

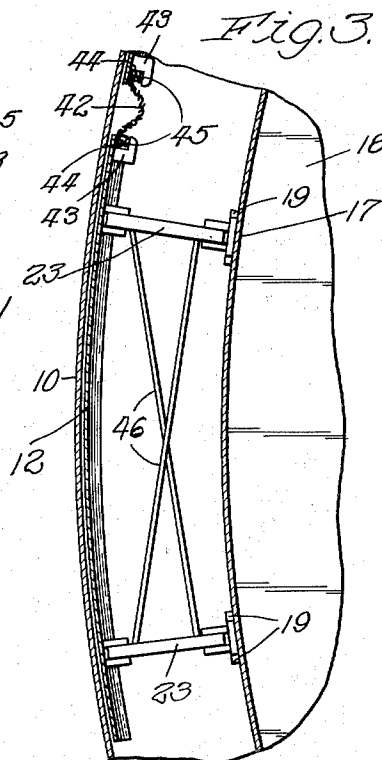
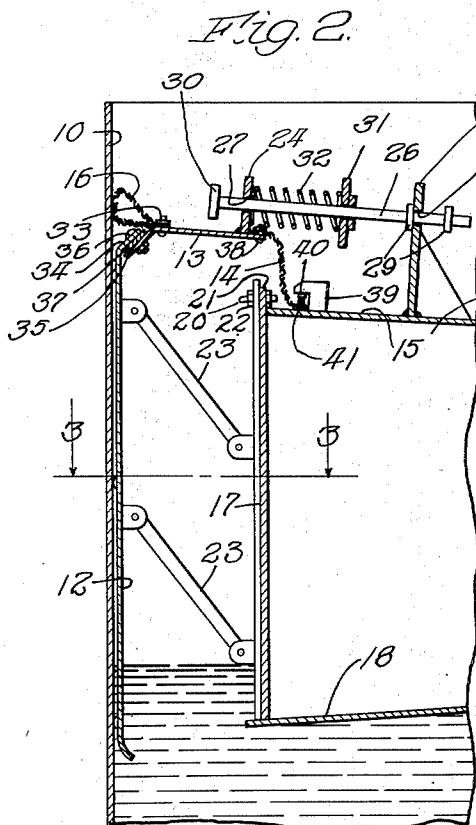
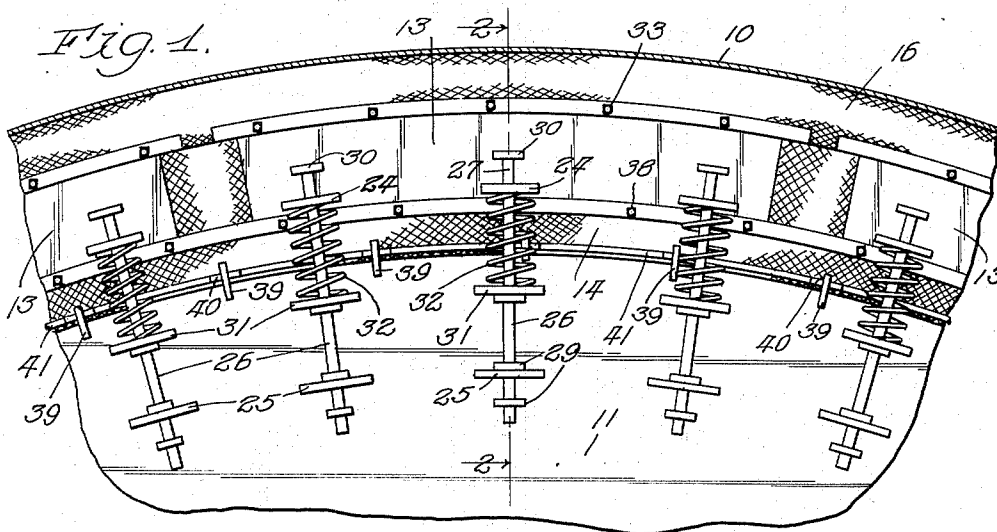
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FLOATING ROOF TANK

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FLOATING ROOF TANK

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This invention relates to a floating roof tank, and particularly to a seal for a floating roof tank for sealing the area between the edge of the roof and the inner surface of the tank shell.

Floating roof tanks for the storage of volatile liquids in which a roof is provided that floats on top of the liquid contents must have means for sealing the annular area between the edge of the roof and the tank shell. This is necessary in order to prevent evaporation of the tank contents and to prevent contamination with water, dirt, and the like. I have invented an improved seal that is light in weight and simple to install, and that provides a positive sealing action between the floating roof and the tank shell.

The new seal comprises a shoe, preferably of metal, normally pressing against the inner surface of the shell and removably attached to the floating roof, and a seal section extending from the shoe to the roof. There is also provided spring means to aid in pressing the shoe against the shell and preferably a secondary seal that is normally held in sealing contact with the tank shell. The seal achieves a positive sealing action partially by its own weight, and partially by the spring means.

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 the floating roof tank embodying this invention; Fig. 2 is a fragmentary vertical section taken through the edge of the floating roof and the adjacent portion of the tank shell; and Fig. 3 is a horizontal section taken along line 3—3 of Fig. 2.

The tank shown in the accompanying drawings comprises a shell 10 and a floating roof 11 positioned therein. Between the edge of the floating roof and the inner surface of the tank shell there is provided a seal comprising a flexible metal shoe 12 adapted to rest flat against the shell, an annular metal cover plate 13 attached to the top of the shoe 12 and held in generally horizontal position, and a flexible sealing strip 14 extending from the cover plate 13 to the top surface 15 of the roof 11. There is also preferably provided a secondary seal 16 comprising a looped fabric fastened to the cover plate 13 and pressing against the shell 10. The flexible sealing strip 14 and secondary seal 16 are preferably made of a fabric impregnated with a flexible impervious material that is wear-resistant.

The seal is held in place by means of vertical bars 17 adapted to be held against the edge of

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the floating roof and upwardly extending hanger bars 23 extending between the vertical bar 17 and the shoe 12. The hanger bars 23 are rotatably fastened to the vertical bar 17 and to the shoe 12, so that the weight of the shoe and attached sealing members will force the shoe and the secondary seal out against the shell. Each bar 17 is held in position on the edge of the roof by means of a base member 18 which may comprise an extending bottom edge of the roof, and each bar is held against lateral movement by means of spaced guide members 19. The vertical bars 17 are removably held in place against the edge of the roof by a pin 20 passing through the top of each vertical bar 17 and the top edge 21 of the roof. The edge of the roof is extended above the top surface 15 in order to provide the top portion 21. Each pin 20 is held in place by means of a second, smaller pin 22 passing through the end.

On the top surface of the metal cover plate 13 there is provided a series of spaced brackets 24 attached to the plate. A series of second brackets 25 is attached to the roof in upstanding position with each second bracket 25 being immediately behind a first bracket 24. Extending between each first bracket and each second bracket is a threaded rod 26 loosely held within holes 27 and 28 provided in the first and second brackets respectively. The rod 26 is held within the second hole 28 by means of spaced collars 29 mounted on said threaded rod. The rod 26 is also provided with a flared end 30 on the other side of the first bracket 24 to prevent accidental displacement of the rod. Mounted on the rod 26 is a threaded base member 31 engaging the threads of the rod 26 and located between the first bracket 24 and the second bracket 25. A spring 32 extends from the base member 31 to the first bracket 24, and this spring is held in compression substantially concentrically to the rod 26.

The secondary seal 16 is mounted on the metal cover plate 13 adjacent the metal shoe 12 by means of a plurality of spaced bolts 33 extending through the cover plate and the edge of the seal. The top edge 34 of the shoe 12 is bent back from the shell and is fastened to the edge 35 of the cover plate 13 by means of a plurality of bolts 35 passing through the edge 34 of the shoe, a compression strip 37, and the edge 35 of the cover plate. The flexible sealing strip 14 is attached to the metal covering plate 13 by means of a plurality of bolts 38 passing through the inner edge of the covering plate 13 and the top edge of the sealing strip 14. The bottom edge of the sealing

strip is fastened to the top surface 15 of the roof by means of a plurality of hooks 39. The edge of the sealing strip is held by wedges 40 contacting the hooks 39 and wedging against a circular bar 41 which presses against the edge of the sealing strip 14.

The seal described herein is light in weight and easy to install, and provides a positive sealing action between the roof and the tank shell. The removable support for the shoe makes erection easier and maintenance of the seal simple. The shoe 12 is held in place against the shell 10 partially by its own weight and partially by the action of the spring 32 pressing the metal cover plate outwardly. The spring 32 also serves to press the secondary shell 16 against the shell. The compression of the spring may be varied by varying the distance of the threaded base member 31 from the first bracket 24.

The metal shoes 12 are ordinarily made in sections and adjoining sections are connected together by means of fabric strips 42 impregnated with a flexible impervious material. The edges of these strips are held in place by means of hooks 43, rods 44, and wedges 45 of the same nature as those used in fastening the edge of the sealing strip 14 to the top surface 15 of the roof. Any other suitable fastening means may of course be used. In a typical installation the shoes were 9 feet long and 4 hanger bars were used, each spaced 2 feet from an end of the shoe. The 4 bars were arranged in vertically aligned pairs, with each pair being substantially parallel to all the others. In order to prevent lateral movement of the seal there were provided crossed bracing rods 46 between two laterally adjacent hanger bars 23. This bracing may be provided either on the top pair of hanger bars, the bottom pair of hanger bars, or on both pairs.

Having described my invention as related to one embodiment of the same, it is my intention that the invention be not limited by the details of description unless otherwise specified, but rather be construed broadly within its spirit and scope as set out in the accompanying claims.

I claim:

1. In a liquid storage tank having a floating roof and a plurality of shoes adapted to slidably contact the inner side walls of the tank, an annular seal between the shoes and the roof, means for supporting said shoes against the tank wall comprising a plurality of pairs of substantially vertical guide members attached to the edge of the floating roof and extending downwardly into the space between the roof and the walls beneath the annular seal, a vertical bar held between each pair of guide members shoe supporting hangers attached to the shoe and attached to the vertical bars, and means for removably securing said bars to the roof, said means being connected to the roof and to the bars only at the upper edge of the roof.

2. Apparatus of the character described in claim 1 in which said annular seal comprises

an annular metal cover plate attached to the top of the shoes, a secondary seal carried by the cover plate and pressing against the side walls above the shoes a flexible sealing strip extending from the cover plate to the roof, a series of spaced brackets mounted on the cover plate, a series of second spaced brackets mounted in upstanding position around the edge of the roof adjacent said first brackets, a threaded rod extending between each of said first brackets and each of said second brackets and loosely held in said brackets, a threaded base member engaging the threads on said rod and located between said first and second brackets, a spring positioned around said rod and extending from the base member to said first bracket, said spring being adapted for compression between the base member and the first bracket.

3. In a liquid storage tank having a floating roof, a plurality of shoes adapted to slidably contact the inner side walls of the tank and means for supporting said shoes against the side walls, sealing means comprising an annular metal cover plate attached to the top of the shoes and extending substantially horizontally inward toward the roof, a secondary seal carried by the cover plate and pressing against the side walls above the shoes, an annular flexible sealing strip extending from the cover plate to the roof, a series of spaced brackets mounted on the cover plate, a series of second spaced brackets mounted in upstanding position around the edge of the roof adjacent said first brackets, a threaded rod extending between each of said first brackets and each of said second brackets and loosely held in the brackets, stop means on each rod adapted to abut the second bracket, a threaded base member engaging the threads on said rods and located between said first and second brackets, a spring positioned around said rod and extending from the base member to said first bracket, said spring being adapted for compression between the base member and the first bracket.

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