No. 865,479. PATENTED SEPT. 10, 1907.

W. S. COOPER.

FLUSHING VALVE.

APPLICATION FILED APR. 3, 1906.

2 SHEETS—SHEET 1.

FIG. 1.

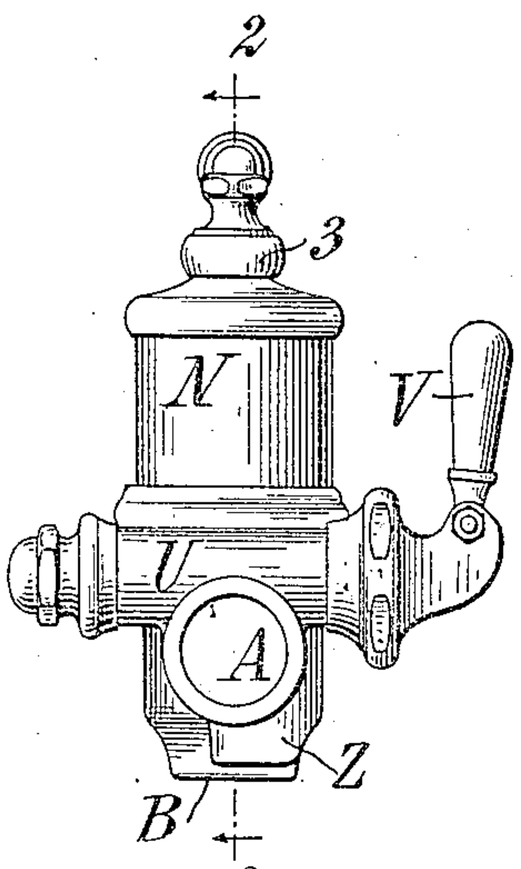
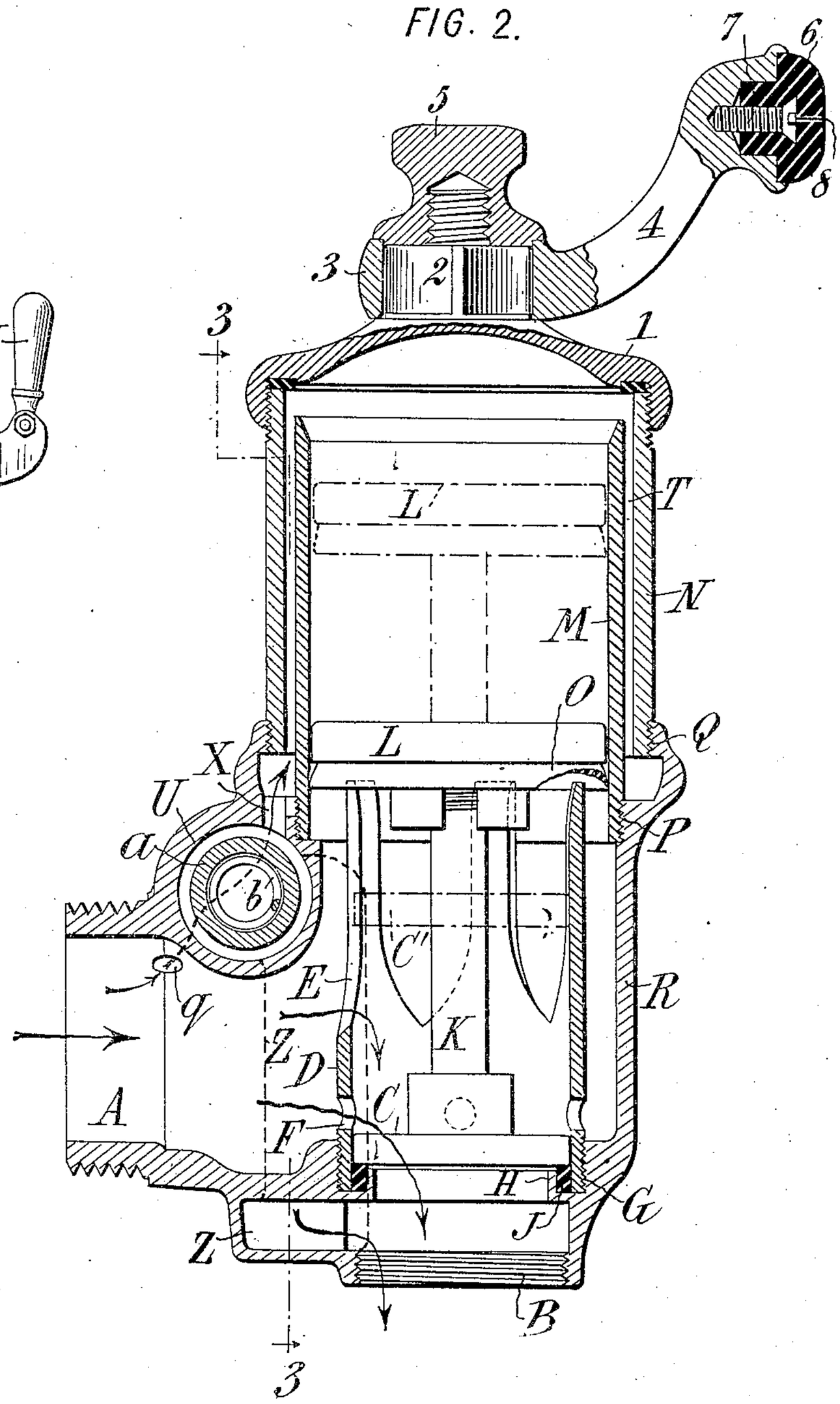


FIG. 2.



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2 SHEETS—SHEET 2

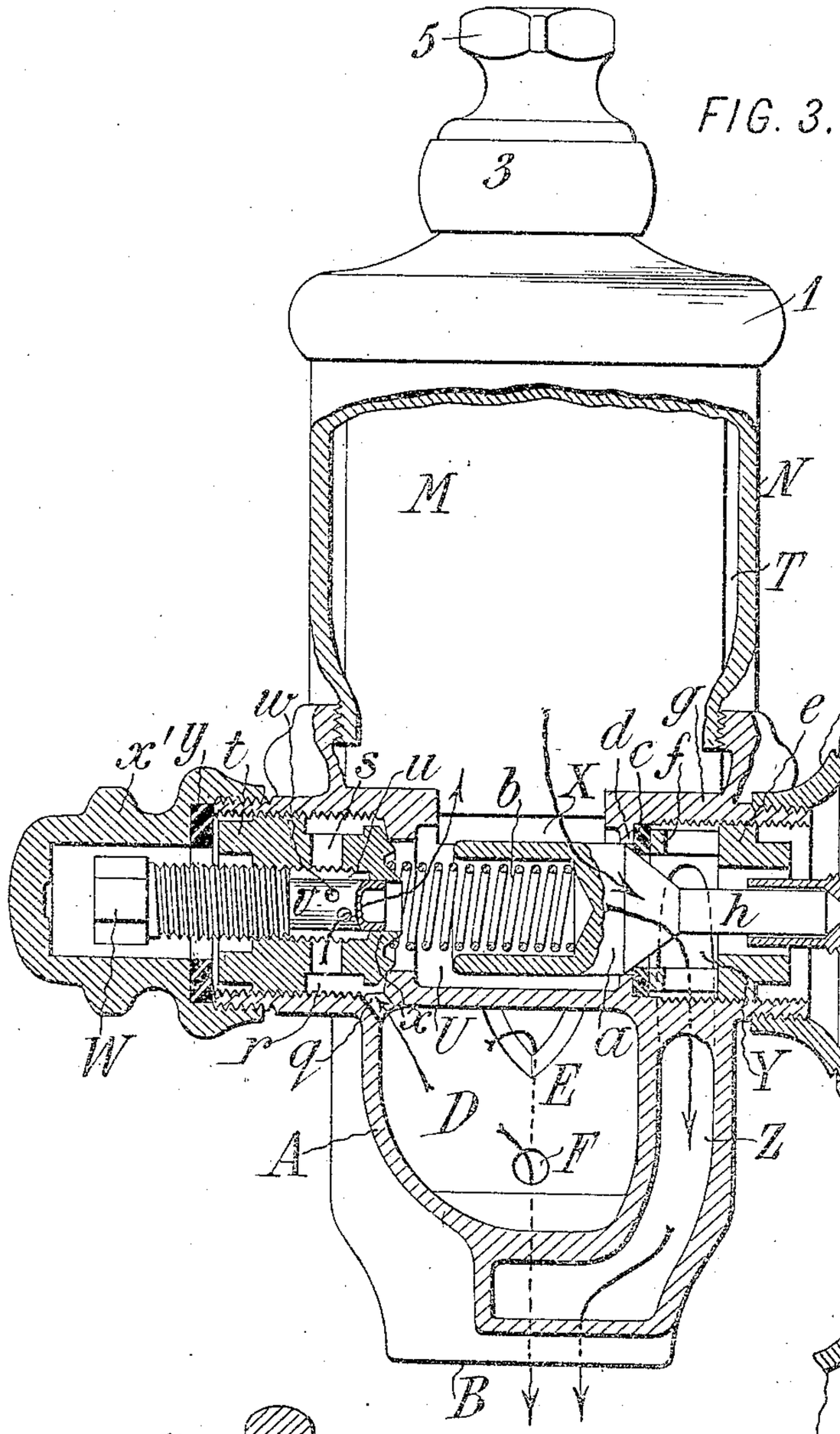
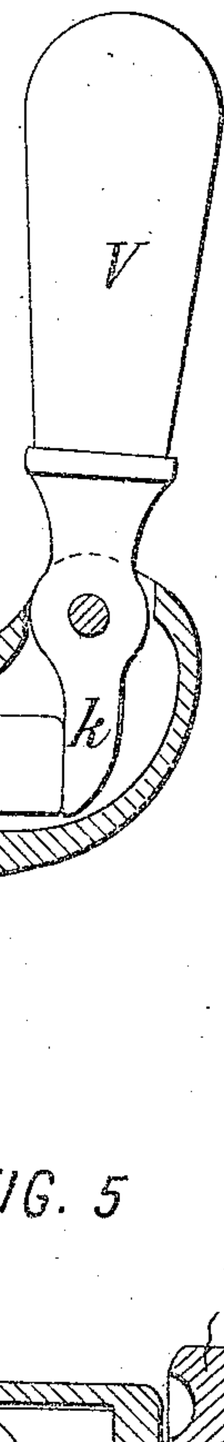


FIG. 3.



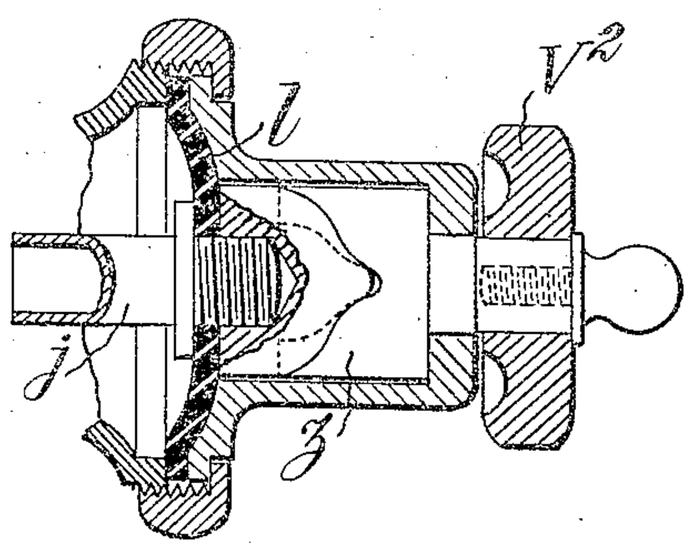


FIG. 5

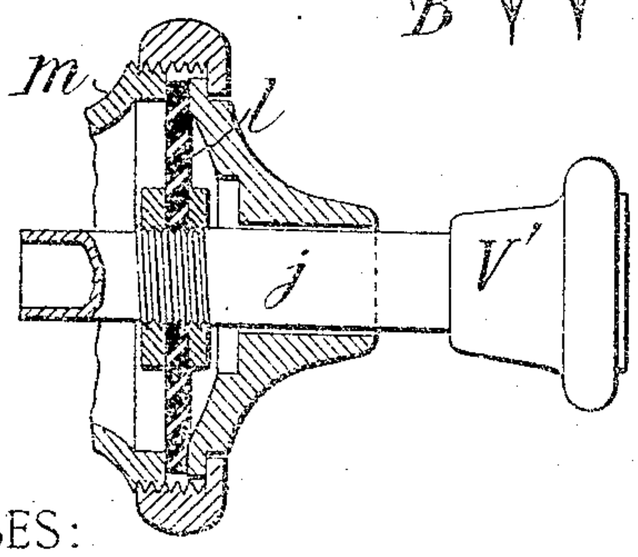


FIG. 4.

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UNITED STATES PATENT OFFICE.

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FLUSHING-VALVE.

No. 865,479. Specification of Letters Patent. Patented Sept. 10, 1907.

Application filed April 3, 1906. Serial No. 309,665.

To all whom it may concern:

Be it known that I, WILLIAM SAMUEL COOPER, a citizen of the United States, residing in the city and county of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in Flushing-Valves, of which the following is a specification.

My invention aims to provide an improved valve useful for various purposes, and of the type employed in the flushing of water closets.

A slow-closing arrangement is provided, and the operation in a general way is similar to previous valves of this type. The valve handle is thrown and held for a desired length of time. It is thereupon released, and a slow-closing arrangement allows the valve to move gradually to its seat, first cutting off the supply entirely or sufficiently to break the seal of the usual siphon closet, so as to stop the siphonic action, and subsequently allowing a small after-flow to fill the bowl to the desired extent. Various other improvements are referred to in detail hereinafter.

The accompanying drawings illustrate embodiments of the invention.

Figure 1 is an elevation of the supply pipe side of the valve; Fig. 2 is a longitudinal section approximately on the line 2—2 in Fig. 1; Fig. 3 is a longitudinal section approximately on the line 3—3 in Fig. 2; Figs. 4 and 5 are sectional views of alternative details.

Referring to the embodiment illustrated in the accompanying drawings, the water or other fluid enters through the supply branch A and discharges through a pipe screwed into the branch B. A valve proper C is guided in a cage D having certain openings through which the water passes to the branch B when the valve is lifted. Supposing for example the valve to be lifted to the point indicated in dotted lines at C', the water from the branch A flows through the passages or slots E, which taper toward the valve seat, that is to say, downward in the present case, and through one or more small apertures F near the lower end of the cage. As the valve moves slowly toward its seat, the flow decreases gradually by reason of the gradually decreasing effective length of the slots E, and more rapidly as the valve covers the tapering lower ends of the slots. When the valve passes the lower ends of the slots, the remaining flow is only through the small apertures F, which is not enough to supply the demand of the siphon, and the seal in the bowl will be broken, and the water in the upgoing leg of the siphon will drop back into the bowl. The movement of the valve is sufficiently slow to allow enough water to flow through the apertures F to provide the desired refill in the bowl before the valve passes said apertures. The cage D is preferably fastened by screwing its lower end into a socket G immediately surrounding the valve seat H, which may be provided with a packing J of any usual or suitable kind.

In order to effect the slow closure of the valve C, it is connected by means of a stem K to a piston L of somewhat larger diameter than the valve, which piston works in a cylinder M. Normally the net upward pressure of the water between the under side of the piston L and the upper side of the valve C, is more than counterbalanced by the downward pressure of water on top of the piston L. In order to operate the valve, the pressure in the cylinder M above the piston is withdrawn or relieved, which results in an upward movement of the piston and valve. The relief of the pressure is effected by the withdrawal of the water from the cylinder M, a passageway being open for this purpose between the cylinder and the discharge pipe. When this passageway is then closed, water from the branch A is admitted at a regulable rate to the upper side of the piston L, and according to the rate of admission the piston L and the valve are allowed to fall slowly.

It is essential to the durability of the apparatus in correct working order, that the piston L shall make a good fit in its cylinder M, but not so tight a fit as to become jammed. In ordinary usage the apparatus is subjected to rough handling, and I propose to protect the cylinder M from becoming dented or otherwise distorted by inclosing it in a surrounding casing N. A freely sliding fit and one which is at the same time perfectly tight and of great durability, is made by means of a fine cup leather O on the under side of the piston. The cylinder M and the outer casing N are preferably fastened by screwing into sockets P and Q on the upper end of the casing R, in which are formed the inlet and outlet branches A and B. For admitting water to the upper side of the piston L or withdrawing water therefrom, the cylinder is open at the upper end and communicates with the annular space T surrounding it.

The operation of the valve is dependent upon the control of the flow through the passages for relieving and for restoring the pressure in the slow-closing cylinder M. A point of considerable value is the provision of a chamber U which forms a part of each of said passages, the relief passage being controlled by a handle V at one end, and the restoring passage being controlled by a nut W (Fig. 3) at the opposite end. This chamber U is preferably formed as a part of the casting R, and lies in the angle between the admission branch A of the valve and the upward portion carrying the cylinder. It extends transversely to the plane of the branches A and B, thus providing a very compact construction, and one in which the parts are most easily accessible.

For relieving the pressure in the cylinder M, the chamber U is provided with an aperture X communicating with the annular space T, and thence with the upper end of the cylinder. From the chamber U the water then passes through an aperture Y into a passage

Z which communicates with the outlet B. The passage Z is made quite large, and is indicated by dotted lines in Fig. 2. The flow through this passage is controlled by a valve *a*, the port of which is of large size, being nearly equal to the inside diameter of the chamber U. The valve has a long cylindrical portion inclosing a spring *b* which presses it toward its seat, the rear end of the spring engaging the mechanism in the opposite end of the chamber. The seat of the valve *a* is a ring *c* of packing material, which is forced against a shoulder *d* of the casing by means of a cage *e* having a ring *f* which presses against the packing ring, the outer portion of the cage being screwed into a threaded socket *g* constituting the end of the chamber U. This is a very convenient construction and utilizes the packing ring *c* for the double purpose of forming a tight joint between the ring *f* and the central portion of the chamber U, and for forming a seat for the valve. At the same time this cage is easily removable to permit the renewal of the packing ring. The stem *h* of the valve is engaged by a rod or pin *j*, which preferably telescopes over the end of the valve stem a short distance, and which is pressed inward by means of a lever *k* operated by the handle V.

An effective packing for the pin *j* is provided by means of a flexible diaphragm *l*, which is fixed at its central portion on the pin *j*, and which is engaged at its edges between a ring *m* on the end of the chamber U and a second ring *n* screwing on to the ring *m*, and having a flange embracing the casing *o* of the handle in the manner of a union joint. The collar *p* limits the backward movement of the pin *j*. This is a most excellent packing, and if the diaphragm is made of the best rubber, will last a lifetime.

For restoring the pressure in the cylinder M after the valve *a* has closed, a passage *q* is provided through which water is constantly flowing from the inlet A. The water then enters a cylindrical chamber *r* at the left hand end of the chamber U, and passes through openings *s* in a cage *t* fastened similarly to the cage at the opposite end. Thence the water passes into a second annular chamber *u* surrounding the regulating "valve" *v*. This valve is in reality a pipe having one or more holes, slots, or other openings *w* adapted to be successively covered by the inner flange *x* of the cage *t* as the valve *v* is screwed further inward. The screwing of the valve *v* into the cage, and the gradual closing of the openings *w* of the valve, and the consequent regulation of the rate of passage of the water from the inlet to the chamber U, is effected by means of the nut W previously described, and which is on the outer end of the valve *v*, and which is covered by a decorative cap *x'*. This construction has the great advantage that the regulation may be effected without cutting off the water supply. The cap *x'* may be removed without permitting any substantial amount of leakage, and the regulation may be very quickly effected and the cap returned, the packing ring *y* being preferably provided for the purpose of preventing absolutely any leakage.

Any style of handle may be used instead of the handle V, such for example as the push button V' (Fig. 4) or the turn button V^2 (Fig. 5) having a cam *z* which alternately throws the pin *j* inward and releases it.

The head or cap 1 is preferably provided with wrench faces 2 upon a concealed portion of the cap. This saves the disfiguring of the head, which occurs in the present construction by reason of plumbers using a pipe wrench or other means of gripping the head in order to turn it. The portion having the wrench faces 2 is that portion within the ring 3 which ordinarily carries a small arm 4 for a buffer for the water closet seat. The ring 3 is held down by a nut 5. I provide also an improved buffer which can never drop out, this dropping out being a fault often found with buffers of the present type which are generally only cemented in place. I propose to use a button 6 of rubber, and to fasten it by a screw 7 into the end of the arm 4, the rubber being provided with a slit 8 which is normally closed, but through which the end of a screwdriver may be inserted to engage the head of the screw. It will readily be seen that this makes a permanent fastening, and a buffer which in appearance and in effect is equal to the best.

Though I have described with great particularity of detail certain particular embodiments of the invention, yet it is not to be understood therefrom that the invention is limited to the specific embodiments disclosed. Various modifications may be made in detail and in the arrangement and combination of the parts, without departure from the invention.

What I claim is:—

1. A flushing valve having a valve proper normally exposed to both an opening and a closing hydraulic pressure, the valve having a casing in two parts, the upper part being provided with a passage for relieving and for restoring the closing pressure, and the lower part being provided with a chamber adapted to register with said passage in various adjustments of the relative angular positions of the two parts of the casing, and through which the pressure is both relieved and restored.

2. A flushing valve having a valve proper, a piston controlling the movement of said valve proper, a cylinder for said piston and a casing surrounding said cylinder with an annular passage between them, and means for admitting pressure to the top of said piston and for relieving it through said annular passage.

3. A flushing valve having a valve proper, a piston controlling the movement of said valve proper and exposed to both an opening and a closing hydraulic pressure, and a casing in two parts, the lower part having a chamber, a passageway directly from the inlet to the outlet, a passageway from the inlet to said chamber and a passageway from said chamber to the outlet, the upper part having a cylinder in communication with said chamber and in which said piston works, and means in said chamber for controlling the communication of said chamber with the passageways thereto and therefrom and for thus varying the relative pressures on opposite sides of said piston to open or close the valve.

4. A flushing valve having a valve proper arranged to slide in a cage having a series of slots therein of decreasing width toward the valve seat, so as to gradually decrease the quantity of water passing as the valve moves toward its seat, and having below said slots one or more small holes of just sufficient cross-section to provide a small after-flow after the main flow has stopped by reason of the valve passing the ends of said slots.

5. A flushing valve having a valve proper normally exposed to both an opening and a closing pressure, means for relieving the closing pressure, and means for restoring the closing pressure comprising a cage *t* communicating with the supply and with the closing pressure chamber, and a valve *v* regulating the communication with the closing pressure chamber and accessible from the outside without cutting off the supply.

6. A flushing valve having a valve proper C, a cage D in which said valve is guided and which has passages E

tapering toward the valve seat and a small aperture F below the end of the passages E, and means for effecting a slow-closing movement of the valve.

7. A flushing valve having a valve proper C, a cage D in which said valve is guided and which has passages E tapering toward the valve seat and a small aperture F below the end of the passages E, and means for effecting a slow-closing movement of the valve, the cage D being fastened by screwing into a socket G immediately surrounding the valve seat.

8. A flushing valve having a single upper passage for relieving the pressure so as to permit the opening of the valve and for restoring the pressure so as to close the valve, a chamber communicating with said passage, two separate lower passages, one from the valve inlet to said chamber and the other from the valve outlet to said chamber, and means at opposite ends of said chamber for controlling communication with the respective lower passages.

9. A flushing valve having a passage for relieving the pressure so as to permit the opening of the valve and for restoring the pressure so as to close the valve, a chamber U forming a part of each of said passages, and means at opposite ends of said chamber for controlling the respective passages, the valve having an admission branch A, and having an upwardly extending casing carrying part of the slow-closing mechanism, said chamber U being arranged in the angle between the branch A and the upward portion and extending transversely to the plane of said parts.

10. A flushing valve having a valve proper exposed to an opening hydraulic pressure, and having a pressure chamber for closing the valve, a chamber U having an aperture X communicating with said pressure chamber and an aperture Y communicating with the discharge, and a valve *a* the port of which is approximately equal to the inside diameter of the chamber U, and which serves to open or close communication between said apertures.

11. A flushing valve having a valve proper exposed to an opening hydraulic pressure, and having a pressure chamber for closing the valve, a chamber U having an aperture X communicating with said pressure chamber and an aperture Y communicating with the discharge, a valve *a*, a ring *c* of packing material constituting the seat of the valve *a*, and a cage *e* having a ring *f* which presses against the packing ring, the outer portion of the cage being screwed into a threaded socket *g* constituting the end of the chamber U.

12. A flushing valve having a valve proper exposed to an opening hydraulic pressure, and having a pressure chamber for closing the valve, a chamber U having an aperture X communicating with said pressure chamber and an aperture Y communicating with the discharge, and a valve *a* the port of which is approximately equal to the inside diameter of the chamber U, and which serves to open or close communication between said apertures, a flexible diaphragm *l*, a pin *j* at the center engaged with the stem of said valve, and means for reciprocating said pin.

13. A flushing valve operated by the releasing and restoring of pressure in a pressure cylinder, and having a chamber U between the inlet and said pressure cylinder, a cage *t* in one end of said chamber, a passage through said cage and through which water may be admitted from the inlet to said chamber and thence to the pressure cylinder, the passage through said cage being controlled by a valve *r*.

14. A flushing valve having an arm carrying a buffer, said buffer consisting of a butten 6 of rubber fastened by a screw 7, the rubber being provided with a slit 8 which is normally closed but through which the end of a screw driver may be inserted to engage the head of the screw.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

WILLIAM SAMUEL COOPER.

Witnesses:
J. W. RITTER,
J. GARDENER.