

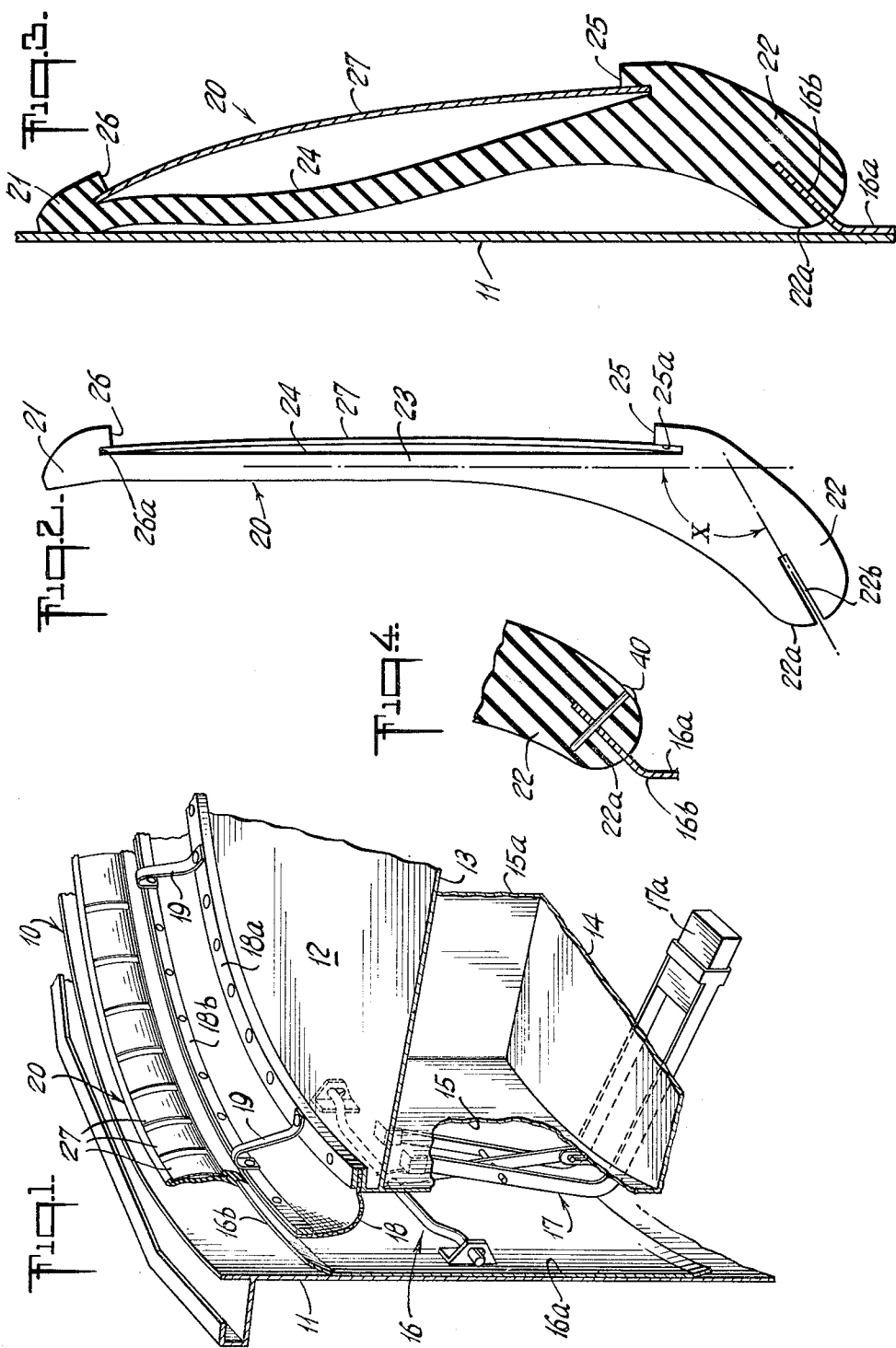
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SECONDARY SEAL FOR FLOATING TANK ROOF

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SECONDARY SEAL FOR FLOATING TANK ROOF
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This invention relates generally to liquid storage tanks having floating roofs and particularly to the secondary seal for the space between the floating roof and the inner tank wall.

Many oil storage tanks require a floating roof cover of the pontoon type which is capable of moving up and down within the tank in accordance with changes in fluid level as the volume of the tank contents varies.

Sealing structures to close the annular area between the inner wall surface of the tank and the floating roof usually include a primary seal comprising a plurality of shoes supported by the floating roof itself, with the open space between the primary seal and the floating roof being closed by a continuous flexible fabric seal usually.

Even though the shoes are held against the inner wall surface of the tank with pressure, it is not always possible to hold them in a seal-tight condition so that water and other contaminants will not seep into the tank through the clearance between the shoes and the wall and become admixed with the stored product. Furthermore, there is a problem of corrosion arising in the areas contacted by the shoes of the primary seal and in case of severe weather, liquids may freeze between the primary seal shoes and the tank wall.

Accordingly, it is an object of the invention to provide an improved floating roof seal which will prevent or minimize the flow of contaminants across the seal contact area into the tank.

Another object of the invention is to provide a simple floating roof seal which is economical with respect to the cost of material and the labor for its installation.

Still another object of the invention is to provide a secondary seal for a floating tank roof which is simple and inexpensive to make and without a requirement for separate and special support therefor.

Another object of this invention is to provide a novel secondary seal for a floating tank roof which is in contact with the tank wall at all times.

These and other objects, features and advantages of the present invention will become apparent from the following description and claim of the present invention when read in the light of the drawing in which:

FIG. 1 is a perspective view of a cross section of a floating tank roof showing the primary and secondary seals;

FIG. 2 is a cross sectional view of the improved secondary seal;

FIG. 3 is a partial, cross sectional view of the secondary seal shown in operative position; and

FIG. 4 is a fragmentary view showing an alternate means of fastening the secondary seal to the edge of the primary seal.

The objects of the present invention are achieved by the application of a flexible seal directly to the primary seal of a floating tank roof, without the requirement of a special support for the secondary seal, and which will be held at all times in sealing position against the tank wall.

Referring to the drawing, part of a cylindrical, open end storage tank, indicated generally at 10, is shown, including the upstanding side wall 11 and the floating pontoon type cover or roof 12. The floating roof 12 comprises the top deck 13, the bottom deck 14, interconnected

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by the rim plate at 15 and bulk heads, one of which is shown at 15a.

The primary seal 16 comprises a number of shoes, such as indicated at 16a, each of which is supported by and interconnected with the floating roof by means of the hanger structure indicated generally at 17. By an appropriate balance of the hanger, 17a, the shoes of the primary seal are held in contact with the inner surface of the tank side wall as the floating roof rises and falls in accordance with changes in the amount of the contents stored in the tank.

To close the annular space between the floating roof and the shoes of the primary seal, a continuous flexible seal, 18, for example, fabric, is fastened to the roof and to the primary seal at 18a and 18b respectively, by means of backing strips and bolts. Conventional grounding straps between the floating roof and the primary seal are indicated at 19. Seals and interconnections between each of the shoes are in a manner well known in the art and are not described here.

With respect to the edge structure of each of the shoes of the primary seal, there is disclosed at 16b an inwardly turned edge or flange portion angled approximately at 45° and about 1/2 inch in extent. On this inwardly turned flange portion or break, a secondary seal 20 is positioned, the seal having a slot or recess for fitting over the break in the shoe for support thereby.

Referring in detail to FIG. 2, there is shown a cross section of the resilient secondary seal of a flexible plastic material, e.g. synthetic rubber resistant to hydrocarbon attack and tendency to set, comprising the offset contact end portion at 21, the enlarged offset support portion at 22, and the planar intermediate interconnecting portion at 23. The contact end portion is shown slightly offset and projecting out of the plane of the back or inner surface of the intermediate portion and having a sharp contact edge, but other configurations can be used for this contact end portion to compensate for wear, and to insure sufficient pressure against the inner tank wall surface.

The offset support portion 22 is shown as ending in a substantially hemispherical cross section, as indicated at 22a, with a recess 22b extending from the edge of the hemispherical surface inwardly at an angle such that the axis of this recess intersects the axis of the straight uniform section of the intermediate portion 23 at an obtuse angle X of slightly less than 135°, so that when the secondary seal is placed on the 45° break of the upper edge of the shoes of the primary seal at 16b, the divergence in angularities will allow adequate contact surface between the contact end portion of the secondary seal and the inner wall surface.

To provide a more positive contact with and to insure pressure on the inner wall surface, use is made of external positioned metallic stiffeners or inserts. On the outer exposed surface 24 of the intermediate portion 23, there are provided tongue-like members 25, 26, projecting toward each other to define grooves 25a, 26a, facing each other. Into these grooves, metallic stiffeners or inserts 27 are cupped and seated, the length of each stiffener in the radial direction being slightly greater than the distance between the bottoms of the facing grooves 25a, 26a, so that the force exerted by the spring action of the stiffeners in a radial direction provides pressure and results in more positive contact with the inner wall surface of the tank. These external positioned inserts are flat sheet metal, e.g. spring bronze strips, about 6" in width, and are spaced circumferentially about 1/8" apart in the grooves to act as radial springs. In view of the substantially large diameter of the storage tank in which the secondary seal is to be used, and with the flexibility of the

inserts, a substantially circumferential application of force is obtained.

The intimate contact with the inner tank wall surface not only provides an effective seal to minimize or prevent the flow of contaminants across the seal into the tank itself, but the configuration of the downwardly directed shape of the secondary seal is such that the rain water runs off toward the center of the tank roof, whence it is removed in a manner well known in the art.

In use, it has been found most expedient to prepare for the application of the improved secondary seal by cleaning the upper edges or breaks of the shoes of the primary seal by scraping and wire brushing, followed by scrubbing with a suitable solvent to remove paraffin or oil deposits. A thin film of a rubber cement or other rubber adhesive is applied to both sides and the edge of each break for use as a lubricant in forcing on the secondary seal and for bonding the seal to the shoe. To complete the joint between individual 50' sections of the secondary seal, tapes well known in the art are used and span the joint adequately. In addition, when conditions require to secure the secondary seal positively, fastening pins or self tapping screws, appropriately spaced, are used as indicated at 40, FIG. 4.

Since the secondary seal will be made of rubber and most likely from synthetic resilient materials which are not subject to deterioration either by contact with hydrocarbon vapors or to abrasion and excessive wear as the seal rubs against the inner tank wall, and even though the shoes of the primary seal may be deflected from the shell by weld seams or deformations of the tank wall, the secondary seal has sufficient flexibility and elasticity to bridge the maximum observed deflection of the shoes from the tank wall. The close contact of the secondary seal with the tank wall surface prevents the escape of oil or other volatile product vapors from the storage tank while preventing contaminants from entering the tank across the face of the primary seal.

Thus there has been shown that the secondary seal of the type shown herein can be used to augment effectively the primary seal of a floating roof of a storage tank in order to retain vapors from the liquid contents thereof while preventing the entrance of contaminants thereinto.

Other modifications and variations of the invention, as hereinbefore set forth, may be made without departing from the spirit and scope thereof, and therefore only such limitations should be imposed as are indicated in the appended claim.

I claim:

In combination with an open end cylindrical container for holding fluid, a cover therefor adapted to move up-

wardly and downwardly in said container corresponding to changes in the volume of the fluid held in said container comprising a floating roof, a primary seal having a plurality of shoes supported in contact position with the inside wall surface of said container by said floating roof and being spaced annularly therefrom, each of said plurality of shoes having its top edge projecting angularly away from said inside wall surface, flexible interconnecting means for closing the annular opening between said primary seal and said floating roof, and a secondary seal affixed on the top edges of said plurality of shoes of said primary seal and contacting said inside wall surface on its inner protected face with respect thereto, comprising a flexible, angular member having an inside tank wall surface contact portion at one end thereof and an offset support portion at the other end thereof with a recess therein, and an intermediate portion interconnecting said contact portion with said support portion, the axis of said recess in said offset portion and the axis of said intermediate portion intersecting at an obtuse angle facing said inside wall surface, said recess in said support portion having dimensions for a tight fit on said top edges of said shoes, deep enough for adequate engagement with said top edges of said shoes and shallow enough to prevent contact of said support portion with said inside wall surface, said intermediate portion having tongue-like members projecting toward each other thereby defining a pair of grooves facing each other on the outer exposed face thereof with respect to said inside wall surface, said tongue-like members extending longitudinally of said secondary seal adjacent the support and contact portions thereof, and a plurality of resilient metallic inserts seated in closely spaced circumferential relationship in said pair of grooves, said inserts having a transverse dimension greater than the distance between the bottoms of said pair of grooves whereby a spring action of the inserts in a radial direction is provided around said offset support portion to maintain said contact portion of said secondary seal in positive contact with said inside tank wall surface.

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