

S. W. LEWIS.
FLUSHING VALVE.

(Application filed Oct. 6, 1899.)

(No Model.)

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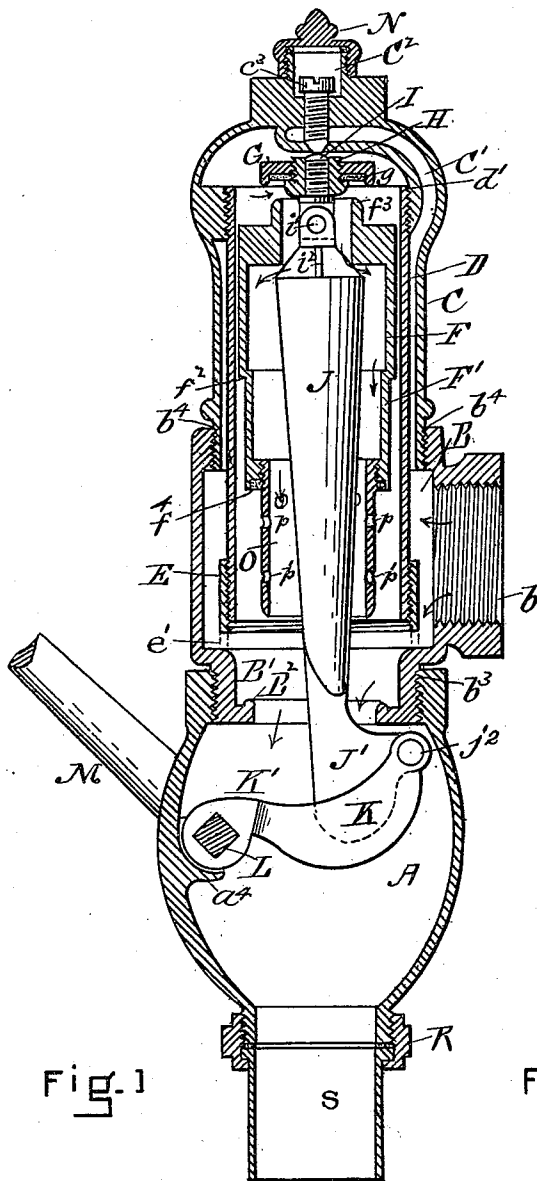


Fig. 1

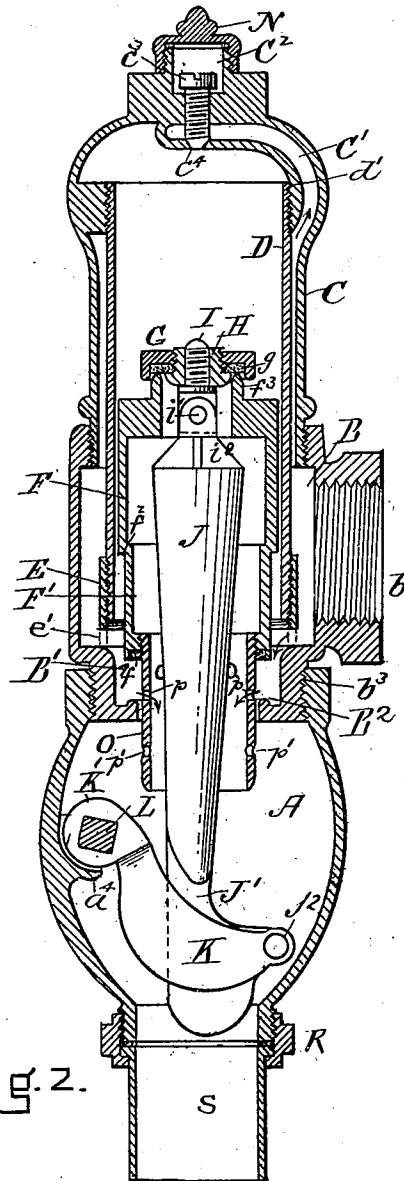


Fig. 2.

WITNESSES

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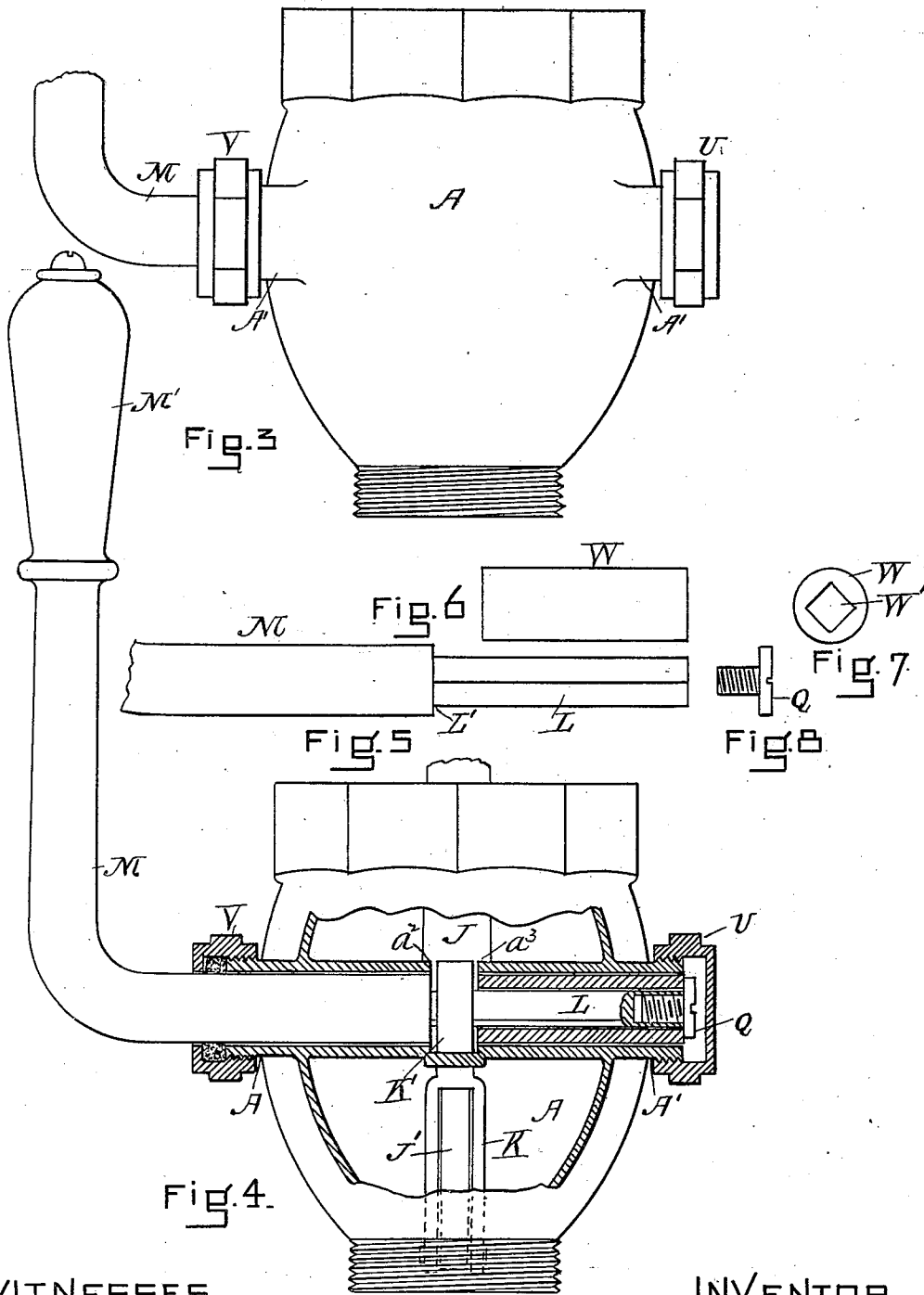
Samuel Walter Lewis
by his atty-
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WITNESSES

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UNITED STATES PATENT OFFICE.

SAMUEL WALKER LEWIS, OF NEW YORK, N. Y., ASSIGNOR TO GEORGE E. GILCHRIST, OF MELROSE, MASSACHUSETTS.

FLUSHING-VALVE.

SPECIFICATION forming part of Letters Patent No. 663,284, dated December 4, 1900.

Application filed October 6, 1899. Serial No. 732,759. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL WALKER LEWIS, a citizen of the United States, residing in the city of New York, borough of Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Flushing-Valves, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification, in explaining its nature.

The object of my invention is a flushing-valve for sanitary purposes to attach directly to water-closets or similar receptacles, whereby the main supply-pressure can be conveyed directly to and caused to operate the receptacle without the intervention or use of a separate overhead tank or cistern for each receptacle and that will open easily and close gently and noiselessly, giving finally at closure an ample afterwash or refill to the receptacle. This object I accomplish by the apparatus hereinafter described, and illustrated by the accompanying drawings, wherein the same letters of reference indicate identical parts in all the views.

Figure 1 is a vertical sectional view (reduced scale) showing the apparatus or valve open in the operation of full discharge; and Fig. 2 is a companion view on the same scale, showing the valve in the act of closing and at the same time refilling the receptacle. Fig. 3 is an external front view of the discharge-chamber of the device, showing the position of the operating-lever and bearings therefor. Fig. 4 is a similar view of the same in section. Fig. 5 is a view of the operating-lever detached from its accessories. Fig. 6 is a view of the detachable journal of the lever. Fig. 7 is an end view of said journal, and Fig. 8 is a view of the securing screw or bolt which holds the lever and its accessories in place.

Referring to the drawings, A is a discharge-chamber forming the base of the device and is provided with integral hollow arms or bearings A', which extend interiorly to a^2 a^3 .

B is a cistern or containing-chamber provided with inlet supply-opening b , which may connect to the main supply-pipe by a screw-thread or otherwise. The chamber B in this instance is T-shaped and provided with a

counterbore B', main-valve seat B², and is preferably secured to the discharge-chamber A by a screw-thread b^3 or otherwise.

C is a cylindrical cap secured to part B by a screw-thread b^4 or otherwise.

C' is a water-passage extending from the side of the cap or casing C to a central downward outlet c^4 .

C² is an exterior counterbore or recess on the top of the cap C and covered by the screw-threaded hood N.

c^3 is an adjusting-screw which engages with a thread in the bottom of the counterbore C² and passes through the passage C' to close down upon and throttle the opening c^4 , as hereinafter set forth.

D is a cylinder open at both ends and adapted to permanently engage the top of the cap C by a screw-thread d' or otherwise, and E is a screw-threaded ring or extension adapted to engage the lower end of the cylinder D, whereby the flow of water under said cylinder can be throttled or controlled by screwing down the ring, as shown by dotted lines e' and as hereinafter set forth.

F is a hollow piston open at both ends and adapted to operate vertically within the cylinder D and is preferably provided with a lower extension or plunger F' of relatively smaller diameter than the piston F, whereby an external shoulder is formed at f^2 to encounter the upward pressure of the water, and the lower end of the piston-plunger F' is preferably counterbored at its lower end to receive the main-valve washer f^4 , which is adapted to close down upon its seat B² to shut off the flow of water. A tubular extension O, which I term a "regulator," is screwed upward into the lower end of the plunger F'. It is provided with a number of lateral holes $p p p'$ to supply the afterfill and to cushion the main valve in closing, as will hereinafter be explained. The upper end of the piston F is provided with a raised seat f^3 to receive the relief or secondary valve washer g , which is clamped within the valve carrier or guide G by the follower H. The follower H screws down upon a spindle I, which is linked or pivoted at i' to a weighted connecting-rod J. The upper end of the connecting-rod is provided with fins or spurs i^2 to prevent

complete closure of the relief-valve opening through the top of the piston on its upstroke, and the lower end of the connecting-rod is flattened at J' and pivoted by a pin j^2 within the forked crank K , the hub end of which latter engages the square end of the axle or rock-shaft L of the operating-lever M , which latter terminates in this instance in a handle M' , or said lever may be arranged to be operated by communication with a door or a seat operating attachment or otherwise.

Fig. 3 is introduced to show the external view or arrangement of the discharge-chamber A , with projecting arms A' , packing-nut V , and cap U , within which the rock-shaft or lever-axle oscillates. In this instance the chamber A is made egg-shaped; but any other suitable shape or form will answer the purpose.

The details of the operating mechanism shown in Figs. 4, 5, 6, 7, and 8 are as follows: In connection with the projecting arms $A' A'$ the interior journal bearings or boxes $a^2 a^3$ are preferably cast integral with the part A ; but, if preferred, loose boxes or bearings could be inserted or used in the usual way for the purpose. The axle M , Fig. 5, is cylindrical to the point or shoulder L' , where it is reduced to a square L to engage with a corresponding square opening K' in the crank K . A rest or bearing a^4 is provided to prevent the crank-hub K' from dropping out of place when the axle $M L$ is withdrawn. The journal W is externally the same size as the axle M and is square-cored to closely fit the square end L of said axle, and a screw Q fits a corresponding thread within the end of the square end L of axle M . A packing-nut V is provided, which fits over the axle M and engages one of the arms A' , and a cap U which engages the screw-thread on the other arm A' . The adjustment of these parts is as follows: The crank $K K'$ being in place in the opening or space between the interior bearings $a^2 a^3$ and supported by the shelf a^4 , the packing-nut V is slipped over the axle M , which latter is then inserted into its bearing in one of the arms A' , the square end L passing through the corresponding square hole or enlargement of the crank-hub K' . The shoulder L' abutting against the crank at K' , the journal W is then inserted in the other arm A' , its square core W' engaging the square L of axle M , whereby it forms a part of and turns with axle M . The screw Q is then inserted in the end of the axle-square L , its flanged head abutting against the outer end of the journal W . The cap is then screwed tightly on the arm A' , completely covering the nut Q and preventing leakage, as shown in Fig. 4. A union $R S$ is preferably provided to connect the apparatus to the receptacle it is designed to flush, and the upper end of the cap C is provided with a projection or nut of suitable shape to engage a wrench or spanner, whereby the cap C is screwed into place.

In Fig. 1 the piston is shown elevated to the

end of its stroke at the top of the cylinder D and borne up by the fins or spurs i^2 on the upper end of the connecting-rod J , the relief-valve $g G$ being open, whereby the water has been discharged from the upper end of the cylinder down between the fins i^2 and through the piston, as indicated by the arrows. In Fig. 2 the fins or spurs have dropped away from contact with the piston, the relief-valve $g G$ being closed upon its seat f^3 . Thus it will be understood that the relief or secondary valve operating on the outside of the piston to open and close its passage is moved by the connecting-rod, which latter has limited play through the hollow or core of the piston, whereby on the upward stroke the relief-valve will be first lifted or opened to let out the water above the piston to facilitate its easy ascent, and when the handle M' is released the weights $J K$ will first draw the relief-valve $g G$ down upon its seat f^3 , when the further descent of the piston will be retarded by the vacuum formed above it and the descent of the piston and main valve will be made quick or slow by the admission of water-pressure through the passage C' and vent-hole c^4 into the cylinder D and cap C above the piston, which admission of water is governed by the regulating-screw c^3 . For instance, when it is desired to close the valve very slowly and prolong the flush the screw c^3 is screwed down so as to almost close the vent-hole c^4 , the opposite effect being obtained by moving the end of the screw c^3 away from the vent c^4 , whereby the freer admission of water will cause the valve to close more quickly. Hence I term the screw c^3 a "regulating-screw," for by its use I am able to regulate the closure of the valve f^4 upon its seat B^2 and provide a long or short flush, as desired. Furthermore, it will be observed that the head of the regulating-screw c^3 is on the outside of the cap C and cylinder D , whereby it is only necessary to remove the cover or protecting-hood N to expose said screw. Hence I am enabled to regulate the operation of the device without shutting off the water-pressure or disturbing any other part or connection.

If desired, the hood N can be dispensed with; but though not essential I prefer to use it to protect the screw from disturbance by those who might not understand its operation or use.

The regulator O is of a size to just fill or pass down within the annular valve-seat B^2 , whereby when the descent of the piston F and plunger F' causes the regulator to enter and choke the outlet the flow of water will be shut off, except the small quantity that escapes through the small annular space between the periphery of the regulator and valve-seat, which might be sufficient for an afterfill if the valve would continue to descend as slowly at the lower end of its downstroke; but with a regulator having no ports or ventage entering the outlet the sudden increase of downward pressure around the plunger and main valve and through the small

annular space between the regulator and valve-seat (before alluded to) operates to draw the valve down so quickly and violently upon its seat as to defeat both the object of
 5 a gentle closure and the necessary afterfilling of the receptacle after the flush. To entirely obviate this difficulty, I provide the regulator O with a series of lateral openings or ports $p p' p'$, whereby when the regu-
 10 lator enters the valve-outlet B^2 and suddenly shuts off the flow or flush the increase of pressure from dynamic toward a static condition finds relief or vent through the holes, at first through all of them, giving a quick
 15 afterfill, and as the lower holes pass below the seat the ventage is gradually reduced and the pressure is gradually equalized between the main valve f^4 and its seat B^2 and around the plunger to such an extent as to
 20 insure (under highest pressure) a reliable afterfill and gentle closure of the valve upon its seat which is essential in a valve of this kind.

The diameter of the piston F being greater
 25 than its plunger or extension F' , the shoulder f^2 is formed, whereby when the relief-valve g G is raised and the piston is relieved of all pressure above it the upward pressure of water under the shoulder f^2 within the
 30 chamber D against the greater diameter of the piston will assist to elevate the piston on its upward stroke, and the higher the pressure the more will be the assistance from that source to operate the device and overcome
 35 friction in opening it—a very important essential under some conditions.

Another advantage of my construction is in connecting the upper end of the cylinder D to and within the upper end of the cap C,
 40 whereby the closed head of cap C serves also as a head for the cylinder D, and by simply unscrewing the cap C at its thread b^4 both cap C and cylinder D can be removed as one. Then by unscrewing the relief-valve g G from
 45 the spindle I the piston F, plunger F' , regulator O, and main valve f^4 can be lifted out as one piece. Thus it will be understood that by screwing or unscrewing two threads the entire working parts of the apparatus can
 50 be put in place or taken apart for repacking or otherwise without disturbing any other connection.

The cylinder D and its extension E preferably extend below the bottom of the main
 55 supply-inlet b . The purpose of this is to prevent the flow of water when under high pressure from striking or bearing against the piston-plunger F' and regulator O, which might cause friction and noise; but by carrying
 60 down the lower end of the cylinder D it acts as a shield to deflect the flow of water around and below the cylinder, whereby the pressure is equalized around the plunger and no lateral disturbance is possible. When used under
 65 conditions of extremely-high pressure or where a gentle flow of water is desired for the receptacle, the extension E is screwed down,

as shown by dotted lines at e' , whereby no more than the desired quantity of water can flow down and out through the valve-pas-
 70 sage B^2 . The pressure of water and area of water-passage being known, but one adjustment of this part of the device is necessary when it is set in place for operation, and so
 75 long as the average pressure remains reasonably near its original static condition no further adjustment of that part will be necessary.

In the examples herein illustrated I have shown only a metal piston operating within
 80 the cylinder D, in which form, it will be observed, there is a small annular space or passage between the periphery of the piston and its cylinder, which space or passage commu-
 85 nicates between the parts of the cylinder above and below the piston. Hence in operation on the downstroke a small quantity of water will pass upward above the piston as it slowly descends. In theory it might be ex-
 90 pected that such flow of water upward around the piston would be sufficient to operate the valve without a vent-screw c^3 or inlet-port c^4 below said screw; but in practice flushing-
 valves without regulating screws or vents have always eventually failed through causes
 95 made evident by experience. For instance, no matter how pure the water may seem to be the piston will soon become coated with precipitation or slime from the water, which in time causes it to stick, because the annular
 100 passage thus becomes closed and no pressure can be made adequate above it to close or drive the piston downward or permit it to fall by gravity. Hence in my description of the
 105 parts and of the operation I make no other allusion to the inflow of water above the piston in closing than through the passage C' and vent c^4 . Furthermore, I may finally dispense with a metallic piston and use a leather cup-
 110 packed piston or otherwise, in which case there would be no passage for water above the piston except through the passage C' and by its vent c^4 . Hence the regulating-screw c^3 is essential in the form shown, or some other
 115 similar arrangement is necessary to admit water above the piston, and thus control the operation of the device.

The apparatus being connected to the supply-main at b and to the water-closet or similar receptacle, with the ring or extension E
 120 set at the proper height for the desired opening and flow, as hereinbefore described, and the regulating-screw c^3 being adjusted for the desired length of flush, the operation is as follows: The first movement of the handle
 125 acts to lift the relief-valve off its seat and bring the ribs or fins i^2 of the connecting-rod J in contact with the under side of the top of the piston. When the piston borne upon the ribs i^2 begins its ascent, opening the relief-
 130 valve allows the water above the piston to be drawn out by the downward flow around the tubular regulator O, which relieves the piston of all resistance above it, and, assisted by

the pressure of water upward against the shoulder f^2 , the device is opened with great ease and without apparent friction. The full stroke having been attained, the handle or other operative mechanism is released, when the weighted lever J and crank K drop by gravity, closing first the relief-valve. Then the piston F, plunger F', valve f^4 , and regulator O begin to slowly descend as fast as water is admitted through the passage C' and vent c^4 above the piston. From the instant the main valve leaves its seat in opening the flush continues until suddenly checked by the descent of the regulator into the outlet-opening, which suddenly checks it, and the sudden increase of pressure finds vent through the lateral openings $p p'$ in the regulator, which is sufficient to quickly refill the closet-receptacle. This operation will be understood by reference to Fig. 2, where the lower holes or ports p' have passed below the valve-seat and the afterfill is still flowing through the upper holes p and around the periphery of the regulator, as indicated by the arrows. Thus the pressure and flow are gradually shut off, and when the upper ports p' have passed below the valve-seat the pressure has become equalized, and the water then between the main valve f^4 and its seat acts as a cushion, and the valve settles quietly upon its seat without concussion.

It will be observed that the shoulder f^2 at the lower end of the piston is always within the cylinder D and never drops below it. Hence the upward pressure of the water against said shoulder acts not only to assist in elevating the piston, but to cushion its descent as the valve drops to its seat, and, as already set forth, the higher the pressure the more benefit will result from this source. Furthermore, the diameter of the plunger F' can be decreased and the area of the annular shoulder f^2 thereby increased to such an extent that by simply opening the relief-valve $g G$ to relieve the piston of pressure above it the water-pressure under and against said shoulder f^2 will act to automatically elevate the piston to the top of its stroke without assistance from the lever, when the closure of the relief-valve and gradual admission of pressure through the vent c^4 will cause the piston and main valve to slowly close, as hereinbefore described.

It will be seen that any partition or plate interposed between the main valve and the water-inlet will serve the purposes of this section of the cylinder so long as its lower edge is on a line with or below the lowest line of the water-inlet, and that it may also have mounted upon it means whereby its length may be extended for the purpose of throttling the water-passage beneath its lower edge, and that where the cylinder is provided with a sleeve, or its equivalent is provided with means for its extension, it is not essential that the lower edge of the cylinder or partition be extended to the lowest line of the

water-inlet so long as the lower edge of the adjustable sleeve or plate is so extended.

A peculiarity of the action of a valve having the above-described construction is found in the fact that the valve opens with great ease and by the application of light force or pressure even when it is used with exceedingly heavy water-pressure and that it also closes easily, noiselessly, and with no hammer. This action of the valve is due to the construction of the main and auxiliary valves, which are shaped and organized to effect these things: First, to provide a full free untar-
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the first opening of the main valve, because it is separated from the hollow interior of the valve-piston and has a direct connection with the water-head. For a similar reason
 5 the head acts in connection with the pressure in the chamber to so retard the final closing action of the main valve as to prevent a water-hammer at the instant the pressure is finally shut off. As the regulator O during
 10 the first part of the opening movement of the main valve checks or retards the flow of the water from the supply-pipe past the stationary valve-seat, but does not act to prevent the immediate flow or release of the
 15 water from the chamber above the main-valve piston through the main valve, it follows that during the first portion of the opening movement of the main valve the water-pressure is considerably greater against the head than
 20 it is when the regulator finally passes above the stationary valve-seat and permits of the relatively unrestricted flow of the water from the supply-pipe, and it is during this period of restriction of flow that the pressure of the
 25 water-head is exerted upon the piston-head outside the valve-seat, while at the same time it is prevented from acting upon the main valve within the main-valve seat.

Having thus fully described my invention,
 30 I claim and desire to secure by Letters Patent of the United States—

1. In a water-measuring, self-closing valve, the combination of a casing forming a part of the waterway and of a chamber for containing operative parts of the valve, a water inlet to and outlet from said chamber, a stationary main-valve seat between the inlet and the outlet, a cylinder attached to the valve-casing, open throughout, and having its lower
 40 end extended to or below the lower line of the water-inlet, a regulating-ring mounted upon the lower end of said cylinder and movable thereon to vary the position of the lower edge thereof with respect to the water inlet and
 45 outlet, a chamber in the upper part of the valve-casing, a passage from the waterway to the said chamber, a hollow, main-piston valve, open at both ends to provide a passage through it, having a valve-seat to cooperate with the
 50 main-valve seat in closing the valve, a hollow, perforated extension below said valve-seat and a valve-seat surrounding the passage through the piston-valve, a secondary valve arranged above the main valve and means
 55 for opening said valves, the secondary valve slightly in advance of the main valve, as and for the purposes set forth.

2. The combination, in a water-measuring, self-closing valve, of a valve-casing having a
 60 main-valve seat and a valve-chamber above the same and a chamber below the same, a cylinder in the valve-chamber, a main-piston valve contained in said cylinder having a main-valve seat to cooperate with the main
 65 stationary seat in closing the valve, a passage extending through the piston connecting a chamber above the same with the waterway,

a secondary valve for closing and opening and means for moving the main-piston valve and the secondary valve to open the valve, consisting of a crank contained in the chamber
 70 below the valve-seat, having one end held between two ears on the valve-casing and provided with a square hole at said end, a cylindrical bearing in the said ears and valve-casing, a lever-handle having a spindle, a portion of which is cylindrical and of the size of
 75 said bearing, and a portion of which is of the size of the square hole in the crank, and which extends through said hole in the crank and
 80 into one of the cylindrical bearings of the valve-casing, a sleeve of the size of said bearing having a square hole for receiving and inclosing the square end of the spindle, means
 85 for holding the sleeve upon the spindle and a link connecting the outer end of the crank directly with the secondary valve and loosely with the main valve, as and for the purposes set forth.

3. In a self-closing valve of the character specified the combination of the lower section
 90 of the valve-casing, forming a portion of a valve-chamber and having a water-inlet at one side thereof, a water-outlet and valve-seat at its bottom and a threaded opening at its
 95 top with a main movable valve and a secondary valve, a detachable cap comprising a cylindrical case closed at its upper end and open at its lower end and an independent cylinder, forming a portion of the valve-casing, open
 100 at both ends and secured to the cap to be simultaneously removed with it, to uncover and render accessible portions of said main and secondary valves.

4. In a self-closing valve of the character specified the combination of a section of the
 105 valve-casing, forming a portion of the valve-chamber and having a water inlet and outlet and opening at the end opposite the outlet and a main-valve seat about the outlet, a cap
 110 in the form of a cylinder closed at one end attached to the valve-casing at said opening and forming an extension of the valve-chamber, a stationary cylinder open at both ends attached to the cap with a portion contained
 115 within the cap and a portion extending into the lower part of the valve-chamber, a water-passage in the cap connecting the waterway with a port at the closed end of the cap opening
 120 into the chamber of the cap, the said port, devices for adjusting its size, a main valve having a valve-seat to close upon the stationary valve-seat about the outlet, a passage extending through it connecting the waterway
 125 with the chamber in the cap, a valve-seat upon the upper end of the main valve surrounding the entrance to said passage, a secondary valve in the chamber of the cap to cooperate with said last-named valve-seat and
 130 means for raising said main and secondary valves from their respective seats, the secondary valve slightly in advance of the main valve, as and for the purposes set forth.

5. In a self-closing valve of the character

specified the combination of a valve-casing having a water-inlet and a water-outlet, a stationary valve-seat surrounding the outlet, a main valve to cooperate with said seat, movable across the line of the water-inlet, and a stationary partition attached to the casing of the valve arranged to extend across the valve-chamber in front of the water-inlet thereto and having its lower edge on a line with, or extending below the lower line of said water-inlet and with the water-passage to the valve-chamber extending below said edge, as and for the purposes set forth.

6. In a self-closing valve of the character specified the combination of a valve-casing having a water-inlet, a water-outlet, a valve-chamber and a stationary valve-seat surrounding the outlet, a main-piston valve movable in the valve-chamber and cooperating with said stationary valve-seat, a stationary partition in two parts, one of which is adjustable upon the other to vary the length of the whole below the lowest level of the water-inlet and whereby the size of the water-passage between the lowest level of the water-inlet and the valve-chamber may be increased or diminished below said level, as and for the purposes set forth.

7. In a valve of the character specified, the combination of a casing forming a portion of a valve-chamber and having a water-inlet and water-outlet and a stationary valve-seat between the inlet and the outlet, a cylindrical casing forming a part of the valve-chamber the lower portion of which projects into the waterway of the valve, a main-piston valve comprising a cylindrical shell open throughout its length to form a straight, continuous passage from its upper to its lower end of relatively large area, having a main-valve seat at or near its lower end surrounding the entrance to the piston opening or passage and a narrow, outer head or shoulder on the wall of the piston above and without the main-valve seat separating the piston into two sections of different size, one of which is of a size to fit the cylindrical casing and the other of which below said head or shoulder is of a size smaller than said cylindrical casing and which reduced portion forms with the head and cylindrical casing, a cylindrical, water-pressure chamber below said head constantly open at its lower end to the direct water-pressure of the water-supply pipe, an auxiliary-valve seat at or near the upper end of said main-piston valve surrounding the entrance to the passage therein, an auxiliary valve to cooperate with said auxiliary-valve seat, a chamber in the valve-casing above the main-piston valve and into and from which it is movable, a water-passage independent of said main-piston valve connecting the water-head with said chamber, means for moving the main and secondary valves from their seats, the latter slightly in advance of the former and further means for automatically slowly closing the said main-piston valve.

8. In a valve of the character specified, the combination of a casing forming a portion of a valve-chamber and having a water-inlet and water-outlet and a stationary valve-seat between the inlet and the outlet, a cylindrical casing forming a part of the valve-chamber the lower portion of which projects into the waterway of the valve, a main-piston valve comprising a cylindrical shell open throughout its length to form a straight, continuous passage from its upper to its lower end of relatively large area, having a main-valve seat at or near its lower end surrounding the entrance to the piston opening or passage and a narrow, outer head or shoulder on the wall of the piston above and without the main-valve seat separating the piston into two sections of different size, one of which is of a size to fit the cylindrical casing and the other of which below said head or shoulder is of a size smaller than said cylindrical casing and which reduced portion forms with the head and cylindrical casing, a cylindrical, water-pressure chamber below said head constantly open at its lower end to the direct water-pressure of the water-supply pipe, an auxiliary-valve seat at or near the upper end of the said main-piston valve surrounding the entrance to the passage therein, an auxiliary valve to cooperate with said auxiliary-valve seat, a chamber in the valve-casing above the main-piston valve and into and from which it is movable, a water-passage independent of said main-piston valve connecting the water-head with said chamber, means for moving the main and secondary valves from their seats, the latter slightly in advance of the former, further means for automatically slowly closing the said main-piston valve and a perforated regulator extending from the main-piston valve through the port or opening of the stationary main-valve seat adapted to retard at the opening and at the closing of the main-piston valve the flow of water through the valve and whereby the water-pressure in the cylindrical chamber, beneath the outer piston head or shoulder, is maintained and created while the regulator acts to throttle the flow of water through the valve and at the beginning of the opening and end of the closing movements of the valve.

9. In a valve of the character specified, the combination of a casing forming a portion of the valve-chamber and having a water-inlet, a water-outlet and a stationary valve-seat between the inlet and the outlet, a cylindrical casing forming a part of the valve-chamber the lower portion of which projects into the waterway of the valve, a main-piston valve comprising a cylindrical shell open throughout its length having a straight, continuous passage from its upper to its lower end of relatively large area, a main-valve seat at or near its lower end surrounding the opening or passage in said main-piston valve, an auxiliary-valve seat upon said main-piston valve at or near its upper end surrounding the opening therein at said end, an auxiliary valve to co-

operate therewith, a valve-chamber to control the closing of the valve in the valve-casing above the main-piston valve and into and from which it is movable, a water-passage independent of said main-piston valve connecting the water-head with the said chamber and a cylindrical, perforated, hollow regulator extending from the lower end of the main-piston valve having a straight, unrestricted passage open at its lower end in continuation of the passage of the main piston and being of a size to throttle the flow of water through the valve and of a length to cause the said flow to be so throttled during the beginning of the opening movement of the main valve and near the end of the closing movement of said valve and at such time relieving its own passage and the passage of the main-piston valve from the full pressure of the water-head whereby upon the opening of the auxiliary valve the contents of the chamber above it may freely escape directly from said chamber through the passage in the main-piston valve and regulator without exerting a retarding action or stress against or upon said main piston and auxiliary valves.

10. In a slow-closing valve of the character specified, the combination of a valve-casing having a water-inlet, a water-outlet and a stationary main-valve-seat between the inlet and the outlet, a main-piston valve having a straight, continuous passage throughout it from one end thereof to the other, a main-valve seat on said piston surrounding the said passage, an outer pressure head or shoulder upon said piston, a water-pressure chamber surrounding said piston constantly connected with the water-supply pipe and in which the said piston head or shoulder is contained and movable, and a cylindrical, perforated regulator having an open passage in continuation of the passage of the cylinder and adapted to throttle or retard the flow of water through the valve at its opening and closing, whereby the pressure in the water-pressure chamber is maintained at such times and whereby also the water-pressure in its passage and the passage of the main piston at the time of the opening of the valve does not restrict the free, frictionless escape of water from the upper chamber of the valve through the passage in the piston and regulator.

11. In a valve of the character specified, the combination of a valve-casing having a valve-chamber, a water-inlet and a water-outlet, a stationary valve-seat in the valve-chamber between the inlet and the outlet, a detachable cap forming a part of the valve-casing and

removable from the remainder of the casing, a cylinder depending from said cap into the waterway of the valve and removable with said cap from the remainder of the valve-casing, a hollow main valve movable in said cylinder and partially closed by a head, a valve-seat at the lower end of said valve, a secondary-valve seat on said valve-head about the opening therein, a secondary valve to cooperate therewith, a chamber in the valve-casing above the main valve formed by the cylinder and the cap, a continuously-open passage in said cap outside said cylinder connecting said chamber with the waterway of the valve and a device for varying the size of said passage extending through and carried by the cap one end of which enters said passage and the other end of which is accessible from the outer side of the cap and means for moving said main and secondary valves upward from their seats and for closing the same, as and for the purposes set forth.

12. In a valve of the character specified, the combination of a valve-casing having a valve-chamber, a water-inlet and a water-outlet, a stationary valve-seat in the valve-chamber between the inlet and the outlet, a cylinder forming a part of the valve-casing and projecting into the waterway of the valve-chamber attachable to the valve-casing by threaded sections upon each and having its lower edge upon a line with or below the line of the lowest level of the water-inlet, a hollow main valve movable in said cylinder partially closed by a head, a secondary-valve seat on said valve-head about its opening, a secondary valve to cooperate therewith, a chamber in the valve-casing above the main valve, a passage connecting said chamber with the waterway of the valve and means for moving the main and secondary valves upward from their seats and for closing the same, as and for the purposes set forth.

13. In a valve of the character specified, a valve-casing having a detachable section comprising a cap having a threaded lower section and an independent cylinder open at both ends attached within the cap and extending below its lower edge, said cylinder and cap forming a valveway and a retarding-chamber, and a passage in said cap extending from its upper end to its lower end outside the cylinder and means carried by the cap for varying the size of said passage, as and for the purposes set forth.

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Witnesses:

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