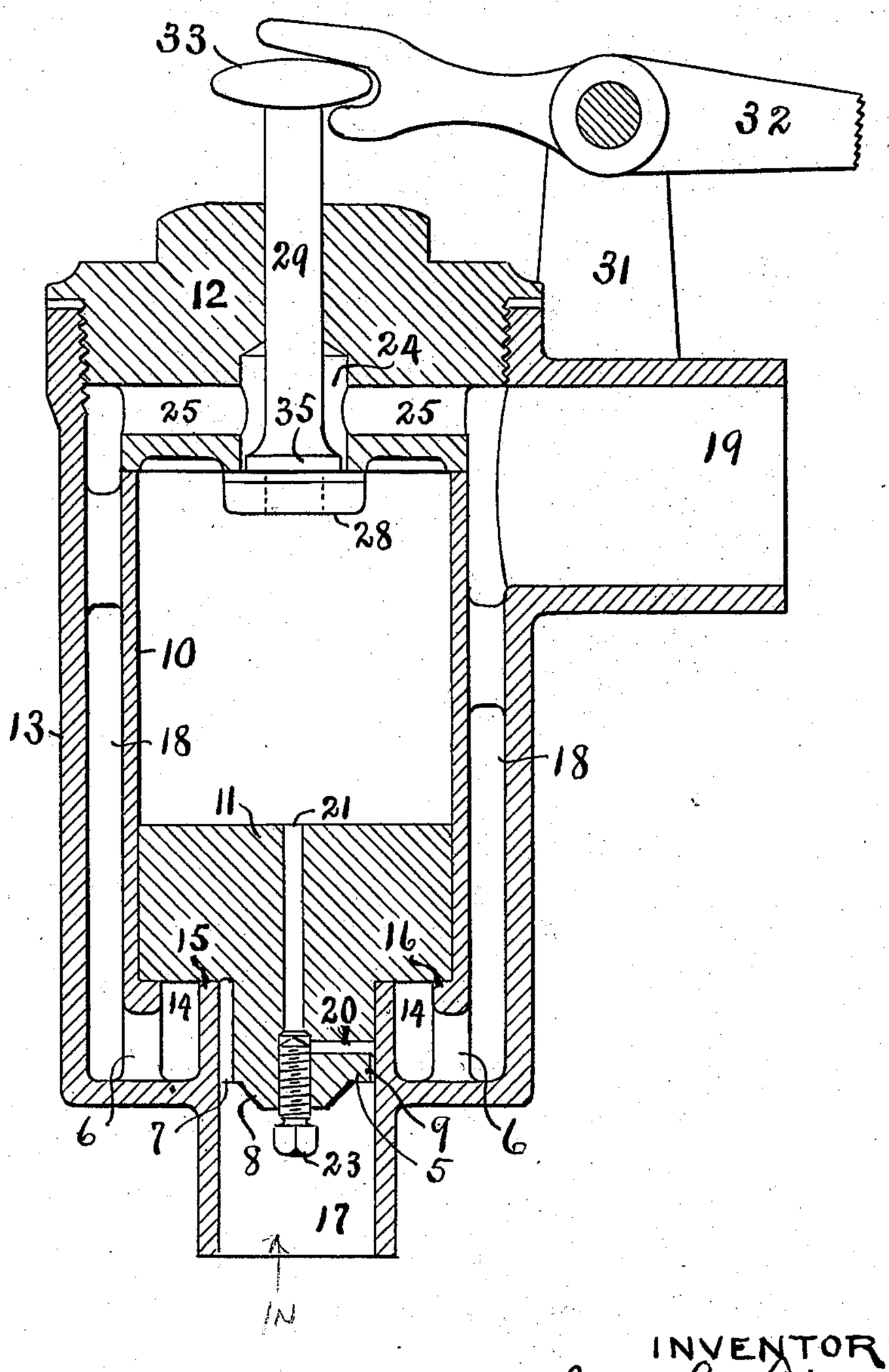
No. 700,485. Patented May 20, 1902.

J. J. FINNEY.

FLUSH VALVE.

(Application filed Apr. 28, 1899.)

(No Model.)



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FLUSH-VALVE.

SPECIFICATION forming part of Letters Patent No. 700,485, dated May 20, 1902.

Application filed April 28, 1899. Serial No. 714,781. (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, 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 for water-closets, and has for its object the provision of simple means for using water direct from the service-pipes, while at the same time retaining all of the advantages obtained from the use of the ordinary tank or reservoir. The requirements of the ordinary closet are that the water should commence its flow with a gush equal to the full flow, should continue the flow for a definite period, and finally stop gradually, so as to give what is technically known as "afterflow." The object of the afterflow is to provide a sufficient body of slowly-flowing water for the purpose of sealing the trap in the lower part of the ordinary closet-bowl.

My invention is illustrated in the accompanying drawing, which is a sectional elevation showing the details of structure at about full size.

The main body of my valve consists of a single casting made up of concentric cylinders 10 and 13, opening into which are the pipe connections 17 and 19. In the cylinder 10 is a piston 11, which at its lower position rests on a seat consisting of the lip 16 on the cylinder 10 and the upper edge 15 of the pipe or tube 17. Between 15 and 16 is an annular opening 14, which communicates by the openings 6 with the annular space 18 between the cylinders 10 and 13. The annular space 18 is in communication with the discharge pipe or opening 19. The lower face of the piston 11 is provided with a circular projection 5, adapted to enter the inlet-pipe 17, and on the projection 5 is a boss 8. Through the center of the piston 11 is drilled a hole 21, the lower end of which is closed by a set-screw 23. From the opening 21 extends a lateral opening 20 to the cylindrical surface of the projection 5. The set-screw 23 serves as a means of regulating the amount of opening between the channels 20 and 21 and consequently the flow of water from one to the other. When the piston 11 is near the upper part of the cylinder 10 and the space beneath it is filled with water under pressure, there will be a flow of water through the channels 20 and 21. When the piston settles down, so that the projection 5 enters the tube 17, this flow will be nearly but not quite cut off. Ordinarily a slight looseness of the fit between 5 and 17 will give all of the flow required when in this position. I have represented a small groove 9 extending from the lower face of the projection 5 to the channel 20, which groove may actually exist or only represent the looseness between 5 and 17. One or more grooves 7 extend along the side of the projection 5, the office of which will appear later.

The upper ends of both cylinders 10 and 13 are closed by a plug 12, in the center of which is an opening 24, which communicates with a cylinder 10. From the opening 24 run lateral openings 25, communicating with the annular space 18, and hence with the discharge 19. A valve 28 on the stem 29 closes the connection between 24 and the cylinder 10. Secured to the main casting is a bracket 31, on which is pivoted a hand-lever 32, that engages a head 33 on the stem 29. Normally the weight of the lever 32 raises the stem 29 and closes the valve 28.

In operation the inlet-pipe 17 is connected to a service-pipe having the ordinary city water-pressure, and the outlet-pipe 19 is connected to a closet-bowl in the ordinary manner. Assuming such connections to be made and the cylinder 10 to be full of water, then the lifting force under the piston will be measured by the area of the pipe 17, and as the water-pressure is communicated through the channels 20 and 21 to the top the depressing force will be measured by the area of the upper face of the piston. The water-pressure, therefore, will hold the piston 11 against its seat and close the annular opening 14. The water-pressure will also hold the valve 28 closed, because the upper face is exposed to only atmospheric pressure. If the lever 32 be moved by hand so as to open the valve 28, then the pressure over the piston 11 will be relieved, and the said piston will rise under the pressure below, forcing the water in the cylinder 10 out through the openings 24 and 25 to the dis-

charge 19. When the piston 11 is near the top of the cylinder 10, the water will flow from 17 through 14 and 18 to 19 and will continue to so flow as long as the valve 28 is held open. It will be observed from this description that there are two separate and distinct passage-ways for water between the inlet-opening 17 and the outlet-opening 19. One of these is by way of the openings 14, 6, and 18 and the other by way of the openings 20, 21, 24, and 25. Of the first of these passage-ways all parts are preferably, though not necessarily, larger in area than the inlet 17. Of the second passage-way the area of the opening 24 25, or some part of it, is smaller than the area of 17, but larger than the opening 20 21. If the lever 32 be released, the weight of it will close the valve 28, when the flow of water through the openings 20 21 will cause the piston to gradually settle downward. This flow and consequent settling is caused by making the piston 11 of some material whose specific gravity is greater than that of water. As the piston descends the entrance of the head of the set-screw 23 into the orifice of the pipe 17 diminishes the flow from 17 to 19 by the amount the area of said orifice is diminished. The entrance of the boss 8 still further diminishes the flow, and as this boss is a cone the further descent of the piston continues to diminish the flow until the body of the projection 5 enters the pipe 17, when the flow is reduced to what will pass through the channel 7. This amount of flow, which constitutes the afterflow, will remain constant until the piston finally reaches its seat and stops the flow entirely. It will be observed that opening the valve 28 immediately produces a discharge through the pipe 19 equal to the amount that the service-pipe pressure will force through the pipe 17 and that this flow will be partly by the way of the smaller passage-way 24 25 and partly by the larger passage-way 14 18. To prevent this flow from starting so suddenly as to cause a pound, I put a shoulder 35 on the stem 29 just above the valve 28, so that the opening of said valve will not cause an instantaneous opening of the full area of discharge from the cylinder 10.

It will be seen that the opening of the valve 28 opens the lesser passage-way between 17 and 19 to relieve the holding pressure on the piston 11, which relief causes the larger passage-way to be opened, so as to permit a full flow of water from the service-pipe to the closet-bowl; also, that as long as the valve 28 is held open by hand this full flow will continue, and, further, that permitting the valve 28 to close causes the water flowing through the openings 20 and 21 to accumulate over the piston, so that it will descend, but that the full flow continues during such descent until the set-screw enters the mouth of the tube 17, after which the flow is gradually diminished. It will be apparent that the speed with which the piston 11 settles to its seat depends upon the smallest area in the passage-way between the lower and upper faces of the piston and that this area is under control of the set-screw 23. Consequently the set-screw serves as a means of regulating the time in which the full flow is permitted to continue after the valve 28 is closed. When the piston has descended far enough for the outer end of the channel 20 to enter the tube 17, the speed of descent will be further reduced, with the result that amount of afterflow through the groove 7 will be increased. In the ordinary flushing devices when one flushing action has taken place it is necessary to wait for a reservoir to fill. With my device I can start a full flushing flow at any time, either immediately after a flushing or even before the afterflow is completed.

It will be seen from the foregoing description that for the ordinary reservoir, float, valve, &c., I substitute a comparatively small and inexpensive flush-valve, from which I get the following results: A quick opening that allows a full volume of water into the closet-bowl direct from the service-pipes, an automatically-maintained opening (due to time required to fill the cylinder 10) that will give a sufficient body of water for ordinary purposes, a gradual closing of the opening that produces the desired afterflow effect, a means of regulating the time the opening is automatically maintained, a means for controlling by hand so as to obtain any desired amount of flow beyond the minimum, and means for immediately obtaining a new flow of any amount without waiting for a reservoir to fill.

Another advantage of my construction is that the usual sucking noise due to breaking of the siphon used with the ordinary reservoir is avoided.

What I claim is—

1. In a flush-valve provided with a piston for opening and closing said valve, the combination with means for adjusting the closing speed of said piston, and means for automatically retarding the latter portion of such closing speed of said piston, of means for maintaining a uniform but reduced flow of water during the retarded portion of the closing movement.

2. In a flush-valve adapted to be connected to a service-pipe and arranged to be operated by the pressure of water in said service-pipe, a valve-body providing an interior chamber, a piston movable in said chamber, and serving to open and close said valve, a passage-way having one end communicating with the water under pressure in said service-pipe and the other end communicating with the chamber over said piston, means whereby a flow of water from the service-pipe through said passage-way will serve to move said piston to a closing position, and means whereby the amount of flow from the service-pipe through said passage-way will be reduced when the piston is near its closing position.

3. In a flush-valve adapted to permit a pre-

determined amount of flow direct from a service-pipe to a closet-bowl and arranged to be operated by the pressure of water in such service-pipe, a piston serving to close said valve and provided with an opening therethrough, means whereby a flow of water from such service-pipe through said opening serves to move said piston to a closing position, and means whereby the amount of flow from the service-pipe through said opening is reduced when the piston is near its closed position.

4. In a flush-valve adapted to be connected to a service-pipe which supplies water under pressure, a piston arranged to open and close said valve, a passage-way through which water flows under pressure from such service-pipe to cause said piston to close said valve, means for adjusting the area of said passage-way so as to regulate the flow of water therethrough, and means for automatically reducing the flow through said passage-way during the latter part of the closing movement of said piston.

5. In a flush-valve provided with a chamber and an opening thereto, a piston in said chamber for closing said opening, said piston being provided with a projection on one side and said projection being provided with an opening extending to the opposite side of the piston so as to permit water to flow from one side to the other, and means whereby the amount of flow through said opening is largely reduced during a portion of the time when said projection is entering the opening to said chamber.

6. In a flush-valve mechanism, the combination with a casing having inlet and outlet openings, of a chamber inclosed therein, a piston-valve sliding in said chamber, open passage-ways leading from said chamber at one side of said valve to inlet and outlet openings, lesser passage-ways leading from said chamber at the other side of the valve to the inlet and outlet openings, means normally closing one of said lesser passage-ways, and means whereby the other of said lesser passage-ways is partially closed by said valve at a predetermined point in the closing movement thereof.

7. The above-described flush-valve which consists of a closed chamber containing a sliding piston and a suitable relief-valve and is provided with suitable 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 by the piston at a predetermined point during the return of the valve to its seat, whereby the tendency to hammer is overcome, and means substantially as described whereby a uniform afterflow is caused to take place for a predetermined period after the closing of said passage.

8. In a flush-valve mechanism, the combination with a casing having inlet and outlet openings, of a chamber inclosed therein, a piston-valve sliding in said chamber, open passage-ways leading from said chamber at one side of said valve to the inlet and outlet openings, lesser passage-ways leading from said chamber at the other side of said valve to the inlet and outlet openings, a relief-valve for opening and closing one of said lesser passage-ways, and means whereby the other of said lesser passage-ways is partially closed at a predetermined time during the closing movement of said valve.

9. In a flush-valve mechanism, the combination with a casing having inlet and outlet openings, of a chamber inclosed therein, a piston-valve sliding in said chamber, a valve-seat at one end of said chamber, open passage-ways of substantially equal area in cross-section leading from said seat to the inlet and outlet openings, lesser passage-ways leading from the chamber at the opposite side of the valve to the inlet and outlet openings, one of which is constantly open, a regulating device in said open lesser passage-way, and a relief-valve by which the other of said lesser passage-ways is normally closed.

Signed by me at Chicago, Illinois, this 15th day of April, 1899.

JAMES J. FINNEY.

Witnesses:
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HOWARD A. REDFIELD.