United States Patent [19]

Levingston

[11] **3,752,326**

[45] **Aug. 14, 1973**

[54] **OFFSHORE OIL AND GAS WELL DRILLING RIG**

[75] Inventor: **Clarence W. Levingston,** Orange, Tex.

[73] Assignee: **Levingston Shipbuilding Company,** Orange, Tex.

[22] Filed: **Feb. 1, 1972**

[21] Appl. No.: **222,586**

[52] **U.S. Cl.** ..... **212/47,** 212/48, 212/46 R

[51] **Int. Cl.** **B66c 23/00**

[58] **Field of Search** ..... 212/47, 48, 49, 56, 212/58, 46 R, 46 A, 46 B, 57, 64; 214/2.5; 175/85

[56] **References Cited**

UNITED STATES PATENTS

2,946,464	7/1960	Guier	214/2.5
2,531,930	11/1950	Woolslayer et al.	214/2.5
2,676,388	4/1954	Favre et al.	212/46 R

FOREIGN PATENTS OR APPLICATIONS

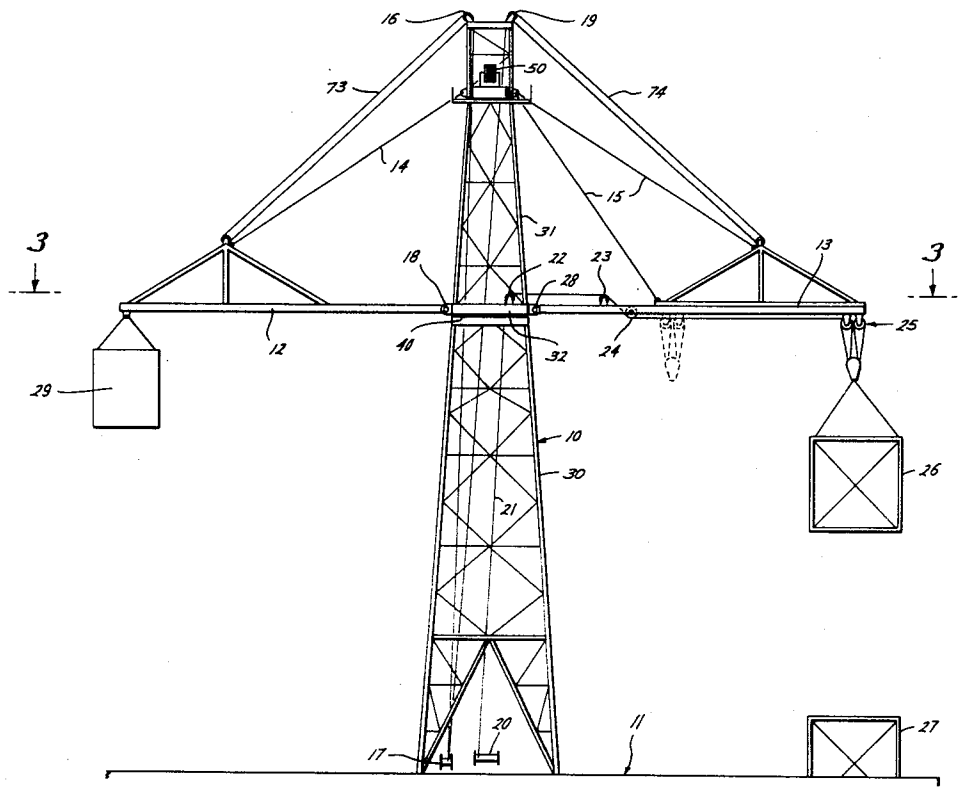
635,162	2/1962	Italy	212/64
558,318	6/1957	Belgium	212/64
1,093,679	12/1967	Great Britain	212/64
1,183,609	3/1970	Great Britain	212/46

Primary Examiner—Evon C. Blunk
Assistant Examiner—Merle F. Maffei
Attorney—Paul E. Harris, Lee R. Larkin and Larry B. Phillips et al.

[57] **ABSTRACT**

An offshore drilling platform and drilling rig mounted thereon having a load boom assembly and a balance boom assembly mounted for pivotal movement on the derrick of the drilling rig. The boom assemblies are erected into load bearing position to move loads about the platform.

2 Claims, 6 Drawing Figures



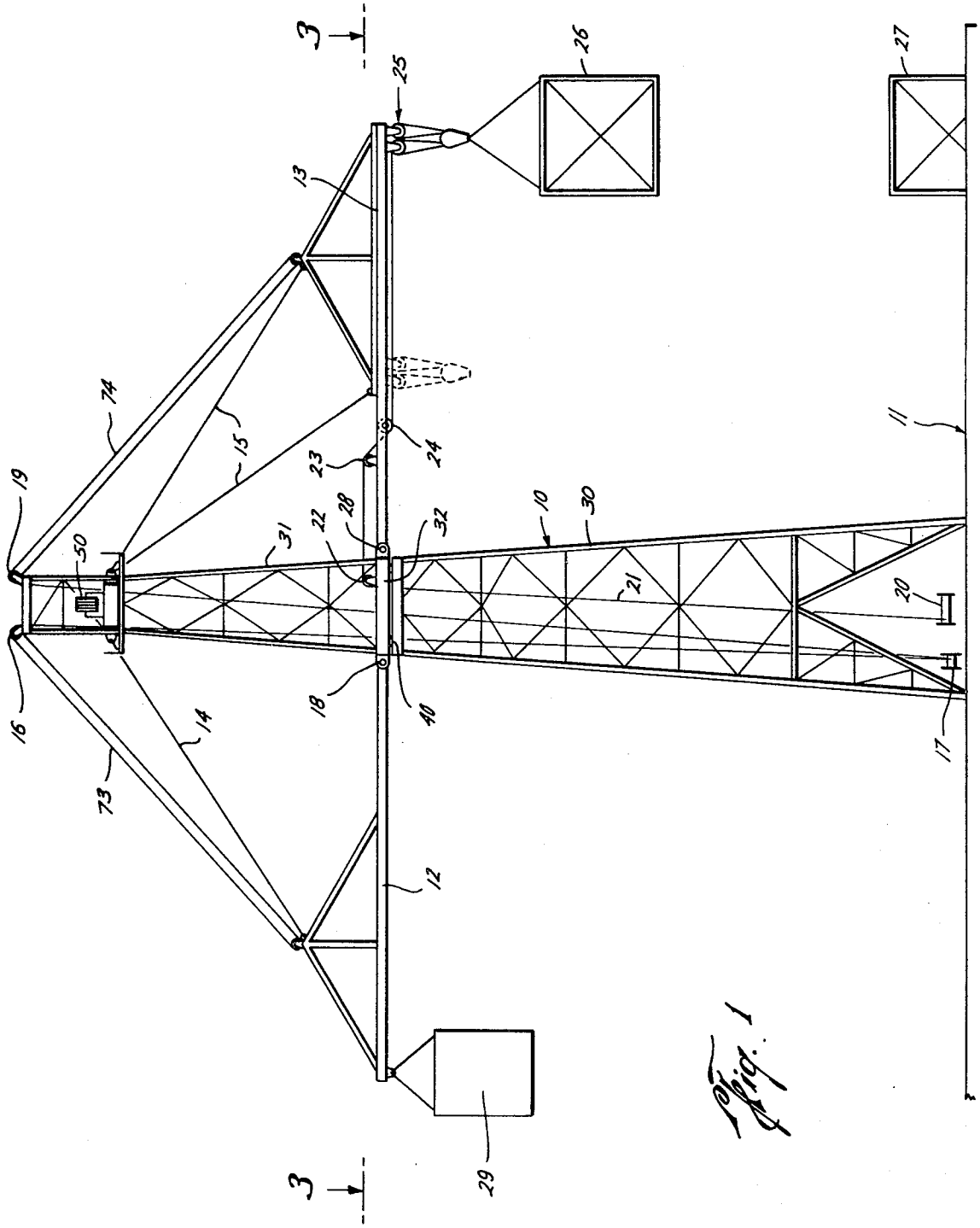

3
25
26
27
13
74
15
19
23
24
11
10
30
31
22
28
32
50
21
20
16
18
40
17
14
73
12
29
3

Fig. 1

Fig. 2

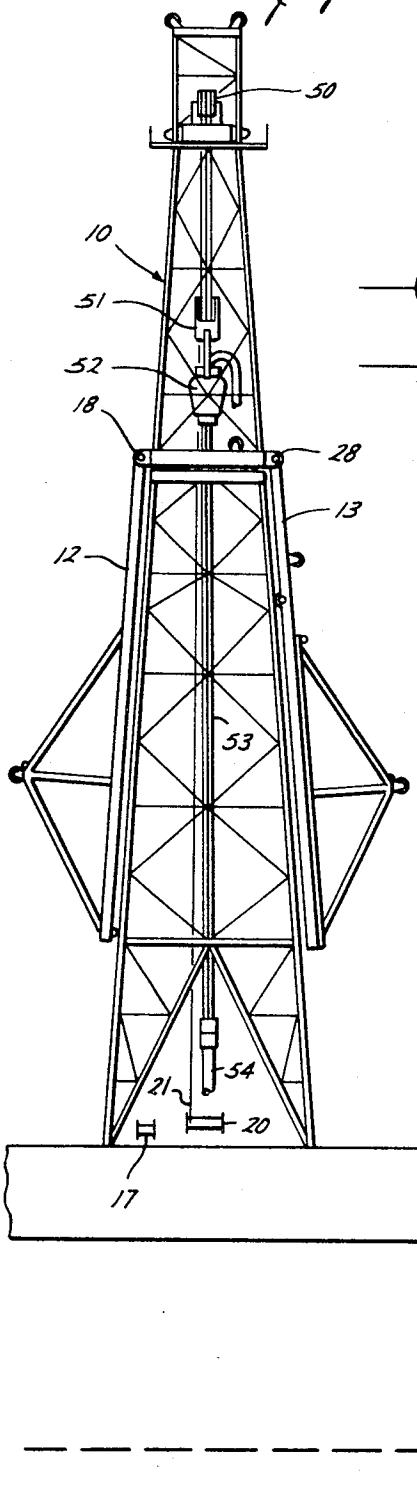
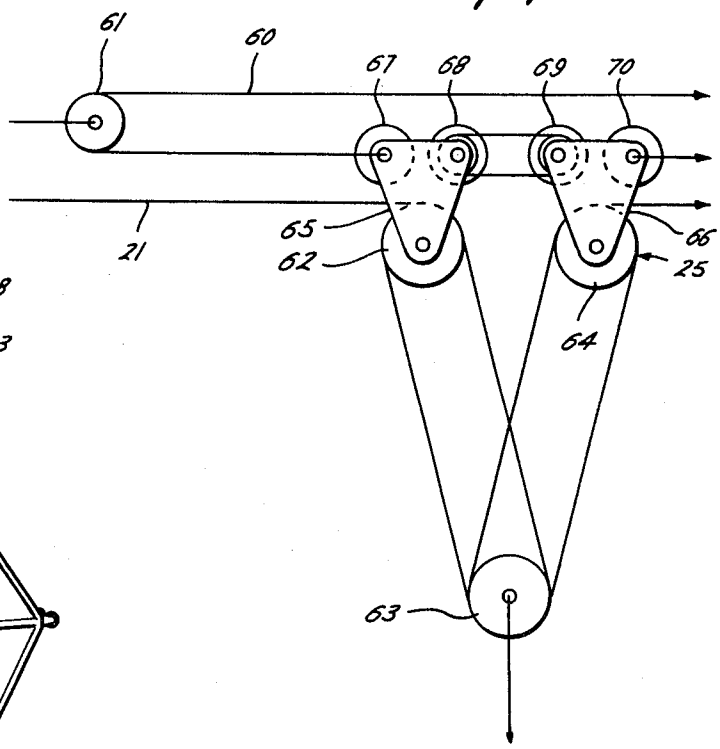

50
10
51
52
18
28
13
12
53
54
21
20
17
11
27
34

Fig. 6


61
60
67
68
69
70
21
65
62
66
25
64
63

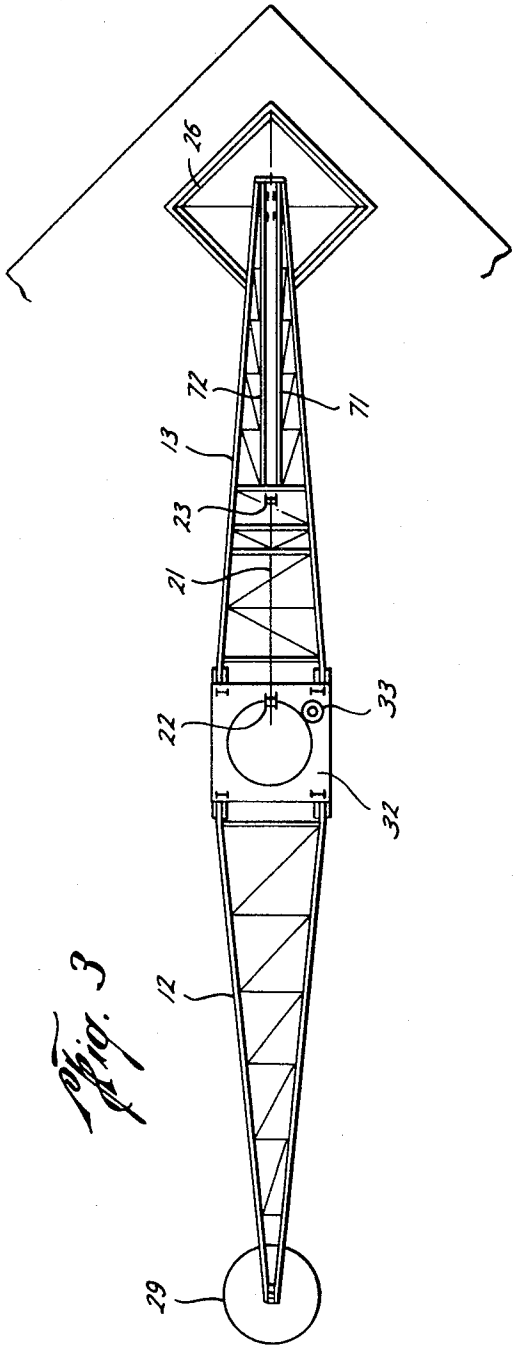


Fig. 3

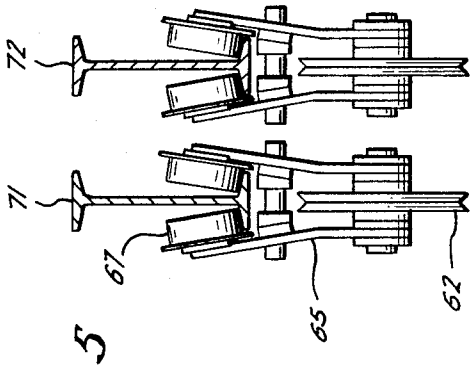


Fig. 5

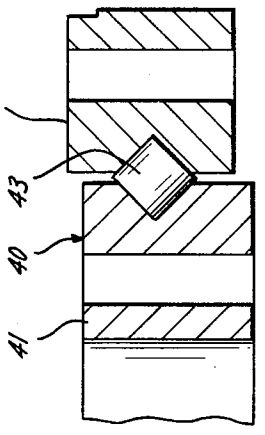


Fig. 4

OFFSHORE OIL AND GAS WELL DRILLING RIG

BACKGROUND OF THE INVENTION

1. Field of the Invention

The field of the invention is offshore drilling rigs and methods for their use.

2. Description of the Prior Art

As is well known in the art of drilling offshore oil and gas wells, the process of erecting a drilling platform over an offshore drilling site is an expensive and time consuming one. It has been found to be particularly advantageous to elevate the drilling platform above the surface of the body of water under which the well is to be drilled. Elevating the platform above the surface of the water reduces lateral stresses on the structure from wave action.

Problems have been experienced, however, with towing such rigs from port to the drilling site. With spuds as long as 400 feet carried in a raised position above the drilling platform, the rigs tend to be unstable in the floating state. Attempts have been made to solve this problem by transporting the drilling rig with the spuds disassembled and carried on top of the drilling platform or on another vessel, but this necessitates the use of a derrick barge or the construction of one or more cranes on the structure of the platform itself to assist in assembling the spuds. The use of derrick barges and the construction of cranes on the platform is a source of great expense, but they have been widely used to avoid the problem of instability while the rigs are being transported from one location to another.

SUMMARY OF THE INVENTION

The inventive concept is the improvement in offshore oil and gas well drilling rigs which lies in the combination of the drilling derrick with a load boom assembly and a balance boom assembly. The load boom and balance boom are mounted on the derrick of the rig for pivotal movement in a vertical plane containing the long axis of the mast and for rotation about the long axis of the mast.

The method of the invention includes the steps of erecting the load boom and balance boom and moving loads about the drilling platform onto and from another vessel with the load boom.

The combination of the load and balance boom assemblies with an offshore drilling derrick provides a structure for moving large loads about the drilling platform without the inconvenience and expense of additional cranes or use of a derrick barge with a crane thereon alongside the platform.

BRIEF DESCRIPTION OF THE DRAWINGS

The inventor's presently preferred embodiment of the invention is shown in the drawings, in which:

FIG. 1 is a side elevation view of the novel offshore oil and gas well drilling rig which includes a showing of the load boom assembly and balance boom assembly in the load-lifting attitude.

FIG. 2 is a side elevation view of the drilling platform in the drilling attitude, showing one spud of the platform and showing the load boom and balance boom folded into the stowed position.

FIG. 3 is a top sectional view of the novel offshore oil and gas well drilling rig which includes a taken along line 3—3 of FIG. 1, showing the load boom and balance boom in the working position.

FIG. 4 is a side elevation sectional view of the boom support bearing which allows rotation of the load boom and balance boom about the long axis of the mast.

FIG. 5 is a side elevation view partially in section of the load sheave block in the load boom assembly.

FIG. 6 is a generally schematic side elevation view of the load sheave block of the load boom assembly.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The inventor's presently preferred embodiment of the invention is shown in FIG. 1. The structure generally designated by the numeral 10 is the drilling derrick, or mast, supported by an offshore platform, generally designated by the numeral 11. The drilling derrick is shown in the load-moving configuration, with the balance boom 12 and the load boom 13 extended therefrom. Balance boom 12 is suspended by balance boom cable 14 and load boom 13 is suspended by load boom cables 15. Balance boom 12 and load boom 13 are raised to operating position, or lowered to stowed position by the lifting cables 73 and 74 and an auxiliary winch 17. Lifting cable 73 passes over balance boom topping lift 16 and down through derrick 10 to auxiliary winch 17. Similary, load boom 13 is raised or lowered by lifting cable 74 passing over the load boom topping lift 19, downwardly through derrick 10 and secured to auxiliary winch 17. Balance boom 12 supports a balancing load 29 for counteracting the force moment of a load 26 to be lifted by load boom 13.

Balancing load 29 may take the form of a tank containing water to provide a variable counteracting moment.

Balance boom 12 is joined to derrick 10 for both vertical pivotal movement and horizontal pivotal movement with respect to derrick 10. Means connecting balance boom 12 to derrick 10 for vertical pivotal movement takes the form of balance boom pivot 18 and lifting cable 73. Disconnecting cable 14 and activating auxiliary winch 17 to let out lifting cable 73 will result in balance boom 12 descending to the folded, or stowed, position, as shown in FIG. 2. It is contemplated that auxiliary winch 17 also will similarly control the attitude of load boom 13. Therefore, disconnecting cable 15 and letting out cable 74 by auxiliary winch 17 would result in a similar lowering of load boom 13 to the folded, or stowed, position, as shown in FIG. 2. The numeral 20 refers to the drawworks winch which is utilized in the drilling attitude for connecting the travelling block 51 to the crown block 50, as shown in FIG. 2 and as will be further described hereafter. Drawworks winch 20 is used in the load lifting attitude as the power source for lifting loads with load boom assembly 13. In the load-lifting attitude, drawworks winch 20 is connected to the drawworks line 21, which line is threaded through a series of pulleys 22, 23 and 24 and passes to the load sheave block 25. Thus, winding drawworks line 21 about drawworks winch 20 will result in shortening of drawworks line 21 and lifting of load 26 thereby. For purposes of illustration, load 26 takes the form of a section of spud 27. In this illustration, sections 26 of spud 27 may be lifted from platform 11 or from another vessel, moved to a position of spud 27 and lowered into mating engagement therewith.

In the embodiment shown in FIG. 1, derrick 10 includes a lower portion 30 and an upper portion 31. Upper portion 31 supports balance boom pivot 18 and

a load boom pivot **28** which provide vertical pivotal movement for those booms. Upper section **31** may also be rotated about its long axis with respect to lower section **30,** thereby rotating balance boom **12** and load boom **13** therewith. Pivots **18, 28** may also be supported from a unitary derrick (not shown) with suitable bearings (not shown) arranged to allow for rotation of load boom **13** and balance boom **12** about derrick **10.** In FIG. **1,** support for upper section **31** is provided by annular bearing **40,** detail of which is shown in FIG. **4.** Annular bearing **40** includes an inner annular member **41** surrounded by an outer annular member **42.** Inner annular member **41** may be supported by lower section **30** of derrick **10** and outer annular member **42** supports upper section **13.** Interposed between inner member **41** and outer member **42** is a roller **43** to provide for relative rotation of inner member **41** and outer member **42.**

As shown in FIG. **3,** upper section **31** is supported at its lowermost portion by a pivot housing **32.** Pivot housing **32** includes means for rotating upper section **31** with balance boom **12** and load boom **13** about the long axis of derrick **10** relative to lower section **30.** The means for rotating includes annular bearing **40** and a pivot drive wheel **33** supported by lower section **30** which may be rotated by any convenient drive means (not shown). As pivot drive wheel **33** is rotated, its arrangement in contact with outer annular member **42** will impart rotation to upper section **31** relative to lower section **30.**

FIG. **2** shows derrick **10** in the drilling attitude. Drawworks winch **20** engages drawworks line **21** as in FIG. **1;** but in FIG. **2,** drawworks line **21** is led through crown block **50** and traveling block **51** to support a swivel **52,** a kelley **53** and string of drill pipe **54.** In the drilling attitude, as shown in FIG. **2,** derrick **10** functions as any other derrick in the drilling art, supporting the string of drill pipe **54** during drilling operations. Auxiliary winch **17** may be utilized for any function normally associated with such devices during drilling procedures, such as lowering well tools (not shown) down the wellbore.

FIG. **6** shows schematically the load sheave block generally designated by the numeral **25** in FIG. **1.** Load sheave block **25** includes means for moving a load radially of the longitudinal axis of derrick **10,** which means includes radial positioning line **60** in the form of a continuous closed loop supported by a positioning line pulley **61** at one end of the loop with the other end of the loop wrapped on a power driven drum (not shown). Drawworks line **21** is shown in the load supporting attitude, threaded through load pulley **62, 63, 64.** The arrow directed downwardly from load pulley **63** indicates the direction of force of a load suspended from load sheave block **25.** Load sheave brackets **65, 66** support load pulleys **62, 64** respectively. Support wheels **67, 68** support load sheave bracket **65** and, in the same manner, support wheel **69, 70** support load sheave bracket **66** and provide means for radial movement of load sheave block **25** along support beams **71, 72,** as shown in FIG. **5.** In FIG. **6,** load sheave block **25** is driven to the left or right, as shown in FIG. **6,** by the force imparted to positioning line **60** by the power driven drum (not shown).

An alternate method of moving the load radially to the long axis of the mast or derrick, is to use lifting line **74** extended over load boom topping lift **19** and connected to auxiliary winch **17** to raise and lower the outer end of load boom **13.**

The inventor's presently preferred embodiment of the method of the invention includes erecting load boom assembly **13** and balance boom assembly **12** on derrick **10** to the load-lifting attitude, as shown in FIG. **1.** Thereafter, a load, such as spud section **26,** is suspended from load boom assembly **13** and moved to a position adjacent the top of spud **27.** Spud section **26** is then attached to the upper portion of spud **27.** Spud **27** may then be extended downwardly through platform **11** and other sections added until the sea bottom is contacted and platform **11** is jacked up above the surface **34** of the water.

Additionally, the inventor's presently preferred embodiment of the apparatus can be utilized on a drilling platform to move heavy objects, such as blow-out preventer stacks, well heads and machinery packages.

Also, it can be used for setting well structures supporting the well head independent of the drilling platform, and for carrying out pile driving operations.

Thus it can be seen that an improved apparatus and method for its use in connection with drilling an offshore well has been shown. Further modifications and alternative embodiments of the invention will be apparent to those skilled in the art in view of this description. Accordingly, this description is to be construed as illustrative only and is for the purpose of teaching those skilled in the art the manner of carrying out the invention. It is to be understood that the form of the invention herewith shown and described is to be taken as the presently preferred embodiment. Various changes may be made in the shape, size and arrangement of parts. For example, equivalent elements or materials may be substituted for those illustrated and described herein, parts may be reversed and certain features of the invention may be utilized independently of the use of other features, all as would be apparent to one skilled in the art after having the benefit of this description of the invention.

I claim:

1. An offshore oil and gas well drilling rig comprising, in combination

an offshore drilling platform

a drilling mast supported by said offshore drilling platform and having an upper section and a lower section

the upper section of said drilling mast being rotatably disposed on the lower section thereof

a draw-works including a draw-works winch and an auxiliary winch disposed on said offshore platform at the foot of the lower section of said drilling mast

a crown block mounted on the upper portion of said drilling mast adjacent the top thereof

a pair of pivot supports secured to the lower end of the upper section of said drilling mast and oppositely disposed with respect to one another

a load boom having its inner end pivotally connected to one of said pivot supports

a balance boom having its inner end pivotally connected to the other of said pivot supports

a load sheave block carried by said load boom

a suitably operated positioning line connected to said load sheave block for horizontally moving the latter along said load boom

a load boom topping lift mounted adjacent the upper extremity of the upper section of said drilling mast

a lifting cable connected to said load boom, trained over said load boom topping lift, and directed downwardly through said drilling mast for attachment to said auxiliary winch

a balance boom topping lift mounted adjacent the upper extremity of the upper section of said drilling mast

a lifting cable connected to said balance boom, trained over said balance boom topping lift, and directed downwardly through said drilling mast for attachment to said auxiliary winch and

a draw-works line connected at one end to said draw-works winch

said draw-works line being passed around said crown block and downwardly through said drilling mast to carry a travelling block, swivel and kelly or alternatively

said draw-works line being directly attached to said load sheave block for raising and lowering the load carried thereby.

2. The combination of claim **1** wherein the pivotally mounted load boom and balance boom are movable between full horizontal and full vertical positions.

* * * * *