

July 13, 1937.

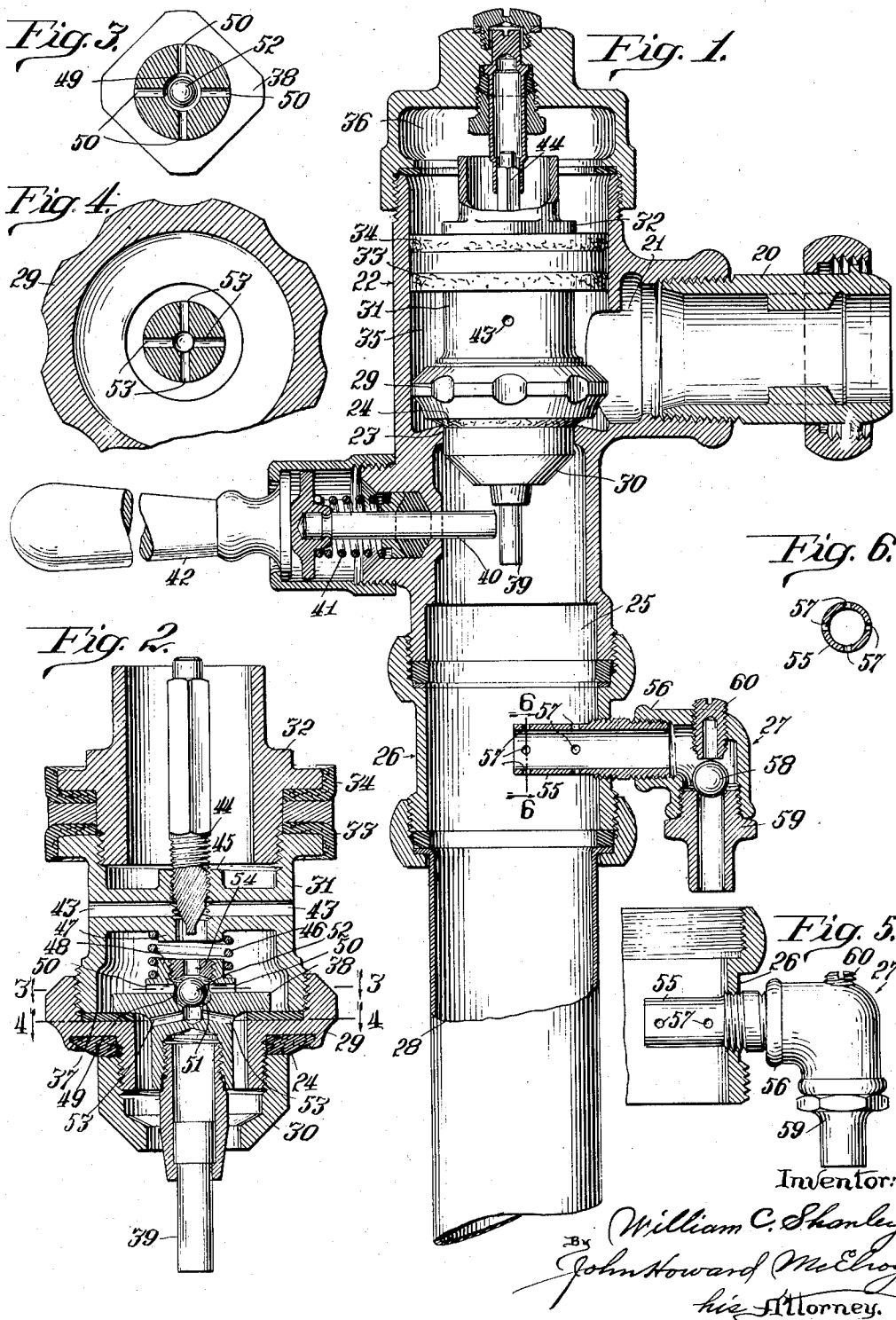
W. C. SHANLEY

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PLUMBING SYSTEM EMPLOYING VACUUM BREAKERS

Filed Dec. 19, 1933

3 Sheets-Sheet 1



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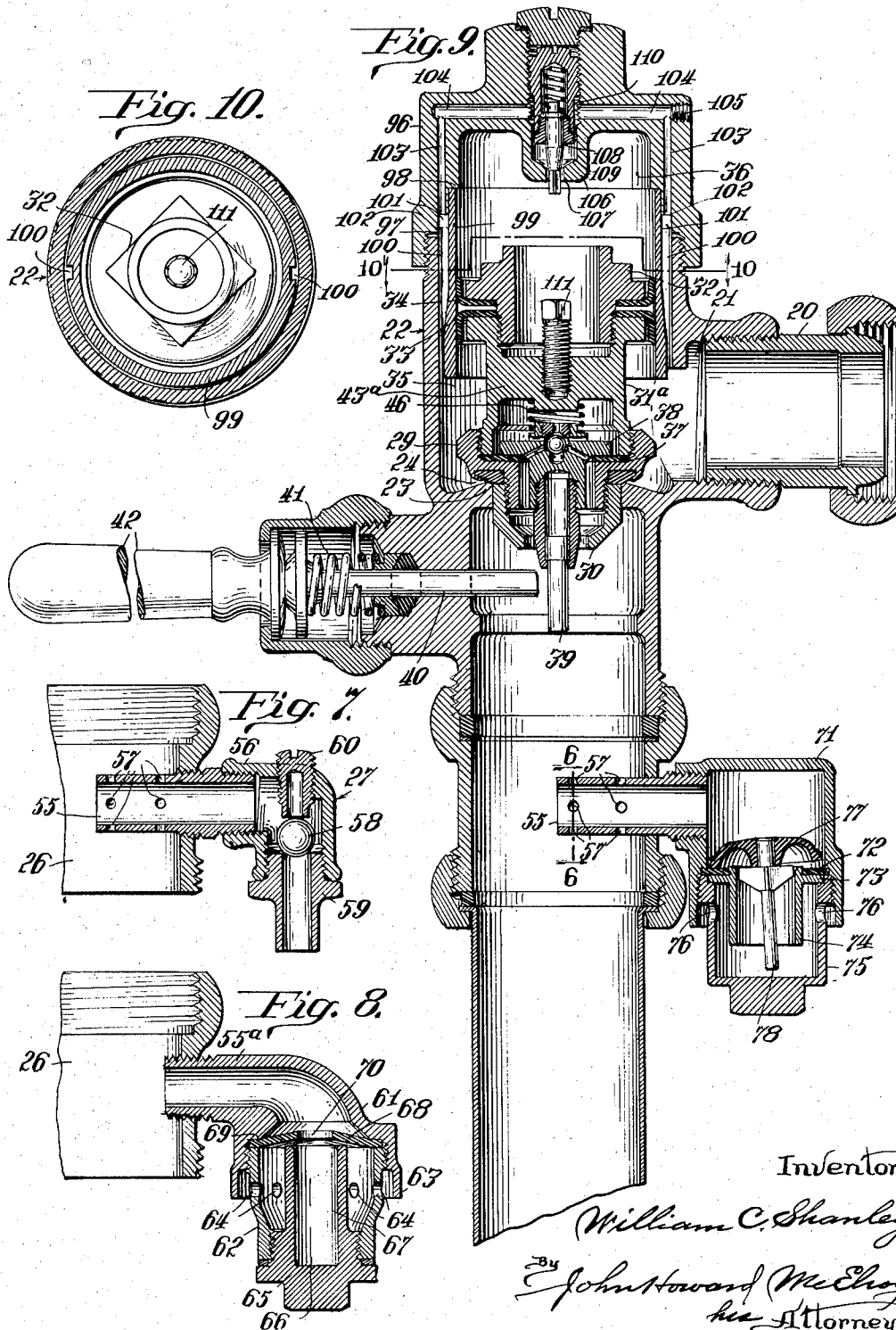
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3 Sheets-Sheet 2



Inventor:

William C. Shanley

By John Howard McElroy,
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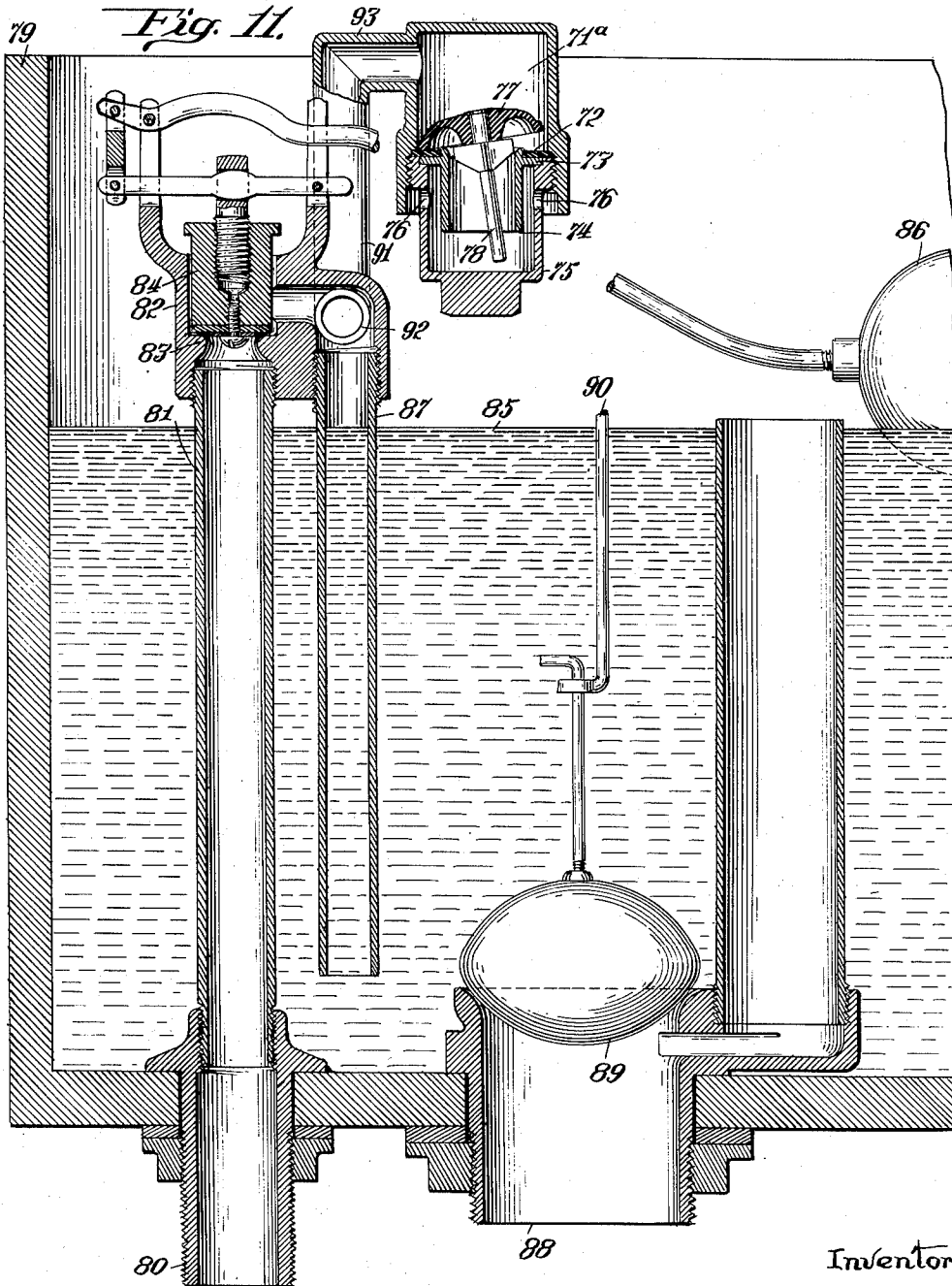
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,087,049

PLUMBING SYSTEM EMPLOYING VACUUM
BREAKERSWilliam C. Shanley, Chicago, Ill., assignor to The
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Application December 19, 1933, Serial No. 703,093

4 Claims. (Cl. 137-93)

My invention is concerned with certain new and useful improvements in plumbing systems employing flush valves and so-called vacuum breakers, and in the vacuum breakers employed therewith, but which may be employed in systems other than those using flush valves.

It is well known that in the ordinary plumbing system, where a supply pipe rises through several floors, a vacuum may be created therein, for instance, by shutting off the water supply and opening faucets, valves, etc., or flushing closets, at a lower level. When this occurs, the water will siphon out of the water-closet bowl, bed-pan closet, bidet, bed-pan washer or slop sink, when the bowl is clogged through stoppage and the water level is above the holes in the rim of the bowl. It will also occur on side-spud closets where the closet spud is partially or completely submerged in the water seal, which is the normal water level in the closet bowl. When back siphonage occurs, it pollutes the water in the supply line.

In the companion application No. 703,094, filed simultaneously herewith, on which Patent No. 2,056,807 was granted October 6, 1936, showing a preferred form of my invention, and where it is used in connection with a flush valve, the pipe connecting the bottom of the flush valve with the bowl is employed as a part of the conduit connecting the supply line with the receptacle which may be siphoned, and in which pipe is an aperture protected by means in the pipe so that it permits the downward passage of the water from the supply pipe through the flush valve and down through the pipe without the possibility of any of it escaping through the aperture, while said means permits the air to enter freely through the aperture in case a vacuum occurs in the supply, and thus prevents the possibility of the contents of the bowl being sucked back into the supply pipe, thereby possibly contaminating its contents. In my present application, I have shown several species of a generic vacuum breaker which is connected to the conduit, but outside of it, so that it can be readily gotten at for renewal or repairs.

My present application is also concerned with an improvement in flush valves of the type in which a spring or some means other than the weight of the relief valve is employed to hold it seated. When a vacuum breaker is attempted to be used with such valves as now constructed, such means will not permit the relief valve to rise under a vacuum, and consequently it pulls the entire piston unit off of its seat, permitting

back siphonage from the closet bowl or other fixture on which the flush valve is used.

To illustrate my invention, I annex hereto three sheets of drawings, in which the same reference characters are applied to identical parts in all the figures, of which,—

Fig. 1 is a vertical longitudinal section of a flush valve employing some of my inventions and one of the specific vacuum breakers shown;

Fig. 2 is a vertical section through the main valve and its connected piston, on a larger scale, which main valve and piston are shown in elevation in Fig. 1;

Figs. 3 and 4 are sections on the lines 3-3 and 4-4, respectively, of Fig. 2;

Fig. 5 is a side elevation of the vacuum breaker shown in section in Fig. 1;

Fig. 6 is a section on the line 6-6 of Figs. 1 and 9;

Fig. 7 shows the vacuum breaker of Fig. 1 detached from the flush valve and in section;

Fig. 8 is a view similar to Fig. 7, but showing a modification of the vacuum breaker;

Fig. 9 is a view similar to Fig. 1, but showing a different construction of the flush valve;

Fig. 10 is a section on the line 10-10 of Fig. 9; and

Fig. 11 is a view showing a third form of the vacuum breaker, the same as is shown in Fig. 9, but applied to the tank of the water-closet.

In a plumbing system embodying my invention, the supply pipe, not shown, is connected by a sleeve 20, or otherwise, to the inlet port 21 of the casing 22 of a piston-type flush-valve, which has a valve seat 23 on which normally rests the main valve 24, which when lifted allows the water from the supply pipe to flow past the valve seat down through the outlet 25, through the coupling sleeve 26 carrying the vacuum breaker 27, and into the pipe 28 connected with the top of the bowl, not shown. The main valve 24 has the washer which constitutes the actual contact part of the valve with the valve seat 23 secured in the annulus 29, by the refill thimble 30 screwed therein, as will be readily apparent from Fig. 2. The generally cylindrical member 31 has its lower end screwed into the ring 29, and its internally threaded upper end has the cylindrical member 32 screwed therein, clamping between them one of the leather cups 33, and also carrying the other cup 34, which cups constitute the actual contact part of the piston which separates the valve casing 22 into the inlet chamber 35 and the controlling chamber 36. In this type of flush valve, the ring 29 has on its interior a seat 37 for the relief valve 38 which

co-operates with said seat, and has its stem 39 extending down through the refill thimble 30 and in position to be contacted by the pin 40, which is normally held out of contact therewith by the spring 41, but which is forced in contact therewith to tilt the relief valve by manipulation of the handle 42, these connections being of a customary and well known type which needs no further description.

The controlling chamber 36 is normally filled with water under pressure, as is the inlet chamber 35, so that the valve is held in position by the balanced pressure on both sides of the piston. When the relief valve 38 is tilted by the operation of the handle 42, the contents of the controlling chamber 36 pass downwardly through the center of the cylindrical member 32, past the transverse tube 43 forming a part of the cylindrical member 31, and down past the valve seat 37 and on through the connection 26 and the pipe 28 to the closet bowl. With the pressure on top of the piston thus released, the pressure in the inlet chamber lifts the piston and unseats the main valve 24, and the water from the supply pipe for the flushing operation passes on down through the outlet 25 and pipe 28. To regulate the refilling of the controlling chamber 36, and thus the duration of the flush, means has to be provided for slowly re-filling the controlling chamber, and for this purpose a screw 44, with a slot or a flattened portion on its lower end, is threaded into the boss 45 of the tube 43 so as to leave a small passage through the boss 45, the size of which is regulated by the adjustment of the screw 44. As soon as the piston reaches the upper limit of its travel, the water under pressure in the inlet chamber 35 passes through the tube 43, up through the small passage in the boss 44, and into the controlling chamber. In this type of valve, a helically-coiled expanding spring 46 is customarily interposed between the boss 47 on the under side of the tube 43 and a boss 48 carried by the top of the relief valve 38.

In a type of relief valve where it is held in place only by its weight, as soon as a vacuum occurs in the supply pipe, the relief valve is lifted or tilted by the vacuum sufficiently to allow the air from the vacuum breaker to pass the relief valve and reach the supply pipe. Where the spring is employed, as shown in the present application, the suction due to the vacuum is not sufficient to lift the relief valve pressed down by the spring 46, and consequently, where this type of valve is employed with a vacuum breaker, it is necessary to change its construction to permit of the passage of air through the relief valve while it is still seated. For this purpose, the boss 48 of the relief valve has an aperture 49 therein, and four equidistant horizontal holes 50 extending thereinto radially, and below these holes is the valve seat 51 for the small, and consequently light, ball valve 52 co-operating with the seat, and below the seat are the four substantially horizontal, radially extending passages 53 to the reduced portion of the aperture 49. A plug having the aperture 54 is screwed into the top of the boss 48 to hold the ball in place. Normally, the pressure of the water in the controlling chamber 36 and its weight hold the ball check-valve 52 seated, but when a vacuum occurs in the supply pipe, the water in the controlling chamber is sucked out through the tube 43, and the check valve 52 is lifted, and the air entering through the vacuum breaker hereinafter described passes upward through the passages 53, past the check

valve and out the passages 50, thus breaking the vacuum and allowing the air to enter the supply pipe.

To supply the air thus used to break the vacuum, I employ a vacuum breaker, such as the one 27, shown in Figs. 2, 5, and 7, or modifications thereof, such as are shown in Figs. 8 and 9. Where the form shown in Figs. 7 and 9 is used, I preferably employ a tube 55, which is threaded at its outer end into the valve casing 56, shown in Figs. 1, 5, and 7, and also threaded through an aperture in the connection 26, and preferably extending to the center of the passage through the connection 26, which forms a part of the large passage for the water used in flushing through the pipe 28 to the bowl. I have found by experiments that its action is more effective if a series of eight small holes 57, seen in Figs. 1, 5, 6, 7, and 9, are employed. With the form shown in Fig. 7, I employ a ball check-valve 58 which has its seat on the top of the tube 59 threaded into the vertical portion of the elbow-shaped valve casing 56. To regulate the height that the ball may be lifted from its seat and prevent its possibly being sucked through the tube 55 into the connection 26, and thus be dropped back into the bowl, I employ the set screw 60 threaded into the top of the casing 56 and extending substantially to the ball 58. With this construction, it will be obvious that when a vacuum occurs, the ball 58 will be lifted from its seat to permit the passage of the air, but that it cannot be drawn into the tube 55.

In Fig. 8, I have shown a modification in which the horizontal arm 55^a of the valve casing 61 is threaded directly into the connection 26, and this form is enough more sensitive than the form shown in Figs. 1 to 9 so that the tube need not be extended to the center of the connection 26 and provided with the holes 57. In this form, the lower half 62 of the valve casing is separate and is threaded into the lower part of the casing 61, which is enlarged as at 63 to form a hood protecting the air inlet apertures 64 formed toward the upper end of the portion 62 of the casing. Threaded into this lower portion and closing it is a member 65 which has a well 66 formed therein by the tubular portion 67 extending upward to and very slightly above the top of the portion 62 of the valve casing, the top of the tube 67 forming the seat for the diaphragm valve 68, which is in the form of an annulus with its outer periphery held in place between the upper end of the portion 62 of the casing and the shoulder 69 formed in the portion 61 of the valve casing. The aperture 70 in the center of the diaphragm 68 is large enough, so that while the valve is normally firmly seated on the top of the tube 67, the aperture 70 will permit any water which might enter the valve casing through the tube 55^a during the flushing operation to pass through the hole 70 in the diagram into the tube 67, which acts as a well while the diaphragm is coming to a closed position, and thereby builds up a pressure on top of the diaphragm, which seats it. There is no pressure on the lower side of the diaphragm, which gives it a positive seat and prevents any leakage of the water into the outer well between the tube 67 and the portion 62 of the casing. When the vacuum occurs, it lifts the water out of the well 66, raises the diaphragm off of its seat, thus permitting the air to pass into the holes 64 over the top of the seat, 75

through the opening 70, and thence to the connection 26, thus breaking the vacuum.

In the form shown in Fig. 9, the valve casing 71 has the tube 55 screwed into its upper portion, and below this upper portion is an annular valve seat 72 formed by a washer resting on the horizontal annular flange 73 projecting from near the top of the tube 74, which is held in place by the cup-shaped lower portion 75 of the valve casing, which is threaded into the upper portion, and acting on the flange 73 and the washer 72 holds the parts in place. Apertures 76 in the cup 75 serve to admit the air, and the lower portion of the valve casing 71 extending below the apertures serves to form a protecting hood, as in the case of the form shown in Fig. 8. The valve 77 is of the mushroom type, and its stem 78 extending down through the tube 74 serves to keep it properly positioned. The action of this valve will be obvious, as the suction produced by the vacuum will tilt the valve 77 on its seat and allow the air to enter to break the vacuum.

In Fig. 11, I have illustrated my invention in the specific form shown in Fig. 9 as applied to a water-closet tank 79, in which the supply pipe 80 has an extension 81 up through the tank to the valve casting 82 provided with the valve seat 83 with which the valve 84 co-operates, which valve is seated when the water 85 rises to the level shown by the action of the float 86 through the system of levers shown, by which the valve is operated. The discharge pipe 87 extends downwardly from the valve casting 82, and during the process of filling discharges the water in the bottom of the tank until it reaches the level shown, when the valve closes and its supply ceases. The outlet pipe 88 to the closet bowl is normally closed by the valve 89 operated from the connection 90 in the customary manner. In applying my invention to this plumbing system, I open a pipe 91 having a horizontal portion 92 into the valve casting above the discharge pipe 87, and on the upper end of the pipe 91, I secure to the horizontal portion 93 the top 71^a of the valve casing, the rest of the vacuum breaker being identical in its structure and mode of operation with that shown in Fig. 9. The vacuum breaker here operates in the same manner as heretofore described, whenever the water level 85 is lowered sufficiently so that the valve 84 is lifted off of its seat and the vacuum can reach the valve 77.

Referring again to Fig. 9, so far as the present feature is concerned, the valve mechanism below the solid cross piece 43^a, which corresponds to the tube 43, is identical with that shown in Fig. 2, but the refilling passage for the controlling chamber 36, instead of being through the member 31^a, is around it, the construction being as follows:—The cap 96, which is threaded on to the casing 22 in the customary manner, has the annular offsets 97 and 98 formed on its interior, and between the offsets 97 and 98 the tubular lining 99 is brazed or otherwise secured in place, and this tubular lining extends downwardly, as seen, below the lowermost position of the cup washer 33, the piston having its bearing in the lining 99. One or more generally vertical grooves 100 are formed in the wall of the lining 99, so that the annular channel 101 formed by the shoulder 102 formed by the reduced upper end of the lining 99 and the shoulder 97 of the cap is open through channels 100 to the water filling the supply chamber 35. The

cap 96 has vertical holes 103 bored from the shoulder 97 upward to meet the transverse passage 104 formed by boring through the top of the cap and closing the end by the screw closure 105. A hollow boss 106 extends downwardly from the center of the cap and has the aperture 107 therein, which is partially closed by the end of the spring-pressed plunger 108, which end is flattened or grooved so as to permit the passage of the water which reaches it through the bores 103 and the passage 104 through the hollow 109 in the boss 106, the spring-pressed plunger being held in the casing 110 threaded into the top of the cap, the lower portion of the casing 110 being reduced in diameter sufficiently to afford a passage from the passage 104 to the hollow 109. In the solid cross piece 43^a, I screw the plug 111, it being screwed in place so that its height can be adjusted so that when the piston rises, the position at which the plug 111 strikes the valve 108 can be accurately adjusted to balance the action of the main valve and piston so that it will operate most efficiently. When a vacuum occurs in the supply pipe, the air from the vacuum breaker 71 will pass up through the holes 53, lifting the check valve 52, out through the holes 50, up through the partially closed valve seat 107, through the passage 104, bores 103, annular channel 101 and slots 100 to the union 20, and thence to the supply pipe, breaking the vacuum as before. It will be noted, with this construction, that the cap 96 can be screwed in place without the necessity of leaving it in any exact angular relation to the valve casing 22, as the channel 101 and the vertical grooves 100 in the lining 99 insure the connection being properly made irrespective of the angular position of the cap 96.

While I have herein shown in Fig. 9 and in the specification described a novel flush valve structure applicable also to flush valves not employing vacuum breakers, I do not herein claim the same, as I have claimed its novel features in a later application, No. 737,464, filed July 28, 1934.

While I have shown and described my invention as embodied in the forms which I at present consider best adapted to carry out its purposes, it will be understood that it is capable of modifications, and that I do not desire to be limited in the interpretation of the following claims except as necessitated by the state of the prior art.

What I claim as new, and desire to secure by Letters Patent of the United States, is:

1. In a flush valve, the combination with a valve casing having inlet and outlet ports and a main valve seat between them, of a main valve movable therein to and from the seat, a member connected therewith separating the casing above the valve seat into a controlling chamber and an inlet chamber and movable to vary the capacity of the controlling chamber, a relief-valve seat in said member, a relief valve in the member co-operating with the seat to control a discharge passage through said member from the controlling chamber to the outlet port, means for holding the relief valve seated, means for opening the relief valve to permit a quick discharge from the controlling chamber to the outlet port, a small filling passage from the inlet port to the controlling chamber, a check valve controlling a passage through the relief-valve opening when a vacuum occurs in the inlet port connection, and a vacuum breaker below the main valve seat.

2. A flush valve as described in claim 1 in which the check valve is a ball resting on a seat in a passage through the head of the relief valve, which passage has a plurality of branches above the ball opening ultimately to the inlet port and a plurality of branches below the seat opening ultimately into the outlet port.
3. As a new and useful article of manufacture, a vacuum breaker adapted to be inserted through the side of a conduit through which liquid is discharged at intervals, consisting of a horizontal tube extending into the conduit, a valve chamber secured to the outer end of the tube and extending parallel to the conduit, a valve seat in the chamber below the entrance

of the tube thereto, a valve cooperating with the seat, air inlet apertures in the chamber below the seat whereby water flowing down the conduit will be intercepted by the valve and prevented from escaping through the air inlets, but in case of suction upward through the conduit, air will be free to enter the inlets, pass the valve and break the vacuum, and a vertical tube which carries the valve seat within and extending below the plane of the apertures in the chamber.

4. A vacuum breaker as described in claim 3 in which the valve is the shape of a mushroom cooperating with said set.

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