E. G. WATROUS.

WATER CLOSET VALVE.

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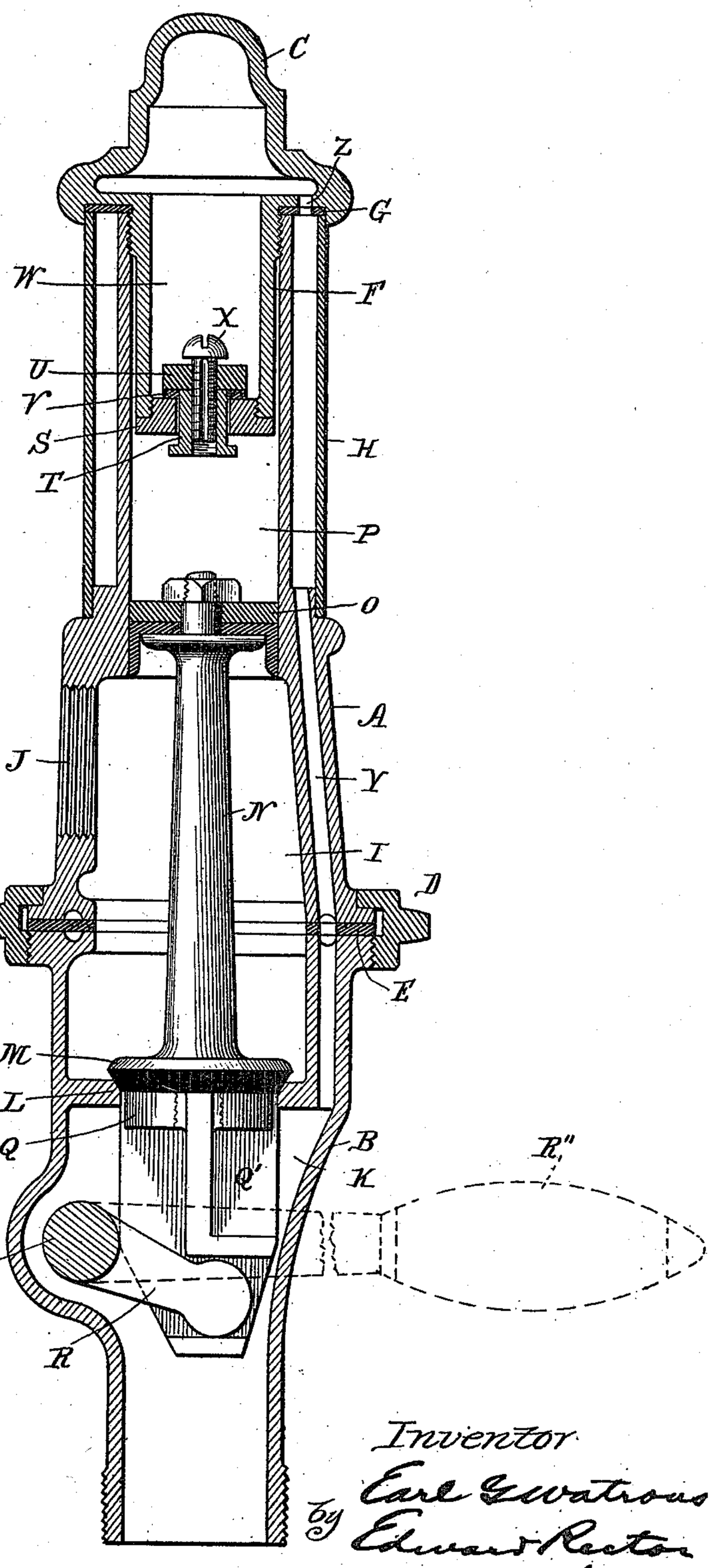
974,939. Patented Nov. 8, 1910.



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UNITED STATES PATENT OFFICE.

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WATER-CLOSET VALVE.

974,939. Specification of Letters Patent. Patented Nov. 8, 1910.

Application filed February 20, 1899. Serial No. 706,224.

To all whom it may concern:

Be it known that I, EARL G. WATROUS, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Water-Closet Valves, of which the following is a description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to that class of slow-closing water-closet valves which are opened by the operation of a suitable handle, for the purpose of flushing the closet, and automatically controlled in their closing movement by the passage of water through a restricted orifice from one chamber to another within the valve casing.

My invention has for its object the provision of a simple valve of this character, of few parts, which may be cheaply constructed and efficient in operation, and in which the valve does not have to be opened against the pressure of the water supply as is now generally the case. Its novelty will be hereinafter set forth and specifically pointed out in the claims.

Referring to the accompanying drawing, illustrating a vertical section of my improved valve, the valve casing is composed in the instance shown of three members A, B, and C, the two former of which are secured together by a coupling nut D, and have interposed between them a packing ring E, and the latter of which, C, consists of a hollow cap having a depending tubular extension F exteriorly threaded near its upper end and screwed into the interiorly threaded upper end of the member A of the casing, a packing ring G being interposed between the two. Surrounding the upper half of the part A of the casing is a cylindrical jacket H whose lower end seats upon a shoulder formed upon the member A and whose upper end is confined within a depending flange upon the periphery of the cap C, this jacket H being separated by a slight space from the casing A for a purpose hereafter explained.

The interior of the valve casing is provided with a water inlet or pressure chamber I, to which the water supply is constantly admitted through the inlet opening at J of the casing, and with a discharge or outlet chamber K below the chamber I, the two chambers being separated by a diaphragm L formed in the casing and having a central opening controlled by the main valve M. The valve M has a vertically extending stem N to whose upper end is secured a piston O adapted to snugly fit and travel upward and downward in the cylindrical chamber P formed within the upper part of the casing A. The piston O is composed of a cup shaped leather or rubber washer and a metal disk, seated upon the upper end of the valve stem N and confined thereon between an enlarged shoulder or flange and a nut screwed upon the upper end of the stem. This piston forms the upper wall of the inlet or pressure chamber I and serves to separate the latter from the chamber P above it, which latter chamber may be termed the controlling chamber, and inasmuch as the chamber I is constantly filled with water under pressure the upward pressure exerted against the under side of the piston O will tend to lift said piston and the valve stem and valve, and counterbalance their weight and the downward pressure of the water upon the upper side of the valve M.

The main valve M consists of a circular enlargement or disk formed upon the lower end of the valve stem N and preferably having secured upon its under side a beveled washer or valve-face of rubber or leather adapted to tightly fit the seat around the central opening in the diaphragm L. The lower end of the valve stem N extends downward through the valve and has screwed upon it a nut Q which serves to hold the rubber washer in place. The nut Q is composed of a circular or cylindrical upper portion of slightly less diameter than the central hole through the diaphragm L (for a purpose hereinafter explained) and depending wings Q′ serving to guide the valve when lifted from its seat, and constructed to receive one end of the crank arm R by means of which the valve is lifted to flush the closet, said arm in the present instance projecting from a rock shaft R′ journaled in the valve casing and extending outward therefrom through a stuffing box, (not shown) and having secured upon it the operating handle R″ by lifting the forward end of which the valve is opened to flush the closet.

The lower end of the depending tubular

extension F of the cap C of the valve casing is closed by a nut S having a central opening in which slides the stem T of a check valve opening upward and provided at its lower end with a flange adapted to contact with the under side of the nut S and limit the upward movement of the valve. The stem T has an interiorly threaded bore extending through it into whose upper end is inserted a screw X. Resting upon the upper end of the stem T is a check nut U also engaging the screw X and serving to lock the latter in its adjusted position in the stem T. This nut U forms the valve proper and normally rests upon the upper side of the nut S, a rubber or leather washer V being interposed between the two, around the stem T, to effect a tight joint. The stem T fits loosely in the central opening in the nut S (or may have a flattened or grooved side) so that when the nut U is raised from its seat upon the washer V (or the latter raised with the nut) a passage is opened from the chamber P to the chamber W above it. The screw X has a flattened or grooved side, as shown, to afford a constantly open but minute by-pass between the chambers P and W, for a purpose hereafter explained. Any other suitable check valve may be substituted for the one above described.

The valve casing is provided along one side with a duct Y communicating at its lower end with the discharge chamber K of the casing and at its upper end with the space between the jacket H and the cylindrical upper half of the member A of the casing, and this space within the jacket H communicates at its upper end, by a small opening Z, with the chamber W within the cap C and its tubular extension F, so that the latter chamber is always in free communication with the discharge chamber K of the valve casing and consequently with the atmosphere, the lower end of the valve casing being connected with the bowl of the closet in the usual or any suitable manner.

Having now described the mechanical construction and arrangement of the parts of my improved valve, its operation may be briefly explained as follows, assuming the chamber P to have first been filled with water by removal of the cap C: The main valve is opened, to flush the closet, by lifting the handle R″, which will serve to lift the main valve M and its stem N and piston O, and permit the water from the chamber I and inlet J to rush through the central opening in the diaphragm L to the closet bowl. The upward movement of the piston O in the chamber P will press the water in the latter chamber and cause it to lift the check valve and pass upward into the chamber W, which latter operates as a temporary reservoir for said water. When the handle of the operating lever is released the weight of the main valve M and its connected parts, (chiefly the weight of the handle) and downward flow of the water upon the upper surface of said main valve will tend to seat the latter and cut off the flow of water to the closet, but the first downward movement of the piston O in the chamber P will serve to close the check valve at the upper end of said chamber and the piston will thereafter descend only so fast as the water which has been driven out of the chamber P is readmitted to it by the minute passage through the check valve formed by the flattened or grooved side of the screw X, with the result that the valve may be caused to close as slowly as desired, according to the adjustment of the screw X. The communication of the chamber W with the atmosphere (through the hole Z, space within the jacket H and duct Y) furnishes a vent for said chamber, to permit outflow of air at the upward movement of the piston O and inflow at the downward movement therefrom.

Owing to the fact that the water pressure in the chamber I, acting in one direction against the main valve and in the opposite direction against the piston O, practically balances the valve, and the fact that the chambers K and P at the opposite ends of the chamber I are both open to the atmosphere, it follows that the valve may freely move, and may be opened much more easily than when it has to be moved against the pressure of the water supply as is commonly the case in the valves of this character now in use. In practice the valve will be preferably so balanced (by the relative pressure areas of the valve M and piston O) that it will have to be lifted simply against the resistance of its own gravity and that of its operating handle. When the valve is used in horizontal position the weight of the handle may be slightly increased to compensate for the loss of the gravity of the valve itself.

To prevent the closet being siphoned and left dry by a sudden cutting off of the full supply of the water at the closing of the main valve the nut Q upon the under side of the main valve is provided with the cylindrical upper portion heretofore referred to. This portion of the nut is of slightly less diameter than the central hole through the diaphragm L, and as the valve closes it will enter the hole in said diaphragm and cut off the larger part of the flow of water to the closet, while leaving a sufficient flow to leave the desired amount of water in the closet at the final closing of the valve.

The jacket H is employed simply as a convenient finish to the valve casing but is in no way essential to my improved valve. In its absence the duct Y may be extended upward the remaining distance through the

wall of the valve casing, the same as its lower portion is. In the present instance a tight joint between the lower end of the jacket H and shoulder of the casing upon which it seats is formed by soldering.

Having thus fully described my invention I claim—

1. In a water closet valve, a water inlet or pressure chamber to which the water supply under pressure is constantly admitted, a discharge chamber at one end thereof, open to the atmosphere and separated from the inlet chamber by the main valve and a controlling chamber at the opposite end of the inlet chamber and communicating with the discharge chamber by a passage independent of the main valve and the water inlet or pressure chamber and also communicating with the atmosphere and separated from the inlet chamber by a piston connected to and moving with the main valve and adapted to traverse said controlling chamber, whereby the pressure in the inlet chamber exerted in opposite directions upon the main valve and piston balances the valve and permits free opening movement of the same, in combination with means for preventing free back flow of water to the controlling chamber at the closing movement of the valve; substantially as described.

2. In a water closet valve, a water inlet or pressure chamber to which the water supply under pressure is admitted, a discharge chamber at one end thereof, a main valve separating said chambers, a controlling chamber at the other end of the inlet chamber, a piston separating the controlling and inlet chambers and connected to the main valve, said piston being arranged to traverse the controlling chamber, a reservoir chamber arranged beyond the controlling chamber and communicating with the discharge chamber by means of a passage extending direct thereto and independent of the inlet chamber, and means for permitting free flow from the controlling chamber to the reservoir chamber but restricting the flow in the opposite direction.

3. In a water-closet valve, a water inlet or pressure chamber to which the water supply under pressure is constantly admitted, a discharge chamber at one end thereof and separated therefrom by a main valve, a controlling chamber at the opposite end of the inlet chamber and separated and cut off therefrom by a piston connected to and moving with the main valve and adapted to traverse said controlling chamber, a reservoir chamber communicating with the controlling chamber and open to the atmosphere, and means permitting free outflow of water from the controlling chamber to the reservoir chamber at the opening movement of the main valve, but preventing free backflow to the controlling chamber at the closing movement of said valve, substantially as and for the purpose described.

4. In a water-closet valve, a water inlet or pressure chamber to which the water supply under pressure is constantly admitted, a discharge chamber at one end thereof and separated therefrom by the main valve, a controlling chamber at the opposite end of the inlet chamber and separated therefrom by a piston connected to and moving with the main valve and adapted to traverse said controlling chamber, a reservoir chamber at the end of the controlling chamber opposite to the inlet chamber, and a check valve and an always open port or by-pass between the controlling chamber and reservoir chamber whereby free passage of water from the controlling chamber to the reservoir chamber is permitted at the opening movement of the main valve but prevented at the closing movement thereof, substantially as and for the purpose described.

5. The herein described water-closet valve, comprising a casing having a middle inlet or pressure chamber to which the water supply under pressure is constantly admitted, a discharge chamber at one end of said inlet chamber and a controlling chamber at the opposite end of said inlet chamber and communicating directly with the discharge chamber through a passage extending around and independently of the inlet chamber, a valve stem extending longitudinally through said middle inlet chamber and carrying at one end the main valve controlling communication between the inlet chamber and discharge chamber, and carrying at its opposite end a piston separating the inlet and controlling chambers and adapted to traverse the controlling chamber, a reservoir chamber communicating with the controlling chamber, means for permitting a free outflow from the controlling chamber to the reservoir chamber at the movement of the piston accompanying the opening of the main valve and restricted inflow through an always open port to said chamber at the movement of said piston accompanying the closing of the main valve, and operating means for moving the main valve to open the same.

6. The herein described water-closet valve, comprising the casing having a middle inlet or pressure chamber to which the water supply under pressure is constantly admitted, a discharge chamber at one end of said chamber and a controlling chamber at the opposite end of said chamber, a valve stem extending longitudinally through said middle inlet chamber and carrying at one end the main valve controlling communication between the inlet chamber and the discharge chamber, and carrying at its opposite end a piston separating and cutting off communication between the inlet and controlling chambers

and adapted to traverse the controlling chamber, a reservoir chamber communicating with the controlling chamber, a check valve controlling the outlet from said controlling chamber to the reservoir chamber and operating to permit free outflow therefrom as the piston moves at the opening of the main valve, but preventing free inflow thereto as the piston moves at the closing of the main valve, means independent of the check valve controlled outlet for restricting the flow in the closing movement of the valve and operating means for moving the main valve to open the same.

7. The herein described water-closet valve, comprising the casing having a middle inlet or pressure chamber to which the water supply under pressure is constantly admitted, a discharge chamber at one end of said inlet chamber and a controlling chamber at the opposite end of said inlet chamber and communicating with the discharge chamber, a valve stem extending longitudinally through said inlet chamber and carrying at one end a main valve which constitutes the major portion of the area of one end wall of said chamber and controls communication between said chamber and the discharge chamber, and carrying at its opposite end a piston forming the major portion of the opposite end wall of said chamber and adapted to traverse the controlling chamber, the areas of piston and valve exposed to pressure being substantially equal whereby the pressure of the water within the inlet chamber against the surface of the main valve and the surface of the piston counteract each other, means arranged in said controlling chamber for permitting free outflow from but preventing free inflow to the controlling chamber, and means for moving the main valve to open the same, said controlling chamber communicating with a discharge chamber through a passage extraneous of the pressure chamber, said controlling chamber being unconnected with the inlet or pressure chamber and arranged to communicate with the atmosphere by its connection with the discharge chamber.

8. The herein described water-closet valve, comprising a valve casing having the middle inlet chamber I communicating with the water supply, and to which the water under pressure is constantly admitted, the discharge chamber K separated from the chamber I by the diaphragm L, the controlling chamber P communicating with discharge chamber K through a passage Y, the main valve M controlling the passage through the diaphragm L and having the stem N extending through the chamber I, the piston O carried by the end of the stem N opposite the valve M and traversing the chamber P, an outwardly opening check valve controlling the outlet from the chamber P and a by-pass through the check valve for permitting restricted inflow to said chamber, and the crank arm R located in the discharge chamber K and connected with the main valve M for opening the same, said controlling chamber being unconnected with the inlet or pressure chamber and arranged to communicate with the atmosphere by the connection with the discharge chamber.

9. The herein described water-closet valve, composed of the casing A B containing an inlet chamber I and discharge chamber K separated by the diaphragm L, and having the cylindrical portion at its upper end containing the controlling chamber P, the hollow cap C seated upon the upper end of the cylindrical portion of the casing and having the tubular extension F depending therein, the upwardly opening check valve mounted in the bottom wall of said extension F, the main valve M seated upon the diaphragm L and controlling the central passage through the same, the stem N extending vertically from the valve M through the chamber I, the piston O carried by the upper end of said stem and adapted to traverse the chamber P, the nut Q screwed upon the lower end of the valve stem beneath the valve M and having the cylindrical upper portion of slightly less diameter than the central passage through the diaphragm L and the depending wings or web, and the lever arm R engaging said depending portion of the nut Q for lifting the main valve M and connected parts.

10. The herein described water-closet valve composed of the casing A B coupled together by the nut D, containing the inlet chamber I and discharge chamber K separated from each other by the diaphragm L, and having the cylindrical upper end containing the controlling chamber P, the jacket H surrounding such cylindrical portion of the casing, the hollow cap C seated upon the upper end of the jacket H and casing A, and having the extension F screwed in and depending into the upper end of the casing A, the chamber W within such extension and within the cap C having communication with the atmosphere through the port Z, space within the jacket H and duct Y in the casing A B, the upwardly opening check valve mounted in the bottom wall of the chamber W and provided with the central screw having the by-pass, the piston O traversing the chamber P and separating it from the chamber I, the vertical stem N extending through the chamber I and carrying at its lower end the main valve M seating upon the diaphragm L and controlling the central passage through the same, the nut Q screwed upon the lower end

of the valve stem beneath the valve M, and the arm R engaging the nut Q for lifting the same.

11. The herein described water closet valve comprising a valve casing having a discharge chamber, a water inlet or pressure chamber and a controlling chamber which is provided with a connecting reservoir having means of communication with the discharge chamber, and a valve device having at one end a piston working in said controlling chamber and at the other end a valve governing communication between the pressure and discharge chambers; substantially as described.

12. The herein described water closet valve comprising a valve casing having a discharge chamber, a water inlet or pressure chamber and a controlling chamber which is provided with a reservoir having means of communication with the discharge chamber and means arranged between the controlling chamber and its said reservoir for permitting a free flow from the controlling chamber into said reservoir, but a restricted flow in the opposite direction and a valve device having at one end a piston working in said controlling chamber and at the other end a valve governing communication between the pressure and discharge chambers; substantially as described.

13. The combination of a valve casing having a discharge chamber, a water inlet or pressure chamber and a controlling chamber, a cap closing said controlling chamber and having an extension depending therein to form a reservoir, means arranged in the lower end or bottom of said extension for permitting a free flow from the controlling chamber into the reservoir, but a restricted flow in the opposite direction, and a valve device, having at one end a piston working in said controlling chamber and at the other end a valve governing communication between the pressure and discharge chambers; substantially as described.

14. The combination of a valve casing having a discharge chamber, a water inlet or pressure chamber and a controlling chamber, a cap controlling said controlling chamber and having an extension depending therein to form a reservoir, means arranged in the lower end or bottom of said extension for permitting a free flow from the controlling chamber into the reservoir but a restricted flow in the opposite direction, said casing having a passage communicating between the reservoir and the discharge chamber and extending outside and around the pressure chamber, and a valve device having at one end a piston working in said controlling chamber and at the other end a valve governing communication between the pressure and discharge chambers; substantially as described.

15. The combination of a valve casing having a discharge chamber, a water inlet or pressure chamber communicating therewith, and a controlling chamber having direct connection with the discharge chamber and unconnected with the pressure chamber, valve mechanism governing communication between the pressure and discharge chambers and controlled in closing by the fluid in the controlling chamber and means for permitting free outflow from the controlling chamber and restricted inflow comprising a check valve governing a passage from the controlling chamber for free outflow, said controlling chamber having an always open restricted port separate from said passage; substantially as described.

16. The combination of a valve casing having a discharge chamber, a water inlet or pressure chamber communicating therewith, and a controlling chamber having direct connection with the discharge chamber and unconnected with the pressure chamber, valve mechanism governing communication between the pressure and discharge chambers and controlled in closing by the fluid in the controlling chamber and means for permitting free outflow from the controlling chamber and restricted inflow comprising a check valve governing a passage from the controlling chamber for free outflow, said controlling chamber being at atmospheric pressure and having an always open restricted port separate from said passage, and means carried by said check valve for varying the amount of said restricting; substantially as described.

17. The combination of a valve casing having a discharge chamber, a water inlet or pressure chamber communicating therewith, a controlling chamber, and a reservoir chamber communicating with the controlling chamber and having direct connection with the discharge chamber and unconnected with the pressure chamber, valve mechanism governing communication between the pressure and discharge chambers and controlled in closing by the fluid in the controlling chamber and means for permitting free outflow from the controlling chamber into the reservoir chamber and restricted inflow comprising a check valve governing a passage from the controlling chamber for free outflow and a screw screwing into said check valve and having a longitudinal groove to form a restricted passage; substantially as described.

18. The combination of a valve casing having a discharge chamber, a water inlet or pressure chamber communicating therewith, and primary and secondary controlling chambers communicating with each other and having direct connection with the discharge chamber, valve mechanism normally balanced by the pressure of the water

supply and governing communication between the pressure and discharge chambers and controlled in closing by the fluid pressure in the primary controlling chamber, and means for permitting free outflow from the primary controlling chamber and restricted inflow comprising a check valve governing a passage from the primary controlling chamber for free outflow and a screw extending into said check valve and having a longitudinal groove constituting a restricted passage, said primary and secondary chambers being under atmospheric pressure; substantially as described.

19. In a water closet valve, a water inlet or pressure chamber to which the water supply under pressure is constantly admitted, a discharge chamber having a valve governed communication with the pressure chamber, a controlling chamber, a reservoir chamber communicating with the controlling chamber and also communicating direct with the discharge chamber through a passage extraneous of the pressure chamber, and a valve device having at one end a piston working in said controlling chamber and at the other end a valve governing said communication between the pressure and discharge chambers, said controlling chamber being normally at atmospheric pressure and normally containing water supplied from the discharge chamber during the flushing operation, substantially as described.

20. In a water closet valve, a water inlet or pressure chamber to which the water supply under pressure is constantly admitted, a discharge chamber adjacent one end of the pressure chamber and having a valve governed communication with the latter, a controlling chamber adjacent the other end of the pressure chamber and having a direct communication with the discharge chamber, said controlling chamber containing water when the valve is closed, a valve governing said communication between the pressure and discharge chambers, and a piston movable in said controlling chamber and operatively connected with the valve; substantially as described.

21. In a water closet valve, a water inlet or pressure chamber to which the water supply under pressure is constantly admitted, a discharge chamber adjacent one end of the pressure chamber and having a valve governed communication with the latter, a controlling chamber adjacent the other end of the pressure chamber and having a direct and always open communication with the discharge chamber, said controlling chamber containing water when the valve is closed, a valve governing the communication between the pressure and discharge chambers, and a piston movable in said controlling chamber and operatively connected with the valve; substantially as described.

22. In a water closet valve, a water inlet or pressure chamber to which the water supply under pressure is constantly admitted, a discharge chamber adjacent one end of the pressure chamber and having a valve governed communication with the latter, a controlling chamber adjacent the other end of the pressure chamber and having a direct communication with the discharge chamber through a passage extraneous of the pressure chamber, a valve governing said communication between the pressure and discharge chambers, said controlling chamber containing water when the valve is closed, and a piston movable in said controlling chamber and operatively connected with the valve, said piston and valve having substantially equal areas exposed to the pressure of water in the pressure chamber whereby the valve and piston are balanced; substantially as described.

23. In a water closet valve, a water inlet or pressure chamber to which the water supply under pressure is constantly admitted, a discharge chamber adjacent one end of the pressure chamber and having a valve governed communication with the latter, a controlling chamber adjacent the other end of the pressure chamber and having a direct communication with the discharge chamber, said controlling chamber containing water when the valve is closed, means for permitting a free flow in one direction through said last named communication and a restricted flow in the opposite direction, and a valve governing the communication between the pressure and discharge chambers; substantially as described.

24. In a water closet valve, a water inlet or pressure chamber to which the water supply under pressure is constantly admitted, a discharge chamber adjacent one end of the pressure chamber and having a valve governed communication with the latter, a controlling chamber containing water when the valve is closed and arranged adjacent the other end of the pressure chamber and having a direct communication with the discharge chamber, stationarily arranged means for permitting a free flow in said last named communication in a direction toward the discharge chamber but restricting the flow in the opposite direction, and a main valve governing the communication between the pressure and discharge chambers; substantially as described.

25. In a water closet valve, a water inlet or pressure chamber to which the water supply under pressure is constantly admitted, a discharge chamber adjacent one end of the pressure chamber and having a valve governed communication with the latter, a controlling chamber containing water when the valve is closed and arranged adjacent the other end of the pressure chamber and having

ing a direct communication with the discharge chamber but unconnected with the pressure chamber, stationarily arranged means for permitting free outflow from the controlling chamber and restricted inflow comprising a check valve having a leak or restricted passage, a valve governing the communication between the pressure and discharge chambers, and a piston operating in the controlling chamber and operatively connected with the valve; substantially as described.

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