

May 5, 1931.

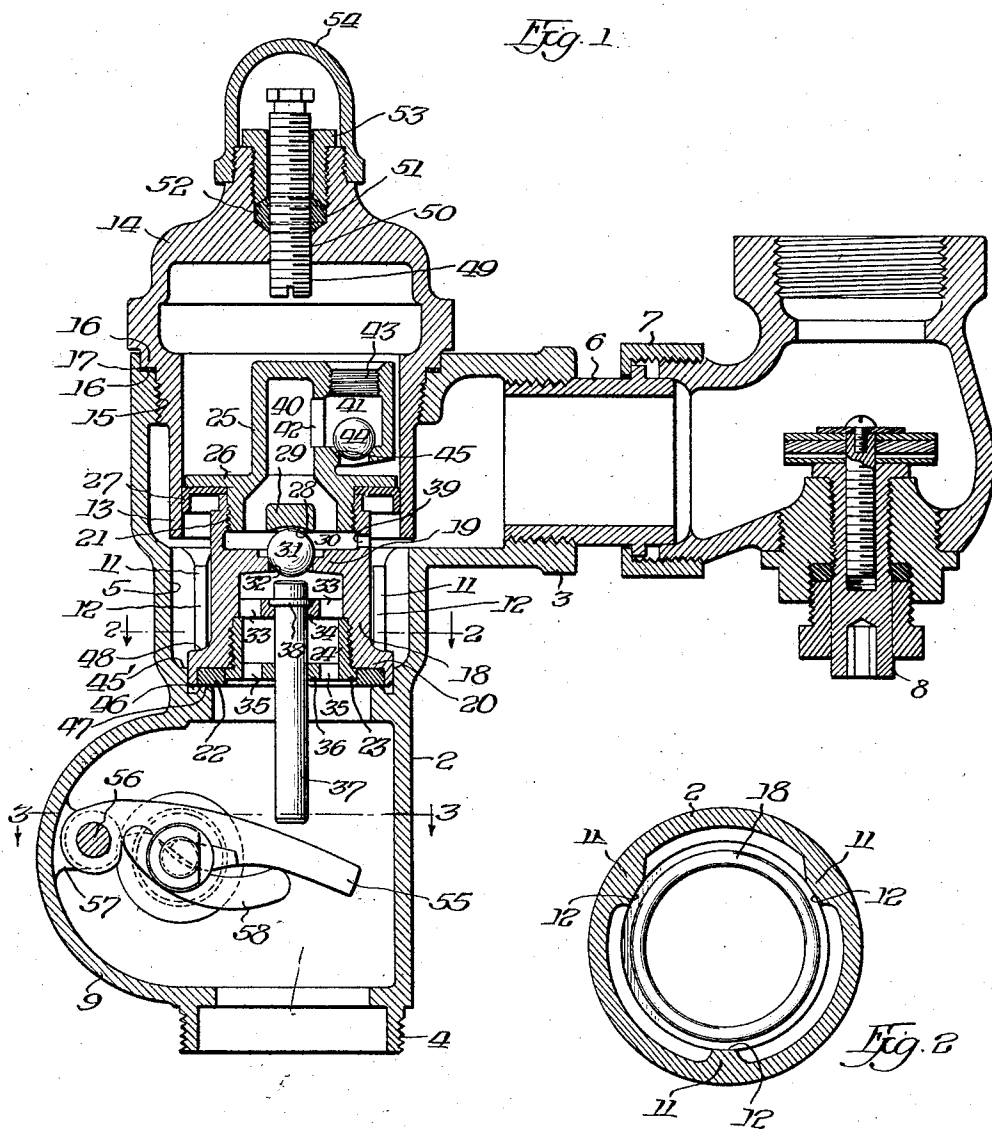
W. S. WHITE

1,803,418

FLUSH VALVE

Filed Dec. 8, 1927

2 Sheets-Sheet 1



Witness:

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May 5, 1931.

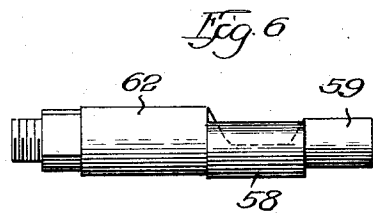
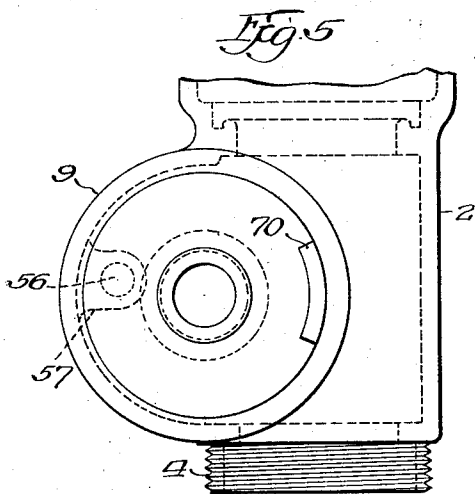
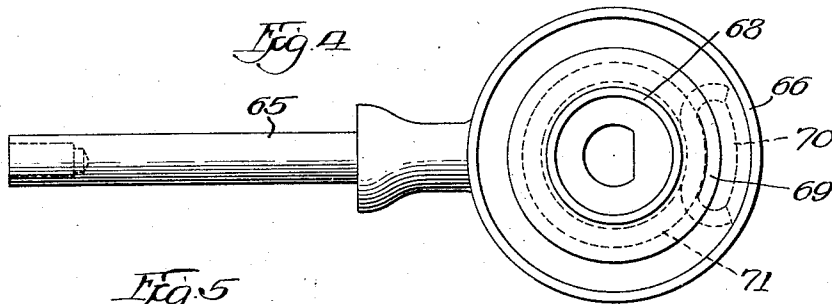
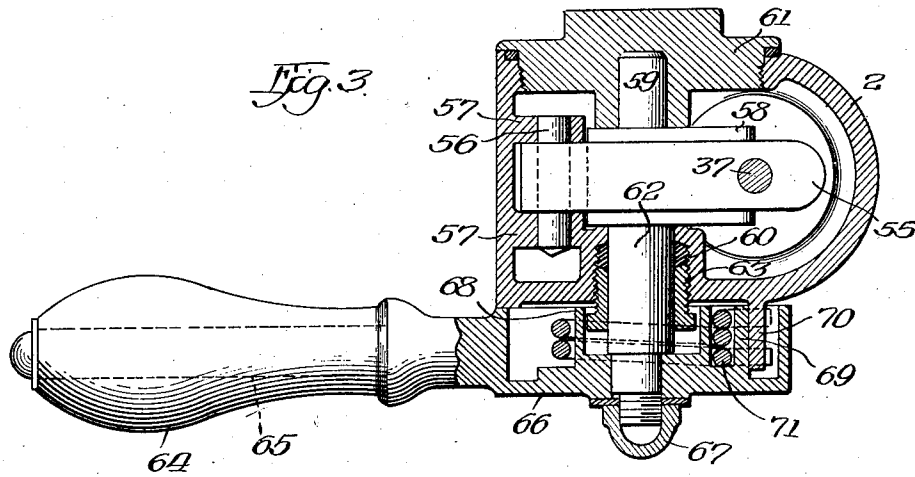
W. S. WHITE

1,803,418

FLUSH VALVE

Filed Dec. 8, 1927

2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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FLUSH VALVE

Application filed December 8, 1927. Serial No. 238,516.

This invention pertains to flushing valves and more particularly to that type of valve having a piston valve reciprocable in a cylinder for opening and closing communication

between a water inlet and a water outlet and manually operable means for displacing the piston valve from its seat for opening the outlet, the valve mechanism returning after a predetermined period to its closing position.

A valve and operating mechanism herein-after more particularly disclosed is an improvement upon the valve and operating mechanism disclosed and claimed in my Re-issue Patent No. 16,764, dated October 4, 1927.

A further object is to provide an arrangement whereby the water flowing from the inlet to the outlet is caused to react against the piston valve during a portion of its final travel or approach toward its seat, to slow it down and to give the water a chance to refill the water storage chamber and restore the pressure therein, whereby chattering or hammering is minimized if not obviated and the quiet closing of the valve is assured.

One of the primary objects of my invention is to provide a valve mechanism of the above described character requiring no obstruction in the water outlet for facilitating the closing movements of the valve whereby the water passing out of the valve is permitted substantially free and unobstructed movement to the fixture and the fixture is given the full benefit of the quantity and pressure of the water at the supply or source.

A still further object of the invention is to provide a novel and extremely advantageous arrangement for raising the piston valve from its seat and an arrangement for returning the manually operable means to its initial inoperative position quickly, silently and effectively, the last mentioned arrangement including a spring never subjected to contact with the water of the valve and the former including an arrangement whereby the working parts of the valve may be operated by a direct lift but easily and quickly.

Another object is to provide a novel piston valve arrangement or valve of the above mentioned character which may easily be forced to its seat by the flow of water, between the inlet and outlet, in its passage gripping a flange or projection preferably integrally formed on the lower end of a part of the piston and a piston valve having accessible regulating and control mechanism which may be easily and cheaply manufactured, assembled and operated. In this connection the cylinder in which the piston valve operates is arranged to project at least partially over and preferably substantially across the water inlet but in spaced relation thereto in order to cause the water from the inlet in its flow path to the outlet to exert its force on the flange or projection on the lower end of the piston and force the piston to its seat.

Many further objects, the advantages and uses of the invention, and the arrangement of the parts of a preferred form, the construction of such parts and their operation will be or should become readily appreciated after perusal of the following description and claims and after viewing the drawings in which:

Fig. 1 is a vertical sectional view through a valve constructed in accordance with the invention,

Fig. 2 is a section taken along the line 2—2 of Fig. 1,

Fig. 3 is a horizontal sectional view taken along the line 3—3 of Fig. 1 showing the valve operating mechanism for the valve,

Fig. 4 is an elevational view of the inside surface of the handle,

Fig. 5 is a fragmentary elevation of the lower end of the valve casing showing the construction for connection of the handle, and

Another object is to provide a piston cylinder of peculiar construction and arrangement so that the cylinder forms a removable cap for the casing, yet is supported in the supply or valve chamber in a proper and correct manner. In the illustrated embodiment

Fig. 6 is a detail elevational view of the handle pivot crank.

Considering for the time being Figs. 1 and 2, it will be noted that the casing generally designated 2 is in this instance of elbow shape having an inlet water connection 3 and a water outlet connection 4 between which the casing is enlarged to provide a valve chamber 5. The water inlet connection is connected through a thimble or sleeve 6 and shouldered ring nut 7 to the usual water shut-off valve, one type of which is generally designated 8 while the water outlet connection 4 is adapted to be connected to the usual closet or bowl or other fixture inlet in the ordinary manner. The casing is also provided with an enlarged portion 9 adjacent its outlet end and below the chamber 5 for connection of the valve operating mechanism as will be later described. Interiorly of the chamber 5, the casing 2 is provided with two, three (in this instance three) or more integrally formed guides 11 each of which has its interior face 12 formed as a segment of a cylinder concentric with a portion of the piston valve to be hereinafter described for guiding the same. Above the guides a depending cylindrical flange 13 of a cap member 14 which at its upper end is threadedly connected as at 15 in the upper open end of the casing 2, provides a cylinder within which the piston end of the piston valve is arranged to reciprocate up and down, its upward movement manually controlled, that is, positively induced by manual operation and its downward movement effected under the influences of gravity and the pull of the water passing from the inlet to the outlet while, of course suitable control mechanism is provided for regulating the closing rate. Between cooperative shoulders 16 formed on the member 14 and casing 2 a washer or gasket 17 is placed to make these parts watertight.

The piston valve comprises a generally cylindrical valve member 18 having a diaphragm or wall 19 intermediate its valve seat end 20 and its piston head end 21. A valve seat 22, preferably of rubber, is held in place in the end 20 between a depending flange on the member 18 and a flanged head 23 on a spider plug 24 screwed into the bottom of the member 18 while the piston head end 21 is internally threaded to receive a water flow regulating chambered cap or piston head member 25 between a flange 26 of which and the end 21 a cup-shaped friction washer 27 is secured. The diaphragm 19 is spaced from the lower end of the member 25 and from a ball seat 28 formed on a bridge portion 29 of member 25, to provide a chamber 30 which has communication past a ball check valve 31 therein and through a valve seated opening 32 in the diaphragm 19, through one or more channels or openings 33 in a spider diaphragm 34 provided in the valve member 18

and through openings 35 in the spider 36 of spider plug 24, with the outlet 4 whenever the ball 31 is raised from its seat by operating pin 37 which is journaled for sliding movements in spiders 34 and 36. The pin 37 is prevented from dropping down by an integral flange 38. The chamber 30 also has communication at all times with the inlet through an orifice 39 formed in its side wall in a position where it will be most efficient and effective for its purpose.

The piston head member 25 is cored out to provide a chamber 40, a continuation of the chamber 30, an auxiliary chamber 41 and a passage 42 connecting them. The chamber 41 is open at its upper and lower ends, the upper end being accessibly closed by a screw plug 43 and the lower end being closed by an interiorly seating ball check valve 44 except for a fluid bleed passage 45 therepast. The check valves 31 and 44 are both adapted to be opened, the first mechanically through the manual operating mechanism including the pin 37 and the latter automatically through the action of the water when the ball 31 is lifted.

The lower end of the casing 2 above the manual operating mechanism for the valve is formed or provided with a circumferentially extending water reactance shoulder 45', a circumferential depression 46 and a circumferential seat 47 upon which the piston valve seats when closed, while circumferentially about the lower end of the valve portion of the piston valve a circumferentially extending water reactance shoulder 48 is provided. The purpose of these reactance shoulders and the depression 46 will be explained in connection with the operation of the valve. The guide surfaces 12 of the ribs 11 serve to guide the lower portion of the piston valve in its up and down movements by engagement with the sides of the portion forming the circumferential shoulder 48 while the upper or piston portion of the piston valve is guided in the cylinder 13.

The extent to which the piston valve may rise in the casing is determined by an adjustment screw 49 which is threadedly engaged in an opening 50 in the top of cap member 14 establishing communication between the interior of the member and a stuffing box recess 51. Packing 52 is disposed about the screw 49 within the recess 51 and is compressed and held therein by stuffing gland sleeve nut 53. A housing cap 54 protects these parts.

The manual operating mechanism for the valve is illustrated more in detail in Fig. 3 et seq. from which it will be observed that a lever 55 arranged with one end directly beneath the pin 37 for direct upward thrust thereon is pivotally secured at its opposite end on a pivot 56 secured between a pair of lugs 57 formed in the enlargement 9 on

the casing 2 and is operated through an oscillatable crank 58 one end 59 of which is pivoted in a screw cap 61 screwed into the casing and the other end 62 of which is pivotally mounted through a stuffing box 60 and there surrounded by packing and stuffing box gland nut 63. The crank is in turn oscillated by means of a suitable handle 64 secured on the extended end 65 of a spring housing generally designated 66 which is centrally keyed to the outer end of the crank pivot 62 and secured thereon by a washer and a cap screw 67.

The spring housing 66 is, substantially, of cup-shape and on its interior is provided with a cylindrical flange 68 and an arcuate abutment lug 69 integral with the housing 66. Between similar arcuate bounds on the exterior of the casing an arcuate abutment lug 70 is formed and arranged to permit the lug 69 to swing back and forth thereby. A coiled or other spring 71, when the parts are assembled, has its ends bent outwardly to embrace the ends of both abutment lugs 69 and 70 so that when the handle 64 is moved in either direction from a predetermined position one end of the spring will be held by the abutment 70 as the other end is being moved away by the abutment 69. The tension of the spring tends to return the handle to its initial position.

In operation, assuming the shut-off valve 8 is open and it is desired to raise the piston valve for flushing purposes, the handle 64 is pressed downwardly or upwardly which through the lever 55 raises the pin 37 into engagement with the ball check 31. The ball check 31 is thus raised from its seat allowing water in chambers 30, 40 and 41 to flow out through the openings 32, 33 and 35. The ball 31 thereupon engages the seat 28 and upon continued upward movement of the pin urges the piston valve upwardly into the cylinder 13 until its further upward movement is limited by the setting of the adjustment screw 49. During this time water trapped in the storage chamber above the piston head has escaped to the outlet by raising the ball check 44 from its seat and passing out through the auxiliary chamber 41, the chamber 40 and 30, the orifice 32 and the passages 33 and 35.

When the valve handle 64 is released the spring 71 returns it to its initial inoperative position, whereupon the check valve 31 closes and the piston valve is closed by the combined action of gravity and water flow from the inlet to the outlet. It will be noted that the cylinder 13 projecting substantially across the inlet opening although in spaced relation to the interior wall of the valve chamber in this arrangement, causes the inlet water which flows circumferentially about the cylinder and between the cylinder and interior wall of the casing, to be directed

downwardly toward the outlet. As the water rushes past the lower end of the cylinder 13 and between the guides 11 it strikes against the reactance shoulder 48 on the lower end of the piston valve and tends to draw the piston valve downwardly toward its seat, water from the inlet in the meantime passing through the orifice 39 into the chamber 30 to the chambers 40 and 41 and to the storage chamber above the piston from the auxiliary chamber 41 in a retarded stream because of the relatively small passage provided by the fluid bleed 45 past the check valve 44. As water gradually fills the storage chamber above the piston head the tendency toward a vacuum is broken therein and the valve is allowed slowly to descend toward its seat.

As water rushing from the inlet to the outlet would tend to draw the valve to its seat before the storage chamber was completely filled, which action would result in what is known as "water-hammer", I have devised means for inhibiting this action. This arrangement includes the water reactance shoulder 45', the circumferential recess or groove 46, the cupped washer 27 and the location of the refill orifice 39. During the closing movement of the valve and more strongly toward the end of its closing movement, the flow of the water toward the outlet is somewhat retarded by the reactance shoulder 45' and the groove 46 so that it tends to back up and react against the underside of the cupped washer 27 to prevent the valve from returning too quickly to its seat. At the same time water flowing directly in from the inlet 3 is forced through the orifice 39 into the chamber 30. With this arrangement "water-hammer" is eliminated.

A flush valve constructed in accordance with the essence of the invention herein described is positive in operation, is simple and economical to manufacture, assemble, repair and replace, successfully eliminates "water-hammer" and has many advantages too numerous to be mentioned herein although all will be or should be apparent to those skilled in the art. Consequently, while I have illustrated and described what is at present a preferred form of construction embodying my invention I do not desire to be limited to such construction or the details thereof but only by the spirit of the invention and scope of the appended claims.

I claim:

1. In a flush valve of the character described, a piston valve comprising, a hollow cylindrical body having a transverse diaphragm intermediate its ends, said body having a valve seat at one end and adapted to be connected to a piston head member at its other end, the wall of said body having a fluid bleed opening therethrough above said

diaphragm and said diaphragm having an opening therethrough and a valve seat surrounding the opening and facing said other end, a piston head secured to said body at said other end and provided with a primary chamber and a secondary chamber, said primary chamber having an opening to the interior of said body above the seat in said diaphragm and an opening to said secondary chamber, and said secondary chamber having an opening adapted to communicate with the interior of a control chamber, a valve seat about the last said opening, gravity closing valves for the last said valve seat and the seat in said diaphragm, and a cylinder wall engaging friction washer secured between said head and body.

2. In a flush valve of the character described, a piston valve comprising, a hollow cylindrical body having a transverse diaphragm intermediate its ends, said body having a valve seat at one end and adapted to be connected to a piston head member at its other end, the wall of said body having a fluid bleed opening therethrough, said diaphragm having an opening therethrough and a valve seat surrounding the opening and facing said other end, a piston head detachably secured to said body and provided with a primary chamber and a secondary chamber, said primary chamber having an opening into the interior of said body above the seat in said diaphragm and an opening to said secondary chamber and said secondary chamber having an opening adapted to communicate with the interior of a control chamber, a valve seat about the last said opening interior of said secondary chamber, gravity closing valves for the last said valve seat and the seat in said diaphragm, and a cylinder wall engaging friction washer secured between said head and body below the opening from said secondary chamber to the interior of said control chamber and above said fluid bleed opening.

3. In a flush valve of the character described, a piston valve comprising, a hollow cylindrical body having a transverse diaphragm intermediate its ends, said body having a valve seat at one end and adapted to be connected to a piston head member at its other end, the wall of said body having a fluid bleed opening therethrough and said diaphragm having an opening therethrough and a valve seat surrounding the opening and facing said other end, a piston head secured to said body and provided with a primary chamber and a secondary chamber, said primary chamber having an opening to the interior of said body above the seat in said diaphragm and an opening to said secondary chamber, and said secondary chamber having an opening adapted to communicate with the interior of a control chamber, a valve seat about the last said opening, gravity closing

valves for the last said valve seat and the seat in said diaphragm, a cylinder wall engaging friction washer secured between said head and body, and means detachably secured to the valve seat end of said body for rendering inoperative the valve seated on said diaphragm.

4. In a flush valve of the character described, a piston valve comprising, a hollow cylindrical body having a transverse diaphragm intermediate its ends and having a valve seat at one end and adapted to be connected to a piston head member at its other end, the wall of said body having a fluid bleed opening therethrough, said diaphragm having an opening therethrough and a valve seat surrounding the opening and facing said other end, a piston head detachably secured to said body and provided with a primary chamber and a secondary chamber, said primary chamber having an opening into the interior of said body above the seat in said diaphragm and an opening to said secondary chamber and said secondary chamber having an opening adapted to communicate with the interior of a control chamber, a valve seat about the last said opening interior of said secondary chamber, gravity closing valves for the last said valve seat and the seat in said diaphragm, a cylinder wall engaging friction washer secured between said head and body below the opening from said secondary chamber to the interior of said control chamber and above said fluid bleed opening, and means detachably secured to the valve seat end of said body for rendering inoperative the valve seated on said diaphragm.

5. In a flush valve having a casing, an operating handle mechanism comprising a valve actuating shaft journaled in the valve casing and extending therefrom at one end, means operated upon movement of said shaft in one direction for operating the valve, a substantially cup-shaped disc secured to said end of said shaft with its mouth directed toward said casing, arcuate abutments concentrically disposed adjacent one another in spaced relation to said shaft on said disc and casing, one of said abutments being on said casing and the other interior of said cup of said disc, a spring surrounding said shaft and having its ends secured between said casing and said disc by said abutments and concealed by said disc for returning the shaft to its normal inoperative position, and means on said disc whereby the same may be manually operated.

6. In a flush valve having a casing, an operating handle mechanism comprising, a valve actuating shaft journaled in the casing and extending therefrom at one end, means operated upon movement of said shaft in one direction for operating the valve, a substantially cup-shaped disc secured to said end of said shaft with its mouth directed toward

- said casing, arcuate abutments concentrically disposed adjacent one another in spaced relation to said shaft on said disc and casing, one of said abutments being on said casing and the other interior of said cup of said disc, a spring surrounding said shaft and having its ends secured between said casing and said disc by said abutments and concealed by said disc for returning the shaft to its normal inoperative position, a stuffing box formed in the casing about said shaft, a packing gland for said stuffing box, and means on said disc whereby the same may be manually operated.
7. In a valve, a casing member having an operating shaft opening therethrough, a shaft passing through said opening and rotatable therein, a handle secured to the outer end of said shaft, a projection on the outer side of said casing member spaced from said shaft and directed outwardly toward said handle, a projection on said handle spaced from said shaft and directed inwardly toward said casing member, said projections normally overlapping one another, and a coiled spring about said shaft and having its ends engaged with said projections.
8. In a flush valve, a casing provided with a cylinder, a valve chamber and a water inlet, the chamber having a restricted portion at its bottom and a water outlet therethrough with a valve seat surrounding the outlet spaced downwardly a substantial distance from the top of the restricted portion, a piston valve having an annular reactance shoulder and just below it an enlarged bottom portion having a diameter slightly less than the diameter of said restricted portion and adapted for reciprocating movement therein, the lower face of the piston being adapted for seating on said valve seat, the upper portion of the piston having an annular downwardly facing reactance shoulder and means bearing on the interior of the cylinder for guiding its movement therein, an upwardly facing reactance shoulder in the chamber immediately above said restricted portion adapted to coact with the upper reactance shoulder on the piston to retard further downward movement of the piston just before and after the lower enlarged portion of the piston enters said restricted portion, a pressure chamber in the cylinder above the piston, a passage through said piston for connecting said inlet with said pressure chamber and a check valve therefor, and a second passage in the piston connected with the first passage and opening to said outlet and a check valve therein, and manually operable means for lifting said second check valve to open said second passage and for lifting the piston valve off its seat.
- In witness of the foregoing I affix my signature.
- WILLIAM S. WHITE.
9. In a flush valve, a casing provided with a cylinder, a valve chamber and a water inlet, the chamber having a restricted portion at its bottom and a water outlet therethrough with a valve seat surrounding the outlet