Oct. 2, 1934. L. G. GATES 1,975,144

BREATHER VALVE

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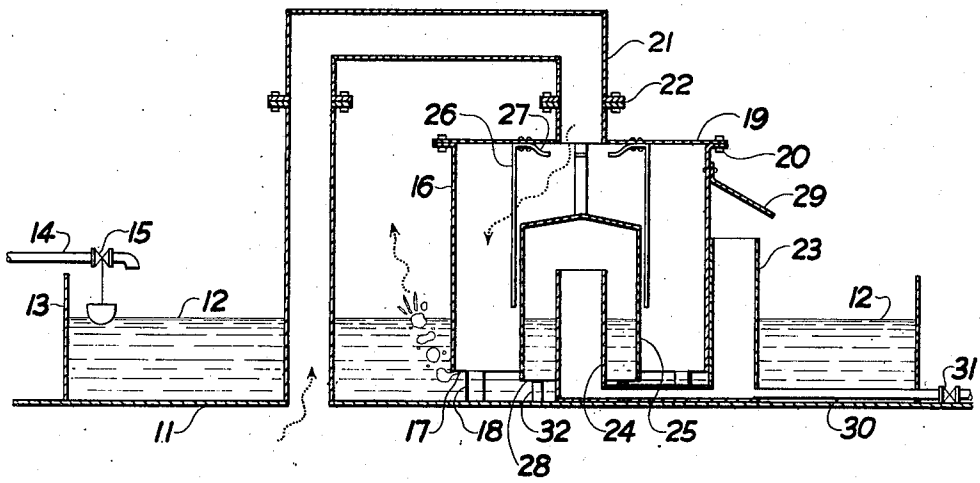


Fig. 1

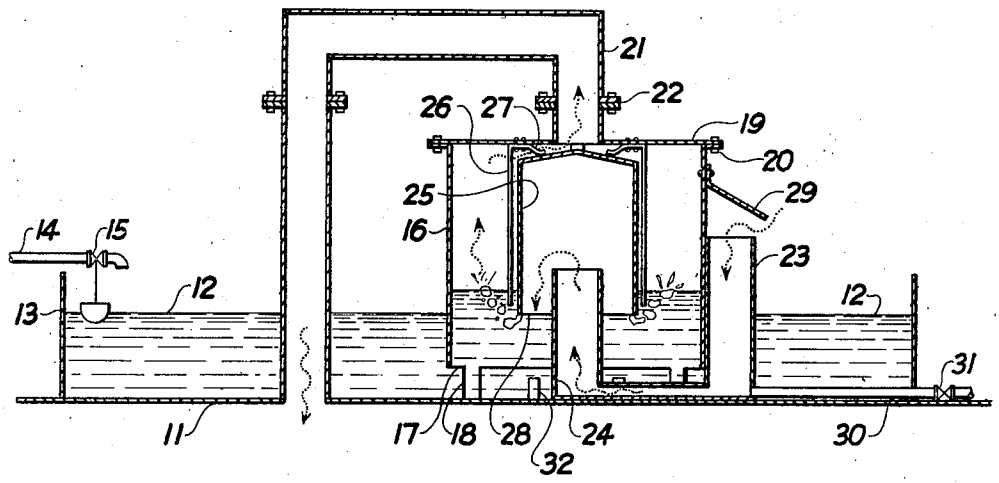


Fig. 2

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BREATHER VALVE

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6 Claims. (Cl. 220—85)

This invention relates to improvements in breather valves, more particularly as applied to the vent pipes from the vapor space of gasoline storage tanks and storage tanks for similar volatile liquids. It is particularly directed toward a breather valve which is adapted to be used on a water sealed or water roof tank. Such tanks are in common use for the storage of very volatile crude or refined oils and are characterized by a flat roof with a raised rim or edge adapted to hold from 4 to 6 inches of water. This water serves to cool the roof and prevent undue evaporation of the contents of the tank, and also serves as an indicator of the gas tightness of the roof.

Heretofore it has been the practice to use mercury sealed valves of various types, such as are disclosed in the Kuhl United States Patents No. 1,595,668 and No. 1,637,489. These provide a tight seal and smooth operation but they are not adapted to the high pressure differentials and severe service which is encountered when widely separated tanks containing light oils are connected to vapor recovery systems or to gas traps. Under these circumstances the pressure in the tank is liable to sudden and violent fluctuations, both above and below atmospheric, which may cause the sealing liquid to be blown out of the valve, thus destroying the seal and allowing gas to escape, or air to enter the tank. When mercury is used, this constitutes a serious economic loss and where the tank roofs are galvanized the zinc coating is amalgamated and destroyed by the spilled mercury, causing corrosion of the exposed steel plates.

It is an object of this invention to provide a simple breather valve which has a minimum of moving parts and which is particularly adapted for use on water sealed or water deck tanks.

Another object of this invention is to provide a breather valve which is adapted to relieve gas at a given pressure differential and draw in gas at a different pressure differential.

Another object of this invention is to provide a liquid sealed breather valve which is readily made from corrosion-resisting materials and at a very small expense.

Another object of this invention is to provide a liquid sealed breather valve in which there is no tendency for the liquid of the seal to be drawn into the tank, thus avoiding contaminating its contents or reducing the effective height of the liquid level of the seal.

It is a further object of this invention to provide a breather valve which may be readily installed or removed from its liquid seal without alteration to the tank roof.

These and other objects and advantages of this invention will become apparent from the following detailed description of a preferred embodiment of this invention and its manner of operation, it being understood that the invention is not limited to the arrangement specifically described.

In describing this invention reference will be made to the accompanying drawing which forms a part of the specification.

In the drawing, Figure 1 represents a vertical sectional view through a breather valve constructed according to this invention and in a position to relieve gas from the tank on which it is placed.

Figure 2 represents a vertical sectional view of this breather valve in a position to admit gas into the tank on which it is mounted.

In the drawing, the numeral 11 represents a section of the roof of a tank in which a volatile oil may be stored. This roof may be arranged with a raised rim (not shown) at the edge of the tank adapted to provide a layer of water 12 over its entire area, or it may be provided with a rim or dam 13 adapted to enclose a body of water or other liquid immediately surrounding the breather valve.

In either case it is advisable to provide some means of maintaining a substantially constant level of water or other liquid on the tank roof or within the rim 13, which may be done by means of a water supply pipe 14 controlled by any form of adjustable float control valve 15.

A cylindrical shield 16 is arranged on the tank roof 11 with its lower edge 17 spaced therefrom by means of supports 18. The vertical distance between the lower edge 17 of shield 16 and the surface of the sealing liquid 12, together with the specific gravity of the sealing liquid 12, determines the pressure above atmospheric at which the breather valve will release vapor or gas from the tank, according to well known laws of hydrostatics.

The upper end of shield 16 is flanged to receive a cover plate 19 which is removably secured thereto by means of bolts 20. A conduit 21 leads from the cover plate to the roof 11 of the tank and provides a passage through which gas or vapor may travel in either direction. This conduit is preferably provided with flanges 22 in order that it may be removed for inspection or repair of the breather valve assembly.

At one side of the cylindrical shield 16 is mounted a conduit 23 which leads from a point substantially above the surface of the sealing liquid 12

downward and under the edge 17 of shield 16. This conduit terminates at its inner end in a riser pipe 24 which also terminates above the surface of the sealing liquid 12. A cylindrical cup 25, preferably of light sheet metal, surrounds the riser pipe 24 inside of the cylindrical shield 16. Cup 25 is free to rise and fall vertically inside of the guide rods 26 which are preferably attached to the cover plate 19. Spring spacers 27 are fitted inside of the cover plate 19 in order to prevent the cup 25 from touching the cover plate and shutting off the flow of gas through the conduit 21, when the breather valve is admitting gas or air to the interior of the tank.

The lower edge of cup 25, when it is in its highest position, as shown in Figure 2, should be at or very slightly above the surface of the liquid seal 12. The weight of cup 25 should be so proportioned to its diameter that the pressure differential at which the breather valve is to admit air or gas to the tank is just sufficient to cause it to rise to its upper position. The lower edge 28 of cup 25 when the latter is in its lowest position, as shown in Figure 1, should be appreciably lower than the lower edge 17 of the cylindrical shield 16 in order to prevent gas passing out beneath edge 28 and into conduit 23. Such a condition might carry sealing liquid into conduit 23 which would seal it off and render the breather valve inoperative as far as admitting air or gas into the tank is concerned. As a further provision against liquid or other foreign material entering conduit 23, a cap or shield 29 is preferably placed over the upper end of conduit 23 as shown. A still further safeguard would be the provision of a small pipe or tube drain 30 leading from the bottom of the conduit 23 outward to the atmosphere through the rim of the tank (not shown) or the rim 13 around the liquid seal. Thus the conduit 23 could be periodically drained by opening valve 31 in tube 30, if such were found necessary.

Spacers 32 may be provided adjacent the lower end of the riser pipe 24 in order to receive the lower edge 28 of cup 25, thus insuring that it stands level when it is in its lowest position.

In operation, when there is an excess of pressure in the tank as illustrated in Figure 1, the cup 25 will be resting in its lower position with its lower edge 28 resting upon the spacers 32. Inasmuch as the inside of the cup 25 is in communication with the atmosphere through conduit 23, the cup will have no tendency to move but will be pressed downwardly by the gas pressure above it. When the pressure within the tank rises to the point where it will displace the liquid between the outer shield 16 and the cup 25, the gas will bubble out below the edge 17 of the cup 16 into the atmosphere. Inasmuch as the breather valve assembly is located in a large body of water such as would cover the entire top of a tank, or is provided with a rim 13 which encloses a substantial quantity of water, the level of the liquid 12 will not be appreciably raised by the liquid displaced from within the shield 16. Furthermore, the splashing which occurs will do no damage to any part of the apparatus, nor will any of the liquid be lost.

Referring now to Figure 2, which illustrates the condition of an internal pressure in the tank lower than atmospheric, it will be seen that the cup 25 is lifted by the pressure differential between the conduit 23, which is open to the atmosphere, and the interior of the cylindrical shield 16, which communicates through conduit 21 to the interior of the tank. Cup 25 rises until it is stopped by spacers 27, at which time its lower edge 28 will be at or slightly above the level of the sealing liquid 12, as mentioned above. This level remains at the same height in the annular space between riser 24 and cup 25 as it does outside of the shield 16, because both these areas are at all times under substantially atmospheric pressure. With the cup in this position, the pressure differential will have displaced the liquid between cup 25 and the shield 16 upwardly as indicated in Figure 2. At this time the gas or atmospheric air entering through conduit 23 will pass below edge 28 of cup 25 and bubble upwardly through the liquid seal thus formed. The gas will rise in shield 16 and flow past spacers 27 into conduit 21 and thence into the tank interior. The top of cup 25 is preferably slightly conical in shape, as shown, in order that any liquid which may be carried upward with the gas will not accumulate on the top of the cup and change its effective weight.

Under ordinary conditions, where the entire tank roof is covered with water, it is advisable, for the sake of the loading on the roof structure, to so proportion the breather valve that it will breathe in or admit gas or air to the tank at a lower differential than that at which it discharges gases from the tank. For example, it could be made to breathe out at plus 4 inches of water, and draw in at minus 2 inches of water. By suitably proportioning the level of the sealing liquid 12 and the height of the lower edge 17 of the shield 16; and the weight of cup 25 as compared to its diameter, this may readily be accomplished as outlined above.

It will be recognized that the arrangement shown is merely diagrammatic and is capable of many variations. For example, it is entirely practicable to place the breather valve at a distance from the tank and not on its roof but in a separate pan or liquid seal. Under these conditions, the conduit 23 would not have to pass through the seal below the rim 17 of shield 16, but could simply pass through the plate of the pan to the atmosphere below, thus greatly simplifying the assembly.

Another modification (not shown), particularly adapted for installation on a tank while it was being fabricated, would be to substitute three or four small riser pipes for the conduit 21, bringing them up through the tank roof 11 into the annular space between shield 16 and cup 25 and terminating above the highest liquid level in that space (see Figure 2), thus forming guide means for the cup 25 and also providing communication between the vapor space of the tank and the inside of shield 16. Top 19 could then be made a single solid sheet, and travel limit stops, taking the place of spacers 27, could be placed either on the lower side of plate 19, on the top of cup 25, or could be eliminated entirely if the lengths of the shield 16 and cup 25 were properly proportioned, as pointed out above.

Under those conditions the breather valve assembly could be located near the rim of the tank so that the atmospheric conduit 23 could be brought downward through the roof 11 into the vapor space, and then extended horizontally out through the tank shell to the atmosphere. This would be self draining at all times and would obviate the necessity for drain pipe 30.

Although a specific construction embodying this invention has been described and illustrated, it is to be understood that the invention is not

limited to that specific device, and all such modifications and changes as come within the scope of the appended claims are embraced thereby.

I claim:

1. A breather valve comprising a receptacle for liquid, liquid in said receptacle, a conduit terminating in a stationary cup member with its open end disposed below the surface of said liquid, a vertically movable cup member within said stationary cup member with its open end normally disposed below the surface of said liquid, and an open conduit with its ends disposed above the surface of said liquid, extending from the exterior of said stationary cup member to the interior of said movable cup member.

2. A breather valve assembly comprising a closed cylindrical shield adapted to be connected to the vapor space of a tank, said shield being open at the bottom and provided with a liquid seal, a conduit leading from the atmosphere through said liquid seal and terminating inside said shield at a point above the liquid level therein, a light cylindrical cup inverted over the inner end of said conduit, guide means for said cup, said cup being adapted to rise in said guide means when the pressure within the shield is below atmospheric to admit air through said liquid seal into said tank.

3. A breather valve comprising a closed shield adapted to be connected to the vapor space of a tank, a liquid seal for said shield, a conduit leading from the atmosphere into the interior of said shield, and a liquid sealed cup within said shield, said cup adapted to admit air into said shield and said tank when the pressure in said tank reaches a predetermined minimum value.

4. A breather valve comprising a closed shield adapted to be connected to a tank, a liquid seal for the lower edge of said shield, a conduit leading from the atmosphere into the interior of said shield to a point above the liquid level, a cup within said shield and surrounding said conduit, said cup being free to move vertically within said liquid seal.

5. A breather valve comprising a liquid sealed outlet communicating with the vapor space of a tank, conduit means leading from the atmosphere into said outlet at a point above the liquid level therein, and a liquid sealed cup positioned over said conduit means, said cup being free to move vertically.

6. A breather valve comprising a liquid sealed outlet communicating with the vapor space of a tank, conduit means leading from the atmosphere into said outlet at a point above the liquid level therein, and a cup surrounding said conduit means, said cup being free to move vertically.

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