

[54] **FLUSH VALVE ASSEMBLY FOR TANK**

[76] **Inventor:** Kurt W. Hollander, Box 693,
 Annapolis, Md. 21404

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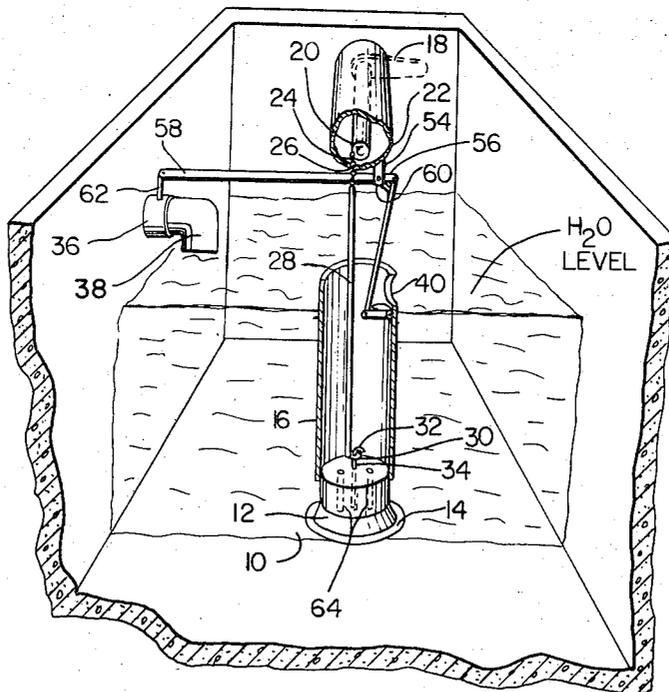
Primary Examiner—John W. Huckert
Assistant Examiner—Stuart S. Levy
Attorney, Agent, or Firm—Laurence, Laurence & Neilan

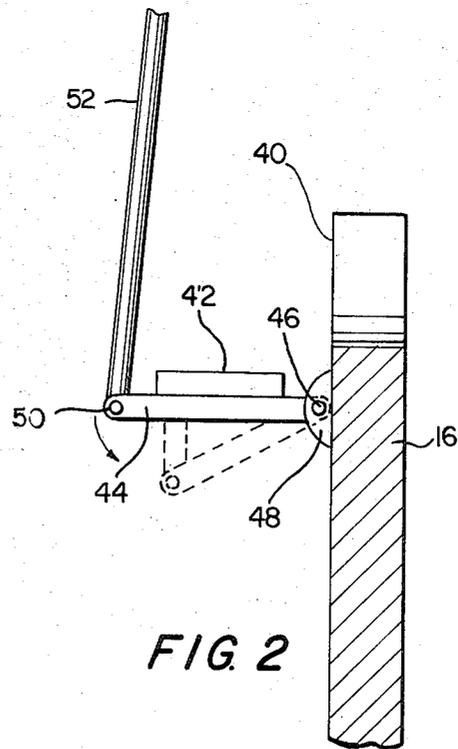
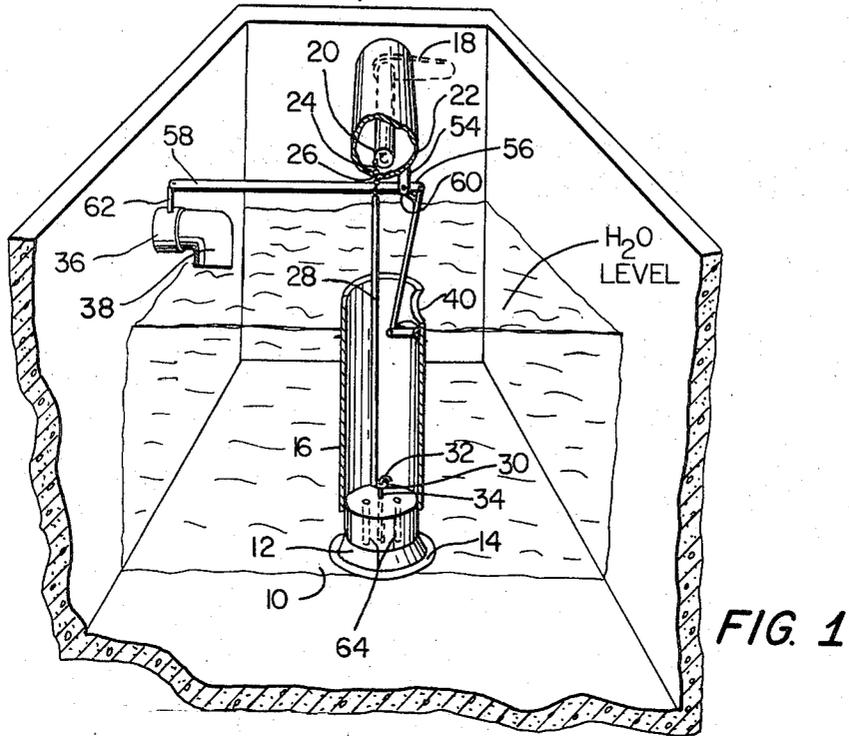
[57] **ABSTRACT**

A tank has an outlet valve which is elevated above a valve seat by a flush mechanism, and an upwardly extending pipe attached to and movable with the outlet valve. After the tank is flushed, the tank is refilled via liquid entering through an inlet valve until the liquid level reaches a predetermined level and overflows into the pipe triggering a link which results in closing the inlet valve.

The invention has particular utility in conventional toilet water tanks but may also be used in other applications in which accumulation and discharge of a predetermined volume of liquid is desired.

7 Claims, 2 Drawing Figures





FLUSH VALVE ASSEMBLY FOR TANK

BACKGROUND OF THE INVENTION

The present invention relates to apparatus for accumulating and subsequently discharging a predetermined volume of liquid from a tank. The invention is particularly useful in connection with flushing conventional toilet water tanks or commodes.

In an ordinary toilet installation, the toilet bowl is flushed by raising a valve closure from its seat within the toilet water tank to allow water to flow from the tank to the bowl. A hollow metal float within the tank is connected to the inlet valve to open this valve when the water level recedes and subsequently to close the inlet valve when the tank is refilled to a predetermined level. While this system is fairly reliable particularly when first installed, it is known that this system is not fully satisfactory and that there is a need for an improved, compact and more reliable flush system.

SUMMARY OF THE INVENTION

It is a primary object of the present invention to provide an inexpensive, novel and improved flush valve assembly for tanks. Another principal object of the invention is to provide such a flush valve assembly which has a minimum number of parts most of which are not in contact with the liquid in the tank and which is more compact than typical prior art systems. Another object of the present invention is to provide a flush valve assembly which obviates the need for metal floats and the associated linkages present in many prior art systems.

The novel apparatus of the invention may be incorporated into a conventional enamel toilet tank either as an initial installation or as a replacement for a used defective valve unit. The apparatus of the invention includes an outlet valve which preferably takes the form of a rubber plug which is normally sealed against an annular valve seat in the bottom of the tank. A generally vertical light weight pipe is attached to the upper periphery of the outlet valve and extends upwardly to just above the desired water level in the tank. The customary handle on the outside of the commode actuates a control rod which elevates the outlet valve above its seat in order to discharge water into the toilet bowl. This control rod preferably extends downwardly through the light weight pipe into engagement with the outlet valve. The outlet valve may be of the type which provides for automatically reseating the valve when the rate of liquid outflow is sufficiently reduced. Alternatively, a known time delay spring actuated device may be used to reseat the outlet valve.

Provision is made to open the tank inlet valve either simultaneously with the opening of the outlet valve which is sized to enable a considerably greater volumetric rate of flow than that through the inlet valve, or the inlet valve may be opened when the outlet valve closes.

With the outlet valve closed, the tank is refilled with water entering through the inlet valve until a predetermined level is reached which level is set by a notch in the light weight pipe. A small amount of water overflowing through this notch or hole falls upon a control link and depresses it. This movement of the control link actuates a mechanical linkage which closes the inlet valve. The small amount of liquid which flows into the vertical pipe is discharged through an opening in the

outlet valve plug into the outlet line. In the event of failure of the inlet valve to be properly closed off, the water will overflow into the vertical pipe which in this case serves the dual function of being an overflow pipe.

While the present system does not eliminate all mechanical linkages, it reduces their number to one per control element, and all linkages heretofore employed in conjunction with the now eliminated float are also eliminated.

The control linkages of the invention may be provided either above the normal water level or enclosed within the vertical pipe. Thus, the only parts of the system normally contacted by the liquid are the outer surfaces of the outlet valve plug and the vertical pipe. For this reason, the system of the invention may be utilized to store and discharge other liquids which might be corrosive or otherwise detrimental to the flush system parts. For example, with only minor modification of the system, the tank may be utilized aboard ships to use sea water as the flushing liquid. For example, a suction pump might be provided to fill the tank through the inlet valve.

Although the invention is being described primarily in conjunction with its application in a toilet water tank, other applications of the invention exist such as for gravity feeding of water into preheaters for boilers in order to assure automatic maintenance of water between two threshold levels from a single low level triggering signal. When used for the automatic dispensing of liquids, the predetermined volume of liquid to be dispensed may be adjusted by changing the vertical pipe or adjusting its length.

Other objects, features and advantages of this invention will become more apparent as this description proceeds.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a part perspective, part sectional view of a presently preferred embodiment of the present invention.

FIG. 2 is a view on an enlarged scale of the mechanism for actuating complete closure of the inlet valve.

Referring now to the drawings and more particularly to FIG. 1, reference numeral 10 designates a toilet water tank or commode containing the novel flush valve assembly of the present invention. An outlet valve 12 which has the form of a rubber plug is normally seated in an outlet valve seat 14 in the bottom of the tank. A lightweight vertically disposed pipe 16, which may be made of a suitable inert material such as sheet metal or a synthetic plastic such as polyvinyl chloride, is bonded to the upper periphery of the valve 12 and the upper end of the pipe extends above the normal water level in the tank.

In order to flush the tank, a conventional handle 18 on the outside of the tank is swung through approximately 90° in customary fashion from the dashline position shown in FIG. 1 causing a corresponding clockwise rotation of a generally horizontally disposed control tube 20.

The control tube is disposed within a stationary cylindrical housing 22 and a chain 24 which is attached to the control tube 20 extends downwardly through an opening 26 in the bottom of the housing 22 and is attached to the upper end of a control rod 28. The lower

end of the control rod terminates in a loop 30 which engages the hooked end 32 of a rod 34 which is connected to the outlet valve 12. In this fashion, rotation of the control tube 20 via the handle 18 causes the chain 24 to be wound upon a portion of the control tube, and consequently elevates control rod 28 which causes elevation of the outlet valve 12 and the pipe 16 so that the tank is flushed through the outlet opening in valve seat 14. The flow of water or other liquid out of the tank has sufficient force to prevent the valve 12 from reseating itself until the tank is nearly empty and the rate of flow is appreciably decreased. This arrangement for an outlet valve is known per se.

In the illustrated embodiment, opening of the outlet valve to flush the tank also results in the opening of an inlet valve 36 so that water commences to flow into the tank through an inlet pipe 38. The mechanism for opening the inlet valve will be described in detail hereinafter. Since the diameter of the outlet opening through valve seat 14 is considerably larger than the diameter of inlet pipe 38, liquid flows out of the tank at a much faster rate than fresh liquid enters the tank through the inlet pipe 38.

Once the outlet valve 12 has reseated itself in valve seat 14 at the end of a flush operation, the water level within the tank rises until it reaches the level of an opening 40 near the upper end of pipe 16. The opening 40 is shown in the form of a notch extending downwardly from the upper periphery of the pipe but can also be in the form of an opening through the wall of the pipe. A small amount of water now flows through opening 40 and falls onto a plate 42 which is disposed upon a lever 44. As seen in greater detail in FIG. 2, the right hand end of lever 44 pivots about a pin 46 which is mounted in a mass of resilient material 48 such as rubber. The other end of lever 44 is pivotally connected at pivot 50 to a vertically disposed control lever 52. In known fashion, for example, by the use of counterweights, the system is designed so that only a small amount of water falling upon plate 42 is required to swing lever 44 downwardly about pin 46 thereby imparting downward motion to the control lever 52.

As seen in FIG. 1, a fixed support arm 54 depends downwardly from the stationary housing 22. A two-armed lever having a short arm 56 and a long arm 58 is attached to the support arm 54 at a fulcrum 60. The free end of the long arm 58 is pivotally connected to a lever 62 which regulates the position of the inlet valve 36. The short arm 56 is pivotally connected to the upper end of the control lever 52 so that downward movement of the control arm as the result of liquid flowing through opening 40 causes the two-armed lever to rotate clockwise about fulcrum 60 causing an upward movement of the lever 62 resulting in the inlet valve 36 being moved to a closed position to prevent the flow of additional liquid through inlet pipe 38.

The water which flows through opening 40 before the inlet valve is closed falls to the bottom of pipe 16 and passes through holes 64 in the outlet valve 12. Pipe 16 may also function as a safety feature since in the event of any malfunction of the inlet valve, water will overflow from the tank into the pipe and out through openings 64 for subsequent disposal into the toilet bowl, and then into the discharge pipe from the bowl which is normally connected to a sewer line.

As will be appreciated by those skilled in the art, in

lieu of opening inlet valve 36 simultaneously with opening outlet valve 12, the system could be modified to provide for opening the inlet valve only after the outlet valve has closed.

While presently preferred embodiments of the invention have been shown and described with particularity, it will be appreciated that the invention is not limited to the specific details of the illustrative embodiments. For example, while the description has referred primarily to toilet water tanks, the principles of the invention are applicable to the accumulation and controlled discharge of numerous fluids. Also, in lieu of actuating the flush cycle via a handle at the outside of the commode, the invention could be utilized in a toilet installation in which a flush cycle is commenced via upward movement of a toilet seat after use as is the case with some pay toilets. It is intended to encompass all changes and modifications as fall within the scope and spirit of the appended claims.

What is claimed is:

1. Apparatus comprising a tank for storing a liquid, means for discharging a liquid from said tank including an outlet valve positioned in a valve seat disposed adjacent the bottom of the tank, control means connected to said outlet valve to open said outlet valve to commence discharge of liquid from said tank, an upwardly extending pipe disposed in said tank, said pipe adjacent its upper end being provided with an opening at a desired normal liquid level in said tank, an inlet valve regulating flow of liquid into said tank, and inlet control means for closing said inlet valve when the normal liquid level in the tank is reached, said inlet control means being actuated by flow of liquid through said opening in said pipe when the normal liquid level in said tank is reached in order to close said inlet valve.

2. Apparatus according to claim 1, wherein said pipe is connected to said outlet valve and is movable with said outlet valve, and said control means including a control rod extending longitudinally within said pipe, and connected to said outlet valve.

3. Apparatus according to claim 2, wherein said control means further comprises a handle disposed on the outside of said tank and connected to a horizontally extending rotatable control tube, said control rod being connected to said control tube and elevated by rotation of said control tube.

4. Apparatus according to claim 3, further comprising stationary housing means extending into said tank and disposed around said control tube, fulcrum means attached to said stationary housing, and said inlet control means including lever means movable about said fulcrum means.

5. Apparatus according to claim 4, wherein said housing means and said fulcrum means are positioned above the normal liquid level in said tank.

6. Apparatus according to claim 1, wherein said inlet control means include plate means disposed within said pipe below said opening in said pipe in a position to be contacted by liquid which flows through said opening.

7. Apparatus according to claim 6, wherein said inlet control means further comprise a control lever having one end extending longitudinally within said pipe and connected to said plate means.

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