

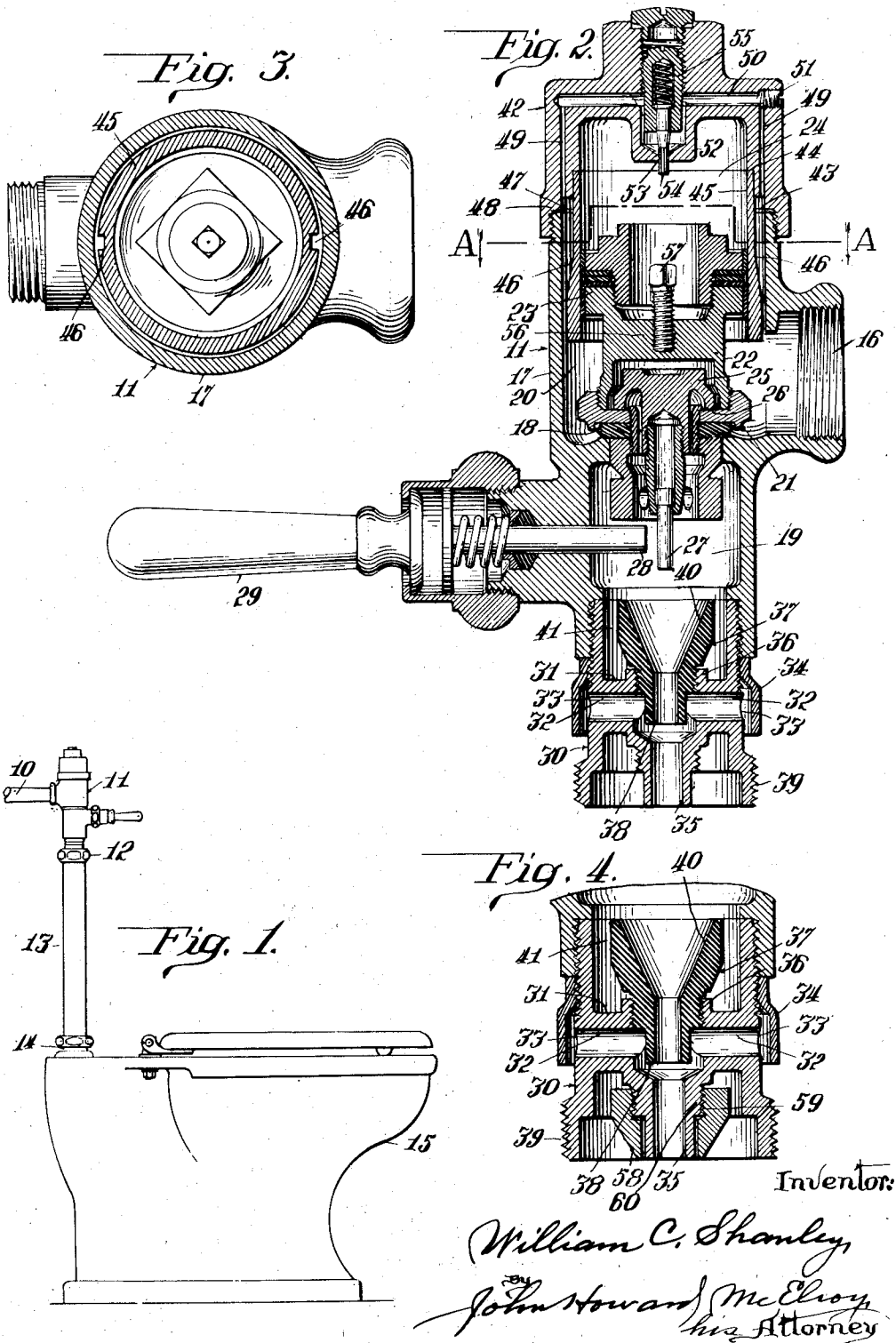
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AIR INLET DEVICE FOR FLUSH VALVES

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AIR INLET DEVICE FOR FLUSH VALVES

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My invention relates to air inlet devices for flush valves, and has for its object to provide a new and improved device of this class to be assembled in flush valves, and also to be attached to flush valves and used in connection with water-closet bowls, bidets, bed-pan washers, slop sinks and other fixtures where flush valves are used. It can also be used on ball cocks commonly used in closet tanks and house supply tanks, and on sterilizing tanks and other receptacles where the end of the supply pipe to the receptacle is submerged in the liquid.

My invention has as a further object to prevent possible contamination of the water supply due to siphoning back into it of water from a closet bowl or other receptacle in case a vacuum is created in the water supply system of the building.

My invention has as a further object, acting as a silencer due to the restriction in the discharge pipe also eliminating what is known as the line noise in the house supply system.

To illustrate my invention, I annex hereto a sheet of drawings, in which the same reference numbers are used to designate identical parts in all the figures, of which,—

Fig. 1 is a side elevation of my invention as applied to a closet bowl;

Fig. 2 is a central vertical section through a flush valve embodying my invention;

Fig. 3 is a section on the line A—A of Fig. 2; and

Fig. 4 is a view like the lower part of Fig. 2 but with an adapter added which is screwed onto the vacuum breaker and silencer when it is to be used with the blow-out type of closet bowl.

The supply pipe 10 is connected to the flush valve 11, the flushing part of which, for the purposes of my main invention, may be of any desired construction. It is connected by the union 12 with the discharge pipe or conduit 13, with the inlet 14 of a water-closet bowl 15, or any other similar receptacle to which flush valves are applied. It may be here noted that it frequently happens that the cross-sectional area of the supply pipe 10 is greater than that of the various outlets to the bowl, so that where a heavy pressure exists in the supply pipe during the flushing operation, the resistance caused by the smaller cross-sectional area of the outlets causes what is known as a back pressure in the conduit 13.

The pipe 10 is connected to the inlet 16 of the valve casing 17, which casing has therein the valve seat 18 separating the lower outlet portion 19 from the inlet or supply chamber 20. Co-oper-

ating with the seat 18 is the main valve 21 carried by the piston cylinder 22, which has at its upper end the piston 23 co-operating with the controlling chamber 24. A relief valve 25 in the piston cylinder co-operates with the valve seat 26 and has its stem 27 projecting, when the main valve 21 is seated, into the path of the plunger 28 actuated by the handle 29 in the customary manner, so that when the handle 29 is swung, the relief valve 25 opens, allowing the water in the controlling chamber 24 to pass by it to the outlet, so that the pressure of the water in the chamber 20 lifts the piston 23 to open the main valve 21 and allow the flushing to occur, all in the customary and well known manner.

In the lower end of the flush-valve casing, I place the structure now to be described, which constitutes the main novel element of the combination with which my invention is concerned. This element constitutes the vacuum breaker and also the silencer and serves to overcome back pressure which may exist in the conduit 13, and I permanently secure it within the valve casing, thus producing a construction that will render it impossible to remove the vacuum breaker without removing the flush valve also, thus preventing the possibility of contamination of the water supply, as obviously the flush valve cannot be removed and the system remain operative, whereas if the vacuum breaker could be removed without removing the valve, it might not be replaced and the system still prove operative, but subject to contamination.

For convenience of manufacture and assembly, I cast the generally cylindrical body portion 30 in a single piece, with the cross-shaped tubular member 31 integral therewith, with the horizontal passage 32 therethrough connecting the openings 33 in the walls of the body portion 30. The upper end of the portion 30 is threaded into the lower end of the flush-valve casing 17, and the collar 34 protecting the openings 33 is soldered in place to the casing 17 and to the body portion 30, so that the latter are in effect integral, and the vacuum breaker cannot be removed from the system without also removing the flush valve, which, of course, is vital to its operation. The lower end 35 of the tubular member 31 forms a nozzle, and the internally-threaded upper end 36 has the silencer member 37 adjusted therein so that its nipple-like lower end 38 extends into the passage 32, thus controlling the effective size of the aperture 33. The lower end of the body portion 30 is externally threaded, as seen at 39, to cooperate with the union 12.

The silencer member 37 is preferably formed of Bakelite, or some similar non-corrosive material which is not affected either by natural impurities in the water or by the bacteria-killing chemicals often introduced therein. Its larger upper end is connected to its lower end 38 by the flaring portion 41, which gives the silencer the general shape of a funnel and forms a restriction that materially increases the speed and pressure of so much of the flush water as passes through it, so as to prevent the possibility of the back pressure heretofore noted as sometimes existing from possibly reversing its flow and allowing any water, during the flushing operation or at any other time, to escape through the openings 33 and onto the floor of the bathroom. The external diameter of the upper end 40 is such that an annular passage 41 is left between it and the inner wall of the body portion.

The operation of this much of my invention is as follows: When the flush valve is operated, the water descends through the outlet portion 19, and in passing the silencer 37 necessarily divides into the portion passing through the annular passage 41, constituting about eighty per cent. of the flow, and that passing through the silencer, which latter portion, as previously noted, necessarily has its speed and pressure increased in passing the funnel-shaped portion 40, and emerges from the nozzle 35 with such speed and under such pressure that the back pressure, while possibly effective against the rest of the flow, cannot possibly back up the water flowing through the silencer and cause it to escape through the openings 33 and onto the floor of the bathroom. On the contrary, the velocity of the water passing through the silencer 37 is such that some air is sucked into the passage 32. As will be readily seen, in case of a vacuum in the supply pipe tending to pull the water up through the flush valve, it will be broken by the air, which was always free to enter the openings 33 and flow up through the silencer and valve, as hereinafter described, to the supply pipe 10.

Referring now to the second feature of my invention, the valve casing 17 has a cap 42 threaded onto it in the customary manner, and this cap has the annular offsets 43 and 44 formed on its interior, and between the offsets 43 and 44 the tubular lining member 45 is brazed or otherwise secured in place, and it extends downwardly, as seen, below the lowermost position of the washer of the piston 23, which has its bearing in the lining 45. One or more generally vertical grooves 46, best seen in Fig. 3, are formed in the wall of the lining 45, so that the annular channel 47 formed by the shoulder 48 formed by the reduced upper end of the lining 45 and the shoulder 43 of the cap is open through the channels 46 to the water filling the supply chamber 20. The cap 42 has vertical holes 49 bored from the shoulder 43 upward to meet the transverse passage 50 formed by boring through the top of the cap and closing the end by the screw closure 51. A hollow boss 52 extends downwardly from the center of the cap and has the aperture 53 therein, which is partially closed by the end of the spring-pressed plunger 54, which end is flattened or grooved so as to permit the passage of the water when it reaches it through the bores 49 and the passage 50 through the hollow in the boss 52, the spring-pressed plunger being held in the casing 55 threaded into the top of the cap, the lower portion of the casing being reduced in diameter sufficiently to afford a passage from

the passage 50 to the hollow of the boss 52. In the cross piece 56 in the piston cylinder, I screw the plug 57, it being screwed in place so that its height can be adjusted so that when the piston rises, the position at which the plug 57 strikes the valve 54 can be accurately adjusted to balance the action of the main valve and the piston, so that it will operate most efficiently. When a vacuum occurs in the supply pipe, the air from the vacuum breaker will pass up through the piston cylinder after tilting the valve 25 through the aperture 53, hollow boss 52, bores 50 and 49, annular channel 47 and slots 46 to the inlet 16, and thence to the supply pipe 10, breaking the vacuum as before. It will be noted, with this construction, that the cap 42 can be screwed in place without the necessity of leaving it in any exact angular relation to the valve casing 17, as the channel 47 and the vertical grooves 46 in the lining 45 insure the connection being properly made irrespective of the angular position of the cap 42.

When my silencer and vacuum breaker is intended to be used with a blow-out closet bowl, which has a greater back pressure than other types of closet bowls, it is necessary to reduce the area for the passage of the water during the flushing operation still more, and in order that it may be used interchangeably with either type of bowl, I employ the adapter 58 seen in place in Fig. 4. It preferably takes the general shape of a hollow inverted truncated cone with its larger upper end internally threaded at 59, and adapted, when needed, to be screwed onto the threaded portion 59 of the lower end 35 of the tubular member 31. When it is in place, it reduces the cross-sectional area of the passage so that the pressure of the water during the flushing operation is increased sufficiently to counterbalance the increased back pressure found in this type of bowl. For the ordinary type, it is, of course, not used.

While I have shown the mechanism which operates as a silencer and to overcome back pressure as operating as a vacuum breaker by providing the air inlets 33, it will be understood that if said inlets were not provided, the mechanism would still operate as a silencer and to overcome back pressure, and that claims omitting the vacuum breaker feature are not to be construed as limited to a structure capable of acting as a vacuum breaker.

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 may be 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 flushing apparatus for toilets, the combination with a conduit for flushing liquids, of a silencer therein consisting of a funnel-shaped member contracted toward its outlet and supported therein and leaving an annular passage about its upper end and furnishing a contracted orifice through its center adapted to have flushing liquid only passing downwardly therethrough.

2. A device as described in claim 1 in which the silencer is supported by and opens into a transverse tube in the conduit registering with an opening to the air in the conduit wall so as to break a possible vacuum above it.

3. A device as described in claim 1 in which an adapter to reduce the cross-sectional area of the annular passage is secured in the conduit.

5 4. A device as described in claim 1 in which the funnel-shaped member is supported by and opens into a transverse tube in the conduit registering with an opening in the conduit wall and having a downwardly extending vertical portion upon which an adapter is secured to reduce
10 the effective cross-sectional area of the annular passage.

5 5. In a device of the class described the combination with a conduit for liquids having an opening in the wall thereof, of a transverse tube in the shape of a cross therein registering with an opening in the conduit wall so as to break a possible vacuum above it, and a silencer threaded into the upper vertical portion of the tube and extending down into the transverse portion.

20 6. A device as described in claim 5 in which the lower vertical portion of the cross forms a nozzle into which the silencer discharges.

7. In a control device for use in systems through which liquid passes and where back pressure may occur, a tubular body having an interior portion of progressively decreasing internal diameter secured therein, the largest external diameter of said portion being smaller than the internal diameter of said tubular body and concentrically spaced therefrom to admit a primary
30 flow of liquid therebetween, a passage leading from said interior portion to furnish passage for a secondary flow of liquid under increased pressure, an air vent between the atmosphere and said
35 secondary stream operating to admit air into said secondary stream and on cessation of flow to admit air in response to a demand by a vacuum which may exist above the tubular body.

8. In a control device for use in systems through which liquid passes and where back pressure may occur, a tubular body having an interior portion secured therein, the large external diameter of said portion being smaller than the internal diameter of said tubular body and spaced therefrom to admit a primary flow of liquid therebetween,
40 a passage leading from said interior portion to furnish passage for a secondary flow of liquid, an air vent between the atmosphere and said sec-

ondary stream operating to admit air into said secondary stream and on cessation of flow to admit air in response to a demand by a vacuum which may occur above said tubular body.

9. In a vacuum breaker, the combination with
5 a casing having an air-inlet aperture in its side, of a member therein forming a concentric passage and nozzle for flush water passing there-through, another member having an outlet into which the nozzle discharges, and an attachment
10 cooperating with said members to reduce the area of the passage through the casing to adapt it for blow-out types of bowls.

10. A vacuum breaker as described in claim 9 in which said attachment consists of a ring
15 threaded onto the under side of the second mentioned member.

11. In a vacuum breaker, the combination with an inlet member having its internal cross sectional area reduced to form a nozzle through
20 which water is discharged downwardly, of an outer casing having air-inlets surrounding and spaced away from the nozzle and having an inwardly directed portion below said nozzle forming an outlet with its edge cooperating with the nozzle to form an annular passage through
25 which passage air from the inlets is sucked downwardly with the water when flushing and through which air is passed upwardly through the nozzle in breaking a vacuum.

12. A control device for use in systems through which liquid passes and where back pressure may occur, made up of a tubular body having an inlet therein and an interior portion of progressively decreasing interior diameter attached
35 thereto, the greatest external diameter of said portion being smaller than the internal diameter of said body, and spaced therefrom to admit a primary flow of liquid therebetween, a passage leading from the interior portion to furnish passage for a secondary flow of liquid therethrough
40 under increased pressure, said increased pressure being of greater magnitude than the back pressure from said flush connection, the device thereby operating to counteract said back pressure.
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