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LIQUID SEAL FOR FLOATING ROOFS

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Fig. 1.

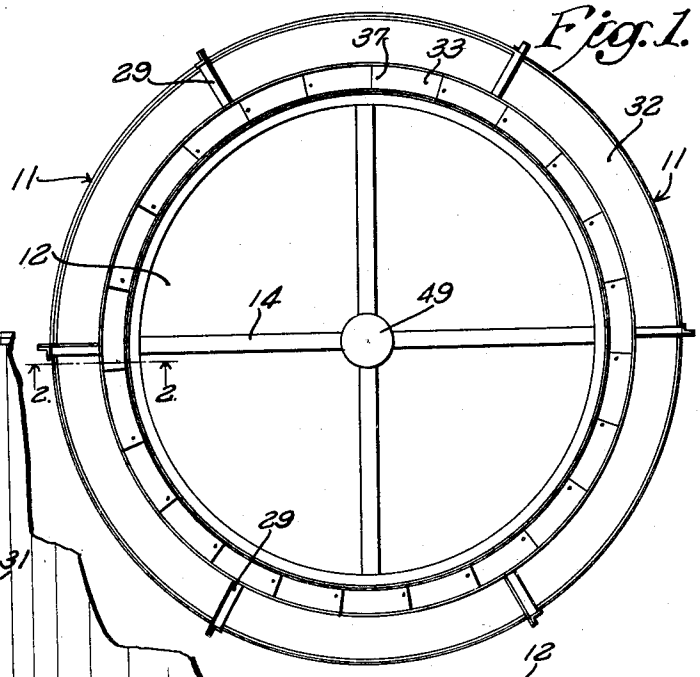


Fig. 2.

Fig. 3.

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LIQUID SEAL FOR FLOATING ROOFS.

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As may be inferred from the above designation, my present invention relates particularly to liquid seals, such as are used, upon oil tanks of large dimensions, at the edges of roofs which are supported directly by the bodies of liquid within the mentioned tanks; and it is an especial object of this invention to provide liquid sealing organizations of the general character referred to, and comprising troughs adapted to receive aprons which depend from the adjacent walls, with means whereby, when said roofs fall, in consequence of the lowering of the oil level, so far that the mentioned aprons are completely withdrawn from a sealing liquid contained in said troughs, subsidiary sealing means, of a novel character hereinafter described, are nevertheless effective to close a peripheral opening, about said floating roofs, and to diminish or to prevent avoidable exposure or evaporation of the contained fluids.

It is a specific object of my invention to provide the troughs of floating roofs, of the general character described, with inclined and rounded subsidiary sealing means, formed of or comprising metallic sheets which project downwardly and inwardly into the mentioned troughs and are adapted yieldably to contact with the surrounding walls; and embodiments of my invention suitable for use in tanks for the storage of gasoline, or the like, may comprise, in addition to the mentioned subsidiary sealing means formed of sheet metal, annular sealing members formed of sheet asbestos, or the like, and supported from or movable with the sheet metal sealing members above mentioned.

In preferred embodiments of that form of my invention last referred to, the mentioned asbestos members, or members formed of any preferred flexible sheet material, may comprise outwardly extending flaps adapted yieldably to contact, in parallel relationship, with a surrounding wall; and these flaps contacting, as mentioned, along parallel lines, may be so spaced apart that at least one of the mentioned flaps shall be effective, at any given moment and regardless of the elevation of the mentioned subsidiary sealing means, and regradless of the existence of inwardly extending rivet or bolt heads or nuts, to form a substantially continuous and tight closure with the peripheral tank wall.

Other objects of my invention, including certain features of support and guidance hereinafter referred to, may be best understood from the following description of an illustrative embodiment of said invention, taken in connection with the appended claims and the accompanying drawings, in which—

Fig. 1 is a diagrammatic top plan view, illustrating one form of my invention on a comparatively small scale.

Fig. 2 is a vertical section, which may be regarded as taken substantially in the plane indicated by the line 2—2 of Fig. 1.

Fig. 3 is a detail view, corresponding to a portion of Fig. 1, but showing parts of an asbestos or other flexible member as differently disposed relatively to bolt or rivet heads, projecting inward from a tank wall.

Referring to the details of that specific embodiment of my invention chosen for purposes of illustration, 11 may be a circular wall of a tank provided with a floating roof 12, this roof being shown as comprising substantially horizontal plates 13 and I-beams 14, and as carrying at its periphery a trough 15, adapted to contain a sealing liquid 16.

The trough 15 may include substantially parallel vertical walls 17 and 18, shown as connected at the bottom by horizontal plates 19,—the wall 17 being shown as carried to a higher level than the outer wall 18, and means such as angle bars 20, 21, and 22, suitably curved, may be used, preferably in conjunction with braces 23, to hold the mentioned parts in their indicated relationships.

The outer trough wall 18 is shown as carrying what I may term vertical guide runners or spacers in the form of bent straps 24, adapted to be secured by means such as bolts or rivets 25, 25′; and these guides or spacers may serve approximately to center and to steady the entire roof relatively to the outer walls 18. The latter walls are shown as formed of plates disposed in overlapping series (26, 27, 28) and as carrying, by means of brackets 29 on posts 30, a peripheral sealing apron 31. The latter

is shown as secured at the outer edge of an annular horizontal plate 32, the arrangement here referred to being such that, by reason of the depth of the trough 15 and the height of the apron 31, said apron, or the lower edge thereof, ordinarily remains submerged in the liquid 16, to maintain the desired liquid seal.

Referring now to the more notable and unique features of my invention, I provide, between the trough 15, or its equivalent, and the wall 11, or its equivalent, additional and subsidiary sealing means of the general character best shown in Fig. 2. For the purpose referred to, I may bend separate sheets 33 of a suitable metal, or the like, in such manner as to provide each sheet with a rounded intermediate portion 34, adapted slidably to engage the wall 11, and to ride over any inwardly extending prominences, such as rivet or bolt heads or nuts,—one end 35 of each of the mentioned sheets being inclined downwardly and inwardly in such manner as to remain constantly immersed within the trough 15, or its equivalent,—whether or not attached thereto; and the other end 36 of each sheet, shown as inclined upwardly beneath the apron 31, may be adapted, if desired, to carry additional subsidiary sealing means of any preferred character.

In order to obviate risk of gradual lateral displacement of the mentioned sheets 33, or equivalent subsidiary sealing elements, I may interconnect the same, as by bolts or rivets 37, optionally inserted through overlapping edges or lower corners thereof, and/or by means such as an annular member 38, shown as secured to the inclined tops 36 by means of bolts 39; and, in the case of tanks intended for the storage of comparatively light liquids, such as gasoline, I may give the annular member 38, or its equivalent, an arcuate cross-sectional outline, as illustrated, securing thereto, as by means including an inner arcuate plate 40 and additional bolts or rivets 41, a flexible sealing element or elements, such as a sheet or sheets 42 of an asbestos or composition fabric, adapted yieldably to contact, along one or more horizontal lines, with the wall 11, or its equivalent.

Instead of employing specially constructed tanks having smooth interiors, I take cognizance of the fact that, in the construction of numerous existing tanks, no special care has been taken to leave the interior cylindrical surfaces thereof entirely smooth; and it is an important feature of my invention, including the subsidiary sealing means above described, that the inwardly projecting folds or flaps of a pliable sheet material, such as the mentioned sheet 42, may be spaced apart by a vertical distance different from that between any rivet or bolt heads or nuts disposed in vertical or other arrangement and inwardly projecting from the wall 11. For example, the laterally projecting flaps 43 and 44 of the sheet 42 (said flaps being adapted to bend either upwardly or downwardly, according to the direction of movement of the described subsidiary sealing organization) may terminate in edges 45 and 46, spaced apart at a greater distance than the interval between the heads or nuts 47, of bolts 48. Thus, whenever the upper flap 43 is locally held, as by nut 47, out of contact with the wall 11, the flap 44, dropping in between a pair of nuts 47, may make effective, contact with said wall; and when, as illustrated in Fig. 3, the lower flap 44 is locally held out of contact, the upper flap 43 may nevertheless maintain an effective closure.

It will be understood that tanks of the general character described may be used for the storage of either light or heavy oils, or other liquids, and may be provided with usual man-holes (as at 49, Fig. 1) and with any usual or preferred breathers, feed pipes, withdrawal pipes, and the like, not shown. In all forms of my invention, the described roof, with its circumferential trough and with any preferred subsidiary sealing means of the general character described, is intended to rise and fall, according to the level of the liquid upon which said roof is made to float; and it will be obvious that the described subsidiary means come automatically into use whenever the roof 12 drops to so low a level as to effect a complete withdrawal of the apron 31, or its equivalent, from the mentioned peripheral sealing trough. Even in the case of troughs containing comparatively heavy oils, I consider it advantageous to employ the metal sheets 33, or their equivalents; the additional and flexible sheets 42 being ordinarily reserved, as indicated, for use in tanks containing comparatively volatile fluids.

Although I have herein described a single complete embodiment of my invention, it should be understood not only that various features thereof may be independently used but also that numerous modifications might be made, by those skilled in the art to which this case relates, without the slightest departure from the spirit and scope of this invention, as the same is indicated above and in the following claims.

I claim as my invention:

1. In a device of the general character described: a tank body; a roof adapted to float on a liquid within said tank; a trough at the edge of said roof; an apron supported from said body and adapted to extend downward into said trough when said roof occupies an upper position; and additional closure means extending into said trough and adapted to rise and fall therewith.

2. In a device of the general character described: a tank body; a roof adapted to float on a liquid within said tank; a trough at the edge of said roof; an apron supported from said body and adapted to extend downward into said trough when said roof occupies an upper position; and additional closure means extending into said trough and adapted to rise and fall therewith, said last mentioned closure means comprising sheets which are provided with rounded portions extending toward the walls of said tank.

3. In a device of the general character described: a tank body; a roof adapted to float on a liquid within said tank; a trough at the edge of said roof: an apron supported from said body and adpted to extend downward into said trough when said roof occupies an upper position; and additional closure means extending into said trough and adapted to rise and fall therewith, said last mentioned closure means comprising sheets which are provided with rounded portions extending toward the walls of said tank and inwardly inclined at the top thereof.

4. In a device of the general character described: a tank body; a roof adapted to float on a liquid within said tank; a trough at the edge of said roof; an apron supported from said body and adapted to extend downward into said trough when said roof occupies an upper position; and additional closure means extending into said trough and adapted to rise and fall therewith, said last mentioned closure means comprising sheets which are provided with rounded portions extending toward the walls of said tank and inwardly inclined at the bottom thereof.

5. In a device of the general character described: a tank body; a roof adapted to float on a liquid within said tank: a trough at the edge of said roof: an apron supported from said body and adapted to extend downwar into said trough when said roof occupies an upper position: and additional closure means extending into said trough and adapted to rise and fall therewith, said last mentioned closure means comprising flexible parts and an annular connecting and supporting member therefor.

6. In a device of the general character described: a tank badv: a roof adapted to float on a liquid within said tank: a trough at the edge of said roof; an apron supported from said body and adapted to extend downward into said trough when said roof occupies an upper position: and additional closure means extending into said trough and adapted to rise and fall therewith, said last-mentioned closure means comprising an annular member carrying a flexible sheet member adapted to contact with said tank.

7. In a device of the general character described: a tank body; a roof adapted to float on a liquid within said tank; a trough at the edge of said roof; an apron supported from said body and adapted to extend downward into said trough when said roof occupies an upper postion; and additional closure means extending into said trough and adapted to rise and fall therewith, said last-mentioned closure means comprising an annular member carrying a flexible sheet member adapted to contact with said tank in a plurality of lines.

8. In a device of the general character described: a tank body; a roof adapted to float on a liquid within said tank; a trough at the edge of said roof; an apron supported from said body and adapted to extend downward into said trough when said roof occupies an upper position; and additional closure means extending into said trough and adapted to rise and fall therewith, said last-mentioned closure means comprising an annular member carrying a flexible sheet member adapted to contact with said tank in a plurality of lines spaced apart by a distance different from that between any prominences extending inwardly from said tank.

9. In a device of the general character described: a tank body; a roof adapted to float on a liquid within said tank; a trough at the edge of said roof; an apron supported from said body and adapted to extend downward into said trough when said roof occupies an upper position; and additional closure means extending into said trough and adapted to rise and fall therewith, said trough being provided with guiding and centering means projecting toward said tank body.

10. In a device of the general character described: a tank body; a roof adapted to float on a liquid within said tank; a trough at the edge of said roof; an apron supported from said body and adapted to extend downward into said trough when said roof occupies an upper position; and additional closure means extending into said trough and adapted to rise and fall therewith, said last mentioned closure means comprising sheets provided with rounded portions extending toward said tank and inwardly bent, and comprising also an annular member carrving flexible sheets adapted to contact with said tank in a plurality of lines.

In testimony whereof. I have hereunto set my hand at Los Angeles. California, this 14th dav of November. 1925.

CHARLES F. H. BOHNHARDT.