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Pfeifer

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[54] FLUSH VALVE DEVICE FOR TOILETS

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[52] **U.S. Cl.** ..... **4/38,** 4/34, 4/67 A

[51] **Int. Cl.** **E03d 1/22,** E03d 1/30

[58] **Field of Search** .. 4/57 R, 57 P, 67 R, 67 A, 37, 4/38, 34, 56, 58

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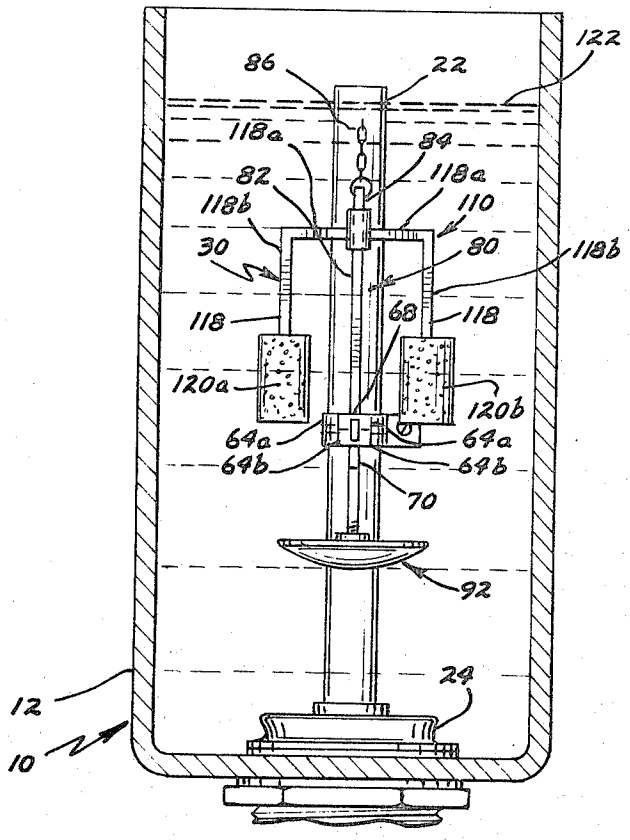
Primary Examiner—Henry K. Artis

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[57] **ABSTRACT**

A pair of laterally spaced float members are supported on the lifting rod or valve stem at an adjusted or preferred elevation above a nonbuoyant and weighted valve member threadedly attached to the lower end of the rod or stem. The lower threaded end of the stem is angled at 7½° and the valve member has a threaded recess therein also angled at 7½°. Owing to the square cross section of the valve stem and a complementally configured guide affixed to the overflow pipe in the toilet tank, the valve member will operate in conjunction with either a flat or slanted valve seat. Smaller seats can also be accommodated by merely selecting an intermediate angular position of the valve member on the valve stem. An indicator pin on the stem and angularly disposed indicia in the form of small bumps enable the user to readily select the proper angular position of the valve member for the particular type of valve seat.

13 Claims, 11 Drawing Figures



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2 Sheets-Sheet 1

FIG. 1

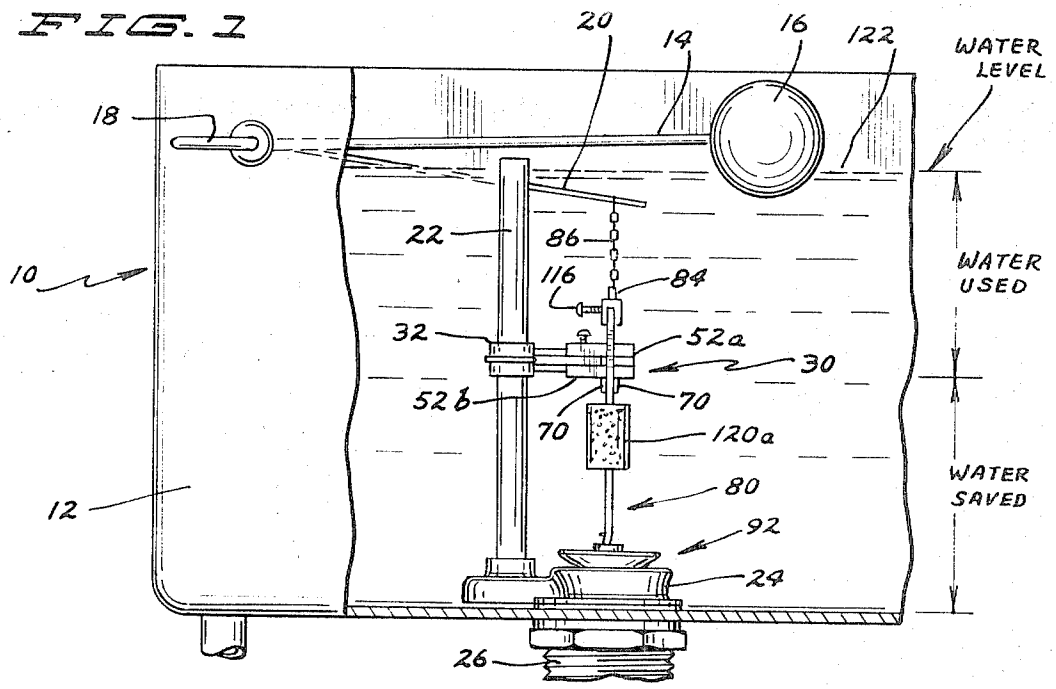


FIG. 2

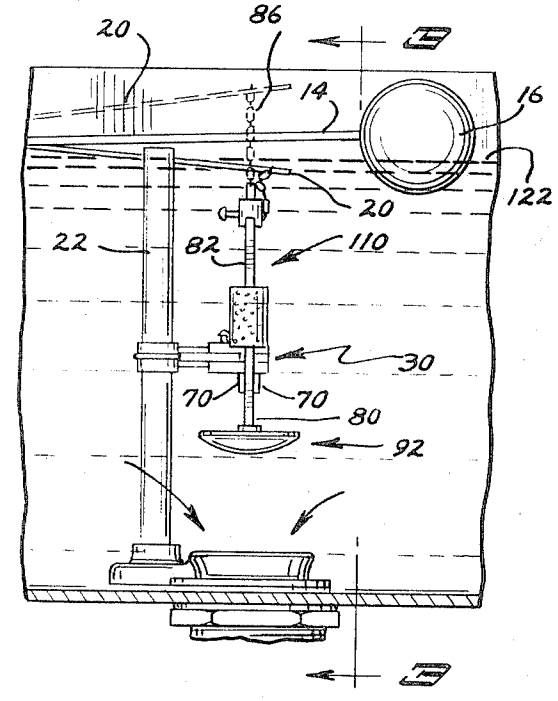
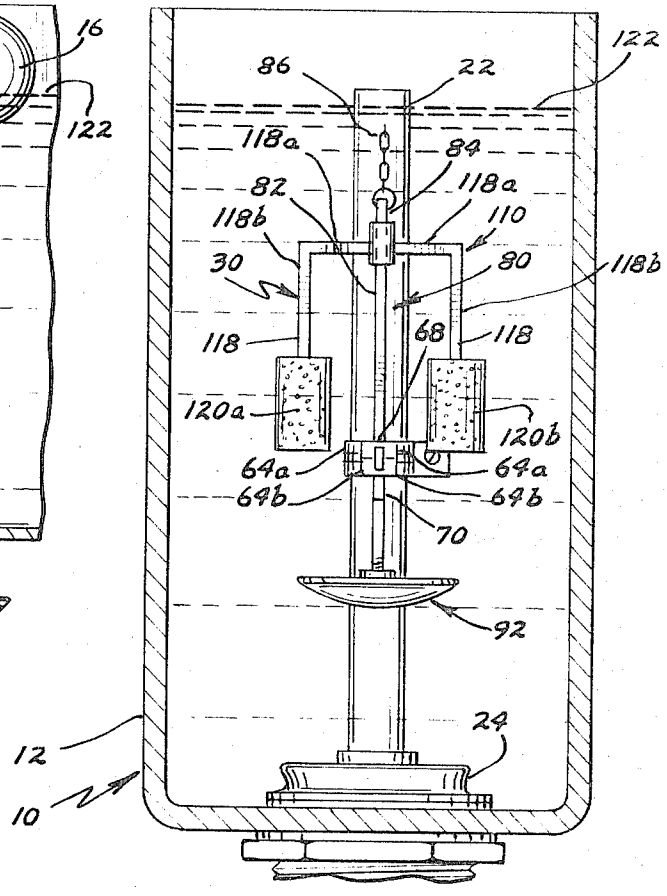


FIG. 3



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FIG. 4

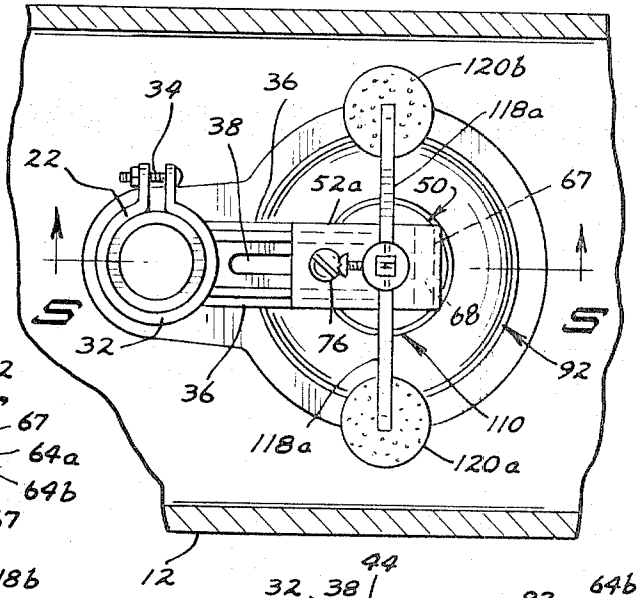


FIG. 5

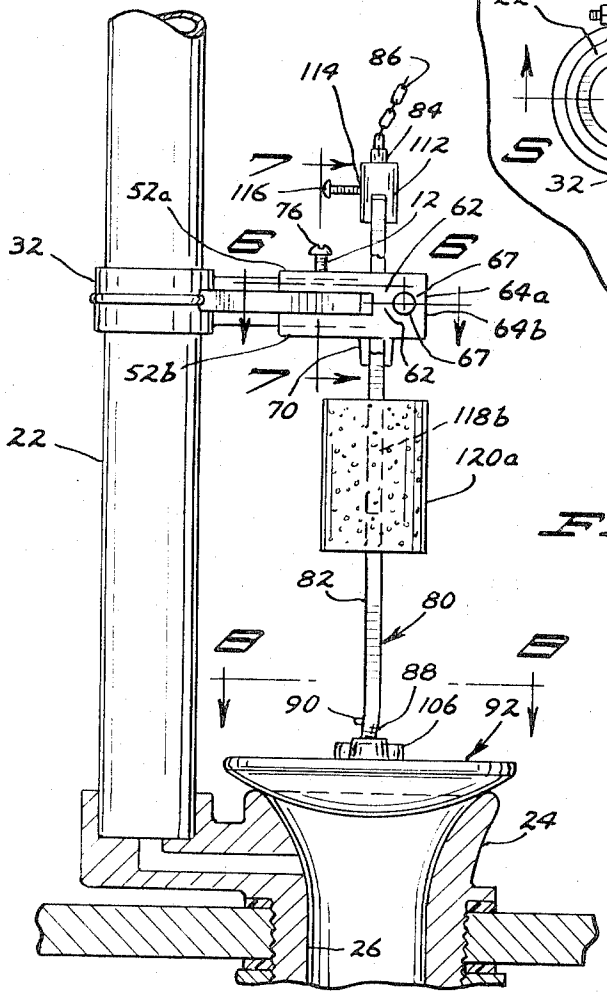


FIG. 6

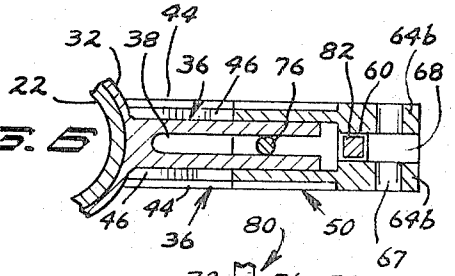


FIG. 7

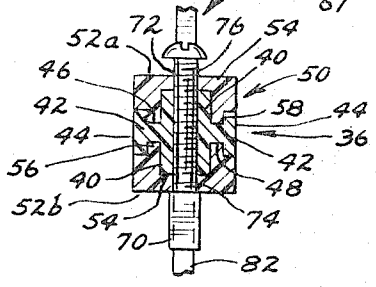


FIG. 8

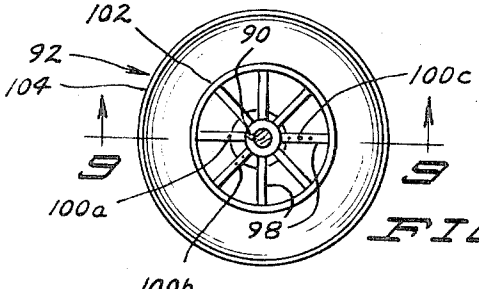


FIG. 10

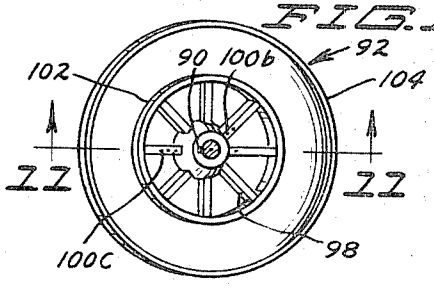


FIG. 9

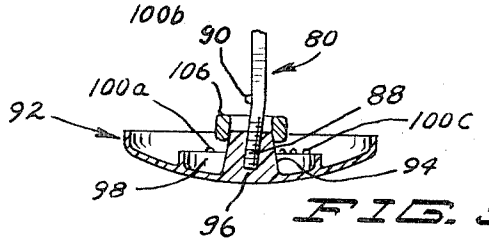
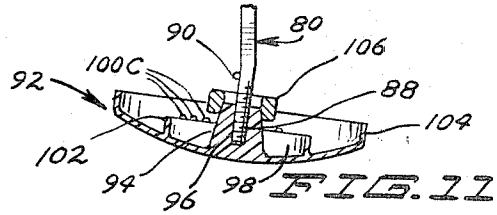


FIG. 11



FLUSH VALVE DEVICE FOR TOILETS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to flush valves for toilets and pertains more particularly to a valve designed to fit a variety of toilets.

2. Description of the Prior Art

Various attempts have heretofore been made in an effort to perfect flush valve devices for use within the storage tanks of toilets. While most of the valves with which I am acquainted have been generally satisfactory, nonetheless they have all had certain shortcomings. More specifically, some valves have been designed to conserve water when flushing the toilets, but such valves have had other inadequacies. Some have been designed to operate silently, or at least in a quiet manner, but these likewise have not been satisfactory in other respects. Generally, toilet valves have been rather costly. Also, their replacement has not always been easy because of the different types of toilets that are encountered in actual practice.

SUMMARY OF THE INVENTION

A general object of the invention is to provide a flush valve device for toilets that will be simple and inexpensive, yet highly effective for its intended purpose.

More specifically, an object is to provide a valve device that will conserve flushing water. In this regard, an aim of the invention is to utilize approximately half the water stored in the flush tank or closet. Not only is there a saving of water, but the most effective portion of the flushing period is retained, this being attributable to the greater head or higher column of water contained in the tank which is available during the earlier portion of the flushing interval. Thus, the lower half, say, of the amount of water after the upper half has been utilized is not nearly as effective because there is only the lower half remaining and the pressure resulting from the decreased head is proportionally reduced.

Not only is there a saving of water with a concomitant retention of excellent flushing capabilities, but an aim of the invention is to minimize tank sweating. In this regard, the incoming cold water mixes with the warmer water that has been saved, thereby obviating the sudden temperature change that would otherwise produce the objectionable condensation or sweating as it is commonly termed.

Further, an object of the invention is to provide a quieter flushing action inasmuch as less water is used, and, therefore, there is less noise involved.

Still an additional advantage that derives from the reduced amount of water discharged each time the toilet is flushed results from the fact that only approximately one-half of the volume of water in the tank is used at any one time; hence, utilizing less than the full amount of stored water will prevent the overflowing of the toilet bowl in the event that it becomes plugged. More precisely, my invention allows the device to be adjusted for the correct amount of water to produce a good flush without completely filling the bowl, thereby avoiding any possibility of overflowing.

Another important object of the invention is to provide a flush valve device that will not be apt to stick in an open position. Various prior art devices have proved to be especially troublesome in this respect. To correct the situation each time it occurs those devices with which I am experienced require the personal attention

of the user or that of a maintenance person, people unfamiliar with these matters usually not realizing that the tank cover must be removed and the valve manually closed. Without this personal attention, a considerable loss of water can be experienced, this being especially true in hotels and motels where the occupant either is not concerned with the loss of water or actually checks out of the room without endeavoring to correct the situation. The loss is of even greater importance in hard water areas where the loss necessitates an earlier recharging of the water softener.

Yet another object of the invention is to provide a valve device of the foregoing character that will provide a better sealing action against the valve seat. In this regard, it is an aim of the invention to provide a valve that will be pulled down by the outgoing water in that there will be no water beneath the valve yet an appreciable amount of tank water on top of the valve. Actual experience has demonstrated that the vacuum is much stronger or more powerful than the action provided by the floats of my device, and this vacuum is effectively employed to enhance the seating action.

Still another object is to provide a flush valve device that will be especially valuable for replacement purposes in that it will fit various types and makes of toilets, particularly those having different sizes of valve seats. More specifically, an aim of the invention is to provide a device that will fit either flat or slanted seats, as well as seats of different sizes without interference with the overflow pipe.

Still further, an object is to provide a valve device that is self-cleaning, thereby contributing to the efficient operation of the device, particularly with respect to the nonsticking feature that has already been alluded to.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of a tiolet tank or closet with a portion of the front wall broken away in order to expose to view my flush valve device;

FIG. 2 is a fragmentary side elevational view corresponding to FIG. 1 but with the valve raised or open;

FIG. 3 is a side elevational view taken from the right in the direction of line 3—3 in FIG. 2, the valve being in its raised position as depicted in FIG. 2;

FIG. 4 is a top plan view of my device;

FIG. 5 is a side elevational view of my device with the valve seat at the bottom of the tank appearing in section, the section being taken in the drection of line 5—5 in FIG. 4;

FIG. 6 is a horizontal sectional view taken in the direction of line 6—6 of FIG. 5 for further illustrating the construction of the guide and the way it is attached to the clamp mounted on the overflow pipe;

FIG. 7 is a vertical sectional view taken in the direction of line 7—7 of FIG. 5 in order to show with additional clarity the construction of the guide, especially the manner it may be radially adjusted;

FIG. 8 is a horizontal sectional view taken in the direction of line 8—8 of FIG. 4 in order to show the upper surface of the valve member;

FIG. 9 is a vertical sectional view in the direction of line 9—9 of FIG. 8 for the purpose of further detailing the construction of the valve member, the view emphasizing the angular position of the valve member on its valve stem when sealing against a horizontal valve seat;

FIG. 10 is a sectional view similar to FIG. 8 but picturing the valve member after it has been twisted or rotated through 180°, thereby rendering it suitable for a slanted seat having a 15° slope or inclination, and

FIG. 11 is a sectional view in the direction of line 11—11 of FIG. 10.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In order to appreciate the benefits to be derived from a practicing of my invention, it is not deemed necessary to show a complete toilet. However, the tank or closet, which is of course conventional with toilets, has been designated by the reference numeral **10**, having a front wall **12** that is broken away in order to expose to view the interior of the tank. Although concealed by the wall **12**, a supply or inlet valve has an operating arm **14** extending therefrom which has mounted thereon a ball-float **16**. It will be understood that when the ball **16** is raised, it acts through the agency of its arm **14** to close the supply or inlet valve to prevent further water from entering the tank **10**. Also, a trip handle or lever **18** rocks a trip arm **20**.

It is the trip arm **20** that a portion of my device is connected to as will be better understood as the description progresses. Also conventional in the closet or tank **10** is an overflow pipe **22**. A valve seat **24** is located at the outlet for the tank **10**, there being a drain pipe **26** extending downwardly from the valve seat which leads directly into the toilet bowl (not shown). The foregoing, as is believed evident, has dealt with conventional details and forms no part of my invention.

Referring now to the valve device exemplifying my invention, it will be perceived that the device has been denoted generally by the reference numeral **30**. The device **30** includes a split ring clamp **32**, suggestively of a suitable plastic, such as that called Delerin which has been used in actual practice, having a metal screw **34**. The clamp **32** encircles a portion of the overflow pipe **22** at the proper elevation, the overflow pipe **22** serving as the mounting means for my device **30**. As can be best discerned from FIGS. **4–7**, the split ring clamp has a pair of integral fingers **36** projecting therefrom, there being a slot **38** between these fingers. As will be perceived from FIGS. **6** and **7**, each finger has a vertical strip **40**, a horizontal web **42** and a second vertical strip **44**, the strip **44** in each instance being outboard of the strip **40**. Thus, there is formed a groove **46** immediately above the web **42** and a groove **48** directly therebeneath.

Passing now to a description of the two-part guide labeled **50**, it will be explained that the guide **50** comprises generally similar upper and lower molded plastic members **52***a* and **52***b*, the same plastic as used for the clamp **32** again being suitable. Each is formed with a groove **54** which receives therein the vertical strips **40** belonging to the fingers **36**. Each member **52***a*, **52***b* has a pair of ribs **56** and **58**, the ribs **56** and **58** on the upper member **52***a* depending downwardly into the upper grooves **46** and the ribs **56** and **58** on the lower member **52***b* extending upwardly into the lower grooves **48** on the fingers **36**. Each member **52***a* and **52***b* has a vertical passage **60**, this passage being square for a purpose later made manifest.

At this time, it will be explained that the members **52***a*, **52***b* additionally have abutting portions **62** that are closely adjacent the square passages **60**. It will also be seen that the upper member **52***a* has a pair of downwardly projecting portions **64***a* and the lower member **52***b* has similar portions **64***b* which project upwardly. It is from the lower ends of the upper portions **64***a* that pins (not shown) extend downwardly into a pair of holes (also not shown) provided in the lower portions **64***b*.

Although the reason therefore will not be entirely clear at this stage, nonetheless attention is directed to a pair of aligned arcuate notches **67** in the members **52***a* and **52***b*, these notches being between the abutting portions **62** and **64**. Together, the arcuate notches **67** form a pair of circular openings. Additional notches **68**, these being of rectangular appearance, communicate with the passage formed by the notches **67**. Briefly, it can be pointed out that the notches **67** and **68** allow water to flow into the region where the square passage **60** is located to wash away any scale that might otherwise collect in this vulnerable region.

The lower member **52***b* in addition to having the previously mentioned holes therein differs further from the configuration of the member **52***a* by reason of a pair of downwardly depending guide fingers **70**, there being one extending downwardly from each side of the square passage **60** in the lower guide member **52***b*. The upper member **52***a* has an untapped hole at **72** and the lower member **52***b* has a tapped hole **74** which contains a screw **76**. The screw **76** loosely extends downwardly through the untapped hole **72** and when tightened simply pulls the two members **52***a* and **52***b* closer together, thereby clamping the fingers **36** therebetween. It will be appreciated that the fingers **36** need not extend fully into the grooves **54**, and in this way the guide **50** composed of the members **52***a* and **52***b* may be tightened at the proper location so as to properly overlie the valve set **24**.

Describing now the lift rod or valve stem **80**, which likewise may be of the same plastic as the clamp **32**, it will be observed that it includes an elongated shank **82** having a transverse hole at **84** in its upper end. A chain **86** has one link connected with the shank **82** by reason of the hole **84** and the link at its upper end connected to the trip arm **20**. The lower end labeled **88** of the valve stem **80** is not only threaded but close inspection of FIG. **9** (and FIG. **11**) will reveal that it is angled at 7-½° with respect to the longitudinal or vertical axis of the shank **82**. An indicator pin **90** projects from one side of the valve stem **80** at the juncture of the threaded end **88** with the shank **82**.

Attached to the lower end **88** of the lift rod or valve stem **80** is nonbuoyant valve member **92** of an elastomeric or plastic material, preferably of semi-cured polyethylene. The valve member **92** has a centrally disposed boss **94** formed with a threaded bore or recess **96**. Here again, close inspection of FIG. **9** (and FIG. **11**) will demonstrate that the bore **96** is angled at approximately 7-½° with respect to the vertical axis of the valve member **92**.

From FIGS. **8** and **10**, it will be noted that there are a number of angularly oriented ribs **98**. Although not yet to be fully comprehended, there are rounded bumps **100***a*, **100***b* and **100***c* on certain of the ribs **98**. More specifically, there is one bump **100***a* which, when aligned with the pin **90**, establishes a flat or horizontal relationship of the valve member **92** with respect to the vertical axis of the lift rod or valve stem **80**, thereby rendering the valve suitable for a horizontal or flat

valve seat. The rib **98** with the two bumps **100***b* thereon simply tells the user or installer when a 180° relationship has been established, thereby conditioning the valve **92** for use with a slanted valve seat as pictured in FIGS. **10** and **11**. The particular rib **98** with two bumps **100***b* thereon establishes an intermediate position that, while not illustrated, would angularly orient the valve **92** for a relatively small seat where there might otherwise be interference between the valve member **92** and the overflow pipe **22**. It is not deemed necessary to actually illustrate this condition, but it should be understood that the versatility of my device **30** takes this situation into account.

Describing further the valve member **92**, it will be noted that it includes a cylindrical lip or flange **102** extending around the outer ends of the angularly disposed ribs **98**. There is still another lip or cylindrical flange **104** at the periphery of the valve member **92**. A weight in the form of a ring **106** (deliberately omitted from FIGS. **8** and **10** to show the boss **94**) has an internal diameter just sufficient to assure a press fit when the ring **106** is forced downwardly over the upper end of the boss **94**. The reason for weighting the valve member **92** will be explained shortly.

At this time, attention is directed to a U-shaped float supporting unit or yoke denoted generally by the reference numeral **110** and which can be of the same plastic as suggested for the clamp **32**, the guide **50**, and support stem **80**. It includes a central sleeve **112** formed with a radially extending tapped hole at **114** for receiving a set screw **116**. The purpose of the set screw **116** is to simply hold or maintain the sleeve **112** at a preferred elevation above the valve member **92**. The support **110** additionally comprises a pair of L-shaped arms **118**, each arm having a horizontal portion **118***a* and a vertical or downwardly extending portion **118***b*.

The supporting unit **110** carries a pair of float members **120***a* and **120***b*. Preferably, these float members **120***a*, **120***b* are of foamed polystyrene because of this material's low density and excellent buoyancy. It will be appreciated that the spacing of the float members **120***a*, **120***b* in a lateral direction assures a better distribution of the buoyant action. Stated somewhat differently, the locating of the float members **120***a*, **120***b* to either side of the guide **50** not only enables each float member to exert a buoyant force upwardly, but by reason of the L-shaped arms having horizontal portions **118***a* of equal length, the resulting moment arm is the same at both sides of the guide **50**, thereby minimizing any tendency for the lift rod or valve stem **80** to bind or cock against portions of the members **52***a* and **52***b* constituting the guide **50**.

INSTALLATION

While my valve device **30** may very well be used as original equipment, it is contemplated that it will find especial utility as a replacement for conventional valves that do not possess the advantages of my device. Since it is within the purview of my invention to provide a valve device **30** that can be installed in such a simple manner that the "do-it-yourself" person will be encouraged to replace his own valve device, the installation procedures will now be outlined.

First, the installer must ascertain the type of toilet valve seat that his tank has. This is a very easy chore because there are only three basic types. If the seat is large and of the flat variety, then the installer immediately knows that he is to rotate the valve member **92** on the threaded lower end **88** of the valve stem **80** so that the particular rib **98** having the bump **100***a* thereon will be brought into radial alignment with the pin **90**. On the other hand, if the valve seat is small or has a flapper valve associated therewith, then the user knows that he must rotate the valve member **92** so that the angled rib **98** having the two bumps **100***b* thereon is brought into radial registry with the pin **90**. The third possibility involves a toilet with a slanted or inclined seat. In this instance, the installer simply aligns the particular rib **98** having the three bumps **100***c* thereon with the pin **90**. This relationship is shown in FIG. **9**. The situation involving the two bumps **100***b*, as already pointed out, has not been illustrated. Usually, the unillustrated situation occurs with the smaller type of seat and the rotation or alignment of the two bumps **100***b* with the pin **90** simply provides adequate clearance between the valve member **92** and the proximally located overflow pipe.

Next, if not already done, all previously mounted hardware should be removed from the particular overflow pipe **22**. The overflow pipe **22** is then in readiness to receive the split ring clamp **32**. This clamp **32** can be forced open after backing off the screw **34** so as to fit over the upper edge of the overflow pipe **22**. It can then be lowered until it is at approximately the correct elevation. The final adjustment can be reserved for later on.

The user then moves the fingers **36** inwardly or outwardly with respect to the two-part guide **50**. Such action moves the valve member **92** into vertical alignment with the particular valve seat **24**. Precise alignment is not necessary, particularly due to the self-seating action that takes place when using my device **30**, as will be better understood when considering the operational sequence that occurs.

After performing the foregoing steps, then the U-shaped support or yoke **110** is raised or lowered, as circumstances dictate, by simply loosening the set screw **116**. It will be understood that this adjustment alters the amount of water that will flow from the tank **10** during a given flush resulting from the operation of the trip handle **18**. By flushing the toilet several times, that is operating the trip handle **18** several times, the installer will quickly discover how much water is required to produce the correct flush. The particular make of toilet will influence the amount of water that can be saved by using my valve device **30**. Some designs permit half a tank to be saved; others permit only a quarter tank or so to be saved.

At some point in the installation procedure, the user should bend the float arm **14** so as to raise the water level to almost the top of the overflow pipe **22**. Actually, one-quarter inch is the preferred distance, this giving the maximum head or column pressure that will result in an optimum flushing operation. Unlike conventional toilets, the proximity of the water level with respect to the top of the overflow pipe **22** does not mean that more water will be used during a flushing operation; it merely means that the efficiency is being improved. This will become clearer from the operational sequence now to be presented.

OPERATION

Assuming that the level of the water in the tank **10** has been adjusted so that it is approximately one-

quarter inch beneath the top of the overflow pipe **22**, this water level having been assigned the reference numeral **122**, then when the trip handle **18** is actuated, the trip arm **20** swings upwardly or counterclockwise as viewed in FIGS. **1** and **2** (to the phantom position shown in FIG. **2**). Such action, through the agency of the flexible chain **86**, simply raises or lifts the valve stem **80**. The upward travel of the valve stem **80** is limited by reason of the weight ring **106** striking the lower ends of the two guide fingers **70** which are integral with the lower guide member **52***b*. Owing to the fact that the two-part guide **50** is affixed to the split ring clamp **32** which is in turn anchored to the overflow pipe **22**, the upward travel is arrested. It is important to understand that this condition results, for it is instrumental in minimizing the flow of water that is discharged while the valve member **92** is open.

The buoyancy of the two float members **120***a*, **120***b* is deliberately selected and incorporated into the design of my device **30** so as to balance the weight of the valve **92** plus its ring **106**. The balancing action does not have to be precise. Actually, the buoyant action can dominate the gravity action attributable to the weight of the valve member **92** and its superimposed weight ring **106**. The important factor to keep in mind is that as the water level **122** falls, the valve member **92**, together with the support or yoke **110** and its floats **120***a* and **120***b*, also falls downwardly from the position depicted in FIGS. **2** and **3** to the position appearing in FIG. **1**.

Toward the lower end of the travel, the rush or turbulent action of the water escaping between the seat **24** and valve member **92** literally sucks the valve member downwardly. It will be remembered that the upper side of the valve member **92** is concave, and the cylindrical lips or flanges **102, 104** plus the pockets between the angularly disposed ribs **98** form a cup-shaped surface that compels the valve member **92** to be forcibly moved downwardly with the rapid flow of water. It will be appreciated, it is believed, that the water flow becomes quite turbulent as the valve member **92** moves into a closer and closer relationship with the valve seat **24**. The foregoing action or movement, accordingly, results in the valve member **92** being seated tightly against the valve seat **24**, there being an appreciable vacuum, after complete closure, on the underside of the valve member **92** assisted by a half tank or so of water on top of the valve member **92**. When the tank **10** is completely refilled, then the full head is applied to the valve member **92**, further contributing to its sealing action. It is only when the vacuum is broken by the operation of the trip handle **18** that the sealing action is disturbed, this being when a flushing operation is desired and thus not detrimental in any sense of the word.

Due to the fact that the entire amount of water in the tank **10** is not used, the amount that is permitted to be discharged for a single flush can be in accordance with the amount or capacity of water that can be accommodated in the bowl. While the bowl has not been depicted, it will be understood that the bowl can receive a considerable amount of water before the water reaches the upper edge thereof to cause an overflow, although the bowl cannot usually accommodate an entire tank of water.

Therefore, it is believed evident that when a toilet bowl becomes plugged, the restricted amount of water transferred gravitationally from the tank **10** into the bowl can be limited so as not to cause overflowing of the bowl. Also as already pointed out, the conservation of water made possible when practicing the teachings of the present invention provides a quieter flushing action because less water is used plus the fact that tank sweating is reduced because all of the water is not discharged from the tank **10**. The incoming cold water mixes with the residual water that, if not at room temperature, is at least closer to ambient temperature than the incoming cold water. Consequently, a radical temperature change is avoided with considerably less condensation.

I claim:

1. A flush valve device for toilets comprising an elongated valve stem, a nonbuoyant valve member attached to the lower end of said stem, said valve member being concavo-convex with the concave side facing upwardly, float means, support means for holding said float means at a location above said valve member, means for adjusting the height of said support means on said stem so as to determine the location of said float means with respect to said valve member, and guide means for attachment to the overflow pipe of the water closet in which the device is to be installed, said guide means having a noncircular passage extending vertically therethrough and said valve stem having a noncircular cross section corresponding to that of said noncircular passage so that rotation of said valve stem is prevented.

2. A flush valve device in accordance with claim **1** in which the lower end of said valve stem is threaded and the concave side of said valve member has an internally threaded boss for receiving said threaded end to attach said valve member to said valve stem.

3. A flush valve device in accordance with claim **2** in which said threaded end extends downwardly at an acute angle with respect to the longitudinal axis of said stem.

4. A flush valve device in accordance with claim **3** in which said boss recess extends at an acute angle with respect to a vertical axis through said valve member so that the angular position of said valve member on the threaded end of said shank determines the angle of said valve member with respect to the longitudinal axis of said stem.

5. A flush valve device in accordance with claim **4** in which said passage through said guide means has a square configuration and the cross section of said stem is also square, said valve stem having an indicating pin extending from one side thereof whereby a selected rib can be angularly aligned with said pin to indicate the degree of angularity of said valve member relative said stem.

6. A flush valve device in accordance with claim **5** in which certain of said ribs have marks thereon so as to denote the proper degree of angularity of said valve member with respect to the longitudinal axis of said stem.

7. A flush valve device in accordance with claim **1** in which said support means is U-shaped to provide arms extending laterally in opposite directions and said guide means extends at right angles to the direction in which said arms extend to thereby obviate any interference between said guide means and said float members.

8. A flush valve device in accordance with claim **1** in which said guide means includes upper and lower members having vertically aligned square openings to form

said vertical passage, and said upper and lower members are formed with notches which form additional openings communicating with said vertical passage to wash away scale that might otherwise collect within said passage and on said valve stem.

9. A flush valve device in accordance with claim 8 including a pair of downwardly projecting guide fingers on said lower member.

10. A flush valve device in accordance with claim 8 including a clamp having a pair of horizontal fingers, said upper and lower members each having a groove which together form a passage for receiving said horizontal fingers therein.

11. A flush valve device in accordance with claim 10 in which said horizontal fingers have a vertical slot therebetween and said upper and lower members form a horizontal slot, and a screw extending downwardly through said upper member, and through said vertical slot into threaded engagement with said lower member for tightening said upper and lower members against said horizontal fingers to hold said upper and lower members in a preferred position.

12. A flush valve device for toilets comprising an elongated valve stem, a nonbuoyant, concavo-convex valve member attached to the lower end of said stem with the concave side thereof facing upwardly, float means, support means for holding said float means at a location above said valve member, means for adjusting the height of said support means on said stem so as to determine the location of said float means with respect to said valve member, said valve member being of plastic material, a weight member carried on said valve member, said valve member being formed with radially directed ribs on its concave side and including an upstanding cylindrical lip extending around the free ends of said ribs, and a second upstanding cylindrical lip extending circumferentially around the outer periphery of said valve member.

13. A flush valve device in accordance with claim 12 in which said valve member is polyethylene.

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