

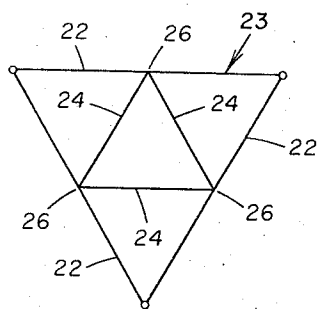
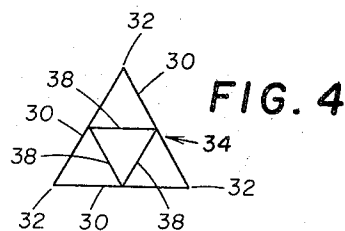
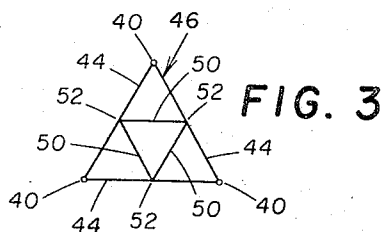
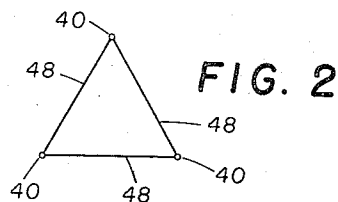
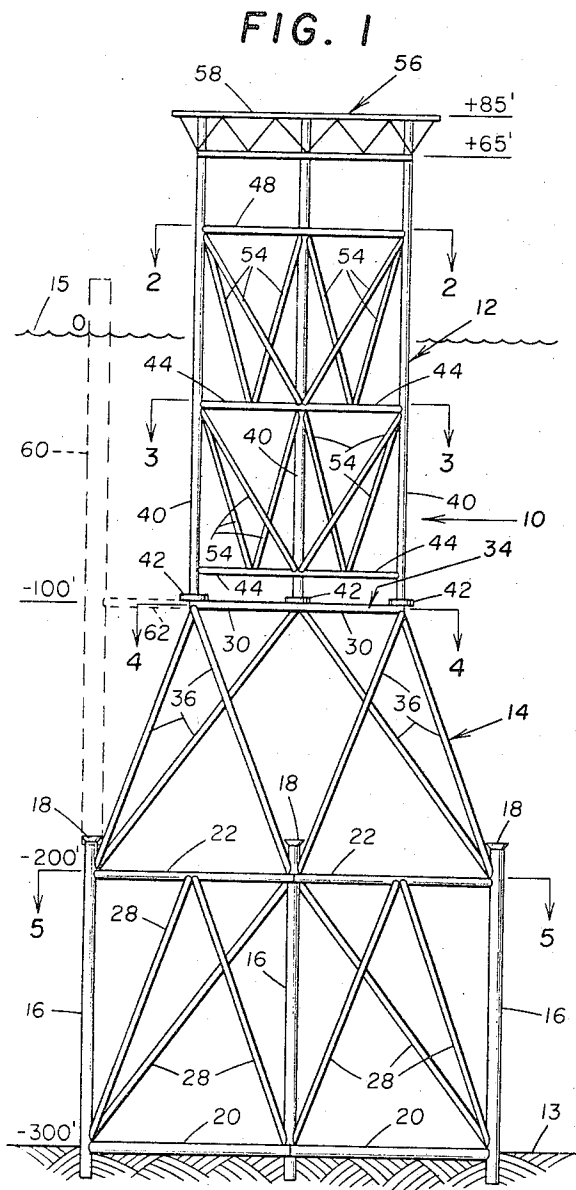
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TENDED DRILLING PLATFORM FOR MULTIWELL SUBSURFACE COMPLETION

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TENDED DRILLING PLATFORM FOR MULTIWELL SUBSURFACE COMPLETION

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The invention relates to a method and apparatus for drilling a subaqueous well from an above-surface deck of a bottom-supported platform and completing the well on a subsurface deck of the same platform. More particularly, the invention relates to a sectional drilling and production platform designed for above-surface drilling, and with the upper section removed, for supporting a production wellhead at diving depth beneath the surface of a body of water.

In many areas of the world, particularly in the Gulf of Mexico, proven oil and/or gas bearing formations underlie comparatively shallow water depths. In some areas, the depth of the water may not exceed three hundred feet over a hundred miles from shore. In these areas, it is economically desirable to drill production wells from a fixed platform. In the past such a platform later became the support for the production wellheads of the wells drilled therefrom. As the oil and gas rich offshore areas become more and more developed and the number of production platforms increases, the danger to navigation becomes increasingly great. Large ships must thread their way between these structures, and utmost care must be used, particularly during foggy weather conditions to prevent collisions. While the spacing of these platforms might not appear to present a navigational problem, at a first glance by a layman, they do present one to the ship captain who usually is confronted with navigating through large open areas with few obstacles. In the Gulf of Mexico where the density of offshore platforms is increasing at a rapid rate, there have already been several collisions.

Another problem that should be considered is that of the violent storms that ravage the Gulf Coast with almost yearly frequency. These storms take their toll of any equipment which breaks the surface of the water. A large production platform, if uprooted, is a tremendous economic loss and, depending upon the individual case, ten or more wells may have to be abandoned.

Therefore, it would be advantageous if the wells were completed below the surface of the body of water. Still in the experimental stage is the completion of wells at the mudline on the marine bottom. Such completions have their own problems such as requiring divers for even the most simple repair and maintenance situations. While robotic and TFL (through flowline) tools have been developed and are available for routine servicing and work-over operations, these devices are complicated and expensive, and are, at this time, only used for a few limited tasks. At over two hundred feet a diver loses a considerable amount of his efficiency and is hampered still further by the short working time at such a depth.

One method for minimizing the described difficulties is to mount a support structure or submerged platform over the well site, the structure extending from the marine bottom to a point beneath the surface, which a diver can easily reach and which is not a navigational hazard. To benefit from these advantages, utilizing prior art methods and structures, the wells would have to be drilled first from a bottom-supported platform with an above-surface deck. The surface platform would then have to be removed by a large barge while the wells were capped near the ocean bottom. A subsurface support structure would then be lowered over the well site and the wells extended

up to this second structure for the mounting of the production wellheads.

Accordingly, it is an object of the present invention to provide a composite structure for the subaqueous completion of a well, drilled from a surface deck, at a point below the surface.

It is another object of the present invention to provide a sectional, bottom-supported structure, with an above-surface drilling deck, which can be separated after a well is drilled, leaving a subsurface deck for mounting the production wellheads.

It is a further object of the invention to provide a sectional bottom-supported platform, the upper section of which can be removed without damage after drilling.

Other objects and advantages of the invention will be readily apparent from the following description, when taken in conjunction with the accompanying drawings that illustrate useful embodiments in accordance with this invention:

FIGURE 1 is an elevational view of a drilling and production platform of the present invention, supported on a marine bottom, and extending above the surface of the body of water to support in turn a drilling rig thereon;

FIGURE 2 is a cross-sectional view through lines 2—2 of FIGURE 1 illustrating a portion of the superstructure of the drilling support section of the bottom-supported drilling and production platform;

FIGURE 3 is a cross-sectional view through lines 3—3 of FIGURE 1 illustrating the bracing of the lower portion of the drilling support section of the bottom-supported drilling and production platform;

FIGURE 4 is a cross-sectional view taken through lines 4—4 of FIGURE 1 illustrating the bracing of the upper portion of the subsurface production support section of the bottom-supported drilling and production platform; and

FIGURE 5 is a cross-sectional view taken through lines 5—5 of FIGURE 1 illustrating the base portion of the subsurface production support section of the bottom-supported drilling and production platform.

Referring now to the drawings, more in detail, by character reference, FIGURE 1 illustrates the structure of a bottom-supported drilling and production platform, of the present invention, generally designated 10, consisting of an upper drilling support section 12 and a lower production support section 14. In the pictured embodiment the composite platform has been designed for three hundred feet of water, the lower production support section 14 extending from the marine bottom 13 to a depth one hundred feet from the surface 15 of the body of water. The drilling support section 12 is mounted on the upper end of the subsurface production support section 14 and extends to a point eighty-five feet above the surface of the water.

The production support section 14 consists of a lower base section, approximately two hundred feet in height, consisting of three vertical tubular jackets 16 arranged in a triangular configuration. The tubular jackets 16 have inverted conical guides 18 affixed to the upper ends thereof to aid in the insertion of anchoring piles (not shown) therethrough when the piles are suspended from above the surface 15 and lowered through the water into the jackets 16. These jackets 16 are horizontally braced by means of interconnecting peripheral braces 20 and 22 forming parallel spaced triangles. The upper triangle 23, formed by braces 22 (FIGURE 5), is further supported by crossbracing consisting of struts 24 forming an inner reverse triangle. From each apex 26 of the triangle formed by the crossbraces 24, a pair of diagonal braces 28 extends to the two adjacent tubular jackets 16 at the points at which the lower peripheral braces 20 are connected

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thereto. The subsurface production section 14 converges upwardly above the jackets 16 to terminate in a reverse triangle consisting of horizontal peripheral braces 30 (FIGURE 4) forming a submerged production deck 34 about one hundred feet below the surface. Each apex 32 of the production deck 34 is connected to the upper ends of the two adjacent tubular jackets 16 by diagonal braces 36. The midpoints of the braces 30 are interconnected by an inner reverse triangular crossbracing made up of struts 38.

The upper drilling support platform section 12 consists of three vertical supports 40 projecting sixty-five feet above the water. The supports 40 are arranged in a triangular configuration and are connected at their lower ends to the apexes 32 of the triangular drilling deck 34 by releasable couplings 42 (which may be no more than pairs of plates welded to the adjoining sections and bolted together). Peripheral horizontal braces 44 interconnect the vertical supports near the lower end of the drilling section 12 and at a point intermediate thereof, still below the surface 15 of the water, forming parallel triangles 46 (FIGURE 3). Another group of horizontal braces 48 (FIGURE 2) interconnects the vertical supports 40 above the water surface. The triangles 46 (FIGURE 3) formed by the horizontal braces 44 are each further crossbraced by struts 50 extending between the midpoints of the braces 44 to form inner reverse triangles having apexes 52. Upwardly diverging diagonal braces 54 are connected between the apexes 52 of the inner triangles and the vertical supports 40 at the next upper horizontal support. Mounted on the upper ends of the vertical supports 40, approximately sixty-five feet above the surface of the water, is a twenty-foot-high superstructure 56 which includes space for a drilling rig that will be mounted on the drilling deck 58. During drilling, due to the limited size of the deck 58 (as shown, one hundred feet on a side), the drilling platform 10 is attended by a floating barge or small mobile bottom-supported platform containing the necessary mud tanks and power machinery necessary for the drilling operations.

Prior to installation of the drilling and production platform 10, a watertight vertical access caisson 60 (shown in phantom) can be positioned over each of the jackets 16 to aid in inserting the piles. If caissons 60 are used to guide the piles into the jackets 16, the conical guides 18, on the upper ends of the jackets 16, would not be needed. The caissons 60 would be long enough to extend upward to a height above the surface 15 after the platform 10 is erected on the drilling site so that each of the piles can be driven down through one of the jackets 16 into the subaqueous bottom. A support 62 (also shown in phantom) removably connects each of the access caissons 60 to the drilling and production platform 10 at the level of the subsurface production deck 34 to align and support the caisson 60. The caissons 60 would normally be removed just after the piles are installed therethrough. A diver would be needed to disconnect the supports 62 of the three access caissons 60 at the production deck 34. It is contemplated that the caissons will be welded to the jackets 16 and it will be necessary to remove them by cutting them off with a casing cutter.

The drilling and production platform 10, designed for the specific water depth at a deep water marine site, is transported to the drilling site and is then set in place on the marine bottom 13. The particular platform 10 is large enough so that, when supported on the marine bottom 13, the upper end of the production support section 14 is at a safe navigational depth beneath the surface but within diving depth, and the drilling support section 12 is far enough above the surface 15 to safely mount drilling equipment thereon. With the platform 10 supported on the marine bottom, piles are driven down through the jackets 16 and rigidly permanently fixed therein. Each of the piles is driven into the marine bot-

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tom 13 until the upper end of each of the piles protrudes up not farther than the upper ends of the jackets 16. The drilling equipment is then set on the drilling deck 58 on the above-surface superstructure 56 after a well has been drilled, it is completed and a production well-head or Christmas tree (not shown) is installed, on the production deck 34 one hundred feet below the surface. After all of the wells have been completed on the production deck 34, a diver is lowered to the production deck where he unbolts, or otherwise disconnects, the drilling support section 12 from the production support section 14. At this time the drilling support section 12 is removed by a derrick on an adjoining barge (not shown).

Although the present invention has been described in connection with details of a specific embodiment thereof, it is to be understood that such details are not intended to limit the scope of the invention. The terms and expressions employed are used in a descriptive and not a limiting sense and there is no intention of excluding such equivalents, in the invention described, as fall within the scope of the claims. Now having described the invention herein disclosed, reference should be had to the claims which follow.

What is claimed is:

1. In the production of offshore oil and/or gas, a bottom-supported drilling and production platform comprising a lower production support section adapted to be submerged completely when supported on the marine bottom at a drilling site and an upper drilling support section adapted to be supported on said production support section and to extend above the surface of the body of water when at said drilling site; means for supporting production wellheads, of wells drilled from said upper drilling section, on said lower production section beneath the surface of a body of water at diving depth; means for supporting drilling equipment on said upper drilling support section above the surface of said body of water; and means for releasably mounting said upper drilling support section on said lower production support section.

2. A bottom-supported drilling and production platform as recited in claim 1 wherein said means for supporting submerged production wellheads on said lower production section comprises a production deck formed by the upper end of said lower production section.

3. A bottom-supported drilling and production platform as recited in claim 1 wherein there is means for anchoring said platform into the marine bottom, said anchoring means comprising a plurality of vertical jackets connected to said lower production section, said upper ends of said jackets extending no closer to the surface of said body of water than said production deck, pile guide means being connected to the upper end of said jackets whereby a pile can be driven down through each of said jackets and into said marine bottom and whereby said piles are then rigidly fixed to said jackets to anchor said platform on said marine bottom.

4. A bottom-supported drilling and production platform as recited in claim 3 wherein said pile guide means comprises an upwardly diverging conical portion fixed to the upper end of each of said jackets whereby a pile can be stabbed into a jacket from the surface.

5. A bottom-supported drilling and production platform as recited in claim 3 wherein said guide means comprises an access caisson mounted over the upper end of each of said jackets, said access caissons extending above said lower production section and adapted to extend above the surface of the water when said platform is supported on the marine bottom at the drilling site; and means for laterally supporting said access caissons above the level of said jackets, whereby a pile may be driven through each caisson.

6. A bottom-supported drilling and production platform as recited in claim 5 wherein said lateral support means is connected between said access caisson and said

platform at approximately the level of said wellhead support means.

7. A bottom-supported drilling and production platform as recited in claim 6 wherein there is means for removably connecting said lateral support means between said access caisson and said platform.

8. A method for installing a plurality of subsurface wellheads on a completely submerged production support section utilizing the bottom-supported drilling and production platform as recited in claim 1 including the following steps:

- (a) releasably connected said drilling support section to the upper end of said production support section;
- (b) transporting said platform to a drilling site at which, when said platform is self-supported on said marine bottom, the upper end of said production support section is at a safe navigational depth beneath said surface but within diving depth, and the drilling support section extends far enough above said surface to safely mount drilling equipment thereon;
- (c) setting said platform on the marine bottom;
- (d) anchoring said platform in the marine bottom;
- (e) drilling subaqueous wells from an above-surface drilling deck;
- (f) completing said subaqueous wells with submerged wellheads supported on said wellhead support means on said production support section;
- (g) disconnecting said drilling support section from said production support section; and
- (h) removing said drilling support section from said site leaving said anchored production support section at a safe navigational depth beneath the surface of the body of water.

9. A method for installing a plurality of subsurface wellheads on a completely submerged production support section as recited in claim 8, including the following additional step:

- (i) locating the blowout preventers, for said wells

being drilled, on said submerged production support section.

10. A method for installing a plurality of subsurface wellheads on a completely submerged production support section as recited in claim 8 wherein said anchoring means consists of a plurality of vertical jackets fixed to said production support section, including the following steps:

- (j) fixedly installing an access caisson over the upper end of each of said jackets, said access caisson extending above the surface of said body of water when said platform is bottom-mounted at the drilling site;
- (k) releasably laterally supporting each of said caissons in conjunction with said platform;
- (l) driving a pile down through each caisson into said marine bottom until the upper end of each of said piles protrudes up not further than the upper ends of said jackets;
- (m) permanently fixing each of said piles within the respective jacket; and
- (n) removing said access caissons at least by the time the upper drilling support section is removed.

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