United States Patent [19]

Mott

[11] **3,714,788**

[45] **Feb. 6, 1973**

[54] **PLATFORM BUOYANT UNDERSTRUCTURE**

[75] Inventor: **George E. Mott,** Metairie, La.

[73] Assignee: **Texaco Inc.,** New York, N.Y.

[22] Filed: **April 30, 1970**

[21] Appl. No.: **33,407**

[52] **U.S. Cl.**.....**61/46.5**

[51] **Int. Cl.**.....**B63b 21/50,** E02b 17/00

[58] **Field of Search**.....61/46.5, 69, 81

[56] **References Cited**

UNITED STATES PATENTS

3,563,042	2/1971	Ryan	61/46.5
3,522,709	8/1970	Vilain	61/46.5
3,355,899	12/1967	Koonce et al.	61/46.5
3,528,254	9/1970	Graham	61/46.5
2,908,141	10/1959	Marsh, Jr.	61/46.5 X
3,086,368	4/1963	Popper	61/46.5
3,256,537	6/1966	Clark	61/46.5 X

Primary Examiner—Jacob Shapiro

Attorney—Thomas H. Whaley and Carl G. Reis

[57] **ABSTRACT**

The invention relates to a floatable understructure for a marine platform or deck located in an offshore body of water. The understructure includes an elongated rigid column unit incorporating buoyancy means so disposed to permit the attitude of the structure to be controlled. In the operating position, one end of the understructure is operably connected to an anchor resting on the ocean floor. The structure other end is buoyed up such that the unit assumes a generally upright disposition in the body of water with a portion protruding beyond the water's surface to support the working deck or platform.

1 Claim, 5 Drawing Figures

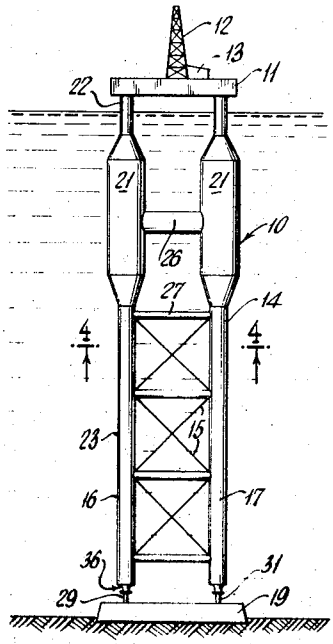


Fig. 1.

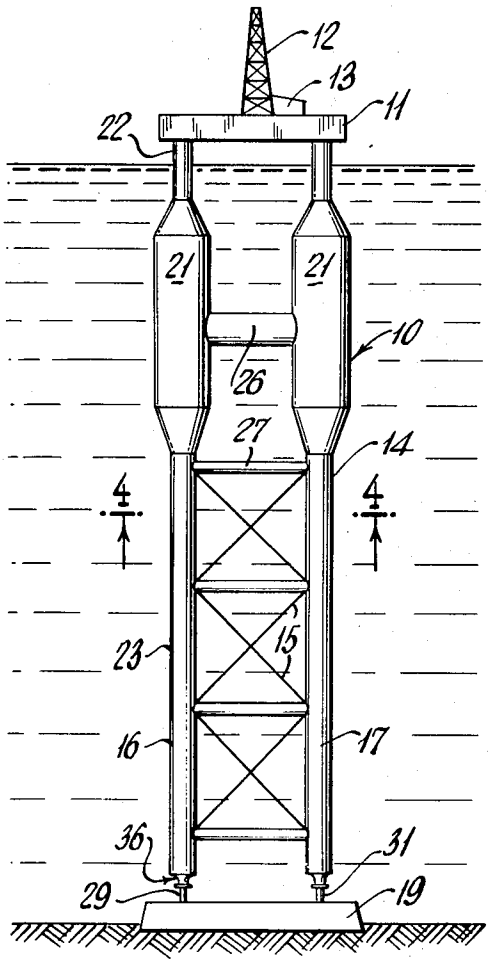


Fig. 4.

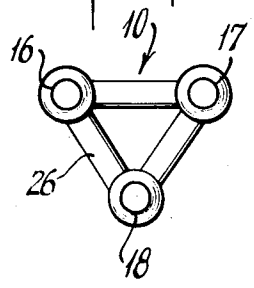


Fig. 5.

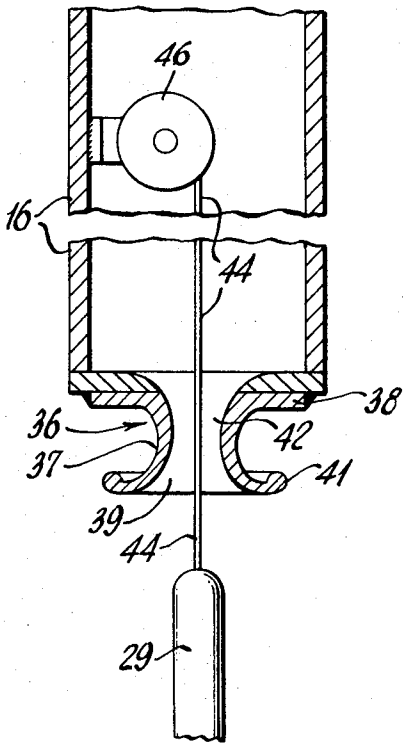


Fig. 2.

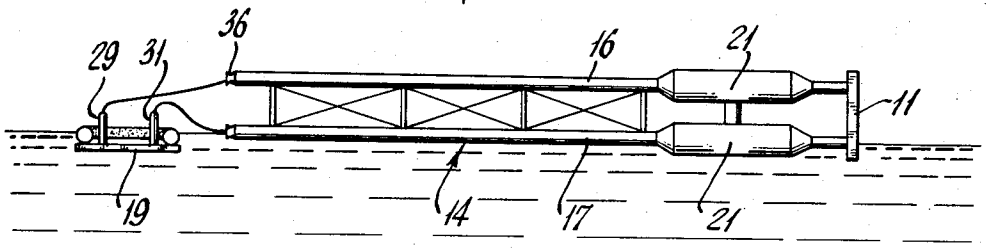
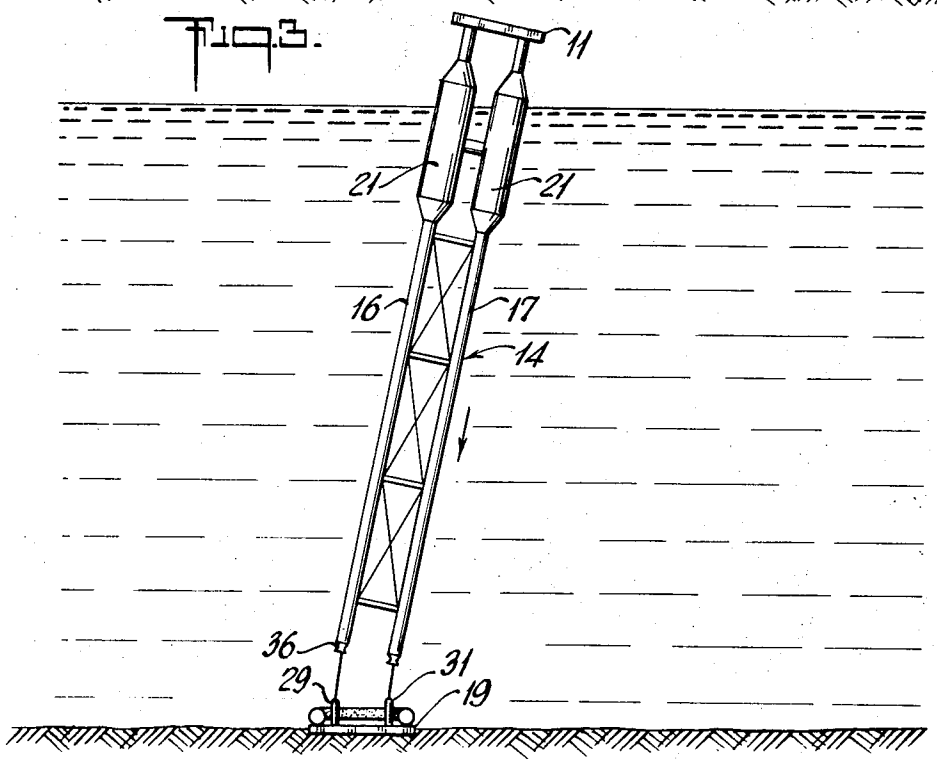


Fig. 3.



PLATFORM BUOYANT UNDERSTRUCTURE

BACKGROUND OF THE INVENTION

In the drilling for and production of offshore sources of crude oil, gas and other petroleum products, such activity has of necessity been extended to increasingly greater water depths. The facility for best working at such increased depths often takes the form of a stationary marine platform anchored to the ocean floor at the drilling site. However, it has been found feasible as well as desirable to provide a non-rigid platform which is more amenable to meeting excessive displacing forces such as turbulent water and high winds. A problem encountered by the use of such non-rigid platforms is the provision of adequate means for anchoring the unit at a desired location while still permitting a safe, continuous drilling operation.

Since such platforms are readily submerged in a partially buoyant condition, or raised to the surface whereby to be transported, the anchoring medium should likewise be flexible in character.

Because of the enormity of a deep water floatable type drilling structure, it is often difficult to control its attitude as it is lowered to a drilling site. On the other hand the anchoring means or foundation member, by virtue of its compactness of weight can readily be accurately lowered to the ocean floor.

Toward facilitating the use of a floating, yet anchored drilling platform, the above mentioned problems are at least partially overcome by providing a platform understructure that is not only buoyant, but is connected at the lower end to a heavy anchoring foundation. Thus, as the latter is controllably lowered to a drilling site it will simultaneously guide the buoyant platform support structure to the ocean floor.

DESCRIPTION OF THE DRAWINGS

In the drawings,

FIG. 1 is a vertical elevation of a floatable platform of the type contemplated anchored above an offshore drilling site.

FIG. 2 illustrates the platform of FIG. 1 shown floating at the water's surface.

FIG. 3 is similar to FIG. 1 showing the platform during the course of being lowered to the ocean floor.

FIG. 4 is an enlarged view in cross-section taken along line 4—4 in FIG. 1.

FIG. 5 is an enlarged segmentary view in cross-section of the lower end of a support leg.

Briefly stated, the understructure includes a rigid column unit of sufficient length to extend between the ocean floor and the water's surface at an offshore well drilling site. Each column making up the unit is buoyantly adjustable to controllably regulate the disposition of the structure between the extremes of substantially vertical and horizontal attitudes.

For positioning the understructure, the latter is provided at the lower end with a ballastable anchor whereby to regulate the weight distribution of the structure and the buoying capacity of the anchor. When fully ballasted, the anchor sinks to the ocean floor, thereby drawing the structure lower end downward. By simultaneously increasing the buoyant capacity of the column unit upper end, an upright floating condition is achieved.

The ballastable anchor is operably connected to the column unit lower end by means of a flexible connector. The latter is adjustable whereby to alter the physical relationship of the anchor at the column lower end in accordance with the unit's position during anchoring or moving operations.

The accompanying description is directed to an offshore platform adapted to drill subterranean wells and includes the necessary well drilling equipment. It is appreciated however, that the basic platform and anchor arrangement could be used for offshore storage, producing or refining of petroleum products. As shown in FIG. 1, in the upright operating position the platform is aligned to drill a submerged well from the water's surface. Drilling platform **10** comprises a working deck **11** which supports a derrick **12**, draw-works **13** and other equipment ancillary to a well drilling and/or producing operation. Deck **11** is preferably supported 50 or 60 feet beyond the surface of the water to protect equipment from high waves and exposure to the water.

The deck support or understructure **14** includes a plurality of elongated column-like members **16**, **17** and **18** which are mutually interconnected by lateral bracing members **15**. The lower end of platform **10** is maintained at a desired drilling site by an anchor **19**, operably carried at the column unit lower end, whereby to permit a degree of adjusting flexibility therebetween.

Referring to FIG. 2, the entire understructure **14** is shown floating at the water's surface prior to being submerged and uprighted into the drilling position. While at the surface, the elongated deck support unit **14** assumes a generally horizontal disposition with anchor **19** connected to, although spaced sufficiently from the column unit lower end, to permit the anchor to be floated independently thereof.

The structure and character of understructure **14** are such that the buoyancy of the unit can be varied. Thus, its floating disposition both in and on the water, is readily controllable. Also as will be hereinafter noted, the unit is sufficiently versatile to be interchangeably used at varying water depths by the addition to or removal of sections at the unit lower end.

Column unit **14** comprises in essence a plurality of vertically arranged buoyant members **16**, **17** and **18** having the major portion thereof submerged sufficiently to extend the upper ends beyond the water's surface. In the illustrated arrangement, and as seen in FIG. 4, three such columns are grouped in the pattern of an isosceles triangle. It is understood however that the particular column arrangement utilized will vary with the character of equipment carried on working deck **11**, with the depth of the water, and on other design factors.

Each column, **16** for example, comprises an upper end which incorporates one or more buoyancy tanks **21**. Said tanks **21** can be incorporated directly into the column structure or may be positioned externally of the column main section. The buoyant tanks comprise a plurality of individual smaller tanks spaced about the column periphery, rather than a single unit. In the present arrangement, buoyant tanks **21** are formed with a diameter substantially greater than the diameter of the column main section whereby to control the column uplift force. Tanks **21** as shown, are disposed completely around the leg member **16**, encased within an outer sheath or cover.

A support extension 22 depending from the upper end of column 16 is adapted to removably engage working deck 11. Thus, said support extension 22 includes means to releasably engage a deck section 11 which is lowered onto the understructure a desired height above the water's surface when the structure has assumed an upright floating position at a predetermined water depth. To facilitate the transportation of understructure 14 between working locations, deck section 11 together with the equipment thereon can be removed, and subsequently re-installed on the structure when the latter is at a new drilling site.

The lower end of column unit 14 includes an elongated main section 23 depending downwardly from the lower side of tank portion 21. Said lower main section 23 comprises preferably a composite member formed of individual lengths of end-welded cylindrical tubing. Said lower section need not be water tight for its entire length, but is rather provided with longitudinally arranged controlled buoyancy tanks to permit the unit to be more closely regulated during transition periods of submerging and raising. Thus, as the understructure is utilized in various water depths, the discrete sections of cylindrical tubing can be either added to, or removed from the column lower end whereby to adjust the length of the leg as needed.

Said main or lower section 23 can be further provided with internal means such as liquid storage tanks, piping manifolds, and similar accessories peculiar to an offshore operation.

The respective columns 16, 17 and 18 are maintained in a spaced apart horizontal relationship by intermediate leg spacers 26 and 27 which function to rigidize and brace the legs or columns.

As shown in FIG. 1, anchor 19 depending from the lower end of column unit 14 comprises a holding or stabilizing member of sufficient bulk that, when positioned at the floor of a body of water, will resist displacing movement of the column unit. Thus, said anchoring member 19 includes a relatively heavy, broad base 28 having one or more upstanding connector posts 29 and 31 depending upwardly therefrom. The latter are adapted to operably engage a corresponding elongated socket formed in the leg lower end. Thus, when in the fully submerged position, understructure 14, and anchor 19 are disposed in sliding engagement to allow the structure a degree of both pivotal and vertical movement while being maintained in a stable drilling position.

One embodiment of a connector for operably engaging anchor 19 with the underwater structure 14, is shown in FIG. 5 wherein leg 16 slidably engages a corresponding anchor connector post 29. In the instance of leg 16, the lower end thereof is provided with a bearing ring 36, which is integral with the connector at leg 16 lower end. Said ring 36 functions to slidably engage connector post 29 when the understructure 14 is uprightly positioned at a drill site. The ring further serves to guide cable 44 when said understructure is being lowered from a horizontal floating position.

Body 37 of ring 36 is generally cylindrical in shape, having an inlet aperture 39 at the end opposite to a flange 38 which fastens to the lower face of leg 16. The inlet aperture 39 is relatively wide, terminating in a peripheral lip 41. The latter in turn blends into a smoothly contoured side wall which forms a longitudinal guide passage 42 through said body 37.

Bearing ring 36 is adapted to slidably register about anchor post 29, whereby to restrain lateral movement thereof and permit vertical and pivotal movement of column unit 14 when the legs of the latter are properly received on the respective anchor columns.

The upper end of each connector post 29 and 31 receives the lower end of a flexible element such as a cable 44, chain or the like. In the instant arrangement cable 44 is shown connected to the upper end of connector post 29, and thereafter being registered through the constricted guide passage 42 of bearing ring 36. Connector cable 44 functions to vary the spatial relationship between the respective anchor posts and corresponding bearing rings in legs 16 and 17. Thus, the upper end of cable 44 is engaged to a wind-up mechanism including a reel or power driven winch 46.

Wind-up mechanism 46 is located at column 14 upper end or on deck 11.

In practicing the method for manipulating the disclosed marine platform, the entire unit, including anchor 14, is normally fabricated at a shore location and thereafter towed to a point of usage at an offshore well drilling or producing site. Thus, and as shown in FIG. 2, column unit 14 is floatably supported at the water's surface on at least two of the elongated columns, i.e., 17 and 18. Such a disposition is maintained by adjusting the buoyancy of the respective buoyancy tanks 21, as well as the supplementary buoyancy tanks within the respective columns, whereby to minimize strain along the length of the column unit as it floats at the water's surface.

Anchor 19 as shown can be provided with self-supporting means including permanent or detachable buoyancy means. However, the anchor can also be supportably held by the floating understructure 14. Cable 44 is unreeled sufficiently to permit anchor 19 to be submerged from the lower end of the structure 14, or to be floated independently thereof.

At a drilling site where it is determined that the platform is to be submerged, the buoyancy system in both the anchor 19 and understructure 14 are adjusted whereby to cause the anchor as well as the lower end of said column unit to sink through the water. The column unit upper end is maintained at the water's surface by adjusting the buoyancy of tanks 21.

After the anchor 19 arrives at the ocean floor, anchor posts 29 and 31 are drawn into the respective leg bearing rings 36 by retracting cable 44 as to slidably register the anchor post 29 within the guide passage 42. Thereafter anchor 19 is ballasted, or otherwise permitted to become at least partially imbedded in the soft substratum. The position of seating ring 36 on the anchoring post 29 is adjusted by varying the buoyancy of tanks 21 at the structure upper end whereby the slidable relationship is maintained between the legs and the anchor as the column unit tends to oscillate and move vertically in response to wave movement at the water's surface.

Because of the relatively elongated structure of the column unit there will be a minimum of vertical movement in response to the ordinary wave movement at the water's surface. Even in the instance of turbulent water and relatively high waves, the vertical movement of the elongated structure will still be minimized and dampened. In effect, the disposition of the drilling equipment maintained on deck 11 will be stabilized re-

gardless of the condition of the wind and waves in the vicinity of the marine platform.

If it becomes necessary to move platform **10** to another site, anchor **19** is raised by deballasting and dislodging it from the substratum. Simultaneously, the buoyancy of tanks **21** is adjusted so that an additional uplift force is applied to the anchor. By adjusting the buoyancy of the tanks **21** at the column upper end, the latter will impose a gradual uplifting force to the anchor until the latter is dislodged from its normal resting place. As the entire unit becomes free of its anchoring spot, cables **44** can be payed out and adjusted to a desired length. The entire unit can now be towed to the next drilling spot in a substantially vertical disposition with the anchor disengaged from the floor. Alternately, for long tows, understructure **14** as well as anchor **19** can be raised to the water's surface as shown in FIG. **2**. Thereafter at the new drilling site the procedure for lowering the anchor and adjusting the column unit into vertical disposition is repeated.

Obviously, many modifications and variations of the invention, as hereinbefore set forth, may be made without departing from the spirit and scope thereof, and therefore only such limitations should be imposed as are indicated in the appended claims.

I claim:

1. In a marine platform for use in an offshore body of water, comprising a plurality of elongated, controlled buoyancy legs having engaging ends thereof, said platform being adapted to position said buoyant legs in horizontal or vertical disposition within said body of water, and anchor means removably connected to the engaging ends of said respective legs whereby to be supported in the water by said buoyant legs, or to position said platform when said anchor is lowered to a fixed location at the ocean floor with said legs in a substantially vertical disposition, said anchor means including a plurality of upstanding anchor posts positioned in alignment with said elongated legs when the latter are disposed in said vertical disposition, and cable means extending longitudinally of said legs and being connected to an anchor post whereby to operably connect said legs and said anchor means, the improvement therein of;

a bearing ring including a body having a flange at one end thereof connected to said leg, guide passage means extending longitudinally of said body and terminating at an enlarged inlet aperture at said body end opposite to said flange, said guide passage means being progressively narrowed from said enlarged inlet aperture to a constricted portion of sufficient opening, to slidably resister about said anchor post whereby to permit restricted vertical oscillatory movement of said platform, said guide passage means intermediate said inlet aperture and said constricted portion, being further defined by a gradually curved configuration to permit smooth passage of said cable through said passage means during movement of said anchor with respect to said legs when the latter is separated from said anchor posts.

* * * * *