

Filed Nov. 26, 1965

FLUSH VALVE ATTACHMENT

2 Sheets-Sheet 1

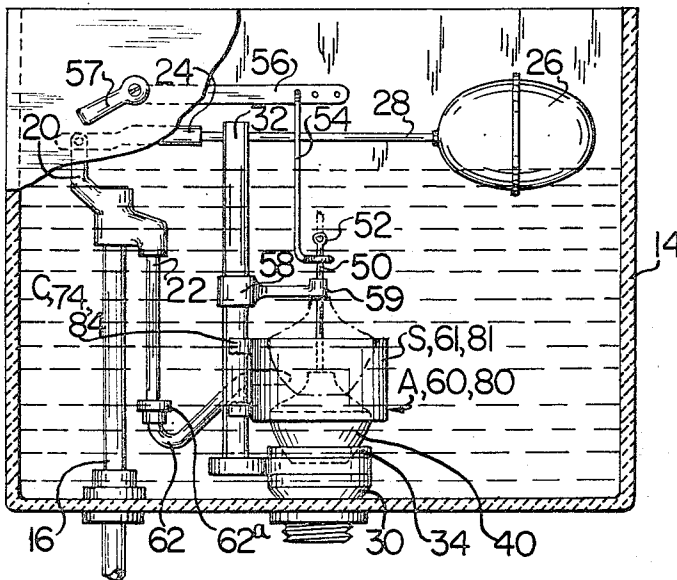


FIG. 1

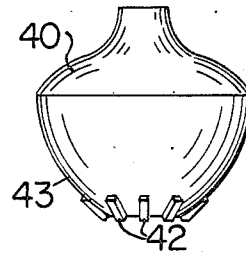


FIG. 10

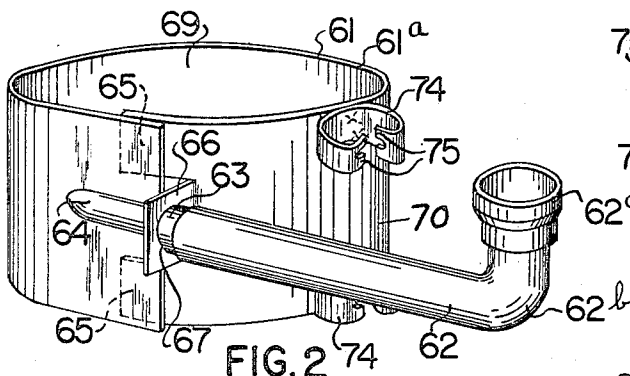


FIG. 2

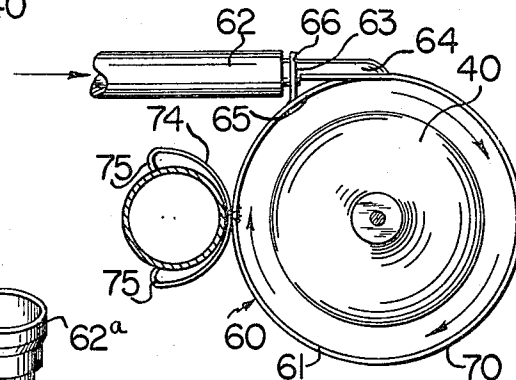


FIG. 3

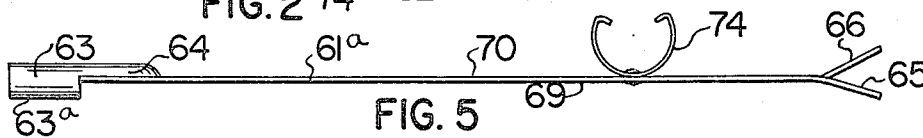


FIG. 5

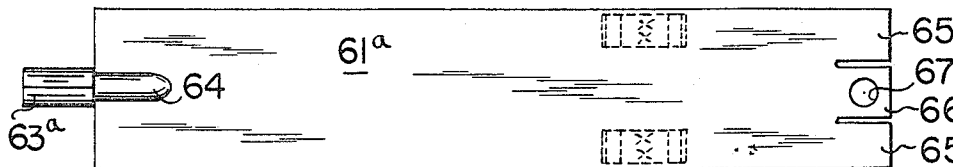


FIG.4

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FLUSH VALVE ATTACHMENT

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2 Sheets-Sheet 2

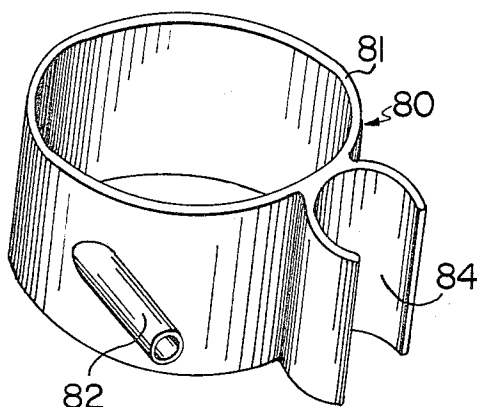


FIG. 6

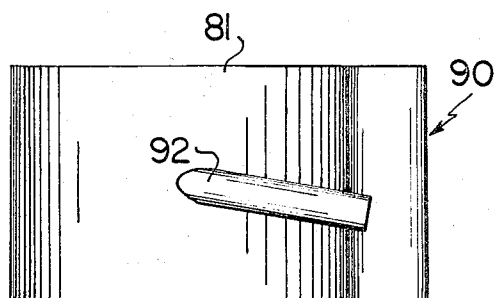


FIG. 7

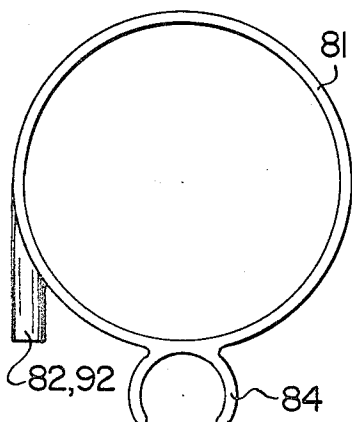


FIG. 8

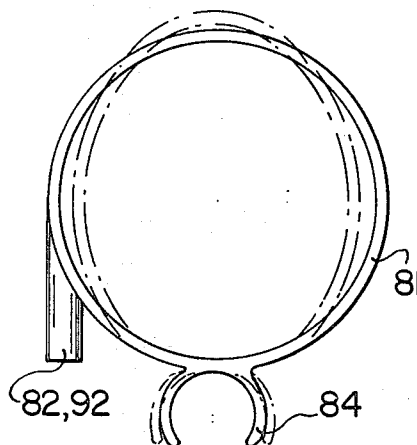


FIG. 9

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FLUSH VALVE ATTACHMENT

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Filed Nov. 26, 1965, Ser. No. 509,885
14 Claims. (Cl. 4—56)

ABSTRACT OF THE DISCLOSURE

The method and attachment (used in a conventional toilet flush tank) rotates the tank ball and guides it to proper seating position. A hose, connected to the tank refill pipe, directs incoming water tangentially into a cylindrical ring surrounding the tank ball. This water forms a rotating vortex as it flows out of the tank, and this vortex rotates the ball to center it over the seat and to reduce the sticking of the ball stem. Either a standard ball or one with vanes may be used.

This invention relates to improvements in valve closures and more particularly the invention pertains to an improved ball valve and valve ball guide for a water closet flush tank.

A flush tank, herein defined as including any liquid tank with a drain valve therein, ordinarily is provided with an outlet flush valve comprising a valve seat and a ball closure or valve head therefor in fluid communication with the tank outlet. The ball is generally provided with a vertical, axially guided stem attached at one end to the ball and having an eyelet shoulder for lifting engagement with a link, which is connected to a flush lever extending externally of the tank for manual actuation. Upon actuation of the flush lever, the link and stem are moved upward, the ball is lifted from its seated position, and the water in the flush tank is discharged through the outlet.

This familiar flush valve presently used in millions of installations has gradually evolved into a simple, relatively reliable mechanism. The few component parts require only modest amounts of material, are easily adjusted for correct operation and are easily replaced when deteriorated.

It is common experience, however, that the operation of the flush valve becomes progressively more erratic as the parts wear, as corrosion products accumulate on the metal parts, and as the rubber ball becomes worn and mis-shaped, sometimes described as the ball taking a set. The ball then frequently fails to seat properly, large amounts of water can be wasted through the unseated valve ball, and the tank is not refilled for subsequent flushing.

Many proposals to solve this problem have been offered in patent structures but none have been effective, economical solutions. Some attempts involve complicated mechanisms or large amounts of expensive materials. Other suggested solutions function only under the ideal condition of new parts and expert adjustment. Many of the patented structures have the disadvantage of not being compatible with the standardized design now almost universally used.

It is, accordingly, an object of the present invention to provide a valve ball guide detachably secured to the overflow pipe of a conventional flush tank, and adjustable thereon for proper positioning with respect to the ball and valve seat so that the ball will be correctly disposed and seated on its valve seat at the end of each flushing operation.

Another object of the present invention is to direct at least a portion of the inflowing water substantially tangentially to the surface of the ball to effect a spinning action of the ball to prevent an accumulation of rust and

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corrosion deposits on the ball stem and associated stem guide, to create gyroscopic forces acting on the ball about its stem axis as the ball approaches the valve seat and tending to center the ball thereon, and to permit random positioning, including rotational positioning, of the ball on the seat so as to prevent unsymmetrical wear on the seating surface of the ball.

A further object of the present invention is to provide an easily attachable and positionable valve ball guide, which mounts on the overflow pipe in any standard type flush tank and which may be economically produced and marketed.

Another object of the present invention is to provide a valve ball with surface configurations thereon which, when impinged by a tangential stream of water, tend to cause the ball to rotate about its central axis.

Another object of the present invention is to provide an economical and easily manufacturable cylindrical valve head guide using only a moderate amount of construction material so as to be easily marketable in a competitive field.

A further object of the present invention is to provide a valve head or ball guide which may be constructed from flat sheet material; shipped, stored and sold in flat condition; and subsequently formed into a cylindrical sleeve for receiving and guiding a valve ball therein.

Another object of the present invention is to provide the guide member with a hollow connection for operatively connecting the inflowing water supply to the guide interior, and so located as to direct the flow of water around the bore within the guide.

A further object of the present invention is to provide a simple arrangement of inexpensive components including a valve ball having a circumferential bank of protrusions located below the maximum peripheral diameter of the ball and spaced from the valve seating surface, a flat sheet bendable into a cylindrical guide having an inner diameter slightly larger than the diameter of the ball, and a hose for connecting the tank inlet to the interior of the guide for directing a portion of the inflowing water along the outer periphery of the ball and the bore of the guide to create a vortex-like flow of water within the guide and to spin the ball.

Another object of the present invention is to provide a valve ball guide characterized by its economy of manufacture, structural simplicity, desirable mode of operation, functional advantages, and sales appeal.

These and other objects of the present invention will become more fully apparent by reference to the appended claims as the following detailed description proceeds in reference to the accompanying drawings wherein:

FIG. 1 is a side view with parts broken away of a flush tank showing a valve assembly in elevation embodying in generic form some of the present invention with a portion of the clamp thereof broken away;

FIG. 2 is a perspective view of a first modification of valve ball guide ring assembly generically shown in FIG. 1 and of the inlet hose of the present invention;

FIG. 3 is an enlarged plan view of a portion of FIG. 1 using the ring assembly form in FIG. 2;

FIG. 4 is a side expanded view of the valve guide sheet in FIG. 2 in flat condition for shipping, storage and merchandising before bending into circular form at the point of assembly;

FIG. 5 is a top plan expanded view of the guide shown in FIG. 4;

FIG. 6 is a perspective view of a second modification of the valve ball guide ring assembly generically shown in FIG. 1;

FIG. 7 is a side elevational view of a third modification of the valve ball guide ring assembly generically shown in FIG. 1;

FIG. 8 is a top plan view of the guide ring assembly shown in FIGS. 6 and 7;

FIG. 9 is a view, similar to FIG. 8, showing in dot-dash lines the configuration of the ball guide sleeve when depressed for attachment to its support pipe; and

FIG. 10 is an enlarged side elevational view of the valve ball shown in FIG. 1.

Although the present invention is described with respect to handling water in a toilet flush tank, it should be apparent that many aspects of this invention also can be used in handling any liquid in any type flush tank.

FIG. 1 illustrates a conventional container or water closet flush tank 14 of the type associated with toilet bowls for flushing water therethrough having inlet pipe 16 connected at its lower end to a water source (not shown) and provided within the tank 14 a float actuated inlet valve 20 for regulating the flow of water into the tank, and having outlet port or pipe 30 connected to the tank and valve ball 40 for selectively permitting the discharge of flush water from the tank when raised from its ball valve seat 34.

Float valve 20, mounted on inlet pipe 16, is typically provided with tank inlet or refill tube 22, valve actuator 24 and float 26 connected to the actuator by float rod 28. During a flushing operation, float 26 moves downwardly in the tank with the water surface to cause actuator 24 to open valve 20 and permit the inflow of supply water from pipe 16 through valve 20 and tube 22. As the tank is refilled, the actuator shuts off valve 20 in response to the ascending float.

Connected to and supported by outlet 30 is overflow pipe 32 which, upon overfilling of the tank, discharges excess water through outlet 30. The overflow pipe additionally provides support for valve ball guide 58, as will be discussed hereinafter. Outlet pipe 30 is chamfered at the upper end of its bore to form valve seat 34 for valve ball 40 of the ball valve. Valve ball 40 is provided at its top with vertically extending guide rod or lower lift wire 50 terminating in eyelet or suitable shoulder 52 for lifting engagement with and by upper lift wire 54, which is pivotally connected to lever 56 pivotally mounted on tank 14. Actuation of lever 56 is customarily accomplished by means of handle 57 pivotally mounted on tank 14 and coupled to the lever and external of the tank for manual manipulation. When it is desired to flush the tank, handle 57 is depressed to raise lever 56, upper lift wire 54, and lower lift wire 50, so as to lift ball 40 from its seat 34 in the outlet pipe. Due to the buoyant nature of the ball and the lost motion connection between the upper and lower lift wires, the ball is not returned to its seat until the water level recedes to substantially the level of the upper surface of outlet pipe 30.

As earlier mentioned, overflow pipe 32 supports lower lift wire guide 58 having sleeve portion 59, which slidably receives and maintains lift wire 50 and attached ball 40 in substantially vertical alignment with valve seat 34 during the tank flushing procedure. Lift wire guide 58 additionally serves as an upper limit stop against which the upper portion of ball 40 will abut as the ball tends to float upward toward the water surface after it has been removed from its seat 34 in outlet pipe 30.

Corrosion of lift wires 50, 54 and lift wire guide 59 often causes restriction in the desired freely sliding relationship of the parts to inhibit the correct, positive, immediate reseating of the ball. On the other hand, excessive wear deteriorates the guiding characteristics of the wire guide so as to permit the ball to become canted or otherwise improperly aligned with valve seat 34 and to cause excessive water loss and waste through discharge pipe 30.

FIG. 1 shows generically a portion of the invention including vortex forming, turbulator or ring assembly A, valve ball guide ring or sleeve S, and clamp or suitable fastener C; and the generic structure, mode of operation, advantages, etc. will be generically described hereinafter by use of these reference numerals. Three different modi-

fications of this generic structure are shown in FIGS. 2-5, FIG. 6, and FIG. 7; and in these respective modifications vortex forming turbulator or ring assembly 60, 80 and 90 corresponds to assembly A; ring or sleeve 61, 81 and 81 corresponds to sleeve S; and clamp or suitable fastener 74, 84 and 84 corresponds to clamp C. These last reference numbers will be used to describe the modifications or species aspect of the invention.

The present invention is designed to overcome these and other shortcomings of the standard flush tank ball valve system, and generically comprises vortex forming, turbulator (device for setting something into turbulence) or ring assembly A positioned around a portion of valve ball 40 and supported thereat by overflow pipe 32. Tank refill or incoming water is directed substantially tangentially into vortex ring, sleeve or valve ball guide S of assembly A through hose or tube 62, made of rubber or any other suitable material, connecting the outlet end of tank inlet tube 22 to ring S so that a vortex-like swirl of water is developed around ball 40 inducing a spinning action of ball 40 about its rotational axis (formed by lift wire 50 rotatably mounted in guide 59 and extending generally perpendicular to the plane of seat 34) when ball 40 is off its seat 34. The word "vortex" is defined herein as describing the flow here obtained and described since the liquid flow path resembles a true vortex, even though a true vortex has the highest rotational velocity at its center and has its velocity varying inversely with the distance from the center. The end of hose 62 connected to tube 22 may have molded thereon universal adapter 62a having different sized, stepped bores (with the largest bore being at the inlet end) for telescopic connection of one bore to any one of several standard inlet tube outside diameters. 90° bend 62b is molded in hose 62 adjacent this end so the hose will not kink when connected in the limited space usually available at the lower end of inlet tube 22.

In FIGS. 2 through 5, one modification of the vortex ring S of assembly A comprises thin-walled cylindrical ring member or sleeve 61 of assembly 60 formed from a generally flat rectangular sheet of pliable material such as non-corrosive metal (stainless steel, for example), fiberglass or plastic. Sleeve 61 has a sheet-like body portion 61a having at one end tubular hose connector, jet tube, or nozzle 63 located with an opening therefrom in one side of the sheet 61a. Hose connector 63 is adapted to receive thereover suitable length of hose or flexible tubing 62 attachable at its other end to tube 22. Connector 63 may be molded, stamped and bent, or affixed to the sheet in any other suitable manner depending upon the properties of the material used. As shown, dimpled section 64 is an integral part of the sheet material in sleeve 61. Sleeve 61 is made from a flat sheet, such as metal, and dimpled section 64 is struck up therefrom in FIGS. 4 and 5 into a half sleeve form having its longitudinal axis in the plane of sheet-like body portion 61a and having two flaps 63a wrapped into cylindrical form until their distal ends meet to complete connector 63. This construction eliminates the disadvantages encountered by welding a connector sleeve to, or forming a connector integral with, sleeve 61, wherein sheet 61a is generally coplanar with the connector wall. Then, these disadvantages would be present: (1) only a small, weak tang or joint would connect sheet 61a and its connector, (2) since the connector would have to be on the inner surface of sleeve 61, its outlet end might protrude within the bore of sleeve 61 to engage with ball 40 to impede its desired free relative movement. Dimpled section 64 in FIGS. 4 and 5 overcomes these disadvantages; it provides a stiff and strong junction between connector 63 and sheet 61a, does not interfere with free travel of ball 40 within sleeve 61, and further provides a transition zone for smoothly directing water flow from tubular connector 63 into ring 61 substantially tangentially to the inner bore surface of ring 61.

The opposite end of sheet 61a is formed in any convenient manner to facilitate bending and securing the sheet in desired cylindrical shape. One configuration includes a number of tabs at the end of the sheet which may be formed either by stamping, slitting or punching. As shown in FIGS. 2 and 4, three tabs, comprising generally symmetrical outer tabs 65 and central apertured tab 66, have proved to be satisfactory. Aperture 67 in tab 66 is chosen to easily pass over connector 63, but is of smaller size than the outside diameter of hose 62. Then, upon bending the sheet into a ring, placing apertured tab 66 over connector 63, and telescoping an end of hose 62 over the connector, the ends of sheet 61a are securely locked to maintain the desired ring shape. Top and bottom tabs 65 may be positioned inside of the ring in FIGS. 2 and 3 to increase the stability of the unit as well as to provide circular continuity of ring inner surface 69 to contribute to development of a vortex-like flow of water therealong.

Metal ring 61 works exceptionally well because it has a smooth bore surface and a large water flow through large connector 63.

It may readily be appreciated that this sheet-like strip 61a and the parts thereon in FIGS. 4 and 5 are formed substantially flat for compact shipping, storage and merchandising, such as by blister packaging on a flat card. Then, sheet 61 may be hand wrapped, rolled or shaped into and locked into cylindrical form by on-the-job assembly by the user at the installation point to permit taking advantage of packaging and marketing economies attendant the use of flat sheets.

Assembly A in FIG. 1 also has clamp C on ring S. In this modification, secured to outside surface 70 of ring 61 is at least one clamp or suitable fastener 74 in assembly 60 for mounting the ring on overflow pipe 32. As shown in FIGS. 2 and 3, two fasteners 74 shown here are spring clips made of springy material, such as stainless steel; are spot welded, soldered, riveted, glued or otherwise integrally attached to the ring; and comprise arcuately shaped members terminating in inwardly directed jaws or teeth 75 which, due to the spring force, tend to penetrate and strongly adhere to overflow pipe 32 when placed thereon.

Other modifications of the vortex forming or turbulator ring S of assembly A are shown in FIGS. 6-9 and are generically described here. They comprise rigidly molded integrally in the shape illustrated plastic ring 81, clamp 84 and either hose connector 82 in assembly 80 in FIG. 6 or hose connector 90 in assembly 90 in FIG. 7. The economies of molding plastic, the elimination of assembling additional parts, the ability to ship and market the toilet attachment with ball 40 telescoped within rigid ring 81, as well as the lack of any propensity of many plastics to deteriorate in even the most corrosive environments, makes this a particularly desirable improvement. Each assembly 80 or 90 is preferably manufactured in one piece of plastic by an injection molding process using any suitable plastic, such as polystyrene or polyethylene, low in cost compared with non-corrosive metal. Also, this one piece plastic construction eliminates the assembly cost in FIGS. 2-5.

When clamp 84 is here made integral with ring 81, there is provided an interesting and useful coaction between these parts. Here, some significant advantages are accomplished in the placement and clamping of ring 81 onto overflow pipe 32 by clamp 84. First, as clamp 84 is snapped into place on overflow pipe 32, it has to flex considerably. Part of the stress of flexing of clamp 84 is carried by the material of ring 81 in view of the integral construction. Second, in FIG. 9, it may be seen that depressing opposite sides of ring or sleeve 81 at points substantially equidistant from clamp 84 distorts the ring into an oval shape as shown in dot-dash lines and further widens the space between the jaws of clamp 84. Such coaction permits easy placement of clamp 84 about pipe

32; and upon release of the depressing force on the ring so that it may return to a circular configuration, the clamp exerts an exceptionally strong frictional clamping force on said pipe. Hence, this construction substantially reduces the required flexing of the jaws of clamp 84 during their assembly and disassembly operation with pipe 32; and carries part of the stress in this operation by the material in ring 81. Therefore, in these two aforementioned advantages, this material, already needed in ring 81 for the operation described herein, serves an additional function in providing part of the clamping force. This characteristic of the ring and clamp advantageously permits a reduction in the cross sectional area of the clamp and of the joint between the clamp and ring, and in the amount of material which would normally be expected to be required to provide a strong clamp. A clamp 84 with a $\frac{3}{32}$ inch wall thickness, and plastic ring 81 of $3\frac{1}{8}$ inch inside diameter, $\frac{3}{32}$ inch wall thickness and $2\frac{1}{4}$ inch height has been found to have this mode of operation.

It has been found that the tangentially directed swirl of inlet water about a hollow tank ball will induce a satisfactory spin of the ball to gyroscopically center the ball over the seat, prevent accumulation of corrosion products on the lift wire and guide, and provide for random circumferential seating of the ball to retard uneven wear on the ball surface. This tank ball may be of any suitable design and two suitable types are here described. First, improved tank ball 40 is particularly useful with the turbulator ring of the instant invention, is shown in FIG. 10 and comprises a circumferential band of small, water-catching protrusions or ribs 42 protruding from a portion of the lower ball surface below seating area 43 and below the maximum diameter of ball 40 so that these ribs do not interfere with the ball seating function. Impingement of the inlet tank refill water on these ribs couples the ball to the motion of the vortex to cause a great spinning rate of the ball to increase the gyroscopic forces acting thereon to insure proper seating of ball 40 on its valve seat 34. This is particularly important in the event lift wire 50 and guide sleeve 59 are excessively worn or corroded. Ribs 42 may satisfactorily be (1) located above or below seat 43, (2) of a variety of configurations including straight (FIG. 10) or curved (helical) design, and (3) oriented either coplanar (vertically extending in FIG. 9) or angularly inclined relative to a longitudinally extending diametrical plane through ball 40. As shown in FIG. 10, conveniently spaced straight, vertically extending teeth 42 provide good operation of the invention. Second, many of the advantages mentioned in this paragraph and satisfactory operation, are obtained with ring S used with a smooth surfaced hollow rubber ball, instead of ball 40 with ribs 42.

As represented in FIG. 1, vortex ring assembly A is clamped by clamp C on to overflow pipe 32 in axial alignment with discharge pipe 30, ball 40, and lift wire 50. Although ring S will work well in nearly any position, the preferred position has the lower edge of ring S approximately $\frac{3}{4}$ to $1\frac{1}{4}$ inches above the top of valve seat 34 so that some tank water leaving tank 14 through drain 30 will flow under ring S (if ring S is too high, the vortex will spin ball 40 too high above seat 34 so the ball centering action by the vortex during ball seating is not obtained even though the seating position of the ball is rotatably changed). Then, in the normal installation with the last mentioned dimension being 1 inch, the upper edge of ring S is in approximate horizontal alignment with the major diameter of the ball in its raised, valve open position. At this $\frac{3}{4}$ to 1 inch height, ring S will guide ball 40 to a proper seating position, and yet will not cause ball 40 to be prematurely sucked into seated position by the outflowing water.

For example, the dimensions for vortex ring S, which has operated well in conventional toilet flush tanks us-

ing standard size tank balls having major diameter of $2\frac{1}{16}$ inches and $2\frac{1}{8}$ inches, were an inside diameter of $3\frac{1}{8}$ inches and a height of $2\frac{1}{4}$ inches. These dimensions and alignment are by no means to be construed as critical, but are illustrative of a preferred size and location of the ring for optimum spinning of the ball by the directed flow of inlet water, while simultaneously permitting the major flow of flush water to pass between ring S and seat 34 to the outlet. The bore of ring S is made large enough relative to the diameter of ball 40 so there will be no tendency for the flow to push the tank ball (piston-like) onto its seat 34 to stop the flush too soon. The diameter of ball 40 is made large enough relative to bore of ring S so that the vortex flow will properly turn ball 40. A generally average radial clearance of about $\frac{1}{4}$ to $\frac{1}{8}$ inch between the bore of ring S and outside diameter of ball 40 has been found to operate satisfactorily.

Flush tanks, and particularly toilet or water closet flush tanks, vary in flushing speed. For example, tests have shown that some tanks may empty in as little as six seconds while others may take as long as eighteen seconds to discharge the flush water. The faster flushing action naturally has a greater tendency to prematurely pull the ball to its seated position without adequate rotation of ball 40, whether or not vortex ring S is used.

It is believed that for proper operation the bottom of ring S should be spaced to some degree from the outlet (top of valve seat 34) to preclude the discharge of all flush water down through the ring with the attendant disruption of the vortex-like inlet swirl of water as well as to avert a tendency to prematurely force the ball downwardly onto seat 34 in piston-like fashion. Vortex ring S has worked consistently well on even the fastest flushing tanks when the aforegiven one inch height is used. However, if the toilet flushes too quickly, ring S can be moved farther above seat 34.

In addition, modified vortex ring 81 in FIG. 7 may be provided with angularly inclined inlet tube 92, inclined 2° – 15° from the horizontal. This inclination gives an upward component of 2° to 15° from the horizontal to the swirling water inside of ring 81 and tends to lift tank ball 40 when it is in its raised, floating position to counteract the tendency for premature seating of the ball even in the down-sucking action in the environment of a rapidly emptying tank. The bottom of inclination ring 81 can be installed less than one inch from the top of seat 34, such as $\frac{7}{8}$ inch, when tube 92 has an 8° upward tilt. In contrast, cylindrical connector 82 and sleeve 81 in FIG. 6 have their longitudinal axes lying in mutually perpendicular planes.

The bore of ring S guides the outside surface of ball 40 when off seat 34 to restrain lateral movement of ball 40, while the inlet vortex spins the ball, during its vertical travel with its lift wire 50. When ball 40 is dropping toward seat 34, this lateral guiding provided by ring S is most important to get good ball seating action. In all installations with or without ring S, the fit between guide wires 50, 52 must be loose enough to float ball 40 down onto, and to position it onto, seat 34 to get good ball valve closing. If ring S is not used and this fit is loose, defective operation may occur by: (1) wires 50, 52 cocking to prevent ball travel, (2) the valve ball will drop on the edge of the valve seat to hang up there and the ball valve will not close, etc. Use of ring S prevents malfunctioning even with a loose fit. This rotation of ball 40 in guide sleeve S: (1) permits satisfactory operation even if the joint between lift wires 50, 52 are so badly worn or corroded that ball 40 would not normally move vertically, but would hang up or cock, (2) prevents build up of corrosion products in this joint by induced rotation of lift wire 50, and (3) rotates ball 40 to a different seating position for each flush to equalize the "set" that rubber eventually takes and to gyro stabilize the ball to a perfect seat on seat 34 after every flush.

Either ring 51 or 81 may be mounted on overflow pipe 32 as shown in FIG. 3 so as to generate a clockwise flow of water when viewed from above, or alternatively, the ring may be inverted if desired to develop a counter-clockwise flow of water and ballspin.

In operation, a flush cycle is initiated by manually depressing flush handle 57 in FIG. 1 to cause ball 40 to be lifted from seat 34 through the linkage comprising flush lever 56, upper lift wire or link 54 and lower lift wire 50; to cause ball 40 to be floated by the water in tank 14 to its normal open position shown in dot-dash lines in FIG. 1; and to permit tank water to flow out of tank 14 through outlet pipe 30 by flowing either underneath or down through ring S. As the surface level of the tank water lowers, float 26 also lowers and depresses valve actuator 24, operatively connected thereto, to open inlet valve 20 and to permit the flow of incoming refill water from supply pipe 16 through inlet pipe 22 into the tank. This water is directed by hose 62 into turbulator ring S to be directed by the sleeve connector to tangentially swirl within the bore surface of ring S and about ball 40, buoyed up above seat 34. This incoming water, confined by ring S, swirls around and creates a strong vortex flow in the out-flowing flush water to cause ball 40 to spin about its vertical axis in alignment with seat 34 until the tank water surface recedes to a low level and thus permits ball 40 to properly reseat in seat 34 of outlet pipe 30 and terminate further discharge of flush tank water. Tank refill water continues to flow through float valve 20 and ring S until the water surface is raised to a level whereat the valve is closed through the conventional action of valve actuator 24 and associated float 26, as is generally understood in the art. Vortex ring S serves no further function, after ball 40 is resealed on its seat 34, until the next flushing cycle is initiated.

Now it should be apparent that the present invention can be either furnished on a new toilet flush tank or used as a replacement item on an existing tank. In either event, clamp C is connected to outlet pipe 32, hose 62 has its opposite ends telescopically secured to inlet pipe 22 and the connector of ring S, and new ball 40 is telescoped into ring S and screwed onto lift wire 50.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive with the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by U.S. Letters Patent is:

1. An attachment for a liquid flush tank having an inlet, an outlet and a ball valve comprising a ball rotatable about an axis and removably seated on its valve seat to close the outlet, including a sleeve concentrically spaced around the ball and above the seat, and means connecting the inlet to the interior of the sleeve so that when said ball is removed from its seat, liquid flowing in said inlet through said means and into the sleeve and around said ball causes the ball to spin about said axis to center the ball over the seat.

2. An attachment for a liquid flush tank having an inlet, an outlet and a ball valve comprising a ball rotatable about an axis and removably seated on its valve seat to close the outlet, including a sleeve concentrically spaced around the ball and above the seat, and means connecting the inlet to the interior of the sleeve so that when said ball is removed from its seat, liquid flowing in said inlet through said means and into the sleeve and around said ball causes the ball to spin about said axis, said means connecting the inlet and sleeve comprising a hose member provided at its inlet end with a portion having a series of stepped inner diminishing diameters with the largest thereof being at the inlet end of said hose member and with

said diameters being selectively engageable with several different conventional flush tank inlets for frictional retention thereon.

3. An attachment for a liquid flush tank having an inlet, an outlet and a ball valve comprising a ball rotatable about an axis and removably seated on its valve seat to close the outlet, including a sleeve concentrically spaced around the ball and above the seat, and means connecting the inlet to the interior of the sleeve so that when said ball is removed from its seat, liquid flowing in said inlet through said means and into the sleeve and around said ball causes the ball to spin about said axis, said sleeve having just sufficient clearance around the ball so that the bore of the sleeve acts as a cylindrical lateral movement restraint for guiding the outside surface of said ball when off its seat, said sleeve being spaced above said seat an adequate distance so that a substantial quantity of tank liquid will flow under said sleeve and out said outlet when the ball is removed from its seat.

4. An attachment for a liquid flush tank having an inlet, an outlet and a ball valve comprising a ball rotatable about an axis and removably seated on its valve seat to close the outlet, including a sleeve concentrically spaced around the ball and above the seat, and means connecting the inlet to the interior of the sleeve so that when said ball is removed from its seat, liquid flowing in said inlet through said means and into the sleeve and around said ball causes the ball to spin about said axis, said means comprising a hose member and further including a hollow connector secured to the sleeve for attachment of the hose to said sleeve and having an opening therefrom into the interior of the sleeve, said connector and opening so arranged that the flow of inlet liquid is directed substantially tangentially to both the inner sleeve surface and adjacent ball surface.

5. An attachment, as set forth in claim 4, with a sheet integrally forming the body of said sleeve and forming said connector, said connector having a half-cylindrical dimpled portion struck up from said sheet with the longitudinal axis of said cylinder being coplanar with the sleeve sheet body to form a strong joint therebetween and to smoothly direct liquid flow into said ring.

6. An attachment, as set forth in claim 4, with said connector being angularly inclined with respect to the sleeve so that the flow of inlet water is upwardly directed at an angle of between about 2° and about 15° from the horizontal.

7. An attachment, as set forth in claim 4, with the sleeve and connector being integrally molded of non-corrosive plastic.

8. An attachment, as set forth in claim 7, with said sleeve and connector each being generally cylindrical in form with the longitudinal axis of each lying in mutually perpendicular planes.

9. An attachment, as set forth in claim 7, with clamp means on said sleeve having coacting clamp jaws for mounting said sleeve in said tank on a convenient vertically extending pipe, said clamp means being molded integrally with said sleeve of non-corrosive, resilient plastic, the dimensions and composition of said plastic being such that depressing opposite sides of the sleeve toward each other at points generally equidistant from the clamp distorts the sleeve into an oval shape and widens the space between the clamp jaws to permit easy placement of the clamp jaws about the pipe and to permit the sleeve to return to its circular configuration and the clamp jaws to strongly frictionally engage the pipe upon release of the depressed sides of the sleeve.

10. An attachment, as set forth in claim 4, with clamp means on said sleeve for mounting said sleeve in said tank on a convenient vertically extending pipe.

11. An attachment, as set forth in claim 4, with the sleeve being formed from a generally rectangular sheet of flexible material and having the connector mounted on one end thereof, a tab attached to the opposite end of the sheet and having an aperture therethrough of larger diameter than said connector so that when said sheet is bent to form a sleeve configuration with the connector protruding through the tab aperture and said hose member is secured to the connector, the one end of the sheet is locked with respect to the opposite end to maintain thereby this sleeve configuration.

12. In a conventional toilet flush tank having an inlet for filling the tank and having an outlet for directing the tank water into a toilet bowl and having a valve seat adapted to receive a valve ball closure, a valve ball having a seating surface, a cylindrical guide having an inner diameter slightly larger than the diameter of the ball, and a hose for connecting the tank inlet to the interior of the guide for directing a portion of the inflowing water along the outer periphery of the ball and the bore of the guide to create a vortex-like swirl of water within the guide and spin the ball to center the ball over the seat, to prevent corrosion on the mounting of said ball, and to retard uneven wear during movement of the ball.

13. A combination, as set forth in claim 12, with a circumferential band of protrusions on said ball located below the maximum diameter of the ball and the valve seating surface thereof.

14. In a closure system for a flush tank having an outlet port, the improvement comprising a ball valve comprising a ball releasably seated on its valve seat for closing said outlet port, ball release mechanism for removing said ball from its seat to permit discharge of liquid from within said tank through the port, said release mechanism comprising a lost motion connection to said ball for selectively and rotatably supporting said ball apart from said seat, vortex forming sleeve means in the tank spaced from the seat and substantially encircling said ball and generally concentrically spaced therefrom, so that upon actuation of said release mechanism the ball is removed from said seat to permit tank liquid to discharge therefrom with only part of the discharged liquid passing through said sleeve, and inlet means for filling said tank operatively connected to said sleeve so as to direct a flow of liquid substantially tangentially within the sleeve and to the ball to impart a spinning motion to said ball about an axis generally perpendicular to the plane of said seat while said ball is supported apart from the seat.

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