July 30, 1957 A. H. BRIDGE 2,800,664

TOILET FLUSH VALVE AND OPERATING MECHANISM THEREFOR

Filed Sept. 5, 1956 2 Sheets-Sheet 1

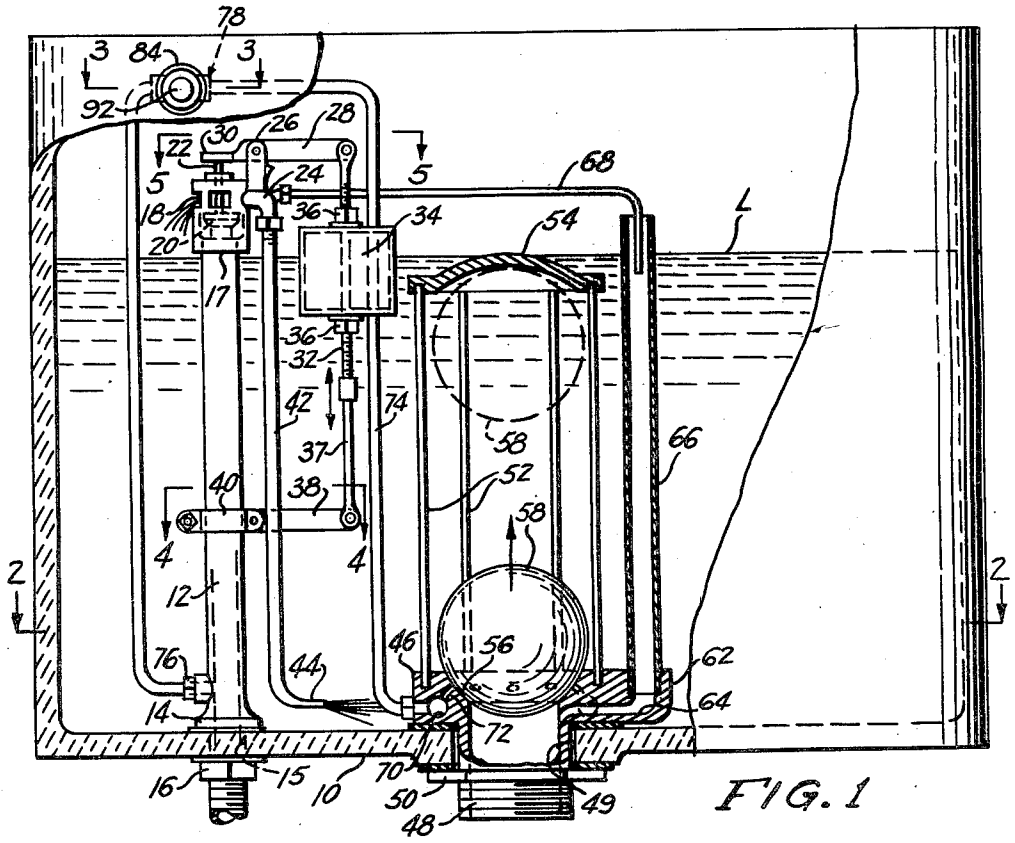


FIG. 1

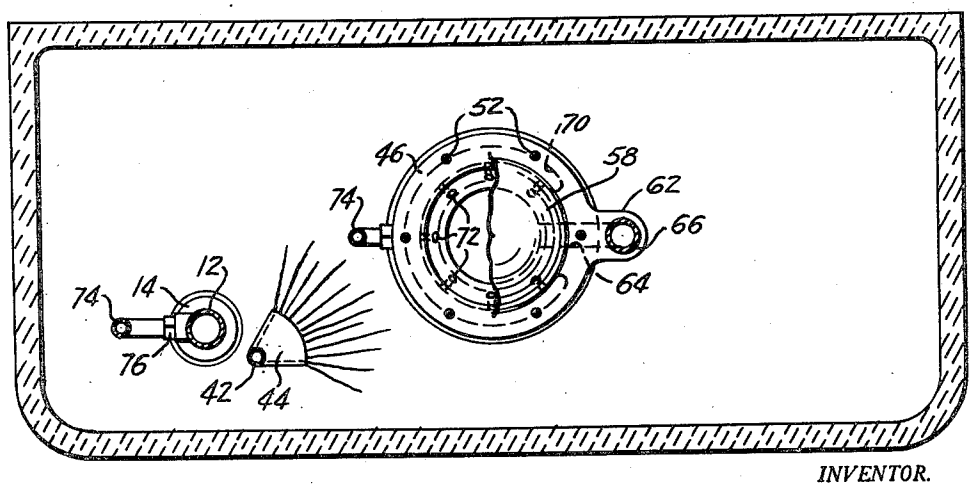


FIG. 2

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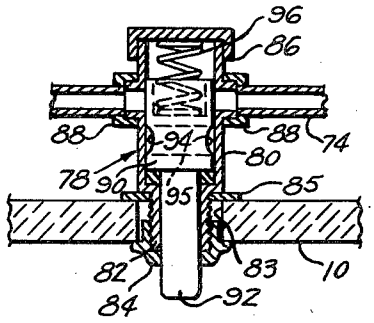


FIG. 3

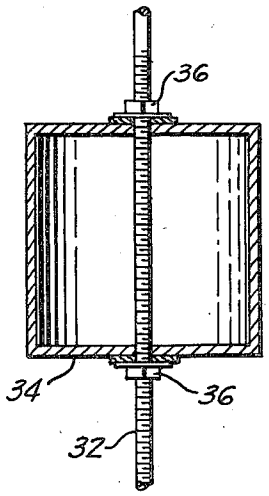


FIG. 6

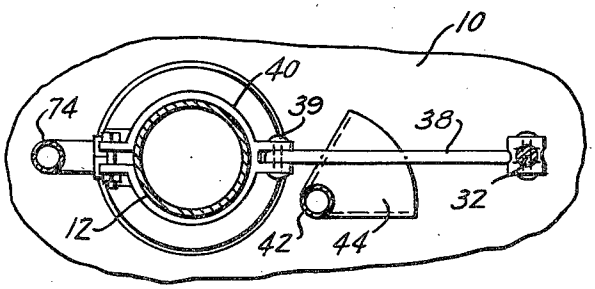


FIG. 4

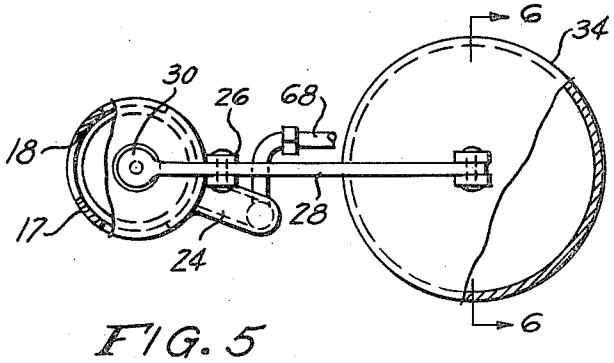


FIG. 5

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TOILET FLUSH VALVE AND OPERATING MECHANISM THEREFOR

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Application September 5, 1956, Serial No. 608,075

6 Claims. (Cl. 4—67)

The present invention relates to the valve assemblies for toilet flush tanks, and more particularly has reference to an improved flush valve and to a control mechanism associated therewith.

Summarized very briefly, the flush valve is in the form of a spherical element, having free rising and falling movement within an associated cage, said element being devoid of connections to other components of the flushing mechanism and being elevated responsive to pressure exerted against the underside thereof by water flowing through a branch of the water supply pipe of the toilet or water closet, with the flow of the water through the branch being controlled by a push-button-operated valve. In association with the flush valve and the described control mechanism therefor, there may be provided an improved float-controlled shut-off valve, and as another feature of the construction, there is included an overflow pipe into which extends a bowl refill tube, the overflow pipe being in continuous communication with the interior of the toilet bowl through the medium of the connection leading from the flush tank to said bowl.

One important object is to provide a device as stated designed to reduce to a minimum the number of mechanical parts capable of wearing, the construction being such as to leave subject to wear only the shut-off valve. This is distinguished from the usual type of flush valve and shut-off valve mechanism, which require not infrequent replacement of the flush valve itself, the connections between the flush valve and the operating lever, the shut-off valve, the shut-off-valve-operating float and associated arm, etc.

A further object is to provide a unit of the type stated which will be capable of being readily substituted for a conventional flush tank valve mechanism, without requiring modification or redesign of the flush tank and other relatively expensive components already in use.

A further object is to provide a construction of the character described in which the flush valve will be free of the usual connections provided upon flush valves for the purpose of elevating the same. Normally, a flush valve, including those of the type guided in their rise and fall within a cage, are lifted by mechanical means including one or more moving parts, generally put into motion by operation of a lever disposed exteriorly of the flush tank. These moving parts are subject to wear, and often result in faulty operation. In accordance with the present invention, the unseating of the flush valve is caused entirely by hydraulic pressure and the flush valve is wholly free of connections of the type described.

A further object is to form the device constituting the invention in a manner such as to insure rapid and efficient flushing of the bowl of the toilet, and equally rapid and efficient refilling of the bowl, by a quietly operating mechanism characterized by the immediate unseating of the flush valve when it is desired to flush the toilet bowl, immediate and accurate reseating of said valve at the completion of the emptying of the flush tank, and

swift, accurately controlled operation of the shut-off valve and the associated bowl refilling means.

A further object is to provide a flush valve mechanism having the characteristics described above which, if desired, can be used with conventional shut-off valve assemblies including the type having a float and a swingable arm connected to the float.

Other objects will appear from the following description, the claims appended thereto, and from the annexed drawing, in which like reference characters designate like parts throughout the several views, and wherein:

Figure 1 is a view of a flush tank partly in front elevation and partly in vertical section, in which is mounted a flush valve and associated mechanism according to the invention, said mechanism being illustrated partly in vertical section and partly in elevation;

Figure 2 is a horizontal section substantially on line 2—2 of Figure 1;

Figure 3 is an enlarged, detail sectional view through the manually operable valve means that controls unseating of the flush valve;

Figure 4 is an enlarged horizontal section on line 4—4 of Figure 1, showing the water supply tube and associated parts;

Figure 5 is an enlarged, detail section on line 5—5 of Figure 1, again showing the water supply tube, together with the shut-off-valve-operating float; and

Figure 6 is an longitudinal sectional view through the float shown in Figure 5, taken on line 6—6 of Figure 5.

A conventional flush tank 10 is illustrated, and mounted therein is a vertical water supply pipe 12 having at its lower end a flange 14 bearing against the bottom of the flush tank. Extending through the usual water supply opening 15 of the flush tank is a depending extension of the water supply tank 12, threaded to receive a nut 16. It will be understood that suitable gaskets would be employed where the water supply tube enters the flush tank. In fact, gaskets may be employed as desired wherever leakage may tend to develop, and hence will not be further discussed herein.

A shut-off valve mechanism, mounted upon the upper end of supply tube 12, includes a cylindrical, upstanding valve housing 17 having adjacent its upper end a circumferential series of outlet openings 18 through which water forced upwardly under pressure within the tube 12 may flow to refill the flush tank following flushing of the toilet.

On the upper end of the tube 12 there is provided a valve seat, against which is engageable a vertically shiftable shut-off valve element 20 secured to the lower end of a stem 22 projecting upwardly through a guide opening provided in the upper end of the cylindrical valve housing 17.

Communicating with the housing 17 substantially in the plane of the circumferential series of outlet openings 18 is an elbow fitting 24, forming an additional outlet for water permitted to flow upwardly through the tube 12 into the flush tank following unseating of the valve element 20. Adjacent the elbow 24, an upwardly projecting, bifurcated bracket 26 is fixedly secured to the housing 17, and pivotally connected to and between the arms of the bracket 26 is a vertically swingable shut-off-valve-operating arm 28, one end of which has a flattened, disc-like portion 30 bearing against the upper end of the stem 22.

Pivotally connected to the other end of the arm 28 is a vertically disposed shut-off valve float support arm 32, extended through smooth-walled openings formed in the opposite, closed ends of a cylindrically shaped, sealed shut-off valve operating float 34 (see Figure 6). Valve 34 can be of molded plastic, or of any other suitable material, and is adjustable vertically of the rod 32, and secured in

selected positions of adjustment by threading of nuts 36 on rod 32 against the opposite ends of the float 34. By vertical adjustment of float 34, the level L of water within the flush tank may be correspondingly adjustably controlled.

At its lower end, rod 32 is connected by a coupling sleeve to an extension rod 37, which is pivotally connected at its lower end to a vertically swingable arm 38 (Figure 4) pivotally connected at 39 to and between ears projecting radially outwardly from a split ring clamp 40 secured to tube 12 at a selected location along the length of the tube.

By reason of the construction so far illustrated and described, it will be seen that when level L falls, float 34 will fall therewith, arms 28, 38 conjointly swinging counterclockwise about their pivots, thus elevating the disc-like end portion 30 and permitting unseating of the valve element 20 under the pressure of water within tube 12, so that water may flow into the flush tank through outlets 18 and elbow 24.

Connected to the elbow and extending downwardly therefrom in parallel relation to and adjacent water supply pipe 12 is a flush tank refill tube 42 terminating at its lower end in closely spaced relation to the bottom of tank 10. A laterally projecting, fan-shaped nozzle 44, disposed in a substantially horizontal plane close to the tank bottom, causes water flowing therethrough to be distributed in a fan-shaped path under substantial pressure over the tank bottom. Water flowing through the nozzle, together with water flowing through the outlets 18, fills the tank. Further, the nozzle causes spraying of the bottom of the tank with each flushing to retard the formation of deposits on the tank bottom.

A support block or fitting 46 for the flush valve is relatively thick and is of disc shape, said fitting having a depending outlet tube 48 projecting downwardly through the usual flush water outlet 49 of flush tank 10. A nut 50 is threaded on the tube 48 against the underside of the tank.

Embedded at their lower ends in the marginal area of fitting 46 and projecting vertically therefrom are cage rods 52 uniformly spaced circumferentially of the fitting 46 and secured at their upper ends to an upwardly concavo-convex top wall 54 of the cage.

At the upper end of the centrally disposed outlet opening of fitting 46 there is formed a spherically concave seat 56 for a flush valve element 58 of hollow spherical shape, formed preferably of plastic and adapted for free rising and falling movements within the cage, between the opposite extreme positions shown in full and dotted lines in Figure 1.

A radial projection 62 is integrally formed upon the fitting 46, and has a counterbored passage 64 extending radially inwardly of the fitting 46 into communication with the tubular outlet member 48, below the valve seat 56 as shown in Figure 1. Fixidly engaged in the counterbore of the passage 64 and projecting upwardly from the radial extension or projection 62 is an overflow tube 66, into the upper end of which extends the depending outer end of an elongated, horizontal, small diameter bowl refill tube 68 connected at its inner end in communication with the elbow 24.

In the marginal portion of the fitting 46 there is formed a circumferentially extending passage 70 lying in a horizontal plane. The passage 70, as shown in Figure 2, does not extend through the full circumference of the fitting 46, the opposite ends of the passage being closed and terminating adjacent opposite sides of the radial passage 64. At uniformly spaced intervals along the length of the passage 70 branch passages 72 extend radially inwardly therefrom, opening upon the valve seat 56 as shown to best advantage in Figures 1 and 2. Branch passages 72 are inclined upwardly in a direction from the main circumferential passage 70 toward the valve seat 56, so that water flowing under pressure into the passage 70 will be directed in jets through the branch passages 72, against the underside of the ball element 58, tending to lift the ball element 58 off its seat.

For supplying water under pressure to the passage 70, there is provided an auxiliary water supply tube 74, which extends upwardly from the fitting 46 as shown in Figure 1, and adjacent the top of the tank merges into a horizontally extending portion of the auxiliary tube, said horizontally extending portion in turn merging into a vertical portion connected at 76 in communication with the lower end of the main water supply tube 12.

In the horizontal portion of the auxiliary water supply tube 74 there is mounted a manually operable control valve assembly generally designated 78 and illustrated in detail in Figure 3. This assembly is mounted in the tank in place of the conventional manually operable lever, and includes a horizontally extending, cylindrical valve casing 80 one end of which is formed with a reduced, externally threaded, axial extension 82 projecting through the opening 83 conventionally provided in the tank wall for the shaft of the usual operating lever. A nut 84 is threaded onto the extension 82, and has a flange bearing against the outer surface of the tank wall. A washer 85 circumposed about the base of the extension 82 cooperates with the flange of the nut in fixedly mounting the valve casing 80 against the tank wall, in position projecting horizontally inwardly from said tank wall.

The inner end of the valve casing 80 is formed open, and closing the same is a cap 86. Intermediate its ends, the valve casing has radially outwardly projecting, diametrically opposed, tubular projections communicating with the auxiliary tube 74, connecting fittings 88 being applied about the tube 74 and said projections to fixedly connect the tube to the casing.

A cylindrical valve core 90 is axially shiftable within casing 80, and is integral at one end with a reduced, axially extending operating stem 92 sliding in the extension 82 and projecting exteriorly of the tank to define a push button. Valve core 90 has diametrically opposed openings 94 provided at opposite ends of a transverse passage 95 of the valve core, and in the end of the valve core remote from stem 92 there is provided a recess receiving one end of a compression coil spring 96 the other end of which bears against cap 86 to normally shift core 90 to its Figure 3 position. In this position, the passage 95 is out of registration with the tube 74. However, on depression of the push button, the valve core is shifted inwardly against the restraint of spring 96 to register the passage 95 with the tube 74, thus to permit water to flow under pressure through the tube 74 from the water supply pipe 12 to the circumferentially extending passage 70 of the flush valve support fitting 46, so that said water may be forced upwardly through the branch passages 72 against the ball element 58.

In use of the device, on depression of the push button, water will flow through auxiliary tube 74 to unseat ball element 58 in the manner previously described. As a result, water flows out of the tank through the outlet fitting 48 into the toilet bowl, not shown, to flush the bowl. As the water level drops, the float 34 will also drop. In this connection, although the push button is immediately released, ball element 58 will not drop downwardly from its dotted line position of Figure 1, due to the fact that the water rushing outwardly through the outlet fitting 48 will prevent the ball element from dropping until the tank is substantially completely emptied.

With the tank substantially fully emptied, the ball element 58 will drop back to its seat 56. Meanwhile, water for refilling the flush tank will be flowing through ports 18 and nozzle 44, due to the dropping of the float 34 resulting in opening of the shut-off valve 20.

With the shut-off valve 20 unseated, not only will the flush tank be refilled to the level L, but also, water will be flowing through the bowl refill tube 68, and from tube

68, into the toilet bowl through the overflow pipe 66, to refill the toilet bowl.

The float valve 58, the cage associated therewith, and the hydraulic means including auxiliary tube 74 and the valve assembly 78 may be used in a flush tank with a conventional shut-off valve mechanism of the type including a vertically swingable arm and a float on the outer end of the arm. However, the particularly improved, vertically shiftable shut-off valve operating float is preferable, if not fully essential to successful operation of the flush valve construction illustrated and described herein.

Of importance is the fact that the entire assembly illustrated in Figure 1 can be mounted in a conventional flush tank, merely by removal of the ordinary valve mechanisms provided in said tank and substitution of the construction illustrated and described. No modification or redesign of the flush tank is needed, the openings of the flush tank already provided therein being properly located to receive the described components of the invention.

A decidedly important characteristic of the invention is the fact that the number of mechanical parts that can wear is reduced far below the number that will be usually found in a conventional flush tank valve mechanism. Ordinarily, the flush valve 58 is suspended by a chain or wire from a vertically swingable arm, which is operated by the lever that is usually provided on the exterior of the flush tank. These parts tend to corrode, bend, or break. Or, in an even more usual flush valve mechanism, a rubber flush ball needs frequent replacement, and is connected to a vertically extending guide rod which tends with annoying frequency to move out of alignment relative to the valve seat, thus preventing the flush valve from dropping when it has been mechanically elevated. In the present invention, the ball 58 has free rise and fall within the cage, and the elevation of the ball element is achieved entirely by hydraulic means, resulting merely from depression and quick release of a push button used in place of the conventional operating lever.

Still further, it will be noted that if it is desired to use the flush valve mechanism of the invention with a conventional shut-off float valve mechanism, the valve assembly 78, the cage, the fitting 46 and ball 58, together with the auxiliary tube 74 can be used as a unit wholly or partially preassembled and readily connected with the conventional water supply tube, overflow pipe, and shut-off valve mechanism of the ordinary flush tank installation.

The absence of a large number of moving parts that can wear, twist, or break, and the fact that the cage and the ball can be readily formed of plastic material, has the desirable result of reducing manufacturing costs to a very substantial degree and it is estimated, in fact, that such costs can be reduced 50 percent below those presently required for conventional flush tank mechanisms not having the features of the invention.

It is believed apparent that the invention is not necessarily confined to the specific use or uses thereof described above, since it may be utilized for any purpose to which it may be suited. Nor is the invention to be necessarily limited to the specific construction illustrated and described, said construction only being intended to be illustrative of the principles of operation and the means for carrying out said principles, it being considered that the invention comprehends any minor change in construction that may be permitted within the scope of the appended claims.

What is claimed is:

1. A flush valve mechanism for flush tanks comprising: means mountable in a flush tank defining an outlet and a valve seat surrounding the outlet, said means having a main water passage and upwardly directed branch passages communicating between the main passage and the seat; a spherical flush ball adapted to engage against the seat to close the outlet; cage means surrounding the ball, said ball having free rising and falling movement within the cage means and being adapted to rise therein for opening the outlet, under the pressure of water directed through the branch passages against the ball; means connectable between the main passage and a source of water under pressure for effecting the flow of water through the main passage; and a manually operable control valve mounted in and arranged for controlling the flow of water through the last named means.

2. A flush valve mechanism for flush tanks comprising: a support fitting mountable in a flush tank and having a central outlet and a valve seat surrounding the outlet, said fitting having a main water passage extending about the outlet and upwardly directed branch passages communicating between the main passage and the seat; a spherical ball adapted to engage against the seat to close the outlet; cage means surrounding the ball, said ball having free rising and falling movement within the cage means and being adapted to rise therein for opening the outlet, under the pressure of water directed through the branch passages against the ball; and means connectable between the main passage and a source of water under pressure for effecting the flow of water through the main passage; and a manually operable control valve mounted in and arranged for controlling the flow of water through the last named means.

3. A flush valve mechanism for flush tanks comprising: a support fitting mountable in a flush tank and having a central outlet and a valve seat surrounding the outlet, said fitting having a main water passage extending circumferentially of the fitting about the outlet and having upwardly directed branch passages angularly spaced about the fitting and extending rearwardly inwardly from the main passage to the seat; a spherical ball adapted to engage against the seat to close the outlet; cage means surrounding the ball, said ball having free rising and falling movement within the cage means and being adapted to rise therein for opening the outlet, under the pressure of water directed through the branch passages against the ball; and means connectable between the main passage and a source of water under pressure for effecting the flow of water through the main passage; and a manually operable control valve mounted in and arranged for controlling the flow of water through the last named means.

4. A flush valve mechanism for flush tanks comprising: a support fitting mountable in a flush tank and having a central outlet and a valve seat surrounding the outlet, said fitting having a main passage extending circumferentially of the fitting about the outlet and upwardly directed branch passages angularly spaced about the fitting and extending radially inwardly from the main passage to the seat; an overflow pipe extending upwardly from the fitting, the fitting having a radial passage communicating between the lower end of the overflow pipe and said outlet at a location below the seat; a bowl refill tube extending into the overflow pipe and connectable in communication with a source of water under pressure; a spherical ball adapted to engage against the seat to close the outlet; cage means surrounding the ball, said ball having free rising and falling movement within the cage means and being adapted to rise therein for opening the outlet, under the pressure of water directed through the branch passages against the ball; and means connectable between the main passage and a source of water under pressure for effecting the flow of water through the main passage; and a manually operable control valve mounted in and arranged for controlling the flow of water through the last named means.

5. A flush valve mechanism for flush tanks comprising, in combination with a water supply tube and with float-controlled shut-off valve means for controlling the flow

of water through said water supply tube: a support fitting mountable in a flush tank and having a central outlet and a valve seat surrounding the outlet, said fitting having a main water passage extending circumferentially of the fitting about the outlet and upwardly directed branch passages angularly spaced about the fitting and extending radially inwardly from the main passage to the seat; an overflow pipe extending upwardly from the fitting, the fitting having a radial passage communicating between the lower end of the overflow pipe and said outlet below the seat, said main passage terminating at its opposite ends at opposite sides of and out of communication with the passage extending from the overflow pipe; a tank refill tube extending from the water supply tube and terminating at its outer end adjacent the bottom of the tank in a fan-shaped outlet nozzle, a bowl refill tube connected in communication with the tank refill tube, for flow of water through the tank refill tube and bowl refill tube responsive to opening of the shut-off valve mechanism; a spherical flush ball adapted to engage against the seat to close said outlet of the fitting; cage means surrounding the ball, said ball having free rising and falling movement within the cage means and being adapted to rise therein for opening the outlet under the pressure of water directed through the branch passages against the ball; an auxiliary water supply tube connected between the main water supply tube and said main water passage for effecting the flow of water to the main passage, said auxiliary water supply tube being connected to the main water supply tube upstream from the shut-off valve mechanism; and a manually operable control valve mounted in and arranged for controlling the flow of water through the auxiliary water supply tube.

6. A flush valve mechanism for flush tanks comprising, in combination with a water supply tube and with float-controlled shut-off valve means for controlling the flow of water through said water supply tube: a support fitting mountable in a flush tank and having a central outlet and a valve seat surrounding the outlet, said fitting having a main water passage extending circumferentially of the fitting about the outlet and upwardly directed

branch passages angularly spaced about the fitting and extending radially inwardly from the main passage to the seat; an overflow pipe extending upwardly from the fitting, the fitting having a radial passage communicating between the lower end of the overflow pipe and said outlet below the seat, said main passage terminating at its opposite ends at opposite sides of and out of communication with the passage extending from the overflow pipe; a tank refill tube extending from the water supply tube and terminating at its outer end adjacent the bottom of the tank in a fan-shaped outlet nozzle, a bowl refill tube connected in communication with the tank refill tube, for flow of water through the tank refill tube and bowl refill tube responsive to opening of the shut-off valve mechanism; a spherical flush ball adapted to engage against the seat to close said outlet of the fitting; cage means surrounding the ball, said ball having free rising and falling movement within the cage means and being adapted to rise therein for opening the outlet under the pressure of water directed through the branch passages against the ball; an auxiliary water supply tube connected between the main water supply tube and said main water passage for effecting the flow of water to the main passage, said auxiliary water supply tube being connected to the main water supply tube upstream from the shut-off valve mechanism; and a manually operable control valve mounted in and arranged for controlling the flow of water through the auxiliary water supply tube, said control valve including a valve casing adapted for mounting upon a wall of the flush tank in communication with the auxiliary water supply tube, a valve core axially reciprocable within said valve casing and spring biased toward one end of the valve casing, and an operating stem-rigid with the valve core and adapted to project exteriorly of the tank for depression by a user, for biasing the valve core axially toward the other end of the casing, the core having a transverse passage adapted to be registered with the auxiliary water supply tube on movement of the valve core toward said other end of the casing.

No references cited.