July 28, 1936. F. J. BRANNEN 2,048,674

FLUSH TANK

Filed May 16, 1935 2 Sheets-Sheet 1

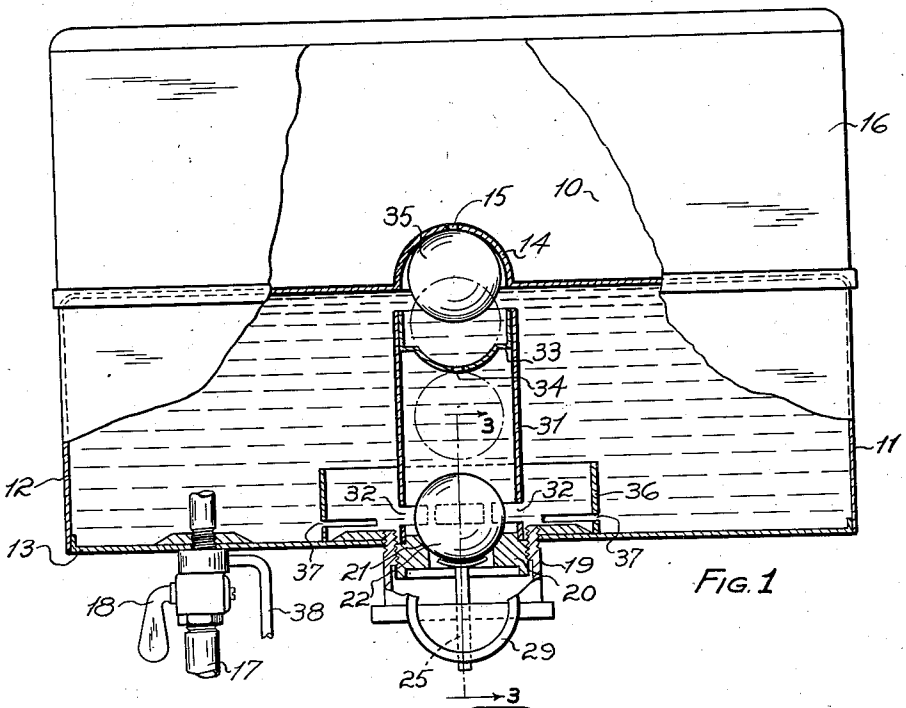


FIG. 1

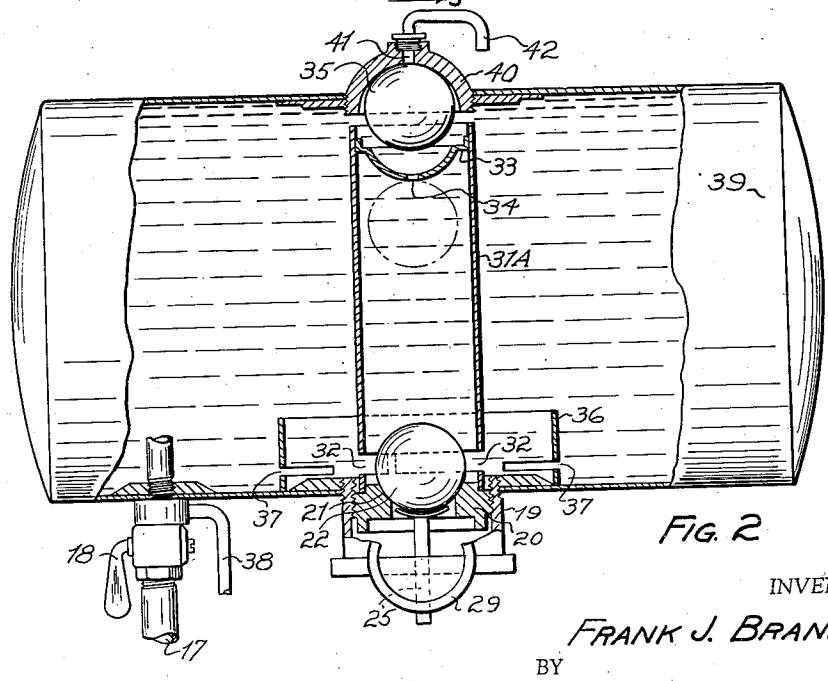


FIG. 2

INVENTOR.

FRANK J. BRANNEN

BY

Kuis, Hudson & Kent

ATTORNEYS.

July 28, 1936. F. J. BRANNEN 2,048,674

FLUSH TANK

Filed May 16, 1935 2 Sheets-Sheet 2

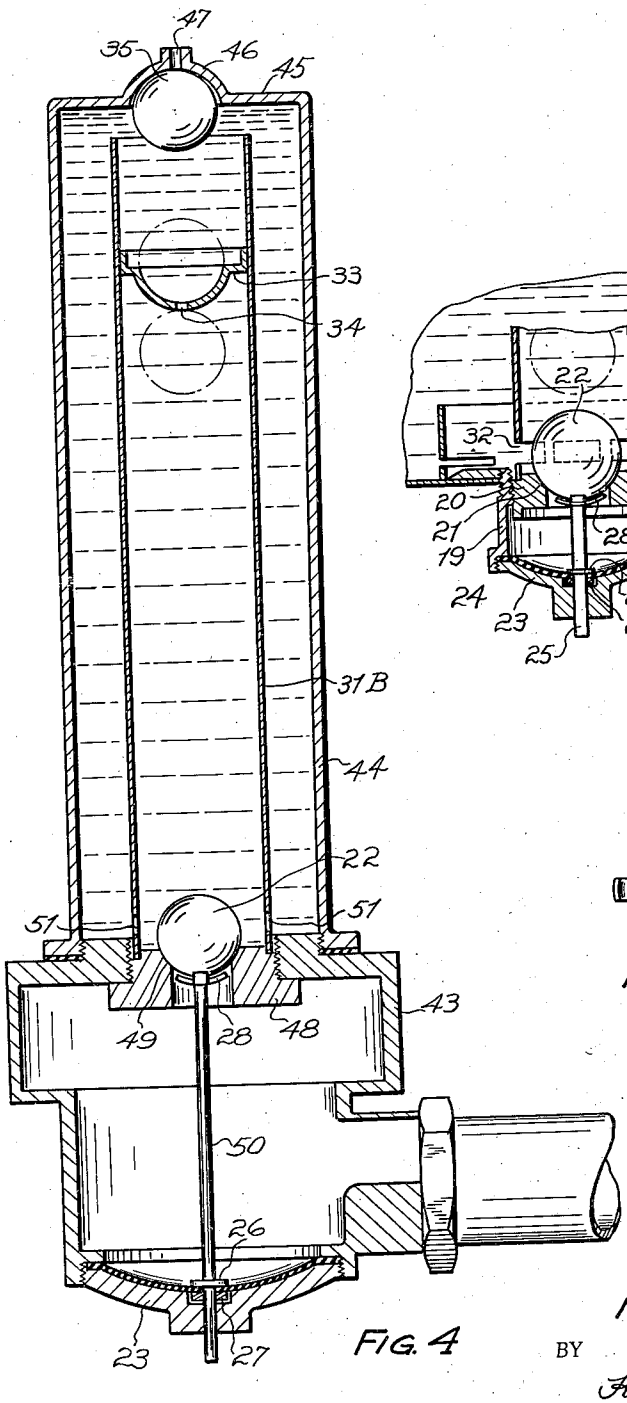


FIG. 4

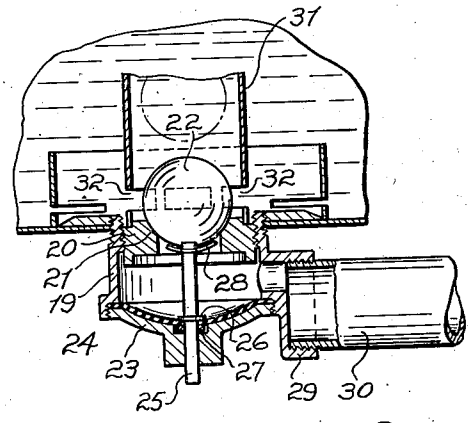


FIG. 3



FIG. 5

INVENTOR.
FRANK J. BRANNEN

BY

Kurs, Hudson & Kent
ATTORNEYS.

Patented July 28, 1936

2,048,674

UNITED STATES PATENT OFFICE

2,048,674

FLUSH TANK

Frank J. Brannen, Lyndhurst, Ohio, assignor of one-half to Glenn A. Toaz, Cleveland, Ohio, and one-half to David P. Robertson, Cleveland Heights, Ohio

Application May 16, 1935, Serial No. 21,744

13 Claims. (Cl. 4—28)

This invention relates to improvements in flush tanks.

One of the objects of the invention is the provision of means for holding a buoyant valve piece out of the way of the flushing water until the latter is discharged from the tank.

Another object is the provision of means for decreasing the rate of flow of water being discharged after the necessary flushing action is completed, the slower flow serving to refill the bowl of the toilet with which the tank is used.

A further object of the invention is the provision of a valve lifter at the bottom of the tank sealed against the leakage of water.

Still another object is the provision in a pressure tank of means for sealing the partition between the air and water chambers, utilizing a float which has the additional function of closing a port in an auxiliary compartment employed for holding the discharge valve ball off its seat.

Other objects and features of novelty will appear as I proceed with the description of those embodiments of the invention which, for the purposes of the present application, I have illustrated in the accompanying drawings, in which

Fig. 1 is an elevational view partly in vertical section of an air pressure flush tank.

Fig. 2 is a similar view of a gravity tank.

Fig. 3 is a detail vertical sectional view taken substantially on the line 3—3 of Fig. 1.

Fig. 4 is a vertical sectional view of still another form of the invention embodying an upright cylindrical tank, and

Fig. 5 is a plan view of the spider at the upper end of the valve lifting rod.

Referring first to that form of the invention which is illustrated in Fig. 1, I have shown a flush tank having an upper air chamber or compartment 10 and a lower water chamber or compartment 11. Preferably the tank is constructed of steel, the lower compartment 11 having a unitary element 12 comprising top and sides pressed out of sheet steel, and a bottom element 13 flanged and welded to the element 12. The top of the element 12 constitutes a horizontal partition for the tank as a whole. In this partition, preferably at the central point, there is an upwardly extending dome 14 with an air port 15 therethrough. The upper compartment 10 is formed of a single element 16 which is preferably pressed steel and has an offset flange around its lower edge fitting over the element 12, and welded thereto. The upper compartment 10 is an air-tight compartment except for the port 15.

A water intake pipe for the lower compartment is shown at 17. 18 is a shut-off valve which is ordinarily open. In the bottom wall of the water compartment there is mounted a valve cage 19 in which there is threadably mounted a bushing 20 having a circular valve seat 21 upon which a buoyant valve piece 22 normally rests, this valve piece being preferably a hollow rubber ball. However, the seat could be soft rubber and the ball a hollow metal one, if preferred. At the bottom of the valve cage there is a plug 23 threaded into the cage. The periphery of a flexible diaphragm 24, made preferably of soft rubber, is clamped between the plug 23 and an annular shoulder on the valve cage 19.

The plug 23 has a central port in which slides a valve lifter rod 25. This rod also projects through the center of the diaphragm 24, to which it is clamped by collars 26 and 27, so that the joint is liquid-tight. The upper end of this rod is provided with a dished spider 28 which extends into the central opening of the bushing 20, standing normally a short distance below the ball 22 in position to unseat the ball when the rod 25 is lifted by pressure on the lower end thereof, which pressure may be exerted manually directly upon the rod or through any suitable operating connections.

At one side of the cage 19 there is an integral extension 29 (Fig. 3) adapted to receive a pipe 30 through which the water is discharged.

The bushing 20 is reduced somewhat on its upper side to fit into the lower extremity of a hollow guide column 31, these two parts being preferably welded or soldered together. Slightly above the level of the plug the column 31 has a series of water passages 32 therethrough which have a flow capacity about equal to the capacity of the opening through bushing 20.

Near the upper end of column 31 there is a partition or closure 33 which is preferably sheet metal downwardly dished, and provided centrally with a small port 34, the column 31 being liquid-tight between the openings 32 and the port 34. A float 35, preferably in the form of a hollow soft rubber ball, is adapted to close and seal the port 34 when the liquid level in the tank descends sufficiently to permit that action. The same ball is also adapted, as shown in Fig. 1, to close the port 15 at the bottom of the air chamber 10 when the chamber 11 is filled with water. The upper end of the column 31 serves as a retainer and guide for the ball 35.

Around the lower end of column 31, and preferably concentric therewith, is a dam 36 which I term a refill baffle ring. This ring is attached to

the bottom element 13 of the tank and extends upward well above the openings 32 in the column. It is spaced from the column a distance sufficient to permit a maximum flow of water through the openings 32. Near the bottom of the ring there are one or more openings 37 which are somewhat restricted in size, so that the flow of water through them is less than the capacity of the openings 32.

The operation of this form of the invention is as follows. Assume that the parts are in the condition shown in full lines in Fig. 1, the water chamber 11 being filled with water, and the air in air chamber 10 being compressed to approximately two atmospheres, the compartments 10 and 11 as shown being approximately equal in size. Now, when it is desired to perform a flushing operation, the rod 25 is lifted sufficiently to unseat valve piece 22. Water then immediately flows underneath the valve piece, and the water pressure on the same is equalized below and above. The valve piece, being lighter than water, then rises to the dotted line position. Water now flows rapidly through the wide annular passage between the ring 36 and the column 31 and through the openings 32 in the column and the central opening in bushing 20, and thence out through pipe 30 with a flushing action. A small quantity of water also flows downwardly through port 34 and column 31 and out of the tank. This latter flow continues until the level of water in the tank descends sufficiently to permit ball 35 to seat itself upon the partition or closure 33 when the port 34 is closed and sealed. Thereafter the water in column 31 is retained therein, because there is no pressure on the top of the water in the column. This flushing action or rapid water flow continues until the level of water in the tank reaches the top of dam 36. Then the flushing action ceases, the rate of discharge of water being decreased. The slower flow thereafter is used to refill the bowl of a toilet or other receptacle to which the tank is connected. It is not until the level of water in the tank descends to the tops of the passages 32 that air begins to bubble up into the column 31 and permit the discharge of the water in the column. With the flow of water downwardly out of the column the ball 22 of course descends and finally seats itself by its own weight upon the valve seat 21, whereupon the discharge of water ceases.

At the start of the flushing operation, or as soon as the float 35 moves downwardly away from port 15, the pressure of the air in chamber 10 is exerted upon the surface of the water in the chamber 11, thereby hastening the flow of water out of the tank. This pressure of course gradually decreases as the water level descends, but it has more or less effect throughout the flushing operation. Water begins to enter the tank through pipe 17 as soon as the flushing action begins, but the size of the pipe 17 is such that this rate of entry is much slower than the rate of discharge. After the ball 22 seats itself upon the valve seat 21, the chamber 11 gradually fills. During this operation a small quantity of air may be drawn into the tank through an air induction tube 38, thus replacing any air that may have been carried out along with the water. The tube 38 may be used for antiseptic purposes. At the moment the discharge valve closes the chamber 11 is of course filled with air. As the water level rises air is forced through port 15 into chamber 10, and it will be apparent that when the chamber 11 is entirely filled with water the space occupied by the air in the tank has then been reduced approximately one-half, so that the air in chamber 10 is then under pressure of substantially two atmospheres. In this pressure type of tank a considerable saving of water may be accomplished due to the fact that a siphon seal in the toilet bowl is obtained quickly because of the rush of water under air pressure.

In Fig. 2 I have shown the invention as applied to a gravity tank, which in this instance is illustrated as a horizontal cylinder 39 adapted to be filled entirely with water. The operating parts are substantially the same as those above described, except that the column 31A is somewhat longer because of the greater height of the water compartment. At the top of the tank I have provided a dome 40 having a central air vent 41, which may have a connection with a vent tube 42 through which leakage of water may be cared for in the event that the ball 35 should become faulty and fail to entirely seal the vent 41. The operation of this form of the invention is precisely the same as that of Fig. 1, except that discharge of water is by gravity only rather than under air pressure.

In Fig. 4 the construction and operation are somewhat different. In this form of the invention there is a valve cage 43, which may be of a rather large size since it may be called upon to discharge the function of supporting the tank. The tank in this case is a vertical cylinder 44 of a fairly considerable height in order to contain the requisite amount of water. It is united with the valve cage by a water-tight joint. At its upper end the cylinder has a head 45 in which is formed a central dome 46 with an air vent 47 adapted to be closed and sealed by the hollow ball float 35.

Threaded into the valve cage 43 there is a bushing 48 with a central opening and a valve seat 49 of spherical contour for the reception of the buoyant ball valve piece 22. This bushing carries a guide column 31B similar to the guide columns 31 and 31A, but of greater length because of the greater height of the tank 44. The ball 22 is adapted to be unseated by a lifter rod 50, similar in all respects to the rod 25 except that it is of greater length. At the bottom of the column 31B there are a series of passages 51 of sufficient size and number to accommodate the necessary flow of water for the flushing action. There is no ring dam in this form of the invention, its functions being carried out in this case by the tall column 31B.

When the flushing action starts it continues until all of the water outside of the column 31B has passed out of the tank. The water in the column below partition 33 is retained because of the closing of port 34 by ball valve piece 35. When the level of water outside of the column descends to the passages 51, the flushing action being ended at that time, air begins to bubble up through those passages into the column 31B. This action is a comparatively slow one, and hence the discharge of the water in the column is not rapid, but is at a rate suitable for bowl refilling. The quantity of water is also sufficient for this purpose.

It will be noted that in all forms of the invention the plug 23 is made of larger diameter than the bushing 20 or 48, as the case may be, and that the bushing is made larger than the column 31, 31A, 31B, and that consequently these various parts may be withdrawn from the tank through the bottom thereof for servicing or replacement.

The invention is not limited in its use to water-

closets and the like, but is applicable to other apparatus, for instance as a laundry tub refilling means or as a liquid measuring device.

In the foregoing description I have necessarily gone somewhat into detail in order to explain fully the particular embodiments of the invention herein illustrated, but I desire it to be understood that such detail disclosures are not to be construed as amounting to limitations except as they may be included in the appended claims.

Having thus described my invention, I claim:

1. In a flush tank, a discharge valve seat, a buoyant valve piece for said seat, an auxiliary compartment in the tank surrounding said seat, said compartment communicating at the lower end thereof with the tank proper, said compartment having a port in the upper end thereof, and means for closing said port shortly after the discharge of water from the tank is initiated.

2. In a flush tank, a discharge valve seat, a buoyant valve piece for said seat, a hollow column surrounding said seat and extending upwardly into the tank, said column having an opening at the bottom thereof communicating with the tank proper, said column having a port at the top thereof connecting the column with the interior of the tank, and a float valve for closing said port when the water level descends sufficiently.

3. In a flush tank, a discharge valve seat, a buoyant valve piece for said seat, a hollow column surrounding said seat and extending upwardly into the tank, said column having an opening at the bottom thereof communicating with the tank proper, a closure at the upper end of the column, a guide extending upwardly from said closure, and a float retained by said guide, said closure having a port therethrough adapted to be sealed by said float when the level of water in the tank descends sufficiently.

4. In a flush tank, a discharge valve seat, a valve piece for said seat, a hollow column surrounding said seat and extending upwardly into the tank, said column having an opening at the bottom thereof communicating with the tank proper, a partition in the column in the upper portion thereof, said partition having a central port, and a float in the column above the partition, the column above the partition being open to the tank proper but adapted to retain and guide said float, whereby the port will be sealed by the float when the level of water descends sufficiently.

5. In a flush tank, a discharge valve seat, a valve piece for said seat, a hollow column surrounding said seat and extending upwardly into the tank, said column having an opening at the bottom thereof communicating with the tank proper, a closure at the upper end of the column having a concave upper surface, a guide extending upwardly from said closure, and a buoyant ball retained by said guide, said closure having a port therethrough adapted to be sealed by said ball when the level of water in the tank descends sufficiently.

6. In a flush tank, a discharge valve seat, a valve piece for said seat, a hollow column surrounding said seat and extending upwardly into the tank, said column having an opening at the bottom thereof communicating with the tank proper, a partition in the column in the upper portion thereof, said partition having a concave upper surface and a central port, and a ball float in the column above said partition, the column above the partition being open to the tank proper but adapted to retain and guide said float, whereby the port will be sealed by the float when the level of water descends sufficiently.

7. In combination, a flush tank having a discharge valve at the bottom thereof, manually operable means for unseating said valve when the tank is to be emptied, and a baffle ring surrounding but spaced from the valve and extending upwardly from the bottom of the tank, said ring having ports therethrough near the bottom thereof of less capacity than the capacity of the discharge opening of the tank, whereby the discharge of water is rapid until the level descends to the top of said ring and at a slower rate thereafter.

8. In combination, a flush tank comprising a vertical cylinder, a discharge valve at the bottom of the cylinder, a hollow guide column surrounding said valve and extending upwardly to a height near the top of the cylinder, said column having openings therethrough near the bottom thereof and having a closure near the top thereof with a port therethrough, and a float adapted to seal said port, said column having means above the closure for retaining and guiding said float, whereby the said port is sealed when the level of water descends sufficiently, and whereby the discharge of water is rapid until the space outside of the column is emptied and at a slower rate thereafter.

9. In a flush tank, a discharge valve seat, a buoyant valve piece for said seat, a hollow column surrounding said seat and extending upwardly into the tank, said column having an opening at the bottom thereof communicating with the tank proper, a closure at the upper end of the column having a concave upper surface and a central port, a guide extending upwardly from said closure to a point near the top of the tank, the tank having an air vent in the top thereof above said column, and a buoyant ball retained by said guide adapted to close said vent when the tank is full and to seal said port when the level of water in the tank descends sufficiently.

10. In a flush tank, a discharge valve seat, a valve piece for said seat adapted to move up and down, means for unseating said valve piece comprising a rod extending upwardly into the bottom of the tank, and a diaphragm secured centrally to said rod and at its periphery to the tank, said tank having a supporting element surrounding the rod upon which the diaphragm is adapted to rest normally.

11. In a flush tank, a horizontal partition separating the tank into an upper air chamber and a lower water chamber, said partition having an air port therethrough, a discharge valve seat at the bottom of the lower chamber, a valve piece for said seat, a hollow column surrounding said seat and extending upwardly into the tank to a height slightly below said partition, said column having an opening at the bottom thereof communicating with the tank proper and having a port at the top substantially in vertical alignment with said air port and connecting the interior of the column with the interior of the tank below said partition, and a float valve adapted to close said air port when the water chamber is full and to close said column port when the level of water descends sufficiently.

12. In a flush tank, a discharge valve seat, an opening in the tank below said seat, a closure for said opening having a central bore therethrough, a valve piece for the seat adapted to move up and down, means for unseating said valve piece comprising a rod extending upwardly through said

bore, and a diaphragm having its edges clamped between the closure and the tank and having a water-tight connection with said rod.

13. In a flush tank, a discharge valve seat, an opening in the tank below said seat, a closure for said opening having a central vertically extending boss, said boss having a vertical bore therethrough, a valve piece for the seat adapted to move up and down, means for unseating said valve piece comprising a rod extending upwardly through said bore, and a rubber diaphragm having its edges clamped between the closure and the tank and having a water-tight connection with said rod, the inner side of said closure having a concave surface to receive and support said diaphragm in its normal position.

FRANK J. BRANNEN.