May 20, 1924. 1,494,708

K. REZNICEK

FLUSH VALVE

Filed March 14, 1923 2 Sheets-Sheet 1

Fig. 1.

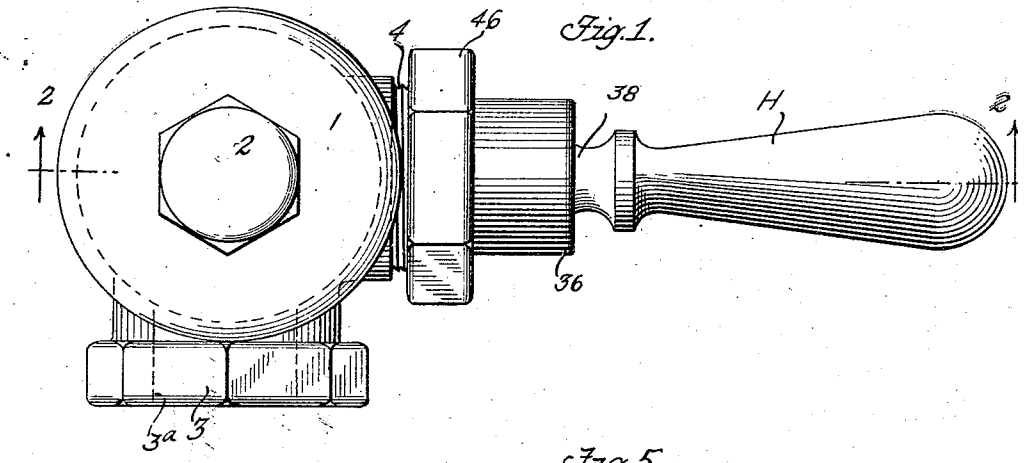

Fig. 5.

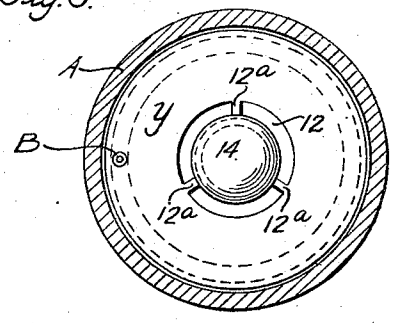

Fig. 2

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Fig. 3

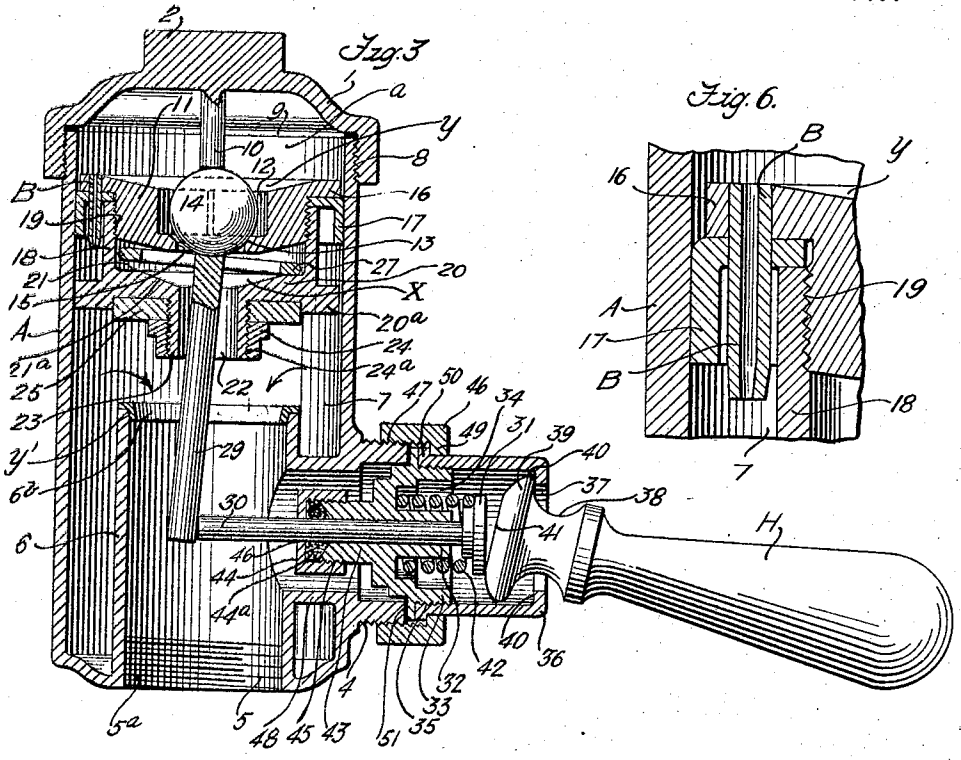
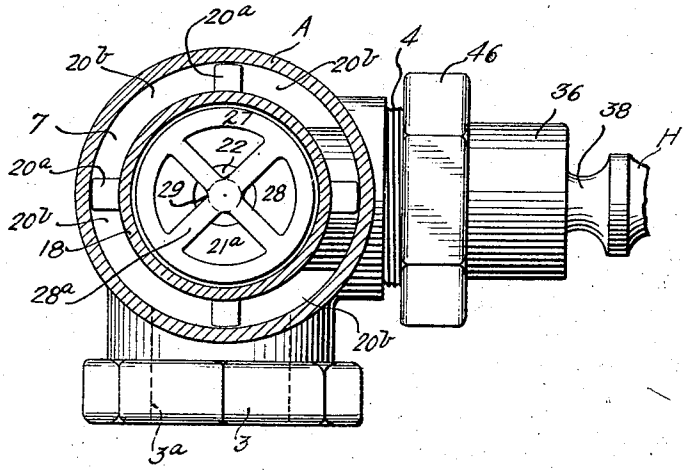


Fig. 6.

Fig. 4.



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Patented May 20, 1924. 1,494,708

UNITED STATES PATENT OFFICE.

KARL REZNICEK, OF NEW YORK, N. Y.

FLUSH VALVE.

Application filed March 14, 1923. Serial No. 625,012.

To all whom it may concern:

Be it known that I, KARL REZNICEK, a citizen of the United States, and resident of New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Flush Valves, of which the following is a specification.

This invention relates to flush valves, its object being to make such valves of low manufacturing cost, of high efficiency and durability; capable of being easily repaired when repairs are required; leakproof; of marked silence in operation and adapted for use in high water pressure systems.

In the accompanying drawings forming a part hereof and illustrating the best form of my invention now known to me,

Fig. 1 is a top plan view of a flush valve embodying the invention.

Fig. 2 is a vertical, central section at line 2—2 of Fig. 1 with the valve closed and the handle shown in elevation.

Fig. 3 is a view corresponding to Fig. 2 but showing the valve lifted for outflow of flushing water.

Fig. 4 is a horizontal section looking down at line 4—4 of Fig. 2 and particularly shows the ball relief-valve lifter.

Fig. 5 is a horizontal section at line 5—5 of Fig. 2 and

Fig. 6 is an enlarged detail view of the tube carried by the main valve for putting the chambers of the valve casing into communication.

In the illustrated form of the invention, the upstanding main casing A is provided with a cover 1 having an exterior nut 2 for application of a wrench in screwing the cover in place and removing it. The valve casing A has a water intake ported pipe connection 3 at its lower portion and is also provided at its lower portion with an exteriorly projected, exteriorly threaded annular member 4. At its bottom casing A has a central outlet port 5 the wall of which is threaded at 5^a for connection with a pipe, if so desired. The outlet port 5 is at the foot of an upstanding, integral conduit 6 which extends upwardly for a part of the length of casing A and the exterior wall of which is spaced apart from the opposed inward wall portion of casing A to form an enclosing chamber 7 in which intaken water is initially received through the intake port 3^a in the water intake pipe connection 3. The cover 1 is threaded on the casing at 8 and is thereby firmly held against high water pressure. A compressible gasket 9 is clamped by the cover against the upper end of casing A and the cover has a central downward relief valve arrester 10 which functions when the associated main valve and relief valve are in their lifted position, as shown in Fig. 3 to arrest the upward movement of the associated main valve and an imperforate, loose, exposed ball valve forming a relief valve carried by the main valve. The upper end member 11 of the main valve, at its upper end, is a sliding fit in casing A and movable up and down therein. It is formed with a central reentrant recess 12 open on the upward side and forms the upper portion of the main valve, the bottom wall of the recess 12 having a central relief pressure opening provided with a valve seat 13 for the imperforate, loose, exposed ball relief valve 14 which controls the relief opening 15 through the bottom of the recess 12. The interior diameter of the recess 12 is greater than the diameter of the ball relief valve 14 and the valve seat 13 in the bottom of the recess tapers upwardly and outwardly and is so dimensioned that the under portion of the ball relief valve, when seated, projects below the under surface of the upper end 11 of the main valve into working proximity and preferably into contact as shown with the hereinafter mentioned head 27 of the relief valve lifter. The main valve member 11 has its under end portion reduced in diameter to form a peripheral shoulder 16. At the upper end of the main valve member 11 a compressible gasket 17 is mounted against this shoulder and clamped in place by the screw threaded side wall of a cup shaped under main valve member designated by 18 applied to its upstanding side wall which is threaded to the reduced portion of the upper main valve member 11 at 19. The main valve member 18 is an upstanding cup or annular wall in the upper end of which the member 11 is fixed, the annular shoulder 16 projecting beyond the outer wall of the member 18. This under cupped member has a bottom 20 and spaced apart horizontal guide lugs 20^a, the peripheral walls of which bear slidingly on the inner wall of casing A on which the peripheral walls of the shoulder 16 of the upper main valve member 11 also slide. The exterior diameter

of the guide lugs 20^a is substantially the same as the diameter of the peripheral shoulder 16 of member 11 so that these lugs 20^a project beyond the outer wall of the cupped or annular member 18; and the peripheral shoulder 16 together with the gasket 17, which is annular, are spaced apart from the upper sides of the lugs 20^a forming a water chamber around the annular wall 18 and between the gasket 17 and the lugs 20^a. The upper, pressure-establishing tube B is mounted vertically in the peripheral shoulder 16 and discharges into the water receiving chamber between the gasket 17 and the lugs 20^a, extending through an upper, horizontal wall of the gasket. The spaces 20^b between the lugs 20^a form waterways in communication with the chamber 7 in which the entrant water is initially received. The upward surface of the bottom of the cupped member 18 of the main valve is marginally flat at 21, the bottom portion 21^a surrounded by the flat marginal portion 21 being dished or slanted downwardly to the central relief port 22 of the under main valve member 18. The relief port 22 discharges into the upper portion of the conduit 6 and is formed in a downward annular extension 23 of the bottom 20 of the cupped under member of the relief valve. A compressible gasket 25 is mounted against the under side of said cupped member enclosingly of the downward extension 23 and is clamped in place by a nut 24 threaded on the extension at 24^a. The margin of this gasket 25 is compressible on the upper end of the conduit 6, which upper end forms a valve seat for the main valve.

The ball relief valve 14 is a metal valve and is seated on the metal valve seat 13 of the metal main valve member 11 so that the joint is formed by metal against metal and forms a permanent and water-tight seat for the port relief valve when it is heavily pressed in place by water pressure that accumulates and becomes established in the upper chamber *a* of the main valve casing A between the upper surface of the upper main valve member 11 and the cover 1 when the main valve and relief valve are seated, as shown in Fig. 2; the chamber 7 in the lower portion of the valve structure being in communication with the chamber *a* through the waterways 20^b and an upper pressure-establishing tube B which has its upper end fixed in the shoulder 16 and extends downwardly through the gasket 17 below which its under end is exposed to water entering the chamber 7 under more or less high pressure, and frequently very high pressure. The bore *b* of the tube B is of very small diameter, of pinhole type, is straight and tapers downwardly being of gradually reduced diameter. The upper and largest diameter is a diameter adapted to permit upward flow of water under the lowest head, from chamber 7 into chamber *a* for building up in the chamber *a* a pressure therein equal to the pressure in chamber 7. The smallest diameter at the under end of the tube B is of a diameter adapted for the same purpose when the entrant water in chamber 7 is of a higher pressure and, therefore, more rapid in its flow through the tube, the under exposed and accessible end of which may be conveniently peened or reduced by squeezing the under mouth of the tube into smaller size for conveniently adjusting the flow to suit the highest water pressures encountered. In all cases as the bore of the tube is straight the upward flow of water under head tends to keep the tube B free of sediment and therefore in constant proper functioning condition.

In the chamber *x* of the under cupped member of the main valve there is loosely mounted the annular head 27 of the ball valve lifter 29 the head being flat on its under side and being seated, when the valves are closed, on the upper margin 21 of the bottom 20 of the under main valve member. The head of the ball valve lifter is provided with water escape openings 28 between spoke-like members 28^a of the head which centrally supports a dependent stem 29 projecting downwardly from the bottom of said cupped member through its relief port 22 into the chamber of the conduit 6, the stem being of lesser diameter than the relief port. The under sides of the lifter head, within the annular margin 21 of the head, are flat and spaced apart from and above the dished central portion of the bottom 20 of the cupped under member of the main valve, whereby the downward flow of water from chamber *a*, when the ball valve is lifted, is facilitated from the chamber of the recess 12 past the lifted ball valve through the relief port 15, the waterways 20^b, the space *w* between the head of the ball valve lifter and the dished bottom 21^a and the port 22 into the chamber of the conduit 6.

When the associated main valve and ball relief valve are in closed positions, as shown in Fig. 2, they are in approximately balanced pressure. But the ball valve is held seated by whatever pressure there is in the upper chamber *a* and this pressure in high pressure systems may be as much as from 80 to 90 pounds per square inch.

In order to lift the ball valve off its seat easily for reduction of the pressure in chamber *a* tending to keep it on its seat, by means of an easily operable handle H, and at all times, the stem 29 is extended well below the axis of the annular member 4 which forms a housing for the handle actuated actuator 30 for the ball valve lifter; and the inward end of the actuator 30 is at all times, whatever the positions of the

valves, in the path of the stem 29. The actuator 30 is an endwise slidable rod having an outer head 31 that is flat on its outward side; and this rod or actuator 30 is mounted in the central bore of a central outward extension 32 of a nut 33 having on its outward side an annular recess 34 the peripheral wall of which is exteriorly threaded at 35 into the inward threaded end of a cup 36 having at its outer end a central opening 37 through which the diametrically reduced neck 38 of the handle H loosely passes, the inward end of the neck 38 having a head 39 of larger diameter than the opening 37 so that the margins of the head bear rockingly in all directions on the annular end wall 40 of the cup 36, the interior diameter of which is greater than the diameter of the head 39. The handle H, therefore, has universal movement in all directions. The inward face 41 of the head 39 is flat and bears against the outer end surface of the head 34 of the actuator rod 30. Within the chamber of the cup 36 and the recess 34 of the nut 33 a coiled spring 42 is compressively mounted with its outer end bearing against the inner side of the actuator head 31 and its inward end bearing against the bottom of the recess 34 in the nut 33. The inward end of the nut 33 is provided with an inwardly projecting, exteriorly threaded extension 43 on which a cupped nut 44 is threaded at 45, the bottom or inward wall of the cupped nut 45 having a central opening at 46 through which the inward end of the actuator rod 30 slidably projects into the chamber of the conduit 6, whereby it is at all times in the path of and closely adjacent the stem 29. The cupped nut 34 encloses the inward end of the actuator rod 30 and holds compressively against the inward end of the threaded extension 43 an annular gasket 44 enclosing the rod with the important result that leakage of water along the rod to the handle or to joints in the handle supporting construction is prevented. The assembled handle, actuator, spring, cup 36, cupped nut 33 and cupped nut 44 are held operatively in place by a cupped clamp nut 46 the peripheral wall of which is threaded at 47 to the exteriorly threaded member 4 that projects from the casing A; the bore of the member 4 communicating with the chamber of the conduit 6 through the bore of an annular integral web 48 which connects the wall of casing A with the conduit wall 6. The cupped clamping nut 46 has a central opening of lesser diameter than the interior diameter of its peripheral wall forming a shoulder 49 enclosing the cup 36. The inward end of the cup 36 has an annular flange 50 which in the assemblage is clamped against the inner wall of the shoulder 49. A compressible gasket 51 is, in the assemblage, clamped between the outer end of a shoulder 50 and thereto opposed outer end wall of the casing member 4. The described construction of the universally movable handle forms a water-tight construction that prevents leakage, even under high pressures; and the assemblage of the handle and actuator holding means just described is one which is very convenient in making repairs to such parts whenever repairs are required.

When the parts are in the position shown in Fig. 2, it is obvious that if the chamber *a* has been filled through the tube B with water from chamber 7 the associated main valves and ball relief valve will as a whole, in relation to the valve seat on the upper end of the conduit 6, be under balanced pressure and remain seated, and that the ball valve relatively to its seat in the main valve will be under the maximum pressure exertable on it by water in chamber 2 and remain seated and will be under an approximately balanced pressure, the pressure from above being somewhat greater than the pressure upwards because less than one-half of the under side of the ball valve is exposed to upward pressure by water in chamber 12.

In whatever direction the handle H is tilted it will move the actuator 30 inwardly and tilt the stem 29 and head 27 so as very slightly to lift the ball valve from its seat and permit the water in chamber *a* to flow past the ball valve into the chamber of the conduit 6, thereby reducing the pressure in the chamber *a* and permitting the pressure of the water in chamber 7 to lift the main valve off its seat on the upper end of the conduit and thereby permit the water in chamber 7 and water flowing thereinto to flow out through the conduit 6 as sufficiently indicated by the lifted position of the valves shown in Fig. 3; but in reference to Fig. 3 it will be perceived that when the associated valves have been lifted very nearly to their maximum height, the upper side of the ball valve will be brought into contact with the under end of the valve arrester 10 with the ball valve still off its seat and mechanically restorable to its seat by the final slight increment of upward pressure and movement of the associated valves whereby as the main valve is moved very slightly upwards the arrester 10 will prevent further upward movement of the ball valve, force it back upon its seat and at the same time force the head of the ball valve lifter downwardly bringing the stem 29 into forcible pressure against the inward end of the arrester 10 and any resistance that there might be then applied by the hand on the handle H. When the hand is removed from the handle H, the spring 42 which has been compressed by any angular movement of

the handle will force the arrester back and bring the handle into its normal horizontal position of rest. And at this time the ball valve thus restored to its seat by impact against the arrester 10 and by the final increment of upward movement of the main valve will drop into its seated position with the main valve as the latter gravitates to its seat with more or less rapidity and the entrant water slowly flows upward through the tube B to build up a pressure in the chamber *a* and keep the main valve seated on the conduit 6 and the ball valve seated in the main valve.

To prevent displacement of the ball valve relatively to its seat in the upward and downward reciprocations of the main valve the wall of the chamber 12 is provided with three equally spaced apart vertical, thin-edged ribs 12ª (Fig. 5) which impinge tangentially on the sides of the ball valve and compel such valve when the lifter is tilted to move in a vertical path within the chamber 12 the maximum diameters of which between the ball confining ribs exceed the diameter of the ball valve which only requires to be moved from its seat by a very slight distance. In operation, the ball valve is merely twiddled off its seat just enough to permit the reduction of pressure in chamber *a*, the under diametric point of the ball bearing on the lifter substantially in line with the axis of the stem 29.

When the associated valves have been lifted to their full extent and the handle H has been brought back into its horizontal normal position of rest, the gravitating movement of the associated valves will, of course, be very slow because of the slow access of water from chamber 7 through the tube B into the upper chamber *a*. So long as the handle H is held out of its horizontal normal position the ball valve will be kept off its seat and water from chamber *a* permitted to flow out of that chamber and escape with water from chamber 7 through the conduit 6. Thus, the ball relief valve confined to vertical unseating and seating movements is always in position to make a tight joint with its seat, metal to metal as described, without the use of any rubber or similar gasket which speedily deteriorates in use and permits the valve structure to leak; and as the ball valve lifter is continuously in close working contiguity or contact with the stem 29, the chamber *a* is well drained when the handle is deflected from its normal position, with the result of creating such a degree of partial vacuum in the chamber *a* that such chamber is more rapidly filled, though slowly filled, than would be the case if the construction were such as to permit the chamber *a* to remain more or less filled with water and subject on the rise of the associated valves to appreciably greater resistance than occurs with the drainable chamber *a* in the present construction.

The main valve is unrestrainedly slidable up and down in the casing A and divides the chamber of the casing into the under water intake and escape chamber 7 and the upper pressure chamber *a*, the size of the chamber 7 being increased and the size of the chamber *a* being decreased as the valve rises. When the valve is at its uppermost, or near its uppermost position, the latter being the position of the main valve as shown in Fig. 3, the main valve structure is lifted so far above the upper end of the conduit 6 as to leave a clear space of the full width of the diametric dimensions of the chamber of casing A for the escape of water into and through the conduit and discharge port at the foot thereof. In view of the very high pressures to which the interior parts of the valve are often subjected, as in high pressure water systems, it is desirable to make all the parts strong and by connecting the spoke members 28 of the lifter by the continuous peripheral marginal wall 27, requisite stiffness is given to this lifter and to its spokes to withstand heavy pressures. When the relief valve lifter is moved angularly, a portion of its peripheral marginal wall 27 fulcrums on an opposed portion of the flat margin 20ª of the recess in the bottom 21 of the cupped member 18 of the main valve, as shown in Fig. 3.

The bottom portion 21ª of the under supplementary member of the main valve is dished downwardly to facilitate outflow of water. The upper surface of the upper member of the main valve is also downwardly dished at *y* to facilitate draining of the chamber *a*. The upper interior margin of conduit 6 is bevelled slightly upwardly and outwardly at *y'* for reception of a removable preferably metal valve seat 6ª formed with an exteriorly tapered dependent annulus 6ᵇ which is a driving fit in the upper bevelled part of the conduit and can be driven into place and when warm driven out of place and replaced. For insurance against leakage of outflowing water along the actuator 30, the chamber of the cupped nut 44 carries a compressible annular gasket 44ª enclosing the actuator and held compressively against the inward end of the threaded extension 43. It is practically important to prevent water crawling along the actuator into the chamber of the cup 36 from which it would escape outwardly past the handle head 39.

What I claim is:

1. In a flush valve, the combination with a vertical casing having in its under portion a water intake port, a water discharge port and a housing for a handle; said han-

dle and a thereby actuatable valve actuator and also having in its under portion an interior, upstanding water discharge conduit having an exterior diameter less than the interior diameter of the casing to form a water chamber between the casing and the conduit, said conduit enclosing the water discharge port and extending thereabove part way to the upper portion of the casing, of a main valve having an upper peripheral flange and an under, spaced apart series of lugs with water spaces between them, said flange and lugs being in sliding contact with the wall of the chamber above the upper end of said conduit and dividing the chamber into an under intake and an upper pressure chamber; the main valve being seatable on and freely slidable towards and away from the upper end of the conduit; and having an upstanding tubular member of lesser interior diameter than the diameters of said flange and lugs; a vertical, upper pressure-establishing tube carried by said flange exteriorly of said tubular member; an open topped, downwardly recessed valve-holding member carried by said tubular member of the main valve and having a ball valve seat at its bottom; a ball relief valve mounted in said recess, projecting below the under side of its seat and being loosely mounted relatively to said seat and exposed to water thereabove; a relief valve lifter carried by the main valve and having a stem dependent into said conduit therein, continuously in actuatable contiguity to the actuator irrespective of the positions of the main and relief valve; and means for restoring the actuator and handle automatically to normal position of rest when the handle is relieved of laterally deflecting force.

2. In a flush valve, the combination with a vertical casing having in its under portion a water intake port, a water discharge port and a housing for a handle; said handle and a thereby actuatable valve actuator and also having in its under portion an interior, upstanding water discharge conduit having an exterior diameter less than the interior diameter of the casing to form a water chamber between the casing and the conduit, said conduit enclosing the water discharge port and extending thereabove part way to the upper portion of the casing, of a main valve having an upper peripheral flange and an under, spaced apart series of lugs with water spaces between them, said flange and lugs being in sliding contact with the wall of the chamber above the upper end of said conduit and dividing the chamber into an under intake and an upper pressure chamber; the main valve being seatable on and freely slidable towards and away from the upper end of the conduit, and having an upstanding tubular member of lesser interior diameter than the diameters of said flange and lugs; a vertical, upper pressure-establishing tube carried by said flange exteriorly of said tubular member; an open topped, downwardly recessed, valve-holding member carried by said tubular member of the main valve and having a ball valve seat at its bottom; a ball relief valve mounted in said recess, projecting below the under side of its seat and being loosely mounted relatively to said seat and exposed to water thereabove; a relief valve lifter carried by the main valve and having a stem dependent into said conduit therein, continuously in actuatable contiguity to the actuator irrespective of the positions of the main and relief valve; and means for restoring the actuator and handle automatically to normal position of rest when the handle is relieved of laterally deflecting force; said casing being provided at its upper end with a detachable cover and a relief valve arrester in the path of the relief valve recess being provided with means to compel the relief valve to move vertically in its unseating and seating movements.

3. In a flush valve, the combination with a vertical casing having in its under portion a water intake port, a water discharge port and a housing for a handle; said handle and a thereby actuatable valve actuator and also having in its under portion an interior, upstanding, water discharge conduit having an exterior diameter less than the interior diameter of the casing to form a water chamber between the casing and the conduit, said conduit enclosing the water discharge port and extending thereabove part way to the upper portion of the casing, of a main valve having an upper peripheral flange and an under, spaced apart series of lugs with water spaces between them, said flange and lugs being in sliding contact with the wall of the chamber above the upper end of said conduit and dividing the chamber into an under intake and an upper pressure chamber; the main valve being seatable on and freely slidable towards and away from the upper end of the conduit; and having an upstanding tubular member of lesser interior diameter than the diameters of said flange and lugs; a vertical, upper pressure-establishing tube carried by said flange exteriorly of said tubular member; an open topped, downwardly recessed, valve-holding member carried by said tubular member of the main valve and having a ball valve seat at its bottom; a ball relief valve mounted in said recess, projecting below the under side of its seat and being loosely mounted relatively to said seat and exposed to water thereabove; a relief valve lifter carried by the main valve and having a stem dependent into said conduit therein, continuously in actuatable contiguity to the

actuator irrespective of the positions of the main and relief valve; and means for restoring the actuator and handle automatically to normal position of rest when the handle is relieved of laterally deflecting force; said casing being provided at its upper end with a detachable cover and a relief valve arrester in the path of the relief valve recess being provided with means to compel the relief valve to move vertically in its unseating and seating movements; the relief valve being contactible with the arrester when in an unseated position and the main valve being then movable upwardly for seating the relief valve when both valves are in their uppermost position, and the relief valve being, when near its uppermost position, liftable off its seat by deflection of the main handle from its normal position of rest and the consequent movements of the actuator and valve lifter whereby the upper pressure chamber is drained when the valves are near their uppermost position for establishment of a partial vacuum in the upper chamber, permitting more rapid filling of that chamber by access of water through the pressure establishing tube.

4. In a flush valve, the combination with a vertical casing having in its under portion a water intake port, a water discharge port and a housing for a handle; said handle and a thereby actuatable valve actuator and also having in its under portion an interior, upstanding, water discharge conduit having an exterior diameter less than the interior diameter of the casing to form a water chamber between the casing and the conduit, said conduit enclosing the water discharge port and extending thereabove part way to the upper portion of the casing, of a main valve having an upper peripheral flange and an under, spaced apart series of lugs with water spaces between them, said flange and lugs being in sliding contact with the wall of the chamber above the upper end of said conduit and dividing the chamber into an under intake and an upper pressure chamber; the main valve being seatable on and freely slidable towards and away from the upper end of the conduit; and having an upstanding, tubular member of lesser interior diameter than the diameters of said flange and lugs; a vertical, upper pressure-establishing tube carried by said flange exteriorly of said tubular member; an open topped, downwardly recessed, valve-holding member carried by said tubular member of the main valve and having a ball valve seat at its bottom; a ball relief valve mounted in said recess, projecting below the under side of its seat and being loosely mounted relatively to said seat and exposed to water thereabove; a relief valve lifter carried by the main valve and having a stem dependent into said conduit therein, continuously in actuatable contiguity to the actuator irrespective of the positions of the main and relief valve; and means for restoring the actuator and handle automatically to normal position of rest when the handle is relieved of laterally deflecting force; in said housing, a horizontal actuator rod in continuous contact with said stem and between the inner end of the handle and the inner end of the actuator rod, actuator rod actuating mechanism comprising at the inner end portion of such mechanism a compressible gasket enclosing the rod and a perforated cap through which the actuator rod passes and which holds the gasket compressively in place to prevent leakage around the actuator rod.

5. In the combination set forth in claim 1, said upper, pressure-establishing tube having a small bore downwardly tapered and the under end of the tube being accessible and compressible.

6. In the combination set forth in claim 1, the vertical wall of the ball relief valve receiving recess being provided with inwardly projecting, laterally spaced apart, ball valve guides.

Signed at New York city, in the county of New York and State of New York, this 13 day of February, A. D. 1923.

KARL REZNICEK.