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APPARATUS FOR USE IN OFFSHORE OPERATIONS

Original Filed Dec. 20, 1955

2 Sheets-Sheet 1

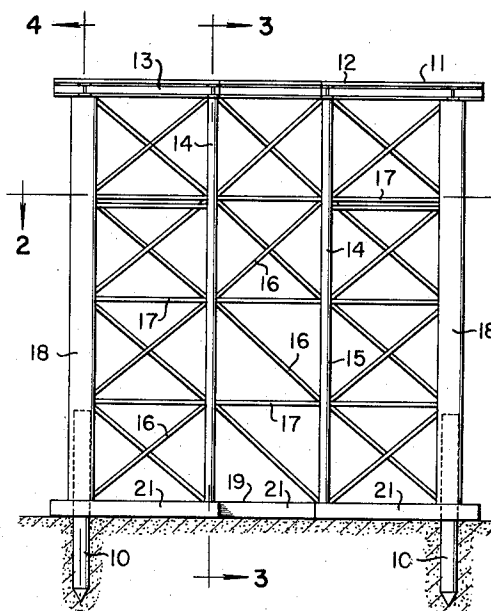


FIG. 1.

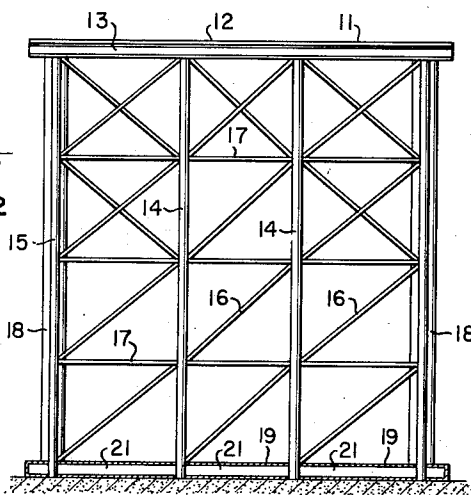


FIG. 3.

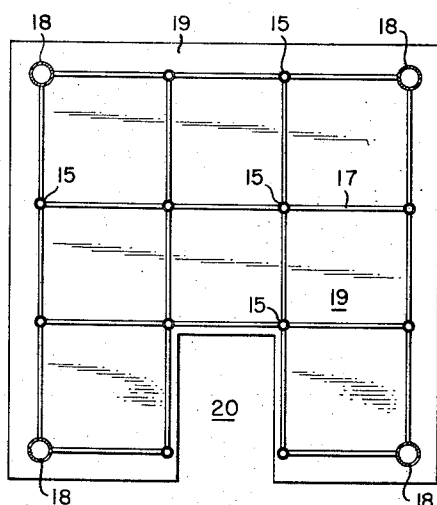


FIG. 2.

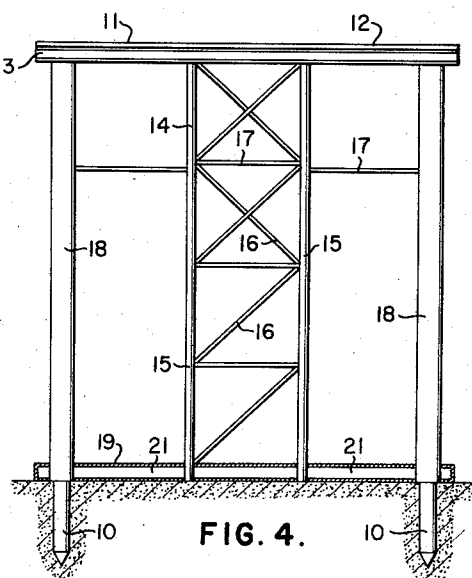


FIG. 4.

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2 Sheets-Sheet 2

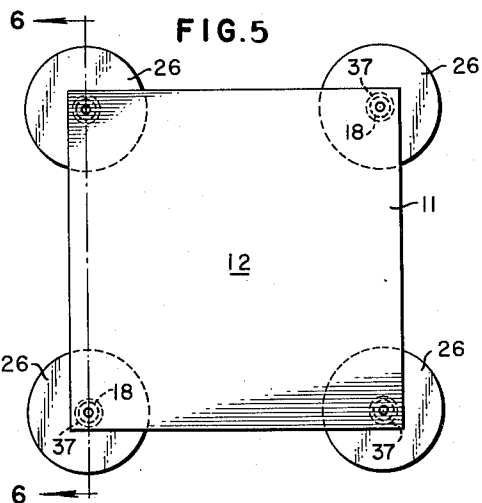
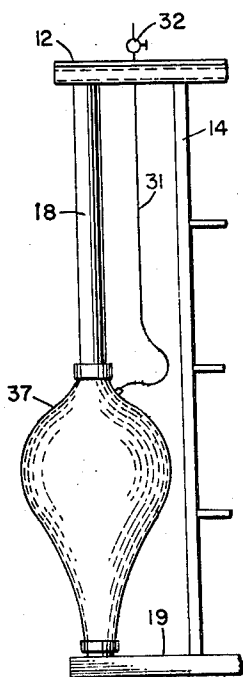
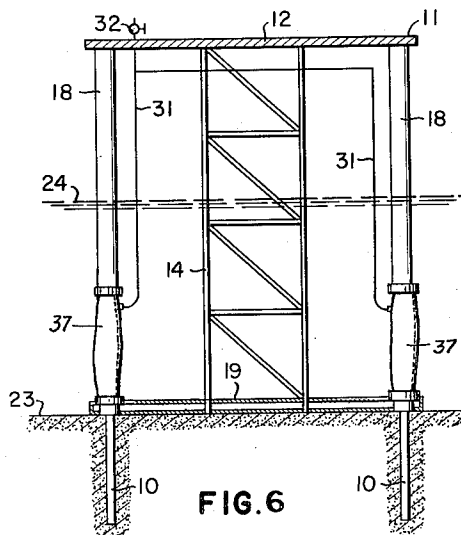


FIG. 7

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Original application Dec. 20, 1955, Ser. No. 554,375, now Patent No. 2,938,354, dated May 31, 1960. Divided and this application Sept. 15, 1958, Ser. No. 760,936
3 Claims. (Cl. 61-46.5)

The present invention is directed to a structure suitable for use in offshore operations. More particularly, the invention is directed to a portable, stable structure which is easily transportable to a marine location. In its more specific aspects, the invention is directed to marine structure which has stability and which is easily transportable to an offshore location.

This application is a division of Serial No. 554,375 filed December 20, 1955, for Richard P. Knapp entitled "Method and Apparatus for Offshore Operations," now U.S. Patent No. 2,938,354.

The present invention may be briefly described as a portable, stable structure suitable for use in offshore marine operations which comprises a bottom bearing member having a plurality of interconnected vertically extending buoyancy columns connected to the bottom bearing member on their lower ends. A platform is supported by the buoyancy columns on the upper ends of the buoyancy columns. Vertically adjustable auxiliary buoyancy means are arranged on all or a selected of the buoyancy columns with a portion of the buoyancy means extending inboard of the structure and the remaining portion of the buoyancy means extending outboard of the structure. The bottom bearing member may be provided simply as a mat but may be constructed such that it has buoyancy and may be suitably compartmented and provided with sea chests, valves, and the like for flooding the compartments of the bottom bearing member with water to ballast same and with suitable air connections to blow the water from the compartments. Suitably the buoyant bottom bearing member may have an open bottom and buoyancy given thereto by maintaining a selected air pressure therein.

The structure of the present invention is provided with vertically adjustable spuds arranged in the buoyant columns, such that they may be extended through the lower end of the buoyant columns to serve as mooring and anchoring means by positioning the spuds into the underlying bottom of the marine location where the structure may be located. The spuds are vertically adjustable such that they may be extended or retracted into the buoyant columns. The spuds may be extended or retracted by employing jacks of the hydraulic type and the like, suitable screw and wedge mechanisms, hydraulic means and the like for raising and lowering the spuds. The spuds may suitably be provided with a hydraulic lock, clamps or pins or other means for locking the spuds in position as may be desired.

It is understood that the structure of the present invention may comprise a plurality of extension supporting members constituting "building" blocks made up of interconnected, vertically extending columns. Thus, the platform may be supported on a plurality of "building" blocks or extension supporting members connected to the bottom bearing members and when it is desirable to extend or lower the height of the structure for use in deeper or shallower water the platform may be removed and "building" blocks or extension supporting members either added to the structure or subtracted therefrom. The extension supporting members comprising the interconnected, vertically extending columns would be connected to each other, either by welding or by a bolted flange arrangement which would allow easy removal of

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the extension supporting members from or addition of the extension supporting members to the structure.

It is contemplated that the auxiliary buoyancy means arranged on all or a selected of the buoyant columns may be removable therefrom. In short, the auxiliary buoyancy means may be provided with a slot and latch arrangement for placing same on the buoyant columns or the buoyancy means may be provided with a removable segment for arranging same on the columns. Alternatively, the auxiliary buoyancy means may comprise a plurality of buoyant chambers interconnected and arranged around selected or all of the buoyant columns. The buoyancy means may also comprise a plurality of buoyant chambers arranged one upon another and separable from each other such that buoyant chambers may be added to provide additional buoyancy or buoyant chambers may be subtracted as may be desired.

It is contemplated that the auxiliary buoyancy means may be inflatable such that when it is desired to provide auxiliary buoyancy the auxiliary buoyancy means would be inflated and when the auxiliary buoyancy is no longer required the buoyancy means may be deflated as desired.

Thus, the present invention relates to a portable marine platform which provides a stable foundation for machinery, drilling equipment, storage tanks, and the like, a base for salvage operation located over a body of water. The platform involving the structure may be moved with or without the drilling equipment and the like from one water location to another as desired or it may be converted to an improved type of permanent marine structure. The platform is easily adjusted to permit safe use in a wide range of water depths.

The invention is particularly suitable to well drilling operations such as oil and/or gas or sulfur wells and may be used with an auxiliary vessel or platform or suitably may be self-contained to provide the necessary living quarters and warehouse facilities to conduct such marine operations.

The present invention will be further illustrated by reference to the drawing in which:

FIG. 1 is a side elevation of the platform structure;

FIG. 2 is a horizontal section along line 2-2 of FIG. 1;

FIG. 3 is a vertical section along line 3-3 of FIG. 1;

FIG. 4 is a vertical section along line 4-4 of FIG. 1;

FIG. 5 is a plan view of the platform showing the working deck area and one arrangement of the buoyancy transport units;

FIG. 6 is a vertical section through the platform along line 6-6 of FIG. 5;

FIG. 7 is a partial sectional view of an inflatable buoyancy transport unit and a transport column;

Referring now to the drawings in which identical numerals will be employed to designate identical parts, and particularly to FIGS. 1 to 4, the structure comprises a working deck or platform structure generally indicated by the numeral 11 which is of rectangular form and having a generally flat working surface generally designated by the numeral 12. The working surface or platform 12 is suitably supported by longitudinal or transverse structural members 13 which are supported by a trusswork indicated generally by the numeral 14 composed of vertically extending columns 15, diagonal members 16, and horizontal girt members 17. The structure is also provided with buoyant columns 18. The trusswork 14 and the buoyant columns 18 terminate in a bottom bearing member 19 which is of general rectangular form with a suitable opening or openings 20 for the conducting of drilling operations and the like. The bottom bearing member is suitably constructed of longitudinal and transverse structural members and may be provided with suitable compartments, chambers, and the like, 21.

Extending through the columns 18 are bottom pene-

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trating mooring spuds indicated generally by the numeral 10 which penetrate into the soil below the bottom bearing member 19 to provide resistance to lateral movement, overturn, and vertical sinkage of the structure. The spuds 10 are adjustable vertically and may be extended or retracted as may be desired.

While the platform structure 12 is shown to have a square working deck and a square bottom bearing member with four buoyant columns forming the four corners of a square horizontal section, it is possible to have other configurations but it is preferred to have a square structure because it provides the most stable structure for a given structural weight. It is to be understood, however, that other shapes and configurations may be used and may be preferable where structural weight is a secondary consideration. For example, a rectangular plan with the length greater than the width may be more desirable where the width is limited by existing land facilities and a greater length is necessary to obtain the required working deck or bearing bottom member area.

As pointed out supra, it is not necessary that the bottom bearing member 19 be a watertight structure and it is preferable that the bottom bearing member 19 have as little buoyancy as possible when the structure is in the moving position. For maximum stability during moving operations the bottom bearing member should be completely flooded or open to the sea, with buoyancy limited to the volume of water displaced by the structural members. As pointed out before some water-tight compartmentation may be desirable for the storage of liquid or to float the platform on the surface of the sea for delivery, overhaul and/or repairs.

Referring now to FIGS. 5 and 6 it is to be noted that the auxiliary buoyancy means 37 are of general bag shape and extend both inboard and outboard of the structure 11. The spuds 10 are shown driven into the underlying land bottom 23 and with the auxiliary buoyancy means 37 resting on the bottom bearing member 19 on bottom. In FIGS. 5 and 6 the auxiliary buoyancy means 37 are arranged permanently on the structure 11 surrounding the columns 18. When the auxiliary buoyancy means 37 are employed, it will be necessary to provide means for introducing air into and removing air from the auxiliary buoyancy means 37. To this end a flexible connection such as 31 provided with a valve 32 may be arranged to extend from the platform 12 to the buoyancy means 37. This flexible connection 31 may be a suitable hose which may be of deformable material and reinforced with metallic members or may be a braided metal hose and the like. The flexible member 31 may extend inboard and outboard of the structure to provide air pressure to the members 37 or to relieve air pressure therefrom.

The auxiliary buoyancy means is shown in FIG. 7 in which an inflatable member 37 is arranged on the columns 18 to surround same. The inflatable member 37 extends both inboard and outboard of the structure and may suitably be deflated and left to rest on the bottom bearing member 19 when not in use and inflated when in use. To this end, a suitable flexible connecting member, such as 31, extending to the platform 12 and provided with a valve 32 may be used for inflation and deflation as desired.

In practicing the present invention with reference particularly to FIGS. 5 and 6, the structure 11 would be floated into position and the auxiliary buoyancy means 37 would then be flooded a sufficient amount of water to cause the structure to sink to the sea bottom 23 with

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the mat 19 on bottom. Thereafter, the spuds 10 would be sunk or forced into the earth 23 by suitable hydraulic means, not shown. Hydraulic pressure is then released which will allow some vertical movement of the structure 11. The auxiliary buoyancy tanks 37 are then dewatered which allow them to rise on the columns 18 to a floating position. The auxiliary buoyancy means 37 are then latched or locked to the columns 18 such that any force exerted by the tanks 37 will be exerted on the columns 18. The auxiliary buoyancy tanks 37 are then flooded with water or has water pumped in to a level above sea level sufficient to provide a maximum preload on the bottom bearing member 19 in excess of that which will be employed on the structure 11. As the auxiliary bags 37 sink to the bottom 23, the soil making up the bottom 23 is compacted under the bottom bearing member 19 to cause moisture to be squeezed out therefrom. The bags 37 are left on bottom to provide the maximum preload for the time indicated and then the spuds 10 are locked into position against vertical movement. The bags 37 are then dewatered to a floating position, unlatched from the columns 18 and then removed therefrom as desired.

The present invention is of considerable utility and advantage in that a stable marine structure is provided which is easily removable and may be anchored permanently at a desired marine location. The structure has stability in that the auxiliary buoyancy means extend both inboard and outboard of the structure. Furthermore, the structure is adjustable in height and may be moved from shallow to deep water or vice versa and used therein. Furthermore, the structure is of considerable utility in that the auxiliary buoyancy means may be arranged permanently on the structure or releasable therefrom.

The nature and objects of the present invention having been completely described and illustrated, what I wish to claim as new and useful and to secure by Letters Patent is:

1. Apparatus for providing stability to a portable structure suitable for use in offshore marine operations comprising a bottom bearing member, a plurality of interconnected vertically extending columns connected to the bottom bearing member on their lower ends, and a platform supported by said columns on the upper ends of said columns, which apparatus comprises vertically slidable inflatable auxiliary buoyancy means arranged embracably on selected of said columns, said buoyancy means being formed such that a portion of said buoyancy means extends inboard of said portable structure and the remaining portion extends outboard of said portable structure when said buoyancy means is inflated, means maintaining said buoyancy means on said columns, and means for inflating and deflating said buoyancy means, said buoyancy means resting on said bottom bearing member when deflated.

2. Apparatus in accordance with claim 1 in which the inflation and deflation means comprises a valved flexible connection member connected to the auxiliary buoyancy means.

3. Apparatus in accordance with claim 2 in which the valved flexible connection means extends to the platform.

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