July 13, 1948. H. F. SMITH 2,444,959

FLUSH VALVE MECHANISM FOR TANKS

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Fig. 1

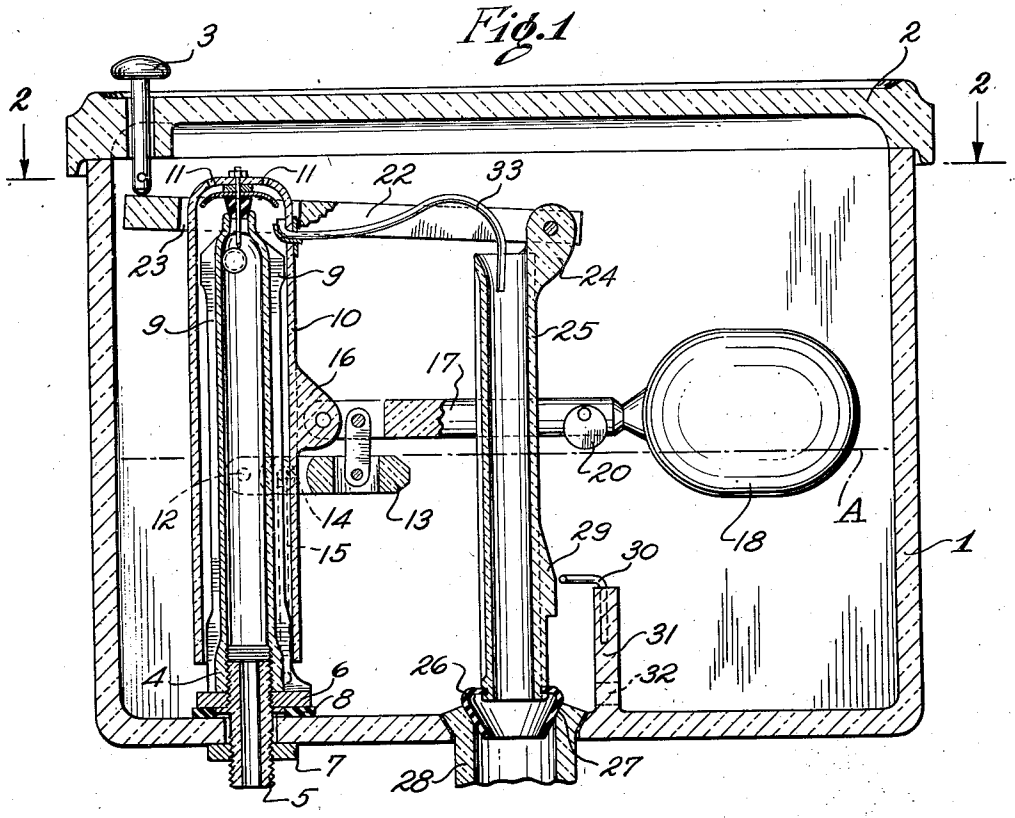
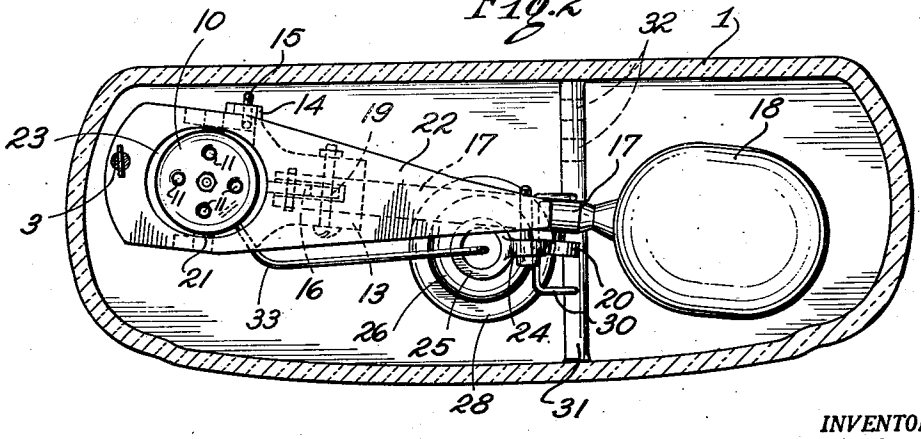


Fig. 2



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Fig. 3

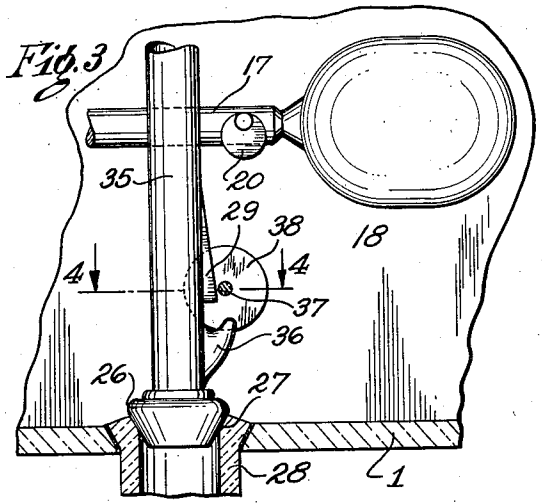
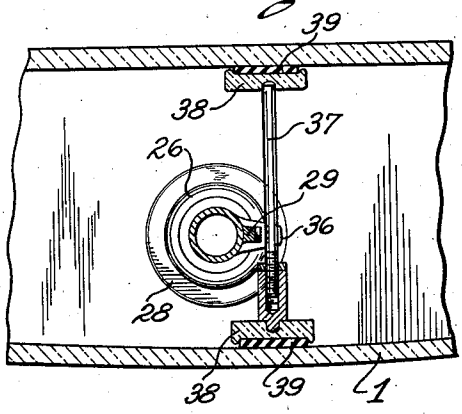


Fig. 4



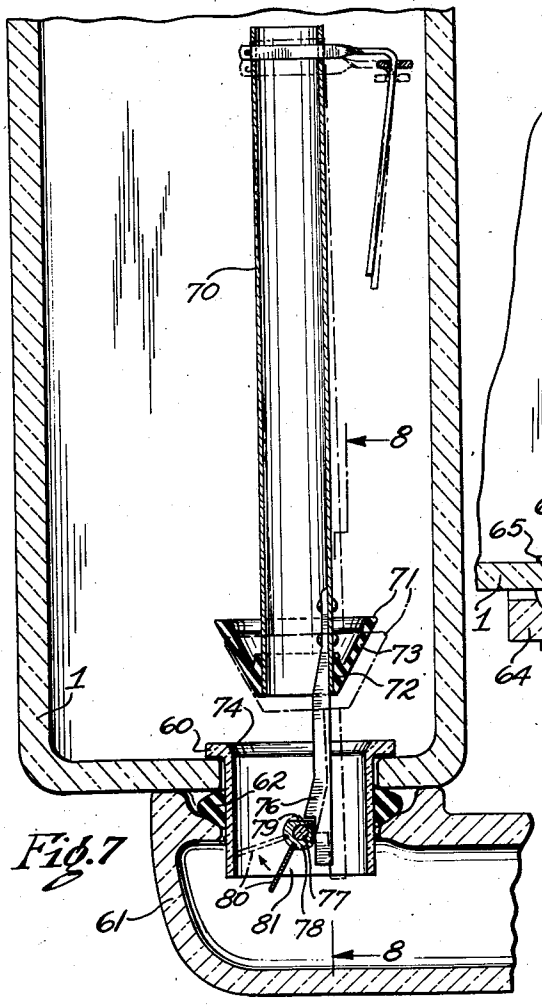


Fig. 7

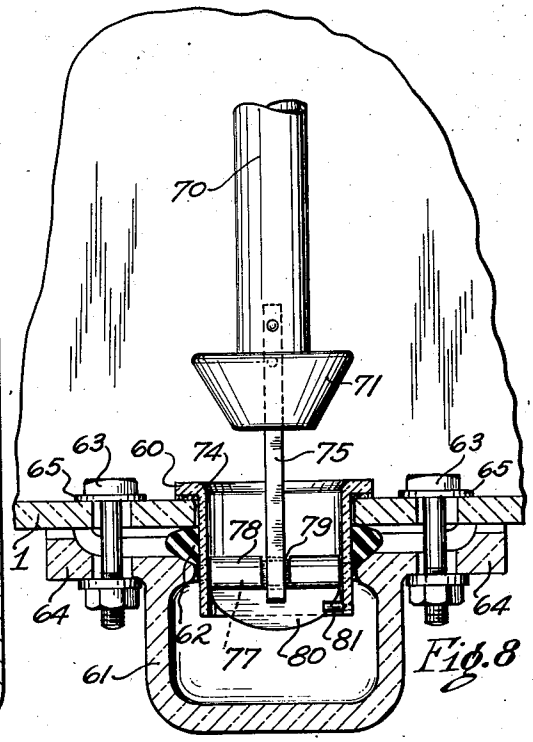


Fig. 8

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FLUSH VALVE MECHANISM FOR TANKS

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Fig. 6

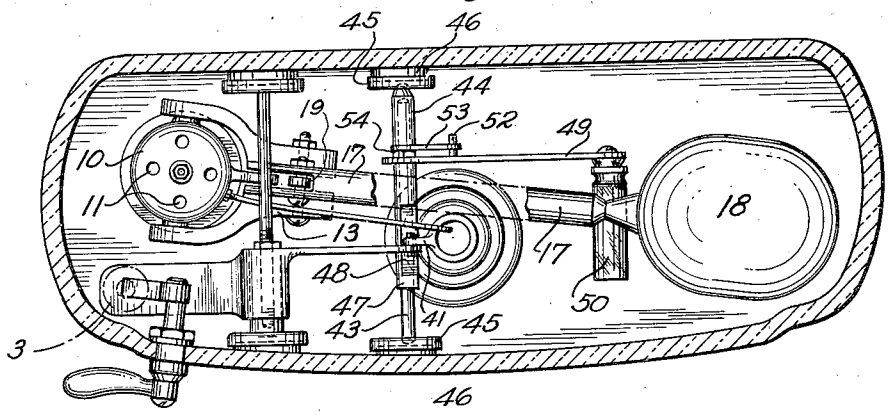
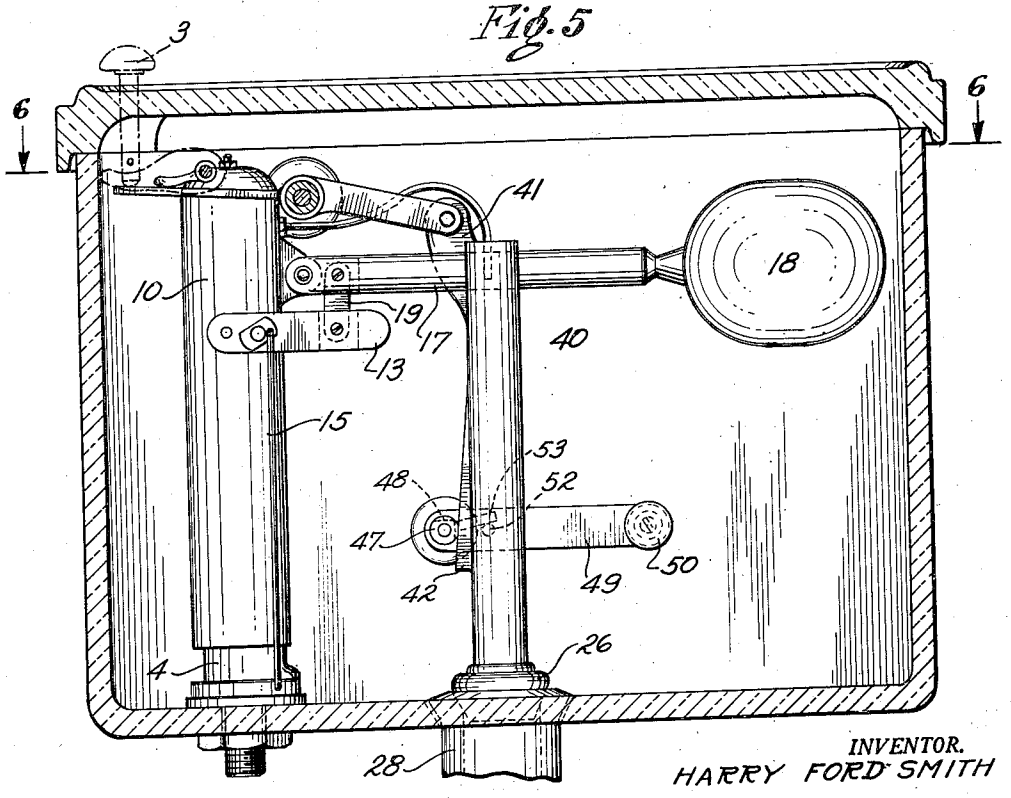


Fig. 5



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FLUSH VALVE MECHANISM FOR TANKS

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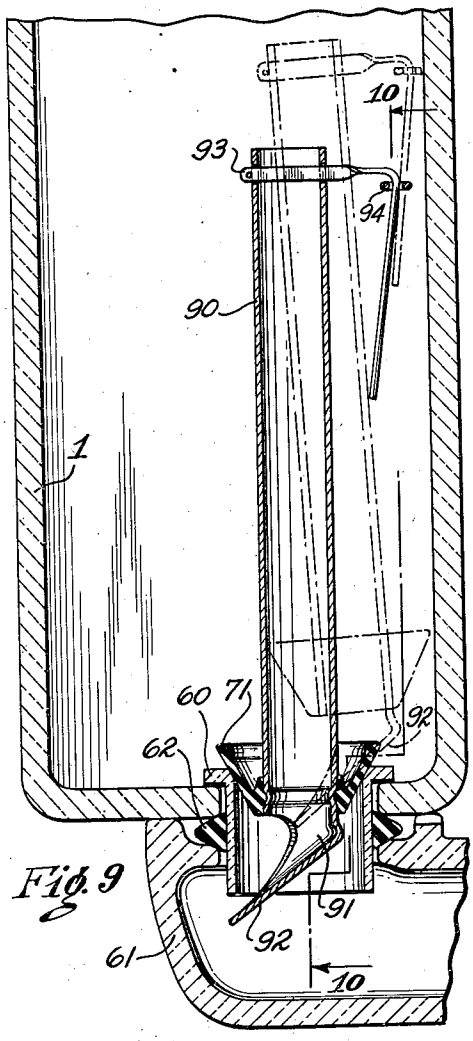


Fig. 9

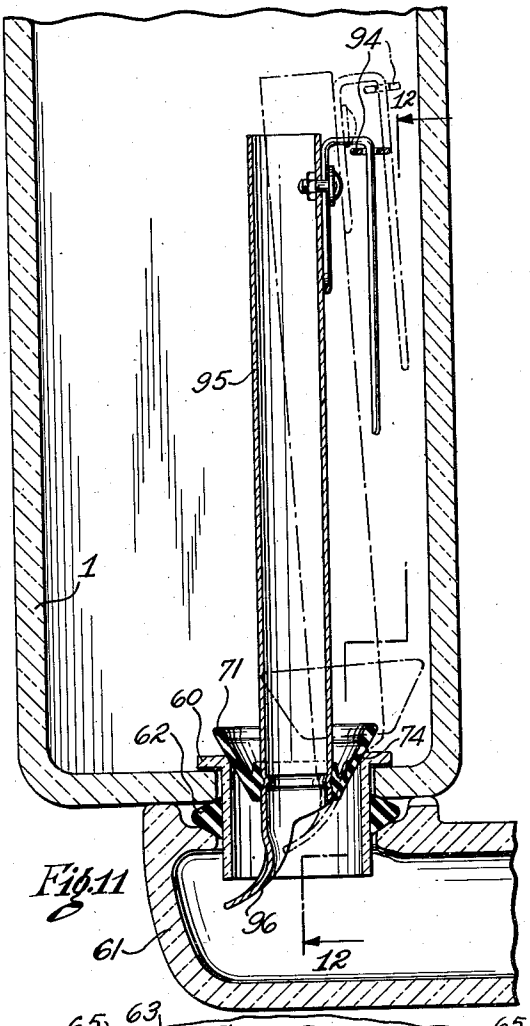


Fig. 11

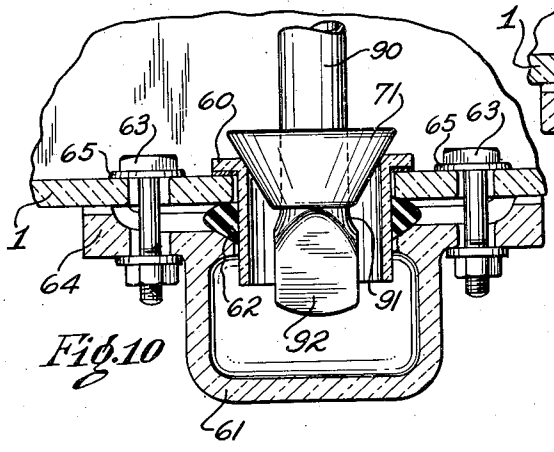


Fig. 10

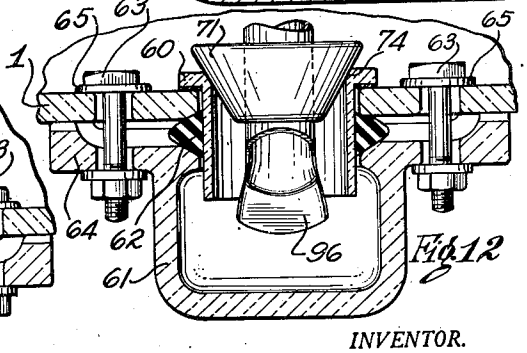


Fig. 12

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2,444,959

UNITED STATES PATENT OFFICE

2,444,959

FLUSH VALVE MECHANISM FOR TANKS

Harry Ford Smith, Lexington, Ohio, assignor to Mansfield Sanitary Pottery, Inc., Perrysville, Ohio, a corporation of Ohio

Application March 31, 1944, Serial No. 528,907

19 Claims. (Cl. 4—53)

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This invention relates generally to toilet flush tanks and more particularly to flush valves and associated parts for use with such tanks.

The present invention has as its main objects the provision of simplified flush valve and flush valve actuating mechanism which is capable of being easily and simply removed from or placed in a flush tank, and the provision of improved liquid sealing means for a spud type tank.

These objects are realized by the present invention. Certain embodiments of the invention realize these objects by the use of a detent for the overflow pipe and means for dislodging the pipe from engagement with the detent, while other embodiments of the invention disclosed herein rely on the volume or rate of flow of liquid out of the tank for retaining the overflow pipe in valve-open position. All embodiments of the flush valve invention herein illustrated include a vertically liftable, laterally swingable, overflow pipe.

In the drawing accompanying and forming a part of this specification,

Figure 1 is a vertical, sectional view showing a toilet flush tank equipped with one embodiment of the present invention;

Figure 2 is a horizontal, sectional view taken on line 2—2 of Fig. 1;

Figure 3 is a fragmentary, side elevational view of a modified form of overflow pipe and its latching and unlatching mechanism;

Figure 4 is a horizontal sectional view taken on line 4—4 of Fig. 3;

Figure 5 is a fragmentary, side elevational view, partly in section, of another embodiment of the present invention;

Figure 6 is a horizontal, sectional view taken on line 6—6 of Fig. 5;

Figure 7 is a fragmentary, elevational view, partly in section, of another embodiment of the present invention;

Figure 8 is an elevational view, partly in section, taken on line 8—8 of Fig. 7;

Figure 9 is a fragmentary, side elevational view, partly in section, showing another embodiment of the present invention;

Figure 10 is an elevational view, partly in section, taken on line 10—10 of Fig. 9;

Figures 11 and 12 are similar, respectively, to Figs. 9 and 10 but showing a modified form of liquid deflector on the overflow pipe.

The embodiment of the present invention which is shown in Figs. 1 and 2 comprises the inlet tank 1 and removable cover 2 carrying a flushing plunger 3.

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An inlet pipe 4 is connected thru the bottom of the tank to a source of water under pressure. This pipe, as shown, has screw-threaded engagement with a spud 5 which extends thru the tank bottom. Leakage of water out of the tank around the spud is prevented by nuts 6 and 7 which have screw-threaded engagement with the spud and which serve to compress a gasket 8 between the tank and nut 6. The inlet pipe 4 is cylindrical, has exterior ribs 9 to serve as positioning guides for hush pipe 10 which is telescoped over inlet pipe 4 and has a top end which is closed, except for air inlet openings 11.

On its opposite exterior sides hush pipe 10 has outwardly extending, diametrically opposed, trunnions 12 to which is pivoted the bifurcated end of a lever 13. This lever carries an adjustable cam 14 from which a rod 15 extends downwardly and at its lower end is provided with a laterally extending portion which seats in a recess in the lower part of the inlet pipe 4. The hush pipe 10 also has an integral ear 16 to which is pivoted a float lever 17 at the free end of which a float ball 18 is attached. Levers 13 and 17 are pivotally connected together by link 19. Float lever 17 carries a cam 20 near the float 18 for a purpose presently to be described.

Near the upper end of hush pipe 10, diametrically opposite trunnions 21 extend outwardly and form pivots for the flush valve actuating lever 22. This lever has an opening 23 which is of sufficiently large diameter to receive hush pipe 10 and to have limited pivot movement about trunnions 21 without interference from the hush pipe. This lever 22 is engageable with the flushing plunger 3 for pivoting action about trunnions 21. At its opposite end lever 22 is pivoted to an ear 24 which is integral with overflow pipe 25. Overflow pipe 25 is hollow, is provided with a flush valve 26 in the form of a hollow resilient member having downwardly converging conical surfaces to engage a seat 27 on a tubular spud 28 which extends thru the bottom of the tank and defines a passage for liquid to flow from the tank. The overflow pipe 25 has a detent 29 near its lower end which is engageable with a detent support 30 carried by a weir 31 which extends across the interior of the tank and for a short distance along the bottom wall thereof and is provided with one or more holes 32.

A refill pipe 33 leads from the upper end of hush pipe 10 into the top of overflow pipe 25.

The apparatus of Figs. 1 and 2 operates substantially as follows: Assuming that there is liquid in the tank to the level indicated by line A and

the parts are in the position shown which they occupy just prior to the operation of flushing the tank, when the flushing plunger 3 is pushed downwardly it engages lever 22 and pivots it about trunnions 21. As lever 22 is thus pivoted, it lifts overflow or flush pipe 25 vertically and that pipe swings laterally due to the fact that the pivotal connection between lever 22 and ear 24 is eccentric to the center of gravity of the pipe 25. This lifting and swinging action brings detent 29 over detent support 30. When the pressure is released from plunger 3 the overflow pipe 25 descends under the influence of gravity until the detent 29 engages support 30. The pipe is maintained in that position while the liquid flows out thru spud 28.

As the liquid flows out of the tank, float ball 18 follows it down, thereby pivoting lever 17 about its pivotal connection to ear 16 of hush pipe 10 and forcing link 19 downwardly and thereby pivoting lever 13 about its connection to rod 15. The downward pressure exerted by link 19 on lever 13 is resisted by rod 15 and lever 13 is pivoted about its connection to that rod with resultant lifting of hush pipe 10 and opening of the inlet valve at the upper end of inlet pipe 4, thereby permitting water under pressure to flow out of the inlet pipe and downwardly in the space between inlet pipe 4 and hush pipe 10. While the construction of the inlet valve is shown in Figs. 1 and 2, its operation is not set out in more detail herein for that apparatus and its operation is more completely described and is claimed in my copending application Ser. No. 492,845 filed June 30, 1943, of which this application is a continuation-in-part.

When the water level in tank 1 falls to a level below top of weir 31, the rate of downward movement of float ball 18 is decreased because the water under the float ball and back of weir 31 flows out thru holes 32. In the mean time, the water on the other side of the weir has been flowing out thru spud 28 at a much more rapid rate. As float ball 18 moves down at its decreased rate of speed, cam 20 engages with detent 29 and, by adjustment of cam 20, overflow pipe 25 may be forced laterally off detent support 30 at about the time substantially all the water on the left-hand side of the weir in Figs. 1 and 2 has flowed out of the tank. When cam 20 dislodges detent 29 from its support 30, overflow pipe 25 drops vertically and flush valve 26 comes to rest on seat 27 on spud 28, thereby preventing further escape of water from the tank.

In Figs. 3 and 4 is shown a tank 1, spud 28, with its seat 27, a float lever 17, float ball 18, and cam 20, all substantially like correspondingly numbered parts in Figs. 1 and 2. It will be understood that the parts not illustrated are similar to corresponding parts of Figs. 1 and 2.

Overflow pipe 35 is like overflow pipe 25 of Figs. 1 and 2 and is provided with a detent 29 and a flush valve 26, as in those figures. It differs from that overflow pipe in that it is provided with a detent seating lug 36. A support for detent 29 comprises a two-part screw-threaded rod 37 which can be lengthened axially and pressed against blocks 38 having flexible facings 39 which can thus be pressed into position- retaining engagement against the inner surface of the tank. This lug 36 is so positioned relative to flush pipe 35 that when the latter is lifted the lug 36 will engage therewith and cause the pipe to swing laterally, thereby bringing detent 29 above support 37 on which the detent will come to rest

when the overflow pipe is permitted to drop after the pressure has been released from the flushing plunger.

The detent 29 is dislodged from its support 36 by cam 20 as the level of liquid in the tank falls due to the flow of water thru the spud 28.

In the apparatus of Figs. 5 and 6 the overflow pipe 40 is substantially like overflow pipe 25 of Figs. 1 and 2, and 35 of Figs. 3 and 4, except that the pivot-engaging-ear 41 and detent 42 are on the side thereof adjacent to the inlet pipe 4. However, the pivot ear 41 is eccentric to the center of gravity of pipe 40 so that when the latter is lifted it will swing laterally toward the inlet pipe. A support for the detent 42 compresses an axially expansible member composed of rod 43 and sleeve 44 which can be pressed against opposed blocks 45 faced with flexible material 46, thereby to press those blocks against the inner surfaces of the tank. A sleeve 47 is rotatably mounted on rod 43 and is provided with a normally horizontal surface 48 which is adapted to be engaged by the lower surfaces of detent 42 when the overflow pipe 40 is lifted and swung as above described. An arm 49 is secured to sleeve 47 and carries a float 50 at its free end. It will be understood that when the overflow pipe has been lifted and swung laterally and its detent 42 rests on the horizontal surface 48 of sleeve 47, the liquid may flow out of the tank while the overflow pipe is held in that actuated position. As the liquid level falls below that shown in Fig. 5 for float 50, that float will follow the level of liquid downwardly. As it does so float arm 49 will rotate sleeve 47, thereby moving surface 48 from the horizontal to an inclined position and when the inclination of that surface has become steep enough, detent 42 will slide off that surface, thereby permitting pipe 40 to fall and bring the flush valve 26 at its lower end into sealing engagement with spud 28. When the flush valve 26 is thus reseated and the level of water rises in the tank, the float 50 is lifted until a stop 52 thereon comes into engagement with an arm 53 which is clamped in adjustable position against sleeve 44 by nut 54.

In Figs. 7 and 8 is shown a modified form of the present invention. In these figures a spud 60 projects thru an opening in the bottom of tank 1 and into an opening in the top of a toilet bowl 61. An annular packing ring of flexible material 62 surrounding spud 60 is pressed into liquid sealing engagement with the outside surface of the spud and with the opposed adjacent surfaces of the tank 1 and bowl 61 when these two members are drawn together as by bolts 63 which extend thru the bottom wall of the tank and thru ears 64 on the bowl. Flexible packing 65 around bolts 63 prevents the escape of liquid thru the bolt holes while deformation of packing ring 62 prevents leakage of water between spud 60 and the tank bottom.

The hollow overflow pipe 70 is provided near its upper end with any suitable means for lifting it vertically and permitting it to be swung laterally, and is provided near its lower end with an overflow valve 71. This valve has an annular portion 72 which may be attached to pipe 70 and an outwardly and upwardly diverging thin wall 73 which has a conical outer surface to engage the seating surface 74 of spud 60. It will be understood that when valve 71 engages surface 74 and the tank is filled with water, the valve will contain water which will press the thin wall

73 into close fitting seating engagement with seat 74.

An extension 75 is attached to pipe 70 near its lower end and projects therebelow into spud 60. This extension has a detent 76 on one side thereof. A support for the detent 76 comprises a rod 77 composed of two parts screw-threaded together for axial expansion to project their ends into opposed retaining sockets in spud 60. A sleeve 78 is rotatably mounted on the rod 77 and has a top surface 79 which is substantially horizontal when the detent 76 engages therewith but which may be moved to such a steeply inclined position that the detent 76 will slide off therefrom. A plate 80 which is substantially semicircular in outline projects from sleeve 78 and is swingable in spud 60 when sleeve 78 rotates. A stop 81 on spud 60 limits the downward movement of plate 80.

When the overflow pipe 70 is lifted so that water flows between valve 71 and seat 74, some of the outgoing water comes into contact with plate 80 and rotates it from its normal position as shown by dotted lines in Fig. 7 to the position shown in full lines in that figure. While the volume or rate of flow of the water which comes into contact with plate 80 is sufficient to offset the weight applied by detent 76 to surface 79 on the opposite side of the center of rotation of rod 77, the plate 80 will be maintained in a downwardly extending position which will keep the horizontal surface 79 at such an angle that it will retain detent 76 thereon. However, when the volume or rate of flow of the outgoing water decreases sufficiently, as will be the case when most of the water has flowed out of the tank, the weight imposed by the detent or surface 79 will be greater than the force of the water applied to plate 80 and will be sufficient to rotate sleeve 78 and dislodge detent 76 therefrom with the result that the overflow pipe will move downwardly and seat valve 71 on spud 60.

In Figs. 9 and 10 the tank 1, spud 60, toilet bowl 61, packing ring 62, bolt 63, ear 64 and packing 65 are all substantially like correspondingly numbered parts shown in Figs. 7 and 8 and described hereinabove. In Figs. 9 and 10 the hollow overflow pipe 90 is provided near its lower end with an overflow valve substantially like valve 71 of Figs. 7 and 8 and is also provided with a deflector 91 which projects downwardly from pipe 90 and across the passage therethru. As shown, this deflector includes a flat part 92 which makes an included angle of about 143° with the longitudinal center line of pipe 90 or, in other words, since pipe 90 is normally vertical, the upper surface of part 92 makes an angle of about 37° with a horizontal. Near the upper end of pipe 90 a rod 93 is adjustably secured and has loose fitting engagement with a flush lever 94 by which pipe 90 may be lifted. Since the point of contact of rod 93 and lever 94 is eccentric to the center of gravity of pipe 90, the latter will swing laterally when lifted by lever 94. This swinging action is depicted by dotted lines in Fig. 9 where deflector 92 is shown in engagement with the upper end of spud 60.

When the flush lever 94 lifts overflow pipe 90 so that water can escape thru spud 60, the outgoing water which engages deflector 91 exerts a force thereon which, while the volume or rate of flow of the water is sufficiently high, maintains the under surface of the deflector in contact with the upper end of the spud. When the volume or rate of flow of water thru the spud

decreases, as is the case when the level of liquid in tank 1 drops below a certain point, the force exerted on deflector 91 will decrease and when it has decreased sufficiently so that it no longer overcomes the force of gravity, the deflector 91 will slide on spud 60 and valve 71 will assume its position in sealing engagement with seating surface 74 of spud 60.

In Figs. 11 and 12 many of the parts of Figs. 7 to 10 are shown with corresponding numerals. The main difference between the apparatus of Figs. 9 and 10 on the one hand and 11 and 12 on the other hand is in the construction of the lower end of overflow pipe and the deflector.

In Figs. 11 and 12 hollow overflow pipe 95 has a deflector 96 extending downwardly and curving laterally from one edge thereof. This deflector extends for slightly less than one-half the circumference of the pipe, the remainder of the lower edge of the pipe sloping upwardly to a high point substantially opposite the midpart of the deflector.

When overflow pipe 95 is lifted vertically, it swings laterally so that its lower sloping end edge will rest on the top surface of spud 60. Since the sloping lower end edge of the pipe makes a large acute included angle with the center line of the pipe, it mainly engages the curving valve seating surface 74 of spud 60 and would not remain in place against the force of gravity unless some force is applied laterally thereto. That force is supplied when there is a sufficient volume or rate of flow of water out of the tank thru spud 60. The out-rushing water which engages deflector 96 exerts a force thereon which is effective to swing the overflow pipe laterally and bring its lower end edge into seating engagement on spud 60, and to retain it there until the volume or rate of flow of water thru the spud is reduced to such an extent that the force delivered to the deflector is not sufficient to overcome the force of gravity, whereupon the overflow pipe slides off spud 60 and returns valve 71 to seating engagement with the spud.

Having thus described the invention so that others skilled in the art may be able to understand and practice the same, I state that what I desire to secure by Letters Patent is defined in what is claimed.

What is claimed is:

1. In a flush tank having an outlet opening, a flush valve for closing said opening, an overflow pipe having an open upper end and said valve being positioned thereon near its lower end, pipe suspending means connected to the upper portion of said pipe to lift it vertically to open the valve and to permit its lower end to swing freely laterally in one direction in a predetermined plane to an extent sufficient to move said valve into final open position, and means connected to said pipe by which said valve is held in open position.

2. In a flush tank having an outlet opening, a flush valve for closing said opening, an overflow pipe having an open upper end and said valve being positioned thereon near its lower end, pipe suspending means connected to the upper portion of said pipe to lift it vertically to open the valve and to permit its lower end to swing freely and laterally in one direction in a predetermined plane to an extent sufficient to move said valve into final open position, and means to retain said pipe in valve open position.

3. In a flush tank having an outlet opening, a flush valve for closing said opening, an overflow pipe having an open upper end and said valve

positioned thereon near its lower end, pipe suspending means connected to the upper end of said pipe to lift it vertically to open the valve and to permit its lower end to swing freely and laterally in one direction in a predetermined plane to an extent sufficient to move said valve into final open position, and movable means to retain said pipe in valve open position.

4. In a flush tank having an outlet opening, a flush valve for closing said opening, an overflow pipe having an open upper end and having said valve positioned thereon near its lower end, pipe suspending means connected to the upper portion of said pipe to lift it vertically to open the valve and to permit its lower end to swing freely and laterally in one direction in a predetermined plane to an extent sufficient to move said valve into final open position, movable means to retain said pipe in valve open position, and means connecting said movable means to permit said valve to move into valve closed position.

5. In a flush tank having an outlet opening, a flush valve for closing said opening, a vertical, open-ended, overflow pipe carrying said valve at its lower end, pipe suspending means connected to the upper portion of said pipe, means connected to said suspending means to lift said pipe vertically to open the valve and to permit the valve end to swing freely and laterally in one direction in a predetermined plane to an extent sufficient to move said valve into final open position, and means connected to said pipe by which said valve may be held in open position.

6. In a flush tank having an outlet opening, a flush valve for closing said opening, a vertically liftable and laterally swingable, open-ended, vertical overflow pipe connected at its lower end to said valve, means including an operating arm pivotally connected to the upper portion of said pipe eccentric to its center of gravity to lift said pipe vertically to open the valve and to permit it to swing freely laterally in one direction in a predetermined plane to an extent sufficient to move said valve into final open position, and means to retain said pipe in valve open position.

7. In a flush tank having an outlet opening, a flush valve for closing said opening, an overflow pipe connected to said valve, means near the upper end of said pipe to lift it vertically into valve open position, a detent for said pipe when it is in valve open position, and means for swinging the lower end of the pipe into engagement with said detent, said means including a vane on the pipe which is movable laterally by liquid passing thru said opening.

8. In a flush tank having an outlet opening, a flush valve for closing said opening, a vertically liftable and laterally swingable overflow pipe connected to said valve and having a detent immovably fixed to the exterior, means to actuate said pipe into valve open position, a support positioned to engage said detent when said pipe is lifted and swung laterally, and means to dislodge said detent from said support.

9. In a flush tank having an outlet opening, a flush valve for closing said opening, a vertically liftable and laterally swingable overflow pipe connected to said valve and having a detent immovably fixed to the exterior, means to actuate said pipe into valve open position, a support positioned to engage said detent when said pipe is lifted and swung laterally, means on the pipe to engage with said support as the pipe is lifted to limit the vertical movement of the pipe and positively to swing the pipe laterally and cause the detent to engage the support, and means to dislodge said detent from said support.

10. In a flush tank having an outlet opening, a flush valve for closing said opening, a vertically liftable and laterally swingable overflow pipe connected to said valve and having a detent immovably fixed to the exterior thereof, a support positioned to engage said detent when said pipe is lifted and swung laterally, and means to rotate the detent engaging portion of said support to dislodge said detent therefrom, means to actuate said pipe into valve open position, and means to retain said pipe in valve open position.

11. In a flush tank having an outlet opening, a flush valve for closing said opening, a vertically liftable and laterally swingable overflow pipe connected to said valve, means to lift and swing said pipe into valve open position, means to retain said pipe in valve open position, and means including a float lever to disengage said pipe from said last named means.

12. In a flush tank having an outlet opening, a flush valve for closing said opening, manually operated means to open said valve by lifting it vertically and permitting it to swing laterally, and means actuated by the flow of liquid thru said opening to maintain said valve in laterally displaced position while said flow of liquid exceeds a predetermined rate.

13. In a flush tank having an outlet opening, a flush valve for closing said opening, an overflow pipe connected to said valve, means near the upper end of the pipe to lift it vertically and to permit its lower end to swing laterally into valve open position, and means controlled by the volume of liquid flow thru said outlet for retaining the pipe in valve laterally displaced position.

14. In a flush tank having an outlet opening, a flush valve for closing said opening, an overflow pipe connected to said valve, means near the upper end of the pipe to lift it vertically and to permit it to swing laterally into valve open position, and fluid controlled means for retaining said pipe in valve laterally displaced position, said means being actuated by more than a predetermined volume of flow of liquid thru said opening.

15. An overflow pipe for a tiolet flush tank comprising a hollow tube having a laterally inclined vane immovably connected thereto at its lower end.

16. An overflow pipe for a toilet flush tank comprising a hollow tube having a laterally inclined vane immovably attached to and projecting from the lower edge of the pipe.

17. An overflow pipe for a toilet flush tank comprising a hollow tube having a laterally inclined vane immovably attached to and projecting from the lower edge of the pipe and adjustable lifting means near the upper end of the tube.

18. A flush valve for a toilet flush tank comprising an overflow pipe having a vane extending downwardly and laterally from part of its lower edge and a valve mounted thereon above said vane, said valve having a tubular portion thru which the pipe extends and a thin skirt portion extending upwardly and outwardly therefrom, said skirt portion being deformable into sealing contact with a valve seat by pressure exerted by liquid within said skirt portion.

19. A flush valve for a toilet flush tank comprising an overflow pipe having a vane extending downwardly and laterally from part of its lower edge and a valve mounted thereon above said

vane, said valve having a tubular portion thru which the pipe extends and a thin skirt portion extending upwardly and outwardly therefrom, said skirt portion being deformable into sealing contact with a valve seat by pressure exerted by liquid within said skirt portion, and adjustable lifting means near the upper end of the tube.

HARRY FORD SMITH.

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