Dec. 5, 1961 R. G. LE TOURNEAU 3,011,467

MOBILE SEA PLATFORM

Original Filed May 22, 1957 5 Sheets-Sheet 1

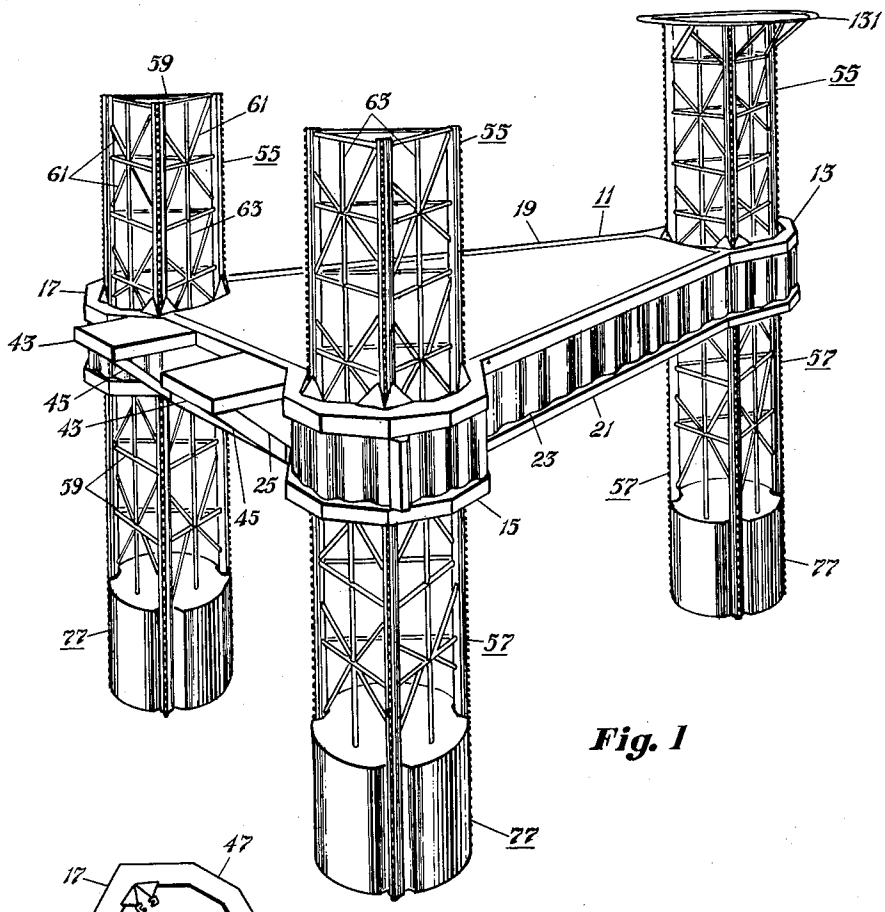

Fig. 1

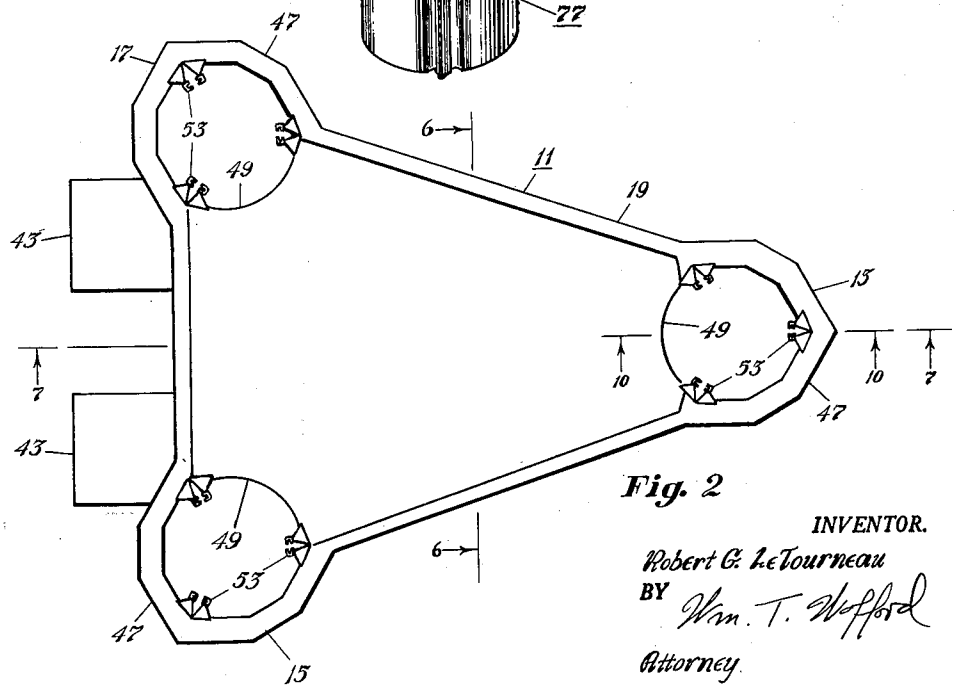

Fig. 2

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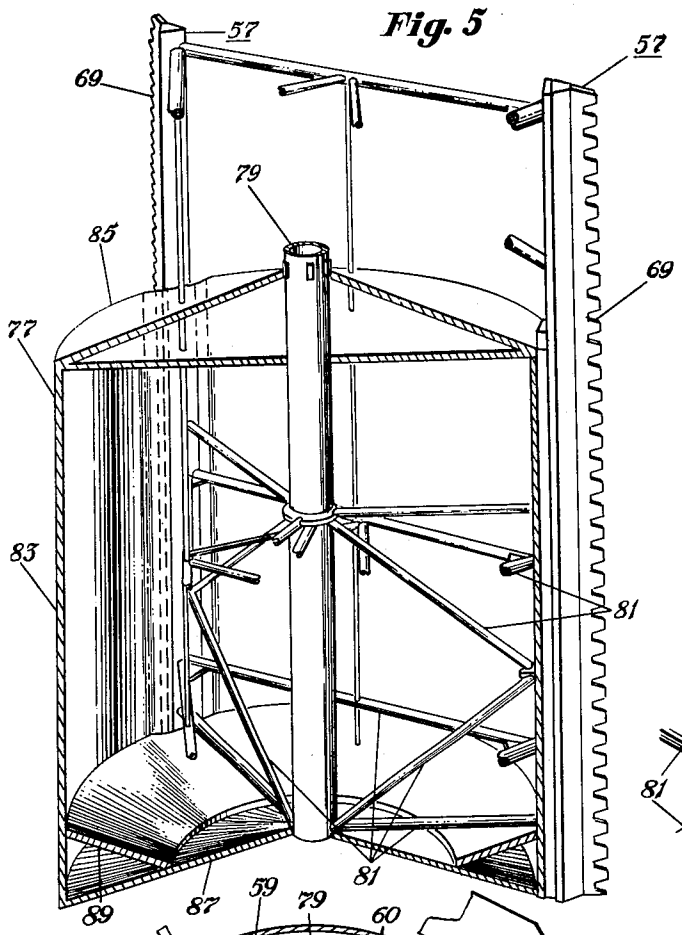

Fig. 5

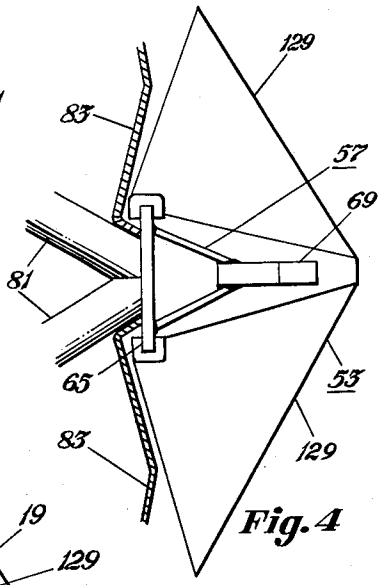

Fig. 4

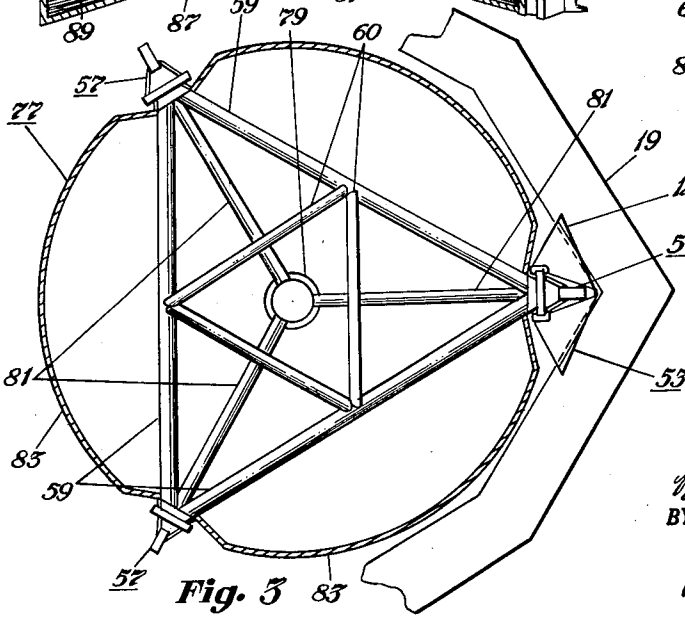

Fig. 3

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MOBILE SEA PLATFORM

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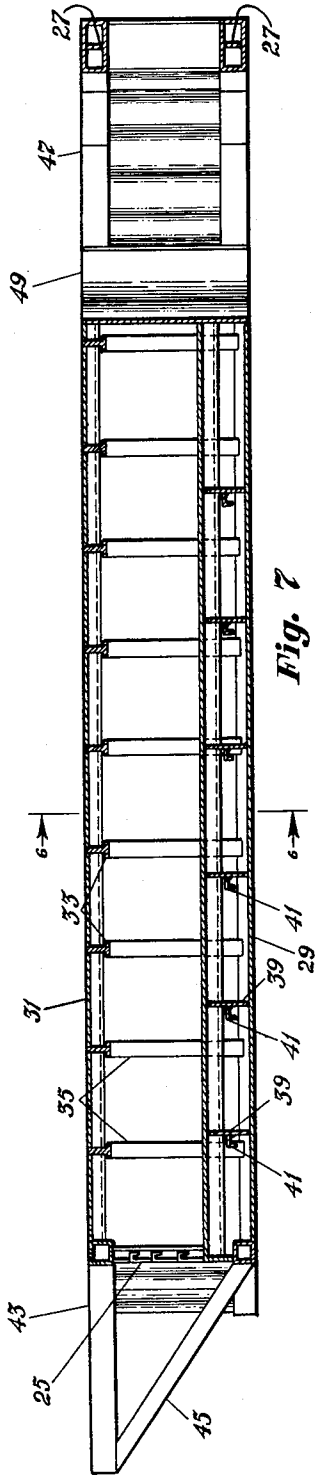

Fig. 7

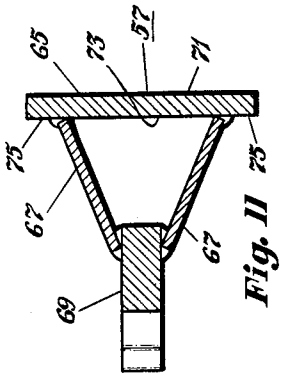

Fig. 11

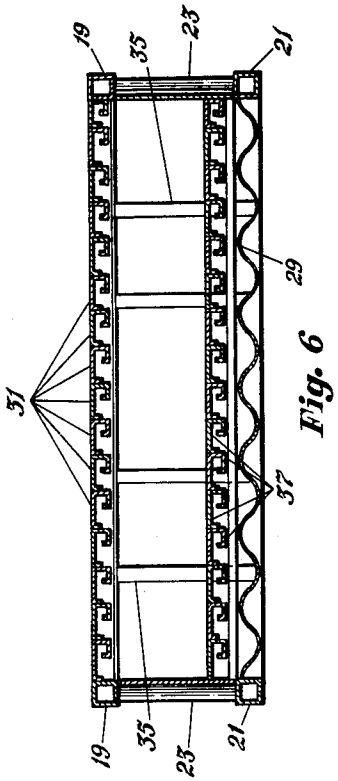

Fig. 6

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MOBILE SEA PLATFORM

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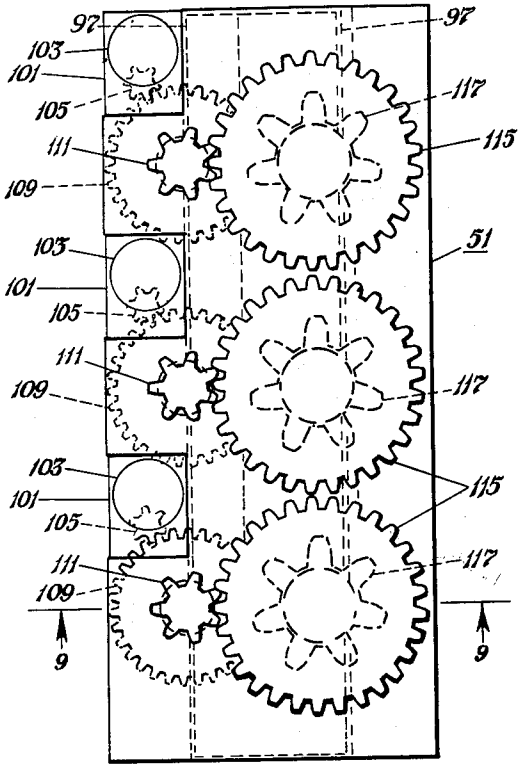

Fig. 8

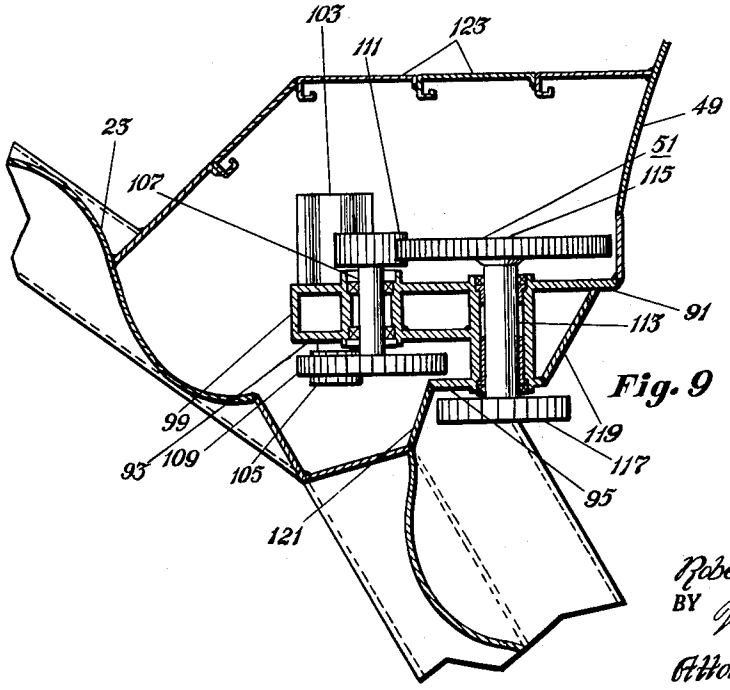

Fig. 9

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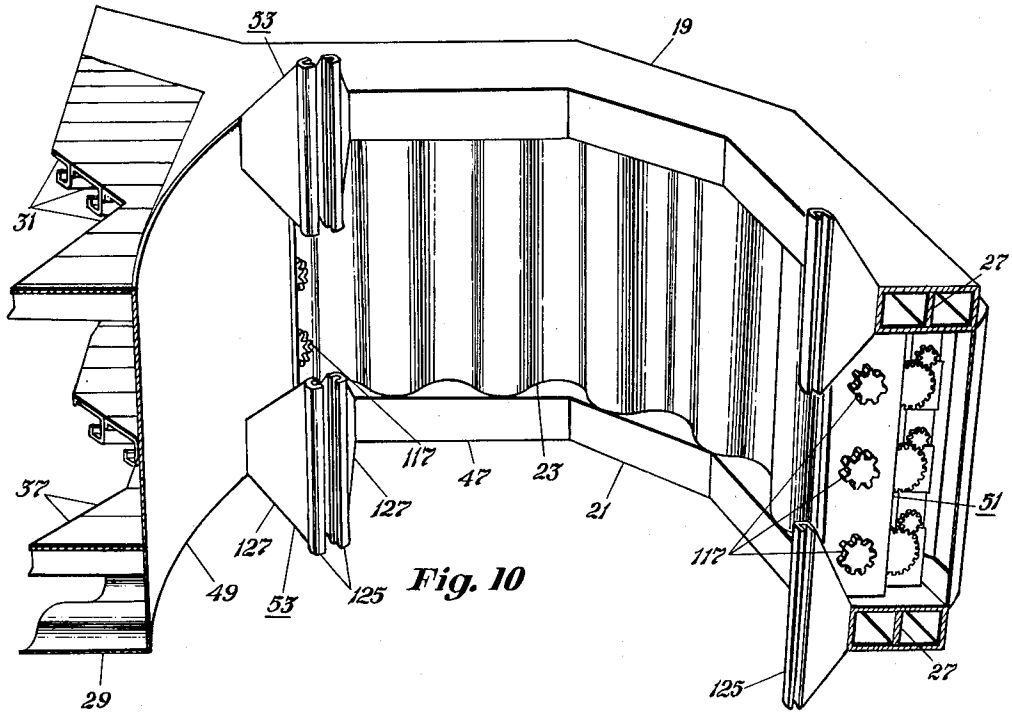

Fig. 10

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3,011,467

MOBILE SEA PLATFORM

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Original application May 22, 1957, Ser. No. 673,491. Divided and this application Aug. 27, 1959, Ser. No. 836,532

5 Claims. (Cl. 114—43.5)

My invention relates generally to improvements in mobile sea platforms, and particularly to floatable vessels which are convertible into stabilized structures over bodies of water. My invention is especially applicable to offshore or "tidelands" oil exploration, drilling and producing operations. This application is a division of my co-pending application S.N. 673,491 filed May 22, 1957, entitled Mobile Sea Platform.

This application includes disclosure of certain improvements over the mobile sea platforms of my co-pending applications, S.N. 473,885, filed December 8, 1954, and S.N. 625,710, filed December 3, 1956, now Patent No. 2,924,077.

The general object of my invention is to provide an improved mobile sea platform.

Another object of my invention is to provide a mobile sea platform having improved hull structure.

Another object of my invention is to provide a mobile sea platform incorporating improved spud tower structure.

Another object of my invention is to provide improved rack structure for use in the hull elevating system of a mobile sea platform.

Another object of my invention is to provide improved rack and rack guide structure for use in the hull elevating system of a mobile sea platform.

Another object of my invention is to provide improved rack drive arrangements for use in the hull elevating system of a mobile sea platform.

These and other objects are effected by my invention as will be apparent from the following description taken in accordance with the accompanying drawings, forming a part of this application in which:

FIG. 1 is a schematic perspective view of the improved mobile sea platform of my invention;

FIG. 2 is a schematic plan view of the mobile sea platform, with the spud towers removed;

FIG. 3 is an enlarged schematic plan view of one spud tower and showing a portion of a spud well;

FIG. 4 is an enlarged schematic plan view showing details of rack and rack guide structure;

FIG. 5 is an enlarged schematic perspective view, partially cut away, showing spud tank structure;

FIG. 6 is a section view taken at line 6—6 of FIG. 2;

FIG. 7 is a section view taken at line 7—7 of FIG. 2, with rack guide structures omitted;

FIG. 8 is a schematic side elevational view, partly in phantom, showing a rack drive assembly;

FIG. 9 is a schematic view, partly in section, taken along line 9—9 of FIG. 8, plus a showing of portions of a spud well and hull structure;

FIG. 10 is a schematic perspective section view taken on line 10—10 of FIG. 2; and

FIG. 11 is a detail schematic transverse section view of a spud tower column.

Turning now to the drawings, the basic structure of the platform is shown by FIGS. 1, 2, 6 and 7. The hull 11 has the general shape of an isosceles triangle in plan, with a spud well located at each corner of the triangle, as shown by FIG. 2. The spud well at the triangle vertex will be referred to herein as the forward spud well 13, and the others will be referred to as the right and left rear spud wells 15, 17, respectively. The principal parts of the hull are sidewalls, bottom, upper or main deck,

lower or inner deck, upper deck support beams, upper deck support columns, and lower deck support columns, and lower deck support bulkheads. The hull side wall structure comprises upper and lower box beams 19, 21 held in vertically aligned rigid spaced parallel relation by formed steel plate wall members 23, these steel plate wall members are each formed by a press to assume the shape in transverse section of a portion of a corrugation. Each steel plate wall member is welded at its ends to the respective upper and lower box beams 19, 21, and at its sides to adjacent wall members. Thus, the steel plate wall members form a continuous corrugated web which extends between the upper and lower box beams. This web together with the upper and lower box beams make up the outer wall of the hull 11. As can be seen from the drawings, the corrugations formed by the steel plate wall members 23 have amplitude such that they extend over most of the width of the box beams 19, 21. As can be seen from FIGS. 1 and 2, the box beams 19, 21 extend all around the outer periphery of the hull 11, and the corrugations likewise, except between the right and left rear spud wells 15, 17 where the corrugations are replaced by a wall section 25 which has the same structure as the decking, to be hereinafter described. The upper and lower box beams 19, 21 in the embodiment herein shown and described have rectangular cross-section, though it is apparent that they could take other cross-section forms, as for example, triangular. The box beams at the spud wells 13, 15, 17 are twice as wide as elsewhere, and are provided with a vertical partition 27 (see FIG. 10). The hull side wall construction employing upper and lower box beams and the corrugated web as just described, is quite simple, yet is very strong and rigid. The hull bottom is made up of corrugated steel plate members 29 formed like those of the side wall structure. These bottom plates are welded to each other to form the hull bottom, with the valleys of the corrugations running parallel to the center line of the hull 11 which passes midway between the rear spud wells 15, 17. The outer edges of the bottom are welded to the inner side face of the side wall lower box beam 21 (see FIG. 6). The upper or main deck is made up of beams 31 formed from strips of steel plate material. The transverse cross-section of these decking beams may be seen in FIG. 7, and includes a surface portion, a downwardly extending short flange on one side of the surface portion, and a generally block J-shaped flange depending from the other side of the surface portion. The decking beams are joined at their longitudinal edges by welding, with the outer surface of the short flange of one beam bearing against the outer surface of the upper portion of the J-shaped flange of the adjacent decking beam, with the surface portions of the decking beams lying generally in a common plane. Short stiffener L-shaped beams (not shown) extend transversely between adjacent decking beams at spaced intervals and are welded thereto. The decking beams 31 extend in the direction parallel to the hull center line which passes midway between the rear spud wells 15, 17. The decking is supported by cross beams 33, which extend transversely of the decking beams at spaced intervals and are welded at their ends to the inner face of the side wall upper box beam 19. The cross beams are supported at spaced intervals by vertical columns 35 which have their footing on the corrugated bottom 29 (see FIGS. 6 and 7). The lower or inner deck of the hull is made up of decking beams 37 which are like the decking beams 31 of the upper deck hereinbefore described. The beams of the lower deck are supported by a plurality of transverse bulkheads 39 which are shaped to conform with the hull bottom corrugations and are welded to the hull bottom members 29. An L-shaped

stiffener member 41 is fixed by welding to each bulkhead 39, running parallel bulkheads 39 to and transversely of the decking members 37. A pair of rectangular deck sections 43 extend outwardly from the rear side of the hull 11 between the rear spud wells 15, 17, the sections being spaced apart and equidistant from the hull center line, to form a slot over which a drilling derrick (not shown) can be erected. The deck extensions 43 are held in place by suitable bracing members 45.

Each of the three spud wells 13, 15, 17, is centered on a line bisecting the angle between respective adjacent hull side walls. Each spud well may be considered as having an outer wall portion 47 and an inner wall portion 49. The outer wall portion is generally polygonal in shape, in plan, each side of the polygon being made up of a length of upper and lower box beams 19, 21 and corrugated web 23 forming a segment of the hull side wall structure as hereinbefore described. The inner wall 49 of each spud well is arcuate in shape, in plan, and is made up of curved steel plate members welded together. Each spud well carries three rack drive assemblies 51, as well as rack guide structures 53, to be hereinafter more fully described.

Each spud well is of course designed to receive a spud tower 55. The spud towers are of triangular transverse cross-section and each comprises three spud tower columns 57 at the triangle vertices and which are held in rigid spaced parallel relation by tubular latticed trusswork members. At spaced intervals along the spud column length there is a tubular truss member 59 disposed between each pair of adjacent spud columns and lying in a horizontal plane. Additional sets of truss members 61 extend from near the midpoint of each horizontal truss member 59 at alternate tower levels both upward and downward to adjacent tower columns. Another set of truss members 63 extends vertically from midpoint to midpoint of the horizontal truss members 59. Still another set of truss members 60 extends horizontally at each level of horizontal truss members and from midpoint to midpoint of same. Each tower column 57 is made up of a primary member 65, a rack 69, and rack support members 67. The primary member 65 is in the form of a heavy steel slab of rectangular cross-section having a width several times its thickness (see FIG. 11). The primary member may be considered as having a front face 71 and a rear face 73. The rack 69 is disposed in such manner that a plane bisecting the rack and rack face will be perpendicular to the faces of the primary member 65 and will bisect the primary member longitudinally. The rack 69 is held in rigid spaced relation to said primary member by a pair of rack support members 67. The rack support members are heavy steel plate strips welded along one longitudinal edge to the rear face 73 of the primary member 65 and along the other longitudinal edge to a respective side face of the rack 69. In transverse cross-section, the rack support members 67 form the sides, and the primary members 65 the base, of an isosceles triangle, with said primary member extending symmetrically beyond the triangle base on each side thereof. The portions 75 of the primary member which extend beyond the triangle base just mentioned, are utilized as guide surfaces as will be hereinafter more fully explained.

Each spud tower carries a watertight cylindrical pontoon tank 77 at its lower end. Each pontoon tank is provided with sea cocks (not shown) for flooding and draining purposes. Each spud tank is also provided with jetting means (not shown) for the conventional well known purpose. Each spud tank is made up of a center column 79, truss work bracing members 81, wall sections 83, a top 85, a bottom 87, and a reinforcing web 89 (see FIG. 5). The center column 79 is a large tubular member centered on the tank longitudinal axis. The bracing members 81 are tubular and may be considered in sets. One set radiates from the center column 79 to the front face 71 of each tower column 57. Another set forms horizontal triangles at a plurality of tower levels, with the tower columns 57 as vertices. There are three tank wall sections 83, made up of curved steel plate sheets joined by welding and extending between adjacent tower columns 57, with each side edge of each wall section 83 being welded to the front face 71 of a tower column primary member 65. The wall section is in each case formed suitably to accommodate the tower column guide structure (see FIG. 4). The spud tank top 85 is a convex dish of heavy steel plate material welded to the tank side walls 83. The tank 87 is a concave dish of heavy steel plate material welded to the tank side walls 83. The bottom reinforcing web 89 is a convex dish of heavy steel plate material with a circular section removed from its center portion so that the web extends from the inside of the tank bottom upwardly at an angle and joins the tank side walls. The web is welded both to the tank bottom 87 and to the tank side walls 83.

Each spud well carries three rack drive assemblies 51, details of which are shown by FIGS. 8 and 9. Each rack drive assembly comprises a gear case which mounts three drive units. The gear case is fabricated of heavy steel plate members welded to form a unitary structure. The gear case has three parallel spaced wall sections which will be referred to herein as the large, intermediate and small wall sections 91, 93, 95 respectively. Each of these wall sections has rectangular shape. The wall sections are held in rigid spaced relation by transverse heavy steel plate partitions 97. The gear case carries three vertically aligned large shaft support openings, and three vertically aligned intermediate shaft support openings. The large and intermediate shaft support openings for each drive unit are horizontally aligned. The large and intermediate gear case walls carry top, intermediate, and lower rectangular slots at their left side portions, and the entire left side of the gear case between the large and intermediate walls is closed by welded steel plate members 99. The drive units may be designated as upper, intermediate, and lower. Each drive unit comprises a primary gear box 101 which is a pre-packaged self-contained unit, driven by an electric motor 103, and having an output pinion 105. The primary gear box of each drive unit fits into a respective slot of the gear case and is welded thereto. An intermediate gear shaft 107 is journaled in each intermediate shaft support opening, and carries a bull gear 109 at one end and an output pinion 111 at the other end. The output pinion 105 of the primary gear box 103 engages the bull gear 109 of the intermediate shaft 107. A large gear shaft 113 is journaled to each large shaft support opening, and carries a bull gear 115 and an output pinion 117. The output pinion 111 of the intermediate shaft 107 engages the bull gear 115 of the large shaft 113, and the output pinion 117 of the large shaft 113 is adapted for engaging the respective rack 69.

There are three gear case assemblies 51 disposed in each spud well. Each gear case is incorporated into the spud well structure in upright position between the upper and lower side wall box beams 19, 21. The height of the gear case is made equal to the distance between the upper and lower box beams, and the top and bottom edges of the gear case are welded to the respective box beam (see FIG. 10). The gear cases are spaced 120 degrees apart, and so that a respective vertical plane passing through the spud well center is parallel to the gear case side walls and bisects the gear case output pinions 117, with said plane also bisecting the angle between adjacent hull sides in the case of the outboard drive assembly of each spud well. The manner in which the side walls of a particular gear case are joined to the hull structure is shown by FIG. 9 for the case of an inboard gear box. The right edge of the gear box large wall 91 is welded to a side edge of the spud well arcuate

wall section 49. A strip 119 of heavy steel plate extends from the right edge of the gear box small wall 95 at an angle to the right end portion of the gear box large wall 91 and is welded thereto. The left edge of the gear box small wall 95 is joined by a heavy steel plate strip 121 to the end of the corrugated web 23 of the spud well wall. The ends of the corrugated webs of the spud well wall and the hull side wall are joined by a section of heavy steel plate wall. A section of wall 123 made up of decking, separates the gear box from the hull interior, and is provided with an access opening (not shown).

As hereinbefore mentioned, each spud well is provided with tower column guide structures 53 at each drive assembly location (see FIGS. 4 and 10). There are two vertically aligned tower column guide structures 53 at each drive assembly location. Each guide structure is made up of a pair of parallel spaced guide rails 125 which are generally U-shaped in cross section. Each guide rail is held rigid by a support structure composed of heavy steel plate sections. Each guide rail support structure is made up of two trapezoidal side sections 127, a triangular top section 129 and a triangular bottom section. The short parallel side of each trapezoidal section is welded to the respective box beam 19, 21 while the long parallel side is welded to the respective guide rail 125. The trapezoidal sides diverge from the guide rail to the respective box beam. The open ends of the enclosure formed by the trapezoidal side walls, the respective box beam and the respective guide rail are closed by top and bottom triangular sections 129.

The manner of operation and the electrical system of the mobile sea platform herein described is essentially the same as that of the platform disclosed by my co-pending application S.N. 473,885 aforementioned. The electric drive motors are each equipped with electromagnetic brakes which automatically engage when the motor is de-energized. A heliport 131 is mounted on top of the front spud tower.

While I have shown my invention in only one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof.

I claim:

1. A hull for a vessel convertible into a stabilized structure over a body of water, said hull comprising a bottom structure, and sidewall structure, with said sidewall structure comprising an upper box beam and a lower box beam, a corrugated steel plate wall extending between said box beams and welded thereto, with said corrugations extending transversely of said beams and having amplitude equal to a substantial portion of the width of said box beams.

2. A vessel hull comprising a bottom structure, and sidewall structure, with said sidewall structure comprising an upper box beam and a lower box beam, a corrugated steel plate wall extending between said box beams and welded thereto, with said corrugations extending transversely of said beams and having amplitude equal to a substantial portion of the width of said box beams, said bottom structure being made up of corrugated steel plates joined by welding to the inner side face of said lower box beam.

3. A vessel hull comprising a bottom structure, and sidewall structure, an upper and a lower box beam each having rectangular cross-section, a corrugated steel plate wall extending between said box beams and welded thereto, with said corrugations extending transversely of said beams and having amplitude equal to a substantial portion of the width of said box beams.

4. A vessel hull comprising a bottom structure, and sidewall structure, with said sidewall structure comprising an upper box beam and a lower box beam, said box beams being mutually parallel, a substantially vertical corrugated steel plate wall extending between said box beams and welded thereto with said corrugations extending transversely of said beams and having amplitude equal to a substantial portion of the width of said box beams, said bottom structure being made up of corrugated steel plates joined by welding to the inner side face of said lower box beam.

5. A vessel convertible into a stabilized structure over a body of water, spud wells carried by said vessel, each said spud well having a wall which is also an outside wall for said vessel, said wall comprising an upper box beam and a lower box beam, a corrugated steel plate wall extending between said box beams and welded thereto, with said corrugations extending transversely of said beams and having amplitude equal to a substantial portion of the width of said box beams.

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