Oct. 5, 1971 W. T. HEYER ET AL 3,609,770

TOILET SHUNT VALVE AND SYSTEM

Filed Jan. 15, 1970 3 Sheets-Sheet 1

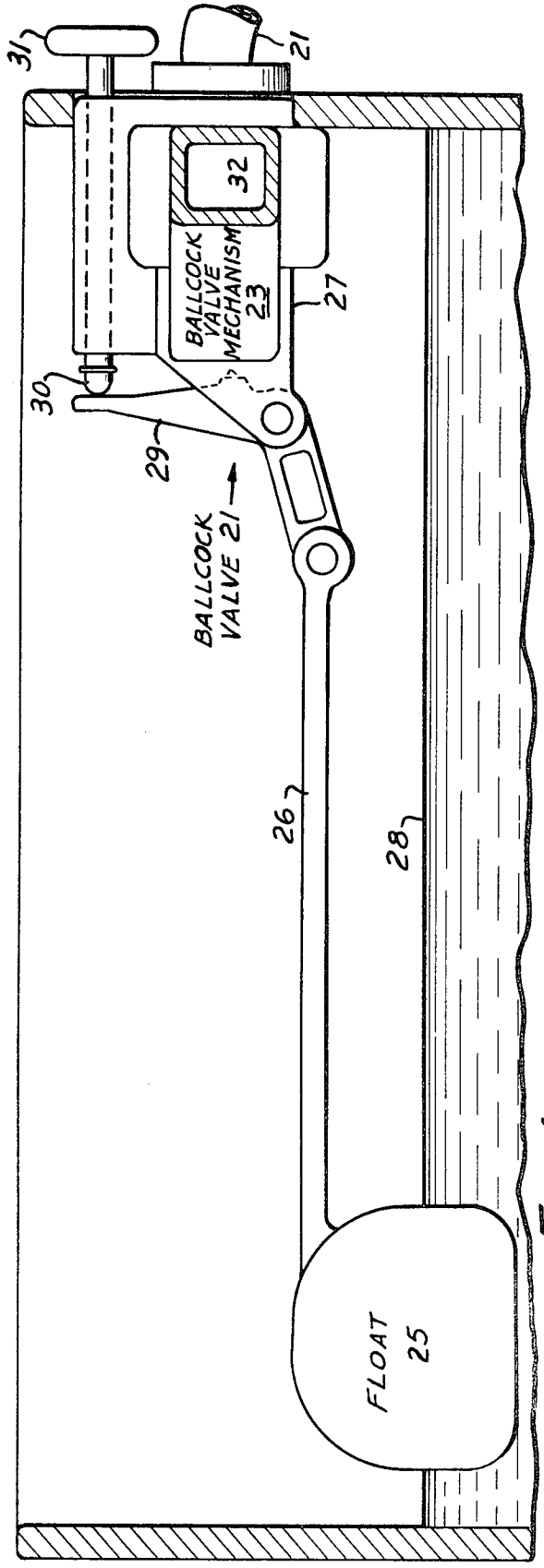


FIG. 4

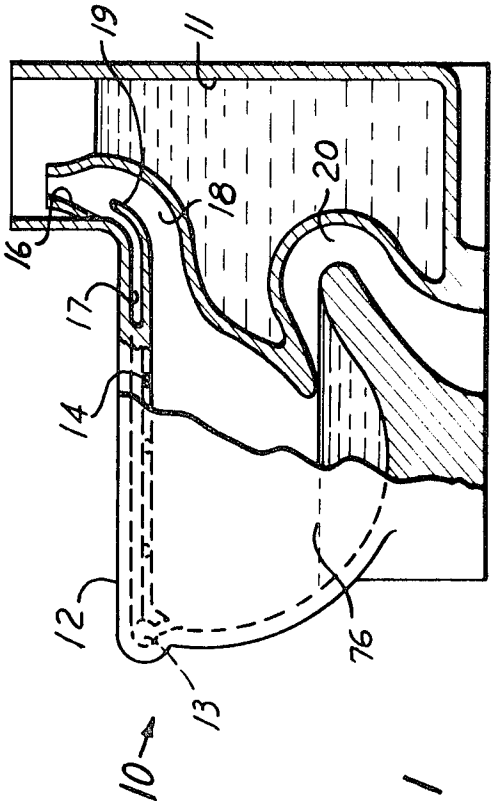


FIG. 1

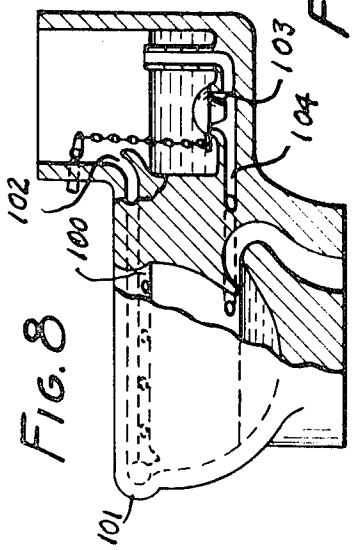


FIG. 8

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TOILET SHUNT VALVE AND SYSTEM

Filed Jan. 15, 1970 3 Sheets-Sheet 2

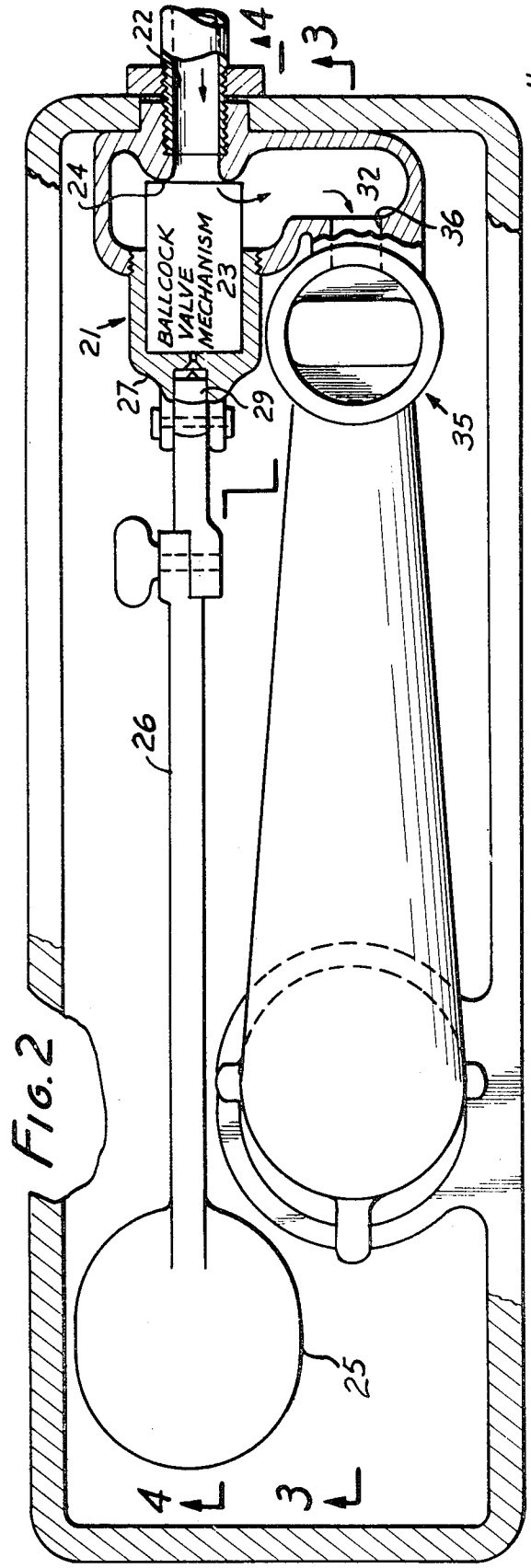


FIG. 2

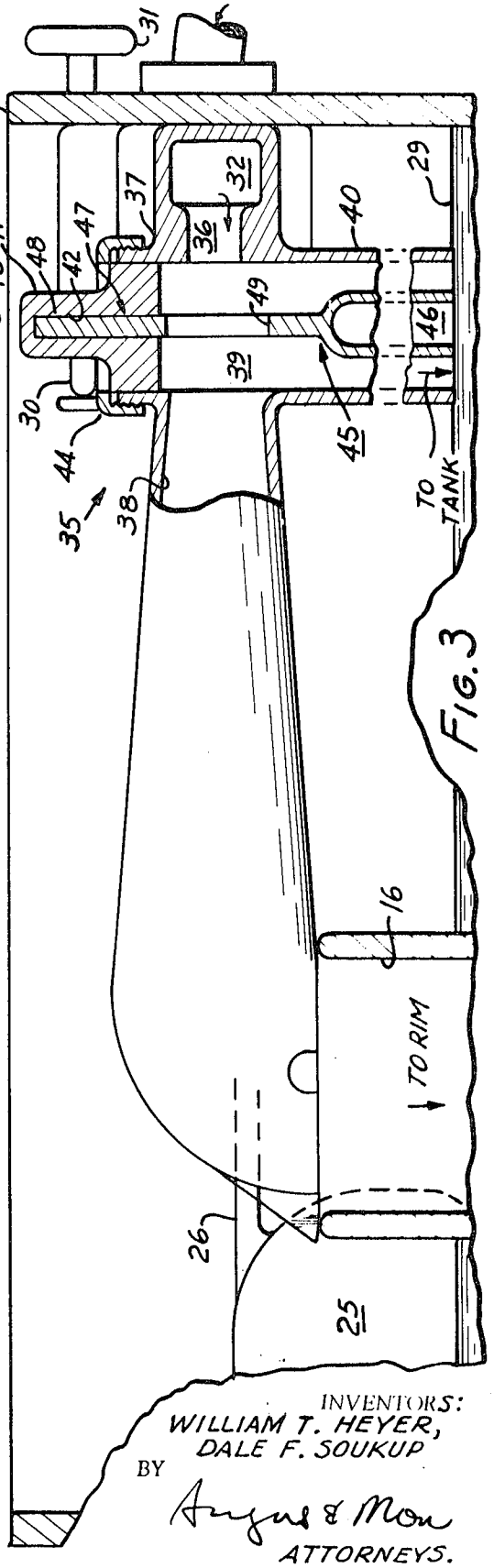


FIG. 3

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TOILET SHUNT VALVE AND SYSTEM

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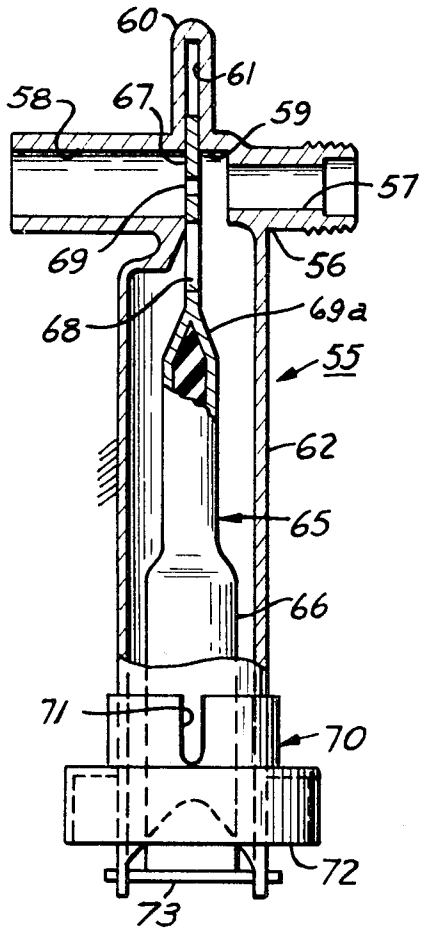


FIG. 6

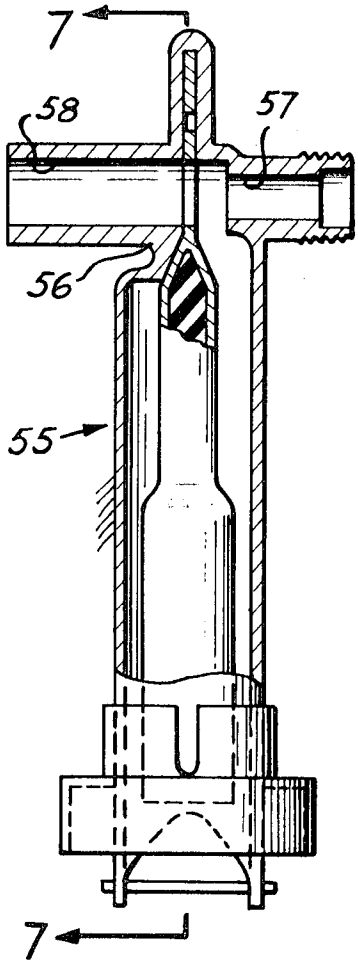


FIG. 5

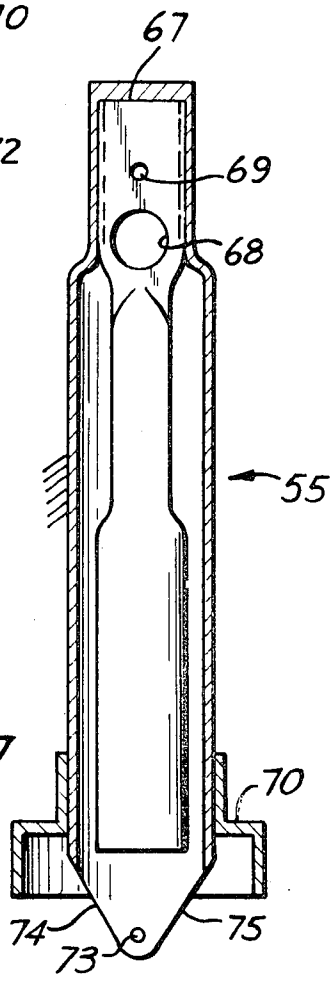


FIG. 7

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TOILET SHUNT VALVE AND SYSTEM

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U.S. Cl. 4—41

16 Claims

ABSTRACT OF THE DISCLOSURE

A toilet shunt valve for use in flushing toilet commodes utilizing flow from a ballcock valve supplemented by water from a storage tank. The shunt valve includes an aspirator passage which passes over the mouth of an aspirator tube so as to draw water from the tank into the flow from the ballcock so as to supplement the same. Water from the aspirator is supplied as desired to the commode, such as for rinsing and flushing the same. The aspirator tube encloses a float member which has a vane with a port that permits the flow of water for purposes of augmented supply in one position, and diverts the flow to the tank to refill it in another position.

This invention relates to a toilet shunt valve which supplements the flow of water from a ballcock valve with water from a storage tank in the process of flushing or rinsing a toilet, or both.

In the flushing of toilets, it is necessary to provide a substantial volume of water in a relatively short time to discharge the contents from the basin, and desirable to provide a substantial rinse flow around the wall of the basin to wash it down. The former requirement is sometimes difficult to supply from a ballcock valve acting alone, or from the discharge of a storage tank alone. The latter is sometimes difficult to supply in combination with an adequate discharging operation from any source, or merely from a ballcock valve.

It is an object of this invention to provide a shunt valve which can provide an augmented flow of water, i.e., water from a ballcock supplemented by water aspirated from a storage tank, to a toilet for either flushing, or rinsing, or a combination, as desired.

A toilet shunt valve according to this invention is customarily utilized in combination with a ballcock valve which is responsive to fluid level in a water storage tank. The ballcock valve is connected to the toilet shunt valve of this invention, and this shunt valve is connected to the commode. It includes an aspirator tube which is in fluid communication with a tank of reserve water. In the aspirator tube there is a float member with a vane having a port therethrough which when in a first position is aligned with flow from the inlet to the outlet of the shunt valve, and the passage of water through the throat creates a low-pressure region which aspirates water from the tank through the aspirator tube. When enough water has been aspirated from the tank to lower the water level to a predetermined elevation, the float member changes its position so the vane blocks substantial flow to the commode and diverts the water from the ballcock down the aspirator tube in order to refill the tank to its storage level. The contents of the tank may, of course, also be discharged through other channels.

According to a preferred but optional feature of this invention, a skirt may be provided on the aspirator tube adjustably to determine the level at which the aspirating action will be concluded.

According to still another preferred but optional feature of this invention, the vane is provided with a second port for passing fill flow to the commode basin while the tank is being refilled.

The above and other features of this invention will be fully understood from the following detailed description and accompanying drawings in which;

FIG. 1 is a side elevation partially in cutaway cross-section of a typical commode structure in which the invention finds utility;

FIG. 2 is a plan view partially in cutaway cross-section of FIG. 1;

FIGS. 3 and 4 are cross-sections taken at lines 3—3 and 4—4 respectively in FIG. 2;

FIGS. 5 and 6 are side elevations partially in cutaway cross-section of the presently preferred embodiment of the invention in two different operating conditions;

FIG. 7 is a cross-section taken at line 7—7 of FIG. 5; and

FIG. 8 is a side elevation, partly in cutaway cross-section, showing another use for the invention.

FIG. 1 shows a toilet commode **10**, wherein a storage tank **11** for supplemental water is built into the structure at an elevation which is approximately that of the rim **12**. Commodes of this type have not heretofore been successfully operated from a tank supply at such a low elevation, nor by a single ballcock valve directly supplying water, especially at low system pressures, because these commodes require rapid flow of substantial volumes of water for successful operation. This invention provides an amplified flow of water which is more than adequate for commode operation, even at relatively low system pressures.

In the commode shown, the upper rim of the bowl is formed with a hollow channel **13** with a plurality of outlets **14** for discharging water on the side walls of the commode bowl to rinse its sides. Occasionally the bowl is referred to as a "basin" herein. Port **16** receives water from the valve system to be described into the commode and from it, water is directed into a rinse channel **17** or to a bowl channel **18**. As shown, a divider **19** divides the flow between the two channels although depending upon the type of operation desired all of the water could be discharged into the rinse channel should no direct flow into the basin be desired, or all could be discharged through channel **18** should no wall rinsing action be desired. Customarily, however, a division of the flow as shown will be made. The place of discharge is unimportant to this invention. A siphon **20** is provided in accordance with common commode construction.

FIG. 2 shows a conventional ballcock valve **21** mounted to the wall of the tank and in fluid communication with an inlet supply pipe **22** to receive water at system pressure from a primary source. A ballcock valve mechanism **23** of any common design is used, which controls flow of water from the inlet pipe past an inlet seat **24**. A float **25** is mounted to a pivoted arm **26**, the arm being pivotally mounted to the body **27** of the ballcock valve. The float, through the arm, controls the operation of the ballcock valve mechanism.

In accordance with common ballcock operation, as best shown in FIG. 4, when the water level **28** drops so does the float, and a control arm **29** which is connected to arm **26** moves relative to the ballcock valve mechanism so as to open the valve. When the water level rises, so does the arm, and when the desired level is restored the ballcock mechanism is closed and the water flow is shut off.

A flushing actuator linkage **30** is provided with a button **31** which stands outside the wall of the tank. When this button is pressed it causes the float to be pressed down as though the water level had dropped and water will begin to flow through the ballcock valve. Also and at the same time a flushing action yet to be described will begin. It is necessary to maintain the actuator linkage in its actuated condition for a moment until the cycle is actuated

either by holding the button down, or by providing a delay mechanism (not shown) to prevent the float from immediately bounding back to its original position before the cycle has progressed to the extent that the water level has dropped sufficiently that the ballcock valve will continue to permit flow of the water.

Water which is passed from inlet pipe **22** by the ballcock valve mechanism flows through passage **32** from which it discharges to toilet shunt valve **35**. The toilet shunt valve has as its function to convey the water to port **16** of the commode. Port **16** is often in the nature of a pipe connected to the commode as shown in FIGS. 1 and 2.

A simplified shunt valve construction is shown in FIGS. 1–4, while the preferred embodiment which involves additional features is shown in FIGS. 5–7.

Toilet shunt valve **35** has an inlet **36** from passage **32** which enters body **37**. The body has an extension in the form of an enlarging venturi **38**. A throat section **39** is formed between inlet **36** and the venturi. An aspirator tube **40** (sometimes called a "branch tube") intersects the throat and projects downwardly into the tank to an elevation beneath the maximum water level. A cap **41** with an internal flat sided slot **42** on the axis **43** of the upright tube is held to the valve by a retainer **44**. Body **37** is mounted in the tank by means not shown.

A buoyant vane member **45** is loosely fitted inside the aspirator tube **40**. In the embodiment of FIGS. 1–4 the buoyancy is provided by air trapped in a lower enlarged hollow section **46**. A vane **47** extends upwardly at the top of the vane member, and has an upper portion **48** with flat sides which fits into the slot. It is guided by the walls of the slot. A shoulder **50** may be formed at the joinder of the lower section **46** and vane **47**.

Vane **47** includes a port **49** which passes water directly from inlet **36** to venturi **38** when the vane is in its upper position as shown in FIG. 3. The upper portion is of substantial lateral extent and is adequate to block at least the major proportion of flow through the throat when the vane is in a second, lower, position yet to be described. The elevation of the vane is in part determined by the water level in the tank.

The presently preferred embodiment of the invention is shown in FIGS. 5–7 wherein a toilet shunt valve **55** which may be substituted directly for valve **35** in FIGS. 1–4 includes a body **56**, an inlet **57**, an outlet **58** which may be or may not be venturi shaped, a throat **59**, and a cap **60** with an internal vertical slot **61** therein. An aspirator tube **62** projects downwardly from the throat section and encloses a vane member **65** with a lower buoyant portion **66** which in this embodiment is filled with foam or other buoyant material.

A vane **67** is attached to the buoyant portion and extends upwardly so as to fit into the slot for vertical reciprocation therein. The vane includes a first, larger port **68** which corresponds to port **49** of vane member **35**, and a second smaller port **69** disposed above the first port for purposes yet to be described. A shoulder **69***a* may be formed at the junction of the vane and portion **66**.

An air skirt **70** is frictionally attached to the bottom of the branch tube and has a pair of slits **71** in its edge so that the skirt may be slid up and down on the branch tube. Its lower margin **72** determines the tank elevation at which air begins to enter the branch tube, and the slidable fit provides an adjustment for this purpose.

The branch tube also carries a cross-pin **73** which holds the vane member inside the tube, extending beneath it so as to prevent it from falling out. Two oblique cuts **74**, **75** are formed in opposite walls of the aspirator tube so as to give the water access to the aspirator tube at a level above the lower margin of the air skirt.

Both embodiments of the invention may be used in either of the systems of FIG. 1 or 8. In FIG. 1, the shunt valve discharges from a tank to perform both functions of flushing and rinsing. In FIG. 8, the shunt valve is used only for rinsing, by discharging its augmented flow to the rim **100** of a commode **101** through a channel **102**. Flushing is separately provided for by a dump valve **103** which discharges directly into the basin through passage **104**. Thus the shunt valve discharges only a fraction of the volume of the tank in FIG. 8, while in FIG. 1, all water discharged to the basin passes through it. This illustrates the fact that this valve can provide a useful supplemental flow not only for the total flow, but for any part of it, and this overcomes many of the individual problems in the prior art.

The operation of this device will now be described with initial reference to FIGS. 1–4. It will be assumed that the condition pertains as shown in FIGS. 1 and 4 wherein the tank is full to its storage level, and the vane member is buoyed upwardly. The ballcock valve mechanism now closes inlet seat **24**, and the system is at rest. Water **76** stands in the basin below the level of the bottom of siphon **20** in accordance with common commode construction.

To start the cycle, button **31** is pressed so as to move the actuator linkage and depress the float. This will operate the ballcock valve mechanism so as to open inlet seat **24** and water will flow from the inlet pipe through passage **32** to the shunt valve. If the linkage were immediately released and float **25** were to restore itself this flow would immediately stop and nothing more would happen. Accordingly, the button is held depressed for a moment until the cycle has progressed far enough that the water level in the tank has dropped to the extent that position of float **25** which follows it will position the arm so that flow will continue. Alternately a delay mechanism may be provided to prevent the immediate rebound of float **25**. Water flowing through inlet **36** passes through port **49** in the vane, through the throat into venturi **38**, and thence to the commode. The flow through the float creates a low pressure region at the top of the aspirator tube, and aspirates water from the tank. The tank level begins to fall and the float follows the level thereby maintaining the ballcock valve mechanism open. Aspiration continues as long as flow through port **49** is possible and there is flow from the ballcock valve mechanism. Of course, aspiration of water will also stop when the tank level is beneath the bottom end of the aspirator tube, for there will then be no water to be aspirated, and only air would be drawn into the aspirator tube.

The vane member stays in its upper position, for reasons yet to be discussed, until the water level in the tank lowers to uncover the end of the branch tube and air is aspirated instead of water. During this time water from the ballcock will be supplemented by water aspirated from the tank. Therefore the volume of water between the upper level and the level at which air instead of water is aspirated is added to the water flowing through the ballcock valve for any cycle, and this augmented or amplified flow renders possible the flushing of toilets at pressures lower than have heretofore been possible.

Although the tank level will have continuously dropped during the foregoing augmented flow, the vane member will not drop until the tank is emptied to the lower margin of the branch tube and air is aspirated instead of water. The upwardly rushing water exerts a dynamic force against the bottom of the vane member so as to bias it toward its elevated position. It is possible to extend the port axially as a slot so that it presents an opening for through-flow of water at all but the lowermost position of the vane member, should it not be desired to rely on this dynamic force. In such an arrangement the vane member could follow the tank level. However, the arrangement shown has proved to be generally advantageous.

The water level in the tank will ultimately drop below the bottom of the aspirator tube, and no further aspirated flow of water from the tank occurs through the branch tube. Instead, air will be drawn in. Now the dynamic force of the water is no longer present and the vane

member drops toward the tank water level. In the lower position the upper portion **48** blocks the flow of the water from the inlet to the venturi, destroys the aspirating effect, and acts as a baffle that shunts the water downward through the aspirator tube to refill the tank. This refilling operation will continue until float **25** is restored to the position shown in FIG. 4, at which time the ballcock valve mechanism will close the inlet seat in accordance with common toilet ballcock valve construction. As the water level rises in the tank, the vane member, although buoyant, should not rise to such level as would restore aspirating conditions. Instead, it should be remain in its lowermost position until the ballcock valve mechanism shuts off. The side-binding force against portion **48** of the vane may be sufficient to overcome the buoyancy. This force presses the vane against the side of slot **42**, and restrains the vane member against upward movement. When the flow from the ballcock stops, the force ceases, and the buoyant vane member bounds upward to its upper position. The system is then at rest and awaits its next actuation. As an alternative or additional means for exerting a force to hold the vane member down, water flowing down the aspirator tube impinges on shoulder **50** or **69***a* when provided. This downward force will continue while the ballcock valve is open and the vane member is in its lower position.

FIGS. 5–7 show several important improvements over the simplified version of FIG. 1. First, the cross-pin attached to the lower end of the aspirator tube keeps the vane member from falling out. Second, the air skirt is adjustable in elevation so as to determine the useful volume of water in the tank by determining the level at which air rather than water is aspirated. Air will begin to flow into the aspirator tube instead of water when the tank level has reached the lower margin of the air skirt, and this is adjustable by slipping the tube up and down. This constitutes a convenient means for adjusting the cycling time of the system. Slots **74** and **75** gives access to the tube at the level determined by the adjusted elevation of the skirt.

Still a further improvement is best shown in FIGS. 5 and 6. In FIG. 5 the vane member is shown in its upper position providing for aspiration of water from the tank. This is the flushing position. FIG. 6 shows another position of the vane member during refilling of the tank, at which position the smaller second port **69** passes a modest amount of water which is insufficient to provide for aspiration but is enough to refill the basin. This eliminates the need for a fill tube. After the tank is refilled, the vane member returns to the position of FIG. 5. Attention is called to the valve seat member to the left of the vane, which assures that no water bypasses the vane in this embodiment.

This device thereby provides a shunt valve which shunts the flow derived from a ballcock valve from a condition of flow supplemented by aspirated water to that of a refill operation for the tank. The device is rugged and simple, operates on low pressures and provides improved operation of toilets in which relatively small water volume and modest pressures are used.

We claim:

1. A shunt valve for a commode system having a primary water supply, a ballcock valve controlling said supply with water tank, the shunt valve acting to supplement flow from the primary water supply with water from the tank in one condition, and to direct water from the primary water supply to fill the tank in another condition, said shunt valve comprising: a body having an inlet to receive water from the ballcock valve, an outlet to discharge water to the commode, and a throat between the inlet and the outlet; an aspirator tube intersecting and/opening into the throat and extending into the tank to an elevation beneath its storage level; a buoyant vane member reciprocably disposed in said aspirator tube, a portion on said vane member being disposed in said throat and having a port therethrough in the path between the inlet and the outlet when the vane member is in a first position, and another portion at least partially occluding said path when the vane member is in a second position, whereby with the vane member in its first position, flow from the inlet passes through the port to the outlet and aspirates water through the aspirator tube from the tank into the throat, lowering of the water level in the tank to an elevation which will admit air to the aspirator tube terminating the aspiration of the water and permitting the vane member to move to the second position, thereby diverting at least some of the water from the inlet to refill the tank to its storage level and return the vane member to its said first position.

2. A shunt valve according to claim **1** in which the vane member includes a laterally enlarged section upon which water flowing to the tank impinges to bias the float member to the second position while the tank is being refilled.

3. A shunt valve according to claim **1** in which that portion of the vane member which occludes the said path in the second position is imperforate.

4. A shunt valve according to claim **1** in which the vane member includes a second port smaller than the first port which stands between the inlet and outlet when the float member is in the second position in order to pass a lesser flow of water to the outlet.

5. A shunt valve according to claim **1** in which the body includes a slot to receive, guide, and laterally support the upper end of the vane member.

6. A shunt valve according to claim **1** in which a skirt is mounted to the aspirator tube in a manner to permit adjustment of the elevation of its lower margin, thereby adjustably to determine the lowest level of water in the tank.

7. A shunt valve according to claim **1** in which a lateral member is mounted to the aspirator tube to retain the vane member in the aspirator tube.

8. A shunt valve according to claim **1** in which a seat is formed at the outlet and is so disposed and arranged as to be contacted and closed by the vane member so that all flow to the outlet must pass through the port in the vane member.

9. In combination: a commode to which water is to be supplied; a water tank having a storage level; a ballcock valve; a water supply inlet connected to the ballcock valve; a float operatively connected to the ballcock member to control the passage of water therethrough as a function of water level in the tank, and a shunt valve connected to the ballcock valve so as to receive water therefrom, said shunt valve comprising: a body having an inlet to receive water from the ballcock valve, an outlet to discharge water to the commode, and a throat between the inlet and the outlet; an aspirator tube intersecting and opening into the throat and extending into the tank to an elevation beneath its storage level; a buoyant vane member reciprocably disposed and buoyant in said aspirator tube, a portion of said vane member being disposed in said throat and having a port therethrough in the path between the inlet and the outlet when the vane member is in a first position, and another portion at least partially occluding said path when the vane member is in a second position, whereby with the vane member in its first position, flow from the inlet passes through the port to the outlet and aspirates water from the tank into the throat through the aspirator tube, lowering of the water level in the tank to an elevation which will admit air to the aspirator tube terminating the aspiration of the water and permitting the vane member to move to the second position, thereby diverting at least some of the water from the inlet to refill the tank to its storage level and return the vane member to its said first position.

10. A combination according to claim **9** in which the vane member includes a laterally enlarged section upon

which water flowing to the tank impinges to bias the float member to the second position while the tank is being refilled.

11. A combination according to claim **9** in which that portion of the vane member which occludes the said path in the second position is imperforate.

12. A combination according to claim **9** in which the vane member includes a second port smaller than the first port which stands between the inlet and outlet when the float member is in the second position in order to pass a lesser flow of water to the outlet.

13. A combination according to claim **9** in which the body includes a slot to receive, guide, and laterally support the upper end of the vane member.

14. A combination according to claim **9** in which a skirt is mounted to the aspirator tube in a manner to permit adjustment of the elevation of its lower margin, thereby adjustably to determine the lowest level of water in the tank.

15. A combination according to claim **9** in which a lateral member is mounted to the aspirator tube to retain the vane member in the aspirator tube.

16. A combination according to claim **9** in which a seat is formed at the outlet and is so disposed and arranged as to be contacted and closed by the vane member so that all flow to the outlet must pass through the port in the vane member.

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HENRY K. ARTIS, Primary Examiner

U.S. Cl. X.R.

4—13; 137—393