

June 19, 1928.

1,673,984

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SEALING CONSTRUCTION FOR TANKS

Filed Dec. 11, 1926

Fig. 1.

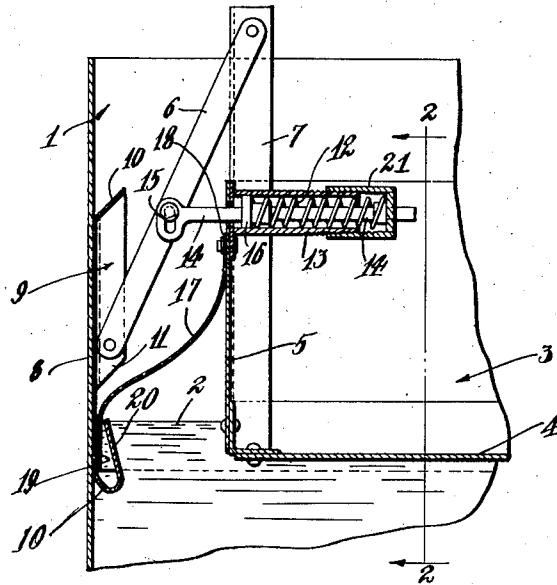
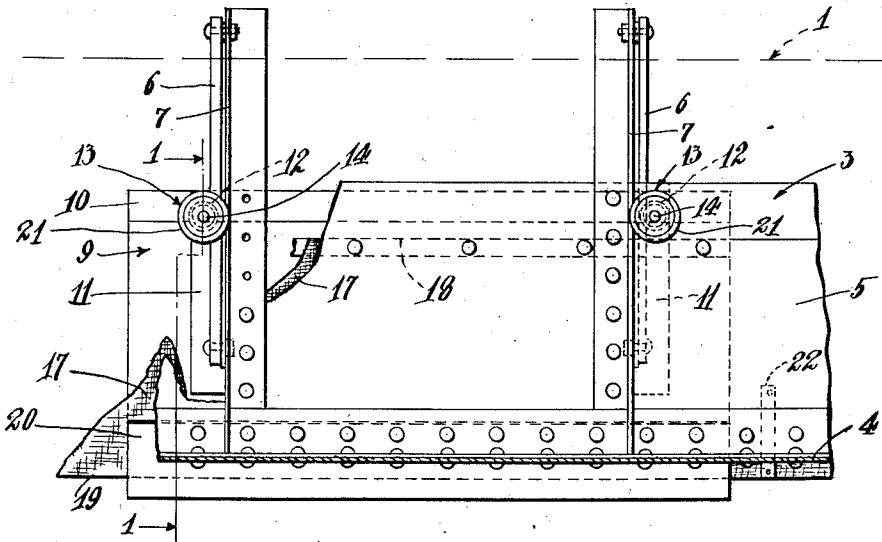


Fig. 2.

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## UNITED STATES PATENT OFFICE.

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## SEALING CONSTRUCTION FOR TANKS.

Application filed December 11, 1926. Serial No. 154,198.

This invention relates to liquid storage tanks of the type which have a roof that floats upon the surface of the liquid in the tank. It is customary to provide such tanks with means for substantially preventing evaporation of the liquid from the annular space between the tank wall and the floating roof.

The general object of this invention is to provide means for sealing the annular space in such a tank by employing a flexible continuous diaphragm or member which is carried by the roof and which substantially covers the annular space; also to provide suitable guiding means for maintaining the roof centered and guiding the same as it rises and falls with changes in the liquid level, and at the same time operating to hold the edge of the diaphragm close to the tank wall without exposing the guiding means to the corrosive action of the gases under the flexible diaphragm.

One of the objects of the present invention is to provide for mounting the guiding means in such a way that it is located above the flexible diaphragm or apron, and also to provide a construction which will enable the force of the guiding springs to be adjusted.

Further objects of the invention will appear hereinafter.

The invention consists in 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 drawing:

Figure 1 is a vertical section taken through the edge of the tank and through the edge of the floating roof. This view is taken substantially on the line 1—1 of Fig. 2.

Figure 2 is a developed view taken as a vertical section substantially on the line 2—2 of Fig. 1, certain parts being broken away.

Referring to the parts in the drawing, 1 represents a tank of any common construction, carrying a volatile liquid 2. On this liquid a floating roof 3 is supported, said

roof having a flat bottom or body 4 provided at its edge with an upwardly extending flange 5.

In order to center the roof in the tank, I provide a plurality of centering arms 6. These arms are preferably disposed in pairs, and their upper ends are pivotally attached to upwardly extending standards 7 which are secured to the inner side of the flange 5. These arms 6 extend downwardly and toward the tank wall 8. At their outer ends, they are provided with shoes 9 to slide along the inner face of the tank wall, as the level of the liquid rises or falls. In order to facilitate the movement of these shoes over rivets and seams in the tank wall, each shoe is preferably formed of a plate. The upper and lower edges are bent outwardly to form guide lips 10. The inner side of each shoe is provided with a pair of angle clips 11, to which the lower ends of the arms 6 pivotally attach.

In order to press these shoes 9 yieldingly against the tank wall, any suitable means may be provided, but I prefer to accomplish this by means of compression or tension springs acting on the arms. In the present embodiment of the invention, these springs are shown in the form of coil springs 12, disposed respectively in spring barrels 13 which are disposed in a horizontal position and in a radial direction. Each spring barrel guides a stem 14, the outer end of which is connected by a pin-and-slot connection 15 to its corresponding arm. The outer ends of these springs thrust against a head 16. These stems 14 slide through the flange 5. With this arrangement it will be understood that the springs all exert an equal outward thrust on the arms 6, the result of which is that the roof will be held centered in the tank.

In order to seal the annular space between the edge of the roof and the tank wall, I provide an apron 17 which extends around the roof. This apron has its upper edge 18 secured to the flange, and the apron extends outwardly and downwardly toward the wall of the tank, the lower edge 19 of the apron being disposed below the level of the liquid 2 and near the tank wall. This apron may be constructed of fabric or light sheet metal bent to substantially the desired form.

I provide means on the shoes for holding the edge of the apron substantially against the face of the tank wall 8. For this purpose, I may bend up the material of the plate which forms each shoe beyond lower lip 10, so as to form an extension or retaining jaw 20 which extends along the inner face of the apron at each shoe.

It will be noted that practically all parts of the guiding means are located on the exterior of the diaphragm or apron 17, that is to say, all parts of this guiding mechanism that are above the surface of the liquid are above the apron. This is most advantageous because it places these parts in a position where they are not exposed to the action of such corrosive gases as may be present in the vapor space.

In order to enable the springs 12 to be adjusted, the spring barrels 13 are preferably provided with screw caps at their inner ends, which are threaded upon the inner end of the barrel.

If desired, stiffeners may be provided for the edge of the apron between the shoes. One of these stiffeners is illustrated at 22 in Fig. 2. It may consist of a short strap or strip of metal secured to the outer side of the apron. These strips not only operate to stiffen the edge of the apron but also operate as wear shoes or wear strips, in case they come in contact with the wall of the tank.

The apron will be effective to prevent the escape of vapors if its edge is held substantially against the wall of the tank throughout the entire circumference of the tank. This, of course, is possible if the ends of the arms engage the wall of the tank close together. In that case it is not essential that the lower edge of the apron be submerged below the level of the liquid. In any case, however, the lower edge of the apron should be near the liquid level.

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.

What I claim is:—

1. In a sealing construction for a volatile fluid, the combination of a tank, a floating roof supported on the liquid in the tank, a plurality of centering arms mounted at the edge of the roof, shoes carried by the outer ends of the arms to slide along the inner face of the tank wall, means for yieldingly pressing the arms outwardly, and an apron attached at its upper edge to the edge of the roof and extending outwardly, with its lower edge near the wall of the tank and disposed below the level of the liquid, said shoes having means for engaging the lower

edge of the apron to hold the same substantially against the wall of the tank.

2. In a sealing construction for volatile liquids, the combination of a tank, a floating roof supported on the liquid within the tank, a plurality of arms pivotally supported at the edge of the roof and extending downwardly toward the side wall of the tank, shoes attached to the ends of the arms to slide up and down on the tank wall, means for yieldingly forcing the said arms outwardly to press the shoes against the wall of the tank and center the roof within the same, and an apron attached at its upper edge to the edge of the tank, extending outwardly, with its lower edge disposed below the level of the liquid and near the wall of the tank, said shoes having means for engaging the lower edge of the apron to hold the same substantially against the wall of the tank.

3. In a sealing construction for volatile liquids, the combination of a tank, a floating roof supported on the liquid in the tank, a plurality of centering arms pivotally supported at the edge of the roof and extending downwardly toward the tank wall, said arms disposed in pairs, a shoe pivotally supported on each pair of arms to slide up and down on the tank wall, stems attached to said arms, means for guiding said stems to move outwardly in a substantially horizontal direction, springs associated with said stems respectively to force the same outwardly and press the shoes against the wall of the tank to center the roof within the same, an apron attached at its upper edge to the edge of the roof below the said stems, said apron extending outwardly with its lower edge disposed below the level of the liquid and near the wall of the tank, and means on said shoes for engaging the lower edge of the apron to hold the same substantially against the tank wall.

4. In a sealing construction for volatile liquids, the combination of a tank, a floating roof supported on the liquid in the tank, having an upwardly extending flange at its edge, a plurality of standards extending upwardly at said flange, a plurality of arms pivotally attached to said standards and extending downwardly toward the wall of the tank, a plurality of spring-barrels mounted at the said flange, stems guided in said spring-barrels to move horizontally in an outward direction, springs in the spring-barrels for forcing the stems outwardly, said stems and said arms having pin-and-slot connections between the same, shoes pivotally attached to the lower ends of said arms to engage the wall of the tank and slide up and down on the same, an apron attached at its upper edge to the said flange below the spring-barrels, said apron extending out-

wardly with its lower edge below the level of the liquid and near the tank wall, and means on said shoes for engaging the lower edge of the apron to hold the same substantially against the tank wall. 30

5. In a sealing construction for liquid, the combination of a tank for the liquid, a floating roof supported on the liquid in the tank, a flexible apron of gas-tight material attached at its upper edge to the roof and extending outwardly with its lower edge near the liquid level, a plurality of shoes supported on a pivotal axis on the roof for engaging the apron near its lower edge to hold the same against the wall of the tank, and means for holding said shoes substantially against the tank wall. 35

6. In a sealing construction for liquid, the combination of a tank for the liquid, a floating roof supported on the liquid in the tank, a flexible apron of gas-tight material attached at its upper edge to the roof and extending outwardly at its lower edge near the liquid level, a plurality of shoes pivotally connected to said roof and engaging said apron near its lower edge, said shoes being disposed far enough apart to prevent their engaging each other as they move in or out when the roof rises and falls with changes 40

in the liquid level, and means for holding said shoes substantially against the wall of the tank.

7. In a sealing construction for a liquid, the combination of a tank for the liquid, a floating roof supported on the liquid in the tank, an apron of gas-tight material attached at one edge to the roof and extending outwardly, and a plurality of shoes engaging the outer end of said apron, with means above said apron for holding said shoes substantially against the wall of the tank. 45

8. In a sealing construction for a liquid, the combination of a tank for the liquid, a floating roof supported on the liquid in the tank, an apron of gas-tight material attached at one edge to the roof and extending outwardly, and a plurality of shoes with means for holding the same substantially against the wall of the tank, located above the apron, said shoes having extensions at their lower ends immersed in the liquid for engaging the lower edge of the apron to hold the same below the liquid level. 50

Signed at San Francisco, California, this 19th day of November, 1926. 55

JOHN KUHLMAN