Feb. 26, 1963 F. D. MOYER ETAL 3,079,029

RESILIENT WEATHER SEAL FOR A FLOATING ROOF

Filed Dec. 3, 1959

Fig. 1.

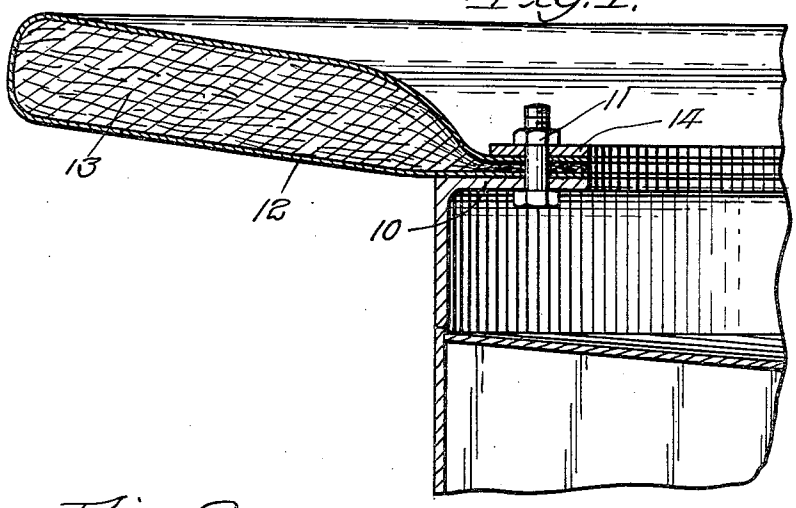


Fig. 2.

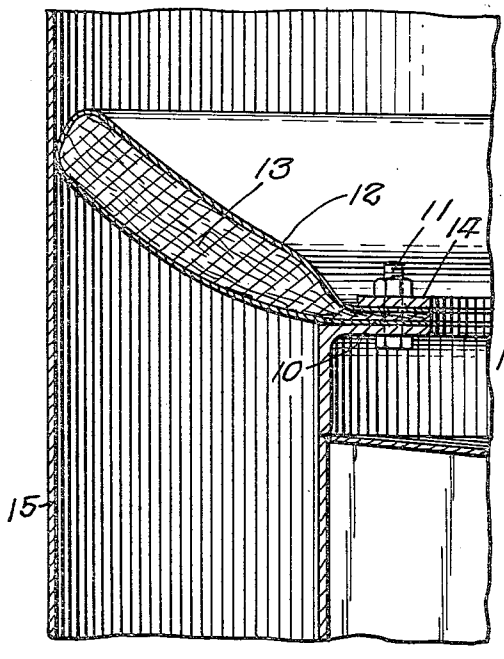
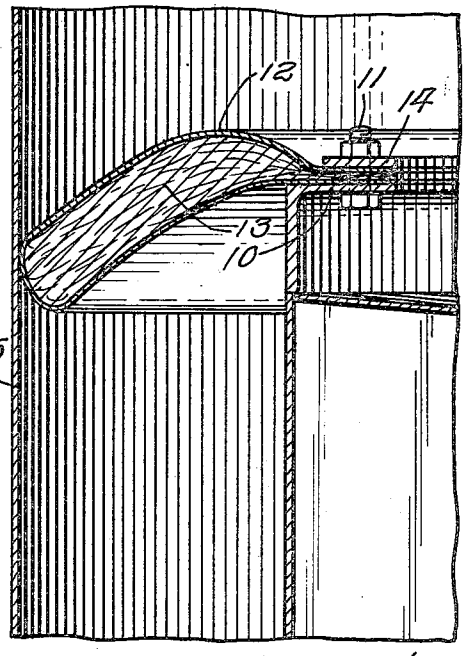


Fig. 3.



Inventors:
Frederick D. Moyer,
Ivan L. Wissmiller,
By Merriam, Smith & Marshall,
Attys.

United States Patent Office

3,079,029
Patented Feb. 26, 1963

1

3,079,029
RESILIENT WEATHER SEAL FOR A FLOATING ROOF

Frederick D. Moyer and Ivan L. Wissmiller, Chicago, Ill., assignors to Chicago Bridge & Iron Company, Chicago, Ill., a corporation of Illinois

Filed Dec. 3, 1959, Ser. No. 856,997
3 Claims. (Cl. 220—26)

This invention concerns an improvement in floating roof tanks for the storage of petroleum products and other volatile liquid materials and in particular relates to an improved weather seal for a floating roof.

In a conventional floating roof tank the floating roof is of somewhat smaller radial dimension than the tank in which it floats, because it is necessary to provide clearance space between the rim of the floating roof and the shell of the tank for accommodating local dimensional variations in the tank shell, commonly called out-of-roundness, which may result from uneven foundation settlement, imprecise fabrication or erection, or unusual live loads such as high winds and the like. In order to prevent costly and sometimes dangerous losses of volatile fractions of the stored product, it is necessary to provide a seal in the space between the floating roof rim and the tank shell and also to provide some means for maintaining the floating roof in a centered position within the tank shell. A large number of such sealing and centering devices are well known to the art. Included among these are sliding metallic shoes adapted to slide against the interior surface of the tank and supported by means of pivoted struts extending from the roof, with impervious fabric curtain material stretched between the sliding shoes and the rim of the roof, and non-metallic sealing and centering devices such as liquid filled fabric tubes which are positioned in the rim space and bear against both the rim of the roof and the interior surface of the tank shell.

In the non-metallic type of sealing and centering device mentioned above, and also in some of the metallic types where the fabric curtain between the shoe and the roof rim is positioned below the metallic hanger members, it is desirable to provide an additional seal between the roof rim and the tank shell to protect the device against deterioration resulting from the effects of wind, water, sunlight, and corrosive vapors. Such a secondary sealing member is often referred to as a weather shield or wiper seal. In the past weather shields have been interleafing metallic sheets pivotally supported from the rim of the roof, or composite members made up partly of metal and partly of rubberized fabric. These conventional weather shields are difficult to fabricate and install and therefore expensive, and in addition are subject to malfunctioning caused by wind, corrosion, lack of maintenance and other factors. More recently, rubberized fabric weather seals have been used but have not been entirely satisfactory because they tend to bend and sag into the rim space.

In accordance with this invention there is provided a simple, inexpensive, easily installed weather shield with no moving metallic parts which is not subject to the disadvantages inherent in existing weather shields. Further, the weather shield of the invention requires a minimum of maintenance while in service. Other advantages will become apparent from the description which follows.

The weather shield of the invention comprises an annular envelope of impervious weather resistant fabric with a compressible resilient material inside the annular envelope, said envelope being clamped to the floating roof at a point adjacent the rim of the roof so as to extend

2

radially outwardly and to come into sliding contact with the interior surface of the tank shell.

In the accompanying drawing:

FIGURE 1 is a cross sectional view of the weather shield and its relationship to the rim of the floating roof, with the weather shield in repose and unaffected by bearing or sliding against the tank shell;

FIGURE 2 is a cross sectional view of the same weather shield in position and in contact with the interior surface of the tank shell at a time when the floating roof is moving downwardly; and

FIGURE 3 is a cross sectional view of the same weather shield in sliding contact with the tank shell at a time when the roof is moving upwardly.

Referring now to FIGURE 1, the uppermost portion of the rim of a floating roof is represented by an angle 10, the horizonal peripheral supporting shelf of which is intermittently drilled to receive bolts 11. An annular envelope 12 is placed upon the horizontal peripheral supporting shelf of rim angle 10 so as to extend radially outwardly across the rim space. A resilient material 13 is placed within the envelope and that portion of the envelope immediately above the shelf of rim angle 10 is tightly compressed by means of clamp bar 14 and held in that position by a plurality of bolts 11 extending through the shelf of rim angle 10 and also through the envelope and the clamp bar 14. It should be noted that the outer edge of clamp bar 14 is set back some distance from the peripheral edge of the angle 10. This setback is necessary in order to permit the weather shield to remain in substantially the position shown in FIGURE 1 while at repose, instead of sagging down into the rim space on account of its own weight. The compression of the filler material causes the upper portion of the fabric envelope to be stretched in tension, which imparts increased resistance to bending or sagging of the envelope. Moreover, the downward force of the clamp is spread by means of compressing the resilient filler so as to be transmitted to and resisted by the entire horizontal shelf of the rim, and the upward resistive forces in the region of the peripheral edge of the shelf produce a moment which bends the shield upwardly, placing it in a desirable position for proper drainage. If the clamp bar 14 extended outwardly to just above or beyond the peripheral edge of the angle 10, a plane of weakness to bending would be created above the peripheral edge of the shelf and the weather shield would tend to droop downwardly and therefore would not have the desirable characteristic of draining toward the center of the roof.

In FIGURE 2, which shows the weather seal in contact with the tank wall 15, it can be seen that the weather shield is deflected upwardly from its angle of repose as the roof moves downwardly in the tank as the result of withdrawing liquid product stored therein.

FIGURE 3 shows the deflection of the weather shield when the roof is moving upwardly within the tank as the result of filling the tank. Since this condition occurs only during filling, it exists only during a small portion of the time, and the undesirable drainage characteristic while in this position is not an important factor.

It is important, of course, to select suitable materials for the weather shield. The envelope should be of a fabric material which is resistant to attack by corrosive vapors, sunlight, salt air, rain water and dust. For example, it may be made of a cloth coated on the outside or on both sides with an elastomer such as a synthetic rubber material such as neoprene. The resilient material to be placed inside the envelope should be a material of relatively high compressibility and of high resistance to permanent set even after repeated compression

or bending. It has been found that a suitable resilient material for this purpose consists of pads of matted glass fibres formed into a resilient mass and held in place by means of a binder such as a thin film of phenolformaldehyde resin. A fibre glass mat having a density of approximately two pounds per cubic foot has been successfully used. Other resilient mats made of other types of natural synthetic fibres, such as synthetic acetate fibres, if properly bonded and selected of a suitable thickness and density, will also work satisfactorily. It has also been found that flexible polyurethane foam is quite satisfactory.

In the preferred embodiment shown in FIGURES 1, 2 and 3, the cross sectional shape of the envelope is relatively narrow vertically compared with its horizontal dimension, but it should be understood that other shapes of envelopes may also be employed without departing from the spirit or scope of the invention. For example, an envelope having a substantially circular cross section when in repose and filled with suitable resilient material may also be effectively employed to serve as either a primary or secondary rim seal as well as a weather shield.

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, as modifications will be obvious to those skilled in the art.

What is claimed is:

1. A seal for use in a liquid storage tank having a tank shell and a floating roof provided with a substantially horizontal peripheral supporting shelf terminating in a peripheral edge radially spaced inwardly from said tank shell, said seal extending continuously around the periphery of said roof and closing the space between said roof edge and the tank shell, said seal being radially elongated and comprising:

a radially elongated, weather resistant, flexible, fabric envelope extending radially outwardly from said roof toward said shell;

a resilient, compressible, solid, material extending integrally within said envelope and filling the envelope continuously substantially from the radially innermost to radially outermost portions thereof;

and substantially continuous peripheral means, located above and offset, substantially, radially inwardly of the peripheral edge of said supporting shelf, for clamping to said shelf the filled radially innermost portion of said envelope and that portion of the resilient material filling the envelope's radially innermost portion;

the greater part of said filled envelope and of said resilient material therein being unclamped and extending radially outwardly beyond the shelf's peripheral edge;

said filled envelope having a substantially uniform thickness in an unclamped state;

said clamped portion of the resilient material being under compression and the upper portion of said envelope being under tension to maintain the seal in an upthrust position extending angularly upwardly from the roof to the tank shell when the seal is in its normal condition of repose.

2. The seal of claim 1 in which said compressible resilient material consists of a bonded fibrous mat.

3. The seal of claim 1 in which said compressible resilient material consists of a polyurethane foam pad.

References Cited in the file of this patent

UNITED STATES PATENTS

1,628,665	Hall	May 17, 1927
2,035,862	Calcutt	Mar. 31, 1936
2,144,082	Randall	Jan. 17, 1939
2,459,178	Moyer	Jan. 18, 1949
2,523,292	Goldsby et al.	Sept. 26, 1950
2,571,817	Armstrong	Oct. 16, 1951
2,859,495	Roberts	Nov. 11, 1958
2,914,212	Fino	Nov. 24, 1959

FOREIGN PATENTS

96,423	Switzerland	Oct. 2, 1922