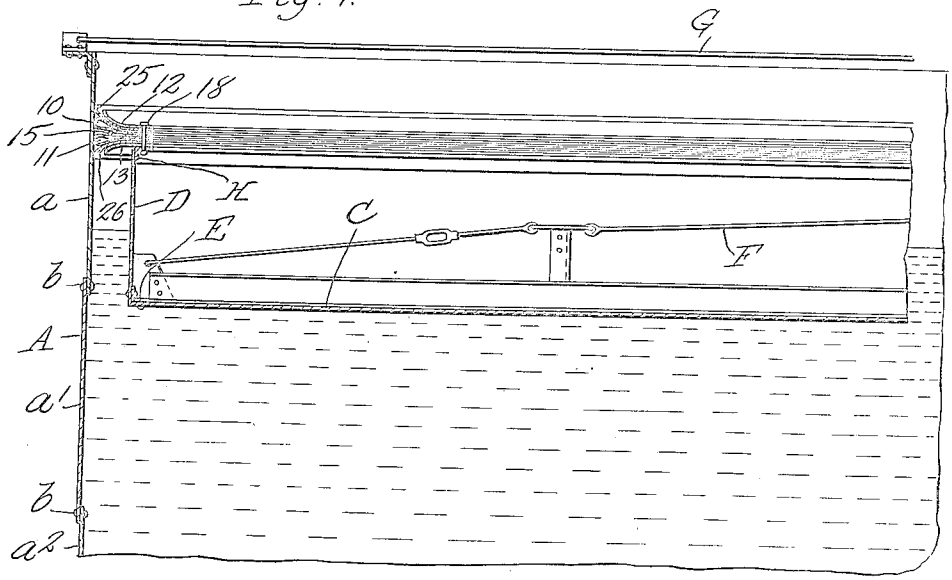
Jan. 3, 1933. J. M. CRANZ 1,893,162

SEALING MEANS FOR FLOATING ROOFS FOR TANKS

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Fig. 1.



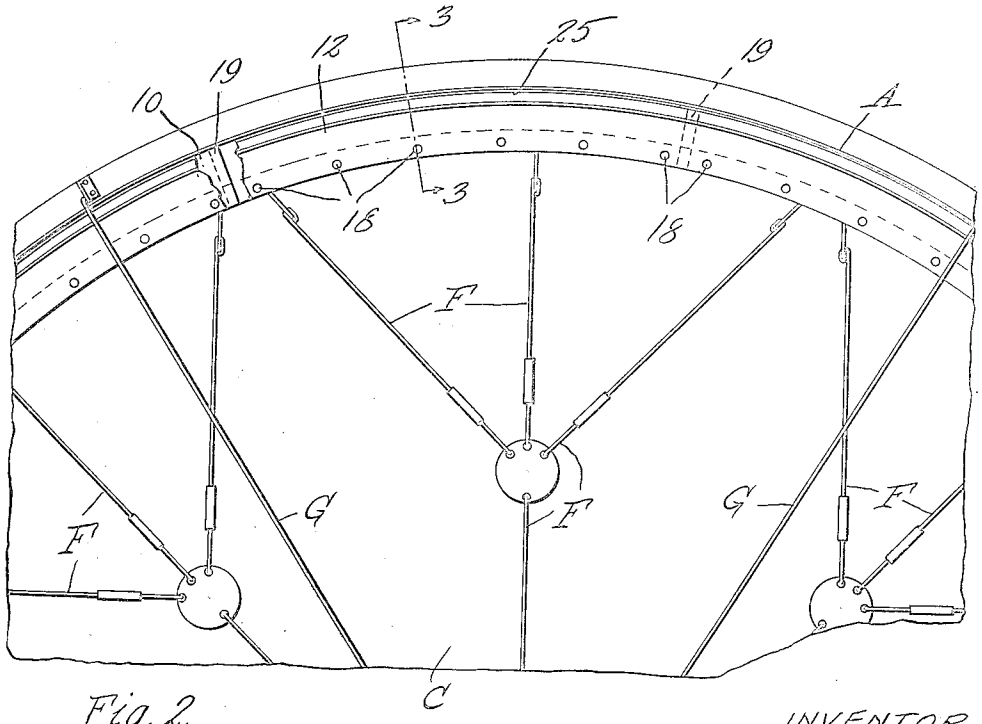


Fig. 2.

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Fig. 3.

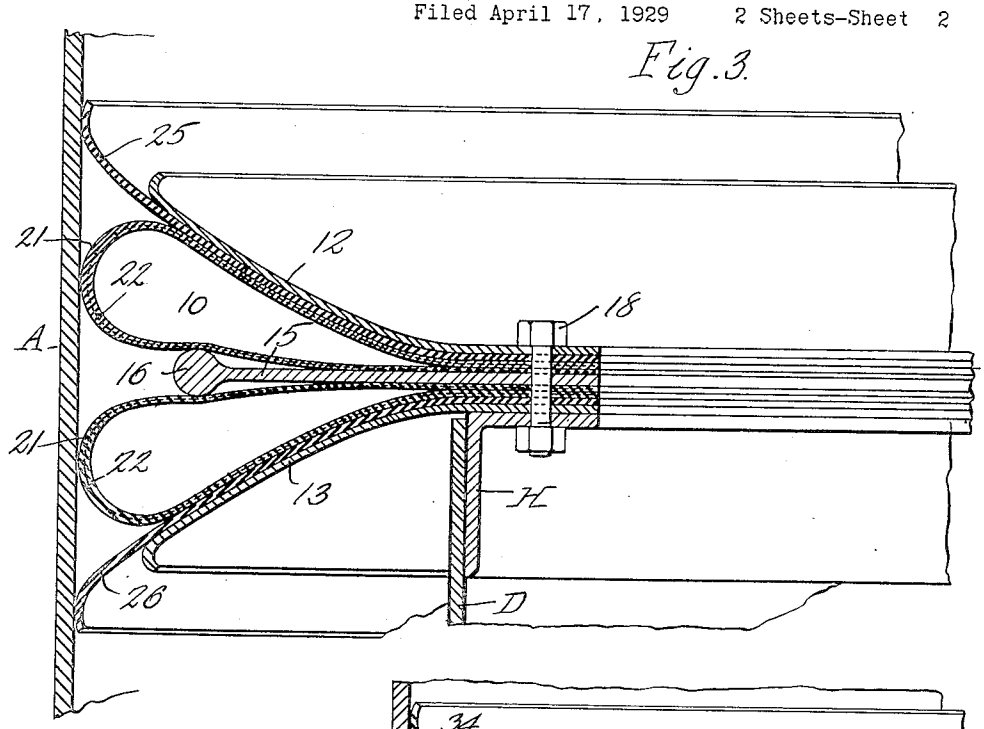
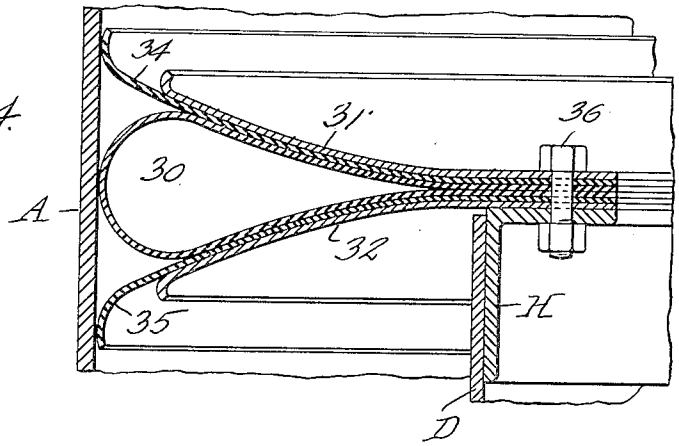


Fig. 4.



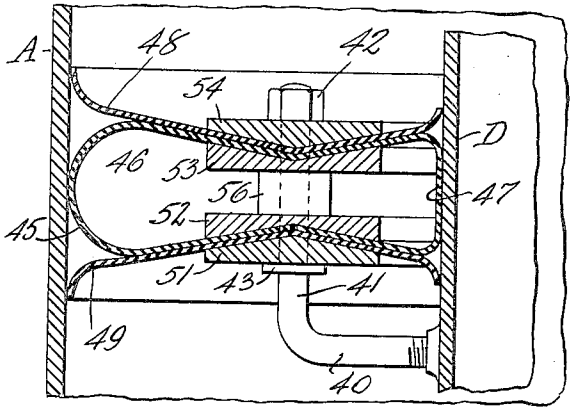


Fig. 5.

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UNITED STATES PATENT OFFICE

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SEALING MEANS FOR FLOATING ROOFS FOR TANKS

Application filed April 17, 1929. Serial No. 355,756.

This invention relates to floating roofs for tanks, such as oil tanks and more particularly to means for forming a seal or gasket between the floating roof and fixed parts of the tank.

The objects of this invention are to provide sealing means or members of improved construction formed of a sheet of rubber or other flexible material, the edges of which are secured to the floating roof and an intermediate portion of which contacts with the wall or other fixed part of the tank; also to provide sealing means of this kind of a bulb-like cross sectional shape which are pressed into engagement with the walls of the tank because of the resiliency of the material itself; also to provide sealing means of this kind of special construction which is reinforced along the portions thereof which wipe the surface of the wall of the tank; also to provide means of improved construction for securing the sealing means to the floating roof; also to provide sealing means of this kind with wiping sheets of flexible material, the outer edges of which engage the tank wall and which cooperates with the tubular wiping members to form a tight seal; also to improve the construction of sealing means of this kind in other respects hereinafter specified.

In the accompanying drawings:

Fig. 1 is a fragmentary sectional elevation of a tank having a floating roof provided with sealing means embodying this invention, the permanent roof of the tank being omitted;

Fig. 2 is a fragmentary top plan view thereof;

Fig. 3 is a fragmentary sectional elevation thereof on an enlarged scale on line 3—3, Fig. 2;

Figs. 4 and 5 are similar sectional elevations showing sealing means of modified construction.

A represents the upright wall of a tank, which may be formed of a series of sector-shaped plates a, a' and a^2, any desired number of these plates being used. These plates are generally connected by means of lap joints secured together by rivets b or other fastening means.

The floating roof of the tank is preferably made of metal plates and bars, and may be of any suitable or desired construction, that shown including the bottom plate or plates C and upright plates D, angle bars E being employed to secure the plates C and D together. The plate structure of the floating roof may be reinforced and stiffened by braces F of any desired form. G represents braces connecting the upper edges of the tank wall A. The metal roof is designed to float on top of the liquid in the tank and this roof is made of a diameter considerably smaller than the interior diameter of the tank so that the outer edges of the roof may have plenty of clearance with reference to the wall of the tank. The tank and the portion of the floating roof thus far described of themselves constitute no part of this invention and may be of any other suitable or desired construction.

In order to prevent the evaporation of liquid in those portions of the tank between the floating roof and the tank walls, sealing means are provided between the floating roof and the tank wall, which are secured to the edge portions of the floating roof and wipe or rub against the walls of the tank. In the particular construction described, these sealing means are secured to a curved angle bar H, one leg of which is secured to the upper edge of the side wall D of the floating roof and a horizontal leg of the angle in the construction illustrated is employed for securing the sealing means to the roof.

A number of different forms of sealing devices for this purpose have heretofore been devised but none of them have proven satisfactory for the reason that they are difficult to maintain in their correct positions or because they fail to accommodate themselves readily to the irregularities of the inner surface of the tank wall, such for example, as are formed at the edges of plates and by the rivets b, or by flattened or eccentric portions of the tank wall. I have found that sealing means of this kind can be formed by using a flexible material such for example as rubber of a composition capable of withstanding the disintegrating action of the oil or other material which may be contained in the tank, and

formed in sheets, the edge portions of which are secured or clamped in such a manner that the rubber sheets will form tubes of a substantially bulb-like or pear-shaped cross section. When sheets of this kind are formed in this manner, it has been found that the intermediate portions of the sheets which engage the walls of the tank much more readily adapt themselves to irregularities of the surfaces of the tank and form a tight joint or seal, than tubular members of circular cross section.

In accordance with my invention as illustrated in Figs. 1–3 inclusive, the seal is formed by means of a pair of these tubular flexible sealing members arranged one above the other. In this embodiment of my invention, the upper and lower flexible sealing members 10 and 11 are arranged between two metal guards 12 and 13 having outwardly flaring curved surfaces which engage respectively the upper and lower surfaces of the upper and lower flexible members 10 and 11. A spacing member 15 may, if desired, be placed between the two flexible sealing members, the spacing member shown having an enlarged outer edge 16.

In order to secure the flexible seal members, the flaring rigid guide members 12 and 13 and the spacing member 15 to the floating roof, these members are provided with apertures, as is also the horizontal flange of the angle bar H, and bolts 18 pass through these apertures and clamp the various parts together and to the angle bar H.

The flexible sealing members 10 and 11 are preferably made of rubber sheets, which may be either cut from flat sheets in lengths on arcs of a circle and then merely bent into the bulb-like or bowed out into the shapes illustrated, or if desired, the members may be moulded into approximately the shapes shown in the drawings. These members are open ended, and the various sections thereof may be joined as shown in Fig. 2 by inserting one end of a section into the end of another section thus forming a telescopic joint between adjacent sections as illustrated at 19, Fig. 2. It is not necessary to make these joints air-tight since it is not intended to employ air under pressure in the tubular sealing members.

The guard plates 12 and 13 may also be made in sections or may be in the form of rings extending completely around the periphery of the floating roof.

The spacing member 15 is used mainly for the purpose of holding the flexible sealing members 10 and 11 in their correct relations to the curved guard plates 12 and 13 and prevents the flexible sealing members from shifting out of these positions during the movement of the floating roof up and down relatively to the wall of the tank, but it will be understood that this spacing member may be omitted if desired.

If desired, the portions of the flexible members which engage the wall of the tank may be reinforced by increasing the thickness thereof as indicated at 21, and if desired, fabric 22 may be formed or embedded in the tubular sheets to increase the strength or stiffness thereof and the resistance to wear, as is clearly shown in Fig. 3.

In some instances where an exceptionally tight seal is required, it is desirable to employ supplemental sealing members in connection with the tubular sealing members 10 and 11. These supplemental members may be in the form of flexible strips 25 and 26 which are arranged on the outer faces of the tubular sealing members 10 and 11 and between these members and the guard plates 12 and 13. The outer edges of the sealing members 25 and 26 engage the wall of the tank and are held in the positions indicated in Fig. 3 by the resilience of the material, which may be rubber or any other suitable flexible material.

By providing a plurality of sealing devices, such for example, as the two tubular flexible sealing members 10 and 11 and the flaring sheets 25 and 26 at least one of the various sealing members will always form a seal with the wall of the tank, even though one or more of the other members may be engaging rivets or irregularities in the wall of the tank.

In the modified construction shown in Fig. 4, a single flexible tubular sealing member 30 is provided which is also formed of a sheet of tubular or other flexible material and which is held in its operative position by means of a pair of metal plates 31 and 32, and supplemental flexible sealing members 34 and 35 corresponding to the sealing members 25 and 26 shown in Figs. 1—3 may also be employed in connection with this seal. The various parts of the seal are then secured to the angle shaped plate H by means of bolts 36 as already described in connection with Figs. 1—3.

In the modified form of my invention illustrated in Fig. 5, the upright annular wall D of the floating roof is provided at intervals with outwardly projecting studs or bolts 40 suitably secured to the wall D of the floating roof in any suitable or desired manner, these bolts extending outwardly from the wall D to a certain distance and then upwardly as indicated at 41.

These bolts are arranged at intervals along the periphery of the floating roof, and the outer ends of the portions 41 of the bolts are threaded and adapted to receive clamping nuts 42. These bolts or arms 41 also have collars or washers 43 suitably held in place thereon. In this construction the seal is formed by flexible sheets 45, which are bent to form an outer loop or tubular part 46 adapted to engage the wall A of the tank

and a second looped portion 47 which engages the wall D of the floating roof. If desired, auxiliary flexible sealing members or gaskets 48 and 49 corresponding to the sealing members 25 and 26 already decribed may be employed. The several flexible gasket members are then secured between rings which are mounted on the studs 40 and pressed together between the washers 43 and clamping nuts 42. The lower pair of rings 51 and 52 are provided with downwardly inclined divergent faces between which the auxiliary sealing member 49 and the lower portion of the tubular sealing member 45 may be secured, these divergent faces causing the portions of the tubular members 45 to assume the position illustrated. The upper two clamping rings 53 and 54 are provided with upwardly inclined divergent faces extending in opposite directions to the faces of the clamping rings 51 and 52, and the auxiliary sealing member 48 and the upper portion of the tubular sealing member 45 are secured between these faces of the rings 53 and 54. The two seats or rings may if desired, be spaced apart by a sleeve 56 or other suitable spacing means to give the flexible sealing member the desired shape. The two edges of the sheet are clamped between one pair of rings and the intermediate part of the sheet is clamped between the other pair of rings. These rings may, of course, also be formed in segments or parts.

By forming and securing the sealing members to the floating roof in the manner described to form the tube into bulb-like cross section, a much more flexible and adaptable sealing gasket is formed than when tubular forms of approximately circular cross section are employed.

This is probably due to the fact that the outwardly extending substantially flat portions of the tube tend to hold the intermediate or bent portion in contact with the tank wall. The resilience of the material from which the members are made is sufficient to maintain these members in contact with the tank wall, so that no air pressure within the sealing members is necessary. The structure described also enables the sealing members to readily adapt themselves to irregularities in the tank walls, so that even extreme irregularities, such as a flat portion of the wall, will not destroy the tightness of the seal. By having the portions of the sealing members which are secured to the roof extend toward the tank wall, the sealing members are securely held at all times in positions to most effectively seal the space between the roof and the tank wall. The use of two or more sealing members, either of bulb-like cross section or in the form of strips and arranged at different elevations above the liquid level in the tank, serves to form a tighter seal since at least one sealing member will form a tight seal with the tank wall while another is riding over irregularities in the tank wall which might allow the escape of vapors.

I claim:

1. A floating roof for a tank, including a sealing member arranged between said roof and the wall of the tank, said sealing member comprising a sheet of flexible and elastic material, means on said roof for clamping the edge portions of said sheet to form a tubular structure which slidably engages the tank wall, and rigid members secured to said roof above and below said sealing member and having diverging faces pressing against the faces of said sealing member to flex the sealing member toward the tank wall.

2. A floating roof for a tank, including a sealing member arranged between said roof and the wall of the tank, said sealing member comprising a sheet of flexible and elastic material having its edge portions secured to said roof, and rigid members having their inner faces engaging said sealing member and diverging toward the tank wall to yieldingly press the intermediate rounded portion of the sealing member into engagement with the tank wall.

3. A floating roof for a tank, including a sealing member arranged between said roof and the wall of the tank, said sealing member comprising a sheet of flexible and resilient material having its edge portions secured to said roof to form said sheet into bulb-shaped cross section with the rounded portion thereof engaging said tank wall, and rigid members arranged above and below said sealing member for holding said sealing member in an elongated bulb-like cross-sectional shape and for deflecting the intermediate rounded portion of the sealing member into resilient engagement with the tank wall.

4. A sealing member for a floating roof of a tank, including a sheet of flexible material bowed lengthwise into bulb-like cross sectional shape and having its edge portions secured to said roof and a strip of flexible material arranged at one side of said flexible sheet and secured at one edge portion to said roof and having its other edge portion engaging the wall of said tank at a different elevation above the liquid level than said sheet.

5. A sealing member for a floating roof of a tank, including a sheet of flexible material bowed lengthwise into bulb-like cross sectional shape and having its edge portions secured to said roof, and strips of flexible material arranged above and below said flexible sheets and each secured at one edge portion to said roof and having its other edge portion engaging the wall of said tank.

6. A sealing member for a floating roof of a tank, including a plurality of sheets of flexible material bowed lengthwise into bulb-like cross sectional shape and having their

edge portions secured to said roof, said sheets being arranged one above the other with their intermediate portions engaging the wall of the tank at different elevations and strips of flexible material arranged above and below said flexible sheets, each of said strips being secured at one edge portion to said roof and having its other edge portion engaging the wall of said tank.

7. A sealing member for a floating roof of a tank, including a sheet of flexible material bowed lengthwise into bulb-like cross sectional shape and having its edge portions secured to said roof, strips of flexible material arranged above and below said flexible sheets and each secured at one edge portion to said roof and having its other edge portion engaging the wall of said tank and common means for securing said flexible sheets and said strips to said roof.

8. A sealing member for a floating roof of a tank, including a sheet of flexible material bowed lengthwise into bulb-like cross sectional shape and having its edge portions secured to said roof, strips of flexible material arranged above and below said flexible sheets and each secured at one edge portion to said roof and having its other edge portion engaging the wall of said tank and guards of relatively rigid material extending in engagement with the upper and lower faces of the upper and lower strips respectively, for holding said strips approximately in their correct positions, the outer edges of said guards terminating at a distance from the tank wall.

9. A sealing member for a floating roof of a tank, including a sheet of flexible and resilient material bowed lengthwise into bulb-like cross sectional shape and having its edge portions secured to said roof, a pair of rigid guards secured to said roof above and below said flexible sheet and having their inner faces diverging toward the tank wall to hold the said sealing member in elongated bulb-like cross-sectional shape with relation to said tank wall, and means for securing said guards to said roof and for clamping said flexible sheets between said guards.

10. A sealing member for a floating roof of a tank, including a plurality of sheets of flexible material bowed lengthwise into bulb-like cross sectional shape and having their edge portions secured to the roof, said sheets being arranged one above the other to contact with said tank wall at different levels therein and a spacing member of relatively rigid material arranged between said sheets to assist in holding the same in correct relation to said tank wall.

11. A sealing member for a floating roof of a tank, including a plurality of sheets of flexible material bowed lengthwise into bulb-like cross sectional shape and having their edge portions secured to the roof, said sheets being arranged one above the other to contact with said tank wall at different levels therein and a spacing member relatively rigid material arranged between said sheets to assist in holding the same in correct relation to said tank wall, said spacing member having an enlarged outer edge portion which holds said flexible sheets apart.

12. A sealing member for a floating roof of a tank, including a plurality of sheets of flexible material bowed lengthwise into bulb-like cross sectional shape and having their edge portions secured to the roof, said sheets being arranged one above the other to contact with said tank wall at different levels therein, a spacing member of relatively rigid material arranged between said sheets to assist in holding the same in correct relation to said tank wall, guards of rigid material, one of which engages the lower face of the lower flexible sheet and the other of which engages the upper face of the upper flexible sheet for holding said flexible sheets in operative relation to said spacing member and common means for securing said sheets, spacing members and guards to said roof.

13. A floating roof for a tank, including a sealing member arranged between said roof and the wall of the tank and made of sheet rubber, and clamping means applying pressure to the edge portions of said sheet to hold said sheet in bulb-like form by its own resilience and without internal air pressure, and having clamping faces arranged in planes extending transversely with reference to the wall of the tank, said clamping faces holding the edge portions of said rubber sheet in positions to cause the intermediate portion of said sheet to assume a shape of bulb-like cross section and to be pressed by its own resiliency against the tank wall.

14. A floating roof for a tank, including a sheet of rubber having a sheet of fabric reinforcement embedded therein, said sheet being flexed lengthwise with the edge portions of one face thereof arranged in proximity and in substantially parallel relation to each other and the intermediate portion formed into bulb-like cross section, and clamping means engaging a part of said roof and applying pressure to said edge portions of said sheet for holding said intermediate portion in a position to be pressed against said tank wall by its own resiliency, and for securing said sealing member to said roof.

15. A floating roof for a tank, including a sealing member arranged between said roof and the wall of the tank and made of sheet rubber, clamping means applying pressure to the edge portions of said sheet to hold said sheet in bulb-like form by its own resilience and without internal air pressure and having clamping faces arranged in planes extending transversely with reference to the wall of the

tank, said clamping faces holding the edge portions of said rubber sheet in positions to cause the intermediate portion of said sheet to assume a shape of bulb-like cross section and to be pressed by its own resiliency against the tank wall, and a rigid member held on said roof by said clamping means and extending into the space between said roof and said tank wall and engaging a face of said sealing member.

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