

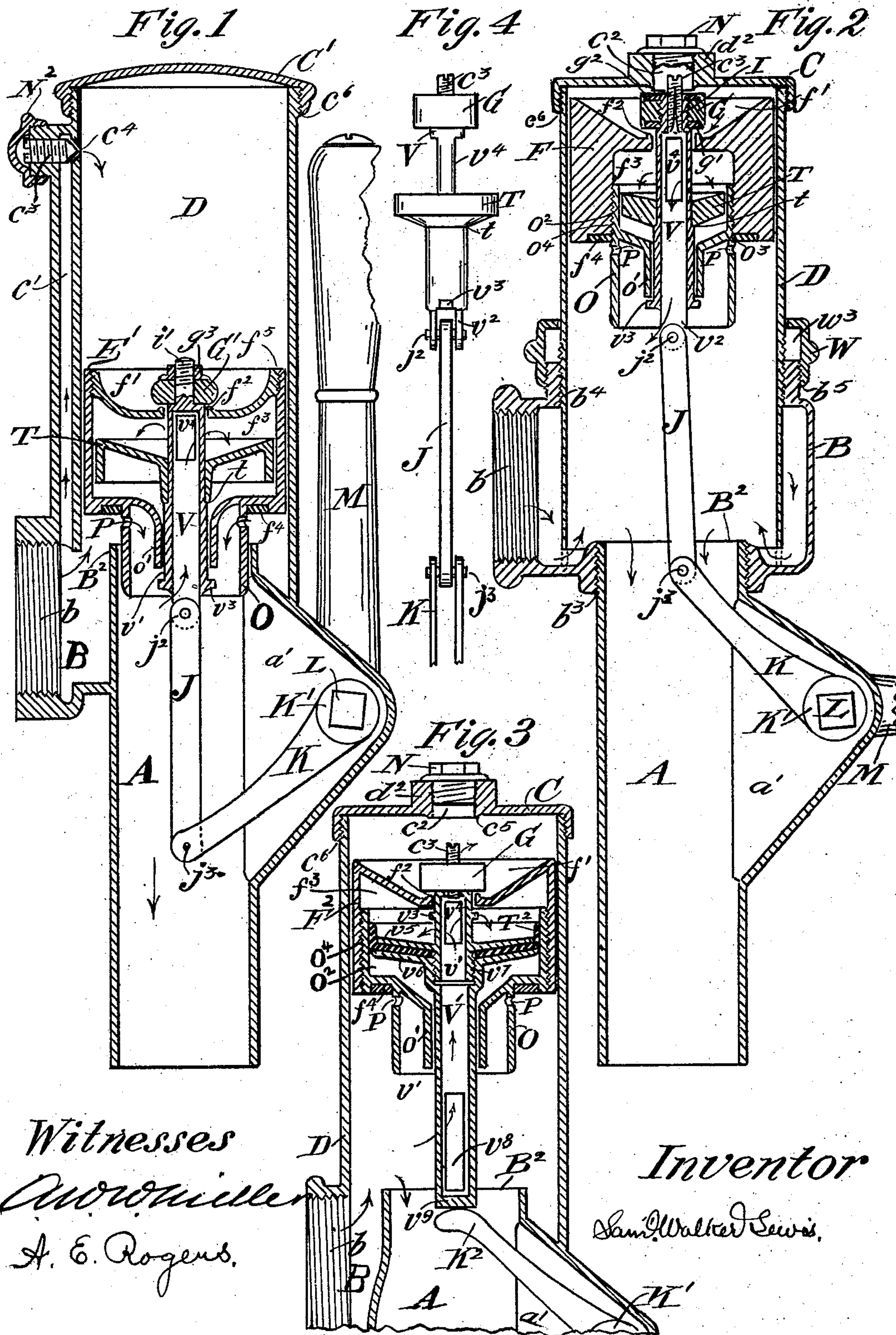
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Patented Dec. 9, 1902.

S. W. LEWIS.
FLUSHING VALVE.

(Application filed Nov. 29, 1901.)

(No Model.)



UNITED STATES PATENT OFFICE

SAMUEL WALKER LEWIS, OF BROOKLYN, NEW YORK.

FLUSHING-VALVE.

SPECIFICATION forming part of Letters Patent No. 715,675, dated December 9, 1902.

Application filed November 29, 1901. Serial No. 83,961. (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 drawings forming a part of this specification in explaining their nature.

The objects of my invention are to produce a flushing-valve for sanitary purposes attachable directly to a water-closet bowl or similar receptacle that will be self-cleansing, will open easily, and close noiselessly, giving at closure an ample refill to the receptacle, and which can be regulated to govern both the length and volume of flush without shutting off or interfering with the supply. These objects 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 showing a modification of the valve in the act of closing and at the same time refilling the receptacle. Fig. 2 is a view showing all features of the invention, the valve being open to its extreme limit in the operation of full discharge. Fig. 3 illustrates another modification showing the open valve in the act of descending to shut off the water, and Fig. 4 is a transverse view of certain parts removed from the main valve of Fig. 2 for clearer illustration.

Referring to the drawings, A is a discharge-chamber, forming a part of the valve casing or body and provided with a lateral extension a' to accommodate a crank-arm K K', shaft or axle L, and handle M for operating the valve.

B is a supply cistern or chamber, forming another part of the valve-body and surrounding the main-valve seat B^2 . It is connected to or made integral with the lower section A and is provided with an inlet connection b , whereby it can be attached directly to the supply pipe or main.

D is a cylinder-casing, with its lower end open, in communication with the supply, and is preferably provided at its upper end with

a cap C, preferably attached by the screw-thread c^6 , and sometimes I employ a square extension d^2 , adapted to receive a wrench for screwing and unscrewing the cap C. In Figs. 2 and 3 an opening c^2 in the cap is provided, with a valve-seat c^5 at its lower edge and the screw-threaded cap or plug N to close its upper end.

F is a hollow main-valve piston, which may be wholly metallic or packed with leather or other material, if desired, to closely hug the cylinder D. It is adapted to operate vertically within the casing D and is preferably provided at its upper end with a concave surface f' and valve-seat f^2 and at its lower end with the main-valve washer f^4 , tubular extension O, pressure-chamber f^3 , and the guide-sleeve o' , leading down from the chamber f^3 within the part O, which latter is provided with perforations P for the purposes of refill and vent when closing, as set forth and described in my Patent No. 663,284.

V is a hollow spindle, having limited vertical movement within the sleeve o' and valve-seat f^2 . In Figs. 1, 2, and 4 it is provided with stops v^3 and lugs v^2 at its lower end, also shoulder l and lateral openings v^4 near its upper end. In Fig. 1 an extension i' carries a relief-valve G', composed of a single packing, which is secured to said extension by the nut g^3 and is adapted to close upon its seat f^2 . In Figs. 2, 3, and 4 the extension I of spindle V carries a relief-valve G, which is provided with a washer g' , adapted to close down upon a seat f^2 , also a washer g^2 , adapted to close upward against a seat c^5 , and also a regulating vent-screw c^3 , as hereinafter described. In Fig. 3 the stops v^3 are located near the upper end of the spindle and within the chamber f^3 . The lugs v^2 are omitted and lateral openings in the spindle provided at v^8 .

In all the views the relief-valve G or G' co-operates with a removable differential-pressure head, septum, or subpiston T or T^2 , which throughout this specification and the claims I will term a "pressure-head." It is of larger diameter than the relief-valve and practically piston-tight within the wall of chamber f^3 and is adapted to operate automatically by the differential pressure of water upon its upper surface to close the relief-valve and hold it firmly upon its seat when

the main valve is closing. In Figs. 1, 2, and 4 the pressure-head or subpiston slips over the spindle and rests tightly upon the shoulder t , whereby when the relief-valve G or G' is removed the main-valve piston can be lifted out and detached from the spindle and as easily replaced. In Fig. 3 the spindle is composed of two parts V' and v' , united by the screw-thread v^7 . The part V' is provided with the flange v^6 , and the part v' is provided with the flange v^5 , and between said flanges is clamped an elastic cupped packing, which forms the pressure-head T^2 , and the lower end of the spindle V' is closed to form a bearing at v^9 for the crank arm or toe K^2 . In this modification, the spindle not being connected to the crank-arm K^2 , by removing the cap C the main-valve piston F^2 , with all its parts, can be removed, taken apart, and replaced with facility. In Figs. 1, 2, and 4 the stop-plugs v^3 are located to engage the sleeve o' , whereby the relief-valve will open slightly in advance of the main valve to relieve the main-valve piston from pressure above it. In Fig. 3, the pressure-head T^2 being rigidly attached to the spindle $V' v'$ to facilitate its removal from the main-valve piston, I locate the stop-plugs v^3 within the chamber f^3 , whereby when the relief-valve G is removed and the upper and lower parts of the main-valve piston are disconnected at the thread o^4 the pressure-head T^2 and spindle can be removed and replaced. In Fig. 1 the extension O and sleeve o' are integral with the main-valve piston F' , which latter is provided with a removable concave head united to it by the screw-thread f^5 . In Fig. 2 the extension O and the sleeve o' are integral and screwed at o^4 into the lower end of the piston F, the interior surface of the extension O at o^2 forming a cylinder for the pressure-head T, and the shoulder o^3 holds up the valve-washer f^4 in position. In Fig. 3 the extension O and sleeve o' form an integral part, which is screwed at o^4 into the main-valve piston F^2 , its interior surface o^2 forming a bearing for the pressure-head T^2 .

In Fig. 1 the outer end of the cylinder D is closed by a cap C', screwed to it at c^6 , a regulating-screw c^3 and its seat c^4 being located at the upper end of the by-pass c' , the lower end of the by-pass communicating with the inlet b . In Figs. 2 and 3 the removable cap C is provided with an opening c^2 , which is preferably sealed by a removable plug N. A seat is also provided at c^5 , and to provide a by-pass into the closed end of the cylinder I employ a regulating-screw c^3 , located in the upper end of the hollow spindle, the operation of which will be hereinafter explained.

In Figs. 1 and 3 the supply-chamber B and its inlet connection b are made integral with the discharge-chamber A, main-valve seat B^2 , and cylinder D. In Fig. 2 the supply-chamber B and its inlet b are separate parts, united to the part A by a screw-thread b^3 and to the cylinder D by a screw-thread b^4 , long enough to enable the cylinder D to be adjusted, as

hereinafter explained. To prevent any leak through the thread b^4 , a packing-nut W, with packing-space w^3 , screws at b^5 to the part B.

In devices of this character provided with a main valve and a relief-valve to open in advance of the main valve, whereby the latter can be more easily opened, springs or weights have been generally employed to maintain the relief-valve upon its seat when the main valve is closing; but a weighted relief-valve is objectionable, because its holding power remains the same under all pressures, and when used upon very high pressure when the main valve approaches its seat the sudden increase of pressure from that of a rapidly-moving toward that of a static column in consequence of the frictional drag of the water upon the portion of the valve which in closing throttles or restricts the outlet or passes below the valve-seat, such frictional drag exceeding the tendency of the increased pressure to open the valve, causes the main valve to suddenly accelerate its closing movement, which in turn causes the relief-valve to instantaneously yield to a vacuum produced above it by the sudden quickening of the main-valve movement, quicker than even the increased pressure can refill the chamber above it, and the main valve thus relieved from the restraining influence of a closed chamber having only a restricted inlet or outlet drops to its seat with concussive force. Different sizes and styles of the same valve have been tried and used for different pressure; but such remedy, not always effective, causes confusion and increases cost of production. To overcome the difficulty and provide a valve of but one size and style for all pressures, I employ the differential-pressure head T or T^2 , of a greater diameter than the relief-valve, whereby the ejector action of the water flowing past the mouth of the sleeve o' , exhausting or reducing the pressure below the pressure-head in the pressure-chamber, will increase the holding power upon the relief-valve until the main valve is closed and the pressure on the discharge side of the valve has fallen.

To make my regulating-screw, which governs the length of flush, always accessible, I locate it in Fig. 1 at the end of the by-pass c' beneath the removable cap N^2 , and in Figs. 2, 3, and 4 I locate it at the upper end of the hollow spindle and preferably provide the upper surface of the relief-valve G with a washer g^2 , adapted to close up against the seat c^5 , whereby when the relief-valve is elevated against the seat c^5 , as in Fig. 2, the plug N can be removed for adjustment of the regulating-screw by reducing the refill to produce a longer wash or increasing the refill to cause a shorter wash.

To regulate the volume of discharge without shutting off the supply, I provide the cylinder D, Fig. 2, preferably with a screw-thread b^4 where it unites with the supply-chamber B, which enables me to adjust the cylin-

der in or out sufficiently to regulate the volume of flow between its lower edge and the outlet when the valve is open, or the cylinder D can be screwed against the bottom of the chamber B, as shown by dotted lines in Fig. 2, and thus shut off the water, when by removing the cap C and relief-valve G the several parts will be accessible for removal. Thus I control and regulate both length and volume of flow or shut off the water without interfering with the supply service or the efficiency of any other fixture or device.

Very serious difficulty in operation of flushing-valves has been their liability to clog when used in water charged with sediment, which lodges between the main-valve piston and its cylinder, causing the main valve to hang up or stick. I obtain most favorable results by making the top of my piston concave, as at f' , and I also make the upper surface of the pressure-head concave, whereby any substance which settles upon either of these parts must drift toward the outlet and away from the wall of the cylinder or chamber. Thus in effect it becomes a self-cleansing device, and I regard this part of my invention as of great value, because if all else be perfect without a means of washing away the sediment any device of this nature is useless in muddy or gritty water. In Fig. 2 the main-valve piston, for example, is solid and heavy to assist by gravity (if necessary) any difficulty of operation in muddy water; but I do not rely upon weight and under usual conditions prefer the lighter forms, (shown in Figs. 1 and 3,) and under all conditions I prefer to make all parts of the relief-valve, pressure-head, and spindle as light as possible, depending wholly upon the pressure of the liquid to operate it.

If desired, the parts A and B in Fig. 2 could be made integral without the screw-thread b^3 , and other various modifications may be made within the scope of the invention.

In operation the first movement of the handle opens the small relief-valve, when, the stops v^3 engaging the guide-sleeve o' , the main-valve piston is easily elevated to the top of the cylinder, as in Fig. 2, the water above it being expelled out and down through the spindle V as the piston moves up. While the main valve is open or any pressure exists beneath the main-valve piston, the large free open way through the hollow spindle allows the pressure to enter through the ports v^4 into the pressure-chamber f^3 above the pressure-head, as indicated by arrows, whereby when the handle M is released the differential pressure down upon the greater area of the pressure-head instantly and firmly closes the relief-valve, and the higher the pressure the more tightly it will remain closed until the main valve is seated, precisely the same as similar action is produced in a pressure-regulator, and in my device it wholly obviates the feature of water-hammer, and at the same

time I obtain a very slow closure, whereby an ample after-fill is provided for the receptacle.

I have shown different forms of the spindle; but in practice I make its bore as large as possible and usually provide lateral openings or ports at its lower end, as at v^8 , Fig. 3, to prevent any possible downdraft effect caused by the water flowing around it, and by proper care in construction and proportion of the parts the pressure always acts freely and certainly through the spindle upon the pressure-head, as described, at the same time, owing to closeness of fit or limited annular space between the spindle and guide-sleeve o' and also to shape of the sleeve, the downward flow around the sleeve acts as an ejector or exhaust to draw out, and thus prevent upward pressure or any balancing effect beneath the pressure-head while the main valve is open or the apparatus is in operation, whereby the effect of pressure above and upon the pressure-head is sufficient to close the relief-valve and at the same time overcome the weight of the handle M and carry it back to its normal position.

Having described my invention, I claim—

1. In a self-closing and slow-closing valve mechanism, the combination with a valve-chamber having inlet and discharge passages and a valve-seat, of a main piston-valve arranged to reciprocate within said chamber and close upon said seat and having a longitudinal passage and an interior chamber, a relief-valve for closing said passage, means for opening said relief-valve and said main valve, a movable pressure-head or septum in said chamber, connections between said pressure-head and said relief-valve such that the relief-valve may be closed by a movement of the pressure-head in one direction, and means whereby when the main valve is open a fluid-pressure will be applied to said pressure-head on the side to close the relief-valve in excess of any fluid-pressure upon the opposite side thereof.

2. In a self-closing flushing-valve, the combination with a cylinder-casing open to the pressure and provided with a main-valve seat between the inlet and the outlet, of a hollow main-valve piston open at both ends to form a passage through it and adapted to operate within the cylinder and to close against and cooperate with the main-valve seat in closing, a pressure-head adapted to operate within the main-valve piston, a relief-valve connected to and of less area than said pressure-head and adapted to close the passage through the main-valve piston, and means for operating both valves, the relief-valve in advance of the main valve, as and for the purpose described.

3. In a self-closing flushing-valve, the combination with a cylinder-casing having one end normally closed and its other end open to the pressure, of a main-valve piston adapted to operate within said cylinder to open and close the valve, a relief-passage between the

open and closed ends of the cylinder, a relief-valve for opening and closing said passage, a pressure-head connected to and of greater area than said relief-valve, a pressure-chamber within the main-valve piston for said pressure-head, and means for operating the main valve and relief-valve common to both, whereby when the relief-valve is opened the main-valve piston will be relieved from pressure in the closed end of the cylinder and when the main valve is closing the relief-valve will be kept closed by the differential pressure upon the pressure-head, as and for the purpose described.

4. In a self-closing flushing-valve, the combination with a valve-body and an inlet and an outlet and a main-valve seat between the inlet and the outlet, of a cylinder-casing open at one end to the pressure with the other end normally closed, a hollow main-valve piston open at both ends to form a relief-passage through it and adapted to operate within said cylinder and to close upon and cooperate with the main-valve seat in closing, a pressure-head adapted to operate within said main-valve piston, a relief-valve attached to and of smaller area than the pressure-head and adapted to open and close the relief-passage, a valve-seat about said passage for the relief-valve, and means for opening both valves, the relief-valve in advance of the main valve, substantially as described.

5. In a self-closing flushing-valve, the combination of an inlet and an outlet and a main-valve seat about the outlet, a cylinder-casing having one end open to the pressure and its other end normally closed, a main-valve piston adapted to operate within said cylinder and to close against and cooperate with the main-valve seat in closing, a relief-passage between the open and closed ends of the cylinder, a relief-valve for opening and closing said passage, a pressure-head connected to and of greater area than said relief-valve, a pressure-chamber within the main-valve piston for said pressure-head, a refill-vent passage between the open and closed ends of the cylinder-casing, a means for graduating and regulating said refill-vent, and means for operating the main valve and relief-valve, as and for the purpose described.

6. In a self-closing flushing-valve, the combination of an inlet and outlet and a main-valve seat about the outlet, a cylinder-casing having its upper end normally closed and its lower end open to the pressure, a hollow main-valve piston adapted to operate within said cylinder and to close against the main-valve seat in closing, a relief-passage through said main-valve piston, a relief-valve for opening and closing said passage, a pressure-head of greater area than said relief-valve and connected to it by a hollow spindle, a pressure-chamber within said main-valve piston for the pressure-head, a refill-vent in the upper end of said spindle for admitting a refill to the closed end of the cylinder-casing

when the main valve is closing, and means for operating the main valve and relief-valve common to both, as and for the purpose described.

7. In a self-closing and slow-closing valve mechanism, the combination with a valve-chamber normally closed at one end and having its other end open to the pressure and provided with inlet and discharge ports and a main-valve seat, of a main piston-valve arranged to reciprocate within said chamber and close upon said seat and having a longitudinal passage and an interior chamber, a relief-valve for closing said passage, means for opening said relief-valve and said main valve, a movable pressure-head in said chamber and connected to said relief-valve, whereby when the main valve is open the relief-valve will be closed by pressure upon the pressure-head, and a tubular extension attached to the main valve of a size to fit within and enter the outlet just before the main valve closes.

8. In a self-closing flushing-valve, the combination with an outlet and a main-valve seat at the outlet, of a cylinder-casing closed at its upper end and a hollow main-valve piston operative within said casing adapted to close against the main-valve seat and having a relief-passage through it, a relief-valve for said passage, a differential-pressure head operative within said main-valve piston and connected to the relief-valve by a hollow spindle, a tubular guide for said spindle below said main-valve piston adapted to form an exhaust-ejector to prevent pressure below said pressure-head, a refill-vent into the closed end of the cylinder-casing, a tubular extension attached to the main valve and adapted to enter the outlet just before the main valve closes, and means for operating said main and relief valves.

9. In a self-closing flushing-valve, the combination with a cylinder-casing having one end closed and its other end open to the pressure, and an inlet an outlet and a main-valve seat, of a hollow main-valve piston operative within said casing to close against the main-valve seat, its upper end being concave and having a relief-passage through it, and an interior chamber, a relief-valve seat at the upper end of said passage at the lower edge of said concave end, a relief-valve to close against said seat to close said passage, a concave pressure-head connected to and of greater area than said relief-valve and operative within said chamber by differential pressure upon its larger surface to automatically close the relief-valve.

10. In a self-closing flushing-valve, the combination with a cylinder-casing having its upper end closed and its lower end open to the pressure, and an inlet an outlet and a main-valve seat, of a hollow main-valve piston operative within said casing and adapted to close against the main-valve seat, its upper end being concave and having a relief-passage

through it, a relief-valve for said passage, a concave pressure-head connected with said relief-valve and operative in a chamber within said main-valve piston, and means for opening said main and relief valves, whereby when open any sediment in said casing or said chamber will drift toward the outlet and wash away, substantially as described.

11. In a self-closing flushing-valve, the combination of an inlet an outlet and a cylinder-casing having one end open toward the outlet and its other end closed, a main valve operative within said casing to close against said outlet, an adjustable refill-vent into the closed end of the casing to regulate the movement of the main valve when closing, an opening in the closed end of the casing normally closed by a removable cover, and a valve to close against said opening when its cover is removed, substantially as and for the purpose described.

12. In a self-closing flushing-valve, the combination of an inlet and an outlet, a cylinder-casing having one end open to the pressure and its other end closed except for an opening normally closed by a removable cover, a main valve operative within said casing to close against said outlet and having a relief-passage through it, a relief-valve for opening and closing said passage and also adapted to close against the opening in the closed end of the casing, an adjustable refill-vent through said relief-valve into the closed end of the cylinder, and means for operating said valves, whereby when the relief-valve is held against said opening and its cover removed the refill-vent can be adjusted without shutting off the water.

13. In a self-closing flushing device, the combination with a valve-body provided with an inlet and an outlet, of a cylinder-casing adjustably attached to the valve-body and having one end closed, its other end open toward the outlet, its closed end being outside and its open end within the valve-body, a valve operative within said casing to close against said outlet and means for operating said valve, said casing being adjustable relative to its distance from the outlet to regulate the volume of discharge therethrough and also to shut off the flow by adjusting the casing against the valve-body about the outlet, as and for the purposes described.

14. In a self-closing flushing device, the combination with a valve-body provided with an inlet and an outlet, of a cylinder-casing attached to the valve-body by a screw-thread and having one end closed, its other end open toward the outlet, its closed end being outside and its open end inside the valve-body, a valve operative within said casing to close against said outlet and means for operating said valve, whereby said casing can be screwed toward or from the outlet to regulate the volume of discharge therethrough or screwed against the body about the outlet to shut off the flow, as and for the purpose described.

15. In a self-closing flushing device, the combination with a valve-body provided with an inlet, of a cylinder-casing adjustably connected to the valve-body by a screw-thread and having one end closed, its other end open toward the outlet, its closed end being outside and its open end inside the valve-body, a main valve operative within the casing to close against the outlet, a relief-passage through said main valve, a relief-valve for said relief-passage, a refill-vent into the closed end of the casing, a removable cap provided with an opening, a cover for said opening, a valve adapted to close against said opening and means for operating said valves, as and for the purposes described.

16. In the self-closing flushing device described, the combination of the valve-body A B having inlet *b* and outlet B², cylinder D adjustably connected to the part B by the screw-thread *b*⁴, the packing-nut W screwed to the part B at *b*⁵, main valve F to close the outlet provided with a relief-passage through it, and a relief-valve for said passage, and means for operating said valves, as and for the purposes described.

17. In a self-closing flushing-valve, the combination of an inlet, an outlet and a main-valve seat about the outlet, a cylinder-casing having one end open toward the outlet and its other end closed, a main-valve piston operative within the casing when opening and adapted in closing to seat upon the outlet and provided with a relief-opening through it, a tubular extension projecting below the main valve of a size to enter the outlet before the main valve closes, said extension constituting a chamber through which water passes, a relief-valve guided by a bearing within said chamber and adapted to seat upon and close the relief-opening, and means for operating the relief and main valves.

18. In a self-closing flushing-valve, the combination of an inlet, an outlet, a main-valve seat upon the outlet, a cylinder-casing having one end open toward the outlet its other end closed by a removable cap and a vent-passage between the open and closed ends of the cylinder, a main-valve piston operative within the cylinder when opening, and to close against the main-valve seat and outlet and provided with a relief-opening through it, a tubular extension projecting below the main valve and of a size to enter the outlet before the main valve closes, said extension constituting a chamber through which water passes, a relief-valve guided by a bearing within said chamber and adapted to close the relief-opening, and means for operating said relief and main valves.

19. In a self-closing flushing-valve, the combination of an inlet an outlet and a main-valve seat at the outlet, a cylinder-casing normally closed at its upper end and a hollow main-valve piston operative within said casing adapted to close against the main-valve seat and having a relief-passage through it, a

relief-valve for said passage, a differential-pressure head operative within said main-valve piston and connected to the relief-valve by a hollow spindle, a tubular guide for said
5 spindle below said main-valve piston adapted to form an exhaust-ejector to prevent pressure below said pressure-head, a refill-vent into the closed end of the cylinder-casing, and means for operating said main and
10 relief valves.

20. In a self-closing flushing-valve, the combination of an inlet and an outlet, a cylinder-casing having one end open toward the outlet and its other end normally closed, a main-
15 valve piston having its upper end substantially concave and adapted to move up into the cylinder when opening and in closing to seat against and close the outlet, a relief-

opening through said piston, a tubular extension projecting from and below the main 20 valve and of a size to enter the outlet before the main valve closes, said tubular extension constituting a chamber through which water passes, a relief-valve guided by a bearing within said chamber and adapted to close the 25 relief-opening, a vent between the open and closed ends of the cylinder and provided with means to regulate the flow of water through it, and a means of operating the relief and main valves. 30

In testimony whereof I hereto affix my signature in presence of two witnesses.

SAML. WALKER LEWIS.

Witnesses:

W. R. SPOONER,
AGNES E. ROGERS.