United States Patent [19]

Mo

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[54] **STORAGE-VESSEL**

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[52] **U.S. Cl.** ..... **114/.5 T**
[51] **Int. Cl.** **B63b 35/44**
[58] **Field of Search** ..... 114/.5 T, .5 F, 74 A; 61/46.5

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[57] **ABSTRACT**

A semi-submersible vessel for loading, storing and transporting liquid has a main hull which lies on the sea bed during loading, unloading and storing of the liquid. This hull is airtight and divided into cargo compartments having outer walls formed as portions of cylindrical shells. A slim superstructure including columns is rigidly connected to and extends upwardly from the main hull and supports a deck structure. The center of gravity of the vessel is always below the center of buoyancy thereof to provide the vessel with a total weight and a weight stability enabling it to rest on the sea bed without anchors, moorings or the like.

4 Claims, 5 Drawing Figures

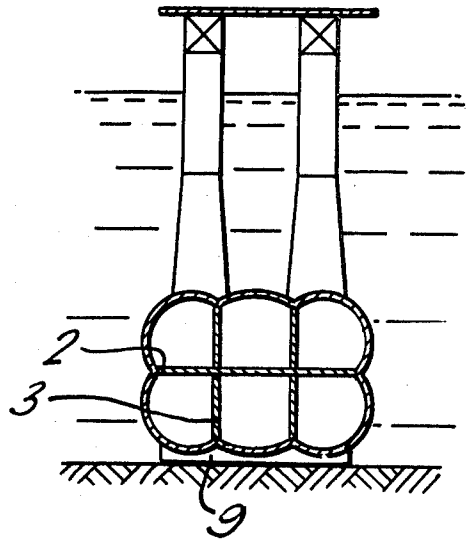


FIG. 1.

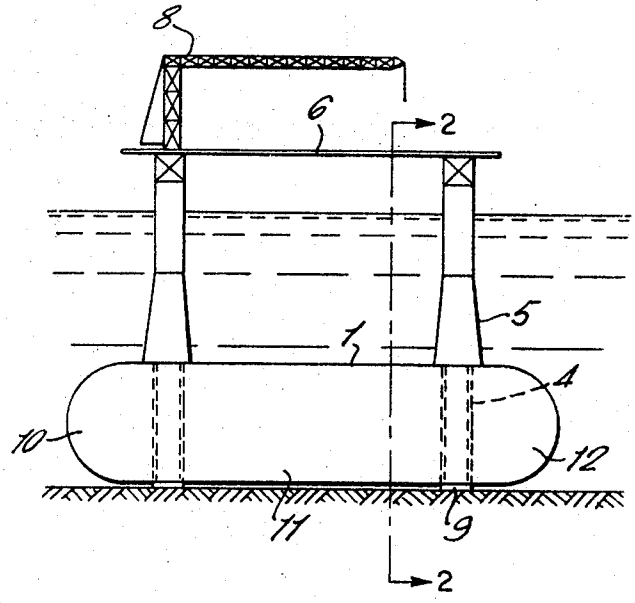


FIG. 2.

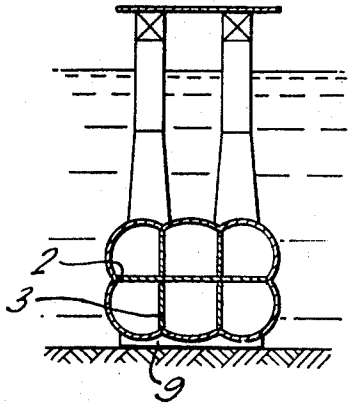


FIG. 3.

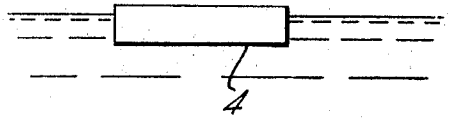


FIG. 4.

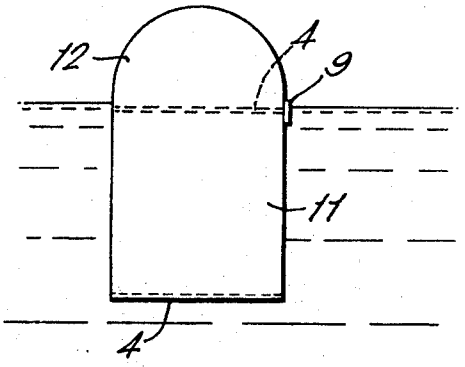
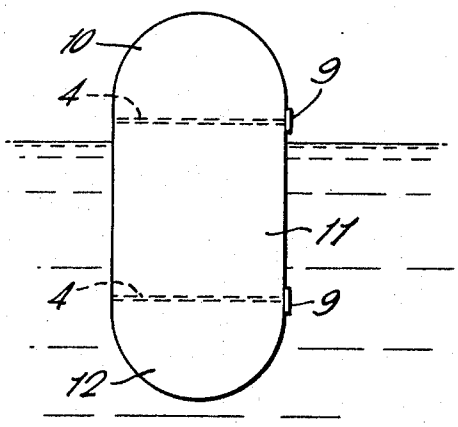


FIG. 5.



STORAGE-VESSEL

The invention relates to a mobile vessel for loading, storing and transport of oil, etc.

The new and characteristic feature, according to the invention, is that the vessel/storage can lie on the bottom of the sea with such heavy weight that it avoids anchorings simultaneously with the vessel/storage having a slim superstructure which always projects up from the water and thus eases the stability-, the lowering- and the access problems.

FIG. 1 is a side elevation view of a vessel according to the present invention.

FIG. 2 is a cross sectional view taken along line 2-2 of FIG. 1.

FIGS. 3 through 5 illustrate different stages in the assembly of a vessel constructed in accordance with the present invention.

FIG. 1–2 show an example of a vessel according to the invention. The main element is a closed hull or a tank, divided by longitudal bulkheads 2, 3 and cross bulkhead 4. Four towers 5 are positioned on the overside of the hull, said towers having a cross section which is too small to offer any particular resistance against the waves, but which at the same time is large enough to secure the stability of the vessel in semi-submerged state.

A deck 6 is present on the towers. Equipment like a crane 8 can be placed on the deck. Bearing points 9 may be arranged under the hull. The vessel can thus stand on the bottom when at the same time the bearing forces appear at the wanted positions and not anywhere on the hull. The bearings may be constructed as legs, adjustable if desired for use at larger depths and to get the centre of gravity further down with regard to the centre of buoyancy. If the cross section of the towers always is small, then the stability in the floating state can always be achieved since the centre of buoyancy always lies above the centre of gravity. If the bearing points 9 are shaped as three "point" arranged on a triangular pattern, then the bearing is statically determined. It is then always known where the vessel is supported, and unexpected moments due to uneven ground cannot occur.

The vessel may be intended for towing or be provided with machinery for propulsion and/or manouevring.

The vessel can lie on the bottom, or float partly submerged or on the surface. The hold of the tank may be filled with oil or other useful cargo, water, air or ballast material as the vessel may be used as a stationary oil tank, lying on the bottom of the sea or afloat. The tank may easily be moved from one place to another. The vessel may also be utilised for transport of oil. The transport of oil may e.g. take place as follows: A vessel according to the present invention is placed on the bottom of the sea near the source of oil such as a stationary tank at the oil field and is filled with water. The flexible pipe from the stationary tank is lifted out to the platform by its own or another crane and a return pipe for the platform to the stationary tank at the oilfield is also positioned. Oil is then pumped from the stationary tank out into the vessel while the (polluted) water in the vessel is returned to the stationary tank where it may be purified. Since oil is less heavy than water, oil and water may use the same tank as vessel without the risk of mixing. When almost all the water is out of the vessel, the oil filling is stopped and the remaining water is forced out by means of air. The vessel will then rise from the bottom of the sea and may be transported to the receiving harbour. The air may here be let out, the vessel places itself on the bottom, oil is pumped out and replaced by water instead.

In smooth waters, where the depth is too large or where other considerations make it necessary, the vessel may also be loaded/unloaded in partly submerged state or afloat on the surface.

The vessel may of course be built in the usual way, e.g., in a dock. It will however be a great advantage to be independent of traditional ways of construction, since the world dock capacity at times is too small, and also because one is not tied to the limits of size which a slipway or a normal dock involves. The construction may take place in the following way (FIG. 1, 3, 4 and 5):

First cross wall 4 is produced in horizontal position, FIG. 3. On that wall is then produced such a large part of the midsection 11 of the vessel that the said part may be launched and floated. While in the floating state the end section 12 is constructed and completed at the same time as the vessel gradually sinks, (FIG. 4). If the vessel is long it is then necessary to balance by means of ballast. When the end-section 12 is ready it is filled with ballast while the ballast in 11 is removed. The vessel will then turn over 180°, and the other end-section 10 may be constructed, (FIG. 5). Lastly, ballast is filled symmetrically such that the vessel positions itself horizontally and the superstructure may then be completed.

The turn of 180° described may of course be avoided if the cross wall 4 is constructed in a hydro-dynamical correct way such that it in itself can be the one end of the tank. The vessel may be made of concrete. This method has the advantage that the walls by means of the described procedure can be made quickly and inexpensive by means of slip forms. The vessel will mainly have pressure forces if lifting and lowering is done by pumping water/oil out of respectively into the vessel and keeping the air always at atmospheric pressure. Concrete is in such a case particularly advantageous. The cell-shaped structure which is illustrated is statically quite favorable if the construction material is concrete, since the walls mainly will be in compression when the vessel is subject to an outside water pressure. The advantages are particularly striking if the cells are cylindrically shaped, since each cell then may be shaped such that a possible breakdown of a cell is without importance for the others.

Repair work and maintenance can be made easily since the vessel may be trimmed with the bottom up, and the work may thus take place on the dry part independent of a dock.

The substantial advantages of the invention are that a storage/transport means at sea is provided, said means not requiring harbours, nor moorings. The vessel is at the same time simple and easy to manouvre since it always has good contact with the surface and one thus avoids all the complications and disadvantages attached to the submarine technique.

It is obvious that the examples which are shown in the drawings and described above only are meant to illustrate the inventive idea, and that it may be varied in a series of ways within the scope of the invention.

I claim:

1. A semi-submersible vessel for loading, storing and transporting a liquid such as oil or the like, comprising:

a main hull intended to lie on the sea bed during loading, unloading and storing of the liquid, said main hull being formed of a single monolithically formed air-tight hull which is divided into cargo compartments, the hull having outer walls formed as portions of cylindrical shells and a slim superstructure including columns rigidly supported by the hull, the columns extending upwardly from the said main hull to above the sea level when the main hull rests on the sea bed, said columns supporting a deck structure, the arrangement of the hull and the columns being such that the center of gravity of the vessel is always below the center of buoyancy of the vessel to provide the vessel with a total weight and a weight stability under all loading conditions to be able to rest on the sea bed without anchors, moorings or the like.

2. A vessel according to claim **1,** wherein the hull includes a series of longitudinally extending cells, and including bulkheads extending transversely thereacross.

3. A vessel according to claim **2,** wherein said cells are cylindrical and are secured to each other only along lines of contact.

4. A vessel according to claim **1,** including bearing points located on the bottom of the vessel for engaging the sea bed.

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