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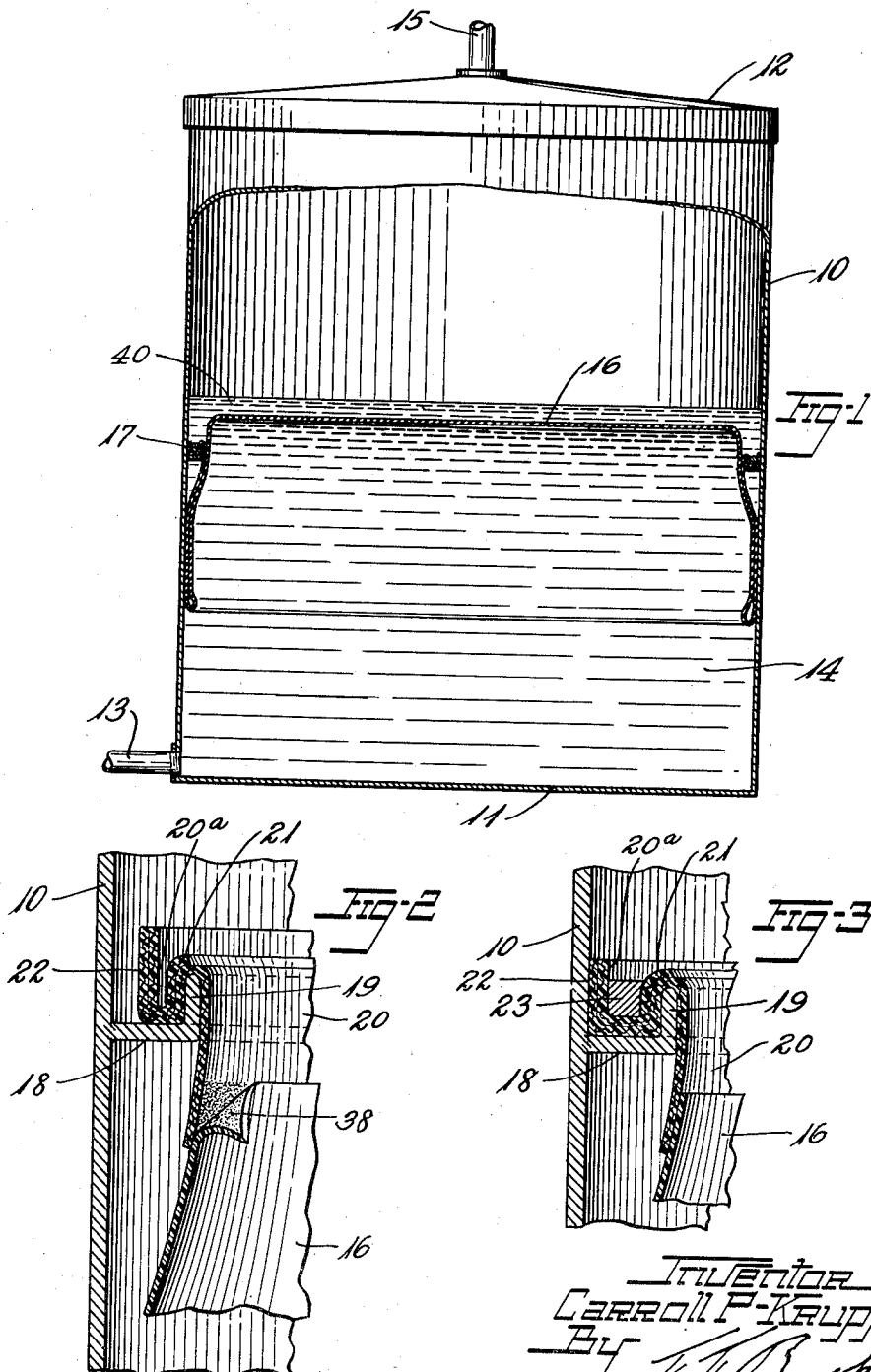
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DIAPHRAGM FOR STORAGE TANKS

Filed Jan. 24, 1950

2 Sheets-Sheet 1



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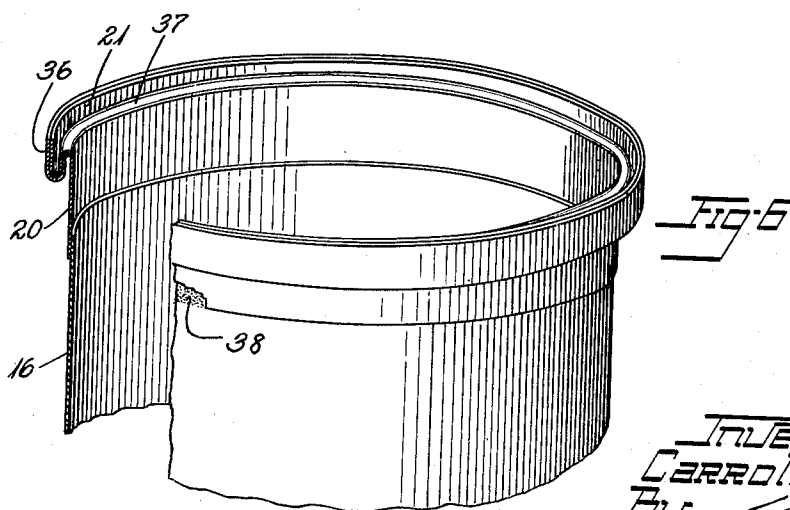
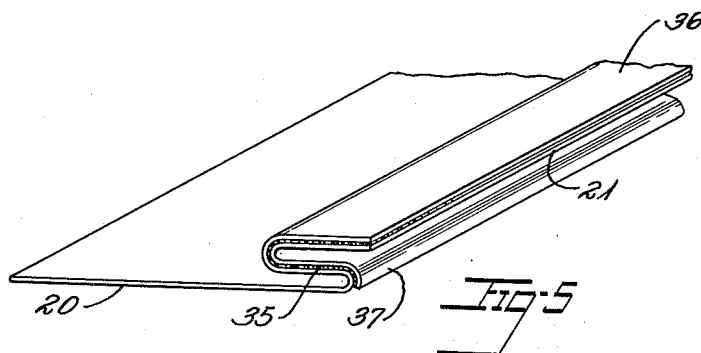
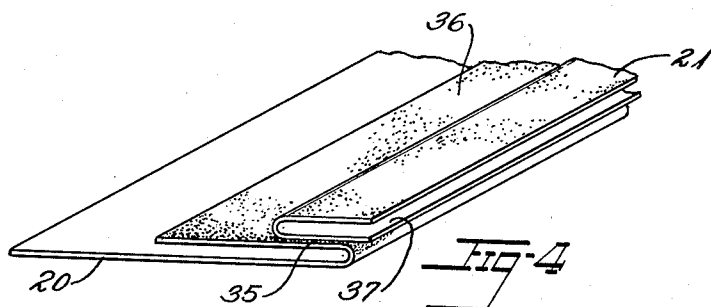
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DIAPHRAGM FOR STORAGE TANKS

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DIAPHRAGM FOR STORAGE TANKS

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6 Claims. (Cl. 220—85)

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This invention relates to diaphragms for tanks used for storing liquids and is especially useful in storage tanks for oils, and the manufacture, installation and use of the diaphragms.

In the storing of liquids where it is desirable to protect the liquid from contact with the atmosphere, as in the storage of volatile petroleum products or other low-boiling liquids subject to loss by evaporation, or in the storage of liquids containing ingredients which might unite with moisture in the air to form corrosive acids, as in the storage of some crude petroleum oils, or in the storage of liquids which may become oxidized by contact with air, such as vegetable oils, it has been found desirable to provide storage tanks with a floating cover. These covers sometimes have been of a complicated construction and in other cases have been merely on the order of flexible floating diaphragms.

In constructions heretofore proposed, difficulties have been encountered, especially in that it has been difficult to seal the diaphragm to the walls of the container and the materials often have been damaged in securing them in place. Furthermore, it has been difficult to position the diaphragm properly before securing it in place.

It is an object of the present invention to provide an improved manner of securing the diaphragm in sealed relation to the walls.

Other objects are to provide protection of the margin of the diaphragm against accidental damage in securing it, to provide facility in properly mounting the diaphragm, to provide a reinforced attaching margin, and to provide for convenience of manufacture and assembly.

These and other objects will appear from the following description and the accompanying drawings.

Of the drawings,

Fig. 1 is an elevational view of a liquid storage tank constructed in accordance with and embodying the invention, the lower part of the container being shown in section and the container being partly filled with liquid.

Fig. 2 is an enlarged detail sectional view thereof showing the diaphragm in place before being sealed to the container, one portion of the diaphragm being turned back to show the construction, parts being broken away.

Fig. 3 is a view like Fig. 2, but after the diaphragm has been secured in place.

Fig. 4 is a perspective view showing the apron and cushion strip in the first position of assembling them.

Fig. 5 is a similar view showing the apron and

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cushion strip in a subsequent position of assembling them.

Fig. 6 is a perspective view, partly broken away, showing the diaphragm with its apron and cushion strip assembled and ready to be placed in the container.

Referring to the drawings, the numeral 10 designates a cylindrical storage tank of metal suitable for application of the invention, having a closed bottom 11 and top 12. A pipe 13 connects with the bottom for supplying or withdrawing a liquid 14. A pipe 15 connects the top of the container to the atmosphere for venting it.

A flexible diaphragm in the form of a bag 16 having a bottom wall and continuous side wall, telescopically reversible on itself, is secured to the side walls of the tank or container at a distance above the bottom of the tank, as at 17 and for this purpose an upwardly open channel is provided at the inner wall of the tank as by welding an angle iron 18 thereto continuously thereabout with one leg 19 of the angle extending vertically and the other leg extending horizontally to provide the floor of the channel.

According to the invention, to provide for supporting and reinforcing the margin of the diaphragm, an apron 20 of impervious material, which may be fabric reinforced, is secured to the bag 16 in extension of the side walls thereof and in overlapping relation to its upper margins. This margin is preferably additionally reinforced at the upper margin of the apron by a cushion layer 21 of heavy impregnated fabric.

To provide for accurately positioning the margin of the diaphragm and to facilitate securing it to the wall of the container at the retaining channel iron 18, the apron and cushion are united and preformed with a reverse bend 22, thereby providing a hook-like fold 20a circumferentially of the apron for positioning over and seating upon the leg 19 of the channel 18. With the hook-like fold resting on the channel leg 19, the remaining margin of the apron outwardly of the fold 20 within the channel, a strip 23 of suitable material such as lead is laid within the upwardly open fold of the apron margin and is caulked in place as by a hammer and caulking chisel or other tool. The caulking thickens the strip of lead laterally and fits, clamps and seals the margin of the apron in the channel. In this caulking operation the fold 20a of the apron seats upon the channel leg 19 and owing to the preformed and vulcanized condition of this fold it retains its position on the leg so that it will not be dragged over the leg during the caulking. At

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the same time the material of the apron for fitting the inner surface of the channel is supplied by the margin of the apron outwardly of the fold, as will be seen by a comparison of Fig. 2 and Fig. 3, which action greatly facilitates the caulking and fitting of the apron in the channel without objectionably distorting, wrinkling or pulling the diaphragm or otherwise injuring it in the caulking operation.

The cushion layer 21 is for the purpose of preventing damage to the apron as by hammer blows. It may be made of heavy belt duck. The duck is frictioned with material such as a rubber material having low expansion properties in the presence of petroleum solvents to preserve the fabric and render it liquid tight. The rubber material commercially known as Nipol rubber has given good results for this purpose. The outer faces of the duck are coated slightly with the frictioning material, the coating preferably being such as would result from frictioning without applying a skim coating.

For best results, the apron must permit flexing and must reinforce the diaphragm and present resistance to wear, while at the same time it should remain impervious to the liquid to be stored. It is also desirable that it have resistance to corrosive solutions such as acids. A layer of nylon fabric of about eight ounce weight has been found satisfactory when properly impregnated and coated. The fabric is first frictioned and coated with the rubber composition. Then a barrier layer of liquid nylon may be applied over its surfaces and a protective coating of rubber may then be applied thereover and cemented thereto. This construction is particularly resistant to gasoline or other light petroleum solvents.

The bag 16 of the diaphragm may be of any suitable flexible sheet material resistant to action of the liquid, such as a suitable rubber or plastic composition or a blend thereof.

In forming and assembling the apron and its cushion, strips of these materials substantially equaling in length the circumference of the tank are folded upon themselves longitudinally and are then superimposed as shown in Fig. 4 with a layer of adhesive material therebetween as at 35. The flap 36 is then folded to the right of the figure about the strip 21 and adhered thereto. Then the flap 37 is folded about the strip 20 and adhered thereto as shown in Fig. 5. The ends of the apron and cushion are stepped with relation to each other and these stepped ends are then joined to provide an endless apron. This apron is then subjected to a vulcanizing operation and then is adhered as at 38 to the bag 16 of the diaphragm, an adhesive material preferably a vulcanizable cement being used which will vulcanize upon application of heat and be resistant to solvent liquids.

After the diaphragm is in place in the tank a liquid 40 may be applied over the diaphragm if desired, although that is not necessary. This liquid when used acts as a lubricant between the folds of the diaphragm and also as a weighting material.

Variations may be made without departing from the scope of the invention as it is defined by the following claims.

I claim:

1. A diaphragm for a storage tank comprising a cover portion and an apron portion about said cover portion, said apron portion comprising flexible sheet material having a circumferentially extending reverse fold permanently formed in said

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material of a shape to hook over the leg of a retaining channel on said tank to position said diaphragm relative to said tank, and said apron portion having a margin of said material outwardly of said fold circumferentially troughed for anchorage in said channel, said troughed margin providing an annular space for caulking material under compression between the sides of the troughed portion.

2. A diaphragm for a storage tank comprising a cover portion and an apron portion about said cover portion, said apron portion comprising flexible sheet material having a circumferentially extending reverse fold permanently formed in said material of a shape to hook over the leg of a retaining channel on said tank to position said diaphragm relative to said tank, said apron portion having a margin of said material outwardly of said fold circumferentially troughed for anchorage in said channel, said troughed margin providing an annular space for caulking material under compression between the sides of the troughed portion, and said apron portion being of increased thickness in the region of said circumferentially extending fold and having a fabric reinforcing cushion in said region.

3. A diaphragm for a storage tank comprising a cover portion of flexible sheet material and an apron portion about said cover portion, said apron portion comprising flexible fabric-reinforced liquid-impervious sheet material having a circumferentially extending reverse fold permanently formed in said material of a shape to hook over the vertical leg of a retaining channel on said tank to position said diaphragm relative to said tank, and said apron portion having a margin of said material outwardly of said fold circumferentially troughed to line said channel in an upwardly open fold to receive caulking material, and a layer of reinforcing cushion material over the troughed area along said margin at said folds and secured to the material of said apron to provide resistance to caulking pressure.

4. A diaphragm for a storage tank, said diaphragm comprising a cover portion and a flexible apron portion comprising a circumferential band of coated fabric about the cover portion and providing a wear-resisting margin thereof, said apron portion having a reversely folded circumferential margin adapted to hook over a leg of a channel about the wall of the tank and provide an anchoring trough for caulking material, a cushioning layer of material within the folded portion of the apron portion providing a protective layer thereabout and deformable caulking means within said folded portion in contact with said cushioning layer for clamping the apron portion in said channel in sealing engagement therewith.

5. A diaphragm for a storage tank, said diaphragm comprising a cover portion and a flexible apron portion comprising a circumferential band of coated fabric about the cover portion and providing a wear-resisting margin thereof, said apron portion having a reversely folded circumferential margin adapted to hook over the leg of a channel about the wall of the tank and provide an anchoring trough for caulking material, a cushioning layer of rubber impregnated belt duck within the folded portion of the apron portion providing a protective layer thereabout, and deformable caulking means within said folded portion in contact with said cushioning layer for clamping the apron portion

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in said channel in sealing engagement therewith.

6. A diaphragm for a storage tank, said diaphragm comprising a bag-like cover portion of flexible impervious sheet material and a flexible apron portion comprising a circumferential band of coated fabric about the cover portion and providing a wear-resisting margin thereof, said apron portion having a reversely folded circumferential margin adapted to hook over a channel about the wall of the tank, a cushioning layer of rubber impregnated belt duck within the folded portion of the apron portion providing a protective layer thereabout, and deformable caulking means within said folded portion in contact with said cushioning layer for clamping the apron portion in said channel in sealing

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engagement therewith, said deformable means comprising a body of lead.

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