July 8, 1952 W. J. TRAVERS, JR 2,602,636

APPARATUS FOR MARINE WELL DRILLING

Filed June 27, 1947 2 SHEETS—SHEET 1

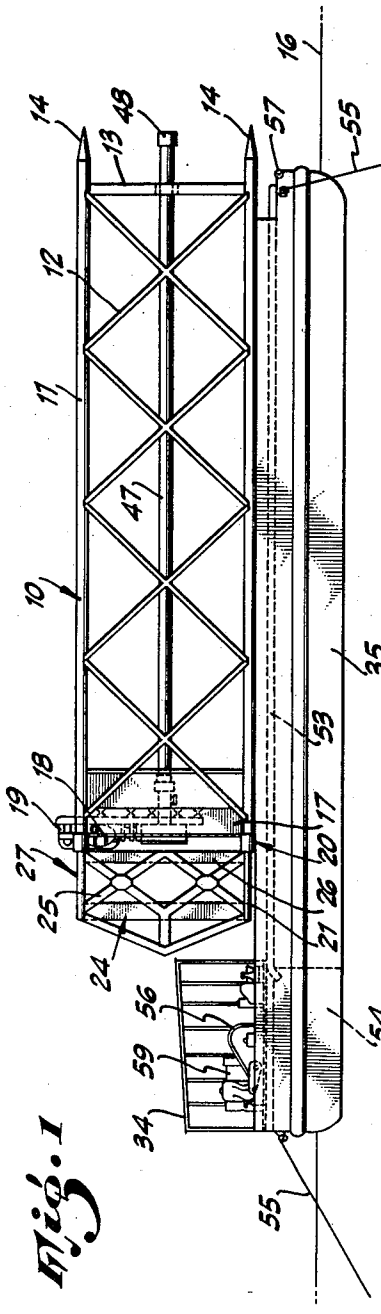


Fig. 1

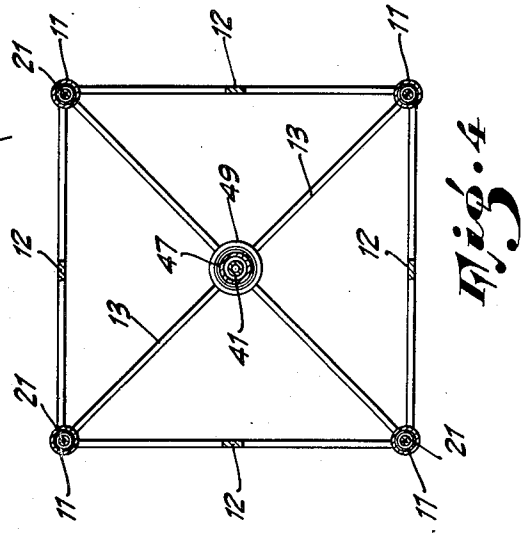


Fig. 4

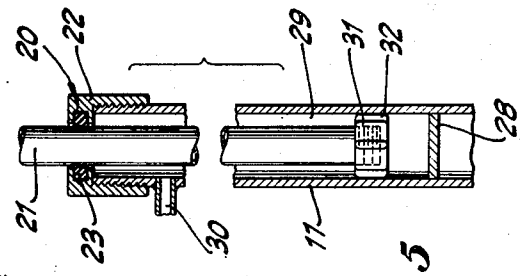


Fig. 5

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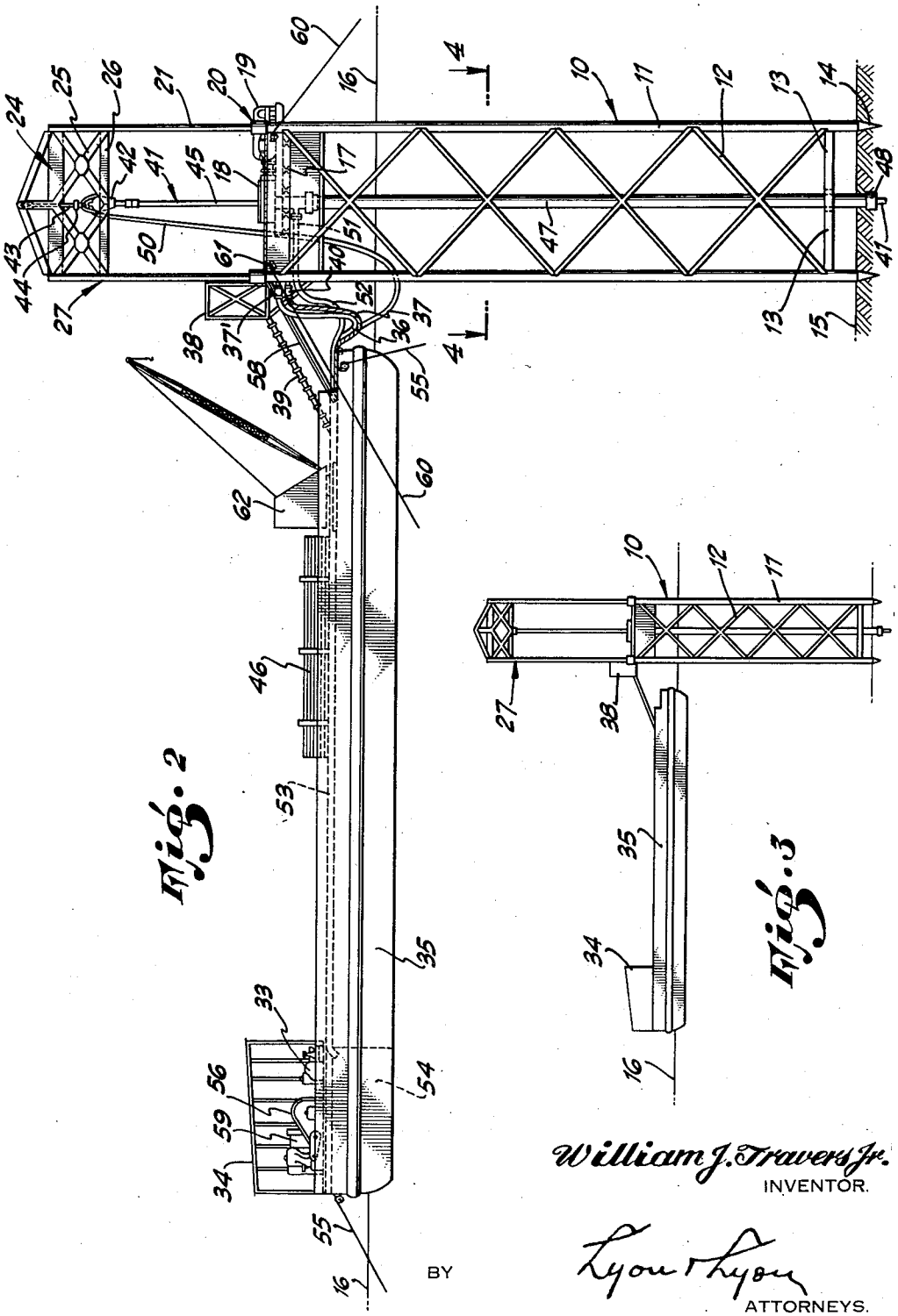


Fig. 2

Fig. 3

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APPARATUS FOR MARINE WELL DRILLING

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2 Claims. (Cl. 255—2)

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This invention relates to apparatus for drilling a well under a body of water and is particularly directed to a device adapted for the drilling of oil wells in off-shore marine locations.

In my prior application, Serial No. 730,337, filed February 24, 1947, now Patent No. 2,472,869, I have shown and described a device for supporting one or more well drilling rigs for commercial exploitation of oil fields known to exist under bodies of water. The initial installation of such a drilling island entails a considerable expenditure of money, and it is highly desirable therefore to have substantial assurance that oil will be found in a quantity sufficient to justify this outlay for such a large scale program.

Accordingly, it is an object of the present invention to provide drilling apparatus for proving territory below a body of water prior to the drilling of production wells. The present invention contemplates the use of portable equipment which may be floated to position on a barge and then set upright on bottom. Well drilling machinery carried on such device is then used to drill an exploratory well into the oil sands believed to exist at that location. It is contemplated that such a well will not be brought into production but that the information acquired during the drilling will be of importance in later exploiting the field commercially if the information obtained indicates that commercial exploitation is feasible. Even if oil in commercial quantity is found by such exploratory drilling, it is contemplated that the well would not be produced, but would be plugged.

It is therefore the principal object of this invention to provide well drilling apparatus suitable for drilling exploratory wells below a body of water.

Another object of this invention is to provide well drilling apparatus including the framework adapted to rest on bottom and to extend upwardly above the water level, the framework having a plurality of vertical tubular members each of which receives a plunger in telescopic relation. The plungers are rigidly connected at their upper ends by a cross head which is adapted to support a drill string depending through a rotary machine carried on the upper end of the framework. The cross head is raised hydraulically by introducing fluid under pressure into the tubular members.

Another object is to provide a device for drilling wells under a body of water, which device extends a minimum distance above the water level in order to reduce the tendency of the device to overturn due to wind loads.

Further objects of this invention are to provide a drilling organization for exploratory wells which eliminates the requirement of a conventional drawworks for raising and lowering the drill string and in which the storage of drill pipe during the operations of going into and coming out of the hole may be accomplished by racking the pipe in a horizontal position at a location away from the structural framework in order that the off-center load imposed by conventional racking methods may be entirely eliminated.

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Other objects and advantages will appear hereinafter.

In the drawings:

Figure 1 is a side elevation illustrating a preferred embodiment of my invention showing the framework, cross head and associated parts carried in a horizontal position on a floating barge.

Figure 2 is a side elevation of the device in position for drilling a well.

Figure 3 is a view similar to Figure 2 showing the cross head in extended position.

Figure 4 is a sectional plan taken substantially on the line 4—4, as shown in Figure 2.

Figure 5 is a sectional detail showing construction of one of the longitudinal tubular members forming a part of the framework.

Referring to the drawings, a framework generally designated 10 includes a plurality of longitudinal tubular members 11, spaced in symmetrical relation and connected by diagonal bracing 12 and horizontal struts 13. The tubular members 11 are closed at their lower ends and provided with pointed foot pieces 14 adapted to rest on bottom 15. The framework 10, including the longitudinal tubular members 11, extends upwardly above the water level 16 and carries a supporting platform 17 for a conventional rotary machine assembly 18. This rotary machine 18 may be of any suitable or desirable commercial type and is provided with a prime mover 19 for rotating it at any desired speed. The prime mover 19 may advantageously take the form of a direct current motor.

At the upper end of each of the tubular members 11 is provided a sealing device 20 which may be of any suitable or desirable type. The purpose of the sealing device 20 is to establish a fluid-tight seal between the tubular members 11 and plunger elements 21 which are telescopically received within the upper ends of the members 11. The sealing device 20, as shown in Figure 5, includes a threaded ring 22 connected to the upper end of each member 11 and carrying a deformable sealing element 23. It is to be understood that any other suitable or desirable type of stuffing box or packing may be employed at this position if desired. The plunger elements 21 extend upwardly from the tubular members 11 and are rigidly joined at their upper ends by means of a cross head structure 24 which includes diagonal braces 25 and horizontal struts

26. From this description it will be understood that the cross head joins each of the parallel plunger members 21 so that they operate as a single unit, hereinafter designated as the carrier 27.

Means are provided for raising and lowering the carrier 27 with respect to the structural framework 11, and, as shown in Figure 5, this means includes a dam 28 positioned within each of the tubular members 11 near the lower end thereof to define a fluid chamber 29 within each of the tubular members above the location of the dam 28. One or more side connections 30 is provided to communicate with each of the chambers 29. Fluid under pressure is introduced into each of the chambers 29 to raise the plunger element 21. A cap 31 may be threaded over the lower end of each of the plunger elements 21 to prevent escape of pressure fluid upwardly through the interior thereof. The cap 31 is provided with a series of flutes or bearing pads 32 which contact the inner wall of the tubular members 11 and thus serve to align the lower ends of the plunger elements 21 while permitting flow of pressure fluid into the lower end of the chambers 29. As shown in Figure 5, the introduction of pressure fluid into the side fitting 30 causes pressure to be applied below the plunger element 21, thereby raising the plunger element 21 with respect to the tubular member 11. If desired, a second connection fitting can be provided for discharge of pressure fluid from the chamber 29 or the same fitting 30 may be utilized for this purpose. In any event, a common supply source for pressure fluid is provided and each of the tubular members 11 is connected to this supply so that an equal force is applied at the lower end of each of the plunger elements 21. When it is desired to lower the carrier 27, pressure fluid is exhausted from the chambers 29 and the carrier descends by gravity.

Means are provided for supplying pressure fluid to the chambers 29, and, as shown in the drawing, this means includes a power driven oil pump 33 mounted within an enclosure 34 positioned at the far end of a floating barge 35. Pressure fluid is pumped through conduits, not shown, to connect with the inlet hose 36 which leads to a distributing system, not shown, carrying pressure fluid to each of the chambers 29. A hose 36 is provided to permit the barge to move with the tide while the structural framework 10 remains stationary. A valve 37' is shown connected with the hose 36 and this valve may be used to regulate the supply of fluid to the chambers 29. The valve 37' is represented diagrammatically only, and, if desired, may be positioned within the control house 38 mounted on the structural framework 10 near the upper end thereof. A foot ramp 39 may be conveniently provided between the control house 38 and the barge 35. A return hose 37 is shown and the purpose of this hose is to return fluid from the chambers 29 to the pump 33 mounted on the barge. A hydraulic accumulator, not shown, may be provided in conjunction with the pump 33 in order that an adequate supply of pressure fluid may be maintained at all times so that merely by adjusting the inlet control valve 37' and discharge control valve 40 in the return hose 37, the position of the carrier 27 with respect to the framework 10 may be accurately regulated and controlled.

A drill string generally designated 41 is suspended from the hydraulic rotary swivel and this in turn is pendently supported from the cross head structure 24 by any convenient means such as, for example, the conventional elevator links 43 and connector piece 44. The uppermost section of the drill string is a kelly 45 which is non-circular in external configuration and which extends through drive bushings, not shown, provided in the rotary table 18 as will be readily understood by those skilled in the art. The lower sections of the drill string 41 are composed of drill pipe of the type shown in the pipe rack 46 carried on the barge 35. The drill string extends downwardly through the rotary machine and through a relatively large diameter conductor pipe 47 which carries a shoe 48 in its lower end extending into the bottom 15. A bit, not shown, is provided on the lower end of the drill string 41. The conductor pipe 47 extends through a guide ring 49 positioned centrally of the structural framework 10 by means of the horizontal struts 13. Mud fluid is delivered into the drill string through the hydraulic rotary swivel 42 and this mud fluid is delivered through a conventional mud hose 50 connected at one end to the swivel 42 and at the other end to a mud conduit, not shown, extending lengthwise of the barge 35. A mud pump of any conventional type, not shown, is positioned within the enclosure 34 and adapted to deliver mud fluid under pressure through such conduit into the hose 50. The mud fluid travels downwardly through the interior of the drill string 41 and returns upwardly through the drilled hole around the drill string into the conductor pipe 47. A lateral outlet 51 is provided on the conductor pipe 47 just below the rotary machine 18 and this outlet 51 communicates via hose 52 with a mud pipe 53 extending longitudinally of the barge 35. Mud fluid in the pipe 53 is carried into a settling basin 54 provided in the barge 35 under the enclosure 34 from whence the fluid is recirculated by means of the mud pump, not shown.

In operation the barge 35 is employed to float the structural framework 10 and carrier 27 to the desired location for drilling a well. As shown in Figure 1, the overall length of the framework 10 and carrier 27 in its retracted position is such that it may be supported on the barge 35. When the desired location is reached, anchor lines 55 are extended from each end of the barge 35 to maintain it in the desired position. A winch 56 within the enclosure 34 is then used in conjunction with floating cranes, not shown, to move the structural framework 10 from the position illustrated in Figure 1 to the position illustrated in Figure 2. A roller 57 is provided on the end of the barge 35 to facilitate this operation. The pointed feet 14 project into the bottom 15 by reason of the weight of the structural framework 10 and carrier 27 and the shoe 48 on the lower end of the conductor pipe 47 is driven into the bottom 15 by any convenient means. The oil delivery and return hoses 36 and 37 are then connected to the distributing system for introducing and withdrawing fluid under pressure from the chambers 29 within the upper ends of the longitudinal members 11. The mud hoses 50 and 52 are also connected for operation. An electric cable 58 is extended from the barge in order that the motor 19 for driving the rotary table 18 may be driven from the generator 59 provided within the barge enclosure 34. Suitable control means for regulating the speed of the motor 19 are not shown but may be provided within the control house 38. Guy wires 60 extend from the upper end of the

structural framework to anchors, not shown, which are imbedded in the bottom 15, and, in order that equal tension may be maintained in the guy wires 60, suitable tie-down devices 61 may be provided on the upper end of the structural framework 10.

A crane 62 is then positioned on the barge 35 for the purpose of transporting the individual pipe sections from the rack 46 into position below the cross head structure 24 in order that they may be added into the drill string as the hole is deepened. The rotary machine is operated to turn the drill string 41 and the carrier 27 is lowered gradually to permit the bit, not shown, to deepen the drilled hole. When the cross head 24 approaches the upper end of the structural framework 10, the rotation of the rotary machine 18 is interrupted and the carrier 27 is lifted to its extended position as shown in Figure 3. The crane 62 is then utilized to transfer a section of drill pipe from the rack 46 and this section is connected into the drill string below the kelly 45. The string is then lowered to bring the bit into contact with the bottom of the hole, the rotary machine is started, mud fluid is delivered into the drill string and the drilling proceeds in the conventional manner. When it is desired to withdraw the drill string from the hole for the purpose of changing the bit or for any other reason, the rotary machine is maintained stationary and the carrier 27 is raised in order that the drill string may be withdrawn from the hole section by section. The crane 62 is employed to move each section of the drill string when removed and store it on the pipe rack 46.

After the well has been completed, it may be plugged by any conventional cementing process well known in the art. The hoses are then disconnected and the winch 56 employed in connection with floating cranes, not shown, to lift the structural framework 10 and carrier 27 back on the floating barge 35 as shown in Figure 1. The barge may then be towed to a new location in order to drill another well.

It will be observed that the requirement of a conventional derrick above water level has been eliminated. Instead of storing drill pipe on and within the derrick in accordance with conventional practice when coming in or going out of the hole, the pipe is stacked in horizontal position on the drilling barge 35. Furthermore, the conventional drawworks is not employed, and instead the carrier 27 which is hydraulically operated is used for raising and lowering the drill string 41. By means of these important differences from conventional drilling practice a lightweight portable drilling unit is provided and the problem of bracing the tall derrick structure against wind loads is eliminated.

Having fully described my invention, it is to be understood that I do not wish to be limited to the details herein set forth, but my invention is of the full scope of the appended claims.

I claim:

1. In a device for drilling a well under a body of water, the combination of: a structural framework adapted to rest on water-covered bottom and to extend upwardly above the water level, a rotary machine fixed on the upper portion of the framework, said framework including a plurality of parallel load supporting vertical tubular members, a plurality of parallel plunger elements each adapted to be received within the upper end of one of said tubular members in telescopic relation, a crosshead above the rotary machine rigidly connected to the upper portion of each of said plunger elements, the cross-head and plunger elements comprising a free-standing unitary carrier movable vertically with respect to the structural framework and thereby varying the over-all height of the device above the water level, a hydraulic rotary swivel pendently suspended from the crosshead for supporting a rotary drill string extending through the rotary machine, and hydraulic means whereby fluid under pressure may be introduced into said tubular members to lift the plunger elements simultaneously and thereby raise the unitary carrier and hydraulic rotary swivel relative to the rotary machine.

2. In a device for drilling a well under a body of water, the combination of: a structural framework adapted to rest on water-covered bottom and to extend upwardly above the water level, a rotary machine fixed on the upper portion of the framework, the framework including four parallel load supporting vertical tubular members resting on bottom and defining the outer boundaries of said framework, four parallel plunger elements each adapted to be received within the upper end of one of said tubular members in telescopic relation, a crosshead rigidly connected to the upper portion of each of said plunger elements above the rotary machine, the crosshead and plunger elements comprising a free-standing unitary carrier movable vertically with respect to the structural framework and thereby varying the over-all height of the device above the water level, a hydraulic rotary swivel pendently suspended from the crosshead for supporting a rotary drill string extending through the rotary machine, and hydraulic means whereby fluid under pressure may be introduced into said tubular members to lift the plunger elements simultaneously and thereby raise the unitary carrier and hydraulic rotary swivel relative to the rotary machine.

WILLIAM J. TRAVERS, JR.

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