

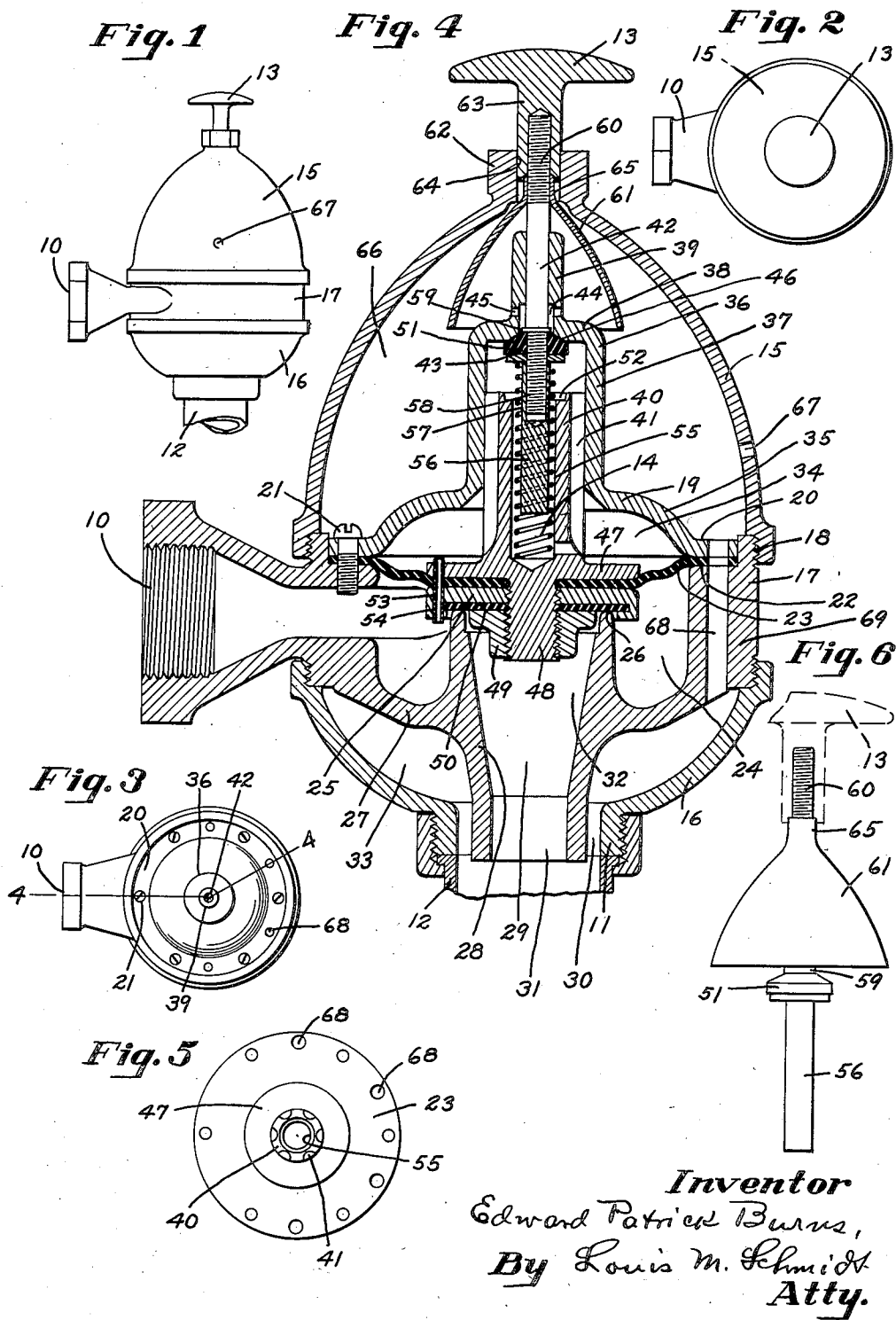
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FLUSH VALVE

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UNITED STATES PATENT OFFICE.

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FLUSH VALVE.

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To all whom it may concern:

Be it known that I, EDWARD PATRICK BURNS, a citizen of the United States, residing at New Britain, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Flush Valves, of which the following is a specification.

My invention relates to improvements in flush valves, for use with water-closets, of the form generally corresponding to that of the flush valve shown and described in my application filed April 12, 1921, Serial No. 460,794, and the object of my improvement is simplicity and economy in construction and convenience and efficiency in use.

In the accompanying drawing:—

Figure 1 is a side elevation of my improved flush valve.

Figure 2 is a plan view of the same.

Figure 3 is a plan view with the casing cover removed.

Figure 4 is a sectional view on an enlarged scale of the entire structure on the line 4—4 of Fig. 3.

Figure 5 is a plan view of the main valve structure.

Figure 6 is a side elevation of the auxiliary valve structure, the stem that it is mounted on, and the hood or watershed that is carried by said stem, the operating handle being indicated by broken lines.

My improved flush valve comprises a generally pear-shaped casing structure having the water inlet 10 at one side, having at the lower end a downwardly extending nipple 11 that is exteriorly screw-threaded for connecting with the outlet pipe 12, and being provided at the upper end with the knob-like handle 13 that is depressed to operate the valve, automatic means involving the use of a spring 14 serving to restore said handle 13 to the normal, elevated position.

Structurally said casing structure comprises for the exterior a casing cover part 15 at the upper end, a base part 16 at the lower end, and the casing body part 17 intermediate said first mentioned parts, co-operating screw-threaded portions 18 of suitable form serving as the means of inter-connecting said parts.

The inlet connection 10 is made integral

with the casing body part 17 and the nipple 11 for connecting with the outlet pipe 12 is made integral with the base part 16.

As a part of the fixed casing structure there is provided in the interior a part that is designated as the water chamber top 19 that is positioned on the upper side of the body part 17 and is secured thereto by means of a flange-like annular border portion 20 through the medium of the screws 21. Said annular border portion 20 serves as a seat, is opposed to a similar seat 22 on the body part 17, and interposed between said seats 20 and 22 is the edge portion of a circular diaphragm 23, which may be made of any suitable material, such as metal or rubber.

The diaphragm 23 bridges generally the upper portion of the body part 17 and serves as the top wall of the main valve chamber 24, the latter being connected with the inlet 10.

The main valve 25 is fixedly connected with the middle portion of the diaphragm 23, on the lower face thereof, and is raised and lowered relatively to the valve seat 26 to correspond to the movements of said diaphragm.

The casing body part 17 extends generally across the lower side of the valve chamber 24 so as to provide the fixed, lower wall 27 therefor, which wall 27 is of annular form, extending around the main valve seat 26.

Extending downwardly from the valve seat 26 and supported by said annular wall 27, is the tubular structure 28 that encloses the main discharge passage 29.

Said tubular structure 28, it will be noted, extends through the nipple 11 and terminates appreciably below the lower end thereof; is separated from the opposed border wall of said nipple 11 by an annular space 30; and is generally in the form of a nozzle or jet, after the manner of an injector, with the lower end portion 31 of the discharge passage 29 appreciably smaller in diameter than the upper end portion 32, adjacent the valve seat 26.

The annular space 30 mentioned serves as the discharge passage or drain passage from the drainage chamber 33 that is provided on the lower side of the annular wall 27,

being intermediate said annular wall 27 and the casing base part 16.

On the upper side of the diaphragm 23 and between the same and the general structure of the water chamber top 19 is the water chamber 34.

Said water chamber top 19 comprises just inside the border and seat portion 20 a curved, dome-shaped portion 35 that extends generally inwardly and upwardly from said seat portion 20 and is surmounted by the axially positioned tubular structure 36.

The tubular structure 36 comprises a lower portion 37 of relatively large diameter, an inwardly directed end wall 38 at the upper end of said lower portion 37, and an upper portion 39 of appreciably smaller diameter extending upwardly from said end wall 38.

The lower portion 37 is of uniform diameter and operates as a cylinder for the piston-like stem 40 of the main valve 25, which stem is fluted or corrugated so as to provide longitudinal passages 41 for water.

The upper and major portion of the upper portion 39 has a bore that is an operative fit for the rod 42 that serves as the valve stem for the auxiliary valve 43. The bore 44 at the lower end of said upper portion 39 is slightly enlarged, so as to provide clearance for the rod 42 for water and the side wall of said enlarged portion or bore 44 is provided with a plurality of perforations 45 for the escape of water.

The corner 46 at the junction of the upper portion 39 and the end wall 38 serves as a valve seat for said auxiliary valve 43.

The auxiliary valve 43, as described, is operative to control the outflow of water from the water chamber 34.

The piston-like stem 40 is provided with a laterally extending flange adjacent the lower end so as to provide a relatively large head 47 for being seated on the diaphragm 23 and is extended downwardly axially in the form of a threaded nipple 48 for receiving the nut 49, the main valve 25 being interposed between said head 47 and nut 48.

The main valve 25 may be provided with contacting washer 50 of yielding material for cooperating with the valve seat 26.

The auxiliary valve 43 is also provided with a contacting washer 51 of yielding material.

The upper end of the piston-like stem 40 is chambered, as shown at 52, to house the lower end portion of the auxiliary valve 43 when the main valve 25 and connected parts are in the extreme upper position.

The water chamber 34 is connected at all times with the water supply by a restricted passage in any proper manner, the means for effecting such connection in the present instance being provided by means of a small tube 53 that is housed in a suitable continu-

ous perforation 54 in superimposed portions of the head 47, diaphragm 23, and main valve 25.

The piston-like stem 40 has an axial bore 55 that is open at the upper end and serves as a spring chamber for housing the spring 14, which spring is of coil form.

The upper and major portion of the spring 14 encloses a spring guide 56 that extends downwardly from the auxiliary valve 43 and that also serves as the means for holding said valve 43 on the rod or stem 42, the upper end portion 57 being longitudinally bored and screw-threaded to cooperate with the threaded lower end portion 58 of said rod or stem 42. A diminutive shoulder 59 on said rod 42 limits the upward movement of the valve 43 along said rod 42.

The upper end 60 of the rod 42 is screw-threaded and certain parts are mounted thereon, comprising the handle 13 that is exposed and accessible on the outside of the casing cover part 15 and a special device 61 designated as a water-shed device or umbrella that is housed within said cover part.

The casing cover part 15 is surmounted by a boss 62 that is perforated to provide an operative fit for the cylindrical body part 63 of the handle 13.

The perforation or bore 64, provided as mentioned, serves as a guide for the handle 13 and the upper end portion 60 of the rod 42 on which it is mounted, some portion of the body part 63 of said handle 13 being housed therein under normal conditions of operation.

The fit, however, between the opposed parts of the handle 13 and the boss 62 is relatively loose, such as would permit of the escape of water under certain conditions of operation and in order to overcome this condition I provide the umbrella 61, mentioned above.

Said umbrella 61 is dome shaped or approximately conical, with a supporting nipple 65 at the upper end for engaging with the rod 42, and extends downwardly below the perforations 45 that serve as the means of escape of the water from the water chamber 34, being made of sheet metal or any other suitable material.

The casing cover part 15 is dome-shaped and provides an air chamber 66 immediately exterior to the water chamber 34 and which is operative to receive the water that is ejected from said water chamber through the perforations 45.

One or more perforations 67 may be provided in the side wall of the casing cover part 15 to admit air and maintain atmospheric pressure in the interior.

In order to drain water that may be admitted to the air chamber 66 one or more connecting passages 68 are provided leading to the drain chamber 33. As shown, said pas-

sages alternate with the holding screws 22 and are in the form of continuous openings that pass through the material of the flange 20 of the water chamber top 19, the diaphragm 23, and the solid material 69 at the border of the casing body part 17.

In use, the drainage of the air chamber 66 is accelerated by the aspirator effect produced by the discharge from the main discharge passage 29, which is relatively restricted, as described, and terminates slightly below the adjacent and concentric discharge outlet 30 for the drain chamber 33.

In use, the main valve 25 and the auxiliary valve 43 are normally closed; water is admitted to the valve chamber 24 below the diaphragm 23 and exterior to the valve seat 26 and the discharge passage 29; the water chamber 34 is filled with water, the water being retained therein by the auxiliary valve 43, which is held in the closed position; and the air chamber 66 is in the drained condition.

The spring 14 tends to hold both valves in the closed position and the water pressure also cooperates to effect this result.

To operate the device, the knob-handle 13 is depressed, so as to unseat the auxiliary valve in opposition to the spring 14, the operation of the handle being momentary only. Thus the water chamber 34 is relieved of the water pressure, the water pressure on the under side of the diaphragm lifts the latter and opens the main valve, the water from the water chamber 34 escaping through the perforations 45.

The movement of the main valve 25 is also in opposition to the spring 14.

The release of the handle is followed by the seating of the auxiliary valve 43, which interrupts the further escape of water from the water chamber 34. This condition is followed by the re-filling of the water chamber from the water supply through the medium of the restricted passage provided by the tube 53.

The dimensions of said tube 53 determine the rate of such re-filling.

As the re-filling described continues the main valve is being brought to the closing position by the downward movement of the diaphragm, the parts being constructed and arranged to effect such closing gradually, according to predetermined conditions.

As shown, the valve 25, designated as the main valve, is provided with an upwardly directed piston-like stem 40 and the latter is operatively housed in a cylinder structure 37 that is provided in the structure of the water chamber top 19, and, also, the stem 40 and the cylinder 37 are appreciably elongated so as to provide a proper guiding effect for the main valve 25.

In use, the diminutive chamber 52 in the upper end of the piston-like stem 40 and

which is adapted to house the lower end portion of the auxiliary valve 43, serves as a bumper for said auxiliary valve 43 or contacting member for actuating the same responsive to upward movement of the main valve 25 and its stem 40.

It will be noted that the coil spring 14 is appreciably elongated. This spring is relatively light and operates merely as a positioning spring for the valves, without forcibly seating the valves.

The seating of the auxiliary valve 43 is effected substantially instantaneously after the knob has been depressed, whether the hand is removed therefrom or not, such action following because of the relatively large area of the diaphragm primarily and because of the detail of the contacting of the stem 40 and the auxiliary valve 43, as described, the action being positive notwithstanding any pressure that may be applied to the knob 13 under normal conditions.

It will also be noted that the spring 14 has the lower and major portion housed in the spring chamber 55 that is provided in the main valve stem 40 when in the expanded position and when in the compressed position it is fully housed therein, as in the latter position the auxiliary valve structure 43 serves as a closure for said spring chamber 55. Also, the lower end portion of the auxiliary valve structure 43 is housed in the diminutive contacting chamber 52. The auxiliary valve structure 43, as described, bridges the open end of the spring chamber 55 and extends outwardly laterally on all sides beyond the spring, having an annular face that is opposed to the upper end portion of the stem 40, the two opposed annular faces surrounding the spring.

I claim as my invention:—

1. In a flush valve, a casing having an inlet and an outlet, mechanism housed within said casing comprising a main valve and a pilot valve, an annular seat for said pilot valve and a tubular structure extending upwardly from said seat, the lower portion of said tubular structure being chambered and laterally perforated for the passage of water, a stem for said pilot valve extending upwardly through said tubular structure, said stem fitting and substantially filling the bore of the portion of said tubular structure that is above said lower portion, and said tubular structure being a fixed part of the casing structure.

2. In a flush valve as described in claim 1, said casing having an opening above and in line with said tubular structure, and a knob, slidable in said opening, mounted on said stem.

3. In a flush valve as described in claim 1, said casing having an opening, a knob mounted on said stem and slidable in said opening, and a watershed mounted on the

portion of said stem intermediate said tubular structure and knob.

4. In a flush valve as described in claim 1, a watershed mounted on said stem, and
5 said watershed extending downwardly below the said lower portion of the tubular structure.

5. In a flush valve having a pilot valve, a tubular structure having a laterally directed outlet passage for water, and a watershed extending outside said structure in the form of a pendant structure directly opposed to said outlet passage.

6. In a flush valve, a casing part having
15 an open interior that is provided with an upwardly directed main valve seat, a diaphragm extended across said part and serving to support a main valve for cooperating with said seat, a second casing part positioned on the upper side of said first casing part, above said diaphragm, and having a seat for a pilot valve, a pilot valve having a stem, a stem for said main valve on the upper side of said diaphragm, and said second casing part having guide means for each of said stems.

7. A flush valve having an inner casing and an outer casing that have upper walls that are opposed and in spaced relation, the upper wall of said inner casing having a laterally directed pilot opening, a valve for said opening having a stem, and a watershedding device supported by said stem in pendant position so as to overhang said opening.

8. A flush valve casing structure comprising an interior casing composed of a lower main part and an upper part, said parts having flange-like border portions that are
40 opposed one to the other, a diaphragm interposed between said border portions, said lower main part having a laterally disposed inlet and a downwardly directed outlet, a shell-like air chamber casing mounted upon the upper side of said lower main part and provided at the upper end with an opening for a tripping device, and a drainage chamber structure secured to the lower side of said lower main part and having a discharge opening concentric with said outlet.

9. A flush valve having an inner casing that is provided with a downwardly directed outlet and an outer casing that is provided with a downwardly directed outlet, the walls of said outlet being fixed and rigid and arranged concentric one with the other.

10. In a flush valve, a casing comprising an interior casing structure that has a downwardly directed main discharge outlet at the lower side and a pilot opening at the upper end portion, a dome-shaped air chamber structure enclosing the upper portion of said interior casing structure, a drainage chamber structure enclosing the lower portion of said interior casing structure and having an

outlet adjacent said main discharge outlet, and said casing having a plurality of connecting passages distributed around said interior casing structure that connect said air chamber and drainage chamber structures.

11. A flush valve as described in claim 2, the part of said exterior casing structure that is above said interior casing structure having one or more perforations in the side wall.

12. A flush valve comprising an interior casing structure housed within an exterior casing structure, said interior casing structure being provided with valve operating devices and having an inlet and an outlet, said interior casing structure having an opening in the side wall that operates as a relief passage for admitting water to the exterior casing structure under operating conditions, the exterior casing structure having a discharge passage for such water, and the outlet for the interior casing structure being projected into said discharge passage, whereby the main flow of water through the outlet will accelerate the drainage of the exterior casing by reason of the aspirator effect of such flow.

13. A flush valve as described in claim 12, the part of the exterior casing structure remote from said discharge passage having a perforation in the side wall.

14. A flush valve as described in claim 12, an umbrella guard device being provided in the exterior casing structure, enclosing said opening, for directing water away from the exterior wall.

15. A flush valve having a casing that is provided with an inlet and an outlet, a diaphragm extended across the interior of said casing, above said inlet and outlet, a main valve supported from the under side of said diaphragm, mechanism for operating said main valve and means for guiding said main valve, and said mechanism and said means being both positioned on the upper side of said diaphragm, the means for guiding the valve comprising a stem that is rigidly secured to said main valve.

16. In a flush valve, a casing having an interior enclosed structure that is divided by a diaphragm into a lower main valve chamber and an upper water chamber, a main valve supported by said diaphragm and having a stem projecting upwardly into said water chamber, the upper wall of said water chamber having a vent opening above said stem that is bordered by a valve seat that is positioned above said stem, an auxiliary valve for said seat, a spring intermediate said valves, said stem being appreciably elongated, and the portion of said upper wall that is opposed to and adjacent said stem being in the form of a cylinder for guiding said stem.

17. In a flush valve as described in claim 16, said stem having a chamber for housing the lower and major portion of said spring.

18. In a flush valve, a discharge outlet that is bordered by a valve seat, a diaphragm sub-dividing the interior of said casing into an upper and a lower chamber, a main valve supported from said diaphragm, positioned on the under side of said diaphragm, and cooperating with said seat, a diminutive passage serving to inter-connect said upper and lower chambers, said main valve being provided with a laterally projecting extension that overhangs said seat, and said passage being provided in said overhanging extension.

19. In a flush valve as described in claim 18, a tube serving as the means for providing said diminutive passage, said tube being housed in registering openings in said valve structure and diaphragm.

20. In a flush valve, a casing, a diaphragm subdividing said casing into an upper and a lower chamber, a disc-like main valve structure mounted on one face of said diaphragm, a stem structure mounted on the opposite face of said diaphragm and connected by means projecting through said diaphragm to said valve structure, an an-

nular flange on said stem structure opposed to the outer portion of said valve structure, and a diminutive connecting passage between said chambers being provided by means of registering openings in said flange, diaphragm, and valve structure.

21. In a flush valve as described in claim 20, a lining for said registering openings being provided in the form of a tube that is housed therein.

22. In a flush valve, a diaphragm of flexible material supported to permit of limited movement of the middle portion thereof, metal parts mounted on said middle portion, a diminutive passage connecting the opposite sides of said diaphragm and positioned in opposed portions of said metal parts and diaphragm, and said passage being provided with a lining in the form of a piece of metal tubing.

23. In a flush valve, an interior casing part having a pilot opening, a pilot valve housed within said part and having an upwardly projecting stem, and a tubular extension of said casing part projected above said opening that serves as a guide for said stem.

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