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2,457,066

ACCESS DOOR FOR LIQUID CONTAINERS

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FIGURE 1.

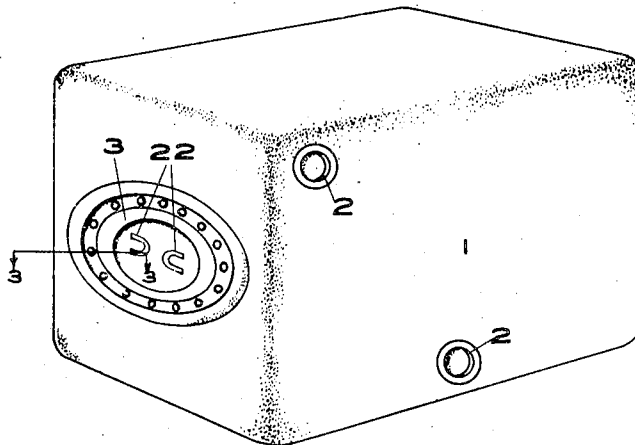


FIGURE 2.

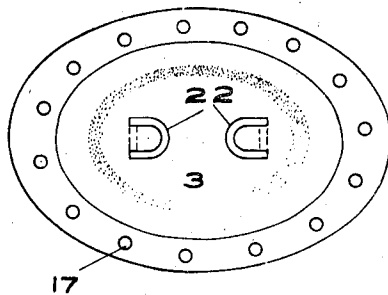


FIGURE 4.



FIGURE 3.

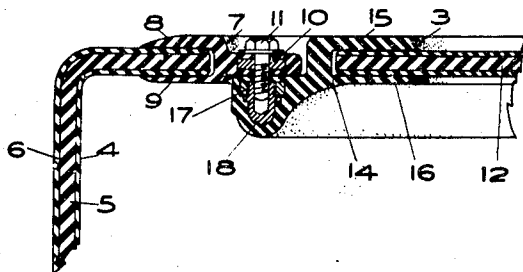
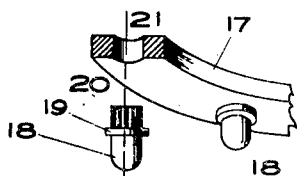


FIGURE 5.



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ACCESS DOOR FOR LIQUID CONTAINERS

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5 Claims. (Cl. 150—3)

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This invention relates generally to liquid holding tanks and is particularly concerned with tanks having flexible walls and liquid-tight seals around access doors in such walls.

In certain industries tanks of special construction are required, particularly when they are to hold certain liquids. For example, airplane fuel tanks have been made with laminated, flexible walls as described in U. S. Patents Nos. 2,102,590 and 2,321,417. Since such tanks must be provided with one or more openings to permit access to the interior thereof for various purposes, including the connecting of outlet fittings to the tank, and since it is essential that there should be no leakage of liquid about the access door, various efforts have been made to provide access door constructions which would be suitable and satisfactory.

Heretofore tanks of the class described have had access doors secured to the outer side of the tank as by bolts extending through the door and engaging the threads of nuts embedded in the tank wall around the access opening. This construction has not been entirely satisfactory for the threads in the nuts often become stripped, thus making it difficult, or impossible, to press the cover closely enough against the outer surface of the tank to prevent escape of liquid through the access opening, especially when that opening is at the bottom or on the side of a large tank. The entire tank becomes useless and has to be discarded when the nuts, or a sufficient number of them, are stripped to the extent that leakage of liquid is permitted.

The present invention aims to avoid the disadvantages of prior constructions and achieves this aim by making a sealing connection between the outer surface of the door and the inner surface of the tank and by embedding nuts in the cover rather than in the tank, thus preventing the installation of the door or cover with the wrong side of the same being placed in contact with the liquid, which would rapidly deteriorate the material comprising the outer portion of the door. The weight of the liquid contents of the tank and pressures existing in the tank assist in preventing leakage, and if any nut should become stripped or loose on the spline in the door only the door need be discarded. Accordingly, the present invention is an important improvement over the prior art in various respects, including economies and results.

In the drawings accompanying and forming a part of this specification,

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Figure 1 is a perspective view of a tank embodying the present invention;

Figure 2 is a plan view of the access door of the tank of Figure 1;

Figure 3 is a fragmentary, sectional view of parts of the tank and access door taken on line 3—3 of Figure 1;

Figure 4 is a side elevational view of the door of Figure 2; and

Figure 5 is a fragmentary, perspective view of the perforated ring and nuts embedded in the door of Figures 1 to 4.

The tank 1 of Figure 1 may be of any desired size or shape and is provided with any desired number of outlet openings 2, and with an access opening closed by door 3.

The walls of tank 1 may be composed of any suitable flexible material and may, if desired, be laminated after the manner described in the above mentioned patents. When the tank is to be used for gasoline on an airplane, the tank walls (see Fig. 3) may consist of an inner layer 4 of material resistant to gasoline, such for example as neoprene, an intermediate layer 5 of crude, unvulcanized rubber, and an outer layer 6 of vulcanized rubber. It will be understood that the walls of tank 1 may be composed of various other suitable materials, depending on the liquids the tank is to contain and the service conditions under which the tank is to be used.

The outlets 2 are provided with suitable outlet fittings and for this purpose the fittings of Patent No. 2,321,417 may be employed. The attachment of those and similar fittings to the tank walls may require access to the interior of the tank which is afforded by the opening which, in Figure 1, is covered by door 3. Such openings permit inspection and repair of the entire tank interior.

In Figures 2 to 5 one embodiment of the present invention is shown. In these figures the flexible wall of the tank consists of the laminations 4, 5 and 6 above described. This wall is provided with an opening, preferably oval or rectangular in shape. A door frame 7, composed of any suitable material such as synthetic rubber, is fitted in the opening through the tank wall and, as better shown in Figure 3, comprises a flexible member bifurcated along its outer periphery to form flanges 8 and 9 which engage, and are secured with liquid sealing contact to, the outer and inner surfaces of the tank wall, respectively. This frame 7, near its inner edge, has embedded therein a perforated annulus 10 and

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thus constitutes a rigid ring assembly. Holes are formed in the material of frame 7 in alignment with the perforations in annulus 10 so that bolts 11 may extend through the frame 7 and annulus 10.

The access door 3 is preferably composed of a central portion or panel 12 which is flexible and is composed of laminations like those of the wall 1, that is laminations 4, 5 and 6 above described. The door 3 includes a peripheral portion 14 which may be composed of any suitable material such as synthetic rubber. This peripheral portion is preferably a separate member which is bifurcated along its inner edge to form flanges 15 and 16 which engage, and are secured to, the outer and inner surfaces of panel 12 with liquid-sealing contact. A perforated ring 17 is embedded in the peripheral portion 14 of the door near its outer periphery. This ring 17, as well as annulus 10, is composed of a relatively stiff, nondeformable material, such as metal, molded Bakelite or the like. Nuts 18 provided with shoulders 19 and longitudinal serrations 20 are disposed in perforations 21 of ring 17 in such a manner that the nuts 18 may not rotate relative to the ring 17. The shoulders 19 press against one surface of the ring 17 and prevent movement of the nuts axially toward annulus 10 and relative to the ring.

It will be noted from Figure 3 that the peripheral portion 14 of access door 3 is offset with respect to the panel 12 so that when the door is assembled with the tank the outer surface of peripheral portion 14 will engage the inner surface of door frame 7, and that when the door and tank are so assembled the perforations in rings 10 and 17 may be aligned. When aligned, the bolts 11 which project into the tank through annulus 10 may be threaded into the nuts 18 of the door.

Since the access opening is oval in shape, the door 3 may be passed therethrough and then turned into the position shown in Figures 1 and 3, whereupon bolts 11 may be inserted through the holes in the frame and screwed into the nuts 18, thereby bringing the outer surface of the peripheral portion of the door into liquid sealing engagement with the inner surface of the door frame.

It will be understood that when the door 3 is in the bottom or side walls of a tank containing liquid the weight of the liquid on the door will tend to increase the sealing contact of the door on the tank walls or door frame and thus such weight will tend to decrease the liability of leakage of liquid past the door. Similarly, any pressure existing in the tank will press the door against the tank wall and increase the liquid-sealing contact therebetween.

If and when any nut 18 has stripped threads or loses its non-rotational contact with ring 17, the door may be replaced without any change being made in the tank or door frame.

While a preferred embodiment of the present invention has been described hereinabove, it will be understood that many changes may be made therein without departing from the present invention. For example, the headed bolts 11 may be replaced by studs detachably or permanently fixed to nuts 18 or their equivalents, and nuts may replace the heads of bolts 11. Also, the door frame 7 may be an integral part of the wall of the tank; and the peripheral portion 14 of the door may be integral with panel 12.

Furthermore, the D-rings 22 of the door, as shown in Figure 2, may be replaced by any equi-

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alent handle or desired gripping means which will enable one to hold the door while it is being located in the desired position within the tank. Furthermore, the nuts 18 may be replaced by threads formed in perforations 21 of ring 17, if desired. Other variations of the construction hereinabove shown and described, and not amounting to invention in themselves, may be made within the scope of the present invention. Having thus described the invention so that others skilled in the art may be able to understand and practice the same, I state that what I desire to secure by Letters Patent is defined in what is claimed.

What is claimed is:

1. In a tank for liquids, a wall consisting solely of flexible, rubber-like material, having an access opening, a perforated rigid ring assembly secured to the tank in liquid sealing relation to said opening, a door of similar flexible material for said opening having a peripheral portion provided with an outer surface to engage the inner surface of the rigid ring assembly about the said opening, a perforated rigid ring embedded in said peripheral portion of said door, and means including screw-threaded members disposed in aligned perforations of said ring and said ring assembly for pressing the said inner and outer surfaces together with liquid-sealing contact.

2. In a tank for liquids, a flexible wall of rubber-like material having an access opening, a perforated rigid annulus embedded in said wall around said opening, a door of similar rubber-like material for said opening having a flexible peripheral portion to engage the inner surface of said flexible wall, a perforated rigid ring, interiorly threaded nuts nonrotatably mounted in said perforations, said ring and nuts being embedded in said peripheral portion of the door, and means including screw-threaded members extending thru the perforations of said annulus and engaging threads in said nuts for clamping the outer surface of the peripheral portion of the door against the inner side of the flexible tank wall with liquid-sealing contact.

3. In a tank for liquids, a wall of flexible, rubber-like material having an opening there-thru, a door frame of similar material secured to said wall in said opening by a liquid-tight seal, a perforated rigid annulus embedded in said frame, a door of rubber-like material for said frame, said door comprising a panel and a peripheral portion having flanges engaging and secured to the outer and inner surfaces of said panel in liquid-tight relation to each other, a perforated rigid ring embedded in said door near its periphery, and means including threaded members extending thru the annulus in said frame and into the ring for forming a liquid-tight seal between the outer surface of the door and the inner surface of said frame.

4. In a tank for liquids, a wall of flexible, rubber-like material having an opening there-thru, a door frame of similar material in said opening and having flanges at its outer periphery engaging and secured to the inner and outer surfaces of the tank wall by a liquid-tight seal, a perforated rigid annulus embedded in said frame, a door of rubber-like material for said frame, said door comprising a panel and a peripheral portion having flanges engaging and secured to the outer and inner surfaces of said panel in liquid-tight relation to each other, a perforated rigid ring embedded in said door near its periphery, and means including threaded members extending

through the annulus in said frame and into the ring for forming a liquid-tight seal between the outer surface of the door and the inner surface of said frame.

5. In a tank for liquids, a wall of flexible, rubber-like material having an access opening, a perforated rigid ring assembly secured to the tank in liquid sealing relation to said opening, a door of similar flexible material for said opening having a peripheral portion provided with an outer surface to engage the inner surface of the rigid ring assembly about the said opening, a perforated rigid ring embedded in said peripheral portion of said door, and means including screw-threaded members disposed in aligned perforations of said ring and said ring assembly for pressing the said inner and outer surfaces together with liquid-sealing contact.

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