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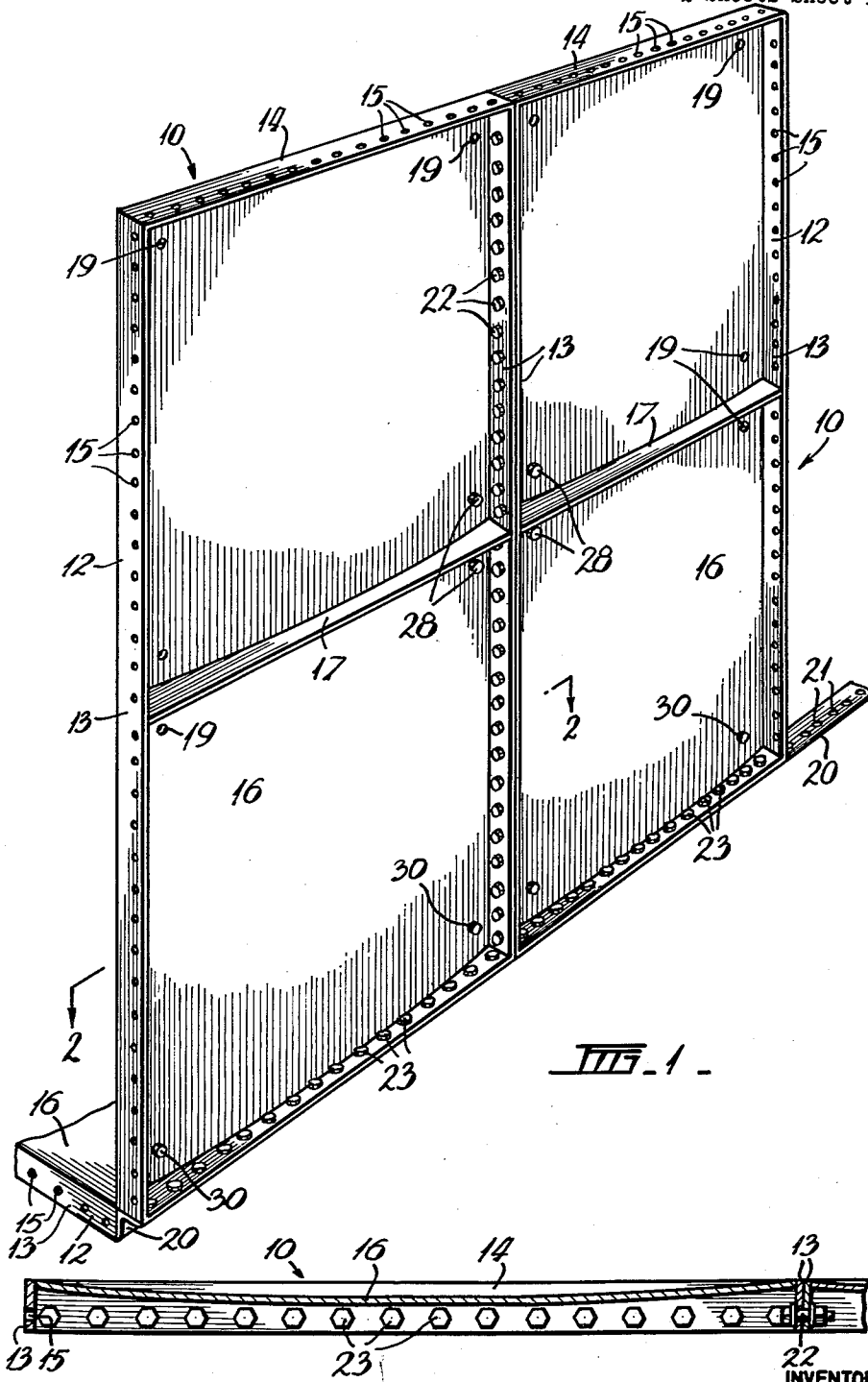
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3,064,770

STRUCTURAL UNIT FOR CONSTRUCTING A TANK OR THE LIKE

Filed May 25, 1960

2 Sheets-Sheet 1



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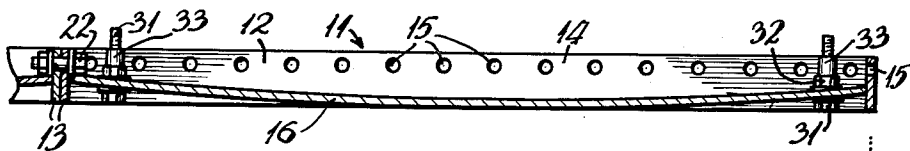


FIG. 5.

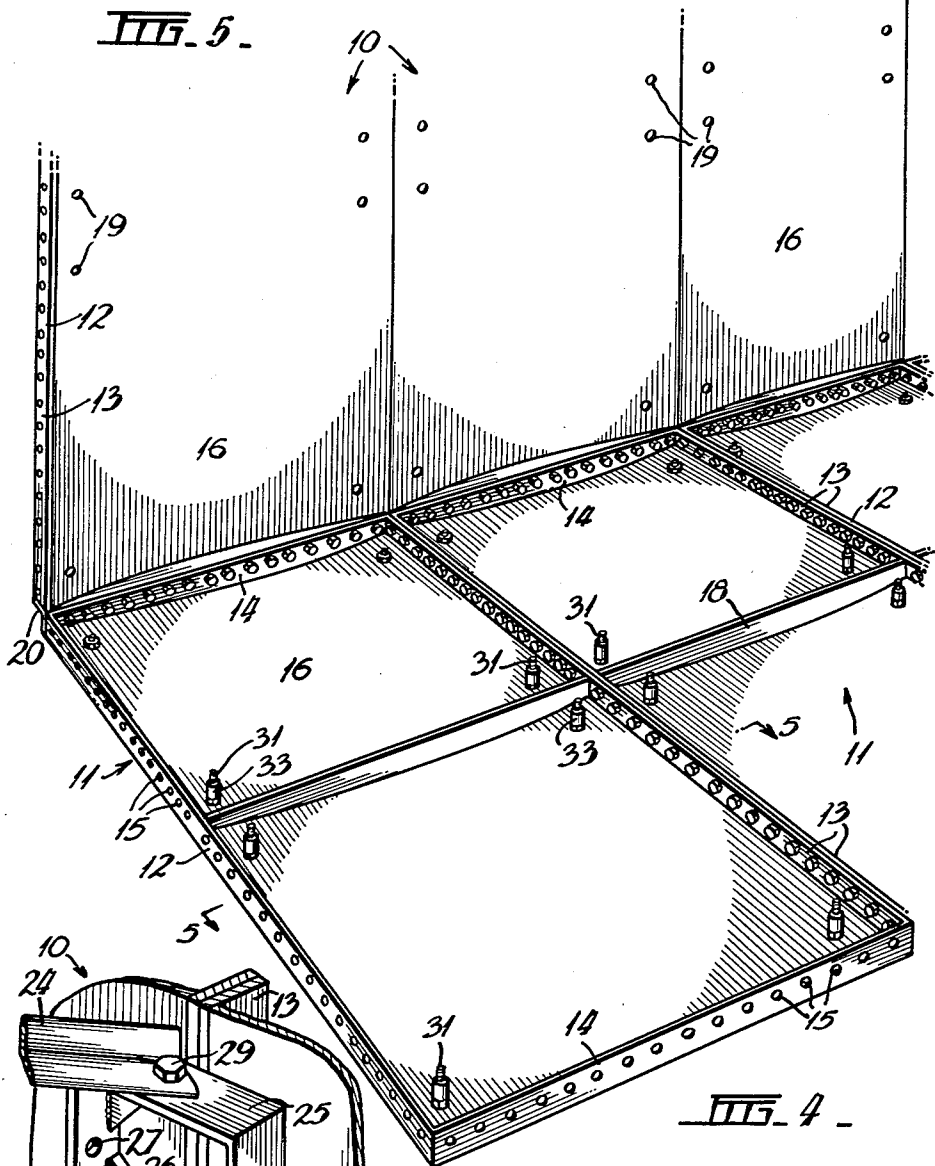


FIG. 4.

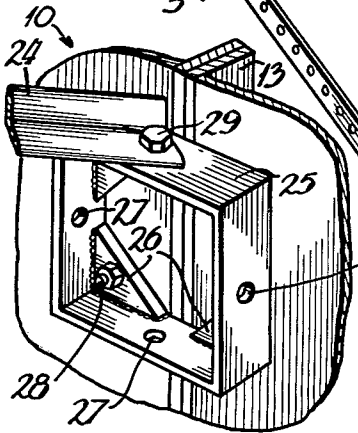


FIG. 3.

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1

3,064,770

STRUCTURAL UNIT FOR CONSTRUCTING A TANK OR THE LIKE

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6 Claims. (Cl. 189—3)

This invention relates to a structural unit for constructing a tank or the like.

It is well-known to construct fairly large storage tanks for water of structural units or plates which are adapted to be bolted together, and stayed as may be necessary, to form the complete tank. Such structural units commonly consist of square plates of special construction, and with peripheral flanges in which are formed bolt holes, the flanges being adapted to be bolted together, with suitable caulking material between, to form the tank. Plates having special flange construction are usually used along corner and bottom edges of the structure.

In order that these structural units may withstand the very considerable pressures exerted by the liquid in the completed tank, the plates of such structural units are formed with embossed strengthening ribs, usually more or less in the form of a diagonal cross. Consequently, the structural units are subject to a good few limitations. The metal employed cannot economically be over a certain gauge owing to the difficulty in embossing thick metal plate and cannot practically be made under a certain gauge (where light-weight construction would otherwise be satisfactory, and desirable for reasons of economy and lightness) owing to the detestful effect of embossing thin metal. Again, in practice such structural units are limited as to size, and are not ordinarily greater than about four feet square. The equipment for effecting the embossing cannot readily be altered to enable the production of plates differing materially from the standard sizes, and the process of embossing the plates requires considerable care and skill if the structural units are to be of good durable quality; for example, the plates should be worked within certain temperature limits.

A further disadvantage is that in the construction of a single tank there are required several different kinds of units, owing to the manner of interconnecting the units at the bottom and the upright edges of the tank, and the differences in the flange constructions of the units used at a corner of a tank, along an edge but spaced from a corner, and at an intermediate position, spaced from upright and bottom edges of the tank.

These and other disadvantages are obviated or materially reduced by the present invention, which has for one of its principal objects the provision of structural units for tanks which are particularly simple and economical to manufacture, though sturdy and durable. Another object of the invention is to provide such units which may be easily and economically constructed to any of a wide range of dimensions and ordinarily of considerably greater size than such units hitherto made, thus permitting very considerable economies in installation and construction of water tanks or the like. Other objects of the invention are to provide such structural units which are such that a tank or the like may be built up of standard interchangeable units, and which are such as to permit a wide variety in efficient staying arrangements.

According to the invention, a structural unit made to be bolted to other similar units in the construction of a water storage tank, or silo or the like, includes a rectangular plate which is pre-formed with a transverse curve, preferably of catenary form. This transversely curved plate is secured within a rectangular frame, more or less in the form of a shallow open-ended box made up of longitudinal flanges and end flanges, each having a series

2

of bolt holes formed therein so that it may be bolted to a flange of another similar unit, or to an angle-iron member to which another similar unit is also bolted, the two units then being at right angles to each other. The units are made so that in an assembled tank, the concave faces of the transversely curved plates are inward; and the flanges of the frames may be such that they are adapted to be bolted together outside the tank structure, or alternatively the flanges may be such that they are adapted to be bolted together from within the tank, in which latter case the outermost part of the convex face of the curved plate, along its longitudinal centre line, is preferably substantially flush with the outermost edges of the frame flanges. It is preferred that the length of the unit be twice its width and that the curved plate be reinforced by a transverse cleat secured to its convex face midway between its ends. It is also preferred that there be formed through the plate bolt holes whereby there may be secured to the inner side of the plate anchorages for internal stays to reinforce the tank structure.

In the drawings:

FIG. 1 is a partly broken-away perspective view of portion of a tank constructed of units according to the invention, and viewed from the outside,

FIG. 2 is a sectional view along line 2—2 in FIG. 1, to enlarged scale,

FIG. 3 is a partly broken-away perspective detail drawing of the attachment of a stay within the tank structure,

FIG. 4 is a perspective view of portion of a tank constructed of units according to the invention and incorporating units of modified form in the tank bottom, the structure being viewed from within, and

FIG. 5 is a sectional view along line 5—5 in FIG. 4.

Each of the standard units 10, and each of the modified units 11 shown in FIG. 4 and FIG. 5, includes a rectangular frame 12, its length being double its width, this frame in each case being made up of a pair of side flanges 13 and a pair of end flanges 14 welded together at their ends. Each of the side and end flanges has a series of bolt holes 15 formed therethrough, the bolt holes being in equally spaced arrangement and fairly close to one long edge of the flange.

A rectangular plate 16 is welded within the frame 12, this plate, instead of being plane, being pre-formed with a transverse catenary curve. In the case of each of the standard units 10, the longitudinal edges of the curved plate 16 are welded to corresponding long edges of the two side flanges 13, at the inner face of the unit, the curvature of the plate 16 being towards, but not to, the outer face of the unit; and the bolt holes 15 are located outwardly of the curved plate 16. In the case of each of the modified units 11, used in the construction of the bottom of the tank, part of which is shown in FIG. 4, the longitudinal edges of the curved plate 16 are welded within the two side flanges 13, the curvature of the plate 16 being towards the outer or lower face of the unit, so that the longitudinal centre line of the outer or lower surface of the curved plate lies in the same plane as the outer or lower edges of the frame 19, the bolt holes 15, in each unit 11, being located inwardly of, or above, the curved plate 16. In both the standard unit 10 and the modified unit 11 the frames 12 are similar, but oppositely arranged, and in both types of unit the curved plates 16 are similar, but located differently with respect to the frames 12.

Each of the standard units 10 is reinforced by a transverse outside cleat 17, located midway between the end flanges 14, the outside edge of the cleat lying in the same plane as the outside edges of the side and end flanges 13 and 14, the inside edge of the cleat being formed with a concave catenary curve to conform to the curvature of the plate 16, to which the cleat is welded.

3

Each of the modified units 11 is reinforced by a transverse inside cleat 18, located midway between the end flanges 14, the inside edge of the cleat lying in the same plane as the inside edges of the side and end flanges 13 and 14, the outside edge of the cleat 18 being formed with a convex catenary curve to conform to the curvature of the plate 16, to which the cleat 18 is welded.

It will be seen that in each of the units 10 and 11, the transverse cleat 17 or 18 divides the unit into two equal sections. In each unit, there is formed in the curved plate 16, near to each corner of each of the two sections, a bolt hole 19.

In constructing a tank of units according to the invention, standard units 10 may be used for the walls and for the bottom, as shown in FIG. 1, the side and end flanges 13 and 14 extending outwardly. Alternatively standard units 10 may be used for the walls their flanges extending outwardly, modified units 11 with their flanges 13 and 14 extending inwardly being used for the bottom, as shown in FIG. 4. The use of standard units 10 for the bottom as well as for the walls of the tank is generally to be preferred when the tank is to be mounted upon raised bearers, for example those of a water tower, so that the whole of the outside of the tank is readily accessible. In such a case, the bottom units are arranged adjacently, with caulking between adjacent side flanges 13 and end flanges 14, which are then bolted firmly together, the bolts passing through registering bolt holes 15. Angle iron members 20, each with a series of bolt holes 21 formed through each of its flanges, are bolted about the periphery of the tank bottom, appropriate caulking being interposed between the angle irons and the tank bottom. The sides of the tank are built up of standard units 10 secured adjacently together, with interposed caulking, by bolts 22, and the tank sides so made are secured to the angle iron members 20 by bolts 23. Upright angle iron members as described are provided at the corners of the tank structure, succeeding tank sides being interconnected at each corner by being bolted to the flanges of such an angle iron.

Although FIG. 1 shows a portion of a tank side composed of a series of single standard units 10 with their longer sides upright, it will be understood that a tank side may be built up to a height of two or more standard units, bolted together with interposed caulking; and that a tank side may consist of or include standard units of which the long sides are disposed horizontally instead of vertically.

In certain cases it is not necessary or desirable that a tank should be erected on a tower, and a suitable foundation may consist of no more than a levelled sand bed or a concrete slab. In such a case, since the tank bottom is not accessible from below, it is preferred that the tank bottom should be built up of the modified units 11, as shown in FIG. 4, for such units may be bolted together from above, or within the tank structure, and the curved plates 16 of the units 11, as well as the side and end flanges 13 and 14 will bear upon the sand bed or concrete slab foundation.

In some cases it may be required to erect a tank in a position where access cannot be obtained to the outside of the walls of the tank structure; and in such a case the walls of the tank may be constructed of modified units 11 instead of standard units 10.

The tank structure is reinforced integrally by stays, which may consist of appropriate lengths of angle iron, as indicated at 24 in FIG. 3. Anchorages for stays are provided by box cleats 25, each consisting of an open-ended square box-like metal device, with triangular gussets 26 welded in the corners thereof, at the outer face of the device, the gussets being spaced from each other as shown in FIG. 3. A bolt hole 27 is formed in the middle of each of the four sides of the box-like device, and a bolt hole is formed in each of the gussets 26. Four bolts 28 are passed through two near bolt holes 19 of each

4

of two adjacent units 10 or through four bolt holes 19 near the four adjoining corners of four units 10. These bolts are engaged with the bolt holes of the gussets 26 of a box cleat 25 located on the inside of the tank structure; and a stay 24 may be secured by a bolt 29 to any one of the four sides of the box cleat. The construction of the box cleat 25 is such that it will not interfere with the subsequent attention to the caulking of joints between succeeding units of the tank.

Bolt holes 19 of the units which are not used for the attachment of box cleats are closed by plug bolts 30.

Box cleats 25 may be secured to modified units 11 by the use of relatively long bolts 31, each of which is passed through a bolt hole in the curved plate 16 and engaged by a nut 32 before the modified unit is set in place. On each bolt 31 there is subsequently fitted a spacer sleeve 33 of such length that its inner end is level with the inner edges of the side and end flanges 13 and 14 of the unit 11. The box cleat may then be secured upon these bolts 30 as before described.

Structural units according to the invention may be easily and economically made to lengths considerably in excess of the lengths economically attainable in conventional units; and it will be appreciated that the cold-working of the plates to bring them to the desired curved cross-sectional configuration is considerably more economical and simple than the embossing of plates as hitherto carried out. Units according to the invention may be readily made of any reasonable desired length, and by making the units fairly large the time and costs involved in erecting a tank from the units is minimised. Moreover, units may, at no excessive cost, be made to non-standard sizes to suit particular requirements. The invention is applicable to structural units of which the plates are of very heavy, or of relatively light, gauge; and in other respects the invention will be found to be effective in achieving the objects for which it has been devised.

Although the invention has been described particularly in relation to the construction of a water storage tank, it is equally applicable to the construction of other containers, such as grain storage silos and the like.

It will be understood, of course, that the particular embodiment of the invention herein described may be subject to many minor modifications of constructional detail and design, which will be readily apparent to persons skilled in the art, without departing from the spirit and scope of the invention as defined by the appended claims.

What I claim is:

1. A structural unit for constructing a tank or the like including a substantially rectangular plate formed with a transverse curve in one direction and secured directly within a rectangular box-like frame consisting of side flanges and end flanges, the longitudinal edges of the curved plate being secured directly to the side flanges at one face of the rectangular frame, bolt holes being formed in each of the side and end flanges near to the other face of the rectangular frame.

2. A structural unit for constructing a tank or the like according to claim 1 wherein a transverse cleat is secured to the convex face of the plate midway between its ends and extending between the side flanges, one longitudinal edge of said cleat uniformly contacting said convex face and the other longitudinal edge of said cleat lying substantially in the same plane with the adjacent face of said rectangular frame.

3. A structural unit for constructing a tank or the like including a substantially rectangular plate formed with a transverse curve in one direction and secured directly within a rectangular box-like frame consisting of side flanges and end flanges, the longitudinal centre line of the convex face of the plate and the edges of the side and end flanges at one face of the rectangular frame lying substantially in the one plane, bolt holes being formed

5

in each of the side and end flanges near to the other face of the rectangular frame.

4. A structural unit for constructing a tank or the like according to claim 3 wherein a transverse cleat is secured to the concave face of the plate midway between its ends and extending between the side flanges, one longitudinal edge of said cleat uniformly contacting said concave face and the other longitudinal edge of said cleat lying substantially in the same plane with the adjacent face of said rectangular frame.

5. A structural unit according to claim 1, wherein said transverse curve is a catenary curve.

6

6. A structural unit according to claim 3, wherein said transverse curve is a catenary curve.

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