May 12, 1942. J. H. WIGGINS 2,282,773

SEAL FOR FLOATING ROOFS

Original Filed April 1, 1939

FIG. 1.

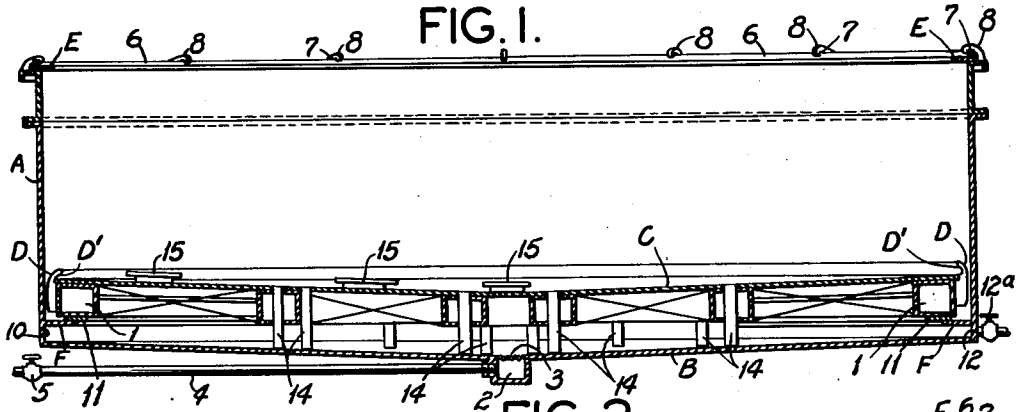


FIG. 2.

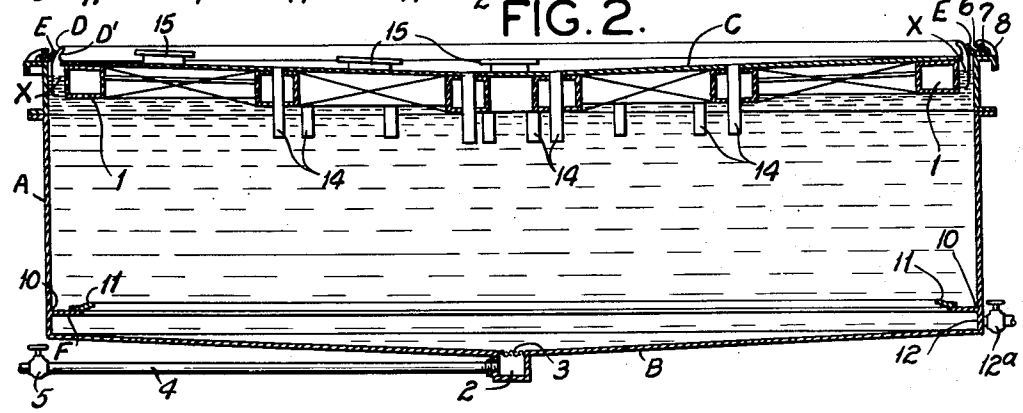


FIG. 3.

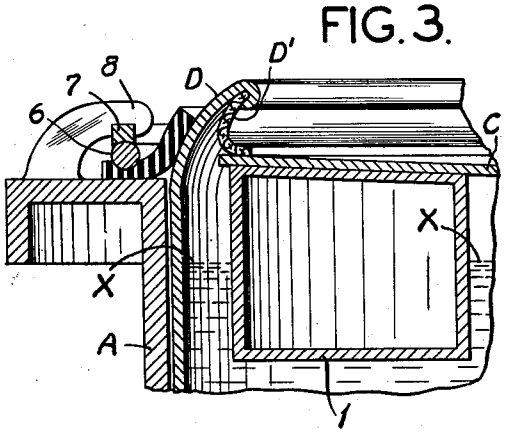
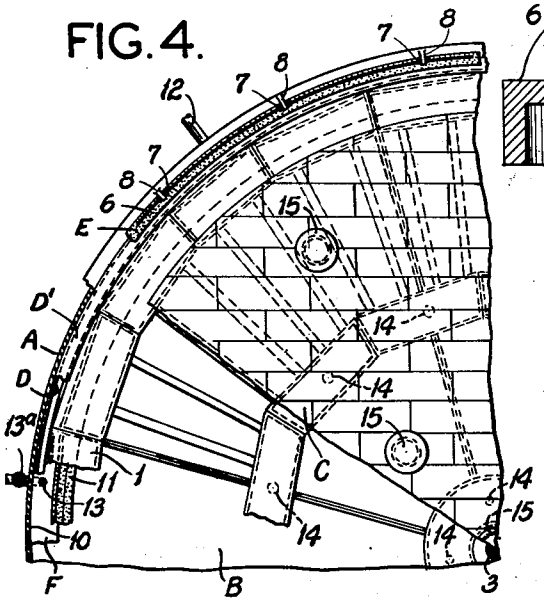


FIG. 4.



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2,282,773

SEAL FOR FLOATING ROOFS

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Original application April 1, 1939, Serial No. 265,432. Divided and this application October 4, 1939, Serial No. 297,800

1 Claim. (Cl. 220—26)

This invention relates to liquid storage apparatus, of the type that consists of a tank for holding the liquid, a vertically-movable roof, that normally floats upon and is sustained by the liquid confined in the tank, and a means mounted on the peripheral portion of said floating roof for closing the space between the roof and the tank wall, so as to protect the contents of the tank from the atmosphere, my present application being a division of my pending application, Serial No. 265,432, filed April 1, 1939.

The main object of my invention is to provide a liquid storage apparatus of the general type mentioned, in which the side wall of the tank is provided at or adjacent its top edge with an auxiliary sealing device, hereinafter referred to as an auxiliary "top" seal, that protects the joint between the tank side wall and the side wall sealing means mounted on the peripheral portion of the roof, when the tank is full, or approximately full, of liquid.

Figure 1 of the drawing is a vertical transverse sectional view of a liquid storage apparatus, constructed in accordance with my invention, showing the tank empty.

Figure 2 is a similar view, showing the tank full of liquid.

Figure 3 is an enlarged fragmentary sectional view, illustrating the auxiliary top seal on the side wall of the tank, and showing how said auxiliary top seal co-acts with the conventional side wall sealing means on the peripheral portion of the roof when the tank is full of liquid; and

Figure 4 is an enlarged fragmentary top plan view of the apparatus, partly broken away so as to more clearly illustrate the construction of the roof and the auxiliary top seal.

In the drawing, the reference characters A and B designate the side wall and the bottom, respectively, of a large circular metal tank of the kind commonly used for storing crude oil, gasoline and other volatile liquids. The liquid *x* in said tank is protected from the atmosphere by a floating roof C, which is provided at its peripheral edge with a primary side wall sealing means D, that is in sliding engagement with the side wall A of the tank. The particular construction of the floating roof C and of the primary side wall sealing means D at the peripheral edge of the roof, are immaterial, as my invention contemplates the use of any type or kind of floating roof and any type or kind of means D for maintaining a substantially gas-tight joint between the roof and the side wall of the tank when the roof is floating, or, in other words, when the roof is sustained or supported by the liquid in the tank. The floating roof herein illustrated is of the pontoon type, and is so constructed that a substantially annular-shaped pontoon **1** at the peripheral edge of the roof constitutes a rim which prevents the liquid in the tank from overflowing onto the top side of the roof, said rim **1** being spaced away from the side wall A of the tank, and the top edge of said rim being located in a higher horizontal plane than the surface of the liquid in the annular space between the tank side wall and the rim **1** of the roof. The means previously referred to that is used to maintain a substantially gas-tight joint between the tank side wall and the roof when the roof is floating, is herein illustrated more or less diagrammatically, inasmuch as it is of conventional construction. It comprises a primary side wall seal or shoe D of considerable height or depth, that is in sliding engagement with the tank side wall, a supporting means for said seal or shoe D formed usually by hangers (not shown) mounted on the roof, and a closure member D', formed usually by an annular-shaped piece of flexible gas-tight fabric, attached at its outer edge to the side wall seal or shoe D, and attached at its inner edge to the rim **1** on the roof C. When the roof is floating on the liquid in the tank, the relatively deep, narrow slot between the tank side wall and the shoe D, is closed at its lower end by the liquid in the tank, thus preventing gases and volatile products from escaping upwardly through the space between the tank side wall and the shoe D.

The bottom B of the tank slopes downwardly from the side wall of the tank to the center of said bottom, where a sump **2** is located, the upper end of said sump being protected by a screen **3**. A drain pipe or draw-off pipe **4**, that leads laterally from the sump **2**, is equipped with a valve **5** that is normally closed. In the operation of cleaning the tank, any dirt, sediment, or other material that is flushed off the internal surfaces of the apparatus, drains down the sloping bottom B of the tank to the sump **2**, and then escapes from said sump through the draw-off pipe **4**.

One novel feature of the apparatus herein illustrated is, that the side wall A of the tank is provided at or adjacent its top edge with an auxiliary top seal E that is adapted to bear against or wipe on the primary side wall seal or shoe D of the floating roof, in the event the tank is filled with liquid to such a height or level that the side wall seal or shoe D projects upwardly some distance above the top edge of the tank side

wall, or above the top edge of an annular extension attached to the side wall of a shallow tank, so as to increase the height of same. Under such conditions, i. e., when the shoe D projects upwardly some distance above the top edge of the tank side wall, the height or depth of the narrow slot between the shoe D and the tank side wall is diminished, and consequently, the efficiency of the primary side wall seal is reduced, but there is no liability of gases escaping past the shoe D, because at such times the auxiliary top seal E presses against the outer surface of the shoe D. It will thus be seen that the auxiliary top seal E protects the primary side wall seal D, and in effect, increases the storage capacity of the tank, because it permits the roof C to float higher in the tank, without danger of gases or vapors escaping through the joint between the tank side wall and the side wall seal D mounted on the peripheral portion of the roof. Usually, the auxiliary top seal E will be formed by an annular-shaped member made of flexible gas-tight fabric, and it may be attached in any suitable way to the side wall A of the tank. It is herein illustrated as being secured to the tank side wall by a clamping ring 6 superimposed upon the outer edge portion of the top seal E, and retained in position by wedge-shape retaining devices 7 that are wedged between the ring 6 and overhanging lugs 8 on the top edge of the side wall of the tank, as shown in Figure 3.

In order that the tank may be cleaned easily and thoroughly with steam, as described in my parent application, Serial No. 265,432, filed April 1, 1939, it is equipped with an auxiliary bottom seal which may be formed by a horizontally-disposed plate or flange F that projects inwardly from the tank side wall adjacent the bottom of the tank, said plate or flange F extending around the entire circumference of the tank side wall and having its outer edge connected to the tank side wall by a welded joint 10. Usually, the horizontally-disposed plate F will be provided on its top side with a compressible element 11, that is adapted to be contacted or engaged by the pontoon 1 of the floating roof, when said roof is in its lowermost position, although the compressible element 11 may be omitted, without departing from my broad idea. When the tank is empty, or not filled with sufficient liquid to seal the roof, the pontoon 1, or some other peripheral portion of the roof, co-operates with the auxiliary bottom seal F to protect the primary side wall seal D carried by the roof, and makes it possible to admit steam to the space on the underside of the roof, so as to effectively remove dirt, sediment, or volatile products that have collected on the underside of the roof, or on the bottom of the tank, and discharge said dislodged substances through the drain 4 leading from the sump 3 at the center of the bottom of the tank. The steam or other medium used to clean the interior of the apparatus may be admitted in various ways to the space on the underside of the roof. Usually, the apparatus will comprise numerous steam supply pipes 12, provided with control valves 12a, attached to the tank side wall at points below the horizontally-disposed plate or flange F that constitutes the auxiliary bottom seal, so as to enable steam to be introduced into the bottom portion of the tank at numerous points throughout its circumference. If desired, the apparatus may be constructed so that steam may also be used to effectively clean the side wall shoe D and the parts associated with same that constitute the primary side wall seal on the roof. Thus, as shown in Figure 4, additional steam supply pipes 13 equipped with control valves 13a may be led in through the tank side wall and attached to the horizontally-disposed plate or flange F, so as to terminate in the top face of said flange, whereby jets of steam may be discharged upwardly onto the primary side wall seal D carried by the roof, and relied upon to maintain a tight joint between the roof and the tank side wall when the roof is floating. Substances that collect on the top side of the horizontally-disposed plate or flange F can be easily removed from same by a flushing stream supplied by a hose that is inserted between the tank side wall and the shoe D carried by the roof when the roof is floating with the pontoon 1 positioned just a slight distance above the auxiliary bottom seal F. Said auxiliary bottom seal not only makes it practical to use steam to clean the interior of the apparatus, due to the fact that workmen are not required to enter the space on the underside of the roof and the steam that is admitted to the space will not be wasted by escaping rapidly at the peripheral edge of the roof, but said auxiliary bottom seal also serves as a support for the peripheral portion of the roof, when the tank is empty, or substantially so. Any suitable or preferred means may be used to sustain the central or intermediate portions of the roof, when the roof is not floating on the liquid in the tank, such, for example, as upwardly-projecting supports on the bottom of the tank, or downwardly-projecting legs on the floating roof C. In the form of my invention herein illustrated the roof C is provided at numerous points throughout its area with depending legs 14 that are adapted to contact with the bottom of the tank, when the roof is in its lowermost position. The roof C is also preferably provided with one or more removable manhole covers 15, so as to provide access to the space on the underside of the roof, if it becomes necessary or desirable for workmen to enter the space on the underside of the roof.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

A liquid storage apparatus, comprising a tank having a vertical side wall, a floating roof adapted to be normally sustained by the liquid in the tank, a primary seal mounted on the roof at the peripheral edge of same and comprising an annular side wall shoe arranged to slidingly engage the tank side wall, said shoe projecting above the top edge of the tank side wall when the roof is at or adjacent its extreme uppermost position, and an annular flexible auxiliary seal carried by the tank side wall at its upper edge and projecting inwardly therefrom into the path of the side wall shoe of the primary seal, thereby sealing the upper end of the gas space between said shoe and tank side wall, when the roof is at or adjacent its extreme uppermost position.

JOHN H. WIGGINS.