

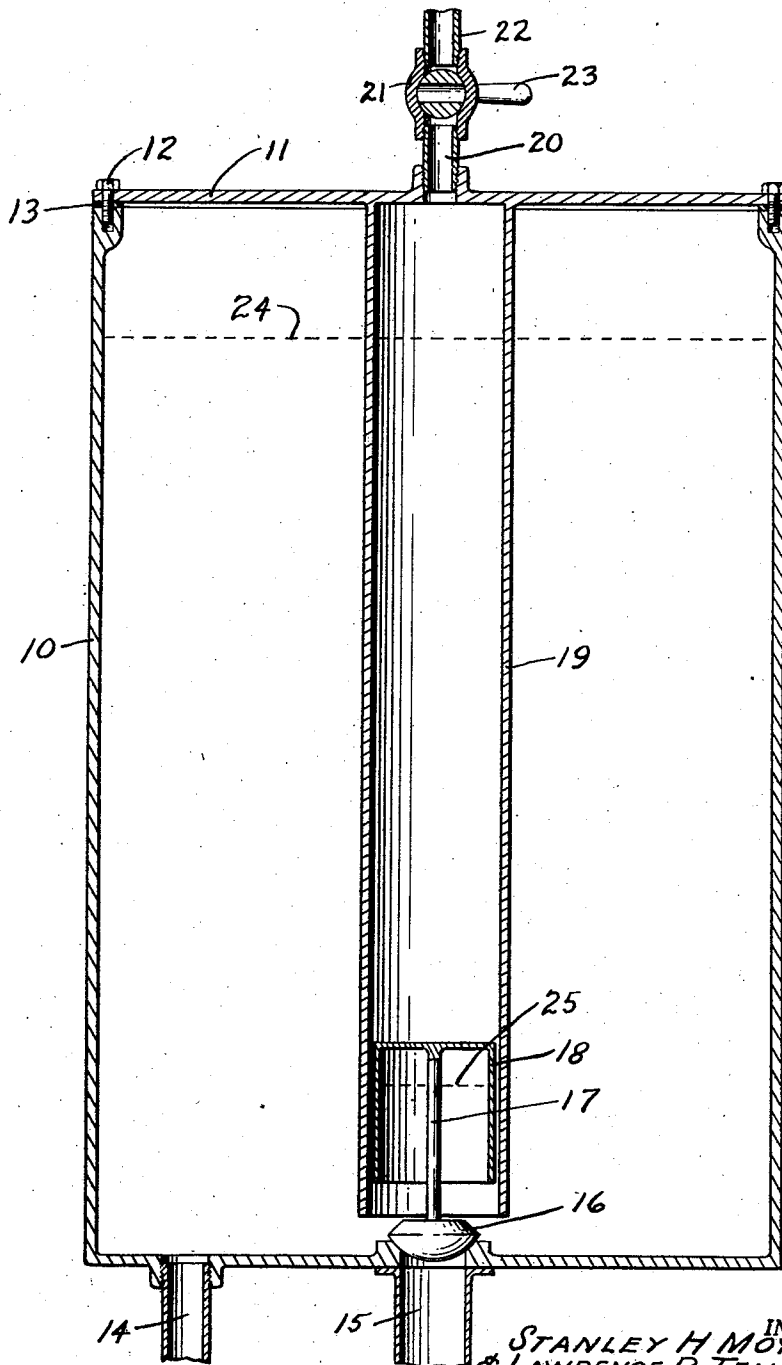
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FLUSH TANK

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FLUSH TANK

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The present invention relates to flush tanks and particularly to tanks such as are used in combination with toilets and the purpose of which is to store a predetermined volume of liquid, such as water, in a position to be discharged by gravity with a flushing action through the toilet bowl or other vessel to be flushed.

Ordinarily, flush tanks include two rather intricate valve mechanisms, one of which is known as a float valve which automatically controls the entry of water into the tank. The other is called a flush valve and is usually manually opened to permit discharge of water from the tank by gravity. The valves commonly used for these purposes are undesirable for many reasons. For example, most of the complicated mechanism which controls their operation is immersed in water where it cannot be lubricated and where it is subject to corrosion and deposits of minerals and other impurities in the water. They are usually noisy and inefficient in operation and are necessarily so positioned that replacement and repair are inconvenient and costly.

It is an object of the present invention to provide a flush tank which overcomes the above mentioned and other disadvantages and to provide a flush tank which functions perfectly with a minimum of mechanical or moving parts. A further object of the invention is to provide a flush tank with but two valves of extremely simple construction for controlling filling and discharging of the tank and in which only one of the valves is immersed in the liquid contents of the tank but controlled by pressure in the tank rather than by mechanical connections. A still further object of the invention is the provision of a flush tank from which the usual float valve is eliminated and in which the level of the liquid in the tank and the flushing operation of the tank are both subject to control by fluid pressure which pressure is controlled by a very simple valve mechanism which may be hand operated. Further objects and advantages of the invention will become apparent from an understanding of the following specification.

To simplify the disclosure of the invention, it will be described herein as applied to a tank for water used in flushing a toilet. It is not intended that this description be taken as limiting the invention to the particular form or use mentioned as it is readily adaptable to use with other liquids and for other purposes.

The drawing is a vertical sectional view of a simple form of flush tank embodying the principles of the present invention.

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In the drawing a fluid tight flush tank is indicated at 10 and may be of any desired shape depending upon the use to which it is to be put and the space in which it is to be installed. The tank is shown as having a removable cover 11 held in place by cap screws as indicated at 12 and a resilient gasket such as shown at 13 may be employed to facilitate a fluid tight joint between the cover and the tank.

Entering the tank preferably, though not necessarily, through its bottom wall is a supply pipe 14 through which water may be introduced to its interior. This supply pipe 14 leads to the source of supply under pressure which, in the event of city use, could be the city water mains by which all houses and buildings are usually served. While the pipe 14 does not contain a valve, it may contain any suitable pressure regulating means if desired or flow restricting means to limit the pressure of water entering the tank 10 or to regulate the time required for filling the tank to capacity. Whatever such means are used in conjunction with the pipe 14, however, it should always remain open for communicating pressure to the interior of the tank 10.

A discharge or flush pipe 15 is also connected with the tank 10 preferably at its bottom and, where the flush tank is being used in conjunction with a toilet, this flush pipe 15 will be joined with the toilet bowl in order to direct the contents of the tank 10 thereto for flushing action. The flush outlet 15 is normally closed by a valve 16 and this valve has a vertically rising stem 17 which carries a float 18 at its upper end in the form of an inverted cup shaped member with its upper end closed and its lower end open. The valve 16, together with its float 18, is guided for vertical opening movement by a guide which may be in the form of a tube 19 secured to and depending from the cover 11 of the tank 10 and terminating a short distance above the bottom of the tank. A vent opening is provided in the cover 11 of the tank and is connected by a pipe 20 with a vent control valve 21 which in turn connects with the pipe 22. The pipe 22 may lead directly to the atmosphere or may be directed elsewhere as will presently be described. The valve 21 is shown as a simple type of valve operable manually to open or close the atmosphere vent by means of a handle 23 but any simple or quick acting type of valve may be substituted therefor.

In operation the flush valve 16 and the vent valve 23 are normally closed as shown. Water under pressure is free to enter the tank 10

through the pipe 14 and will attain a level in the tank and within the guide tube 19 limited by the presence of air in the tank and determined by the exact pressure in the source of supply. For example, as the water enters adjacent the bottom of the tank the level of the water will rise until the air which cannot escape is compressed to a pressure which equals that of the water supply. Consequently, the tank will be filled to a point below its top as, for example, may be indicated by the dotted line 24. As the level of the water is rising in the tank and also within the tube 19, it enters the open bottom of the cup shaped float 18 and also rises within the float to a level determined by the pressure of air compressed within its upper closed end. A dotted line 25 is shown in the float to indicate approximately the line of the water level therein when the air above such line is compressed by the water pressure below the line. The weight of the valve 16 and the design of the float portion 18 thereof are such that the air entrapped in the float makes it sufficiently buoyant to raise the valve 16 from its seat under atmospheric pressure. The pressure in the tank 10, however, is substantially greater than atmospheric and overcomes the tendency of the float to open the valve 16. When the tank 10 is filled to capacity with water, a balance of pressures will have been obtained which retains the valve 16 in its closed position.

In order to flush the water from the tank through the pipe 15, it is only necessary to open the valve 21 which will immediately exhaust the pressure from the upper end of the tubular guide 19 so that the pressure therein will fall toward normal atmospheric pressure and the valve 16 will be raised from its seat by the float 18 which will rise to the water level in the tube 19. Consequently, all of the water in the tank 10 will be free to discharge through the flush pipe 15 and the discharge of the water will in fact be hastened by the air pressure in the upper portion of the tank. As the level of the water in the tank 10 is lowered because of its discharge, the water level within the tubular guide 19 will also move downwardly and the float 18 will return to its normal position with the valve 16 again seating to close the flush outlet 15. The valve 21 should be maintained open for only a short period of time so that after the flushing action has commenced the vent will be closed and upon seating of the valve 16 the water level will commence rising in the tank to charge it for the next flushing operation. A spring closed valve may be substituted for the valve 21 so that it will close automatically when it is released.

With the construction herein disclosed, the flush tank is automatically charged by reason of its connection with a source of water under pressure and the same pressure is effective to control the operation of the flush valve and also to hasten the water in its discharge from the tank when the flush valve is open. In order to effect the flushing operation and a subsequent charging of the tank, it is necessary merely to vent the tank to atmosphere momentarily.

The vent control valve 21 should be air tight when it is closed for the operation herein described. It is not, however, necessary that a perfect seal be produced by this valve as, should a slight leak be present to permit the escape of a small quantity of air, the water level within the tubular member 19 would gradually increase until it reached the valve and if water leaked through the valve it would pass outwardly through the

pipe 22. The pipe 22 therefore could be connected with the flush pipe 15 or directly with the toilet bowl or other vessel for reception of the leaking water. The presence of water filling the tube 19 would, however, not prevent the operation, as described, so long as it was not leaking through the vent valve at a rate sufficient to effect a material reduction of pressure within the tank.

Under the theory of operation hereinbefore described, it is apparent that successful opening of the flush valve 16 when the vent valve is open depends upon a rather sensitive balance of pressures and it is conceivable that with the relatively high pressure entering the tank through the supply line 14 the pressure within the tank when it is filled will be so great that it will tend to hold the flush valve 16 closed with a greater force than would be overcome by the buoyancy of the float 18 unless the proportions of the float were so large as to be impracticable. Any tendency of the valve 16 to be held closed by pressure within the tank 10 is, however, overcome by the structure shown wherein the guide tube 19 is shown as imperforate so that there is no communication between the inside of the tube 19 and the tank 10 outside of the tube except through the bottom of the tube. Furthermore, the size of the float 18 is just slightly smaller than the tube 19 so that any pressure communicated from the interior of the tank to the upper portion of the tube 19 is substantially obstructed by the float and must be communicated to the upper portion of the tube 19 through the very small annular channel between the float and the tube. As a consequence of this construction, when the vent valve 23 is open to effect flushing of the tank, the pressure within the upper portion of the tube 19 is reduced without reducing the pressure within the tank 10 and if the valve 16 remains closed against the tendency of the float to raise it through buoyancy alone, the pressure in the tank 10 will seek to exhaust itself upwardly through the tube 19. In entering the bottom of the tube 19, this pressure is largely obstructed by the presence of the float 18 and a sudden and substantial force is applied to the float in addition to the lifting force of its own buoyancy to positively insure raising of the valve 16 to permit flushing of the contents of the tank 10.

The tank 10 has been disclosed herein as sealed by the cover 11 arranged at its top. It is not intended that this invention is to be limited by this particular disclosure, however, as the means for permitting access to the tank 10 may be arranged at the bottom of the tank rather than the top or, in fact, in any convenient position.

It is believed apparent from the foregoing disclosure that the exact structure of the tank and the structure and arrangement of the several outlets and valves therein need not be exactly as herein described but may be varied considerably within the scope of the invention as it is defined in the appended claims.

We claim:

1. A flush tank comprising a fluid tight receptacle, means connecting said receptacle with a source of liquid under pressure, a discharge opening in said receptacle, a valve normally closing said opening, a float normally tending to open said valve but prevented from floating by pressure within the receptacle, and means for venting the receptacle to atmosphere to permit the float to open said valve.

2. A flush tank comprising a fluid tight re-

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ceptacle means connecting said receptacle with a source of liquid under pressure whereby the receptacle will normally fill with liquid to a level determined by air trapped in its upper portion, a discharge opening in the bottom of the receptacle, a float valve normally closing said opening and maintained closed by the pressure within the receptacle, and means to vent the receptacle to atmosphere, whereby the float valve will be permitted to open to flush the liquid contents through said discharge opening.

3. A flush tank of fluid tight construction comprising means connecting the interior of the tank with a source of liquid under pressure, a flush opening in the bottom of the tank, a valve normally closing said opening, a tubular member depending from the top of the tank to a position above said valve, a float connected with the valve and guided for rising movement in said tubular member, a vent to atmosphere from the upper part of said tubular member, and a valve for controlling said vent.

4. A flush tank of fluid tight construction comprising means for introducing liquid under pressure to the tank, a flush opening in the bottom of the tank, a valve normally closing said opening, a float connected with said valve and comprising an inverted cup shaped member adapted to be partially filled with liquid rising in the tank whereby air will be entrapped in the float, a normally closed vent adjacent the top of the tank for maintaining pressure in the tank to prevent the float from opening the flush valve, and means for opening said vent whereby the float will be effective to open said valve and effect discharge of the liquid through the flush opening.

5. A flush tank of fluid tight construction comprising means for introducing liquid under pressure to trap air under pressure in the upper portion of the tank, a flush valve arranged in the bottom of the tank, a tube extending ver-

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tically in the tank to a point below the normal liquid level therein and open for communication with the tank only at its lower end, a member connected with the flush valve and substantially obstructing the lower end of said tube, and means for venting the tube to reduce the pressure in its upper end whereby the pressure in the tank will be exerted upwardly against said obstructing member to effect opening of the flush valve.

6. A flush tank comprising a fluid tight receptacle, means connecting said receptacle with a source of liquid under pressure, a flush opening in the bottom of said receptacle, a valve normally closing said opening, a tube depending from the top of said receptacle to a point directly over the flush opening, a stem on the valve, an inverted cup shaped member on the stem disposed within the tube and of smaller diameter than the interior of the tube whereby liquid entering the tank will compress air in the top of the tank and tube and will trap air in the inverted cup shaped member to make it buoyant in the liquid, and a valve controlled vent communicating with the upper end of the tube for permitting the buoyant cup shaped member to float and unseat the flush valve.

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