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FLUID PRESSURE ACTUATED DIAPHRAGM VALVE WITH HUSH TUBE

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2 Sheets-Sheet 1

Fig. 1

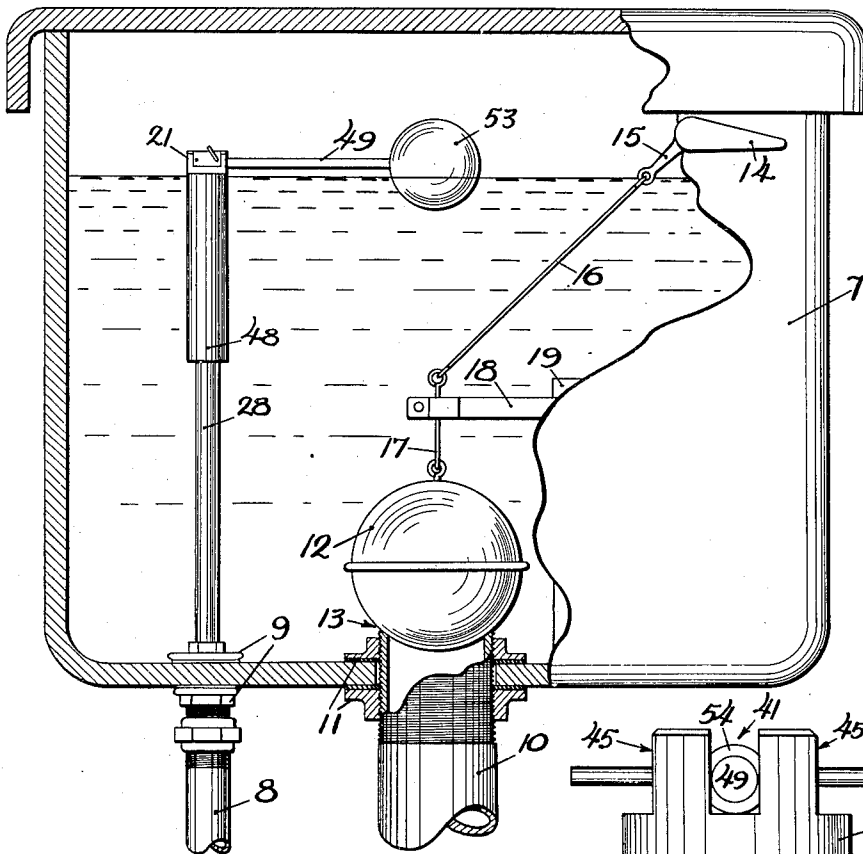


Fig. 2

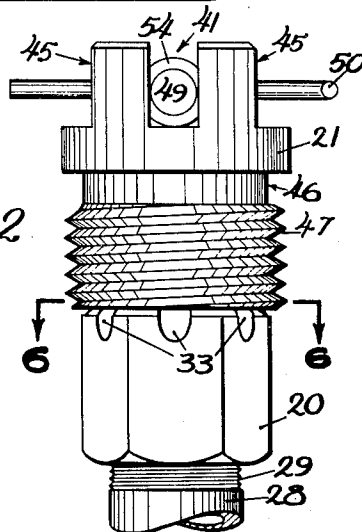
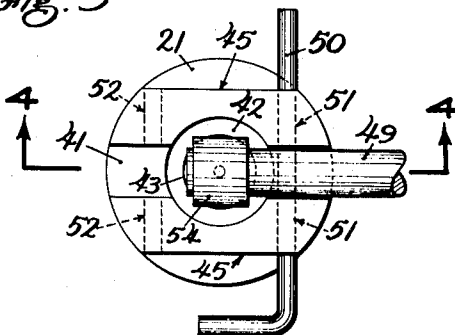


Fig. 3



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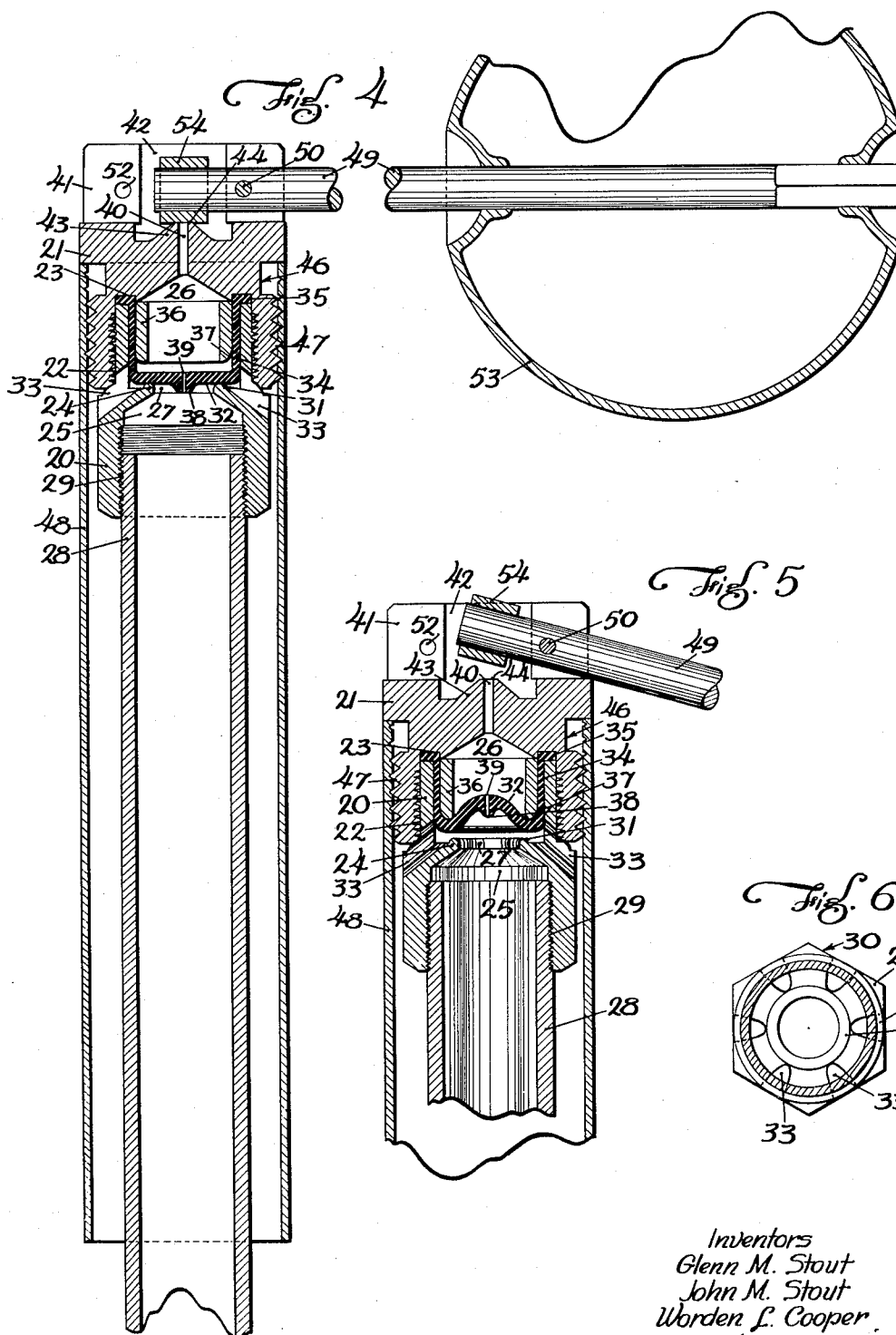
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1

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FLUID PRESSURE ACTUATED DIAPHRAGM VALVE WITH HUSH TUBE

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5 Claims. (Cl. 251-118)

Our present invention relates to improvements in fluid pressure actuated valves.

An object of this invention is to provide a valve that is opened and closed by automatic means, without a bodily movable part, that is entirely within the body member of the valve and said automatic means being externally controlled.

A further object of this invention is to provide a valve that is extremely simple, compact, positive and quiet in its action, without a part or parts that will wear excessively and get out of adjustment, and the valve proper is capable of being installed as a self-contained unit, thus eliminating danger of error in installation.

These and other objects of the invention will be apparent from the following description and the accompanying drawings.

To the above end, generally stated, the invention consists of the novel devices and combination of devices hereinafter described and defined in the claims.

In the accompanying drawings, which illustrate one embodiment of the invention, like characters indicate like parts throughout the several views.

Referring to the drawings:

Fig. 1 is a fragmentary view partly in front elevation and partly in section showing the flushing tank of a water closet and associated parts in which the improved valve is embodied;

Fig. 2 is an elevational view of the improved valve with the silencing tube removed, on an enlarged scale;

Fig. 3 is a plan view of the valve as shown in Fig. 2;

Fig. 4 is a view principally in section taken on the line 4-4 of Fig. 3 and showing the valve closed;

Fig. 5 is a view corresponding to Fig. 4, with the exception that the valve is open; and

Fig. 6 is a view partly in plan and partly in section taken on the line 6-6 of Fig. 2.

For the purpose of showing the improved valve as the same would appear in an actual installation, there is shown in the drawings the cover-equipped flushing tank 7 of a water closet, not shown. A water pipe 8, leading from any suitable source of supply under pressure, is attached at its delivery end to fittings 9 secured in the bottom of the tank 7. The intake end portion of a drain pipe 10 that leads to the water closet extends into the tank 7 at the bottom thereof and is secured thereto by fittings 11. This drain pipe 10 is normally closed by a ball 12 that rests on an annular seat 13 formed on the end of the drain pipe 10 that extends into the tank 7. To flush the water closet, the ball 12 is manually lifted from its seat 13 by a handle 14 turnably mounted in the front member of the tank 7 and has on the inside of said tank a crank arm 15. A link 16 connects the crank arm 15 to the upper end of an upright stem 17 flexibly attached to the top of the ball 12 and works in a guide arm 18 on a post 19 secured to the tank 7 at the bottom thereof.

The parts thus far described in detail are all of well known construction and have been shown simply to illus-

2

trate one of the many installations of which the improved valve is capable.

Referring now in detail to the improved valve which includes a body member 20 and a cap 21 therefor connected by screw-threads 22: The cap 21 has in its under side an annular channel 23. The body member 20 is tubular and has therein a transverse partition 24 that divides said body member into an intake chamber 25, open at its lower end, and an upper pressure chamber 26, the upper end of which is closed by the cap 21. In the center of the partition 24 is a large passageway 27. The top of the intake chamber 25 is tapered to the passageway 27.

The valve body member 20 is mounted on the upper end portion of a water pipe section 28 which extends into the open lower end portion of the intake chamber 25 and is connected to said body member by screw-threads 29. The pipe section 28, at its lower end portion, is screwed into the fittings 9, supported therefrom and forms an extension of the water pipe 8. The external lower end portion of the body member 20 is hexagonal, as indicated at 30, for the application of a wrench for use in mounting said body member 20 on the pipe section 28.

On the upper side of the partition 24, surrounding the passageway 27, is an annular bead-like seat 31 for a closure member 32, for said passageway. In the walls of the body member 20, above the partition 24, is a plurality of circumferentially spaced discharge ports 33. The intake ends of the discharge ports 33 are at the upper surface of the partition 24 and are outwardly and downwardly inclined therefrom. The closure member 32 is in the form of a horizontally disposed disk that rests on the seat 31 and closes the passageway 27. This closure member 32 has at its perimeter an integral upstanding tubular retaining member 34. This closure member 32 and its retaining member 34 are cup-shaped and made of molded flexible rubber. It is important to note that the closure member 32 is relatively thick and its retaining member 34 is relatively thin and very flexible. Integral with the upper end of the retaining member 34 is an external annular flange 35 that extends into a channel 23 in the upper end of the body member 20 and clamped between said upper end and the cap 21 to form a water-tight joint. This flange 35 securely holds the retaining member 34 with the closure member 32 in its proper relation to the seat 31.

Within the retaining member 34 is an anti-collapse tube-like ring 36 that holds said retaining member pressed against the inner walls of the body member 20. The lower end of the anti-collapse ring 36 is spaced above the partition 24 and the discharge ports 33 and its lower outer edge portion is rounded at 37. That portion of the retaining member 34 at the periphery of the closure member 32 permits, by flexing, the opening and closing of the closure member 32 or the buckling thereof. On the under side of the closure member 32, as an integral part thereof, is a deflecting boss 38 at the axis of said closure member. An inlet port 39 extends axially through the closure member 32 and the boss 38. The purpose of the deflecting boss 38 is to prevent dirt from entering the port 39. An outlet port 40 extends through the cap 21 at the axis thereof and the under side of said cap is tapered to said outlet port. It is important to note that the fluid-conducting capacity of the inlet port 39 is a great deal less than that of the outlet port 40. The purpose of the difference in the conducting capacity of the two ports 39 and 40 is to permit the fluid in the pressure chamber 26 to be expelled much faster than the inflow of liquid through the port 39. This permits the greater pressure of fluid from the intake chamber 25 to flex the retaining member 34 and buckle the closure member 32 to open the passageway 27 to the discharge port 33.

In the top of the cap 21 is a deep radial channel 41 and at the axis of said cap is a round hole 42 that is deeper than the channel 41. The diameter of the hole 42 is considerably larger than the width of the channel 41. On the bottom of the hole, at the axis thereof, is a truncated cone 43 that is an integral part of the cap 21 and through said cone the outlet port 40 extends. The top of the cone 43 affords a seat 44 for a seal that closes the outlet port 40, as will presently appear. The purpose of the cone 43 is to prevent dirt or other foreign matter from lodging on the seat 44.

The sides of the cap 21, opposite the channel 41, are flattened at 45 for the application of a wrench for use in applying the cap 21 to the body member 20. A circumferentially extended annular channel 46 is formed in the cap 21 at its intermediate portion. On the cap 21 below the channel 46 is a coarse external screw-thread 47. The section of the cap 21 between the channels 41 and 46 is of a larger diameter than the threaded portion 47.

A silencing or hush tube 48 surrounds the body member 20 and the upper portion of the water pipe section 28 and is spaced outwardly therefrom. The upper end portion of the tube 48 is attached to the cap 21 by the screw-thread 47, with its upper end engaging the cap 21 on the upper side of the channel 46 and holds said tube suspended from the cap 21. Water from the discharge ports 33 strikes the inner surface of the silencing tube 48 and flows downwardly thereon and into the tank 7.

One end portion of a float arm 49 extends endwise into one end portion of the channel 41 and is attached to the cap 21 by a long pivot pin 50 for vertical swinging movement. This pivot pin 50 extends through a pair of aligned holes 51 in the cap 21 between the hole 42 and the outer side of the cap 21. A second pair of aligned holes 52, similar to the holes 51, extend through the cap 21 on the opposite side of the hole 42 from the holes 51. The purpose of the second pair of aligned holes 52 is to permit the float arm 49 to be attached to the cap 21 in reverse order from that shown. On the outer end of the float arm 49 is a float 53 and on the inner end thereof is a seal 54 for closing the outlet port 40. This seal 54, as shown, is a rubber sleeve encircling the float arm 49. When the water level in the tank 7 is up to normal, the float 53 holds the float arm 49 with the seal 54 pressed onto the seat 44 and thereby closes the outlet port 40.

It will be noted that when the closure member 32 is on its seat 31 and closing the passageway 27, the area of its upper side exposed to water pressure in the pressure chamber 26 is materially larger than the area of its under side exposed to water pressure in the passageway 27. These unequal water pressures on the closure member 32 securely hold said closure member on its seat 31, see Fig. 4. When the closure member 32 is open, as shown in Fig. 5, the area of its upper side is materially reduced by the anti-collapse ring 36 with which the closure member 32 is in contact, and the entire area of said closure member is exposed to water pressure from the inlet chamber 25.

When the handle 14 is manually operated to lift the ball 12 from its seat 13 to drain the tank 7 and flush the water closet, the float 53 moves downwardly with the lowering water level and lifts the seal 54 from its seat 44, opens the outlet port 40 and thus releases water pressure on the upper side of the closure member 32 that holds the same closed. Lowering of the float 53 is limited by the engagement of the float arm 49 with the cap 21 at the bottom of the channel 41. With the water pressure on the upper side of the closure member 32 released, the water pressure on the under side thereof upwardly buckles the closure member 32, lifts the same from its seat 31 and opens the passageway 27 for the flow of water therefrom to the discharge ports to fill the tank 7. Buckling of the closure member 32 presses

the same against the lower end of the anti-collapse ring 36 and thus materially reduces the area of the upper side of the closure member 32 exposed to the pressure of the water in the pressure chamber 26. This buckling of the closure member 32 exposes the entire under side thereof to water pressure.

During the filling of the tank 7 from the discharge ports 33, the float 53 is finally lifted into a position in which the float arm 49 presses the seal 54 onto its seat 44 and closes the outlet port 40. With the closing of the outlet port 40, the pressure chamber 26 will be filled with water entering the same through the inlet port 39 until unit water pressure on both sides of the closure member 32 is the same. But as the effective area of the upper or convex side of the closure member 32 is somewhat larger than the effective area of the lower or concave side of the closure member 32, the unequal water pressure on said closure member will start the closing thereof and the initial closing movement of the closure member 32 will move the same away from the engaged anti-collapse ring 36 and thus expose the entire upper surface of the closure member 32 to the water pressure in the pressure chamber 26 and force said closure member onto its seat 31 and close the passageway 27.

From a broad viewpoint, the cap 21 is the top of the body member 20 and is so treated in the claims.

The drawings illustrate a commercial form of the invention, but it will be understood that the same is capable of certain modifications as to details of construction, arrangement and combination of parts within the scope of the invention herein disclosed.

What we claim is:

1. In a device of the class described, a depending hush tube, a cap closing the upper end of the tube and having a depending cylindrical portion extending into the tube and secured thereto, a body member having an upstanding cylindrical portion extending into the depending cylindrical portion of the cap and having screw-threaded engagement therewith, said body member also having a depending cylindrical portion spaced from the tube, an upright pipe extending into the depending cylindrical portion of the body member and secured thereto, an axial passageway in the body member and a seat surrounding the same, an axial port in the cap, a discharge port in the body member above said seat and leading from the interior of the upstanding cylindrical portion thereof, a closure member for said seat having an upstanding cylindrical retaining member telescoped into the upstanding cylindrical portion of the body member, said retaining member having on its upper end an outturned flange clamped between the cap and the upper end of the upstanding cylindrical portion of the body member, an anti-collapse sleeve in the retaining member, and a small axial port in the closure member.

2. In a device of the class described, a body member having an upper chamber and a lower chamber, a partition between the chambers and having a communicating passageway connecting the chambers and a seat in the upper chamber surrounding the passageway, a closure member normally resting on the seat and closing the passageway, said closure member having at its perimeter an upstanding cylindrical retaining member, and an anti-collapse tubular member in the retaining member and holding the same pressed against the body member, said tubular member at its lower end being spaced above the seat and the closure member when said closure member is resting on the seat, at least one port in the body member leading from the upper chamber between the seat and the lower end of the tubular member and normally closed by the closure member and its retaining member, said closure member and its retaining member being formed of a flexible material whereby the closure member may be buckled upwardly into the tubular member and its retaining member folded around the lower end

5

of the tubular member to lift the closure member from the seat and open the passageway and the port.

3. The structure defined in claim 2 further including a port extending through the closure member, and a second port leading from the upper chamber.

4. The structure defined in claim 2 further including a boss on the under side of the closure member, a port extending through the closure member and the boss, and a second port leading from the upper chamber.

5. The structure defined in claim 2 in which the closure member is relatively thick and its tubular member relatively thin.

References Cited in the file of this patent

UNITED STATES PATENTS

269,886 Semple Jan. 2, 1883
281,608 Browne July 17, 1883

729,271
925,538
1,416,317
1,851,062
1,884,213
1,976,851
1,992,043
2,213,753
2,382,427
2,394,911

258,871
848,325
102,794
289,562

6

Bumpus May 26, 1903
Weaver June 22, 1909
Banta May 16, 1922
Protzer Mar. 29, 1932
Pratt Oct. 25, 1932
Landis Oct. 16, 1934
Saunders Feb. 19, 1935
Teahen Sept. 3, 1940
Langdon Aug. 14, 1945
Griswold Feb. 12, 1946

FOREIGN PATENTS

Switzerland May 16, 1949
France 1939
Sweden 1941
Great Britain May 1, 1928