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FLUSH VALVE CONTROL

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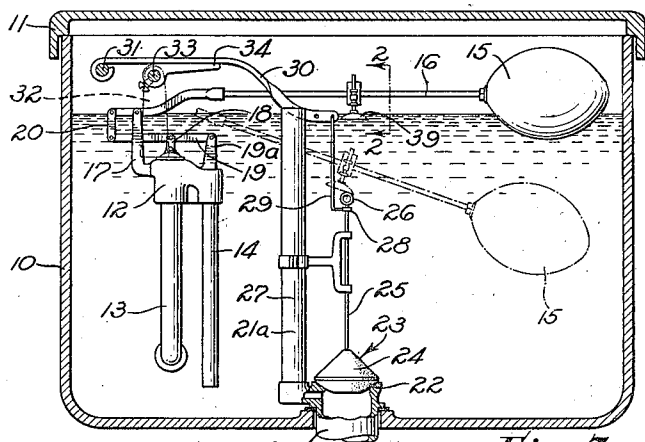


Fig. 1.

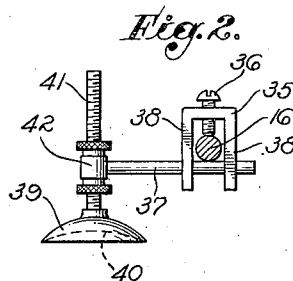


Fig. 2.

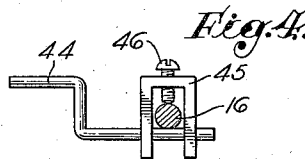


Fig. 4.

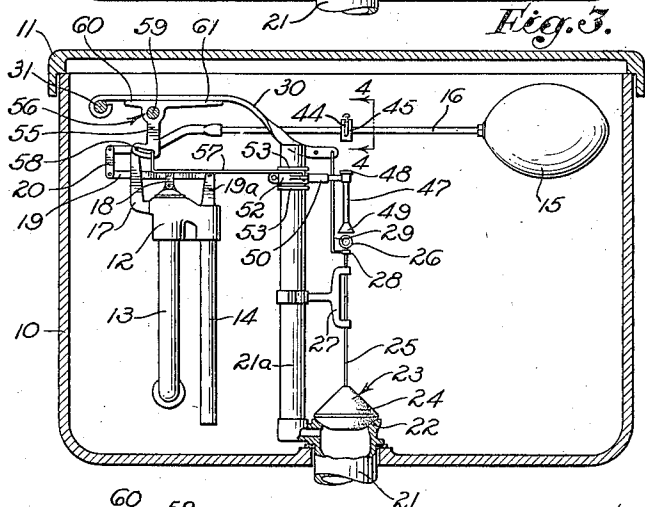


Fig. 3.

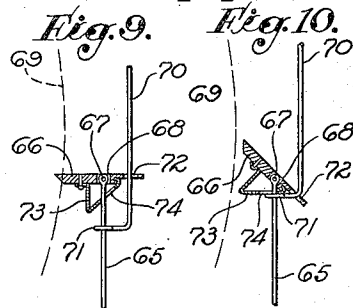


Fig. 9.

Fig. 10.

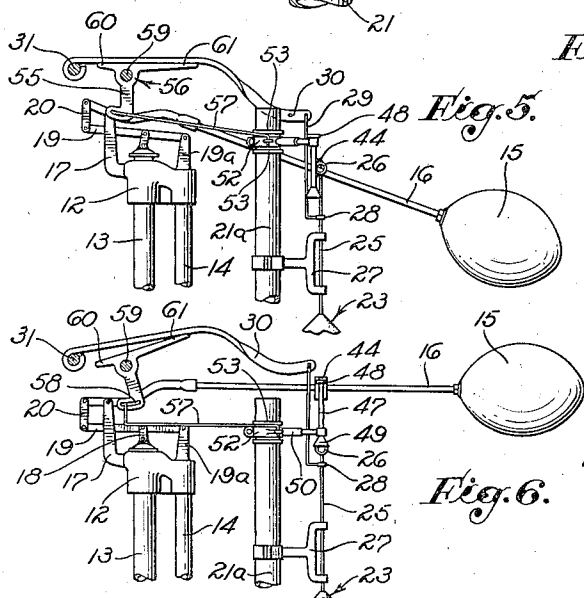


Fig. 5.

Fig. 6.

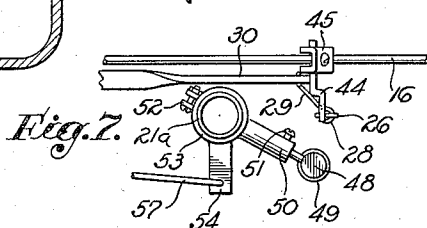


Fig. 7.

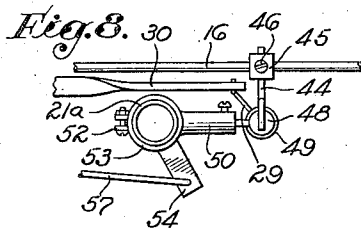


Fig. 8.

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FLUSH VALVE CONTROL

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17 Claims. (Cl. 4—37)

My invention relates to tanks, more particularly to flush tanks for toilets and the like, and is directed to an improved form of valve control for such tanks. While my invention may be adapted to any type of reservoir tank from which fluids are discharged, it is particularly applicable to toilet tanks, and the present disclosure, by way of illustrating the principles involved, will be devoted to a toilet tank construction.

The usual toilet tank has an inlet valve connected to the domestic water line and controlled by a float arranged to cut off the valve when the tank is filled to a predetermined level. The usual outlet valve is buoyant, generally of hollow rubber construction, and is adapted to be held seated in closed position by fluid pressure. An automatic cycle of tank discharge and refill is initiated by manipulating a handle to unseat the valve, whereupon the valve is moved upward by fluid pressure to permit discharge from the tank. When the fluid level lowers sufficiently to drop the valve back into its seat, the tank outlet is cut off and the fluid level rises until the float turns off the inlet valve.

For the purpose of minimizing the number of models required, and of avoiding the necessity for adjustment and servicing after sale, toilet tanks are usually designed for the maximum capacity required for any normal installation, and the valve control mechanism is arbitrarily set at nearly maximum capacity. Toilet bowls vary widely, however, in the volumes required for efficient flushing and not infrequently will operate satisfactorily with substantially less volume of fluid flow than provided by the arbitrary factory adjustment of the valve mechanism.

An important object of my invention is to achieve economies in the water consumption of such toilet tanks by providing means to reduce the volume discharged regardless of the factory adjustment of the flush tank, and, further, to make such means conveniently adjustable.

Another object of my invention is to provide such a volume-reducing means in the form of an accessory that may be sold as a separate article of manufacture adapted for convenient installation in a standard toilet.

It may be observed that the pressure head of fluid discharge from such a tank progressively drops as the fluid level in the tank lowers, so that the effectiveness of the initial flow is greatly superior to the effectiveness of the later flow. It is a further object of my invention to confine the discharge of a toilet tank to the more effective flow under the higher pressure heads.

Economies may be had in the operation of a typical toilet, moreover, by arranging for controlled flexibility in the quantity of fluid discharged. Contemplating such a possibility, I have as another object to provide selective operative means whereby at the choice of the operator the tank may be caused to discharge one of at least two different volumes, and I further propose to achieve such discharge with a smooth and quiet mechanical action.

Broadly described, my invention comprises the combination, with a buoyant outlet valve, of automatic means to move the valve into its seat when the liquid in the tank is at some predetermined level above that seat.

The above and other advantages of my invention will be apparent in my detailed description to follow and in the accompanying drawing.

In the drawing:

Fig. 1 is a vertical section through a toilet tank revealing mechanism incorporating one form of my invention.

Fig. 2 is an enlarged fragmentary view taken as indicated by the line 2—2 of Fig. 1, showing the valve-seating means which is novel in Fig. 1.

Fig. 3 is a view similar to Fig. 1, showing a second form of my invention incorporating a selective control, the parts being in the position that follows a minimum discharge cycle.

Fig. 4 is an enlarged fragmentary view taken as indicated by the line 4—4 of Fig. 3.

Fig. 5 is a side elevation of parts of the mechanism of Fig. 3 taken during the discharge stage of a maximum discharge cycle.

Fig. 6 is a view similar to Fig. 5 with the parts positioned just after the initiation of a minimum discharge cycle.

Fig. 7 is a partial plan view showing parts of the mechanism of Fig. 5.

Fig. 8 is a similar view of the same mechanism shown in the positions of Fig. 6.

Fig. 9 is an enlarged vertical section showing the construction of a selective control that may be incorporated in a third form of my invention, the control being in effective position to produce a minimum discharge.

Fig. 10 is a similar view showing the control in an ineffective position to permit a maximum discharge of the tank.

Figs. 1 and 3 show a typical tank 10 having the usual cover 11. An inlet valve 12 controls a water supply pipe 13 and discharges water through a nipple 14 that is downwardly disposed in the usual manner for silent filling of the tank. The inlet valve 12 is controlled in the

usual manner by a hollow metal float 15 mounted on the end of a float arm 16 that is pivotally mounted near its end in a bracket 17 extending upward from the valve 12. The operative connections between the float arm 16 and the valve 12 include a link 18 connected to the valve, and a lever 19 that is connected at an intermediate point to the link 18 and is connected at one end to the float arm 16 by means of a second link 20, the lever being pivoted at its other end to a bracket 19a extending upward from the valve 12. At the position of the float 15, shown by full lines in Fig. 1, the valve 12 is closed, the valve opening as the float drops from that position.

The usual tank discharge pipe 21 communicates with both a discharge valve seat 22 and the usual vertical overflow pipe 21a. The well-known prevailing type of buoyant outlet valve 23, normally resting in the valve seat 22, has a hollow rubber valve member 24 open at the bottom, and a vertically disposed stem 25. The valve stem 25 has a ring 26, or other enlargement, at its upper end and is slidably mounted in a bracket arm 27 that is mounted in turn on the overflow pipe 21a. Slidably embracing the valve stem 25 is a loop 28 formed in a wire 29 that pivotally depends from the end of a valve-trip arm 30, the arm being pivotally mounted on a suitable pin 31. This valve-trip arm 30 is manually operated from the exterior of the tank. For instance, a manually operable toilet handle 32 on the outside of the tank may be fixed to a suitable rock shaft 33 extending through the tank wall and carrying on the inside of the tank a cam means, such as a rocker arm 34, positioned to lift the valve-trip arm 30.

When the handle 32 is rotated counter-clockwise, the ring 28 engaging the ring 26 lifts the outlet valve 23 from its seat, and the unseated valve, by virtue of its buoyancy, moves upward, guided by the bracket arm 27. In the normal action of prior art toilet tanks, the valve 23 will remain elevated until dropped back into its seat by the receding water level when the tank is substantially empty. Once the valve is seated, water pressure is effective only against its upper surface and the water level rises until the float 15 turns off the inlet valve 12, thereby completing a normal automatic discharge cycle.

The parts of the mechanism described to this point are typical of a large proportion of the present toilet tanks and are recognized as old in the art.

The part of the combination shown in the drawing that is contributed by the present form of my invention comprises means to operatively associate the float valve 15 with the outlet valve 23 for the purpose of seating the valve prematurely with respect to the usual discharge cycle. In other words, it is contemplated that the outlet valve will be automatically forced into its seat at a predetermined fluid level substantially above the level of the valve seat 22.

This means, in the form depicted by Figs. 1 and 2, may be a simple accessory attachable to the float arm 16. A suitable saddle 35 fits over the float arm 16, and the float arm is engaged between a set-screw 36 in the saddle and a horizontally disposed arm 37 that fits through suitable apertures in the legs 38 of the saddle. At the outer end of the horizontal arm 37 is an engagement member 39 having, by preference, a cup-shaped lower face 40. The engagement member 40 may be adjustably mounted on the

arm 37 by a stem 41 in threaded engagement with a sleeve 42 on the end of the arm. It will be apparent that the position of the engagement member 40 may be widely adjusted by virtue of its screw-threaded relation to the arm 37 and the slidable relation of the arm 37 to the float arm 16.

The discharge cycle of a toilet tank incorporating my accessory is initiated in the usual manner by manually rotating the handle 32 to unseat the outlet valve 23. By virtue of its buoyancy the outlet valve remains elevated until the engagement member 39 is moved downward by the descending float 15 and makes contact with the upper end of the valve stem 25. The combined weight of the float 15 and the float arm 16 is sufficient to overcome the buoyancy of the valve 23, and consequently as the water level in the tank drops, the superimposed weight forces the valve 23 into its seat. By this action the water discharge is curtailed, for example, when the water in the tank drops to the level corresponding to the position of the float 15 in the dotted position of Fig. 1. Once the valve 23 is seated, it remains seated, since water pressure cannot be effective against its lower surface. The valve 23 remains seated as the float 15 carried upward by the rising water level finally cuts off the valve 12 to complete the discharge cycle of the tank.

It will be noted that the extent to which the water level drops during this discharge cycle is determined by the adjustment of the engagement member 39 relative to the float arm 16, and that the average pressure head of discharge during the cycle is higher than the average pressure head of discharge without the use of my invention. The float 15 in the new combination has the dual function of both controlling the inlet valve 12 and closing the outlet valve 23 against liquid pressure.

A second and somewhat more elaborate form of my invention is illustrated in Figs. 3 to 8. In the figures in the drawing of this second embodiment, the valve assembly including the fluid control and the major portion of the outlet valve assembly including the overflow pipe and the buoyant outlet valve are the same as described above, corresponding parts being given corresponding numbers. The description of the mechanism will be confined to the novel portions thereof.

The means associated with the fluid arm 16 for closing the outlet valve 23 may be of the construction shown in Fig. 2, but as indicated in Fig. 4 may consist of simply an offset finger 44 secured to the float arm 16 by a suitable saddle 45 and a set-screw 46. As the float arm 16 drops downward, this finger 44 is positioned to move into contact with a plunger 47, which plunger may be broadly termed an operative connection or connection member, since it serves to transmit forces from the finger to the valve stem 25.

The plunger 47 has a flanged head 48 and an expanded lower end 49 which, by preference, has a concave lower face to engage the ring 26 of the valve stem 25. The plunger 47 is slidably mounted in the end of an arm 50 that is adjustably secured by a set-screw 51 in a tubular radial extension of a collar 52. The collar 52 rotatably embraces the overflow pipe 21a between two fixed rings 53 that are clamped to the pipe. The collar 52 has a second radial extension or arm 54 that is operatively connected to an arm 55 of a valve-trip cam 56, the operative connection being a bent wire 57 pivotally engaging the arm 54

by one of its ends and at its other end slidably engaging an arcuate slot 58 in the arm 55.

The cam 56 is mounted on a cam shaft 59 that is controlled from the exterior of the tank by a suitable toilet handle, not shown, identical with the toilet handle 32 above. The cam has two cam arms, a shorter arm 60 disposed toward the pivot of the float arm 16, and a longer arm 61 disposed toward the outer end of the float arm 16, the cam arms being so proportioned that the same degree of angular movement of the control handle in either direction will have approximately the same lifting effect on the valve-trip arm 30 to unseat the valve 23. The slot 58 in the arm 55 is of an approximate length corresponding to such rotation.

The wire 57 and the collar 52 are so constructed and arranged that when the wire engages the right end of the slot 58, the cam 56 being in its normal position, the plunger 47 is in effective registry with the valve stem 25, as indicated in Fig. 3, so that the lowering of the float arm 16 moves the finger 44 against the plunger and thereby causes the valve 23 to be seated; and, on the other hand, when the wire is positioned at the left end of the slot 58, as indicated by Fig. 5, the collar 52 is rotated sufficiently to carry the plunger 47 out of effective registry with the valve stem 25 and out of the path of the finger 44, so that the float 15 is permitted to drop undeterred to the bottom of the tank for a full discharge cycle.

Considering the cam 56 in the position indicated by Fig. 3, it is apparent that the cam may be rotated in a counter-clockwise direction to unseat the valve 23 without interference from the wire 57 in the slot 58, the plunger 47 being in registry with the valve stem 25 throughout the counter-clockwise movement of the cam 56. If, however, starting with the parts in the position indicated in Fig. 3, the cam 56 is rotated clockwise sufficiently to unseat the valve 23, the wire 57 is pulled over to such an extent that the plunger 47 is moved to its ineffective position, and the wire will be at the left end of the slot 58 when the cam 56 returns to its normal position, as indicated by Fig. 5.

Considering the mechanism disposed as indicated by Fig. 5, it is apparent that the cam 56 may be moved clockwise to unseat the valve 23 without interference from the wire, but that counter-clockwise movement of the cam sufficient to unseat the valve returns the wire to the position indicated by Fig. 3, thereby moving the plunger 47 into effective position in registry with the valve stem 25 and in the path of the finger 44.

It is apparent that by virtue of the arrangement set forth, regardless of the position of the wire 57 and the plunger 47 at the beginning of rotation of the cam 56 from its normal position, counter-clockwise movement of the toilet handle to initiate a discharge cycle ends with the plunger 47 in the effective position to provide a discharge cycle of minimum or reduced volume and, on the other hand, clockwise rotation of the cam 56 to initiate a discharge cycle ends with the plunger 47 displaced from its effective position, thereby permitting a discharge cycle of full volume, the tank then functioning exactly as if my invention were not incorporated therein.

When counter-clockwise movement of the toilet handle unseats the valve 23 to initiate a discharge cycle of reduced volume, the valve 23 by virtue of its buoyancy pushes upward, the stem

25 engaging the lower end 49 of the plunger 47 and moving the plunger upward to meet the descending finger 47, the parts then being disposed as shown in Fig. 6. Since the buoyancy of the valve 23 causes operative contact to be established between the valve stem 25 and the plunger 47 and between the plunger 47 and the finger 44, the subsequent mechanical action of the toilet is smooth and silent without noticeable impact between cooperating parts. As the float 15 descends, the finger 44, acting through the plunger 47 in a progressive but positive manner, depresses the valve 23 into its seat, thereby cutting off the water discharge and causing the float 15 thereafter to move upward with the rising water level until the valve 12 is closed.

It is apparent that the essential difference between the two embodiments resides in the fact that in the second form of my invention I provide selective means whereby the discharge of the toilet tank may either approximate the maximum volume of the tank or a predetermined fraction thereof at the choice of the operator.

The construction of a third form of my invention providing selective action similar to that of the second form just described, may be readily understood by considering Figs. 9 and 10 together with Fig. 1.

In this form of the invention the buoyant outlet valve 23 is constructed as heretofore described, but instead of a ring at the end of its valve stem 65 there is a control plate 66 hinged to the upper end of the valve stem by a suitable pin 67, the pin extending across a suitable slot 68 in the control plate. The dimensions and disposition of the control plate are such that when the control plate is in the horizontal position indicated by Fig. 9 it intercepts the arcuate path of the engagement member 40 on the float arm 16; this arcuate path being indicated by the broken line 69, and when the control plate is suitably tilted, it clears the path of the control member, as indicated by Fig. 10. A suitable wire 70 similar to the wire 29, previously described, has the same function as the wire 29 in operatively connecting the valve stem 65 with the valve-trip arm 30, the wire having a loop 71 slidable upon the valve stem for the purpose of unseating the valve 23. The control plate 66 has a second slot 72 receiving the wire 70 with sufficient clearance to permit the required tilting of the control plate.

The control plate 66 is adapted for manually-actuated movement by the wire 70 against gravity from its normal effective position of Fig. 9 to its ineffective position of Fig. 10. The required relationship may be achieved, for example, by providing an inclined cam member 73 on the bottom of the control plate 66, the cam member shown in the drawing being a simple strap bent to the proper configuration and having a suitable slot 74 to receive the valve stem 65 with sufficient clearance to permit the required tilting of the control plate 66.

In the normal disposition of these parts between flushing operations of the tank, the loop 71 is below and out of contact with the cam 73, permitting the control plate 66 to rest substantially horizontally in the position effective to intercept the arcuate path 69 of the engagement member 40, as indicated in Fig. 9. When the control handle 32 of the toilet is manipulated for initiation of a flushing cycle, the loop 71 moves upward against the cam 73, thereby serving not only to unseat the valve 23 but also to