R. M. KEATING.

FLUSHING VALVE.

APPLICATION FILED APR. 5, 1913.

1,220,856.

Patented Mar. 27, 1917.

2 SHEETS—SHEET 1.

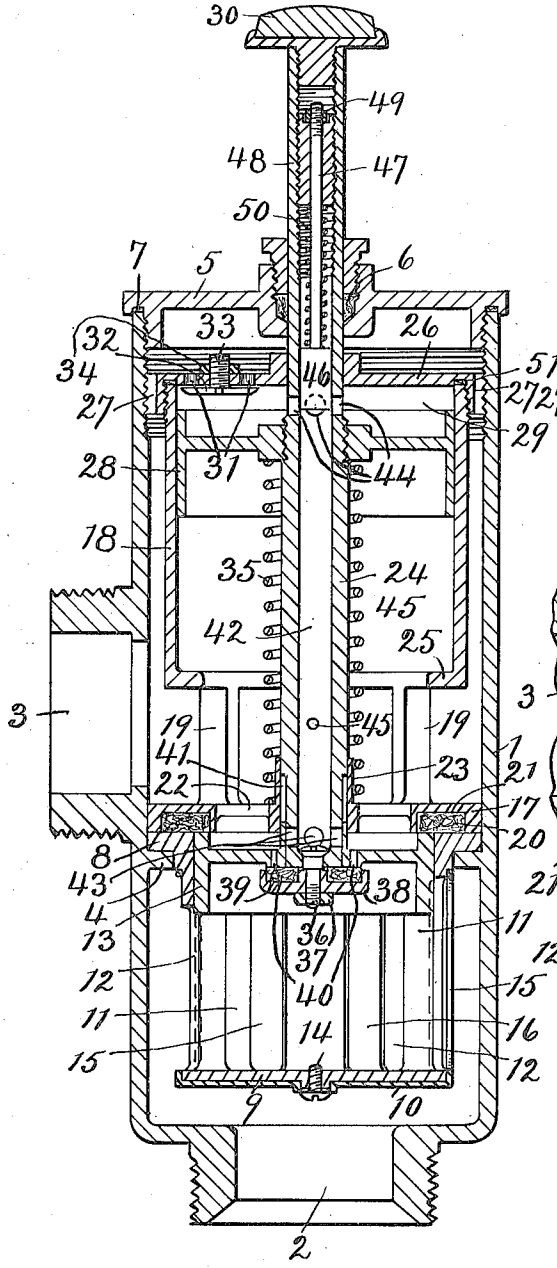



FIG. 1.

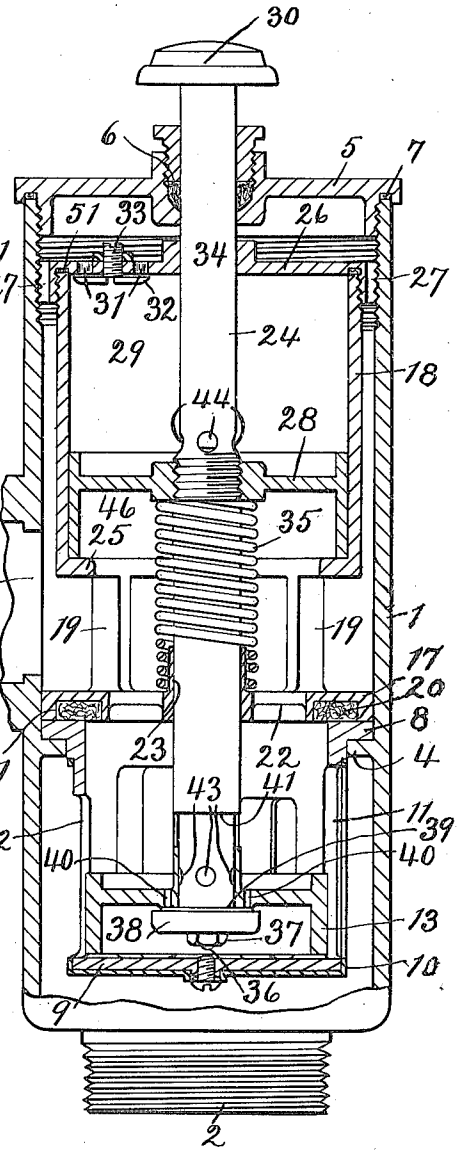



FIG. 2.

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2 SHEETS—SHEET 2.

FIG. 3.

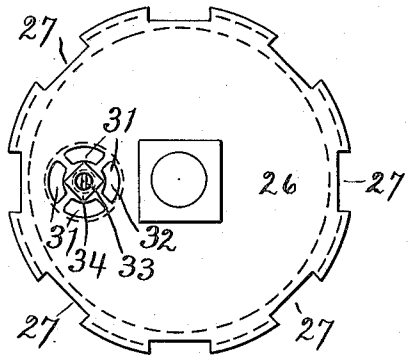



FIG. 4.

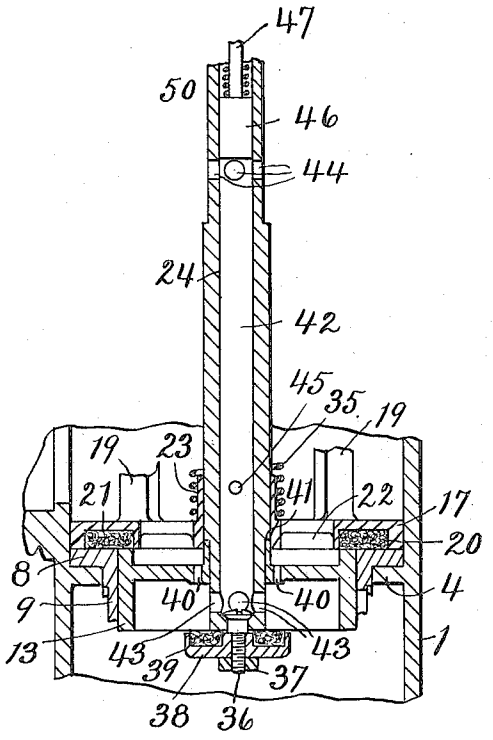



FIG. 5.

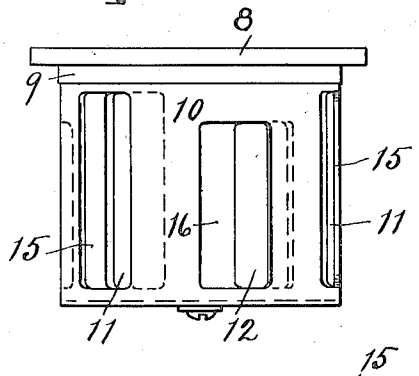



FIG. 6.

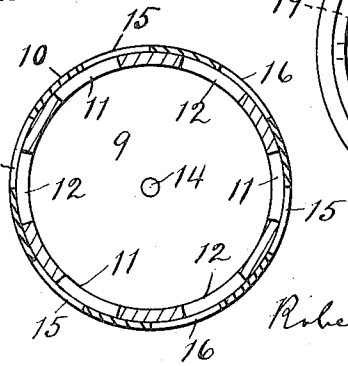
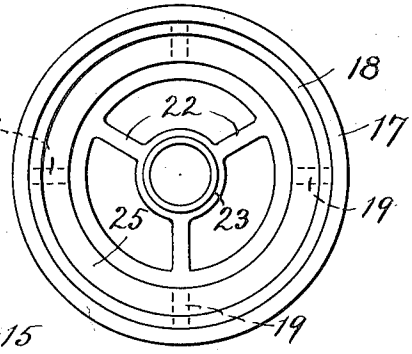



FIG. 7.




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# UNITED STATES PATENT OFFICE.

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## FLUSHING-VALVE.

1,220,856. Specification of Letters Patent. Patented Mar. 27, 1917.

Application filed April 5, 1913. Serial No. 758,995.

*To all whom it may concern:*

Be it known that I, ROBERT M. KEATING, a citizen of the United States of America, residing at Springfield, in the county of Hampden and State of Massachusetts, have invented a new and useful Flushing-Valve, of which the following is a specification.

My invention relates to improvements in automatic, self-closing water-closet-flushing devices, which take the place of the tanks and valves commonly used, and consists of a casing having an inlet cage and a retarding chamber therein, main and auxiliary valves in such casing for the control of the intake valves for the control of the flow of water to and from said retarding chamber, together with such other parts and members as may be required to make my device complete and render it effective, all constructed, arranged and combined in a novel manner, and as hereinafter more fully set forth.

The objects of my invention are, first, to produce a flushing valve that, although comparatively simple in construction and operation, is highly efficient, being easily opened by hand for the flushing operation, and automatically closed at the end of such operation, and requiring no other cushioning or retarding fluid medium than the water admitted during the flushing operation; second, to provide such a valve with ample means of adjustment, so that the same is adaptable to any water pressure, which renders the valve particularly advantageous for use in high buildings wherein adjustments are needed for the different floors or elevations, as well as making it available for localities (cities and towns) where there are different pressures, and, third, to afford means whereby the entire interior mechanism of the valve can be easily and quickly removed, and this without disturbing the casing or the water connections leading thereto and therefrom.

Other objects will appear in the course of the following description.

A preferred or practical form of embodiment of the invention, whereby I attain the objects and secure the advantages of the same, is illustrated in the accompanying drawings, and I will proceed to describe the invention with reference to said drawings, although it is to be understood that the form, construction, arrangement, etc., of the parts in various aspects are not material and may be modified without departure from the spirit of the invention.

In the drawings, in which like numerals designate like parts throughout the several views, Figure 1 is a central vertical section through a valve, showing the invention as aforesaid, the same being closed; Fig. 2, a similar section, except that here less parts are in section and the valve is shown fully open; Fig. 3, a top plan of the retarding chamber cap, and of the outlet valve with which such cap is provided; Fig. 4, a sectional detail illustrating the operation of the auxiliary valve, and of the inlet valve for said chamber, such valves being open; Fig. 5, a side elevation of the intake cup; Fig. 6, a cross-section through said cage, looking down, and, Fig. 7, a top plan of said chamber and the attached parts below.

The valve comprises a vertical cylindrical casing 1, and the valve mechanism within such casing, which mechanism, including all of its parts and members, is removable from the casing through the top of the latter. The aforesaid parts and members of the valve mechanism are so constructed preferably that they are a unit for removal and replacement, with one exception, as will subsequently be explained. This is a very advantageous feature of my invention, because I am thus enabled to take out such parts and members readily and conveniently whenever necessary for the purpose of renewing the main-valve-seat, repacking, or otherwise repairing any part of the mechanism needing attention, and as readily and conveniently to restore said parts and members.

The casing 1 has an inlet 2 at the bottom and an outlet 3 in one side about midway between the two ends of said casing. Around on the inside of the casing 1, below the outlet 3, is a flange 4. A cover or cap 5 is provided to close the casing at the top, such cap being provided with a central stuffing-box 6. The cap 5 may have a screw connection with the casing, substantially as shown, and a packing-ring 7 may be introduced between the upper edge of said casing and said cap. Upon removing the cap access is had to the interior to the casing, and all parts therein can be withdrawn, as previously observed.

Pipe connections are made in the usual manner with the inlet end and the outlet flange or nozzle of the casing.

Supported on the casing flange 4 by a flange 8 is a regulator for the intake preferably in form of an annular cage 9 provided with an adjustable cut-off shutter 10. The flange 8 is at the top of the cage 9 and external so as to enable said flange to rest on the flange 4 and thus to support the body of said cage within and below said flange 4. There are vertical slots or ports 11 and 12 in the cage 9, which have a common level at their bases, but rise to different heights, the former extending above the tops of the latter. A main valve 13 operates in the cage 9, and the purpose of making the ports in said cage of different heights, in the manner just noted, is so that said valve, when forced downward in opening, does not at first admit the full volume of water which would be admitted if said ports were all on a level at the top, but admits only the amount that can enter the uncovered upper portions of the ports 11 before the ports 12 are uncovered or opened. As soon as the valve 13 passes below the tops of the ports 12, however, the water flows into the cage 9 through said ports as well as through the ports 11, and in increasing volume as said valve continues to descend. Without some provision of this kind the inrush of the water would in many cases be too violent, as will readily be understood.

The shutter 10 fits under and around the cage 9 to which it is attached by means of a binding screw 14. The screw 14 is tapped into the bottom of the cage 9 at the center, and the head of said screw bears against the bottom of the shutter 10 and so normally prevents said shutter from being rotated about said cage. The shutter 10 has vertical slots or ports 15 and 16 therein, which correspond to the slots in the cage. Thus it is seen that, by loosening the screw 14, the shutter 10 can be rotatably adjusted so as to bring the ports in both members into exact coincidence, when the cage 9 is open to its full capacity, or said shutter can be rotatably adjusted so as to cover to a greater or less extent the ports 11 and 12, with the result that less than the full volume of water admissible to said cage is permitted to enter the same, the amount being greater or less accordingly as said ports 11 and 12 are opened more or less. After such adjustment the screw 14 is tightened to prevent displacement of the shutter 10.

In this device I have a very simple but effectual means for regulating the valve to different water pressures.

The cage is taken from the casing to set or readjust the shutter 10, such cage and its attached parts being lifted out without difficulty when the parts above are out of the way.

Bearing firmly on the top of the cage 9 and its flange 8 is the base of a member which comprises a main valve-seat 17 and a retarding-chamber casing 18, the latter being supported on a plurality of uprights 19 which rise from said valve-seat.

The valve-seat 17 fits the interior of the casing 1, and is provided with a packing-ring 20 let into an annular channel 21 opening through the underside of said seat and being the part against which the valve 13 actually impinges in closing, and with a spider 22 which supports in the axial center of said casing a guide sleeve 23 for a hollow spindle or plunger 24. The packing-ring 20 is wide enough to extend over onto the top of the cage 9, and so makes a tight joint between said cage and the valve-seat member.

The casing 18 is open at the bottom except for an internal flange 25, and is closed at the top by means of a removable cover, such as a screw cap 26. This cap has vertical ports 27 in the edges thereof, to provide means of communication between the casing chamber above said cap and said chamber below the horizontal plane of said cap but outside of the casing 18. A retarding piston 28 is secured to the plunger 24 in the casing 18, and fits said casing. A retarding chamber 29 is thus formed in the casing 18 between the cap 26 and the piston 28. The flange 25 limits the downward movement of the piston 28 and the plunger 24 with attached parts.

Both the valve 13 and the piston 28 are of the slide-valve type of construction, although said piston is not a valve.

The plunger 24, which extends above the stuffing-box 6 and has a handle or knob 30 on its upper end, is arranged to slide up and down through said stuffing-box, a central opening in the cap 26, and the sleeve 23.

In the cap 26 is a series of openings 31 for the escape of the water from the retarding-chamber 29, and a valve in the form of a screw 32 is provided to regulate the flow of water through said openings. The screw 32 is tapped into the cap 26, and the openings 31 are arranged around said screw. The screw 32 is inserted from below, and has a screw-driver slot 33 in its small end so that said screw can be adjusted without difficulty when the cap 5 is removed. The water escapes between the head of the screw 32 in the retarding chamber 29 and the edges of the openings 31, to and through such openings, and the amount of water thus permitted to escape is greater or less accordingly as said head is located nearer to or farther from the cap 26. A set-nut 34 is placed on the screw 32 above the cap 26 to lock said screw in place after adjustment.

It is necessary to secure the interior removable members at some point to the casing 1, and to this end in the present con-

struction I have screw-threaded the interior of said casing at the upper terminal thereof, and also screw-threaded the peripheral parts of the cap 26, beyond the ports 27. By this means the cap 26, after being secured to the casing 18, is screwed down in the casing 1 until the valve-seat member 17 bears hard on the cage flange 8 which is bearing on the casing flange 4. It is now clear how the interior parts and members can be taken from the casing 1 and returned to place therein.

The knob 30 has a screw connection with the plunger 24, and can be detached from said plunger in case it is desired to remove the cap 5 from said plunger as well as from the casing 1, or to gain access to the interior of the plunger 24 at the top.

A spiral spring 35 encircles the plunger 24 between the spider 22 and the piston 28, and has a tendency to force upward said piston and with it said plunger and attached parts.

Securely fastened to the base of the plunger 24, by means of a screw 36 and set-nut 37, is an auxiliary or starting valve 38. Let into the upper side of the valve 38 is a packing-ring 39 which is capable of being seated against the underside of the horizontal part of the main valve 13 and when so seated of closing a series of ports 40 in such part. The valve 13 is slidingly mounted on the plunger 24, the amount of independent movement being fixed by the valve 38 below and a shoulder 41 on said plunger above. The operation of the main and auxiliary valves will be explained in the description of the complete operation which will follow in due course.

The plunger 24 has a central passage 42 therein, which opens at the bottom through ports 43 in the sides of said plunger into the space below the horizontal part of the valve 13, when said plunger is forced down to bring the shoulder 41 into contact with said valve, as shown in Fig. 4. At other times the ports 43 are closed by the valve 13 or its hub. The passage 42 also opens, above the hub of the piston 28 into the retarding-chamber 29, through ports 44 in the sides of the plunger. There may be still another lateral port or opening in the plunger, as shown at 45. This last opening is so situated that, when the plunger is in its upper-most position, said opening affords means of communication between the passage 42 and the space within the uprights 19. It may be observed, in passing, that the aforesaid space is adjacent to the outlet 3, so that water rising through the valve-seat 17, when open, flows freely to and through such outlet.

A plunger valve 46 is provided in the passage 42 for the ports 44. The valve is arranged so that it normally closes or partly closes the ports 42, but can be driven upward by a column of water in the passage 42 to open said ports and admit the water to the retarding-chamber 29. In this organization the valve 46 has a stem 47 which rises from the top of said valve and passes through an adjustable plug 48 screwed into the passage 42 near the upper end of the same. A nut 49 on the upper terminal of the stem 47, coming to rest on the top of the plug 48, limits the downward movement of the valve 46. A spiral spring 50 encircles the stem 47 between the plug 48 and the valve 46 and retains the latter in closed position in the absence of pressure from below. By adjustment of the plug 48 the valve 46 can be located lower or higher in the passage 42, so as to require more or less movement of the valve and a consequent greater or less compression of the spring 50 in order to open the valve, the matter of such adjustment being governed or regulated in agreement with any given water pressure. The plug 48 can be reached for adjustment upon removing the knob 30. The valve 46 is represented in the drawings as being set so as to leave uncovered or open the lower portions of the ports 44, when said valve is in its closed position, as might be the case with a very low water pressure, because then the water when it rises in the passage 42 commences at once to flow through said ports and only a comparatively small amount of force is required to open said valve wide, but in cases where the water pressure is greater the valve is adjusted lower so as to completely close the ports and not infrequently when closed to have its base located well below the same.

The operation of the valve is described as follows, it being assumed that all adjustments have been made and the parts stand as shown in the first view. With the hand grasping the knob 30 the operator forces the plunger 24 downward, against the resiliency of the spring 35 and of the pressure of the water in the lower part of the casing 1 and in the cage 9, until the bottom edge of the rim of the piston 28 comes to rest on the flange 25, when said knob is released, the valve requiring no further attention on the part of the operator. This simple manual act performed by the operator has, however, not only opened the valve and brought about the full flushing operation for which the valve is designed, but started a train of automatic operations which do not cease until the valve is again fully closed and all movable parts are in readiness for a repetition of the complete flushing operation, all movements being orderly, quite noiseless aside from the rushing sound produced by the water, and certain so that there is no failure in obtaining the desired result every time, or uniform results.

When the plunger 28 is pushed down, it first carries the valve 38 away from the center of the valve 13, which latter is then held to its seat by the water below, uncovers the ports 40, thus breaking the water seal, and a quantity of water immediately rushes through said ports on the way to the outlet 3. At the same time the ports 43 pass below the main-valve hub and some of the water enters said ports, rises in the passage 42, passing by the opening 45, forces the valve 46 upward, against the resiliency of the spring 50, and flows through the now wide open ports 44 into the retarding-chamber 29, which chamber is becoming larger and larger as the piston 28 moves downward with the plunger. Next the shoulder 41 encounters the main-valve hub and forces the main valve away from its seat. As soon as the valve 13 commences to descend, water flows over the same, through the upper portions of the slots 15 and 11, and such flow increases when said valve passes below the tops of the slots 16 and 12, more and more entering above said valve, as it continues on the downward course, until the limit is reached. The water passing through the valve-seat 17 escapes to the outlet 3. When the pressure above the valve 13 and gravity overcome the pressure below said valve, the latter moves down on the plunger 28 into contact with the valve 38 or with the packing-ring 39 which is a part of said last-mentioned valve. This closes the ports 43 so that no more water can rise in the passage 42, consequently the valve 46 descends and closes or partly closes the ports 44. The valve 46 descends under the influence both of the spring 50 and of gravity, but such spring might be omitted and gravity above depended upon to close this valve. At the end of the down stroke of the plunger the valve is wide open, as shown in Fig. 2.

Having been released by the operator, the plunger 42 begins to rise under the influence of the spring 35 acting against the piston 28, but it can rise only as fast as the water in the retarding-chamber 29 is expelled through the openings 31 in the cap 26, and through the partly open ports 44 when the valve 46 is set for partial closing. The slow closing of the valve 13, thus brought about, gives ample time for the passage of a sufficient amount of water to flush the bowl. In rising the valve 13 cuts down the volume of water flowing through the valve-seat 17 gradually until the tops of the slots 16 and 12 are passed, when a decided reduction is made and an easy seating and final closing effected. The valve is completely closed when the seating of the main valve takes place, and no more water can flow through the valve-seat 17 until the plunger is again forced down. The valve 38 is in closed relation to the ports 40 during the entire time that the main valve takes in closing, and during the same time the ports 43 are also closed.

The water which is forced out of the retarding-chamber 29, through the openings 31, escapes into the space in the casing 1 between the caps 5 and 26, and passes down through the ports 27 and the water chamber in said casing from which the outlet 3 leads, and the water forced from said retarding-chamber, through the partially open ports 44, escapes into the same common water chamber by way of the passage 42 and the opening 45, and out through the ports 43 and around the part of the plunger in which such ports are located, the fit between such part and the main-valve hub and spider sleeve 29 not being tight enough to prevent this. If the valve 46 be adjusted to completely close the ports 44, the water expelled from the retarding-chamber must all escape through the openings 31, and in that event only the water in the passage 42 passes through the opening 45 and out at the lower end of such passage. The opening 45 may be omitted. Some water will be left in the retarding-chamber at the end of the closing operation, a less amount when the ports 46 are not fully closed, but this is not of importance.

The packing-ring 20 is to be considered as a part of the seat for the main valve, just as the packing-ring 39 is a part of the auxiliary or starting valve.

A packing-ring 51 may be introduced between the upper edge of the casing 18 and the adjacent part of the cap 26.

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

1. The combination, in a flushing-valve, with a casing having an interior supporting member, of a non-reciprocating perforated intake member adapted to be carried on said supporting member in said casing, and a combined valve-seat and retarding-chamber casing, which is separate from said intake member, and capable of being mounted on said supporting member in said first-mentioned casing, the arrangement of parts being such that said valve-seat retarding-chamber casing, by itself, and said intake member, by itself, are removable through the top of said first-mentioned casing, and a packing-ring between said combined valve-seat retarding-chamber casing and said intake member.

2. The combination, in a flushing valve, with a casing, a non-reciprocable perforated intake member in said casing and removable through the top thereof, a second member also in said casing and removable through the top thereof, such second member being separate from said intake member and comprising a retarding-chamber casing and a valve-seat having a guide sleeve, a combined packing and valve-seat ring between

said intake member and said valve-seat and extending inwardly from the former, and means to support said members in said first-mentioned casing, of a plunger having a sliding fit in said sleeve and the top of said retarding-chamber casing, a valve carried by said plunger for said valve-seat and operating in said intake member, and a piston carried by said plunger in said retarding-chamber casing.

3. The combination, in a flushing-valve, with a casing provided with an inlet and an outlet, and an intake cage supported in said casing below said outlet, of a valve fitted to said cage and sliding therein, a seat for said valve above said cage, and means to operate said valve, said cage having ports therein which extend below said valve and admit water to the underside thereof, when the valve is closed, and which extend above said valve and admit water to the upper side thereof, when the valve is open.

4. The combination, in a flushing-valve, with a casing, and a valve-seat and a retarding-chamber casing in said first-mentioned casing, said valve-seat having a spring-supporting part, and said retarding-chamber having a closed top, of a suitably supported plunger, a piston carried by said plunger for said seat, a spring arranged between said spring-supporting part and said piston to elevate, when depressed, said plunger and attached parts, means of communication between opposite sides of said piston, closing means for said communicating means, such closing means being actuated by the water, when said plunger is actuated downward, to open said closing means and admit the water to said retarding-chamber above said piston, and means to permit said water to escape slowly from above said piston, when said plunger rises with said piston and valve.

5. The combination, in a flushing valve, with a casing, and a valve-seat and a retarding-chamber casing in said first-mentioned casing, said retarding-chamber casing having a closed top, of a hollow plunger passing through said retarding-chamber casing, a piston carried by said plunger and forming the movable bottom of the retarding-chamber, a valve carried by said plunger for said seat, a spring arranged to elevate, when depressed, said plunger and attached parts, means to admit water to said plunger at the base, means, operated by the water in said plunger, to permit said water to enter said retarding-chamber, when said plunger is depressed, closing means carried by said valve for the base of said plunger, and means to permit said water to escape slowly from said chamber, when said plunger rises with said piston and valve, the base of said plunger then being closed by said valve-carried closing means.

6. The combination, in a flushing valve, with a casing, and a valve-seat and a retarding-chamber in said first-mentioned casing, said valve-seat having a spring-supporting part, said retarding-chamber casing having a closed top, of a hollow plunger passing through said retarding-chamber casing and opening at the base and below the top of said retarding-chamber casing, a piston carried by said plunger and forming the movable bottom of the retarding-chamber, a valve mounted for a limited amount of independent axial movement on said plunger, for said seat, and having a part that is adapted to open and close the entrance to said plunger at the base, a spring-pressed water-operated valve in said plunger for the upper exit therefrom, a water-way from said retarding-chamber, and a spring arranged between said spring-supporting part and said piston to elevate, when depressed, said plunger and attached parts.

7. The combination, in a flushing valve, with a casing, and a valve-seat and a retarding-chamber casing in said first-mentioned casing, said valve-seat having a spring-supporting part, said retarding-chamber casing having a closed top, of a hollow plunger passing through said last-mentioned casing and opening at the base and below the top of said last-mentioned casing, a piston carried by said plunger and forming the movable bottom of the retarding-chamber, a valve carried by said plunger for said seat, means carried by said valve, to open and close the entrance to said plunger at the base, longitudinally-movable spring-pressed water-operated means within said plunger to open and close the exit therefrom into said retarding-chamber, a water-way from said retarding-chamber, and a spring arranged between said spring-supporting part and said piston to elevate, when depressed, said plunger and attached parts.

8. In a flushing valve, an internally screw-threaded casing provided with an interior flange, a flanged intake cage suspended by its flange from said casing flange, a one-piece member, comprising a combined valve-seat and plunger guide, a retarding-chamber casing, and uprights between said combined valve-seat and guide and said last-mentioned casing, mounted on said casing flange, with said cage flange between, said one-piece member being separable from said cage, and means to secure said one-piece member in place, such means consisting of a cap on said retarding-chamber casing which cap screws into said first-mentioned casing.

9. In a flushing valve, an outer casing provided with an interior flange, a one-piece member, comprising a combined valve-seat and plunger guide, a retarding-chamber cas-

ing, and uprights between said combined valve-seat and guide and said last-mentioned casing, mounted on said flange in said outer casing, said retarding-chamber casing being of less diameter than said outer casing, and a cap on said retarding-chamber casing in threaded engagement with said outer casing, said cap having openings therein both for communication between the parts of said outer casing separated by said cap, outside of said retarding-chamber casing, and between said last-mentioned casing and said outer casing above.

10. The combination, in a flushing valve, with an outer casing, and a valve-seat and a retarding-chamber casing in said outer casing, said retarding-chamber casing having a closed top, of a hollow plunger provided with a removable top, passing through said retarding-chamber casing, and having an entrance opening at the base and an exit opening therein below the top of said last-mentioned casing, the latter opening communicating with the retarding chamber, a piston carried by said plunger and forming the movable bottom of the retarding-chamber, a valve carried by said plunger for said seat, means to open and close the said entrance opening, a valve in said plunger for said exit opening, means to adjust said valve, such means being accessible when said removable top of said plunger is removed, a water-way from said retarding-chamber, and a spring arranged to elevate, when depressed, said plunger and attached parts.

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Witnesses:
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