April 19, 1932. J. H. WIGGINS 1,854,534

FLOATING ROOF FOR LIQUID STORAGE TANKS

Filed March 17, 1930

Fig. 1.

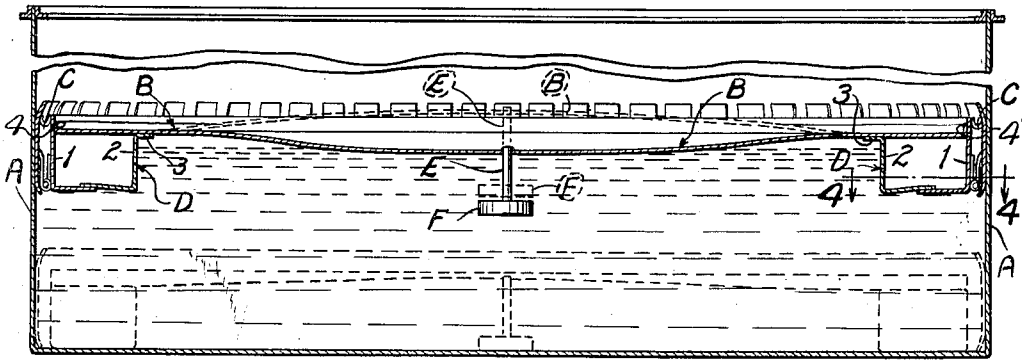


Fig. 2.

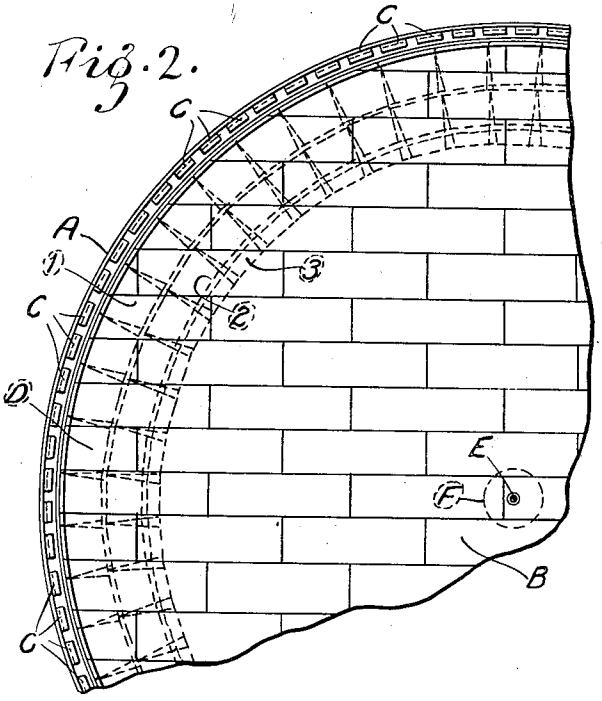


Fig. 4.

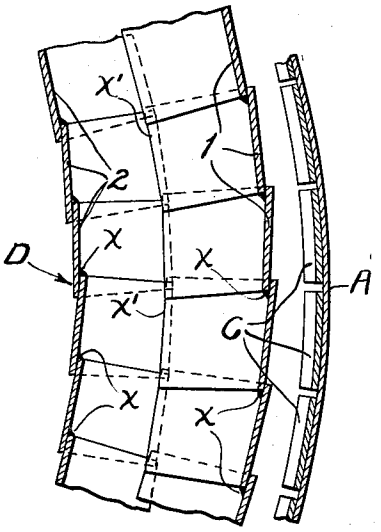
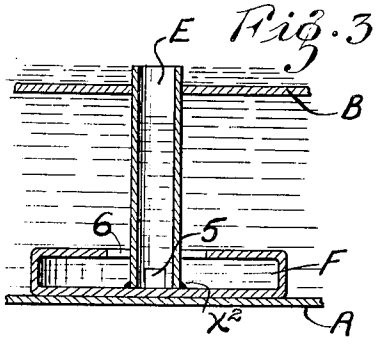


Fig. 3.



INVENTOR:
JOHN H. WIGGINS.
BY Bakewell & Church.
ATTORNEYS

Patented Apr. 19, 1932 1,854,534

UNITED STATES PATENT OFFICE

JOHN H. WIGGINS, OF TULSA, OKLAHOMA

FLOATING ROOF FOR LIQUID STORAGE TANKS

Application filed March 17, 1930. Serial No. 436,482.

This invention relates to floating roofs for liquid storage tanks.

One object of my invention is to provide a floating roof that is equipped with an annular pontoon which is constructed in a novel manner that reduces the cost of manufacture of the pontoon and facilitates the shipment of same from the point of manufacture to the place of use.

Another object is to provide a tank roof of the breather-floater type, in which the drain that is used to carry rain water off the top side of the roof is of such design or construction that it serves as a support which holds the central portion of the roof in spaced relation with the bottom of the tank when the tank is empty and the load of the roof is sustained by the bottom of the tank.

And still another object is to eliminate the necessity of forming a well in the bottom of a liquid storage tank equipped with a floating roof provided with a drain of the inverted siphon type. Other objects and desirable features of my invention will be hereinafter pointed out.

Figure 1 of the drawings is a vertical transverse sectional view of a liquid storage tank equipped with a floating roof embodying my present invention.

Figure 2 is a fragmentary top plan view of said structure.

Figure 3 is an enlarged vertical sectional view of the roof drain; and

Figure 4 is a detail sectional view on an enlarged scale, taken on the line 4—4 of Figure 1.

In the accompanying drawings which illustrate the preferred form of my invention, A designates the side wall of a liquid storage tank, and B designates a floating roof that normally rests upon and is sustained by the liquid in the tank. The roof B covers the major portion of the surface of the liquid in the tank, and the space between the peripheral edge of the roof and the side wall A of the tank is closed by an expansible and contractile structure, commonly referred to as a "seal", that is provided with vertically-disposed shoe members C that slide vertically over the inner face of the side wall of the tank when the roof B rises and falls, due to variations in the level of the liquid in the tank. The roof B herein shown is of the breather type, and is constructed of metal plates connected together in such a way as to form a limber sheet or diaphragm that is capable of flexing upwardly, as indicated in broken lines in Figure 1, so as to increase the volume of the vapor space of the tank when the roof is sustained by the liquid in the tank. At the peripheral portion of the roof is an annular pontoon D that floats on the liquid in the tank and imparts buoyancy to the roof B. In the roof herein shown the pontoon D is so designed that the portion of the roof adjacent the inner edge of the pontoon will be held spaced slightly above the top surface of the liquid in the tank, thus providing a vapor space or gas space for gases that rise from the liquid. If the pressure which the gases or vapors exert upwardly on the under side of the central portion of the roof is less than the weight of said central portion, the central portion of the roof will deflect downwardly, as shown in full lines in Figure 1, and when the pressure of the gases or vapors increases, the central portion of the roof will flex upwardly, as shown in broken lines in Figure 1, thereby increasing the volume of the vapor space.

Floating roofs of the kind to which my invention relates often have a diameter in excess of 100 ft. Accordingly, the fabrication and shipment of the circular pontoon for a large-sized roof is an item of considerable importance in the cost of manufacturing and installing the roof.

One object of my invention is to cut down this cost. To this end I propose to construct the pontoon D from metal plates that can be shaped easily by a simple bending operation and which can be shipped in nested relation from the point of manufacture to the place of use. In the form of my invention herein illustrated the pontoon D is made up of two groups of L-shaped members or plates 1 and 2 that constitute the bottom and side walls of the pontoon D, the top wall of the pontoon being formed preferably by the peripheral edge portion of the roof B.

As shown in Figure 4, the L-shaped members 1 constitute the outer side wall and a portion of the bottom of the pontoon D, and the L-shaped members 2 constitute the inner side wall and a portion of the bottom of said pontoon. The members 1 are arranged so that the edge portions of the vertical flanges and the horizontal flanges are in overlapping relation, and the overlapped portions of said members are permanently connected together in any suitable way, but preferably by welded joints x. The inner group of members 2 are similarly arranged and connected together by welded joints, and the horizontal flanges of the two groups of members 1 and 2 are overlapped and joined together by welded joints x' or in any other suitable manner. It is immaterial how the pontoon D is combined with the roof B, but I prefer to provide the vertical legs of the inner group of members 2 of the pontoon with laterally-projecting flanges 3 that are attached to the underside of the roof B in any preferred way and provide the roof B at its peripheral edge with an upwardly-projecting flange 4 (see Figure 1) that is attached in any suitable or preferred manner to the vertical legs of the outer group of members 1 of the pontoon.

By referring to Figure 4 it will be seen that the horizontal legs of the members 1 and 2 of the pontoon are tapered longitudinally slightly or are made substantially wedge-shaped, and it will also be noted that the inner group of members 2 are narrower than the outer group of members. It is possible to proportion the members 1 and 2 in this way, because the inner vertical wall of the pontoon is of less diameter than the outer vertical wall of the pontoon, and by constructing the pontoon in this way, I materially reduce the cost of manufacturing the same, due to the saving in metal effected by using narrower members 2 to form the inner portion of the pontoon. As the members 1 and 2 are angle-shaped, or L-shaped in outline, they can be produced from flat metal plates by a simple bending operation, and another advantage of such a design of pontoon is that it permits pontoons of large and small diameters to be fabricated with equal ease. In shipping the roof from the place where the parts of same are shaped or formed to the place where the roof is installed in a tank, the members 1 and 2 of the pontoon can be arranged in nested relation, thereby permitting them to be packed in a relatively small space, and thus effecting a considerable saving in the cost of shipping the roof. The number of the members 1 and 2 may vary, but in practice I prefer to construct the pontoon from inner and outer groups of members, each of which groups comprises the same number of parts as the number of shoes C used in the seal of the roof, as this is advantageous in the fabrication of the roof.

While I prefer to construct the pontoon D from two concentric rows of L-shaped members whose vertical legs constitute the side walls of the pontoon and whose horizontal legs constitute the horizontal wall of the pontoon, I wish it to be understood that my broad idea contemplates constructing the pontoon from members of other shapes or form, as my invention, broadly stated, consists of a floating roof provided with a pontoon having a circular portion (either vertical or horizontal) made up of or comprising a plurality of flat or straight plate-like members whose edge portions are connected together in such a way that said plate-like members, taken collectively, constitute a circular portion of the pontoon. It is preferably that the edge portions of said plate-like members be overlapped and joined together by welded points, and that said plate-like members have straight flanges or laterally-projecting portions that co-operate with each other to constitute another wall or portion of the pontoon. The thing that distinguishes the pontoon of my improved floating roof from the pontoons heretofore used in such structures, is that the pontoon is made up principally of a plurality of straight flanged metal plates that do not have to be curved or bent or cut into segmental shape during the fabrication of the pontoon, and any floating roof pontoon that embodies this feature or characteristic should be considered as coming within the scope of my invention, even though the members or elements that make up the principal portion of the pontoon are not of the particular shape and arrangement herein illustrated. Another desirable feature of such a pontoon is that the joints of same can be caulked from the upper side, even though the roof is floating on the liquid.

The drain that is used to conduct rain water off the top side of the roof B is preferably of the inverted siphon type, and is composed of a vertically-disposed pipe E attached to the center of the roof B, and depending from the underside of same, and a hollow member or cup F arranged horizontally at the lower end of the pipe E and having its bottom butting against the lower end of the pipe E and secured to same in any suitable way, as, for example, by a welded joint x^2. Water which collects on the top side of the central portion of the roof B will overflow from same downwardly through the pipe E, as indicated by the arrow in Figure 3, and will thence escape from said pipe into the cup F through ports 5 in the lower end of said pipe, said water finally escaping from the cup F through an opening 6 in the top of same, and thence flowing downwardly towards the bottom of the tank. If the liquid confined in the tank is oil, the rain water that escapes from the top

side of the roof through the drain pipe E will collect in a layer on the bottom of the tank, from which point said rain water can be discharged through an outlet in the side wall of the tank, as is common practice in oil storage tanks. The cup F may vary in shape and size, so long as it is of such design that the top edge of the side wall of the cup, or the opening 6 at the upper end of the cup, is located at a point higher than the ports 5 through which the water escapes from the pipe E, thereby producing a drain of the inverted siphon type that embodies the desirable features and characteristics of the drain described in my U. S. Patent No. 1,574,013, dated February 23, 1926.

In the roof herein shown the drain, formed by the pipe E and cup F, is used as a support for the central portion of the roof B when the tank is empty, and the roof is arranged at the lower end of the tank, as shown in broken lines in Figure 1. At such times the pontoon D rests upon the bottom of the tank, thus sustaining the load of the peripheral portion of the roof, and the drain sustains the load of the central portion of the roof. The cup F of the drain serves as a foot piece for the drain pipe E that has a relatively large bearing area on the bottom of the tank, and the pipe E is made long enough to produce a safe drain of the inverted siphon type whose long leg is of sufficient length to eliminate the possibility of the oil in the tank escaping upwardly through the pipe E. Notwithstanding the relatively great length of the drain pipe E, it is not necessary to form a vertical well in the bottom of the tank to receive the drain when the tank is empty or substantially so, due to the fact that the central portion of the roof to which the drain is attached has sufficient flexibility to permit the central portion of the roof to flex upwardly, as indicated in broken lines at the lower end of Figure 1, when the pontoon D rests upon the bottom of the tank. Hence, in a floating roof embodying my present invention it is not necessary to equip the roof with depending legs or similar devices whose sole function is to sustain the weight of the roof when the tank is empty, because in my improved roof the pontoon D which is used to impart buoyancy to the roof and the drain pipe E which is used to conduct water off the top side of the roof, co-act with each other to support the roof and hold it spaced away from the bottom of the tank when the tank is empty.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A floating roof for liquid storage tanks, provided with a pontoon having a vertical wall of circular form made up of a plurality of flat or straight metal plates whose vertical edge portions are lapped and joined together, said plates having lateral extensions that constitute a horizontal portion of the pontoon.

2. A floating roof for liquid storage tanks, provided with a pontoon having a vertical wall of circular form made up of a plurality of flat or straight metal plates whose vertical edge portions are lapped and joined together, said plates having laterally-projecting flanges that are overlapped and connected together so as to form a horizontal portion of the pontoon.

3. A floating roof for liquid storage tanks, provided with a circular pontoon having a horizontal portion and vertical side walls made up of substantially L-shaped members joined together.

4. A floating roof for liquid storage tanks, provided with a circular pontoon having a horizontal portion and vertical side walls made up of substantially L-shaped members arranged in overlapping relation and joined together.

5. A floating roof for liquid storage tanks, provided with a circular pontoon that comprises two concentric rows of L-shaped members arranged with their edge portions overlapped.

6. A floating roof for liquid storage tanks, provided with a circular pontoon that comprises two concentric rows of L-shaped members arranged with their edge portions overlapped, the members of the respective rows also being overlapped.

7. A floating roof for liquid storage tanks, provided with a circular pontoon made up principally of L-shaped members whose horizontal legs are tapered or substantially wedge-shaped.

8. A floating roof for liquid storage tanks, provided with a circular pontoon that comprises an inner row and an outer row of flanged metal plates, the plates of the inner row being of smaller circumferential dimension than the plates of the outer row.

9. A floating roof for liquid storage tanks, and an annular pontoon at the peripheral edge of the roof whose top wall is formed by the roof and whose side walls and bottom wall are formed from substantially L-shaped members arranged in opposed relation in two concentric rows.

10. A floating roof for liquid storage tanks, and an annular pontoon at the peripheral edge of the roof whose top wall is formed by the roof and whose side walls and bottom wall are formed from substantially L-shaped members arranged in opposed relation in two concentric rows, with the members constituting each row disposed in overlapping relation and with the horizontal legs of the members of the respective rows disposed in overlapping relation.

JOHN H. WIGGINS.