No. 700,487. Patented May 20, 1902.

J. J. FINNEY.

FLUSH VALVE.

(Application filed May 27, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

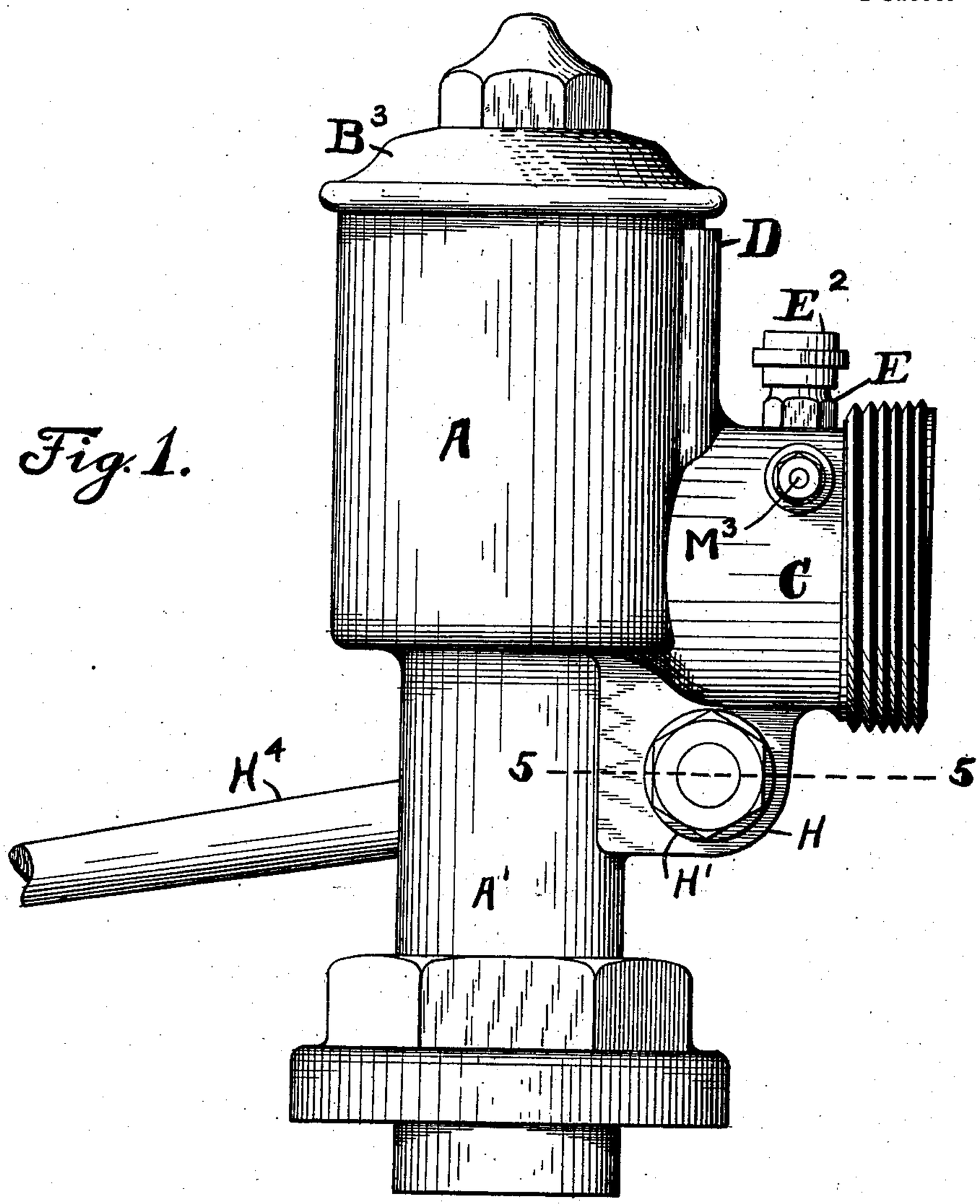
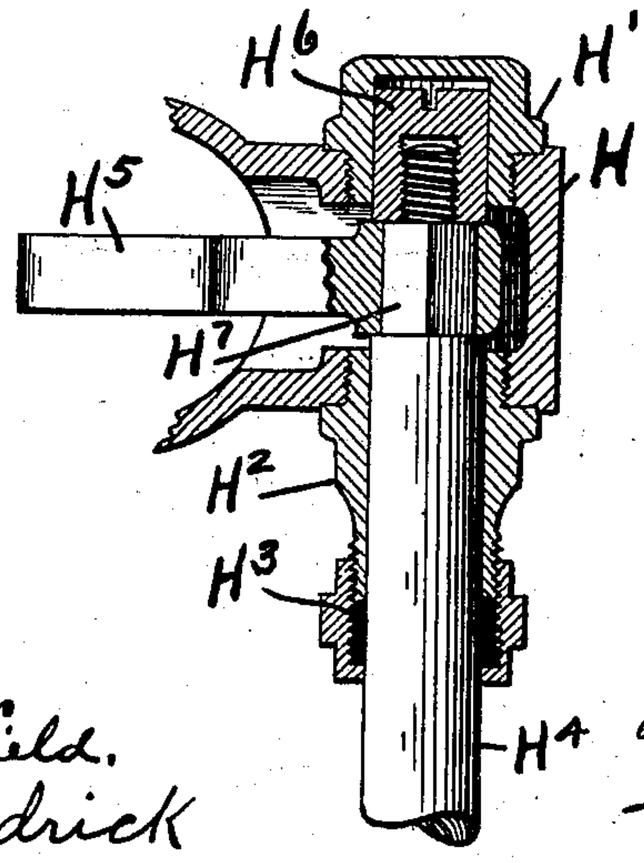


Fig. 5.



Witnesses:
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John F. Kendrick

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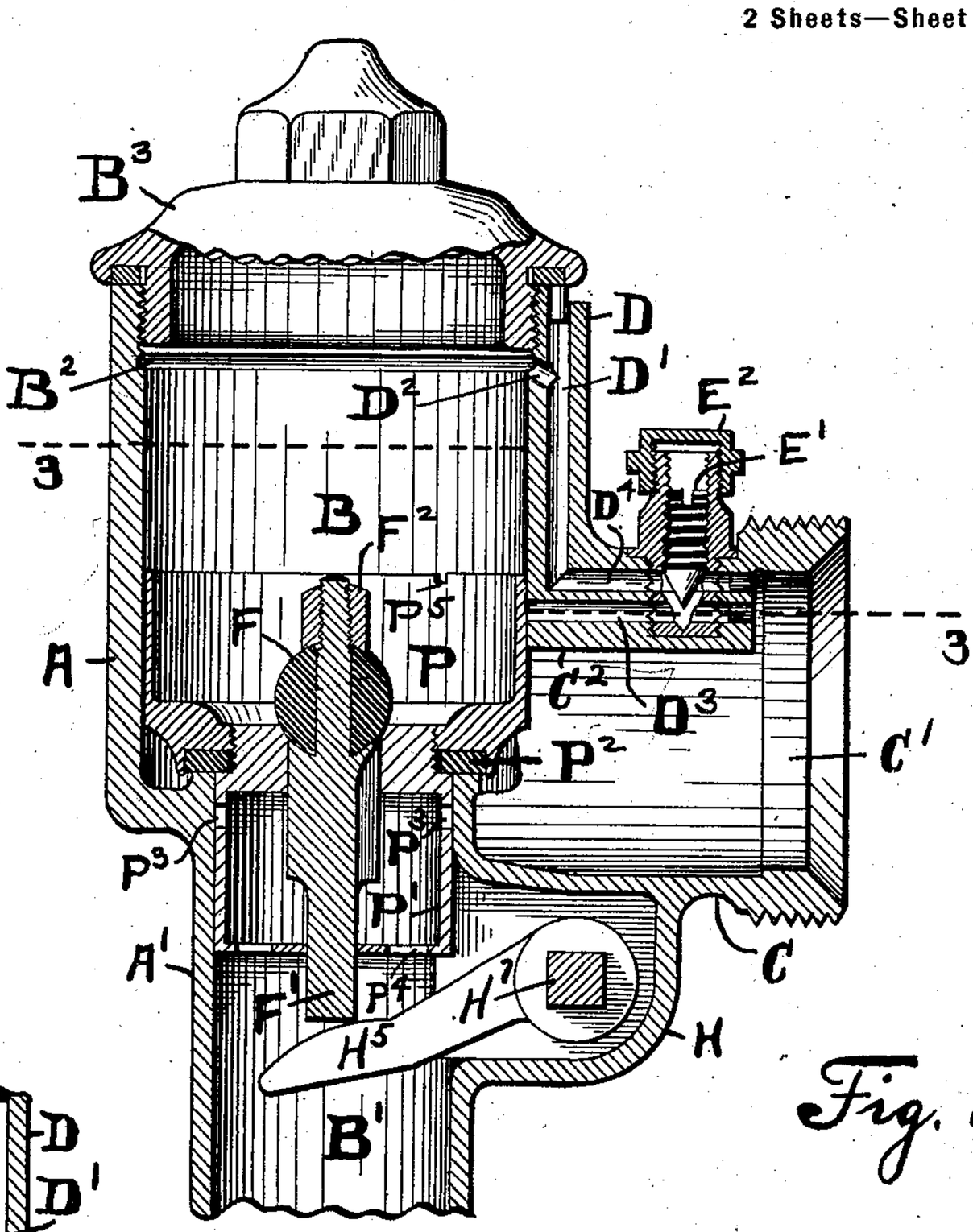

Fig. 2.

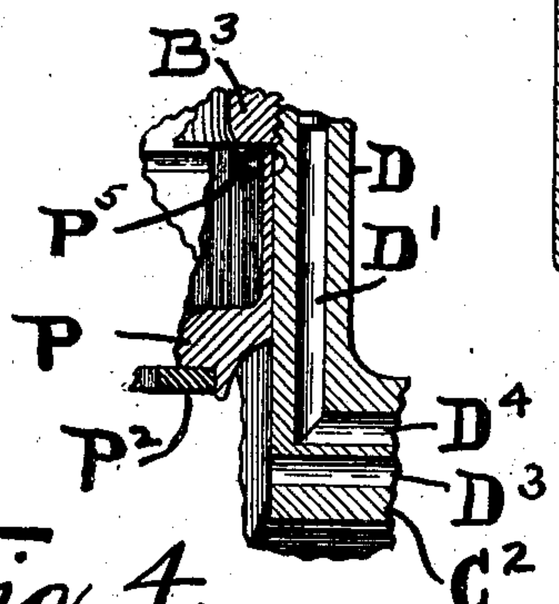

Fig. 4.

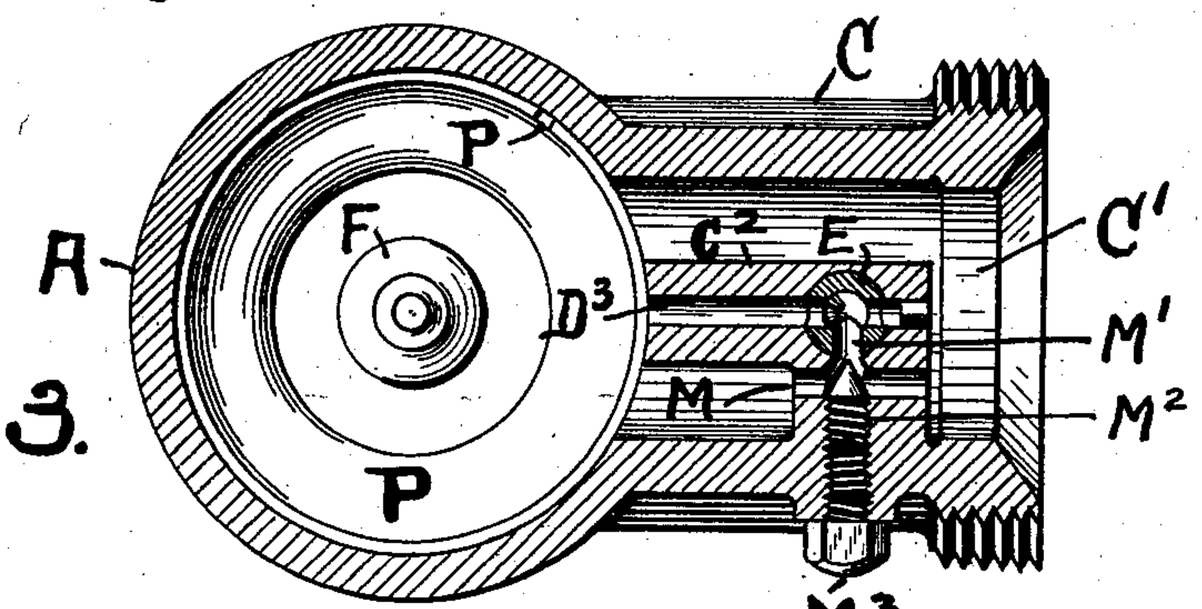

Fig. 3.

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UNITED STATES PATENT OFFICE.

JAMES J. FINNEY, OF CHICAGO, ILLINOIS.

FLUSH-VALVE.

SPECIFICATION forming part of Letters Patent No. 700,487, dated May 20, 1902.

Application filed May 27, 1901. Serial No. 62,071. (No model.)

To all whom it may concern:

Be it known that I, JAMES J. FINNEY, a citizen of the United States of America, and a resident of Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Flush-Valves, of which the following is a specification.

My invention relates to flush-valves of the character of those illustrated in my pending applications, No. 714,781, filed April 28, 1899, and No. 27,359, filed August 20, 1900, and has for its object improvements in the valves therein illustrated. Flush-valves of this character are intended to be connected directly to ordinary service water-pipes on one side and to an ordinary closet-bowl on the other. Such valves are opened and closed by a movable piston, which piston is moved by the pressure of the water in the service-pipe. Such pressure will under different circumstances vary from two pounds to two hundred pounds per square inch, and a valve that is suitable for one pressure is not suitable for another pressure unless there are special appliances whereby it may be made suitable for both pressures. It is one of the requirements of a valve of this kind that it must give a full or maximum flow of water for a definite and predetermined period of time, which flow must be followed by a reduced or minimum flow of water which should be uniform in quantity and continue for a definite period of time. It is also desirable, in fact, practically necessary, that the change from the full flow to the reduced flow should be rapid. Another requirement of valves of this character is that the piston should come to its seat for closing the valve without jar. These conditions require that the piston have three variations of movement in its closing motion, all of which are controlled by the water-pressure. The first movement is a quick one for making the change from maximum to minimum flow, the second movement is a slow one for continuing the minimum flow for a definite period of time, and the third movement is an extremely slow one just before the valve comes to its seat, so that the actual seating of the valve will not cause a jar or water-hammer. Variations of friction in the valve due to variations of closeness of fit of the parts will vary the qualities of these movements when all other conditions are the same, also with a valve having a given amount of friction in its moving parts the qualities of the movement will vary with the amount of pressure existing in the service-pipe. Consequently it has heretofore been the custom to make different valves to meet different conditions and to test all valves to see that they meet these conditions.

The main object of my invention is to make a valve so that without taking special pains with its construction or special consideration of its friction and without the necessity of testing any valve or a number of such valves may be taken indiscriminately from stock and may be caused to work satisfactorily under varying conditions of pressure without the necessity of making structural changes therein. This result is accomplished by providing adjustments which control the movements of water through channels for causing the closing action. One of these adjustments, that for the quick movement, is shown in the previous applications. The other adjustment is subject-matter of the present application.

In the accompanying drawings, Figure 1 is a side elevation of my flush-valve. Fig. 2 is a vertical section. Fig. 3 is a transverse section on line 3 3 of Fig. 2. Fig. 4 is a partial section similar to Fig. 2, showing the piston at its upper position; and Fig. 5 is a partial section on line 5 5 of Fig. 1.

In the said drawings, A represents the upper portion of the valve-body, and A′ the lower portion. These portions are of different diameters and the interiors are cylindrical and marked, respectively, B and B′. The upper end of the cylinder A′ B′ terminates in a valve-seat that projects into the lower portion of the upper cylinder A B. Within the larger cylinder is a piston P, having secured to its lower end a hollow projection P′, which fits into the lower cylinder B′. Secured between the piston P and its projection P′ is a packing P^2, which engages the seat formed on the upper end of the cylinder A′ B′. Through the sides of the projection P′ are a series of small apertures P^3, which are located a short distance below the lower face of the packing P^2. In the bottom of the said projection P′ are also apertures P^4. Projecting from one side of the valve-body A A′ is

a horizontal cylindrical portion C, provided with screw-threads by which it is attached to the ordinary service-pipe. The interior of this projection is marked C′, and within the opening C′ there is a boss or lug C^2. Projecting upward from the projection C is a bead D, and within this bead is a channel D′, which terminates in a branch channel D^4, which extends horizontally through the boss C^2. Another channel D^3, adjacent to channel D^4, is drilled through the boss C^2 and terminates within the space B. Screwed into the boss C^2 from the exterior is a hollow plug E, and in this plug E is a conical set-screw E′. The upper end of the hollow plug E is covered by a cap E^2. The plug E is inserted in place before the channels D^3 and D^4 are drilled. Consequently the said channels D^3 and D^4 communicate with the hollow portion of the plug E. The outer ends of the channels D^3 and D^4 are then plugged up, as shown in Fig. 2, so that the communication to said channels is only from the interior B or through a branch channel M, as hereinafter described. The channel D′ communicates with the interior of B by a short channel D^2, which terminates in a groove B^2, cut in the cylinder B. The upper portion of the cylinder B is closed by a cap B^3. Adjacent to the channel D^3 and on a level therewith is a second channel M, as shown in Fig. 3. Perpendicular to the channels M and D^3 and on a line therewith there is drilled an opening M′, which connects the channel M with the interior of the plug E. The exterior portion of the opening M′ is then tapped out and there is inserted a set-screw M^2, and the opening is subsequently covered by cap-screw M^3. Located just below the projection C is a boss H, which is transversely drilled and into the opposite sides of which are screwed the plugs H′ and H^2. The plug H′ is closed on the outside and therefore acts as a cap. The plug H^2 has formed on its outer end a stuffing-box H^3, through which passes a handle H^4. One portion of the handle H^4 is made square, as shown at H^7, and on the square portion is a lever H^5. Beyond the square portion H^7 is secured a nut H^6, which is the same diameter as the handle H^4. These various parts are so arranged that the plugs H′ and H^2 may be inserted on either side of the boss H, and consequently the handle H^4 may be either a right-hand or left-hand lift, as it is desired. In the interior of the piston P there is a relief-valve F, carried on a stem F′ and held in place by a nut F^2. The stem F′ projects down through an opening in the piston P and its lower projection P′ and comes in line with the lever H^5 on the handle H^4. These parts are so arranged that if the lever be lifted by hand the relief-valve F will be raised from its seat in the interior of the piston P and water in the cylinder B will be permitted to pass through said piston into the cylinder B′ below.

In a condition of rest the flush-valve stands in the position shown in Fig. 2. In this case the pressure of the service-pipe exists in the opening C′ and communicates through the channels M M′, the interior of E, D^4, D′, and D^2 to the chamber B over the piston P. This pressure on top of the piston P holds it firmly on its seat and prevents a flow of water from the service-pipe through the cylinder B′ to the closet-bowl. When it is desired to operate the valve, the handle is moved to raise the relief-valve F′. This provides an opening from the chamber B downward of greater area than the area of supply through the channels between the chamber C′ and the chamber B. As a consequence the pressure over the top of the piston is relieved. By virtue of the fact that the area of the piston is greater than the area of its seat there is an annular pressure on said piston, which causes it to rise as fast as the water flows from the chamber B downward to the chamber B′. When the valve is moved to its extreme upper position, as shown in Fig. 4, there is then a full and free flow of water from C′ to B′. The area of inlet at C′ is somewhat greater than the area of outlet at B′, and in consequence there is maintained in C′ a surplus pressure of water greater than would exist if the two channels were of equal area. Under the piston when at its upper position this pressure exists only through the annular portion previously mentioned and is reduced to nearly nothing at the central portion of the piston over the cylinder B′. In this condition there is a flow of water from the inlet-chamber C′ into the inner end of the chamber D^3, up through the interior of the plug E into the channel D^4, thence through D′ and D^2 into the groove B^2, and from the said groove through a small notch P^5 in the upper portion of the cylinder P. This flow of water produces on the upper face of the piston a pressure equal to that within the inlet-chamber C′, and as this flow continues the piston will descend from its higher position. The area of this channel is regulated by the set-screw E′ and is adjusted so that the flow through the said channels will cause a comparatively rapid downward movement of the piston P until the edge of said piston laps and covers the inner end of the channel D^3. When this occurs, the full flow through the channel D^3 cannot occur, and the only communication with the chamber C′ to the channel D^4 is through the auxiliary channels M and M′ into the interior of the plug, and thence to the channel D^4. Ordinarily the set-screw M^2 is adjusted very close to its seat, so that this flow of water will be very slight, and consequently the piston will move downward very slowly. Just previous to the lapping of the port D^3 by the piston P the projection P′ enters the upper end of the cylinder B′, shutting off the full flow from C′ to B′. When this occurs, the flow of water is only such as will be permitted to pass through the openings P^3 and P^4. These openings are made small or relatively small, so that the amount

of water passing through them will be enough to seal the trap of the closet-bowl, and consists of what is technically termed "afterflow." The requirement of an afterflow is that it should be of a volume less than will flush the trap, but of a volume sufficient to seal it. The slow downward movement due to the adjustment of the screw M^2 continues until the descent of the piston causes the ports P^3 to be lapped by entering the upper portion of the cylinder B'. As long as there is a full flow of water from C' to B' the amount of pressure within C' is considerably reduced by virtue of that flow. When the projection P' enters the cylinder B', the flow from C' to B' is reduced, and consequently the pressure is somewhat increased within C' and on the annular space upon which there is an upward pressure of water on the piston P. When the piston descends far enough for the ports P^3 to be lapped and closed, the pressure in the chamber C', and consequently the annular pressure on the piston is still further increased, so that the movement after the lapping of the said ports P^3 is slower than before the said ports were lapped. As a consequence the terminal portion of the closing movement is exceedingly slow. The adjustment of the screw M^2 will be determined in each case by the pressure of water in the service-pipe on the one hand and by the normal or natural friction of the piston P on the other hand. For very high pressures the screw M^2 may be practically set against its seat, so that there would be little flow to the port D^4 except what would pass by leakage around the piston P to the port D^3. For very low pressures the screw M^2 will be moved outward, so as to allow a larger area for the flow of water through the channels.

Matters herein shown and described relating to regulating and to retarding the closing movement of the piston, to the maintenance of a uniform afterflow during a portion of the closing movement, and to the arrangement of passage-ways for water are not herein claimed, as they form subject-matter of my copending application, Serial No. 714,781, filed April 28, 1899. The matter relating to the shutting off of the afterflow prior to the final closing action of the valve, which is herein shown and described but not claimed, forms the subject-matter of my copending application, Serial No. 27,359, filed August 20, 1900.

What I claim is—

1. In a flush-valve, the combination with a piston for opening and closing said valve, and an inclosing chamber provided with water-passages leading to both sides of said piston and so arranged that the passage leading to one side is normally open and the passage leading to the other side is partially closed during the closing movement of said piston, of an adjustable device for regulating the flow of water through last-named passage when left open by said piston, and a second adjustable device for regulating the flow of water through the same passage when partially closed by said piston.

2. In a flush-valve, the combination with a piston for opening and closing said valve, and an inclosing chamber provided with two passage-ways extending from a water-supply to the space over said piston and so arranged that one of said passage-ways is automatically closed by the said piston at a predetermined point in its closing movement, of an independently-adjustable device in each passage-way for regulating the flow of water through the said passage-ways.

3. In a flush-valve, a piston arranged to open and close said valve, an adjustable device for regulating the speed of the closing movement of said piston, means for automatically retarding the latter part of said closing movement, and a second adjustable device for regulating the amount of such retardation.

4. In a flush-valve adapted to permit a flow of water from a service-pipe to a closet-bowl, a valve-body provided with passage-way for water whereby the pressure of water in said service-pipe operates to close said valve, a movable piston arranged to open and close said valve, means whereby the closing movement of said piston operates to close the inlet to said passage-way so as to cause a retardation of the valve-closing movement, and an adjustable device whereby the amount of such retardation may be regulated.

5. In a flush-valve adapted to be opened and closed by water-pressure, the combination with a piston arranged to be moved by such pressure so as to cause such opening and closing, and a valve-body in which said piston operates, said valve-body being provided with passage-ways through which the water-pressure acts to close said valve and said passage-ways being located so as to be closed by said piston before the closing of the valve, of means for permitting water to flow to said passage-way from a different point, and means for regulating the amount of the last-mentioned flow.

Signed at Chicago, Illinois, this 25th day of May, 1901.

JAMES J. FINNEY.

Witnesses:
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C. L. REDFIELD.