherein the self-closing valve is of the push-button type; and wherein the U-shaped portion is of a size for location of said push-button valve above the upper level of the actuator cylinder.

6. The invention of claim 1, wherein the actuator cylinder is conveniently mounted to the flush-tank overflow by aid of a clamp device including major and minor split loops; and wherein the major loop is rigidly applied to the actuator cylinder, and the minor loop is correspondingly attached to the overflow aforesaid.

7. The invention of claim 1, wherein the end closure is provided with a circumferential lip for insertion into the related end of the actuator cylinder; and wherein said closure is secured in place by stud-screws passed through circumfer-

entially spaced holes and engaged in the lip aforesaid.

8. The invention of claim 1, wherein the end closure is provided with a surrounding flange for socket reception of the related end of the actuator cylinder; and wherein securing means attach said flange exteriorly to the cylinder end aforesaid.

9. A flush valve operating device comprising a container for liquid, a closure for the bottom of said container, said closure having a relief opening therein, piston means reciprocable in said container toward and away from said closure, said container having a vent above said piston means, a rigid pull member attached to said piston means and extending through said closure, a flush valve secured to said pull member outside said container and reciprocable in response to the reciprocation of said piston means, liquid supply means for conducting liquid under pressure into said chamber between said closure and said piston means, and a rocker valve mounted adjacent to said closure with capacity for rocking movement toward and away from the relief opening in said closure, said rocker valve including an overbalancing element normally tending to rock said valve by gravity action to open said relief opening and thereby discharge liquid from said container, and said overbalancing element also being responsive to the inflow of liquid to rock said valve and urge it to close said relief opening, whereby the incoming liquid is confined in said container and forces said piston away from said closure and thereby operates said flush valve.

10. A flush valve operating device comprising an actuator container having a vent therein, a closure for said container spaced below said vent, means whereby a pressure fluid supply conduit may be attached to said container, an apertured guide sleeve through said closure, a piston reciprocable up and down in said container, a piston rod attached to said piston and reciprocable through said guide sleeve, stop means for limiting the movement of said piston upwardly, a flush-controlling valve secured to said piston below said container, a relief orifice spaced below said vent in said container, and an overbalanced rocker valve pivotally mounted within the container, said overbalanced rocker valve being effective to tilt and open the relief orifice when the piston is above said relief orifice and the fluid in said supply conduit is cut off, and said overbalanced valve automatically closing the relief orifice when the fluid is flowing through said supply conduit into said container.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,553,940	Kangieser	Sept. 15, 1925
1,997,401	Barce	Apr. 9, 1935
2,234,774	Owens	Mar. 11, 1941
2,341,116	Owens	Feb. 8, 1944
2,534,524	Molloy	Dec. 19, 1950