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SEALING MEANS FOR FLOATING ROOFS FOR TANKS

Filed July 30, 1932

2 Sheets-Sheet 1

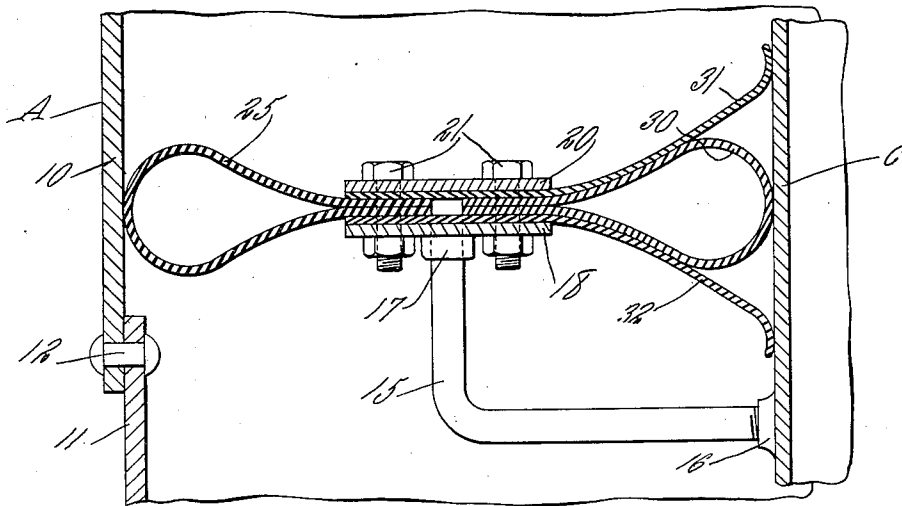
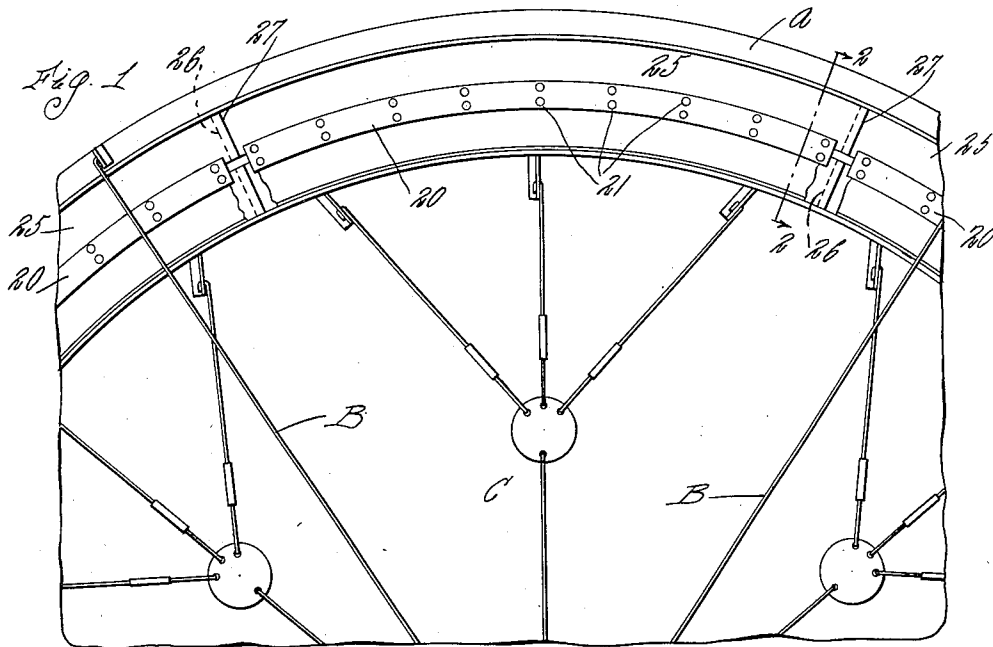


Fig. 2

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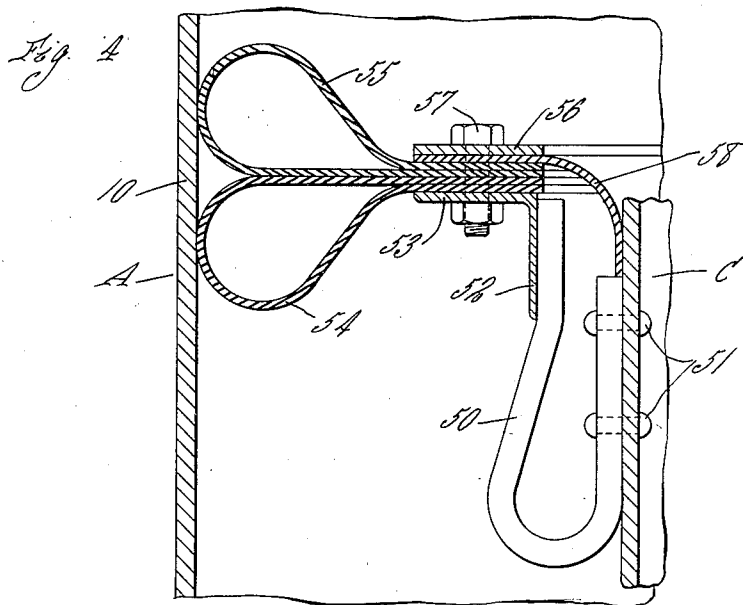
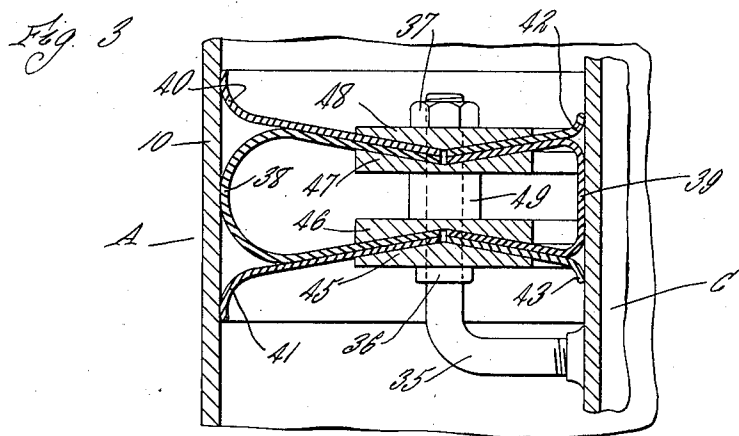
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SEALING MEANS FOR FLOATING ROOFS FOR TANKS

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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SEALING MEANS FOR FLOATING ROOFS
FOR TANKSJames M. Cranz, Buffalo, N. Y., assignor to
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Application July 30, 1932, Serial No. 626,375

9 Claims. (Cl. 220—26)

This invention relates to floating roofs for tanks, such as are used for storing volatile liquids, and more particularly to means for forming a seal or gasket between the floating roof and the tank wall. This application is a continuation in part of my co-pending application Ser. No. 355,756, filed April 17, 1929, which has subsequently been issued as Patent No. 1,893,162, January 3, 1933.

The objects of this invention are to provide sealing means of this kind which can be readily adapted to form an effective seal for the space between the tank wall and the floating roof, even when the width of this space varies at different portions of the tank; also to provide sealing means of this kind held in place by a clamping member supported at a distance from the floating roof and forming a seal between the clamping member and the roof and another seal between the clamping member and the tank; also to improve the construction of sealing means of this kind in other respects herein disclosed.

In the accompanying drawings:

Fig. 1 is a fragmentary top plan view of a tank having a floating roof provided with sealing means embodying this invention.

Fig. 2 is a fragmentary sectional elevation thereof, on line 2—2, Fig. 1.

Figs. 3 and 4 are similar fragmentary sectional elevations showing sealing means of modified constructions.

A represents the upright wall of the tank which is generally cylindrical in form and the upper edges of which may be connected by or reinforced with radial tie rods or tension members B, the outer ends of which may be secured to an angle bar *a* secured to the upper edge of the tank. The cylindrical walls of these tanks are usually constructed of a series of sector shaped plates connected together by means of lap joints as are the plates 10 and 11 shown in Fig. 2, and 12 represents rivets for fastening the adjacent edges of the plates together. C represents the floating roof of the tank which may be of any suitable or desired construction, and which is arranged to float on the top of the liquid contained in the tank, and which, consequently, moves up and down as the level of the liquid in the tank changes. Since these tanks are usually employed for storing oil, petroleum products, and volatile liquids, it is desirable to provide sealing means which will effectively keep air out of contact with the liquid, and prevent evaporation of volatile liquids or constituents, and which sealing means are capable of cooperating with the

irregular tank wall resulting from the overlapping construction of the plates, as shown in Fig. 2. The tank and the floating roof thus far described, of themselves, constitute no part of this invention and may be of any other construction.

In many tanks, the upright wall of the tank is not truly cylindrical either due to faulty construction, or due to dents or irregularities in the tank wall which are formed after the tank has been constructed. With tanks of this kind, consequently, the annular space between the floating roof and the tank wall varies in width in different parts of the tank, so that the seal must be constructed in such a manner as to be capable of accommodating itself to variations in the width of this space.

In the constructions shown, this is accomplished by providing the peripheral portion of the floating roof at intervals with suitable brackets extending outwardly from the periphery into the space between the tank wall and the roof, and these brackets support clamping plates or members between which flexible sealing members are secured which extend outwardly from the clamping members into engagement with the tank wall, and the same or other sealing members may be provided which extend inwardly from the clamping members into engagement with the floating roof. Since these brackets can be readily made longer or shorter as may be desired, it will be evident that the sealing means thus constructed can be adapted to cooperate with spaces between the tank and the floating roof varying materially in width.

In the construction shown in Figs. 1 and 2, the floating roof C is provided at intervals with brackets 15 which may be formed of rods or bolts bent intermediate of their ends to provide a portion extending outwardly from the floating roof and another portion extending substantially vertically. One end of each rod or bracket is secured to the floating roof C in any suitable or desired manner, and in the construction shown for this purpose, this end of the rod is threaded and engages a corresponding thread in a lug or projection 16 which may be in the form of a nut, welded or otherwise secured to the floating roof C. The other end of the rod or bracket which extends upwardly in the construction shown in Fig. 2 has a sleeve or washer 17 secured thereto by welding or other means, and a clamping plate 18 rests on the sleeve or washer. The clamping plate is of curved form and is arranged approximately midway of the space between the roof and the tank wall, and may be supported at intervals on the

rods or brackets 15. This lower clamping plate 18 is adapted to cooperate with a similar clamping plate 20, the two plates being arranged to be moved toward each other by any suitable means such, for example, as bolts 21. Other means for supporting the clamping plate 18 from the floating roof may, of course, be provided, and clamping means of other construction may also be used.

The flexible sealing members are preferably similar to those disclosed in my beforementioned application Ser. No. 355,756, and include strips of flexible material, such, for example, as rubber of a composition capable of withstanding the action of oil or other liquid which may be contained in the tank, and the strips 25 of this flexible material have their opposite edge portions lying with their flat faces in contact with each other, so that the strips have a cross section of substantially a bulb-like or pear shape. These strips may be made entirely of rubber, or of rubber reinforced either partly or entirely with canvas or other material. The intermediate portions of the members 25 which engage the tank wall are held in engaging position by means of the resiliency of the flexible material, so that no air pressure is required within these sealing members, and no springs or other means are necessary to urge these sealing members into their operative positions. Furthermore, these members are so flexible that even if the clamping members 18 and 20 should move into close proximity to the tank wall, the flexible sealing members will be in no way damaged by being materially distorted out of the position shown in Fig. 2, or pinched between the roof on a clamping member, and will return to the position shown in Fig. 2, when the space between the rigid clamping members and the tank wall is again enlarged. In a similar manner, the sealing member 25 will readily ride over and conform itself to any irregularities in the wall of the tank, such as the edges of overlapping plates, or dents or deformations in the tank wall. The contacting edge portions of the sealing members 25 are clamped between the clamping members 18 and 20, as shown in Fig. 1, for the purpose of holding the upper and lower walls of these flexible members in positions in which their outer surfaces will engage the tank wall because of the resiliency in the material of which these members are made.

For large tanks, it is more convenient to make these sealing members in sections as illustrated in Fig. 1, in which case, the end 26 of one section is inserted or telescoped into the end portion 27 of an adjacent section, as indicated in Fig. 1, and the adjacent ends of the upper plates 20 may be spaced apart sufficiently to leave the telescoped portions of these sealing members uncovered. Since no air pressure is employed, the joints between adjacent portions of the sealing members need, of course, not be cemented or otherwise connected by air-tight joints.

In the case of the construction shown in Figs. 1 and 2, the sealing member 25 extends only from the clamping plates 18 and 20 to the outer wall of the tank and another sealing member 30 of similar construction extends from the clamping plates to the floating roof and forms a seal with the upright wall of the floating roof in the same manner as the sealing member 25 forms a seal with the tank wall, except that there is no relative movement between the sealing member 30 and the upright wall of the floating roof. In the construction shown in Fig. 2, the sealing member 30 is supplemented by other sealing

members 31 and 32 in the form of single strips of rubber or other flexible material and arranged respectively above and below the sealing member 30. These strips together with the contacting edges of the sealing member 30 are clamped between the clamping plates 18 and 20. It will be obvious that similar supplementary sealing members could be used in conjunction with the sealing member 25 to cooperate with the tank wall, if desired, or a pair of sealing members 25 could be used one above the other and held in place by the same clamping members, if desired. The sealing members are preferably formed or curled approximately into the desired shapes and curvatures during the vulcanizing or other manufacturing process.

In the modified construction shown in Fig. 3, arms or brackets in the form of angularly bent bolts or rods 35 are provided, which are secured to the floating roof C in a manner similar to the bolts 15 shown in Fig. 2, and the upright portions of which have collars or washers 36 suitably secured thereto. The upper ends of these bolts are threaded and are provided with clamping nuts 37. In this construction, the seal with the tank wall is formed by a flexible sheet or sealing member 38 which is somewhat similar to the sealing member 25 shown in Fig. 2. A similar flexible sealing member 39 forms a seal with the outer wall of the floating roof. If desired, auxiliary flexible sealing members or gaskets 40 and 41 may be provided above and below the sealing member 38 and similar supplementary sealing members 42 and 43 may be arranged above and below the sealing member 39. The several flexible sealing members or gaskets are then secured between curved clamping plates which are mounted on the studs or brackets 35 and pressed together between the washers or collars 36 and the clamping nuts 37 of the brackets. A lower clamping member 45 rests against the sleeves or washers 36 and cooperates with a clamping member 46, both of these clamping members having downwardly inclined converging faces between which the lower side walls of the sealing members 38 and 39 and also the supplementary sealing members 41 and 43 are clamped. Two additional clamping members 47 and 48 with upwardly inclined engaging faces are provided above the clamping members 45 and 46 and are adapted to receive the upper side wall portions of the sealing members 38 and 39 and parts of the supplementary sealing members 40 and 42. If desired, the two sets of clamping members may be separated by means of a sleeve 49 or other suitable spacing means to give the flexible sealing members 38 and 39 the desired shape. The sealing plates described are, of course, formed as segments of sealing rings extending completely around the floating roof.

Still another modified form of sealing member is shown in Fig. 4, in which the bracket is in the form of a substantially U-shaped strap 50 of steel or other suitable material having one leg thereof secured to the side wall of the floating roof, for example, by means of rivets 51, and the upper portion of the outer leg thereof is suitably welded or otherwise secured to a downwardly extending flange 52 of a lower clamping plate or member 53. These brackets 50 are readily adjustable to accommodate the seal to spaces of different width between the floating roof and the tank wall by bending the outer leg of the U-shaped member toward or from the leg which is fastened to the floating roof. In this construction, a pair of

flexible sealing members 54 and 55 are employed which correspond to the sealing members 25 as shown in Fig. 2, and an upper clamping plate or segment 56 cooperates with the clamping member 53, bolts 57 being employed for pressing the clamping members toward each other.

I have found that with a pair of sealing members, such as the sealing members 54 and 55, when arranged one above the other without any intermediate rigid support between these members, an exceptionally tight and at the same time flexible seal is provided, since each of the two members cooperates with the other to assist in holding the other member in its sealing position, and the two adjacent walls of the sealing member act more or less as a single wall of correspondingly increased rigidity.

In order to form a seal between the clamping members and the roof of the tank, a strip of rubber or other flexible material 58 is provided, one end portion of which is secured between the two clamping members, and the free portion, which extends beyond the clamping members, is bent so that the edge portion thereof lies flatly in contact with the upright wall of the floating roof C, so that the resiliency of the material in the sealing member 57 yieldingly presses the free edge of this member into engagement with the upright wall of the floating roof.

In any of the forms illustrated, it will be noted that the brackets can readily be adjusted to compensate for variations in the space between the floating roof and the tank wall. Figs. 2 and 3 illustrate how the brackets or bent bolts 15 and 35 may be varied in length by cutting off a portion of the horizontal part of the bracket and threading the cut end thereof to produce a wide variation in the distance that the bracket extends outwardly from the floating roof, and in the construction shown in Fig. 4, it is merely necessary to bend the looped or U-shaped bracket to secure the desired adjustment. Any of the brackets shown can, therefore, be readily made to fit the particular tank on which the installation is made, and this fitting can be done on the job, instead of at the factory where the parts are made.

The construction described is readily adaptable to tanks having dents or other irregularities in the outer wall thereof, or which are not truly circular in cross section, since the clamping members are made in the form of segments, and not as continuous circular rings, so that the clamping members can be readily positioned to accommodate themselves to major variations in the tank wall by changing the extent to which the brackets extend outwardly from the roof. Minor irregularities are, of course, taken care of by the flexibility of the sealing members themselves. The sealing members between the clamping means and the tank wall take care of adjustments of the clamping member relatively to the roof.

I claim as my invention:

1. The combination of a tank having an upright wall, a roof within said tank arranged to float on the liquid in said tank and spaced from said wall of said tank, clamping means arranged in the space between said roof and said tank wall, brackets secured to said roof and supporting said clamping means and being adjustable to vary the distance of said clamping means from said roof, and sealing means comprising strips of flexible material gripped by said clamping member and extending from said clamping member into engagement with said tank wall and said roof.

2. The combination of a tank having an upright wall, a roof within said tank and arranged to float on the liquid in said tank and spaced from the wall of said tank, clamping means arranged in the space between said roof and said wall, said clamping means being formed of a series of segmental plates adapted to be pressed toward each other and forming a substantially continuous annular clamping device extending around said roof, flexible sealing means having portions thereof secured between said clamping plates and held by said plates into positions to extend into sealing engagement with said tank wall and said roof, and adjustable means for supporting said segmental clamping plates at different distances from the peripheral portion of said roof.

3. The combination with a tank having an upright wall and a roof within said tank arranged to float on the liquid in said tank and spaced from said wall, of an annular clamping member arranged in the space between said wall and said roof and formed in a plurality of segments adjustable relatively to each other to conform to the contour of said tank wall, flexible sealing members including strips of material having their edge portions clamped by said clamping member and extending into engagement with said tank wall and into engagement with said roof, and means for supporting said clamping member from said roof.

4. The combination with a tank having an upright wall and a roof within said tank arranged to float on the liquid in said tank and spaced from said wall, of an annular clamping member arranged in the space between said wall and said roof and formed in a plurality of parts adjustable independently of other parts relatively to said tank wall, a sealing member of bulb-like cross section having its edge portions engaged by clamping faces of said clamping member, said clamping faces extending toward said tank wall, means for supporting said clamping member from said roof, and means for forming a seal between said clamping member and said roof.

5. The combination with a tank having an upright wall and a roof within said tank arranged to float on the liquid in said tank and spaced from said wall, of an annular clamping member arranged in the space between said wall and said roof and formed in a plurality of parts adjustable relatively to each other toward and from said wall, flexible sealing means gripped by said clamping member and extending into engagement with said tank wall, flexible sealing means connecting said clamping member and said roof and adapted to yield to compensate for adjustment of said clamping member relatively to said roof, and means for supporting said clamping member from said roof.

6. The combination of a tank having an upright wall, a roof within said tank arranged to float on the liquid in said tank and spaced from said wall of said tank, a clamping member arranged in the space between said roof and said tank wall and adjustable toward and from said roof, sealing means carried by said clamping member and extending into sealing engagement with said roof and said wall, and brackets supporting said clamping member from said roof and having a substantially horizontal part which may be shortened to compensate for variations in the distance of said clamping member from said roof.

7. The combination of a tank having an upright wall, a roof within said tank arranged to

float on the liquid in said tank and spaced from said wall of said tank, a clamping member arranged in the space between said roof and said tank wall and adjustable toward and from said roof, sealing means carried by said clamping member and extending into sealing engagement with said roof and said wall, and brackets, each having a leg secured to said roof and another leg secured to said clamping member, said legs being connected by an intermediate portion which may be bent to vary the distance at which said clamping member is arranged from said roof.

8. A seal adapted to be interposed between a tank wall and a floating roof arranged therein, said seal including a sealing member of flexible material and of substantially U-shaped cross section and having its bent portion arranged to engage said tank wall, two pairs of clamping plates, each pair being adapted to engage one edge portion of said sealing member for support-

ing said edge portions in position to yieldingly hold said sealing member in engagement with said tank wall, and a second sealing member of U-shaped cross section held between said clamping plates in position to engage said roof.

9. The combination of a tank having an upright wall, a roof within said tank arranged to float on the liquid in said tank and spaced from said wall of said tank, holding means arranged in the space between said roof and said tank wall, means supported from said roof for adjustably supporting said holding means in spaced relation to said roof and said tank wall, flexible sealing means carried by said holding means and extending therefrom to said tank wall, and flexible sealing means closing the space between said holding means and said roof, said two sealing means being adjustable independently of each other relatively to said holding means.

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