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2,746,477

VACUUM BREAKERS

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Fig. 1

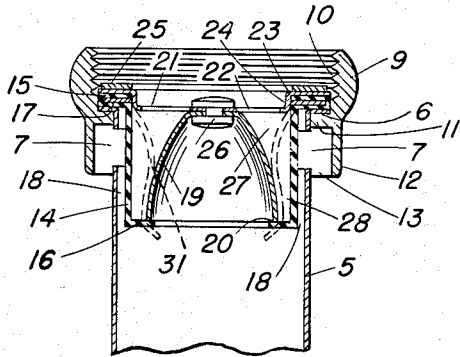


Fig. 2

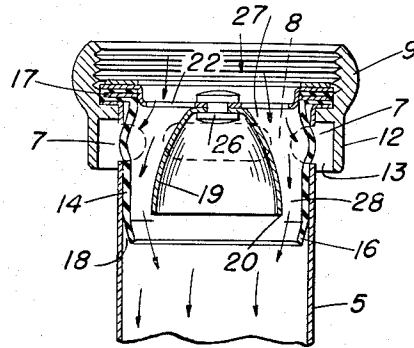


Fig. 3

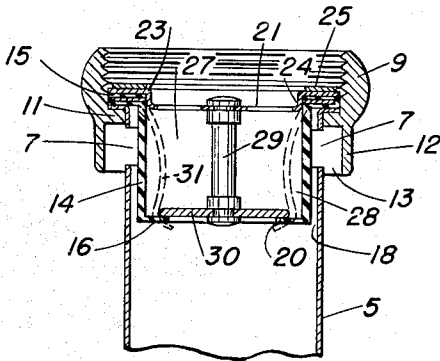


Fig. 4

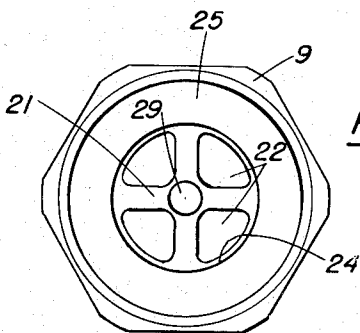
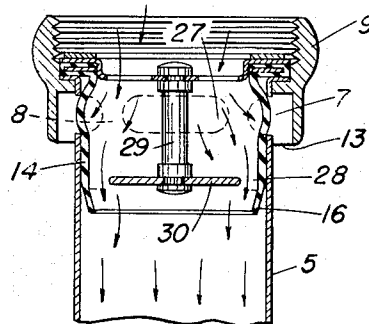


Fig. 5

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VACUUM BREAKERS

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2 Claims. (Cl. 137—218)

This invention relates in general to vacuum breakers particularly adaptable for use in water supply systems where there is danger of back syphonage occurring from contaminated plumbing fixtures such as water closets and the like.

The principal object of the invention is to provide a new and improved vacuum breaker and check valve which is positively leak proof under all conditions and which will perform in a reliable manner to prevent back syphonage from a plumbing fixture.

Another object is to provide a new and improved vacuum breaker which will not appreciably restrict the flow of water therethrough at low inlet pressures and which will not leak when relatively high back pressures exist at the outlet end thereof.

Further objects of the invention reside in the provision of a new and improved vacuum breaker which is relatively inconspicuous in appearance on a plumbing fitting, which is simple, durable and compact in construction and operation, economical to manufacture and easy to install, and is highly efficient and reliable in use.

With the foregoing and other objects in view, the invention consists in certain novel features of construction, operation and combination of elements as will be more fully pointed out hereinafter, reference being had to the accompanying drawings disclosing the invention in which:

Fig. 1 is a full sized cross-sectional view of the novel vacuum breaker with the parts shown in normal position;

Fig. 2 is a similar view showing the parts operated when water flow takes place;

Fig. 3 is a cross-sectional view of another form of the invention with the parts in normal position;

Fig. 4 is a view similar to Fig. 3 showing the parts operated; while

Fig. 5 is a top view of Fig. 3.

Referring now to Figs. 1 and 2 of the drawings, the vacuum breaker device includes a tubular outlet member or casing 5, the lower end of which may be connected to a water closet bowl or other plumbing fixture, while the upper end is connected to a flush valve for controlling the amount of water passing into the plumbing fixture. The vacuum breaker unit is interposed between the water closet bowl and flush valve for the purpose of preventing back-syphonage of contaminated water from a possible clogged water closet into the potable water supply line connected to the flush valve. This could occur whenever a sub-atmospheric or vacuum condition existed in the water supply line brought on by reasons well known. The vacuum breaker in the usual installation is located at a certain height above the spill line of the plumbing fixture and directly below the flush valve outlet.

The upper end of the outlet tube 5 is provided with an annular supporting flange portion 6 formed therein together with a series of air ports or vents 7 arranged around the tube 5 immediately below the flange 6 and spaced apart by the connecting portions 8 shown in Fig. 2. A coupling nut 9 is provided for securely attach-

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ing the vacuum breaker unit, as by the internal screw threads 10, to the outlet end of a flush valve for example. This coupling nut 9 has an inner annular flange 11 upon which the tube flange 6 rests to support the outlet tube 5 and other elements of the unit. An annular depending skirt portion 12 is formed integral with the coupling nut 9 and is spaced from the outer walls of the outlet tube 5 as indicated at 13 in a manner to overhang the air ports 7 and protect the same from the insertion of foreign objects tending to obstruct the air ports 7 and interfere with their normal function. The annular space 13 is of sufficient size and area so that the air ports 7 are fully effective to break any vacuum condition that may occur, as will be pointed out.

Arranged within the outlet tube 5 and in nested relation therewith is a flexible annular sleeve valve member 14 constructed preferably of a synthetic product such as "neoprene" which has certain well known superior qualities over natural rubber when utilized for the present purposes. Flexible sleeve valve 14 has thin side walls vertically disposed and spaced apart slightly from the outlet tube 5 and at its upper end has an annular outward extending supporting flange 15 which rests directly on top of the outlet tube flange 6. At the lower end flexible sleeve 14 is provided with an inwardly projecting lip or flange 16 made somewhat thinner than the side walls of the sleeve to provide greater flexibility and present less restriction to the free flow of water at that point. In order to prevent distortion of the flexible sleeve side walls when the coupling nut 9 is drawn up tight, a reinforcing ring 17 is imbedded in the sleeve flange 15. As indicated at 18, the flexible sleeve 14 is spaced apart from the side walls of outlet tube 5 so that the interior of the outlet tube below the vacuum breaker is normally exposed to atmospheric pressure, except when water flow takes place through the device.

Axially disposed within the flexible sleeve 14 is a rigid metal flow director 19 shaped in the form of an inverted cup with the apex facing the upstream side of the device and the lower circular edge portion 20 facing downward. The flexible sleeve 14 is interposed between the rigid cup member 19 and the outlet tube 5 with the side walls spaced parallel to the tube walls and the cup member 19 converging upward away from the sleeve walls. The thin lip 16 lightly engages the bottom edge 20 of the flow director cup 19 and projects inward a short distance as shown.

In order to accurately support the cup member 19 within the outlet tube 5, there is provided an annular supporting plate 21 arranged across the opening and having a number of openings 22 therein for the passage of water into the device. The outer rim portion constitutes a flange 23 resting on top of the flexible sleeve flange 15 within the coupling nut 9, and a shoulder portion 24 formed in the supporting plate 21 serves to accurately and rigidly hold the flexible sleeve 14 centralized and in proper spaced relationship with the cup member 19 and the outlet tube 5. The apex of the cup member 19 is securely fastened by rivet 26 to the center of the supporting plate 21 and hangs downwardly from it.

In the operation of the vacuum breaker device when installed in association with a flush valve and water closet, the manual tripping of the flush valve handle results in a flow of water through the device as indicated by the arrows in Fig. 2. The water passes into the inlet end 27 around the outside of the cup member 19 and is deflected outwardly slightly as shown due to the curved outer surface of the cup, forcing the flexible sleeve 14 to expand its side walls into engagement with the inner walls of the outlet tube 5 and to close off the annular space 18 therebetween. This action likewise causes the flexible sleeve to seat upon the air ports 7 to seal them off and prevent

leakage of water through these parts during the water flow. In the event the pressure of the water is relatively high, the portion of the flexible sleeve closing the air ports will effect a slight bulge therethrough to seal them tighter. Splashing of water through the air ports is quickly prevented because the flexible sleeve is immediately forced into engagement with the air ports due to the path of water flow being initially diverted towards the air ports by the shape of the cup member 19.

Water flow further passes into the space 28 between the cup 19 and flexible sleeve 14 and parallel therewith, bending and forcing the thin flexible lip 16 downward and outward until it is substantially parallel to the side walls of the flexible sleeve 14 and the water flow as shown in Fig. 2. The end of thin lip 16 being normally lightly in contact with the cup member 19 only offers slight restriction to the free passage of the water. The bending or hinging action of lip 16 also enables a tighter seal to be applied between the bottom of the flexible sleeve 14 and the outlet tube 5 to further assist in preventing leakage from the air ports 7. The flexible sleeve 14 is made sufficiently elastic so that fairly low water pressures will be effective to expand the side walls and seal off the air ports and still not be bulged out of the air ports by high pressures to cause a bursting of the sleeve.

In the event that back pressures are built up in the outlet tube 5 either due to restrictions imposed by the type of water closet bowl connected thereto, or to partial stoppage of the same, the flexible sleeve 14 is caused to bulge outward by pressure applied below the lip 16 and by the expansion caused by the inlet flow, causing the air ports 7 to be sealed off and preventing spurting and leakage therethrough.

Assume, now, for example, that a vacuum condition occurs within the inlet water supply line, due possibly to a sudden withdrawal of the water from the plumbing system caused by any number of conditions well known in the plumbing trade. Operation of a flush valve under such circumstances will usually result in the contaminated contents of a clogged water closet being sucked back as by syphonic action, into the pure water supply line. The present vacuum breaker prevents this undesirable action and in response to such a vacuum condition the side walls of the flexible sleeve 14 are immediately forced or bulged inward by atmospheric pressure passing through air ports 7, and in case the degree of vacuum present is great enough, the walls will come to rest against the outside of the cup 19 and bulge slightly against them, as shown at 31 in Fig. 1. This action effectively seals off the flow of water in the manner of a back-check and prevents reverse flow. At the same time that the flexible sleeve walls 14 are forced inward, the space 18 between the flexible sleeve and outlet tube is greatly enlarged, affording a wide opening for entry of atmospheric pressure through the air ports 7 to the space below the vacuum breaker to break the vacuum therein and thereby prevent any rise in the water level in the outlet tube. In addition to the flexible sleeve "hugging" the cup member 19 on a vacuum condition, the thin lip 16 likewise closely embraces the bottom of the cup to act as a back-check, and in most instances where a low degree of vacuum is encountered, this check alone is sufficient to prevent back-syphonage.

In the event any defect occurs in the flexible sleeve 14, attention will be quickly brought to the same by the leakage which will pass out of the air ports. The device is therefore self-policing and replacement or repair can be quickly and easily accomplished.

Referring now to the further exemplification of the invention as shown in Figs. 3, 4, and 5, certain elements thereof are similar to that of Fig. 1 and have corresponding reference numbers. The difference resides principally in a simplification of the invention by the use of a flow director in the shape of a flat disc 30 in place of the cup member 19 of Fig. 1. This metal disc 30 is riveted at its center to one end of a supporting stem 29 while the other

end of the stem is riveted to the center of the supporting plate or spider 21. The stem 29 is axially disposed within the device and holds the flow disc 30 rigidly spaced and dependent from the supporting plate. The periphery of the disc 30 is lightly engaged on the bottom surface as indicated at 20 by the inwardly projecting thin lip portion 16 of the flexible sleeve 14.

Upon water flow taking place through the device as depicted in Fig. 4, the flow director disc 30 deflects the water to cause the flexible sleeve 14 to bulge against the inner walls of the outlet tube 5 and close off the air ports 7. The flow path further extends around the edge portion of the disc 30 past the space 28 and results in the thin edge 16 being bent outward as shown, assisting in preventing spurting of water outward from the air ports. Upon the occurrence of a vacuum condition, the flexible sleeve 14 is pressed inwardly as shown at 31 in Fig. 3 and away from the air ports 7, affording a wide opening for atmospheric pressure to enter into the interior of the outlet tube 5 effectively preventing a rise of water in the tube 5. At the same time the thin lip 16 hugs the edge of the flow director disc 30 tightly to act as a back check and prevent back syphonage.

From the foregoing, it is seen that the invention contemplates a simple device acting as a combination back-check and vacuum breaker which can be cheaply and easily made of few parts and which is positive in its action.

Other applications and modifications of the invention are contemplated within the scope of the present invention, as will be apparent to those skilled in the art. It is therefore to be understood that the embodiments herein disclosed are to be regarded as only illustrative of the invention and not restrictive, and the appended claims are therefore to be construed broadly, except for such limitations as may be necessary in view of the prior art.

What is claimed is :

1. In a vacuum breaker for a water supply system, a tubular casing having air ports in the sides thereof, a flexible sleeve inside said tubular casing and centrally spaced from the side walls thereof, a flow director inside said flexible sleeve comprising a rigid disc transversely disposed across the lower end of said flexible sleeve and closing the opening therethrough, a supporting plate across the upper end of said flexible sleeve having openings therein for the passage of water, a connecting stem axially disposed for supporting said rigid disc from said supporting plate, and coupling means for clamping said tubular casing, said flexible sleeve and said supporting plate together, a lip portion on the lower end of said flexible sleeve thinner than said sleeve and extending inwardly thereof into slidable engagement with the bottom of said rigid disc, said rigid disc being effective to direct the water flow outward against the sides of said flexible sleeve to force the same tightly against said air ports to prevent leakage therethrough, said thin lip portion being forced outward by the water flow and away from the edge of said rigid disc to force the lower portion of said flexible sleeve tightly against the wall of said tubular casing to further assist in preventing leakage from said air ports, said thin lip portion also being bent by the water flow parallel to the water flow and to the tubular casing to thereby reduce restriction to the free flow of water.

2. In a vacuum breaker for a water supply system, a tubular casing having air ports in the sides thereof, a flexible sleeve inside said tubular casing centrally spaced from the side walls thereof, a flow director inside said flexible sleeve centrally spaced from said flexible sleeve and comprising a rigid disc transversely disposed across the lower end of said flexible sleeve and closing the opening therethrough, a supporting plate transversely disposed across the upper end of said flexible sleeve, a connecting stem axially connecting said rigid disc with said

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supporting plate for supporting said rigid disc, a flange formed on the upper end of each of said flexible sleeve, tubular casing and supporting plate, and coupling means for clamping all of said last elements together to form a unitary unit, a lip portion formed on the lower end of said flexible sleeve extending radially inward into engagement with the periphery of said rigid disc to normally close the opening through said device, said lip portion being thinner than the walls of said flexible sleeve, said rigid disc being effective to direct water flow outward against the sides of said flexible sleeve to force the same tightly against said air ports to prevent leakage there-through, said thin lip portion being forced outward by the water flow and away from the edge of said rigid disc to force the lower portion of said flexible sleeve

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tightly against the wall of said tubular casing to further assist in preventing leakage from said air ports, said thin lip portion also being bent by the water flow parallel to the water flow and to the tubular casing to thereby reduce restriction to the free flow of water around the edge of said rigid disc.

References Cited in the file of this patent

UNITED STATES PATENTS

2,098,885	Safford	Nov. 9, 1937
2,098,886	Safford	Nov. 9, 1937
2,270,737	Langdon	Jan. 20, 1942
2,382,427	Langdon	Aug. 14, 1945
2,395,906	Owens	Mar. 5, 1946