United States Patent [19]

Wiegand

[11] **3,733,618**

[45] **May 22, 1973**

[54] **WATER SAVER ATTACHMENT FOR TOILET TANK FLUSH VALVE**

[76] Inventor: **William A. Wiegand,** 2440 East Commercial Boulevard, Fort Lauderdale, Fla. 33308

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[52] **U.S. Cl.** ..... **4/57 R,** 4/56, 4/57 P, 4/67 A

[51] **Int. Cl.** **E03d 1/34**

[58] **Field of Search** ..... 4/1, 57 R, 67, 67 A, 4/63, 57 P, 37, 52, 55, 65, 38, 36, 34, 61, 15

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Primary Examiner—Henry K. Artis
Attorney—Robert E. LeBlanc et al.

[57] **ABSTRACT**

A water saver attachment for toilet tank flush valves is presented. The attachment includes an automatic one-way vent valve mounted in an opening through the wall of the flush valve. The vent valve may be preset to control the rate of flow therethrough. As the buoyant flush valve vents water replaces the vented air to decrease the buoyancy of the valve causing it to close before all water has drained from the tank. The rate of flow through the vent then is proportional to the amount of water retained in the tank when the flush valve closes. A variety of one-way valves are contemplated, within the scope of this invention, however, in a preferred embodiment, a ball check or stem check valve is utilized. A kit is also disclosed including a vent valve and a punch for making the valve-receiving opening in a conventional flush valve. Flush valves are also described wherein the vent valve is molded therein.

23 Claims, 14 Drawing Figures

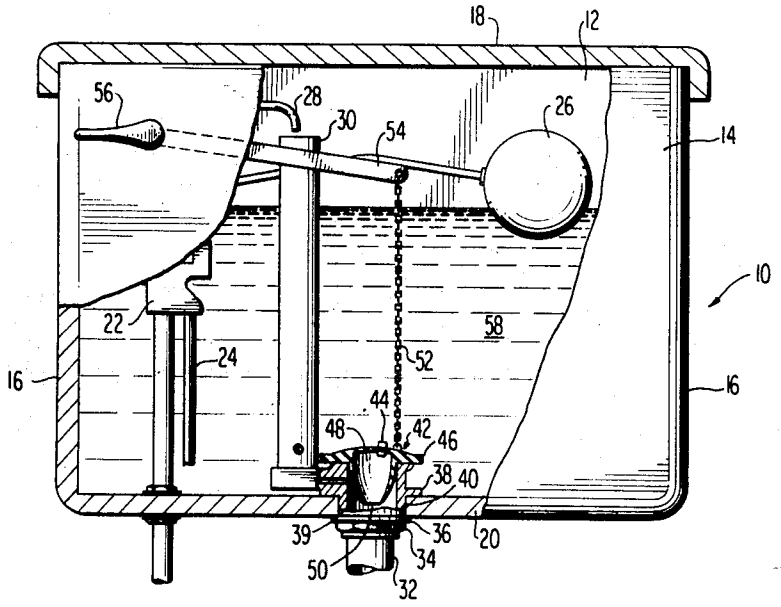


FIG.1

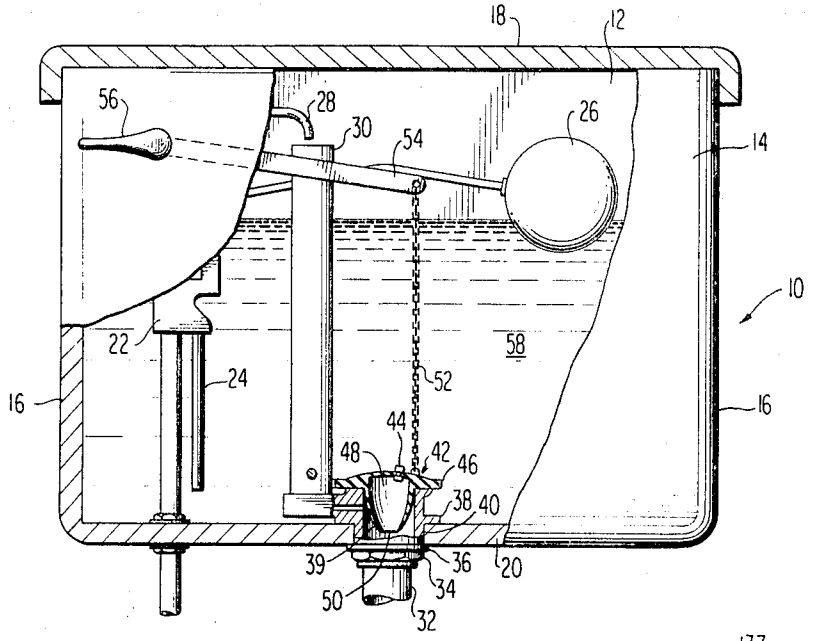




FIG.2

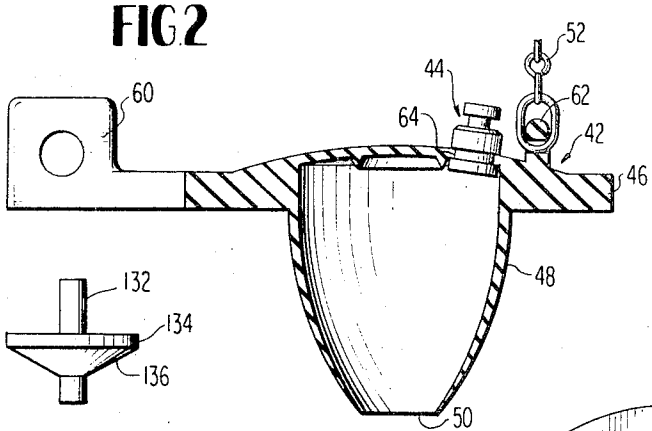


FIG.14

FIG.11

FIG.3

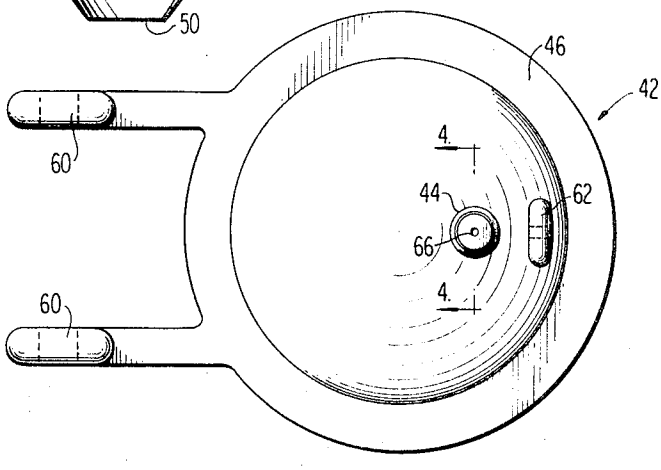


FIG.12

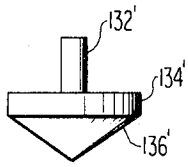


FIG.13

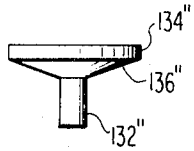


FIG.4

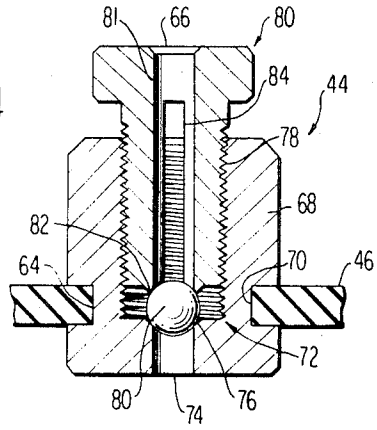


FIG.5

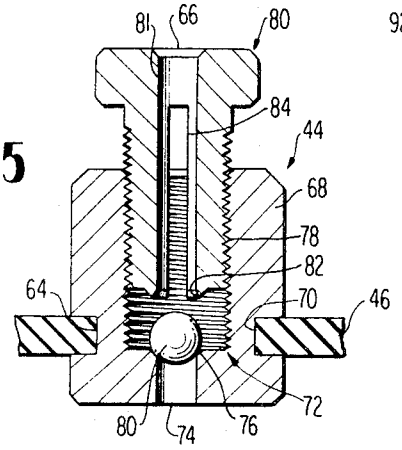


FIG.6

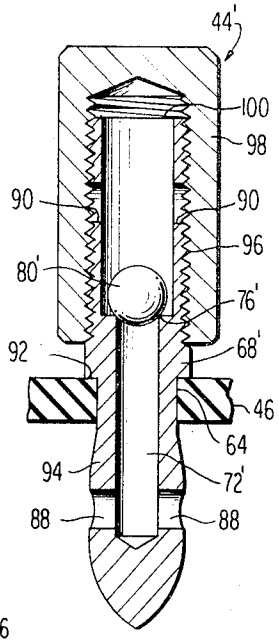


FIG.7

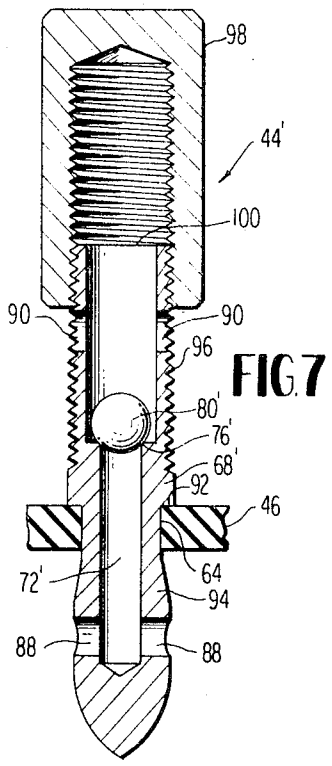


FIG.8

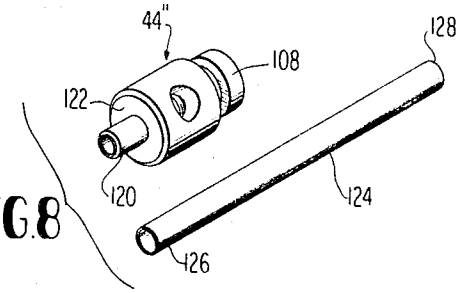


FIG.9

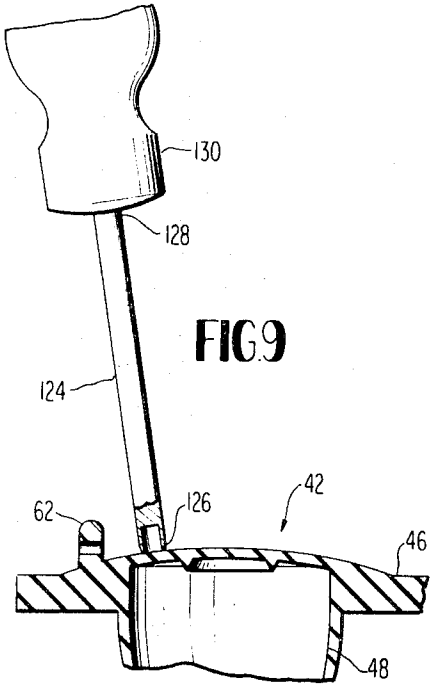
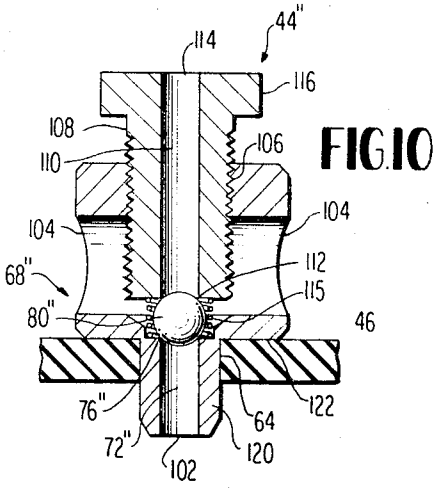


FIG.10



WATER SAVER ATTACHMENT FOR TOILET TANK FLUSH VALVE

This invention relates to flush valves for tank-type toilets, and particularly to a flush valve assembly adaptable to automatically permit flushing with only a preselected quantity of water from the toilet flush tank. For example, the valve of this invention may be preset to allow one quarter, one half, three fourths or the full tank of water, as desired, to drain from the tank during flushing before the flush valve closes.

In recent years domestic water conservation, especially in urban areas, has become increasingly important. Extended periods of drought have required severe water restrictions in many cities accompanied by bans of domestic activities such as lawn watering and car washing. However, a major domestic source of water over-consumption has not been satisfactorily regulated as yet, primarily due to the lack of an inexpensive, uncomplicated means therefor.

The reservoir in a tank-type toilet normally amounts to over 5 gallons of water. Depending on the type of mechanism used for opening the water inlet valve, a normal flush may permit from 6–8 gallons of water to drain from the tank. In conventional toilets, when the flush valve is opened and the water level in the tank begins to drop, downward displacement of the float attachment opens the water inlet valve. Water then enters the tank through this valve as the tank drains. The buoyant flush valve remains open until the water level in the tank has nearly reached the level of the valve seat on the outlet port. The valve then descends with the water level and seats therein. The tank then refills and the float raises until it closes the inlet valve.

Satisfactory toilet operation, however, does not, in most instances, require flushing with this quantity of water. Normally three to four gallons will be sufficient. Therefore, by modifying the domestic tank-type toilets to use a reduced amount of water in flushing, water consumption may be economized without restricting normal domestic activities.

A wide variety of devices have been proposed for use with tank-type toilets to close the flush valve before the tank empties. Many of these devices are complicated and require substantial alteration of the flush valve structure or the valve actuator linkages for installation. The altered structures also often require a change in flushing techniques. Both of these features are undesirable, however, limiting public acceptance and wide implementation of an otherwise sound concept for water conservation. For example, many devices have been proposed for admitting water into either conventional ball type or flapper type flush valves to decrease the buoyancy thereof, and terminate the flushing operation before all water drains from the tank. Many of these devices require substantial alteration of the valve itself, and the installation of controls either inside the tank above the waterline or externally thereto on the tank handle.

The standard ball type and flapper type flush valves both include a downwardly opening hollow portion (hereinafter described as the float member), and an external surface, flange, or plate thereon adapted to engage the valve seat and cover the outlet port. When the flush valve is raised air retained in the float member maintains valve buoyancy, and the valve remains open until the water level in the tank lowers nearly to the level of the outlet port whereupon the valve seats, closing the port. The valve remains seated due to suction created in the outlet pipe until the handle is manually depressed to unseat the valve and flush the toilet again.

Many prior water saver devices attempt to close the flush valve before the tank empties by venting the float member to replace air therein with water as water drains from the tank. During venting, water enters the float member, after the flush valve is opened, through the lower opening therein. The water decreases buoyancy of the valve until it sinks and closes the outlet port. These devices as noted above uniformly require an elaborate valve and control system, typically mounted on or near the toilet handle and connected to the flush valve whereby rotation of the handle or manipulation of a separate actuator is necessary to open a vent in the float member. If the vent is not biased it must then be manually closed when the flush valve closes to maintain decreased pressure in the tank outlet pipe.

These devices often utilize an intricate flush valve assembly and a modified handle actuator with a linkage or conduit therebetween. Accordingly, public acceptance and use of prior devices has been hampered by factors such as the expense thereof, the time necessary for installation, and the complicated techniques necessary for normal operation. The intricate design of prior devices also decreases the chances of maintenance-free operation.

The instant invention, however, solves the aforementioned problems by providing an automatically operating, one-way vent valve which may be quickly and easily installed on any standard flush valve, and preset to permit use of only the desired quantity of water. The valve is adapted to be mounted in an opening through the wall of the float member portion of the flush valve. When the flush valve is opened air from the interior thereof vents through the valve to the surrounding water at a controlled rate governed by the dimensions thereof, and when the flush valve seats the vent valve is automatically closed by the decreased pressure created in the outlet pipe.

The quantity of water retained in the tank will be governed by the rate at which the flush valve is permitted to vent. Although any well-known one-way valve structure is contemplated within the scope of this invention, in a preferred embodiment of this invention a ball check or a stem check valve is used. The displacement of the check valve element disposed therein is separately adjustable, as will be subsequently explained, to vary the rate of venting. Therefore, the desired quantity of water may be retained in the tank merely by presetting the vent valve. Thereafter the toilet may be flushed in the usual manner without further adjustment.

Any standard flush valve may be adapted to utilize the vent valve of this invention merely by punching a small hole in the upper surface and inserting the valve. Because the flush valves are constructed of rubber or a flexible rubber-like material, a shoulder on an outer surface of the portion of the valve housing extending into the float member will be sufficient to retain the vent valve in the flush valve, or if the opening is small enough the vent valve may be frictionally retained therein. A kit comprising the vent valve and a suitable punch will provide the home owner with the capability of installing this device himself. In the alternative, a flush valve may be provided having the vent valve

molded therein. The vented flush valve unit may then be installed merely by substituting it for the conventional toilet flush valve.

Accordingly, it is an object of this invention to provide a flush valve assembly for tank-type toilet which will automatically permit flushing with either the entire reservoir or any desired portion thereof.

It is another object to provide an adjustable one-way vent valve which may be easily and quickly installed on a conventional toilet flush valve for a tank-type toilet for dependable operation to permit said valve to fill with water and close to retain a preselected portion of the water reservoir in the tank.

It is another object to provide a tank-type toilet flush valve having an adjustable check valve mounted in an opening through the wall thereof, said check valve being adjustable to govern the quantity of water used in flushing said toilet.

It is still another object to provide an installation kit for installing a water saver vent valve in a conventional tank-type toilet flush valve including a punch for providing an opening through the wall thereof and a check valve for insertion into said flush valve through said opening.

It is yet another object to provide a ball check vent valve for installation in a toilet flush valve, said ball check valve having a housing adapted to be retained in said flush valve, and an adjustable control means mounted thereon for governing the rate at which said flush valve vents.

It is a further object to provide a stem check vent valve for installation in a toilet flush valve, said stem check valve having a housing adapted to be retained in said flush valve, and an adjustable control means mounted thereon for governing the rate at which said flush valve vents.

It is yet another object to provide an adjustable check valve for venting a tank-type toilet flush valve which check valve housing defines an internal fluid passage therethrough with an adjustable restriction therein to permit one-way flow only, adjustment of said restriction being controlled by movement of a restricting member mounted at an end of the valve housing so that when said check valve is inserted through an opening in the wall of said flush valve, the position of said restricting member relative to said housing will control the rate of flow of air from within said flush valve and therefore the quantity of water retained in the tank when the flush valve closes.

These and other objects will become readily apparent with reference to the drawings and following description wherein:

FIG. 1 is a view partially in elevation and partially in section of a toilet tank having the vented flush valve assembly of this invention mounted therein;

FIG. 2 is a sectional view of a flapper-type toilet flush valve having the vent means of this invention mounted therein;

FIG. 3 is a top view of the flush valve of FIG. 2 having the vent valve of this invention mounted therein;

FIG. 4 is a fragmentary, cross-sectional view taken along lines 4—4 of FIG. 3 showing the vent valve of this invention in a closed position;

FIG. 5 is a fragmentary, cross-sectional view showing the vent valve of FIG. 4 in an open position;

FIG. 6 is a fragmentary, cross-sectional view of an alternate embodiment of this invention showing a ball check vent valve in a closed position;

FIG. 7 is a fragmentary, cross-sectional view showing the vent valve of FIG. 6 in an open position;

FIG. 8 is a combined perspective view of an embodiment of the vent valve of this invention and a punch member utilized in an installation kit;

FIG. 9 is a fragmentary view partially in elevation and partially in section illustrating the use of the punch member of FIG. 8 to form an opening for installation of the vent valve of this invention;

FIG. 10 is a fragmentary cross-sectional view of the vent valve of FIG. 8 mounted in an opening in the upper surface of a toilet flush valve;

FIG. 11 is a side elevation of an alternate embodiment, a stem valve element which may be used in the vent of this invention;

FIG. 12 is a side elevation of another, alternate stem valve element;

FIG. 13 is a side elevation of yet another, alternate stem valve element;

FIG. 14 is a side elevation of a disc valve element which may be used in the vent of this invention.

With attention to the drawings, FIG. 1 illustrates a toilet flush tank **10** having a rear wall **12**, a front wall **14**, side walls **16**, a removable top **18**, and a bottom wall **20**. The tank **10** has a water supply valve **22** with a water delivery pipe **24** carried thereby and controlled by a float **26** in a well-known manner, with a hush tube **28** extending down into the overflow pipe **30**.

A delivery pipe **32** communicates with the toilet bowl (not shown) and is threadedly attached by a nut **34** and washer **36** to the outlet valve seat **38** disposed in the outlet opening **40** in the bottom wall **20** of tank **10**.

Although the vent valve of this invention may be adapted for use with any conventional flush valve, a flapper-type valve **42** is shown with a vent valve of this invention **44** mounted therein for the purposes of illustration. A conventional ball valve assembly such as that pictured in U.S. Patent No. 3,365,730 may be substituted for the flapper-type valve assembly, if desired, without departing from the intended scope of this invention.

The flush valve **42** is attached to the overflow pipe **30** by any well-known means. The flapper **42** includes an upper plate **46**, and a float member **48** having a downwardly directed opening **50** therein. Chain **52** connects plate **46** and lever arm **54**. Lever arm **54** is actuated by depression of handle **56** mounted on the front wall **14** of tank **10** in the well-known manner.

When handle **56** is depressed lever arm **54** raises flush valve **42** and water **58** exits tank **10** through the outlet port **39** in valve seat **38** and through delivery pipe **32**. During conventional operation when the water level in tank **10** nears the level of the upper surface of valve seat **38** flush valve **42**, buoyed by the air within float member **48** descends and seats on valve seat **38** to close the outlet port **39**.

When the water level initially falls float **26** opens the water inlet valve **22**, and after flush valve **42** closes to stop egress of water from tank **10** the tank refills until float **26** raises to a predetermined level to close inlet valve **22** in the well-known manner.

With attention to FIGS. 2 and 3 the flapper flush valve **42** is typically constructed of a rubber-like material. The valve **42** is typically rotatably attached at

brackets 60 to delivery pipe 30. Chain 52 is attached to the outer edge of plate 46 by an upstanding lip 62 so that when handle 56 is depressed chain 52 will cause plate 46 and brackets 60 to rotate about the connection (not shown) to pipe 30 to remove the float member 48 and plate 46 from the valve seat 38 thereby permitting egress of water from the tank 10 through port 39 to delivery pipe 32.

A one-way vent valve 44 is adapted to be mounted in an opening 64 through valve 42 according to this invention. When vent valve 44 is opened, as will be hereinafter described, air from within float member 48 is permitted to vent through exit port 66 in vent valve 44. As air vents from float member 48 water enters through opening 50 to replace the vented air. Therefore, the rate at which air vents from float member 48 through valve 42 will determine the rate at which water enters float member 48 through opening 50. As water enters float member 48 the buoyancy of the valve 42 decreases until the valve 42 sinks into valve seat 38 and plate 46 stops egress of water from the tank 10 through port 39 and delivery tube 32.

Although any type of one-way valve may be adapted to be disposed in opening 64 to control venting from float member 48 a preferred embodiment of this invention utilizes a check valve. The valve may be a ball check valve, a stem check valve, or the valve member may be a disc, as desired.

FIGS. 4 and 5 illustrate one embodiment of a ball check vent valve 44 which may be utilized according to this invention. Valve 44 includes a housing 68 having an annular groove 70 therein. Groove 70 is adapted to receive that portion of valve 42 surrounding opening 64 to mount vent valve 44 on flush valve 42. Housing 68 defines a fluid passage 72 therethrough. Passage 72 includes an inlet port 74 and a valve seat 76. Passage 72 also defines a threaded portion 78 adjacent valve seat 76 and distal to inlet port 74. A movable valve element 80 is disposed in passage 72 normally seated in valve seat 76. A control member 80 is threadedly received in passage 72 at threaded portion 78.

Control member 80 has a valve seat 82 and an axial passage 81 therethrough extending from valve seat 82 to exit port 66. Control member 80 also defines longitudinally directed ports 84 extending from the valve seat 82 to a boss 86 surrounding exit port 66. As shown in FIG. 4 when valve element 80 is seated against valve seats 76 and 82, passage 72 is blocked and the valve is closed. However, rotation of boss 86 to partially withdraw control member 80 from passage 72, as shown in FIG. 5, will permit longitudinal movement of valve member 80. At this time, if the pressure within float member 48 exceeds the ambient water pressure at the outlet ports 66 and 84 valve element 80 will displace from seat 76 toward seat 82 to permit venting through outlet ports 66 and 84. The rate of venting will be determined by the longitudinal position of control member 80 relative to housing 68.

FIGS. 6 and 7 show an alternate embodiment of a one-way valve 44' of this invention disposed in opening 64 in flush valve 42. Housing 68' defines a passage 72' extending therethrough, including lateral entrance ports 88, lateral exit ports 90, and a valve seat 76' disposed therebetween. Shoulders 92 on housing 68' abut the external surface of valve 42 surrounding opening 64 and housing 68' is retained in valve 42 by shoulders 92 and the widened, terminal portion of elongated probe 94. A movable valve element 80' is disposed within passage 72', normally seated on valve seat 76'.

A portion 96 of housing 68' adjacent outlet ports 90 is externally threaded and to receive internally-threaded control cap element 98.

When control cap 98 of valve 44' is secured on the threaded portion 96 of housing 68' in the position shown in FIG. 6 the valve will be closed. When the cap 98 has been rotated to the position of FIG. 7 and the pressure within float member 48 exceeds the ambient water pressure at ports 90 air from the float member 48 will rapidly vent through passage 72', and outlet ports 90. If the cap 90 is in a position intermediate the positions shown in FIGS. 6 and 7 air, under the above conditions, will vent through ports 90 and opening 100, through the threaded connection between cap 98 and housing 68', but at a slower rate. Therefore, rotation of cap 98 on housing 68' from the position shown in FIG. 6 to the position shown in FIG. 7 will produce an increasing rate of flow of air through the vent valve 44'.

FIG. 10 shows a third embodiment of the vent valve 44'' of this invention. In this embodiment housing 68'' defines a passage 72'' therethrough including a valve seat 76'', an entrance port 102 and lateral exit ports 104. The portion of housing 68'' adjacent entrance port 102 is adapted to be received in opening 64 in the valve 42 and frictionally retained therein as will be subsequently explained. A movable valve element 80'' is disposed within passage 72'' adjacent a valve seat 76''.

The passage 72'' through housing 68'' further defines a threaded opening 106 axially aligned with the inlet opening 102. An externally threaded, hollow control member 108 is received within opening 106. Control member 108 has a longitudinal passage 110 therethrough extending from a recessed valve seat 112 at one end to an outlet port 114 at an opposite end. A boss 116 surrounds the outlet port 114 to facilitate rotation of member 108 within opening 106. A spring 115 surrounds movable valve element 80'' and extends from the valve seat 76'' in housing 68'' to the recessed valve seat 112 in control element 108.

The position shown in FIG. 10 illustrates a closed position for the valve similar to that shown in FIG. 4. As a member 108 is rotated and withdrawn through opening 106, valve element 80'' will be freed to move between the seats 112 and 76'' within the confines of spring 115. Air will thereby be permitted to vent through passage 72'' from inlet port 102 through outlet ports 104 and 114. The rate of venting will be controlled by the position of control member 108 within housing 68'' and the spacing between seats 112 and 76''.

Vent valve 44'' is also adaptable for mounting on an existing flush valve 42 in the following manner. The neck 120 surrounds inlet port 102, and extends from the face 122 of housing 68''. Neck 120 may be easily inserted in an opening 64 through valve 42, and is frictionally retained therein by engagement with the rubber-like material from which the valve 42 is constructed. In a preferred version of this invention a kit may be provided including a valve member 44'' and a punch 124. Punch 124 has a hollow end portion 126 adapted to cut an opening 64 in plate 46, as shown in FIG. 9, when the opposite end 128 is struck with a hammer 130, or other heavy object. Once the opening 64 has been cut in valve 42, neck 120 may be inserted therethrough, control member 108 rotated to the de-

sired setting, and the device of this invention will be installed on any conventional flush valve.

It must be understood that the embodiments of FIGS. 4–7 are also suitable for mounting in a manner similar to that hereinabove described with relation to the embodiment of FIG. **10.** The combination or kit shown in FIG. **8,** may then include any type of valve member and a punch member having an end suitable for cutting the desired opening in the flush valve plate.

Alternatively the device of this invention may be molded in the valve wall when the flush valve is constructed. The embodiment of FIGS. **4** and **5** is particularly suitable for this construction. The vent valve **44** will then be set in the flush valve mold in a conventional and well-known manner and molten material poured therearound to form the flush valve **42.** The portion of valve **42** surrounding opening **64** is then molded in annular groove **70.** It must also be understood that any embodiment of this invention may be molded in a conventional flush valve as hereinabove described without departing from the scope of this invention.

The valve housing and control member which form the vent valve of this invention may be constructed of any suitable material, but metal such as stainless steel is preferred. The valve element may also be constructed of metal or teflon, or any other suitable material, but nylon is preferred. It must be understood that the valve element, within the scope of this invention need not be the ball **80.** Alternatively the valve **44** may include a stem element shown in FIGS. **11–13.** The stem valve element of FIGS. **11–13** include stem members **132** and plate members **134** having a tapered surface **136** adapted to seat in valve seat **76, 76′,** or **76″,** as desired. The stem element **132** is utilized to guide the valve element within passage **72, 72′,** or **72″.**

It must also be understood that the valve element of this invention may, in the alternative, be a disc. FIG. **14** illustrates a disc element **137** which may be used in the valve of this invention. As will be readily apparent to those skilled in the art disc **137** may have a fulcrum from either end or the center, and any well-known type of disc element may be substituted therefor within the scope of this invention.

The check valve construction will dictate the proper setting in order to retain the desired amount of water within tank **10** during flushing. Therefore, after either a flush valve **42** having the vent valve **44** of this invention molded therein is installed in the tank, or, in the alternative, after a vent valve of this invention has been installed in an existing flush valve as described hereinabove with relation to FIGS. **8** and **9,** the proper setting therefor may be easily determined by trial and error, by rotating the control member a predetermined amount, flushing the toilet, and observing the quantity of water retained in the tank. Once the desired quantity of water is retained in the tank, the vent valve of this invention need not be reset unless desired. The toilet may be used normally without additional manipulation of the control member until it is desired to retain a different quantity of water in the tank.

In summary, a settable one-way vent valve for a toilet flush valve has been described which may be easily installed in an existing flush valve, or molded as an integral part of flush valve assembly. The vent valve of this invention is a one-way valve adapted to permit venting of air from the float member of the flush valve at a controlled rate, when the toilet is flushed. When the flush valve is closed, however, the vent valve will also close, and the decreased pressure within the delivery pipe will maintain the valve element in a seated position to close the valve against the reverse flow of water therethrough. The vent valve will thus remain closed until the toilet is flushed whereupon the valve element will unseat permitting air to vent from the float member at a rate controlled by the preset control member.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. In a water saver attachment for toilet tank flushing assembly including a valve seat disposed in the tank exit port; a downwardly opening, hollow flush valve, said valve adapted to engage the valve seat to close said port; and a manually operated lever assembly connecting said flush valve and an external handle mounted on the tank, said lever adapted to raise said valve member out of engagement with the valve seat to open said port responsive to movement of said handle, the improvement comprising:

a check valve for venting the interior of said hollow flush valve mounted on said flush valve and extending therethrough said check valve adapted to open responsive to movement of said flush valve out of engagement with the valve seat to vent air from the interior of said hollow flush valve, and to close responsive to movement of said flush valve into engagement with the valve seat;

control means carried by said check valve for regulating the rate of flow therethrough.

2. The device of claim **1** wherein said check valve comprises: a housing defining a fluid passage and carrying a valve seat in said passage; a valve element disposed in said passage, said valve element movable in response to a pressure on the upstream side greater than the pressure on the downstream side thereof, and adapted to seat in response to a pressure on the upstream side less than the pressure on the downstream side thereof.

3. The device of claim **2** wherein said check valve is a ball check valve.

4. The device of claim **2** wherein said check valve is a stem check valve.

5. The device of claim **2** wherein said valve element is a disc.

6. The device of claim **2** wherein said control means comprises: a member movably carried by said housing; means cooperating between said member and said housing for varying the area of the fluid passage in response to axial movement of said member relative to said housing.

7. The device of claim **6** wherein said member is received in the passage, said member having a port forming a part of the passage, so that axial movement of said member relative to said housing will vary the area of the port.

8. The device of claim 6 further comprising means carried by said member for engaging said valve element against said valve seat.

9. The device of claim 6 further comprising stop means carried by said member within said passage, and engageable with said valve element for varying the maximum extent of displacement of said element away from said seat in response to axial movement of said member relative to said housing.

10. The device of claim 9 further comprising means disposed within the fluid passage for limiting displacement of the valve element away from the seat to a predetermined space, said stop means being operable to establish the height of the space above the valve seat.

11. The device of claim 10 wherein the means for limiting displacement of the valve element is a spring axially disposed between the seat and said stop means, defining the space in substantially cylindrical form.

12. The device of claim 6 wherein axial movement of the member away from the housing increases the area of the fluid passage to increase the rate of flow through said valve.

13. The device of claim 6 wherein said housing has a port downstream of said valve seat, the port forming a part of the fluid passage, and said member surrounds a portion of said housing downstream of said valve seat so that axial movement of said member relative to said housing will vary the area of the port.

14. The device of claim 13 wherein said downstream portion of said housing is substantially cylindrical and said member is a cap threadedly received thereon.

15. A flush valve for a toilet tank, said tank having an outlet port, a flush valve seat disposed therein, and means including manually operable lever means adapted to be coupled to said flush valve for raising said flush valve from said seat to open said port, said flush valve comprising:

a hollow float member having a first opening in the lower surface thereof, means mounted on the external surface of said float member for engaging said valve seat to close said port; coupling means mounted on the upper surface of said float member for connecting said member and said lever means;

a check valve mounted on said float member and extending through a second opening therein, a portion of the external surface of said check valve engaging the portion of said float member surrounding the second opening, said check valve operable to open responsive to movement of said flush valve out of engagement with the valve seat to vent air from said hollow float member and to close responsive to movement of said flush valve into engagement with said valve seat;

control means carried by said check valve for regulating the rate of flow therethrough.

16. The device of claim 15 wherein said check valve comprises: a housing defining a fluid passage and carrying a valve seat in said passage; a valve element disposed in said passage, said valve element movable in response to pressure on the upstream side greater than the pressure on the downstream side thereof, and adapted to seat in response to pressure on the upstream side less than the pressure on the downstream side thereof.

17. The device of claim 16 wherein said housing has an external circumferential groove therein for receiving the portion of said float member defining the second opening therein.

18. The device of claim 16 wherein the control means comprises: a member movably carried by said housing; means cooperating between said member and said housing for varying the area of said passage in response to axial movement of said member relative to said housing.

19. The device of claim 18 wherein said member is received in the fluid passage, said member having a port forming part of the passage whereby the axial movement of said member relative to said housing will vary the area of the port.

20. The device of claim 19 wherein axial movement of the member away from the housing increases the area of the passage to increase the rate of flow through said valve.

21. The device of claim 18 wherein said housing has a port downstream of said valve seat, the port forming a part of the fluid passage, and said member surrounds a portion of said housing downstream of said valve seat so that axial movement of said member relative to said housing will vary the area of said port.

22. The device of claim 18 further comprising stop means carried by said member within said passage, and engageable with said valve element for varying the maximum extent of displacement of said element away from said seat in response to axial movement of said member relative to said housing.

23. A kit for adapting a tank-type toilet flush valve to permit closing of said valve a preselected time after said valve opens to retain a preselected quantity of water in said tank after flushing said kit comprising:

a check valve assembly for venting the interior of said hollow flush valve, said check valve adapted to open responsive to movement of said flush valve out of engagement with the valve seat to vent air from the interior of said flush valve, and to close responsive to movement of said flush valve into engagement with the valve seat, said assembly including a housing defining a fluid passage and carrying a valve seat in said passage; a valve element disposed in said passage said valve element movable responsive to pressure on the upstream side greater than the pressure on the downstream side thereof, and adapted to seat in response to a pressure on the upstream side less than the pressure on the downstream side thereof, said housing also defining a neck portion depending from the lower face thereof, said neck having an inlet port therein forming a part of said fluid passage, the external surface of said neck portion having a preselected cross-sectional configuration throughout the axial extent thereof; a member movably carried by said housing; means cooperating between said member and said housing for varying the area of said fluid passage in response to axial movement of said member relative to said housing whereby movement of said member will regulate the rate of flow through said check valve;

punch member having a cutting head thereon, the cross-sectional configuration of the cutting head corresponding to the cross-sectional configuration of said neck portion of said housing so that when the cutting head of said punch means is driven through said flush valve to form an opening therein said check valve may be mounted therein by insertion of said neck into said opening.

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