

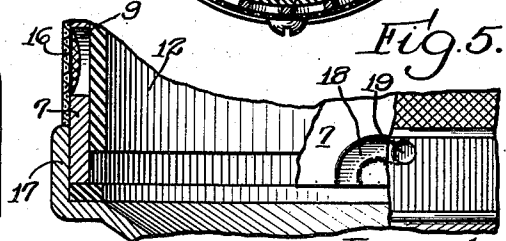
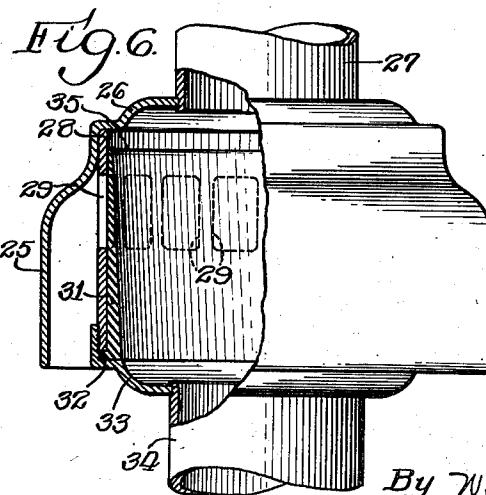
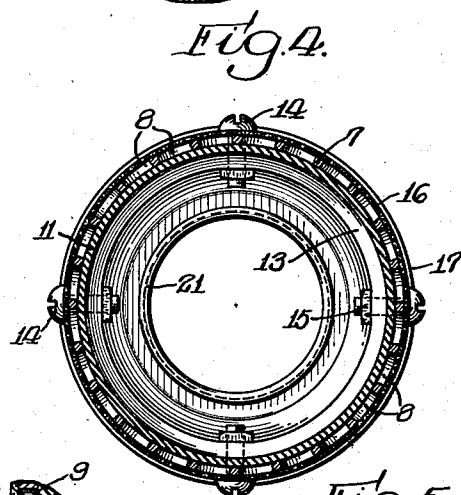
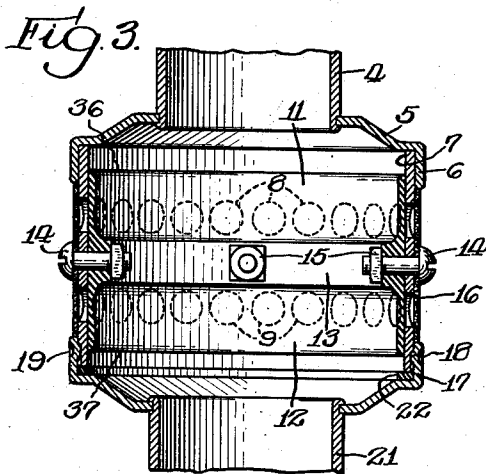
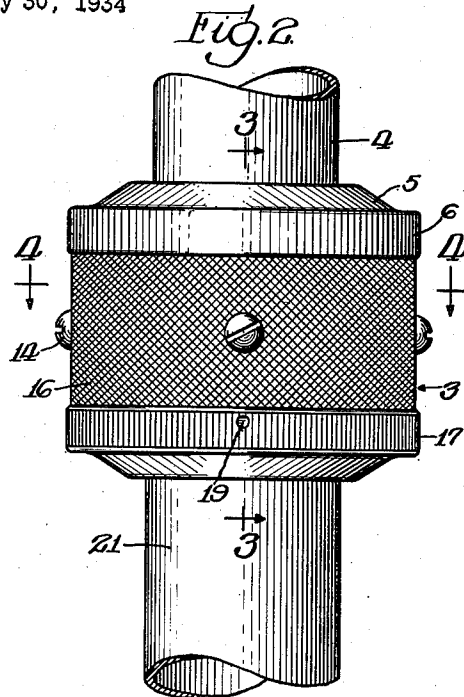
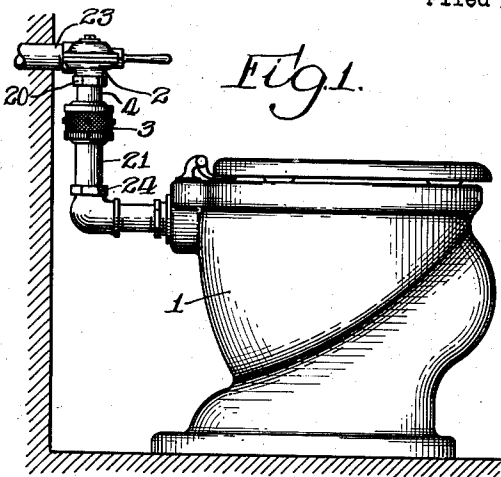
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VACUUM BREAKING DEVICE

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VACUUM BREAKING DEVICE

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13 Claims. (Cl. 4—70)

This application pertains to vacuum breaking devices intended particularly for installation in conjunction with closets.

This invention is intended to break the vacuum in supply systems for closets and prevent siphoning, which is a condition which occurs under circumstances altogether too familiar to require detail explanation. Some of the devices heretofore provided which include metal valves seated on metal seats have the disadvantage that they are subject to the effects of corrosion and are hence unreliable. Some of the prior devices, for preventing siphoning from the closets back into supply systems, have been objectionable in that when breaking a vacuum and when subjected to back pressure they allow a certain amount of water to spill on the floor near the closet.

This invention provides apparatus which is certain of operation, is not affected by the types of corrosion present in the usual supply systems, and which does not leak water either in conjunction with vacuum breaking or as a result of back pressure.

The attainment of the foregoing advantages constitutes some of the objects of this invention. Other objects and advantages will be described hereinafter.

Referring now to the drawing:

Fig. 1 is a side elevation showing my invention installed for normal use,

Fig. 2 is an enlarged elevation of the vacuum breaking device itself,

Fig. 3 is a central vertical section of the same device taken on the line 3—3 of Fig. 2,

Fig. 4 is a horizontal sectional view on the line 4—4 of Fig. 2,

Fig. 5 is a sectional view of a portion of the device showing the bayonet locking feature employed in the device, and

Fig. 6 is a view partly in section and partly in elevation of a modified form of my invention.

Further referring to the drawing, when the apparatus is installed for use it is connected between a closet 1 and a valve 2 of the flushometer type, the latter receiving water directly from the supply line and discharging it at the will of the operator through my device which is generally designated as 3.

The device includes an inlet pipe 4 which is secured by spinning (as shown) to an upper cap 5. Secured within the flange 6 of the cap 5 by a drive fit is annulus 7 having an upper row of closely spaced perforations 8 and a lower row of similarly spaced perforations 9, each row extending entirely around the annulus. The

parts 4, 5, 6, and 7, thus far described, are preferably made of rust-proof materials, such as brass or the equivalent and have sufficient rigidity for the purposes they serve.

Positioned within the annulus in a manner to cover both rows of perforations is a rubber sleeve having an upper portion 11 and a lower portion 12 formed unitarily with a central circumferential ridge or thickened portion 13. A plurality of screws 14 provided with nuts 15 may be employed in the manner shown for securing the rubber sleeve within the annulus, the heads of the screws resting on the outside of and retaining a tubular screen 16. This screen is intended to discourage children and meddlesome persons from introducing foreign substances into the interior of this vacuum breaker.

The lower edge of the annulus is connected with a bottom cap 17, the connection being preferably made by means of a plurality of bayonet slots 18 (see Fig. 5) functioning in conjunction with struck-in buttons 19 provided on the cap. The outlet pipe 21 is secured to the bottom cap 17 preferably by spinning as shown. When the lower cap and annulus are being assembled together, the shape of the bayonet slots will force the lower edge of the annulus tightly down upon a gasket 22.

In the operation of the device shown in Figs. 1 to 5, inclusive, whenever the valve 2 is opened in the usual manner for flushing the closet, the water from the supply pipe 23 will flow through this vacuum breaker without any disturbance of the rubber sleeve. Should any back pressure from the closet back toward the valve build up, this increase of pressure will serve to seal more tightly the rubber sleeve upon the perforations 8 and 9 which open to the atmosphere through the screen. Should a partial vacuum occur from the supply line under conditions which might tend to siphon water from the closet when the valve 2 is open, the upper and lower portions of the rubber sleeve will collapse inwardly, uncovering the perforations and permitting air from the surrounding atmosphere to enter and break the vacuum, thus avoiding drawing water from the closet up into the supply line. Upon termination of the vacuum the rubber sleeve will automatically restore itself in the position shown in Fig. 3 and cover the perforations.

In order to comply with possible extreme conditions where the vacuum may suddenly become very great, it is contemplated that the total area of the perforations 8 and 9 shall be approximately three times the cross sectional area of

the pipe 4. The obtaining of this ratio is possible by employing a double row of perforations. The device shown in Fig. 3 is substantially full size for the average closet installation and the rubber sleeve therein shown is intended to be sufficiently flexible to be responsive to any vacuum which is sufficient to draw water upwardly from the closet and to have sufficient resiliency to restore itself thereafter to sealing position.

The ease with which the device may be disassembled by means of the bayonet slots facilitates the replacement of the rubber sleeve should the latter deteriorate.

The upper and lower connecting tubes of the vacuum breaker preferably are connected in the fluid system between the valve and closet by being inserted into the compression nuts 20 and 24, a connection commonly employed with closets.

The modified form of the invention shown in Fig. 6 employs, instead of a protective screen, a bell-shaped apron surrounding the air inlet ports. Also the form of the rubber valve differs. In this modification a protective apron 25 having a reduced portion 26 is secured preferably by spinning, as shown, to the inlet pipe 27. An annulus or cylindrical member 28 having a single row of elongated apertures 29 is fitted into the bell 25, as shown, by a pressed fit. A cylindrical rubber sleeve 31 is positioned, as shown, with an outwardly extending flange 32 thereof clamped between the bottom cap 33 and the annulus 28. The threaded connection of these two parts enables a tight seal to be formed at this point. The cap 33 is connected preferably by spinning to the outlet pipe 34, as shown. It is preferred that the rubber sleeve 31 have a tapered cross section, as shown in the drawing, so that the upper portion thereof which covers the air inlet ports 29 may readily be responsive to partial vacuum and thus be drawn inwardly to uncover the ports.

It is noted that the ports are elongated and may have the proportions shown substantially at full size in this figure. The total area provided through these ports and through the opening within the bottom of the bell 25 will be substantially equal and several times the cross sectional area of the air inlet pipe so that assurance may be given that suddenly created vacuums in the pipe 27 will be broken by the admission of air in sufficient quantities through the inlet ports. Slight vacuums will readily uncover a small amount of port area while large vacuums will readily fold the rubber sleeve inwardly enough to freely open the ports. Upon cessation of vacuum the rubber sleeve will restore itself to port sealing position. Should any back pressure from the water occur within the device of Fig. 6 during operation, the rubber sleeve will keep the ports tightly sealed and prevent leakage of water.

The edge 35 of the rubber sleeve shown in Fig. 6 and edges 36 and 37 of the rubber sleeve shown in Fig. 3 preferably should be chamfered, as shown, to prevent drops of water from accumulating on such of these edges as face upwardly. If water could accumulate on these edges it might seep in back of the rubber sleeves and leak to the outside. The sleeve of Fig. 3 is chamfered at top and bottom so that either edge may be placed uppermost.

It should be understood that the drawing and specification disclose two embodiments of the invention which have been selected to illustrate the nature and character of the invention without suggesting that the invention is limited to

the two embodiments shown. Other embodiments and variations of the invention are contemplated and are intended to be included within the scope of the appended claims.

Having shown and described my invention, I claim:

1. In a fluid system, the combination of a tubular member for guiding the flow of a liquid, an air inlet vent communicating to atmosphere in the wall of said member, and a resilient tubular valve normally covering said vent and constructed to collapse radially inwardly upon the existence of a partial vacuum within said tubular member.

2. In a fluid system, a tubular member for guiding a liquid flow, an air inlet vent communicating with the atmosphere in a wall of said member, and a flexible tubular valve secured within said member normally closing said vent and constructed to yield inwardly responsive to a partial vacuum for uncovering said vent.

3. In a fluid system, a tubular member for guiding a liquid flow, an air inlet vent communicating with the atmosphere in a wall of said member, a flexible tubular valve secured within said member normally closing said vent and constructed to yield inwardly responsive to a partial vacuum for uncovering said vent, and an annular guard member surrounding said tubular member and providing communication from said vent to the atmosphere only at a level well below said vent.

4. In a fluid system, a tubular member arranged with its axis in vertical position for conducting a liquid, an air vent in the wall of said member communicating with the surrounding atmosphere, and a resilient, flexible tubular valve positioned within said member secured to the inner wall thereof below said vent and extending upwardly and positioned for normally closing said vent and yieldable responsive to a partial vacuum within said member to uncover said vent for admitting air.

5. In a fluid system, a tubular member for conducting a liquid when in use being arranged with its axis in vertical position, a plurality of ports in the wall of said member communicating with the surrounding atmosphere, and a tubular resilient, flexible rubber valve secured within said member in sealed relation with the interior surface thereof below said ports and extending upwardly therefrom normally to cover and seal said ports and being constructed to yield inwardly responsive to a partial vacuum within said member to uncover said ports.

6. In a fluid system, a tubular member for conducting a liquid when in use being arranged with its axis in vertical position, a plurality of ports in the wall of said member communicating with the surrounding atmosphere, and a guard member secured to the upper end of said tubular member extending downwardly and in spaced relation to said member to a level well below said ports having imperforate side walls and providing an opening to atmosphere communicating with said ports at its lower margin, the area of the last said opening and the area of said ports each being substantially greater than the cross sectional area of the upper inlet of said tubular member.

7. A vacuum breaker comprising a tubular member arranged when in use with its longitudinal axis in vertical position with its inlet end uppermost and connectible with a supply pipe in which a partial vacuum may occur, an air inlet

vent in the wall of said member communicating to atmosphere, and a resilient rubber sleeve secured to said wall below said vent and having an imperforate tubular portion extending upwardly over said vent normally sealing it and resiliently yieldable radially inwardly responsive to a vacuum pulling from said inlet.

8. A vacuum breaker comprising a tubular chamber having an air inlet aperture in its tubular wall, a flexible tubular sleeve normally sealing said aperture and capable of collapsing inwardly to unseal the same during existence of a partial vacuum within the chamber, a fluid inlet member at one end of said chamber, and a fluid outlet member at the opposite end of said chamber.

9. A vacuum breaker comprising a tubular chamber, fluid inlet and outlet connections at opposite ends of said chamber, the chamber walls intermediate said connections having air inlet apertures, and a flexible tubular sleeve in part affixed to said walls and leaving a movable marginal portion positioned to overlie said apertures normally and collapsible inwardly responsive to a vacuum to uncover said apertures.

10. A vacuum breaker comprising a tubular chamber, a tubular inlet connection at one end of said chamber, a tubular outlet connection at the other end of said chamber, air inlet apertures arcuately disposed in the side walls of said chamber, and a resilient tubular sleeve posi-

tioned normally to close said apertures but in part collapsible inwardly to uncover them under the action of a vacuum.

11. A vacuum breaker comprising a tubular chamber having a plurality of air inlet apertures in its wall, fluid inlet and outlet connections at opposite ends of said chamber, and a flexible diaphragm secured to said wall adjoining said apertures and having a movable marginal portion normally sealing said apertures but movable inwardly responsive to a vacuum in the chamber to unseal said apertures.

12. A vacuum breaker comprising a tubular chamber having a plurality of arcuately arranged air inlet apertures in its wall, fluid inlet and outlet connections at opposite ends of said chamber, and a flexible diaphragm secured to said wall adjoining said apertures and having a movable marginal portion normally sealing said apertures but movable inwardly responsive to a vacuum in the chamber to unseal said apertures.

13. A vacuum breaker comprising a body member having liquid inlet and outlet connections and providing a tubular chamber surrounding the area to be occupied by a stream of liquid flowing therethrough, air inlet ports in the tubular wall of said chamber, and a tubular sleeve for sealing said ports to prevent leakage of the liquid and movable to admit air responsive to a vacuum in said chamber.

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