Oct. 14, 1930. C. E. MACE 1,778,114

TANK FILLING VALVE

Filed Feb. 12, 1929 2 Sheets-Sheet 1

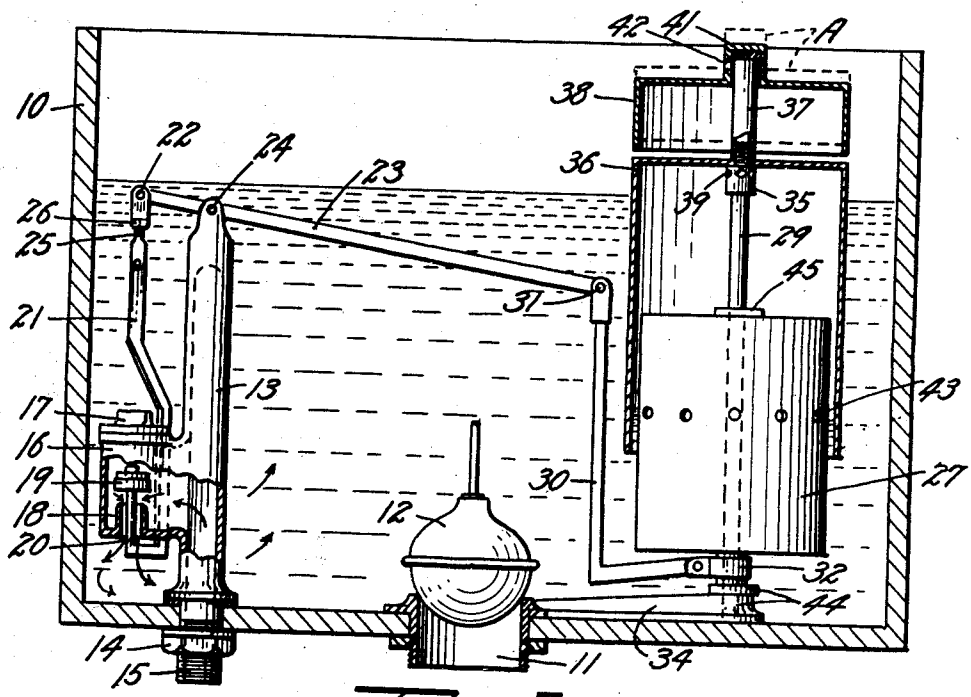


Fig 1

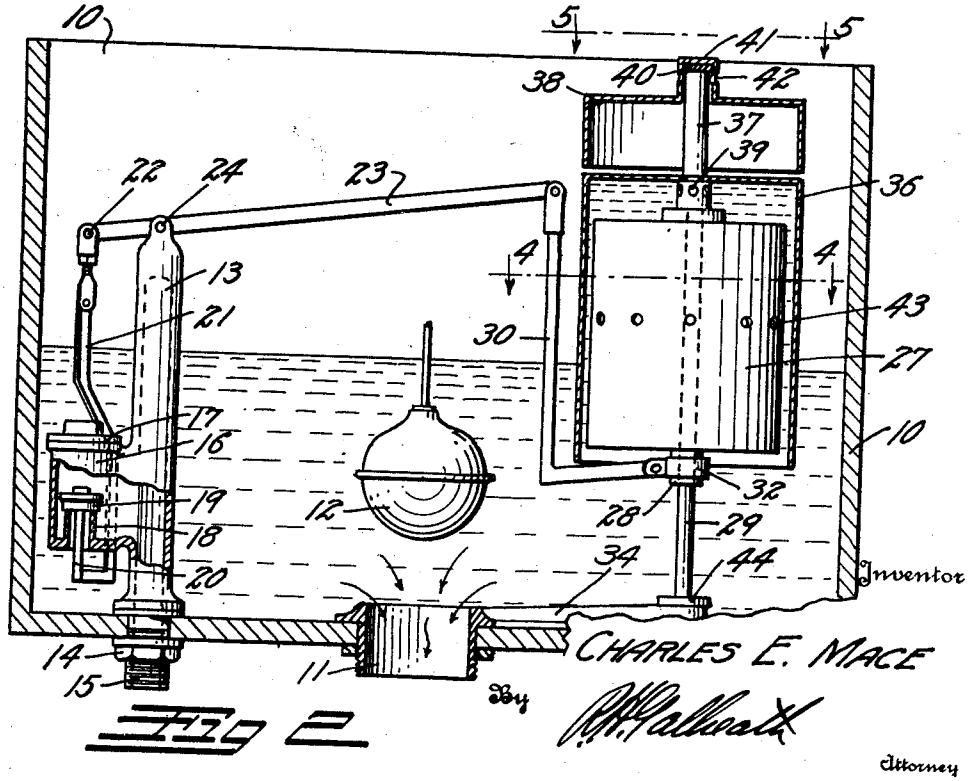


Fig 2

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TANK FILLING VALVE

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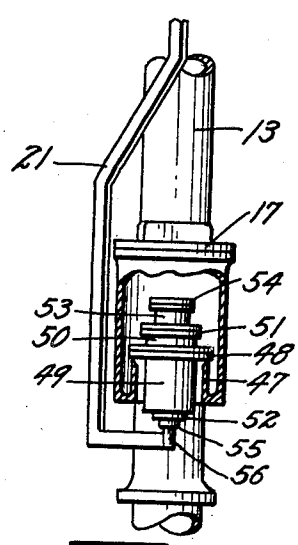


Fig 6

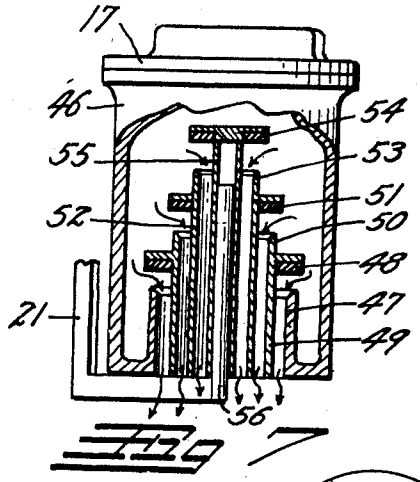


Fig 7

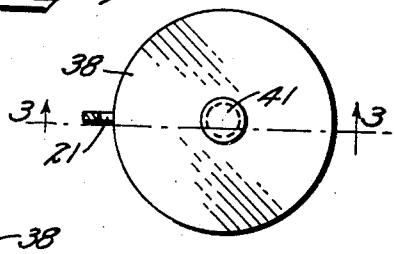


Fig 5

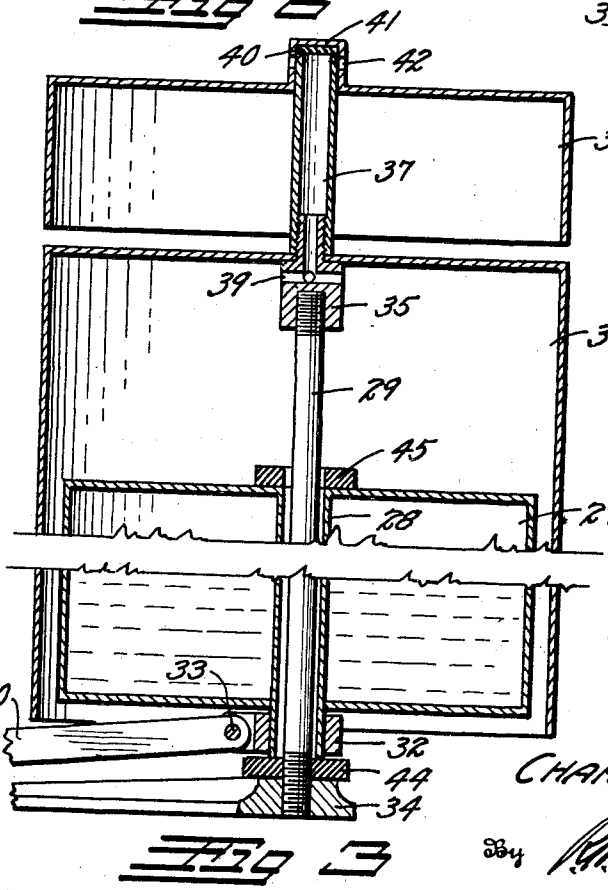


Fig 3

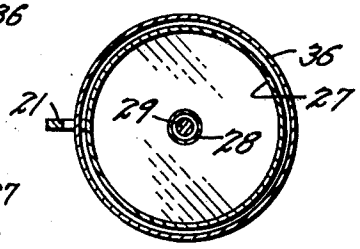


Fig 4

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Patented Oct. 14, 1930 1,778,114

UNITED STATES PATENT OFFICE

CHARLES E. MACE, OF DENVER, COLORADO

TANK-FILLING VALVE

Application filed February 12, 1929. Serial No. 339,330.

This invention relates to tank filling valves and float operated mechanisms for operating the same. It is more particularly applicable to toilet tanks and will be described as applied to such a use. It is not, however, limited to this use but will find many valuable applications wherever it is desired to control the filling of a tank by means of a float operated valve.

Toilet tanks at present in use will begin to fill as the water level therein lowers so that the noise of the gradually opening valve becomes apparent even before the water has been discharged from the tank. One of the objects of this invention is to provide a supply valve and operating mechanism which will not function until the desired quantity of water has been discharged from the tank and which will then open quickly to a full opening.

Another disadvantage of the present toilet tanks is that the supply valve will gradually close as the tank fills, resulting in a long, drawn-out, whistling and exceedingly annoying sound. Another object of the invention is to provide a valve and mechanism which will not function until the tank has been completely filled and will then operate quickly to close the supply valve.

Still another object of this invention is to provide a valve which can be opened against the pressure of the water in the supply pipe with but a minimum of effort and which will open immediately to provide a large discharge opening so that all noises caused by restriction of the flow will be eliminated.

A further object of this invention is to provide a valve which will be opened by means of a weight and in which the weight will weigh nothing when the valve is being closed, so that it will be unnecessary for the operating mechanism to lift the weight when closing the valve.

A still further object of this invention is to provide an operating mechanism which will be positive in operation; which will always discharge and admit exactly the same quantity of water; which will have a minimum of wearing surfaces; and which can not become misadjusted by constant use or by the interference of unskilled workmen.

Other objects and advantages reside in the detail construction of the invention, which is designed for simplicity, economy, and efficiency. These will become more apparent from the following description.

In the following detailed description of the invention reference is had to the accompanying drawings which form a part hereof. Like numerals refer to like parts in all views of the drawings and throughout the description.

In the drawing:

Figs. 1 and 2 are vertical, longitudinal sections through a toilet tank, illustrating the invention in place therein. In these views, various parts of the invention are illustrated in section to show the interior mechanism. In Fig. 1 the mechanism is shown as it would appear while the tank is filling. In Fig. 2 the mechanism is shown as it would appear while the tank is emptying.

Fig. 3 is an enlarged, fragmentary, vertical section through the valve operating float mechanism, taken on the line 3—3, Fig. 5.

Fig. 4 is a horizontal section through the float and float chamber taken on the line 4—4, Fig. 2.

Fig. 5 is a plan view of the float mechanism as it would appear from the line 5—5, Fig. 2.

Fig. 6 is a detail view of an alternative form of supply valve which might be used in place of the valve illustrated in Figs. 1 and 2.

Fig. 7 is an enlarged, vertical section through the supply valve of Fig. 6.

In the drawing, a toilet tank of the usual construction is illustrated at 10 with its flushing nipple at 11 and flush ball valve at 12. The mechanism for operating the flush ball valve has not been illustrated since it forms no part of this invention and any of the present types of flushing mechanism may be employed for discharging or flushing the tank.

My invention employs a standpipe 13 clamped to the bottom of the tank 10 by means of a clamp nut 14 and threaded as shown at 15 for attachment to the water supply pipe, as is usual in constructions of this nature. Alongside of and opening to the standpipe

13 is a valve housing 16 to which access may be had by means of a threaded cap 17. The bottom of the valve housing 16 is open, the opening being surrounded by a valve seat 18 arranged to be closed by means of a supply valve 19.

The supply valve 19 is actuated from a stem 20 on an operating arm 21. The operating arm 21 is pivoted at 22 to a lever 23, hinged to the top of the standpipe 13 at 24. The amount of opening of the supply valve 19 can be adjusted by means of a threaded stem 25 provided with a lock nut 26.

The lever 23 is actuated by means of a combined weight and float 27, which will be hereinafter designated simply as the float 27. The float 27 is preferably cylindrical in shape and is formed around an axial tube 28 which opens through the top and bottom of the float 27 and is arranged to slide over a vertical rod standard 29. The float 27 is connected to the lever 23 by means of an L-shaped arm 30 hinged to the extremity of the lever 23 at 31, and hinged to a clamp fitting 32 at 33. The fitting 32 is clamped or soldered on a projecting extremity of the axial tube 28, as illustrated in Fig. 3.

The standard 29 is maintained vertical by means of a base member 34 into which it is threaded or otherwise secured. The base casting 34 can be so constructed as to form a part of the flushing nipple 11 or may be clamped under the flange of any of the present nipples so as to maintain it vertical in the tank 10.

The upper extremity of the standard 29 is threaded into an air fitting 35 which supports an open-bottomed, cylindrical float chamber 36 about the float 27. The float chamber 36 is clamped to the fitting 35 by means of a hollow sleeve or air tube 37 which is threaded thereon and acts to clamp the top of the float chamber and maintain it rigidly in position.

Passages 39 are formed in the fitting 35 which allow air to escape from the float chamber 36 into the air tube 37. The upper extremity of the tube 37 is normally closed by means of a resilient washer 40 carried in a concentric projecting cap 41 on the air chamber 38. The cap 41 is provided with discharge openings 42, and is formed by closing the upper extremity of a bearing tube 57 which passes thru the float 38 and acts as a slide or guide upon the air tube 37.

It will be noted that the walls of the float 27 are perforated by means of openings 43 which allow the float to fill and remain filled with water to a predetermined height so that it will act both as a weight to open the supply valve 19 and as a float to close the valve 19.

Let us assume that the mechanism is in the position illustrated in Fig. 1. Water is now flowing from the supply pipe into the standpipe 13 through the open valve seat 18 into the tank 10—the ball valve 12 being closed to prevent discharge of the water. The float 27 cannot rise with the rising water level in the tank 10, because of the fact that the float chamber 36 acts as an "air bell" to prevent the water from rising about the float 27. The float will, therefore, maintain the position of Fig. 1 until the water level passes above the top of the float chamber 36 and lifts or floats the air chamber or float 38 as indicated in broken line at "A" in Fig. 1. This raises the washer 40 from the extremity of the air tube 37 and allows the air in the float chamber 36 to immediately escape through the passages 39, the tube 37 and the openings 42. This allows the water to immediately fill the float chamber, lift the float 27, and immediately close the supply valve 19.

It will be noted that that part of the float above the openings 43 is never filled with water and will always be buoyant to operate the mechanism. That part of the float below the openings 43, tho filled with water, will have no weight when submerged since the water contained therein will displace an equal amount of water in the tank.

Let us now assume that the tank is flushed or in other words that the ball flush valve 12 is lifted from the flushing nipple 11, as illustrated in Fig. 2. This allows the water to rush from the tank 10 and rapidly lowers the water level therein. The float 27, however, cannot fall with the falling water level since it is completely surrounded by the water in the float chamber 36, which cannot escape from the float chamber until air is admitted thereto to displace it. Therefore, the float 27 will remain raised or suspended and will maintain the supply valve 19 closed until the water level reaches the open bottom of the float chamber 36. This will allow air to rush in at the open bottom to immediately displace the water therein and allow the weight of the water within the float 27 to drop the float to the position of Fig. 1, quickly opening the supply valve 19.

The impact of the falling float is partially absorbed by the remaining water in the tank 10, and the float is finally stopped by means of a rubber cushion 44, which surrounds the standard 29 above the base member 34. The impact of the rising float is absorbed by a similar rubber cushion 45 which is compressed between the top of the float and the air fitting 35.

The supply valve 19 will operate under conditions where the pressure in the supply pipe is relatively low. For operations where there is a relatively high pressure in the supply pipe a valve, such as illustrated in Figs. 6 and 7, is preferred. This valve is illustrated, described, and claimed more in detail in applicant's copending application, Serial No. 269,915, filed April 14, 1928, which issued Oct. 8, 1929, as Patent No. 1,730,374.

Its construction will be but briefly outlined herein.

This valve employs a valve housing 46, somewhat similar to the previously described valve housing 16. The housing 46 has a relatively large cylindrical valve seat 47 in its bottom, closed by means of an annular valve 48 carried on a large, concentric tube 49. The tube 49 extends above the valve 48 to form a second valve seat 50, which is in turn closed by means of a second valve 51, carried on a second smaller concentric tube 52. The tube 52 projects above the valve 51 to form a third valve seat 53, which is in turn closed by means of a third valve 54 carried on a small concentric tube 55. The tube 55 surrounds a valve stem 56 formed on the extremity of the L-shaped arm 21.

When the valves are all closed the large tube 49 will project below the bottom of the housing 46; the smaller tube 52 will project below the tube 49; and the smallest tube 55 will project below the tube 52, as illustrated in Fig. 6. Thus, when the arm 21 rises, it will first lift the first or smallest valve 54 against the pressure of the water in the housing 46. This immediately relieves the pressure in the housing so as to facilitate the opening of the remaining valves.

The arm 21 will then contact with the sleeve 52 and open the valve 51 followed by contact with the sleeve 49 and opening of the valve 48. Thus, the valves do not open simultaneously, but follow each other in such quick succession that the opening of all of them is practically instantaneous and noiseless. When all of the valves are opened, the passageways for the flow of the water are so numerous and so large that there will be no restriction whatever in velocity and no noises of restriction at this point.

It will be noted that the standpipe 13 is hollow and closed at its top. It thus acts as an air cushion to prevent the quick closing of the valve from creating a "water hammer."

While a specific form of the improvement has been described and illustrated herein, it is desired to be understood that the same may be varied, within the scope of the appended claims, without departing from the spirit of the invention.

Having thus described the invention, what I claim and desire secured by Letters Patent is:—

1. Means for operating a valve from the changing water level in a tank comprising: a float chamber open to said tank; a float adapted to rise in said float chamber; an operative connection between said float and said valve; and means for relieving air from said float chamber when said water reaches a predetermined level in said tank.

2. Means for operating a valve from the changing water level in a tank comprising: a float chamber communicating with said tank; a float adapted to rise in said float chamber; an operative connection between said float and said valve; and means for relieving air from said float chamber when said water reaches a predetermined level in said tank; said means comprising a second float; an air valve communicating with said float chamber and actuated by said second float.

3. Means for operating a valve from the changing water level in a tank comprising: an open bottomed float chamber supported in said tank; a float adapted to operate in said float chamber through the open bottom thereof; an operative connection between said float and said valve; a second float above said first float; and an air valve controlled by said second float so as to allow air to discharge from said float chamber when the water in said tank reaches a predetermined level.

4. Means for operating a valve from the changing water level in a tank comprising: an open bottomed float chamber supported in said tank; a float adapted to operate in said float chamber through the open bottom thereof; an operative connection between said float and said valve; a second float above said first float; and an air valve controlled by said second float so as to allow air to discharge from said float chamber when the water in said tank reaches a predetermined level; said air valve comprising an air tube extending above said float chamber into said second float; and a valve disk carried by said second float and arranged to close the upper extremity of said air tube.

5. Means for operating a valve from the changing water level in a tank comprising: an open bottomed float chamber supported in said tank; a float adapted to operate in said float chamber through the open bottom thereof; an operative connection between said float and valve; a second float above said first float; and an air valve controlled by said second float so as to allow air to discharge from said float chamber when the water in said tank reaches a predetermined level, said float having openings in its walls so that it will remain partially filled with water and act as a weight as it descends.

6. Means for operating a valve from the changing water levels in a tank comprising: a vertical standard in said tank; a float arranged to slide along said standard; an operative connection between said float and said valve; an open bottom float chamber supported by said standard above and about said float; and a float operated air valve adapted to allow air to exhaust from said float chamber when the water in said tank reaches a predetermined level.

7. Means for operating a valve from the changing water levels in a tank comprising: a vertical standard in said tank; a float arranged to slide along said standard; an oper-

ative connection between said float and said valve; an open bottom float chamber supported by said standard above and about said float; and a float operated air valve adapted to allow air to exhaust from said float chamber when the water in said tank reaches a predetermined level, said air valve comprising: a tube extending above said float chamber and supported by said standard; passages communicating from said float chamber through said tube; a second float arranged to be guided by said tube; and a valve disk carried by said float and adapted to close the extremity of said tube.

8. Means for operating a valve from the changing water levels in a tank comprising: a vertical standard in said tank; a float arranged to slide along said standard; an operative connection between said float and said valve; an open bottom float chamber supported by said standard above and about said float; and a float operated air valve adapted to allow air to exhaust from said float chamber when the water in said tank reaches a predetermined level, the open bottom of said float chamber being spaced above the bottom of said tank so that air will enter said float chamber when the water level in said tank falls below said open bottom.

9. Means for operating a valve from the rise and fall of water in a tank comprising: an air bell inverted in said tank; a float adapted to rise and fall within said air bell; an operative connection between said float and said valve; means for discharging air from said bell when said water reaches a predetermined high level so as to allow said float to rise therein; and means for admitting air to said bell when the water reaches a predetermined low level so as to allow the suspended water to discharge from said bell and allow said float to fall therein, said means comprising the open bottom of said bell.

10. Means for operating a valve from the rise and fall of water in a tank comprising: an air bell inverted in said tank; a float adapted to rise and fall within said air bell; an operative connection between said float and said valve; means for discharging air from said bell when said water reaches a predetermined high level so as to allow said float to rise therein; and means for admitting air to said bell when the water reaches a predetermined low level so as to allow the suspended water to discharge from said bell and allow said float to fall therein, said former means comprising a float operated air valve, said latter means comprising the open bottom of said bell.

11. Filling mechanism for toilet tanks comprising: a standpipe; a valve chamber supported alongside of and communicating with said standpipe; a valve seat in said valve chamber; a supply valve adapted to close said seat with the water pressure in said standpipe and open said seat against the water pressure therein; a lever pivoted on said standpipe; a connecting member between one extremity of said lever and said valve for operating said valve; and a float actuated mechanism operatively connected to the other extremity of said lever.

12. Filling mechanism for toilet tanks comprising: a standpipe; a valve chamber supported alongside of and communicating with said standpipe; a valve seat in said valve chamber; a supply valve adapted to close said seat with the water pressure in said standpipe and open said seat against the water pressure therein; a lever pivoted on said standpipe; a connecting member between one extremity of said level and said valve; and a float actuated mechanism operatively connected to the other extremity of said lever, said float actuated mechanism comprising: a fixed standard; a float having an axial internal sleeve adapted to slide over said standard; an inverted air bell carried by said standard above and about said float; and a float operated air valve adapted to relieve the air pressure in said air bell when the water in said tank has reached a predetermined level.

13. Means for operating a valve from the rise and fall of water in a tank comprising: an air bell inverted in said tank; a float adapted to rise and fall within said air bell; an operative connection between said float and said valve; means for discharging air from said bell when said water reaches a predetermined high level so as to allow said float to rise therein; and means for admitting air to said bell when the water reaches a predetermined low level so as to allow the suspended water to discharge from said bell and allow said float to fall therein, said latter means comprising the open bottom of said bell, there being openings through the wall of said float so as to allow it to partially fill with water to create a weight.

In testimony whereof, I affix my signature.

CHARLES E. MACE.