Nov. 10, 1931. F. L. MAKER 1,831,020

SEALING CONSTRUCTION FOR TANKS

Filed June 6, 1928

Fig. 1.

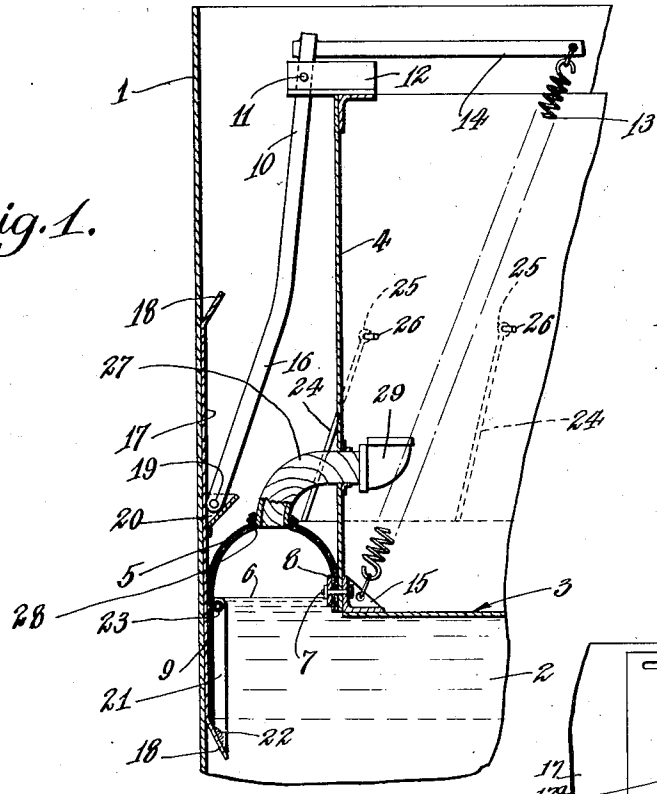


Fig. 4.

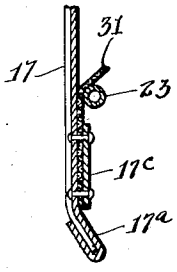
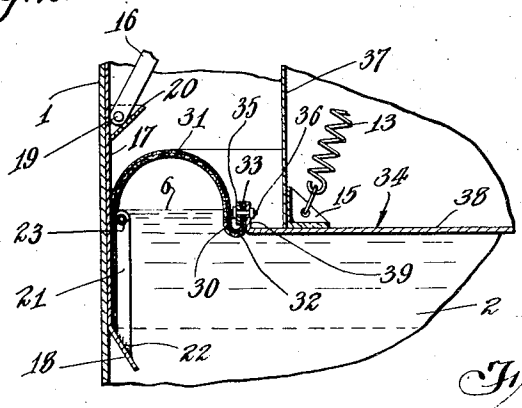


Fig. 2.



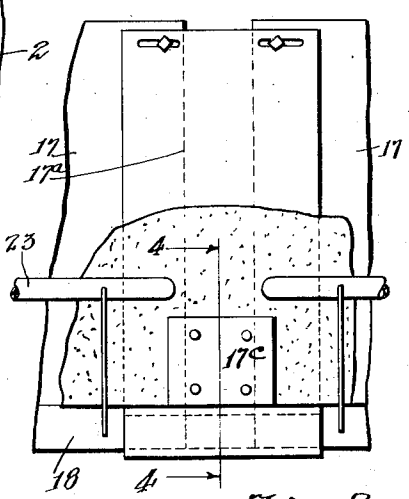


Fig. 3.

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UNITED STATES PATENT OFFICE

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SEALING CONSTRUCTION FOR TANKS

Application filed June 6, 1928. Serial No. 283,433.

This invention relates to a sealing construction for tanks such as tanks used for storing volatile liquids, such as crude oil and other petroleum products. These tanks embody in their construction an open tank containing the liquid and a floating roof floating on the liquid. Between the edge of the roof and the wall of the tank an apron or hood is provided which seals the space between the roof and the tank wall and traps gas or vapors that many tend to rise from the liquid. These vapors may have a corrosive effect upon all metal parts with which they come in contact. The general object of this invention is to provide a simple construction for sealing such a tank and having an organization of parts which will prevent the gases from coming in contact with the working metal parts of the apparatus and prevent contact of the gases with the metal wall or rim at the edge of the roof and with the tank's shell itself; also to provide a construction for such a tank as will enable the roof to be effectively guided and centered in the tank as it rises and falls with the liquid level; also to provide simple means for maintaining the outer edge of the hood substantially against the inner face of the tank wall.

Further objects of the invention will appear hereinafter.

The invention consists of the novel parts and combination of parts to be described hereinafter, all of which contribute to produce an efficient sealing construction for tanks.

A preferred embodiment of the invention is described in the following specification, while the broad scope of the invention is pointed out in the appended claims.

In the drawings:

Figure 1 is a vertical section taken through the upper portion of the wall of a tank with a floating roof and illustrating the other apparatus embodied in my invention, certain parts being broken away and shown in elevation. In this view the body of the tank and roof are broken away and the view is taken at about the level of the liquid in the tank.

Figure 2 is a view similar to Figure 1 but more restrictive and illustrating a modified construction for connecting the inner edge of the apron or hood to the edge of the floating roof.

Figure 3 is a fragmentary elevation of the inner face of the hood with adjacent parts broken away, and illustrating details of this embodiment of the invention.

Figure 4 is a section on the line 4—4 of Figure 3.

Referring to Figure 1, 1 represents the wall of a tank of the usual construction for containing a liquid 2, for example, crude oil. On this liquid a floating roof 3 is supported, having the usual upwardly extending side wall or rim 4 at its edge. According to my invention I provide an apron or hood 5 which is of general concavo-convex form, that is, it bulges upward and covers the annular space just above the level 6 of the liquid and between the lower edge of the rim 4 and the tank wall 1. This hood is a substantially gas tight septum preferably constructed of one or more layers of a flexible sheet which is preferably of a gas tight material which will trap the gas or vapors that rise from the liquid. The inner edge of this hood is preferably secured to the outer edge of the floating roof at the lower portion of the rim 4. This may be accomplished by means of through bolts 7 attached through a binding strip 8.

Suitable means is provided for holding the outer edge 9 of the hood substantially against the inner face of the tank wall 1 and also immersed in the liquid. If desired this means may be formed as a part of the guiding and centering means which I employ for centering the roof 3 as it rises and falls with the liquid level. For this purpose

I prefer to provide a plurality of arms 10 which are movably mounted preferably by means of a pivot 11 on a bracket 12 attached to the upper edge of the rim 4. Each of these arms is mounted in this way so that it can swing outwardly toward the tank wall, being constrained to move outwardly in this way by means of a coil spring 13 the upper end of which is attached to a rigid arm 14 extending inwardly from the arm 10.

This spring extends downwardly and in an inclined direction and its lower end is attached to an angle bracket 15 which is secured in the angle between the flange 4 and the bottom of the roof. The said bolts 7 may pass through the vertical flange of this bracket.

Each arm 10 extends downwardly and has its lower portion 16 bent outwardly as shown. These arms 10 are preferably disposed in pairs and each pair of arms carries a shoe 17 in the form of a vertically elongated plate that slides up and down on the inner face of the wall 1 as the roof rises and falls. In order to facilitate the movement of this shoe over the rivets in the tank wall, each end of the shoe is provided with an inwardly extending inclined flange 18.

The pivots 19 that attach the lower ends of the arms to the shoes pass through the vertical flanges of angle clips 20 which are secured to the faces of the shoes. The outer edges of these clips are flanged over to provide an enlarged surface, so that if movement of the shoes tends to press the clips against the apron or hood 5, they will not tend to cut or wear holes in said apron.

The outer edge 9 of the hood extends a considerable distance below the liquid level and lies against the inner face of the shoe 17. In order to secure this edge to the shoe I provide each shoe near its side edge with a substantially vertical clip 21 the lower end of which is welded at 22 to the lower flange 18 of the shoe, and these clips 21 may be connected by a transverse bar 23 which may consist of a short piece of pipe welded to the clips.

Between this pipe and the adjacent face of the shoe 17 the edge 9 of the hood 5 extends downwardly. The cross-bar 23 is near enough to the face of the shoe to pinch the hood slightly and the construction at this point is such as to enable the shoe to hold the hood tight enough to enable it to keep the hood from pulling itself out of place as the shoe and floating roof 3 move up and down with the liquid level. Additional means of holding the hood 5 in place against shoes 17 may be provided in the form of floating plates 17*a* riveted to the lower edge of the hood and hooking under the lower edge of the shoe, as shown in Fig. 3. The rivets 17B that secure the floating connecter plate to the hood are placed through a pad 17*c* in the form of a small square plate, the hood being clamped between the pad and the floating connecter plate. The upper edge of each conecter plate is connected to the adjacent shoes 17 by bolt and slot connections permitting lateral play.

The hood, of course, is of annular concavo-convex form with the concave side of the hood disposed downwardly.

I provide means for supporting the hood at a plurality of points around the roof. Any suitable means may be provided for this purpose but I prefer to employ short diagonal suspension links 24, the lower ends of which are attached to the hood and the upper ends of which have eyes 25 secured to eye-bolts 26 fastened to the rim of the roof.

The hood is, of course, disposed below all of the working parts of the centering and guiding apparatus described above and it is attached to the rim of the roof 4, and held tightly against shoe 17, at substantially the liquid level 6, so that there are no metal parts exposed to the vapors or gas under the hood except the binding strip 8 to bolts 7.

It is preferable to provide a connection for carrying off the gas from under the hood as may be desired. This is preferably in the form of a flexible tube 27 in the form of an elbow one end of which is attached at an opening 28 through the dome of the hood and the inner end of which passes through the rim 4 of the roof so as to receive an elbow 29 for connection to a breather valve.

In Figure 2 I illustrate an embodiment of the invention in which the inner edge 30 of the hood 31 extends in a general downward direction and is bent downwardly to form a downwardly extending bight or loop 32 near its inner edge 33 so that the inner edge 33 extends upwardly instead of downwardly at the point where it is attached to the roof 34. This enables the metal binding strip 35 and bolts 36 to be placed on the outside of the hood completely so that they are not subjected to the action of the gases under the hood. In this embodiment of the invention, if desired the edge 33 need not be attached directly to the flange or side wall 37 of the roof but the bottom 38 of the roof may be extended outwardly beyond the rim 37 and may itself be provided with a narrow vertical flange or coaming 39 to which the edge 33 may be bolted.

In other respects the construction would be the same in this embodiment of the invention as in the embodiment shown in Figure 1.

In the operation of the roof it will be evident that as the level of the liquid rises and falls, the hood 5 will be guided at its outer edge so as to rise and fall with the roof, at all times being held immersed in the liquid and substantially against the face of the wall 1 of the tank. In this way the hood will operate to trap all the gases or vapors arising from

the liquid and will prevent the same from coming in contact with the working parts of the guiding means, and it will also operate to keep such vapors out of contact with the faces of the flange 4 and the tank wall. In this way the use of these hoods materially reduces the corrosive effect of vapors arising from such a tank.

It will be noted that the hood 5 is so disposed that a variable vapor space is formed beneath it and no part of the bounding wall for this space is formed by either the tank wall or the rim of the roof.

It is understood that the embodiment of the invention described herein is only one of the many embodiments this invention may take, and I do not wish to be limited in the practice of the invention, nor in the claims, to the particular embodiment set forth.

I claim:

1. In a sealing construction for volatile liquids, the combination of a tank, a floating roof for the same supported on the liquid, a hood consisting of a flexible diaphragm connected to the edge of the roof at its inner edge, with its outer edge lying near the inner face of the side wall of the tank so as to prevent the escape of gas from the liquid, and trap the same under the hood, means located above the hood out of contact with the gas for centering the roof in the tank as the roof rises and falls with the liquid level, means for holding the edge of the hood substantially against the inner face of the tank wall, and a connection for a breather valve attached to the hood and extending from the hood through the side wall of the roof.

2. In a sealing construction for volatile liquids, the combination of a tank, a floating roof having an upwardly extending rim at its edge and supported on the liquid, a hood consisting of a flexible diaphragm with its inner edge attached to the roof adjacent the lower portion of the said rim, a plurality of arms movably supported on the said roof and extending outwardly from the roof toward the tank wall, means for yieldingly pressing the arms outwardly toward the tank wall, shoes carried by the ends of the arms to slide on the wall of the tank as the roof rises and falls and thereby guide and center the roof within the tank, and means for holding the outer edge of the hood substantially against the inner face of the wall so that the said arms are located above the hood and out of contact with volatile gases trapped by the hood.

3. In a sealing construction for volatile liquids, the combination of a tank, a floating roof for the same supported on the liquid and having an upwardly extending rim at its edge, a plurality of arms pivotally mounted on the said roof near the upper edge of said rim and extending outwardly toward the wall of the tank, means for yieldingly pressing the said arms outwardly, shoes carried by the outer ends of said arms, a hood in the form of a flexible diaphragm having its inner edge connected to the roof adjacent the lower portion of said rim and means on the lower ends of said shoes for holding the outer edge of the hood substantially against the inner face of the tank wall and below the level of the liquid in the tank, said hood operating to trap volatile gases and keep the same from coming in contact with the upper portions of the shoes and said arms.

Signed at El Segundo, Calif., this 28th day of May, 1928.

FRANK L. MAKER.