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SEAL FOR FLOATING ROOF TANKS

Filed Jan. 5, 1946

Fig. 1.

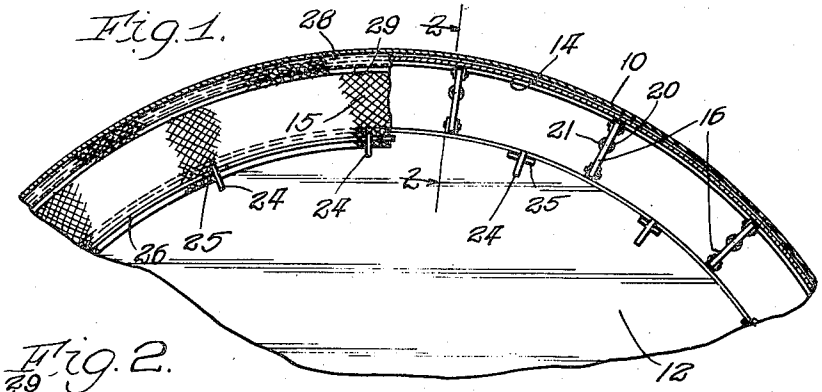


Fig. 2.

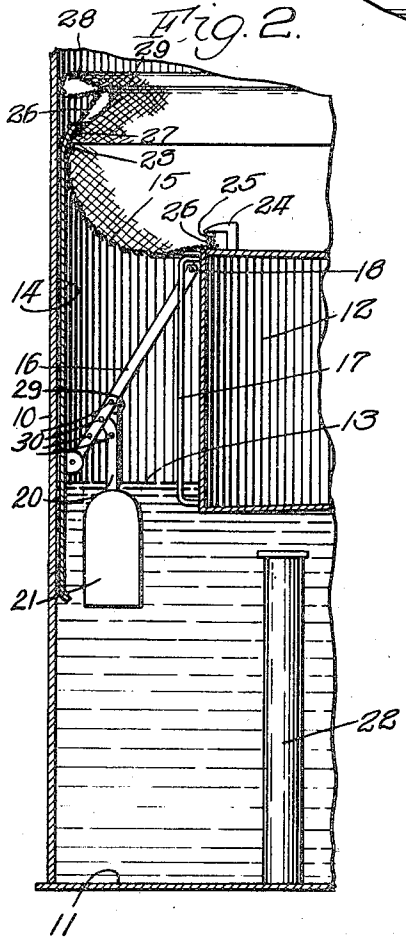
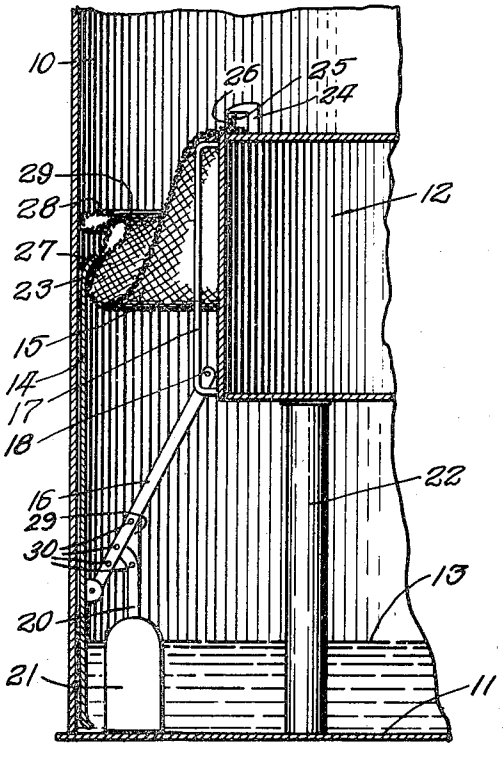


Fig. 3.



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SEAL FOR FLOATING ROOF TANKS

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9 Claims. (Cl. 220—26)

1

This invention relates to a floating roof tank wherein the roof floats on top of the stored liquid, and relates particularly to a seal for sealing the area between the edge of the roof and the shell of the tank.

In floating roof tanks there is sometimes provided a shoe to rest against the shell of the tank in sealing relationship therewith and a flexible seal extending from the shoe to the floating roof. The roof rises and falls as the stored liquid within the tank is increased and decreased. There are usually provided supports on the bottom of the tank upon which the roof rests when the liquid level has been withdrawn below a given point. It has been found that when almost all liquid has been withdrawn the bottom of the sealing shoe is above the liquid level and the mixture of air and vapor beneath the floating roof tends to be forced out between the shell and the shoe due to a raise in temperature within the tank, usually caused by the heat of the sun.

We have invented a seal wherein the bottom of the shoe is kept immersed in the stored liquid until substantially all the liquid has been withdrawn from the tank. The seal comprises, broadly, a shoe held against the shell and movable vertically in a restricted path relative to the edge of the roof, and buoyant means immersed in the stored liquid for pushing the shoe upwardly and outwardly against the shell.

The invention will be described as related to the embodiment shown in the accompanying drawings. Of the drawings, Fig. 1 is a fragmentary plan view of a floating roof tank embodying the invention with portions broken away for clarity of illustration; Fig. 2 is a vertical section taken along line 2—2 of Fig. 1 showing the roof floating on top of the stored liquid; and Fig. 3 is a view similar to Fig. 2 showing the roof resting on supports at the bottom of the tank.

The floating roof tank shown in the accompanying drawings comprises a shell 10, a bottom 11, a floating roof 12 normally floating on the stored liquid 13 within the tank, a shoe 14 held against the shell 10, and a flexible sealing member 15 extending between the top of the shoe 14 and the top surface of the floating roof 12.

The shoe 14 is held against the shell 10 by means of a plurality of spaced support arms 16 hingedly attached to the shoe near the bottom thereof, and extending upwardly to near the top of the vertical edge of the floating roof 12. The roof end of each support arm 16 is held in a slotted retainer 17 with the slot held away from the vertical edge of the roof and with the upper end of arm 16 within the slot.

2

in the slot. This upper end is held within the slot by means of a pin 18 extending from either side of the support arm 16 within the slot 19.

Near the bottom of each support arm 10 there is located a buoyant means comprising a downwardly extending arm 20 having a float 21 on the bottom end immersed in the stored liquid 13 with the bottom of each float being about even with the bottom of the shoe 14. The arm 20 is preferably rigidly fastened to the support arm 16 as by the plate 29 and rivets 30. All arms 20 may be connected by an annular ring, if desired, to give greater rigidity, in which case the connections of arms 20 to support arms 16 would be hinged.

On the bottom 11 of the tank there is located support means comprising a plurality of posts 22. These posts are to hold the floating roof above the bottom of the tank when the liquid is being withdrawn from the tank. The float 21 is preferably held immersed in the liquid 13 at a depth less than the height of the posts 22.

With the construction described above the floats 21 serve normally to push the shoe 14 upwardly and outwardly against the shell 10. When the roof is floating on top of the liquid each support arm 16 will be held with its roof end at the top of its slotted retainer 17. When the liquid is withdrawn from the tank the roof 12 will come to rest on top of the posts 22. As the withdrawal of the liquid is continued the shoe, floats and support means go down with the liquid level. The bottom of the shoe is kept immersed in the liquid until substantially all liquid has been withdrawn. When the last portion is withdrawn the floats will be resting on the bottom of the tank.

The floats 21 must have sufficient buoyancy to support the weight of the shoe and other portions of the seal plus a small amount of friction. The shoe is preferably made in sections with each pair of adjacent sections joined to each other. The depth at which the floats 21 are immersed in the liquid 13 depends upon the buoyancy of the floats, the weight to be supported, the specific gravity of the liquid 13, and the friction of the shoe 14 against the shell 10. This depth may be so regulated that the floats will be resting on the bottom of the tank when the roof ends of the support arms 16 are substantially at the bottom of the slots 19. This construction, however, is not absolutely necessary. The bottom of the shoe 14 should be substantially even with, or just above, the bottom of the floats 21.

The flexible sealing member 15 that is fastened between the top of the shoe 14 and the floating

roof 12 should have a length greater than the shortest distance between its points of attachment to the shoe and the roof when the support is in its lowest position. The sealing member 15, which may be of fabric impregnated with a flexible impervious material, may be fastened to the top of the shoe by means of bolts 23 and to the top edge of the roof 12 by hooks 24 holding wedges 25 pressing against a circular rod 26 in contact with the edge of the sealing member 15.

If desired, a secondary seal may be provided between the top of the shoe 14 and the shell 10 in order to provide a tighter seal. The secondary seal shown comprises a series of spaced brackets 126 mounted on the top edge of the shoe 14 by bolts 27 with the brackets carrying a loop 28 of flexible sealing material in contact with the shell 10. A length of flexible sealing material 129 extends between the loop 28 and the top of the shoe 14, and has its bottom edge held by the bolts 27.

Having described our invention as related to the embodiment shown in the accompanying drawings it is our intention that the invention be not limited by any of the details of description, but rather be construed broadly within its spirit and scope as set out in the accompanying claims.

We claim:

1. In a floating roof tank comprising a shell and a floating roof therein normally floating on top of the stored liquid within the shell, a seal comprising a shoe held against the shell, a support arm hingedly attached near the bottom of the shoe and extending upwardly to the vertical edge of the roof, said roof end of the support arm being permissibly movable in a vertical direction along the vertical edge of the roof, and buoyant means attached to the support arm and immersed in the stored liquid for pushing the support arm and shoe upwardly.

2. The seal of claim 1 wherein the buoyant means is rigidly attached to the support arm near the shoe.

3. The seal of claim 1 wherein the buoyant means holds the shoe at the top of said path when the roof is floating on top of the stored liquid.

4. In a floating roof tank comprising a shell, a floating roof therein normally floating on top of the stored liquid within the shell, and support means on the bottom of the tank for supporting the roof above the bottom when the liquid level is beneath the top of the support means, a seal comprising a shoe held against the shell, a support arm hingedly attached to the shoe near the bottom of the shoe and extending upwardly to the vertical edge of the roof, means

permitting vertical movement of the roof end of said arm along the edge of the roof, and buoyant means attached to the support arm and immersed in the stored liquid for pushing the support arm and shoe upwardly.

5. The seal of claim 4 wherein the bottom of the buoyant means is substantially even with the bottom of the shoe.

6. The seal of claim 4 wherein the buoyant means is rigidly attached to the support arm near the shoe.

7. The seal of claim 4 wherein the holding means comprises a slotted retainer mounted on the vertical edge of the floating roof with the roof end of the support arm movably held in said slot.

8. In a floating roof tank comprising a shell, a floating roof therein normally floating on top of the stored liquid within the shell, and support means on the bottom of the tank for supporting the roof above the bottom when the liquid level is beneath the top of the support means, a seal comprising a shoe held against the shell, a support arm hingedly attached to the shoe near the bottom of the shoe and extending upwardly to the vertical edge of the roof, a slotted retainer mounted on the vertical edge of the floating roof with the roof end of the support arm movably held in said slot, and buoyant means rigidly attached to the support arm near the shoe and immersed in the liquid to a depth less than the height of the support means, the bottom of said shoe being substantially even with the bottom of the buoyant means.

9. The seal of claim 8 wherein there is provided a flexible sealing member attached to the top of the shoe and the top edge of the floating roof above the slotted retainer with the sealing member being longer than the maximum distance between its points of attachment when the roof end of the support arm is at the bottom of the slotted retainer.

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