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MARINE OIL WELL DERRICK FOUNDATION

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FIG. 1.

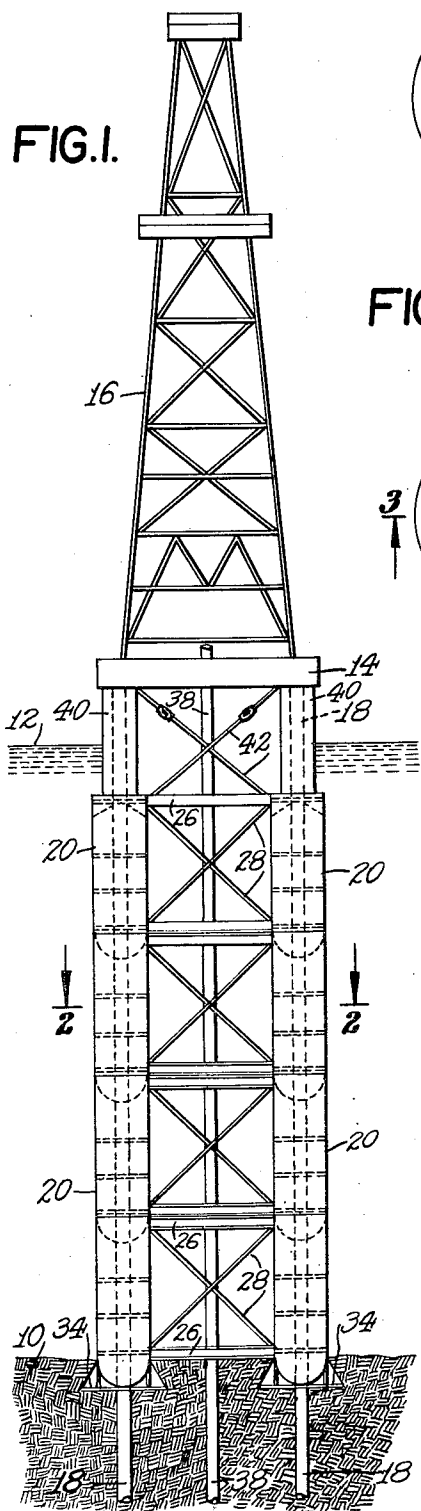


FIG. 2.

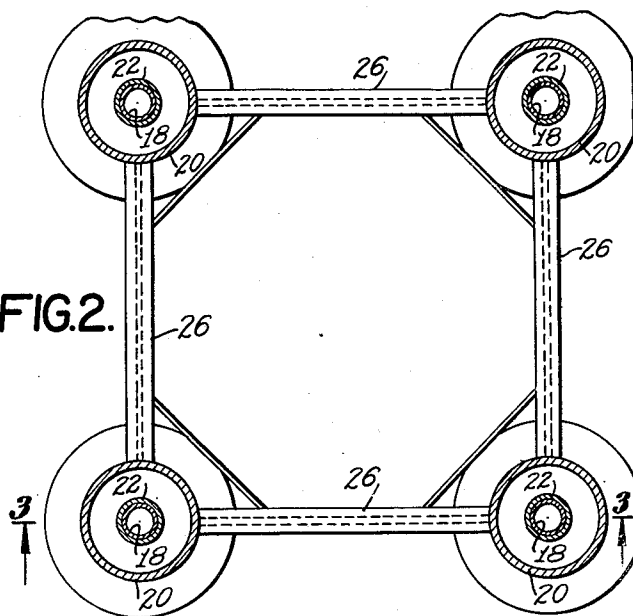
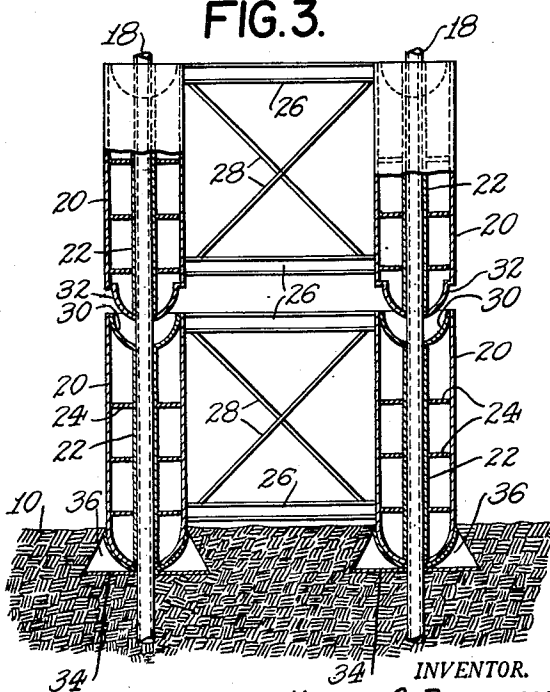


FIG. 3.



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MARINE OIL WELL DERRICK FOUNDATION

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8 Claims. (Cl. 61—46)

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In the drilling of oil wells by the rotary method, it is necessary to provide a foundation for the drilling derrick and a working platform to carry the equipment. These foundations must be designed to carry the dead load of the derrick and all the equipment required in drilling, such as the cable hoisting machine, hoisting engine, rotary table and engine, and all the other equipment usually used in rotary drilling.

The process of rotary drilling requires very heavy equipment and, in addition, must be capable of hoisting a drill stem and rod the full depth of the well, which may run to 14,000 feet or more. During the process of drilling, this drill pipe is usually in the well or stacked in long sections on the drill derrick while bits are being changed.

The derricks themselves must be capable of hoisting the maximum length of drill rod and be able to take care of forces due to wind and the horizontal component of the stacked drill pipe. They may also have to take a temporary heavy pull equal to the ultimate capacity of the hoisting engine or the strength of the hoisting cable; this, of course, when a tool is stuck or there is an attempt made to pull out the well casing. The derrick base itself must also be capable of taking the torsional moment produced by the rotation of the drill pipe. Above all, however, the foundation for the derrick and its platform must be sufficiently rigid and strong to not only support the above mentioned loads and forces but must give a feeling of security to the men operating the equipment.

The drilling for oil in shallow water has been accomplished by means of floating barges temporarily sunk on the bottom, and by a number of methods employing wood piles and cylinders in constructions similar to wharves.

In the exploration for oil under lakes or off the continental coast, the providing of adequate marine derrick foundations becomes a complicated and expensive problem. The depth of water may be 100 feet or more, and the foundations must be designed to resist waves and tides, and high wind forces due to extreme exposure of the structures.

A well is usually drilled in a three to six months period, and if it proves productive, it continues to operate for several years. If the well is non-productive, it is desirable to remove and recover as much of the construction involved as is possible. In certain waters the corrosion is so severe that anything remaining more than six months must be made of concrete or some other non-corrosive material. All tropical waters are

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infested with marine borers and any wood must be thoroughly treated with a preservative material.

As indicated above, the working platform must accommodate the derrick and the drilling equipment. The auxiliary equipment required, such as boilers, mud pumps, mud storage tanks, pipe racks, etc. may be supported on an adjacent platform or on floating barges. The use of barges for carrying all auxiliary equipment and supplies is generally more economical as it permits easy removal during storms, and if the well should prove to be non-productive the material can be completely recovered.

That portion of the foundation between the supporting soil and the platform must be designed to resist both vertical and horizontal forces and withstand corrosion and marine borer attack. For shallow water, the design of this tower is not difficult and the horizontal forces can easily be taken. In deep water, however, the problem may become very difficult, and consideration must be given to length of columns and general buckling. The total weight of the members involved may be considerable and must be limited to equipment capable of installation. An object of this invention is to provide a derrick foundation adapted for severe service under difficult conditions.

Further and other objects and advantages will be apparent from the specification and claims, and from the accompanying drawings which illustrate what is now considered the preferred embodiment of the invention.

In the drawings:

Fig. 1 is a side view of the complete structure;

Fig. 2 is a view on line 2—2 of Fig. 1, and

Fig. 3 is a view on line 3—3 of Fig. 2.

The supporting soil is indicated at 10, the water line at 12, working platform at 14 and the derrick at 16.

As illustrated, there are four columns 18, usually of steel tubing sunk into the supporting soil. Assembled on each column 18 is a stack of tanks 20 preferably of annular cross-section. The tanks have tubular bores 22 of proper diameter to permit them to slide over columns 18, and they are provided with stiffening partitions 24. Each group of tanks at the same level may be welded into bracing sets, with steel connecting beams 26 and brace rods 28.

The top of each tank 20 is concave as at 30, and its bottom is convex as at 32, so that when they are stacked one above the other on columns

18, each tank 20 firmly engages the next adjacent tanks above and below it.

The bottoms of the extreme lowermost tanks are provided with large footing plates 34 which provide additional bearing capacity in the soil which otherwise might not be capable of taking the extreme loads encountered when pulling a stuck well casing (indicated at 38). Plates 34 are stiffened by bracing plates 36.

In the assembly of the structure the individual frames may be floated to location, set over the supporting columns 18, and then filled with water to sink them to position.

When the foundation is completed, with the derrick and equipment ready for operation, the tanks may be unwatered by air pressure to provide additional load carrying capacity.

Platform 14 is supported above tide water 12 on the tops of columns 18, which are closely surrounded by tubular columns 40 resting on top of the uppermost tanks 20, well below water level. Diagonal braces 42 help to stiffen the platform.

When drilling operations are completed, the frames can be floated to the surface and removed for use again on other derricks. Then, if the well is a producer, a light platform may be erected on the tubular columns which are left in place, and a temporary derrick or pump installed. If the well is non-productive the supporting columns can also be jettied out and the entire installation removed.

It is to be understood that the invention is not limited to the specific embodiment herein illustrated and described but may be used in other ways without departure from its spirit as defined by the following claims.

What is claimed is:

1. A marine derrick foundation comprising a plurality of columns sunk through water into supporting soil, in combination with hollow annular tanks, adapted to be floated to location while empty, stacked one above the other around and along said columns, said tanks being adapted to be filled with water to sink them to position.

2. A marine derrick foundation comprising a plurality of columns sunk through water into supporting soil, in combination with hollow annular tanks, adapted to be floated to location while empty, stacked one above the other around and along said columns, means for interlocking the bottom of each tank with the top of the tank below it, said tanks being adapted to be filled with water to sink them to position, and then unwatered to provide additional load carrying capacity.

3. A marine derrick foundation comprising a plurality of columns sunk through water into supporting soil, in combination with hollow annular tanks, adapted to be floated to location while empty, stacked one above the other around and along said columns, each of said tanks having convex and concave ends, with the convex end of each tank engaging the concave end of the next adjoining tank, said tanks being adapted to be filled with water to sink them to position.

4. A marine derrick foundation comprising a plurality of spaced-apart columns sunk through water into supporting soil, in combination with hollow annular tanks stacked one above the other around and along said columns, and means structurally interconnecting the tanks at the same level.

5. A marine derrick foundation consisting of a plurality of columns sunk through water into supporting soil, in combination with a bracing system consisting of hollow annular tanks, adapted to be floated to location while empty stacked one above the other around and along said columns, each of said tanks having convex and concave ends, with the convex end of each tank engaging a concave end of an adjoining tank, said tanks being adapted to be filled with water to sink them to position, and then unwatered to provide additional load carrying capacity.

6. A marine derrick foundation comprising a plurality of columns sunk through water into supporting soil, in combination with a bracing system comprising hollow annular tanks stacked one above the other around and along said columns, each of said tanks having convex and concave ends, with the convex end of each tank engaging a concave end of an adjoining tank, and means structurally interconnecting the tanks at the same level.

7. A marine derrick foundation comprising a plurality of columns sunk through water into supporting soil, in combination with hollow annular tanks, adapted to be floated to location while empty, stacked one above the other around and along said columns, a footing plate under each stack of tanks, each of said plates being of greater diameter than said tanks, said tanks being adapted to be filled with water to sink them to position, and then unwatered to provide additional load carrying capacity.

8. Apparatus for drilling an oil well under water comprising a plurality of columns sunk through water into supporting soil and adapted for supporting a platform, in combination with a structure comprising hollow, annular, and buoyant tanks stacked one above the other around and along said columns for bracing said columns during the drilling operation, said bracing structure being readily removable from said columns upon completion of the drilling operation, by utilizing the buoyancy of said tanks.

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