Oct. 17, 1933. F. G. HAMPTON 1,930,953

SEAL FOR FLOATING ROOFS

Filed Sept. 15, 1930

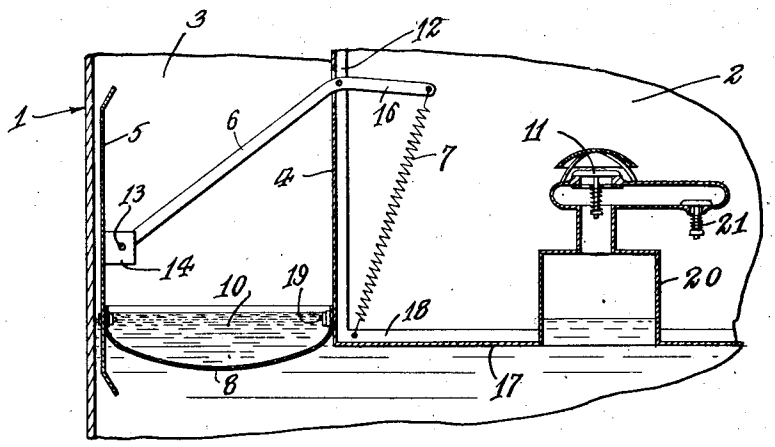


Fig. 1.

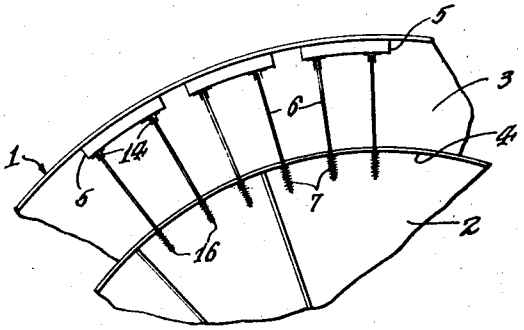
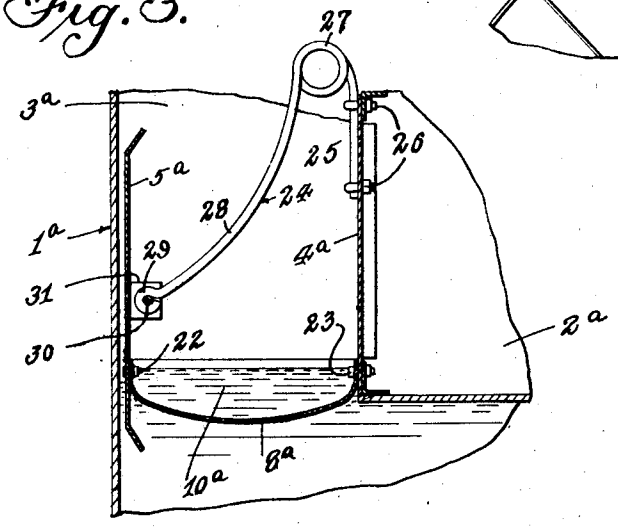


Fig. 2.

Fig. 3.



Inventor

Frederick G. Hampton

By Lyon & Lyon Attorneys

Patented Oct. 17, 1933 1,930,953

UNITED STATES PATENT OFFICE

1,930,953

SEAL FOR FLOATING ROOFS

Frederick G. Hampton, San Francisco, Calif., assignor to Standard Oil Company of California, San Francisco, Calif., a corporation of Delaware

Application September 15, 1930
Serial No. 481,997

2 Claims. (Cl. 220—26)

This invention relates to a seal for sealing the space between a floating roof and the side walls of a tank and refers particularly to a floating roof and seal therefor to be used in storing petroleum oil.

The general purpose of the present invention is to provide a floating roof and seal for a storage container or tank which is designed insofar as it is practicably possible, to eliminate or prevent the formation of a free liquid surface at any point in the container to the end that all vapor spaces are eliminated above the liquid level.

Another object of the present invention is to provide a floating deck with a seal so constructed that there is a minimum of material exposed to the frequently corrosive and destructive vapors from the liquid in the container and to provide ample means for cooling the liquid surface at the periphery of the container where it receives a maximum heat from the outside and has its greatest tendency to gasify.

In the storage of petroleum oils in a tank provided with a floating roof it is frequently found that the vapors from the oil are much more corrosive than the liquid oil itself. For this reason the metal of the floating deck or seal which is immersed in the liquid does not corrode rapidly but where vapors from the liquid oil can come in contact with the deck walls relatively rapid corrosion may take place. This is particularly true when the oil stored is high in sulfur bodies. I have found that by providing a floating deck with a seal including a septum which lies on or slightly below the natural liquid surface of the oil supporting the roof and prevents the formation of vapor pockets around the seal, that corrosion of the seal and side walls of the floating deck is very greatly reduced.

In the storage of petroleum, particularly light oils, under a floating roof frequently the sun's rays striking the side walls of the storage tank heat these walls to such a temperature that the oil adjacent the side walls of the storage tank is sufficiently heated to gasify readily. This causes the development of considerable gas pressure around the seal and frequently causes gas to escape by the seal.

It has been discovered that by providing a floating deck with a seal which contains a flexible septum covering the liquid surface between the periphery of the floating roof and the adjacent tank wall and by ballasting this septum with water or other cooling fluid the tendency of the oil around the side walls of the roof to gasify can be reduced.

Various further objects and advantages of the present invention will be apparent from the description of a preferred form or forms of floating roof and seal therefor embodying the invention. For this purpose there is hereafter described, with reference to the accompanying drawing, the preferred form or forms of seals for floating decks embodying the present invention.

In the drawing:

Figure 1 is a fragmentary elevation partially in vertical section.

Figure 2 is a fragmentary plan view.

Figure 3 is a fragmentary elevation of a slightly modified form of seal supporting means.

Referring to the drawing, 1 generally indicates the side wall or shell of a liquid storage container or tank such, for example, as is employed for storing petroleum oil. 2 represents a floating roof or deck which covers the majority of the surface of the liquid in the container and which in this case is indicated to be in the form of a pan float, although it may have any suitable form. 3 indicates the annular space between the side wall or upstanding edge 4 of the deck and the shell 1 of the storage tank. As is well known, it is necessary to provide an annular space of this kind in order that the floating deck may rise and fall freely in the container which is always somewhat out of round and has various joints and irregularities. 5 indicates shoes or runners attached to suitable supporting means such as pivotal hanger arms 6 which are pivoted to brackets 12 mounted upon the top of the upstanding wall 4 of the floating deck. These pivotal arms are in turn pivoted as indicated at 13 to brackets 14 attached to the runners 5. The runners 5 are preferably of flexible plates of metal and are slightly spaced apart at their edges so that as the runners are pivoted towards and away from the floating roof to accommodate different irregularities in the shape of the storage tank, the spaces between the runners will be sufficient to accommodate for the necessary expansion and contraction of the total runner surface.

The pivotal arms 6 have extensions 16 extending over the side walls 4 of the floating roof and at their ends are connected with springs 7 which are attached to brackets 18 suitably secured to the bottom wall 17 of the floating roof. By this means a yielding pressure is provided for urging the runners into the outer position, and the runners are suitably supported by the floating roof.

Connected between the runners and the lower part of the floating roof is a flexible septum 8,

preferably a gas-tight fabric curtain suitably secured or bolted to the runners 5 at one end and at its inner end suitably secured, as indicated at 19 to the floating roof near its lower outer edge. Sufficient flexible fabric curtain or septum is provided extending between the runners and side wall of the floating roof as to leave the septum even in the more expanded position in the form of a trough which is in practice suitably weighted down by ballast water, as indicated at 10. The ballast water serves both the purpose of insuring that the septum will be at all times in contact with the liquid surface and also serves to cool the liquid around the periphery of the floating deck, thereby eliminating to an extent at least, the tendency of such liquid to gasify. The flexible septum also assists in rendering the seal more gas-tight with the result that less of the liquid being stored will be lost in use of the floating deck and seal.

The shoes or runners 5 serve to support the outer edge of the sealing septum and hold it closely adjacent the side wall of the tank 1, while protecting it from being injured through contact with rivets, bolts, joints or other irregularities in the side wall of the tank.

In certain cases it may be desirable to provide the floating deck with suitable means for releasing or drawing off gas from under the deck. Such would be the case where there was introduced into the storage tank an oil containing fixed gases. It is also desirable to have a means for admitting air under the roof when all of the contents of the tank are to be removed for cleaning the tank. In such case the bottom wall of the floating roof is provided with a dome 20 which connects with a pressure valve 11 and a vacuum valve 21. These valves may be set to permit of any desired pressure being maintained under the roof or any desired vacuum, after which the valves are opened.

It will be observed that by the floating roof and seal herein described there is virtually no free liquid surface in the container excepting a very narrow one between the outer edge of the septum 8 and the tank shell. As long as the liquid in the tank is below its boiling point, therefore, there can be no evaporation excepting from this very narrow annular space.

The ballast water tends to evaporate slowly and cool the upper surface of the liquid in the container at the periphery as it ordinarily absorbs heat most rapidly from the tank 1. This tends to prevent ebullition of the liquid when the oil within the storage tank is of a volatile nature.

I have found that various common materials may be used for the septum 8, such as, impregnated asbestos and metal fabric. This septum in operation is especially durable due to the fact that it is entirely submerged in the liquid and is exposed to no petroleum vapors. When a fabric of this kind contacts with gas or vapors from the liquid being stored, such as is practically always the case with the seals at the periphery of the floating roofs as have heretofore been constructed, the septum becomes rapidly destroyed. I have also found that the material used for ballast of the septum can be so chosen as to exert a preservative action upon the septum since by the reason that its greater hydrostatic pressure or its greater tendency to wet the fabric it tends to prevent the stored liquid from penetrating the pores of the septum.

Now referring to the embodiment of my invention shown in Figure 3, the elements are much the same in that there is provided a pan shaped floating deck 2^a having a side wall 4^a. Between the side wall 4^a of the floating deck and the side wall 1^a of the storage tank there is an annular space 3^a which is to be sealed by the sealing means. The sealing means comprises runners or shoes 5^a which are similar in design to those described in connection with the previous form of the invention. There is also a septum 8^a of fabric attached to the runners at the outer edge, as indicated at 22, and to the lower outer edge of the floating roof, as indicated at 23. Sufficient of this material is provided to form a trough holding ballast water, as indicated at 10^a and the septum is in operation so disposed as to be substantially entirely in contact with the oil underneath the floating roof. The runners or shoes of the floating roof are supported in position by spring member 24 which is provided with one end 25 suitably attached as indicated at 26 to the side wall 4^a of the floating roof near its upper end. The spring is provided with one or more loops 27 and with the arm 28 which provides an eye 29 at its outer end for pivotally connecting the spring with the pin 30 carried by a bracket 31 attached to the shoe 5^a. It is to be understood, of course, that a spring or a plurality of springs 24 is provided for each of the shoes or runners used in supporting the flexible septum 8^a.

While the particular form of floating roof and seal therefor which has been herein described is well adapted to carry out the objects of the present invention, it is to be understood that various modifications and changes may be made without departing from the present invention, and the present invention includes all such modifications and changes as come within the scope of the following appended claims.

I claim:

1. A seal for the annular space between a floating deck of a liquid storage tank and the tank wall, which seal comprises runners for engagement with the tank wall extending down to below the surface of the liquid in the tank supporting the deck, means for supporting said runners on the floating deck and urging the same yieldingly outwardly into contact with the tank wall, and a flexible septum of substantially liquid-tight character attached at its inner edge to the floating deck near the lower edge thereof and supported at its outer edge by the runners near the liquid surface, whereby the major portion of said flexible septum lies at or slightly below the natural liquid surface, and a liquid ballast carried by the flexible septum.

2. A seal for the space between a floating deck and the wall of a liquid storage tank, which seal comprises runners and means for supporting the runners on the floating deck and urging the same yieldingly outward into engagement with the side wall of the storage tank, a flexible fabric curtain for covering the liquid surface which supports the floating deck, said flexible fabric curtain being attached at its inner edge to the floating deck and at its outer edge to the runners in such a manner that the curtain lies at or slightly below the natural liquid surface of the liquid supporting the deck, and a cooling liquid carried by the flexible septum and operating also as a ballast therefor.

FREDERICK G. HAMPTON.