June 8, 1965 P. J. GRESHAM 3,187,348

FLUSH TANK VALVE

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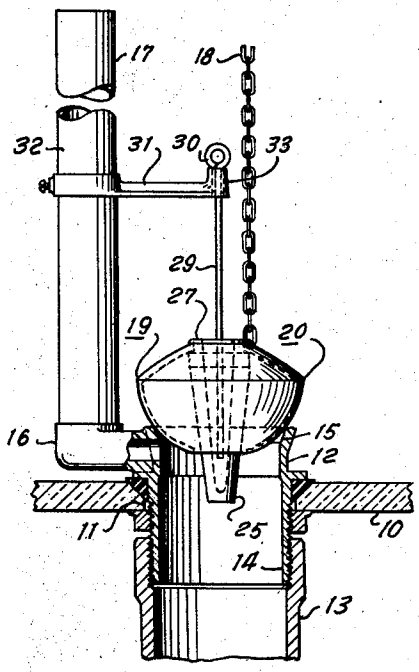


FIG. 1

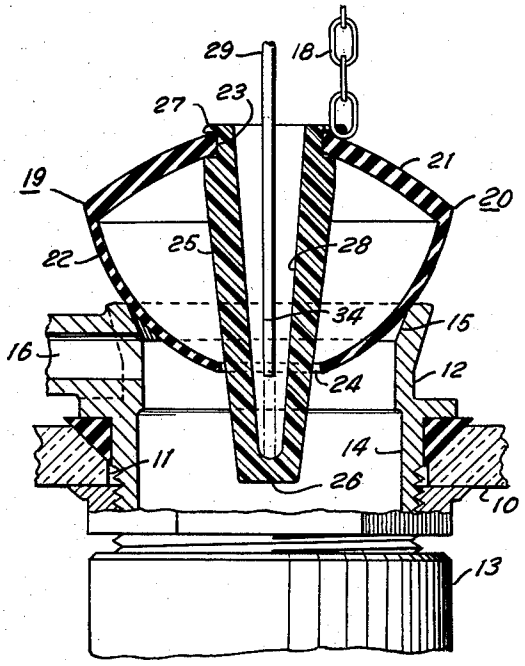


FIG. 3

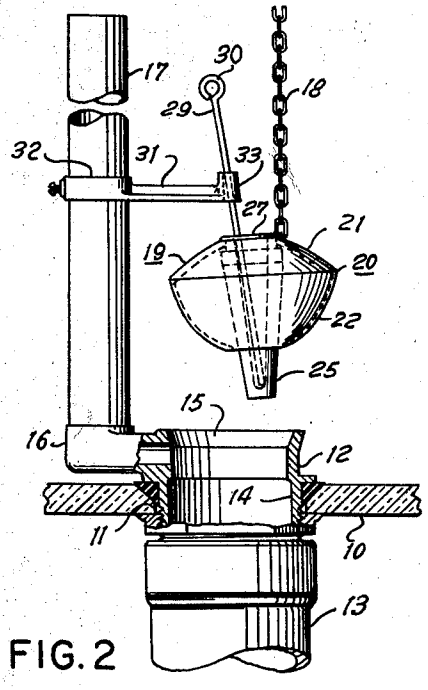


FIG. 2

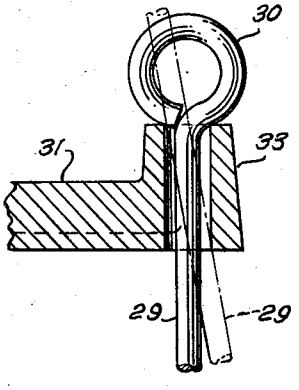


FIG. 4

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FLUSH TANK VALVE

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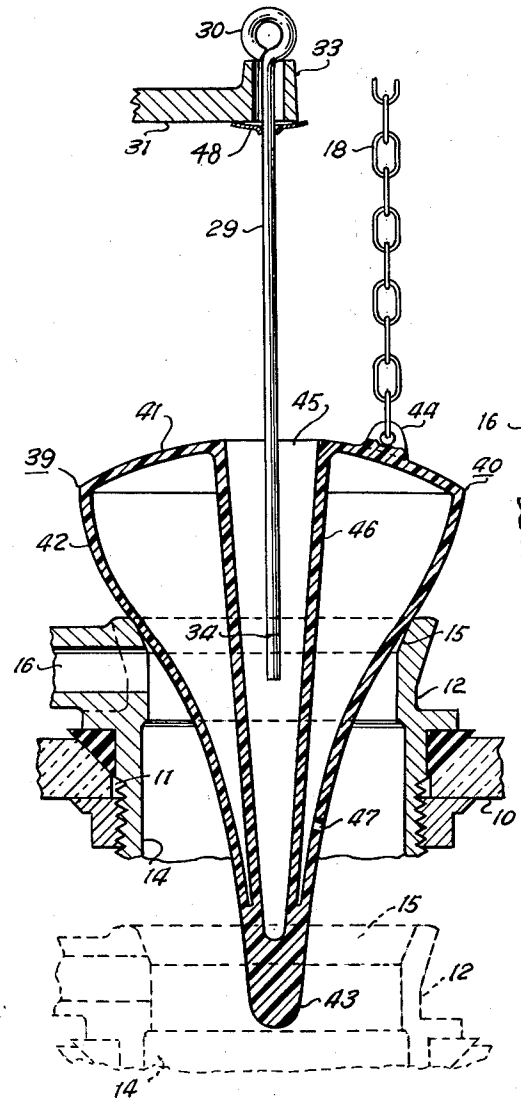


FIG. 5

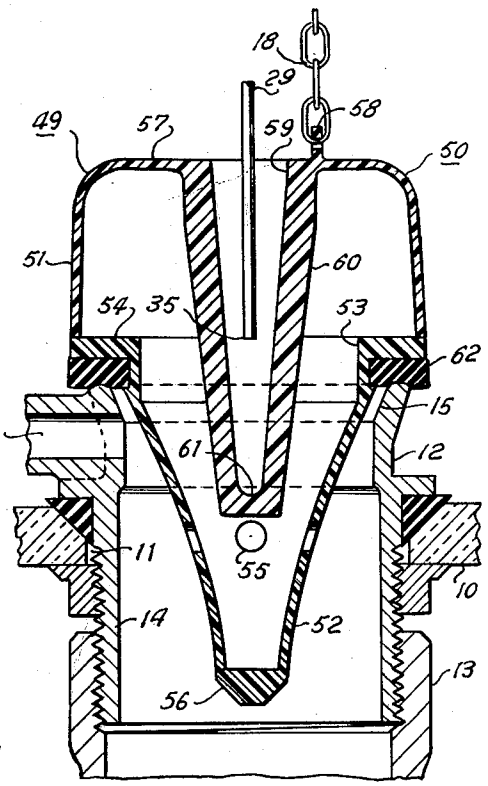


FIG. 6

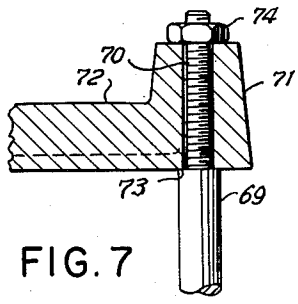


FIG. 7

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United States Patent Office 3,187,348 Patented June 8, 1965

3,187,348

FLUSH TANK VALVE

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Filed Jan. 14, 1964, Ser. No. 337,688
16 Claims. (Cl. 4—57)

This invention relates to new and useful improvements in flush tank valves.

One object of the invention is to provide a novel valve for a flush tank which is of economical, efficient construction and of such structure that the valve is positively guided into seating engagement with an outlet opening upon emptying of the tank without binding or hanging thereof in open position.

Another object of the invention is to provide a novel flush tank valve which is movable laterally as well as upwardly and downwardly relative to a guide rod or similar means for opening and closing the outlet opening of a flush tank and which is adapted to coact with the rod or similar means for guiding the valve toward said outlet opening and maintaining said valve in position for seating engagement with said opening whereby said valve may be mounted in most flush tanks with minimum effort and expense.

A particular object of the invention is to provide a novel flush tank valve having a member in which an upwardly-opening cavity is formed for receiving the lower portion of an upright guide element, such as the conventional rod for suspending the common flush valve or tank ball, which may be stationary or which may be movable laterally and/or reciprocally relative to as well as with the valve member whereby the element loosely guides the opening and closing movement of said valve member and maintains said member in sufficient alinement with the flush tank outlet opening to ensure seating engagement thereof with said outlet opening upon emptying of the flush tank.

An important object of the invention is to provide a novel flush tank valve, of the character described, wherein there is amplified clearance between the guide element and the upper portion of the cavity of the valve member and restricted clearance between said element and the lower portion of said cavity whereby lateral movement of said valve member in its opened position is limited so as to maintain said member in overlying relation to the flush tank outlet opening for engagement therewith upon closing movement of said member and whereby greater lateral movement of said member is permitted upon seating thereof so that said member may rock into full engagement with said outlet opening.

Another object of the invention is to provide a novel valve, of the character described, wherein the valve member is suspended for lateral and reciprocal movement and wherein the lower portion of the cavity of said valve member is reduced to provide restricted clearance between the guide element and the lower portion of said cavity and amplified clearance between said element and the upper portion of said cavity whereby limited lateral movement of said member is permitted when it is lifted so as to dispose said element in said cavity lower portion and greater lateral movement of said member is permitted when it moves downwardly relative to said element toward its seated position.

Another object of the invention is to provide a novel valve, of the character described, wherein the cavity of its member depends into the flush tank outlet opening below its seat and the lower end of the lowered guide element terminates adjacent the seat whereby the valve member may undergo pivotal or rocking movement relative to said guide element when said member drops into engagement with said seat.

A further object of the invention is to provide a novel valve, of the character described, wherein the clearance between the cavity of its member and the guide element permits said element to be bent or offset relative to the axis of the outlet opening without interfering with the movement of the valve member between its opened and closed positions.

Another object of the invention is to provide a novel valve, of the character described, wherein the cavity of its member functions as a sump for retaining water to weight the valve member for more positive sealing engagement with the flush tank outlet opening upon seating movement of said member before refilling of the flush tank.

A further object of the invention is to provide a novel valve, of the character described, having means for limiting upward movement of the valve member, which means may also suspend the guide element and be the usual bracket which is mounted on the overflow pipe or other portion of the flush tank, and wherein said valve member may have means depending therefrom into the outlet opening for guiding said member into seating position and prevented from removal from said outlet opening by said movement limiting means.

Still another object of the invention is to provide a novel valve, of the character described, wherein the valve member is adapted to be opened by a chain or other flexible means and is free to spin with the swirling motion of the water emptying from the flush tank whereby the chain tends to wind and kink upon itself upon closing movement of said valve member and wherein said chain is unwound upon lifting of said member due to the engagement of the guide element with said chain.

A construction designed to carry out the invention will be hereinafter described, together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings wherein examples of the invention are shown, and wherein:

FIG. 1 is a transverse, vertical, sectional view of the outlet and the adjacent portion of a flush tank having a valve constructed and mounted in accordance with the invention seated in said outlet,

FIG. 2 is a view, similar to FIG. 1, showing the flush valve in its lifted or open position,

FIG. 3 is an enlarged, transverse, vertical, sectional view of the seated flush valve and tank outlet,

FIG. 4 is an enlarged, transverse, vertical, sectional view showing the relatively loose mounting of the guide rod,

FIG. 5 is a sectional view, similar to FIG. 1, of a modified flush valve seated in a tank outlet with the position of the outlet relative to the lifted valve being shown in broken lines,

FIG. 6 is a view, similar to FIG. 3, of another modification, and

FIG. 7 is a view, similar to FIG. 4 of a rigid mounting for the guide rod.

In the drawings, the numeral **10** degisnates the bottom of a conventional flush tank having an outlet opening **11** for receiving a complementary drain fitting **12** which connects a discharge pipe **13** to the tank. The drain fitting **12** has a large bore or outlet opening **14** with an annular, flared seat **15** surrounding its upper end and spaced above the tank bottom **11**. A hollow extension **16** extends laterally from the upper portion of the drain fitting to support an upright overflow pipe **17** in communication with the bore **14** between the seat **15** of said fitting and the tank bottom. Although not shown, the tank includes an operating lever from the free end of which a

chain or other flexible element 18 is suspended. In some flush tanks, the valve seat and overflow pipe are made integral with the tank and not separately thereof.

For controlling the discharge of water through the drain fitting 12, a hollow or buoyant valve member 19 is adapted to be suspended from the chain 18 and includes a ball-like or bulbous body 20 for sealing engagement with the annular seat 15 of said drain fitting. The valve body 20 is formed of rubber, plastic or other suitable flexible material and may have a frusto-conical top portion 21 and a hemispherical bottom portion 22 of greater flexibility than the top portion. It is noted, however, that the shape of the valve body is not critical and is subject ot variation. Axial openings 23 and 24, of relatively large diameter, are formed in the top and bottom portions 21 and 22 of the valve body for receiving a tubular core or element 25 which may be of greater length than said body so as to project through the lower opening 22 and depend below said body into the bore 14 of the drain fitting when the valve member is seated.

Manifestly, the depending projection of the element 25 functions as a guide to assist directing the valve body 20 into engagement with the seat 15. The tubular element has a closed lower end 26 (FIG. 3) and, preferably, is relatively rigid to facilitate its insertion through the openings of the valve body and particularly the upper opening 23, being formed of stiff plastic, rigid rubber or other suitable material. An annular, external flange 27 is provided at the upper end of the element 25 by grooving or recessing said element for complementary engagement with the opening 23 to detachably secure said element to the valve body. As shown in FIG. 3, the chain 18 may be attached to the flange 27. If desired, the tubular element may be of inverted substantially conical shape to assist assembly of the valve member 19. An axial bore 28 extends throughout the element 25 from its closed lower end 26 to provide an upwardly-opening cavity for coacting with a guide element or rod 29 and may be of inverted substantially conical contour. Although the upper portion of the bore or cavity 28 is shown as being of larger diameter than its lower portion and of much larger diameter than the guide rod 29, the conical configuration of said bore is not essential and variations thereof may be employed.

The rod 29, which is similar and may be identical to the conventional guide rod of a flush tank, has an eye or other enlargement 30 on its upper end to permit its suspension from the usual guide bracket 31 adjustably mounted on the overflow pipe 17 by its clamp collar 32. When the overflow pipe is made integral with the flush tank, it is customary to mount the guide bracket for the guide rod on a wall of the tank. A collar or tubular boss 33 is formed on the outer, free end of the bracket 31 for receiving the guide rod and, usually and preferably, has a bore of greater diameter than said rod to permit reciprocation of the latter without binding as well as limited lateral and canting or tilting movement (FIGS. 2 and 4). Although desirable, it is not essential that the guide collar 33 be in axial alinement with the seat 15 since the bore or cavity 28, particularly its upper portion, of the valve member 19 is of much greater area than the rod 29. In addition to being freely movable relative to the guide collar, the guide rod is movable relative to as well as with the valve member since it has no connection therewith.

As shown in FIGS. 1 and 3, the guide rod 29 is adapted to extend an appreciable distance into the cavity 28 of the valve member 19 when the latter is seated and is engaged by the bottom 26 of said cavity so as to be slid upwardly relative to the guide collar 33 when said member is lifted or unseated by the chain 18 (FIG. 2). It is noted that the cavity extends into the outlet opening 14 below the seat 15 and that the lower end of the guide rod terminates adjacent said seat. Upon opening, the valve member may move out of alinement with the seat as well as with the guide rod and collar due to the relatively large diameter of the cavity 28. The rod 29 may cant or tilt to permit this misalinement while remaining engaged with the cavity so as to guide the misalined valve member to its seated position upon closing movement of said member. In addition to misalinement of the guide collar 33, the lower end of the guide rod may be misalined with the valve member 19 due to being bent or crooked; however, the limited canting or tilting of said guide rod maintains its lower end in sufficient proximity to alinement with the seat to ensure guiding of said valve member into its seated position, of course, when the tubular element 25 depends below the valve body 20, it assists the seating of the valve member. As the valve member approaches its seated position, it enters a zone in which the discharging water is swirling and causes a partial rotation of said member. When the valve member 19 is lifted from the seat 15, the engagement of the lower end of the guide rod with cavity 28 provides a pivot point for free, unimpeded rotation of said member into alined relation to the upper attachment point of the chain whereby no kinks can develop therein. As will be apparent, the guide rod may be stationary when the distance between its lower end and the lower end of the cavity is sufficient to permit adequate lifting of the valve member. This may be accomplished by shortening the guide rod 29 as shown by the line 34 in FIG. 3.

A modified hollow or buoyant valve member 39 is shown in FIG. 5 and includes a bulbous body or exterior 40, of rubber, plastic or other suitable flexible material, having a convex top portion 41 and an elongated, tapered lower portion 42 of ogee contour which terminates in a closed tip 43 of relatively small diameter. As shown by the broken lines, the tip 43 is adapted to remain within the bore 14 of the drain fitting 12 upon lifting of the valve member 39 out of engagement with the seat 15, but need not so remain since the lower portion 42 of the valve body may be relatively short like the tubular element 25 of the valve member 19. An eye or aperture lug 44 may upstand from the top portion 41 of the valve body 40 for connection with the chain 18. The valve body has an upwardly opening bore or cavity 45, similar to the cavity 28 of the valve member 19, formed by an integral tubular core or interior portion 46 extending axially from the top portion of said body to its tip 43 and of much larger diameter than the guide rod 29 which is suspended by its enlargement 30 from the collar 33 of the guide bracket 31. Preferably, the cavity 45 is of inverted substantially conical contour, like the cavity 28, so that its upper portion is enlarged relative to its lower portion. A vent opening 47 is provided in the lower portion of the valve body to permit equalization of the pressures internally and externally of the valve member. It is pointed out that the cavity 45 may be formed separately of the valve body, such as by an element similar to the tubular element 25 of the valve member 19. The valve members cooperate with the guide rod 29 and function substantially in the same manner; however, the guide bracket 31 may be positioned so as to prevent the tip 43 of the valve body 40 from being lifted out of the bore 14 of the drain fitting 12. Also, the guide rod may be reciprocable or substantially stationary and held against reciprocation by a clip 48 confined on said rod in engagement with the underside of the guide collar 33. This engagement need not be tight enough to prevent canting or tilting of the guide rod 29. Again, it is noted that the non-reciprocable guide rod may be shortened, as shown by the line 34, if necessary to permit adequate lifting of the valve member.

Another modified valve member 49 is shown in FIG.

6, and includes a hollow or buoyant body or exterior 50 having a cylindrical upper portion 51 and an inverted, concavo-conical lower portion 52 of reduced diameter connected to the upper portion by axial and radial flange portions 53 and 54. The valve body is adapted to be formed of relatively stiff plastic or other suitable rigid material and openings 55, similar to the vent opening 47, may be formed in the lower portion 52. A reduced, frusto-conical plug or tip 56 closes the bottom of the lower portion of the valve body 50, while a flat top 57 closes the upper end of the upper portion of said body. The chain 18 may be connected to the valve member by an eye 58 upstanding from the valve body top 57 and similar to the eye 44. An upwardly-opening bore or cavity 59, similar to the cavities 28 and 45, extends axially of the valve body and may be formed by an integral, tubular core or interior portion 60. The core 60 is most similar to the tubular element 25 of the valve member 19 and, in fact, may be formed separately of the valve body 50 in the same manner. As shown by the numeral 61, the lower end of the cavity 59 is closed for engagement by the lower end of the guide rod 29 whereby said rod is raised when the valve member 49 is lifted out of its seated position. Preferably, the cavity is of inverted substantially conical contour whereby its upper portion is of greater diameter for permitting relative transverse movement or misalinement of the guide rod and valve member, particularly when said member is unseated. Instead of engaging within the seat 15 of the drain fitting 12, the valve member 49 is adapted to seat upon the upstanding rim of said seat and has an annular gasket 62, of suitable elastic material, surrounding the axial flange 53 and overlying the radial flange 54 of its body 50 for sealing engagement with said rim. Except for its differences of structure, this valve member functions in substantially the same manner as the valve members 19 and 39.

It is the essence of this invention that the lateral movement of the valve member be limited when said valve member is in its opened or unseated position so that the lower portion of said member is maintained in overlying relation to the seat of the outlet opening for engagement therewith upon closing or downward movement of said member. This limited movement may be provided by the lifting of the guide rod with the valve member and the consequent shortening of the effective length of said rod together with the restricted clearance between the lower portions of the cavity and rod. As the valve member moves downwardly, the effective length of a reciprocable guide rod is increased so as to permit greater lateral movement of said member and facilitate axial alinement thereof with the seat. When any part of the valve member engages the seat, said member is substantially free to pivot or rock into full engagement with said seat due to the large area of the upper portion of the cavity relative to the adjacent portion of the guide rod as well as the increased effective length of a reciprocable rod. Since the lower end of the guide rod terminates adjacent the seat, the rocking movement of the valve member may be of appreciable magnitude.

It is noted that the guide rod may be absolutely stationary when its lower end is spaced from the lower end of the cavity of the valve member a distance sufficient to permit adequate lifting of said valve member. As shown by the numeral 35 in FIG. 6, the guide rod 29 may terminate an appreciable distance above the seat 15 of the drain fitting opening 14 to permit said rod to be stationary and provide enough clearance to permit opening of the valve member. This is particularly true when the valve member has a guide portion depending below the seat. As shown in FIG. 7, a stationary guide rod 69 may be utilized with the valve member 49 as well as with the valve members 19 and 39. The rod 69 has a reduced, screwthreaded upper end 70 extending through a complementary guide collar 71 formed on the outer

end of a guide bracket 72, similar to the guide bracket 31, and providing a shoulder 73 for underlying engagement with the collar. A nut 74 is threaded on the upper end 70 of the rod to clamp said rod against reciprocal as well as lateral movement in coaction with the shoulder 73. Manifestly, the rigidly mounted guide rod must be positioned at an elevation which permits adequate lifting of the valve member to its opened position. Except for this limitation, the stationary rod functions in the same manner as the reciprocable rod and may be employed with any of the valve members. It is pointed out that the cavities of all of the valve members function as sumps for retaining water to weight said members for more positive sealing engagement with the seat of the outlet opening before refilling of the flush tank. Also, any of the valve members may be provided with the non-reciprocable guide rod shown in FIG. 5.

The foregoing description of the invention is explanatory thereof and various changes in the size, shape and materials, as well as in the details of the illustrated construction may be made, within the scope of the appended claims, without departing from the spirit of the invention.

What I claim and desire to secure by Letters Patent is:

1. A valve for a flush tank having an outlet opening including a buoyant valve member for seating engagement with the outlet opening, means for lifting the valve member out of engagement with the outlet opening, said valve member having an axial upwardly opening cavity, and upright guide means suspended above said valve member with its lower end portion extending into the cavity, said cavity having an upper portion of appreciably greater transverse dimension than the adjacent portion of said guide means to permit pivotal and amplified lateral movement of said valve member when it is adjacent its seated position, said guide means and cavity having restricted clearance between their lower portions to limit lateral movement of said valve member when it is lifted relative to said guide means for maintaining said valve member in overlying relation to said outlet opening.

2. A valve as set forth in claim 1 including means for limiting upward movement of the valve member relative to the outlet opening of the flush tank.

3. A valve as set forth in claim 1 including means for slidably supporting the guide means whereby said guide means is liftable by and lowerable with the valve member as well as movable relative to said valve member.

4. A valve as set forth in claim 1 wherein the major portion of the cavity is of relatively large transverse dimension with respect to the guide means.

5. A valve as set forth in claim 4 wherein the upper portion of the cavity is of larger transverse dimension than the lower portion thereof.

6. A valve as set forth in claim 5 wherein the cavity is substantially conical.

7. A valve as set forth in claim 4 wherein the cavity is elongated and increases gradually in transverse dimension upwardly.

8. A valve as set forth in claim 1 wherein the guide means is in the form of a rod.

9. A valve as set forth in claim 8 including means for slidably supporting the guide rod and limiting upward movement of the valve member relative to the outlet opening of the flush tank, the slidable rod being movable with and relative to said valve member.

10. A valve as set forth in claim 1 including means for supporting the guide means and preventing reciprocal movement thereof.

11. A valve as set forth in claim 1 wherein the valve member includes a ball-like body for seating engagement with the outlet opening of the flush tank and having an axial opening in at least its upper portion, and an element mounted in and depending through the axial opening into the body and having the upwardly opening cavity formed therein.

12. A valve as set forth in claim **11** wherein the element extends through the body of the valve member so as to project therebelow and has an inverted substantially conical interior.

13. A valve as set forth in claim **1** wherein the valve member includes a bulbous exterior portion for seating engagement wtih the outlet opening of the flush tank and a tubular interior portion forming the upwardly opening cavity.

14. A valve as set forth in claim **13** wherein the tubular interior portion of the valve member is of inverted substantially conical shape.

15. A valve for a flush tank having an outlet opening including a buoyant valve member for seating engagement with the outlet opening, means for lifting the valve member out of engagement with the outlet opening, said valve member having an axial upwardly opening cavity, and an upright guide element suspended above said valve member with its lower end extending into the cavity and terminating above the lower end thereof, said valve member being movable relative to the guide-element so that the lower end of said cavity engages the lower end of said element upon lifting of said member, said guide element and cavity having restricted clearance between their lower portions to limit lateral movement of said valve

member when it is lifted for maintaining said valve member in overlying relation to said outlet opening, said cavity having an upper portion of appreciably greater transverse dimension than the adjacent portion of said guide element to permit amplified lateral and pivotal movement of said member when it drops relative to said element toward seating engagement with said outlet opening.

16. A valve as set forth in claim **15** wherein the guide element is of substantially constant transverse dimension, the cavity of the valve member having its lower portion of reduced transverse dimension to restrict the clearance between the lower portions of said cavity and guide element.

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