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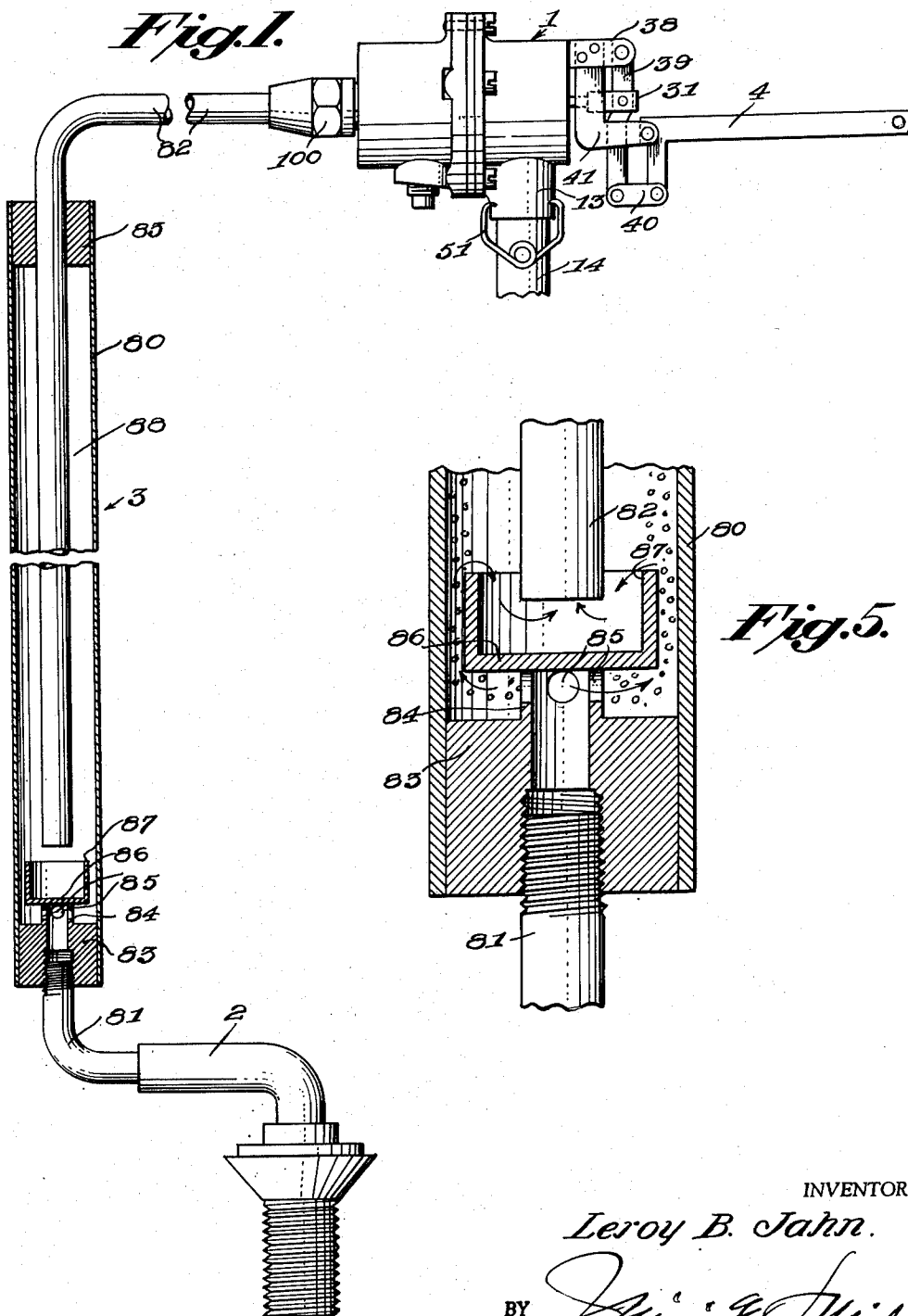
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2,802,481

ANTI-SIPHONING VALVE

Filed Dec. 16, 1954

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

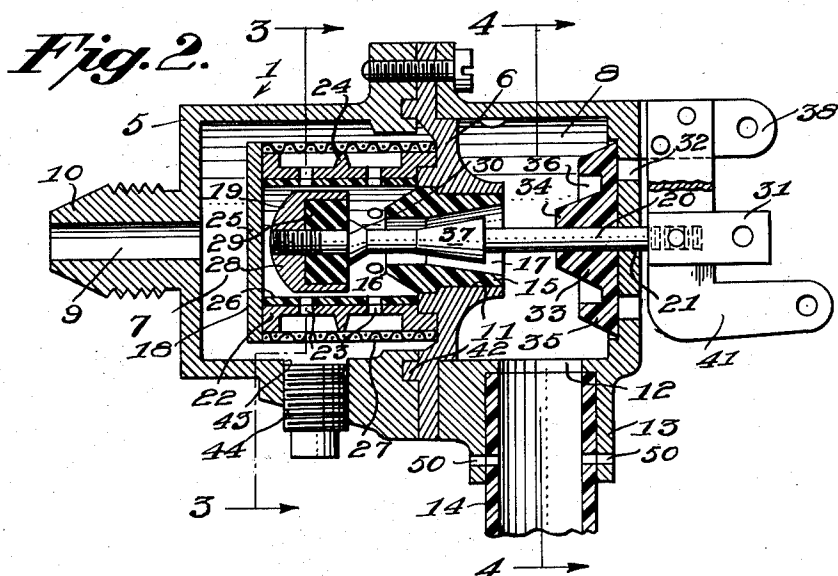


Fig. 3.

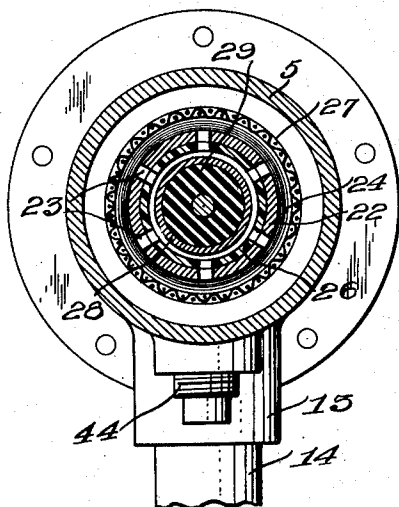
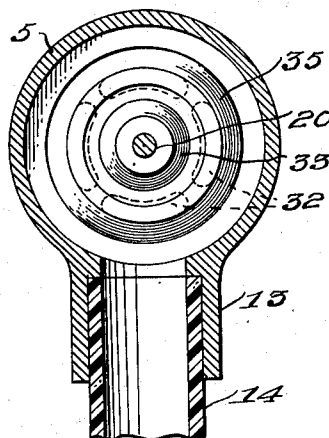


Fig. 4.



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ANTI-SIPHONING VALVE

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1 Claim. (Cl. 137—218)

This invention relates to a supply valve and water supply pipe, especially for use with water closets and is an improvement on and continuation-in-part of my copending application Serial No. 287,380, filed May 12, 1952, now Patent No. 2,762,059 granted September 11, 1956, for Water Closet Flushing Mechanism.

It is an object of the invention to provide a water inlet system, particularly for a flush tank, that is quiet in operation.

It is another object of the invention to provide a supply system that is efficient in operation, is simple and economical in design and construction and is automatic.

It is still another object of the invention to provide an automatic, pressure operated quick closing supply valve.

It is a further object of the invention to provide an automatic, pressure closing supply valve having anti-siphoning means and which is capable of withstanding long use and wear without deterioration.

It is a still further object of the invention to provide a connection between an automatic pressure operated quick closing supply valve and supply pipe having an automatic, self supplied air cushion for absorbing the surge of quick closing and eliminating the chattering, jarring noises incident to the closing of the valve.

It is yet another object of the invention to provide a water inlet connection for a supply valve wherein the air is removed from the water during the supplying of the water.

The novel features that are considered characteristic of the invention are set forth with particularity in the appended claim. The invention itself, however, both as to its organization and its method of operation together with additional objects and advantages thereof, will best be understood from the following description of specific embodiments when read in connection with the accompanying drawing, wherein like reference characters indicate like parts through the several figures and in which:

Figure 1 is a side view of a supply valve and supply connection with the latter shown in section;

Figure 2 is a cross-sectional view taken axially of the inlet valve shown in elevation in Figure 1;

Figure 3 is a cross-sectional view corresponding to line 3—3 of Figure 2;

Figure 4 is a cross-sectional view corresponding to line 4—4 of Figure 2, and

Figure 5 is an enlarged fragmentary vertical section of the lower end of the supply connection and showing the means for separating air from the water.

Referring now to the drawing, specifically to Figure 1, the present invention is broadly concerned with water supply means, particularly but not necessarily for supplying water to a flush tank mechanism, the water being supplied free from air and foreign substances. This water control mechanism comprises, in general, a supply valve 1 connected to a water supply pipe 2 by means of an intermediary air detaining and cushion device 3. When used with flush tanks, the supply pipe 2 is at-

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tached to the bottom of the tank in the usual manner, while the valve is operated by a control lever 4.

The valve comprises a sectional casing 5, preferably substantially cylindrical, that is divided by a transverse partition 6 to define an inlet chamber 7 and an outlet chamber 8. The chambers 7 and 8 are preferably cylindrical as shown in Figures 3 and 4. The inlet chamber 7 is provided with an inlet opening 9, preferably axially disposed, and is provided with a standard fitting 10 on the casing 5 for connection with a supply pipe. The partition 6 is provided with an opening 11 which connects the two chambers 7 and 8 substantially axially thereof. An outlet opening 12 from the outlet chamber 8 is surrounded by a boss 13 integral with the casing 5 and adapted to receive a discharge tube 14. The boss 13 and tube 14 are provided with corresponding diametrical holes 50, as shown in Fig. 2, and the tube is secured by a spring clip 51, as shown in Fig. 1, having opposed prongs for insertion in said holes 50.

A valve seat and passage member 15, comprising a tubular element made of nylon or the like, is mounted in the opening 11, this member having a valve seat 16 at one end protruding beyond the partition 6 and a water passage 17 having a conical wall at the outlet portion thereof.

A cylindrical cage or valve chamber 18 is mounted on the inlet side of the partition 6 and surrounds the valve seat 16, and a valve member 19 is slidable in the cage or chamber 18 for cooperation with the valve seat 16. The member 19 is mounted on one end of a valve stem 2 which passes freely through the passage 17 in the valve seat member 15 and extends through and is slidable in a hole 21 of the casing 5 substantially axially of the outlet chamber 8.

The cage 18 comprises a brass cylinder 22 provided with a plurality of circumferential rows of apertures 23 with the apertures of one row preferably staggered in relation to the apertures of the other row. The rows are separated by at least one annular bevelled flange 24 and radially outward flanges at each end. The end of the cylinder 22 is closed by a plate 25 having a diameter slightly greater than the flanges on said cylinder. Within the cylinder is a sleeve 26, made of nylon or the like and provided with openings to register with the openings 23 of the cylinder 22 to permit the water to enter the cage. This sleeve 26 forms a slide for the valve member 19 and protects the cylinder from wear and corrosion. Surrounding the cylinder 22 and supported by the flanges thereof is a cylindrical screen 27 which is held in place between the rim of the plate 25 and partition 6. This screen 27 excludes sand or other foreign matter from the cage and passage 17.

The valve member 19 comprises a rigid outer cap 28 having a skirt and an axial internally threaded bore, and an inner washer 29 of rubber or the like and having an axial bore. The valve stem 20 has a threaded portion at its inner end for engagement within the bore of the cap 28 and spaced from the threaded inner end the stem is provided with a flange 30 having a radial surface disposed to be substantially coplanar with the rim of the cap skirt and a conical surface extending from said radial surface. The radial surface of the flange 30 is adapted to flatly abut the adjacent surface of the washer 29 and retain the washer in position while the conical surface of said flange is adapted to engage the inner edge of the valve seat 16 and center the valve member 19 so that the washer 29 is axially seated on the valve seat 16.

The rear end of the valve stem 20 is connected beyond the casing 5 with a connecting member 31, preferably the stem being threaded into the member 31 and being secured by a lock pin. The casing 5 has in its rear wall, surrounding the valve stem opening 21, a plurality of anti-siphoning openings 32, and, when the valve is open, these openings are closed by a check valve 33 which is slidably

mounted on the valve stem 20 within the outlet chamber 8. This check valve 33 comprises a disc of nylon or the like and having a flat rear surface for engaging the casing wall to cover the openings 32, the casing wall being recessed slightly to receive the check valve. On its front face, the check valve has a protruding frusto-conical collar 34 surrounding the axial bore by which the check valve is mounted on the valve stem, and a protruding skirt 35 around its peripheral portion and forming an annular channel 36 surrounding the collar.

The valve stem 20 is provided intermediate its length with a flared portion 37 having a conical surface which is oppositely disposed relative to the conical flange 30. The portion 37 is moved into the conical portion of the passage 17 when the valve 19 is opened and moved from the seat 16, and these portions cooperate to deflect water passing through the passage 17 into a stream in the form of a conical sleeve that impinges against the check valve within the annular channel 36 so that the force of the water presses the check valve 33 against the wall of the casing 5 to close the openings 32.

Spaced apertured ears 38 extend from the top of the rear wall of the casing 5 and straddle and pivotally support the upper end of a lever 39 which is pivotally connected intermediate its length to the valve stem connector 31 and at its lower end to a link 40. A bifurcated angle bracket 41 is rigidly secured at its upper end between the ears 38, the arms of said bracket straddling the connector 31 and the lever 39. The valve actuation lever 4 comprises a bell crank which is pivotally connected at one end with the link 40 and intermediately pivotally mounted between the arms of the bracket 41.

As shown, the casing 5 is preferably in two parts with the partition 6 secured therebetween and sealed by an annular flange 42 on the partition nesting in a complementary groove in the inlet housing portion. The inlet chamber 7 is provided on the bottom with a threaded drain port 43 to permit collected foreign matter surrounding the cage or chamber 18 to be washed out. A threaded drain plug 44 normally closes the drain port 43.

When in operation, the lever 4 is pulled down which moves the link 40 which swings the lever 39 that pushes the connector 31 toward the casing 5 and slides the valve stem 20 inwardly or forwardly to move the valve 19 away from the seat 16. Water is then admitted from the inlet chamber 7, through the cage 18 and valve passage 17 into the outlet chamber 8 and then out through the outlet 12 and tube 14. When the water enters the inlet chamber 7 through the inlet opening 9 it is diverted by the end plate 25 to permit settling of foreign matter. The water then passes through the cage, which screens out any foreign matter, so that only clean water passes through the passage 17. Upon movement of the valve stem 20 to open the valve 19, the check valve 33 is carried by the rod away from the wall of the casing. However, as the water passes through the passage 17 it is deflected by the flared portion 37 to impinge upon the check valve 33 and the water stream is trapped within the channel 36 so that the force of the water slides the check valve 33 back along the stem 20 into engagement with the casing wall to seal the openings 32.

When the outlet chamber 8 is receiving water from the passage 17, considerable pressure is built up within the chamber which holds the check valve 33 tightly against the casing to prevent water from leaking through the apertures 32. When the valve 19 is closed, the water settling out of the outlet chamber 8 creates a momentary vacuum within the chamber and the normal atmospheric pressure on the outside moves the check valve 33 away from its seat by the inrush of air through the apertures 32, thus leaving a free air passage through apertures 32 around the check valve and through the valve and precluding any syphoning suction in the supply pipe 14. Should vacuum be created in chamber 8 from any cause,

syphoning of the water is prevented by the inlet of air through the openings 32.

The valve member 19 may be moved to closed position either by lifting the lever 4 or merely by releasing said lever because the pressure of the incoming water will then force the valve member 19 against its seat 16. As the valve member 19 moves toward its seat 16, the conical portion of the flange 30 on the stem 20 engages the inner edge of the seat 16 and centers the valve member relative to the seat 16 so that the washer 29 squarely engages the seat 16.

Another of the major objects of the invention is to eliminate the excessive noise inherent to present water supply mechanism and to provide an air cushion for fluid lines and also to remove air from the water. Referring more particularly now to Figures 1 and 5 of the drawing, the improvement resides in the air cushion device 3 which comprises a tubular casing 80 which is joined at its lower end with the end of an inlet pipe 81 that is connected with the supply pipe 2, said casing 80 being joined at its top with the outlet pipe 82 which is connected with the valve 1 by the usual fitting 100. The outlet pipe 82 extends down into the casing 80 a considerable distance, preferably to within a short distance from the lower end of the casing, and forms an annular chamber 88 between the pipe 82 and casing 80.

The pipes 81 and 82 are connected to the casing 80 by any well known means such as by sleeve plugs 83, 83' which are threaded, sweated or otherwise secured to the casing and the pipes. A small tubular extension 84 is provided on the lower sleeve 83 and in communication with the inlet pipe 81. This tubular extension 84 is provided, adjacent its upper end and above the sleeve 83 with a plurality of lateral openings 85 and the upper end of said tubular extension 84 is closed by a baffle 86 above the openings 85 and extend radially beyond said member. The baffle 86 is of size or diameter smaller than the inner diameter of casing 80 so as to provide a relatively narrow annular passage adjacent the casing walls. The baffle 86 may be and preferably is provided with an upwardly directed skirt 87 and the upper edge of this skirt may terminate below (Fig. 1) but preferably terminates above (Fig. 5) the lower edge of outlet pipe 82.

In the operation of this fitting, the water is supplied to the lower end of the casing 80 from the inlet pipe 81 and through the extension 84. As the water passes through the fitting its course and velocity is suddenly altered by the baffle 86 and lateral ejection through the holes 85. This sudden alteration of flow creates turbulence in the water which releases entrained air so that the air separates from the water to form bubbles. The detrained water and air bubbles are then forced to the periphery of the casing 80 before passing upwardly around the edge of the baffle 86. As indicated in Fig. 5, the detrained air bubbles rise through the water in the casing 80 adjacent the casing wall into the annular chamber around the pipe 82 while the air-free water flows inwardly to the lower end of the outlet pipe 82 as indicated by arrows. The skirt 87 on the baffle 86 assists in guiding and maintaining the air bubbles within an annular layer around the casing 80.

This fitting also has the advantage of eliminating the noises and water hammer in the supply line. The sudden interruption of water flow caused by the closing of a valve, particularly the pressure actuated valve 1, to which the outlet pipe 82 is connected causes a surge of fluid, the inertia of which must be accounted for. This surge of fluid passes up into the annular chamber 88 surrounding the pipe 82 and compresses the air accumulated therein. The compressibility of the air provides resilient cushioning for the sudden surge of fluid and eliminates the force thereof. In the event the annular chamber 88 becomes filled with air, excess air will reach the lower end of outlet pipe 82 and escape leaving sufficient air in the annular chamber to serve as an air cushion. The air

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cushion is constantly replenished by the detained air bubbles.

Although a certain specific embodiment of the invention has been shown and described, it is obvious that many modifications thereof are possible. The invention, therefore, is not to be restricted except in so far as is necessitated by the prior art and by the spirit of the appended claim.

What I claim is:

An inlet valve comprising a casing, a partition in said casing and forming an inlet chamber and an outlet chamber, means for connecting a water supply with said inlet chamber, said partition having an opening defining a passage from said inlet chamber to said outlet chamber, a valve seat on said partition and surrounding said passage, a valve in said inlet chamber, a stem carrying said valve and movably extending through said passage and said valve seat, said valve being cup-shaped in cross-section and having a socket receiving said stem, a washer positioned in said cup-shaped valve and surrounding said stem, and means on said valve stem for retaining said washer in said valve and having a cam surface engageable with said valve seat to center said valve relative to said seat, said casing having an inlet opening into said inlet chamber and substantially aligned with said passage, an anti-clogging means surrounding said valve and valve seat and secured to said partition within said inlet chamber, said anti-clogging means comprising a perforated cage forming a chamber surrounding the valve seat and housing the valve, an imperforate plate closing the end of the cage facing the inlet to preclude direct inlet pressure on the valve, a cylindrical screen between said plate and said partition and surrounding said cage in spaced relation, a cylindrical nylon sleeve lining the inner surface of the cage and provided with openings registering with the openings of the cage, and flanges on the outer surface of said cage at each end and intermediate the ends and

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supporting said screen, said casing having anti-siphoning apertures in said outlet chamber, a check valve slidable on said stem within said outlet chamber to close said apertures but movable therefrom upon creation of vacuum in said outlet chamber, said check valve comprising a disc having a frusto-conical hub portion and an annular flange spaced from said hub portion to provide an annular channel between said hub portion and annular flange, said passage having a conical portion, and a flared portion on said stem to direct water to said annular channel and force said check valve against the casing wall to cover said apertures.

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