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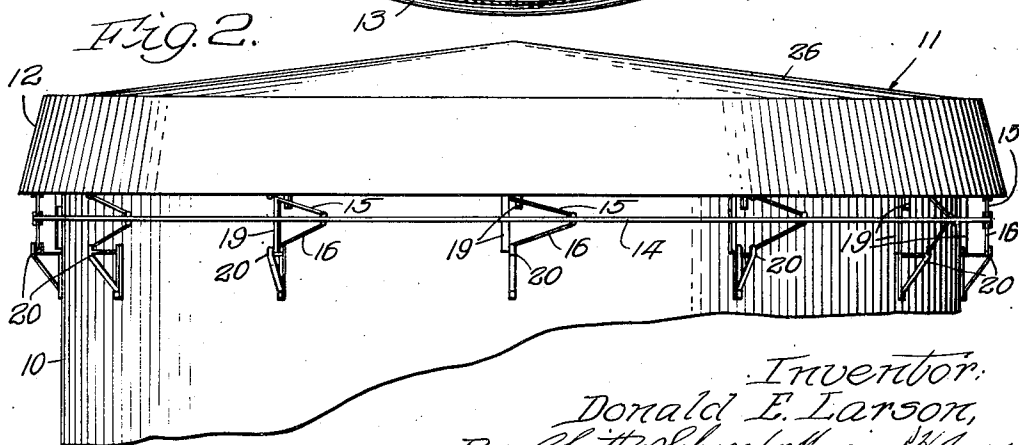
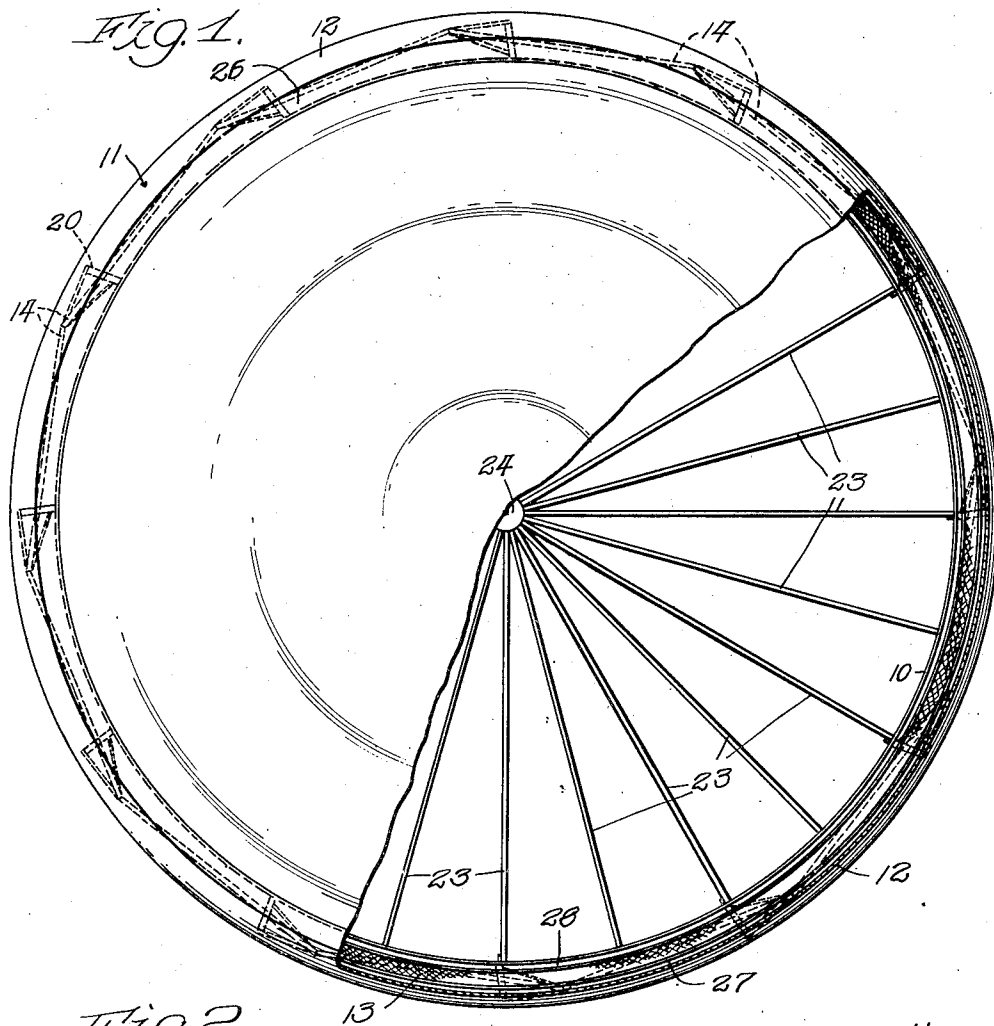
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2,485,613

GUIDE FOR LIFTER ROOF TANKS

Filed Feb. 7, 1946

2 Sheets-Sheet 1



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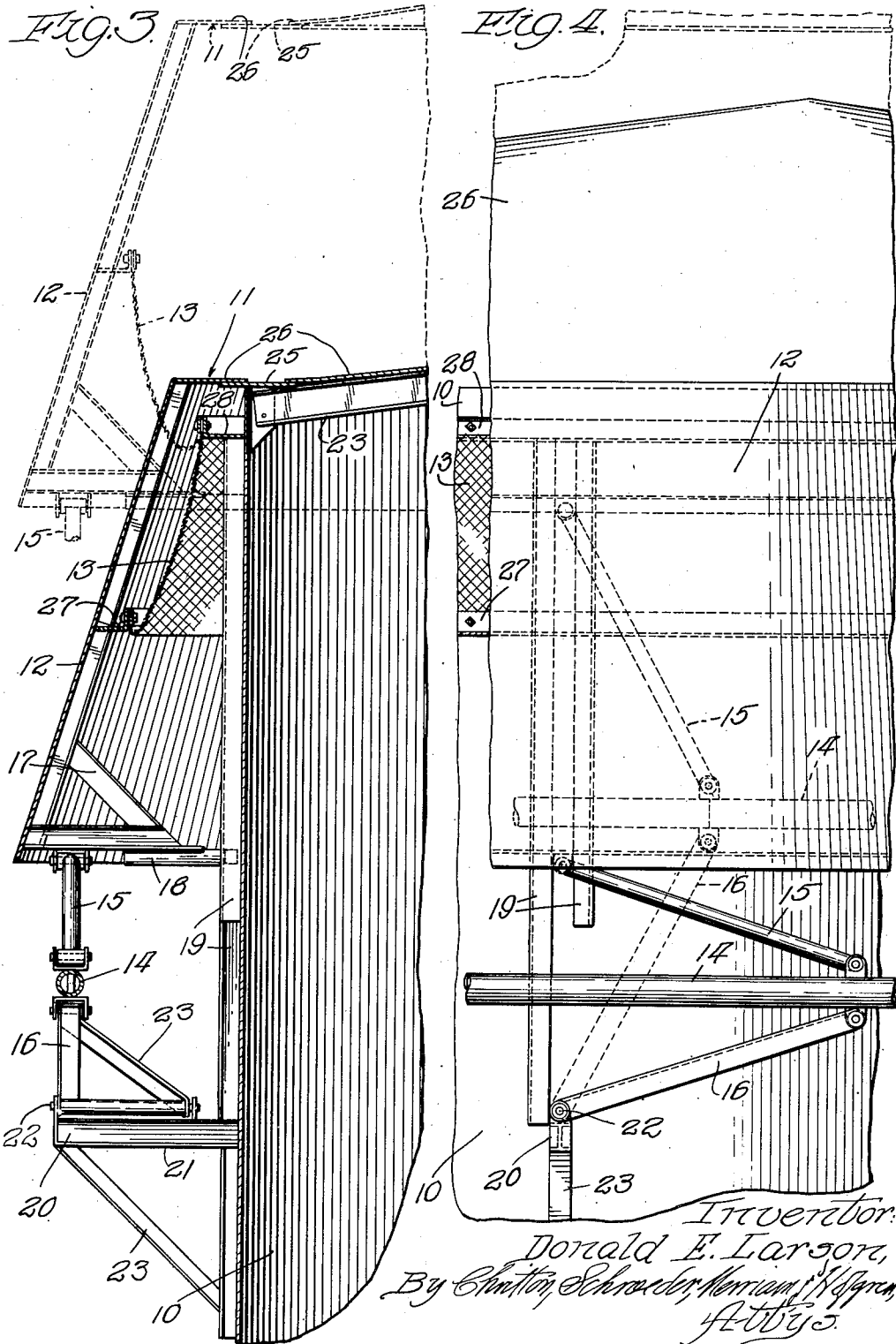
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UNITED STATES PATENT OFFICE

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GUIDE FOR LIFTER ROOF TANKS

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This invention relates to a lifter roof tank wherein the roof rises and falls with increasing and decreasing pressure of gas within the tank, and relates particularly to a guide means for maintaining the roof substantially level at all times.

Lifter roof tanks are used for the storage of gas and for the storage of mixtures of liquid and gas. The tank is designed so that the roof rises and falls when increasing and decreasing gas pressure. Flexible sealing members of impregnated cloth or the like are ordinarily provided between the roof and the shell of the tank. These tanks, which are sometimes quite large in diameter, are subjected to wind pressure and snow, all of which tend to unbalance the roof. Various means have been proposed for maintaining the roof level during storage, but these have often been quite complicated and cumbersome.

I have invented a stabilizing means for maintaining a lifter roof substantially horizontal at all times during its travel. In a lifter roof tank including the shell and a roof thereover adapted to rise and fall at increasing and decreasing gas pressure within the shell, the stabilizing means comprises broadly a bar member spaced from the shell and at least two pairs of arms hingedly attached to the bar member with one arm of each bar hingedly attached to the roof and the other arm hingedly attached to the shell. Adjacent shell arms are inclined at substantially the same angle with respect to the horizontal and in the same direction, and adjacent roof arms are also inclined at substantially the same angle with respect to the horizontal and in the same direction. Each of the pairs of arms is at all times at an angle of less than 180° with respect to each other, with the angle increasing as the roof rises and decreasing as the roof falls. In a preferred embodiment the bar member is continuous and extends around the shell. The bar member may have the shape of a regular polygon with a pair of arms attached to the bar member at each apex of the polygon.

I have also invented a simplified means of erecting such a lifter roof tank having the stabilizing means of this invention. With this method of erection the outer rim or skirt of the roof is installed around the shell, and the bar member and arms are installed with the skirt of the roof resting on the shell. The deck of the roof is then assembled and permitted to rest on rafters without being connected to the skirt. The skirt of the roof is then raised by pulling at one or more points on the bar member so as to increase the

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angle between each pair of arms. With the skirt of the tank in its highest position there is free access to the top edge of the shell and the inner surface of the skirt so that a flexible sealing member may be installed between the skirt and the shell. After the sealing member is in place the skirt is lowered until it rests on the edge of the shell, and the deck of the roof is then connected to the skirt. After the deck of the roof has been assembled the tank is ready for use.

The invention will be described as related to the embodiment shown in the accompanying drawings. Of the drawings Fig. 1 is a plan view of a lifter roof tank having the new stabilizing means, with portions broken away for clarity of illustration; Fig. 2 is a fragmentary elevation of the tank; Fig. 3 is a vertical section taken through the edge of the lifter roof and the top of the shell; and Fig. 4 is an enlarged fragmentary elevation of a top portion of the tank.

The lifter roof tank shown in the accompanying drawings comprises a shell 10, a roof 11 thereover having a downwardly extending and outwardly flared skirt 12, a flexible sealing member 13 attached to the shell near the top edge thereof and attached to the skirt 12 at substantially the middle of the skirt. The roof 11 rises and falls with increasing and decreasing gas pressure within the shell 10.

In order to maintain the roof level at all times a stabilizing means is provided. This stabilizing means comprises a bar member 14 extending around the shell and spaced therefrom. The bar member is preferably in the form of a regular polygon. At each apex of the polygon there is hingedly attached a pair of arms 15 and 16. The upper arm 15 is hingedly attached to a bracket 17 on the bottom of the skirt 12. The bottom horizontal portion 18 of each bracket extends inwardly to a point adjacent the shell 10. This inner end of each bracket is slidably held by a vertical guide 19 formed of a pair of spaced parallel lengths of angle iron. Each bottom arm 16 has its lower end hingedly mounted on a bracket 20 mounted on the shell. This bracket comprises a horizontal reach 21 extending outwardly from the shell and carrying the hinge 22, and a diagonal brace 23 extending from the outer end of the horizontal reach 21, diagonally downward to the shell 10. The bottom arm 16 is braced by an inclined bracing member 23 that is also attached to the hinge 22.

The top of the shell 10 is provided with radial struts 23 extending from a post 24 in the center of the shell to the top edge portions of the shell.

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The roof 11 has a top deck formed of an annular plate 25 resting on the top edge of the shell and roof plates 26 attached to the annular plate 25. The annular plate is connected to the skirt 12 by means of a second annular plate 26.

Each pair of adjacent upper arms 15 are inclined at substantially the same angle with respect to the horizontal and are inclined in substantially the same direction. Likewise each adjacent pair of bottom arms 16 are downwardly inclined at substantially the same angle with respect to the horizontal and in the same direction. It is preferred that each of the arms 15 and 16 have substantially the same effective length. As the roof rises and falls the bar member 14 moves vertically and tangentially around the shell 10. During this movement the angle between each pair of arms 15 and 16 is increased and decreased, but the angle is always less than 180°.

A preferred method of erecting the tank is to construct the shell 10, assemble the first and second annular plates 25 and 26 and the skirt 12, but leaving the deck and skirt unconnected, and then assemble the stabilizing means. The skirt is then raised to its highest position by pulling on the substantially horizontal bar member 14. With the skirt in this highest position, the flexible sealing member 13 is installed by bolting it to an inwardly extending skirt bracket 27 and an outwardly extending shell bracket 28. The skirt 12 is then lowered. The outer roof plates 26 are then welded or bolted to the annular plate 25.

In replacing the seal, the connection at 25 may be broken, the skirt raised, and the process repeated. When the tank is empty of gas the plates 26 will rest on the radial struts 23.

Having described my invention as related to the embodiment set out in the accompanying drawings, it is my intention that the invention be not limited by the details of description unless otherwise specified, but rather be construed broadly within its spirit and scope as set out in the accompanying claims.

I claim:

1. In a lifter roof tank including a shell and a roof thereover adapted to rise and fall with increasing and decreasing gas pressure within the shell, a stabilizing means comprising a horizontal floating annular bar member spaced from the shell, and at least two pairs of arms pivotally attached to the bar member with one arm of each pair pivotally attached to the roof and the other arm pivotally attached to the shell, each of said pairs of arms being at all times at an angle of less than 180° with respect to each other with the angle increasing and with the arms being free to pivot as the roof rises and decreasing as the roof falls.

2. The stabilizing means of claim 1 wherein the shell arms are of substantially the same effective length and the roof arms are of substantially the same effective length.

3. The stabilizing means of claim 1 wherein the bar member is straight between adjacent pairs of arms.

4. The stabilizing means of claim 1 wherein the bar member extends around the shell and describes a polygon, with the pairs of arms being attached to the bar member at substantially the apices thereof.

5. In a lifter roof tank comprising a shell and a roof thereover adapted to rise and fall with increasing and decreasing gas pressure within the shell, a stabilizing means comprising a substantially horizontal floating bar member spaced

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from the shell and extending therearound, said bar member having the shape of a regular polygon, and pairs of arms pivotally attached to the bar member at substantially the apices of the polygon with one arm of each pair pivotally attached to the roof and the other arm pivotally attached to the shell, each of said pairs of arms being at all times at an angle of less than 180° with respect to each other, said angle being small when the roof is in its lowest position and large when the roof is in its highest position and said arms being free to pivot with vertical movement of the roof.

6. The stabilizing means of claim 5 wherein each shell arm is pivotally attached to a bracket mounted on the shell.

7. The stabilizing means of claim 5 wherein each roof arm is pivotally attached to a bracket mounted on the roof.

8. The stabilizing means of claim 5 wherein each roof arm is hingedly attached to a bracket mounted on the roof, said bracket having an inwardly projecting post which engages and is vertically guided by a substantially vertical guide mounted on the outside of the shell.

9. In a lifter roof tank comprising a shell and a roof thereover adapted to rise and fall with increasing and decreasing gas pressure within the shell, a stabilizing means comprising a substantially horizontal floating bar member spaced from the shell and extending therearound, said bar member having the shape of a regular polygon, pairs of arms pivotally attached to the bar member at substantially the apices of the polygon with one arm of each pair pivotally attached to a bracket on the roof and the other arm pivotally attached to a second bracket mounted on the shell, said roof bracket having an inner end adjacent the shell, and a substantially vertical guide mounted on the outside of the shell for holding the inner end of the roof bracket, each of said pairs of arms being at all times at an angle of less than 180° with respect to each other, said angle being small when the roof is in its lowest position and large when the roof is in its highest position and said arms being free to pivot with vertical movement of the roof.

10. A lifter roof tank comprising a shell, a lifter roof thereover adapted to rise and fall with increasing and decreasing gas pressure within the shell, a depending skirt around the roof and forming a part thereof, spaced brackets around the skirt extending to points adjacent the shell, substantially vertical guides mounted on the shell for holding the inner ends of said skirt brackets, a substantially horizontal floating bar member spaced from the shell, and at least two pairs of arms pivotally attached to the bar member with one arm of each pair pivotally attached to the skirt bracket and the other arm pivotally attached to a second bracket mounted on the shell, said arms being free to pivot with vertical movement of the roof and with adjacent shell arms being inclined at substantially the same angle with respect to the horizontal and in the same direction and adjacent roof arms being inclined at substantially the same angle with respect to the horizontal and in the same direction, each of said pairs of arms being at all times at an angle of less than 180° with respect to each other with the angle increasing as the roof rises and decreasing as the roof falls.

11. The tank of claim 10 wherein the bar member is continuous around the shell and has the

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shape of a polygon with one pair of said arms at substantially each apex of the polygon.

12. The tank of claim 10 wherein each arm is substantially equal in effective length.

13. The method of erecting a lifter roof tank 5 having a shell, a roof thereover including a downwardly extending skirt, a flexible sealing member between the skirt and the shell, and a stabilizing means comprising a bar member surrounding the shell and spaced pairs of arms hingedly attached to the bar member with the upper arm of each pair attached to the skirt and the lower arm attached to the shell, said method comprising erecting the shell, assembling the skirt and an annular portion of the roof deck adjacent the skirt, with said annular portion resting on the top edge of the shell, assembling the stabilizing means, moving the bar member upwardly and

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tangentially to raise the skirt and annular portion, installing the flexible sealing member, lowering the skirt until the annular roof portion again rests on top of the shell, and connecting the skirt to the deck.

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