

Jan. 18, 1949.

F. D. MOYER

2,459,178

SEAL FOR FLOATING ROOFS

Filed Oct. 20, 1945

Fig. 1.

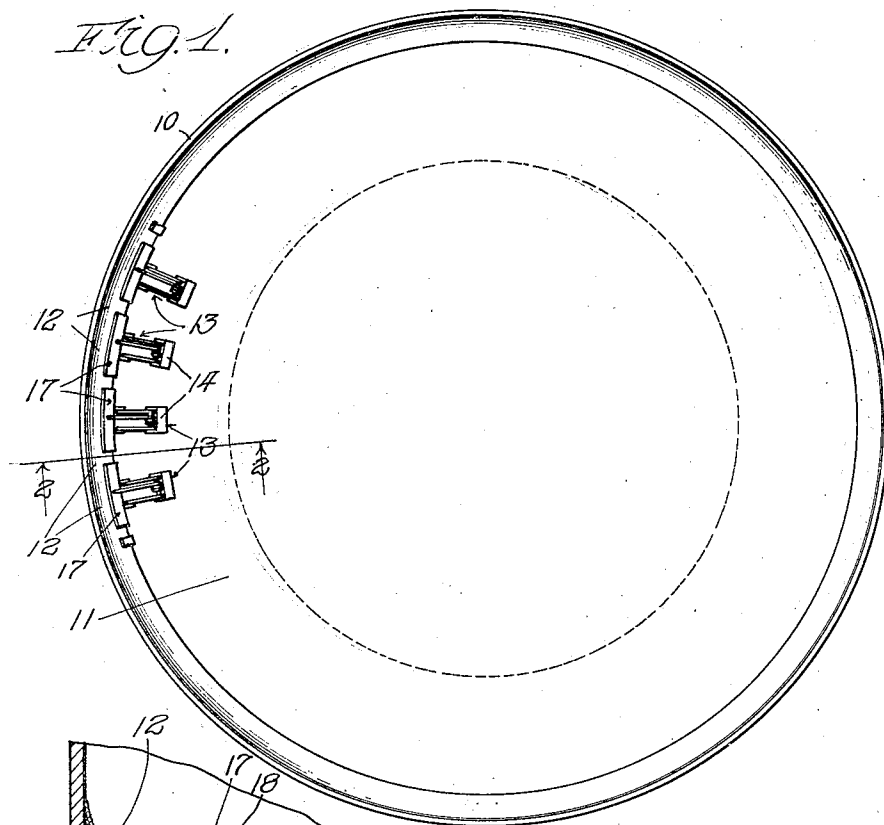
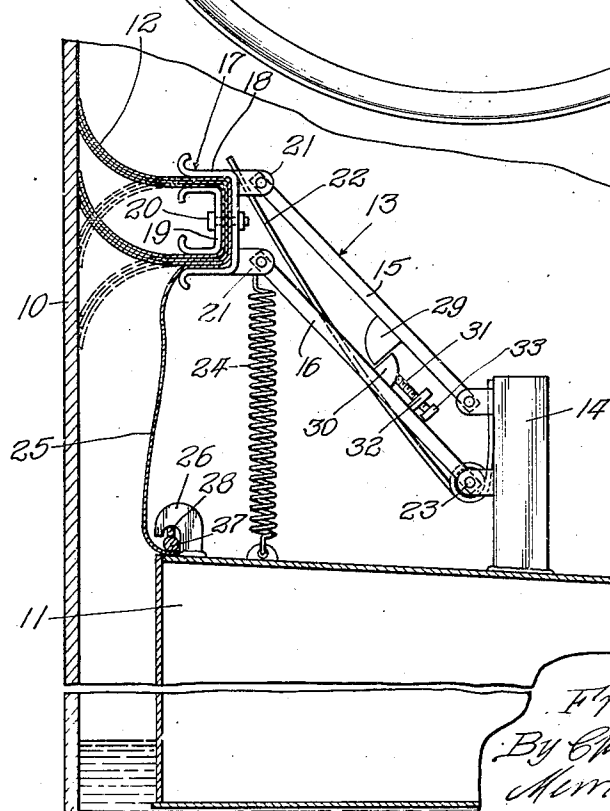


Fig. 2.

Inventor:
Frederick D. Moyer,
By Clinton, Miles, Schroeder,
Merriam, Krogren, Attys.

UNITED STATES PATENT OFFICE

2,459,178

SEAL FOR FLOATING ROOFS

Frederick D. Moyer, Chicago, Ill., assignor to
Chicago Bridge & Iron Company

Application October 20, 1945; Serial No. 623,515

10 Claims. (Cl. 220-26)

1

This invention relates to a seal for a floating roof tank wherein the space between the floating roof and the inner surface of the tank shell is maintained vapor tight.

The seal which is the subject of this invention may be applied to any large piston-like object that is movable in a housing such as a cylinder, and will provide a fluid-tight positive seal between the object and the cylinder. The seal is simple in construction and uses very little material. As the sealing member wears it may be easily adjusted because the seal wears in during use. When the seal is mounted on the roof of a floating roof tank sufficient sealing action may be achieved with one sealing member only if the member contacts the sides of the tank shell and the roof of the tank. In the normal construction, however, there is provided a primary seal in addition to the sealing member that contacts the inner surface of the tank shell, and this primary seal will extend from the sealing member to the roof. When this primary seal is used the contacting sealing member is normally arranged above the top surface of the roof and the primary seal will extend substantially vertically from the contacting sealing member to the top edge of the roof. This construction is preferred as the primary seal is then self-draining and will not collect rust, mill scale, water, or the like.

The seal when applied to a floating roof tank includes a plurality of circumferentially arranged pivotally mounted upstanding arms around the edge of the roof and extending toward the inner surface of the shell of the tank. At the outer ends of these arms there is located an annular flexible sealing member to press against the shell. There is also provided means normally urging the outer ends of the arms toward the inner surface of the shell to provide sealing contact between the sealing member and the shell. Adjustable stop means are provided for limiting the movement of the arms whereby pressure of the seal against the shell is limited. The body of the sealing member is preferably held in substantially horizontal alignment against the shell of the tank through all movements of the arms. There is provided an annular primary seal of flexible impervious material extending from the floating roof to the sealing member.

The invention will be described in detail as related to the typical embodiment shown in the accompanying drawings. Of the drawings, Fig. 1 is a plan view of a floating roof storage tank showing several of the brackets that hold the sealing member in contact with the tank shell;

2

and Fig. 2 is an enlarged fragmentary vertical section taken along line 2-2 of Fig. 1.

The storage tank shown in the accompanying drawings comprises a vertical cylindrical shell 10 and a floating roof 11. There is provided a sealing member 12 contacting the shell 10 of the tank. This sealing member is held in place by a plurality of brackets 13 mounted on the top of the roof 11 and substantially equally spaced around the edge of the roof.

Each of the brackets 13 includes a vertical post 14 mounted on top of the roof and located a short distance back from the edge. Pivotally mounted on the post 14 are top members 15 and bottom members 16. These members may be iron bars, and the top bars 15 are parallel to each other, and the bottom bars 16 are also parallel to each other. One of the top bars 15 is parallel to a bottom bar 16 and is arranged in a substantially vertical plane. At the outer ends of the parallel bars 15, 16 there is located a base member 17 for holding the sealing member 12. This base member 17 is pivotally connected to the outer ends of the bars so that the post 14, bars 15 and 16, and base member 17 form vertical parallelograms whose shape can be altered as each portion of the parallelograms is pivotally connected to its adjoining portion.

The base member 17 comprises an outer U-shaped member 18 and an inner U-shaped member 19 of smaller size. These U-shaped members have the sealing member clamped between them by means of one or more bolts 20 passing through all three members. The bases 35 of the U-shaped members 18 and 19 are arranged substantially vertically and parallel to the shell 10. The outer member 18 has projecting lugs 21 to which the outer ends of the parallel bars 15 and 16 are pivotally attached. The sealing member 12 is held by the U-shaped members 18 and 19 substantially in the center, with the main body portion of the sealing member on each side of the clamped area held substantially horizontally, and the ends of the sealing member contacting 45 the shell at an acute angle.

The sealing member 12 is held in close contact to the sides of the shell 10 by a rod spring 22 urging the outer ends of the parallel bars 15 and 16 down toward the roof of the tank. This spring 22 lies along the post 14 and extends down under the hinge 23 by which the bottom bars 16 are attached to the post and up to the top of the outer U-shaped member 18 which holds the sealing member 12. A spring 24 is provided to augment 55 the outward pressure of the spring 22, the spring

24 extending from the outer end of the bottom rod 16 to the top of the roof. Either of the springs 22 or 24 may be dispensed with or both may be eliminated by the provision of a weight (not shown) for maintaining the sealing member in contact with the sides of the tank.

In the construction shown there is located a primary seal 25 between the sealing member 12 and the top of the roof 11. This primary seal is a flexible, impervious material and is arranged substantially vertically, so that there will be no pockets therein to collect water, rust, mill scale, and the like. The primary seal 25 has its lower edge fastened to the roof by means of a plurality of hooks 26 and a circular rod 27. The lower edge of the primary seal is placed under the rod 27 and wedges 28 are driven between the rod 27 and the hook 26 to clamp the seal between the rod and the top edge of the roof.

The top edge of the primary seal is clamped between the shell contacting sealing member 12 and the outer U-shaped member 18.

In order to limit the pressure of the sealing member 12 against the shell 10 there is provided a stop means on the parallel rods 15 and 16. This stop means includes a projection 29 on one top bar 15 and extending toward its corresponding bottom bar 16, and a second projection 30 on the bottom bar 16 and extending toward the top bar 15. These projections 29 and 30 have flat sides substantially parallel to each other with the first projection 29 being above the second projection 30. The second projection 30 is slidably mounted on its bar 16 and is movable by means of a screw 31 held in a third projection 32 mounted on the bottom bar 16. The screw 31 has its top end engaging the movable second projection 30, and has a knob 33 on its bottom end for turning the screw. Thus the second projection 30 may be moved toward and away from the first projection 29 to regulate the movement of the bars 15 and 16, and thus determine the pressure of the sealing member 12 on the inner surface of the shell 10. As the ends of the sealing member wear by frictional contact with the shell the second projection 30 may be lowered to take up this wear.

The primary seal 25 is preferably made of a fabric base impregnated with an impervious, flexible material. This material may be a synthetic rubber, and is preferably neoprene. The sealing member 12 that contacts the shell also comprises a fabric base impregnated with a flexible synthetic rubber such as neoprene, and is preferably constructed of layers of impregnated fabric cemented to each other. As shown, the sealing member 12 is made of three layers of material cemented together. These layers may be short lengths, and are arranged one on top of the other in staggered relationship. Thus when the individual sections are 6 feet long one end of the middle layer may be positioned 2 feet from one end of a section in the first layer and one section in the third layer will be 2 feet from the end of the middle layer section and 4 feet from the end of the section in the first layer.

The brackets 13 holding the sealing member 12 and circumferentially spaced around the edge of the roof 11 serve to hold the sealing member 12 tightly against the shell 10. Only one of these brackets has been shown in detail in the drawings, but all brackets are constructed like the one shown.

Having described my invention in considerable detail as related to one embodiment of the same,

it is my intention that the invention be not limited by any of the details of description, but rather be construed broadly within its spirit and scope as set out in the accompanying claims.

I claim:

1. A storage tank comprising an outer shell, a floating roof, a plurality of circumferentially arranged pivotally mounted upstanding arms around the edge of the roof and extending toward the shell of the tank, an annular flexible sealing member carried on the outer ends of said arms, each of said arms comprising a pair of substantially parallel bars of substantially equal length mounted one above the other with their inner ends mounted on a substantially vertical post member attached to the roof and with the outer ends of said bars connected by a substantially vertical base member pivotally connected thereto and carrying the sealing member, means operating at the outer ends of said bars normally urging them down toward the roof to press the seal against the inner surface of the shell, and adjustable stop means for limiting the movement of said bars whereby pressure of the seal against the shell is limited.

2. The tank of claim 1 wherein the sealing member is held by the base member with the body portion of the sealing member held substantially horizontally at all times and the end of the sealing member contacting the inner surface of the shell at an acute angle.

3. The tank of claim 1 wherein the base member comprises two substantially parallel portions arranged vertically with the sealing member clamped therebetween at substantially the center of the sealing member, the sides of the sealing member being arranged substantially horizontally and the ends contacting the inner surface of the shell at an acute angle.

4. A storage tank comprising an outer shell, a floating roof, a plurality of circumferentially arranged pivotally mounted upstanding arms around the edge of the roof and extending toward the shell of the tank, an annular flexible sealing member carried on the outer ends of said arms and comprising a plurality of layers of fabric impregnated with a flexible impervious material, each of said arms comprising a pair of substantially parallel bars of substantially equal length mounted one above the other, with the inner ends mounted on a substantially vertical post member attached to the roof and with the outer ends of said bars connected by a substantially vertical base member pivotally connected thereto and carrying the sealing member, said base member comprising two substantially parallel portions arranged vertically with the sealing member clamped therebetween at substantially the center of the sealing member with the sides of the sealing member arranged substantially horizontally and the ends contacting the inner surface of the shell at an acute angle, means operating at the outer ends of said bars normally urging them down toward the roof to press the seal against the inner surface of the shell, and adjustable stop means for limiting the movement of said bars whereby pressure of the seal against the shell is limited.

5. The tank of claim 4 wherein the adjustable stop means comprises an adjustable member mounted on one of said bars normally operating against a fixed member on the other bar, said members being adapted to contact each other after a predetermined downward movement of

5

the bars to prevent further downward movement.

6. The tank of claim 1 wherein there is provided an annular primary seal of flexible impervious material extending substantially vertically from the top edge of the roof to the sealing member.

7. The tank of claim 4 wherein there is provided an annular primary seal of flexible impervious material extending substantially vertically from the top edge of the roof to the sealing member.

8. The tank of claim 4 wherein the adjustable stop means comprises an adjustable member mounted on one of said bars normally operating against a fixed member on the other bar, said members being adapted to contact each other after a predetermined downward movement of the bars to prevent further downward movement, and there is provided an annular primary seal of flexible impervious material extending substantially vertically from the top of the roof to the sealing member.

9. A storage tank comprising an outer shell, a floating roof, a plurality of circumferentially arranged pivotally mounted upstanding arms around the edge of the roof and extending toward the shell of the tank, each of said arms comprising a pair of pivotally mounted substantially parallel members of substantially equal length with their inner ends in substantially vertical alignment and their outer ends in substantially vertical alignment, an annular flexible sealing member, a base member pivotally connected to the outer ends of said arms and carrying the sealing member, means normally urging the arms down toward the roof whereby the seal is pressed against the inner surface of the shell, and adjustable stop means on each parallel member for limiting the movement of said arms whereby pressure of the seal against the shell is limited, the body of the sealing member being held in sub-

6

stantially horizontal alignment through all movements of the arms.

10. A storage tank comprising an outer shell, a floating roof, a plurality of circumferentially arranged pivotally mounted upstanding arms around the edge of the roof and extending toward the shell of the tank, each of said arms comprising a pair of substantially parallel bars of substantially equal length mounted one above the other with their inner ends mounted on a substantially vertical post member attached to the roof, an annular flexible sealing member, a substantially vertical base member pivotally attached to the outer ends of said bars and carrying the sealing member, means normally urging the arms down toward the roof whereby the seal is pressed against the inner surface of the shell and adjustable stop means on each arm for limiting the movement of said arms whereby pressure of the seal against the shell is limited, the body of the sealing member being held in substantially horizontal alignment through all movements of the arms.

FREDERICK D. MOYER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
Re. 22,169	Hammeren	Sept. 1, 1942
1,426,998	Leland et al.	Aug. 22, 1922
1,660,021	Wiggins	June 19, 1928
1,673,984	Kuhl	June 19, 1928
2,072,798	Cranz	Mar. 2, 1937

FOREIGN PATENTS

Number	Country	Date
487,774	Great Britain	June 24, 1938