E. G. WATROUS.

WATER CLOSET VALVE.

APPLICATION FILED JUNE 21, 1899.

975,664.

Patented Nov. 15, 1910.

2 SHEETS—SHEET 1.

FIG. 1

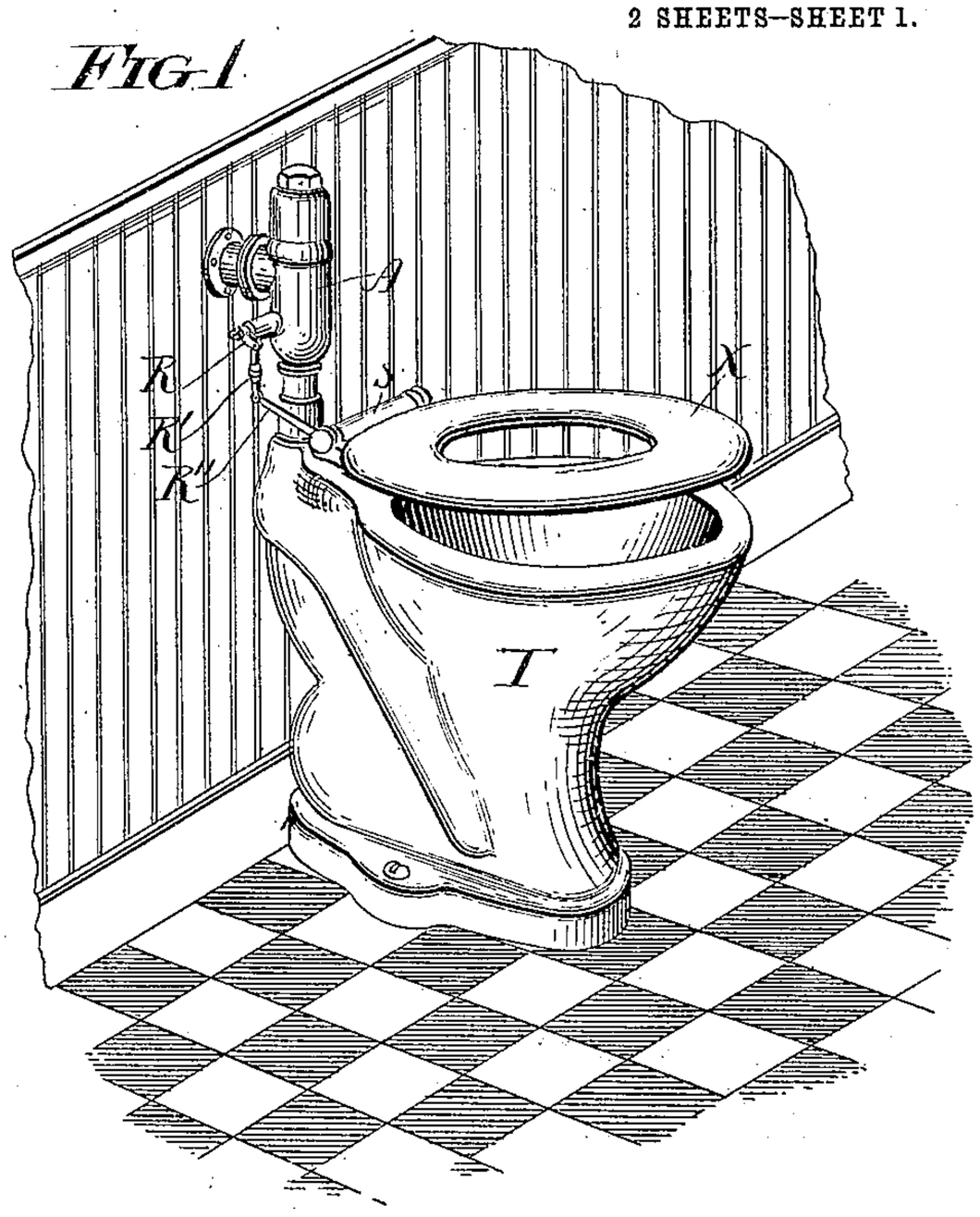


FIG. 3

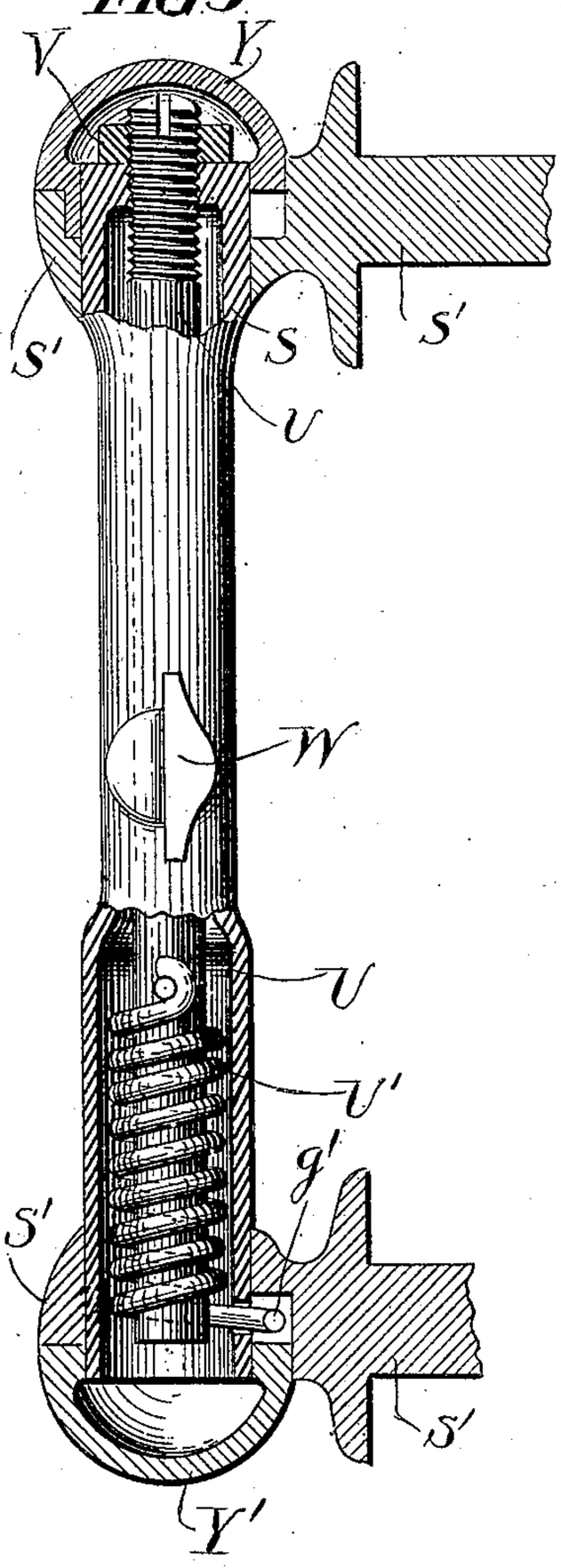
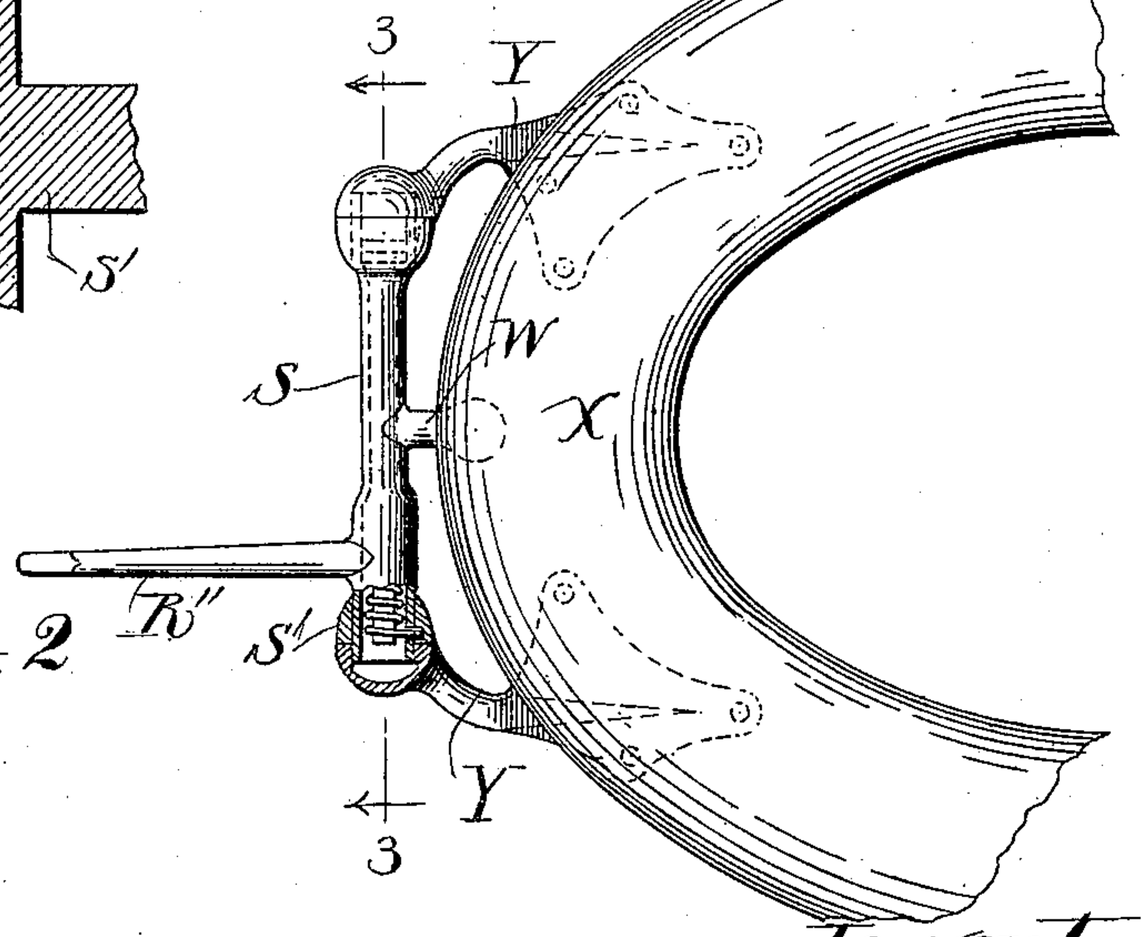


FIG. 2



Witnesses:
Ira D. Perry
J. B. Weir

Inventor
Earl G. Watrous
by Edward Rector
his atty

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2 SHEETS—SHEET 2.

FIG. 4

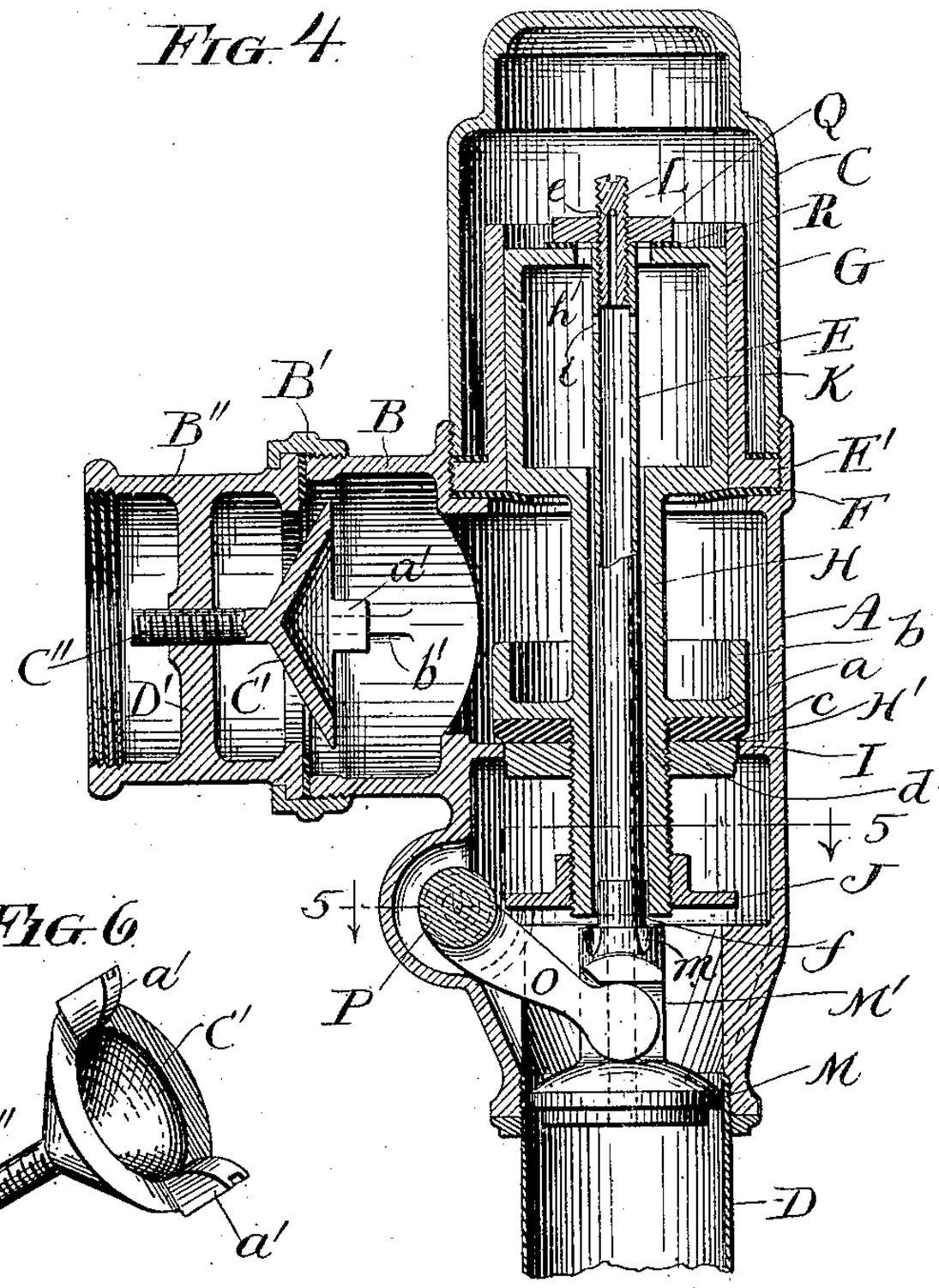


FIG. 6

FIG. 5

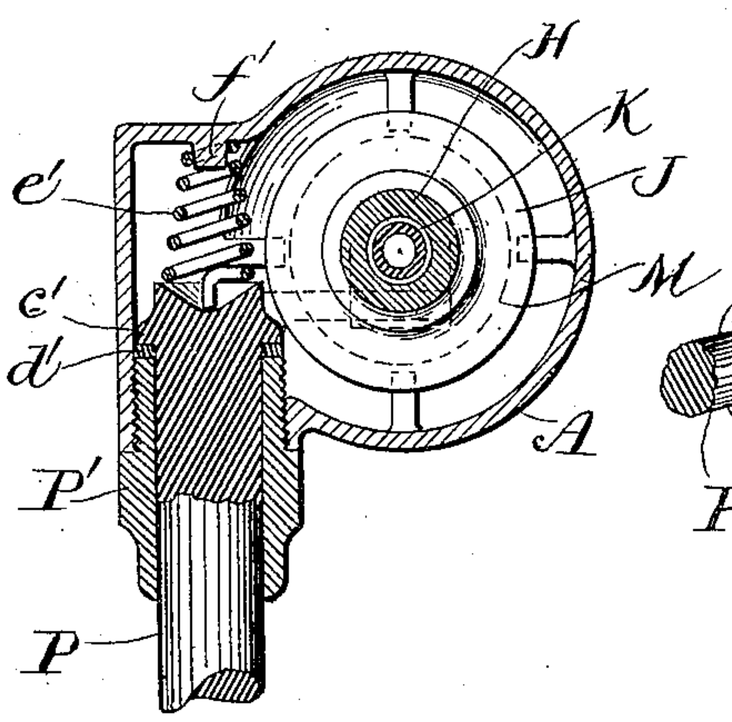
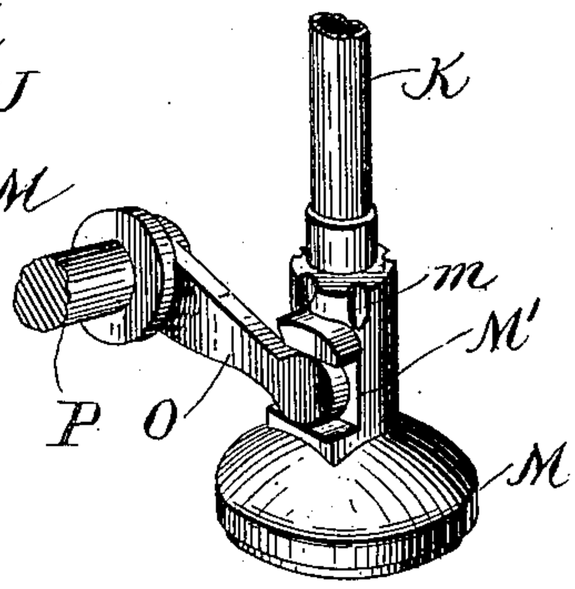


FIG. 7



Witnesses:
Ira D. Perry
J. B. Weir

Inventor:
Earl G. Watrous
by Edward Rector
his atty

UNITED STATES PATENT OFFICE.

EARL G. WATROUS, OF CHICAGO, ILLINOIS.

WATER-CLOSET VALVE.

975,664. Specification of Letters Patent. Patented Nov. 15, 1910.

Application filed June 21, 1899. Serial No. 721,330.

To all whom it may concern:

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

My invention has for its object the provision of an improved slow-closing water-closet valve, adapted more especially to be automatically operated by the seat but also capable of use as a hand-operated valve. Its novelty will be hereinafter set forth and particularly pointed out in the claims.

In the accompanying drawings Figure 1 is a perspective view of a closet provided with my improved valve arranged to be automatically operated by the seat; Fig. 2 a detail top-plan view of the rear portion of the seat and its hinges and coöperating devices; Fig. 3 an enlarged sectional detail on the line 3—3 of Fig. 2; Fig. 4 a middle vertical section of the valve; Fig. 5 a horizontal section on the line 5—5 of Fig. 4; Fig. 6 a perspective detail of the adjustable inlet valve in the supply pipe; and Fig. 7 a perspective detail of the lifting arm on the rock-shaft.

The same letters of reference are used to indicate corresponding parts in the several views.

Describing first the novel construction of the valve, and later the means for operating it, and referring more particularly to Fig. 4, the main casing is composed of the middle body portion A having upon one side the pipe connection B, a cap or dome C at its upper end, and a pipe D screwed into its lower end and communicating with the closet. Within the upper part of this casing is secured an open-ended cylinder E which in the present instance is provided at its lower end with an outwardly projecting flange E′ which seats upon an annular shoulder formed upon the inner surface of the casing A and is confined in place by the lower end of the cap C, being clamped between said cap and shoulder when the cap is screwed into place in the upper end of the casing A. Tight joints are insured by rubber packing rings, the lower one of which, F, will be hereafter referred to.

The provision of the separate cylinder E within the casing or cap C (instead of employing the walls of the casing as the cylinder to receive the piston, as usual) produces an annular sediment chamber surrounding the cylinder, to receive the sediment deposited by the water within the cap and prevent it lodging between the piston and cylinder walls and causing wear of said parts.

Fitting within the cylinder E and adapted to move up and down therein is a piston G having a depending tubular stem H which carries, beneath the piston G, the main valve H′ which coöperates with an annular shoulder or seat I formed upon the internal surface of the casing A. The main valve H′ may in the present instance be said to be composed of three parts, a disk *a* formed integral with the central tube H and having an up-turned flange *b*, a rubber ring *c* fitting against the under side of the disk *a*, and a nut *d* screwed upon the threaded exterior of the tube H, beneath the ring *c* and serving to clamp the latter between the nut and the under surface of the disk *a*. The nut *d* has a smooth periphery adapted to pass freely through but approximately fit the central hole through the valve-seat I. This particular construction of the main valve H′ is not essential to the main features of my invention.

Screwed upon the lower end of the piston-stem or tube H is a flanged nut or disk J, constituting a supplemental valve for a purpose hereafter explained.

Extending vertically through the tube H is a smaller tube K, open at its extreme lower end and partially closed at its extreme upper end by a screw L provided with a groove *e* constituting a minute by-pass or vent between the interior of the tube K and the interior of the cap C above the piston G. Carried by the lower end of the tube K is a circular casting M having in the present instance a convex upper surface connected by an integral stem M′ with the lower end of the tube K, the internal bore of the latter being extended downward through the stem M′ and member M. The stem M′ terminates in a shoulder *f* a short distance beneath the lower end of the outer one of the two central tubes H, so that the inner tube K and parts carried by it are free to move up and down a limited distance independently of the tube H and parts carried by it. The stem M′ is provided with a recess, Fig. 7,

engaged by the end of an arm O fast upon a rock-shaft P having a suitable bearing in the casing as hereafter described. Upon rocking the shaft P in a direction to lift the arm O the latter will lift the stem M′ and parts carried by it until the shoulder *f* contacts with the lower end of the larger tube H, whereupon further movement of the rock-shaft P and arm O will lift the tube H and parts carried by it, including the main valve and the piston G.

The tube K does not fit tightly within the tube H, but on the contrary there is a passageway between them, and at its extreme upper end of the tube K passes through a hole *h* in the top of the hollow piston G, which hole is considerably larger than the tube, to afford free passage between them. Secured upon the upper end of the tube K, in the present instance by being screwed upon the screw L, is a nut Q constituting a valve and adapted to rest, in its lower position, upon a rubber washer R upon the upper surface of the piston G and close the passage-way around the upper end of the tube K. The latter opens into the interior of the hollow piston G by ports *i*.

The operation of the parts under the above described construction, assuming the interior of the casing A above the main valve, to be filled with water under pressure, and the cap C to be filled with water or water and air is as follows: Upon rocking the shaft P in a direction to swing its arm O upward the latter will at the beginning of its movement lift the inner tube K independently of the tube H, which will serve to raise the valve Q at the upper end of the tube K from its seat upon the top of the piston G, thereby placing the interior of the cap C in free communication with the tube H and thence downward through the same to the interior of the casing beneath said tube. In order to prevent the closing of the annular passage between the stem H and tube K when the shaft P is operated as described, I provide a groove or grooves *m* in the stem M′ through which the water may pass from the interior of the cap C as just stated, notwithstanding the fact that at this time the top of said stem M′ is in contact with the lower end of the stem H. The provision thus made for the escape of the water within the cap C will permit the piston G to be lifted in its cylinder E by the further upward movement of the arm O and inner tube, the shoulder *f* at the lower end of the latter engaging the lower end of the tube H as before explained. A full stroke of the shaft P and arm O will carry the tube H upward to position for the upper edge of the flange *b* of the disk *a* to contact with and bear against the under side of the packing-ring F whose inner edge projects inward beneath the piston G. This will lift the main valve from and carry it entirely above its seat I and bring the disk J upon the lower end of the tube H into the circular opening in the seat I, which it snugly fits. So long as the arm O is held in elevated position, therefore, the water supply will be cut off from the closet (and also from the chamber above the piston) by the disk J fitting within the valve-seat I, excepting the small quantity of water permitted to pass through the opening during the interval between the lifting of the main valve from its seat and the bringing of the disk J into the same. When the rock-shaft P and the arm O are now released the inner tube K and parts carried by it will instantly drop downward until the valve Q upon the upper end of the tube K rests upon the washer R upon the top of the piston, thus cutting off the free communication between the cap C and interior of the piston G and tube H. As the tube H and parts carried by it (including the piston G) then begin to descend the partial vacuum created within the cap C by the descent of the piston G in the cylinder E will retard the downward movement of the parts, and they will be permitted to move downward only so fast as water or air can pass from the interior of the inner tube K to the cap C through the groove *e* in the screw L. By regulating the size of this by-pass by adjusting the screw L, (the groove *e* being tapered) the closing movement of the valve can be gaged as desired.

It will be understood that when the main valve is closed as in Fig. 4, the interior of the casing A, between the upper side of the main valve and its seat, and the under side of the piston G, is filled with water under pressure admitted through the pipe-connection B and the coupling B″ by the open valve C′, and that when the main valve is lifted from its seat water under pressure rushes downward through the open valve seat and fills the lower part of the casing A and pipe D, the escape of the water to the closet through the pipe D not being as free as its admission through the valve-seat when the valve is lifted. Whenever the valve is opened, therefore, the consequent upward movement of the valve and piston will displace part of the water in the cap C, which displaced water will escape downward into the discharge chamber through the tube H, inasmuch as the valve Q has been lifted from its seat so as to afford a free communication of the water thereat. At the closing movement of the main valve and downward movement of the piston such free communication with the interior of the cap C will be cut off by the closing of the valve Q, leaving only the minute passage or by-pass *e*, through which the water will again

pass upward into the cap C as the main valve slowly descends upon its seat. After the valve is closed and during the time it remains closed, therefore, the middle portion of the main casing A will remain filled with water and the cap C will remain partially filled with water. The main valve remains seated inasmuch as the area of such valve is larger than the area of the cylinder G. Consequently there will always be a greater pressure exerted on the main valve in order to force or rather hold it to its seat.

The purpose of the flange *b* projecting upward from the disk *a* of the main valve and adapted to seat, at the end of the upward movement of the parts, against the packing-ring F, is to form a tight joint at that point and thereby prevent the water under pressure leaking past the piston G within the cylinder E during the time the main valve is lifted from its seat, which might otherwise occur and produce back-pressure upon the upper end of the piston G. This provision may be omitted where the valve is used as a hand-operated valve, as may also the disk J upon the lower end of the tube H, since in such event the main valve is simply lifted from its seat by means of the operating handle and at once released and there is no occasion for cutting off the flow of water to the closet while the main valve is open.

The circular member M carried by the lower end of the inner tube K approximately (but not snugly) fits the internal bore of the extreme lower end of the valve casing A and pipe D, Fig. 4, but the casing A flares outward above its lower end so that when the parts are lifted by rocking the shaft P and swinging upward the arm O there will be a large free passage within the casing A around the member M. As the parts descend, however, and the main valve approaches its seat, the downward movement of the member M through the inwardly contracting lower end of the casing A will gradually reduce the size of the passage around said member M and restrict the flow of water from the interior of the casing A to the pipe D and closet. As the lower portion *d* of the main valve enters the seat I the water within the casing beneath the valve will be trapped as it were between said valve and the disk M, and as the valve is of larger diameter than the disk it follows that the parts can therefore descend only so fast as the escape of the water downward around the disk M will permit. The provision of this construction and arrangement of the parts prevents the main valve being forced suddenly against its seat at the end of its closing movement and the consequent "hammering" which might otherwise occur.

The chamber within the cap C of the casing constitutes what may be called the retarding chamber, the space within the casing A opposite the pipe-connection B (between the main valve and under side of the piston) constitutes the inlet chamber, and the space beneath the main valve and its seat, within the casing, constitutes the discharge chamber; and it will be seen that the retarding chamber is in communication by central supply and exhaust passages with the discharge chamber in the lower part of the casing, the water in the retarding chamber escaping downward through said central passages as the main valve and piston are lifted, and passing upward through the supply passage, from the discharge chamber to the retarding chamber, as the piston descends and the main valve closes. When the valve is closed the water pressure is entirely cut off from the retarding chamber and the latter is in communication (by the minute supply passages or by-pass) with the atmosphere, through the discharge chamber and closet. These conditions are novel in valves of this character, and are of importance in the operation of such valves. Owing to the fact that the retarding chamber has no communication with the inlet chamber or water-supply (except through the discharge chamber) and owing to the fact that the water pressure in the discharge chamber is gradually reduced as the main valve approaches its seat and cuts off communication with the inlet chamber it follows that there is no considerable pressure in the retarding chamber during the closing movement of the valve, and the result is that the latter moves to its seat slowly and gently, without any sudden shock or jar or hammering at the end of its closing movement, as is likely to occur where the supply passage or by-pass for the retarding chamber communicates directly with the inlet chamber or pressure supply and the valve closes under pressure in the retarding chamber, as is common in other valves of this character.

A further novel feature of my new valve relates to an adjustable throttle-valve interposed in the supply pipe, for regulating or entirely cutting off the supply of water admitted to the main valve of the closet. As before explained the main casing A is provided upon one side with the pipe connection B which is coupled by a union nut B′ with a short pipe section B″ interiorly threaded at its opposite end to be screwed upon the exteriorly threaded end of the supply pipe. A suitable packing ring is interposed between the parts B and B″ to form a tight joint, while the member B″ is provided at its inner end with an inturned flange adapted to form a seat for a valve C′ having a convex outer surface from whose center projects a threaded stem C″ passing through a threaded hole in a bridge D′ extending across

the interior of the member B''. The valve C' is provided upon its opposite edges with slotted ears *a'* which engage ribs *b'* formed upon the inner surface of the pipe connection B and serve to prevent rotation of the valve C' and to guide it in its inward and outward adjustments. In the drawing the valve C' is shown in a position intermediate its closed position and its maximum open position. By slightly loosening the coupling nut B', so as to permit independent rotation of the members B and B'', and turning the member B'' in one direction or the other, the valve C' will be moved toward or from its seat, to reduce or increase the size of the passage around it, as may be desired. In initially setting or adjusting the valve C' the member B'' will be turned as above indicated and the coupling nut B' then tightly screwed up again; but after the main valve has been connected to the supply pipe and to the closet the practice will be to disconnect the valve from the closet and loosen the coupling nut B' and then turn the whole valve in one direction or the other relatively to the fixed member B'' screwed upon the supply pipe, and after the valve C' has been adjusted to the desired position the main valve will be reconnected to the closet and the coupling nut B' tightened again.

A tight joint is effected and maintained between the rock shaft P and the valve casing by the novel means shown more particularly in Fig. 5. As there shown the rock-shaft is surrounded by a bushing P' slipped over the shaft from its opposite end and screwed into the casing A. The rock-shaft P is provided with a shoulder *c'* between which and the inner end of the bushing P' is confined a packing-ring *d'*, and the rock-shaft is constantly pressed outward and its shoulder *c'* forced tightly against the packing-ring *d'* by a spring *e'* confined between the inner end of the rock-shaft and the opposite wall of the casing. In the present instance this spring is a coiled spring held in place at one end by engaging a stud *f'* formed upon the inner face of the casing and having its opposite free end projected centrally from the coil and engaging a tapered recess formed in the end of the rock-shaft. This particular construction and arrangement of the spring *e'* and its engagement with the rock-shaft facilitates the ready assemblage and self-adjustment of the parts, but may be varied without losing the main advantages of this feature of my invention, which consist in providing and readily maintaining a tight joint by the yielding pressure of the shoulder *c'* against the packing-ring *d'* without producing objectionable friction, as is the case where an ordinary stuffing-box is employed. This is particularly important where the valve is to be automatically operated by the seat, in the manner to be now explained.

As shown in Fig. 1 the rock-shaft P has secured to and projecting forwardly from its outer end a short arm R connected by a depending adjustable link R' with the rear end of an arm R'', Fig. 2, formed upon and projecting rearwardly from a sleeve S, Figs. 1, 2, and 3, which sleeve has bearings at its opposite ends in vertical supports S' secured at their lower ends in the closet T. Extending longitudinally through the sleeve S is a rod U which is surrounded at one end by a coiled spring U' connected at one end to the rod and at its opposite end projecting therefrom and confined in a recess at *g'* in one of the supports S'. At its opposite end the rod U is exteriorly threaded and extends through a threaded hole in the otherwise closed end of the sleeve S, and has screwed upon its outer end a lock-nut V engaging the end of the sleeve S and by tightening which the rod U and sleeve are locked together. The rod U has a nick formed in its end for the reception of a screw-driver so that by loosening the lock-nut V the rod may be turned in one direction or the other to regulate the tension of the spring U'.

As will be understood from the foregoing, the locking of the rod U and sleeve S together by means of the nut V causes the spring U' connected to the rod U to exert its force upon the sleeve S. The latter is provided near its middle with a forwardly projecting arm W, which extends under the rear edge of the seat X. The latter has secured to it hinges Y provided at their rear ends with cup-shaped bearings fitting over the opposite ends of the sleeve S, by which the seat is supported and held in place. The spring U' tends to turn the sleeve S in a direction to throw the arm W upward, its movement in such direction being limited by any suitable means, in the present instance by the limit of downward movement permitted the parts connected to the rear end of the arm R'', Fig. 1. The seat X is free to be swung up and down independently of the other parts described, and in normal position rests upon the arm W and is held slightly elevated thereby as in Fig. 1. When entirely depressed upon the closet T it will rock the sleeve S and thereby throw the rear end of the arm R'' upward, thereby rocking the shaft P and operating the main valve as heretofore described. When the seat is released the spring U' will return the parts toward normal position and permit the main valve to gradually close as heretofore described.

While my new valve has been designed more particularly for automatic operation by the seat, it will be understood that it may be employed as a hand-operated valve, in

which case the rock-shaft P would be simply extended as usual to form a handle.

Having thus fully described my invention, I claim:

1. A water closet valve having inlet, discharge and retarding chambers, the latter two chambers having a communicating escape passage and a separate by pass or restricted passage; substantially as described.

2. In a water closet valve having inlet, discharge and retarding chambers, an exhaust passage between the latter two chambers a supply passage or by-pass for the retarding chamber connecting such chamber with the discharge chamber and controlling the closing movement of the valve, and means for gradually reducing the water pressure in the discharge chamber as the valve closes, substantially as described.

3. In a water closet valve having inlet, discharge and retarding chambers, an exhaust or escape passage connecting the retarding chamber with the discharge chamber, a valve controlling such passage and operating to open the same at the opening movement of the main valve and to close the same at the closing movement of the main valve, and a supply passage or by-pass for the retarding chamber connecting such chamber with the discharge chamber and serving to control the closing movement of the main valve, substantially as described.

4. In a water closet valve having inlet, discharge and retarding chambers, an exhaust or escape passage for the retarding chamber communicating with the discharge chamber, a valve controlling the same, a supply passage or by-pass for the retarding chamber connecting the same with the discharge chamber, and means for reducing the water pressure in the discharge chamber as the main valve closes, substantially as described.

5. In a water closet valve having inlet, discharge and retarding chambers arranged in axial line with each other, a central supply passage or by-pass which is restricted and extends through the inlet chamber, connecting the retarding chamber with the discharge chamber, and a separate exhaust passage between the retarding and discharge chambers; substantially as described.

6. In a water closet valve having inlet, discharge and retarding chambers arranged in axial line with each other, a central exhaust or escape passage extending from the retarding chamber through the inlet chamber into the discharge chamber, a valve controlling such passage, and a central supply passage or by-pass for the retarding chamber also extending through the inlet chamber and connecting the retarding chamber with the discharge chamber, substantially as described.

7. In a water closet valve having a middle inlet chamber and discharge and retarding chambers upon either side and in axial line with it, a main valve and a piston moving together, the former controlling communication between the inlet and discharge chambers and the latter serving to separate the inlet and retarding chambers, and a pipe or tube forming central supply passage or by-pass for the retarding chamber and extending through the piston and main valve and connecting the retarding chamber with the discharge chamber, substantially as described.

8. In a water closet valve having a middle inlet chamber and discharge and retarding chambers on either side and in axial line with it, a piston separating the inlet and retarding chambers, a main valve carried by the stem of said piston and controlling communication between the inlet and discharge chambers, and a pipe or tube forming a supply passage or by-pass for the retarding chamber and extending through the piston and its stem and communicating with the discharge chamber, substantially as described.

9. In a water closet valve having a middle inlet chamber and discharge and retarding chambers on either side and in axial line with it, a piston separating the inlet and retarding chambers, a main valve carried by the stem of said piston and controlling communication between the inlet and discharge chambers, an escape or exhaust passage for the retarding chamber extending through the piston and its stem and communicating with the discharge chamber, a valve controlling such passage, and a pipe or tube forming a supply passage or by-pass for the retarding chamber and extending through the piston and its stem and communicating with the discharge chamber, substantially as described.

10. In a water closet valve having a retarding chamber for controlling the closing movements of the main valve and having a discharge chamber, and separate exhaust and supply passages between the retarding and discharge chambers; the supply passages being restricted as compared with the exhaust passages substantially as described.

11. In a water closet valve having a retarding chamber for controlling the closing movement of the main valve, a restricted supply passage or by-pass for said retarding chamber communicating with the water pressure at the discharge side of the main valve when said valve is opened and communicating with the atmosphere through the discharge end of the valve when the main valve is closed, and an exhaust passage normally substantially closed but opened in the opening movement of the main valve for relieving the retarding chamber when such main valve is opened; substantially as described.

12. In a water closet valve having inlet, discharge and retarding chambers, a piston separating the inlet and retarding chambers, a main valve moving with said piston and controlling communication between the inlet and discharge chambers, a supply passage or by-pass for the retarding chamber communicating with the water supply during the closing movement of the main valve and cut off therefrom and communicating with the atmosphere when the main valve is closed, and a valve-controlled exhaust passage for relieving the retarding chamber when such main valve is opened; substantially as described.

13. In a water closet valve having inlet, discharge and retarding chambers, a piston separating the inlet and retarding chambers, a main valve moving therewith and controlling communication between the inlet and discharge chambers, an exhaust or escape passage for the retarding chamber, a valve controlling said passage, and a by-pass or supply passage for the retarding chamber communicating with the water supply during the closing movement of the main valve and cut off therefrom and communicating with the atmosphere when the main valve is closed, substantially as described.

14. In a water closet valve having inlet, discharge and retarding chambers, a piston separating the inlet and retarding chambers, a main valve carried by the stem of said piston and controlling communication between the inlet and discharge chambers, separate supply and exhaust passages for the retarding chamber extending through the piston stem and communicating with the water supply during the closing movements of the main valve and with the atmosphere after said valve is closed; substantially as described.

15. In a water closet valve having inlet, discharge and retarding chambers, a piston separating the inlet and retarding chambers, a main valve carried by the stem of said piston and controlling communication between the inlet and discharge chambers, an exhaust or escape passage for the retarding chamber extending through the piston and piston-stem, a valve controlling said passage, and a supply passage or by-pass for the retarding chamber communicating through the piston and piston-stem with the water supply during the closing movement of the main valve and with the atmosphere after said valve is closed, substantially as described.

16. In a water closet valve having inlet, discharge and retarding chambers and a main valve controlling communication between such chambers, a supplemental valve operating to close communication between the inlet chamber and the discharge and retarding chambers when the main valve has been fully opened, and to open communication between said chambers as the main valve closes, substantially as described.

17. In a water closet valve having inlet and discharge chambers and a main valve controlling communication between said chambers, a supplemental valve moving with the main valve and operating to close communication between the inlet chamber and the discharge and retarding chambers when the main valve is fully opened and to open communication between said chambers as the main valve closes, substantially as described.

18. In a water closet valve having inlet, discharge and retarding chamber, a piston separating the inlet and retarding chambers, two separate passages extending through said piston and connecting the retarding chamber directly with the discharge chamber, one of said passages being a supply passage for the supply of fluid from the discharge chamber to the retarding chamber and being restricted in carrying capacity as compared with the other passage which exhausts the retarding chamber for permitting the quick opening movement of the main valve, a main valve carried by the stem of said piston and controlling communication between the inlet and discharge chambers, and a supplemental valve also carried by the stem of said piston and operating to close communication between the inlet and discharge chambers when the main valve is fully opened; substantially as described.

19. In a water closet valve having inlet, discharge and retarding chambers arranged in axial line with each other, a piston separating the inlet and retarding chambers, a main valve carried by the stem of said piston and controlling communication between the inlet and discharge chambers, a supplemental valve also carried by the stem of said piston and operating to close the communication between the inlet and discharge chambers when the main valve is fully opened, and separate supply and exhaust passages for the retarding chamber extending through the piston and piston stem and into the discharge chamber for controlling the closing movement of the main valve and permitting the quick opening of the latter; substantially as described.

20. In a water closet valve having inlet, discharge and retarding chambers arranged in axial line with each other, a piston separating the inlet and retarding chambers, a main valve carried by the stem of said piston and controlling communication between the inlet and discharge chambers, a supplemental valve also carried by the stem of said piston and operating to close communication between the inlet and discharge chambers when the main valve is fully opened, an escape or exhaust passage from the re-

tarding chamber extending through the piston and piston-stem, a valve controlling said passage, and a by-pass or supply passage for the retarding chamber also extending through the piston and piston-stem and controlling the closing movement of the main valve.

21. The combination, with a closet and its seat, of a valve having inlet, discharge, and retarding chambers, a main valve controlling communication between the inlet chamber and the discharge and retarding chambers, a piston between the inlet and retarding chambers for operating the main valve, a valve-governed by-pass or conduit extending directly between the retarding and discharge chambers and passing axially through the piston for quickly exhausting or relieving the retarding chamber of fluid, a second by-pass or conduit extending between the retarding and discharge chambers for admitting fluid to the retarding chamber in the closing movements of the main valve and of less carrying capacity than said exhaust by-pass, a supplemental valve operating to close communication between the inlet and discharge chambers when the main valve is fully opened, and means operated by the closet seat to open the main valve; substantially as described.

22. The combination, with a closet and its seat, of a valve having inlet, discharge and retarding chambers, a main valve controlling communication between the inlet chamber and the discharge and retarding chambers, a supplemental valve operating to close communication between said chambers when the main valve is fully opened, means operated by the closet seat for opening the main valve, and a restricted by-pass or supply passage connecting the retarding chamber with the discharge chamber and controlling the closing movement of the main valve, substantially as described.

23. The combination, with a closet and its seat, of a valve having inlet, discharge, and retarding chambers, a main valve controlling communication between the inlet and discharge chambers, a supplemental valve operating to close communication between said chambers when the main valve is fully opened, an escape or exhaust passage for the retarding chamber, a valve controlling said passage, a supply passage or by-pass for the retarding chamber, and means operated by the closet seat for opening both the valve controlling the escape or exhaust passage and the main valve, substantially as described.

24. The combination, with a closet and its seat, of a valve having inlet, discharge, and retarding chambers, a piston separating the inlet and retarding chambers, a main valve carried by the stem of said piston and controlling communication between the inlet and discharge chambers, a supplemental valve also carried by the stem of said piston and operating to close communication between said chambers when the valve is fully opened, separate supply and exhaust passages for the retarding chamber, and means operated by the closet seat for opening the main valve, substantially as described.

25. In a water closet valve, a valve casing having a retarding chamber, an open-ended cylinder E located therein and surrounded by an annular sediment chamber formed between its outer walls and the inner walls of the retarding chamber, a main valve in said casing for controlling the passage of water therethrough, a hollow piston movable within said cylinder E and having a hollow stem communicating with its interior and connected with said main valve, said hollow piston being also arranged to communicate with the retarding chamber, and means for governing said communication and to open the same in the opening movements of the main valve; substantially as described.

26. In a water closet valve, the combination of the casing A having inlet and discharge chambers, a removable cap C connected with the casing and forming a retarding chamber, an open-ended cylinder E having an outwardly extending marginal flange E′ clamped between the cap C and the casing A, said cylinder E being arranged to form an annular sediment chamber between its outer walls and the inner walls of the cap C, a main valve governing the passage of water through the casing, a piston G which is arranged to travel in the cylinder R and which is hollow and adapted to communicate directly through its upper end with the retarding chamber and through its stem with the discharge chamber, and separate valve devices for governing said communications; substantially as described.

27. The combination of the casing, the cylinder E, the piston G working therein and provided with the depending tubular stem H carrying the main valve coöperating with the seat I, the central hollow tube K extending longitudinally through the piston stem H and piston G and provided at its upper end with a by-pass connecting the interior of the tube with the chamber above the piston and with a valve controlling communication between said chamber and the hollow piston stem, said central tube K having limited movement independently of the piston and main valve, and means for lifting said tube K, substantially as described.

28. The combination of the casing composed of the body portion A and the cap C, the open-ended cylinder E secured therein, the hollow piston G working in said cylinder and having the depending tubular stem H carrying the main valve coöperating with the seat I, the central tube K extending lon-

gitudinally through the piston stem H and piston G and provided at its upper end with the screw L having the by-pass *e* connecting the interior of said tube with the chamber above the piston and the nut Q screwed thereon and coöperating as a valve with the top of the piston G, and provided at its lower end with the shoulder *f* adapted to permit limited upward movement of the tube K independently of the piston stem and to then engage the lower end of the piston stem and lift the latter and the parts carried by it, and means for lifting said tube K, substantially as described.

29. In a water-closet valve, the combination of the casing having the valve-seat I, the cylinder E, the packing-ring F surrounding its lower end, the piston G working in said cylinder and having the depending stem H, and the main valve H′ carried by the stem H and coöperating in its lower position with the seat I and in its upper position with the packing-ring F, substantially as described.

30. The combination of the casing, the cylinder E secured therein, the packing-ring F surrounding the lower end of said cylinder, the piston G working in said cylinder and having the depending tubular stem H, the main valve carried by said stem H and coöperating in its lower position with the seat I and in its upper position with the packing-ring F, the central tube K having at its upper end the by-pass and the valve coöperating with the upper end of the piston G, and provided at its lower end with the shoulder *f* adapted to coöperate with the lower end of the piston stem H, and means for lifting the tube K, substantially as described.

31. In a water closet valve, the combination of the casing provided with the valve seat I, the cylinder E, the hollow piston G working therein and having the hollow or tubular depending stem H, said piston being arranged to communicate at its upper end with the retarding chamber and at its lower end through the piston with the discharge chamber, the main valve H′ carried by said valve stem and coöperating in its lower position with the seat I, valve devices controlling said communications of the hollow piston with the retarding chamber and discharge chamber, respectively, a movable tube K extending through the stem H for controlling the flow of water through cylinder E, and the disk J carried by the stem H at a point beneath the valve H′ and coöperating with the seat I when the main valve is in elevated position to cut off the passage of water through the valve casing.

32. In a water-closet valve, the combination of the casing having the seat I, the cylinder E, the packing-ring F around the lower end of said cylinder, the piston G working in said cylinder and having the depending stem H, the main valve H′ carried by said stem and coöperating in its lower position with the seat I and in its upper position with the packing-ring F, and the disk J carried by the stem H beneath the valve H′ and coöperating with the seat I when the valve H′ is lifted to its upper position, substantially as described.

33. The combination of the casing composed of the body portion A and the cap C screwed into its upper end, the cylinder E provided at its lower end with an outwardly projecting flange E′ confined between the lower end of the cap C and a shoulder upon the casing A, the packing-ring F confined between said flange and shoulder and projecting inwardly beneath the cylinder E, the piston G working in the cylinder E and having the depending stem H, and the main valve H′ carried by the stem H and provided with the up-turned flange *b* adapted to coöperate with the packing-ring F when the valve is in its upper position, substantially as described.

34. The combination of the casing having the seat I, the cylinder E, the piston G working therein and having the depending tubular stem H, the main valve H′ carried by said stem and coöperating in its lower position with the seat I, the disk J also carried by said stem beneath the valve H′ and cooperating with the seat I to close the same when the valve is in its upper position, the central tube K extending longitudinally through the stem H and piston G and having at its upper end a by-pass and a valve coöperating with the upper end of the piston G, and provided at its lower end with a shoulder *f* adapted to coöperate with the lower end of the stem H, and means for lifting the tube K, substantially as described.

35. In a water-closet valve, the combination of the casing A having the seat I and contracted lower end, the main valve H′ cooperating with the seat I and the disk M supported by and movable with the main valve and coöperating with the contracted lower portion of the casing A in the manner and for the purpose described.

36. In a water-closet valve, the combination of the casing having the contracted lower portion and seat I, the cylinder E, the piston G therein having the depending tubular stem H, the valve H′ carried by said stem and coöperating with the seat I, the central tube K extending longitudinally through the stem H and piston G and provided at its upper end with a by-pass connecting the interior of said tube with the chamber above the piston and with a valve coöperating with the upper end of the piston G, and carrying at its lower end the disk M coöperating with the contracted lower portion of the casing A, and means

for lifting the tube K and coöperating parts, substantially as described.

37. In a water-closet valve, the combination of the open-ended cylinder E, the hollow piston G therein, the depending tubular stem H, the main valve H′ coöperating with the seat I, the central tube K extending through the piston stem H and hollow piston G and provided within the latter with the ports *i*, the screw L screwed into the upper end of the tube K and provided with the groove *e*, and the nut Q carried by said screw L and coöperating as a valve with the upper end of the piston G to control the passage *h* around the tube K, and means for lifting the tube K and coöperating parts, substantially as described.

38. The combination, with the valve-casing having the pipe-connection B, of the pipe-section B″ provided with the bridge D′, the coupling nut B′, the valve C′ having the threaded stem C″ passing through the bridge D′, and means for preventing rotation of the valve C′ relatively to the pipe-connection B, substantially as described.

39. The combination, with the valve casing having the pipe-connection B provided with the ribs *b*′, the pipe-section B″ having the bridge D′ and inturned flange forming a valve-seat, the coupling nut B′, and the valve C′ having the threaded stem passing through the bridge D′ and provided with the grooved ears *a*′ engaging the ribs *b*′ upon the pipe-connection B, substantially as described.

40. The combination of the valve casing A, the bushing P′ secured thereto, rock shaft P extending into the bushing and provided with the flat annular shoulder *c*′ and also having a conical recess at its extreme end, a coiled spring *e*′ having one end bent to a position along the central axis thereof and projecting therefrom and into the apex of the conical recess, and means within the valve casing for engaging the other end of the spring and thereby keeping the same centered; substantially as described.

41. The combination of the casing A having the stud *f*′, the bushing P′ screwed therein, the rock-shaft P extending through said bushing and provided with the annular shoulder *c*′, and having the tapered central recess in its inner end, and the coiled spring *e*′ engaging at one end the stud *f*′ upon the casing and having its opposite end centrally projected into the tapered recess in the end of the rock-shaft P, substantially as described.

42. The combination of the valve casing, having inlet, discharge and retarding chambers, a cylinder E in the retarding chamber, a piston having a hollow head working in said cylinder provided with a hollow stem, a main valve carried by said stem, said hollow head being arranged to communicate with the retarding chamber and through its piston stem with the discharge chamber, a tube extending axially of said piston stem and piston head and arranged to communicate with the retarding chamber at a point above said piston head, a valve carried by said tube for governing the communication between the retarding chamber and the interior of the piston head, and means for operating said main valve and also the tube, but operating said tube and its said valve slightly in advance of the opening movement of the main valve; substantially as described.

43. The combination of the valve casing having inlet, discharge and retarding chambers, a main valve for controlling the passage of the water through the casing, a cylinder E located in the retarding chamber, a piston comprising a hollow head G working in the cylinder and a hollow depending stem H extending axially through the inlet chamber and into the discharge chamber but leaving an annular passage for water from the discharge chamber to pass upward, the interior of said piston head being arranged to communicate with the retarding chamber and with the discharge chamber, a valve Q controlling communication between the interior of the piston and the retarding chamber and permitting the quick exhaust or relief of fluid from the retarding chamber through the hollow piston head and its hollow stem and directly into the discharge chamber, a tube K extending axially through the piston head and its stem and carrying the valve Q at its upper end, said tube being arranged to communicate with the retarding chamber through a restricted passage for supplying fluid to such retarding chamber in the closing movements of the main valve, and means for operating said piston and said valve Q; substantially as described.

44. The combination of a casing communicating with the water discharge of a water closet, a rock shaft extending therein, and having substantially conical end recess and a spring received at one end by such recess and abutting at its other end against the casing and valve mechanism operated by such shaft.

45. The combination with a water discharge pipe D having a laterally arranged chamber and communicating with a water closet, of valve mechanism governing the discharge in such pipe, a rock shaft P extending into such chamber for operating such valve mechanism, such shaft having a flange *c*′ and having its end within such chamber conically recessed and a spring with one end received by such recess and the other abutting a wall of the chamber; substantially as described.

46. The combination with a water discharge pipe having a laterally arranged chamber and communicating with a water

closet, of valve mechanism governing the discharge in such pipe, a rock shaft P extending into such chamber for operating the valve mechanism, said shaft being provided on its extreme inner end with a conical recess and also provided with a flange e', a bushing p' secured in such chamber and encircling the shaft P, packing d' confined between the flange e' and the inner end of such bushing, a coiled spring c' having one end turned and pointing in the direction of its central axis and projecting into the apex of said conical recess, and a stud f' formed on an inner wall of the casing and arranged to engage the other end of the spring; substantially as described.

47. The combination with a water discharge pipe D having a laterally arranged chamber and communicating with a water closet, of valve mechanism governing the discharge in such pipe, a rock shaft P extending into such chamber for operating such valve mechanism and provided with a flange c', the inner end of such shaft being conically recessed and a spiral spring interposed between a wall of the chamber and the end of the shaft, an extreme end of the spring bearing in the apex of the conical recess; substantially as described.

EARL G. WATROUS.

Witnesses:
EDWARD RECTOR,
LEONORA WISEMAN.