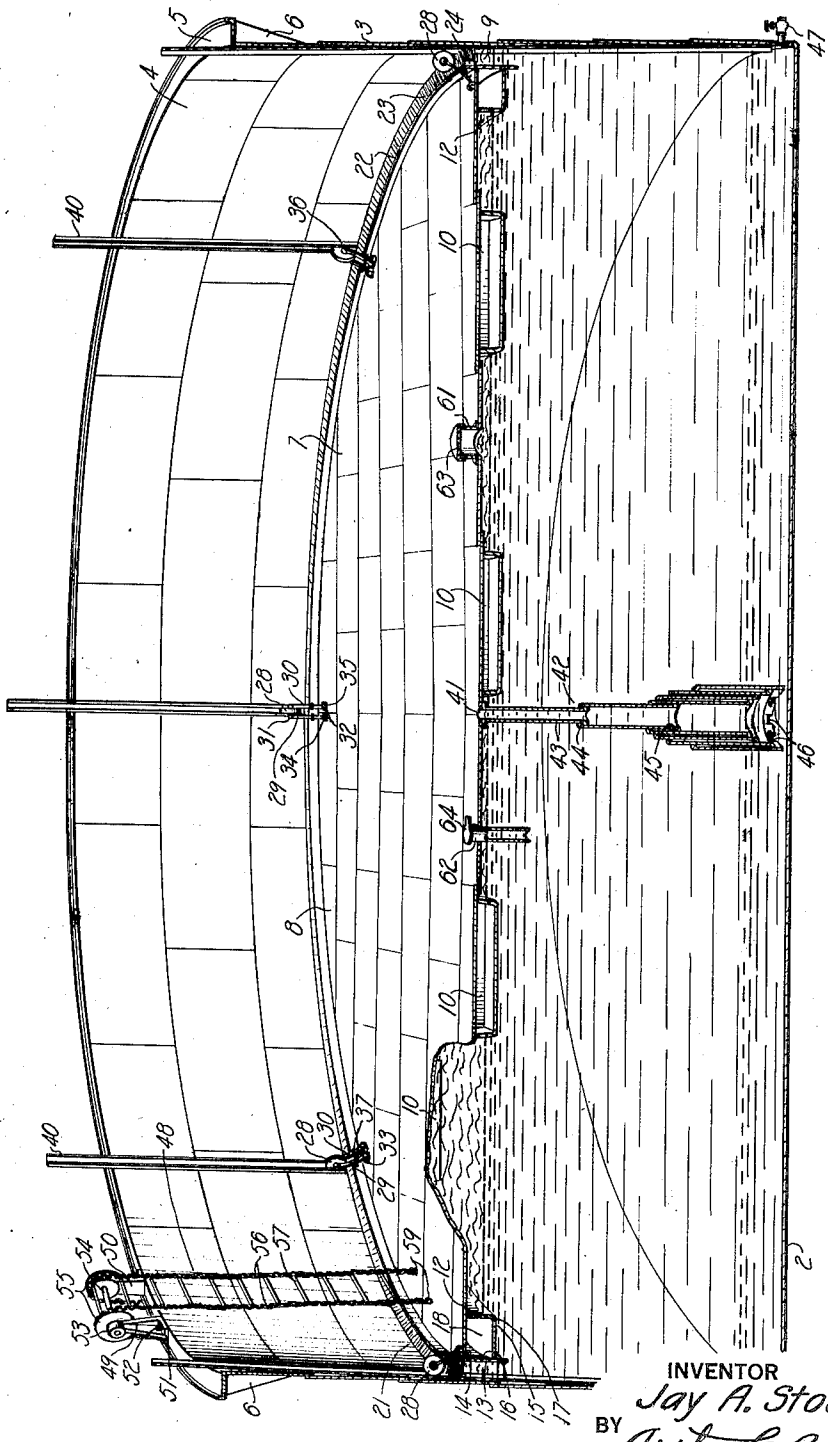
April 7, 1936. J. A. STOUGH 2,036,372

FLOATING DECK FOR OIL STORAGE TANKS

Filed Aug. 1, 1930 2 Sheets-Sheet 1

Fig. 1.



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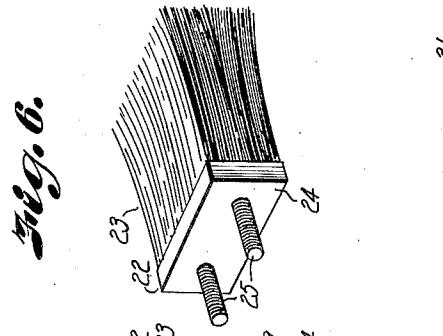


Fig. 6.

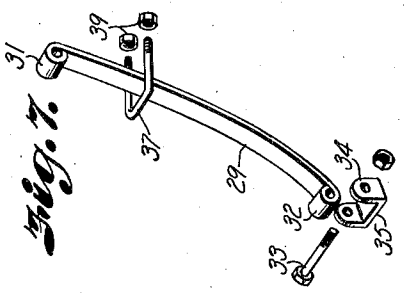


Fig. 7.

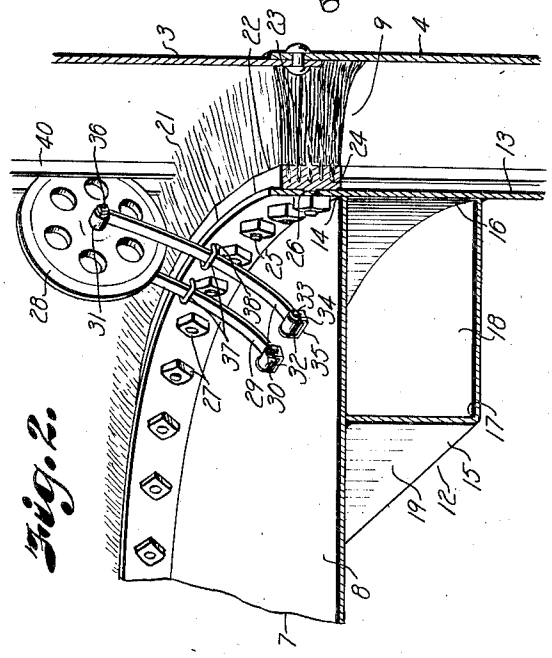


Fig. 2.

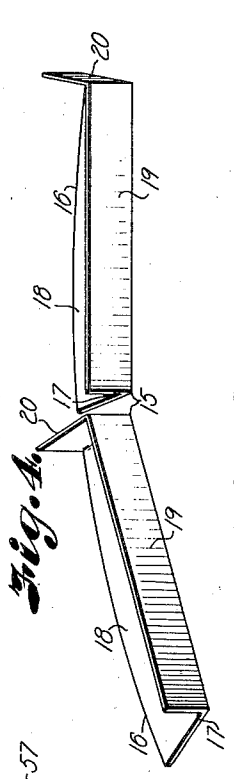


Fig. 4.

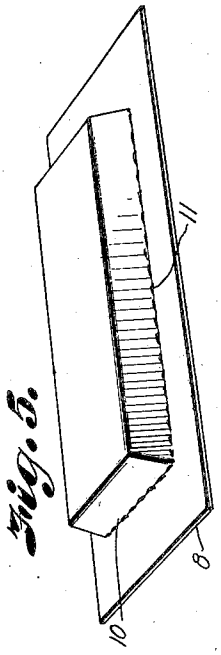


Fig. 5.

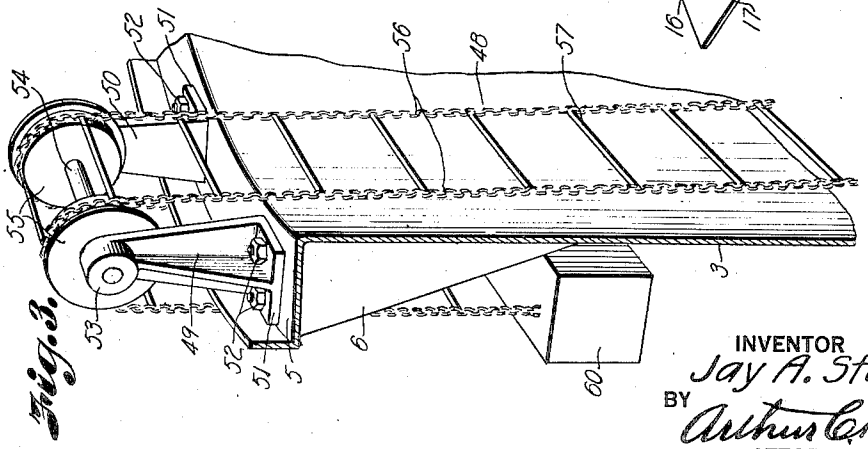


Fig. 3.

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UNITED STATES PATENT OFFICE

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FLOATING DECK FOR OIL STORAGE TANKS

Jay A. Stough, Tulsa, Okla., assignor to Stough Tank Erecting Company, Tulsa, Okla., a corporation of Oklahoma

Application August 1, 1930, Serial No. 472,254

6 Claims. (Cl. 220—26)

My invention relates to storage tanks and more particularly to floating roofs for storage tanks, the principal object of the invention being to provide for thermo-breathing of the roof, an action resulting from expansion and contraction due to variations in the temperature of a layer of gas collected on the body of oil in the tank below the roof, and to permit such breathing of the roof without loss of the collected gas.

Other important objects of the invention are to provide effective sealing means for roofs of this character, to embody simple and efficient drainage for the roof and to provide inexpensive means for guiding and centering the roof in the tank.

In accomplishing these and other objects of my invention I have provided improved details of structure the preferred form of which is illustrated in the accompanying drawings, wherein:

Fig. 1 is a perspective view of a tank in central cross section equipped with a floating roof embodying my invention.

Fig. 2 is a fragmentary perspective view of the sealing means, guide means and an annular pontoon.

Fig. 3 is a fragmentary perspective view, partly in section, of the ladder and mounting therefor.

Fig. 4 is a perspective view of associated sections of the annular pontoon.

Fig. 5 is a perspective view of a rectangular pontoon secured to a roof section and shown in inverted condition.

Fig. 6 is a detail perspective view of a brush element.

Fig. 7 is a view in perspective of a guide wheel mounting.

Referring more in detail to the drawings:

1 designates a storage tank of a form commonly used for storing petroleum products, and includes a bottom 2 and an annular side wall 3 built up of sections 4, the upper end of one section snugly receiving the lower edge of a superimposed section. The upper end of the wall terminates in an outwardly directed annular ledge 5, braced from the side wall in the usual manner as indicated at 6.

A roof 7, adapted to float on the body of liquid in the tank, comprises a plurality of metal sheets 8, secured together as by welding to form a circular roof complementary to the tank wall; a space 9 being reserved between the roof and the wall to accommodate flexible sealing means as later described for retarding escape of fluid such as gas from within the tank, and to prevent, to a great extent the entrance of water into the upper portion of the body of liquid in the tank.

Alternate sections of the roof are preferably provided with pontoons 10 formed rectangular in shape complementary to the sections and welded to the lower sides thereof as indicated at 11, the principal object for securing the pontoons to the roof sections in this manner being that the sections may thus be provided with pontoons before they are assembled to form a continuous roof, and that a pontoon member may be welded to a roof section in inverted condition as shown in Fig. 5 of the drawings, thus eliminating overhead welding, and thereby reducing the cost of construction.

As shown in Fig. 1 of the drawings, an annular pontoon 12 is provided on the periphery of the roof to prevent sagging of the outer edge of the roof under heavy loads of snow and ice. This annular pontoon is preferably constructed by providing a continuous vertical band 13 around the outer edge of the roof which is welded thereto as indicated at 14, a relatively narrow portion of the band extending above the surface of the roof and the remaining portion projecting beneath the roof to a point below the lower surface of the pontoons.

The pontoons are so designed that they will ordinarily be partially submerged in the body of oil in the tank, and the purpose for extending the lower edge of the band to a point below the lower surface of the pontoons is to prevent escape of gas collected on the oil in the tank when the gas is sufficiently expanded, due to excessive heat, to elevate the pontoons entirely out of the oil.

A metal sheet 15, having an arcuate edge 16 conforming to the peripheral band, is then bent at right angles as indicated at 17, to produce a lower wall 18 and an inner wall 19 welded respectively to the annular band and to the roof 7. One end of each of these pontoon sections is then closed by an end wall 20, and the open end of a following section is next welded thereto so that the annular pontoon will be divided into individual sections of equal length and leakage of one section will not effect the buoyancy of an adjacent section.

The portion of the band extending above the roof serves as a support for an annular sealing member 21 comprising a series of wiping elements or brushes 22. The bristle-like members 23 of the brushes are preferably impregnated with an acid-resisting solution to neutralize the action of acids in the oil, and are embedded in a head 24 which is preferably formed of metal and includes integral bolts 25 adapted to be received in com-

plementary openings 26 formed in the upper portion of the circular band, and nuts 27 are threaded on the bolts for securing the brushes to the band.

With this method of mounting the sealing members, worn brushes may be readily replaced without removing the roof from the body of liquid whereon its rests.

In order to maintain the roof in a substantially central position in the tank and to prevent rotation thereof on the body of liquid, centering means are provided including a plurality of wheels 28, rotatably carried between spring leaves 29 and 30 having loop portions 31 and 32 at their upper and lower ends respectively. The lower loops 32 are pivotally mounted on bolts 33 extended through ears 34 of brackets 35 secured to the roof by welding or the like, and the upper loop portions of the springs are adapted to receive bolts 36 extended through the loops and through the hub of a wheel 28.

U-bolts 37, engaging the spring members intermediate their ends, are extended through openings 38 formed adjacent the upper edge of the annular band, and are secured thereto by nuts 39.

Vertical guide members 40 preferably in the form of channel irons are mounted in the interior of the tank for receiving the rims of wheels 41, thereby maintaining the roof in central position on the liquid. A flexible mounting for the wheels is thus provided to compensate for irregularities of the tank wall such as the laps of successive sections of the wall.

The roof declines toward its center for drainage purposes and is provided with an opening 41 cooperating with telescoping drain members 42 comprising a plurality of tubular sections 43 adapted to telescope into each other; each section having an inwardly directed flange 44 on one end and an outwardly directed flange 45 on its opposite end so that said flanges will serve as means for guiding and limiting the extension of one tubular section on its adjacent section.

The lower end of the bottom section is preferably provided with notches 46 to permit egress of water from the drain into the body of liquid in the tank. In this manner rain and melted snow and ice drains toward the center of the roof and is led to the bottom of the tank. Since oil and water will not commingle, and due to the specific gravity of water being heavier than that of oil, the water will settle to the bottom and may be drained from the tank, when necessary, through a valved outlet 47.

In order to provide an automatically adjustable ladder 48 for the tank roof, spaced brackets 49 and 50 having foot portions 51 are fixed to the ledge 5 of the tank by bolts or the like 52. The upper portions of the brackets terminate in bearings 53 for journalling a shaft 54 carrying flanged wheels 55.

The ladder preferably comprises chains 56 spaced by bars 57, serving also as rungs, and the chains are reeved over the rims of the wheels 55. The inner end of the ladder is secured to the floating roof as indicated at 59 and the outer end thereof is provided with a counter-weight 60 to maintain the chains in taut condition and to counteract the weight of an operator ascending or descending the ladder.

Manholes 61 and test openings 62, normally closed by lids 63 and 64 respectively, may be provided at any convenient location in the floating roof.

Assuming a storage tank to be provided with a floating roof constructed and mounted therein as described, the action of the roof on the body of liquid in the tank would be as follows:

Due to the annular pontoon surrounding the outer edge of the roof and to the intermediate rectangular pontoons the roof will be supported in a substantially level relation with the tank. As the roof moves either upwardly or downwardly with the changing liquid level in the tank the wheels move correspondingly in the grooves to prevent rotation of the roof on the liquid.

Through provision of the lower edge portion of the band extending below the pontoons and into the body of oil under conditions when the pontoons are raised above the surface of the oil, breathing of the roof is permitted without loss of gas from the tank.

Irregularities in the tank wall and variations in the diameter thereof are compensated for by the flexibility of the brushes, and escape of gas and like fluids from the body of liquid is thereby further prevented.

Rain and melted snow accumulating on the roof drains toward its center and passes through the telescoping drain to the tank bottom below the lower surface of the oil and may be drained from the valve outlet as frequently as necessary.

The ladder, maintained in taut condition by the counter-weight, is available at all times for operators descending on the tank roof for making tests and the like.

From the foregoing description it will be apparent that I have provided an efficient floating roof for storage tanks that can be manufactured at a cost that is not prohibitive and that will give long and satisfactory service.

What I claim and desire to secure by Letters Patent is:

1. In combination with a storage tank, a roof spaced from the tank wall and adapted to float on liquid in the tank, a peripheral band surrounding the edge of the roof with a portion of said band extending above the roof, sealing means on said upwardly extending portion for closing the space between the roof and wall, a peripheral pontoon for the roof, comprising an inner wall secured to the roof and a lower wall secured to a portion of the band extending below the roof, and a skirt on said peripheral band extending downwardly below said pontoon.

2. In combination with a storage tank, a roof spaced from the tank wall and adapted to float on liquid in the tank, a peripheral band surrounding the edge of the roof with a minor portion of the band extending above the roof and a major portion of said band extending below the roof, sealing means on said upwardly extending portion for closing the space between the roof and wall, a peripheral pontoon comprising an inner wall fixed to the roof and a lower wall fixed to the downwardly extending portion of the band for supporting the roof, and a skirt comprising the extreme lower end of said band and projecting below said pontoon.

3. In combination with a storage tank, a roof spaced from the tank wall and adapted to float on liquid in the tank, a peripheral band surrounding the edge of the roof with a portion of said band extending above the roof, sealing means on said upwardly extending portion for closing the space between the roof and wall, resilient roof-centering means pivotally mounted on the roof and means for anchoring said centering means to said upwardly extending portion.

4. In combination with a storage tank, a roof spaced from the tank wall and adapted to float on liquid in the tank, a peripheral band surrounding the edge of the roof with a portion of said band extending above the roof, sealing means on said upwardly extending portion for closing the space between the roof and wall, spaced resilient arms pivotally mounted on the roof, a guide wheel rotatably mounted between said arms, and means for anchoring said arms to the upwardly extending portion.

5. In combination with a storage tank, a roof spaced from the tank wall and adapted to float on liquid in the tank, a peripheral band surrounding the edge of the roof with a portion of said band extending above the roof, sealing means on said upwardly extending portion for closing the space between the roof and wall, resilient roof-centering means pivotally mounted on the roof, means for anchoring said centering means to said upwardy extending portion, and vertical guide members on the tank wall adapted to be engaged by said centering means.

6. A roof for storage tanks including a peripheral band surrounding the edge of the roof with a portion of said band extending below the roof, and an annular pontoon for the roof comprising individual angular sections having lower and inner walls secured respectively to said band and to the lower surface of the roof, each section having an open end and an opposite closed end adapted to abut the open end of an adjacent section.

JAY A. STOUGH.