July 20, 1965 E. P. SWATEK, JR 3,195,313

OFFSHORE DRILLING PLATFORM

Original Filed Feb. 9, 1959 5 Sheets-Sheet 1

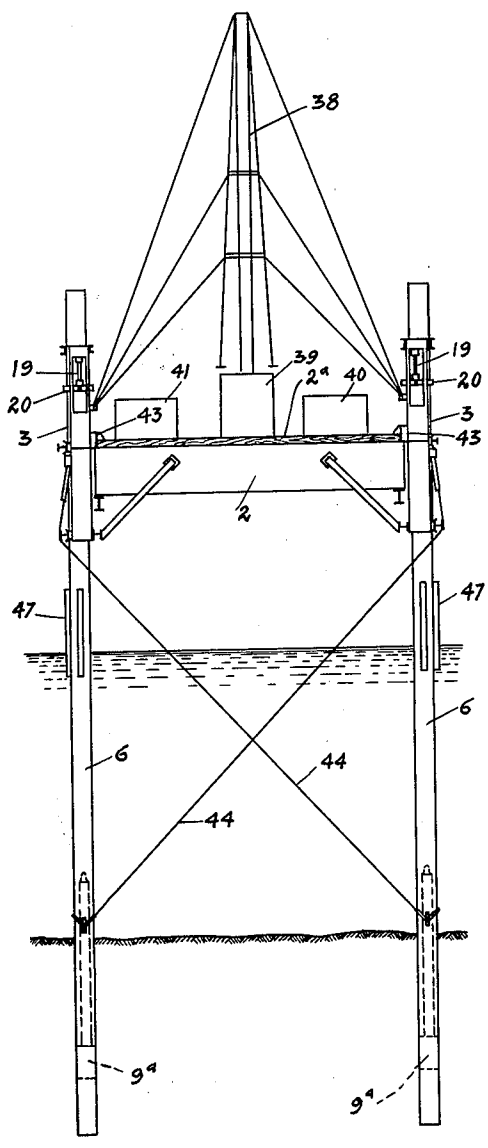


Fig. 1.

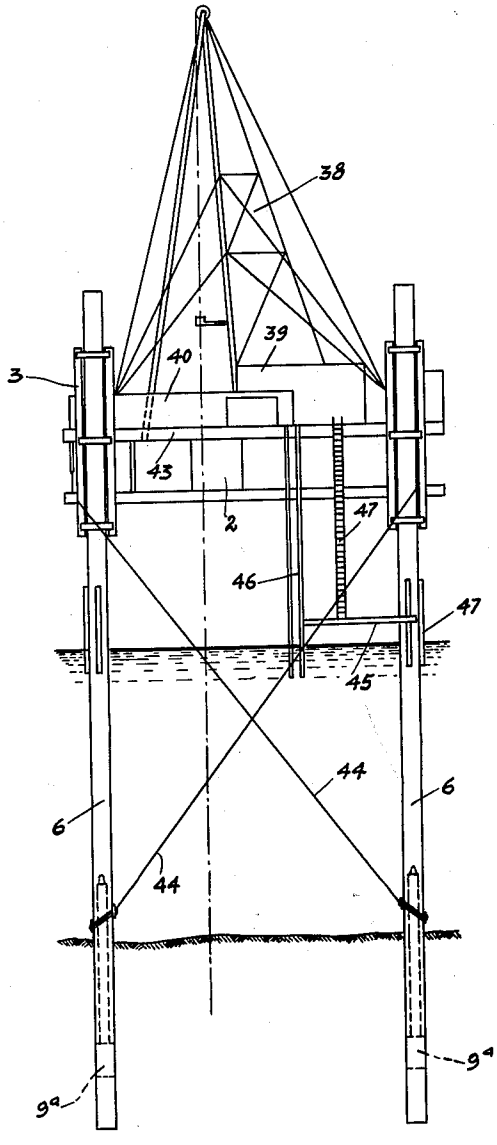


Fig. 2.

INVENTOR.
EDWIN P. SWATEK, JR.

BY
Christy, Parmelee & Stickland

ATTORNEYS.

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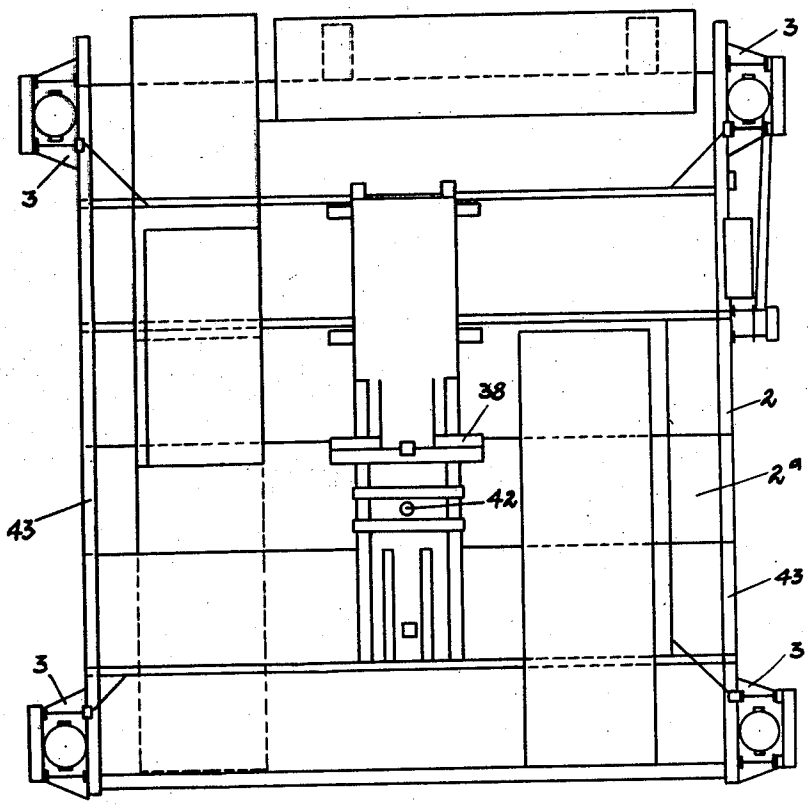


Fig. 3.

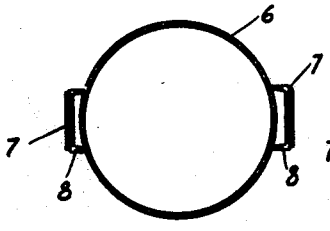


Fig. 5.

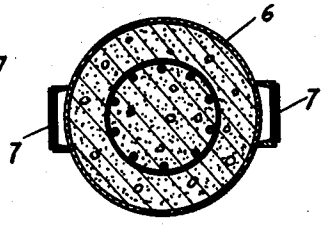


Fig. 6.

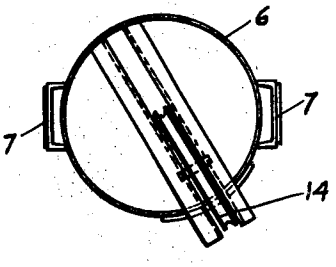


Fig. 7.

INVENTOR.
EDWIN P. SWATEK, JR

BY
Christy, Parmelee & Strickland

ATTORNEYS

July 20, 1965 E. P. SWATEK, JR 3,195,313

OFFSHORE DRILLING PLATFORM

Original Filed Feb. 9, 1959 5 Sheets-Sheet 3

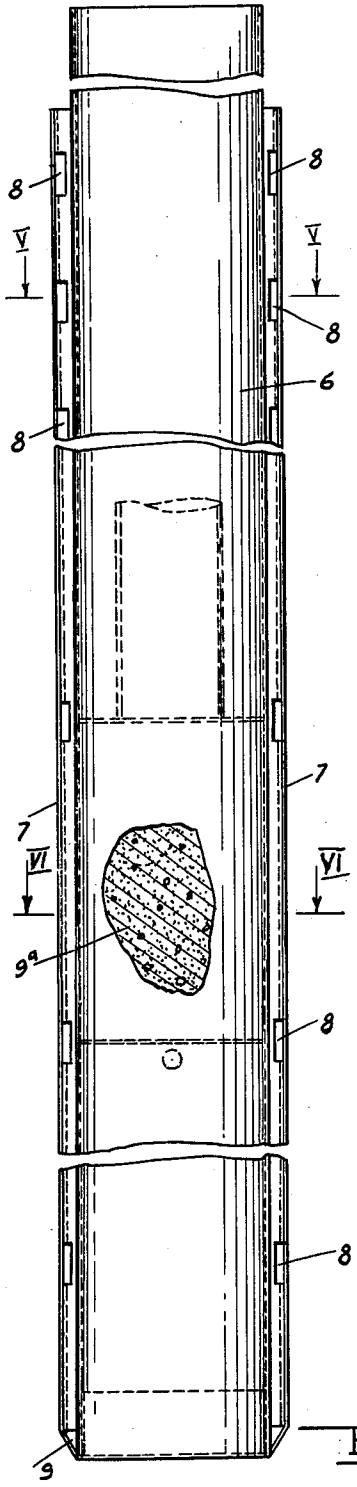
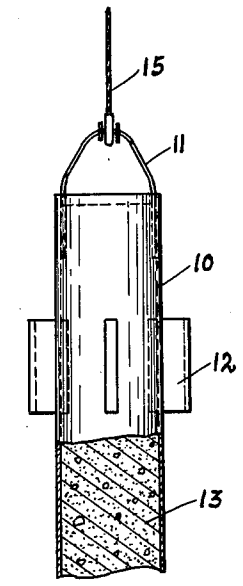


Fig. 4.



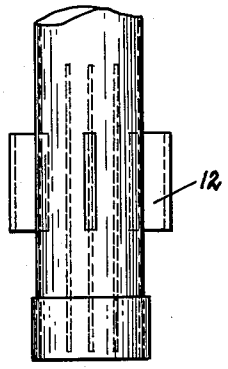


Fig. 10.

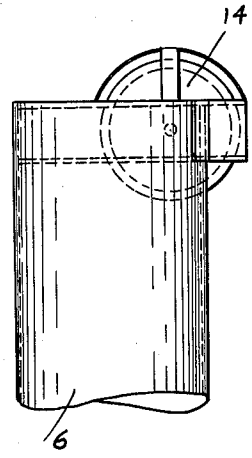


Fig. 8.

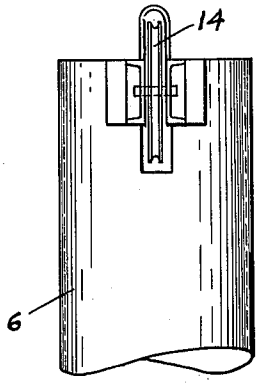


Fig. 9.

INVENTOR.
EDWIN P. SWATEK, JR.

BY Christy, Parmelee & Strickland

ATTORNEYS.

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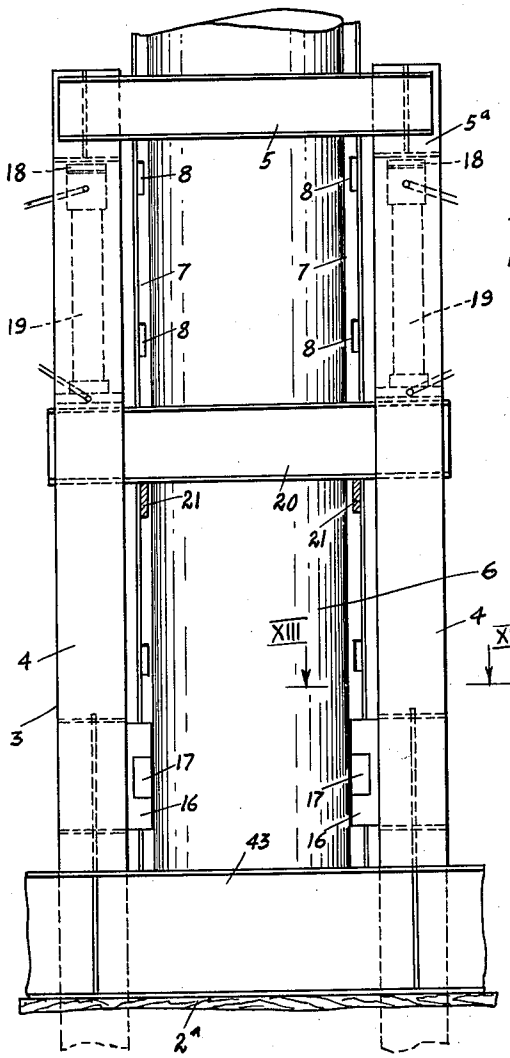


Fig. 11.

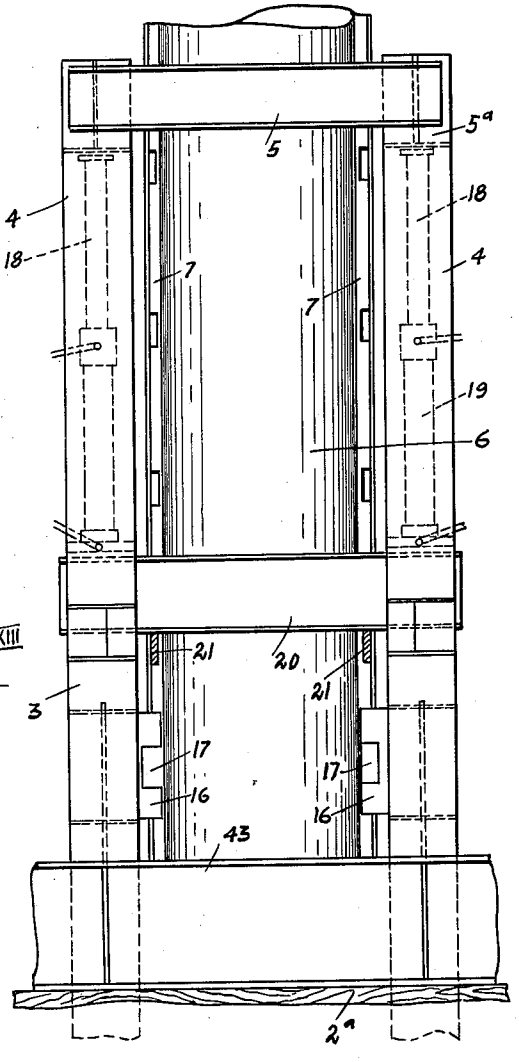


Fig. 12.

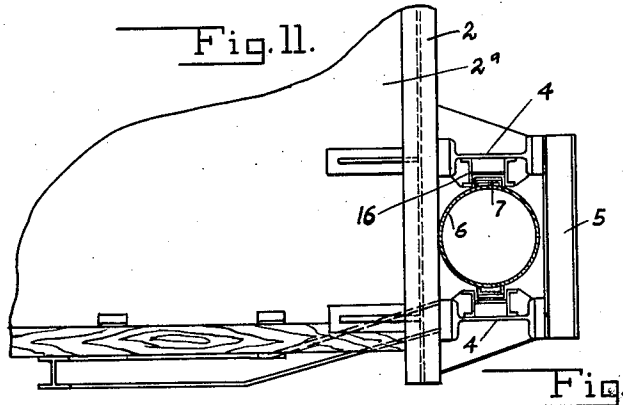


Fig. 13.

INVENTOR.
EDWIN P. SWATEK, JR.

BY Christy, Parmelee & Strickland

ATTORNEYS.

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OFFSHORE DRILLING PLATFORM

Original Filed Feb. 9, 1959 5 Sheets-Sheet 5

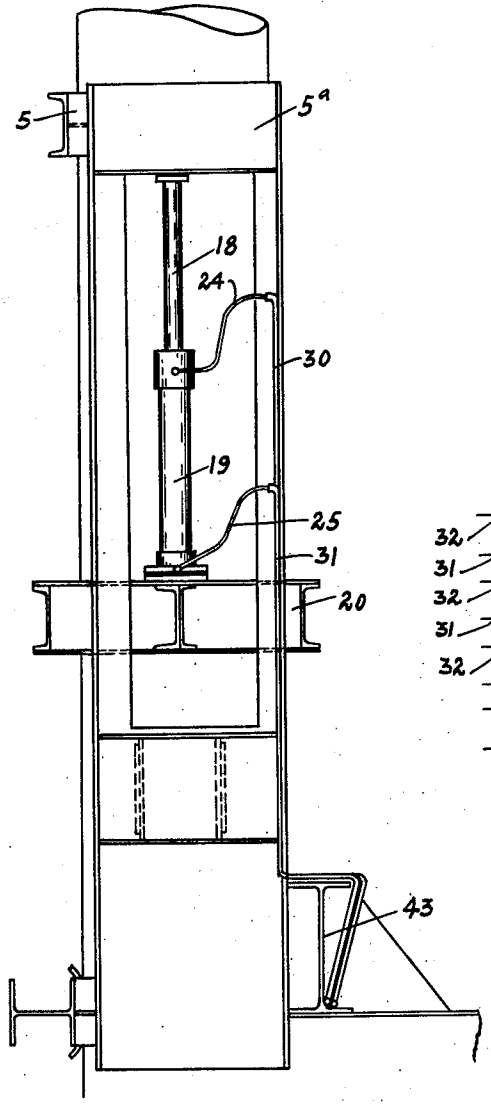


Fig. 14.

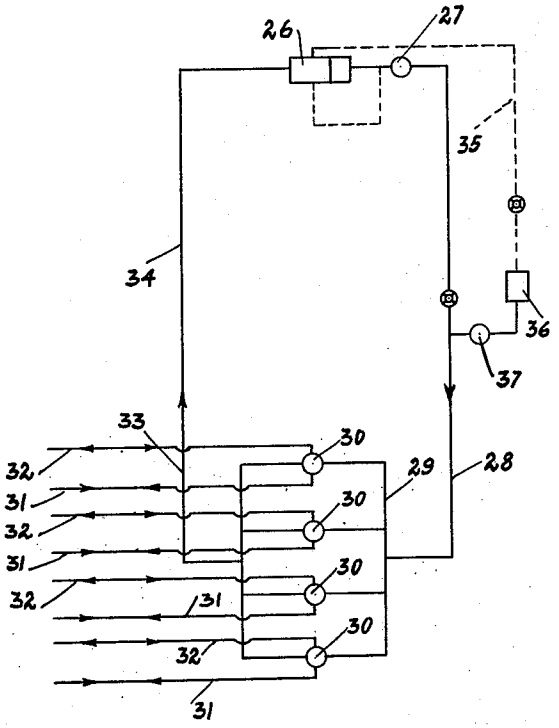


Fig. 15.

INVENTOR.
EDWIN P. SWATEK, JR.

BY
Christy, Parmelee & Strickland

ATTORNEYS.

United States Patent Office 3,195,313 Patented July 20, 1965

3,195,313

OFFSHORE DRILLING PLATFORM

Edwin P. Swatek, Jr., Sewickley, Pa., assignor to Dravo Corporation, Pittsburgh, Pa., a corporation of Pennsylvania

Continuation of application Ser. No. 792,112, Feb. 9, 1959. This application Oct. 8, 1962, Ser. No. 230,030
2 Claims. (Cl. 61—46.5)

This application is a continuation of my copending application, Serial No. 792,112, filed February 9, 1959.

This invention relates to an earth drilling or similar apparatus for use in drilling operations over a body of water, and which is generally termed an offshore drilling rig, and the present invention is for the platform on which the drilling rig is mounted, and from which the drilling operations are conducted. While the platform is designed primarily for drilling purposes, it may also be used in various construction projects where a stable over-water platform is needed.

The primary object of my invention is to provide a floating hull with legs that may be raised to enable the hull to be towed over water to or from its place of use without requiring excessive draft, and which may be lowered and driven, even in relatively deep water into the strata under the water, together with provision for elevating the platform above the level of wave action, and to lower it when the platform is to be moved or located elsewhere.

In general the platform comprises a water-tight steel hull which is buoyant so that it may be towed from place to place, and which provides adequate deck space for the drilling rig and other equipment, living quarters for the drilling crew, and other space necessary for the operation to be carried on. There are a number of guides, at least one at each corner, through which the legs may be raised and lowered. Hydraulic jacks are associated with the guides for effecting vertical movement of the platform up and down the legs.

My invention may be more fully understood by reference to the accompanying drawings, in which:

FIG. 1 is a side view of a platform embodying my invention, showing it in position with the platform elevated above the level of the waves;

FIG. 2 is an end view of FIG. 1;

FIG. 3 is a plan view of the platform;

FIG. 4 is an elevation of one of the legs, all of which are alike;

FIGS. 5 and 6 are transverse sections through one of the legs in the plane of lines V—V and VI—VI respectively of FIG. 4;

FIG. 7 is a top plan view of one of the legs;

FIGS. 8 and 9 are elevations at right angles to each other of the upper end of one of the legs;

FIG. 10 is a side elevation, partly in section, of the driver located within one of the legs;

FIG. 11 is a fragmentary view showing in side elevation on a larger scale than FIG. 2 the guide at one corner of the platform with the hydraulic jacks retracted;

FIG. 12 is a similar view with the jacks extended;

FIG. 13 is a transverse section of a single leg guide at one corner of the platform, the section being on line XIII—XIII of FIG. 11;

FIG. 14 is a front view of FIG. 12; and

FIG. 15 is a schematic diagram of the fluid pressure system for the jacks.

Referring to the drawings, 2 designates a platform provided with a water-tight buoyant metal hull which may be made as a single unit or of sections secured together. As here shown, it is substantially square, but it need not be square or even rectangular, and over which is a deck

2*a*. At each corner of the platform there is a vertical leg guide 3, formed of structural steel members, including vertical parallel I-beams 4 secured to the platform and hull and connected by structural cross members 5, so as to provide a frame through which the leg 6 extends vertically.

Each leg 6 comprises a long length or joined length of steel pipe, and extending along diametrically opposite sides of the pipe from the lower end to a level near but below the top of the leg are steel channels 7 faced against the exterior of the pipe and welded thereto. These channels form rib-like projections down the pipe, and transverse openings or keyways 8 are formed therethrough at intervals. The lower end of each leg terminates in a cutting edge 9 (see FIG. 4) and has an internal reinforced concrete plug 9a near the bottom, while there are one or more vent openings through the leg below the plug.

There is an internal weight 10 (see FIG. 10) inside each tubular leg which is movable vertically within the leg. It is here shown as a metal shell with a lifting bail 11 at the top, and having guide fins 12 around its periphery to keep it centered in the leg, and is filled with reinforced concrete 13. A sheave 14, which for clarity of illustration is shown only in FIGS. 7, 8 and 9, is mounted on the top of each leg over which a cable 15 attached to the bail 11 may pass to the drilling rig or other hoisting mechanism to raise the weight and drop it, so that each leg may be driven into the strata at the bottom down to bed rock. The drilling rig or hoist for this purpose is of any usual construction and forms no part of the present invention.

The leg guide 3 adjacent the bottom thereof is provided with blocks or chocks 16 that fit about the tubular leg and form channels to receive the ribs 7 on the leg 6. As viewed in FIGS. 11 and 12, steel bars or keys (not shown) can be thrust horizontally through openings 17 in these chocks and through the openings 8 in the ribs 7 to hold the platform and legs against relative vertical movement.

In addition to the cross member 5 the leg guide has cross members 5*a* at the top (see FIG. 14) to which are secured, or against which bear, the tops of rams 18 operated by fluid pressure cylinders 19, the cylinder and ram constituting a jack. The base of the jack is attached to a structural frame 20 movable vertically in the leg guide. Removable steel bars or keys 21 are passed through the openings 8 of channels 7 under this frame 20 to hold it against relative movement on the leg. These bars or keys are similar to the ones that are passed through openings 17 in the chocks, as above described.

Flexible fluid pressure lines 24 lead to the upper end of each cylinder 19, and a similar connection 25 leads to the bottom of the cylinder. Referring to FIG. 15, there is a fluid pressure reservoir 26 on the platform, and 27 is a pump that supplies hydraulic fluid under pressure through pipe 28 to manifold 29 leading to four-way valves 30, there being one valve for the jacks at each corner of the platform. Pipes 31 and 32 connect to lines 24 and 25, respectively. A return manifold 33 connects each four-way valve with a return pipe 34 leading to the reservoir. Dotted line 35 indicates a pipe leading to an auxiliary reservoir 36 and hand pump 37 to be used if the primary pump 27 fails.

The derrick or hoist or other structures carried on the platform form no part of the present invention, but there may be a derrick 38, while 39 indicates schematically the motor and hoist drum for the device. Casing pipe storage is diagrammatically indicated at 40 and 41. There is an opening or well 42 through the hull at the base of the derrick through which drilling operations are

carried on. There is a structural beam 43 along two opposite edges of the deck forming part of the structure to which the leg guides are attached.

In operation, when the platform is initially readied for use, the legs are set in their guides and lowered only to the depth permitted by the channel over which the float is to be towed. When lowered to this depth (or less) bars similar to bars 21 are placed through the openings 17 in the chocks and registering openings 8 in the ribs on the legs holding the legs in this elevation. The platform is towed to the place where drilling is to be done, and the keys or bars 21 are then withdrawn to lower the legs to the bed of the body of water. The legs are then driven one at a time, this being done by operating the internal weight 10 of each leg, raising the weight and dropping it to drive the leg down to a solid footing. When the legs are set, the bars 21 are inserted under the frame 20 to pass through the openings 8 in the side ribs on the legs, the jacks being at this time retracted, as shown in FIG. 11. Then fluid pressure is applied to the jacks to extend them. At this time there are no similar bars in the openings 17 in the chocks. The pressure of the jacks, thrusting up on the members 5a, lift the platform, the thrust on the base of the jacks being transmitted through the frame 20, and bars 21 to the legs. When the jacks are fully extended, bars 21 are thrust through openings 17 of chocks 16 and registering openings 8 in the ribs 7 on the legs, so that the platform cannot now move down and the bars 21 under the frame 20 are removed and the jacks retracted. After the jacks are retracted the bars 21 are again placed under the frames 20, bars 21 are removed from the chocks 16 on the platform, and the operation is repeated. This procedure is continued until the platform has "climbed" up the legs sufficiently above the water level to be clear of wave action. Then, with the aid of a diver, bracing cables 44 are secured to the legs and platform to steady the structure against side sway.

When the platform is to be moved, it is lowered in steps similar to the manner in which it was raised, except the retracting of the jacks is used to lower the platform, whereas the extending action of the jacks is used in raising it. The legs can then usually be pulled by jacking against the hull's buoyancy, that is the jacks are operated to push the platform down into the water to submerge its normal water line, whereas the platform is pushed up by its buoyancy, thus exerting a thrust upwardly on the legs, and wave action at this time may assist the operation. If this does not succeed, water can be jetted into the earth around the legs in a manner well known in the art, or if this is not successful, they can be cut off at the earth level. After the legs are free of the bottom, they can be raised by operation of the jacks to the extent desired and the platform moved to a new location.

My invention therefore provides an offshore drilling platform that may be constructed completely on shore, towed to the place of use, and then anchored and elevated clear of the water with no equipment other than that on the platform itself. When it is to be moved to another site, it may also be operated to pull its own supporting legs out of the bottom and lift them to draft depth.

A boat platform 45 may be attached to vertical struts 46 attached to the platform and to one of the legs. A ladder 47 may then be placed on this boat platform and lashed to the drilling platform. Removable bumper strips are indicated on the legs at 47, these being at water level.

While I have shown and described a preferred construction embodying my invention, various changes and modifications may be made therein within the contemplation of my invention and within the scope of the following claims, and it will be apparent that any number of legs may be used, depending on the size and weight of the drilling platform and soil conditions beneath it.

What is claimed is:

1. In an offshore drilling rig, the combination comprising a buoyant hull, a deck fixed to the hull for supporting a drilling rig, a plurality of leg guides fastened to the hull, the guides each including an openwork structure with an upper rectangular framework rigidly attached to the deck by depending column members and a lower rectangular framework in vertically sliding connection with the vertical columns, a jack positioned between and connected to the upper and lower frameworks for moving the lower framework toward and away from the upper framework, legs guidingly supported through the openwork structure and surrounded by the upper and lower frameworks of the guide frame, ribs attached along the length of each leg and parallel with the leg axis, each rib having slotted opening extending horizontally and spaced vertically along the length of the ribs, a chock attached to the guide with flanges in relative sliding engagement with the ribs and having aligned spaced openings extending horizontally, the chock openings being in alignment with the slotted openings of the ribs, pins passed through the slotted openings of the ribs and of a length greater than the width of the lower framework of the guide whereby the lower framework is supported on the pins for elevation of the upper framework and deck upon extension of the jack, the pins being inserted into the openings of the chocks and aligned slotted openings of the ribs for fixing the location of the guide on the ribs of the leg when pins are removed from supporting position beneath the lower framework such that retraction of the jack elevates the movable lower framework toward the upper framework, the pins being reinserted beneath the lower framework and removed from the chock openings for subsequent extension of the jack and lifting of the deck and upper framework for incrementally raising the hull and deck on the legs.

2. In an offshore drilling rig, the combination comprising a buoyant hull, a deck fastened to the hull, a plurality of leg guides spacially arranged on the hull, each leg guide including an upper portion rigidly connected with the deck and in vertically spaced relation thereto, a leg slideably engaged through each guide and through the deck, a lower guide portion spaced intermediate the upper guide portion and the deck and vertically movable with respect to the leg, each leg having diametrically opposed ribs extending lengthwise on the leg and provided with a plurality of transversely slotted openings spaced vertically of the ribs, a jack connected to the upper and to the lower guide portions and extensible and retractable therewith, chocks rigidly connected to the deck and having flanges with transversely aligned openings between which a leg rib is guidingly supported for movement in vertical direction, pin engageable through the slotted openings of the ribs of each leg and extending beneath the lower movable portion of the guide whereby the extension of the jack raises the guide upper portion and the deck simultaneously while the guide lower portion is supported in fixed relation to the leg on the pins, the pins being slideably engaged through aligned openings of the chocks and ribs for locking the guide in position on the leg, the pins engaging the chocks being removed when the pins are inserted in the slotted openings of the ribs beneath the movable lower portion of the frame after retraction of the jack for subsequent incremental elevation of the deck and guide relative to the leg by extension of the jack.

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EARL J. WITMER, *Primary Examiner.*

JACOB SHAPIRO, *Examiner.*