June 14, 1949. W. J. TRAVERS, JR 2,472,869

ISLAND FOR WELL DRILLING

Filed Feb. 24, 1947 2 Sheets-Sheet 1

Fig. 1

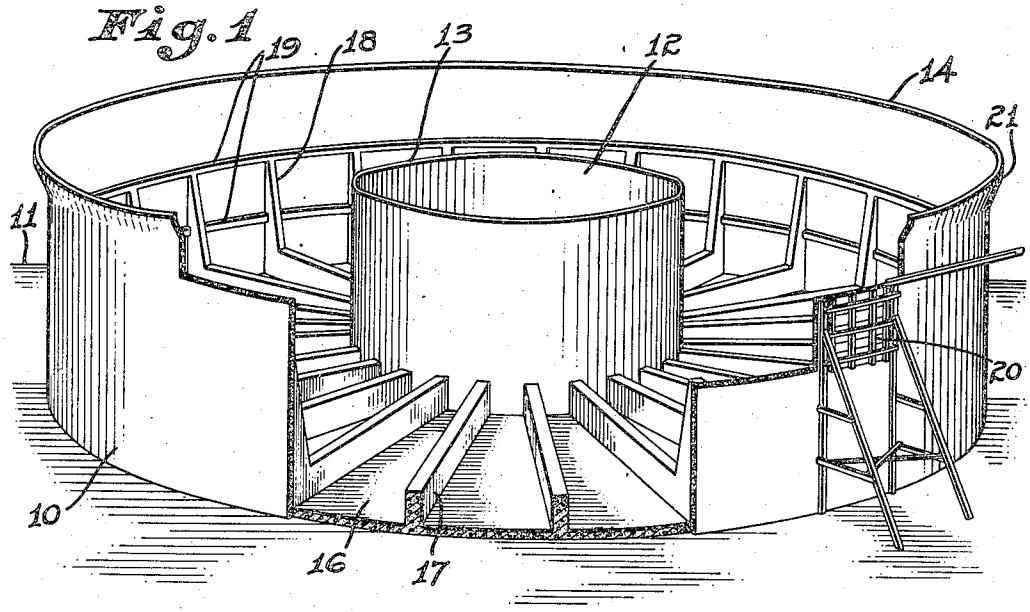
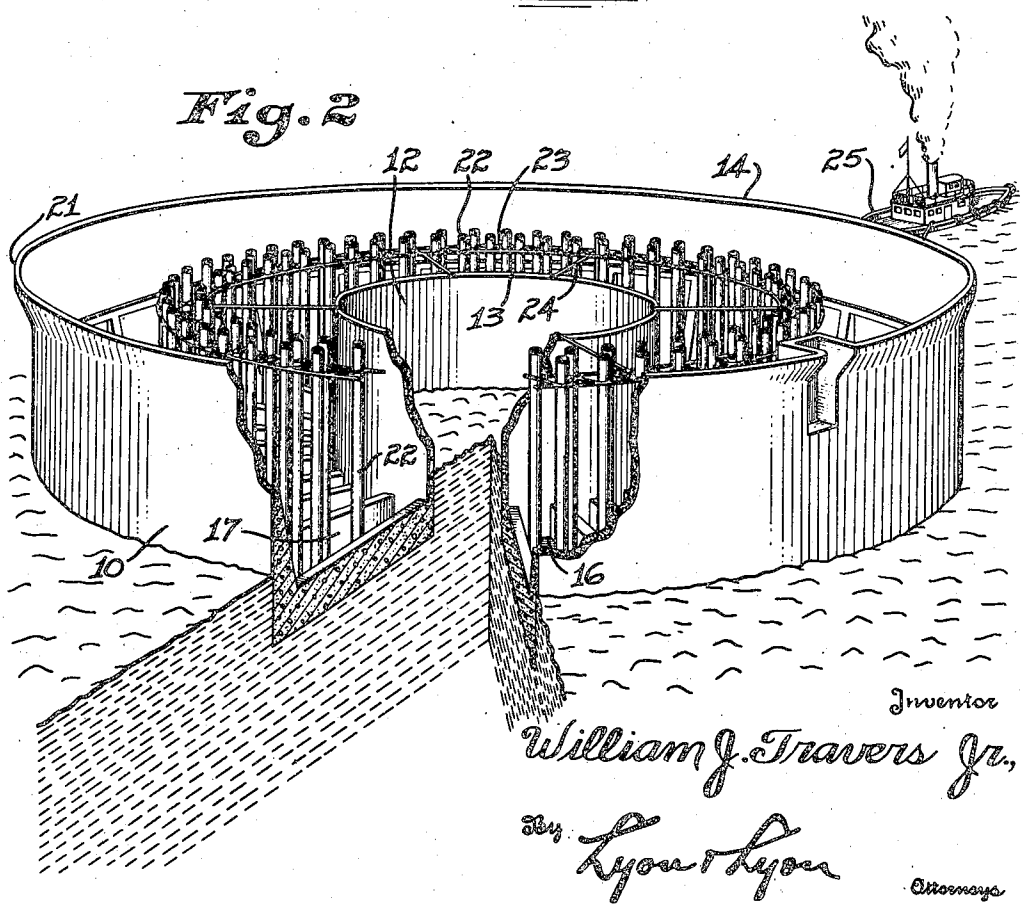


Fig. 2



Inventor

William J. Travers Jr.,

By Lyon & Lyon

Attorneys

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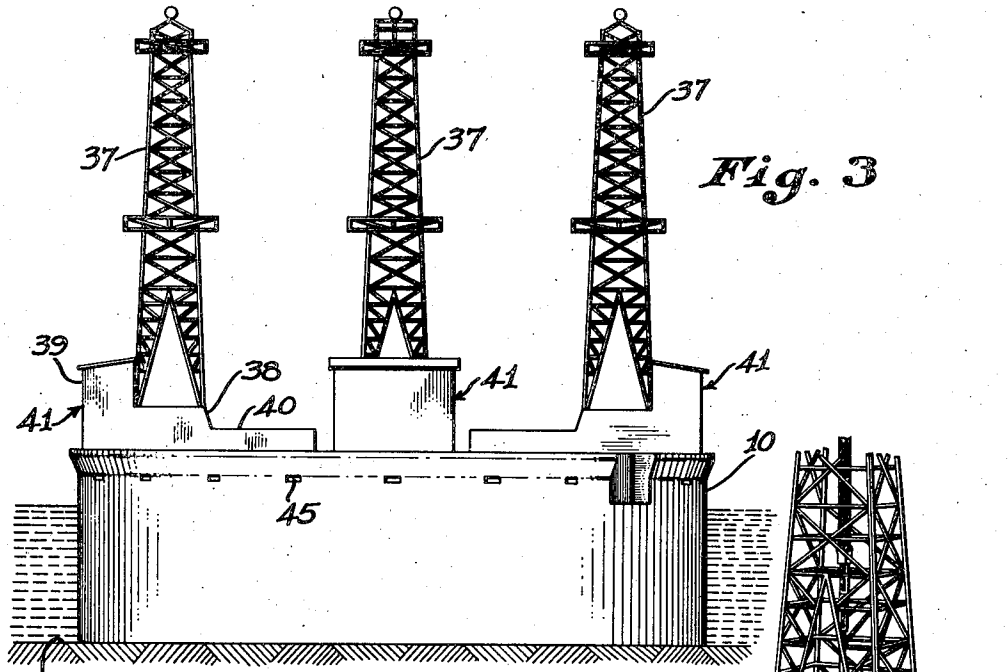


Fig. 3

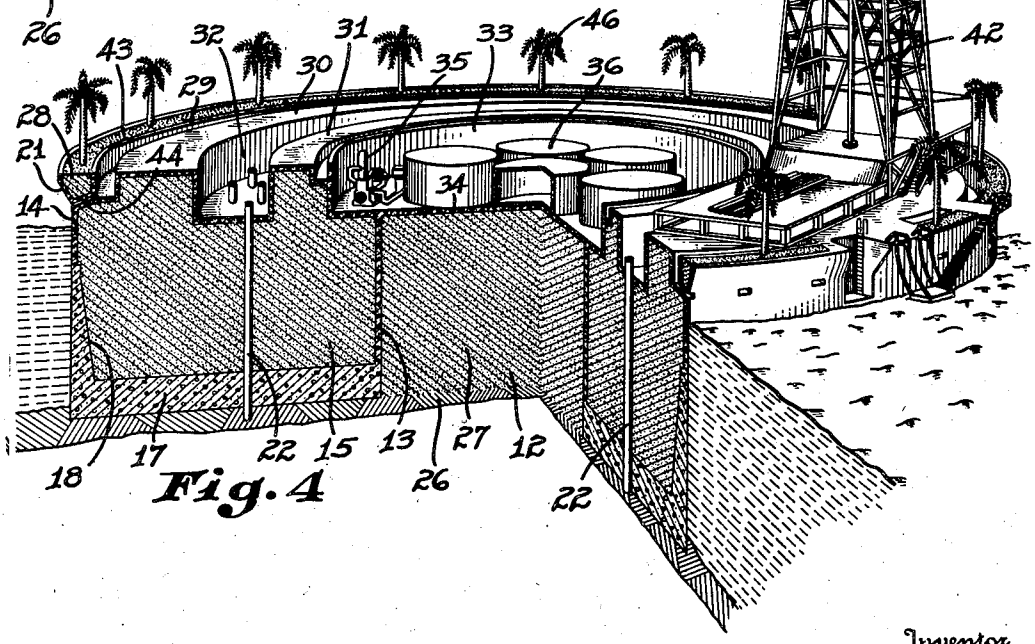


Fig. 4

Inventor

William J. Travers Jr.,

By Lyon & Lyon

Attorneys

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ISLAND FOR WELL DRILLING

William J. Travers, Jr., Los Angeles, Calif., assignor to Richfield Oil Corporation, Los Angeles, Calif., a corporation of Delaware

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4 Claims. (Cl. 61—46)

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This invention relates to an artificial island for the drilling of wells from offshore marine locations or for supporting well drilling apparatus above any body of water of relatively shallow depth. This invention is particularly directed to a method of installing an artificial island in a desired location and to an artificial island structure particularly well adapted for supporting well drilling apparatus.

The principal object of this invention is to provide a normally buoyant structure having a central opening, the structure being sinkable to rest on bottom with a portion of the structure projecting above the water level and in which the central opening may be filled with water-displacing material resting on bottom to prevent lateral shift of the structure.

Another object is to provide an improved method of constructing a normally buoyant structure and positioning it at a desired location on bottom in a body of water with a portion of the structure projecting upwardly beyond the water level.

Another object is to provide an artificial drilling island comprising an annular ring having a central opening, the ring being normally buoyant to permit the ring to be floated to position and being sinkable to rest on bottom.

Another object is to provide such a ring structure having concentric inner and outer upwardly extending walls joined by an annular floor, the floor being reinforced by radially extending beams formed integrally with the walls and floor to resist deflection of the floor while the structure is being floated to position.

Another object is to provide a ring structure of this type having a plurality of upwardly extending pipes through which a plurality of wells may be drilled, the pipes being spaced at intervals around the annular floor.

Another object is to provide an artificial island for supporting drilling apparatus which is floatable to position and which is adapted to resist action of waves, tide, weather and storms for a period of years until depletion of wells drilled from the island and which may then be refloated if desired for removal to some remote point.

Other objects and advantages will appear hereinafter.

In the drawings:

Figure 1 is a perspective view, partly broken away, showing construction of a preferred form of artificial island embodying my invention, the device being built on low ground behind an artificial dam adjacent tide water;

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Figure 2 is a perspective view partly broken away showing the artificial island being floated to position;

Figure 3 is an elevation showing the island resting on bottom and a plurality of wells being drilled simultaneously; and

Figure 4 is a perspective view partly in section showing the artificial island resting on bottom and illustrating a preferred form of contour of the upper surface of the island during well drilling operations.

Referring to the drawings, the ring structure generally designated 10 may preferably be constructed behind a temporary dam 11 adjacent tide water. The ring structure may be of any convenient or desirable shape and is provided with a central opening 12. As shown in the drawings, the opening 12 is defined by an inner upstanding circular wall 13. This wall 13 is encircled by an outer upstanding circular wall 14 defining an annular space 15 between the inner and outer concentric walls 13 and 14.

An annular floor 16 extends between the walls 13 and 14 near the lower ends thereof and is stiffened by radially extending beams 17 which are integrally connected at their inner ends to the wall 13. The lower sides of the beams 17 are integrally formed with the floor 16 and the outer ends of the beams 17 are integrally joined with the outer wall 14 and with the tapering reinforcements 18. Bands 19 may be provided on the inner surface of the outer wall 14 for additional stiffness.

It is contemplated that the entire structure so far described may be formed of reinforced concrete. Steel reinforcement members are not shown in the drawings, although it is to be understood that such steel reinforcing will be included in the manner taught by conventional practice. Concrete forms 20 are shown diagrammatically in Figure 1, illustrating a preferred manner of forming the outer wall 14, but it is recognized that these forms may take any convenient or desirable shape and may be constructed of wood, metal or other materials. It will be noted that the upper portion of the outer wall 14 is flared outwardly, as shown at 21, for a purpose to be later described.

A plurality of upwardly extending pipes 22 extend through the floor 16 flush with the bottom surface thereof and these pipes are arranged in the annular space 15 between the inner and outer walls 13 and 14. Suitable interconnecting bracing 23 is provided for maintaining the pipes

22 in position, and additional lateral tie rods 24 may be provided, if desired.

When the reinforced concrete structure thus described is complete, the temporary dam 11 is removed to allow tide water to encircle the structure. The proportions of the structure are such that it floats with only a relatively small portion of the outer wall 14 submerged.

Figure 2, which is partly broken away, shows the buoyant ring being floated to position and one or more tugs 25 may be provided for towing the ring to the desired location.

An important advantage of the annular buoyant structure just described resides in the provision of the central opening 12. If this opening were to be omitted and the floor 16 continued completely across the structure in circular form, the buoyant forces acting on the floor 16 would require reinforcing beams 17 of greatly increased size in order to provide sufficient stiffness over such an increased span. Floor beams of such large size would be seriously detrimental in that the increased weight would more than offset the increased buoyancy with the result that the structure would float much lower in the water, and the hazard of capsizing or foundering before reaching the desired location would be greatly increased. Furthermore, the additional cost of greatly increasing the size of the floor beams would be economically disadvantageous.

When the annular buoyant structure is positioned over the desired drilling location, the ring is sunk to rest the bottom surface of the floor 16 on the bottom of the ocean floor 26. This is accomplished by admitting water into the annular space 15 by means (not shown). Subsequently this water may be displaced by filling the space 15 with sand or rock dredged from the ocean floor. Additional sand or rock 27 is deposited within the central opening 12 and acts as a core or plug resting on the ocean floor 26 to prevent lateral shift of the entire structure. When the ring is resting on bottom, any convenient form of top surface is constructed over the annular space 15 between the walls 13 and 14 and over the central opening 12.

As shown in Figure 4, the upper surface of the structure may be formed by concentric concrete pads and walls forming an annular scupper 28, an annular ditch 29 and flat ring surfaces 30 and 31 separated by the annulus 32. The pipes 22 project upwardly into the annulus 32.

A central depression 33 is provided by the horizontal pad 34 extending over the central opening 12 and over a portion of the annular space 15. This central depression 33 is adapted to accommodate the usual pumps 35 for circulation of drilling fluid employed in the rotary process of drilling wells. Mud tanks 36 are also contained within the depression 33 for storing, settling and mixing of such mud fluid as will be readily understood by those skilled in the art.

The annular structure 10 is formed of sufficient size to accommodate a plurality of well drilling derricks and their associated equipment for simultaneous drilling of a plurality of wells. Each of the derricks 37 is mounted on a substructure 38 and is provided with the usual engine house 39 and pipe rack 40. Each of the derricks 37, together with its associated drilling equipment comprises a unitary assembly hereinafter designated 41.

Each of the drilling assemblies 41 is supported on the upper surfaces of the structure 10 and may rest on the annular pads 30 and 31, if desired.

Suitable means (not shown) are provided for securing each of the assemblies in selected position so that a plurality of wells may be drilled simultaneously. Each of the derricks 37 is centered over one of the pipes 22 and the drill string 42 operates through the particular pipe 22 selected for drilling a well. Conventional techniques for slant drilling are employed so that a relatively large area of formation may be exploited from the relatively small area of the single artificial island 10.

After each individual well is completed, the drilling unit 41 is moved to position over one of the other pipes 22. As an example of the relative size of operations to be conducted from such an artificial drilling island, it is contemplated that with a particular embodiment of my invention over one hundred wells may be drilled from an island of approximately two hundred feet outside diameter and that as many as four drilling units may operate simultaneously.

The flaring portion 21 at the upper end of the outer wall 14, together with the circular rim 43 provides the scupper 28 for collecting any water which comes over the edge of the outer wall due to wave action or storms. Water passing over the upper edge of the outer wall flows into the scupper 28 and passes outwardly through ports 44 and drainage openings 45 back into the sea. The annular ditch 29 is also connected to the drainage passageways 45 so that water passing the scupper 28 is also trapped and returned. The flaring portion further acts as a deflector to prevent waves from breaking over the wall 14.

When the drilling of wells has been completed, the drilling units 41, including the derricks 37, are dismantled and withdrawn from the artificial island and the tanks 36 and pumps 35 are likewise removed.

Conduits (not shown) are provided for conveying the oil produced from the wells to shore for disposal since, under ordinary circumstances, it is contemplated that oil will not be stored on the island. Any suitable means for producing the oil, such as natural flow, gas lift, plunger lift, sucker rod, etc. may be employed for raising the oil to the surface through the pipes 22.

After a period of years, the oil strata will be depleted to the point where it is not economically feasible to continue productive operations. At such time the island could be converted into a park for recreational purposes, small boat anchorage, etc., and if such use is adopted, the scupper 28 can be used, if desired, for ornamental planting of trees, such as the palm trees 46. It is to be understood that the ornamental trees and other recreational facilities may not be installed on the island until after removal of the well drilling units 41.

If it is desired to remove the island at the end of its period of usefulness, the annular space 15 between the walls 13 and 14 may be evacuated and thereby again render the structure buoyant. The structure thus refloated may be towed to any desirable point for scrapping or disposal in some other manner.

It is contemplated that the use of reinforced concrete for the side walls and floor of the structure will be sufficiently resistant to wave action, weather and chemical erosion to remain in service during the useful productive period in withdrawing oil from the strata below the ocean floor.

While the structure 10 has been shown and described as annular in shape, it is recognized

that either the inner wall 13 or the outer wall 14, or both could be polygonal in shape rather than circular, the only essential requirement being that a central opening can be provided.

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 device for supporting well drilling apparatus in an offshore marine location, comprising in combination: inner and outer concentric upstanding walls joined by an annular floor, the inner wall defining a central opening completely through the device, the annular space between the walls being filled with material to sink the ring and thereby hold it on bottom with the outer wall extending above the water level, and the central opening being filled with water-displacing material resting on bottom to thereby resist lateral shift of the device.

2. A device for supporting well drilling apparatus in an offshore marine location, comprising in combination: inner and outer concentric upstanding walls joined by an annular floor, the inner wall defining a central opening completely through the device, the annular space between the walls being filled with material to sink the ring and thereby hold it on bottom with the outer wall extending above the water level, a plurality of upwardly extending pipes spaced about the annular floor through which wells may be drilled, and the central opening being filled with water-displacing material resting on bottom to thereby resist lateral shift of the device.

3. A device for supporting well drilling apparatus in an offshore marine location, comprising in combination: inner and outer concentric upstanding walls joined by an annular floor, the inner wall defining a central opening completely through the device, the annular space between the walls being filled with material to sink the ring and thereby hold the floor on bottom with the walls extending above the water level, the outer wall being flared outwardly above the water level, and the central opening within the inner wall being filled with water-displacing material resting on bottom to thereby resist lateral shift of the device.

4. A device for supporting well drilling apparatus in an offshore marine location, comprising in combination: inner and outer concentric upstanding walls joined by an annular floor, the inner wall defining a central opening completely through the device, the annular space between the walls being filled with material to sink the ring and thereby hold it on bottom with the outer wall extending above the water level, and the central opening being filled with water-displacing material resting on bottom to thereby resist lateral shift of the device, and a plurality of reinforcing beams extending radially on said annular floor from said inner to said outer walls.

WILLIAM J. TRAVERS, JR.

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