

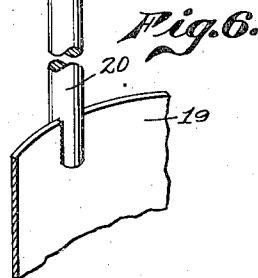
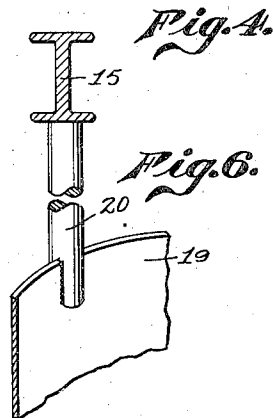
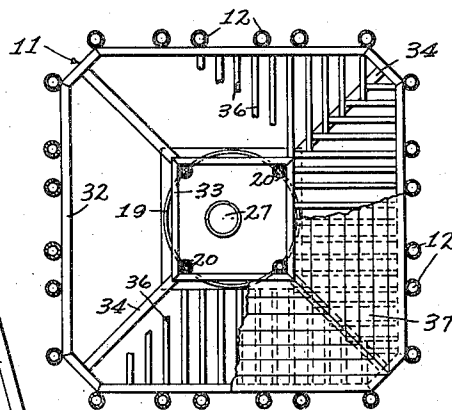
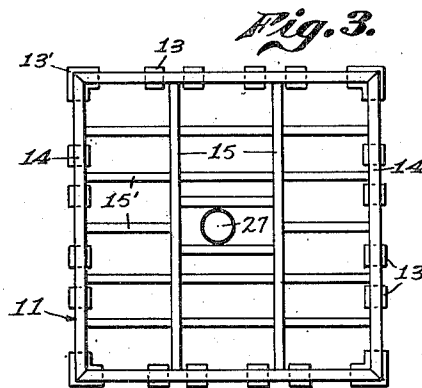
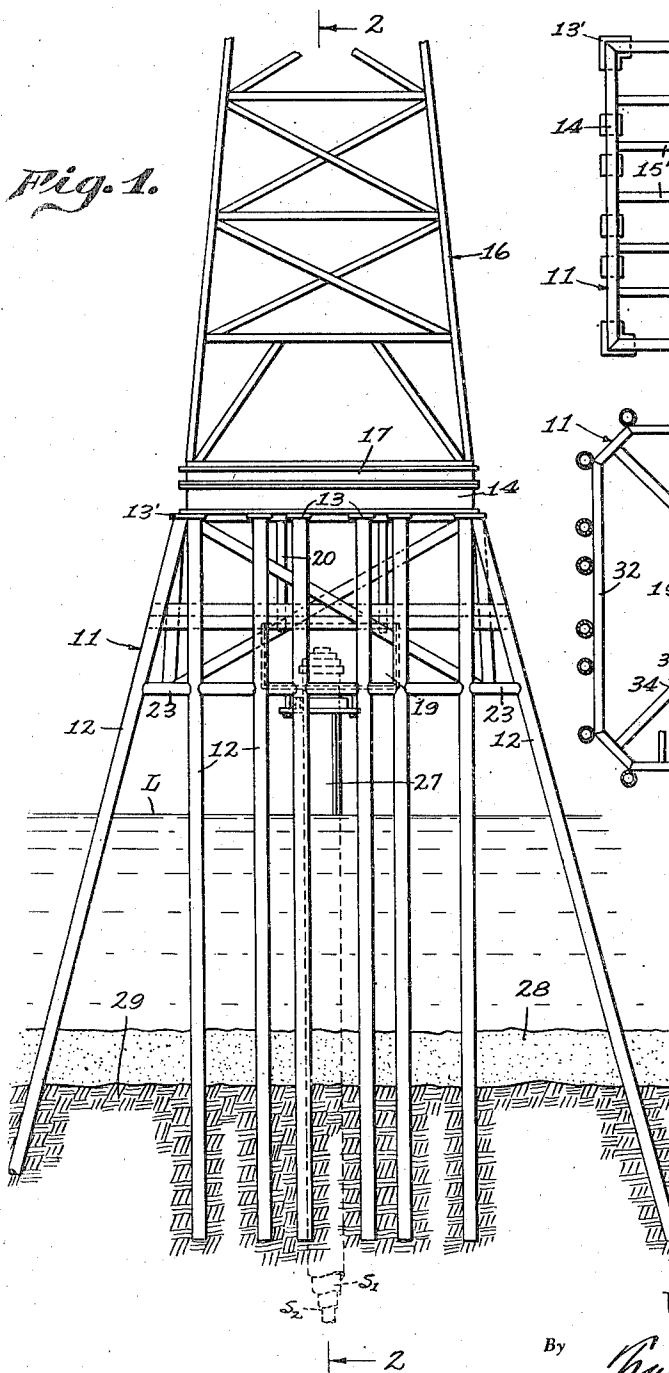
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V. F. GRACE ET AL
MARINE DERRICK STRUCTURE

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2 Sheets-Sheet 1



Inventor

Victor F. Grace
Walter H. Richardson

By

Wm. L. Abraham

Attorney

April 13, 1937.

V. F. GRACE ET AL

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2 Sheets-Sheet 2

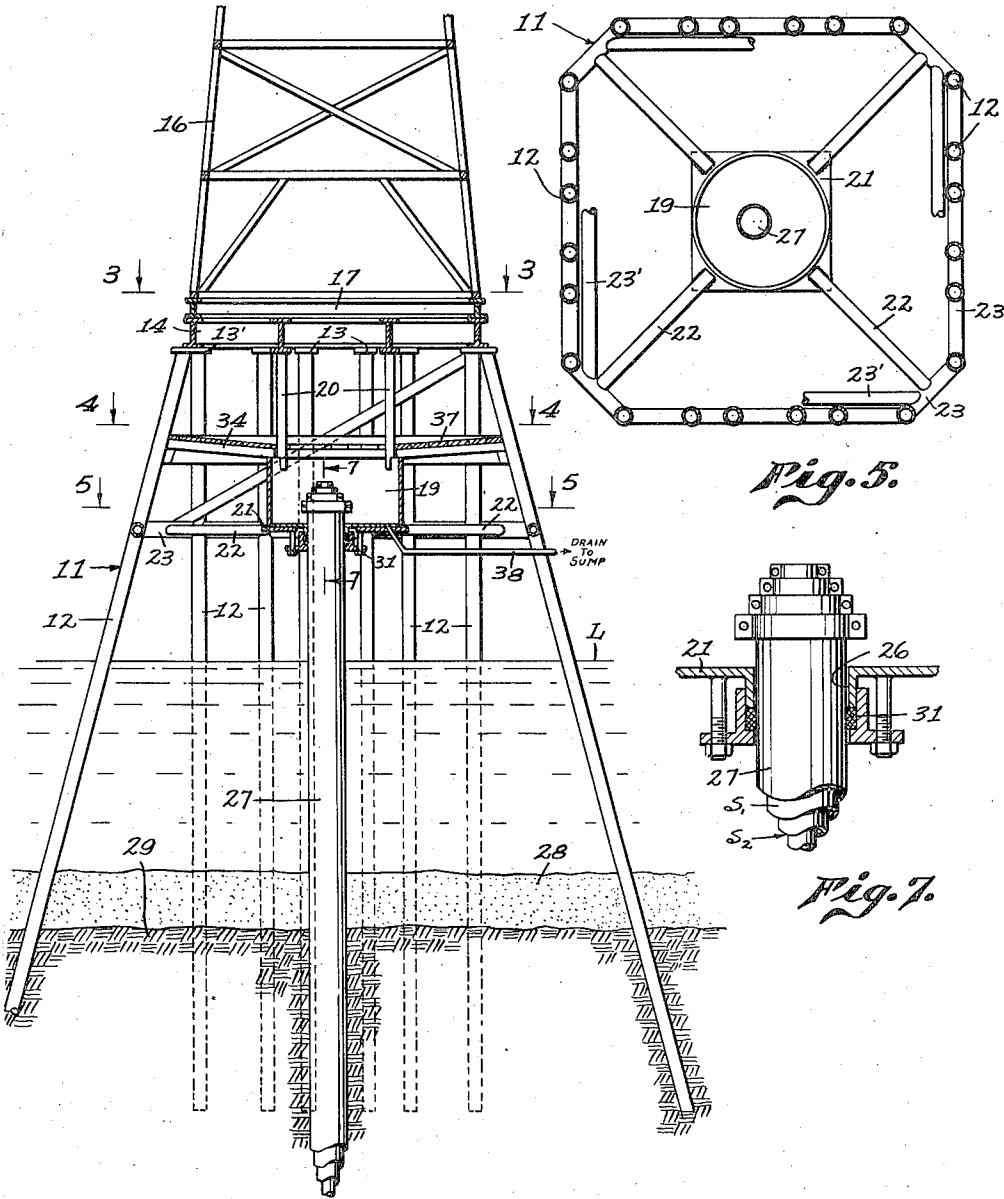


Fig. 2.

Inventor

Victor F. Grace
Walter H. Richardson

 B_y

Hans Rabschum

Attorney

UNITED STATES PATENT OFFICE

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MARINE DERRICK STRUCTURE

Victor F. Grace, Balboa, and Walter H. Richardson, Los Angeles, Calif., assignors to General Petroleum Corporation of California, a corporation of Delaware

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3 Claims. (Cl. 61—48)

This invention has to do in a general way with oil well drilling operations and is more particularly related to the so-called "marine" oil well derrick structures such as are used in drilling and producing oil from submarine formations at substantial distances from the shore line and in considerable depths of water.

As is well known to those familiar with the art, the production of oil from submarine formations is practiced to quite a great extent, particularly along the California coast line, and the construction of a foundation or a wharf structure on the floor of the ocean, which will support the derrick and the drilling equipment, and will also withstand the enormous forces of the elements, involves a difficult and expensive engineering problem.

In certain prior structures with which we are familiar, it is the practice to employ a foundation structure consisting of a system of vertical piles or piers positioned beneath the corners of the derrick floor and symmetrically arranged about a centrally disposed caisson, the piers and the caisson all being supported on the shale of the ocean floor. This caisson constitutes a container for a conductor pipe and the various casings employed in drilling the well. It also constitutes a support for a tank or sump which must be provided in order to prevent contamination of the ocean water with oil and drilling fluid which is always thrown upon a derrick floor from time to time during drilling operations.

Due to the enormous expense involved in building a caisson of the type employed in these prior structures, it becomes the primary object of this invention to provide a derrick foundation of the class described which does not employ a caisson. In the structure contemplated by this invention we employ what may be termed a substantially open foundation structure formed by four sets of parallel piles, the piles preferably being driven into the formation at an angle with the vertical so that the four sets converge at their upper ends to form the edges of a rectangle or square which constitutes the support for the derrick floor. The arrangement of the piles in the foundation structure contemplated by this invention may be described as the frustum of an open pyramid. It is an important feature of this invention that the sump or drainage tank is supported directly from the same piles which carry the derrick structure. There is no caisson, nor is there any substructure enclosed within the system of piles for the purpose of supporting the tank. We have discovered that it is not necessary to em-

ploy a caisson but that the conductor pipe may be extended directly down through an opening in the bottom of the tank and into the formation into which the well is drilled.

Inasmuch as the conductor pipe and the first string of casing, used in the structure contemplated by this invention, are cemented into the formation to quite a great depth, and constitute the sole support for the remainder of the casing used in the well, whereby the derrick and its foundation is relieved of the tremendous weight of the casings extending into the well, we consider it important that the conductor pipe and the tank through which it extends be adapted to have relative movement with respect to each other. In other words, the derrick and the well casings are independently supported. With this in mind we employ a sealing means between the conductor pipe and the opening in the tank which will permit such relative movement. This sealing means in the preferred form of our invention comprises a stuffing box.

In various structures of this nature it is necessary that a tight sub-floor or drainage floor be positioned below the derrick floor and above the top of the tank for the purpose of draining oil and drilling fluid into the tank. It is an important feature of the structure contemplated by this invention that this sub-floor, which we will hereinafter refer to as a "dished" floor, is supported entirely by the same piling system which carries the derrick structure.

It is the principal object of this invention to provide a foundation structure of the class described which is of simple form and construction and which may be erected at a considerable saving over the types now in use.

The details in the construction of a preferred form of our invention, together with other objects attending its production, will be best understood from the following description of the accompanying drawings, which are chosen for illustrative purposes only, and in which

Fig. 1 is an elevational view showing a foundation structure of the type contemplated by this invention and illustrating the manner in which the same supports an oil well derrick;

Fig. 2 is a sectional elevation taken in a plane represented by the line 2—2 of Fig. 1;

Fig. 3 is a plan section taken in a plane represented by the line 3—3 of Fig. 2;

Fig. 4 is a plan section taken in a plane represented by the line 4—4 of Fig. 2;

Fig. 5 is a plan section taken along the line 5—5 of Fig. 2;

Fig. 6 is an enlarged fragmentary section illustrating a preferred form of hanger used in supporting the tank from the derrick supporting means; and

Fig. 7 is an enlarged fragmentary section taken along the line 7-7 of Fig. 2 and illustrating one form of stuffing box which may be used between the conductor pipe and the opening through the drainage tank.

More particularly describing the invention as herein illustrated, reference numeral 11 indicates a foundation structure which consists of a plurality of piles 12, shown as being arranged in four sets or panels, the individual piles in each set or panel being parallel with each other, and the four sets of piles being arranged to form the sides of the frustum of an open pyramid. In other words, the four sets or panels of piles converge at their upper ends to define a rectangle or square as clearly illustrated in Fig. 3.

The top of the piles are provided with plates generally indicated at 13 and 13', such plates supporting beam members 14 which are secured to the plates 13, 13' and to cross beams 15, 15'. These beam members constitute a supporting frame structure which carries the derrick, generally indicated at 16, and the derrick floor 17 which in turn supports the drilling machinery.

As has previously been pointed out, it is an important feature of this invention that the system of piles just described constitutes the only foundation or supporting structure which is positioned beneath the derrick. It was also previously pointed out that it is necessary, in submarine derrick structures, to provide a drainage tank which is situated beneath the derrick floor. Such a tank is indicated by reference numeral 19 and is shown as being supported from the frame structure made up of beams 15 and 15' through the medium of hangers 20 which are secured by means of welding or in any other suitable manner at their upper ends to the beams of the frame structure and are secured at their lower ends to the tank. In this form of our invention this latter attachment is made by notching the lower ends of the hangers 20, as clearly shown in Fig. 6, so that the notched portions receive the edge of the tank 19, and then welding or otherwise securing the edge of the tank to the notched portion of the hanger 20.

The bottom of the tank is preferably made in the form of a square plate 21, which makes for convenient attachment to diagonal braces 22 extending from the bottom of the tank to what we may term cross braces 23 which are shown as being positioned between adjacent corner piles in a plane at or near the plane of the bottom of the tank. In addition to the cross braces 23 we provide a series of cross braces between each pair of piles as indicated at 23' so that the complete system of piles is rigidly braced at a point between the mean water level L and the top of the foundation structure.

The bottom 21 of the tank is provided with an opening 26 through which a conductor pipe 27 is driven through the sand 28 into the shale 29. The use of such a conductor pipe is conventional in oil well drilling practice, both on land and "over water" operations. This conductor pipe is cemented into the formation and the drilling operation takes place therethrough in the manner well known to those familiar with the art.

Since the conductor pipe and the first string of casing S₁ contained therein constitute the sole support for the remainder of the casing (generally

indicated at S₂) extended into the well, as the drilling operations proceed, and since the tank 19 is supported by the piling or foundation structure which carries the derrick, we consider it preferable that some latitude be allowed for relative movement between the conductor pipe and the tank due to possible differences in settling over an extended period of time. With this in mind, instead of welding or rigidly sealing the bottom of the tank to the conductor pipe, we propose to use some type of sealing means which will permit such relative movement. One form of such sealing means is shown as comprising a stuffing box, generally indicated by reference numeral 31.

In conjunction with the tank 19 it is necessary to employ a sub-floor or drainage floor which will convey any oil or drilling fluid that may leak through the cracks in the derrick floor directly into the tank 19. In this form of our invention we construct the sub-floor by welding or otherwise securing an outer frame 32 to the inner surface of the piling system. An inner frame member 33 is supported by the upper edge of the tank 19 and diagonal brace members 34 are interposed between the corners of the inner and outer frame members. It will be observed from Fig. 2 that the outer frame member is placed at a slightly higher elevation than the inner frame member so that the diagonal braces extend downwardly from the outer edge of the foundation structure to the upper edge of the tank. Joist members 36 are then positioned between the outer and inner frame members and the diagonal braces 34, such joist members constituting the support for a tight floor which is generally indicated by reference numeral 37. The construction of this floor is perhaps best illustrated in Figs. 2 and 4.

Any conventional means may be employed for withdrawing the contents of the tank 19. In the illustration we have shown the tank as being provided with a drain pipe 38 which extends to a suitable sump or pump, not shown, that may be located at some point on the pier or on the shore.

It will be apparent to those familiar with the art that the type of structural members employed, and the particular shape defined by the piers or piles which constitute the foundation, can be varied to suit the particular conditions at the location of the derrick structure. We prefer to employ tubular metal piles and, at all points where it is possible, make the connections between the various structural elements by means of welding.

It is to be understood that, while we have here-in described and illustrated one preferred form of our invention, the invention is not limited to the precise construction described herein but includes within its scope whatever changes fairly come within the spirit of the appended claims.

We claim as our invention:

1. In a marine derrick structure the combination of: a plurality of piles arranged to support a derrick; a plurality of horizontal beams mounted on said piles to form a supporting structure; hangers suspended from said supporting structure; and a tank supported by said hangers.

2. In a marine derrick structure, the combination of: a plurality of piles arranged to support a derrick; a derrick supporting frame mounted on said piles; hangers suspended from said frame; a tank supported by said hangers, said tank having an opening in its bottom; a conductor pipe extending through said opening; and sealing means in said opening surrounding said

conductor pipe, said sealing means being of a nature such as to permit relative movement between said tank and said conductor pipe.

5 3. In a marine derrick structure, the combination of: a plurality of piles arranged to support a derrick; a derrick supporting frame mounted on said piles; hangers suspended from said frame;

a tank supported by said hangers, said tank having an opening in its bottom; a conductor pipe extending through said opening; and a stuffing box in said opening surrounding said conductor pipe.

VICTOR F. GRACE.
WALTER H. RICHARDSON.