Sept. 10, 1957 J. H. WIGGINS 2,805,631

SUSPENSION ROOF STRUCTURE FOR STORAGE TANKS

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FIG_1

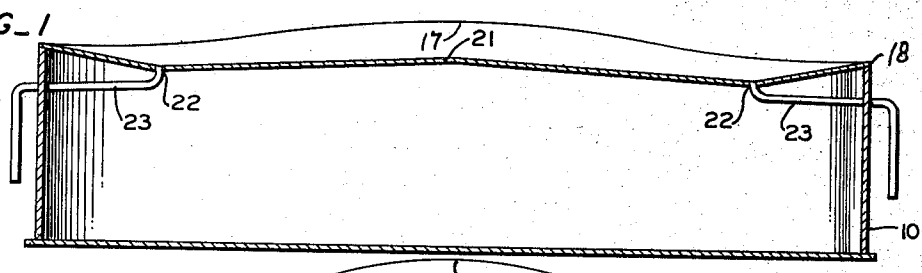


FIG_2

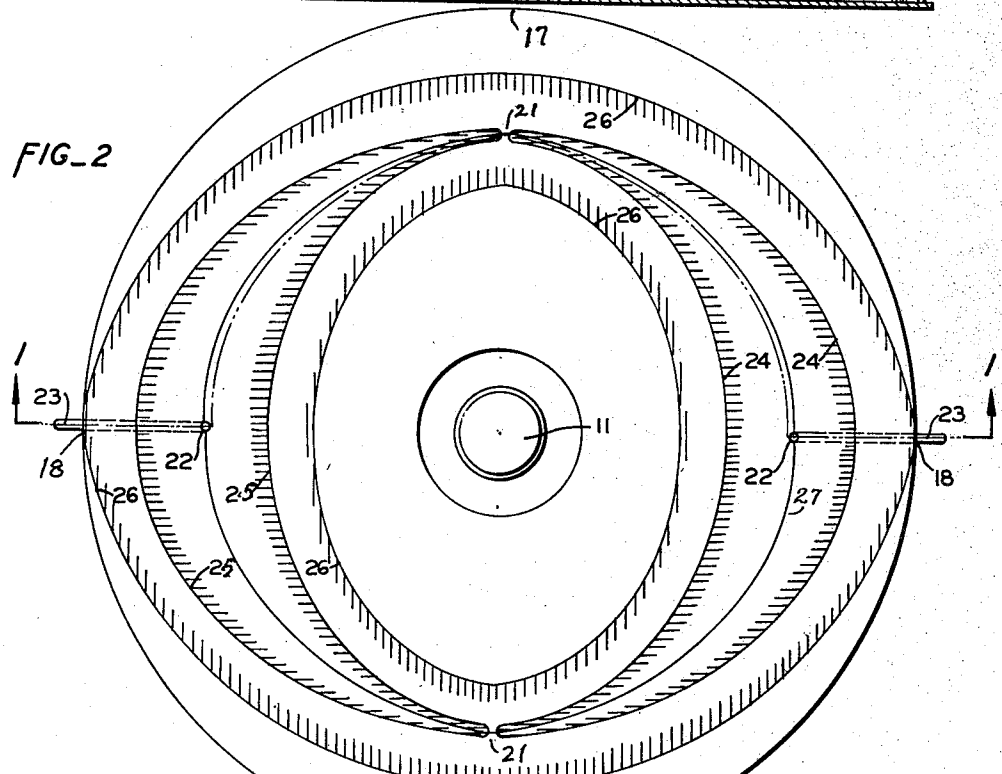
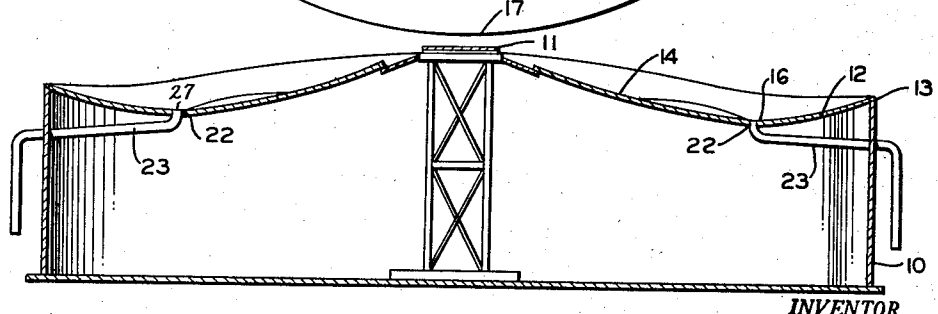


FIG_3



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SUSPENSION ROOF STRUCTURE FOR STORAGE TANKS

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3 Claims. (Cl. 108—1)

My invention relates to large metal tanks of the kind that are used for holding liquid, grains, and other materials, and is concerned more particularly with a metal tank employing a suspension-type roof constructed for good drainage conditions and to handle the water loads thereon in a satisfactory manner in the event of plugging of one or more drains, either by maintaining a balanced water load or for maintaining a safe unbalanced load.

This application is a continuation-in-part of my copending application Serial No. 499,552, filed April 6, 1955, for "Metal Storage Tank."

In metal storage tanks of from about 70 feet in diameter to 150 feet in diameter and over, the problems of proper drainage of rain water and proper control of the loads imposed by such water are severe, this being particularly true in suspension-type tank roofs where the entire weight of the roof load and the water load is carried by a center support and an outer tank side wall. My present invention is concerned primarily with a drainage and control structure for handling water loads in such suspension roofs and provides an economical way of preventing severe unbalanced loads beyond the strength and capacity of the metal tank or its foundation.

Accordingly, it is an object of my present invention to provide metal storage tanks employing a suspension-type roof which has built-in safety characteristics insofar as the water loads than can be imposed therein.

Another object is to provide a tank structure of the above character in which the collection of water into drainage areas is effected in a plurality of pools which are so located as to provide a counter-balancing of the respective water load of pools on opposite sides of the center, and also to provide an empty pool storage area as an emergency drain for overflow from an adjacent pool.

A further object of the invention is to provide suspension roofs of the above character in which the structure provided for the water load control decreases the overall cost of the tank.

Other objects and advantages of the invention will be apparent from the following description of a preferred embodiment taken in conjunction with the accompanying drawings, in which:

Figure 1 is a vertical sectional view taken along the line 1—1 in Figure 2, and including a transverse composite section taken through the water collection trough at either side of the tank, and a center section portion along a circular line adjacent the bottom of the water trough.

Figure 2 is a plan view of the tank.

Figure 3 is a vertical sectional view through the center of the tank, showing the center support in elevation.

My present invention is illustrated as embodied in a liquid storage tank having a suspension type roof of the general character disclosed in my pending applications

for U. S. Letters Patent Serial Nos. 507,887 and 525,478 both filed September 24, 1954.

Referring to the drawings, the tank includes a cylindrical side wall **10**, having an upper edge **13** of special configuration as referred to hereinafter, and a vertical center support or tower **11** at the center of the tank whose height is greater than the height of the side wall **10**. The roof of the tank is constructed of conventional metal roof plates, fabricated or welded to each other in such a manner as to produce a circular diaphragm comprising an annular outer peripheral portion **12** that slopes inwardly and downwardly from the top edge **13** of the tank side wall **10**, and a center portion **14** of slightly curved shape or form that slopes downwardly and outwardly from the center support **11**. The two roof portions **12** and **14** merge into each other to form a water collection trough **16** of annular form in plan and of substantially V-shape in cross-section. Thus a continuous water collection trough is formed at the juncture of the two roof portions **12** and **14** extending circumferentially around the roof. The peripheral portion or outer portion **12** usually constitutes from thirty to fifty percent of the total area of the top surface of the roof.

In accordance with the instant invention, the top edge **13** of the tank side wall **10** is provided with a plurality of opposite high points **17** and opposite low points **18**, there being two high points and two low points in alternating relation in the illustrated embodiment, so that the slope of the side wall is downwardly for a quadrant from each point **17** to the adjacent low point **18**. The plates of the roof constitute a roof diaphragm suspended from the upper edge **13** of the side wall **10**. This diaphragm is correspondingly sloped and has corresponding high points and low points in registry with the high and low points respectively of the upper edge **13** of the side wall **10**. Correspondingly the V-shaped drain trough or water collection trough **16** also is provided with high points **21** and low points **22** adjacent to and corresponding to the corresponding high and low points of the upper edge **13** of the tank side wall.

A drain outlet or discharge means in the form of a pipe **23** is provided leading from each of the low points **22** of the trough, so that each of the two areas or pools of water collection provided by the shape of the roof have a drain outlet. Referring to Figure 2, the approximate crescent shape of the maximum pools **24** and **25** of water is indicated for each of the two low regions of the roof. It will be seen that the right hand half of the roof drains into the right hand pool area **24** and the left hand half of the roof diaphragm drains into the left hand pool area **25**. It will also be noted that the high points **21** of the trough which are spaced below the adjacent high points **17** of the upper edge **13** of the side wall also provide overflow discharge from one pool to another pool, thus which would occur, for example, if the drain pipe **23** for the pool **24** becomes clogged or substantially stopped so that it is insufficient to take care of the total drainage to it, the other pool **25** draining dry by virtue of its unstopped drain pipe **23**.

It will also be noted that the low points **18** of the side wall **10** of the tank provide for emergency overflow in the event that both drains become clogged and the roof has assumed its maximum permissible water load by virtue of the present roof and drainage control construction. The maximum pool of water to be contained by the roof diagram is indicated in Figure 2 at **26**.

It will be noted from the above description of the drainage control structure provided by the roof construction of the instant invention that if both drains **23** are plugged, then the water collects evenly in the two pools **24**, **25** and the water load on the roof is balanced, the

roof structure being designed to carry this maximum water load.

If one drain **23** is plugged but the other is open, the pool formed on one side of the roof drains over the high points **21** of the water collection trough into the other pool and is discharged through the unplugged drain pipe **23**, so that an unbalanced load is provided on the roof, but its size is controlled to be within the permissible unbalanced load of the structure, the presence of one pool **24** or **25** being substantially less than the total load imposed on the roof and its supports by the pool **26**.

The provision of multiple high and low points around the upper edge of the tank wall and the corresponding high and low points of the water collection trough, by virtue of the undulating or serpentine shape of the tank side wall edge **13** and the water collection trough **27**, reduces the amount of steel required in constructing a tank with a shell extension on this type of tank. Since the level of the liquid in the tank is maintained always below the drain trough **27** a true measurement of the amount of liquid can be obtained. Also by virtue of this construction, the main drain and emergency drain ordinarily provided in a storage tank of this character are located respectively as shown at **23** in the drawings so that no increase in the number of drain pipes is required, where the two high points and two low points construction is employed. If for some reason in the tank construction the total weight of a pool **24** or **25** should be limited below that of the embodmient illustrated, then additional high and low points can be provided to correspondingly limit the total water to be collected in an individual pool.

While I have shown and described a preferred embodiment fo the invention, the invention is capable of variation and modification from the form shown, so that the scope thereof could be limited only by the scope of the claims appended hereto.

I claim:

1. A liquid storage tank having a circular side wall and a center roof support, a suspension roof attached at its inner periphery to said center support and at its outer periphery to said side wall, said suspension roof including an inner central portion sloping downwardly from said center support and an outer roof portion sloping downwardly from said side wall, said roof portions meeting and forming a generally V-shaped water collection trough, the upper edge of said side wall having at least two spaced apart high points and at least two intermediate low points so as to provide alternate high and low points along said side wall, said water collection trough having corresponding high and low points adjacent to but spaced below the corresponding high and low points of said side wall, and drainage means leading from each of the low points of said trough, the high points of said water collection trough providing for overflow from a full trough portion to an empty trough portion.

2. A liquid storage tank having a circular side wall and a center roof support, a suspension roof attached at its inner periphery to said center support and at its outer periphery to said side wall, said suspension roof including an inner central portion sloping downwardly from said center support and an outer roof portion sloping downwardly from said side wall, said roof portions meeting and forming a generally V-shaped water collection trough, the upper edge of said side wall having at least two spaced-apart high points and at least two intermediate low points so as to provide alternate high and low points along said side wall, said water collection trough having corresponding high and low points adjacent to but spaced below the corresponding high and low points of said side wall, and drainage means leading from each of the low points of said trough, the high points of said water collection trough providing for overflow drainage from a full trough portion to an empty trough portion, and said low points of said side wall constituting an emergency overflow in the event of the collection of water to the full capacity of the roof.

3. A liquid storage tank having a circular side wall and a center roof support, a suspension roof attached at its inner periphery to said center support and at its outer periphery to said side wall, said suspension roof including an inner central portion sloping downwardly from said center support and an outer roof portion sloping downwardly from said side wall, said roof portions meeting and forming a generally V-shaped water collection trough, the upper edge of said side wall being of generally serpentine or undulating configuration to provide alternate high points and intermediate low points so as to provide alternate high and low points along said side wall, said water collection trough also being of generally serpentine or undulating configuration to provide alternate high and low points adjacent to but spaced below the corresponding high and low points of said side wall, and drainage means leading from each of the low points of said trough, the high points of said water collection trough providing for overflow from a full trough portion to an empty trough portion.

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