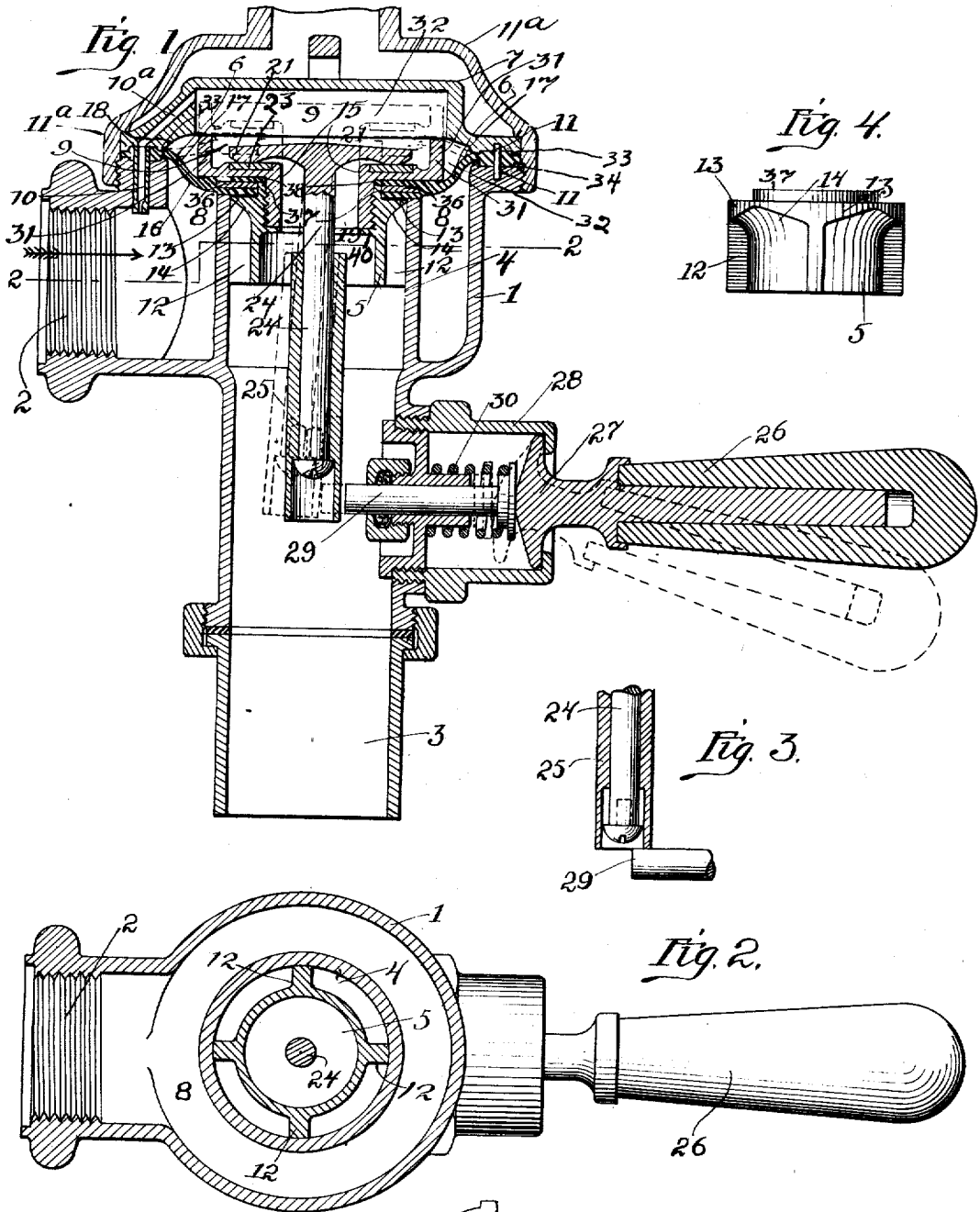


W. E. SLOAN.
FLUSH VALVE.
APPLICATION FILED JUNE 2, 1909.

1,114,398.

Patented Oct. 20, 1914.



Witnesses,
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Fig. 5.
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UNITED STATES PATENT OFFICE.

WILLIAM E. SLOAN, OF CHICAGO, ILLINOIS, ASSIGNOR TO SLOAN VALVE COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

FLUSH-VALVE.

1,114,398.

Specification of Letters Patent.

Patented Oct. 20, 1914.

Application filed June 2, 1909. Serial No. 499,757.

To all whom it may concern:

Be it known that I, WILLIAM E. SLOAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Flush-Valves, of which the following is a specification.

This invention relates to flush valves, and has for its object to provide a new and improved valve of this description.

Referring now to the drawings, wherein one form of valve embodying my invention is illustrated, Figure 1 is a longitudinal sectional view; Fig. 2 is a sectional view taken on line 2—2 of Fig. 1; Fig. 3 is a view showing the end of the controlling part for the auxiliary valve; Fig. 4 is a view showing the upper end of the main valve. Fig. 5 is enlarged view showing the double curvature of the diaphragm.

Like numerals refer to like parts throughout the several figures.

The casing 1 of the valve is provided with the inlet 2 and the outlet 3. Within the casing is a cylinder 4, containing the main valve 5 which, in the present instance, has connected therewith a flexible diaphragm 6 clamped between the main body of the casing and inside cover or cap 7. This diaphragm divides the valve into two chambers 8 and 9, the chamber 8 being the working chamber and the chamber 9 the controlling chamber. The controlling chamber is connected with the working chamber by one or more connections 10.

The connection 10 has its inlet smaller than the remaining portion thereof, as shown in Fig. 1. That is to say, the passageway through the connection is enlarged just back of its entrance or mouth. This construction permits anything that can enter the mouth to pass freely through the connection and also reduces the friction of the water passing therethrough. In the drawing this connection is shown as a tube, and the end thereof projects into the current of water which flows to the valve. This current of water sweeping past the end keeps it free from foreign material. It will be seen that the only time when water passes

through this connection is when the main valve is open, and that at that time the water is rushing past swiftly so as to carry with it all foreign particles, and as the inlet of this connection is the smallest part thereof, any foreign particles that should enter would not produce a stoppage of the connection, as there is no restriction to the escape of the material from the connection after it passes the restricted mouth thereof.

The diaphragm is provided at its edge with openings through which pass the pins 11. The connection 10 may act as one of these pins, and by this means the diaphragm is located. The inside cover 7 is provided with openings into which the ends of these pins project so as to prevent this inside cover from turning. The inside cover is provided with a passageway 10^a for the connection 10, such passageway leading to the top thereof. An outside cover 11^a has a screw-threaded connection with the casing 1, and engages the inside cover 7 so that when the outside cover is screwed down, the inside cover will clamp the diaphragm to the casing 1.

It will be seen that by means of this construction the rubber diaphragm is clamped without any relative rotary movement between it and the part which engages it during the clamping operation, and hence injury to the diaphragm is thus prevented.

By making the inside cover 7 non-rotatable, and by locating it by means of the pins 11, it will be seen that the connection 10 and the passageway 10^a will always be in proper relative position to permit the free passage of the water therethrough, this relation not being disturbed by the movement of the outside cover 11^a while being screwed into its clamping position. These pins also act as stops to limit the compression of the diaphragm by the clamping action of the outside cover.

It will be noted that the inside cover 7 has metal rings 33, and the opposed part of the casing 1 has similar metal rings 34, and that the portion of the diaphragm which is clamped or compressed to obtain a watertight joint between the lower and upper

chambers is located between these rings, and hence these rings carry the strain of its operation when the valve is opened and closed as they engage shoulders on the diaphragm 5 and make it unnecessary to rely wholly upon the clamping pressure, thus reducing the strain on the compressed part of said diaphragm.

The diaphragm 6 engages the upper end 10 of the cylinder 4 as shown. The main valve 5 is provided with lateral projections or wings 12, and its upper end is provided with an annulus 13 meeting the beveled faces 14 so that when the valve descends it 15 will gradually shut off the flow of the water, there being a gradually decreasing opening during the latter part of the closing movement. During the first part of the closing movement of the valve 5 there is preferably 20 a full discharge opening so that the discharge of the water will not be interfered with, and as the valve nears its seat at the latter part of its closing movement, the discharge opening is gradually decreased, and 25 as the valve closes against the pressure of the water, this gradual decrease of the opening facilitates the closing of the valve and decreases noise in closing. The diaphragm 6 may be fastened to the main valve 5 in 30 any desired manner, as by means of a removable clamping piece 15. This diaphragm is preferably provided with a double curvature having the two oppositely curved parts 16 and 17, and is made thinner 35 at the points between the valve and the casing, as shown, thus securing greater flexibility. The engaging face 18 of the cap part of the casing is preferably made the same shape as the diaphragm which en- 40 gages it, so as to prevent an increase of flow due to an increase in pressure in chamber 8. The lengths of the flexible portion of the diaphragm and the face 18 should be substantially equal. It will also be seen that in 45 this construction the diaphragm is flexible throughout its entire opening length, instead of being simply flexible at the points next to the casing and the valve.

The main valve 5 is provided with an 50 opening 19 by means of which the material in the controlling chamber may be discharged. This opening is controlled by the auxiliary valve. As herein shown, this auxiliary valve consists of a tilting valve 21 55 at the top of the valve. This auxiliary valve is provided with a projecting annulus which engages a suitable packing 23. The auxiliary valve is provided with a controlling part which is preferably made up of 60 two parts 24 and 25, which are free to move longitudinally with relation to each other. As herein shown, the part 24 is provided with a sleeve 25 which preferably extends up into the hollow of the main valve 5. This

sleeve is limited in its downward movement, 65 but may be moved upwardly. The auxiliary valve is controlled by means of a rocking handle 26 which may be moved in any direction, having, as it were, an universal movement. This rocking handle has an en- 70 larged end 27 working in a guide 28. This end engages a plunger 29 working in a suitable guide, and provided with a retracting spring 30. The end of the plunger is adapted to engage the controlling part for the 75 auxiliary valve. The sleeve 25 is of sufficient length to prevent its being lifted high enough to expose the lower end of the part 24, thus preventing foreign particles from 80 lodging on the stem, and also preventing the flow of water from the main valve from passing down between the two parts 24 and 25. This movement, however, is sufficient to permit the sleeve 25 to rise out of reach of the operating part. 85

The main valve and its associated parts located at the center of the diaphragm have sufficient weight to cause the main valve to be closed by gravity, in the event the water supply to the valve is not sufficient to cause 90 enough water to pass through the connection 10 to fill the upper chamber, while the main valve is open, thus insuring the proper closing of the main valve after the closet has been flushed. 95

The main valve is provided with an annulus 31 which projects loosely into a receiving space 32 in the inside cover 7, when the valve is opened. This annulus when the valve is closed preferably projects slightly 100 into the receiving space 32, or comes even with the bottom thereof, so as to act as a wall to prevent the fluid opposite the flexible part of the diaphragm from being too quickly expelled by the pressure under- 105 neath said diaphragm, that is, the pressure in the chamber 8. Without such protecting device the flexible part of the diaphragm is liable to injury. This is particularly true when the valve is first started up and the 110 upper chamber contains only air. In such event the air or other fluid in the portion of the chamber 9 between the annulus 31 and the curved portions 16 and 17 of the diaphragm can only pass out gradually, be- 115 cause of the restricted opening between the annulus 31 and the inside cover 7. When the main valve reaches the upper limit of its movement, the danger is eliminated, because the flexible part of the diaphragm then 120 engages the engaging face 18 of the inside cover or cap 7. The inside cover 7 is made so as to fit closely the movable parts of the main valve when said valve is in its full open position. This close fitting construc- 125 tion is desirable for the purpose of causing the expulsion of all air, which is troublesome in a valve of this character, and to

provide a water cushion or clearance at the upper end of the travel of the auxiliary valve. This secures the expulsion of substantially the same amount of water out of the upper chamber of the valve at each operation, thus insuring a discharge of approximately the same amount of water through the main valve at each operation as long as the relation of the area of the connection to the upper chamber of the valve to that of the main valve is not altered. As both the main valve and the upper chamber secure their supply of water from the same source, this equality of discharge prevails, even though the pressure from the source of supply varies, with this exception, that if the pressure is excessively high the discharge of water through the main valve will be decreased, due to the fact that during the downward travel of the main valve in closing, the excess of pressure in the lower chamber over that of the upper chamber will cause an upward curve in the flexible part of the diaphragm, and thus reduce the area of the upper chamber so that a small amount of water, that is, less than the normal amount, will close the main valve. The opening of the auxiliary valve exposes such a large area for the exit of the comparatively small amount of water in the upper chamber, that this water is expelled very quickly, the expulsion being aided by the pressure exerted in the lower chamber against the diaphragm. In this construction the valve acts through its normal cycle of operation after the operation is started, the controlling device keeping the auxiliary valve open during its upward movement, thus starting the flow of water and causing it to continue until the operation is completed. If the handle is held so that the part 29 is projected into the path of the stem of the auxiliary valve, the part 25 engages the top of it after the valve has been seated, and the flow of water stopped, the parts then being in the position shown in Fig. 3.

The diaphragm is preferably arranged as shown in Fig. 1, there being embedded in it a non-elastic ring 36 made of metal or the like.

It has been found in practice that when the inner edge of the diaphragm is clamped between two clamping pieces to secure the water-tight joint, it expands when pressure is applied to the diaphragm and is more or less pulled out from between these parts because of the stretching of the material, and when the pressure is released, the diaphragm does not move back in between the parts, and in a short time the tightness of the joint is destroyed. To prevent this I associate the non-elastic ring with this diaphragm, and only clamp a small portion of the inner

edge, namely, the part 38, this part being clamped between the part 37 of the main valve and the clamping piece 15. The non-elastic ring, which may be of metal, surrounds the part 37 and preferably engages it so as to be held against movement. The clamping piece 15 is screw-threaded to the part 5 and is provided with a stop 40 which stops its movement so as to prevent the edge of the diaphragm from becoming injured by too much compression.

The use and operation of my invention are as follows: Under normal conditions the parts are in the position shown in Fig. 1. When it is desired to flush the device with which the valve is used, the handle 26 is moved to the position shown in dotted lines. This causes the plunger 29 to move inwardly so as to engage the controlling part for the auxiliary valve and move it into the position shown in dotted lines, thus tilting the valve and permitting the water in the chamber to escape. The pressure in chamber 8 then moves the valve 5 and the diaphragm 6 upwardly, and the water in this chamber passes across the upper end of the cylinder 4, and down between the wings 12 of the main valve. When the main valve reaches the limit of its upward motion the part 25 passes above the plunger 29 and the auxiliary valve automatically rights itself so as to close the passageway 19. The water in chamber 8 then passes up through the connection 10 into the chamber 9, gradually filling such chamber, and forcing the main valve 5 downwardly so as to shut off the flow of water. During the latter part of the downward movement of this valve the opening is gradually diminished by the beveled faces 14, so as to produce a gradual shut off and prevent water hammering. The curved face 18 of the casing accurately fitting the curved face of the diaphragm causes the diaphragm to move to the same position, regardless of the variation of pressure in chamber 8, and thus prevents an increase of flow of water when there is a high pressure, and a decrease when there is a low pressure. This construction prevents the main valve from being held open so as to produce a continuous flow of water. If the handle 26 is moved to tilt the auxiliary valve, the main valve is moved upwardly, and if this handle is then held so as to hold the plunger 29 in its operative position, shown in dotted lines in Fig. 1, the main valve will still return to its seat, because as it lowers, the part 25 will strike the top of the plunger 29 and slide along the part 24, thus permitting the main valve to move to its seat without causing a tilting of the auxiliary valve. It is therefore necessary to let the plunger 29 return to its initial position so that the part 25 can slide past

it before the valve can again be operated. This construction therefore permits the valve to be opened, and a certain amount of water to be discharged through it, but insures the closing of the valve after this discharge, regardless of the position of the operating mechanism, and hence under no conditions can the valve be held open, or a continuous flow of water through the valve secured.

The auxiliary valve is forced to its position, first, by gravity, provided the main valve is in a vertical position, and, second, by the pressure transmitted from the lower chamber to the water in the upper chamber.

I claim:

1. A valve device comprising two valves, one a main valve which controls the flow of water, the other an auxiliary valve for controlling said main valve, a stem for controlling said auxiliary valve comprising two parts connected together so as to be free to move with relation to each other, one of said parts projecting beyond the other, said projecting part movable with relation to said auxiliary valve, a controlling device for engaging said stem at one side thereof to move it laterally when the valves are in their closed position but disconnected from said stem, said projecting part adapted to engage said controlling device when the latter is held in its path as the main valve is returned to its closed position, so as to be moved thereby to permit the closing of said main valve.

2. A valve device comprising two valves, one a main valve which controls the flow of water, the other an auxiliary valve for controlling said main valve, a laterally movable stem for controlling said auxiliary valve, a controlling device for engaging said stem so as to move it laterally to open the auxiliary valve when the valves are in their closed position, and means for permitting both valves to return to their closed positions while the controlling device is in its operative position.

3. A valve device comprising two valves, one a main valve which controls the flow of water, the other an auxiliary valve for controlling said main valve, a laterally movable stem for controlling said auxiliary valve comprising two telescoping parts free to move one upon the other, a controlling device adapted to engage one of said telescoping parts when the valves are closed so as to move said stem laterally to open the auxiliary valve, means for moving said valves when the auxiliary valve is opened to move the stem out of the reach of said controlling device.

4. A valve device comprising a casing, a cylinder in said casing, a piston valve working in said cylinder, a diaphragm connected with said piston valve and with said casing,

the portion of the diaphragm between the valve and the casing having a double curvature formed in the material itself.

5. A valve device comprising a casing, a diaphragm extending thereacross and dividing the casing into two chambers, a valve connected with said diaphragm, the portion of the diaphragm between the valve and the casing having a double curvature formed in the material itself.

6. A valve device comprising a casing, a diaphragm extending thereacross and dividing the casing into two chambers, a valve connected with said diaphragm, clamping parts for the outer part of said diaphragm, the portion of the diaphragm between the valve and the casing having both faces free from engaging parts and provided with a double curvature formed in the material thereof, said portion also being thinner than the center and periphery of the diaphragm and means associated with the casing for engaging the edge of the thickened portion to resist its withdrawal from between said clamping parts.

7. A valve device comprising a casing, a diaphragm extending thereacross and dividing the casing into two chambers, a valve connected with said diaphragm, the portion of the diaphragm between the valve and the casing having a double curvature formed in the material itself, an engaging face on said casing against which the portion of said diaphragm between the casing and the valve strikes, said engaging face also having a double curvature.

8. A valve device comprising a casing, a diaphragm extending thereacross and dividing the casing into two chambers, a valve connected with said diaphragm, the portion of the diaphragm between the valve and the casing having a double curvature formed in the material itself, an engaging face on said casing against which the portion of said diaphragm between the casing and the valve strikes, said engaging face also having a double curvature and being equal in length to the portion of the diaphragm between the casing and the valve.

9. A valve device comprising a casing, a cylinder therein, a main valve in said cylinder, a diaphragm connected with said valve and said casing, an auxiliary tilting valve associated with said main valve, a telescoping stem for said auxiliary valve having two parts, one connected with the auxiliary valve, the other connected with said latter part and free to slide therealong, a controlling part for engaging the side of said telescoping stem so as to tilt the valve.

10. A valve device comprising a casing, a cylinder therein, a controlling valve at the upper end of said cylinder and projecting into the cylinder, said valve smaller in diameter at its lower end than the inner di-

ameter of the cylinder and having lateral projections which engage the inner face of the cylinder, the upper end of said valve being enlarged and of substantially the same diameter as the inner diameter of said cylinder, the enlarged portion of the valve provided with short beveled faces extending from the outer face of said enlarged end at the upper end of the valve downwardly and inwardly through a portion of its length, the remaining portion of said valve being free therefrom, said beveled faces arranged so that there is a full discharge opening during the first part of the closing movement, and a gradually decreasing discharge opening at the end of the closing movement of said valve.

11. A valve device comprising two valves, one the main valve which controls the flow of water, the other an auxiliary tilting valve for controlling said main valve and mounted thereon, a controlling device for said auxiliary valve, and means for preventing said controlling device from holding said auxiliary valve open when the controlling device is kept in its operative position.

12. A valve device comprising a valve casing, a diaphragm extending across said casing, an inside cover closed at the top, engaging said diaphragm, means for fixing said inside cover against rotation, and an outside cover inclosing the inside cover and having a screw-threaded connection to the exterior of said casing, and arranged to engage the inside cover so as to apply pressure thereto to clamp the diaphragm in position.

13. A valve device comprising a casing divided into two chambers, an upper chamber and a lower chamber, a connection by which water passes from the lower chamber to the upper chamber, said connection comprising a tube having its lower end projecting into the lower chamber substantially at right angles to the current of water flowing through said lower chamber, the lower end of the tube being the inlet and having a small inlet opening, the opening in said tube enlarged back of the small inlet opening whereby the current of water sweeping past the small inlet keeps its free from foreign material.

14. A valve device comprising a casing, a diaphragm extending across said casing and dividing it into two chambers, a valve controlled by the movement of said diaphragm, and means for restricting the escape of the fluid between said diaphragm and the part of the casing which it engages in the full open position of the valve for protecting the flexible portion of said diaphragm from injury resulting from differences in pressure on the two sides thereof during the opening movement of the said valve.

15. A valve device comprising a casing, a

movable diaphragm extending across said casing, a main valve connected with said diaphragm, an auxiliary valve co-acting with said diaphragm so as to move therewith, and means separate from the auxiliary valve for retarding the escape of fluid from one side of the flexible portion of said diaphragm to the other during the opening movement of the main valve.

16. A valve device comprising a casing, a movable diaphragm extending across said casing, a main valve connected with said diaphragm, an auxiliary valve connected with said diaphragm, means for retarding the escape of the fluid between said diaphragm and the part of the casing which it engages in the full open position of the valve, so as to protect the flexible portion of said diaphragm from injury resulting from differences in pressure on the two sides thereof.

17. A valve device comprising two valves, one the main valve which controls the flow of water, the other an auxiliary tilting valve for controlling said main valve, a controlling device for said auxiliary tilting valve, and means for preventing said controlling device from holding said auxiliary valve open when the controlling device is in any position.

18. A valve device comprising a casing, a main valve therein, a tilting valve therein, a movable part outside the casing for starting the tilting valve, a connection between said movable part and the tilting valve, and means for causing said main valve when started to act through its normal cycle of operation independent of the position of said movable part during said operation.

19. A valve device comprising a casing, a cylinder therein, a piston working in said cylinder, a diaphragm connected with said piston, a tilting auxiliary valve mounted on said piston, a stem for said auxiliary valve, a sliding sleeve separated from said piston and mounted on said stem, and means for limiting the movement of said sleeve along said stem.

20. A valve device comprising a casing, a cylinder in said casing, a valve associated with said cylinder and projecting therein for controlling the passage of material therethrough, a diaphragm with which said valve is connected extending across the casing, clamping parts associated with said valve between which a portion of the diaphragm is secured, a nonelastic ring embedded in the material of said diaphragm and surrounding a portion of said valve and located between said clamping parts so as to take the strain when a clamping pressure is applied to the diaphragm to clamp said diaphragm in position, and prevent the portion of the diaphragm between said clamping parts from being moved by the pressures so as to lengthen the flexible portion

of the diaphragm between the valve and the casing.

21. A valve device comprising a casing, a flexible diaphragm therein, two clamping parts engaging said diaphragm, one on each side thereof, by means of which said diaphragm is clamped in position, to said flexible diaphragm, a non-flexible ring connect-

ed with said diaphragm so as to receive said clamping pressure and prevent the diaphragm from being squeezed from between the clamping parts. 10

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Witnesses:

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Corrections in Letters Patent No. 1,114,398.

It is hereby certified that in Letters Patent No. 1,114,398, granted October 20, 1914, upon the application of William E. Sloan, of Chicago, Illinois, for an improvement in "Flush-Valves," errors appear in the printed specification requiring correction as follows: Page 4, line 79, for the word "clamipng" read *clamping*; page 6, lines 7-8, strike out the words "to said flexible diaphragm"; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 5th day of January, A. D., 1915.

[SEAL.]

R. F. WHITEHEAD,

Acting Commissioner of Patents.

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