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PATENTED MAR. 3, 1903.

M. HOGAN.

FLUSH VALVE FOR WATER CLOSETS.

APPLICATION FILED FEB. 21, 1901.

MODEL.

2 SHEETS—SHEET 1.

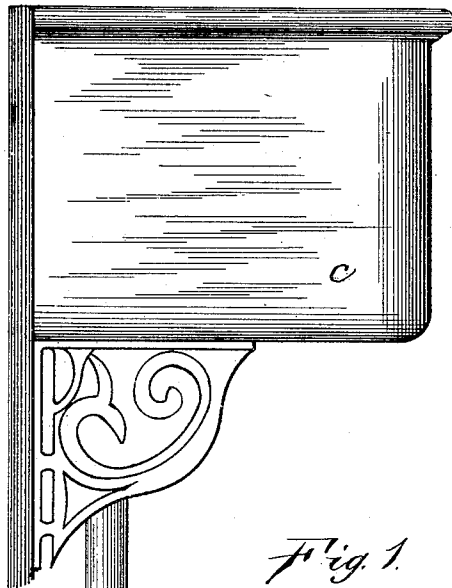


Fig 1.

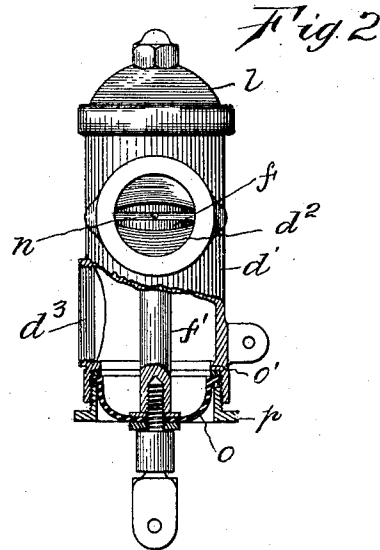
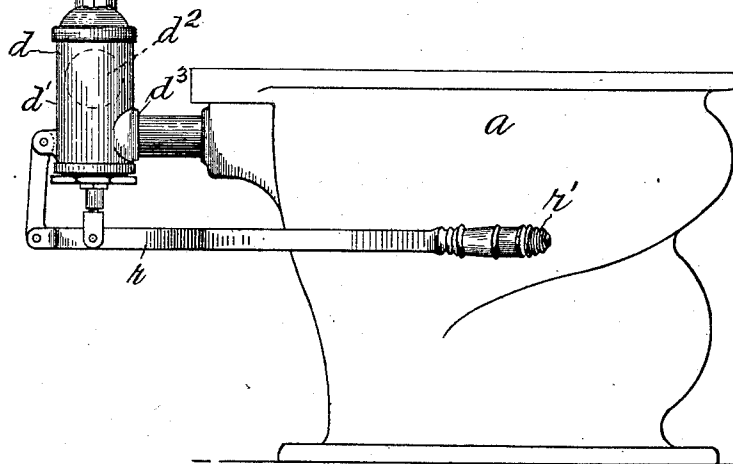


Fig 2



Witnesses:
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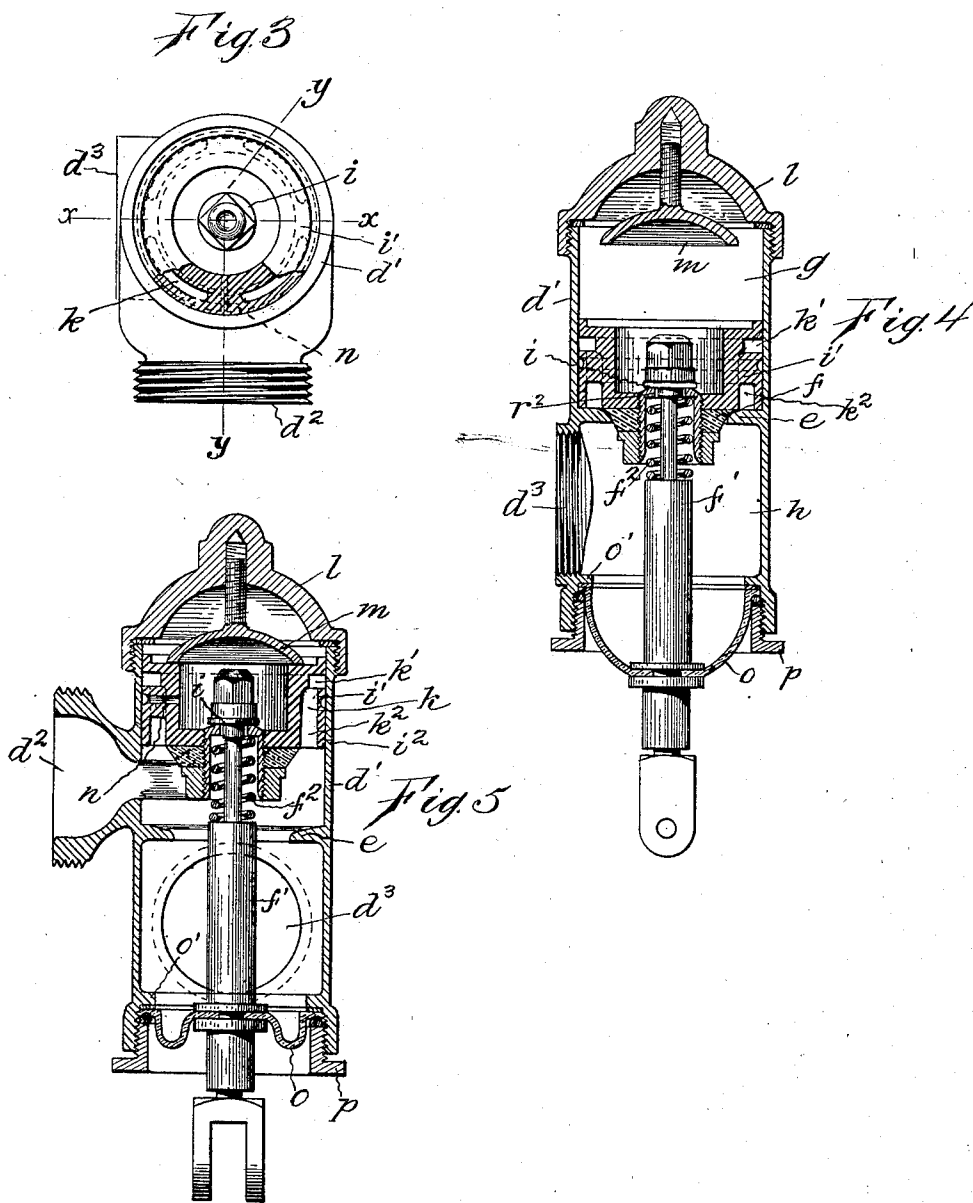
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FLUSH VALVE FOR WATER CLOSETS.

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MODEL.

2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

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FLUSH-VALVE FOR WATER-CLOSETS.

SPECIFICATION forming part of Letters Patent No. 722,106, dated March 3, 1903.

Application filed February 21, 1901. Serial No. 48,332. (Model.)

To all whom it may concern:

Be it known that I, MATTHEW HOGAN, a citizen of the United States, and a resident of Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Flush-Valves for Water-Closets, of which the following is a full, clear, and exact description, whereby any one skilled in the art can make and use the same.

My invention relates to the class of devices used to control the flow of water into a bowl or like receptacle for flush purposes where a fresh supply of water is required; and my invention consists in details of construction of the several operative parts and in their combination, as described herein, and more particularly pointed out in the claims.

Referring to the drawings, which form a part hereof, Figure 1 is a view in elevation of part of a system of plumbing in a building, showing a water-closet, a flush-tank, and the preferred location of the flush-valve. Fig. 2 is a view in elevation of the flush-valve on enlarged scale with part broken away to show construction. Fig. 3 is a plan view of the flush-valve with the cap removed and part broken away in section. Fig. 4 is a view in vertical central section of the flush-valve on dotted line xx of Fig. 3, showing the main valve closed. Fig. 5 is a view in vertical section of the flush-valve in a plane at right angles to the plane of view of Fig. 4 and showing the main valve open, the plane of section, however, passing through one of the openings extending depthwise through the valve.

In the accompanying drawings the letter a denotes a water-closet of ordinary construction, b the water-supply pipe, and c a tank from which a measured supply of water is delivered to the bowl, the flow being controlled by the flush-valve d in the line of the supply-pipe between the bowl and the tank or other source of measured supply.

The body d' of the flush-valve is preferably shaped as a short cylinder, with an inlet-opening d^2 and an outlet-opening d^3 , each provided with means (such as threaded parts) for the attachment of inlet or supply and outlet connections. In the preferred form shown the

inlet d^2 is above the central line and the outlet d^3 below it and facing in a direction at about ninety degrees with the line of the inlet-opening. About midway of and within the flush-valve body d' a valve-seat e for the main valve is formed, the space above forming what may be called a "retarding-chamber" g and the space below the "outlet-chamber" h . A partial vacuum is formed in the retarding-chamber and prevents the too-rapid closing of the main valve. The main valve is formed with a contact-face, preferably of hard rubber, f , to fit upon the valve-seat e , and a vent-valve i is carried on the valve-spindle f' , a spring f^2 thrusting with one end against the valve and with the other against a shoulder on the spindle, (see Fig. 4,) serving to keep the vent-valve normally in a closed position.

The valve f is formed on a main valve or piston i' , preferably cylindrical in outline and having a sliding fit in the valve-body d' and supporting a cut-off i^2 so located and arranged as to reduce the area of the inlet-opening during the closing movement of the main valve. The valve-body d' and the main valve i' are of such relative size as to their respective inner and outer surfaces that while the main valve closely fits within the valve-body there is a sufficient space between its outer surface and the inner surface of the valve-body d' to allow a small quantity of water or other fluid to pass between the outer surface of the main valve i' and the inner surface of the valve-body d' , as is common in devices of this class. In the form of the device shown a circular channel k^2 is formed back of the cut-off and a channel k' is formed in the periphery of the main valve i' . Openings k extend from the peripheral channel k' into the circular channel k^2 , these channels k^2 and k' and the openings extending between them forming what I term a "by-pass."

The location of the channel k' in the periphery of the main valve i' provides what may be termed a "cut-off" channel, and the by-pass formed by this channel, the openings k , and the circular channel k^2 intercepts or cuts off the flow of water passing upward between

the main valve i' and the inner surface of the valve-body d' . This effectually prevents the flow of water between the main valve and the valve-body into the retarding-chamber g in such quantity as to destroy the vacuum too quickly and allow a too-rapid movement of the valve. This by-pass provides a free and unobstructed passage through which the water will readily travel in preference to following the narrow and obstructed passage between the main valve and the inner surface of the valve-body. The principal object of this by-pass formed by the channels k' k^2 and the openings k , extending between said channels, is to control the pressures in the chamber g and permit such an equalization or variation of pressures on opposite sides of the main valve as will insure the valve closing at the proper speed and without pound or chatter.

In that embodiment of my invention illustrated herein the function of the main valve is to control the flow of water through the structure and the function of the vent-valve i is to enable the pressure in the retarding-chamber, or above the valve when it is closed, to be decreased, so as to permit of any upward movement of the main valve, and the function of the cut-off is to reduce the area of the inlet-opening before the main valve is seated, and thus diminish the volume of flow, so as to break the siphon in the bowl.

It is obvious that other means than those described and a different arrangement of the parts may be employed to secure the cutting off of the supply of water through the inlet-opening before the main valve has been closed without departing from my invention, and such changed forms are contemplated by me as part thereof.

The retaining of a partial vacuum in the chamber g by providing a by-pass for the water under pressure during the closing movement of the valve avoids any sudden movement which would result from the absence of a partial vacuum in the chamber g .

There is a cap or cover l , preferably of convex shape, secured to the top of the flush-valve body d' by means of interengaging threaded parts, and the adjustable stop m is mounted on this cap, with its lower end in the line of movement of the main valve in opening, and thus serves to regulate the extent of its opening and closing movement. The object of this stop is simply to limit the said movement of the main valve; but it obviously may be changed as to construction and location and in this changed form and location embody the same idea that is embodied in the form of stop shown.

In the operation of the device the main valve is opened to admit a flushing flow of water into the bowl, and the amount of this flow may be regulated by the adjustment of the stop m . If the main valve is opened to the fullest extent possible, a certain quantity

of water will pass through the flush-valve body before the main valve reaches its seat in closing; but if the opening movement of the main valve is limited by means of a stop then the valve closes sooner and a less quantity of water flows through to flush the bowl. A part of the refilling flow goes through the by-pass opening in the main valve, forming part of or connected to said valve, and this is substantially constant as to quantity, the water taking the same time in each instance to pass through the small pressure-passage n , which extends through the wall of the main valve and connects the retarding-chamber above the main valve with the inlet or pressure side of the valve. This pressure-passage n is so located (see Fig. 3) that the balancing of pressures on the back and face of the valve will take place in time to close the valve after allowing for the refill of the bowl, said passage n when the valve is closed being located in line and communicating with the inlet d^2 . (See Fig. 2 of the drawings.)

The valve-spindle f' projects from the bottom of the valve-body d' , passing through a cup or dome shaped elastic packing o , the edge of which is clamped between a shoulder o' on the valve-body and the edge of the bottom piece p , which is secured to the bottom of the valve-body d' . The valve-spindle is clamped to the edge of the opening through the center of this packing o , and provision is made for the reciprocating movement of the spindle by the play of the flexible packing. This flexible packing performs the function of a stuffing-box, but has features of advantage in the absence of friction which is present in a stuffing-box and in permitting a slight lateral movement of the spindle to accommodate any slight irregularity of fit between pivoted parts.

To the lower end of the valve-spindle f' the lever r is pivotally connected, the front end of the lever bearing a handle r' in convenient position for use in opening the main valve.

In the operation of the valve the first application of force to lift the handle of the lever r moves the vent-valve against the force of the spring on the valve-spindle and opens the relief or vent passage r^2 , through which the valve-spindle extends, for the passage of water from the chamber g , thus relieving the pressure on the main valve. In this operation of the handle the force applied to the spindle f' raises the relief-valve i against the tension of the spring f^2 and permits the water in the chamber g to flow through the relief-passage into the chamber h . As soon as the pressure in the chamber g is sufficiently reduced the main valve, being forced upward by the spring f^2 , overtakes the relief-valve, which closes and remains closed after the upward movement of the controlling-handle is completed. The parts are now in the position shown in Fig. 5, and the inlet-opening

d^2 is entirely uncovered, permitting a free flush of water through said opening into and out of the chamber h . The main valve now gradually settles back, aided by a small supply of water passing between the outer surface of the main valve i' and the inner surface of the valve-body d' into the small groove in the periphery of the main valve and through the pressure-opening n . As the cut-off apron i^3 begins to close the opening d^2 a certain amount of water is forced upward between the main valve i' and the inner side of the valve-body, and upon reaching the annular groove k' the greater part of it passes freely through the by-pass channel formed by said groove, the openings k , and the groove k^2 , a small portion, as above described, passing through the pressure-opening n to break the vacuum which has been formed in the chamber g by the downward movement of the main valve. As the valve gradually settles to its seat the cut-off apron i^3 reduces the opening from the inlet-passage to the chamber h , and the amount of water flowing through the by-pass is increased until the valve directly cuts off the flow of water. After the inlet-opening has thus been cut off the pressure-opening n is brought into registering position with the inlet-opening, and water is conducted under full pressure to the chamber g . By this arrangement it will be seen that a very gradual closing of the valve is insured by the gradual breaking of the vacuum in the chamber g . In fact, the valve merely settles to its seat and when once there is firmly held by the pressure of water through the opening n to the chamber g . There is no pounding or chattering, and at the same time provision is made for insuring a proper refilling of the bowl upon the closing movement of the valve.

In the production of my improved valve I have gained an important advantage over many of the devices of the prior art by reason of the even working of my valve under a great or small pressure, as I have found by extended experiment that a valve constructed with the by-pass opening and with the pressure-passage through the valve-body connecting the inlet-opening with the chamber above the valve will work equally well under slight or heavy pressure without the change of any of the parts or without any perceptible difference in the manner of operation.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In combination in a flush-valve, a valve-body having inlet and outlet openings and a valve-seat formed within the valve-body, a main valve, a relief-valve borne on the main valve, a pressure-opening through the body of the main valve, an unobstructed by-pass opening located in the main valve and adapted to convey water from between said valve and its casing, a cut-off, and means for operating the main valve through the medium of the relief-valve spindle.

2. In combination in a flush-valve, a main valve, a vent-valve and a cut-off with a by-pass opening in the one structure, a valve-spindle attached to the main valve and having a limited movement thereon, a retarding-chamber above the main valve, a passage through the wall of the main valve to the retarding-chamber, inlet and outlet openings in the flush-valve body, and means for reciprocating the valve-spindle.

3. In combination in a flush-valve, a valve-body having an inlet and an outlet opening and a valve-seat, a main valve located within the valve-body and having a cut-off with a by-pass opening from the periphery of the main valve, and means for operating the valve.

4. In combination in a flush-valve, a valve-body having an inlet and an outlet, a valve movable within said valve-body, a peripheral channel in said valve forming a part of a by-pass, and an unobstructed passage leading from said peripheral channel to the front side of the main valve and constituting the remainder of said by-pass.

5. In combination in a flush-valve, a valve-body having an inlet and an outlet opening and a valve-seat, a main valve located within the valve-body, a cut-off appurtenant to the main valve, and an opening extending through the main valve from the inlet side to the retarding-chamber above the main valve.

6. In combination in a flush-valve, a valve-body having an inlet and an outlet, a main valve movable within said valve-body and providing a narrow passage between the two, and an unobstructed by-pass opening from the periphery of the main valve and extending through said valve into the outlet-chamber.

7. In a flush-valve, in combination, a valve-body having an inlet and an outlet passage, a main valve movable within said body and providing a narrow passage between said valve and valve-body, a cut-off on the bottom of the main valve for reducing the area of the inlet-opening, and an unobstructed by-pass extending from the periphery through the main valve into the inlet-chamber.

8. In a flush-valve, in combination, a valve-body having an inlet and an outlet opening, a main valve movable within said body and providing a narrow passage between the two, a vent-valve located on the main valve and having a spindle, a yielding connection between said spindle and the main valve, a cut-off on the main valve to reduce the size of the inlet-opening, and an unobstructed by-pass extending through the main valve from the periphery thereof to the inlet-chamber.

9. In a flush-valve, in combination, a valve-body having an inlet and an outlet opening, a main valve movable in said valve-body and having a recess on the back thereof, a vent-valve located in said recess and having a valve-spindle, a by-pass extending through the main valve from the periphery to the in-

let-chamber, and a relief or vent opening extending through the main valve into said recess.

10. In combination in a flush-valve, a valve-body having an inlet and an outlet, a main valve movable within the valve-body and providing a narrow passage between the two, a vent-valve located on the main valve and closing a vent or relief opening through the main valve, a groove formed in the periphery of the main valve, openings extending from said groove to the inlet-chamber, a pressure-opening extending from the periphery of the main valve into the retarding-chamber back of said valve, a cut-off located on the bottom of the

main valve to reduce the size of the inlet-opening, and means for operating the vent-valve.

11. In combination in a flush-valve, a valve-body having an inlet and an outlet, a valve movable within the valve-body and forming a retarding-chamber, and a by-pass located within said valve and arranged to intercept fluid passing upward between the valve and valve-body and prevent its entrance into the retarding-chamber.

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Witnesses:

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