FLUSHING TANK FOR WATER CLOSET OR THE LIKE

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A flushing tank for water closet or other similar container provided with a first device designed to control the water level in said tank and with a second device of the so called "Sifonic" type designed to control the water flushing into a flushing pipe connected to a water closet bowl or the like characterized by the fact that means are provided for increasing the buoyancy of the outlet ball valve of the device controlling the water flushing and for obtaining a pneumatic watertight closure of said valve against its seat, while the device designed to control the water level into the tank is provided with means for adjusting the maximum water level into said tank and with other means for obtaining a watertight closure of a piston valve in the line from the water supply to a discharge pipe to the bowl and including means to regulate any high pressure source of water.

2 Claims, 5 Drawing Figures
FLUSHING TANK FOR WATER CLOSET OR THE LIKE

The present invention relates to flushing tanks or other similar containers designed to accumulate water for flushing a drain or sewer which is not laid at a self-cleansing gradient. More in particular the invention relates to the water line device in said flushing tank which controls the level of the water in said flushing tank and to the flushing control device which controls the water flushing into the flushing pipe and then into the bowl from which the excreta have to be carried away. Said flushing is primed by actuating a ball valve which has to be raised in order to let the water contained in the flushing tank to flow down into the flushing pipe, said water flow into said flushing pipe inducing a suction effect on the water contained in said tank, which promotes a ready emptying of said tank. A flushing control device of this type is commonly called as "Sifonic" device.

An object of this invention is to provide an improved device for controlling the water level in the flushing tank so that said level cannot exceed a predetermined and adjustable value, said first device being controlled by a floating hollow ball connected through a linkage system to a valve which is moved "off" and "on" by the rising and falling of said hollow ball floating on the surface of the water, said valve thus controlling the outflow of the water into the flushing tank. In particular this device is so constructed as to perform a rectilinear path to and from its seat so as to be able to perform a perfect closure even in the case wherein the supplied water has a high pressure. Said valve further is provided with seal closure means which separate a chamber into which the water from the supply source flows from an adjacent chamber housing the valve means and open to the atmosphere. Said first device includes a pipe union for the connection with the pipe supplying the water and connected with the supply network.

Another object of this invention is to provide improvements in the valve controlling the water flushing from the tank, in order to ensure a perfect seal closure of the inlet of the flushing or discharge pipe. Said flushing control device which is commonly called Sifonic device is known in its operative principle and includes a substantially spherical hollow valve, connected to control means provided to raise said ball valve from its seat which is the inlet of the flushing pipe. According to the present invention said valve is constituted of a substantially spherical hollow body, made of an elastomeric substance, as, for instance, rubber, said body being divided by a horizontal partition into two superposed chambers, the upper of which is closed and empty so as to co-operate to increase the buoyancy of the valve, while the lower one is provided with a wide central orifice of a diameter slightly smaller than that of the entrance orifice into the flushing pipe. As the tank is about to be emptied and the ball valve lowers and rests on its seat, that is the inlet of the flushing pipe downstream of said seat a vacuum is generated which induces an aspiration within the lower chamber of the valve which causes a squashing of the elastic valve body so that its height decreases and it forms a watertight seal against the edge of the entrance orifice of the flushing pipe which is the seat of said ball valve. Concurrently the water which begins to enter said tank, forces the valve body against its seat, while the emptying of the flushing pipe is being completed, at the end of which action the atmospheric pressure is restored in said pipe. Thus the watertight closure of said ball valve is first assured by the depression downstream of the valve seat and thence by the hydraulic pressure of the water upstream of said seat. When it is desired to empty the flushing tank, the control means are actuated which cause the raising of the valve, which then remains in its upraised position due to its buoyancy created by the closed upper chamber of the valve and concurrently by the air entrapped in the lower chamber. In consequence thereof the valve cannot close until the emptying of the tank or the like has been completed. As another object of the invention, means are further provided in order to make readily disassemblable the parts, forming said second control device of the flushing tank in order to allow the replacement of the valve, which is the most stressed member of the flushing tank.

Owing to the particular structure of such a ball valve a perfect semi-pneumatic closure of the valve is obtained without the use of springs or the like.

Other objects and advantages of the invention will be apparent upon consideration of the following description taken in consideration with the accompanying drawings, in which:

FIG. 1 is a vertical sectional view taken along the axis of the movable member of the valve controlling the outflow orifice of the water into the flushing tank;

FIG. 2 is a similar view relating to a variant of the device controlling the level of the water into the flushing tank;

FIG. 3 is a cross section taken on the line A—A of FIG. 2;

FIG. 4 is an axial section of the device controlling the water flushing, taken on the line B—B of FIG. 5; and

FIG. 5 is the horizontal section taken on the line C—C of FIG. 4.

Now referring to the FIG. 1, at 1 is marked the stationary body of the device for controlling the level of the water into the flushing tank 8, only a portion of which is shown in this FIG. 1. At one of its ends said body 1 forms a pipe union 2 provided with means for its connection with the end of the supply pipe (not shown in this Figure), with other known means for a watertight connection of the said body 1 to the tank body 8. At the other end the body 1 forms an inner cylindrical subchamber 3 into which projects the outflow orifice of the supply conduit 2, into which is mounted a nozzle 4, upstream of which is provided a breakwater device 5. The outflow orifice of the nozzle 4 facing the chamber 3 has rounded edge 4a. Into said chamber 3 opens the discharge pipe 6 which extends downwardly with a sound deadening pipe 7 the lower end of which is placed near the bottom of the tank 8, of which only that side portion has been shown in FIG. 1 which supports the said device controlling the level of the water into the tank 8. The chamber 3 extends outwardly with a second subchamber 16 arranged in a cylindrical dismountable body, which is constituted of an enlarged tubular portion 9 of a diameter substantially equal to that of the chamber 3 and of a following tubular portion 10 the inner diameter of which is narrower than that of the chamber 16 and into which is slidable mounted the piston 11, at the end of which is pivotally connected the arm 13 of a lever pivoted at 14 to the portion 10, the other arm 13a of which is made integral.
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with the bar 15 which in turn is integral with one of the two parts of an adjusting device, which comprises an annular slot 17 arranged at the end of the bar 15, into which can be adjustable locked a locking screw, provided with a dripping head 18 supported by the end of an arm 19 carrying the floating body attachment rod 20, the devices 17, 18 enabling to adjust the angle between the bars 15 and 19 in order to vary the maximum level that the water can attain in the flushing tank 8. The head of the piston 11 projecting into the chamber 16 defined in the inside of the tubular portion 9 and within the chamber 3 is lined with a shaped member made of elastically deformable material, said member forming a cap 21a covering said head and which enlarges outwardly so as to form a deformable diaphragm 21 which separates the chambers 3 and 16 one from the other, the peripheral edge 21a of which is locked between the free end edge of the portion 9 and an annular shoulder 1b arranged in the inner surface of the chamber 3, a threaded locking ring 22 being provided to engage a flange 2a extending outwardly from the tubular portion 9 and to the socket 1c of the body 1 so as to lock said peripheral edge 21a of the diaphragm 21 between the bodies 1 and 9 in a disassemblable manner. At its central part the diaphragm 21 forms the cover cap 21a lining the head of the piston 11 to which is fixed by means of an annular edge 21c projecting inwardly and engaging an annular groove 11b arranged around the head of piston under the effect of an elastic pressure. At the side of the diaphragm 21 facing the nozzle 4 said diaphragm extends with a conical central projection 21b designed to enter into the nozzle outlet 4a. Therefore as the level of the liquid into the container increases, as, for instance, the water into a flushing tank 8, the float 20 moves upwards and force the piston 11 to approach the outlet 4a of the nozzle 4, so that the conical projection 21b will enter said outlet orifice pressing against its edge 4a.

In consequence thereof the water under pressure which is in the conduit 2 finds the way obstructed by the piston 11 so that it presses against the conical projection 21b causing its squashing and the expansion of its side surface against the inner portion of the outlet orifice 4a of the nozzle 4 so that not only a watertight closure of the piston valve is ensured but also afterward the disengagement of said piston valve from its seat takes place after the complete discharge of the water from the tank 8. A self-cleaning action of said nozzle 4 is thereby caused which ensures a perfect and durable watertight closure of said valve device.

By the removal of the locking ring 22 the chamber 8 becomes accessible for the overhauling and the optional replacing of the operating members, located therein.

In the variant of the device for controlling the water level into the flushing tank shown in FIGS. 2 and 3 like references designate parts corresponding to those shown in FIG. 1. Thus the device controlling the outflow of the water into the flushing tank 8 is operatively identical to that shown in FIG. 1, but the stationary body 1 is now made integral with a sleeve 24 into which opens the nozzle 4 which has the axis set at right angle with that of said sleeve 24. Into said sleeve 24 can be inserted selectively from one or the other of its ends a plug cock unit, the normally stationary tubular body of which is generally marked 25, said body having an elongated shape and forming near one of its ends an outwardly extending annular flange 26 designed to, rest against one of the ends of the sleeve 24, with the interposition of a packing ring 27, beyond said flange 26 said body 25 forming a pipe union 25a which is internally threaded and which is designed to be engaged with the externally threaded end of a water supply pipe 23. The outer surface of the central portion of the stationary body 25 has such a diameter as to define in combination with the inner surface of the sleeve 24 an annular inner space 29 into which opens the inlet of the conduit of the nozzle 4. Radial through holes 28 are arranged in the side wall of the body 25 which open into said annular space 29 which thus communicates with the inner cavity of the body 25. Just beyond the section where the holes 28 are arranged and towards the pipe union 25a a cross partition 25b of the body 25 separates the pipe union 25a from a chamber wherein is mounted the rotatable movable member or valve of the plug cock, generally marked 31. In said partition 25b an axial opening 30 being bored which constitutes the seat controlled by the movable member 31 of the plug cock which is conventional in its operation and therefore is not described in detail. Said rotatable movable member 31 of the plug cock is controlled by a control handle 32 so as to move its head to and from the seat 30 so as to vary the delivery of the water flow passing through said plug cock and conveyed through the holes 28 and the nozzle 4 into the device provided to control the water level into the flushing tank 8. At 13 is indicated a threaded locking ring designed to be screwed around the body 25 which is externally threaded and which is provided to watertight lock a member, supporting the rotatable valve 31, to the supporting sleeve 24 with the interposition of a packing ring 34.

By using this alternative embodiment the plug cock can be mounted into the supporting sleeve in two different operative positions, so that the device for controlling the water level can be mounted at the right or left side of a common flushing tank without requiring the replacement of any member.

Further by simply replacing the body 1, 24 with another similar body, wherein a different angular position is provided between the plane of the axes of the sleeve 24 and of the nozzle 4, and the axis of the pipes 6, 7, any desired mutual position between the supply pipe 23 and the device controlling the water level can be obtained and therefore any mutual position between the handle 32 and said coaxial pipes 6, 7 in order to permit said device controlling the water level to be applied to W.C. flushing tanks or similar containers having particular shapes.

It will be apparent that nothing forbids the construction of the parts 24 and 1 as separate members, connected to one another with means allowing said members to be locked to one another in any angular position so as to have a device of a universal application.

Reference is now made to the second improved device, i.e., to the flushing control device shown in FIGS. 4 and 5. In FIG. 4 8a indicates a portion of the bottom of the flushing tank or the like, to which by suitable means is connected said device which comprises a stationary body including a vertical tubular flushing water conduit 42 externally threaded at 42a and which is provided at its upper part with an externally extended flange 42b by means of which the body 42 rests on the bottom 8c of the tank, through which passes the con-
duit 42 which is fixed to said bottom wall 8a by means of the threaded locking ring 43 with the interposition of a packing ring not shown in this Figure. The conduit 42 will be in turn connected with the flushing pipe (not shown in the drawings) which is in turn connected to the water closet bowl or the like. The upper edge 42c of the conduit 42 forms the seat of a bolt valve body generally indicated 44 supported by a vertical control rod 45, which is slidable carried by a three-leg supporting unit comprising an upper plate 46a and the legs 46c, said unit being disassemblably connected to the tubular body 42, as will be hereinafter described. The rod 45 is provided with a dismountable head 47 and is associated with a linkage system or other suitable transmission means controlled from the outside of the flushing tank 8 by means of a control lever 48 having a fork arm 48a and pivoted at 49, to the tank body 8 or which is associated with a remote control device, which may be, for instance of a pneumatic type, said valve control means being well known, to all the persons skilled in the art.

Twelve valve body 44 is made of an elastomeric material or of rubber so as to be elastically deformable and have a spherical shape, the inner space of which is separated by a horizontal partition 44a into two chambers 40 and 41. The upper chamber 40 is closed and the lower chamber 41 is provided with a central wide orifice 52 of a diameter slightly lesser than that of the inlet orifice of the conduit 42; at least the portion of the valve near the orifice 42c has reduced thickness in order to increase the deformability of the valve body. The valve 44 is connected, in any detachable manner, by means 53 to the vertical rod 45 in order to allow the user to readily replace the valve 44.

As the tank is near to being empty, the valve 44 falls down on its seat, i.e., the inlet orifice 42c of the conduit 42 under the effect of the gravity. The water flowing down into the conduit 42 and then into the flushing pipe generates, downstream of the valve seat 42c, a suction which induces an aspiration into the chamber 41 which causes the valve body 44 to be squashed against the inlet orifice 42c of the conduit 42 so as to instantaneously water tightly close the valve 44 against said seat 42c, notwithstanding the substantial small weight of said valve 44. Concurrently the tank 8 begins to be filled with the water while the discharge of the water through the flushing pipe ends so that, downstream of the valve seat 42c, the atmospheric pressure is restored. At the same time the water which outflows into the tank 8 generates an increasing hydrostatic pressure of the valve 44, said pressure maintaining said valve 44 pressed against its seat 42c; first in responset to the suction effect due to the depression downstream of the valve seat 42c, which is generated by the discharge water, flowing down into the flushing pipe, and then under the effect of the hydrostatic pressure which reaches its maximum as the water into the tank 8 has reached the predetermined maximum level controlled by the first device. Afterwards the delivery of the water into said tank 8 is stopped by said first device which is shown in FIG. 1 or in the FIGS. 2 and 3.

For the discharge of the flushing tank 8 to be carried out, the rod 45 is raised together with the valve 44 so that the water begins to be discharged into the conduit 42, thus priming the flushing into the flushing pipe and then into the water closet bowl. The upraised valve 44 cannot fall down, owing to the air entrapped in the chamber 41 and due to the presence of the upper closed chamber 40. This takes place until the emptying of the tank 8 is completed.

The three legs 46a of the support carrying the rod 45 are each provided with a foot 46b extending inwardly and designed to be engaged into a radial recess 54 arranged along the outer surface of the inlet orifice 42a of the conduit 42. The support 46, 46a, and 46b is made of a plastic material which is sufficiently resilient so that the feet 46b can be inserted into the recesses 54 by forcing the legs 46a to elastically retract outwardly; according to such an arrangement said support 46, 46a, 46b together with the valve 44 can be readily removed from the stationary body 42 for an optional replacement of the valve 44.

I claim:

1. A flushing tank provided with a first water inlet device designed to control the water level in said tank and with a second flushing control device designed to control the water flushing into a flushing pipe, wherein said first device comprises a normally stationary tubular body formed of disassemblable parts and including a chamber into which opens a nozzle which is connected to a water supply through a pipe union controlled by a dismountable plug cock as well as a pipe for delivering said water into the tank, said chamber being separated into two subchambers by a shaped diaphragm made of resiliently deformable material and perpendicular to the axis of said nozzle, one of said subchambers containing openings of said nozzle and delivery pipe, while in the other is a slidable mounted piston, coaxial with said nozzle opening and which is actuated through a linkage system by a hollow body floating on the water surface, the head of said piston being completely capped by a shaped diaphragm which is connected to the piston's side by a rib and groove arrangement, said diaphragm having a conical central projection designed to enter the nozzle opening and close it in a water tight manner as the water level in the tank attains a predetermined value, the normally stationary body is connected to a sleeve into which opens the inlet opening of the delivery nozzle, the axis of which is substantially orthogonal to the sleeve axis, a plug cock is mounted at one end of said sleeve, said plug cock comprising a stationary tubular body housing a rotatable body or valve which is coaxial with the stationary body, which, at one of its ends, forms a pipe union for the connection to the water supply pipe, while from the other end extends outwardly a control handle for actuating the said rotatable body which is caused to move to and from a seat provided in a transverse partition wall of said stationary body which is bored by an orifice coaxial with said rotatable body, downstream of said partition, the inner surface of the stationary body communicates with the outside of said stationary body by means of radial holes therein which open into an annular recess arranged around the stationary body in the inside of the sleeve.

2. A flushing tank according to claim 1 wherein the sleeve and the stationary body of the device for controlling the level of the water into the tank are connected one to the other by means permitting the rotation of said stationary body about the axis of the nozzle and the locking of said parts in the desired mutual position.