WATER SAVING CUP DEVICE FOR TOILET TANKS

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References Cited
UNITED STATES PATENTS
1,323,703 12/1919 Linfoot

Abstract

A thin, flexible-walled, cup-like vessel surrounds a flush valve in a conventional closet water tank forming an open ended water column extending upward around the valve assembly thereby preventing water stored in the base of the tank outside the column from being discharged during flushing.

8 Claims, 7 Drawing Figures
WATER SAVING CUP DEVICE FOR TOILET TANKS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application relates to and constitutes an improvement over copending applications, Ser. No. 105,032, entitled “Water Saving Apparatus and Method for Water Closets,” and Ser. No. 191,228, entitled “Auxiliary Water Saving Attachment for Water Closets and Method,” all by the same inventor.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to water closets, and particularly to water closets which are adapted to be employed in connection with conventional water closet flush tank assemblies for the purpose of reducing the amount of water consumed by flushing.

2. Description of the Prior Art

Water closets of the type utilizing a flush tank and flush valve mechanism have enjoyed wide use in households as well as institutions. The prior art has taught a number of such water closets which are adapted to effect a savings in water consumption during flushing. These have primarily consisted of structural modifications of the flush tank itself. Others have employed mechanical flush valve controls adapted to provide choices between a full flush or a water saving flush. Still others teach the use of auxiliary rigid box members which require partial disassembly of the plumbing to install. Pertinent prior art to be noted includes U.S. Pat. Nos. 1,323,703, 3,041,630, 383,045 and 3,259,918. While effectively reducing the amount of water consumed during flush, these adaptations of the prior art generally involve high costs of fabrication and require complex modifications and installations by plumbers so as to be beyond the means of the average homeowner. Further, the devices of the prior art cannot be bent to avoid internal plumbing.

Copending application, Ser. No. 105,032, teaches the concept of providing a flexible four-walled box structure having open ends and which can be bent, assembled and installed inside a closet water tank without removing or altering any internal plumbing to provide an open-ended column immediately surrounding the flush valve mechanism. Copending application, Ser. No. 191,228, teaches the use of a flexible, five-walled, U-shaped device which is sealed against the tank bottom and immediately surrounds the flush valve mechanism and is held in place by spring plunger rods pressing against a side of the tank. This type of construction adapts the invention to a wider variety of flush tank configurations than had formerly been possible. All of the mentioned copending applications are directed to the concept of saving water during flushing by means of an inexpensive, easily assembled, flexible-walled auxiliary column which immediately surrounds a flush valve in a closet water tank. During bowl evacuation only the water contained above the column or within the column is permitted to be discharged. That water lying outside and below the top of the column is retained. While the devices and methods of the aforementioned copending applications are believed to be unique and to have been the first teaching of a convenient, inexpensive and effective means of saving water during flushing without requiring disassembly of the tank plumbing, a need for further improvement has been revealed.

Due to the increasing burden on water resources especially in rapidly expanding metropolitan areas, water shortages often reach critical proportions. There is clearly a need for a type of inexpensive water saving device adapted for use in existing water closets as well as for permanent application in new installations. The prior art has not taught such an inexpensive device which adapts to a wide variety of installations yet is of lasting construction as is required for initial plumbing. These problems constitute objects of the present invention and, as will be perceived, other objects will appear in the description and appended claims which follow.

SUMMARY OF THE INVENTION

In a preferred embodiment the apparatus of the invention comprises a cup-like vessel formed of mating vertical half sections, molded construction and having an open end. The vessel, once assembled, is adapted to be sealingly secured around the beveled ring gasket which is conventionally found beneath the flush valve assembly in a conventional closet water tank and once so secured forms a watertight column extending upwardly only a portion of the height of the tank. When the tank is flushed by opening the outlet valve, the water level drops essentially to the level of the top of the column while the water within the column is rapidly drained. Water surrounding the column below the topmost rim is prevented from exiting and is thereby saved.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective cutaway view showing the placement of the invention apparatus inside a conventional flush tank. Plumbing parts have been simplified for the purpose of illustration.

FIG. 2 is a perspective view of the disassembled invention apparatus.

FIG. 3 is a cutaway top view of the portion of the flush tank bottom wall occupied by the invention apparatus.

FIG. 4 is a side elevation showing the apparatus in an auxiliary relationship with an existing conventional flush tank installation.

FIG. 5 is a side elevation showing the apparatus in cooperative arrangement with original flush tank parts in an initial installation.

FIG. 6 is a top view of a supportive wedge.

FIG. 7 is a blowup view of the mating snap seals employed to join the half-sections.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, the apparatus of the invention, 10, represented by dashed lines, is shown situated inside a conventional flush tank 21. The flushing mechanism typically consists of an inlet tube 15, inlet valve 16, fillier tube 17, overflow tube 18, beveled ring gasket 22, outlet valve 26, trip arm 19, trip handle 28, trip linkage wire 23, ball float 24, ball float arm 25, and refill tube 27. Flushing normally proceeds as trip arm 19 is activated by depressing handle 28, causing trip linkage wire 23 to open valve 26 permitting stored water in tank 21 to flow into bowl 20 to effect evacuation.
Once the water has reached the minimum level 29, valve 26 closes. Inlet valve 16, having been opened when float 24 began to fall with the exiting water, allows incoming water to refill tank 21 through filler tube 17 and refill bowl 20 through refill tube 27. Once the water reaches the maximum level 14, float 24 is high enough to cause inlet valve 16 to close readying the toilet for the next use.

In a preferred embodiment best shown in FIG. 2, the apparatus of the invention is composed of two molded vertical, thin wall, mating half sections 30, 31 which consist of base 32 and sidewall 33 and which join in sealing relationship at edges 39, 40 by edge snap means, best shown in FIG. 7, to form a cup-like structure. Referring to FIG. 3, a tapered aperture 38 is formed along the base edges 39, 40 of the two sections. Referring next to FIG. 4, the apparatus 10 is assembled inside a conventional flush tank so as to clamp tapered aperture 38 around beveled ring gasket 22 in a sealing relationship. Edges 39, 40 become snapped together forming a watertight column peripheral to outlet valve 26 and refill tube 17 and extending upwardly to the height of walls 30 and 31. Of particular importance is that this operation requires no tools and no alteration or removal of any of the internal plumbing mechanism. Since outlet valve design and beveled ring gasket height varies between different manufacturers and installations, supportive wedges 50, 51 (see also FIG. 6) may in some cases be placed at appropriate locations beneath the apparatus to accommodate different style configurations while maintaining a watertight seal.

In an alternate embodiment shown in FIG. 5, the apparatus of the invention is formed as a thin wall, flexible cup and is depicted without snap edges. It is contemplated that in new installations where a more permanent fixture is necessary, one-piece fabrication is more desirable than split construction. Herein, the aperture 38 is positioned between beveled ring gasket 22' and outlet valve washer 11 during normal plumbing assembly. Outlet nut 12 is tightened down on outlet shank 13, seating valve 26 and apparatus 10' against gasket 22'. This embodiment, in no case, requires wedging or other additional supportive devices due to the greater stability afforded by the tightness of the seal. Furthermore, since the apparatus does not rest on the tank bottom, nor against the tank sides, as have previous auxiliary devices, no special sealing problems are created. Installation is very easily accomplished as part of the initial installation without added expense and by reason of the flexibility of the cup wall, the cup wall may be bent to avoid internal plumbing during installation and may, if necessary, be left permanently bent. Thus, this embodiment, as with the first embodiment, adapts to a wide variety of types of closets and internal plumbing arrangements.

Operation of the flush tank in accordance with the objectives of the invention apparatus proceeds as follows. Referring again to FIG. 1, the water saving apparatus divides the volume of water beneath surface level 14 into two volumetric portions. One portion consists of the water inside vessel 10 and also includes the water in the tank above the level represented by dashed line 70, thus insuring utilization of the normal full flush water head and maintenance of normal flush water flow qualities. The other portion comprises the water confined below level 70 outside vessel 10. During flushing, the water within vessel 10 descends by siphonic action at a faster rate than water above and outside the vessel 10 until valve 26 is closed and refilling is begun. Since water being stored outside vessel 10 and below level 70 is effectively prevented from passing through valve 26 it is saved in the tank. This represents a net savings of approximately 30 to 50 percent, depending on the particular tank construction, of the volume of water normally consumed during flushing. Also, since filler tube 17 is outside vessel 10, as best shown in FIG. 3, sufficient turbulence is created by the incoming stream of water to adequately mix stored water with fresh incoming water, thus maintaining a fresh water supply inside the tank.

Structurally, the apparatus of the preferred embodiment is molded according to volumetric and operational considerations. As shown in FIG. 3, the non-cylindrical curvature of wall 34 enables the apparatus to effectively immediately surround flush outlet 60 yet not interfere with the normal operation and placement of the inlet valve 16. As best shown in FIG. 3, a preferred form calls for the half-section A to be substantially semicylindrical as viewed in plan, for the dimension X to be greater than the dimension Y, for the quarter-section B to be substantially elliptically shaped as viewed in plan and for the quarter-section C to follow the alternating concave-convex curvature as viewed in plan. In addition, the volume of the column is predetermined to be large enough to allow passage of a sufficient volume of water to cause evacuation of the bowl, yet small enough to maintain a Venturi effect necessary to adequately agitate and wash the bowl sides by accelerating the flow of the reduced volume of water. The invention apparatus therefore achieves a further object of being a highly efficient means of effecting normal bowl evacuation with a minimum amount of water. The unique shape of the vessel of the invention, together with its flexibility, also adapts to a great variety of internal tank constructions. Particularly in old installations, the non-cylindrical and flexible shape shown enables the two half-sections to be worked into place and snapped together without requiring tools or any alteration of the existing plumbing.

As an example, in one embodiment the cup vessel was molded in half-sections of flexible plastic having a thickness of about 1/16 inch. The aperture was 2 3/8 inches in diameter, the height "H" was 5 1/2 inches, the dimension "X" was 3 1/4 inches and the dimension "Y" was 4 3/8 inches. The sections were formed with snap fit edges as in FIG. 7 and wedges were employed as shown in FIGS. 4 and 6. The dimension "W" was 5 inches.

From the foregoing, it is evident that the apparatus of the invention provides an extremely simple and effective means to save very substantial amounts of water while effecting normal flushing operations. It has an added advantage of maintaining a fresh water supply within the tank. It has a further advantage of lending itself to easy permanent installation in a great variety of water closets without requiring additional modification and at absolutely nominal expense, as compared to the cost of water saved. That is, it has been discovered possible to mold the vessel of the invention in the flexible and non-circular shape shown and thereby adapt the invention to installation in any of a great variety of toilet tanks having different types of internal plumbing arrangements. Also, by reason of making the walls of thin molded plastic, they become flexible and bendable which enables the mating half-sections to be flexed as
required and worked around existing tank mechanism without having to remove or alter the same. If necessary in close fits, the wall section may even be left slightly bent to avoid internal plumbing without affecting the operation. None of the prior art teaches either the half-section, snap-together vessel or flexible wall vessel concept and thus the prior art has now been given a simple but substantial improvement.

What is claimed is:

1. A water closet of the type having a tank formed by bottom and sidewalls and providing a hydraulic head and storage of predetermined height and capacity, having internal tank mechanism including a movable flush valve mounted in the bottom wall of the tank and seated in one end of a conduit connecting the tank to a lower positioned bowl, having manual handle means adapted to open the valve to empty the tank and cooperative water supply means for refilling the tank upon the valve returning to a closed position, the opening of the valve normally causing initiation of flushing and bowl evacuation followed by substantial emptying of the tank and then closing of the valve, the improvement comprising, in combination:
   a. an auxiliary thin-walled, flexible, cup-shaped member having side and bottom walls and an aperture formed in the bottom wall and adapted to be vertically positioned within the tank whereby the edges of the aperture sealably engage selected internal peripheral surfaces of the tank outlet structure and said cup member forms in effect a tubular open top column extending above and immediately around the valve and closed at the bottom by the said cup member bottom wall, said cup member having a predetermined volume and non-cylindrical configuration selected such that said cup member adapts to being installed by flexing as required to avoid altering the normal position of any internal tank mechanism and to form said column in said tank without disturbing the normal functioning of the handle and water supply means or reducing the hydraulic head above the valve; and
   b. retainer means adapted to retain said cup member in said column form and with the respective contacting aperture edges and outlet surfaces in relatively tight sealing engagement to minimize water flow therebetween, said cup member and retainer means thereby being effective upon said valve being opened to prevent emptying of said tank below a level substantially equal to the level of said column top end and to cause said valve to seat and said tank to start refilling substantially immediately after said evacuation.

2. A water saving device as claimed in claim 1 wherein said cup member is formed of molded mating vertical half-sections and said half-sections are adapted to be releasably secured together at the edges by edge snap connection means thereby enabling said vessel to be readily mounted around existing flush valve assemblies without requiring disassembly or further adaptation of existing flush tank parts.

3. A water saving device as claimed in claim 1 including wedges adapted to be positioned between the underside of the bottom wall of said vessel and the bottom wall of the flush tank to maintain said vessel in a substantially stabilized position when filled and during flushing.

4. A water saving device as claimed in claim 3 wherein said vessel in plan presents a curved, concave-convex, shape adapting said vessel to fit within plural types of conventional flush tank assemblies so as not to interfere with the conventional placement and normal operation of said assemblies.

5. A water saving device as claimed in claim 1 wherein said water closet includes a beveled gasket within the tank around the outlet, said vessel is of unitary fabrication and includes a base aperture adapted to seat above said beveled ring gasket and below said outlet valve to become sealingly secured therebetween during the initial assembly of a conventional flush valve mechanism.

6. A water saving device as claimed in claim 1 wherein said aperture includes tapered edges adapted to correspond to the angle of tapering of said beveled gasket outer edges.

7. A water saving device as claimed in claim 5 wherein said aperture includes tapered edges adapted to correspond to the angle of tapering of said beveled gasket outer edges.

8. A water saving device as claimed in claim 4 wherein said water closet includes a beveled gasket within the tank around the outlet, said vessel is of unitary fabrication and includes a base aperture adapted to seat above said beveled ring gasket and below said outlet valve to become sealingly secured therebetween during the initial assembly of a conventional flush valve mechanism.

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