June 14, 1960 V. SMITH 2,940,266

METHOD OF CONSTRUCTING AN OFFSHORE WELL DRILLING ISLAND

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FIG. 2.

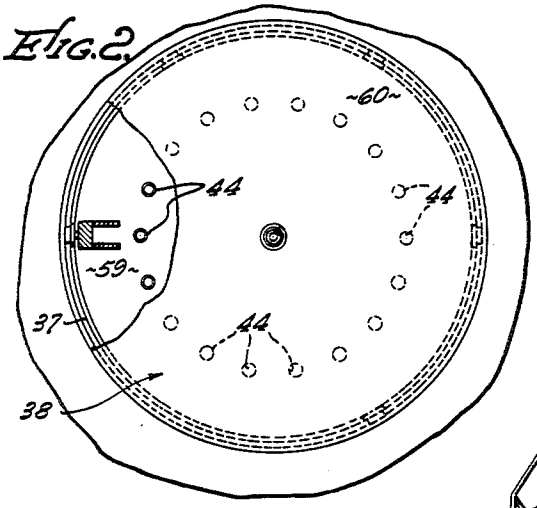

FIG. 1.

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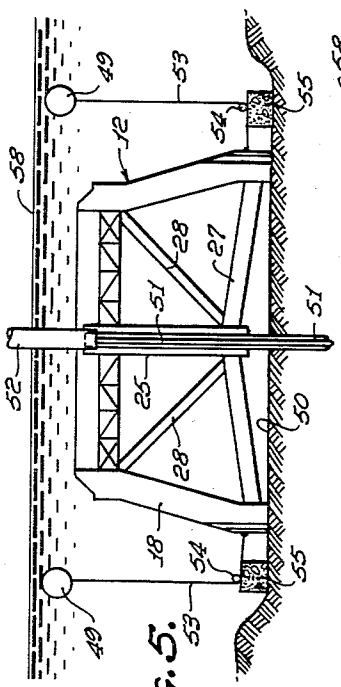

Fig. 5.

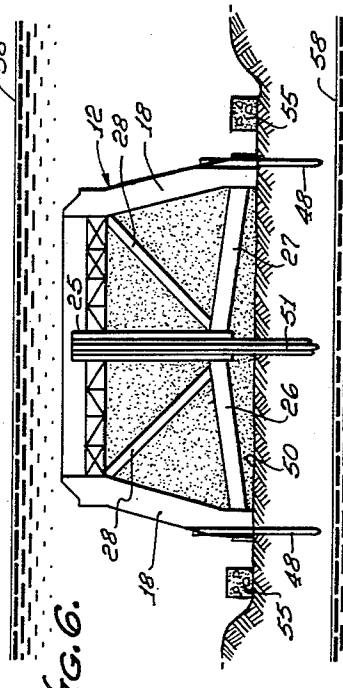

Fig. 6.

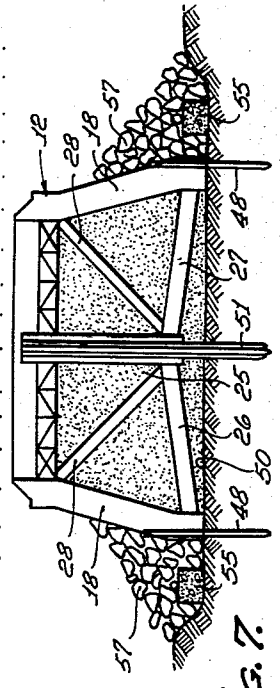

Fig. 7.

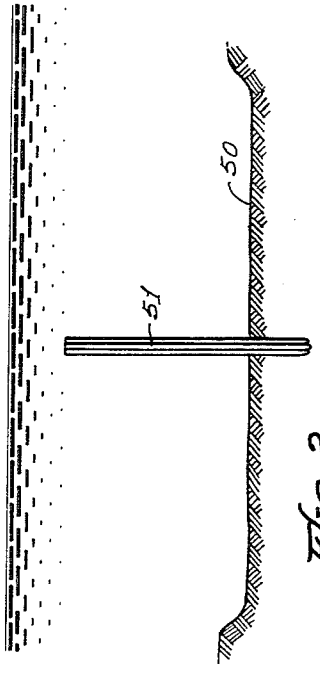

Fig. 3.

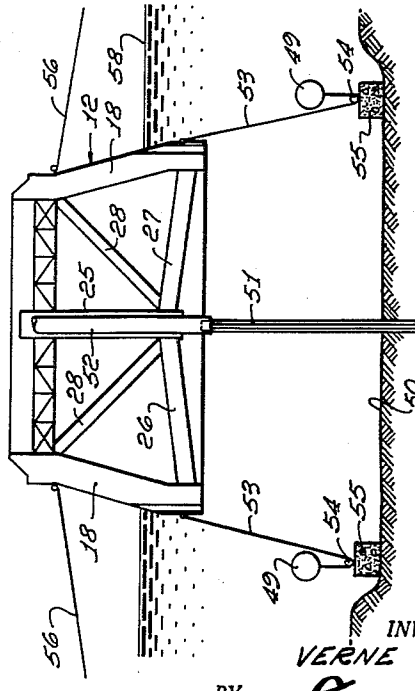

Fig. 4.

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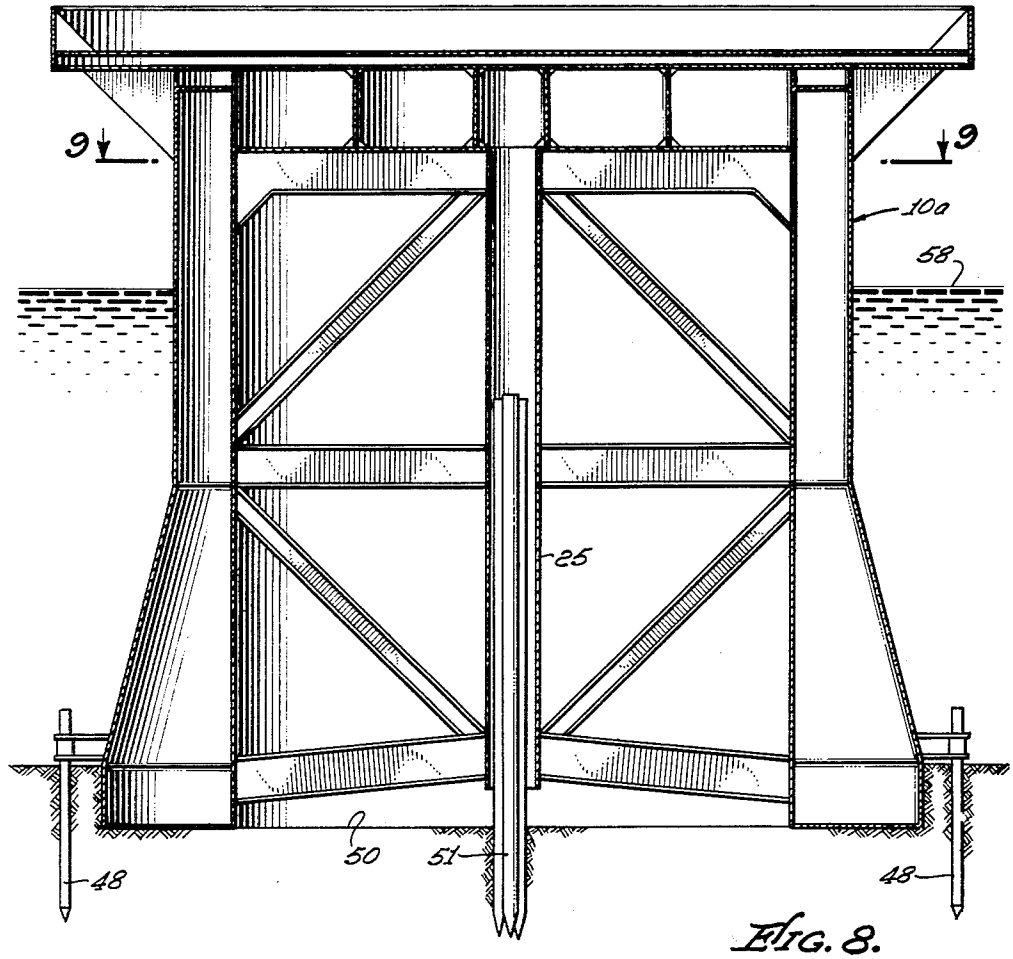

FIG. 8.

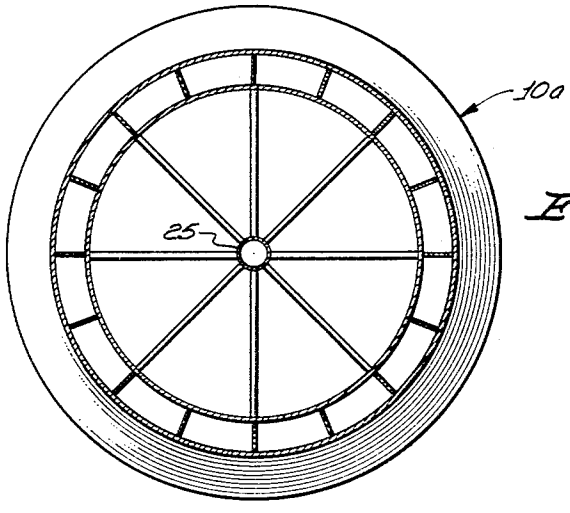

FIG. 9.

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METHOD OF CONSTRUCTING AN OFFSHORE WELL DRILLING ISLAND

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5 Claims. (Cl. 61—46.5)

This invention relates to a method and apparatus for drilling and producing oil, gas or other wells in an offshore marine location. This invention finds particular usefulness in connection with a drilling and production island structure which is portable to the extent that it can be floated to the desired site, rested on the bottom and used as a supporting structure for drilling and producing oil wells, the entire device being movable to float to a new location if desired.

Among the objects of the present invention are to provide method and apparatus for constructing a support for a well drilling rig in a marine location and for producing oil or gas from wells drilled from such island. Another object is to provide method and apparatus for constructing a removable island of this type and wherein parts thereof may be separately floated to the drilling site. Another object is to provide a drilling island which is relatively inexpensive to manufacture and erect, which is inherently stable in resisting wind, wave and tide action and which may be used to drill a number of directional holes from the single location. Other related objects and advantages will appear hereinafter.

In the drawings:

Figure 1 is a side elevation showing a preferred embodiment of my invention.

Figure 2 is a fragmentary top plan view thereof, certain parts being omitted for clarity of illustration.

Figures 3, 4, 5, 6 and 7 show steps in the method of erection of the device.

Figure 8 is a sectional elevation showing a modification.

Figure 9 is a sectional plan view taken substantially on lines 9—9 as shown in Figure 8.

Referring to Figures 1–7 of the drawings, a drilling island generally designated 10 includes an upper member 11 and a bottom member 12 connected at the joint 13 by a plurality of removable fastener elements 14. The bottom member 12 comprises concentric frustoconical walls 15 and 16 connected by partitions 17 forming buoyant chambers 18. The lower ends 19 and 20 of the walls may be cylindrical and these cylindrical portions are joined by an annular bottom wall 21. The upper ends of the walls 15 and 16 likewise may be cylindrical as indicated at 22 and 23 and the connecting annular top wall 24 forms one side of the joint connection 13.

A central vertical guide tube 25 is mounted within the lower member 12 and is connected to the wall 16 by means of suitable beams 26 and 27 and by angle braces 28. These beams and braces preferably extend radially with respect to the central tube 25.

The upper member 11 is preferably formed of concentric walls 30 and 31 defining an annular space 32 between them. This annular space is divided by partitions 33 to form buoyant chambers. At the lower ends of the walls 30 and 31 there is provided an annular floor 34 which is shaped to cooperate with the wall 24 to form

the connection joint 13. Rubber pads 35 may be provided at the joint if desired.

Support structure 36 carried on the upper member 11 is provided with a circular track having conventional rails 37. A carriage 38 is provided with wheels which roll on this track and with a bearing 39 which is positioned on the vertical axis of the island 10. A drill rig assembly generally designated 40 is mounted on this carriage 38.

The drill rig assembly 40 includes a mast 41, drilling and hoisting machinery 42 and engines 43. The carriage 38 may be moved to bring the mast 40 and drilling machinery into position for drilling a hole through any one of the vertical conductor pipes 44 provided in the upper member 11. The vertical axes of these conductor pipes are spaced to pass between the beams 26 and 27 and inclined braces 28 on the lower member 12.

In constructing the drilling island in accordance with my method, the drill site 50 on the ocean floor may be levelled or smoothed, if desired, as shown in Figure 5. A vertical cluster of piles 51 is then driven into the ocean floor at the center of the well site by conventional means such as, for example, by pile driving apparatus mounted on a floating barge (not shown). The lower member 12 is then floated to the drill site, the compartments 18 being filled with compressed air. A vertical tubular guide or bar 52 is telescoped over the upper end of the pile cluster 51 after the tubular guide 52 has been inserted into the central tube 25 on the member 12. Pull down cables 53 are attached to the member 12 and pass under pulleys 54 connected to the weight blocks 55 resting on the ocean floor. Each of the cables is connected to one or more buoyant tanks 49 so that the tension applied to the cables by the buoyant tanks serves to apply downward force to the member 12. Additional guy wires 56 are used to maintain the member 12 against lateral movement. The parts are then in the position shown in Figure 4.

The buoyancy tanks 18 are then flooded to cause the member 12 to descend and rest on the ocean floor. The descent is accomplished with the tubular guide 52 and cluster of piles 51 serving to prevent any substantial tilting of the lower member 12 as it descends toward the ocean floor. The member comes to rest with the annular floor surface 21 resting on the ocean floor. The device is then in the position shown in Figure 5. Sand or other material heavier than sea water is then pumped into the interior of the lower member 12 to fill the entire space within the inner wall 16. Piles 48 are then driven through vertical openings 57 provided around the periphery of the member 12. The cables 53 and 56 are then removed. The device is then in the position shown in Figure 6. Rock and rip-rap 57 may then be placed around the outer periphery of the lower end of the member 12 as shown in Figure 7. The lower member 12 is then firmly anchored in place with its upper end substantially below the water line 58. It will be understood that although I have referred to the body of water as the ocean, it is intended that the device may be used in any body of water and not necessarily the open sea.

It will be observed that the rocks and rip-rap 57 lie against the inclined outer wall 15 and thereby effectively prevent movement of the lower member 12.

The upper member 11 is then floated to a position above the lower member 12 and the buoyancy tanks within the annular spaces 32 are flooded to cause descent of the member 11. Suitable mechanism (not shown) is provided for flooding and emptying the buoyancy chambers. Such mechanism may conveniently be of the type disclosed in the Willey Patent 2,217,879. The

upper member 11 is thus brought to rest on the lower member 12 and the two members are connected together by the fastener elements 14 to function as a single integral unit. The upper member then extends substantially above the water level 58 so that the machinery on the decks 59 and 60 are positioned above the maximum height of the waves. The drill rig assembly 40 may be in position on the upper member when it is floated out to sea and as soon as the members 11 and 12 have been connected solidly together, the drilling operations may commence. The mud pits, mud pumps and associated equipment may be located on the deck 59. The carriage 38 is moved on the rails 37 to a position to bring the drill string (not shown) into alignment with one of the conductor pipes 44 and the well is directionally drilled through the conductor pipe in the conventional manner. Additional wells may be directionally drilled at each of the other conductor pipes so that a large number of wells may be drilled from the single island. The wells may be completed and produced in conventional manners. Pumping jacks (not shown) may be mounted on the upper deck 59 for each of the wells. If the island is to be used for production, it is desirable to fill the chambers 18 with concrete so that the island becomes a permanent installation.

If oil is not found in commercial quantities, the island 10 may be refloated and moved to a new site. This is accomplished by removing the rocks and rip-rap 57 and by pumping out the sand within the inner wall 16. The entire island may then be refloated as a unit after the piles 51 and 56 have been cut by divers.

The island 10 also may be refloated and moved to a new location in two sections. In this case, the removable fastenings 14 are disconnected; the chambers within the annular spaces 32 are pumped free of water to refloat the upper member 11. The lower member 12 is subsequently refloated after removal of the rocks and rip-rap 57 and after the sand has been pumped out of the interior. The island is reinstalled on a new site in the manner outlined above.

In the modified form of my invention shown in Figures 8 and 9 only one floatable member 10*a* is used and it extends from the ocean floor to a height above high water level. The joint 13 is omitted. In all other respects the construction and operation are the same as that previously described. The member 10*a* is floated to the drill site and installed on bottom using the same series of steps as described above in connection with the lower member 12.

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. A method of constructing a well drilling or production island in a marine location comprising the steps of: installing central vertical piling on the ocean floor terminating below the water level, floating a member into position over the piling so that a guide element on the member is aligned with the piling, placing a guide bar having a tubular portion through the guide element and over the top of the piling to form an extension thereof, and lowering said member so that the guide element thereof telescopes over said guide bar and piling until the lower end of said member rests on the ocean floor.

2. A method of constructing a well drilling or production island in a marine location comprising the steps of: installing central vertical piling on the ocean floor terminating below the water level, floating a member into position over the piling so that a single central guide element on the member is aligned with the piling, extending a guide bar having a tubular portion through the guide element and over the top of the piling to form an extension thereof, and lowering said member so that the guide element thereof telescopes over said guide bar and piling until the lower end of said member rests on the ocean floor.

3. A method of constructing a well drilling or production island in a marine location comprising the steps of: installing vertical piling on the ocean floor terminating below the water level, floating a lower member into position over the piling so that a guide element on the member is aligned with the piling, placing a guide bar having a tubular portion through the guide element and over the top of the piling to form an extension thereof, lowering said lower member so that the guide element thereof telescopes over said guide bar and piling until the lower end of said member rests on the ocean floor, removing the guide bar, floating an upper member into position above the lower member, and lowering said upper member to rest on said lower member so that the upper portion of said upper member extends above the water level.

4. A method of constructing a well drilling or production island in a marine location comprising the steps of: installing central vertical piling on the ocean floor terminating below the water level, floating a lower member into position over the piling so that a single central guide element on the member is aligned with the piling, extending a guide bar having a tubular portion through the guide element and over the top of the piling to form an extension thereof, lowering said lower member so that the guide element thereof telescopes over said guide bar and piling until the lower end of said member rests on the ocean floor, removing the guide bar, floating an upper member into position above the lower member, and lowering said upper member to rest on said lower member so that the upper portion of said upper member extends above the water level.

5. A method of constructing a well drilling or production island in a marine location comprising the steps of: installing central vertical piling on the ocean floor terminating below the water level, floating a member into position over the piling so that a guide element on the member is aligned with the piling, extending a guide bar having a tubular portion through the guide element and over the top of the piling to form an extension thereof, lowering said member so that the guide element thereof telescopes over the guide bar and piling until the lower end of said member rests on the ocean floor, filling the interior of the member with material heavier than water, and driving piles into the ocean floor at intervals around the periphery of the member.

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