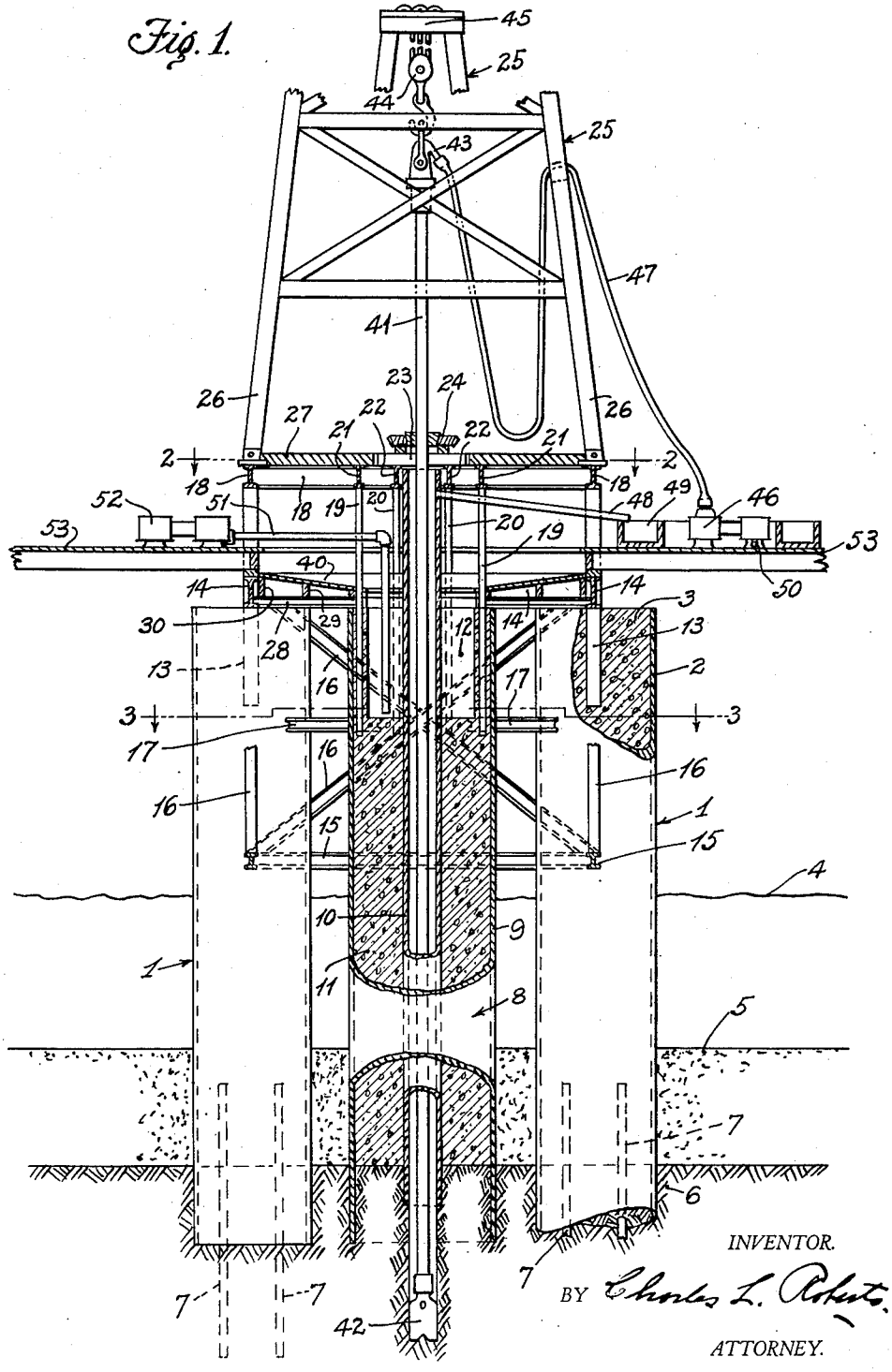
June 23, 1931. C. L. ROBERTS 1,811,761

SUBMARINE OIL WELL DERRICK

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Fig. 1.



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SUBMARINE OIL WELL DERRICK

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Fig. 2.

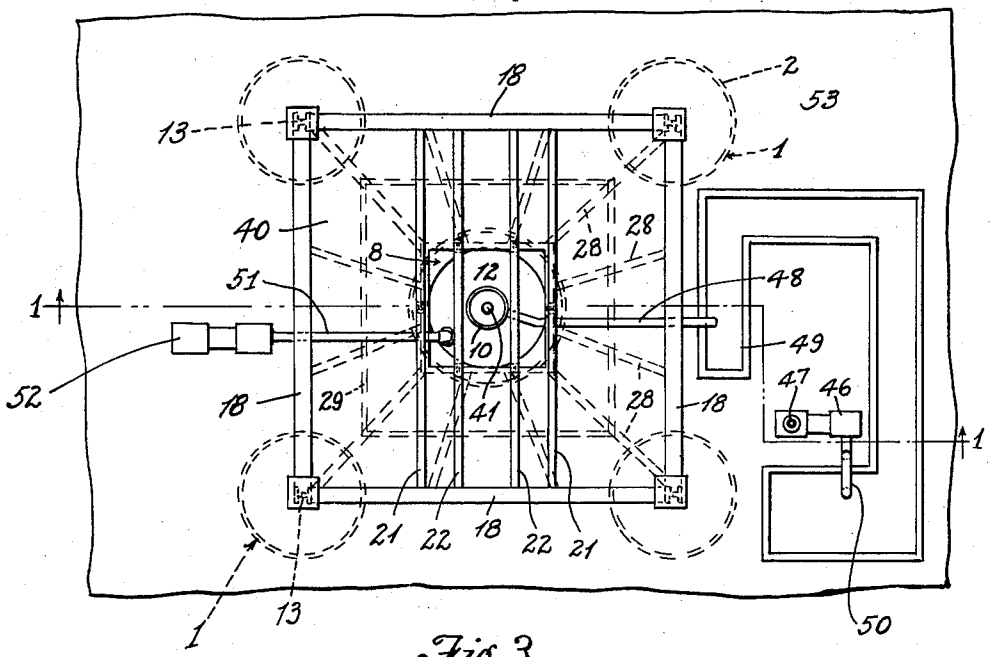
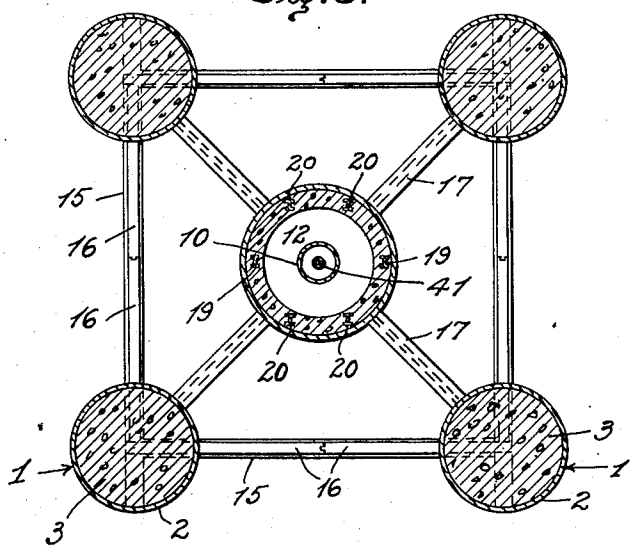


Fig. 3.



INVENTOR.

BY Charles L. Roberts,

ATTORNEY.

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UNITED STATES PATENT OFFICE

CHARLES L. ROBERTS, OF RENO, NEVADA

SUBMARINE OIL WELL DERRICK

Application filed February 8, 1930. Serial No. 426,863.

Recent developments have led to the discovery of a number of important oil formations beneath large bodies of water. Among the most notable are the oil bodies lying under the Pacific Ocean off the coast of southern California, particularly off Santa Barbara County.

This invention is directed to a device for drilling in the bed of the ocean or other bodies of water. The peculiar problems incident to such drilling makes the ordinary drilling devices heretofore used entirely unsuited to this new environment. This is especially so when applied to deep well bores of several thousands of feet deep, at great distances from shore. Well locations have been determined as far as two thousand feet off shore, in depths of water in the neighborhood of 30 feet of water and even greater. The normal surge of the waves creates a tremendous force tending to wreck any derrick which is set in them and when storms prevail, the force of the waves and the blast of the wind creates tremendous forces tending to upset even the staunchest derrick. When it is considered that derricks now employed for deep well bores are in the neighborhood of over 100 feet, generally 106 feet, and the derrick floor is normally 30 feet or 40 feet above mean high tide, and at depths of water neighboring 30 feet, and when it is considered that the derricks normally cannot be guyed, the overturning moment due to wind pressure and eccentric load is enormous. It is one of the purposes of this invention to design a derrick and derrick structure which will overcome all of the forces heretofore mentioned and be stable and rigid under the most adverse of circumstances.

Drilling in the ocean has developed an additional important problem. For many years oil wells have been drilled in southern California on land almost at the water edge. Laws have been passed directed against the contamination of the ocean water by either oil or drilling fluid. This is easily avoided when drilling is done on land, but the problem becomes acute when the derricks are positioned in deep water at great distances from the shore line.

It is, therefore, another object of this invention to design and construct a derrick and derrick structure wherein the drilling fluid and oil is segregated and contamination of the water of the ocean is prevented.

Further objects will be apparent from the description of the device which is not intended to be limiting, but merely illustrative of the best method of carrying out my invention.

In the drawings, Fig. 1 is a partly broken away and partly sectional view of the elevation of the derrick structure taken substantially on line 1—1 of Fig. 2, showing, however, pump 52 and connecting pipe 51 and the connecting pipe 48 for purposes of descriptive illustration.

Fig. 2 is a view taken on line 2—2 of Fig. 1.

Fig. 3 is a view taken on line 3—3 of Fig. 1.

The derrick foundation consists of a plurality of piers 1, shown as four in number and positioned at the points of a square. These piers are constructed by driving sheet piling 2 in the usual manner through the sand 5 and into the shale sub-strata 6 until the piles will go no farther, that is, to "refusal." Water level is indicated at 4. When the caisson thus constructed is completed, the sand is excavated, if it is not too great in depth, until the shale is revealed. A number of piles 7, preferably H-beams, are driven into the shale to "refusal." The cement 3 is then poured into the cylinder, which is thus constructed. Before the cement sets, a vertical H-beam 13, to be described later, is set in the cement. In like manner, beams 15 and 16 are also set. These

will be described in detail later. Centrally of these piles a fifth cylinder or caisson 8, larger in diameter, is constructed by driving sheet piling 9 in a like manner. Sand is excavated as shown, and a central conductor pipe 10 is set concentrically of the cylinder. At the top of the caisson 9 a concentric hollowed out portion 12 is formed, with appropriate forms, to act as a sump to be described later. In the annular wall thus formed, vertical beams 19 and 20 are positioned as shown, and the concrete poured.

The piers and the caisson thus constructed are connected together in the manner shown. The beams 15 in the form of a square connect the piers 1. These are set in the concrete through holes cut in the piling. Beams 14 connect the vertical beams 13 to form a second square connection at the top of the piers. Cross beams 16 connect beams 14 and 15 on each of the four sides of the parallelogram thus formed. These are set in the concrete of the piers through holes cut in the piling. Intermediate the plane of beams 14 and 15, angular cross section 17 connects the piers 1 to caisson pier 8. The foundation thus formed is extraordinarily rigid and will overcome any twist in any plane. If any motion occurs, the five piers must move as a unit.

The wharf 53, which may be of any construction, surrounds this structure and is in part carried by beams 14. Positioned upon the vertical uprights 13 is a second square formed of I-beams 18. Cross connected between these beams 18 are a pair of beams 21, (see Fig. 2) which are supported upon the vertical uprights 19. A second pair of beams 22 are cross connected between beams 18 and positioned on and carried by the four vertical uprights 20. (See Fig. 2). The upper level of beam 22 is slightly below that of beams 21. The derrick 25 shown partly broken away for convenience is of the standard design. Each of the four legs is positioned immediately above the vertical uprights 13 and rest upon the beams 18. The legs are rigidly connected to 18 in any conventional manner. The floor of the derrick 27 is positioned on these beams 18 and carried also by beams 21.

One of the important elements of this invention is the provision of a trough 40. This is constructed by connecting a plurality of beams 28 to beams 14 and connected to the periphery of the annular wall of the caisson 8. Upon these beams is positioned squares composed of sills 29 and 30 and upon these is placed sheet metal to form the trough 40. The sills 29 and 30 are so constructed that the trough 40 inclines from its outer edge to the center. A square hole is cut in the trough immediately above and in register with the opening of the chamber 12.

A number of beams 23 are laid on and across beams 22. On these beams is set the rotary table of conventional design, so that the hole through the rotary table is in line with the center line of the conductor pipe 10. Through this rotary is placed the conventional drill pipe 41, carrying at the bottom a drill 42 and connected at its upper end to a swivel 43, carried by a block 44, and by cable threaded through the cat-head 45. A mud pump 46 positioned on the wharf 53 takes suction by line 50 from a mud trough and tank 49 and the drilling mud is pumped through line 47 to the swivel 43, sent down through the drill pipe 41 and through the conventional opening in drill 42 to be returned with cuttings up the bore hole and the conductor pipe 10. As shown here, the mud is then returned through pipe 48 to mud trough 49, where the cuttings are separated, and the mud eventually returned by pump 46. The conventional power means for operating the rotary table and the lines and other drilling equipment is not shown because their use is well understood.

During drilling operations and especially when the pipe 41 is withdrawn and disconnected, mud and oil accumulates upon floor 27, and falls through cracks and other apertures onto trough 40 to be directed to the chamber or sump 12. Many other occasions such as bailing will result in a "wet job", as occurrences when liquid is spilled on the floor is termed in oil well drilling parlance. A pump 52 is provided for withdrawing this mud through line 51 to be sent to any appropriate storage. This trough and sump is also effective to collect and segregate any oil when the well is producing on the beam, i. e., by means of a mechanical pump. When removing the pump from the well, oil is usually spilled on the floor.

The method of construction which provides for positioning of the conductor pipe in the cemented portion of the caisson 8 has a twofold function besides holding the pipe rigidly. By cementing the conductor pipe both below and above the water line an impervious wall is constructed which prevents seepage of water into the well bore and thus prevents contamination of the oil when the well is put on production. During the drilling operation it prevents the passage of drilling fluid under the pipe and caisson and eventual seepage into the ocean and resultant pollution. While other means of sealing the conductor will suggest themselves to those skilled in the art, it is believed that the method here suggested is the most practical.

It will be observed that this device provides a rigid foundation for the derrick capable of carrying the tremendous loads which are incident to drilling operations. It

will be observed that the load is transmitted through the legs of the derricks to the corner piers. Any load which is carried by the rotary table, especially during the periods when the drill pipe 41 is withdrawn, wherein it is necessary to carry the full load of the drill pipe on the rotary table by means of slips which act as wedges, this load is transmitted to the walls of the central caisson. During drilling all the load is on the corner piers. It will be further observed that adequate provision is made for the segregation of drilling fluid or oil. As described, the drilling fluid is circulated up the conductor pipe and through a take-off pipe 48 to the mud trough. It may be further advantageous, on occasions, to do away with the take-off line 48 and by cutting the conductor pipe off at a point nearer the top of the caisson, to permit the drilling mud to spread over the conductor pipe into the sump 12, to be removed by a pump such as 52 and returned to the mud trough 49. When the drilling operation is finished and the necessary valves are to be set, sump 12, as well as the other parts of the structure, will act as foundations or anchorages to hold down the valve settings, such as the "Christmas tree". Connections between metallic members are made in the manner well known in the art and are preferably made by welding the metallic members together.

While this construction is designed particularly for ocean drilling, it is equally adapted for sub-aqueous drilling in lakes or other bodies of water where problems similar to those here described are encountered. The above description is not to be taken as limiting, but merely descriptive of my invention and various modifications may be made by those skilled in the art to meet various conditions, as will be well understood by them.

What I claim as my invention is:

1. In apparatus for off-shore oil wells consisting of a derrick supported on a series of piers, the combination therewith of a caisson extending down into the ocean bottom, a conductor pipe within said caisson for reception of drills and production of oil, said pipe extending down into the ocean bottom, the space between the pipe and the caisson walls, except for a suitable space adjacent the top of the caisson acting as a cellar, being filled with concrete, said concrete extending to the ocean floor to seal the interior of the caisson to prevent contamination of the ocean waters by oil, and vice versa.

2. An apparatus for off-shore oil wells consisting of the combination with a suitably supported derrick, of a caisson extending down into the ocean bottom, a conductor pipe within said caisson extending down into the ocean bottom, and concrete within the caisson contacting with the caisson and pipe and sealing the joints between said pipe and the ocean bottom and between the caisson and the ocean bottom, to prevent seepage of ocean water under the caisson and around the pipe.

Signed at Los Angeles, in the county of Los Angeles, and State of California, this 3d day of Feb., A. D. 1930.

CHARLES L. ROBERTS.