Nov. 18, 1952 L. A. WILKIN 2,618,401

STORAGE BUILDING

Filed Aug. 2, 1951 2 SHEETS—SHEET 1

FIG. 1

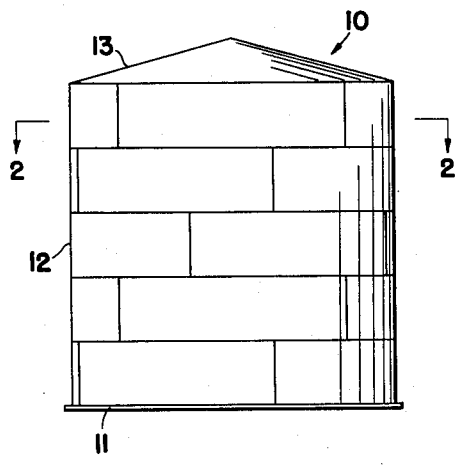


FIG. 4

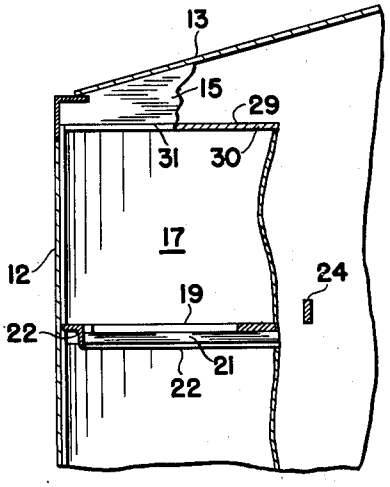


FIG. 2

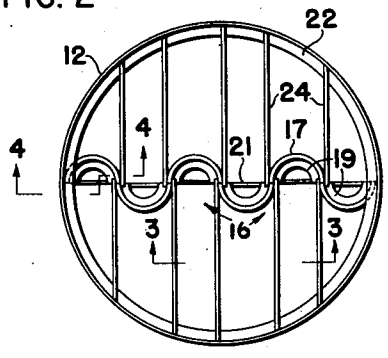
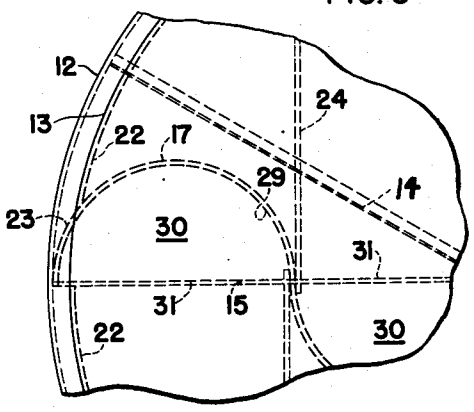


FIG. 5



INVENTOR:
Lester A Wilkin

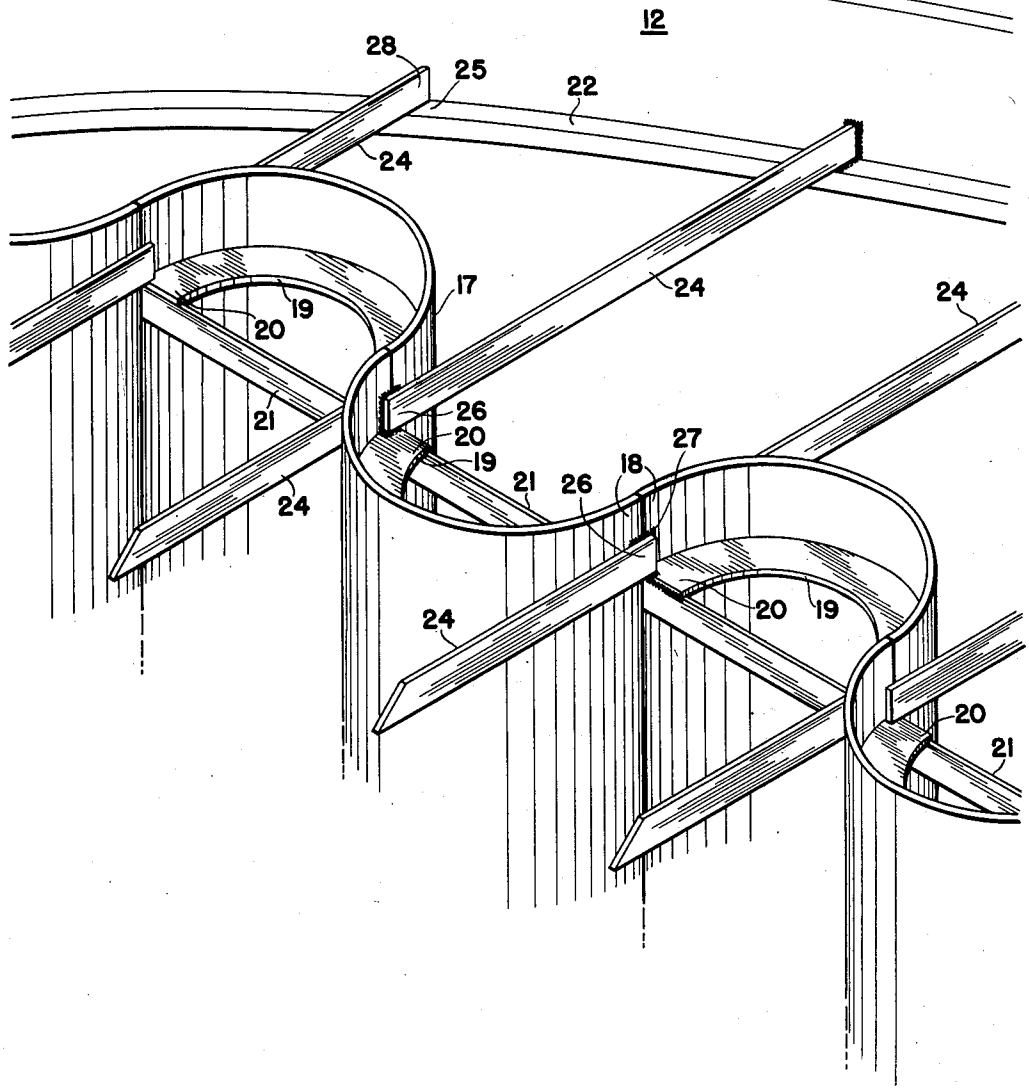
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STORAGE BUILDING

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FIG. 3



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UNITED STATES PATENT OFFICE

2,618,401

STORAGE BUILDING

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Application August 2, 1951, Serial No. 239,962

6 Claims. (Cl. 220—20)

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This invention relates to tanks, bins and similar storage buildings, generally constructed of metal, such as steel, for the storage of a variety of liquids and other materials. The invention relates particularly to a partition bulkhead for such a storage building, forming two or more compartments therein which are fully or partly separated from one another for the individual storage of more than one type of materials. The invention provides a new and improved construction for such a bulkhead and cooperating parts, making the entire structure either cheaper or stronger or both.

In the new construction both the side walls of the building and the bulkhead walls are usually curved; preferably lying in vertical cylindrical planes. Horizontal reenforcement members are longitudinally secured to concave wall areas, both of the side walls and partition walls. These members lie in a plurality of superposed horizontal planes. In each plane, the reenforcements are substantially coextensive with the side walls and partition walls, and they are so interconnected by suitable tie members as to form a truss, thereby enabling any one or more compartments formed by the bulkhead to withstand the interior and exterior pressures and mechanical stresses to be expected in the operation of the compartmented storage tank. Special joints are preferably used between the tie members, reenforcement members and curved walls, providing high strength while requiring low amounts of material and labor.

Many reenforcing structures for tank shells or bulkheads are known to the art. When I applied such earlier structures for purposes as indicated herein, the idea of the present structure occurred to me and I found, on actual test, that the new structure provides a surprisingly large increase in strength, when held to equal cost. In addition I found that the new structure compares favorably with most of the earlier structures as to simplicity of fabrication, erection, and utilization of the storage building. These and other advantages will appear more clearly from the detailed description of a preferred embodiment which follows.

In the drawing, Figure 1 is the general front elevation of a gasoline storage tank the inside of which can be partitioned in accordance herewith. Figure 2 is a horizontal section along lines 2—2. Figure 3 is a perspective view, on a large scale, of a sectional detail cut off along lines 2—2 at the top and along lines 3—3 in front. Figure 4 is a front view of a sectional detail cut off along lines

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2—2 at the bottom and along lines 4—4 in front. Figure 5 is a plan view of the detail of Figure 4.

The tank 10 has a flat-bottom 11, a vertical, cylindrical shell or side wall 12 and a flat, conical roof 13, supported by suitable rafters 14 and partition means 15. A vertically corrugated partition or bulkhead 16 extends across the tank and separates two compartments, of equal size and form, from one another. Each compartment may have gasoline or other material supplied to it, and removed therefrom, by suitable inlet and outlet means (not shown).

The bulkhead 16 comprises a plurality of vertical, semi-cylindrical plate units or wall sections 17, joined together endwise in vertical edge portions 18, which as shown may be butt welded. Alternate sections 17 are oriented to face in opposite directions. An even number of such alternating sections or vertical corrugations are provided.

Secured to the concave or inside surface of each section 17, there are several vertically superimposed, horizontally disposed reenforcing bars 19 of rectangular cross-section and of an arcuate shape substantially coextensive with that of the section. The vertical spacing of these reenforcements is equal in the entire bulk head, so that, in the plane of each reenforcing bar 19 there is a chain or system of such bars. The system is substantially coextensive with the horizontal extension of the bulkhead.

The vertical spacing of these reenforcements is preferably proportioned to the downwardly increasing hydrostatic pressure when reenforcements of uniform strength are used on all levels. Aside from variations due to such proportioning and the like, the vertical spacing of horizontal reenforcements 19 and the horizontal diameters of semicylindrical wall sections 17 are preferably of the same order of magnitude, such as about three to eight feet.

The two terminal areas 20 of each arcuate bar 19 are interconnected by a straight stiffening tie member 21. By means of reenforcements 19 and stiffeners 21, each vertical corrugation unit or section 17 is made rigid enough to withstand substantial hydrostatic pressure and mechanical stress. The members 17, 19 and 21 can be made substantially uniform, regardless of the size of tank 10 and number of bulkhead corrugations, so long as general pressure and stress conditions are comparable.

The inside surfaces of the side walls 12 have secured thereto a number of superposed reenforcement members 22; each member 22 having

a flat horizontal surface lying in the same plane with the flat, horizontal surface of a bulkhead reenforcing bar 19. The member 22 may consist of structural shapes of suitable strength. If the side wall 12, between the ends of the bulkhead 17, consists of a single semicylindrical element as shown, relatively strong reenforcements 22 are required for this side wall, in comparison with the reenforcements 19 of the relatively short-radius bulkhead sections; both sets of reenforcements being arranged at uniform vertical spacings. The side-wall reenforcing members 22, like the chains of bulkhead reenforcements 19, are substantially coextensive with the reenforced wall; but a small section of each complete shell reenforcing ring 22 is cut off, adjacent each vertical, terminal edge portion 23 of the bulkhead; the cut-off edges being secured to these terminal edges for greater rigidity.

Straight tie bars 24 of rectangular cross-section are horizontally supported on the flat top surface of arcuate reenforcing members 19 and 22, being secured to terminal edges 18 of bulkhead sections 17, and to opposite areas 25 of the shell ring 22. The tie bars 24 are shown as extending parallel with one another, thereby simplifying access to the interior of the tank and the installation of auxiliary equipment such as gauging devices (not shown). The bulkhead ends 26 of all tie bars, and preferably the entire tie bars 24, extend tangentially of the terminal edges 18 of the bulkhead walls 17. They are secured thereto, as well as to the adjacent terminal areas 20 of the arcuate bulkhead reenforcements, thereby providing simple but strong and reliable joints at these ends 26. Preferably the members 17, 19, 21 and 24 are joined together at each intersection of vertical edges 18 and horizontal reenforcements 19, by substantially continuous weld seams 27 along the vertical terminal side surfaces of the bars 24 and the horizontal bottom edges supported on the bars 19. The opposite ends 28 of the tie members do not, inherently, extend parallel with adjacent wall areas, but can be jointed to the wall with equal simplicity and strength, along the vertical edges of the bars 24 and the horizontal surfaces of the wall reenforcements 22, since these wall reenforcements, as mentioned, are generally quite large.

In effect the arcuate reenforcement members 19, 22 and the straight tie members 21, 24 form a horizontal truss, in each plane of reenforcement. The overall strength of the truss and tank structure depends largely on the strength of the joints (*a*) between outer terminal tie member areas 28, ring areas 25 and adjacent areas of side walls 12, and (*b*) between inner terminal tie member areas 26, reenforcement areas 20, and bulkhead areas 18. It will be seen by persons skilled in the art, on consideration hereof, that the shearing and other stresses which are important for these joints can easily be proportioned and controlled, with the design as shown and described. It will also be seen that the construction is extremely simple to fabricate and erect. Lower bars 21 and 24 can serve as supports of working platforms for higher shell and bulkhead elements, reenforcements and ties. It is possible in some instances to prefabricate the horizontal trusses, or panels thereof, and to use them as falsework for the shell plate erection.

The bottom edges of the bulkhead 17 (not shown) are generally secured to the flat bottom 11 in obvious manner. Instead of specially shaping the top of the bulkhead, for attachment to the underside of a cone roof, I found it preferable in many cases to fabricate all bulkhead sections 17 uniformly from rectangular plates, with horizontal, semicircular top edges 29; to secure semicircular plates 30 with their curved edges to the top edges 29; to secure the bottom edges 31 of the vertical, cone roof supporting partition plates 15 to the diametrical edges of the plates 30; and to secure the top edges of the vertical plates 15 to the underside of the roof 13. In this manner the members 13, 15 and 30 serve as an uppermost set of reenforcements and ties, and a simple tight bulkhead closure is provided.

Various modifications will occur to persons skilled in the art. I claim:

1. In apparatus for the storage of a variety of liquids and the like, a shell; a vertically corrugated, horizontally reenforced bulkhead, separating different parts of the space inside the shell from one another, the vertical corrugations consisting in curvatures of the bulkhead alternating facing in opposite directions and having vertical edge portions which are tangent to one another in adjoining corrugations, the horizontal reenforcements substantially consisting in a plurality of vertically spaced sets of horizontally alined rigid members longitudinally secured to and horizontally substantially coextensive with the concave surfaces of the corrugations, and the vertical spacing of such sets being approximately of the same order of magnitude as the diameters of said curvatures; and a set of tie members for each set of horizontally alined reenforcement members, the tie members of each set comprising straight, elongated bars terminally secured to the bulkhead adjacent the intersections of horizontal reenforcements and vertical edge portions, interconnecting such edge portions with opposite portions of the shell, and cooperating with the connected reenforcement members in forming a substantially horizontal truss.

2. Apparatus according to claim 1, wherein the bulkhead is formed of a plurality of semicylindrical formed plate units, each unit forming one of said curvatures and being vertically joined to an adjoining unit along said edge portions of the respective curvatures, and each intersection of horizontal reenforcements and vertical edge portions of the bulkhead corrugations being formed by the two vertical edge portions; a horizontally extending arcuate bar forming one of said rigid members; and two horizontal, substantially alined straight bars supported by the arcuate bars, tangent on the edge portions, and extending in opposite directions to one another and to the respective, most nearly adjoining bulkhead plate units.

3. Apparatus according to claim 2, wherein the different members of each of said horizontal trusses are welded together; said bulkhead reenforcing bars having horizontal top surfaces, said straight tie bars having vertical side surfaces, and substantially uninterrupted weld joints being formed around the ends of said straight tie bars, along said vertical edge portions and horizontal top surfaces.

4. In apparatus for the storage of a variety of liquids and the like, a shell; a plurality of sets of vertically spaced, horizontally alined, substantially annular reenforcement members for the shell; a vertically corrugated, horizontally reenforced bulkhead, separating different parts of the space inside the shell from one another, the vertical corrugations substantially consisting in semicylindrical curvatures of the bulk-

head, alternately facing in opposite directions and having vertical edge portions which are tangent to one another in adjoining corrugations, the horizontal reenforcements substantially consisting in a plurality of vertically spaced sets of horizontally alined rigid members longitudinally secured to and horizontally substantially coextensive with the concave surfaces of the corrugations, and the vertical spacing of such sets of shell and bulkhead reenforcements being approximately of the same order of magnitude as the diameters of said semicylindrical curvatures; and a set of tie members for each set of horizontally alined reenforcement members, the tie members of each set comprising straight, elongated bars terminally secured to the bulkhead adjacent the intersections of horizontal reenforcements and vertical edge portions, some of said bars horizontally interconnecting such edge portions with one another and others of said bars being tangent to such edge portions and parallel with one another and connecting such edge portions with opposite portions of the shell reenforcements, thereby cooperating with the connected reenforcement members in forming a horizontal truss.

5. Apparatus according to claim 4, wherein each set of reenforcement members for the bulkhead provides a horizontal surface and each set of reenforcement members for the shell provides a wider, horizontal surface, lying in the same plane, said tie bars being supported by and welded to said horizontal surfaces.

6. In apparatus for the storage of a variety of liquids and the like, a substantially cylindrical, horizontally reenforced shell; a vertically corrugated, horizontally reenforced bulkhead, extending across the space inside the shell and having vertical edge portions secured to the inside surface of the shell, the vertical corrugations substantially consisting in uniform semicylindrical curvatures of the bulkhead, alternately facing in opposite directions and having vertical edge portions which are tangent to one another in adjoining corrugations; the horizontal reenforcements of the shell and bulkhead substantially consisting in a plurality of vertically spaced sets of horizontally alined rigid members longitudinally secured to and horizontally substantially coextensive with the concave surfaces of the shell and bulkhead, and the vertical spacing of such sets being approximately of the same order of magnitude as the diameters of said semicylindrical curvatures; and a set of tie members for each set of horizontally alined reenforcement members, the tie members of each set comprising straight, elongated, parallel, horizontal bars terminally secured to the bulkhead adjacent the intersections of horizontal reenforcements and vertical edge portions, interconnecting such edge portions with opposite portions of the shell, and cooperating with the connected reenforcement members in forming a horizontal truss.

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No references cited.