Oct. 26, 1943. J. J. CANTOR 2,332,695

VACUUM BREAKER

Filed June 21, 1941

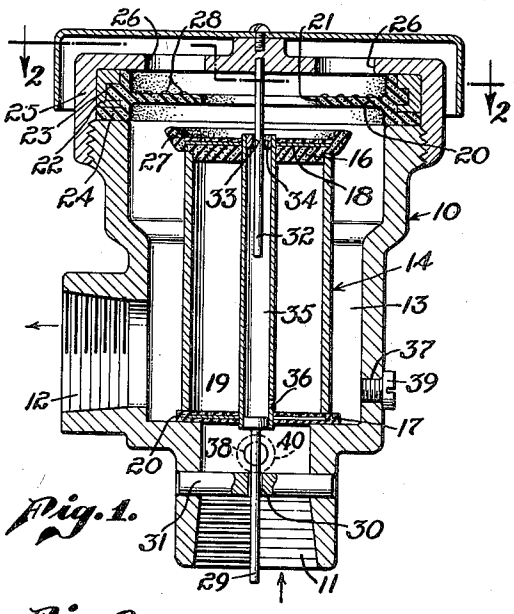


Fig. 1.

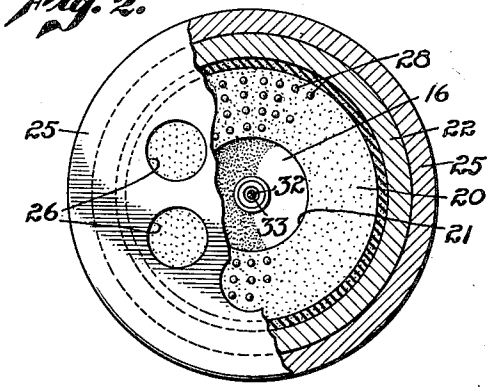


Fig. 2.

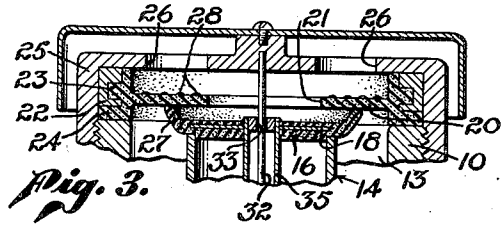


Fig. 3.

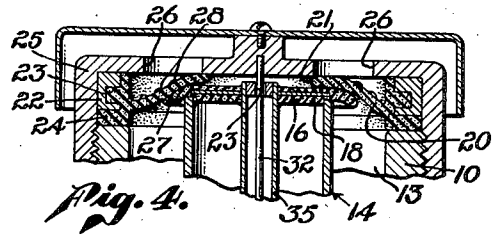


Fig. 4.

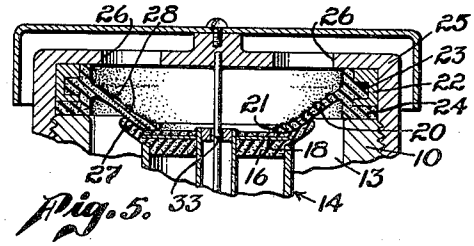


Fig. 5.

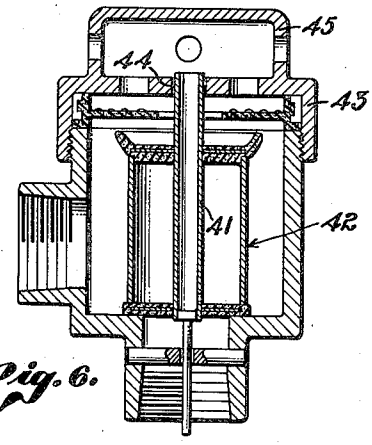


Fig. 6.

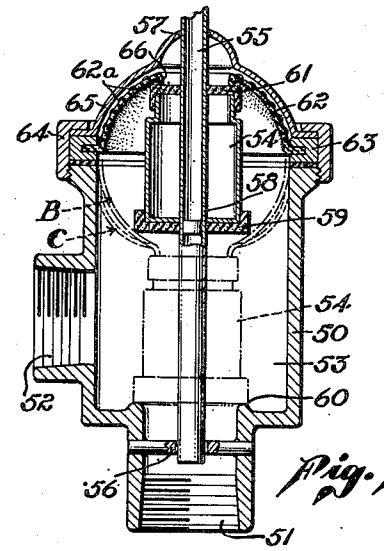


Fig. 7.

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VACUUM BREAKER

Jacob J. Cantor, Los Angeles, Calif.

Application June 21, 1941, Serial No. 399,163

5 Claims. (Cl. 137—69)

This application is continuation in part of my pending application Serial #287,033, filed July 28, 1939, for Vacuum breaker device, and since issued as Patent No. 2,252,164, dated August 12, 1941.

In vacuum breakers as heretofore developed, involving a float member for closing the atmospheric opening, there is a tendency for float members which contain confined air to become waterlogged or distorted, because of the stresses developed by the pressure changes of the confined air under changing temperature conditions. Attempts to remedy this by the provision of an opening in the float to permit water to rise in the float member, and trap air in the upper part of the float, have not been successful, because the water surging through the apparatus has a tendency to sweep out the air; or, possibly, the air may be absorbed by the water.

The above mentioned distortion or loss of buoyancy of the float causes the device to leak through the atmospheric valve, as the tightness of the atmospheric valve depends upon the accurate seating of the valve member, which valve member is actuated by the float member.

In addition to the above defects, there is a tendency for the atmospheric valve to adhere to its seat, after the valve and seat have been in contact for a long period of time. Such long continued contact also causes ridges in the valve or seat, or actually cuts the seat, causing ultimate leakage. These tendencies have prevented the application of vacuum breakers in any situation where there is a valve at the outlet side of the vacuum breaker, and, consequently, a vacuum breaker is required for every valve or faucet.

With the above defects of previous vacuum breakers in mind, it is an object of the present invention to provide a novel means for the prevention of the development of stresses in the float due to temperature changes acting upon air therewithin.

It is a further object of the present invention to prevent the accumulation of condensed moisture within the float member.

It is a further object of the present invention to provide means for preventing marring of the mating faces of the atmospheric valve and valve seat.

It is a further object of the present invention to provide means to avoid leakage at the atmospheric valve when the system is at low pressure and the valve member is vibrated by changing water currents, turbulence, or pulsations pressure.

It is a further object of the present invention to provide, in an atmospheric valve involving a movable valve seat, means for prevention of adhesion between the valve seat and its motion limiting member.

It is a further object of the present invention to provide means for permitting atmospheric pressure, upon development of a vacuum in the system, to break any seal which may have formed between the atmospheric valve and its seat.

It is a further object of the present invention to provide a means which will indicate development of a leak in the float.

It is a further object of the present invention to furnish a means to test the device to indicate its correct functioning.

This invention possesses many other advantages, and has other objects which may be made more easily apparent from a consideration of one or more embodiments of the invention. For this purpose there are shown a number of forms in the drawing accompanying and forming part of the present specification. These forms will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring now to the drawing:

Figure 1 is a vertical sectional view through one type of vacuum breaker embodying the present invention;

Figure 2 is a transverse sectional view taken on line 2—2 of Figure 1;

Figures 3, 4 and 5 are fragmentary sections similar to the upper portion of Figure 1, showing the parts in different positions of operation;

Figure 6 is a section similar to Figure 1, of a modified form of the invention; and

Figure 7 is a similar section of still another form of the invention.

Referring first to Figure 1, the device disclosed therein comprises a chamber, through which liquid is intended to flow in one direction. In the event that a vacuum is developed within the chamber, tending to cause flow in the opposite direction, a float member within the chamber opens a valve to the atmosphere, and closes the inlet to prevent reverse flow. As shown, the body member 10 is provided with an inlet 11 and an outlet 12, liquid being intended to flow through

the chamber 13 in its passage from the inlet to the outlet. Within this chamber 13 is provided a float member 14, which performs the functions of sealing an atmospheric opening and closing the inlet, according to its position. The float member is a hollow body of sufficient rigidity to withstand the crushing pressure of the fluid within the chamber 13, and is shown as being essentially a cylindrical member, provided with soft heads 16 and 17, at its top and bottom respectively. These heads may be made of rubber or similar material, vulcanized or cemented in place, and provided in their interiors with stiffening washers 18 and 19. They serve as closures for the ends of the float and also function as valve members.

As shown in Figure 1, the lower head 17 rests on a valve seat 20 when there is no fluid in the chamber, thus effectively closing the inlet 11 against reverse flow. The upper head 16 of the float member 14, in conjunction with a special seat, acts as an atmospheric valve. This seat is in the form of a flexible diaphragm 20, formed of rubber or similar material, having an opening 21 in the center thereof. The diaphragm 20 is vulcanized, or otherwise suitably secured, to a ring 22, which has an annular groove 23 therein to allow the rubber to be more securely fastened to the ring. For the sake of convenience, the rubber may extend over the bottom of the ring 22, as at 24, to provide a gasket for preventing leakage between the ring and the upper end of the body member 10. The ring and diaphragm assembly are secured to the top of the body 10 by a cap 25, threaded to the body member, the top of said cap having a series of openings 26 extending therethrough for the passage of air.

As will be noted from Figures 1, 3, 4 and 5, the flexible diaphragm 20, the cap 25, and the end 16 of the float member 14 are so related as to form an atmospheric valve. An annular member 27, of resilient construction, is secured to the end 16 of the float and is adapted to engage the diaphragm 20. Under low pressures, the diaphragm and the annular member 27 engage as shown in Figure 3, the diaphragm and member 27 yielding slightly under pulsations, vibration or rocking of the float member 14. However, when the pressure increases, it forces the float and diaphragm upwardly, the limiting position being that shown in Figure 4. In this position it will be observed that the annular member 27 is bent downwardly, so that a very large area is presented to the diaphragm. This prevents the diaphragm from being cut or ridged if it remains in this position for a long period under high pressure.

In order to prevent the diaphragm 20 from adhering to the cap 25, the diaphragm is provided with a roughened upper surface; which may be formed by projections 28, or by any other suitable means. If desired, the interior of the cap may be roughened instead of the diaphragm. This roughening results in the entrapping of small volumes of air between the surface of the cap and of the diaphragm, and thus prevents the adhesion of the diaphragm to the cap. It will be noted that the openings 26 are located at points where the diaphragm touches the cap, and the upper surface of the diaphragm is in communication with the atmosphere even in the position shown in Figure 4, so that air pressure will act upon it to force it downwardly upon development of a vacuum in the system.

There is a possibility that the inner surface of the diaphragm 20 and the resilient valve member 27, may adhere to each other. But, as shown in Figure 5, the development of a vacuum in the system will result in a stretching of the diaphragm 20 and a consequent enlargement of the opening 21, which will tear it loose from the valve. It is thus seen that there is no opportunity for the atmospheric valve to stick closed, which would destroy the effectiveness of the device.

In order to guide the float 14 in its vertical travel, a pin 29 is secured to its lower end, which pin passes through an opening 30 in a guide member 31 secured to the body member 10. The upper end of the float is guided by a pin 32, secured to the cap 25, and passing through an opening 33 in a guide member 34 in the float itself. These guide pins are comparatively quite loose in the guide openings 30 and 33, as the flexible diaphragm 20 is of such construction that it does not depend upon the accurate positioning of the float for its efficacy.

The opening 33 in the guide member 34 also serves to prevent the development of pressure changes within the float 14, as it is in communication with the atmosphere. However, air breathing in and out of the float interior would result in condensation of moisture in the float, causing it to lose its buoyancy. For this reason, a tube 35, within the float member, prevents communication between the atmosphere and the interior of the float except through an opening 36 near the bottom of the float. Any condensation forming in the float will be driven up the tube 35 upon expansion of the air in the float chamber due to rise in temperature. This tube 35 also serves to prevent the float from losing its buoyancy in the event that a leak develops in the walls of the float. Any water entering the float will rise in the tube, and appear at the atmospheric valve, giving warning that the unit is in need of attention.

In order to provide means for periodical testing of the device, to give assurance that a vacuum will be broken, a pair of openings 37 and 38 are provided in the body member 10, the opening 37 being through the wall of the float chamber 13, and the opening 38 being in the wall of the inlet 11. By connecting these openings with a vacuum pump or other mechanism, and observing the action of the device, it can be readily determined whether it is functioning correctly. When these openings are not being used for testing, they can be closed by suitable plugs 39 and 40.

A second form of this invention is shown in Figure 6. The main difference to be noted in this form, as distinguished from that of the previously described form, is the utilization of an extension of the interior tube 41 of the float 42 to guide the float in its vertical movement. In order to accomplish this, the cap 43 is formed with a central opening 44 for guiding the tube 41 in its vertical movement with the float 42, and a member 45 is formed thereon to protect the moving tube from mechanical injury. The rest of the structure may be exactly as described in connection with Figure 1, and will not be further described.

In Figure 7 is shown still another form of the invention, which is chiefly notable because of the form of the diaphragm utilized for the valve seat A body member 50 has an inlet 51 and an outlet 52 leading to and from the float chamber 53. A float member 54 within the chamber is guided for vertical movement by the tube 55 secured to the float and passing through guides 56 and 57.

This tube also serves to remove condensation from the interior of the float through a small opening **58** through its wall near the bottom of the float **54**. The float **54** has valve members at each end, the lower member **59**, engaging a seat **60** upon downward movement of the float and stopping reverse flow. The upper valve element **61** engages a diaphragm **62** to close the atmospheric opening.

This diaphragm **62** is cup-shaped in configuration, and is supported on the body member **50** by a ring **63** held in place by a flanged, threaded sleeve, **64**, which also secures the cap **65** in place. It will be noted that the cap is similarly cup-shaped. The central opening **66** of the diaphragm is provided with an annular projection **67**, which is engaged by the valve member **61**, and cooperates therewith to form a seal.

It will be understood that at low pressure, the float **54** will rise, if the chamber **53** contains liquid, until it assumes the position shown in Figure 7 in full lines. High pressure will tend to force the diaphragm into contact with the cap **65**. For this reason, the exterior of the diaphragm **62** may be roughened as at **62***a* to prevent it from adhering to the interior of the cap **65**.

Downward movement of the float member normally opens the atmospheric valve by causing the member **61** to leave the annular projection **67**. However, in the event that the member **61** and the diaphragm adhere to each other, the diaphragm will be inverted by the pressure of the atmosphere, to take the position B shown in dotted lines in the figure. This inversion causes the projection **67** to roll over the valve, which will tend to loosen it. In the event that it does not do so, the outside pressure will distort the diaphragm to the position C, which will exert a tension on the diaphragm, and tend to increase the size of the opening **66**. This will tear the projection **67** of the diaphragm loose from the valve member **61**, and admit air into the chamber **53**.

I claim:

1. A vacuum breaker including a housing having a liquid inlet and outlet and an atmospheric inlet; a valve seat at said atmospheric inlet; a hollow float valve member movable by the rise of liquid in said housing into sealing contact with the valve seat; and an opening in said float valve member in communication with the atmosphere through the opening of the valve seat when said valve member is in closed position.

2. A vacuum breaker including a housing having a liquid inlet and outlet and an atmospheric inlet; a valve seat at said atmospheric inlet; a hollow float valve member movable by the rise of liquid in said housing into sealing contact with the valve seat; a tube extending to the interior of the float and open to the interior of the float near the bottom thereof, said tube being in communication with the atmosphere through the valve seat when said valve member is in closed position.

3. A vacuum breaker including a housing having a liquid inlet and outlet and an atmospheric inlet; a valve seat at said atmospheric inlet; a hollow float valve member movable by the rise of liquid in said housing into sealing contact with the valve seat; a tube extending to the interior of the float and open to the interior of the float near the bottom thereof, said tube being in communication with the atmosphere through the opening of the valve seat; and a pin secured to the housing extending into said tube to thereby guide the float in its movement.

4. A vacuum breaker including a housing having a liquid inlet and outlet and an atmospheric inlet; a cup shaped flexible member forming a valve seat and secured to said housing by its outer periphery; a float valve in said housing movable by the rise of liquid in said housing into sealing contact with the valve seat; the extent of travel of said float valve being such as to permit inversion of the flexible member in the event that the valve seat adheres to and follows the float valve in its downward movement.

5. A vacuum breaker including a housing having a liquid inlet and outlet and an atmospheric inlet; a cup shaped flexible member secured to said housing by its outer periphery, said member having a projecting ring portion forming a valve seat; a valve member in said housing movable by the rise of liquid in said housing into sealing contact with said valve seat; the extent of travel of said valve member being such as to permit inversion of the flexible member in the event that the valve seat adheres to and follows the valve member in its downward movement.

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