(54) Title: WATER CLOSET TANK FILL VALVE

(57) Abstract

A water closet valve (10), automatically closed, following the passage of a predetermined quantity of water therethrough, includes a cylindrical housing having an inlet valve (32) and water passageway (29) at its depending end, is mounted within a water closet on its bottom wall (28). A manually triggered control wheel (22) unseats the valve (32) by a cam surface (42) on the control wheel (22) which permits water to enter the cylindrical housing and drive a water wheel (52), in turn driving a gear train (24) connected with the control wheel for angular rotation of the control wheel (22) and its camming surface (42) to a valve closed position after a predetermined number of revolutions of the gears of the gear train (24).
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WATER CLOSET TANK FILL VALVE

Technical Field

This invention relates to water closets and more particularly to an inlet valve closed by water entering the tank, to close the valve.

It is well known that water closet mechanisms frequently malfunction and fail to close after flushing the water closet, as for example by a worn out ball float or foreign objects under or between the valve and it's seat which may result in numerous gallons of water passing unused from the source of supply to the sewer system.

This invention will eliminate water waste, as a result of malfunctioning water closet components, by automatically shutting or closing the inlet valve to the water tank after a predetermined quantity of water flows through the inlet valve.

Background Art

To reduce the quantity of water discharged to the sewer each time a water closet is flushed, it has been common practice to place objects in the tank of a water closet which will displace the amount of water stored in the tank prior to it being flushed. This has been accomplished by placing bottles of water within the tank or placing a plurality of bricks, or the like, each displacing a quantity of water normally contained by the tank and yet maintaining a fill level which floats a valve-operating float.

Other efforts for conserving water as for example in controlling the quantity of water discharged through lawn sprinklers, or the like, a small valve assembly is inserted in the water hose or at its connection with the source of
water connected with a lawn sprinkler. These valve controls are usually time responsive, shutting off the water after a predetermined time or quantity of water has passed through the hose to the sprinkler.

Neither of the above types of water conservation methods is entirely satisfactory; and this invention provides a valve which may be easily installed in a water closet connection with the water supply, which limits the quantity of water to a desired volume and may be adjusted by the home owner or building operator.

Disclosure of the Invention

A generally cylindrical casing is installed in a water closet tank and supported by its bottom wall with a depending end of the casing connected with the incoming water supply. An inlet valve and seat in the depending end of the casing normally precludes water entry into the tank. The inlet valve is open and closed by a shaft engaging a camming surface on a control wheel which is manually angularly rotated for flushing the water closet. The inlet valve connection has a branch tube discharging water against the vanes of a water wheel which drives a series of vertically stacked gears forming a gear train, gradually applying torque to a shaft with a gear thereon, mating with a spur gear on the inlet valve opening control wheel. After a predetermined number of revolutions of the gears in the gear train, the cam of the control wheel has been rotated to a position permitting a spring to bias the inlet valve closed.

Brief Description Of The Drawings

Figure 1 is a vertical cross-sectional view of the device;
Figure 2 is a horizontal sectional view taken substantially along the line 2--2 of Figure 1;
Figure 3 is a fragmentary vertical cross-sectional view taken substantially along the line 3--3 of Figure 1;
Figure 4 is an side elevational view of one gear rack and gears forming one unit of a gear train; and,
Figure 5 is a horizontal sectional view taken substantially along the line 5--5 of Figure 1.

The Best Mode For Carrying Out the Invention

In the drawings:

The reference numeral 10 indicates the device as a whole, which is cylindrical in general configuration. The device 10 comprises a casing formed by a tube-like base housing 12 and a tubular upper housing 14, having a drain tube 16 depending from its upper end portion.

The bore of the base housing 12 contains a valve means 18, initially opened by a manually triggered control means 20, including a lever 21 for angularly rotating a timing wheel 22 in one direction and supplying water to a water wheel means 23 contained by the top end portion of the upper housing 14, with a gear train means 24, interposed between and connecting the water driven wheel means 23 with the manually triggered valve opening and closing means 20.

The base housing 12, includes a water inlet tube 26 connected with a water supply, not shown, and projects through and is sealed water tight with the bottom end wall 28 of a water closet in a conventional manner. The tube member 26, forms a fluid passageway 29 and is provided with an annular valve seat 30 on its inner wall surface, which seats and seals with a normally closed valve 32 to open and close the passageway 29. The valve 30 includes an elongated valve stem 34, extending axially upward into the upper housing 14.

The manually triggered control means lever 21 is mounted on and projects inwardly at one end through the wall of the upper housing to form a lever stem 38 axially connected by one way ratchet teeth and rack means 39 to a valve control cam wheel 40. The cam wheel is provided with a circumferential camming surface 42, in frictional contact with the top end of the valve stem 34. The cam surface is characterized by a radially disposed stop surface 43 laterally abutting the top end portion of the valve stem 34 when the valve 32 is seated. The cam wheel 40 includes a circum-
ferential rack of teeth 44 adjacent its periphery, opposite the lever 21 for the purposes presently explained.

The inlet tube 26 is provided with a lateral and upwardly extending tube portion 46 offset with respect to the axis of the valve stem 34. The tube portion 46 is connected with one end of a flexible tube 48, having its upper or top end connected with a depending tubular inlet 49 of a water outlet bracket 50, horizontally journalling a water wheel 52, and directing water in a tangential direction toward the vanes 54 of the water wheel. The axle of the water wheel axially supports a pinion 56 at its depending end. Water driving the water wheel drains from the housing top through the drain tube 16 to fill the water closet.

Angular rotation of the water wheel 52 by the flow of water rotating it and its pinion 56, drives a pair of spur gears 58, mounted on and secured to a planar generally circular gear rack 60, similarly having a depending axial drive pinion 62 which forms one unit of the three unit gear train 24.

The drive pinion 62 in turn angularly rotates a second pair of spur gears 58' on a second gear rack 60' having a second drive pinion 62' depending from its axis, which in turn, drives a third set or pair of spur gears 58" mounted on and secured to a third gear rack 60", having a depending drive pinion 64 for cooperatively engaging the control wheel gear teeth 44.

After a predetermined number of revolutions of the water wheel 52, the control wheel 40 is rotated in the direction of the arrow 66, until the valve stem 34 is urged toward a valve closed position, adjacent the cam shoulder 43. A spring 65 surrounding the valve stem 34 between the base housing 12 and a stop 66 axially secured to the stem snaps the valve 32 closed with its seat when the top end of the valve stem reaches the outer limit of the radial shoulder 43.

The control wheel lever 21 is connected with the manually operated flush lever on the exterior of the water
tank, not shown, in a manner to angularly rotate the lever 21 and the control wheel 40 in the direction of the arrow 66. The connection between the lever 21 and the manually tripped water closet lever is such that the control wheel is angularly rotated a distance sufficient to position the top end of the valve stem 34 on the circular portion 42' of the camming surface. In addition to a predetermined number of revolutions of the water wheel and gear train gears for closing the valve, further adjustments of the quantity of water entering the water closet may be controlled by limiting angular rotation of the control wheel to a predetermined arc and thus the position of the valve stem on the cam surface 42' by the adjusting connection between the control wheel lever 21 and the water closet manually operated lever.

Additionally, a control button 70 at the top end of the upper housing permits restricting the quantity of water flowing against the vanes of the water wheel 52 to limit the amount of water entering the water closet.

**Industrial Applicability**

In operation, the lever 21 is angularly rotated by manually tripping the water closet trip lever, not shown, which lifts the water discharge valve of the water closet, not shown, and exhausts the water therefrom. Rotation of the lever 21 in direction of the arrow 66 (Fig. 3) positions the upper end of the valve stem 34 on a portion of the circular camming surface 42' thus opening the valve 32, while simultaneously water from the supply entering the inlet passageway 29, flows through the tube 48 and begins rotating the water wheel 52, in turn driving the spur gears and pinions of the gear train 24 and angularly rotating the control wheel 40 in the direction of the arrow 66, which continues until a predetermined number of revolutions of the gears and the water wheel positions the camming surface 42' so that the spring 65 urges the valve stem toward the cam surface 42 adjacent the radial control wheel shoulder 43, thus abruptly closing the valve 32 and stop-
ping inflow of water, whether or not the water tank has been filled. Thus when malfunction of the drain closing components of the water has failed to close, water is discontinued from entering the water closet.
Claims

1. A self closing valve for a water closet tank, comprising, an upright casing (10) having a top (15) and having a depending inlet tube (26) forming a water inlet port (29) a valve seat (30) in the inlet port, a valve (32) mating with said seat (30) for opening and closing the inlet port (29) said valve (32) having an upstanding stem (34) a control wheel means (20) including a wheel (22) having a gear rack (44) adjacent its periphery and having a camming surface (42) bearing against the end of said valve stem (34) opposite the valve (32) for seating or unseating said valve in accordance with the angular position of said control wheel (22), means (65) biasing said valve (32) toward the valve seat (30), water wheel means (23) including a water wheel (52) having radially disposed vanes (54) journalled by the casing (10) adjacent its top (15), tube means (46, 48) communicating at one end with the inlet port (29) downstream from the valve seat (30) and having its other end disposed adjacent the water wheel means (23) in water wheel angular rotating position, and, water wheel driven gear train means (24) operatively interposed between said water wheel (52) and said control wheel (22) for angularly rotating said control wheel (22) to a valve closed position in response to a predetermined number of revolutions of said water wheel.

2. The valve according to claim 1 in which the control means (20) further includes an axial hub (41) on the control wheel (22), and, a lever (21) having a lever stem (38) projecting through the wall of said casing and coaxially entering the control wheel hub (41) for angularly
rotating the control wheel (22) manually.

3. The valve according to claim 2 in which the control means further includes, ratchet means (63) connecting said lever stem (38) with the control wheel hub (41) for manually rotating said lever (21) and said control wheel (22) in one direction as a unit about the axis of said lever stem (38) and permitting angular rotation of said control wheel (22) relative to said lever (21) in said one direction by said gear train means (24).

4. The valve according to claim 3 and further including, a horizontal partition (51) adjacent said casing top (15) for forming a water wheel compartment surrounding said water wheel (52), bracket means (50) in said water wheel compartment for directing water in a tangential direction toward said water wheel (52), and, a drain tube (16) communicating with the water compartment.

5. The valve according to claim 4 in which the water wheel further includes, an axle depending through said partition, and, a water wheel pinion (56) on the water wheel axle for driving said gear train means (24).

6. The valve according to the claim 5 and further including, a driven pinion (64) depending from said gear train means (24) and drivably engaged with the gear rack (44) on said control wheel (22), and, other ratchet means (63) interposed between said gear train means (24) and said driven pinion (56) for angularly rotating said control wheel (22) in said one direction and permitting manual angular rotation of said control wheel in said one direction independently of said gear train means.

7. The valve according to claim 1 and further including, a horizontal partition (51) adjacent said casing top (15) for forming a water wheel compartment surrounding said water wheel, bracket means (50) in said water wheel compartment for directing water in a tangential direction toward said water wheel (52), and, a drain tube communicating with the water compartment.

8. The valve according to claim 7 in which the water
wheel further includes, an axle depending through said partition (51), and, a pinion (56) on the water wheel axle for driving said gear train means (24).

9. The valve according to claim 8 and further including, a driven pinion (64) depending from said gear train means (24) and drivably engaged with the gear rack (44) on said control wheel (22), and, other ratchet means (63) interposed between said gear train means (24) and said driven pinion (56) for angularly rotating said control wheel (22) in said one direction and permitting manual angular rotation of said control wheel in said one direction independently of said gear train means.
**INTERNATIONAL SEARCH REPORT**

**I. CLASSIFICATION OF SUBJECT MATTER**

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC(5): B67D 5/30
US CL.: 137/624.11; 251/20; 222/20

**II. FIELDS SEARCHED**

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<td>U.S.</td>
<td>137/624.11, 624.22; 251/15, 20, 74; 222/20</td>
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**Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched**

**III. DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
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<th>Category</th>
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<tr>
<td>A</td>
<td>US,A, 3,638,882 (Heyer et al) 01 February 1972 See entire document</td>
<td>1 - 9</td>
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<tr>
<td>A</td>
<td>US,A, 4,202,467 (Rutten et al) 13 May 1980 See entire document</td>
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<tr>
<td>A</td>
<td>US,A, 2,761,587 (Schantz) 04 September 1956 See entire document</td>
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**IV. CERTIFICATION**

Date of the Actual Completion of the International Search: 27 June 1990
Date of Mailing of this International Search Report: 4 OCT 1990

International Searching Authority: ISA/US

Signature of Authorized Officer: A. Michael Chambers

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