

Oct. 20, 1964

H. J. WALSH

3,153,247

PLURAL FLUSH TOILET VALVE

Filed Jan. 7, 1963

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Fig. 1

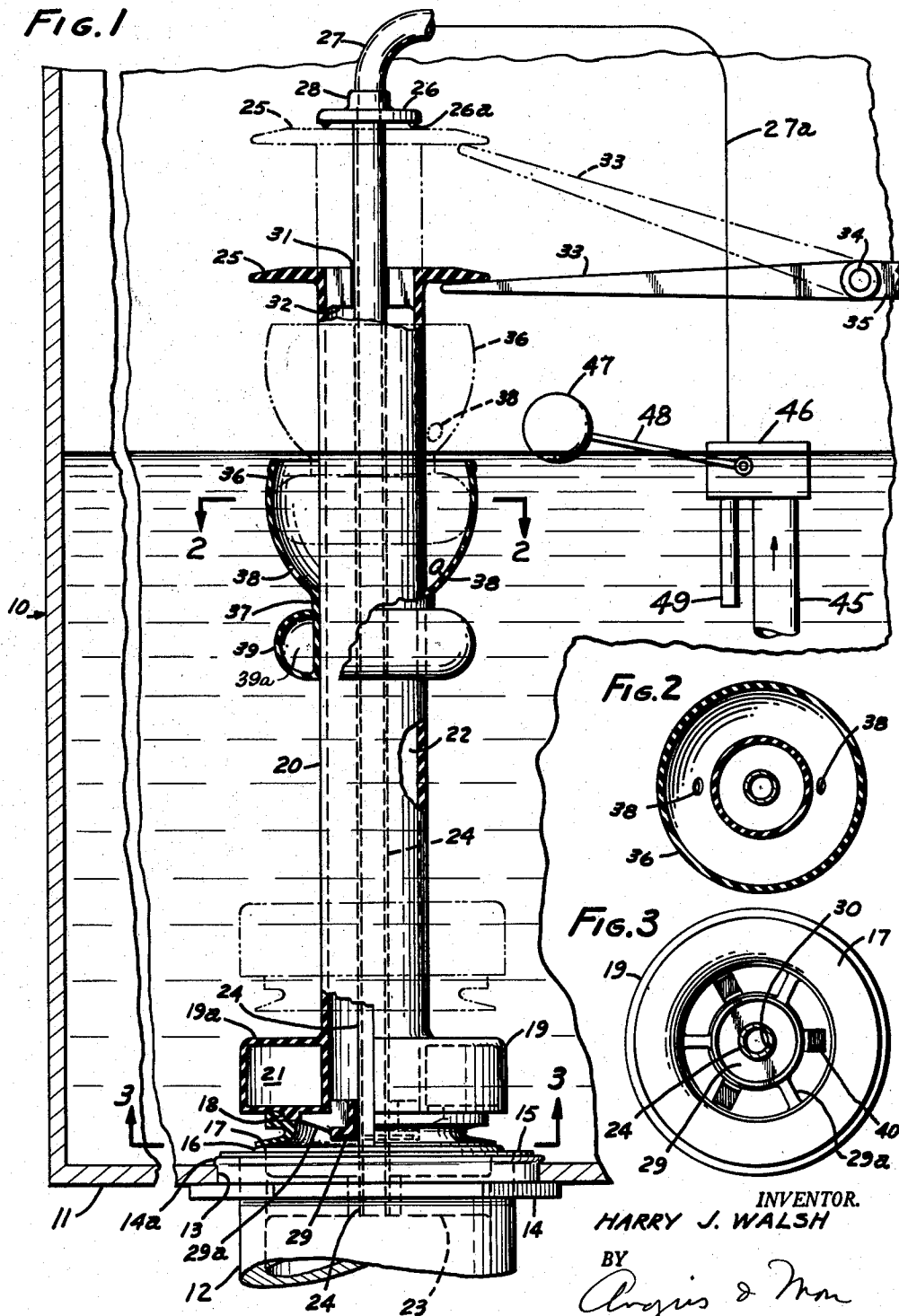


Fig. 2

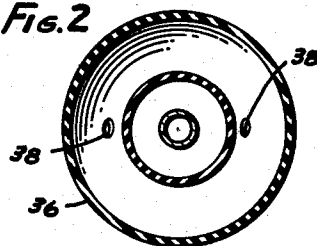
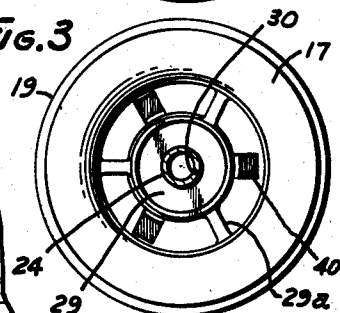


Fig. 3



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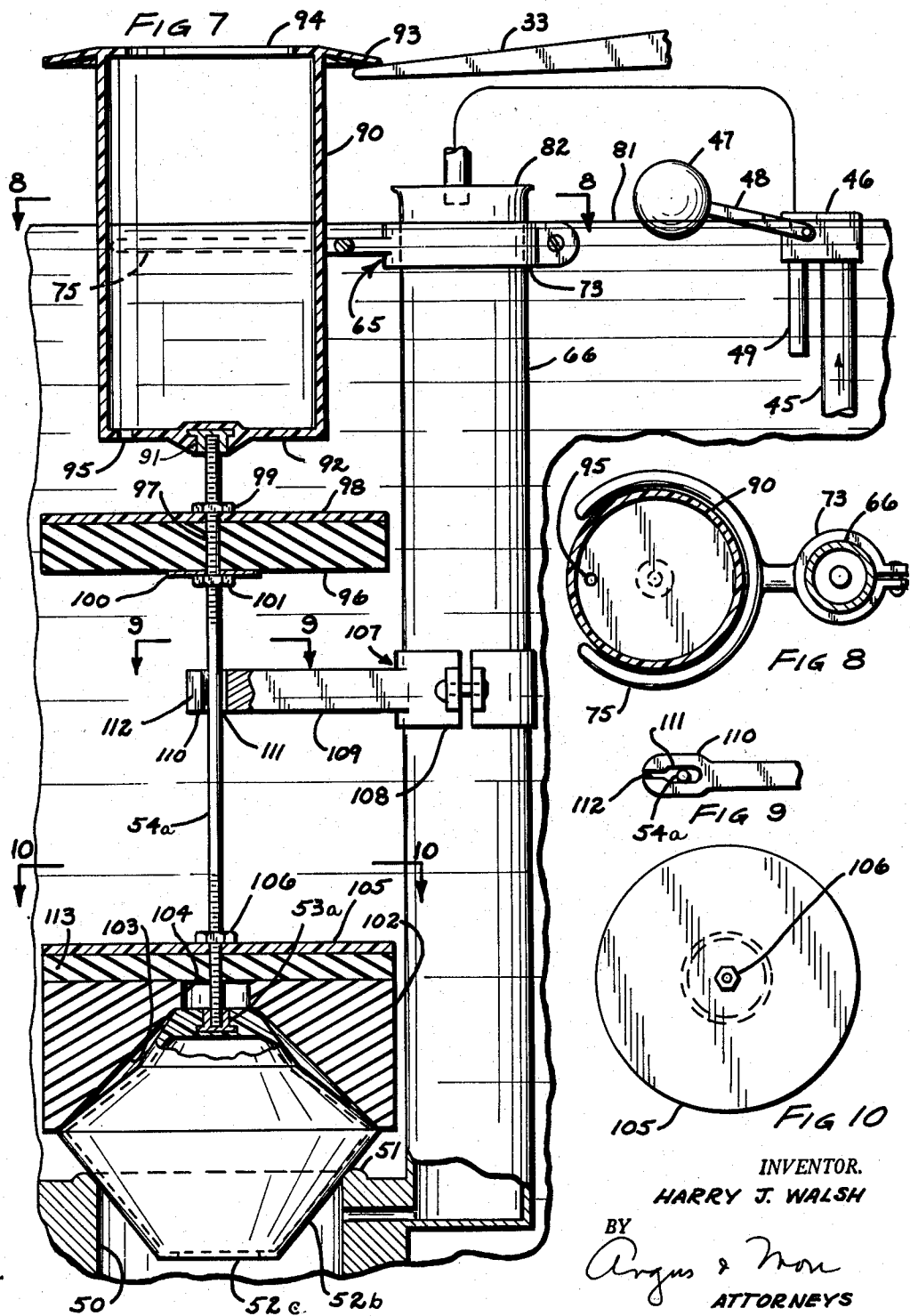
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PLURAL FLUSH TOILET VALVE

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Filed Jan. 7, 1963, Ser. No. 249,950
1 Claim. (Cl. 4—58)

This invention relates to flush valves, especially flushing valves of the type used in toilet water tanks.

This is a continuation-in-part of my co-pending application Serial No. 145,421, filed October 16, 1961, which is a continuation-in-part of my application Serial No. 125,401, filed July 20, 1961, both now abandoned.

An object of this invention is to provide an arrangement by which the required time and amount of water for a flushing can be reduced.

A water tank for flushing a toilet commonly comprises a water tank with an opening at the bottom of which is seated a main valve which is retractable. When the valve is retracted the water in the tank passes down through a pipe fitted into the opening, to perform the flushing operation. There is ordinarily associated with the flushing mechanism a water inlet through which water may be admitted to the tank for filling it; and this water inlet is controlled by an inlet valve operated by a float in the tank so that when the water which has been admitted through the inlet into the tank reaches the desired full level in the tank, the float will operate the inlet valve to shut the inlet water off. There is commonly provided a hand operated lever for retracting the main valve seated at the tank outlet; and this latter valve ordinarily has attached to it a member which provides enough buoyancy so that when the main valve is retracted, the buoyancy will keep it in a raised retracted position until the tank becomes substantially emptied whereupon the main valve drops and seats again. Shortly after the tank starts to empty pursuant to retraction of the main valve, the float controlling the water inlet valve will drop, thereby admitting more inlet water to fill the tank again.

In accordance with the present invention there is attached to a stem fastened to the main valve, a cup open to the atmosphere when the upper part of the cup is above the water or liquid level in the tank. An opening or openings are provided through a wall of the cup to permit drainage of liquid out of the cup when the water level in the tank drops relative to the position of the cup.

According to a feature of the invention a buoyant means is connected and located just below the cup.

An optional feature resides in the provision of another buoyant means near the region of the main valve.

Another optional feature resides in the provision of means for easily fitting the valve assembly to and removing it from, its supporting means.

Another optional feature resides in the provision of a means for varying the effective buoyancy of the buoyant means to regulate the amount of water being flushed.

In accordance with one embodiment of the present invention, the top of the cup is somewhat below the normally filled level of the liquid in the tank, so that the cup is full of liquid when the tank is filled. An opening or openings are provided through the cup to permit drainage of liquid out of the cup when the cup emerges above the surface of the water.

According to another embodiment of the invention, the upper part of the cup is maintained above the liquid level while the opening through the wall of the cup is below the liquid level when the tank is filled with liquid.

When a retracting means is operated to produce a flushing so that the level of the liquid in the tank starts to become lower after the valve is raised by this operation, the cup is raised enough relative to the liquid surface to permit liquid to flow out of the hole or holes through the cup,

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which thereby reduces the weight of the liquid held by the cup.

At the instant of the operation of this retracting means, the weight of the liquid in the cup would be enough to cause the main valve immediately to seat down on its seat again if the retracting means were then released. Under this circumstance the main valve would be opened to produce the flushing only at the moment of operation of the retracting mechanism. It is desirable, of course, that when the main valve is opened by the retracting mechanism it should remain open at least until an amount of liquid has run out of the tank sufficient to produce a desired amount of flushing. The presence of the buoyant means associated with the cup functions, however, to hold the main valve open while liquid is running out of the cup. Thus, as the liquid in the tank continues to drop down to, and below, the level which will cause this buoyant means to remain in its uppermost position, this buoyant means will drop lower in the tank on the receding liquid; at which time at least some liquid will have run out of the cup. This action will cause the main flushing valve to seat again a short, but appreciable, time after the retracting mechanism was operated and released; and will be attended by some substantial flow of the liquid out of the tank for the flushing operation, while leaving a substantial amount of liquid still in the tank.

If it is then desired to flush still more liquid out of the tank, or to completely empty the tank, this can be accomplished by operation of the retracting mechanism again within a short interval of time after the first operation of it and before the tank has had a chance to fill up again. This second retracting operation will again lift the main valve off its seat; and at this time the cup and the buoyant means associated with the cup will be raised above any level at which the fluid in the tank can perform any function on them. Under this circumstance the valve mechanism will simply operate in its normal manner in which the main valve stays open until the tank is substantially completely emptied of liquid after which it will seat again in the usual manner.

The foregoing and other features of the invention will be better understood from the following detailed description and the accompanying drawings of which:

FIG. 1 shows part of a tank, partly in cross-section, containing a flushing valve mechanism, partly in cross-section, in accordance with the present invention;

FIG. 2 is a cross-section view taken at line 2—2 of FIG. 1;

FIG. 3 is a cross-section view taken at line 3—3 of FIG. 2;

FIG. 4 shows another embodiment of the invention, partly in cross-section;

FIG. 5 is a cross-section view taken at line 5—5 of FIG. 4;

FIG. 6 is a cross-section view taken at line 6—6 of FIG. 4;

FIG. 7 is a side view of another embodiment of the invention, partly in cross section;

FIG. 8 is a cross-section view taken at line 8—8 of FIG. 7;

FIG. 9 is a cross-section view taken at line 9—9 of FIG. 7; and

FIG. 10 is a cross-section view taken at line 10—10 of FIG. 7.

Referring to FIGS. 1, 2 and 3 of the drawings, there is shown part of a liquid tank 10, ordinarily a water tank, which may be of a type commonly used with a toilet for flushing purposes. In accordance with common practice there is fitted through the bottom 11 of the tank a flushing pipe or conduit 12 through which water within the tank can flow into a toilet bowl. The upper end of the pipe conduit 12 is passed through an opening 13 through the

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bottom of the tank and is fitted by a water-tight connection comprising a nut 14 which is turned upon outside threads of conduit 12 against a washer 14a of resilient material held between a flange 15 of the conduit and the nut so that the washer is squeezed between members 14 and 15 and between the wall of the conduit and the wall opening 13. The flange 15 is provided with an annular valve seat 16 adapted to have seated thereon an annular member 17 preferably of rubber or rubbery material which acts as the main valve. This main valve 17 is fitted over the depending circumference 18 of a toroidally shaped member 19 having an outer cylindrical wall and provided with an upwardly extending valve stem 20. The toroidal member 19 has a hollow enclosed toroidal internal chamber region 21 containing air and which is sealed closed except for small openings 40 leading into it, so that it is buoyant. The central region within the closed toroidal chamber is in communication with conduit 12 and with the hollow interior 22 of the valve stem 20; so that the interior of conduit 12 is maintained at atmospheric pressure when the main valve 17 is seated.

Within the upper end of conduit member 12 there are provided radial webs 23 which support a hollow upwardly extending pipe 24 located concentric with the conduit 12 and the valve stem 20. This pipe extends upwardly above the top flange 25 of the valve stem; and at the upper end of this pipe there is attached a stop member 26. A tube 27 is attached within a flange 28 of the stop member to communicate with the interior of the pipe 24.

Within portion 18 of the valve stem there is provided a disc member 29 supported by radial webs 29a extending from the portion 18; and at the center of this disc member there is an opening 30 through which the pipe 24 extends and over which the disc member can slide. Likewise, at the upper end of the valve stem 20 there is provided a cylindrical hub member 31 supported by radial webs 32 extending inwardly from the interior wall of the stem and through which the pipe 24 may slide.

In accordance with common practice, there is provided a valve retracting lever 33 rotatable on a pivot 34 fixed to the wall of the tank and adapted to be operated by hand by a hand lever attached to the end 35 of the lever. The hand lever is commonly placed outside the tank and is not shown in the drawing. The inner section 33 of the lever extends to a position beneath the upper flange 25 of the valve stem so that when the end 35 of the lever is depressed by manual operation, the inner end 33 is lifted to raise the valve stem and thereby lift the main valve 17 up off its seat 16.

Provision will also be commonly made to fill the tank with water after water has run out of it pursuant to a flushing. This means commonly comprises a water inlet pipe 45 which is usually lead through the bottom of the tank and operated by a shut-off valve 46 controlled by a float 47. Such a float-operated valve for controlling the water inlet is well known and is no part of the present invention and is therefore illustrated only schematically in the drawing. It is sufficient to say that the float 47 floats on top of the water in the tank and is attached to a stem 48 which extends to the valve 46 so that when the pressurized water from pipe 45 flowing through valve 46 and into the tank through outlet 49 to fill the tank to its pre-assigned full level, the float will rise sufficiently to shut off further flow of water at the valve. But when the water level in the tank drops below the desired full level the float correspondingly falls on top of the falling water level which permits the float stem to open the inlet valve to admit water until the tank is filled up again. It is noted that tube 27 also connects with the outlet side of valve 46 as represented schematically by line 27a, to allow a trickle of water to flow from inlet 45 down through pipe 24 to the toilet bowl to insure that water will be left there after a flushing.

The equipment as described above will be sufficient to produce a flushing of the tank by operation of the lever

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33; for when the main valve 17 is lifted from its valve seat by a momentary operation of the hand lever 35, this lifting will cause the flange 25 to be brought up to its uppermost position as shown in dotted lines, which is determined by the position of the stop 26. In doing this, the valve stem will ride up on its hub members 29 and 31. When this occurs, the main valve will remain in its lifted position even after release of the handle 35, which will allow lever arm 33 to drop from its dotted line position down to its full line position which is its normal unoperated position. The reason for this is that while the main valve 17 is seated as shown in full lines in the drawing, the horizontal top portion 19a of member 19 is under substantial pressure from the water in the tank, which is considerably greater than the atmospheric pressure below and within member 19; and this will hold the main valve seated even though the member 19 is buoyant. When, however, the lever 35 is caused to lift the main valve up off its seat to the dotted line position, the water of the tank will not only rush down through the conduit 12, but will also flow in under and inside the toroidal member 19 through openings 40 so that the water pressure above and below it becomes equalized. The water pressure at the level of member 19 compresses the air in chamber 21 and allows a small amount of water to enter into the chamber. The buoyancy of member 19 in this water will now be sufficient to hold the valve stem flange 25 at its uppermost position against stop 26. Preferably the stop 26 is provided with knobs 26a which will insure that the inner region 22 of valve stem 20 is at all times in communication with the atmosphere. When the tank becomes almost empty, the water level goes down to the level of float 19 so that in the last stages of the flushing operation the float 19 will float down on the water until the valve 17 again seats on its seat at the termination of the flushing operation. At this time, of course, the tank will be filling with inlet water which will cause the level to rise again in the tank. But since there will now be some water pressure on top of valve 17, the member 19 will not float up upon the rising water in the tank; but instead, will remain down to keep the main valve seated as the tank fills up again, and the water again rises on top of member 19.

In accordance with the improvement provided by the present invention, provision is made for modifying the flushing action just described. This improvement comprises a cup 36 open at the top and fitted around the circumference of valve stem 20 at its lower position 37. Near the bottom of the cup there are provided some holes 38 through the wall of the cup. The top of this cup is located a short distance below the flange 25 and also below the normal water level in the tank when the tank is full.

Just beneath the bottom of the cup there is fastened to the stem a toroidal float 39 which is herein called a supplemental float. This supplemental float is a toroidal member adapted to fit around the cylindrical circumference of valve stem 20 to provide a toroidal chamber 39a filled with air by reason of the fact that the walls of the float are closed against the introduction of water from the tank. Accordingly, this supplemental float is buoyant.

The operation of the flushing mechanism as modified by the cup and supplemental float is as follows: When the hand lever is operated to raise the main valve off its seat and is then quickly released in the normal operation, the upper rim of the cup member is raised above the normal full water level of the tank; and furthermore, the holes near the bottom of the cup are at the same time raised, preferably above the water level, by the time the cup reaches its uppermost position while the water level in the tank is dropping. For this purpose it is desired that the distance of upward travel of flange 25 from the valve seated position until stop 26 is reached, be somewhat greater than the distance from the full tank

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water level down to holes 38. Thus, when the lever 35 is first operated to open the main valve, water immediately starts rushing out through the main valve, which causes the water level in the tank immediately to start to move lower, and just as soon as the upper rim of the cup protrudes above the water in the tank, water starts running out of the cup through these holes at a rate dependent on the size of the holes, that is, a metered rate, to reduce the weight of the cup at a rate dependent on the rate of flow of the liquid out through holes 38. The water in the cup does not all leave the cup immediately, but rather, takes an interval of time such as a number of seconds to leave the cup.

At the moment of opening of the main valve, the weight of the water in the cup would be enough to cause the main valve immediately to drop down on its seat again upon release of lever 35. Thus, insofar as the cup alone is concerned, the main valve will seat again just as soon as the hand lever is released. It is the function of the supplemental float 39, however, to prevent such immediate reseating of the main valve. It does this by providing enough buoyancy to the valve stem to keep the main valve in its raised position, even while the cup is still heavy enough with water so that it would cause the main valve to drop to its seat if the supplemental float were absent. As the water level in the tank recedes, the water pressure on the entrapped air in chamber 21 decreases allowing the water in chamber 21 to pass through openings 40 therefrom, thereby increasing the buoyancy of member 19. In order to insure that this operation will occur there should be enough weight of water remaining in the cup (while the main valve is dropping down toward its seat while the water level is receding) to insure that the main valve will move down to within a short distance of its seat, for example, about a quarter of an inch from the seat. When the main valve thus gets close to its seat the effect of the water rushing past it and down the conduit 12 will be to pull it down on its seat.

In the operation just described, only part of the water will flow out of the tank. For example, the water level may drop about three inches in the tank before the main valve reseats. This is sufficient for a liquid flushing of the bowl.

When it is desired to obtain a complete flushing, as for example in the case of a solid flushing, the hand lever 33 should be operated a second time (followed by its release) very shortly after the first operation; that is, practically immediately after the main valve reseats after the short initial flushing just described and before the tank has had a chance to fill up again to its full level. This second lever operation of this time will lift the main valve off its seat (and it will stay up during the flushing for the reasons stated above); and at this time, the cup and supplemental float will be lifted above any level at which they can perform any function, because now the water level in the tank is still down from its full condition so that the supplemental float is above a position at which it can contribute to a buoyancy to lift the valve stem. Its buoyancy is not needed at this time because the cup is in its upper position out of the water, the level of which is still down from its full position. Thus, the main valve will simply operate in its normal manner as though the cup and supplemental float were not present. Accordingly, there will result a complete flushing from the tank before the main valve seats again and allows the cup to drop down to its lower position.

In practice the short and long flushes can conveniently be done by a person simply counting the numbers 1, 2, 3 in normal easy succession immediately after the first operation of the hand lever. The counting of these three numbers will normally account for about one and one-half seconds of time which is about the right amount of time for the short flushing operation. This will create approximately a three inch drop in the level of a normal toilet tank.

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The extent of the short flush can be adjusted by selecting the position at which the cup and the supplemental float are fixed on the valve stem. Moving the cup and supplemental float down on the stem will increase the amount of the initial short flush; in which case the time between the short and long flushing operations should be increased.

It will ordinarily not be desirable to have more than about a three inch initial short flush because the greater this initial flush the less will be the final long flush.

FIGS. 4 to 6 illustrate another embodiment of the invention which is shown as located within a tank like tank 10 of FIG. 1, the actual walls of the tank not being shown in FIG. 4. There is shown in FIG. 4 the upper end of a pipe conduit 50 which is assumed to pass through the bottom of the tank and having an annular valve seat 51 adapted to have seated thereon a plunger member 52 preferably of rubber or rubbery material, to act as the main valve. The valve member 52 can be of a common conventional type having an opening 52a at the bottom, below the valve seat 51 when the valve is seated, and which opens into a hollow interior 52b. There is snugly fitted within an opening at the top central part of the plunger, a bushing 53 which is internally threaded to receive the threaded lower end of a wire-like stem 54.

The threaded upper end of stem 54 is threaded into a bushing 55 fastened into the bottom member 56 of a vessel having a cylindrical side wall 57 attached to the bottom member 56 for support. At the top of the vessel there is provided a flange member 58 having a suitable opening 59 through it leading into the top of the vessel.

At a position somewhat above the bottom 56, there is provided a partition 60 transversely across the vessel, forming a buoyant watertight compartment 61, containing air, at the lower part of the vessel; the upper compartment 62 between the partition 60 and the flange member 58 being open to the atmosphere at the top through opening 59. Compartment 62 is provided with at least one opening 63 leading into it immediately above the partition 60. It will be recognized that compartment 62 corresponds with the cup 36 of FIG. 1; although in FIG. 4 the upper rim of the cup is above the water level even when the tank is filled. It will also be recognized that compartment 61 acts as a float corresponding with the supplemental float 39 of FIG. 1.

The main valve mechanism just described is supported by guide brackets 64 and 65 clamped to a suitable support. In FIG. 4, this support is shown as the vertical overflow pipe 66 commonly found in water tanks of this character. Thus, the member 64 comprises a suitable flexible clamp 67 caused to grip the pipe 66 by tightening a headed screw 68 passing through a hole in lip 69 of the clamp and threaded through an opposite lip 70 to draw the flexible clamp tightly around the pipe. An arm 71 from the clamp supports a guide member 72 having a vertically extending hole through it to act as a guide for stem 54 so that the stem may slide up and down through this guide. The other guide member 65 comprises a similar clamp 73 from which there extends an arm 74 which supports a guide member 75 in the form of at least a portion of a cylinder, the dimension of which is such as to permit the cylindrical vessel wall 57 easily to slide up and down through it and be guided by it.

At the region of the plunger valve member 52 there is provided a buoyant device 76 formed by a circular top member 76a fastened to a cylindrical side member 77 and a frusto-conical member 78 which extends from the lower end of the cylindrical side 77 to the under side of the circular top member 76a. This forms an annular chamber 79, containing air, which is made watertight, so that it will be buoyant. This buoyant device is fastened to the top surface of plunger valve 52 by passing the stem 54 through a hole located at the center of the top 76a. A lock nut 80 is tightened down on the top member 76a to bind the top member 76a between this lock nut and the top of plunger 52. Device 76 provides a buoyancy

in correspondence with the buoyancy provided by member 19 of FIG. 1.

In FIG. 4 the plunger is shown in its seated position with the tank filled with water to its full level at 81 which will be just below the open top 82 of the overflow pipe 66. This level at 81 will, of course, be established by suitable means such as a float and inlet valve arrangement shown as parts 45, 46, 47, 48 and 49 which are similar to the same numbered parts of the device of FIG. 1.

It is noted that an overflow pipe such as pipe 66 of FIG. 4 is not shown in FIG. 1, since it is not used for support in the arrangement of FIG. 1. Actually, the member 20 in the arrangement of FIG. 1 will act as an overflow pipe inasmuch as it is open at the top and extends through to the pipe 12. In FIG. 4 there is shown a tube 83, the function of which corresponds with that of tube 27 in FIG. 1.

The operation of the arrangement of FIG. 4 will become apparent from what has been said of the operation of the system of FIG. 1. Thus, in the normal filled condition of the tank, the main valve member 52 rests on the valve seat 51 to maintain the tank at its normal full level at 81; under which condition, water enters the chamber 62 through opening 63 to the same level as the level 81.

When the hand lever 33 is operated to lift up on flange 58 and thus raise the valve 52 off its seat, followed quickly by release of the lever 33, the ensuing lowering of the tank level from the full level 81 and the raising of cup 62, causes water immediately to run out from cup 62 into the tank through opening 63 at a metered rate. As the water runs out of opening 63 in the cup, the reduction of the effective weight of the cup upon the buoyant members 61 and 76 is controlled. In order to provide good operation in this respect, it is preferred to provide that when the valve 52 is thus lifted from its seat, the partition 60 will be brought up high enough to expose opening 63 at least to the full water level at 81. For this purpose, a satisfactory arrangement is to have the partition 60 approximately one and one-half inches below the full level 81 when valve 52 is seated. This degree of rise can be had by positioning clamp member 64 so that the member 72 will act as a stop for lock nut 80 to limit the amount of rise of the stem 54 to that which will just raise the partition 60 to its desired upper limit.

From what has been stated it is apparent that the chamber 61 will act as a buoyant float corresponding with the action of float 39 of FIG. 1. The chamber 79 in the region of the main valve provides a buoyancy like that of chamber 21 in the system of FIG. 1. It will be recognized that the valve member 52 itself contains an air chamber to act as a float; hence, the chamber 79 brings the combination of the valve 52 and chamber 79 into correspondence with the main valve and chamber 21 combination of FIG. 1.

The first operation of retracting lever 33 will produce the brief flush which will partly empty the tank as described in the operation of the system of FIG. 1. When this first operation is immediately followed by another lever operation the more complete flush, substantially emptying the tank, will result as described in connection with FIG. 1.

FIGS. 7 to 10 illustrate still another embodiment of the invention which is shown as located within a tank 10 of FIG. 1, the actual walls of the tank not being shown in FIG. 7. A plunger member 52b similar to the plunger member 52 shown in FIG. 4, being hollow with an opening 52c at the bottom has an internally threaded bushing 53a adapted to receive a threaded end of a wire-like stem 54a. The opposite end of the stem 54a is also threaded and receives cylindrically shaped vessel 90 wherein the stem end is threaded into a bushing 91 located at the bottom member 92 of the vessel. At the top of the vessel is a flange member 93 extending radially away from the vessel and an opening 94 leading into the vessel.

A hole 95 extends through bottom member 92 to allow passage of water between the tank and the vessel 90.

A cylindrically shaped buoyant member 96 having a centrally located hole 97 extending axially through the member is disposed beneath the vessel. The stem 54a passes through said hole and a retaining washer 98 and nut 99 hold the buoyant member to keep it from sliding up the stem when submerged in water. Another washer 100 and nut 101 located directly below the buoyant member restrict it from sliding down the stem when raised above the surface of the water. Another buoyant member 102 being cylindrical with a frusto-conical cavity 103 at one end has a centrally located hole 104 extending axially through the member with stem 54a passing there-through. The buoyant member 102 is disposed on the stem adjacent the plunger 52b wherein member 102 accepts the upper portion of the plunger within the cavity 103. A retaining washer 105 with a holding nut 106 hold the buoyant member 102 against the plunger 52b.

The stem 54a is amply threaded to permit buoyant wafers, such as wafer 113, to be inserted between washer 105 and buoyant member 102. The opposite end of the stem is also amply threaded to permit the buoyant member 96 to be fixed at any desired position on the stem.

The buoyant members may be comprised of any water-tight member or non-water-absorbent foam plastic such as an expanded and extruded polystyrene foam which is obtainable under the trademark Styrofoam, made by Dow Chemical Company, of Midland, Michigan; the main requirement being that the buoyant members have an overall specific gravity of less than 1.0.

The main valve mechanism as shown in FIG. 7 is supported in a vertical position by guide brackets 65 and 107. Guide bracket 65 is similar to member 65 of FIG. 4, being attached by a flexible clamp 73 to the vertical overflow pipe 66 and having a flexible guide member 75. Guide member 75 embraces the cylindrically-shaped vessel extending circumferentially around a portion thereof. Guide bracket 107 comprises a flexible clamp 108 attached to the overflow pipe 66 in a manner similar to clamp 65, an arm 109 extending from the clamp 108 to a flexible guide member 110. Guide member 110 has a vertically extending hole 111 to guide stem 54 and a vertical slot 112 extending from the hole 111 to the outer surface of the guide member, such that stem 54a may be snapped into hole 111 through vertical slot 112. Guide brackets 65 and 107 when attached to the vertical overflow pipe are disposed to accept the main valve mechanism by snapping the cylindrical vessel 90 into member 75 and valve stem 54a into member 110. The valve mechanism is disposed in the same manner as shown in FIG. 4 wherein the plunger 52b is seated upon a valve seat 51 of pipe conduit 50 located in the bottom of the tank.

In FIG. 7, the plunger is shown in its seated position with the tank filled with water to its full level at 81, which will be just below the open top 82 of the overflow pipe 66. This level at 81 will be established by a float and valve assembly shown as parts 45, 46, 47, 48 and 49 which are similar to those numbered parts as shown in FIG. 1.

The operation of the flushing mechanism of FIGS. 7 to 10 retains the same principle as previously described for the mechanisms shown in FIG. 1 and FIG. 4. As the water level in the tank recedes after operating hand lever 33 and reaches a level where the weight of the water in the cup or vessel becomes greater than the buoyancy of members 96 and 102, the plunger will be caused to fall down to the valve seat and close the valve. The water level of the tank, as the plunger reseats itself, will be slightly below the upper surface of buoyant member 96 and is dependent upon the vertical positioning of the buoyant member 96 on the valve stem and the number of wafers attached adjacent buoyant member 102. Immediately after the plunger 52b is reseated onto the valve

seat at the termination of the short flush, the bottom 92 of vessel 90 will be in the vicinity of the water level in the tank and the water still remaining in the vessel will continue to run out through hole 95 until equilibrium between the water level in the tank and the water level in the cup is reached. When the hand lever is operated again, immediately after the termination of the short flush, to initiate the long flush, member 102 is sufficiently buoyant to hold the decreased load of the vessel 90, being the small amount of water remaining to be drained out of the vessel through hole 95, as well as the buoyant member 96 which is very light in weight in air and to hold the plunger away from the valve seat until the water level recedes to a point where the buoyancy of member 102 is decreased and the combined weight of vessel 90 and buoyant member 96 causes the valve to close as in the normal manner.

The guide brackets 65 and 107 which are attached firmly to the overflow pipe in the tank are advantageous in having flexible clamps embracing the cup and stem. This feature permits snapping the valve stem assembly including the plunger into the flexible clamps 75 and 110 of the guide brackets for relatively easy assembly as well as removal from the tank.

The invention is not limited to the particular embodiments described in the specification and illustrated in the drawing, which are given by way of illustration rather than of limitation, and are only limited by the scope of the appended claim.

What is claimed is:

In combination, a tank comprising an inlet to provide liquid to flow into said tank up to a predetermined level, thereafter said inlet being closed, an outlet disposed in the bottom of the tank and having a valve seat connected therewith, a valve assembly comprising a valve, said outlet normally closed by said valve when the liquid in said tank is at the predetermined level, a means coupled with the valve assembly to remove the valve from the valve

seat thereby permitting liquid to flow out of the outlet, an overflow pipe attached at one end to the bottom of the tank and extending vertically to the predetermined level in the tank, said valve assembly comprising a cup and a stem, said stem being attached at one end to the valve and extending substantially parallel to said overflow pipe, said cup open at the top and rigidly attached to the other end of the stem and having a bottom below the predetermined level when the valve is closed, an opening means for the passage of liquid between the inside of the cup and the outside of the cup at a metered rate disposed on the cup below the predetermined level when the valve is closed, a buoyant means comprising two floats separated from each other and attached to said stem between the cup and the valve, a cup guiding member rigidly fastened to said overflow pipe and having resilient arms embracing said cup, a stem guiding member rigidly fastened to said overflow pipe and having resilient fingers extending around the stem, whereby said cup may be snapped onto and off of said cup guiding member and said stem may be snapped onto and off of said stem guiding member permitting the insertion and removal of the valve assembly within the tank.

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