A toilet flapper valve has a rigid bulb insert and a surrounding flapper top, the latter being preferably made of an elastomeric material. The flapper valve of the present invention can be used as equipment in toilets of original manufacture and as replacement after-market devices.
TOILET FLAPPER VALVE AND ASSEMBLY

SPECIFICATION


FIELD OF THE INVENTION

[0002] The present invention relates to indoor plumbing, and more particularly, to gravity-operated flush toilets.

BACKGROUND OF THE INVENTION

[0003] A conventional gravity-operated flush toilet has several basic components. The porcelain or china components include a bowl and a water tank mounted on top of a rear portion of the bowl. The bowl and tank are usually separate pieces bolted together to form a so-called two-piece toilet. Modern gravity-operated flush toilets are also made as a so-called one-piece toilet in which the bowl and tank are assembled prior to the firing process and end up as a single piece of china.

[0004] The plumbing components of a gravity-operated flush toilet include a fill valve in the tank which is connected to a water supply line and a flush valve combined with a flapper valve that normally closes and seals the flush valve, the flush valve being positioned above a drain hole in the bottom of the tank. The plumbing components further include a control such as a pushbutton or lever mounted on a wall of the tank that moves a lever whose remote end is connected to the flapper valve for lifting the same.

[0005] It is recognized that every gravity operated flush toilet has an optimum fill level that ensures that enough water is in the tank for proper flushing without wasting water or risking incomplete waste carry out. For many years, gravity operated flush toilets in the United States had tanks with capacities of three and one-half gallons, five gallons, or more. Due to water shortages governmental regulations have imposed size limits on the amount of water normally used during a single flush cycle in a gravity-operated flush toilet.

[0006] More recently, the Environmental Protection Agency (EPA) has mandated that low water consumption toilets be installed in all new construction and during all re-models, with a maximum water usage of 1.6 gallons per flush. Some toilets have large diameter drain holes in the tank, e.g. more than three inches, in order to improve flushing. However, in such designs there is a tendency for the flapper valve to close too soon, especially due to the significantly higher flow rate and corresponding suction force associated with larger flush valve openings. Additionally, and because the typical flapper valve is made of a soft elastomeric material to ensure proper seating of the flapper valve with the valve seat of a flush valve, the use of a large diameter valve seat can collapse the flapper valve as a result of water pressure across a large surface area. This is due to the fact that the typical flapper valve is configured to be a device that includes a void or buoyancy chamber which typically spans the large orifice area of the flush valve. Additionally, it is desirable to allow the flush valve to empty the maximum amount of water from the tank so as to create a good, stable and consistent flush cycle every time. This prevents increased water consumption by the toilet which can occur every time an original manufacture (OEM) time-rate flapper valve wears out and is replaced by the consumer with an after market full-flush flapper valve. Note also that time-rate flapper valves have a tendency to close prematurely, thereby only flushing part of the water stored in the flush tank.

[0007] Accordingly, a primary objective of the device of the present invention is to provide a new, useful and non-obvious flapper valve that can be used to cover and seal the main flush valve orifice, especially where extremely large orifice areas of flush valves are used and to prevent collapse of the flapper valve as a result of water pressure across a large surface area. It is another object to provide such a flapper valve that can be used in original manufacture toilet fixtures as well as for the after market gravity operated flush toilets. It is still another object to provide such a flapper valve that is made of the same soft elastomeric material that is used in flapper valves of current manufacture but which is not backed up by or supported by any stiffener plate. It is yet another object to provide such a flapper valve that utilizes an elastomeric portion whereby the flapper valve is still allowed to conform, with head pressure, to the seating surface of the flush valve body and ensuring a good seal under all uses and flush cycles.

[0008] In accordance with the aforementioned objectives of the present invention, there is provided a flapper valve having a rigid bulb insert and a surrounding flapper top. The flapper valve of the present invention can be used as equipment in toilets of original manufacture and as replacement after-market devices. The flapper valve of the present invention is unique and improved in a number of key respects. For example, although the top of the flapper valve is made of an elastomeric material, and covers the main flush valve orifice, it has a rigid bulb insert disposed within the bottom of the flapper valve. The design of the rigid bulb insert allows it to be the buoyancy chamber, but it also serves as the reinforcement means for the soft elastomeric flapper top to prevent collapse as a result of water pressure across a large surface area, which is especially true with the latest designs of extremely large orifice areas for flush valves.

[0009] The flapper top is configured with a large cavity to receive the rigid bulb insert and to trap more air for full-flotation even with a short-lift flushing action by the flush lever. This is a full-floating flapper valve design, which allows the flush valve to empty the maximum amount of water from the tank so as to create a good, stable and consistent flush cycle every time. This prevents increased water consumption by the toilet which can occur every time an OEM time-rate flapper valve wears out and is replaced by the consumer with an after market full-flush flapper valve. It is to be noted that time-rated flappers have a tendency to close prematurely, thereby only flushing part of the water stored in the flush tank.
The rigid bulb insert of the present invention has one or more drain holes or apertures to ensure proper drainage of any water that may enter the bulb chamber around the top lip, so that the flapper valve will not get heavier with usage. This means that a water-tight seal between the lower flange of the flapper top and the rigid bulb insert flange is not necessary, though for most practical purposes a fairly good seal can be maintained due to the configuration of both parts. The sealing flange on the flapper valve is made of the same soft elastomeric material but that portion is not backed up or supported by any stiffener plate. That is, the stiffener ribs and flange of the insert is “inboard” of the lip of the sealing surface on the flush valve body. This allows the flapper valve to conform, with head pressure, to the sealing surface of the flush valve body, thereby ensuring a good seal. Additionally, the hinge attachment of the flapper valve of the present invention is unique and allows stable pivoting while being easily removable and allowing easy attachment onto the flush valve pegs.

The foregoing and other features of the device and method of the present invention will be apparent from the detailed description that follows.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top, front and left side perspective view of one embodiment of a flapper valve that is constructed in accordance with the present invention.
FIG. 2 is a bottom, front and left side perspective view of the flapper valve shown in FIG. 1.
FIG. 3 is a top plan view of the flapper valve shown in FIG. 1.
FIG. 4 is a left side and cross-sectioned elevational view of the flapper valve shown in FIG. 1 and taken along line 4-4 of FIG. 3.
FIG. 5 is a left side elevational view of the flapper valve shown in FIG. 1.
FIG. 6 is a rear elevational view of the flapper valve shown in FIG. 1.
FIG. 7 is a front elevation view of the flapper valve shown in FIG. 1.
FIG. 8 is a top plan view of the flapper valve shown in FIG. 1.
FIG. 9 is a top, rear and left side perspective view of the rigid bulb insert of the flapper valve shown in FIG. 1.
FIG. 10 is a bottom, rear and left side perspective view of the rigid bulb insert shown in FIG. 9.
FIG. 11 is a bottom plan view of the rigid bulb insert shown in FIG. 9.
FIG. 12 is a left side and cross-sectioned elevational view of the rigid bulb insert shown in FIG. 9 and taken along line 12-12 of FIG. 11.
FIG. 13 is a bottom, front and left side perspective view of the flapper top of the flapper valve shown in FIG. 1.
FIG. 14 is a bottom plan view of the flapper top shown in FIG. 13.
FIG. 15 is a front and cross-sectioned elevational view of the flapper top shown in FIG. 13 and taken along line 15-15 of FIG. 14.
FIG. 16 is a view of the flapper top similar to FIG. 14.
FIG. 17 is a left side and cross-sectioned elevational view of the flapper top shown in FIG. 15 and taken along line 17-17 of FIG. 16.

FIG. 18 is a top, left side and front perspective view of an offset flush valve with which the flapper valve of the present invention can be used, the flapper valve being shown in phantom view.
FIG. 19 is a left side elevational view of the offset flush valve shown in FIG. 18 and showing the flapper valve in phantom view.

DETAILED DESCRIPTION

Referring now to the drawings in detail, wherein like-numbered elements refer to like elements throughout, FIGS. 1 through 7 illustrate a flapper valve, generally identified 10, that is constructed in accordance with the present invention. The flapper valve 10 is the type that is intended to be used with a toilet flush valve 70, of the type illustrated in FIGS. 18 and 19. As shown, the flapper valve 10 is comprised of two primary elements, a rigid bulb insert, generally identified 20, and a flapper top, generally identified 40.

The rigid bulb insert 20 of the flapper valve 10 comprises a generally vertical and upwardly extending upper wall 22. See FIG. 9. The upper wall 22 is supported by a plurality of inner support lattices 24, the inner support lattices 24 also being generally vertically disposed. The rigid bulb insert 20 further comprises a generally curved rim portion 26 and a generally flat rim portion 28, which together comprise a peripheral lip 30 about the rigid bulb insert 20. Extending downwardly in a cup-shaped fashion, and below the rim portions 26, 28, is a curved lower wall 32 and a flat lower wall 34. The curved lower wall 32 and the flat lower wall 34 are integrally formed, together with a bottom floor 36. In the preferred embodiment, the floor 36 of the rigid bulb insert 20 has a small aperture 38 defined in it. See FIG. 10. It is to be understood that the rigid bulb insert 20 is not limited to the particular configuration of the walls 32, 34 and floor 36 as shown, other configurations could be used.

Referring now to FIGS. 13 through 17, they show the flapper top 40 that is constructed in accordance with the present invention. The flapper top 40 is typically made of an elastomeric material such as synthetic rubber having a suitable durometer or softness. The flapper top 40 has an upper inverted cup-shaped portion 42. Extending rearwardly of the cup-shaped portion 42 is a pair of spaced apart parallel mounting arms 62 with rear ends that include apertures 64, the apertures 64 being used to rotatably connect the flapper valve 10 to pegs 79 that form part of the flush valve 70. See FIGS. 18 and 19. The hinge attachment means of the flapper valve 10 of the present invention is unique and allows stable pivoting while being easily removable and allowing easy attachment onto the flush valve pegs 79. Pegs used in the prior art typically include vertically disposed tabs that require more manipulation of the mounting arms to attach them to the pegs. Such manipulation is eliminated in the flapper valve 10 of the present invention. The positioning of the spaced apart parallel mounting arms 62 means that the flapper valve 10 is less susceptible to side-to-side movement and is more stable. The apertures 64 are also configured to more fully engage the pegs 79 of the flush valve 70. Extending about the periphery of the flapper top 40 is an annular peripheral flange or lip 44, 54 that mates with the cylindrical valve seat 73 of the flush valve 70. More specifically, the annular peripheral flange or lip includes a curved front portion 44 and a generally straight rear portion 54. Again, this shape is illustrative only and not a limitation of the flapper valve 10 of the present invention.
Extending inwardly of the peripheral lip portions 44, 54 are secondary lips 46, 56 which form a sealing flange for the rigid bulb insert 20 and the inner edges of a centrally-disposed opening 50 that is defined within the bottom portion of the elastomeric flapper portion 40. The opening 50 and the cup-shaped portion 42 form a cavity 52. The cavity 52 is functionally adapted to receive the upper wall 22 and rim portions 26, 28 of the rigid bulb insert 20 within it. That is, the rigid bulb insert 20 is intended to be received within the opening 50 of the flapper top 40 such that the rim portions 26, 28 rest upon the inwardly-disposed flange or lips 46, 56, respectively, of the flapper top 40. In this fashion, the rigid bulb insert 20 is held in place within the flapper portion 40 as is shown in FIG. 2. Finally, situated on top of the cup-shaped flapper portion 42 is a connection member 48, the member 48 being configured to receive an attachment means (not shown) for lifting the flapper valve 10 upwardly during the initiation of the flush cycle of the toilet.

In application, the flapper valve 10 sits atop the flush valve 40 as shown in FIGS. 18 and 19. Specifically, FIGS. 18 and 19 illustrate an offset outlet flush valve, generally identified 70, of the type with which the flapper valve 10 of the present invention may be used. As shown, the flush valve 70 has a valve body 72 that is similarly intended for OEM applications. As shown, the valve body 72 includes an outlet offset 75 which functions in the way described in the currently co-pending U.S. patent application Ser. No. 11/268,319 entitled “Offset Outlet Flush Valve and Method for Making Same.” The overflow tube 77 of this embodiment is formed as part of a socket 76 and its height is manufactured in accordance with a predetermined dimension. The uppermost portion 78 of the overflow tube may be flared to impart greater flow capacity in an overflow condition. The placement of the outlet 75 more closely to the socket 76 greatly increases flow during overflow condition since the rigid bulb insert 20 (not shown in FIGS. 18 and 19) of the flapper valve 10 (shown in phantom view) does not create a barrier to effective water flow through the valve body 71. The inlet 72 of the valve body 71 also includes a rim 73 upon which the annular peripheral lip 44, 54 of the flapper top 40 (shown in phantom view) may rest. As shown, the rim 73 has a “flattened” portion 74 at its point closest to the socket 76 and overflow tube 77. This embodiment requires the use of the particularly-formed flapper valve 10 of the present invention but is not limited to the configuration illustrated. It should also be noted that the use of the rigid bulb insert 20 as described above provides the added benefit of allowing the walls 32, 34 of the rigid bulb insert 20 to engage corresponding and similarly-shaped portions of the flush valve inlet 72. This feature allows the flapper valve 10 to “seat” within the flush valve 70, and to actually rest upon or be supported by a portion of the flush valve inlet 72, with resulting limited distortion of the elastomeric peripheral flanges 44, 54 along the valve seat 73, 74, respectively. Although the foregoing has been described with a certain degree of particularity, it is to be understood that the present disclosure has been made by way of example only and that numerous changes in the construction and the arrangement of components, some of which have been alluded to, may be resorted to without departing from the spirit and scope of the invention as it is described.

From the foregoing detailed description of the illustrative embodiment of the invention set forth herein, it will be apparent that there has been provided a new, useful and uncomplicated toilet flapper valve having a rigid bulb insert and a surrounding flapper top, the latter being preferably made of an elastomeric material. The flapper valve of the present invention can be used as equipment in toilets of original manufacture and as replacement after-market devices.

The principles of this invention being described in accordance with the foregoing, we claim as our invention the following:

1. A flapper valve for use with a toilet flush valve, the toilet flapper valve comprising:
   a flapper top, the flapper top being made of an elastomeric material, and
   a rigid bulb insert.

2. The toilet flapper valve of claim 1 wherein the rigid bulb insert of the toilet flapper valve comprises a generally horizontal rim portion, a generally vertical upper wall extending upwardly from the rim portion, a lower wall extending downwardly from the rim portion, and a floor.

3. The toilet flapper valve of claim 2 wherein the rigid bulb insert of the toilet flapper valve comprises a plurality of inner support lattices, the inner support lattices being disposed generally vertically.

4. The toilet flapper valve of claim 3 wherein the floor of the rigid bulb insert of the toilet flapper valve comprises an aperture defined in it.

5. The toilet flapper valve of claim 4 wherein the rigid bulb insert comprises a generally curved rim portion and a generally flat rim portion, a generally curved upper wall portion and a generally flat upper wall portion, and a generally curved lower wall portion and a generally flat lower wall portion.

6. The toilet flapper valve of claim 5 wherein the rigid bulb insert further comprises a curved lower wall and a flat lower wall extending downwardly in a cup-shaped fashion below the rim portions, the curved lower wall and the flat lower wall being integrally formed with the floor.

7. The toilet flapper valve of claim 1 wherein the flapper top comprises an upper inverted cup-shaped portion and an outer peripheral flange that is configured to mate with a valve seat of the toilet flush valve.

8. The toilet flapper valve of claim 7 wherein the flapper top comprises an inner flange that is configured to form a seal surface for the horizontal rim of the rigid bulb insert.

9. A toilet flapper valve and flush valve assembly, the flush valve comprising a valve body inlet and a valve seat, and the toilet flapper valve comprising:
   a flapper top, the flapper top being made of an elastomeric material, and
   a rigid bulb insert.

10. The assembly of claim 9 wherein the rigid bulb insert of the toilet flapper valve comprises a generally horizontal rim portion, a generally vertical upper wall extending upwardly from the rim portion, a lower wall extending downwardly from the rim portion, and a floor.

11. The assembly of claim 10 wherein the rigid bulb insert of the toilet flapper valve comprises a plurality of inner support lattices, the inner support lattices being disposed generally vertically.

12. The assembly of claim 11 wherein the floor of the rigid bulb insert of the toilet flapper valve comprises a window defined in it.

13. The assembly of claim 12 wherein the rigid bulb insert comprises a generally curved rim portion that is continuous with a generally flat rim portion, a generally curved upper wall portion that is continuous with a generally flat upper wall.
portion, and a generally curved lower wall portion that is continuous with a generally flat lower wall portion.

14. The assembly of claim 5 wherein the rigid bulb insert further comprises a curved lower wall and a flat lower wall extending downwardly in a cup-shaped fashion below the rim portions, the curved lower wall and the flat lower wall being integrally formed with the floor.

15. The assembly of claim 9 wherein the flapper top comprises an upper inverted cup-shaped portion and an outer peripheral flange that is configured to mate with the valve seat of the toilet flush valve.

16. The assembly of claim 15 wherein the flapper top comprises an inner flange that is configured to form a seal surface for the horizontal rim of the rigid bulb insert.

17. The assembly of claim 16 wherein the rigid bulb insert is configured to engage and rest upon a portion of the valve body inlet.

18. The assembly of claim 17 wherein the flush valve further comprises a pair of opposing pegs and the flapper top comprises a pair of opposing mounting arms and apertures for securing the arms to the pegs.

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