

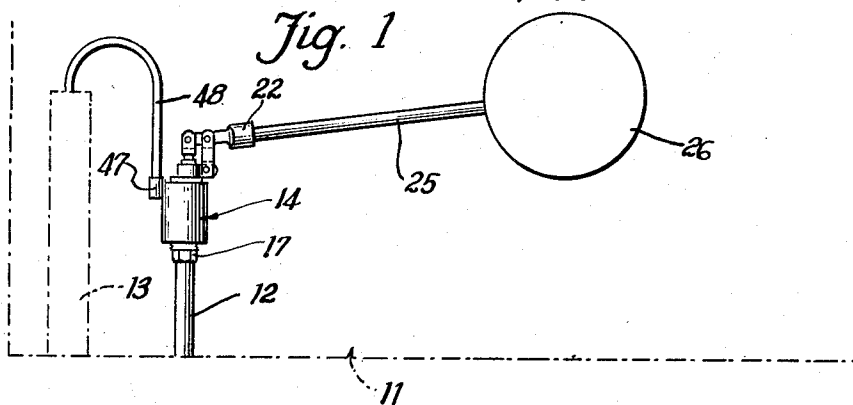
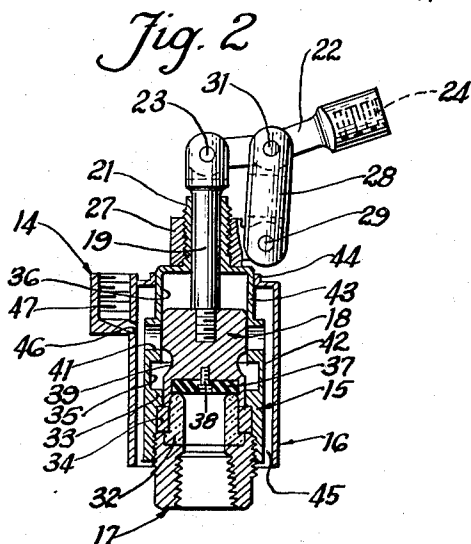
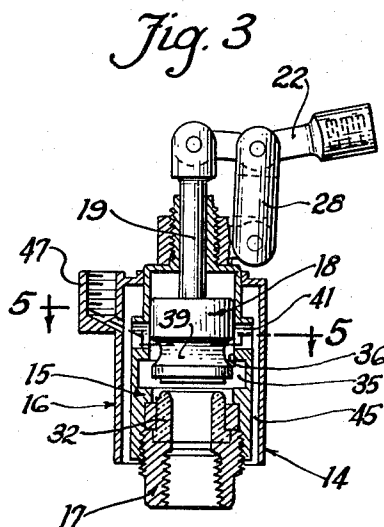
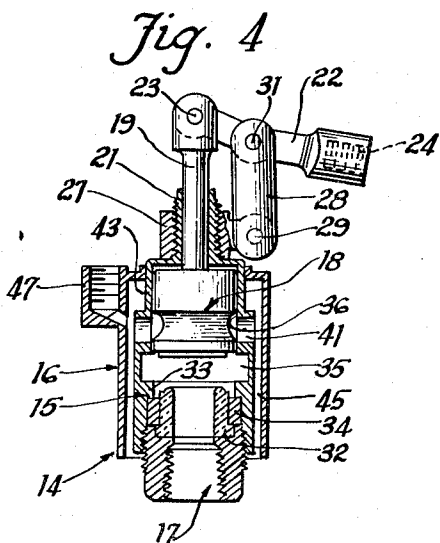
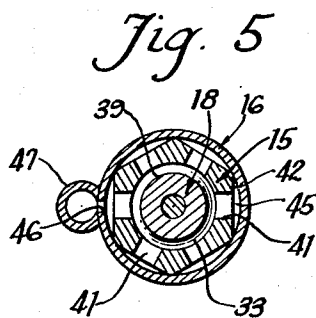
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FLUSH TANK VALVE

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FLUSH TANK VALVE

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This invention relates in general to valves, and more particularly to an improved valve structure specifically applicable for use in conventional flush tanks.

The float-actuated flush tank valves of the prior art generally have two outstanding disadvantages. They are fully opened long before the tank has been completely emptied of the water stored therein and before the float reaches its lowermost position, and remain in such fully opened position during substantially the entire tank draining and filling cycle, and they are inherently noisy in operation.

A principal object of the instant invention, therefore, is the provision of an improved valve, applicable for use in conventional flush tanks, which effectively obviates such disadvantages.

Another important object of the invention is to provide a water inlet valve structure which is substantially inaudible in operation, so that it does not require additional or special piping or the like, when used in a conventional flush tank, to conduct the inflowing water to the bottom of the tank and direct it tangentially thereto in order to quiet its operation, as is the case in some well-known prior art structures.

A further important object of this invention is the provision in such a valve structure of a movable valve member which cooperates with two different stationary valve members to establish either a minimum or a maximum flow, or to prevent any discharge of water therefrom.

Another object is to effect automatic cyclic actuation of such movable valve member under the control of the conventional float in a flush tank, whereby the usual rapid lowering of the float during a flushing action will move the valve member from its normal lowermost, float-retained shut-off position quickly past its intermediate, fully open position to an upper, seepage position to insure the fastest possible discharge from the tank of the flushing charge of water contained therein.

A further object of the invention is to insure refilling of the tank in the shortest possible time, which is accomplished during the closing portion of the cycle of operation of the movable valve member under control of the float; a very short upward movement of the float, resulting from water passing the movable valve member in its upper seepage position, being sufficient to lower the valve member therefrom to its fully open position.

Another object is to provide a valve structure having such advantageous characteristics which may readily be substituted for any well-known

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conventional flush tank valve and, at the same time, with the exception of one stationary valve part, in the form of a porcelain nipple, and a rubber valve washer, is constructed entirely of component parts adapted to be manufactured on screw machines.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, when taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

In the drawings:

Figure 1 is a side elevational view of a valve structure embodying the invention, showing the same mounted in a conventional flush tank, the latter and its standard associated parts being illustrated diagrammatically;

Figure 2 is a vertical sectional view through the valve structure of Figure 1 showing the same in closed position;

Figure 3 is a view similar to Figure 2 showing the movable valve member in a fully opened position;

Figure 4 is a view similar to Figures 2 and 3 showing the movable valve member in its upper, seepage position; and

Figure 5 is a horizontal sectional view taken substantially on the line 5—5 of Figure 3.

Referring more particularly to the drawings, reference numeral 11 indicates a conventional flush tank, illustrated diagrammatically in Figure 1, having a standard water inlet or supply pipe 12 and overflow 13. The valve structure comprising the instant invention is designated generally by reference numeral 14, and is illustrated in Figure 1 as mounted in the conventional flush tank 11 upon the upper end of the water supply pipe 12. The conventional flush valve which is manually operated to drain the tank 11 is not illustrated in Figure 1, since this forms no part of the present invention.

Referring more particularly to Figure 2, the valve structure 14 comprises an inner casing 15, an outer casing 16 mounted thereon, a mounting nut 17 having screw threaded attachment with the lower end of the inner casing 15 and adapted to be screwed onto the upper end of the water inlet pipe 12, and a movable valve member 18 slidably mounted interiorly of the inner casing 15. A connecting rod 19 is threaded into a suitable tapped aperture in the upper portion of the movable valve member 18 and extends through the bore of a reduced upper end portion 21 formed integrally with the inner casing 15. The upper end of this rod 19 is transversely slotted

to receive the inner end of a lever 22 which is pivotally connected thereto by means of a pin 23. The outer end of the lever 22 is provided with a tapped aperture 24 for receiving one end of a conventional rod 25 having the usual float 26 (Figure 1) attached to its other end. The outer surface of the reduced upper end 21 of the inner casing 15 is threaded to receive a tapped collar 27 having a flatted extension formed integrally therewith which is embraced by the lower slotted end of a link 28 pivotally connected thereto by a pin 29. The upper end of the link 28 is similarly slotted to embrace the central portion of the lever 22 to which it is connected by a pivot pin 31.

As previously mentioned, the inner casing 15 is adapted to be mounted upon the upper end of the conventional water supply pipe 12 by means of the mounting nut 17. The upper end of mounting nut 17 is counterbored, as illustrated in Figures 2 to 4, to receive the lower flanged end of a porcelain nipple 32 which comprises a stationary valve member. The lower portion of the bore of the inner casing 15 is provided with an annular flange 33 against which a nipple-retaining washer 34 is held by the upper end of the mounting nut 17. With this arrangement, the porcelain nipple 32 is held firmly in place within the casing 15 by the washer 34, which embraces the nipple 32 and overlies its flanged bottom end, and the washer limits upward movement of the mounting nut 17 to relieve the lower flange of the porcelain nipple of undue stress.

Above the flange 33, the bore of the inner casing 15 is relieved or enlarged to provide an annular chamber 35 normally surrounding the lower end of the movable valve member 18. The outer diameter of the movable valve member 18 is slightly smaller than the diameter of the main portion 36 of the bore of the inner casing 15, this difference being approximately two thousandths of an inch. The lower end of this movable valve member 18 is counterbored to receive a standard hard rubber washer 37 forming a valve which cooperates with the upper end of the porcelain nipple 32 to shut off the water supply from the inlet pipe 12. The lower end of the movable valve member 18 also preferably is provided with an axially depending protuberance 38 which extends into the central aperture of the valve or washer 37 and is slotted to facilitate assembly of the valve member 18 on the connecting rod 19.

The outer surface of the movable valve member 18 is provided with a circumferential groove 39 for the purpose of establishing communication, when the valve 18 is in an intermediate or fully opened position as illustrated in Figure 3, with a plurality of transversely disposed outlet apertures 41 extending through the walls of the inner casing 15. The bottom portions of these apertures 41 are spaced from the upper end of the chamber 35 within the casing 15 substantially the same distance that the lower edge of the circumferential groove 39 is spaced from the bottom end of the movable valve member 18, as best illustrated in Figure 4. As seen in Figure 5, the outer surface of the main portion of the inner casing 15 is hexagonal in cross section, and one of the outlet apertures 41 is centrally located with relation to each of the resulting vertical outer walls 42 of the casing. As illustrated in Figures 2 to 4, the inner casing 15 is provided intermediate this main hexagonal portion and its reduced upper end 21 with a cylindrical portion 43, and it is upon this cylindrical portion that the outer casing 16 is mounted, the outer casing having an

aperture formed in its upper wall, defined by an annular flange 44, into which the upper end of the cylindrical portion 43 of the inner casing 15 is press-fitted. As shown in Figure 5, the bore of the outer casing 16 is so dimensioned as to slidably engage the vertical intersecting edges of the walls 42 of the inner casing 15, so that a plurality of separate vertical outlet passages 45 are provided between the casings 15 and 16, each one of which communicates at its upper end with one of the outlet apertures 41 and is open at its lower end. At its upper end, the outer casing 16 is provided with an overflow aperture 46 communicating with the lower end of a tapered aperture in a nipple or fitting 47, which is secured in any suitable manner, as by soldering, to the outer surface of the casing 16. The tapped aperture of this fitting 47 is adapted to receive one end of a standard copper overflow tube 48 (Figure 1), the other end of which communicates with the conventional overflow 13 of the tank 11.

From this description of the preferred embodiment of the valve structure 14 herein illustrated, it will be readily apparent how the latter is adapted for use in any conventional type of flush tank, being supported therein at the desired distance above the bottom of the tank 11 by attachment of the mounting nut 17 on the upper end of the water inlet or supply pipe 12. The standard rod 25 which is secured to the float 26 may be screwed into the tapped aperture 24 in the valve-actuating lever 22, and since the outer casing 16 is free to be twisted around its vertical axis relative to the inner casing 15, the fitting 47 may be positioned as required in any particular installation for attachment thereto of the overflow tube 48. The length and shape of the rod 25, together with the length of the inlet pipe 12, will determine the depth of water in the tank 11 that will effect closing of the valve structure 14. This closed position of the valve is illustrated in Figure 2, wherein the movable valve member 18 is held in its lowermost position by the float 26, through the agency of the lever 22, link 28 and connecting rod 19, to maintain the movable valve or washer 37 in firm contact with the upper edge of the stationary valve seat or porcelain nipple 32.

Whenever a flushing action is instituted, resulting in the rapid draining of the water stored in the tank 11, the float 26 will fall quickly to its lowermost position, thereby lifting the movable valve member 18 to its upper most position of Figure 4. In such position, the lower end of the valve member 18 functions in conjunction with the main bore 36 of the stationary casing 15, which acts as a second stationary valve member, to permit seepage of water from the inlet pipe 12 through the outlet apertures 41. This result is obtained because of the above-described difference between the diameters of the movable valve member 18 and the bore 36. The water thus permitted to enter the outlet apertures 41 will flow downwardly through the associated outlet passages 45 and along the outer surface of the inlet pipe 12 to the bottom of the tank 11. Such seepage flow of the water is insufficient to result in any appreciable quantity thereof being drained from the tank during a flushing operation and before the automatic closing of the usual flushing valve controlling draining of the water from the tank. It is sufficient, however, to result in enough water being disposed in the bottom of the tank, after such automatic closing of the conventional flushing valve, to result in the float 26 being raised within a relatively short time far

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enough to move the valve member 18 downwardly a sufficient distance to provide communication between the chamber 35 in the inner casing 15 and the groove 39 of the movable valve member. This results in a rapid flow of water from the inlet pipe 12 into the tank to effect continued lifting of the float 26.

In Figure 3, the movable valve member 18 is illustrated in such a fully opened or intermediate position. When so disposed, the valve member 18 permits flow of water from the inlet pipe 12 through the nipple 32, the chamber 35, the groove 39 and the several outlet apertures 41 to their associated vertical passages 45. The shape of the groove 39, the disposition of the outer casing 15 on the inner casing 15 to provide these outlet passages 45, and the resulting direction of the flow of water by these vertical passages down the outer surface of the inlet pipe 12 results in an extremely quiet and substantially inaudible filling of the tank 11.

As the valve member 18 is moved downwardly from its intermediate position of Figure 3 to its lowermost position of Figure 2 by the resulting raising of the float 26, the rate of flow of water into the tank from the inlet pipe 12 is gradually decreased, until again reduced to a seepage flow by virtue of the outer surface of the valve member 18 cooperating with the inner surfaces of the flange 33 and bore 36 of the casing 15 below the outlet apertures 41. The valve member 18 thus is quietly moved into its lowermost position of Figure 2, and throughout the above-described automatic operation of this valve structure 14, the only sound that may be heard is a very slight "pop" as the valve member 18 starts its upward movement.

During draining of the flush tank 11, the resulting lowering of the float 26 causes the valve member 18 to be moved from its closed position of Figure 2 to its seepage position of Figure 4 through the intermediate position of Figure 3. While passing through this latter, fully open position, a maximum flow of water from the inlet pipe 12 to the tank will be permitted, but as previously noted, this opening movement of the valve 18 is so rapid that only a very small quantity of water is thus permitted to enter the tank 11. Consequently, the instant valve 14 is extremely economical in use, and the position of the float 26 may be so determined by the shape and length given the rod 25 that the amount of water normally maintained in the tank 11 for flushing purposes may be accurately predetermined. The operation of the valve 14 is such, as previously described, that exactly the same amount of water will be drained from, and refilled into, the tank 11 during each flushing operation.

As will be appreciated from this description, the particular water pressure available in the inlet pipe 12 will not affect the operation of this valve structure. Another distinct advantage of this particular valve mechanism resides in the fact that all of the parts thereof, with the single exception of the porcelain nipple 32, are adapted to be manufactured on screw machines, and the assembly of this structure and its installation in any conventional flush tank are quickly and readily accomplished. With the connecting rod 19, actuating lever 22, tapped collar 27 and link 28 joined as a subassembly, mounting thereof on the inner casing 15, and attachment of the valve member 18 to the connecting rod 19 may be accomplished at the same time. If it is desired to remove the valve structure 14 from the flush tank 11, it is necessary only to disconnect the rod 25

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and the overflow tube 48 and unscrew the mounting nut 17 from the inlet pipe 12. If, because of a long period of service, the nut 17 has become frozen on the pipe 12, the valve structure 14 may readily be removed from the tank merely by knocking out the pivot pins 29 and 31 to enable separate removal of the connecting rod 19 and the tapped collar 27. Thereafter, the outer casing 16 may be removed upwardly from the inner casing 15 to enable removal of the latter from the mounting nut 17, which will give easier access for removal of this nut 17 from the pipe 12.

The porcelain nipple 32 should last as long as it is desired to use the valve 14, but the washer 37 may in time wear to such an extent as to result in leakage therepast with the valve member 18 in its lowermost position of Figure 2. As above described, however, the valve structure 14 may be readily removed from the inlet pipe 12 to enable replacement of the washer 37 if it becomes worn. Any leakage resulting from wear of the washer 37 will not cause overflow of water from the tank 11, however, except through the overflow aperture 46, fitting 47, and overflow tube 48.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction, and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment of the invention.

I claim:

1. A valve structure adapted to be mounted in a container having a water supply pipe extending upwardly into the interior thereof, comprising an inner casing connectable at its lower end to said supply pipe and having outlet means intermediate its ends, valve means disposed interiorly of said casing to control the flow of water from said pipe to said outlet means, said inner casing having a portion of its outer surface defined by a plurality of vertically extending intersecting walls and said outlet means comprising a separate aperture extending through each of said walls and an outer casing surrounding and supported at its upper end by said inner casing and having a bore slidably engaging the vertical intersecting edges of said walls to define a separate outlet passage communicating with each of said apertures and open at its lower end to provide means for directing the flow of water from said outlet means down the exterior of said pipe.

2. A valve structure of the class described for controlling the flow of fluid from an inlet conduit in response to vertical movements of a float, comprising a casing attachable to said inlet conduit and having an inner bore and outlet means communicating therewith, a stationary valve seat mounted in said casing in spaced relation to said outlet means and interposed between the latter and said inlet conduit, an imperforate movable valve member having an outer diameter slightly smaller than that of said bore and slidably mounted therein, said movable valve member being interconnectable with said float for actuation thereby between a closed position in engagement with said valve seat and a seepage position permitting only a minimum flow of fluid from said inlet conduit to said outlet means, the bore of said casing being enlarged between said valve seat and said outlet means to form an annular chamber, said movable valve member

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being provided with a circumferential groove adapted to interconnect said chamber and said outlet means to permit a maximum flow of fluid to the latter from said inlet conduit when said movable valve member is disposed intermediate said closed and seepage positions, a portion of the outer surface of said casing being defined by a plurality of intersecting walls, said outlet means comprising a plurality of apertures one of which extends through each of said walls, and an outer cylindrical member mounted on said casing and having a bore slidably engaging the intersecting edges of said walls to define a separate outlet passage communicating with each of said apertures.

3. A valve structure, comprising an inner casing attachable at one end to a fluid supply conduit, an outer casing mounted on the other end of said inner casing and defining outlet passage means therewith, said inner casing having a bore with a stationary valve seat mounted therein and outlet apertures spaced from said valve seat and interconnecting the bore with said outlet passage means, said bore being enlarged to provide an annular chamber intermediate said apertures and said valve seat, and a movable valve member mounted for sliding movement in, and of only slightly smaller diameter than, said bore for cooperation therewith in one extreme position to permit seepage flow of fluid therebetween from said conduit to said apertures and cooperating with said valve seat in the other extreme position thereof to prevent flow of fluid from said supply conduit, said movable valve member having a circumferential groove for interconnecting said annular chamber and

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said outlet apertures to enable maximum flow of fluid from said conduit to said outlet passage means when said movable valve member is disposed intermediate said extreme positions, and said outlet passage means comprising a separate passage communicating with each of said outlet apertures adjacent one end and open at the other end, a portion of the outer surface of said inner casing having intersecting walls, and said outer casing having a bore slidably engaging the intersecting edges of said walls to define a said passage with each of said walls.

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