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[54] FLOATING PLATFORM
10 Claims, 8 Drawing Figs.

[52] U.S. Cl. 114/0.5
[51] Int. Cl. B63b 35/00,

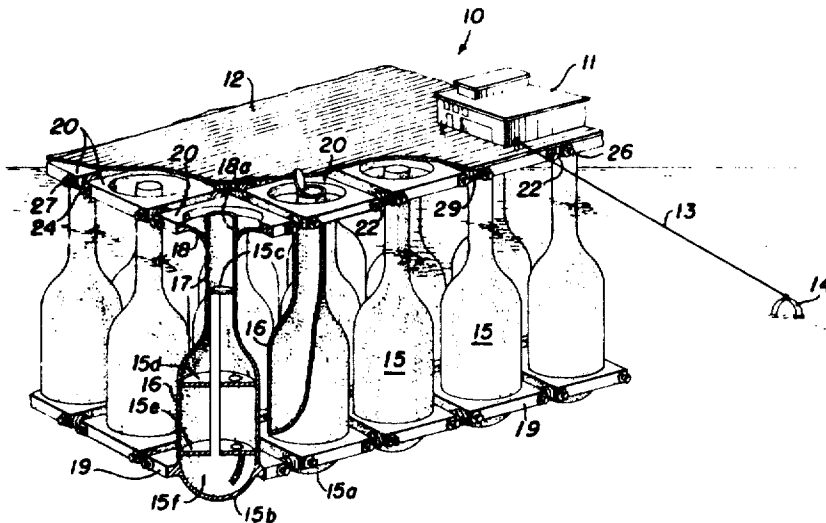
[50] **Field of Search**..... B63b 35/44
114/0.5, 0.5
F, 0.5 D, 43.5; 220/9

[56] **References Cited**

UNITED STATES PATENTS

3,246,476	4/1966	Wolff	114/0.5 X
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ABSTRACT: A flotation structure in the shape of an elongate bottle is cast in concrete as well as are sets of prestressed rods disposed at opposite ends of the structure. A plurality of such structures is joined together in sets by coupling devices provided at opposite ends of the prestressed rods to yield a highly stable floating platform since the center of buoyancy is well below surface wave turbulence. The necks of the bottle-shaped flotation structures have reduced cross-sectional area to minimize the possibility of an adverse reaction to surface wave action, e.g., rolling or heaving reactions within each flotation structure enables a selective shifting of ballasts to facilitate launching and alignment when several structures are joined together without requiring any elaborate support facilities. Sets of flotation structures are hinged together to form runways or include spaces vacant of flotation structures to form dry docks or reduced capacity platforms.



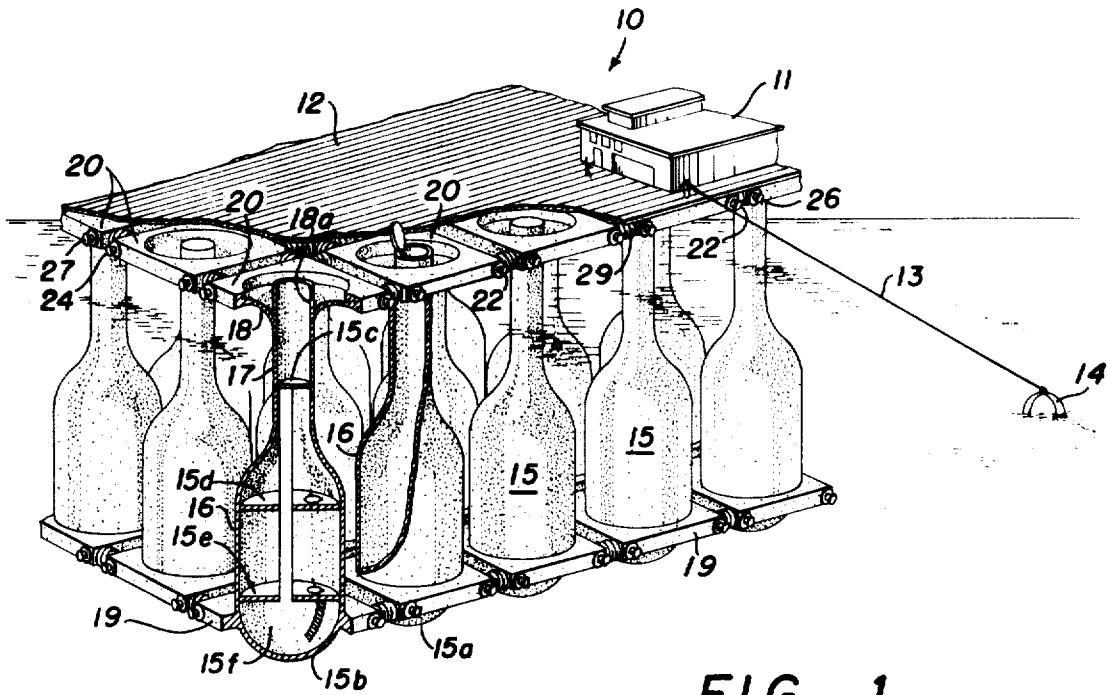


FIG. 1

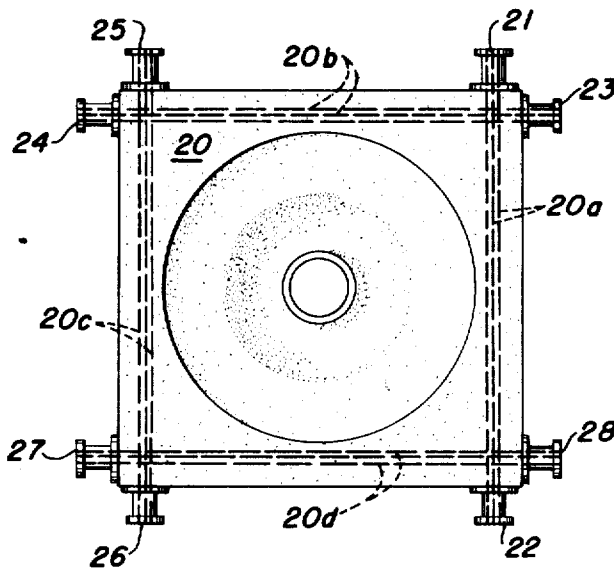


FIG. 2

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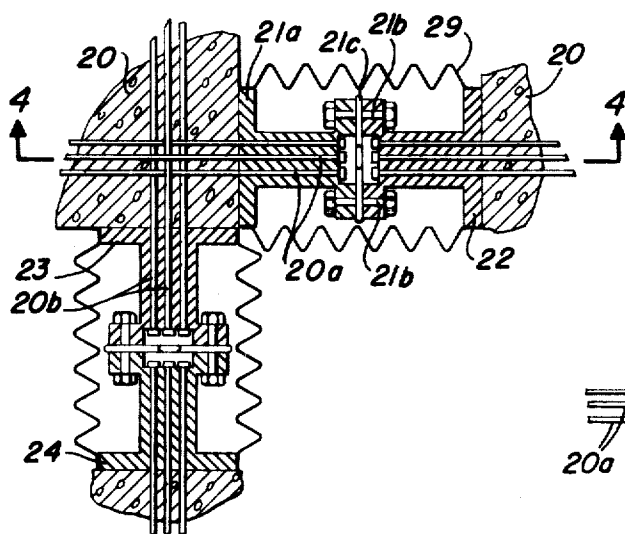


FIG. 3

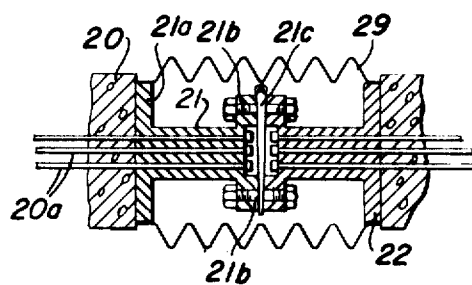


FIG. 4

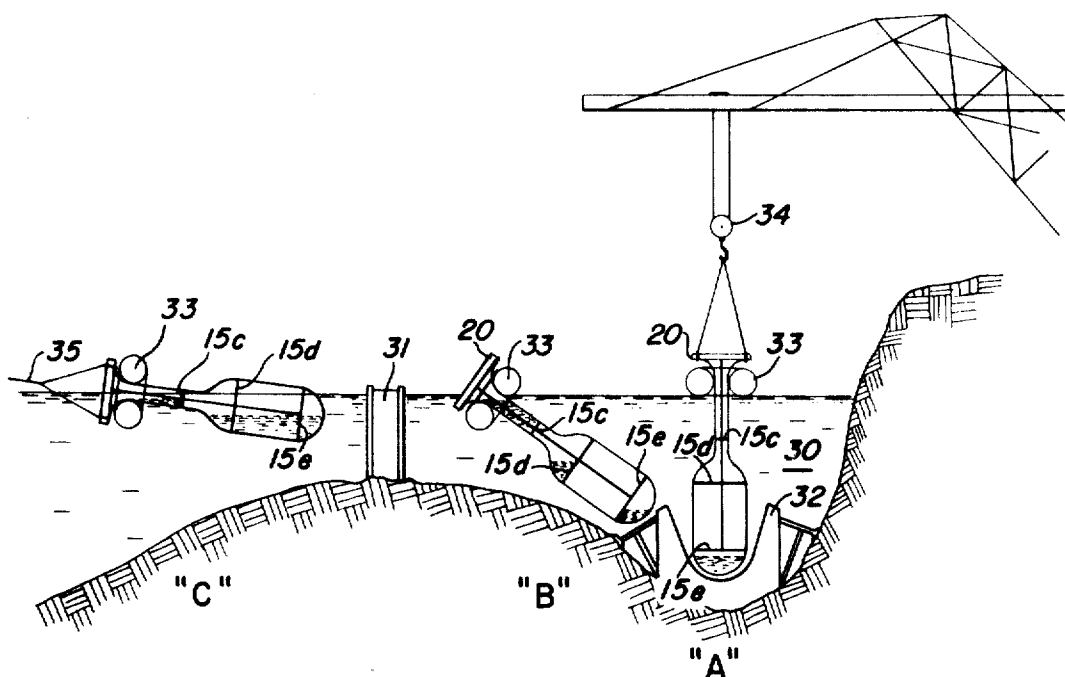


FIG. 5

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FIG. 6

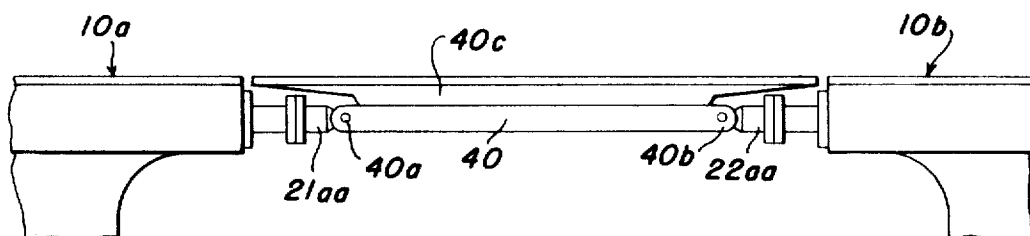


FIG. 7

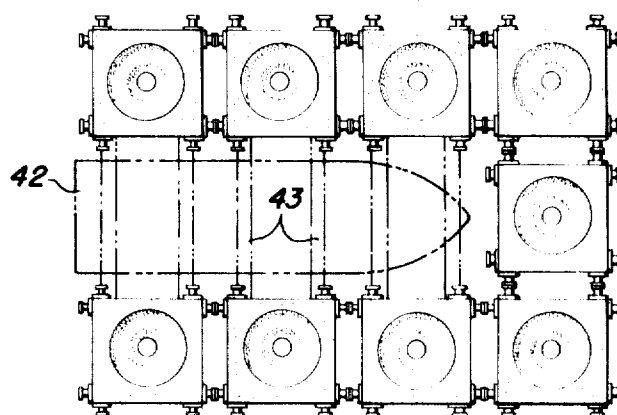
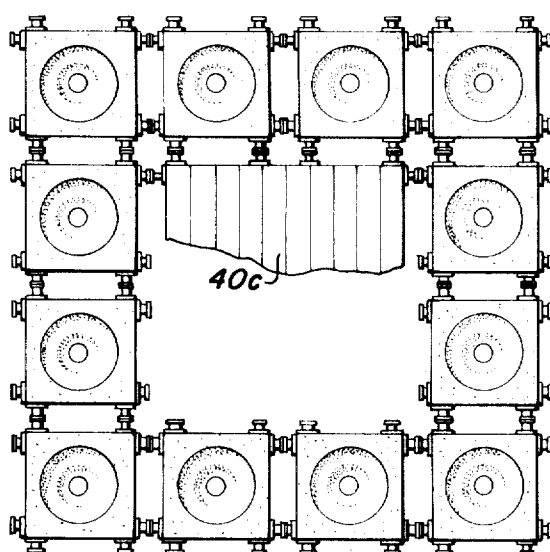


FIG. 8

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FLOATING PLATFORM

STATEMENT OF GOVERNMENT INTEREST

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

BACKGROUND OF THE INVENTION

Contemporary oceanographic floating platforms are usually either one of two types, namely, platforms having elongate cylindrical tanks extending a considerable distance into the water or platforms of the floating barge type. From a performance standpoint, the floating barges present a relatively large water plane area at and slightly below the surface of the water where wave action and similar turbulences are most prevalent. The turbulences cause a rolling, pitching and yawing reaction rendering the barges unsatisfactory for most operations where stability is paramount. The elongate cylinder floating platforms, while having a lesser water plane area at the surface wave area, are still found to adversely react to wave action and are unsatisfactory for offshore operations demanding platform stability. In addition, the elongate cylinder types are currently constructed of costly welded steel sections that are vulnerable to their corrosive environment.

SUMMARY OF THE INVENTION

The present invention is directed to providing a flotation platform for diminishing its reaction to surface wave action and turbulence and is formed of a plurality of elongate wine bottle-shaped flotation structures cast of a homogeneous unitized material, such as concrete, including a lower and upper prestressed sections for interconnecting adjacent such flotation structures. Thusly provided, an inexpensive structure ensures a minimal adverse reaction to surface wave turbulence since the neck portion extending through the area of surface wave turbulence is of small cross-sectional area.

An object of the invention is to provide a unitized flotation module rapidly constructed at a low construction cost.

Another object is to provide a platform minimizing the unstabilizing effects of surface wave turbulence.

Yet another object is to provide a rugged platform constructed of concrete that is highly resistant to corrosion and weathering.

Another object is to provide a floating platform constructed from a plurality of buoyantly independent, bottle-shaped modules.

A further object is to provide a method of launching elongate concrete flotation modules.

Still another object is to provide a plurality of separate bottle-shaped modules capable of being connected as a floating airstrip or dry dock.

These and other objects will readily become apparent from the ensuing description when taken with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a isometric view of the invention operatively disposed.

FIG. 2 is a top view of an upper connecting collar.

FIG. 3 is a sectional top view of a pair of couplings.

FIG. 4 is a sectional side view of a coupling connection generally taken along lines 4-4 in FIG. 3.

FIG. 5 depicts a launching sequence.

FIG. 6 shows a side view of a connecting hinge joining two platforms.

FIG. 7 is a top view of a platform having spaces vacant of flotation modules to form a floating dry dock.

FIG. 8 is a top view of a platform having a reduced lift capacity.

PREFERRED EMBODIMENTS OF THE INVENTION

Referring now to the drawings, a representative offshore floating platform 10 basically consists of superstructure elements 11 resting on a planar deck section 12 supported by a plurality of bottle-shaped flotation modules 15. Although the platform optionally is employed in a free floating manner, anchoring lines 13 extending to remotely located buoys 14 are usually included to hold the platform in one position.

Designing and constructing a platform, using bottle-shaped flotation modules, is performed with great flexibility since the modules are added to or taken away from a platform increasing or decreasing its lift capabilities and stability as the situation demands.

Each of the flotation modules is cast in concrete according to conventional methods using reusable internal and external forms. Greater lateral and longitudinal strength is provided when wire mesh or reinforcing rods are embedded in the concrete although their inclusion is essential only from an increased strength of materials standpoint. In appearance, the bottles take the form of a long-necked wine-bottle having a spacious lower portion 16 sized to displace enough water to create a buoying force greatly in excess of the weight of the cast module. The lower portion communicates directly with an upper or neck portion 17 terminating in an outer flared portion 18.

Integrally cast with the lower, upper, and outer portions is a pair of stress collars, a lower stressed connecting collar 19 and an upper stressed connecting collar 20. Provision is made in the external casting molds for tensilely stressing a plurality of sets of rods according to well known techniques. Here a representative set is depicted in an upper stressed connecting collar 20 having sets of prestressed rods 20a, 20b, 20c, and 20d terminating at opposite ends in flanged couplings 21 and 22, 23 and 24, 25 and 26, and 27 and 28, respectively.

The connection between two adjacent flotation modules is shown in FIGS. 3 and 4 by coupling 21 and its adjacent, opposed coupling 22. Each coupling, serving as an example, consists of a coupling 21 of a large bolting flange having a base portion 21a functioning as a bearing surface for its associated set of prestressed rods 20a. The adjacent, opposed flange couplings are secured together by a plurality of circumferentially disposed bolts 21b inserted and secured through holes drilled in their opposed flanges. Opposed surfaces of the adjacent opposed flanged couplings are shaped to define a wedge-shaped volume into which a spacer wedge 21c is placed when the couplings are bolted together, the purpose of which will be set out below.

Protection from corrosion caused by salt water and salt air is ensured by encasing the flanged couplings in a bellowslike enclosure 29 filled with a corrosion inhibiting agent such as oil. Because oil is relatively noncompressible, an enclosure protecting the couplings associated with lower stressed connecting collar 19 need not be pressurized.

As noted before, each of the flotation modules is essentially bottle-shaped with the upper neck portion flaring out to form an aperture in the upper stressed connecting collar, although an inner passageway 18a for facilitating the transfer of men and supplies is optionally provided. By flaring outwardly and upwardly in convexly conically form, the weight of their bulk and the supported load on deck hold outer flared portion 18 and neck portion 17 in compression. Since concrete is well known for its ability to bear heavy compressive loads, being so shaped enables each module to transfer a considerable buoying force without risking the possibility of failure.

The lower stressed connecting collar, having its concrete held in compression by sets of prestressed rods, is joined to buoying lower portion 16 by a circular ring of concrete held in compression to provide points of juncture with other modules without transferring tensile forces to the lower portion since the prestressed rods would absorb such forces. Being thusly constructed, it is apparent that if a single flotation module were placed in the water, whether loaded or not, substantially

all of the forces acting on the module would be of a compressive nature.

Looking to FIG. 1 of the drawings, two types of flotation modules are shown, 15a depicting a module totally hollow and, a compartmented module 15b, depicting a module with internal water tight dividers 15b, 15c, and 15d.

The advantage of compartmenting a module is twofold namely compartmentation provides convenient storage space for personnel, petroleum products, supplies, etc., as well as providing a ballasting chamber 15b to which water is flooded or evacuated in accordance with ocean conditions or varying loads. Surface leading pipes and conduits, not identified by reference characters for the sake of simplicity, extend upward from the internally formed compartments through the outer-flared portion to communication with the surface and form a means for transferring ballasting water and supplies as desired.

The second advantage of having a compartmented flotation module, such as 15b, becomes apparent when the module is launched.

In order to produce a sufficient buoyant force for a floating platform, each module has a lower portion of considerable bulk. To avoid surface wave action the neck portion is of considerable length and consequent weight. By way of example, flotation modules approximately 200 feet in length with the connecting collars being 50 feet across, are cast of approximately 1000 cubic yards of concrete. Casting an integral flotation module must necessarily be performed by inner and outer molds oriented to form a vertically standing module.

In FIG. 5, the casting operation is most suitably accomplished by blasting and removing rock from a cut 30 near a body of water. The bottom of the cut is considerably below the water level approaching the length of the module. Material adjacent the casting cut is a nonporous rock that cooperates with a relatively shallow drydock gate 31 to keep water from within the casting cut.

After a module is cast and held in its upright position by an external bracework 32, a donut-shaped float 33 is placed around outer flared portion 18, and a stabilizing overhead crane support 34 is connected to upper stressed connecting collar 20. With the module in the vertical position, water ballast is pumped into the ballast chamber 15f while the other chambers formed between the internal watertight walls 15c, 15d, 15e are dry.

The casting cut is flooded and the module floats as shown in position "A."

Shifting the module to position "B" involves pumping a portion of the ballasting water from ballasting chamber 15f into the chamber formed between watertight walls 15c and 15d. At this time, the donut-shaped float 33 begins to exert a vertical force to counteract a downward force created by the weight of the flooded outer flared portion and the upper stressed connecting collar. The counteracting forces provided by these downward weights and the buoying force of the donut-shaped float are predetermined to ensure that excessive sheer and tensile forces are not created that could tear apart the flotation module. Releasing crane assembly 34 from the module and attaching a line 35 to a remotely located winch or ship allows withdrawal of the module from the casting cut and through the now-opened drydock gate.

However, first the module must be further rotated to a near horizontal position to allow its passage through the relatively shallow gate 31. More ballasting water is pumped from ballasting chamber 15f to the chamber formed between internal watertight walls 15d and 15e while a portion of the ballasting water disposed in the chambers between internal watertight walls 15c and 15d is evacuated eliminating the creation of lateral torsional forces which would tend to separate the base from the neck portion. Upon rotating the module to its side as shown in position "C," the module is towed through the gate to a distant deep water location whereat the flooding process is reversed and the module is counterrotated to an upright position.

The drydock gate is closed, the water is evacuated from the cut, and the scene is set for casting another flotation module.

Modules are joined together to form the substructure for a floating platform by maneuvering the vertically oriented modules to place their respectively associated flanged couplings in contact with each other. Bolts 21b are inserted through holes in the adjacent flanged couplings, FIGS. 3 and 4, and adjacent modules are joined together with a spacer wedge 21c inserted between the bolted couplings. The spacer can be one of several shapes, that is, it could be nothing more than a shim to make up for routine irregularities existing among the mass produced modules or a spacer can be wedge-shaped to expedite the removal of a ruptured flotation module from a platform.

An appropriate arrangement of hydraulic jacks and/or block and tackle arrangements are arranged to raise the damaged module to take the pressure off bolts 21b joining the damaged flotation module to adjacent intact flotation modules. Removing spacer wedge 21c creates a sufficient space between flanged couplings to allow lowering the damaged module via guide rails, etc. past adjacent modules' upper and lower-stressed connecting collars. Once the damaged module is below the other modules, it is released and another module is put in its place either by successively shifting adjacent modules into the space formerly occupied by the ruptured module or by buoying a flooded module into the vacant space.

Noting FIG. 6, adjacent platforms 10a and 10b are joined together by a plurality of sets of hinges 40 having ends 40a and 40b pivotally connected to pivot carrying couplings 21aa and 22aa. The sets of hinges allow independent motion by adjacent platforms to eliminate an undue longitudinal torque transmittal through the length of several platforms. Deck sections 40c extending between long lengths of joined platforms are easily placed to form a stable floating airstrip.

Individual platforms having spaces vacant of flotation modules are easily assembled by merely not including individual modules, see FIG. 7 and FIG. 8. Selectively flooding and evacuating the modules lowers and raises the platform to lift a ship 42 from the water for repairs when a supporting cradle 43 is provided.

When center modules are removed and elongate cross decking 12a is provided, a platform having a reduced lift capacity is produced formed of fewer modules while retaining a high degree of stability, such as is required by helicopters on an offshore landing pad.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings and it is therefore to be understood that within the scope of the disclosed inventive concept, the invention may be practiced otherwise than as specifically described.

What I claim is:

1. A flotation structure for diminishing the effects of surface wave action comprising:

an elongate bottle-shaped chamber cast of concrete and formed to include,

a first portion having a cross-sectional area disposed and sized for defining a center of buoyancy below said wave action and,

a second portion defining the neck of said bottle-shaped chamber integrally extending therefrom through and above the area of said wave action having a fractional said cross-sectional area;

lower connecting means carried adjacent said first portion including a plurality of prestressed members mounting coupling means attached on their opposite ends; and

upper connecting means carried adjacent said second portion including a plurality of prestressed members mounting coupling means attached on their opposite ends, said lower and said upper connecting means also cast in said concrete thereby forming an integral said flotation structure.

2. A structure according to claim 1 further including:

a plurality of flotation structures each having a coupling means carried on its lower connecting means and on its upper connecting means oriented for interconnection to

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adjacent elongate bottle-shaped chambers to form a stable platform.

3. A structure according to claim 1 in which the neck-shaped portion is shaped with a convex-conically flaring outer portion.

4. A structure according to claim 3 in which each said lower and said upper connecting means is a square-shaped stress collar provided with a center area configured to encompass a lower portion of said bottle-shaped chamber and said flaring outer portion, respectively.

5. A structure according to claim 4 in which said prestressed members are four sets of prestressed reinforcing rods each set cast within a separate side of said stress collar for maintaining same in compression.

6. A structure according to claim 5 in which said coupling means is a bolting flange connected to said rods in a prestressing relationship.

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7. A structure according to claim 6 further including:

a plurality of said elongate chambers each having said lower connecting means and said upper connecting means and being oriented for interconnecting opposed bolting flanges to form a stable platform.

8. A structure according to claim 7 further including a surface deck disposed on said upper connecting means.

9. A structure according to claim 8 further including;

a plurality of the stable platforms, and

a plurality of sets of hinges, each set joining adjacent said stable platforms.

10. A structure according to claim 7 in which spaces are provided vacant of said elongate chambers in said stable platform to form a floating drydock and reduced lift capacity platform.

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