July 12, 1938. W. GLYNN 2,123,356

FLUSH VALVE

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Fig. 1.

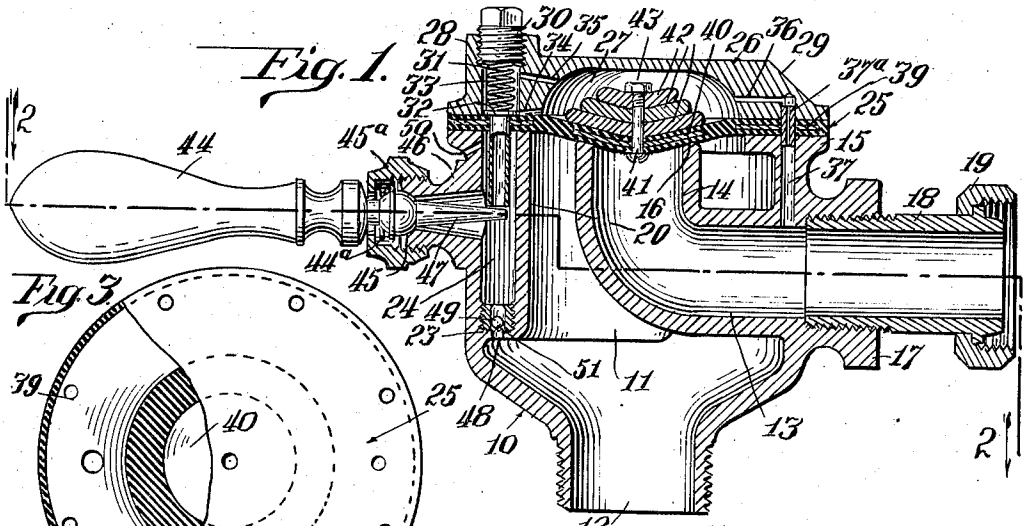


Fig 3

Fig. 2.

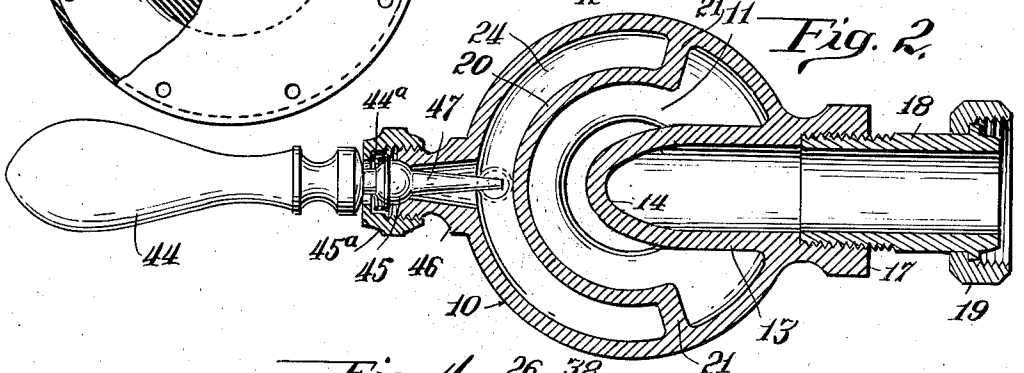
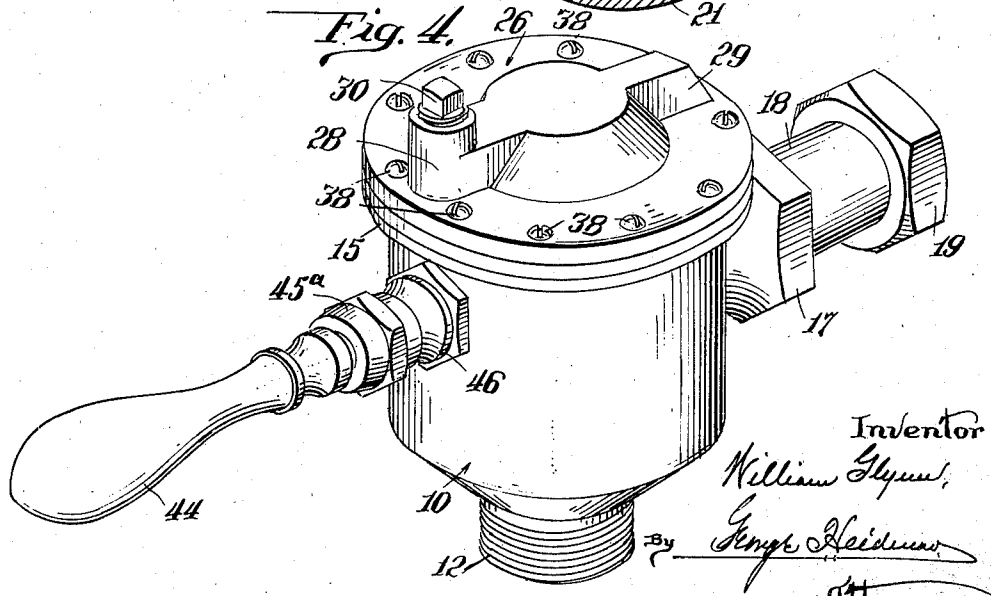


Fig. 4.



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FLUSH VALVE

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4 Claims. (Cl. 137—93)

My invention relates more particularly to a valve adapted to be interposed in a pressure line or water supply pipe adjacent the soil or toilet bowl and has for its object the provision of a construction whereby a complete emptying of the chambers of the valve will be obtained when the flushing operation has been completed and which, in the event of a shutting off of the water supply line, will prevent the resulting vacuum action created in the supply line from causing a siphonage from the soil line or bowl or reverse flow into the supply line and hence will eliminate all possibility of contamination of the water supply in the fresh water lines of the building.

Another object of my invention is to provide a flush valve wherein the water supply is discharged into an encircling chamber connected with the discharge line; and an auxiliary chamber adjacent the outer wall of the valve is also provided which is in constant communication with the outside air.

A further object of my invention is the provision of a flush valve wherein the flow of water is controlled by means of a diaphragm involving regulable means whereby the valve may be readily adjusted to variations or differences in pressures in the supply lines, within prescribed limits, thus adapting my improved flush valve to various localities where differences in water pressure exist.

The above enumerated objects, as well as other objects and advantages inherent in my invention, will be more fully comprehended from the detailed description of the accompanying drawing, wherein:

Figure 1 is a vertical sectional view of my improved valve with the operating handle shown in full lines.

Figure 2 is a cross sectional view taken substantially on the line 2—2 of Figure 1 looking downwardly.

Figure 3 is a detail sectional plan of my improved diaphragm.

Figure 4 is a perspective view of my improved flush valve.

The specific embodiment of my invention, as illustrated in the drawing, comprises a main shell or casing 10 of suitable dimensions and contour and formed to provide a main chamber 11 provided with a central outlet 12 at bottom. Disposed through one side of the shell or casing, and preferably formed integral therewith, is a conduit 13 extending into the chamber 11 and provided with an upwardly disposed end 14 located substantially at the vertical longitudinal axis of the chamber.

The upwardly disposed end 14 terminates slightly below the horizontal plane of the top flanged surface 15 of the main shell or casing 10. The orifice of the upturned end 14 of the conduit portion 13 is preferably made slightly arcuate as shown at 16 in Figure 1, in order to provide a greater seating surface for a diaphragm valve hereinafter described. The conduit portion 13 is shown terminating at its outer end in the angularly surfaced boss portion 17 which is internally threaded to receive the short nipple 18 provided with union 19 whereby the conduit 13 may be suitably connected with a water supply line not shown.

The shell or casing 10 is provided with a preferably arcuate partition 20 disposed a predetermined distance throughout the main wall of the shell or casing and in spaced relation with the upturned end 14 of the conduit 13. The ends of the arcuate partition 20 are integrally united with the main wall of the shell or casing as at 21, 21, see Figure 2, while the bottom of the arcuate partition 20 curves toward and is united with the main wall of the shell or casing at a distance above the outlet as shown at 23 in Figure 1. With the bottom and ends of the partition 20 integrally united with the shell or casing, a segmental chamber is provided which, like the main chamber 11, extends to and is open at the top of the main shell or casing 10.

As previously stated, the top or upper end of the main shell or casing 10 is preferably slightly enlarged or flanged, at 15, and provided with a smooth surface adapted to provide a flat seat for the marginal portion of a flexible disc or diaphragm 25 which is preferably of a diameter substantially equaling that of the top of the main shell or casing. This disc or diaphragm 25 is intended to be firmly clamped in place by the cap or top 26 of the valve.

The cap or top 26 is centrally dished on its underside to provide chamber 27 above the diaphragm, as shown in Figure 1, while the marginal portion is comparatively thick and the upper outside of the cap is provided with enlargements or bosses at 28 and 29 at diametrically opposite points, as more clearly shown in Figure 4. The enlargement or boss 28 and the thick margin of the cap is provided with an opening extending from top to bottom of the cap member; the outer end of the opening being preferably threaded to receive a closure plug 30. The hole or opening through boss 28 and cap member 27 provides a

small chamber 31 which permits upward movement of a plunger valve 32 and in reality constitutes what may be termed a reciprocating chamber to permit upward movement of the plunger valve and to also receive a light coil spring 33, one end whereof seats against the bottom of the closure plug 30 while the other end rests on the flanged top of what has been termed the plunger valve 32.

The plunger chamber 31 has communication with diaphragm chamber 27 in the main portion of the cap by means of a groove 34 arranged in the lower face of the top member 26, extending from plunger chamber 31 to the diaphragm chamber 27; and also by means of a port 35 intermediate of the upper part of plunger chamber 31 and diaphragm chamber 27, all as shown in Figure 1.

The enlargement or boss 29, at the opposite side of top or cap 26, is provided with a port 36 extending from diaphragm chamber 27 and communicating with by-pass 37. The upper end of by-pass 37 is shown provided with a small tubular member 37a intended to extend through a small hole in the diaphragm 25 and ensures communication between port 36 and the by-pass 37 which connects with inlet conduit portion 13.

The inflow of water through inlet conduit 13 is controlled by the diaphragm 25 which is preferably made of rubber or other suitable flexible material and of diameter substantially similar to the diameter of the upper part of the main casting 10 and of the cap or top 26 in order that the diaphragm may be firmly clamped in place when the top or cap 26 is secured in place, as for example, by means of screws as at 38, in Figure 4, arranged at spaced intervals apart circumferentially adjacent the perimeters of the various elements. The rubber diaphragm 25 is, of course, provided with suitable holes adapted to register with the screw receiving holes of the cap and casing; the diaphragm being also provided at proper points with holes for passage of the by-pass element 37a therethrough and of plunger valve 32 therethrough.

In order to properly reenforce the apertured portion and to give the diaphragm proper resistance at its perimeter, I prefer to provide the rubber diaphragm 25 with an annular thin sheet flat faced ring, as at 39 as shown in Figures 1 and 3; which is preferably molded into the rubber as shown and provided with holes for passage of the screws 38; with a hole for the by-pass element 37a; and with a hole to receive the stem portion of plunger valve 32. The diaphragm preferably effects a snug fitting relation with the by-pass element 37a, while the opening for the depending stem portion of the plunger valve 32 is large enough to permit free vertical movement of the plunger valve. The portion of the diaphragm which is intended to seat on the arcuate orifice of inlet conduit 13 is also preferably provided with an annular metallic disc 40 molded into the rubber diaphragm as shown; this disc 40 being preferably slightly dished or concaved to conform to the arcuated orifice of conduit 13 in order to effect a better seal or closure for the inlet conduit 13. A sufficient annular space between the marginal ring 39 and disc 40 is provided to permit the degree of flexing desired in the opening and closing movements of the diaphragm. The center of the diaphragm and the embedded disc 40 are apertured to receive screw-pin 41 which is intended to receive one or more suitable weights 42 in the nature of lead discs of which three are shown arranged in what has been termed the diaphragm chamber 27, namely superposed on the central portion of the diaphragm; the screw pin 41 being provided with a small nut, as at 43, whereby the pin and weights are firmly held in place.

The valve also includes a suitable lever 44, tiltably mounted by means of the ball-and-socket mounting at 45 in the extension or hub 46 formed integral with the valve shell 10 on the side provided with the chamber 24. The hub 46 is provided with a flared passage therethrough through which the inner reduced end 47 of the lever 44 extends and enters chamber 24 immediately beneath the depending stem portion of valve 32. With the ball-and-socket mounting, it is apparent that the hand lever 44 is free to oscillate vertically, causing its inner end to engage the depending stem and force valve 32 upwardly off its seat on the diaphragm 25 and above the port or groove 34 and thereby establish communication between the diaphragm or pressure chamber 27 and the segmental chamber 24. The lever is held in and returned to normal position shown in any suitable manner as by conical spring 44a bearing against a flange on the spherical portion and held in place by the nut 45a. The bottom wall of the segmental chamber 24 is provided with port 48 having a ball check-valve 49 adapted to seat against upward flow through the port while permitting downward flow through the port from segmental chamber 24 into the bottom or discharge end of the main chamber of the valve; the ball 49 being held from closing the bottom of the port in any suitable manner as by small burrs or serrations. The main wall of the shell or casing is provided with a small air port 50, see Figure 1, which communicates with the segmental chamber 24 a slight distance beneath the seat of plunger valve 32.

In practice, the water in the inlet conduit portion 13 passes upwardly through by-pass 37, 37a and port 36 and flows into chamber 27 above the diaphragm 25; and as plunger valve 32 is normally on its seat, outflow from chamber 27 through ports 34 and 35 and into segmental chamber 24 is prevented. The pressure in chamber 27 is built up by the water, in addition to weights 42, so as to firmly hold the diaphragm on the orifice of conduit 13 against the pressure in the supply line and conduit portion 13 and hence will prevent flow of water into the main chamber 11 and out through outlet 12. This condition will maintain until lever 44 is depressed sufficiently to force plunger valve 32 off its seat, thereby allowing the water in chamber 27 to flow through port 34, through the opening in the diaphragm controlled by valve 32 and to flow into segmental chamber 24, from whence it will discharge through port 48 controlled by check-valve 49. With port 48 located in the bottom of the chamber 24, this chamber will completely empty into the lower or discharge end of the main chamber 11, because the ball check-valve is held against seating at the discharge orifice of the port 48 by the small upwardly disposed burrs or serrations, indicated at 51. With the pressure on top of diaphragm 25 released, the intermediate portion of the diaphragm will immediately flex upwardly from its seat on the orifice of conduit portion 13 due to the pressure of the water supply and produce a flushing action; the water rapidly discharging

from chamber 11 through outlet 12 connected with the toilet or other soil bowl.

As soon as lever 44 is released, it will return to normal position, allowing plunger valve 32 to again seat itself—such action being aided by spring 33—closing off port 34 and allowing the water pressure to again build up in pressure chamber 27—the water being admitted through by-pass 37. When the pressure on the diaphragm is sufficient to overcome the pressure therebeneath, further discharge from conduit portion 13 will be discontinued.

With the auxiliary or segmental chamber 24 located adjacent the outer wall of the valve, it is apparent that said chamber may be in constant communication with the outer air.

Should occasion arise for shutting off the water supply in the feed line for purposes of repair, the very undesirable and serious conditions which heretofore have been encountered will be impossible with my improved valve. When the supply line is shut off to enable repairs to be made, a vacuum is set up in the line which, with valves as heretofore constructed, induced a siphonage from the toilet or other soil bowl because the vacuum caused a lifting of the diaphragms and allowed the soil or contaminated water to pass into the inlet or supply pipe. As the supply line also connects with the lavatory and drinking water faucets, contamination of the water after the supply was turned on resulted with very serious consequences.

It is apparent from my improved valve that all possibility of such siphonage is entirely eliminated because any vacuum action set up in the feed line when the supply has been shut off and the line drained will lift the plunger valve 32 off its seat on the rubber diaphragm and allow the air entering through port 50 to pass about the plunger valve and into the pressure chamber 27 through ports 34, 35, thereby preventing any siphonage from the soil connection up through auxiliary chamber 24, and into chamber 27. Air port 50 is preferably of much larger capacity than that of by-pass element 37a and hence causes a building up of air pressure in pressure chamber 27.

As shown in Figure 1, plunger valve 32 consists of a thin disc which seats on the rubber diaphragm and a thin tubular guide stem which depends through the opening in the diaphragm, while a very light spring 33 is employed intended merely to ensure return of the valve to seating position.

With the plunger valve so constructed any slight degree of vacuum set up in the feed line and hence in the pressure chamber 27 will, by reason of the port 35 at the upper end of the plunger valve chamber 31, lift the valve 32 off its seat against the light spring 33; and as the disc portion of the valve 32 has free movement in the chamber 31, the air will pass around the valve.

As previously stated, in order to adapt the valve to variations in supply pressures, the pressure resistance of the seating portion of the flexible diaphragm valve may be regulated by the addition or removal of the weights 42.

The weights on the diaphragm at all times must be heavier than the weight of plunger valve 32 and the action of its spring 33, with the result that any vacuous action set up in pressure chamber 27 will cause plunger valve 32 to be lifted off its seat before the vacuous action can become effective on the diaphragm; and after plunger valve 32 has been lifted the incoming air through port 50 will, of course, prevent any upward movement of the diaphragm.

The exemplification of my invention as disclosed in the drawing is believed to be a simple embodiment but modifications are possible without departing from the spirit of the invention as expressed in the appended claims.

What I claim is:

1. A flush valve comprising a main shell defining a chamber provided with an outlet in its bottom; a water inlet whose orifice is disposed upwardly in the chamber; an auxiliary chamber provided with an air port and with an outlet in its bottom; a check-valve for said outlet closable against upward flow through said outlet; a top member adapted to be removably secured on the shell and formed to provide a chamber above the water inlet; a flexible diaphragm adapted to be clamped in place between said top member and the main shell and to seat on the water inlet orifice; a valve chamber in the top member adapted to have communication with the auxiliary chamber and arranged in communication with the chamber in said top member; a by-pass between the water inlet and the chamber in said top member; a loosely mounted valve intermediate of said valve chamber and said auxiliary chamber adapted to control the communication between the chamber in the top member and said auxiliary chamber; and an operating lever for moving said loosely mounted valve off its seat.

2. A flush valve of the character described comprising a shell or casing having a main chamber with an outlet, an auxiliary chamber provided with an outlet in the bottom thereof, a normally open check valve for controlling inflow through said outlet, and a water supply inlet disposed upwardly in the main chamber; a top member formed to provide a pressure chamber therein, a diaphragm between the shell and the top adapted to control said supply inlet; a by-pass between the water supply and said pressure chamber; a passage between said last mentioned chamber and said auxiliary chamber; a normally closed vertically movable valve in said auxiliary chamber for controlling communication between said passage and said auxiliary chamber; means whereby said last mentioned valve may be controlled; and an air port in the shell or casing beneath the seat of said last mentioned valve for admitting air into said auxiliary chamber and of capacity greater than said by-pass whereby air is admitted into the pressure chamber when pressure in the supply inlet is less than the external pressure.

3. A flush valve comprising a main shell defining a chamber provided with an outlet in the bottom; a water inlet conduit extending through the shell with its discharge orifice disposed upwardly and spaced from the walls of the chamber; an auxiliary chamber in said shell provided with an outlet port in its bottom communicating with the main chamber; a check-valve in said port adapted to prevent inflow through said port; a resilient diaphragm arranged on the upper surface of said shell and adapted to close the discharge orifice of said conduit; a top dished on its lower face and having a flat perimetrical portion coinciding with the top of the main shell adapted to seat on the marginal portion of said diaphragm and thereby clamp the latter in place, the dished portion of the top constituting a pressure chamber above the diaphragm, the top adjacent its perimeter being also provided with a

vertically disposed socket; a valve movable upwardly in said socket for controlling communication between said auxiliary chamber and the pressure chamber whereby the pressure medium is caused to discharge from the pressure chamber into the auxiliary chamber and the discharge from the inlet conduit permitted; means whereby air is admitted to the pressure chamber when the water supply has been shut off; and means whereby said last mentioned valve may be moved off its seat.

4. A flush valve comprising a casing provided with a chamber having an outlet in the bottom; a water supply conduit arranged concentrically in the casing with an upwardly disposed orifice; an auxiliary chamber disposed about the first mentioned chamber and provided with an air port in its side and with an outlet port in its bottom communicating with the first mentioned chamber; a ball-valve arranged at the outlet port in the bottom of the auxiliary chamber and closable against inflow from the first mentioned chamber; means for preventing seating of the ball-valve in the direction of outflow from said auxiliary chamber; a top member removably secured on the casing and formed to provide a pressure chamber; a flexible diaphragm between the casing and the top member adapted to close the water inlet; a by-pass between the water supply conduit and the pressure chamber in the top member; a port between the auxiliary chamber and said pressure chamber at a point above said air port; a vertically movable plunger valve at the upper end of the auxiliary chamber for controlling said air port and the port between the auxiliary chamber and the pressure chamber, said plunger valve being adapted to admit air through said air port and into said pressure chamber when the pressure in the water supply conduit is less than the external pressure; regulable means for normally moving the plunger valve to closed position; and manually operated means for moving said plunger valve to port opening position.

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