Feb. 11, 1969 W. J. MARULIC 3,426,934

SEAL

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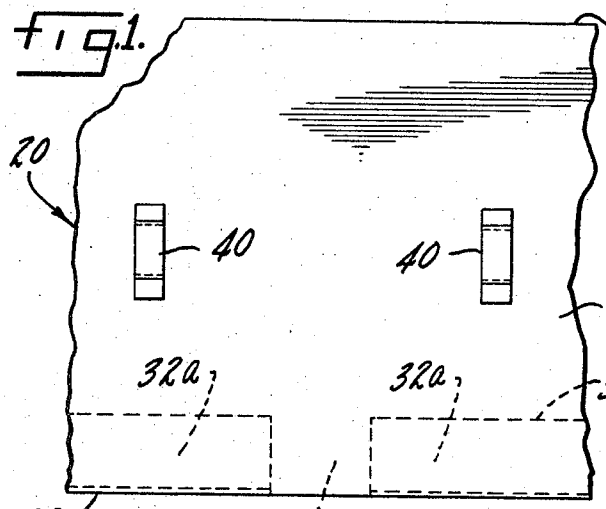


Fig. 1.

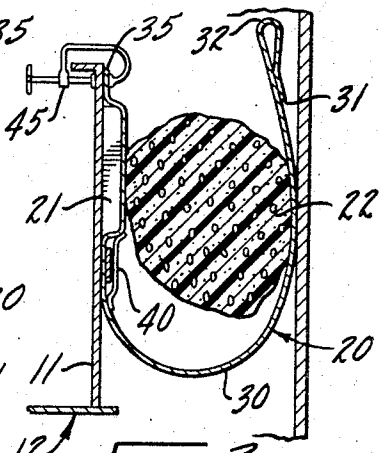


Fig. 3.

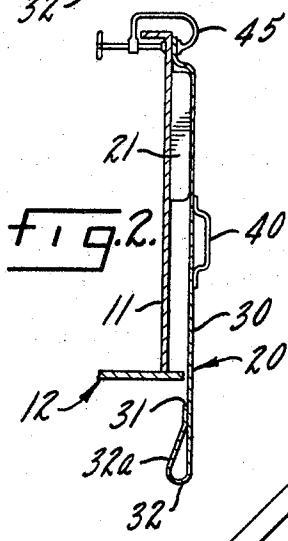


Fig. 2.

Fig. 4.

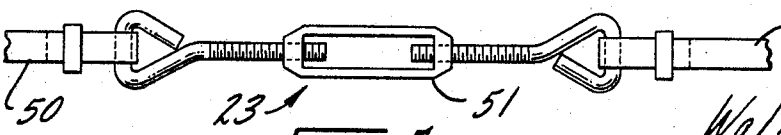


Fig. 5.

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SEAL

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Int. Cl. B65d 87/20

ABSTRACT OF THE DISCLOSURE

A seal arrangement for a floating roof storage tank wherein a horizontally elongated fabric casing is folded vertically upon itself in to enclose flexible, resilient foam plastic members. Vertically arranged upper and lower loops on the casing spaced horizontally around the casing receive clamping bands which hold the casing to the tank rim above and below the seal mounting and locating means.

This invention relates in general to floating roof storage tanks of the type generally used in storing volatile liquids such as petroleum products and the like. It deals more particularly with a seal arrangement and method of mounting a tubular, toroidal seal in a floating roof storage tank.

It is an object of the present invention to provide an improved seal arrangement of the tubular toroidal seal type.

It is another object to provide a seal arrangement which facilitates simple installation and removal of a flexible tubular seal from the rim of a floating roof with minimal effort.

It is still another object to provide a seal arrangement whose vertical position on the floating roof rim can easily be varied in the field.

It is yet another object to provide a seal arrangement that is effective, inexpensive in materials, economical in shop and field labor, and can easily and rapidly be installed and removed while the tank is floating on a stored liquid.

It is a further object to provide a new and improved method of mounting a tubular seal on the roof of a floating roof storage tank.

The foregoing and other objects are realized in accord with the present invention by providing a seal arrangement comprising a fabric casing, sections of flexible foam plastic buns for enclosure by the fabric casing, and metal bands which strap the fabric to the floating roof rim by running entirely around the circumference of the roof above and below suitably disposed vertical rim bars. There is no need for punching bolt holes in the fabric seal or for laboriously and precisely punching bolt holes in the top of the floating roof rim. The horizontal strapping bands are all that is required to hold the seal on the roof rim. In mounting the sealing arrangement, the casing, consisting of a rectangular flat piece of elastomer-coated fabric with loops on its surface, is clamped along its upper edge to the upper edge of the annular roof rim. The casing depends over vertical rim bars shop welded to the rim. Strapping bands assembled with turn buckles to keep them in tension are passed through the aforementioned loops on the casing to hold the envelope tightly against the roof rim on the vertical rim bars with the casing filled with flexible foam plastic buns which provide the seal with resiliency. The preliminary clamps are removed from the casing.

The invention, both as to its organization and method of operation, taken with further objects and advantages thereof, will best be understood by reference to the accompanying drawings, in which:

FIGURE 1 is a partial front elevational view of the toroidal seal casing as it would appear lying flat before assembling in the seal arrangement;

FIGURE 2 is a sectional view taken through the rim of the roof of a floating roof storage tank, with the envelope pictured in FIGURE 1 arranged in the initial step of mounting the seal arrangement according to the present arrangement;

FIGURE 3 is a view similar to FIGURE 2, also showing the tank wall and the foam plastic material used to fill the seal casing, all in an intermediate stage of mounting the seal arrangement on the roof rim;

FIGURE 4 is an enlarged sectional view of the seal arrangement as it is finally mounted between the floating roof rim and the tank wall; and

FIGURE 5 is an enlarged view of a strapping and turnbuckle assembly utilized in mounting the seal arrangement on the tank roof rim according to the present invention.

As previously pointed out, the present invention relates to a floating roof tank of the type used to store volatile petroleum products. Typically, in such a tank, a roof floats on the surface of a stored liquid within the tank, substantially eliminating any space between the liquid and the roof in which vapors might accumulate. The tank is normally cylindrical in shape and relatively large in diameter; an exemplary tank might be 75 feet in diameter, for example.

The roof is circular, and is so constructed that it has a diameter slightly less than the diameter of the cylindrical wall of the tank, leaving an annular space between the peripheral rim of the tank and the wall thereof. The width of this space might vary from tank to tank, of course, and, in addition, vary in width around the same tank because of irregularities in construction, metal expansion and contraction and the like. The space width might vary between 6 and 12 inches or more.

To prevent the escape of vapors from the stored liquid through the aforementioned space between the tank roof and wall, a flexible sealing arrangement **10** embodying features of the present invention is mounted (see FIGURE 4) on the annular rim **11** of the roof **12** between the roof and the tank wall **13**. The sealing arrangement **10** includes an envelope **20**, a series of vertical rim bars **21** welded in horizontally spaced relationship around the outer periphery of the annular rim **11** on the roof **12**, a series of flexible foam plastic buns **22** retained within the envelope to provide necessary resilience, and a pair of strapping band and turnbuckle assemblies **23** and **24** which extend around the sealing arrangement according to the present invention and retain it tightly against the annular rim **11**.

Referring now to FIGURE 1, the envelope **20** consists of an elongated, rectangular, flat casing of elastomer-coated fabric **30**. The length of the rubberized fabric casing **30** is substantially identical to the circumference of the rim **11** on the tank roof **12**. The width of the casing **30**, on the other hand, is sufficient to permit it to completely enclose a foam plastic bun **22**, in the manner illustrated in FIGURE 4. The relationship of the mounted casing **30** and enclosed bun **22** permit the bun to roll upon its axis as the tank roof changes its direction of travel within the tank wall, thus changing the compression axis of the plastic foam.

The elastomer coated fabric casing **30** is folded upwardly along its lower edge **31** to form a loop **32** extending along the bottom of the casing. The free edge **31** is secured to the inner face of the casing **30** by vulcanization or the like. Actually, the loop **32** comprises a series of loop segments **32***a* separated by cut-outs taken from the loop every 20 feet along its length to provide

a series of evenly spaced openings **33** in the loop. As will hereinafter be discussed in detail, it is through these openings **33** that the strapping and turnbuckle assemblies **23** is introduced and adjusted.

Intermediate the loop **32** and the upper edge **35** of the elastomer-coated fabric casing **30** are secured a series of vertically disposed, horizontally spaced loops **40**. The loops **40** are on the opposite side of the casing **30** from the loop **32**, as illustrated in FIGURE 2, and also secured thereto by vulcanization. A plurality of these loops are spaced along the length of the casing **30** on approximately five foot centers. The loops **40** are adapted to receive the other band and turnbuckle assembly **24** in a manner hereinafter discussed.

To assemble the seal arrangement **10** in the annular rim **11** of the roof **12**, the elastomer-coated fabric casing **30** is first clamped along its upper edge **35** to the upper periphery of the rim **11**, as illustrated in FIGURE 2, with conventional C-clamps **45**. The clamps **45** are spaced evenly around the rim **11** and the casing **30** is drawn taut underneath them. The overlapping free ends of the casing **30** are suitably spliced together.

With the casing **30** clamped in the manner illustrated in FIGURE 2, it depends around the annular rim **11** of the roof **12** over a spaced series of vertically extending rim bars **21**. These rim bars **21** are formed of plain steel bar stock and are preferably ¾ inch wide, ¾ inch thick, and 4½ inches long. The bars **21** are welded to the periphery of the rim **11**. These vertically extending rim bars **21** are spaced on approximately four foot centers around the periphery of the roof. They have rounded edges to avoid damaging the casing **30**.

The casing **30** is now disposed as illustrated in FIGURE 2, depending over the vertically disposed rim bars **21**. At this point, the static drain straps **42** are fastened to the lower edge of the rim **11** after pulling the casing **30** up to permit this. The static drain straps **42** are also secured to the upper edge of the rim **11** (see FIGURE 4). The band and turnbuckle assembly **23** is then assembled through the loops **40**. In this light, the band and turnbuckle assembly **23** comprises a series of stainless steel band strips **50** and a series of interconnecting conventional turnbuckles **51**.

The number of band strips **50** required to extend through the loops **40** around the entire casing **30** is determined by counting the number of twenty foot sections **32***a* of the loop **32**. One twenty foot strip **50** for each loop section **32***a* is then connected to one end of a turnbuckle **51** in a well known manner. These separate band strips **50** and turnbuckles **51** are then each inserted through appropriate loops **40** and the band strips are connected to the free ends of adjoining turnbuckles to complete the assembly **23**. Suitable adjustment may be made in the length of one strap **50** to make the assembly **23** precisely extend the entire length of the casing **30**.

With the band and turnbuckle assembly **23** extending through the loops **40** on the outside of the casing **30**, the turnbuckles **51** are tightened around the entire roof **12**. This process involves two men working 180 degrees apart on the roof **12** tightening turnbuckles **51**. With the band and turnbuckle assembly **23** drawn tight in the loops **40**, the casing **30** is pressed against the rim **11** of the floating roof **12** immediately below the vertically disposed rim bars **21**, as illustrated in FIGURE 3.

At this point, the upper edge **35** of the envelope **30** is gripped and pulled upwardly to be sure the band and turnbuckle assembly **23** is seated tightly underneath the rim bars **21**. Then a prescribed number of individual buns **22** of polyurethane foam are set down into the casing **30** from the top of the roof **12**, as illustrated in FIGURE 3. Each bun **22** is ten to twenty feet in length and octagonal in cross-section. They are each compressed approximately six inches in length to fit snugly in the envelope **20** formed by the casing **30**.

At this point, the band and turnbuckle assembly **24** is

threaded through the loop sections **32***a* of the loop **32** formed on the lower edge of the envelope (now pulled into the position seen in FIGURE 3). The assembly **24** is assembled through the loop **32** in the same way the assembly **23** was assembled through the loops **40**.

At the same time, all of the C-clamps **45** clamping the upper edge **35** of the casing **30** to the upper periphery of the rim **11** are removed. The band and turnbuckle assembly **24** is then tightened by drawing the turnbuckles **51** tight to draw the loop **32** tight against the upper edge **35** of the envelope **20** and the rim **11**, immediately above the vertical rim bars **21**. The envelope **20** is thus completed and holds the foam buns **22** completely enclosed.

With the band and turnbuckle assembly **24** drawn tight, drawing the casing tight against the upper periphery of the rim **11** on the roof **12**, it will be seen that the envelope **20** with its enclosed foam plastic buns **22** is anchored to the rim above and below the vertically extending rim bars **21**. No holes had to be cut in the casing **30**, nor were any bolt holes necessarily cut in the rim **11** of the roof **12**. The seal arrangement **10** is retained against the rim **11** solely by the band assemblies **23** and **24** extending through the loops **32** and **40**, in cooperation with the rim 11 and the vertically disposed rim bars **21**.

If it is desired to raise or lower the seal assembly **10** with respect to the rim **11** and, accordingly, the liquid surface, provision can be made for effecting the change by having duplicate or triplicate sets of rim bars **21** welded to the rim **11** at various elevations. The seal assembly **10** is then removed by releasing the band and turnbuckle assemblies **23** and **24** and replaced at a different level.

I claim:

1. In a floating roof storage tank, a seal arrangement for providing an effective seal between the rim of the floating roof and the tank wall, comprising: an elongated casing of flexible material extending around the roof rim, said casing being folded upon itself to form a horizontally disposed envelope, resilient means in said envelope for pressing it into sealing relationship against the rim and the wall, vertically extending first loop means on said envelope disposed horizontally around said envelope, vertically extending second loop means on said envelope disposed horizontally around said envelope above said first loop means, locating means on said rim extending radially therefrom between said first and second loop means, first horizontally extending band means threaded through said first loop means around said rim to clamp said envelope against said rim, second horizontally extending band means threaded through said second loop means around said rim to clamp said envelope against said rim.

2. The seal arrangement of claim **1** further characterized in that said locating means comprises a horizontally spaced series of vertically disposed rim bars extending radially from said rim.

3. The seal arrangement of claim **1** further characterized in that said second loop means is formed along one longitudinal edge of said casing, and said first loop means is formed on one surface of said casing intermediate its longitudinal edges.

4. A method of constructing a seal arrangement on the rim of the floating roof in a floating roof storage tank, comprising the steps of: providing a generally rectangular piece of casing material having a length substantially equal to the circumference of the roof rim, forming first loop means along one surface of the casing intermediate its longitudinal edges, forming second loop means along one of said longitudinal edges of said casing, attaching a mounting and positioning means on said rim so that it extends radially outwardly therefrom, temporarily clamping the other of said longitudinal edges of said casing to said roof rim so that said casing hangs downwardly around said rim and over said mounting and positioning means, passing band means through said first loop means below said mounting and positioning means and drawing said

first band means tight around said rim to clamp said casing tightly against said rim below said mounting and positioning means, drawing said one longitudinal edge of said casing upwardly so as to form an envelope with said casing, positioning flexible, resilient means in said envelope around the circumference of said rim, passing second band means through said second loop means, and drawing said second band means tight to draw said envelope closed and clamp said one longitudinal edge of said casing tightly against the other longitudinal edge thereof and against said tank rim, and removing said temporary clamping.

References Cited

UNITED STATES PATENTS

2,085,752	7/1937	Horton et al.	220—26
2,089,645	8/1937	Dickmann	220—26
2,647,654	8/1953	Cibulka	220—26
3,043,468	7/1962	Horner	220—26
3,119,510	1/1964	Wiggins	220—26
3,135,415	6/1964	Fino	220—26
3,307,733	3/1967	De Bock	220—26

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