April 4, 1939. J. M. WORKMAN 2,153,492

TANK, HOLLOW COLUMN SUPPORT THEREFOR, AND METHOD OF BUILDING THE SAME

Filed Jan. 18, 1936

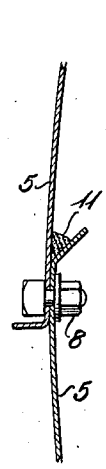



Fig. 3.

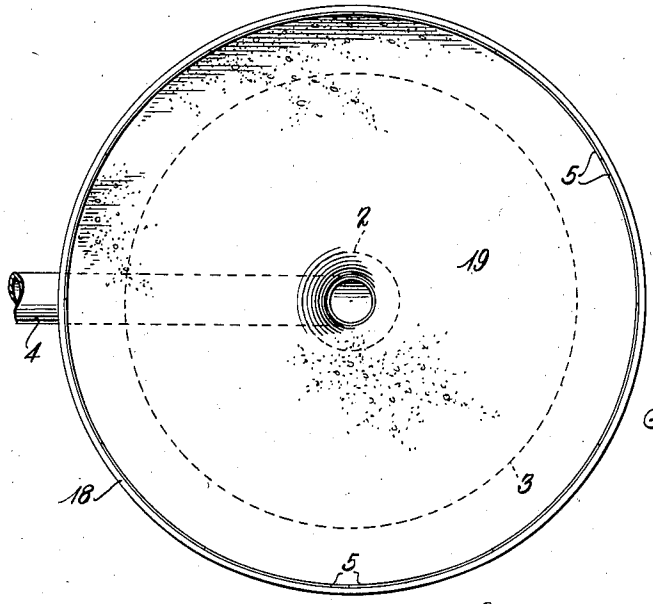



Fig. 1.

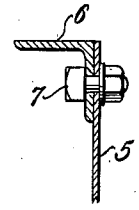



Fig. 4.

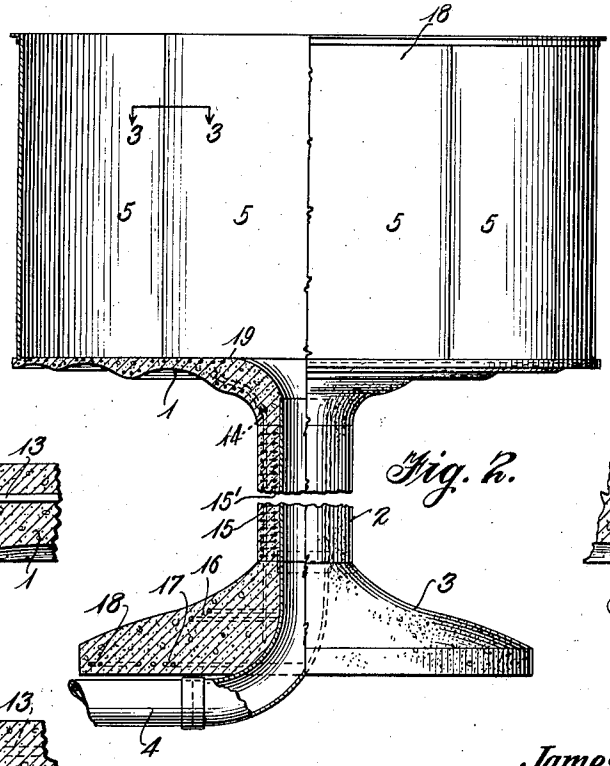



Fig. 2.

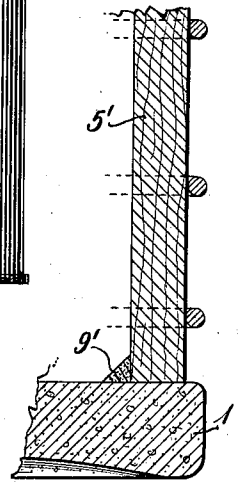



Fig. 7.

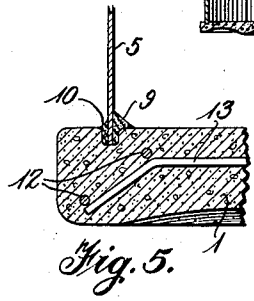



Fig. 5.

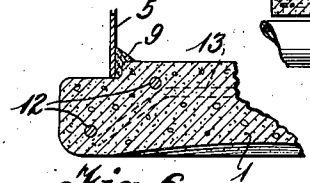



Fig. 6.

Inventor
James M. Workman

By
Brown & Phelps
Attorneys

Patented Apr. 4, 1939

2,153,492

# UNITED STATES PATENT OFFICE

2,153,492

## TANK, HOLLOW COLUMN SUPPORT THEREFOR, AND METHOD OF BUILDING THE SAME

James Minor Workman, Winnsboro, S. C.

Application January 18, 1936, Serial No. 59,785

5 Claims. (Cl. 72—13)

The invention relates to tanks, hollow column support therefor, and method of building the same.

It is an object of the invention to provide a tank structure which may be constructed with extreme economy and which shall be free from upkeep and repair costs.

The principles involved in the structure of the present invention are an elaboration of the invention described in my copending application Serial No. 686,183, filed August 21, 1933, for Concrete construction, now Patent No. 2,035,007, and the present invention comprises a continuation in part of said application.

It is an object of the invention to provide a hollow column shown as utilized as a support for the tank structure but which is capable of general use as a column.

It is a further object of the invention to provide a composite tank structure having a novel seal at the junction of the side and bottom of the tank.

It is a further object of the invention to provide a tank structure supported upon a hollow column utilizing the hollow of the column not only as an intake or outlet from the tank but also in the method of constructing the same.

Further objects of the invention will appear from the following description when read in connection with the accompanying drawing showing illustrative embodiments of the invention, and wherein:

Figure 1 is a plan view;

Fig. 2 is a side elevation partially in central vertical section;

Fig. 3 is a detail horizontal section upon an enlarged scale of a joint between elements of the walls of the tank;

Fig. 4 is a detail vertical section upon an enlarged scale of the upper rim of the tank;

Figs. 5 and 6 are detail vertical sections upon an enlarged scale showing structures of the joint between the side and bottom of the tank; and

Fig. 7 is a like view showing another form of composite tank.

As shown, the tank is supported upon a hollow column 2 supported upon and preferably integral with a base 3 and supporting and preferably integral with the slab 1 which serves as the bottom of the tank.

The foundation 3 is shown as provided with ring reinforcements 16, 17, and 18 placed in the concrete in the position to conform with the principles outlined in my former application above referred to. The hollow column is shown as provided with ring or spiral reinforcements 15 adjacent the outer periphery, and 15' adjacent the inner periphery of the hollow column.

The hollow column portion is also shown as provided with vertical reinforcements 14 adjacent the outer rings 15 and desirable extending rather deeply into the foundation 3, and shown as curved at its junction with the column and extending out into the slab to the termination of the column head.

The form of slab utilized as the bottom of the tank in the structure shown follows the principles outlined in my copending application above referred to which may be stated briefly as follows: by provision of properly designed dimensions of the slab and substantially circular and concentric reinforcing band elements grouped in radially spaced groups alternating between the upper and lower portions of the slab respectively there are developed radial compressive stresses and circumferential tensile stresses, the latter occurring in circumferential stress bands alternately at the upper and lower portions of the slab.

While it is preferred to use the principles of my former application referred to, the invention of the present application is not considered as confined to these principles as other forms of reinforced slab may be utilized.

A difficulty with tanks made wholly of concrete is found to be that the differences of expansion between the submerged and non-submerged portions of the walls introduce destructive force. It is preferred therefore, and as shown, to make the tank a composite structure comprising a concrete bottom and steel or wooden side walls.

When made of steel the side walls may be made as indicated in Figure 2 of vertical plates 5 desirably welded at their joints and shown as provided with an angle rim 6 bolted thereto by bolt 7, as shown in Figure 4.

A different form of joint between the plates is indicated in Figure 3 wherein the edge of the other plate is turned outwardly at a 90° angle, the bolt hole for bolt 8 being placed sufficiently near the outturned portion to prevent revolution of the bolt when the nut is tightened. The edge of the remaining plate 5 is shown as deflected inwardly substantially at an angle of 45° to provide a V-shaped recess in which packing material 11, desirably of some permanently plastic material, as putty, may be placed. It will be seen that the deflected margins of the plates will provide a desirable stiffness to the plates, particularly while being handled before assembly.

As a means for locating the plates during construction of the tank, there is shown in Figure 5 a groove in the slab 1 adjacent its periphery, which groove is shown as filled with an internal packing material 9 and external packing material of the nature shown at 11 in Figure 3. The outer packing material is for the purpose of preventing access of moisture which, freezing in the space, might cause deterioration of the structure.

In Figure 6 the slab 1 is shown as provided with an annular rebate for the purpose of locating the plates during the construction and the packing material 9 is shown interiorly only of the joint.

The groove of Figure 5 and the rebate of Figure 6 are not for the purpose of assisting in prevention of leakage. The packing material 9 is sufficient for this purpose since the same adheres to the surfaces and hydraulic pressure will cause a tight joint and effectually prevent leakage.

In Figure 7 is shown a form of composite tank wherein the side walls 5' are formed of wooden staves and leakage is prevented by a packing in the form of a fillet 9'. This form of joint between the side walls and the slab is equally effectual when the side walls are made of steel plates and it is found that merely the form of packing shown at 9' is sufficient to prevent leakage at the joint without the provision of a groove or rebate.

I have discovered that a hollow column will support a greater weight than a solid column of the same diameter if properly reinforced and if the hollow of the column is properly proportioned to the total diameter of the column. To secure this result, the interior space should approximate one-half of the outer diameter of the column. It is not to be understood that the proportion stated is critical as a part of the advantage of the invention may be secured by approaching this ratio.

The principle of this discovery is that the natural organization of stresses in a cylinder is such that the movements propagated in the central quarter of the gross area impose a bursting tendency upon the outer shell, so that a column of a given diameter will have its strength increased by the omission of this central core, while the internal ring of the shell preferably should be protected against circumferential stress (produced by the shell) by the use of the internal spiral 15.

The vertical bars used in conjunction with this inner spiral, if used at all, should be square and placed outside of the spiral.

In accordance with the method of construction provided by the invention, the conduit 4 is first placed at the site of the foundation 3, to be constructed, desirably initially terminating adjacent the junction between the column and the foundation whereupon concrete is pumped through the conduit 4 to spill over the edge thereof and which may be struck off with a revolving templet of the form desired for the finished surface of the foundation.

When this portion has been placed, forms for the hollow column and for the slab are placed and the conduit 4 is extended upwardly substantially to the upper limit shown in Figure 2.

The pumping of the concrete is then continued, which spilling over the upper edge of the conduit, fills the cylindrical portions of the form and upon continued flow of the concrete, a templet is utilized to be revolved about the center of the structure to strike off the bearing portion and the upper surface of the slab. Upon completion of the placing of the concrete, the conduit 4 is cleared of concrete as by use of compressed air or a swab, and is utilized in the use of the tank as for instance for an intake or an outlet conduit.

In structures where the central hollow of the column is desirably too large for efficient delivery of concrete, the invention includes the expedient of inserting a concrete delivery flexible conduit as of rubber or the like of smaller bore than the hollow of the column, which may terminate in a washer-like cap to seat upon the upper end of the metal conduit 4 through which the concrete may be pumped.

When the central form of column is extended upwardly, the hose may be drawn upwardly to the new position to continue the delivery of the concrete.

This expedient will enable the use of even lighter metal for the lining of the hollow of the column, and the joints, if any, in the said lining need not be strictly tight.

In the case of the use of this last named expedient, a metal lining for the hollow of the column is not essential and a collapsible and removable inner form may be used, but in this case the inner reinforcing rings or the outer rings or both may require to be increased in strength or number to enable the column to support the hydraulic pressure of liquid within the tank.

The portions of the conduit 4 which are encased in the concrete may be of very light material as they are merely for convenience in the placing of the concrete and in the formation of the hollow portion of the column.

Minor changes may be made in the physical embodiments of the invention, or in the steps of the process, within the scope of the appended claims without departing from the spirit of the invention.

I claim:

1. A tank structure comprising, in combination: a foundation; a concrete column integral therewith and having a head integral with its shaft; a concrete slab tank bottom integral at its center portion with said column head, thinnest adjacent its periphery and widely overhanging and solely supported by said column; said slab comprising a plurality of circumferentially disposed concentric reinforcing elements, said elements alternating in position relative to the top and bottom of the slab and tank side walls of assembled preformed elements having expansion characteristics differing from concrete seating on said slab adjacent the periphery thereof and free for movement thereon.

2. A tank structure comprising, in combination: a circular foundation; a cylindrical column supported on said foundation; said column formed with a central hollow concentric with its axis to increase its weight-carrying capacity; a concrete slab tank bottom widely overhanging and supported at its central portion upon said column as its sole means of support; said slab comprising a plurality of circumferentially disposed concentric reinforcing elements, said elements alternating in position relative to the top and bottom of the slab and tank side walls of assembled preformed elements having expansion characteristics differing from concrete seated upon said slab adjacent its periphery.

3. A tank structure comprising, in combination: a foundation member; a hollow column and a tank bottom concrete slab formed as a monolith; tank side walls of assembled preformed ele-

ments having expansion characteristics differing from concrete seating freely upon said slab adjacent its periphery; and a packing fillet of substantially permanently viscous material at the interior of the joint between the slab and side walls to seal the joint against leakage.

4. A tank structure comprising, in combination: a foundation member having a central opening; a hollow column supported on said foundation; the hollow of said column communicating with said opening; a slab tank bottom having a central opening communicating with the hollow of said column; said slab centrally supported by and widely overhanging the upper extremity of said column; tank side walls seating on said slab adjacent its periphery; and a conduit extending from said foundation and communicating with its central opening.

5. The method of forming a tank bottom and support therefor which comprises: placing a conduit at the site of the structure below the bottom area of the structure and including an upwardly directed portion central of the site; delivering concrete material under pressure through said conduit; and shaping the said material as it overflows from the upper end of said conduit to the form of a foundation, a hollow central column integral therewith, and a tank bottom slab integral with said hollow column.

JAMES M. WORKMAN.