March 12, 1946. T. ASTON 2,396,226

FLOATABLE SUBSTRUCTURAL CAISSONS AND THE LIKE

Filed Sept. 5, 1944

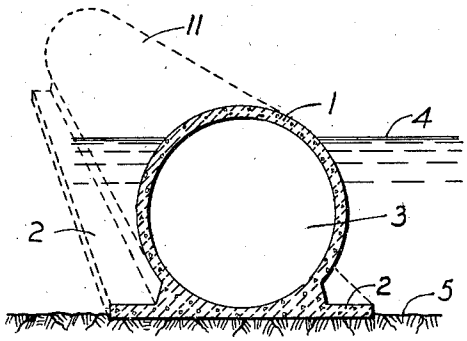


FIG. 1

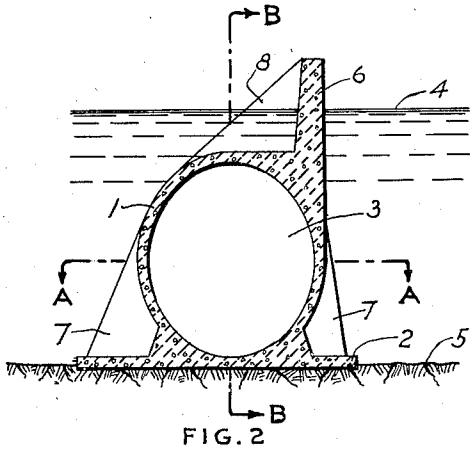


FIG. 2

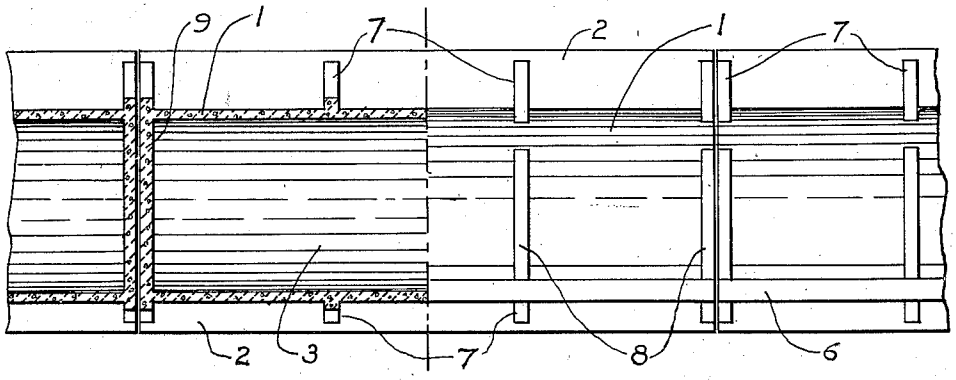


FIG. 3

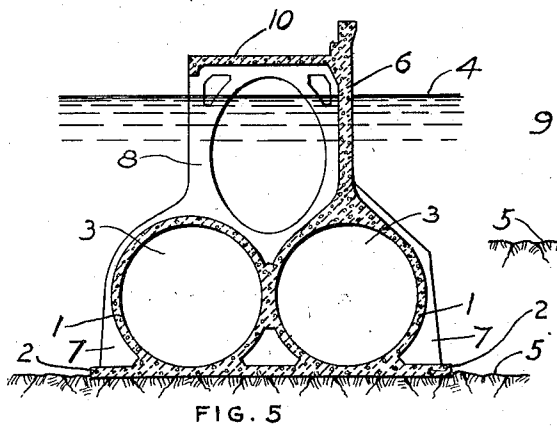


FIG. 5

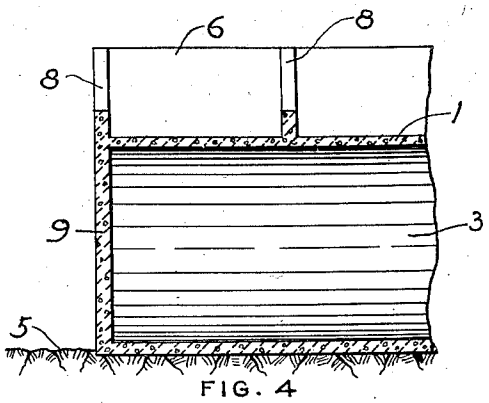


FIG. 4

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Patented Mar. 12, 1946 2,396,226

UNITED STATES PATENT OFFICE

2,396,226

FLOATABLE SUBSTRUCTURAL CAISSONS AND THE LIKE

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Application September 5, 1944, Serial No. 552,722

3 Claims. (Cl. 61—46)

This invention relates to improvements in floatable caissons with substructural horizontally disposed substantially cylindrical cells, for use in breakwaters, bulkheads, wharf walls, piers, and dam-like structures, to be placed on a subaqueous foundation.

The object of this invention is to provide a caisson substantially cylindrical cell substructure as herein described to be disposed longitudinally and horizontally and paralleling the ground foundation upon which it would be placed; to be supported on a base in order to provide added stability to the cell, and to afford less tendency of the caisson to tilt.

A further object is to provide a caisson in which the cylindrically shaped cells, being laid in a horizontal position, are thus more resistant to horizontal bending strains than connected vertically disposed cylinders would be. In this connection, where a line of vertical and connected cylindroids were placed on the ocean bed at Santa Monica, California, the structure broke in two. In this instance a horizontally disposed cylinder of equal diameter and of equal length of structure would have possessed a greater resistance to fracture due to bending strain.

A still further object is to provide a caisson structure in which horizontally disposed substantially cylindrical cells will be placed in end to end units, each cell unit to have end walls in order that the cells may be enabled to retain a fill to give added weight to the substructure.

Another object is to provide a caisson structure in which—in addition to the substructural horizontally disposed substantially cylindrical cells and their bases—added height having been gained by a lighter superstructure being placed above the cells, the center of gravity of the whole structure is thus kept lower, by reason of the heavier horizontally disposed substantially cylindrical cells having been placed beneath said superstructure, than it would be in vertically disposed cylinders which extend into both the substructure and the superstructure. I am aware that vertically disposed and connected cylindrical cells have been used for concrete caissons extending up to the top thereof, but my horizontally disposed cells would provide a structure having a lower center of gravity; whilst comparative designs and estimates have shown a lesser quantity of concrete and lesser cost, with fewer cross walls and connections and less complicated construction and in the horizontal cell type, than in rows of vertically disposed and connected cylinders designed for analogous purposes.

A further object is to provide substructural substantially cylindrical cells in a floatable caisson that can be prefabricated and used in a horizontal position on a base resting upon a ground foundation.

Another object is to provide a horizontally disposed substantially cylindrically shaped cell structure possessing inherent resistance to external and internal pressure, so that internal strutting and bracing is not required.

Another object is to provide a horizontally disposed caisson substructural substantially cylindrical cell that can be refloated by pumping out filled material from within the cell, preferably through openings in the cell top.

My invention possesses other advantageous and novel features, some of which, with the foregoing, will appear in the following description where I shall outline selected forms of my invention for illustration in the drawing accompanying and forming a part of the present specification. In said drawing I have shown three forms of caisson embodying my invention, and in the specification I have described one method of fabricating and placing the caisson, but it is to be understood that I do not limit myself to such form or method, since my invention as set forth in my claims may be embodied in a plurality of forms and constructed by a plurality of methods. It is further to be understood that by my use of the terms cylinder and cylindrical herein that a cylindroid—i. e., nearly approaching a cylindrical shape, is also contemplated by use of the term cylinder, as I do not limit myself to a truly cylindrical shape either on the inside or outside surface of the horizontally disposed cell; my main object being to be free to obtain a ring action in some adaptations and a substantially arch action in others. It may also be contemplated to make the cells in other cases elliptical and ellipsoidal; provided that their horizontally placed internal length may exceed their internal height or width, as said terms cylinder and cylindrical in my descriptions and claims are used for convenience to cover, and are to be understood to also apply to any of the aforementioned cross sectional forms of horizontally disposed substructural cells so as to obtain a lower center of gravity in a floatable caisson structure, and also to provide a more economical and stable form of caisson structure to serve a desired end. However, the nearer the cells approach a true cylindrical shape and form then thinner walls may be used for like ends, and

hence a more economical result would be attained.

More than one line of horizontally disposed cells may be used side by side, and laterally connected. When my horizontally disposed cells and their connected superstructure have been placed in position, with a filling medium in the cells, it is readily apparent that the center of gravity of the whole caisson structure would be lower than a caisson of filled vertical and connected cylinders of equal diameter and extending to the top of the caisson structure, or to a higher level than the top of the horizontal cells.

It will also be apparent that only one internal form will be required in molding concrete around a horizontally disposed substantially cylindrical cell, whilst in a similar length consisting of a multiple of connected vertical cells a multiple number of internal forms will be required.

The center of gravity in my horizontally disposed cylindrical cellular caisson being lower than in vertically disposed cylinder types, then the width and weight of my caisson structure may thus be reduced, allowing therefore for a decrease in cost by reason of being enabled to use lesser quantities of material to accomplish a like end. My floatable caisson may be fabricated prior to floating it to its position on its subaqueous foundation; this constitutes an advantage.

In the accompanying drawing I have shown some alternate methods by which my invention may be applied: in one of these I show a primary form of my horizontally disposed cell and base; in another I show a primary form with a connected seawall superstructure; and in another I show a more complete structure comprising—in addition to two substructural horizontally disposed cylindrical cells arranged and connected side by side—a breakwater type superstructure consisting of a seawall and deck supported by transverse supports, resting upon and connected to the substructure. However, as aforesaid, I do not limit myself to these particular forms and methods in applying my invention:

Referring to said drawing:

Fig. 1 is a transverse section of a primary form of floatable caisson, having a substructural horizontally placed substantially cylindrical cell and base, and showing also—by dotted lines—an outline perspective extension of the structure.

Fig. 2 is a transverse section showing a substructural horizontally disposed substantially cylindrical cell and base with buttress supports, and a superstructural connected seawall with counterfort supports.

Fig. 3 shows a closed end unit and part units of Fig. 2 with joints between the units. On the right of the vertical dotted line is a plan view on top of the structure, and on the left is shown a sectional plan taken through A—A on Fig. 2.

Fig. 4 is a part vertical longitudinal section of one end of the cylinder structure taken through B—B on Fig. 2.

Fig. 5 is a transverse section of a typical floatable caisson breakwater incorporating my substructural horizontally disposed substantially cylindrical cells and base with a connected superstructure consisting of a seawall and deck supported by and connected with a transverse walling, which would be placed at desired intervals; buttresses are also shown to act as an added support to the substructure.

With further reference to the drawing: 1 represents a horizontally disposed substantially cylindrical cell composed of walls of selected thicknesses; in Fig. 5 two connected horizontally disposed substantially cylindrical cells 1, 1 are shown.

2 is a base resting upon the subaqueous ground surface foundation and serves to support 1 thereon.

3 is the space within the substantially cylindrical cell, and which may be filled with a selected medium to give added weight to the substructure.

4 represents a water surface, which may vary in height above or below the top of the caisson structure.

5 is the subaqueous ground surface foundation upon which the caisson structure will rest when sunk into position.

6 is a sea wall connected to the top of the horizontally disposed substructural substantially cylindrical cells.

7, 7 are buttresses supporting the horizontally disposed cell upon the base 2.

8, 8 are supports for the sea wall against lateral pressure; and may also be used as supports for a deck—as in Fig. 5.

9 is one of the two end walls of the horizontally disposed substantially cylindrical cell 1, and which serve—together with the cell walls—to retain a filling medium within them.

10 is a deck supported by 8—in Fig. 5.

11, in Fig. 1, indicates in dotted outlines a perspective extension of the horizontally disposed substantially cylindrical cell and its base.

The desired filling medium might be inserted through holes in the top of the substructural substantially cylindrical cells—these holes are not shown on the drawing. The floatable substructural caissons may be made of any desired material or combination of materials, but concrete—preferably reinforced—would be deemed preferable. After prefabricating the floatable caissons and floating them over their position in the work, water may then be placed in the horizontally disposed substructural cells thus causing them to sink on to their subaqueous ground foundation: later it may be found desirable to displace the water with a heavier medium—such as sand. The separate elements in my drawing and specification constituting the floatable caisson are shown and deemed to be prefabricated into one integrated floatable structure, except that a part of the structure that will remain above water level may—if desired—be molded on to the prefabricated substructure after the latter has been sunk on to its foundation.

One of the purposes for which my invention may be used would be that of a breakwater to provide a "wave break" to intercept waves, and that would also—where the top of the caisson structure was submerged or close to the water surface—cause said waves to break over said top and thus reduce their height inshorewards. My invention may also be used as a floatable bulkhead; also as a floatable wharf wall, and as a floatable pier. Where used as a floatable wharf caisson—or as a bulkhead—a filling medium might be placed on the side of the caisson remote from the water face. Standard protective measures may be used—if required—to prevent any erosion that may be anticipated at the base of the caisson structure due to currents or wave action. The words "circular cell" in my claims are understood to refer to and are to be considered synonymous with the words "cylinder" and "cylindrical cell" in my description.

Having thus described my invention, what I claim is:

1. A prefabricated integral floatable caisson structure adapted to be floated into position and to be sunk in place to form a foundation for a marine structure comprising a horizontally extending substantially circular cell construction having walls of substantially uniform thickness and closed ends, said cell being of greater length than diameter and having attached to the bottom thereof and coextensive with the length thereof a laterally extending base of a width in excess of the external diameter of the cell.

2. A structure as defined in claim 1 having a superstructure integrated therewith, said superstructure being in the form of a vertically extending sea wall.

3. A prefabricated integral floatable caisson structure adapted to be floated into position and to be sunk in place to form a foundation for a marine structure comprising horizontally extending substantially circular cells in side by side relationship and having walls of uniform thickness and closed ends, said cells being of greater length than diameter and having attached to the bottom thereof a base extending laterally beyond the projected area of said cells.

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