Nov. 3, 1942. R. T. LOGEMAN 2,301,061

TANK CONSTRUCTION AND THE LIKE

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Fig. 1

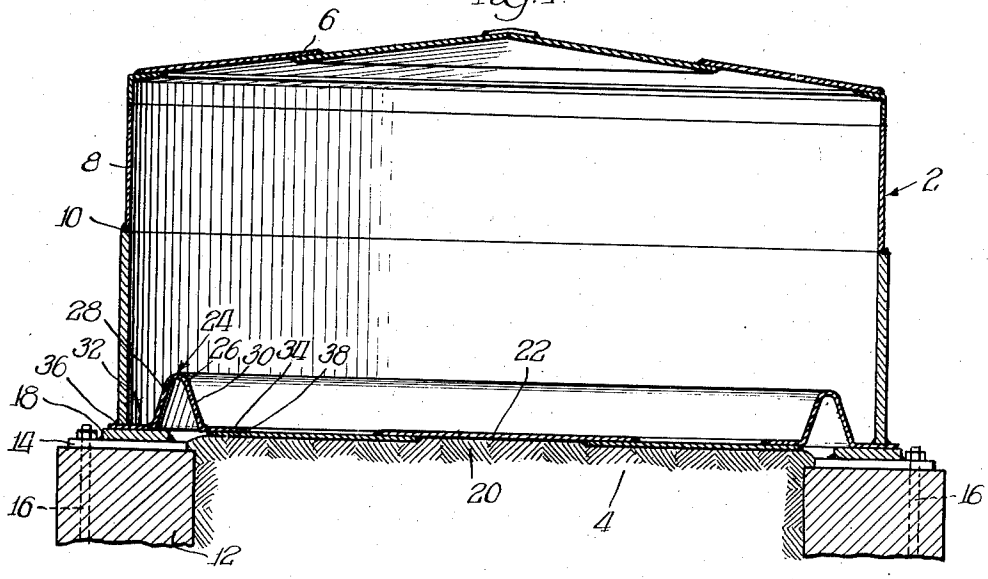


Fig. 2

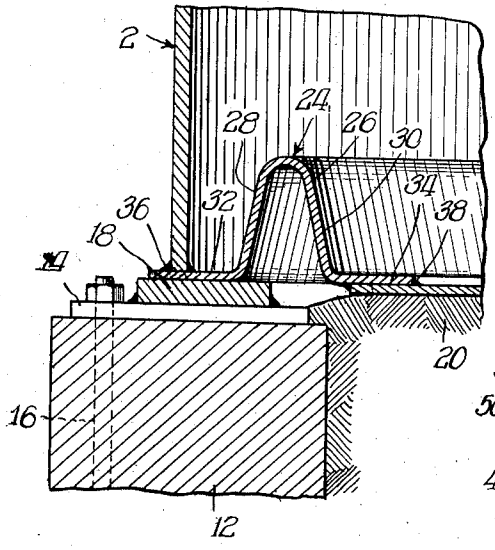
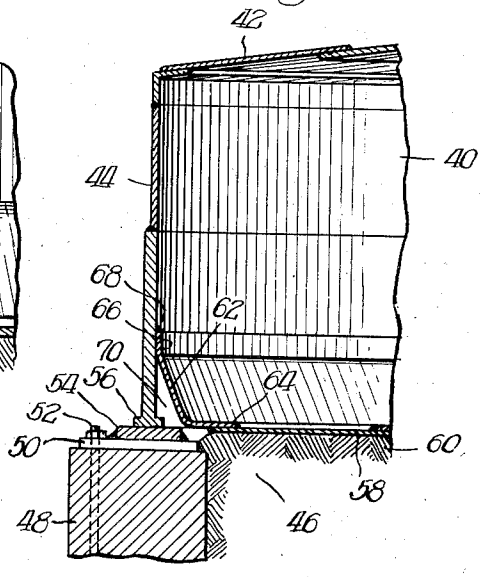


Fig. 3



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TANK CONSTRUCTION AND THE LIKE

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5 Claims. (Cl. 220—18)

The present invention relates to tank structures for retaining fluids, such as oil and the like, or other materials, and more particularly to improvements in tank structures to prevent structural failure thereof due to temperature changes.

Among the objects of the present invention is to provide a novel tank structure embodying in its assembly improvements designed particularly to prevent over-stressing of the structural parts of the tank due to the difference in temperature between the inside and outside of the tank.

Present-day tank structures for oil and other materials embody in their design in most instances a circular or cylindrical shaped side wall constituted by a plurality of plates welded or riveted together and which rests upon a suitable foundation and is fixed at its lower end or edge to said foundation or bottom structure either directly or through the medium of a corner angle whereby the said side wall is secured in operative association with respect to the foundation or bottom structure.

These tank structures are designed for the hydrostatic stresses set up therein by the material contained within the said wall, which stresses are in direct ratio with the area or thickness of the material. The stresses in these plates set up because of difference in temperature of the material within the interior of the tank and that of the outside atmosphere, and which difference may be considerable, bear no relationship to the area or thickness of the material, so that where such differences in temperature exist the restrained side walls of the tank are stressed at substantially the rate of 200 pounds per square inch for one degree change or difference in temperature. On the other hand, steel or other metal from which these tanks may be made is unaffected by temperature changes when the same is free to move with respect to the foundation.

According to present-day structures, where the lower part of the side wall of these tanks is restrained by a corner angle or bottom plates of the foundation or bottom construction, and where there is a temperature difference due to cold atmospheric conditions on the outside of the tank and the warm or sometimes heated material disposed within the tank, the contraction of the steel fibers along the outside surface of the plates, resisted by the restraining effect of the steel fibers along the inside surface of the side wall, will result in an increase in the tensile stresses of the side wall at a rate approaching twice the 200 pounds per square inch per one degree temperature change hereinabove referred to. This restraining action at the lower portion of the side wall of the tank accordingly results in overstressing of the metal fibers thereof and will at some time result in failure of the tank, which consists in those instances which have been inspected of a tearing and buckling of the plates at and adjacent the lower portion of the side wall.

The present invention therefore has as one of its principal objects the provision of novel means for producing a tank structure having all of the attributes and features of present-day tank structures and fully adequate to meet all structural requirements, yet providing for an unrestrained side wall structure at and adjacent the foundation or bottom structure, permitting free inward and outward movement of said side wall due to temperature changes, thus relieving the said side wall of any additional stresses set up because of such temperature changes, and accordingly preventing any failure in the tank structure.

While the invention is particularly adapted for use in connection with circular or cylindrical-shaped tank structures, nevertheless, as one of the objects of the present invention, novel means constituting an improvement in accordance with the present disclosure is adapted for use in other tank structures to permit unrestricted movement of the wall or walls due to contraction and expansion resulting from differences in temperatures between the interior of the wall and outside atmospheric conditions.

More particularly, the present invention has as an object the provision of a suitable expansible connection between the bottom structure for and the side wall of the tank, providing for the unrestricted movement of said wall in respect to said bottom structure because of expansion and contraction due to temperature changes.

Other objects, features, capabilities and advantages are comprehended by the invention, as will later appear and as are inherently possessed thereby.

Referring to the drawing:

Figure 1 is a fragmentary view in cross section of a tank structure embodying improvements according to the present invention;

Figure 2 is an enlarged fragmentary view in cross section of the expansible joint of the tank structure shown in Figure 1 of the drawing; and

Figure 3 is an enlarged fragmentary view in section similar to Figure 2 showing an alternative form of construction for a tank to permit

unrestrained movement of the side wall thereof due to temperature changes.

Referring now more in detail to the drawing, an embodiment selected to illustrate the invention is shown in Figures 1 and 2 as comprising a tank 2 mounted upon and supported by a foundation or bottom structure, generally represented as 4.

The tank 2 is of the welded type, comprising a lapped plate roof 6 supported upon the cylindrical-shaped side wall 8 constituted by a plurality of plates disposed in butting relation to one another and welded at various points, as at 10, to provide a rigid structure meeting all structural requirements for the particular use to which the same may be put. This side wall 8 is operatively supported by the foundation or bottom structure 4.

The bottom structure 4 for the tank in the illustrated embodiment comprises a circular concrete curb 12 having a bearing plate 14 mounted thereon and secured in position by a plurality of bolts 16 or the like, and which bearing plate has mounted thereon at spaced intervals a plurality of bar fillers or bearing blocks 18 welded or otherwise secured to the bearing plate 14 and being preferably of non-corrosive material to provide a suitable surface for movement of the side wall 8 thereover through the medium of a bearing member, as will be hereinafter more fully described.

The intervening space between the concrete curb 12 is of earth or other fill 20 providing a suitable support for a liner plate 22 forming an interior bottom closure for the tank.

In order to provide for the unrestrained movement of the side wall 8 with respect to the bottom structure 4 due to temperature differential inside and outside the tank, an expansion member 24 is provided between the side wall 8 and the bottom structure 4. In the illustrative example of the invention shown in Figure 1, this expansible member forming the joint within and at the bottom of the tank comprises a central ridged part 26 having the opposed walls 28 and 30 terminating in the laterally disposed flanges 32 and 34, respectively, the former being connected to the lower edge of the side wall 8 as by means of weld joints, such as 36, to provide a suitable bearing for said side wall slidably engaging the spaced fillers or support blocks 18, and the latter of which flanges is connected by a suitable weld joint as at 38 to the marginal edge of the liner plate 22.

According to the improved structure as above set forth, any contraction or expansion of the side wall 8 due to temperature differences existing on opposite sides of the wall which would occur, for example, where there was a drop in atmospheric temperature on the outside of the tank, is unrestrained because of the sliding cooperative bearing relation between the side wall 8 and its support, constituted by the spaced fillers or blocks 18, the expansion joint 24 permitting such unrestrained movement of the said side wall 8. The space between the supports 18 serves as air ducts communicating with the air chamber formed by the central part 26 of the expansible joint.

The ducts disposed between the bearing supports 18 permit the introduction of and circulation of air at outside or atmospheric temperature into the environment of the expansion joint 24 to bring about a temperature change in the material contained within the tank at and adjacent the bottom of the side wall of the tank so that the temperature of said material will tend to approach atmospheric temperature on the outside of the tank, thus facilitating the movement of the side wall adjacent its bearing relation with the bottom structure, and to provide, in effect, an additional safety factor to assure proper operation of the tank structure, in accordance with the theory herein advanced.

As above alluded to, the foundation or bottom structure may be of different and various designs, it being necessary only to embody in that structure suitable means for carrying the weight of the tank and its contents in a manner which will produce a uniform bearing which is desirable along the circumference thereof and over the entire bottom, it being clearly appreciated, accordingly, that the concrete curb 12 is optional in providing a suitable base or bottom structure. Therefore, in this application where reference has been made to a "bottom structure," any of these alternative constructions are contemplated, all within the scope and purview of the present invention.

Referring to Figure 3, an alternative form of construction is disclosed, embodying improvements in accordance with the present invention to provide unrestricted movement of the side wall of a tank due to temperature changes. In this assembly the tank 40 is formed with the roof 42 and a circular or cylindrical-shaped side wall 44 patterned after that disclosed in Figure 1 of the drawing, which is movably disposed in association with a base or bottom structure 46 formed substantially in accordance with the disclosure of Figure 1 of the drawing. This base or bottom structure has the concrete curb 48 provided with a bearing plate 50 secured thereto by a plurality of bolts, such as 52, and upon which at spaced intervals are mounted a plurality of fillers or bearing blocks 54 secured to the bearing plate 50 as by means of weld material or the like.

The side wall 44, if desired, may be formed at its lower end with lateral flanges or feet 56 to provide for suitable sliding bearing relation with respect to the fillers or bearing blocks 54.

The base or bottom structure, as in the previously described embodiment, includes in its construction the bottom or liner plate 58 for the interior of the tank, which rests upon the filler material 60 disposed between the concrete curb 48. The tank structure herein contemplated is completed by means of an expansible member 62 having one of its marginal edges as at 64 connected to the liner plate 58 in spaced relation to the wall 44, and has its other marginal edge, as at 66, connected to the side wall 44 in spaced relation to the bearing thereof with said fillers or bearing blocks 54, the said connections being effected by way of welded joints or the like, such as 68. By means of this expansible member, relative sliding movement of the side wall 44 with respect to the bottom structure may take place over the fillers or bearing blocks 54, all in accordance with the above disclosure of Figures 1 and 2 of the drawing.

In addition, this alternative form of tank structure provides air ducts between the fillers or bearing blocks 54 communicating with the interior space 70 formed between the expansible member 62 and the side wall 44 for the purposes hereinabove explained in connection with the previously described embodiment.

While I have herein described and upon the drawing shown an illustrative embodiment of the invention, it is to be understood that the invention is not limited thereto but may comprehend other constructions, arrangements of parts, details and features without departing from the spirit of the invention.

I claim:

1. In a tank structure, the combination of a tank having a substantially cylindrical shape metallic side wall, a bottom structure including means for movably supporting the side wall of said tank, and a metallic peripheral expansion joint disposed adjacent the bottom of said tank and connecting the bottom structure to the movable side wall of said tank to provide for the unrestrained movement of said side wall with respect to said bottom structure due to expansion and contraction, said expansion joint being rigidly connected to the side wall and positioned inwardly thereof and forming a peripheral portion of the bottom structure.

2. In a tank structure, the combination of a tank having a substantially cylindrical shaped metallic side wall, a bottom structure including means for movably supporting the side wall of said tank, said bottom structure also including a bottom closure plate for said tank, and a metallic peripheral expansion joint disposed inwardly of the side wall adjacent the bottom of said tank and connecting the said plate to the movable side wall of said tank to provide for the unrestrained movement of said side wall with respect to said bottom structure due to expansion and contraction, said expansion joint being rigidly connected to the side wall and forming a peripheral portion of the bottom structure between the bottom closure plate and side wall.

3. In a tank structure, the combination of a tank having a substantially cylindrical shaped metallic side wall, a bottom structure including means for movably supporting the side wall of said tank, and a metallic peripheral expansion joint disposed inwardly of the side wall and adjacent the bottom of said tank and connecting the bottom structure to the movable side wall of said tank to provide for the unrestricted movement of said side wall with respect to said bottom structure due to expansion and contraction, said expansion joint being rigidly connected to the side wall and forming a peripheral portion of the bottom structure, said means comprising spaced supports disposed beneath said side wall providing ducts therebetween communicating with said expansible joint.

4. In a tank structure, the combination of a tank having a substantially cylindrical shaped metallic side wall, a bottom structure including means for movably supporting the side wall of said tank, and a metallic peripheral expansion joint disposed inwardly of the side wall and adjacent the bottom of said tank and connecting the bottom structure to the movable side wall of said tank to provide for the unrestrained movement of said side wall with respect to said bottom structure due to expansion and contraction, said expansion joint forming a peripheral portion of the bottom structure and comprising a member having an upstanding central portion provided with opposed walls and laterally extending marginal flanges, one of said flanges being fixed to the bottom structure and the othes of said flanges being rigidly connected to the side wall and having slidable engagement with said means.

5. In a tank structure, the combination of a tank having a substantially cylindrical shaped metallic side wall, a bottom structure including means for movably supporting the side wall of said tank, and a metallic peripheral expansion joint disposed inwardly of the side wall and adjacent the bottom of said tank and connecting the bottom structure to the movable side wall of said tank to provide for the unrestrained movement of said side wall with respect to said bottom structure due to expansion and contraction, said expansion joint forming a peripheral portion of the bottom structure and comprising a member fixed to said bottom structure inwardly of and in spaced relation to the side wall, said member also being rigidly connected to the side wall in spaced relation to said means.

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