E. D. BARRETT & I. B. WOOD.

VALVE MECHANISM.

APPLICATION FILED JULY 13, 1911.

1,013,725. Patented Jan. 2, 1912.

Fig. 3

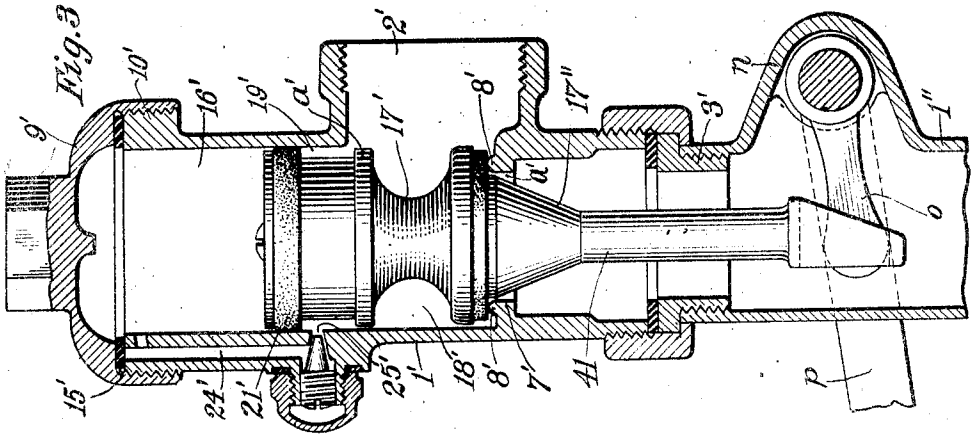


Fig. 2

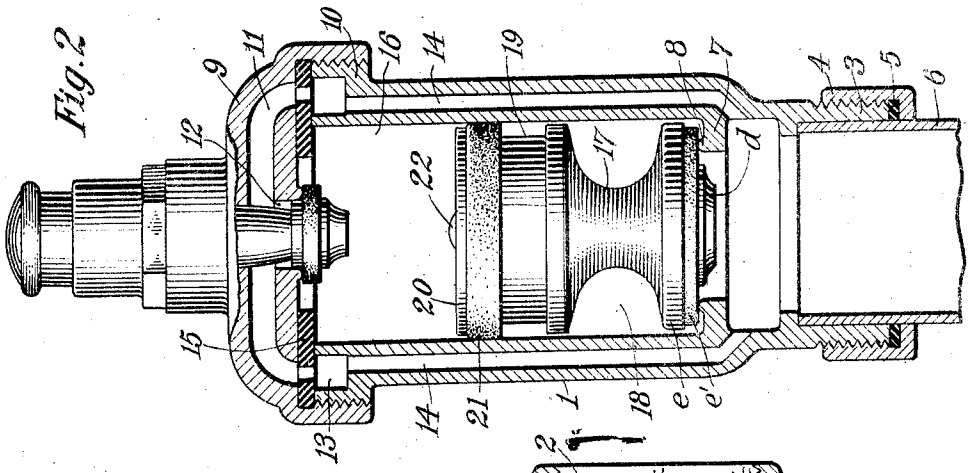
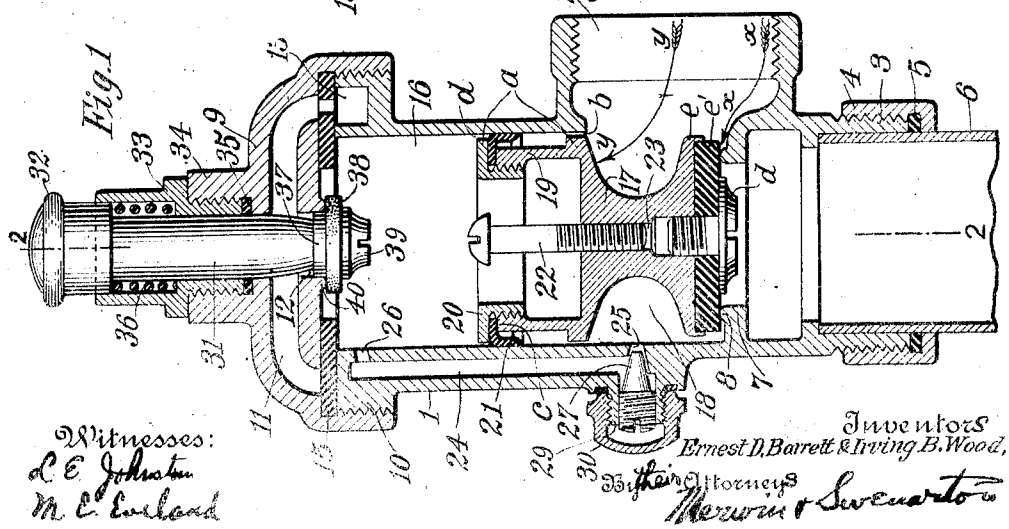


Fig. 1



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VALVE MECHANISM.

1,013,725. Specification of Letters Patent. Patented Jan. 2, 1912.

Application filed July 13, 1911. Serial No. 638,289.

To all whom it may concern:

Be it known that we, ERNEST D. BARRETT and IRVING B. WOOD, citizens of the United States, residing in the borough of Brooklyn, county of Kings, city and State of New York, have invented new and useful Improvements in Valve Mechanisms, of which the following is a specification.

This invention relates to certain improvements in automatic valve mechanisms, adapted to supply predetermined amounts of fluid under pressure to suitable receptacles and especially to bowls or basins of sanitary apparatus. Heretofore the valve mechanisms of this general type have been either extremely complicated in construction or else so crude as to be commercially of little valve and in either event they were more or less unsuccessful in operation owing to the frequent adjustment required in order to render the same operative under the varying conditions of supply and demand. In many cases moreover certain of these valves were wholly inoperative if the pressure exceeded a certain maximum point, as in many of the modern office buildings, or if the pressure fell below a certain required minimum often found in the modern residence as the normal pressure therein.

The objects of the present invention consist in the provision of an economical, durable yet simple and efficient valve mechanism, which owing to its containing but a minimum of elements can be readily dismantled or assembled and yet which will withal effectually control the flow of fluid therethrough under wide ranges of pressure.

The said invention is set forth in detail in the following specifications, reference being had to the accompanying drawings, in which—

Figure 1 is a vertical sectional view including the axis of the inlet pipe, Fig. 2 is a similar view along the line 2—2 of Fig. 1, including the axes of the fluid-ways, and Fig. 3 is a vertical section view of a modification, all of the improved valve mechanisms.

Referring to the drawings and the operation of the valve mechanism therein shown, the reference numeral 1 designates a cylinder casing, provided with an inlet opening 2 positioned intermediate the top and bottom of said casing, and having an outlet 3 at the bottom thereof said outlet being connected in any suitable manner, preferably by means of a coupling 4 and gasket 5 to a pipe 6 of any suitable sanitary apparatus. A transverse apertured partition 7, provided with a suitable valve-seat 8, projects across the interior of said casing, preferably at a level slightly above, as shown, the level of the lowermost portion of the inlet opening, the said partition, merging in a gradual curve, or substantially circular curve, with the lower wall of said inlet pipe.

The cylindrical casing is provided at its upper end with an apertured screw-cap 9, which, as shown, is adapted to be threaded onto the flanged boss or extension 10. Said cap is substantially hollow being provided with a passage 11 intermediate its upper and lower faces. The passage is substantially circular and serves to afford communication between an aperture 12, centrally positioned in the lower face of said cap, and an annular chamber 13, formed in the boss 10, the said annular chamber comprising the respective terminals for two oppositely disposed fluid ways 14 connecting said chamber with the outlet chamber of the valve-casing at a point below the apertured partition 7. A suitable perforated disk-washer 15, positioned intermediate said cap 9 and the upper end of the casing 1, serves to effectually seal the upper end of said casing against the escape of fluid from the pressure chamber 16, which, as shown, is formed at the upper end of said cylindrical casing.

A main valve-element or piston 17 preferably consisting of a single piece of casting, being of cylindrical configuration at its upper and lower ends and of a configuration of superposed cone frusta intermediate said ends, one of said cone frusta being oppositely disposed with respect to the other, is adapted to reciprocate within the inlet chamber 18 and the pressure chamber 16 which pressure chamber is a continuation of said inlet chamber, and separated therefrom by the upper end of said piston. This upper end of the piston as indicated at the points designated by the reference letter *a* is of considerably less cross-sectional area than said pressure chamber or said inlet chamber and preferably the extremity 20 of this upper end of the piston is detachable and is adapted to be threaded into said hollow or upper end. As shown an annular groove forming a

reduced necked portion 19 is provided on said upper end between the respective points designated by the letter *a*, and is adapted to receive water direct from the inlet 2 through the annular aperture *b* formed intermediate said portion *a* and the annular wall of the casing 1. A cup washer 21, which as shown is secured between the removable threaded end 20 and the upper end *c* of the reduced neck portion 19 projects downwardly between the inner wall of the casing 1 and the reduced neck portion 19, and as is well known thereby serves when expanded by the pressure of the water flowing upwardly from the inlet 2 and against the same to effectually seal the passage *d* intermediate the outermost end of the extremity 20 and the innermost wall of the casing 1, against the passage of liquid therethrough and into the pressure chamber. Owing however to the fact that the said piston at its points of greatest cross section as designated by the reference letter *a* is, as stated, of substantially less cross sectional area than the internal cross-sectional area of the casing, any water confined above said cup washer can freely escape around said cup washer during the upward movement of the piston, notwithstanding the fact that upon the downward movement of the piston, owing to the expansion of the cup washer by the pressure of the water entering from said inlet, the water confined in the pressure chamber above said cup washer cannot escape from said pressure chamber. This cup washer construction is employed for the reason that an expansible packing of this nature permits of the said valve operating under all conditions and pressures as long as the cup-washer subserves its function of expansion, whereas, were the piston made to have a tight fit either by grinding the same so that it was substantially of the same cross-sectional area as the internal cross-sectional area of the brush chamber or supplied with a leather or rubber gasket to render the same tight fitting therein, it has been found that the uniform and positive operation which is above obtained is difficult if not impossible of obtainment. Preferably, a stop 22, which is adjustable by threading the same into the aperture 23 in said piston is provided in order to limit the upward movement of said piston, and facilitate the regulation of the period of flow of water through the outlet in the apertured partition. As shown the lower end of said piston element *e* is of substantially the same cross-sectional area as the upper end of said piston element at the points *a* which designate the points of greatest cross-sectional area. A leather or rubber washer or so-called valve *e'* is secured within an annular recess as shown, formed in the bottom of said lowermost end *e*, said valve being removably secured thereto by means of a nut *d*, and said valve is of sufficient cross-sectional area to extend completely across the main aperture in said partition 7, whereby it serves to effectually close said aperture upon engagement of said valve with the annular valve seat 8 surrounding the central aperture in said partition.

A fluid inlet-way 24 serves to connect an aperture 25, which extends through the wall of the inlet chamber, with an aperture 26 that opens into the pressure-chamber 16. In order to prevent the entrance of a large body of fluid under high pressure into said inlet-way a needle-valve or regulating valve 27 is provided in such a position that it is adapted to register with and optionally close completely the flaring aperture 25. The provision of the needle-valve at the inlet end of said inlet-way thus insures of the exact regulation of the flow of water into said way and also complete elimination of any pressure that would tend to burst the walls of said way. Said needle-valve is preferably threaded into a boss 29 of said casing and a closure-cap 30 is threaded onto said boss in order to conceal said adjusting screw and to prevent accidental or intentional rotation thereof. As shown the inlet 25 to said inlet fluid-way affords communication between the inlet chamber 18 and said fluid-way, owing to the fact that it is opposite the point of juncture of the two cone frusta. The aperture 25 receives the water under maximum pressure as it enters the inlet chamber.

The said cap 9, as shown, is provided with a perforation in each of its faces and in said perforations is journaled the shank 31, of a reciprocating push-button element having a push-button 32 secured to its outer end. Said element is elastically mounted within a thimble 33, which is threaded into an annular boss 34, that is integral with the upper portion of the said cap. A suitable packing 35 serves to prevent the escape of fluid from the passage 11 into the casing containing the coil-spring 36. The aperture in the lower face of said cap is adapted to receive the inner reduced end of said shank 31, the said shank being sufficiently reduced to permit of the free passage of water intermediate the wall forming said aperture and the shank, when the same is in its lowermost position. At the inner end of said shank is an integral annular flange 37, to which is secured the flexible valve-face 38 by means of a nut, of any ordinary type 39. Said valve-face is obviously of greater diameter than the seat 40 which forms the peripheral wall of said aperture, while the said flange is adapted to fit snugly within said aperture

when the shank is in its uppermost position, although the said flange projects wholly below the seat 40 when the push-button is depressed.

The operation of the mechanism shown in Figs. 1 and 2 is obvious in view of the foregoing description. In fact it is so extremely simple owing to the minimum number of elements of the valve that it can be said to consist of but four steps, to wit, the depression of the push-button in order to permit of the escape or efflux of the fluid which enters through the aperture 25 from the water-main into the pressure chamber at a greater rate than its rate of influx, said water passing through the fluid outlet ways into the outlet chamber or outlet main. Second. The upward travel of the piston due to the pressure being greater upon the upper cone frustum than upon the lower cone frustum, and the absence of an opposing pressure in said pressure chamber owing to the free escape of water therefrom during the upward movement of said piston. Third. The passage of the fluid directly from the fluid inlet-main through the apertured partition into the outlet chamber or outlet main and the simultaneous passage of a restricted amount of water through the opening 25, controlled by the needle-valve, and thence through the fluid inlet-way and the aperture 26, into the pressure chamber 16, and fourth, the seating of the said piston due to the pressure of the water confined in said pressure chamber exceeding the amount of pressure upwardly exerted against the valve face e' when in an elevated position, or the pressure represented by the difference between the pressure downwardly exerted upon the lower cone frustum and the pressure upwardly exerted upon the upper cone frustum by the inflowing fluid from the inlet main when the valve is in the zone in which the inflowing fluid is capable of exerting pressure both upwardly and downwardly. The elevated position of the apertured partition as shown in Fig. 1 and the curvilineal web connecting said partition with the inlet pipe as heretofore described, serve to deflect the inflowing fluid against the under faces of the flexible valve-face e, as indicated by the arrow x—x, and also serve to deflect the fluid in the direction indicated by the arrow y—y against the periphery of the upper cone frustum and thus more effectually serve to induce the upward movement of the piston immediately upon the release of pressure from above the same which is exerted by fluid when confined in said inlet chamber throughout the period that the needle-valve in unseated sufficiently to permit of the flow of fluid to the fluid inlet-way. Moreover, since the said piston element is of a cross-sectional area greater than that of said aperture in the partition, it is evident that it will be incapable of projecting into said aperture and into contact with the lateral walls thereof but will merely rest upon the valve-seat surrounding said aperture. Accordingly, the under surface of the flexible valve-face only will contact with the seat surrounding said aperture and the quick release of the valve element will be in no ways hindered by skin friction due to intimate contact of a plug or other projection with the inner walls of said aperture or by suction due to the current of fluid which passes in a large volume through the said aperture immediately the piston element is elevated.

In Fig. 3 is illustrated a modification which is adapted to be actuated by a crank or handle in which the said piston element is provided with a downward extension adapted to extend through the aperture in the transverse partition, preferably without contact with the inner walls of said aperture, which extension is adapted to engage with an element operated by said crank. The construction therein shown consists of a casing 1′ having an inlet 2′ and an outlet 3′, and a supplemental casing 1″ secured preferably by threaded engagement to said outlet end 3′. Said casing 1″ is laterally extended to permit of its serving as a bearing for a journal n upon which is mounted a contact element o which is secured to and adapted to be actuated by a crank p which projects externally of the casing 1″. As shown in this construction, fluidways similar to the fluidways 14 shown in the construction of Figs. 1 and 2 are dispensed with, as the action of the flexible cup-washer 21′ is such that when the piston is forced upwardly through the agency of the stem 41 and the operating lever or crank p, the water can freely escape downwardly around said cup-washer at a much greater rate than the rate of influx into the pressure chamber 16′ through the needle-valve and the inlet-way 24′. Moreover, the upper end of the inlet-way is preferably sealed as shown by an imperforate annular gasket 15′. The stem 41 is preferably rigidly secured to the lower end of the piston element 17′, and is somewhat enlarged at its top 17″ in the form of an inverted cone frustum whereby, as is evident, it almost but not quite engages with the vertical inner walls of the central aperture 8′ of said partition 7′, and thus while avoiding the objections heretofore noted, as regards skin friction and suction when a close fitting extension projects into and contacts with the aperture in the partition, the flow of the water is gradually retarded and diminished in volume as the piston approaches its seat 8′. Thereby the requisite after-fill into a

bowl or basin is permitted. As shown also in the constructions in all of the figures, the opening into the fluid inlet-way 24′, designated as aperture 25′, is in the line of travel of the piston so that the lower ends of the upper portion as designated by the reference letters *a* and *a′*, will tend to impinge against and thereby automatically cleanse said aperture and prevent clogging of the same by foreign particles such as sand and other impurities. It is evident that any particles that escape into the inlet-ways 24 and 24′, will be sufficiently small to readily pass through the same and also through the aperture 26 which opens into the pressure chamber. The needle-valve itself as shown, has a blunt end and the aperture 25 is preferably at least one-sixteenth of an inch in constructions of the size illustrated in Figs. 1, 2, and 3.

Having thus described our invention, what we claim is:

1. In an automatic valve mechanism, the combination comprising a casing, provided with a pressure chamber at one end thereof, and having an inlet opening and an outlet opening respectively, a transverse partition, provided with an aperture, positioned between said inlet opening and said outlet opening, a longitudinally reciprocatable piston-element positioned in said pressure chamber above said partition, and adapted to normally seal communication through the aperture in said partition, said piston being loosely mounted in said pressure-chamber and being free to move transversely therein when unseated, in response to the pressure of water entering through the inlet-opening of said casing, and said piston having a maximum cross-sectional area substantially less than the cross-sectional area of said pressure-chamber, whereby said piston when seated is normally out of contact with the wall of said casing, said maximum cross-sectional area of said piston being sufficiently great to admit of frictional engagement between a portion of the wall of said piston and a portion of the wall of said casing when said piston moves transversely therein during its travel within said casing in response to said pressure of inflowing water, flexible valvular means secured to said piston capable of projecting beyond the outermost lateral limits of and completely surrounding the same, permitting of uni-directional passage only of fluid intermediate said piston and the wall of said pressure chamber, a conduit provided with a terminal aperture positioned in the wall of said casing at a point intermediate the upper and lower ends of said piston when seated on said partition, said conduit permitting of the permanent influx of fluid into said pressure chamber at a substantially less rate than the rate of the uni-directional flow around said piston-element permitted by said flexible valvular means, and means independent of and supplemental to said flexible valvular means for optionally permitting the efflux of fluid from said pressure chamber at a greater rate than the rate of influx thereto.

2. In an automatic valve mechanism, the combination comprising a casing, provided with a pressure chamber at one end thereof, and having an inlet opening and an outlet opening respectively, a transverse partition, provided with an aperture positioned between said inlet opening and said outlet opening, a longitudinally reciprocatable piston-element positioned in said pressure chamber above said partition, and adapted to normally seal communication through the aperture in said partition, said piston being loosely mounted in said pressure-chamber and being free to move transversely therein when unseated, in response to the pressure of water entering through the inlet-opening of said casing, and said piston having a maximum cross-sectional area substantially less than the cross-sectional area of said pressure-chamber, whereby said piston when seated is normally out of contact with the wall of said casing, said maximum cross-sectional area of said piston being sufficiently great to admit of frictional engagement between a portion of the wall of said piston and a portion of the wall of said casing when said piston moves transversely therein during its travel within said casing in response to said pressure of inflowing water, flexible valvular means secured to said piston capable of projecting beyond the outermost lateral limits of and completely surrounding the same, permitting of the uni-directional passage only of fluid intermediate said piston and the wall of said pressure chamber, and a conduit provided with a terminal aperture positioned in the wall of said casing at a point intermediate the upper and lower ends of said piston when seated on said partition, said conduit permitting of the permanent influx of fluid into said pressure chamber at a substantially less rate than the rate of the uni-directional flow around said piston-element permitted by said flexible valvular means.

3. In an automatic valve mechanism, the combination comprising a casing, provided with a pressure chamber at one end thereof, and having an inlet and outlet opening respectively, a transverse partition positioned between said inlet and outlet opening and above the level of the lowermost portion of said inlet opening, said partition being provided with an aperture, a longitudinally reciprocatable piston element positioned in said pressure chamber above said partition and adapted to normally seal communica-

tion through the aperture in said partition, the said piston being loosely mounted in said pressure-chamber and being free to move transversely therein when unseated, in response to the pressure of water entering through the inlet-opening of said casing, and said piston having a maximum cross-sectional area substantially less than the cross-sectional area of said pressure-chamber, whereby said piston when seated is normally out of contact with the wall of said casing, said maximum cross-sectional area of said piston being sufficiently great to admit of frictional engagement between a portion of the wall of said piston and a portion of the wall of said casing when said piston moves transversely therein during its travel within said casing in response to said pressure of inflowing water and a portion of said piston having a configuration corresponding to superposed cone frusta inverted with respect to each other, a flexible cup-washer, secured to said piston adjacent the upper end thereof and completely surrounding the same, permitting uni-directional passage only of fluid intermediate said piston and the wall of said pressure chamber, a conduit provided with a terminal aperture positioned in the wall of said casing at a point intermediate the upper and lower ends of said piston when seated on said partition, said conduit permitting of the permanent influx of fluid into said pressure chamber at a substantially less rate than the rate of the uni-directional flow around said piston-element permitted by said flexible cup-washer, and controlling means provided with a relatively blunt end, adapted to be projected into proximity to said aperture in said casing wall, for regulating the passage of liquid through said aperture and for baffling the passage of solid particles therethrough.

4. In an automatic valve mechanism, the combination comprising a casing, provided with a pressure chamber at one end thereof, and having an inlet opening and an outlet opening respectively, a transverse partition, provided with an aperture, positioned between said inlet opening and said outlet opening, a longitudinally reciprocatable piston-element positioned in said pressure chamber above said partition, and adapted to normally seal communication through the aperture in said partition, said piston being loosely mounted in said pressure-chamber and being free to move transversely therein when unseated, in response to the pressure of water entering through the inlet-opening of said casing, and said piston having a maximum cross-sectional area substantially less than the cross-sectional area of said pressure-chamber, whereby said piston when seated is normally out of contact with the wall of said casing, said maximum cross-sectional area of said piston being sufficiently great to admit of frictional engagement between a portion of the wall of said piston and a portion of the wall of said casing when said piston moves transversely therein during its travel within said casing in response to said pressure of inflowing water, flexible valvular means secured to said piston capable of projecting beyond the outermost lateral limits of and completely surrounding the same, permitting of uni-directional passage only of fluid intermediate said piston and the wall of said pressure chamber, and a conduit provided with a terminal aperture positioned in the wall of said casing at a point in a different quadrant thereof from that in which said inlet opening is positioned, said conduit permitting of the permanent influx of fluid into said pressure chamber at a substantially less rate than the rate of the uni-directional flow around said piston-element permitted by said flexible valvular means.

In witness whereof we have hereunto set our hands at the city of New York, county and State of New York, this 30th day of June, 1911.

ERNEST D. BARRETT.
IRVING B. WOOD.

Witnesses:
W. H. Swenarton,
Clarence J. Wyckoff.