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FLUSH VALVE UNIT

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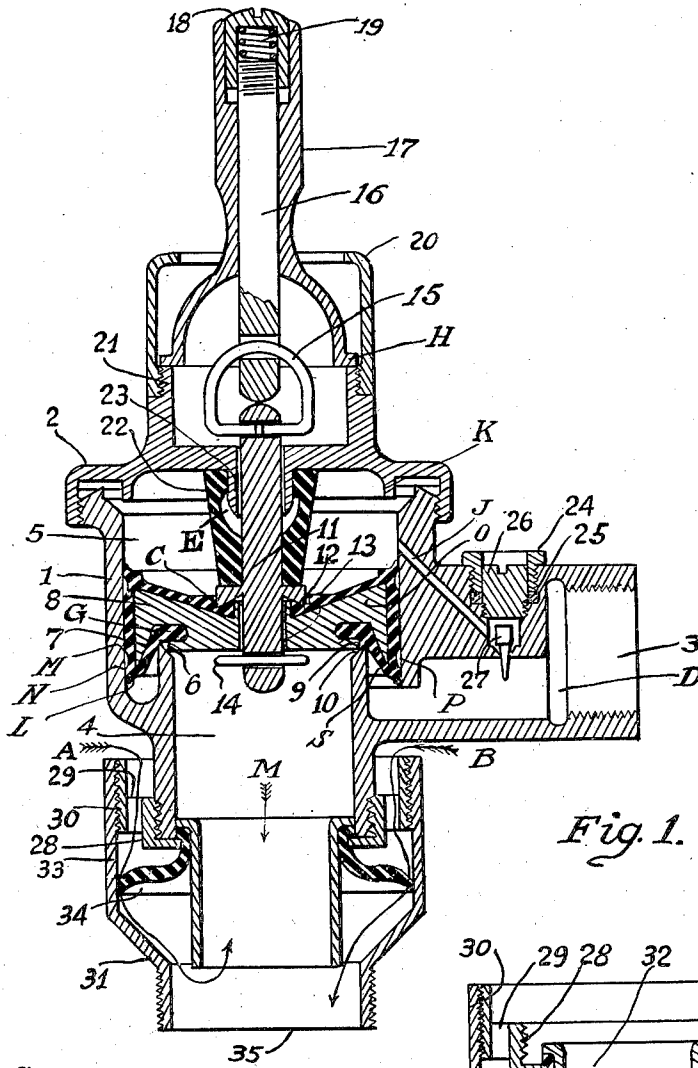


Fig. 1.

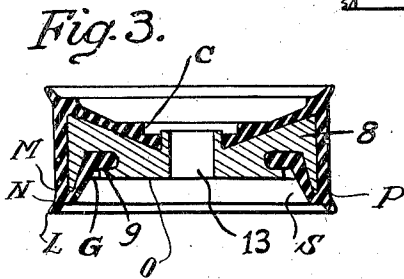
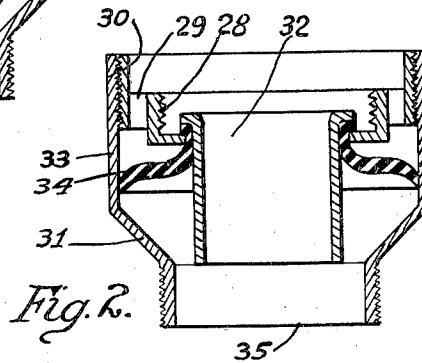


Fig. 2.

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FLUSH VALVE UNIT

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REISSUED

JAN 16 1940

The present invention relates to valves and aims to provide novel and improved measuring valves for water, or other fluid, which may be used for permitting either a manually determined or predetermined flow of fluid, or which may be used for a flush valve for toilets.

The other objects of my invention are,

First, to provide direct mechanical flush valve opening means combined with pressure opening means.

Second, to provide pressure closure means combined with direct manual and mechanical closure means, for a valve mechanism.

Third, to provide self cleaning and positive valve seats.

Fourth, to provide a tapered off and slow closure to cause the toilet bowl to refill where used for a flush valve.

Fifth, to provide several means to control the timing and amount of fluid passing through the flush valve during automatic closing operation.

Sixth, to provide a flush valve which is non-syphonic, acting as a check valve when closed.

Seventh, to provide a flush valve which is non-syphonic when held open for operation.

Eighth, to provide an air inlet around the flush valve outlet and prevent water from being forced out through the air inlet so provided.

Ninth, to provide a non-syphonic unit conveniently built in, or adapted to be attached to a flush valve outlet.

Other and further objects will appear as the descriptive matter proceeds, as illustrated by the drawing which, it is understood, are used for the purpose of illustration only, and the mechanical structure of my invention may be changed according to the exigencies of its use within the scope of what is claimed.

The drawing:

Fig. 1 is a cross-sectional view showing the entire flush valve assembly.

Fig. 2 is a detailed drawing of a non-syphonic unit adapter nut and flexible expansion member for attachment to flush valve units.

Fig. 3 is a detailed cross-sectional view of piston valve member.

Like numerals indicate like parts in all the figures of the drawing. The parts comprising the valve are valve body 1, having a cap 2, an inlet 3, an outlet 4, a cylinder 5, a valve seat 6, having a sharp seating edge 7, adapted to seat against flexible material surrounding piston 8, which is preferably of rubber molded around a metal core having a special shape, including beaded extremities at both sides of said piston 8. The exposed

metal shoulder 9 of the piston 8 is adapted to rest against tapered shoulder 10 of the valve seat 6 to limit the imbedment of sharp seating edge 7. It will be noted that both ends of the piston as of Fig. 4 are flared to be compressed within the cylinder of the valve to insure a snug fit.

Special attention is called to Figure 3 of the drawing. The shape of the piston illustrated there is vital to the proper continuous operation of the valve. The flare L of the piston forms a clearance space P between the points designated by M, N, the flared extension portion S beyond the face of O, it will be noted, is not backed up by the relatively hard and solid body portion of the piston 8 backed by the core O, which forms a solid backing to create the relatively solid body portion in conjunction with the material moulded around said core O. When the piston 8 is inserted into the cylinder 5, it is impossible for the external wall of the piston 8 next to the flared extension portion S, L, to take the contour of the cylinder 5 because the material of the flared portion 8 is stretched and forced radially inward by the apex L of the flare S, contracting away from the wall of the cylinder 5, there being no solid body disposed inward of the flared portion S to resist the compressing effect of flare L within the cylinder 5. Thus, the clearing space P is formed immediately next to the flare L between the piston and cylinder walls.

Relief valve 11 has a sharp knife-edge relief valve seat portion 12 which is adapted to cut a seat within the relief valve recess C in piston 8. Said recess has a flat surface surrounding the relief valve opening 13. A lifting pin member 14 is provided and inserted through the lower end of relief valve 11, which is attached by connecting link 15 to handle stem 16, which is inserted through a handle 17 and held in assembly by means of adjusting nut 18 and lock spring 19, the whole assembly being held in alignment by handle cowl 20, which is mounted on cap 2, the threaded extension 21 of cap 2 forming a fulcrum shoulder on which handle flange H normally rests. Flexible packing sleeve and cushion 22 surrounds relief valve guide 23 and stem of relief valve member 11. The flexible packing sleeve and cushion 22 has an enlarged passage at the point where relief valve member 11 enters valve guide 23. It will be noted that the valve cap 2 and the parts assembled in a unit therewith are removable from the valve as a unit, adding greatly to the accessibility of the valve.

Near the inlet end and through the upper side

of the inlet passage near the inlet 3 is a threaded by-pass packing nut 24, holding in place the by-pass packing 25 surrounding by-pass adjusting plug 26, which is above by-pass adjusting pin 27, extending through a by-pass opening into the passage from inlet 3. Surrounding the internal circumference of inlet 3 is a clearance groove D to allow free flow of fluid and a full waterway.

Surrounding the outlet opening 4 is an adapter nut 28 integral with a suspension spider 29 attached to circumferential tube 30, which tapers to a restriction waist 31 into which is extended reduced outlet insert 32 around which is an air passage defined by arrows A and B, the assembly described in this paragraph comprising a non-syphonic unit 35.

The operation of my invention is as follows:

To open the valve the handle 17 has oscillatory connections and may be moved laterally in any direction radial to the axis formed by stem 16, the fulcrum formed by the circumferential rim H of handle 17 resting on threaded extension 21 acting as a fulcrum base for lever formed by handle 17. The longitudinal pull exerted through the medium of handle 16 held in place by adjusting nut 18 located in recess of handle 17, lock spring 19 serving to prevent nut 18 from turning, exerts a pull upon the universal connection formed by link 15 which is adapted to move longitudinally, circumferentially and pivotally through enlarged hole in lower end of stem 16. Link 15 is pivotally connected to the upper end and stem of relief valve 11, which extends through the port in center of piston 8, the lifting pin 14 serving as mechanical means to lift flexible piston 8 from valve seat 6 when handle 17 is manipulated. The flexible packing sleeve and cushion 22 serve as means to exert a tension to close the valve mechanically by automatic expansion of said packing sleeve 22 after said sleeve 22 has been manually compressed by the manipulation of handle 17. This is of material benefit in case of low water pressure.

When the handle 17 is oscillated in any lateral direction the valve is opened. The handle connecting link 15 providing a universal joint allows for universal lateral movement. When the handle is released closure of the valve is automatically accomplished by the flow of fluid through by-pass passage J into cylinder 5 above piston 8, and an automatic mechanical closure is also accomplished through the medium of packing sleeve 22, which is of a compressible flexible material, preferably rubber, exerting a constant tension against relief valve seat 12, the sharp edge of which is imbedded in the bottom of relief valve recess C in piston 8, thus causing the final closure of the valve. The valve may be closed manually by sustained pressure against the end of handle 17 directly toward the relief valve member 11 and piston 8.

Adjusting nut 18 provides means to adjust the distance between the piston 8 and valve seat 6 by limiting the lift of piston 8 when the valve is opened.

The sharp seat of relief valve 12 is a self cleaning feature as any foreign particles are forced to one side or the other from the sharp seat 12, which is imbedded into the bottom of recess C of flexible piston 8, and this imbedment is limited by the metal shoulder formed around relief valve opening 13. The sharp edge 7 of valve seat 6 operates in the same manner as the sharp edge of relief valve 12, the metal shoulder 9 limiting

the depth of embedment. When the relief valve member 11 is raised in recess C the pressure above piston 8 is relieved faster than it can be built up through the medium of by-pass passage J, thus assisting in the opening of the valve by the volume and pressure of fluid entering through inlet 3 and exerted against the piston surface exposed to pressure surrounding the valve seat 6. When the valve is closed the sharp edge 7 is imbedded in the flexible piston 8 insuring a leak proof closure.

Diametrically enlarged beaded lip portions are provided at the extremities on both sides of piston 8. These lip portions are compressed into the cylinder 5, tending to flex the wall of the piston 8 away from the wall of said cylinder 5 between the two diametrically enlarged beaded lip portions of piston 8, so that the friction between the wall of piston 8 and the wall of cylinder 5 is diminished and the friction at the beaded extremities of said piston 8 is increased to seal said piston 8 against the by-passing of liquid between the wall of said piston and the wall of said cylinder 8.

It will be noted that the lifting pin 14 is drawn against the lower side of the piston 8 during the oscillatory operation of handle 17 exerting a positive manual stress against piston 8 to open the valve.

It has been found that the flexible packing sleeve 22, due to its compressed state, will exert sufficient expansive force to cause sufficient water to by-pass around the piston when the by-pass is closed, so that the valve will eventually close by the force thus exerted. When the valve is operating on gravity flow of water the valve is opened manually and mechanically and is closed mechanically by the expansion of the packing sleeve 22 acting against the piston in such a manner as to draw fluid through the by-pass J when the by-pass is open.

By-pass pin 27 is moved up and down constantly by the flow of water when the valve is operating, thus tending to keep the by-pass passage surrounding the pin 27 clear of any deposit.

Flexible packing sleeve 22 also acts as a check valve to allow air to enter the chamber formed between the cap 2 and the piston 8 within cylinder 5 to prevent the piston 8 from being lifted from its seat by any vacuum created in a reverse direction through inlet 3, as would happen in case the water was drained off through the main supplying water, as in case of a flush valve. The packing sleeve 22 also acts to prevent fluid from leaking out around the stem of relief valve 11 through guide 23. Air can enter through relief valve guide 23 around relief valve member 11, but fluid cannot be expelled by pressure. It will be noted that a vacuum may draw the flexible packing sleeve 22 away from relief valve member 11 and guide 23 while pressure compresses packing sleeve 22 tightly around relief valve member 11 and guide 23.

It will be noted that the flexible sleeve or member 22 disposed across the valve guide and opening in valve cap 2 is adapted to be moved away from valve cap 2 and valve guide 23 by vacuum when exerted from within the pressure chamber in cylinder 5 to allow the ingress of air at atmospheric pressure through the opening in valve cap 2 and valve guide 23. The upper edge of sleeve 22 is freely disposed against cap 2, so that the effects of vacuum may easily withdraw said sleeve 22 from around said guide 23.

If any valve is held open when the water main is drained of water (as in the case of a flush

valve) the contents of the bowl may be drawn into the water main and cause contamination thereof. Any type of flush valve is in reality a mechanically or automatically operated check valve. Therefore, if the valve is opened at the time that the water is being drained from the supply line, or water main, it is necessary to break any syphonic effect by the introduction of air between the water level in the bowl and the valve. The antisiphonic unit 35, as hereinafter described, has been devised to take care of such conditions, and may be built integral with the valve or in a detachable combination as illustrated.

The operation of the antisiphonic unit is as follows:

When the valve is installed in an upright position, and is open at a time when a suction is created in a reverse direction through inlet 3, air passes in the direction shown by line and arrow A, but when water is running through the valve in a normal direction, as indicated by arrow M, then air is drawn through the external inlet tube 33 surrounding adapter nut 28, thence through restriction waist 31, surrounding the reduced outlet insert 32, which is extended to or below the narrowest point indicated as restriction waist 31. It has been found that the weight of the water plus the velocity of the water, passing through cylinder 5 according to the outlet pressure, will overcome the back pressure from the bowl due to the restrictive openings in the structure of the bowl itself and in direct ratio to the air velocity initially created by the suction of the water flow, through cylinder 5 so that, with the ordinary toilet bowl restrictions comprised by the passages into the bowl, water is not forced against the air movement out through the passage indicated by lines and arrows A and B as flexible member 34 is forced radially against the inside of air inlet tube 33. It has been discovered that if the valve is installed in a horizontal position water will at times leak back through the air passage indicated by lines and arrows A and B. To prevent this leakage a flexible expansion member 34 has been provided. This is held in position surrounding the reduced outlet insert 32 and between the valve outlet 4 by adapter nut 28. The flexible expansion member 34 is preferably molded of very soft rubber or may be made of fabric, leather or other flexible material suitable to offer as little resistance as possible to the passage of air and is bell shaped in form. The peripheral edge of expansion member 34 is disposed against the internal wall of air inlet tube 33. The air passing in, as indicated by line and arrow A is not interfered with but, when water is forced upward by back pressure, flexible member 34 is expanded tightly against the wall of external air inlet tube 33, thus preventing water from being forced in reverse direction and spilling out through air passage indicated by lines and arrows A and B. Thus it will be seen that air can be freely admitted through antisiphonic unit 35 but water cannot be expelled through the passage admitting air. The movement of fluid through the outlet side of said valve will therefore be seen to expand or contract flexible member 34 as the case may be.

Coincident with the objects of my invention set forth, the objects of my invention are attained as follows:

The handle 17 provides manual opening means combined with pressure closing means as described.

Mechanical closure is accomplished by the expansion of flexible packing sleeve 22, while a pressure exerted on the end of handle 17 causes a manual closure of the valve.

The sharp edges of valve seats provide self cleaning and positive valve seats.

The tapered rim of the piston concentric to the valve seat 6 causes a tapered off closure by gradual approach of the concentric tapered portion of piston 8 toward valve seat 6.

The timing may be adjusted for the flow of more water or fluid through the valve by limiting the opening movement of piston 8 through the adjustment of adjusting nut 18 and handle 17 by allowing a greater movement of handle before valve starts to open.

A syphonic action when the valve is open is prevented by the provision of an air inlet concentric to the valve outlet.

Additional anti-siphonic provision is made for the valve when in closed position by the provision of an air by-pass formed by the clearance around the stem of relief valve 11, through relief valve guide 23, to allow the ingress of air into pressure chamber formed in cylinder 5 above piston 8, in case a vacuum is formed by siphonic action.

Flexible packing sleeve and cushion 22 will allow air to enter the pressure side of the valve and provides means to prevent fluid from being forced outward through guide 23.

Having described my invention, the purposes thereof, its operation and provisions for meeting the purposes set forth, I claim,

I claim:

1. For use with a combination manual non-syphonic valve, a non-syphonic unit comprising a circumferential air inlet surrounded by an external air inlet tube, including means to allow air to enter around the outlet end of said valve, and positive check valve means to prevent the egress of water through said circumferential inlet.

2. A non-syphonic valve unit, comprising a handle located in continuous alignment with a handle stem, an adjusting nut, a connecting link, a retaining cowl, a relief valve member extending through a guide in a cap, said cap threadedly mounted in alignment with a cylinder, a piston in said cylinder, said relief valve member extending through said piston, a valve seat on said relief valve member adapted to be forced against said piston by an end thrust against said handle, an element on the end of said relief valve member located at the opposite side of said piston, said element adapted to pull said piston toward said cap when said handle is oscillated laterally, a valve seat extended into said cylinder, said valve seat having a sharp edge, and including a shoulder adapted to prevent the imbedment of said sharp edge too deeply into said piston, said piston having a metal shoulder adapted to rest against the shoulder of said valve seat, an inlet opening entering said cylinder at one end of said piston, a self cleaning by-pass assembly located between the inlet passage of said valve and expansion chamber formed by the piston and the closed end of the cylinder.

3. A valve of the nature described, comprising a body having an inlet and outlet, an expansion chamber in said body, a movable valve member at one side of said expansion chamber, a by-pass communicating with said expansion chamber from the inlet side of said valve, a valve seat between said inlet and outlet, a port communicating

with said expansion chamber through said valve member, a relief valve member to close said port in said valve member, said relief valve member having a stem extending through one side of said valve body, a flexible sleeve surrounding the stem of said relief valve, said flexible sleeve forming a packing compressible by fluid pressure against the stem of said relief valve and guide to prevent the egress of fluid from said valve, said flexible sleeve adapted to be retracted by vacuum to allow ingress of pressure into said expansion chamber, a lever attached to said relief valve stem, said lever adapted to be moved laterally to open said valve and to be pushed endwise to close said valve.

4. A flush valve unit having a valve cap and direct mechanical opening means combined with pressure opening means, consisting of a piston having a relief port therethrough, a relief valve extending across and having a stem extending through said relief valve port, the stem extending through said relief valve port having means attached thereto adapted to contact the opposite side of said piston from said portion of the relief valve extending across said relief valve port through said piston, said relief valve having a rubberlike sleeve surrounding a second stem thereof, said second stem extending into the pressure chamber of said flush valve unit, and said rubberlike sleeve coacting with said cap to urge said relief valve toward the relief valve seat of said piston at all times.

5. A flush valve unit as of claim 4, in which the second stem extends through the cap of said flush valve unit, the rubberlike sleeve surrounding the second stem of said relief valve being compressed against the seating portion of said relief valve and the inside of said valve cap, said rubberlike sleeve being retractable from said valve cap when the pressure chamber formed between the piston of said valve and the valve cap of said flush valve unit is subjected to a vacuum, said rubberlike sleeve being compressible to act as a packing under pressure to prevent the egress of fluid from said pressure chamber.

6. A flush valve unit as of claim 4, in which the second relief valve stem extends through the valve cap on said flush valve unit, a link joining said relief valve stem with a handle stem extending slidably through a handle, the end of said handle stem having an adjusting nut thereon to permit of adjustment for longitudinal movement of said handle stem through said handle.

7. For use with a valve of the nature described, a non-siphon attachment comprising a leakproof flexible, bell-like member, held in position surrounding a reduced outlet insert, said leakproof, flexible member being disposed between a valve outlet and a circumferential air inlet tube surrounding the outlet of said valve, said flexible member being composed of rubberlike material adapted to be compressed away from the wall of said circumferential air inlet tube when the outlet passage of said valve is subjected to a vacuum; said leakproof, flexible bell-shaped member adapted to be forced against the internal wall of the circumferential tube surrounding the outlet portion of said valve when fluid pressure is exerted within the passage formed by the outlet passage of said valve in conjunction with the described non-siphon attachment.

8. For use with a valve of the class disclosed by the descriptive matter hereof, a non-siphon unit comprising an external air inlet tube disposed concentrically to an outlet tube portion of said

valve, a space between said outlet tube portion of said valve and said external, concentrically disposed inlet tube, a bell-shaped, flexible member disposed across said space between said outlet portion of said valve and said external, concentrically disposed air inlet tube, said bell-shaped, flexible member adapted to be collapsed by the ingress of air pressure through said space between said outlet tube portion of said valve and said external, concentrically disposed air inlet tube; said bell-shaped, flexible member adapted to be expanded by internal water pressure across said space between said outlet portion of said valve and said external, concentrically disposed air inlet tube.

9. For use with a valve of the class described, a non-siphon device, comprising an expansible and collapsible member disposed within an air inlet consisting of an annular space between an external, concentrically disposed air inlet tube surrounding the outlet portion of a valve of the class described, said expansible and collapsible member subject to expansion by internal pressure to close said annular space and said air inlet tube, said expansible and collapsible member capable of collapse by external pressure to open said annular space comprising said air inlet tube.

10. In combination, a valve comprising a body, an inlet port and an outlet port in said body, a pressure chamber between said inlet and said outlet port in said body, a by-pass passage communicating with said inlet port and said pressure chamber, a piston disposed in said pressure chamber, a relief valve member extending through a port in said piston, said relief valve member loosely attached through said port in said piston, said relief valve extending through said pressure chamber and the wall of said pressure chamber, said relief valve having an enlarged seat portion adapted to seat across said port in said piston, an elastic member disposed around the stem portion of said relief valve extending through said pressure chamber and the wall of said pressure chamber, said elastic member extending across an opening and a relief valve guide in the wall of said pressure chamber, a link attachment connected to said relief valve stem extending through the wall of said pressure chamber, said link attachment attached to a handle, said handle adapted to be moved laterally in any direction to open said valve, said valve adapted to be closed by manual pressure against the end of said handle.

11. A piston for flush valves comprising a reinforcing core of relatively hard material and an outer portion of relatively flexible material, said piston having a substantially cylindrical peripheral wall terminating in outwardly flared lips, said lip portions in their entirety, and also those parts of said peripheral wall closely adjacent thereto, being beyond the ends of said core, whereby when the piston is inserted in a cylinder of a diameter substantially equal to the diameter of the main body portion of the piston the lips are forced inwardly by the wall of said cylinder and said portions of the peripheral wall of the piston closely adjacent to said lips, being unsupported by the reinforcing core, are also forced inwardly, resulting in a clearance space between the piston and cylinder walls closely adjacent to said lips.

12. A piston having a relatively solid cylindrical body portion and having faces at the ends of said body portion, an outwardly flared lip at

an end of said body portion, the outward projection of said lip being of sufficient extent and being sufficiently abrupt that when the piston is inserted in a cylinder of a diameter substantially
5 equal to the diameter of said body portion the flared lip is forced inwardly beyond the end of the body portion and that portion of the cylin-

drical body wall immediately adjacent the lip is also carried inwardly beyond the end of the body portion thereby forming a clearance space between the piston and cylinder walls adjacent to said flared lip.

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