TOILET VALVE REFILL WATER ADJUSTER

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Filed: Aug. 14, 2009

Abstract:
A toilet bowl refill water adjuster, including: a frame; a refill tube inlet and a refill tube outlet in the frame; a pair of opposing grooves in the frame, the opposing grooves having a series of positioning detents therein; and a roller moveable along in the pair of opposing grooves, wherein the frame is dimensioned to receive a toilet bowl refill tube passing through the refill tube inlet and outlet in the frame such that movement of the roller along in the pair of opposing grooves causes the roller to move in a direction to pinch the toilet bowl refill tube and thereby restrict flow through the toilet bowl refill tube, and wherein there is a linear relationship between the position of the roller in the pair of grooves and the flow rate through the toilet bowl refill tube.

Related U.S. Application Data
Provisional application No. 61/089,819, filed on Aug. 18, 2008.

Publication Classification
Int. Cl. E03D 1/00 (2006.01)
U.S. Cl. 4/415
TOILET VALVE REFILL WATER ADJUSTER
CROSS-REFERENCE TO RELATED APPLICATIONS


TECHNICAL FIELD

[0002] The present invention relates generally to toilet valves, and in particular to valves for adjusting the volume of refill water to a toilet bowl.

BACKGROUND OF THE INVENTION

[0003] Standard siphonic toilets have a curved S-shaped siphon that drains the bowl. The same is true of “dual-flush” siphonic toilets (i.e.: where the tank is partially emptied in the case of liquid waste or fully emptied in the case of solid waste). This siphonic action results in only a very small amount of water being left in the bowl after a flush. This low volume of water remaining after a flush is not sufficient to trap sewage gasses, nor is it sufficient to drain the bowl during the next flush cycle. As a result, a siphonic toilet requires additional water to be added to fill the bowl to a desired level after a flush. If too little water is added to the bowl, the siphon will not function properly. Conversely, if the volume of water used to refill the bowl is too great, then water will simply be wasted as the water drains away through the back of the S-shaped siphon (while keeping the fluid height in the bowl constant). Therefore, the need exists for a system that adjusts the amount of refill water directed into the bowl of a siphonic toilet. It would be most desirable if this system reduces the amount of water that is simply wasted by excess filling of the toilet bowl, yet still provides sufficient refill water to keep the siphon system operating properly.

[0004] Moreover, siphonic toilets are typically designed such that their tank and bowl are refilled at the same time. Thus, after a flush, refill water enters the toilet through a single water refill line. The bulk of this water is used to refill the water tank, while a smaller amount of this water is used to refill the toilet bowl. In the case of most standard siphonic toilets, the water tank and bowl refilling starts and stops at the same time. As a result, the flow rate into the toilet bowl is typically pre-set such that the predetermined volume of water enters the bowl during the time it takes for the water tank to refill. However, as described above, the need still exists for a system that can be used to adjust this volume of bowl refill water to an optimal value.

SUMMARY OF THE INVENTION

[0005] The present invention provides a system for conveniently adjusting the volume of refill water directed into a toilet bowl. As such, the user can ensure that a proper (i.e.: adequate but not excessive) amount of water passes into their toilet bowl.

[0006] In one aspect, the present invention provides a toilet bowl refill water adjuster, comprising: a frame; a refill tube inlet and a refill tube outlet in the frame; a pair of opposing grooves in the frame, the opposing grooves having a series of positioning detents therein; and a roller moveable along in the pair of opposing grooves. The present invention is dimensioned to receive a toilet bowl refill tube passing through the refill tube inlet and outlet in the frame. Movement of the roller along its travel path in the pair of opposing grooves causes the roller to move in a direction to increasingly or decreasingly “pinch” the toilet bowl refill tube and thereby restrict flow through the toilet bowl refill tube. Thus, a user can set the device to increasingly pinch the refill tube to put less water into the bowl, or vice versa.

[0007] A unique feature of the present invention is that there is a generally linear relationship between the position of the roller in its travel path along in the pair of grooves and the flow rate through the toilet bowl refill tube. In other words, when the roller has been moved a certain percentage of the distance along in its grooves, the water flow through the refill tube is increased or decreased by the same percentage. This feature of the invention represents a significant advance in water flow control by providing a system in which precise adjustments can be easily and quickly made. A user need only move the roller a certain percentage of the distance between the “open” and “closed” positions, and the volume of water flow into the bowl is increased or decreased by that same percentage.

[0008] In certain preferred aspects, the unique linear relationship between the position of the pinch roller and the flow rate in the refill tube can be achieved by the unique shape of a refill tube bottom support surface positioned opposite to the roller (i.e.: where the refill tube is pinched between the roller and the bottom support surface). For example, the refill tube bottom support surface may optionally have a longitudinally curved and laterally flattened portion. Such longitudinally curved and laterally flattened portion may also be tapered. In other examples and embodiments, each of the pair of opposing grooves may extend in a curved path along the frame. It is to be understood that the present invention is not limited to either or both of these exemplary design embodiments. Instead, the present invention more generally encompasses a frame shape in which the degree to which the refill tube is pinched depends (in a linear relationship) upon the position of the pinch roller.

[0009] Furthermore, an advantage of the positioning detents is that they hold the roller at a desired location in the grooves irrespective of pressure changes in the bowl refill tube line. Thus, a user simply “clicks” the roller into a desired position and it is locked in place between successive detents in grooves.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] These and other features of the invention are described in further detail in the following description and will be better understood with reference to the accompanying drawings, which are briefly described below.

[0011] FIG. 1 is a top perspective view of the present invention in a fully open position.

[0012] FIG. 2 is a sectional side elevation view corresponding to FIG. 1.

[0013] FIG. 3 is a top perspective view of the present invention in a fully closed position.

[0014] FIG. 4 is a sectional side elevation view corresponding to FIG. 3.

[0015] FIG. 5 is a top perspective view of the frame with the roller and refill tube removed.

[0016] FIG. 6 is a bottom perspective view of the frame with the roller and refill tube removed.
FIG. 7 is a top plan view of the frame with the roller and refill tube removed.

FIG. 8 is a front elevation view of the frame.

FIG. 9 is a back elevation view of the frame.

FIG. 10 is a cut-away schematic illustration of the present adjuster roller valve in operation in a toilet.

DETAILED DESCRIPTION OF THE DRAWINGS

Exemplary embodiments of the invention are described in detail below with reference to the appended figures, wherein like elements are referenced with like numerals throughout. The figures are not necessarily drawn to scale and do not necessarily show every detail or structure of the various embodiments of the invention, but rather illustrate exemplary embodiments and mechanical features in order to provide an enabling description of such embodiments.

The present invention provides a system for adjusting the volume of refill water to a toilet bowl by adjustably restricting the amount of flow to the toilet bowl when the toilet water tank is refilling after a flush.

FIGS. 1 to 4 show general operation of the present invention (between its fully open and fully closed positions). FIGS. 5 to 9 show additional views of the frame of the adjuster body itself, and FIG. 10 schematically illustrates the present invention in use in a toilet.

Referring first to FIGS. 1 to 4, the present invention provides a roller pinch valve bowl refill water adjuster 10. Adjuster 10 comprises a frame 20: a refill tube inlet 22 and a refill tube outlet 24. A pair of opposing grooves 30 are provided on opposite interior surfaces of frame 20. The opposing grooves 30 have a series of positioning detents 32 therein. A roller 40 is moveable along a path in the pair of opposing grooves 30. In preferred embodiments, roller 40 is a knurled cylinder that is moveable by a user's finger to adjust the setting. Frame 20 is dimensioned to receive a toilet bowl refill tube 50 passing through refill tube inlet 22 and outlet 24. Movement of roller 40 along its travel path in the pair of opposing grooves 30 causes roller 40 to move in a direction that is not parallel to toilet bowl refill tube 50. Thus, movement of roller 40 along its travel path in the pair of opposing grooves 30 causes roller 40 to pinch toilet bowl refill tube 50. Preferably, roller 40 has centrally extending shafts on either end that stick out and are received into opposing grooves 30. These shafts are held in position between successive detents 32. Thus, a user conveniently "clicks" roller 40 into various positions between successive detents 32 along opposing grooves 30.

Such pinching restricts flow passing through toilet bowl refill tube 50 in a manner such that there is a linear relationship between the position of roller 40 in grooves 30 and the flow rate through toilet bowl refill tube 50. Specifically, when roller 40 has been moved a certain percentage of the distance along in its grooves 30, the water flow through refill tube 50 is increased or decreased by the same percentage. This feature of the invention represents a significant advance in water flow control by providing a system in which precise adjustments can be easily and quickly made.

FIGS. 1 and 2 illustrate adjuster 10 in its fully "open" position. In this position, roller 40 is positioned away from refill tube 50 such that water flows unimpeded through refill tube 50. In this setting, a maximum amount of water passes through refill tube 50 such that the resulting water level in the toilet bowl is at its highest. Conversely, as roller 40 is progressively moved from the fully open position shown in FIGS. 1 and 2 to the fully "closed" position shown in FIGS. 3 and 4, refill tube 50 will be progressively "pinched", choking off more and more of the water passing through refill tube 50. If roller 40 is set at the fully "closed" position shown in FIG. 3, all water flow will be choked off and the only a minimal amount of residual water will remain in the toilet bowl after the flush. Also provided is an optional bump 25 near outlet 24 to ensure zero water flow through refill tube 50 when roller 40 is in the fully closed position of FIGS. 3 and 4.

It is to be understood that a user will typically choose to set roller 40 to a position mid-way between those shown in FIG. 1 and 3. As can be seen, roller 40 is moveable along in grooves 30 to positions that progressively pinch toilet bowl refill tube 50. Specifically, roller 40 moves in a path at an angle to toilet bowl refill tube 50 to progressively pinch the toilet bowl refill tube.

In accordance with the present invention, there is a linear relationship between the position of roller 40 (in grooves 30) and the cross section of toilet bowl refill tube 50 adjacent to (and pinched by) roller 40. This preferred linear relationship can be achieved in a number of different ways, including shaping frame 20 as follows.

First, frame 20 may comprise a novel shaped refill tube bottom support surface 26 positioned underneath toilet bowl refill tube 50 opposite to roller 40. In one embodiment, refill tube bottom support surface 26 may have a longitudinally curved and laterally flattened portion 27. Specifically, portion 27 may be curved in the longitudinal direction along frame 20 (i.e.: the direction along frame 20 between inlet 22 and outlet 24), but be flattened in the lateral direction across frame 20 (i.e.: in the direction across frame 20 between opposing grooves 30). As can also be seen in FIGS. 6 and 7, the longitudinally curved and laterally flattened portion 27 may be tapered (i.e.: narrowing toward outlet 24). Refill tube bottom support surface 26 may also be curved so as to support toilet bowl refill tube 50 passing through frame 20 in a curved orientation.

Secondly, as can also be seen, each of the pair of opposing grooves 30 may extend in a curved path along frame 20 (i.e.: in a path that is not straight between the opposite ends of frame 20 at which inlet 22 and outlet 24 are located). As a result, movement of roller 40 with respect to refill tube 50 may be at a varying angle along the length of grooves 30.

An advantage of either or both of these above described first and second exemplary designs is that separately or together they provide a system that pinches refill tube 50 in a manner such that the cross sectional area of the tube adjacent to roller 40 is increased or decreased in a linear relationship with respect to the positioning of roller 40 along in groove 30. In other words, when roller 40 is at the "open" position shown in FIG. 1, the flow through refill tube 50 is 100% unrestricted. When roller 40 is positioned half way between the position of FIGS. 1 and 2, the flow through refill tube 50 will be 50% restricted. Similarly, when roller 40 is positioned three quarters of the way between from the position shown in FIG. 1 and 2, the flow through refill tube 50 is 75% restricted, etc.

Lastly, FIG. 10 schematically shows the present system 10 for adjusting the volume of refill water in a toilet bowl, as follows. A toilet bowl 100 is provided. Toilet bowl 100 comprises a toilet tank 110, a toilet bowl 120, and a flush valve 130 for passing water from toilet tank 110 into toilet bowl 120, and a fill valve 140. The toilet bowl refill tube 50 on flush valve 130 passes water from toilet tank 110 into toilet bowl 120 when
the toilet tank is refilling. The present toilet bowl refill water adjuster 10 is shown (positioned with toilet bowl refill tube 50 passing therethrough).

Another feature of the present invention is that positioning detents 32 advantageously hold roller 40 in its pre-set position regardless of water pressure changes in toilet bowl refill tube 50. This feature is particularly advantageous in that water pressures in toilet parts vary considerably during the normal flushing cycle. In addition, water pressures vary considerably between different buildings. As a result, it is desirable to have a secure roller positioning system, as is provided by the present invention.

What is claimed is:
1. A toilet bowl refill water adjuster, comprising:
a frame;
a refill tube inlet and a refill tube outlet in the frame;
a pair of opposing grooves in the frame, the opposing grooves having a series of positioning detents therein; and
a roller moveable along in the pair of opposing grooves, wherein the frame is dimensioned to receive a toilet bowl refill tube passing through the refill tube inlet and outlet in the frame such that movement of the roller along in the pair of opposing grooves causes the roller to move in a direction to pinch the toilet bowl refill tube and thereby restrict flow through the toilet bowl refill tube, and wherein there is a linear relationship between the position of the roller in the pair of grooves and the flow rate through the toilet bowl refill tube.
2. The adjuster of claim 1, wherein the roller is moveable along in the pair of opposing grooves to positions that progressively pinch the toilet bowl refill tube.
3. The adjuster of claim 2, wherein the roller moves in a path at an angle to the toilet bowl refill tube to progressively pinch the toilet bowl refill tube.
4. The adjuster of claim 1, wherein there is a linear relationship between the position of the roller in the pair of grooves and the cross section of the toilet bowl refill tube adjacent to the roller.
5. The adjuster of claim 1, wherein the frame comprises a refill tube bottom support surface positioned opposite to the roller.
6. The adjuster of claim 5, wherein the refill tube bottom support surface has a longitudinally curved and laterally flattened portion.
7. The adjuster of claim 5, wherein the longitudinally curved and laterally flattened portion is tapered.
8. The adjuster of claim 5, wherein the refill tube bottom support surface is curved to support the toilet bowl refill tube passing in a curved orientation through the frame.
9. The adjuster of claim 1, wherein the roller moves in a path at an angle to the toilet bowl refill tube.
10. The adjuster of claim 1, further comprising:
a toilet bowl refill tube passing through the refill tube inlet and outlet in the frame.
11. The adjuster of claim 10, wherein the toilet bowl refill tube is positioned between the roller and a refill tube bottom support surface.
12. The adjuster of claim 1, wherein each of the pair of opposing grooves extend in a curved path along the frame.
13. The adjuster of claim 1, wherein the refill tube inlet and refill tube outlet are positioned on opposite ends of the frame.
14. A system for adjusting the volume of refill water in a toilet bowl, comprising:
(a) a toilet, comprising:
a toilet tank,
a toilet bowl,
a flush valve for passing water from the toilet tank into the toilet bowl, and
a toilet bowl refill tube on the flush valve for passing water from the toilet tank into the toilet bowl when the toilet tank is refilling; and
(b) a toilet bowl refill water adjuster positioned to receive the toilet bowl refill tube therethrough, wherein the toilet bowl refill water adjuster comprises a pinch roller mechanism that restricts water flow through the toilet bowl refill tube, and wherein there is a linear relationship between the position of the roller in the pinch roller mechanism and the water flow rate through the toilet bowl refill tube.
15. The system of claim 14, wherein the toilet bowl refill water adjuster comprises:
a frame;
a refill tube inlet and a refill tube outlet in the frame;
a pair of opposing grooves in the frame, the opposing grooves having a series of positioning detents therein; and
a roller moveable along in the pair of opposing grooves, wherein the frame is dimensioned to receive a toilet bowl refill tube passing through the refill tube inlet and outlet in the frame such that movement of the roller along in the pair of opposing grooves causes the roller to move in a direction to pinch the toilet bowl refill tube and thereby restrict flow through the toilet bowl refill tube.
16. The system of claim 15, wherein the positioning detents hold the roller in position regardless of water pressure changes in the toilet bowl refill tube.