No. 710,960. Patented Oct. 14, 1902.

F. & F. H. ENGELHARD.

SELF CLOSING ANTIWATER HAMMER BALANCE VALVE.

(Application filed Feb. 24, 1902.)

(No Model.) 2 Sheets—Sheet 1.

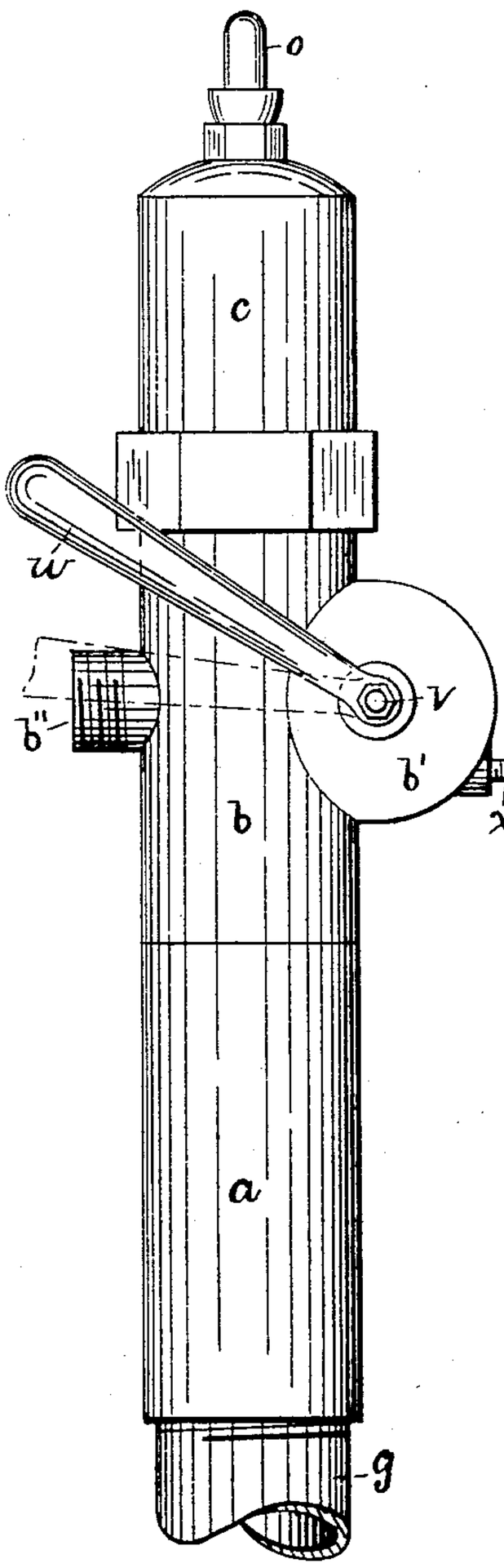

FIG. 1.

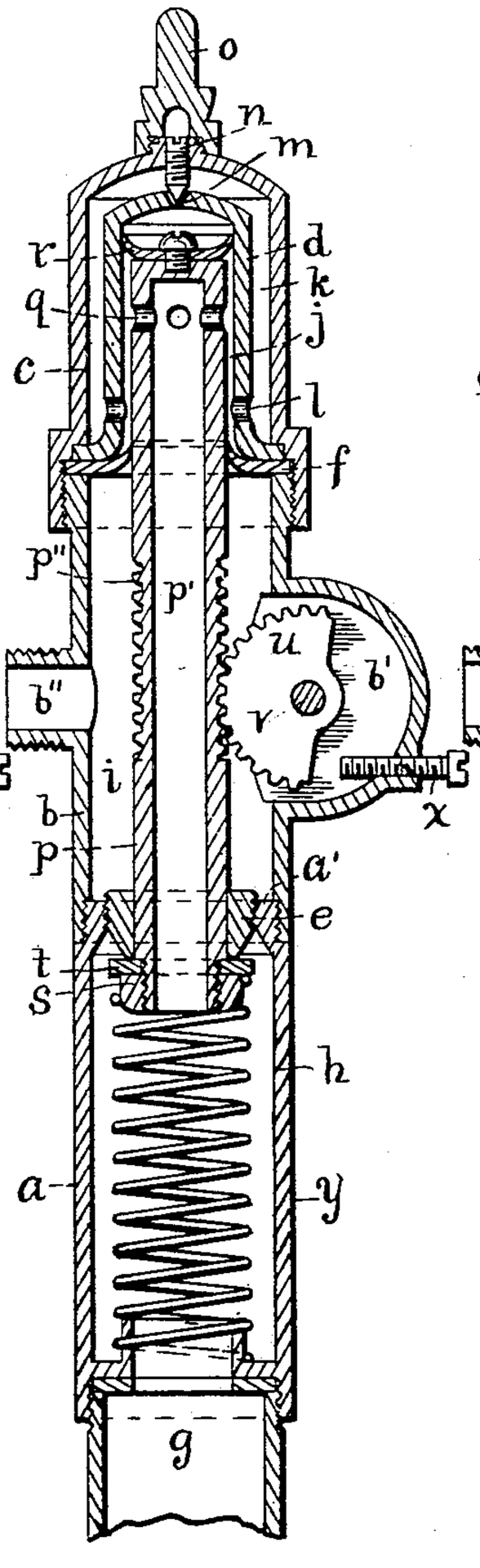

FIG. 2.

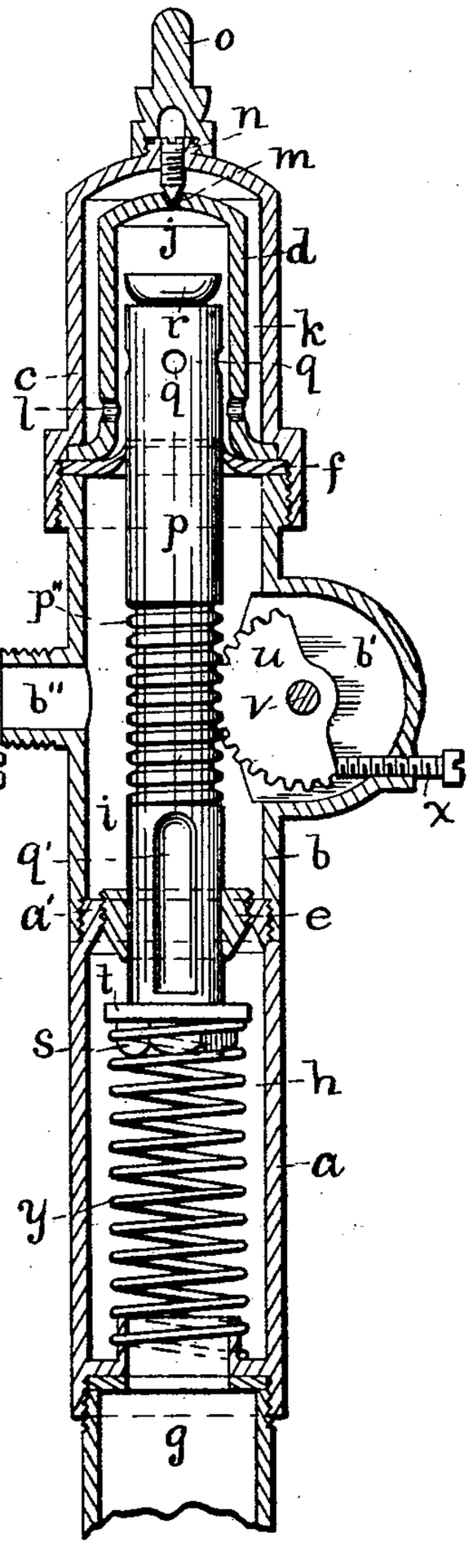

FIG. 3.

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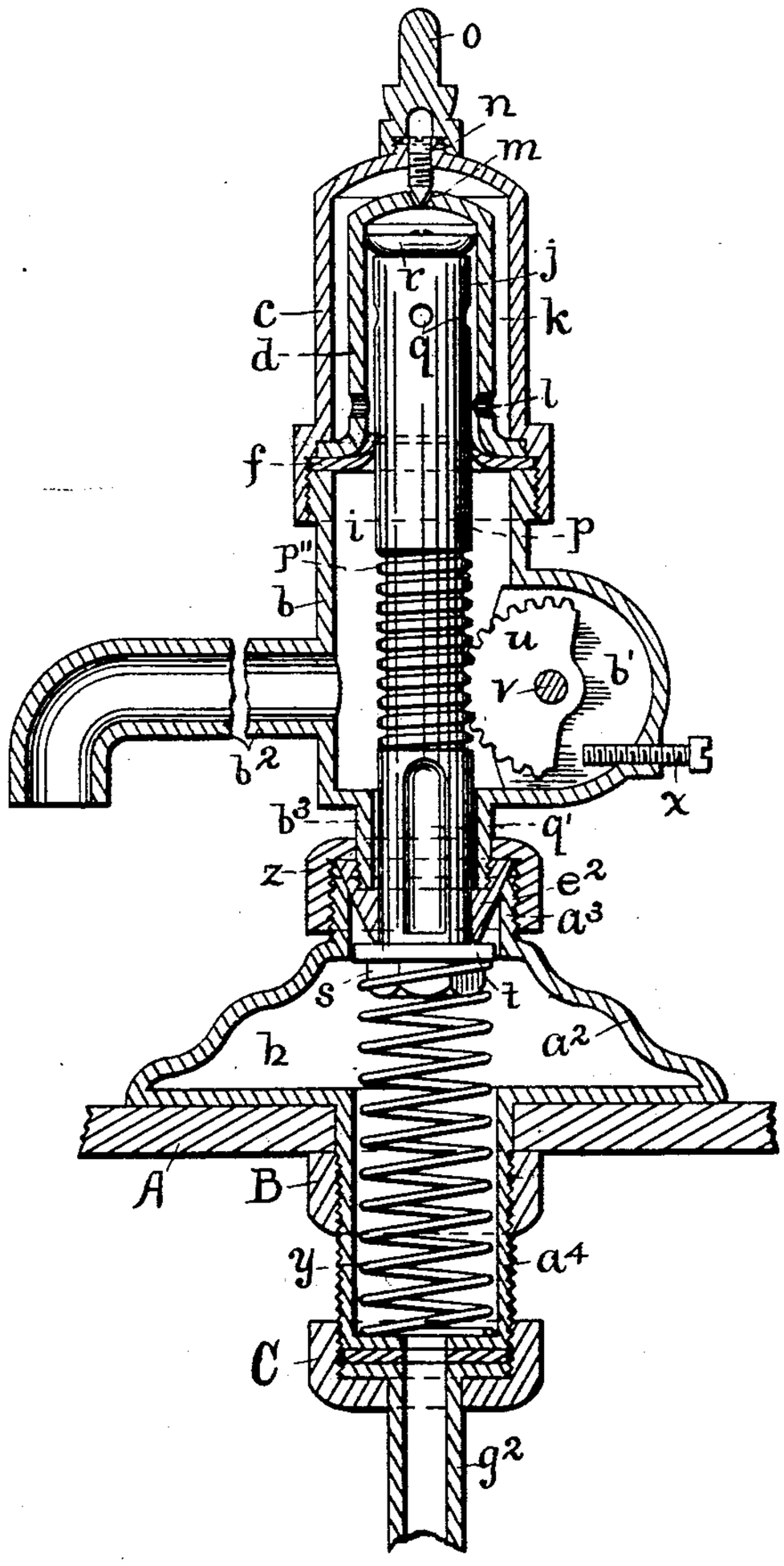

FIG. 4.

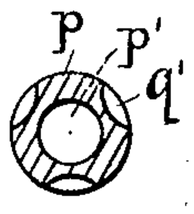

FIG. 5.

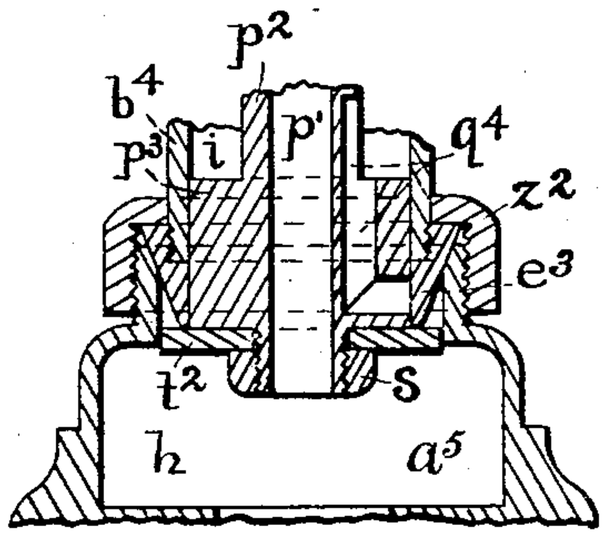

FIG. 6.

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UNITED STATES PATENT OFFICE.

FRANK ENGELHARD AND FREDERICK H. ENGELHARD, OF SPRINGFIELD, MASSACHUSETTS.

SELF-CLOSING ANTIWATER-HAMMER BALANCE-VALVE.

SPECIFICATION forming part of Letters Patent No. 710,960, dated October 14, 1902.

Application filed February 24, 1902. Serial No. 95,253. (No model.)

To all whom it may concern:

Be it known that we, FRANK ENGELHARD and FREDERICK H. ENGELHARD, citizens of the United States, residing at Springfield, in the county of Hampden and State of Massachusetts, have invented a new and useful Self-Closing Antiwater-Hammer Balance-Valve, of which the following is a specification.

Our invention relates to improvements in valves for water-closets, set-bowls, and the like in which a specially-arranged casing is equipped with a peculiarly-constructed valve-plunger manually actuated in one direction and automatically actuated in the other direction against a restraining liquid, all as hereinafter fully described, and especially pointed out in the claims.

The objects of our improvement are, first, to provide a self-closing valve which is compact, durable, and simple in construction; second, to furnish a valve that is free from water-hammer-producing vibration; third, to afford means for regulating the time required for the closing of the valve proper; fourth, to produce a valve that can be readily taken apart for the purpose of cleaning or for replacing worn-out members; fifth, to provide means for limiting the manually-produced movement, and, sixth, to provide a device or apparatus which accomplishes the objects herein set forth in an economical and practical manner. We attain these objects by the mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a side view of our invention as adapted for water-closets; Fig. 2, a vertical section of the same, showing the movable members normally disposed and the valve closed; Fig. 3, a similar view showing the position of said members at the instant the valve is opened to its fullest extent; Fig. 4, a vertical section of our invention as adapted for set-bowls, the movable members normally disposed as in Fig. 2; Fig. 5, a cross-section of the lower part of the plunger; and Fig. 6, a sectional view of a part of a device similar to that shown in Fig. 4, showing an arrangement whereby the spring is dispensed with.

Similar letters refer to similar parts throughout the several views.

Although the essential features of the two forms of construction shown in the first four figures are the same, or substantially so, for the sake of convenience we will first describe the water-closet valve and afterward point out the differences in the set-bowl valve. The differences referred to are not so great as to prevent one valve from being substituted for the other; but we prefer the two constructions for the two purposes.

We prefer to employ a casing made up of a base *a*, a body *b*, and exterior and interior domes *c* and *d*, respectively, with a removable valve-seat *e* at the junction of said base and body and a hydraulic packing *f* at the junction of the body and said domes. An inlet or supply pipe *g* opens into the bottom or through the floor of the base *a*. The valve-seat *e* is externally threaded at the top to screw into an internally-threaded flange *a'* at the top of the base *a*, and said valve-seat separates the inlet-chamber *h* in said base from the outlet-chamber *i* in the body *b*. The base *a* and body *b* are preferably screwed together at the flange *a'*, as shown. By preference a flange is formed on the bottom of the interior dome *d*, which rests on the hydraulic packing *f*, and the exterior dome *c* is screwed onto the body *b* with said flange and outer rim of said hydraulic packing tightly confined between. The hydraulic packing *f* separates the outlet-chamber *i* from the inner balance-chamber *j* in the dome *d*, and said hydraulic packing and the interior dome-flange separate said chamber *i* from the outer balance-chamber *k* in the dome *c*. Communication is had between the balance-chambers *j* and *k* through one or more holes *l* in the lower part of the side walls of the dome *d* and a conical hole *m* in the top of said dome. A regulating-screw *n* is threaded into the top of the dome *c* and has a conical base adapted to register with the hole *m*. By turning the screw *n* up or down it will be seen that the amount of water escaping through the hole *m* is increased or decreased accordingly. A recessed cap *o* is screwed onto the top of the dome *c*, by removing which access is had to the screw *n*. A plunger *p* extends through the chamber *i* into the chamber *h* below and the chamber *j* above and is provided with a central passage *p'*, opening at the base into said chamber *h*

and at the top through one or more holes q in the sides of said plunger into said chamber j, the top of said passage being closed. An inverted cup-packing r is fastened to the top of the plunger p by means of a screw or otherwise. This cup-packing is collapsible, so that it can contract or expand. The lower terminal of the plunger p is of less diameter than the major portion thereof and externally threaded to receive a nut s, which secures a valve t in place. The valve t is adapted to normally bear against the valve-seat e, so as to shut off the flow of water between the inlet and outlet chambers. In order to afford passage for the escape of water from the chamber h into the chamber i when the plunger p is depressed, one or more grooves q' are provided in the lower part of said plunger, the bottoms of said grooves being closed to furnish an unbroken bearing-surface for the valve t, as shown in Fig. 3. These grooves form external plunger passages or waterways for the flow of liquid through the opening in the valve-seat when the plunger is depressed. In place of the grooves q' the lower part of the plunger may be made square or angular, if desired. The plunger is centered by the valve-seat e and the hydraulic packing f. An annular rack p'' is formed on the plunger p to mesh with a segment u, which is secured on a spindle v in an extension b' of the body b. The body b is provided with an outlet b'', to which a pipe (not shown) is attached, which conveys the water to the bowl of the closet. A handle or lever w is fastened to the spindle v outside of the extension b' and is the medium by means of which the valve is manually operated to open the same. A screw x, threaded through the extension b', extends into the path of travel of the lower corner of the segment u to limit the movement of the same when actuated by the lever w for the purpose of opening the valve. By means of the screw x the downward thrust of the plunger p may be varied.

A spiral spring y is interposed between the valve t and the floor of the base a to normally force said valve and the plunger p upward. The spring y is centered by the nut s and a flange about the opening in the floor of the base a.

Assuming that the parts stand as shown in Fig. 2, it will be understood that water rises through the pipe g to fill the chamber h and that it also fills the plunger-passage p' and escapes therefrom into the chamber j through the holes q below the cup-packing r. From the chamber j the water enters the chamber k through the holes l and rises in said chamber k to overflow through the hole m into said chamber j above the cup-packing r, or the force of the water escaping from the plunger-passage p' may be great enough to contract the cup-packing, and thus fill the whole of the chamber j at once, in which event it will enter the chamber k through the holes m and l. The operation of the device will now be as follows: Depress the lever w until the segement u strikes the end of the screw x and then release the same. The parts now stand substantially as shown in Fig. 3. The depression of the lever forces down the plunger p against the resistance offered by the spring y, (or by the water in the chamber h under the modified construction hereinafter described,) carries the valve f away from the valve-seat e, and the water in said chamber and from the supply-pipe g is thereby permitted to flow into the chamber i through the external passages in said plunger and to escape through the outlet b''. At the same time the descent of the plunger p has drawn down the cup-packing r and the water below the same in the chamber j causes said cup-packing to contract, if it has not already done so; otherwise the latter would not be able to descend freely, owing to the pressure of the water beneath. The operation just described does not materially disturb the water in the balance-chambers. As soon as the operating-lever is released the valve and plunger come under the influence of the pressure exerted beneath them and are raised by said pressure, but the plunger is permitted to move upward only so fast as the water above the cup-packing can be forced from the balance-chamber j through the hole m into the balance-chamber k, because this water is now under pressure, which causes said cup-packing to expand against the walls of the dome d, thereby preventing the passage of water outside of the plunger at this point. The aforesaid movement also forces the water from the chamber k through the holes l into the chamber j beneath the cup-packing and from this chamber through the holes q into the passage p' of the plunger p. Although the plunger is retarded in this manner, the pressure in the chamber h continues, nevertheless, to operatively exert itself until the valve f is finally closed. The water continues to escape from the outlet b'' until the external plunger waterways or grooves clear the bottom of the valve-seat opening, when the valve t once more shuts off the flow. The parts now occupy their original positions, ready for a repetition of the above-described operation. By turning the screw x out or in the length of the downward stroke of the plunger is increased or decreased accordingly, thereby increasing or diminishing the quantity of water above the cup-packing, which must be expelled through the hole m before the valve can be closed. This is one means of regulating the time required to close the valve, and the device would be operative and capable of being regulated in the absence of the screw n; but by introducing said screw another means for changing the time required for closing the valve is provided. By turning in the screw n the time required for closing is increased, for the reason that a less amount of water is thereby permitted to es-

cape through the hole m, and by turning said screw out the time is decreased.

In order to clean out the casing or to renew the cup-packing r or hydraulic packing f, it is only necessary to unscrew the dome c from the body b and remove it, with the dome d, thus giving ready access to the upper parts of the device. This is an important feature of the invention, since more or less dirt will accumulate in the balance-chambers, and the cup-packing must be renewed from time to time, while even the hydraulic packing may become worn so badly as to require a new one.

In devices of this kind a valve-seat will wear out in time and the valve must be renewed occasionally. Hence it is very desirable to provide convenient means for replacing the worn parts. The base and body may also need to be cleaned out. Provision for all this is afforded by the construction hereinbefore described, the operation being as follows: The domes and hydraulic packing are first removed, thus giving access to the valve-seat e, which is unscrewed from the flange a' with a suitable spanner-wrench. The plunger p and the valve-seat e are then removed from the base a, the nut s is taken off, and a new valve t or valve-seat e, or both, are substituted for the old ones. The nut s is then replaced and the parts assembled as before. The whole interior of the casing may be cleaned at this time, if necessary. Ordinarily the body need not be removed from the base; but it can be unscrewed therefrom, if desired. The lower part of the valve-seat e is tapered toward the center, so as to permit a valve to be used which is sufficiently small in diameter to pass through the flange a'.

Passing now to a description of the set-bowl valve (shown in Fig. 4) it may be said that all of the parts of this device above the lower edge of the extension b' are similar to those already described with the exception of an outlet-pipe b^2 in place of the outlet b', and the plunger and valve are the same. The body b in this case has a depending neck b^3, to which is threaded the valve-seat e^2. The base a^2 flares at the bottom and has a cylindrical top a^3, which receives the tapered sides of the valve-seat e^2. A nut z encircles the neck b^3, and it is threaded to the top a^3 of the base, drawing the contiguous members into close contact when seated. In order to get at the valve-seat e^2 and the valve t, it is simply necessary to unscrew the nut z and remove the casing above the base a^2, with the plunger and attached parts, when the valve-seat and valve may be replaced as before and the parts reassembled. The valve-seat e^2 is unscrewed from the neck b^3 with a suitable spanner-wrench after the parts have been separated. Depending from the floor of the base a^2 is a tubular part a^4, which passes through a hole in the slab A, which supports the device. The part a^4 is externally screw-threaded to receive a nut B, which secures the device to the slab A, also a nut C, which holds the inlet-pipe g^2 and a packing-ring in place. The operation of the device shown in Fig. 4 is identical with that previously described.

The methods herein set forth for securing the device in place or attaching pipes to the same are not vital elements in our invention and may be departed from at will, provided the essential features of the invention are not materially altered.

All joints should be made tight by some suitable and convenient means, as rubber packing-rings, stuffing-boxes, &c. In Fig. 6 we show how the device shown in Fig. 4 may be constructed so as to dispense with the spring y, reliance being placed upon the force of the intake solely for closing the valve. A larger surface is here provided for the water to impinge upon at the base of the plunger. A valve t^2 of larger diameter than the valve t may be used in this connection, which necessitates a correspondingly larger valve-seat e^3 and an enlargement of the contiguous or adjacent parts, the nut z and the base a^5 being substantially the same as before with the exception of the necessary increase in diameter. In this case the body b^4 is carried down straight, or it may even be enlarged at the lower terminal. A collar p^3 is formed on the lower terminal of the plunger p^2, which is otherwise unchanged. The collar p^3 serves as a backing for the valve t^2. Waterway grooves and passages q^4, as shown, are present in this construction and correspond to the grooves q', previously described. If desired, grooves may be cut into the collar p^3, as well as into the sides of the plunger. instead of the vertical and horizontal passages shown. By merely enlarging the base a and the body b at their joined terminals and the valve-seat e, Figs. 1, 2, and 3, and substituting the Fig. 6 construction of the plunger and valve a similar construction to that described in the preceding paragraph and one that accomplishes the same results may be secured for the water-closet valve. It has not been deemed necessary to illustrate this, because nothing new or materially different is involved in addition to what has been fully shown in the drawings.

We prefer to make the rack p'' annular, so that it will always mesh with the segment regardless of any rotary movement that may be imparted to the plunger from any cause; but these serrations may be placed on one side only, if desired, and some convenient means employed to prevent the plunger from turning. Any of the well-known equivalents for the rack and segment which are applicable may be employed in our invention.

We do not wish to be confined strictly to the construction shown and described, as modifications such as those hereinbefore pointed out and others may be made without violat-

ing the spirit of our invention. Changes in shape, size, and position may also be made and in the number of grooves, holes, &c.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. The combination, with a casing having inlet and outlet chambers and two balance-chambers formed by a valve-seat and a hydraulic packing and a perforated interior dome, of a plunger operating in said inlet and outlet chambers and inner balance-chamber, having a passage opening into the inlet-chamber and through side holes into said inner balance-chamber, and a cup-packing at the closed end of said plunger, substantially as set forth.

2. The combination, with a casing divided into inlet and outlet chambers and two balance-chambers by a valve-seat and a hydraulic packing and a perforated interior dome, of an upwardly-pressed plunger operating in said inlet and outlet chambers and inner balance-chamber, having a passage opening into the inlet-chamber and through side holes into said inner balance-chamber, and outer waterway-passages, a valve on said plunger in the inlet-chamber, normally pressed against said valve-seat, and manually-operated means for depressing the plunger, substantially as set forth.

3. The combination, with a casing divided into inlet and outlet chambers and two balance-chambers by means of a valve-seat and a hydraulic packing and a perforated interior dome, of a plunger operating in said inlet and outlet chambers and inner balance-chamber, having a passage opening into the inlet-chamber and through side holes into said inner balance-chamber, a cup-packing at the closed end of said plunger, and a screw in the exterior dome arranged to register with a hole in the interior dome, to regulate the flow of water forced from the inner balance-chamber by said cup-packing, substantially as set forth.

4. The combination, with a casing divided into inlet and outlet chambers and two balance-chambers by a valve-seat and a hydraulic packing and a perforated interior dome, of a plunger operating in said inlet and outlet chambers and the inner balance-chamber, having a passage opening through one end thereof into the inlet-chamber and through side holes into said inner balance-chamber, and outer waterway-passages opening into the inlet and outlet chambers when the valve is open, a cup-packing at the closed end of said plunger, a valve at the open end of the plunger, a valve-seat, a spring arranged to normally force said valve against said valve-seat, and manually-operated means for moving the plunger and valve away from the valve-seat, substantially as set forth.

5. In combination, a body, an exterior dome mounted thereon, an interior dome, and a hydraulic packing, the chamber in said body being separated from the chambers in said domes, substantially as set forth.

6. The combination, with a casing divided into inlet and outlet and balance chambers, of an upwardly-pressed externally-serrated valve-plunger operating in three of said chambers, a segment adapted to engage the plunger-serrations to depress the plunger and valve, and a regulating-screw x extending through the casing into the path of said segment to directly limit its movement in one direction and indirectly limit the downward movement of the plunger, substantially as shown and described.

7. The combination, with a casing divided into inlet and outlet chambers and two balance-chambers by a valve-seat and a hydraulic packing and a perforated interior dome, of an upwardly-pressed plunger operating in said inlet and outlet chambers and inner balance-chamber, having a passage opening into the inlet-chamber and through side holes into said inner balance-chamber, and outer waterway-passages opening into the inlet and outlet chambers when the valve is open, a cup-packing at the closed end of said plunger, a screw in the exterior dome arranged to register with a hole in the interior dome, to regulate the flow of water forced from the inner balance-chamber by said cup-packing, a valve at the open end of the plunger, a valve-seat, and means to normally force said valve against said valve-seat, substantially as set forth.

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