Oct. 30, 1945. L. ALBRECHT 2,387,969

SUPPORTING COLUMN FOR TANKS AND THE LIKE

Original Filed May 26, 1938

Fig.1.

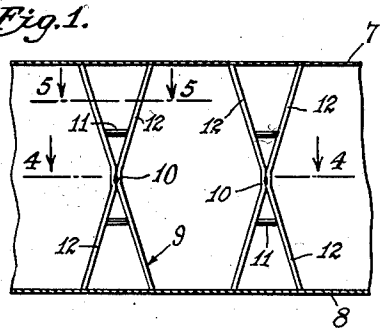


Fig.2.

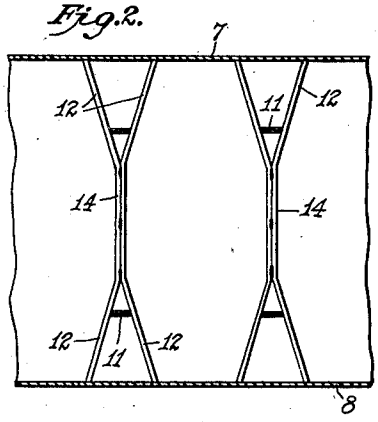


Fig.3.

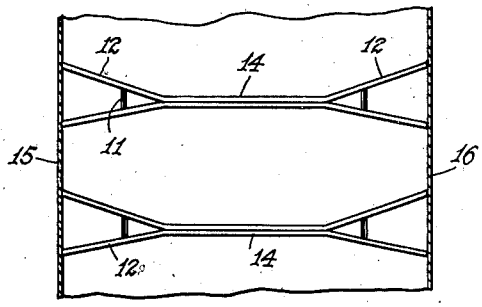


Fig.4.

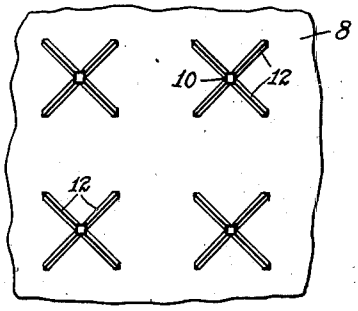


Fig.6.

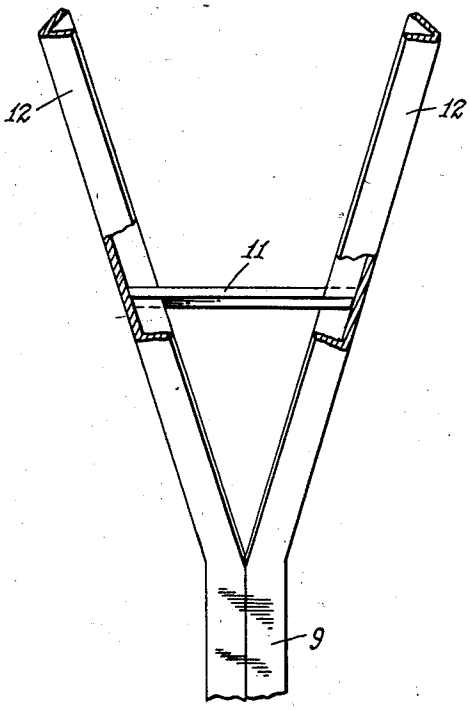
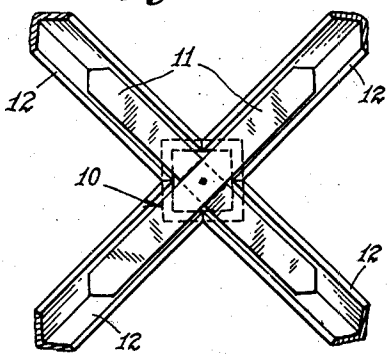


Fig.5.



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Patented Oct. 30, 1945

2,387,969

UNITED STATES PATENT OFFICE

2,387,969

SUPPORTING COLUMN FOR TANKS AND THE LIKE

Lewis Albrecht, Mahwah, N. J.

Original application May 26, 1938, Serial No. 210,176. Divided and this application August 18, 1942, Serial No. 455,189

6 Claims. (Cl. 220—71)

This invention relates to tanks or the like structures in which there are opposed parallel walls and compression-tension connectors between the walls. Such tanks are usually fabricated from sheet steel, of minimum thickness for reasons of economy; they may be of very considerable dimensions, both in height and laterally, and are frequently located underground. Consequently, and, of course, particularly in the case of connectors between the top and bottom walls of such a tank, the connectors may have to be provided in large numbers and closely spaced to insure against collapse of the structure due to stresses induced by forces exerted internally or externally of the tank, and especially those working externally against the top and/or bottom walls. The problem is (1) to provide a form of connector which, while it may necessarily have very considerable length or reach, will, by reason of its unusual characteristics and relation to the walls with which it cooperates, exhibit the desired maximum strength and several times the resistance to deflection under compression that would be expected and normal in a conventional simple column or compression member of the same length, metal content, and strength of material; (2) to provide a kind of connector such that there may be the maximum number of them, closely spaced, for a given horizontal area of tank, while at the same time there is minimum resulting interference with the movements of a workman in cleaning out the tank, etc.; and (3) to accomplish the foregoing objectives most economically and with the least massive construction.

In the accompanying drawing, in which I have indicated embodiments of the invention as at present preferred:

Fig. 1 is a vertical section through a tank, with parts broken away and showing in elevation a form of my compression-tension connector in its relation to the top and bottom walls of the tank, and in which the length of the connector, so far as its deflection-liability under compression is concerned, is halved;

Fig. 2 is a view similar to Fig. 1, showing a modification of the connector in which the effective length so far as deflection-liability is concerned, is divided by three;

Fig. 3 is a view similar to Figs. 1 and 2, showing a modified form of the Fig. 2 connector in its relation to opposed vertical walls of a tank;

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 1;

Fig. 5 is an enlarged sectional view taken on the line 5—5 of Fig. 1; and

Fig. 6 is a view partly in section and with parts broken away, revealing details of the connector construction.

Referring now to the numerals on the drawing, and particularly to Fig. 1, the top and bottom plate members or walls of a tank are indicated by 7 and 8. A connector (two of them appear in Fig. 1) is made up of a plurality, more than two, of angle-bars 9, or equivalent bars half-round or curved in cross-section, the longitudinal edges of the bars being welded together at 10 to constitute what I term a trunk or waist, from which point they diverge in pyramidal outline towards the top and bottom plate members or walls, to which their ends are welded. Where the connector is made up of alternate compression-tension members such as four angle-bars, which is the preferred form, so that the waist or trunk 10 is a hollow square in cross-section, (see Fig. 5), there may be a cross-brace 11 having its ends welded within the angle of and to the confronting surfaces of each pair of diverging bar sections of the group of alternate compression-tension members, and these braces 11 may cross each other and be welded together at the crossing. Figs. 1, 2, 3 and 6 show braces 11, but for the sake of clearness show only two angle-bars per connector. Fig. 5, however, shows the connector as I prefer to make it, i. e., of four angle-bars, brought together to provide a trunk or waist portion as shown in all the figures, with alternate compression-tension leg portions 12 proceeding thence in symmetrical arrangement (Figs. 4 and 5) towards the opposed tank walls to which their ends are welded.

In Figs. 2 and 3, the trunk portion of the connector, marked 14, is of considerable length, approximately one-third of the total reach of the connector or stay-strut member. In Fig. 3, the connector, in general like what is shown in Fig. 2, extends horizontally to connect opposed vertical walls 15—16 of a tank. And it will be observed that the prolongations of the trunk portion 12 (there will be preferably four of such prolongations or legs 12 going from the trunk towards each wall, as per Fig. 5, and not merely two, as Fig. 3 would indicate) are not symmetrically arranged. That is to say, some of the legs may be at a different angle to the wall to which they are attached than others, to allow for differences in pressure arising from fluid in the tank at different heights.

With the constructions shown it will be obvious

that I have solved the problems referred to above, using familiar structural elements, and producing stay-strut members that are almost frail in appearance, though amply and surprisingly strong for their function. And the trunk feature makes for the convenience of the working, giving him what may be called "arm-room," which is no less important than leg-room.

The trunk portion is effectively stayed against cross-axial movement, and the resistance of the stay-strut member to bending is multiplied by two (Fig. 1) or by three (Fig. 2), so far as the overall length factor is concerned. Of course, the expression "multiplied by two—or three" is not to be taken in a strict arithmetical sense. And, of course, the engineer, in designing such stay-strut members for a given job, will take into account the factors of overall length, radius of gyration, strength of materials, etc., etc.

This application is a division of my copending application Ser. No. 210,176, filed May 26, 1938, and now matured into Patent No. 2,296,414, in which are shown more details of the kind of tank in which my stay-strut member may be used.

I claim:

1. A tank or like structure comprising a pair of opposed spaced plate members of broad expanse inherently tending to bulge and buckle under the stresses incident to its use, and means for mutually supporting and restraining said plate members against such relative displacement and distortion under said stresses, said means comprising a multiplicity of attenuate compression-tension members each spanning the space between said plate members and each rigidly terminally attached to both of said plate members at distributed points thereon and disposed in inwardly converging groups the component members of each group of which are integrally merged for a portion of their intermediate extent defining a unitary trunk resisting collective compressive and tensional stresses imposed upon the individual component members of each group by the displacement and distortion tendencies of said plate members.

2. A tank or like structure comprising a pair of opposed spaced plate members of broad expanse inherently tending to bulge and buckle under the stresses incident to its use, and means for supporting and restraining said plate members against such relative displacement and distortion under said stresses, said means comprising a multiplicity of attenuate compression-tension members each spanning the space between said plate members and each rigidly terminally attached to both of said plate members at distributed points thereon and disposed in inwardly converging groups the component members of each group of which are contiguous for a portion of their intermediate extent and are integrally merged in said portions defining a unitary trunk resisting collective compressive and tensional stresses imposed upon the individual component members of each group by the displacement and distortion tendencies of said plate members.

3. A tank or like structure comprising a pair of opposed spaced plate members of broad expanse inherently tending to bulge and buckle under the stresses incident to its use, and means for mutually supporting and restraining said plate members against such relative displacement and distortion under said stresses, said means comprising a multiplicity of attenuate compression-tension members terminally attached to one of said plate members at distributed points thereon and disposed in inwardly converging groups each of pyramidal outline, a multiplicity of attenuate compression-tension members terminally attached to the other of said plate members and disposed in inwardly converging groups each of pyramidal outline, the apical axis of each one of said last-recited pyramidal groups alining respectively with the apical axis of a one of those of the first-recited groups, and compression-tension trunk members connecting the apices of each thusly-alined pair of pyramidal groups and secured to the component attenuated compression-tension members thereof to resist collective compressive and tensional stresses imposed upon the individual component members of each group by the displacement and distortion tendencies of said plate members.

4. A tank or like structure comprising a pair of opposed spaced plate members of broad expanse inherently tending to bulge and buckle under the stresses incident to its use, and means for mutually supporting and restraining said plate members against such relative displacement and distortion under said stresses, said means comprising a multiplicity of attenuate compression-tension members each spanning the space between said plate members and each rigidly terminally attached to both of said plate members at distributed points thereon and disposed in inwardly converging groups the component members of each group of which are integrally merged for a portion of their intermediate extent defining a unitary trunk resisting collective compressive and tensional stresses imposed upon the individual component members of each group by the displacement and distortion tendencies of said plate members, and cross-tie compression-tension members secured to and bridging the individual compression-tension members of each group in transverse planes lying between the trunk extremities and their respectively proximate plate members.

5. A tank or like structure comprising a pair of opposed spaced plate members of broad expanse inherently tending to bulge and buckle under the stresses incident to its use, and means for mutually supporting and restraining said plate members against such relative displacement and distortion under said stresses, said means comprising a multiplicity of attenuate compression-tension members terminally attached to one of said plate members at distributed points thereon and disposed in inwardly converging groups each of pyramidal outline, a multiplicity of attenuate compression-tension members terminally attached to the other of said plate members and disposed in inwardly converging groups each of pyramidal outline, the apical axis of each of said pyramidal groups defining an angle of less than 45° with its component members, the apical axis of each one of the first-recited pyramidal groups alining respectively with the apical axis of a one of those of the last-mentioned groups, and compression-tension trunk members connecting the apices of each thusly-alined pair of pyramidal groups and secured to the component attenuated compression-tension members thereof to resist collective compressive and tensional stresses imposed upon the individual members of each group by the displacement and distortion tendencies of said plate members.

6. A tank or like structure comprising a pair of opposed spaced plate members of broad expanse inherently tending to bulge and buckle

under the stresses incident to its use, and means for mutually supporting and restraining said plate members against such relative displacement and distortion under said stresses, said means comprising a multiplicity of attenuate compression-tension members of L-shaped cross-section terminally attached to one of said plate members at distributed points thereon and disposed in inwardly converging groups each of pyramidal outline, a multiplicity of attenuate compression-tension members of L-shaped cross-section terminally attached to the other of said plate members and disposed in inwardly converging groups each of pyramidal outline, the apical axis of each of said pyramidal groups defining an angle of less than 45° with its component members, the apical axis of each one of the first-recited pyramidal groups alining respectively with the apical axis of a one of those of the last-mentioned groups, and compression-tension members each of polygonal box form connecting the apices of each thusly-alined pair of pyramidal groups, integrally formed from apical-axis-parallel contiguous extensions of the component L-shaped members of each pair of alined groups, and resisting collective compressive and tensional stresses imposed upon the individual members of each group by the displacement and distortion tendencies of said plate members.

LEWIS ALBRECHT.