Sept. 16, 1930. R. D. GEORGE 1,775,758

CELLULAR SEAL FLOATING DECK TANK

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Fig. 2.

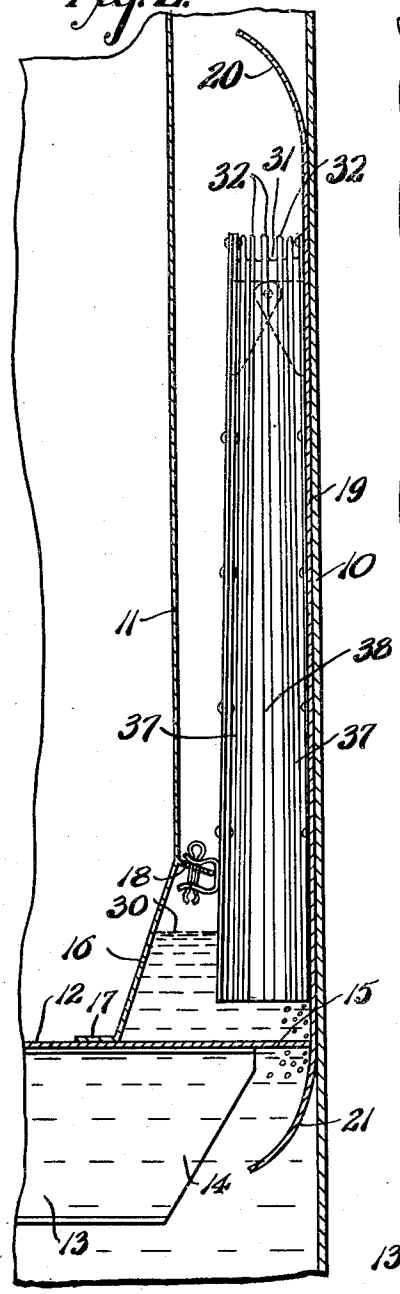
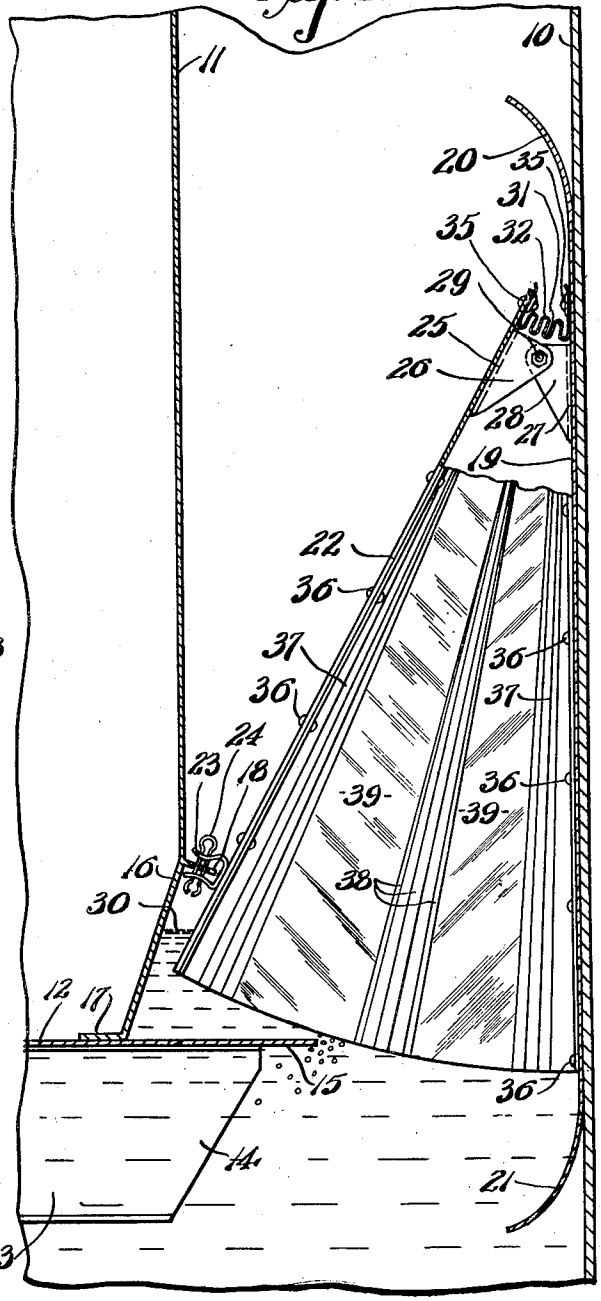


Fig. 1.



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Fig. 3.

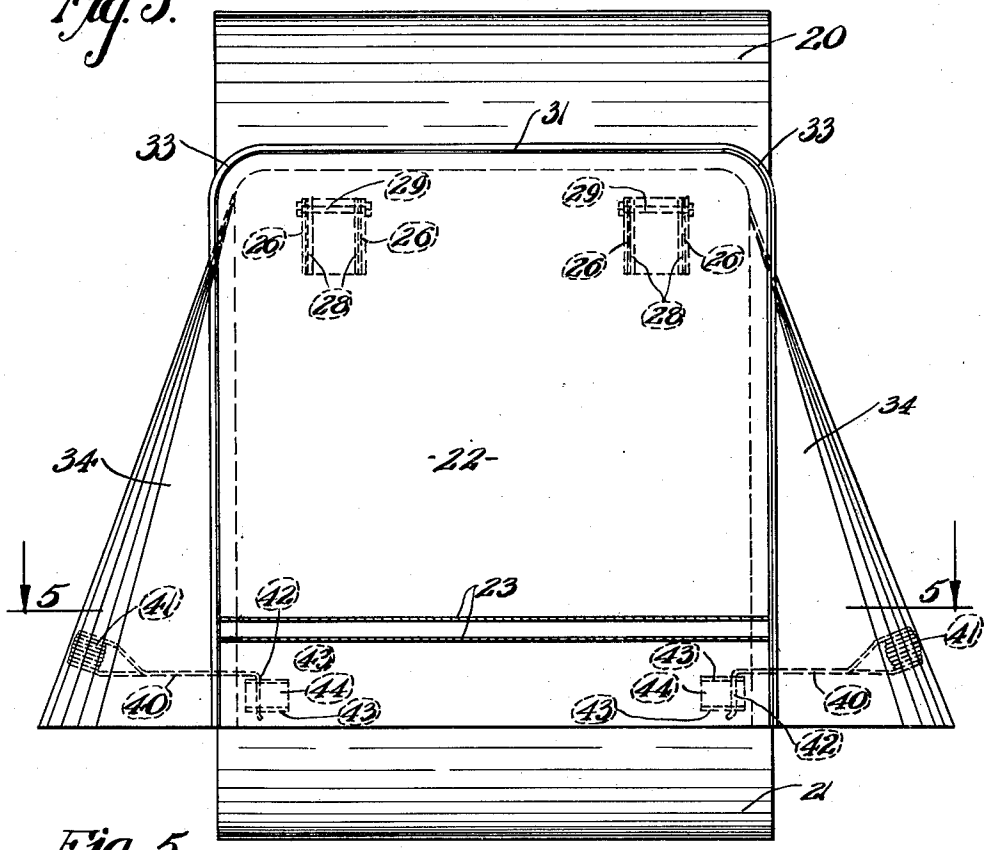
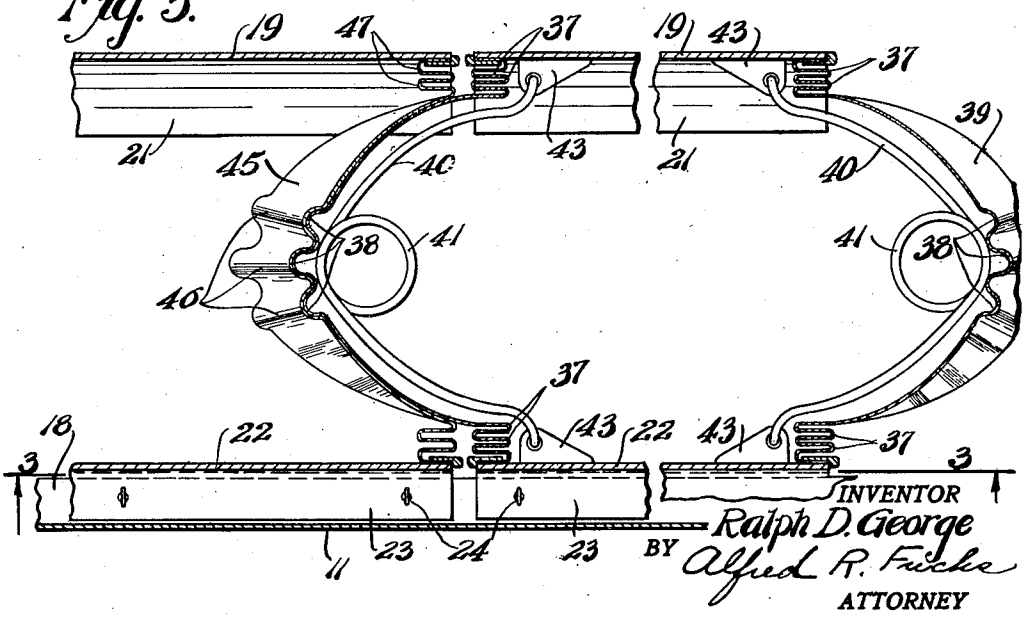


Fig. 5.



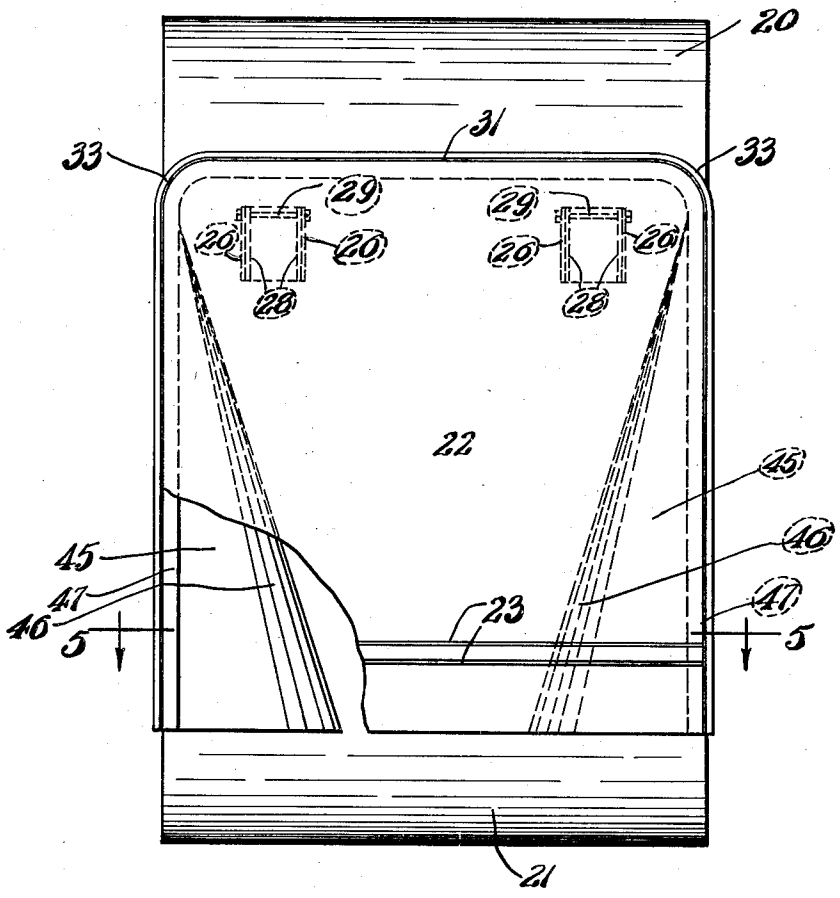
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CELLULAR SEAL FLOATING DECK TANK

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Fig. 4.



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CELLULAR SEAL FLOATING DECK TANK

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Fig. 7.

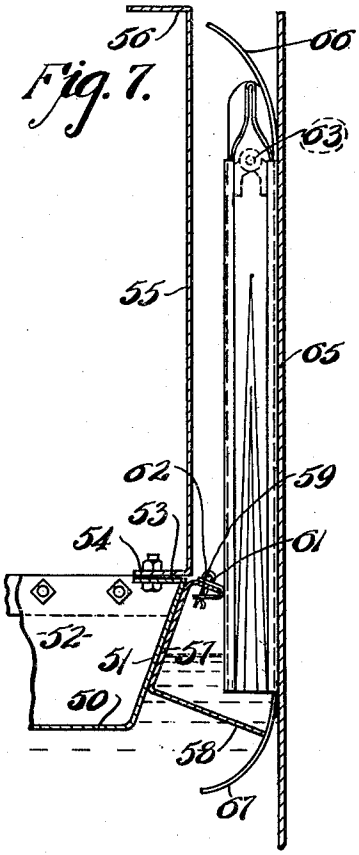


Fig. 6.

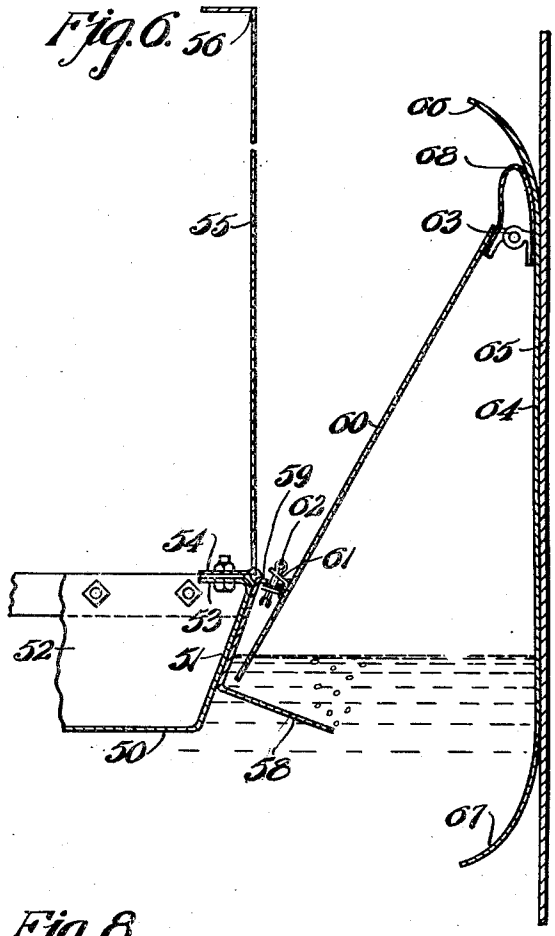
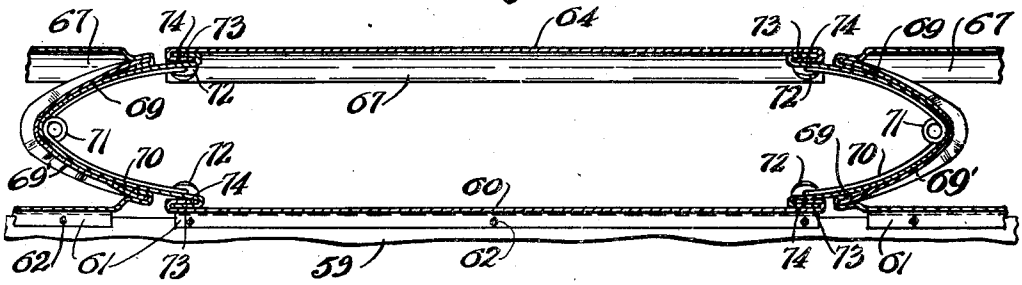


Fig. 8.



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UNITED STATES PATENT OFFICE

RALPH D. GEORGE, OF KANSAS CITY, MISSOURI, ASSIGNOR TO ANDREW A. KRAMER, OF KANSAS CITY, MISSOURI

CELLULAR-SEAL FLOATING-DECK TANK

Application filed June 14, 1928. Serial No. 285,439.

My invention relates to floating deck tanks and more particularly to the sealing means between the floating deck and the side wall of the tank. The particular sealing means forming the subject matter of this invention comprises a plurality of gas-tight cells.

It is a purpose of my invention to provide sealing means between the peripheral edge portion of a floating deck in a tank and the side wall of the tank, comprising a plurality of independent gas-tight cells. Said cells preferably each comprise a shoe portion engaging the side wall of the tank and an expansible and contractible portion extending between the deck and said shoe.

It is a further purpose of my invention to provide sealing means of the above mentioned character that is expansible and contractible to fill the gap between the deck and the tank and provide a gas tight seal between the peripheral portion of the floating deck and the side wall of the tank.

It is a further purpose of my invention to provide a seal made up of overlapping cell members that are so constructed and arranged that any one of the cell members can be removed without dismantling the whole seal, this being accomplished by providing alternating cell members that overlap the intervening cell members instead of making all the cell members alike.

It is another purpose of my invention to make each of the cells contractible and expansible independently of the others, and to so construct the same that these may be made entirely of metal, or partly of metal and partly of gas tight flexible fabric, and which are so overlapped and interfitted that said cells may each expand and contract independently to conform with the side wall of the tank and maintain the gas tight seal between the deck and the tank.

Other objects and advantages of the invention will appear as the description of the drawings proceeds. I desire to have it understood, however, that I do not intend to limit myself to the details of structure shown or described, but that I intend to include as part of my invention all such obvious changes and modifications as would occur to a person skilled in this art and as would fall within the scope of the claims.

In the drawings:

Fig. 1 is a fragmentary transverse section through one form of sealing means and the adjoining portions of the tank and deck, showing said sealing means in an expanded condition.

Fig. 2 is a similar view, showing the sealing means in a contracted position.

Fig. 3 is an enlarged side elevation of one of the male cell members, as viewed from the inner or deck side thereof.

Fig. 4 is a view similar to Fig. 3 of a female cell member.

Fig. 5 is a horizontal sectional view through a pair of adjoining cell members, the section being taken on a line corresponding to the line 5—5 of Fig. 3 and Fig. 4.

Fig. 6 is a view similar to Fig. 1 of another form of sealing means in an expanded condition.

Fig. 7 is a view similar to Fig. 2 of the form of sealing means shown in Fig. 6 in contracted condition and

Fig. 8 is a horizontal sectional view through one of the cells shown in Figs. 6 and 7 and portions of the adjoining cells.

Referring in detail to the drawings, in Figs. 1 to 4 inclusive is shown a sealing means mounted between the side wall 10 of a tank and the upstanding rim portion 11 provided on the deck 12 mounted for movement within the tank, said deck being adapted to float on the liquid in the tank. Said deck may be provided with suitable stiffening or strengthening members 13 of any desired form or arrangement. The members 13 preferably have extensions 14 thereon that extend beyond the rim portion of the deck. The deck 12 also preferably has an extension forming flange portion 15, extending beyond the rim 11, said extension serving as a gas bubble directing or deflecting portion and as stop means for the shoes as will be described below. The rim portion 11 at the lower end thereof is preferably provided with an inwardly inclined portion 16, joined to the deck by means of the flange 17. A pivot flange 18 is preferably provided on the rim portion at substantially

the point where the inclined portion 16 joins the vertical portion of said rim.

Each of the cells forming the sealing means comprises a shoe 19 engaging with the side wall of the tank and having the upper portion 20 and the lower end portion 21 curved away from the said side wall to prevent the shoes from catching on any obstructions or offsets that may exist on the tank wall. Each cell is also provided with a hanger member 22, which may be a flat sheet or plate of metal having the U-shaped channel clip or yoke 23 thereon, embracing the flange 18 and loosely hingedly connected therewith by means of the cotter pins 24. The shoes are hinged to the hanger members at the upper ends thereof by means of the hinge members 25 on the hangers having the paired ears 26 and the hinge members 27 on the shoes having the paired ears 28 cooperating with the ears 26 and connected therewith by means of the hinge pins 29.

The shoe 19 will thus engage with the side wall of the tank by the action of gravity and will be free to move toward and away from said side wall due to the mounting thereof. The bottom end of the hanger plate 22 and the bottom end of the shoe 19 extend below the surface of the liquid in the tank, the surface of the liquid being indicated by the numeral 30. The spaces between the end edges of the shoes and hanger plates and the spaces between the top edges of the shoes and hanger plates are closed by flexible means forming expansible and contractible end and top walls for said cells.

In Figs. 1 to 4 inclusive the said flexible wall portions are shown as being made of metal suitably corrugated to provide for the necessary expansion and contraction of said walls. While various arrangements of corrugations to accomplish this purpose may be provided, in the arrangement shown the top wall portion 31 of each cell is provided with a plurality of similar corrugations 32, said corrugations extending around the rounded upper corners 33 of said cells. The cells shown in Figs. 1 to 3 inclusive are the male cells, and these are provided with end walls that flare outwardly in a downward direction both endwise and sidewise to form distortable end walls of a substantially semi-conical shape, said end walls being indicated by the numeral 34. The top wall member 32 of each cell is secured to the shoe portion 19 and the hanger plate 22 by means of suitable fastening devices such as the rivets 35 and the end wall members 34 are secured in a similar manner to said shoe and hanger plate by means of rivets 36. While many arrangements of corrugations to obtain the desired flexibility may be provided, in the form of the invention shown, the end wall members 34 are provided with corrugations 37 running substantially up and down on the same adjacent the shoe and hanger plate, and with corrugations 38 adjacent the protruding middle portions thereof.

The corrugations 38 may taper both in height and width toward the top of said end walls and may also approach each other upwardly as shown in Fig. 1. The corrugations 37 and, if desired, certain of the corrugations 38 may be continuations of or align with the corrugations 32 at the upper ends thereof. Between the corrugations 38 and the side corrugations 37 the end walls are provided with uncorrugated portions 39 that are bowed outwardly. In order to hold the end walls 34 in a bowed out condition the springs 40 having the coils 41 are provided. The end portions 42 of the springs extend through openings in the ears 43 provided on the clips 44, which are mounted on the hanger plates 22 and the shoes 19.

Accordion-like cells are thus provided and said cells are gas tight. The lower ends of the wall portions 34 extend below the level of the liquid in the tank and thus seal off the surface of the liquid below each cell from the outer air and prevent escape of gas from the interior of the tank.

Alternating with the male cells described above are the female cells which are very similar in structure to the male cells, except that the end walls thereof are concave instead of convex and are not provided with any spring means to distend the same. One of said female cells is shown in Fig. 4 and the same numerals are applied to the similar parts in Figs. 3 and 4. The end walls of the female cells are indicated by the numeral 45 in Figs. 4 and 5 and have a complementary shape to the end walls 34, tapering inwardly from the upper ends thereof so that the recesses formed therein are deeper and wider toward the bottoms thereof and are of a substantially semi-conical form. Said end walls are corrugated in a similar manner to the end walls 34, as shown at 46 and 47 in Figs. 4 and 5. The corrugations 46 however project inwardly to intermesh with the corrugations 38.

The end walls 34 and 45 thus interfit and the recessed ends of the female cells overlie and engage with the projecting end walls of the male cells throughout substantially the entire extent of said end walls 34 to thus form a gas-tight joint between the cells no matter what the position thereof may be. As all the cells are expansible and contractible and as the lower ends of the shoes, hanger plates and end walls of all of the same terminate below the level of the liquid in the tank, a gas-tight seal is provided thereby between the deck and tank wall.

In Figs. 6, 7 and 8 a slightly different form of sealing means is shown, said sealing means comprising cells similar to those previously described and being mounted on the

deck in a similar manner to that described in connection with the form shown in Figs. 1 to 5 inclusive. A slightly different deck construction is also shown in Figs. 6, 7 and 8, said deck comprising a panlike portion having a bottom 50, and an outwardly inclined upwardly extending peripheral wall portion 51. Said deck is provided with any desired form of stiffening and reinforcing means 52, mounted above the bottom 50 thereof. The wall portion 51 is provided with an inwardly extending flange 53 to which is bolted or otherwise secured the base flange 54 of the upstanding rim forming channel 55 having the inwardly directed flange 56 at the top thereof. Mounted on the inclined wall portion 51 is a channel member 57 having an outwardly projecting downwardly inclined bubble directing and shoe stop flange 58. A slightly downwardly inclined short pivot flange 59 is provided at the upper end of the channel 57.

The cells shown in Figs. 6, 7 and 8 comprise male and female cell members that are arranged in alternating overlapping relation similar to those shown in Figs. 1 to 5 inclusive. Each of said cells comprises a hanger plate 60 having a substantially U-shaped channelled clip 61 thereon loosely pivotally connected with the flange 59 by means of the cotter pins 62. Connected with the hanger plates 60 by means of the hinge members 63 are the shoes 64 engaging the side wall of the tank 65. Said shoes 64 are provided with outwardly curved upper ends 66 and outwardly curved lower ends 67 and are in this respect substantial duplicates of the shoes 19 shown in Figs. 1 to 5 inclusive.

The cells in this form of the invention are provided with top closure members 68 of flexible gas-tight fabric secured to the top edge portions of the hanger plate 60 and the shoe 64, and with the end closure members 69 of gas-tight flexible fabric, secured to the members 60 and 64 by securing the edge portions 73 thereof under the inturned flanges 74 on said members. The members 69 are bowed outwardly on the male cell members and the endwise projection thereof increases from the upper to the lower portions thereof similar to that of the end walls 34. Springs 70 having the coils 71 and having the ends thereof mounted in the ears 72 and the members 60 and 64 are provided for holding the projecting end walls of the male cells in distended position. The end walls 69′ of the female cells are recessed so that the same are complementary to the end walls 69, and overlap and interfit with the same, the overlapped and interfitting arrangement of the adjoining cells being substantially the same as in the form shown in Figs. 1 to 5 inclusive. The principal difference between the two forms of cells shown is, that those in Figs. 1 to 5 are provided with flexible metallic end walls, while those in Figs. 6 to 8 are provided with end walls of gas-tight flexible fabric.

Having thus described my invention what I desire to claim and secure by United States Letters Patent is:—

1. The combination with a tank and a panlike deck movable therein of means for sealing the space between said deck and the side wall of said tank comprising a plurality of substantially gas-tight hollow cells mounted between the peripheral wall of the deck and the side wall of said tank.

2. The combination with a tank and a deck movable therein of means for sealing the space between said deck and the side wall of said tank comprising a plurality of substantially gas-tight cells having the lower ends of the walls thereof extending below the liquid level in said tank and closed at the top thereof.

3. The combination with a tank and a deck movable therein of means for sealing the space between said deck and the side wall of said tank comprising a plurality of substantially gas-tight hollow cells mounted on said deck and engaging said side wall, said cells being provided with gas confining means at the top thereof.

4. The combination with a tank and a deck movable therein of means for sealing the space between said deck and the side wall of said tank comprising a plurality of independently movable substantially gas-tight hollow cells having gas confining means at the top thereof.

5. The combination with a tank and a deck movable therein of means for sealing the space between said deck and the side wall of said tank comprising a plurality of expansible and contractible substantially gas-tight cells.

6. The combination with a tank and a deck movable therein of means for sealing the space between said deck and the side wall of said tank comprising a plurality of substantially gas-tight cells, said cells comprising overlapping male and female cells.

7. The combination with a tank and a deck movable therein of means for sealing the space between said deck and the side wall of said tank comprising a plurality of substantially gas-tight cells, said cells comprising alternating overlapping male and female cells.

8. The combination with a tank and a deck movable therein of means for sealing the space between said deck and the side wall of said tank comprising a plurality of substantially gas-tight cells pivotally mounted on said deck.

9. The combination with a tank and a deck movable therein of means for sealing the space between said deck and the side wall of said tank comprising a plurality of substantially gas-tight cells pivotally mounted on

said deck and comprising shoes engaging the side wall of said tank.

10. The combination with a tank and a deck movable therein of means for sealing the space between said deck and the side wall of said tank comprising a plurality of substantially gas-tight cells comprising members pivotally mounted on said deck and shoes pivotally mounted on said members and engaging said side wall of said tank.

11. The combination with a tank and a deck movable therein of means for sealing the space between said deck and the side wall of said tank comprising a plurality of cells comprising members pivotally mounted on said deck, shoes pivotally mounted on said members and engaging said side wall of said tank, flexible means connecting the upper portions of said members and shoes and flexible means closing the ends of said cells.

12. The combination with a tank and a deck movable therein of means for sealing the space between said deck and the side wall of said tank comprising a plurality of cells comprising members pivotally mounted on said deck, shoes pivotally mounted on said members and engaging said side wall of said tank, flexible means connecting the upper portions of said members and shoes and flexible means closing the ends of said cells, said last mentioned means on adjoining cells interfitting and overlapping to provide a tight joint between adjoining cells.

13. The combination with a tank and a deck movable therein of means for sealing the space between said deck and the side wall of said tank comprising a plurality of cells comprising members pivotally mounted on said deck, shoes pivotally mounted on said members and engaging said side wall of said tank, flexible means connecting the upper portions of said members and shoes and flexible means closing the ends of said cells, said last mentioned means on alternate cells projecting endwise therefrom and on the cells alternating therewith being recessed and overlapping said projecting means.

14. The combination with a tank and a deck movable therein of means for sealing the space between said deck and the side wall of said tank comprising a plurality of cells comprising members pivotally mounted on said deck, shoes pivotally mounted on said members and engaging said side wall of said tank, flexible means connecting the upper portions of said members and shoes and flexible means closing the ends of said cells, said last mentioned means on alternate cells projecting endwise therefrom and on the cells alternating therewith being recessed and overlapping said projecting means, the cells having the projecting means being provided with resilient means tending to hold the projecting means distended.

15. The combination with a tank and a deck movable therein of means for sealing the space between said deck and the side wall of said tank comprising a plurality of interfitting overlapping substantially gas-tight cells.

16. The combination with a tank and a deck movable therein of means for sealing the space between said deck and the side wall of said tank comprising a plurality of substantially gas-tight cells and means on said deck for directing gas toward said cells.

17. The combination with a tank and a deck movable therein having a peripheral wall of means for sealing the space between said deck and the side wall of said tank comprising a plurality of substantially gas-tight cells mounted on said deck and comprising shoes engaging said side wall, and means projecting beyond the peripheral wall for limiting the movement of said shoes toward said deck.

18. The combination with a tank and a deck movable therein of means for sealing the space between said deck and the side wall of said tank comprising a plurality of expansible and contractible substantially gas-tight cells and means on the deck for limiting the contraction of said cells.

19. The combination with a tank and a deck movable therein of means for sealing the space between said deck and the side wall of said tank comprising a plurality of independent substantially gas-tight chambers having closed top portions and comprising members pivotally mounted on said deck and shoes pivotally mounted on said members and engaging said side wall of said tank by the action of gravity.

20. The combination with a liquid storage tank and a deck movable therein, of means for sealing the space between said deck and the side wall of said tank comprising a plurality of substantially gas tight hollow members between said tank and deck and having open bottom portions extending into the liquid in said tank and being otherwise closed to provide gas confining sealing means.

21. A sealing member of the character described comprising an inverted hollow chamber having flexible end and top wall portions whereby said chamber may be expanded and contracted.

22. The combination with a liquid storage tank and a deck movable therein, of means for sealing the space between said deck and the side wall of said tank comprising a plurality of substantially gas tight inverted hollow chambers arranged in a circular series between said deck and tank.

In testimony whereof, I hereunto subscribe my name this 18th day of May, 1928.

RALPH D. GEORGE.