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FLUSH VALVE AND RELATED CONSTRUCTION

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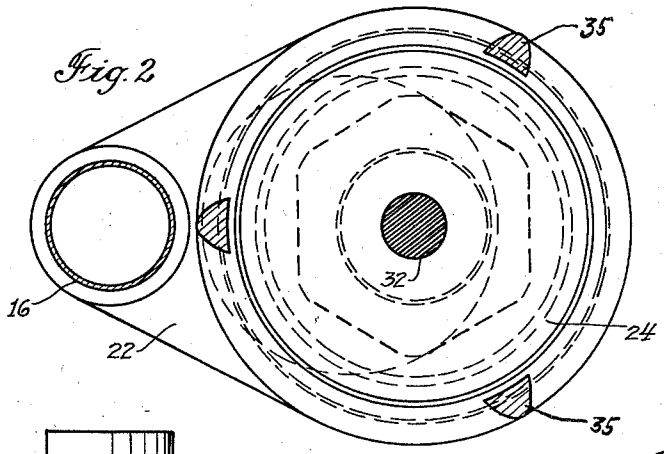


Fig. 2

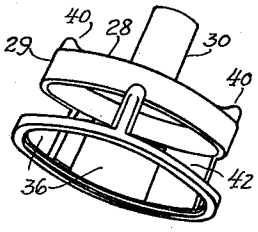


Fig. 4

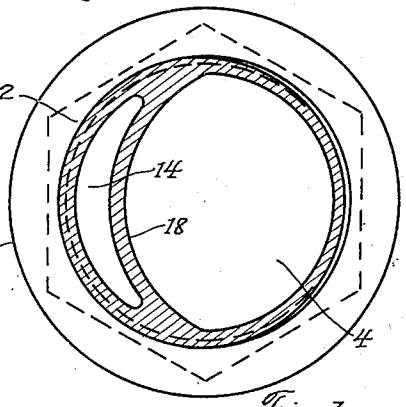


Fig. 3

Fig. 1

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FLUSH VALVE AND RELATED CONSTRUCTION

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6 Claims. (Cl. 4—52)

My invention relates to constructions for use in flush tanks and particularly to flush valves and related elements for controlling the discharge of water from the flush tank of a toilet or other fixture.

One of the commonest types of flush valve is the well known hollow rubber float member which is raised from its seat when the valve is operated and remains in raised position until the water in the tank has fallen sufficiently for the float member to descend therewith to reengage the valve seat. While this type of valve is inexpensive, its operation is unsatisfactory because the vortex created by water passing through the spud or outlet opening draws the float member downward and the valve closes while three or four inches of water remain in the tank. For this reason the tank must be made sufficiently large to deliver the requisite volume of water before the valve closes.

Another inexpensive type of valve is shown in the prior art, and embodies a valve member in the form of a flat disc which when raised is held off its seat by the action of jets of water impinging on its under surface as it passes from the tank into the spud. This type of valve when used by itself and without the conventional overflow serves to discharge substantially all of the water from the tank permitting the use of a relatively small tank. However, when used in conjunction with an overflow communicating with the spud below the valve seat the action of the valve is altered so that it closes, while three to four inches of water still remain in the tank. This is presumably due to the fact that air drawn into the spud through the overflow by the action of the water being discharged, decreases the velocity of the water and the force of the jets supporting the valve is diminished, permitting the valve to close too soon. Furthermore, in order to produce the desired jets of water, it is necessary for the openings in the sides of the valve casing to be relatively narrow or small. The rate of discharge of water from the tank, therefore, is not great enough to produce the most effective operation in flushing the toilet.

I have discovered that these disadvantages in the operation of such valves can be overcome and a construction provided which will discharge substantially all of the water from a flush tank while at the same time employing an overflow for preventing flooding of the fixture in the event the ball cock fails to close when the tank has been filled to the desired level. Moreover, the construction discharges water for flushing a toilet or for other purposes at substantially the same rate as when a ball float valve is used. In attaining these results I prefer to employ a construction similar in general appearance to that of the disc valve mentioned but provided with relatively large inlet ports, the cross-sectional area of which may be nearly as large or even larger than the cross-sectional area of the spud. I also provide means preventing the overflow from adversely effecting the action of the valve so that closing of the valve does not take place until substantially all of the water has been discharged from the tank. This means also serves to decrease the sounds incidental to the discharge of water from the tank, thus rendering the operation relatively quiet.

One of the objects of the present invention is to provide an inexpensive flush valve which will remain open until substantially all of the water has been discharged from the tank.

Another object of my invention is to provide a flush valve which is maintained in raised position by the action of water passing through the spud or outlet opening and which will remain open until substantially all of the water has been discharged from the tank.

A further object of my invention is to prevent the presence of an overflow from adversely effecting the operation of a flush valve.

Another object of my invention is to provide a novel form of spud and overflow construction which co-operate with a vertically movable flush valve to maintain the valve in raised position until the level of the water in the tank has fallen to a relatively low level.

Another object of my invention is to provide a flush valve and spud construction capable of discharging water from the tank fast enough to insure proper operation or flushing of the toilet and which is relatively quiet in its action.

These and other objects and features of my invention will appear from the following description thereof, in which reference is made to the accompanying figures of the drawing, wherein:

Fig. 1 is a vertical sectional view through a flush valve and spud assembly embodying my invention;

Fig. 2 is a horizontal sectional view of the construction shown in Fig. 1 taken on the line 2—2 thereof;

Fig. 3 is a horizontal sectional view of the

construction illustrated in Fig. 1 taken on the line 3—3 thereof, and

Fig. 4 is a perspective of the upper portion or cage of the valve construction.

In that construction chosen to illustrate my invention the device embodies a casting 2 including a downwardly extending spud portion 4 threaded externally to receive a nut 6 for securing the casting in position in the opening 8 in a flush tank 10. The upper portion of the casting is provided with a laterally extending part 12 formed with a passage 14 with which an overflow tube 16 communicates. The opposite end of passage 14 is formed by the web 18 which extends downwardly adjacent the wall of the spud portion 4. The lower end of the passage thus extends in a direction parallel to the axis of the spud and terminates well below the valve so that any air entering the construction through the overflow tube and passage 14 does not interfere with the flow of water through the spud or the action of the valve. The action of the web 18 in shielding the passage 16 and rendering the action of the device relatively quiet is described more fully in my copending application, Serial No. 737,722 filed April 10, 1936.

The upper portion of the casting opposite the part 12 projects beyond the spud portion 4 and presents an upwardly facing inclined surface 20 below the valve seat 22. The inner surface of the casting below the valve seat is thus seen to be unsymmetrical and formed with a surface directing water across the opening in the spud. This surface evidently operates with the web 18 on the opposite side of the spud opening to produce turbulence in the water passing through the spud, thereby decreasing the tendency of the water to form a vortex as it is discharged from the tank. Moreover, the web 18 and downwardly extending portion of the overflow passage prevent air entering the spud from retarding the flow of water therethrough. For this reason the valve, whether of the ball type or the disc type, is held in raised position longer, permitting more of the water to be discharged before the valve closes. The rate of discharge of water through the spud is not decreased with this construction despite the presence of the web 18 because the entire area of the spud is filled with the water being discharged. This is in contrast with the action of water in passing through a straight spud of conventional type wherein it has been observed that water flowing rapidly over the edge of the valve seat is projected toward the center of the spud leaving an unfilled space adjacent the walls and throughout the circumference of the spud.

The turbulence produced not only appears to prevent the formation of a vortex but aids in supporting the valve as it is lowered causing it to close more slowly and quietly while allowing additional water to be discharged. The discharge of substantially all of the water from the tank renders it possible to use a smaller, lighter tank, and therefore, one which is less expensive to produce, crate, and ship while serving to discharge the necessary amount of water for proper flushing action. The construction described may be used with valves of various types, but I have found it to be of particular advantage when employed in conjunction with disc valves which are supported by the water being discharged. A valve of this type is illustrated in the drawing wherein the valve disc 24 is indicated as having a suitable facing 26 of rubber or leather for engaging the valve seat 22 to seal the outlet opening. The valve is movable vertically within a cage 28 to a raised position shown in dotted lines in which the valve is surrounded by the downwardly extending skirt portion 29 of the cage. A tubular extension 30 on the top of the cage 28 serves as a guide for the valve stem 32 to direct the valve in its movement and insure proper seating thereof. If desired the stem of the valve may be formed of hard rubber or other suitable material resistant to corrosion while the cage may be made of brass or other metal, so that the valve will continue to operate easily and smoothly at all times, even though the water is hard or alkaline.

The cage is secured to the casting 2 in which the spud is formed by any suitable means such as the threads 34 engaging complementary threads on the outside the valve seat 22. Inlet openings 36 are formed in the cage above the valve seat and below the skirt portion 29 to admit water to the spud when the valve is raised. These openings are separated by small supporting members 35 and may be relatively large, in fact, the total area of the openings may be equal to or even greater than the opening through the spud since the turbulence of the water beneath the valve evidently reduces the necessity of forming jets to impinge against the valve for supporting the same.

The upper inner face of the cage may be formed with downwardly projecting studs 38 for spacing the valve from the top of the cage or other suitable means may be provided for admitting water above the valve when in raised position so that it will close readily when the water has fallen to a sufficiently low level. I also provide the cage with upstanding finger grips 40 for screwing the cage in position, but obviously these are not essential or important to the operation of the valve.

As illustrated in Fig. 4 I may form the openings 36 in the cage with different spacings between the same so that water passing through the openings is directed as necessary to obtain the most effective results. The web 42 between the openings may act as a deflector to shield the valve from the action of water entering the tank from the usual ball cock or may be positioned to compensate for any lack of symmetry in the formation of the spud opening.

While I have illustrated a typical construction and combination embodying my invention and have indicated the principle on which I believe the construction operates, it will be evident that my invention may be embodied in other forms and types of elements and it is not limited to the theory of operation advanced to explain the action thereof. For this reason it should be understood that the device shown and described herein is intended only to be illustrative of a preferred form of my invention and is not intended to limit the scope thereof.

I claim:

1. In combination with a flush tank having an overflow open at its upper end and having a member with a passage therethrough with which the lower end of said overflow communicates and through which water from said tank may be discharged, a valve for closing said passage, which valve is of the type that is heavier than water but is held open by the action of water against a surface thereof, and means interposed between the lower end of said overflow and said passage for shielding water acting against said

surface from the influence of air entering said passage from said overflow.

2. In combination with a flush tank having an overflow open at its upper end and having a member with a passage therethrough with which the lower end of said overflow communicates and through which water from said tank may be discharged, a valve for closing said passage, which valve is of the type that is heavier than water but is held open by the action of water against a surface thereof, and means extending into said passage for shielding water acting against said surface from the influence of air entering said passage from said overflow.

3. In combination with a flush tank having an overflow open at its upper end and having a member with a passage therethrough with which the lower end of said overflow communicates and through which water from said tank may be discharged, a vertically movable disc valve for closing said passage, means for directing water flowing into said passage in streams beneath said valve to hold said valve in raised position and means interposed between the lower end of said overflow and said passage for shielding water acting against said surface from the influence of air entering said passage from said overflow.

4. In combination with a flush tank having an overflow open at its upper end and having a member with a passage therethrough with which the lower end of said overflow communicates and through which water from said tank may be discharged, a vertically movable disc valve for closing said passage, means for directing water flowing into said passage in streams beneath said valve to hold said valve in raised position and means extending into said passage for producing turbulence in water acting against said valve and for shielding water acting against said surface from the influence of air entering said passage from said overflow.

5. In combination with a flush tank having an overflow open at its upper end and a member having a passage therethrough with which the lower end of said overflow communicates and through which water may be discharged from said tank, a vertically movable disc valve for closing said passage, a cage surrounding said valve and having openings therethrough the total cross-sectional area of which is substantially as great as the cross-sectional area of said passage, means for raising said valve above said openings and means in said passage for creating turbulence in water flowing through said openings and beneath said valve to support said valve in raised position.

6. In combination with a flush tank having an overflow open at its upper end and a member having a passage therethrough with which the lower end of said overflow communicates and through which water may be discharged from said tank, a vertically movable disc valve for closing said passage, a cage surrounding said valve and having openings therethrough the total cross-sectional area of which is substantially as great as the cross-sectional area of said passage, means for raising said valve above said openings and means in said passage for creating turbulence in water flowing through said openings and beneath said valve to support said valve in raised position, said means serving to shield said water from the action of air entering said passage from said overflow.

BERT O. TILDEN.