No. 2009-1556

United States Court of Appeals for the Federal Circuit

TRANSOCEAN OFFSHORE DEEPWATER DRILLING, INC.,

Plaintiff-Appellant,

v.

MAERSK CONTRACTORS USA, INC.,

Defendant-Appellee.

Appeal From The United States District Court
For The Southern District of Texas
In Case No. 07-CV-2392, Judge Kenneth M. Hoyt

NON-CONFIDENTIAL BRIEF FOR PLAINTIFF-APPELLANT

CHARLES B. WALKER, JR.
MICHAEL S. MCCOY
WARREN S. HUANG
FULBRIGHT & JAWORSKI L.L.P.
1301 McKinney, Suite 5100
Houston, Texas 77010-3095
(713) 651-5151

GREGORY A. CASTANIAS
THOMAS J. DAVIS
JONES DAY
51 Louisiana Avenue, N.W.
Washington, D.C. 20001
(202) 879-3939

Attorneys for Plaintiff-Appellant Transocean Offshore Deepwater Drilling, Inc.

CERTIFICATE OF INTEREST

Counsel for the appellant, Transocean Offshore Deepwater Drilling, Inc., certifies the following:

1. The full name of every party or amicus represented by me is:

Transocean Offshore Deepwater Drilling, Inc.

2. The name of the real party in interest represented by me is:

Transocean Offshore Deepwater Drilling, Inc.

3. All parent corporations and any publicly held companies that own 10 percent or more of the stock of the party or amicus curiae represented by me are:

Transocean, LTD.

4. The names of all law firms and the partners or associates that appeared for the party or amicus now represented by me in the trial court or agency or are expected to appear in this court are:

Fulbright & Jaworski L.L.P. (Charles B. Walker, Jr., Michael S. McCoy, Warren S. Huang, K. Rachelle Goldman, & Lucas S. Osborn);

Jones Day (Gregory A. Castanias & Thomas J. Davis).

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TABLE OF ABBREVIATIONS

Parties

Transocean	Transocean Offshore Deepwater Drilling, Inc.
Maersk	Maersk Contractors USA, Inc., a Delaware corporation

Defined Terms

"Transocean's patents" or "the patents"	Transocean's U.S. Letters Patent No. 6,085,851, filed May 3, 1996 and issued July 11, 2000, entitled "Multi-Activity Offshore Exploration and/or Development Drill Method and Apparatus," and the following continuations of the '851 patent application: U.S. Letters Patent No. 6,047,781, issued April 11, 2000; and U.S. Letters Patent No. 6,068,069, issued May 30, 2000
___:_____	Column and line number in the cited patent
Statoil	Statoil Gulf of Mexico LLC, a Texas corporation
Horn	Lars Horn's U.K. Patent GB 2 041 836 A, issued September 17, 1980, entitled "Vessel for, and Method of, Drilling Hydrocarbon Wells"
Lund	Thomas A. Lund's U.S. Letters Patent No. 4,850,439, issued July 25, 1989, entitled "Method and a Drilling Rig for Drilling a Bore Well"
Williford	Frank B. Williford's U.S. Letters Patent No. 4,819,730, issued April 11, 1989, entitled "Development Drilling System"
Hereema	Heerema Group Services BV's U.K. Patent GB 2 291 664 A, issued January 31, 1996, entitled "Method and device for drilling for oil or gas"
GlobalSantaFe	GlobalSantaFe Corporation, adjudged to have infringed Transocean's patents in *Transocean Offshore Deepwater Drilling, Inc. v. GlobalSantaFe Corp.*, No. H-03-2910 (S.D. Tex.)

A___	Joint Appendix page(s)
court	United States District Court for the Southern District of Texas, the Honorable Kenneth M. Hoyt presiding
Court	United States Court of Appeals for the Federal Circuit
PTO	United States Patent and Trademark Office

All emphasis in this brief is added unless otherwise indicated.

STATEMENT OF RELATED CASES

Pursuant to Federal Circuit Rule 47.5, Transocean provides as follows:

(a) There have been no previous appeals in this case.

(b) A decision from this court may affect *Transocean Offshore Deepwater Drilling, Inc. v. Stena Drilling, et al.*, C.A. 4:08-cv-03287, in the Southern District of Texas, involving the same patents at issue here.

STATEMENT OF JURISDICTION

The district court had jurisdiction under 28 U.S.C. § 1338(a). On August 18, 2009, the court entered final judgment. Transocean timely filed its notice of appeal on August 26, 2009, *see* Fed. R. App. P. 4(a)(1)(A); this Court has jurisdiction under 28 U.S.C. § 1295(a)(1).

STATEMENT OF THE ISSUES

On Maersk's summary-judgment motions, the district court held seven claims of three Transocean patents both obvious and non-enabled, and further held that Maersk did not infringe or willfully infringe Transocean's patents. The court also denied Transocean's summary-judgment motion directed to infringement of a single patent claim. The questions presented are:

1. **Invalidity**. (a) Did the district court err by granting summary judgment of obviousness, where prior art did not disclose the invention, and where there are strong secondary considerations of non-obviousness, unmentioned by the court, including expert skepticism, industry praise, and widespread commercial success; and (b) did the court err by granting summary judgment of non-enablement, where the portion of the claim challenged as non-enabled involves a modification of known equipment that defendant's expert described as "trivial"?

2. **Infringement.** Did the court err by finding non-infringement (and no willfulness) on summary judgment, despite these facts: (a) Maersk deliberately

copied Transocean's patented dual-activity drilling rig despite Transocean's warnings and Transocean's success in litigation against GlobalSantaFe; (b) Maersk, a U.S. corporation, executed a contract with Statoil, another U.S. corporation, to sell Statoil an infringing offshore-oil-well-drilling rig for delivery and use in the U.S., thereby establishing both an offer for sale and sale under 35 U.S.C. § 271; and (c), after contracting with Statoil, Maersk voluntarily assumed some (but not all) aspects of an injunction entered in the *GlobalSantaFe* case, without removing the infringing equipment from the rig? Further, did the court err in denying Transocean's motion for summary judgment of infringement where there is no genuine issue that Maersk's rig infringes Claim 17 of the '069 patent?

STATEMENT OF THE CASE

A. Preliminary Statement

Offshore oil-well drilling is an expensive business, central to U.S. energy policy and the goals of energy independence, availability, and affordability. This case involves Transocean's significant advancement to the economics of offshore drilling, a new "dual activity" system that has made deep-sea oil-well drilling significantly faster and cheaper—on the order of millions of dollars per well. Transocean's dual-activity system was so inventive that, even after it had been implemented, industry experts were still skeptical that it would work, because its principal advancement—a single derrick with two tubular advancing stations capable of operations at the seabed ("tubulars" are pipes), with drill strings working on a single well, in concert, only a few feet apart but with pipe extending one to two miles underwater—was believed to result in "clashing" (collision and tangling) between the pipe, caused by ocean currents.

The skeptics were eventually silenced. By 2004, five years after the first commercial embodiment, Transocean's new rig had been named as one of 50 technologies that "shaped the offshore industry" for its time- and cost-savings. The patented feature commanded premiums of 8% to 15% over conventional rigs, and industry members accepted multi-million dollar licenses for the technology.

None of that impressed the district court. It ruled that this game-changing invention was obvious in view of two patents which had been issued many years prior. The court never addressed secondary considerations of nonobviousness, which explained why, despite the obvious need and massive financial incentive for more efficient rigs, no one had even thought to *try* to create a dual-activity rig until Transocean did. Moreover, the court summarily found the patents' transfer system non-enabled, because the patents did not show how to use or "program" this equipment, even though Maersk's expert testified that the system was a "trivial" modification of well-known prior-art equipment. The court also found the patents noninfringed because of the absence of a domestic offer for sale or sale under Section 271(a), (despite the fact that the allegedly infringing act was Maersk's contracting with another U.S. company, Statoil, to deliver an offshore-oil-well-drilling apparatus for its use in the U.S.), as well as the claimed collateral-estoppel effect of a modification Maersk made to the rig, but not until *after* contracting to provide an infringing rig. These rulings should be reversed on appeal.

B. Procedural History

On July 24, 2007, Transocean sued Maersk for infringement of patents on Transocean's dual-activity rig, including the three patents which remain at issue on appeal. (A36.) The operative second amended complaint was filed on April 9, 2008. (A652-57.) Maersk raised nine defenses and asserted counterclaims, including a declaration of non-infringement and invalidity. (A658-78.)

The court issued its *Markman* order on October 22, 2008, following which the parties filed several motions for summary judgment. (A43-46, A3695-A3719.) Maersk filed four summary-judgment motions, on (1) Transocean's willful-infringement claim; (2) non-enablement (apparatus claims only); (3) obviousness and anticipation; and (4) non-infringement. (A44-46.) Transocean moved for summary judgment of infringement. (A46.)

On May 14, 2009, the court granted Maersk's motion for summary judgment of "no willfulness." (A23-32.) On July 28, 2009, it denied Transocean's infringement motion, and granted Maersk's remaining summary-judgment motions, holding Transocean's apparatus claims non-enabled, and its patents obvious and noninfringed. (A3-22.) Final judgment was entered on August 18, 2009. (A1-2.) This appeal followed. (A8300-02.)

STATEMENT OF FACTS

Transocean LTD is the world's oldest and largest offshore drilling contractor. It designs, owns, and operates offshore drilling rigs for oil companies, especially for use in deep and harsh waters. The patents at issue are Transocean innovations that have revolutionized the deepwater-drilling industry.

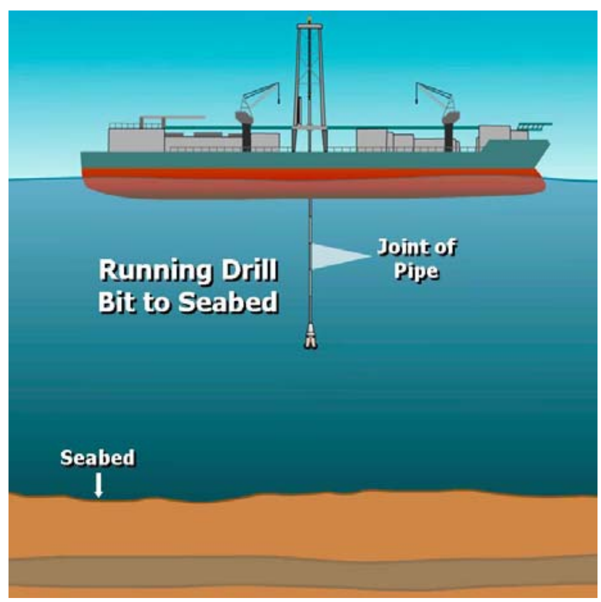
A. The Need for Improved Efficiency in Deepwater Drilling

Offshore drilling is expensive. "Drilling vessels and other apparatus employed in the drilling of oil wells offshore are generally large and very expensive and their daily operation involves rates exceeding many thousands of dollars a day." (A1112:2:22-25.) Currently, the rate for operating a deepwater rig can approach $500,000 *per day*, and a single well can take months to drill, meaning that drilling a single well can cost $30 million or more. (*See, e.g.*, A809, A822, A5004-07, A7235-37.) Thus, there has long been a desire to improve efficiency, as "even a relatively small reduction of the necessary idle time is of great economical importance" (A3146:2:24-31); the daily costs make it "very important that the drilling operations of such a [drilling] vessel be performed with as little interruption as possible." (A1112:2:26-28.) In fact, the patents-in-suit recognize that "[a]s drilling depths double and triple, drilling efficiency must be increased and/or new techniques envisioned in order to offset the high day rates that will be necessary to operate equipment capable of addressing deep water applications." (A62:2:56-59.) More efficient designs thus could "offset inherent increases in cost attendant to deep water applications." (A62:2:66-A63:3:5.)

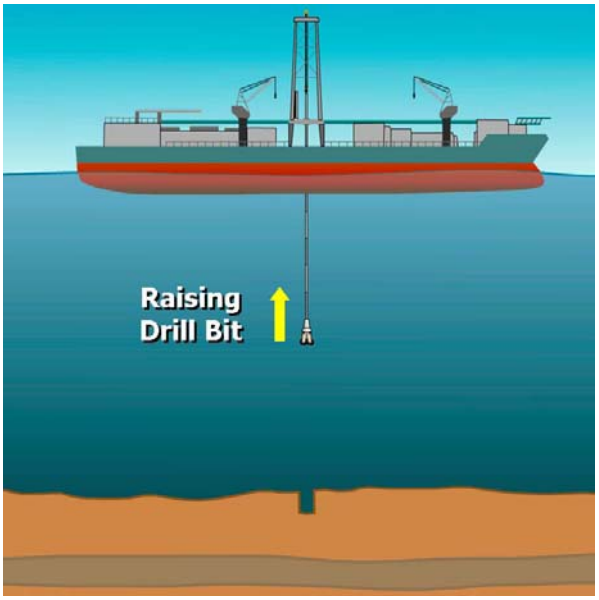
B. Transocean's "Project Enterprise"

In 1995, Transocean began "Project Enterprise," for developing a new generation of offshore drilling rigs. (A4593-94, A6207-16, A6614.) Transocean tasked its most experienced employees, and skilled outside consultants, with designing a rig at least 40% more efficient than existing technology. (*Id.*)

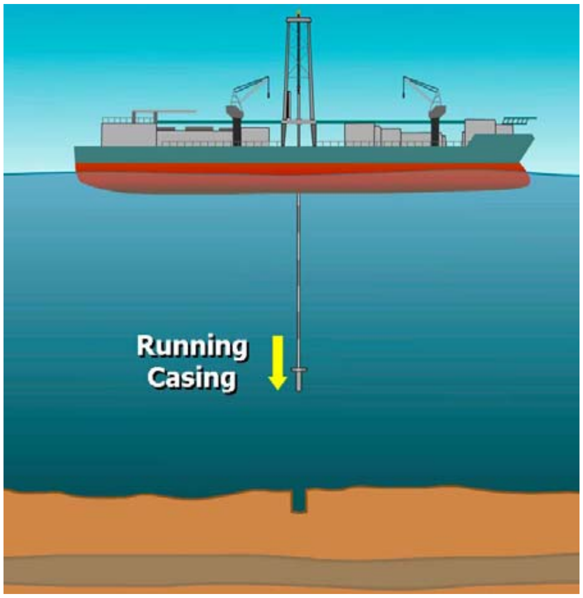
Traditional drilling rigs perform operations in sequence. (A66:10:35-62, A614, A617-30, A6806-09.). First, a drill bit must be lowered from the drilling station on a series of interconnected pipes called a "drill string." (A809, A812-15.) The drill string is lengthened at the drilling station by adding new pipe at the top of the string. (*Id.*) Once at the seabed, the drill string is rotated to drill a wellbore. (A814.) The drill string is then raised in stages, with a portion of the drill string removed, at the drilling station, at each stage. (A815.)

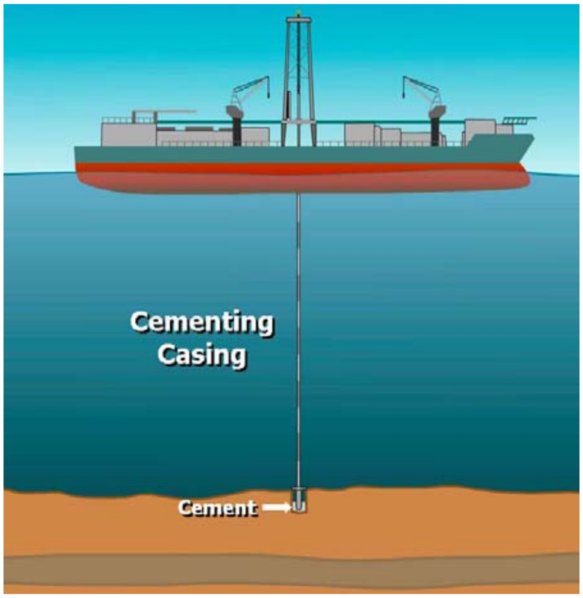


Once the drill bit is retrieved, a type of pipe known as "casing" is lowered on a drill string. (A816.) Casing is installed into a wellbore to prevent it from caving in. (*Id.*) The casing is again lowered in stages, with new stands of pipe added to the top of the drill string. (*Id.*)

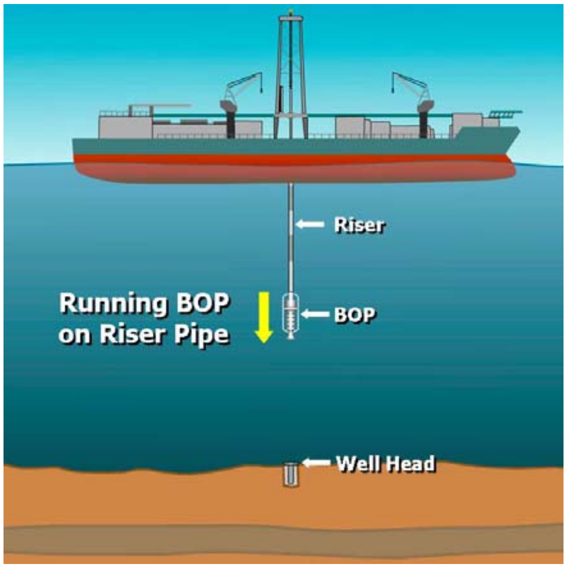


Once in the wellbore, the casing is cemented into place. (A816-17.) Cement is pumped down the drill string, which flows through the casing and up the gap between the casing and the walls of the wellbore. (*Id.*) The drill string (absent the installed casing) is then again raised in stages. The driller may repeat this process, by drilling and casing a second, smaller hole through the original casing, at a deeper depth. (*Id.*)

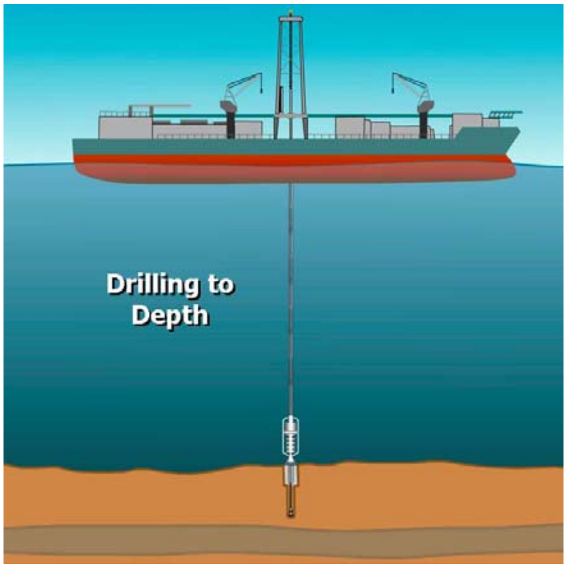




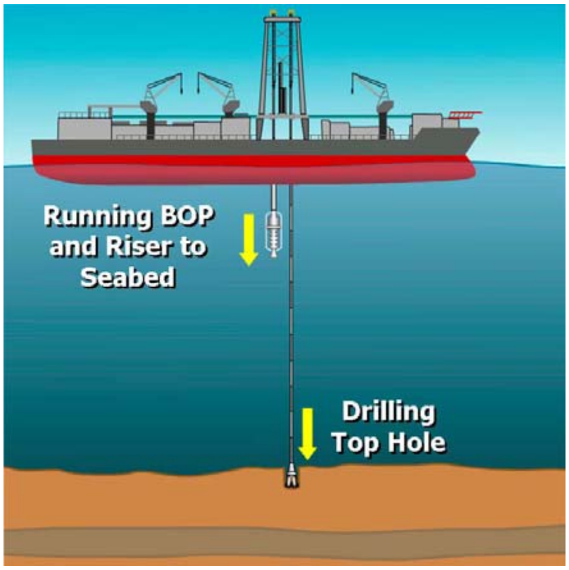
The next step is to lower a extremely heavy piece of equipment known as a "blow-out preventer" ("BOP") on a heavier type of pipe known as "riser." (A817-18.) The BOP, which prevents the well from gushing oil, is lowered onto, and connected to, the casing at the top of the wellbore. (*Id.*)

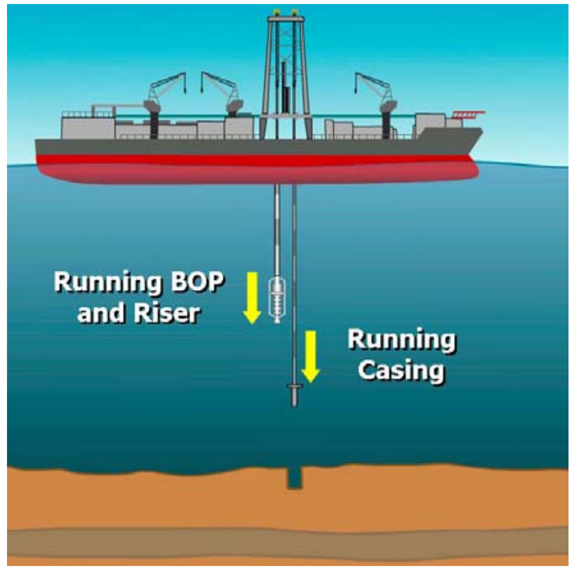


Once the BOP and riser are in place, the rig may begin the drilling process again. (A818.) The alternating process of drilling and casing is repeated several times, with the drill string passing through the riser and BOP, until final drilling depth is achieved. (A818, A821.) The final well thus resembles a telescope made of successively smaller diameters of casing pipe. (*Id.*)

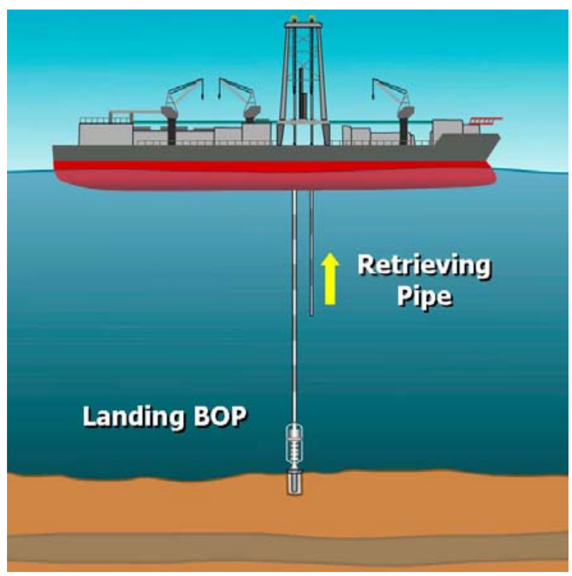


In order to improve the efficiency of this process, the skilled Transocean team conceived, developed, and patented a rig consisting of a single derrick supporting two tubular advancing stations—capable of simultaneous drilling and auxiliary seabed operations—used in tandem to drill a single well. (A67:11:1-67, A6215, A6809-12.) Such a rig lowers a drill string from one station, while simultaneously lowering auxiliary equipment from the second station, such as casing pipe, riser pipe, and the blow-out preventer ("BOP"):

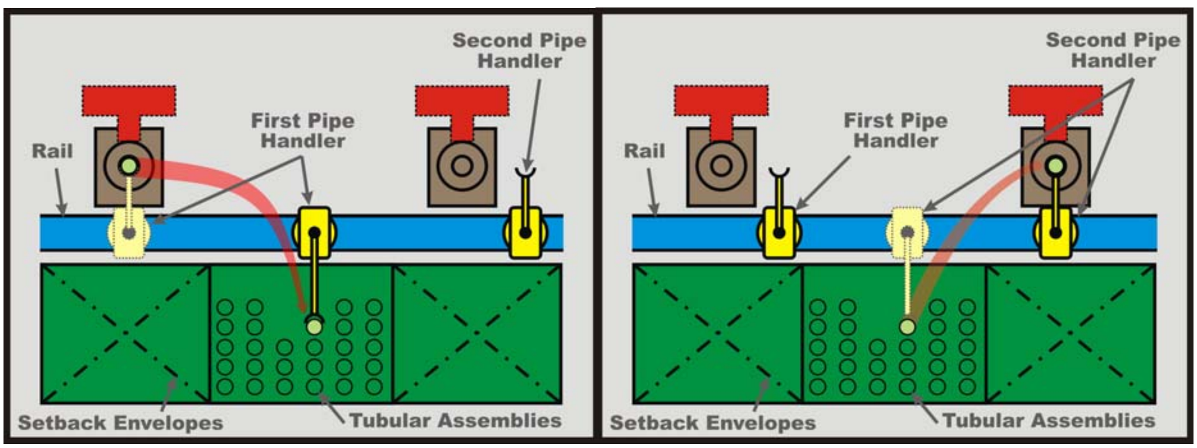




(A6207-15.) Thus, once a drilling operation was completed, the second station could quickly position the already-lowered casing, riser, or BOP and set it into place, obviating the need to wait to retrieve and lower drill strings between successive operations in the wellbore, as in conventional drilling. (*See id.*)



The team also envisioned using pipe-handling equipment to transfer pipe between the two stations. (A65:7:22-64; A6207-15; A6812.) In this manner, one advancing station could preassemble equipment, test the equipment, or preassemble or multiple sections of pipe (called "stands" or "tubular assemblies"). (A67:12:46-61; A6615; A6812.) As described in the patent and shown below, the pipe-handling equipment transfers the stands, or assembled and tested equipment, to a storage area (called a "setback envelope") with a first rail-mounted pipe handler. (*Id.*; A58; A632-33; A6213.) When the other station needs the stand or equipment for drilling operations, the second pipe handler transports it from the setback envelope to the second station. (*Id.*; A66:9:34-37.)



The transfer equipment allows the advancing stations to further cooperate to greatly reduce the time needed to drill a single well. (A6207-15.) Together with the ability to both stations to advance tubulars to the seabed, the new dual activity designed enabled drillers to save 20% to 50% in time and money drilling a well over conventional rigs. (A61; A67:11:56-57; A6631; A7362.)

The Transocean inventors filed the patent application for the dual-activity apparatus and method in 1996; this application issued as the '851 patent and was assigned to Transocean. The other patents at issue—the ’781 and ’069 patents—are continuations of that same application. (A53-71, A94-129.)

The apparatus claims are all directed to dual-activity structures: two stations positioned within a single derrick and a means for transferring tubular assemblies between the stations. Claim 17 of the ’069 patent exemplifies this:

> A multi-activity drilling assembly operable to be supported from a position above the surface of a body of water for conducting drilling operations to the seabed and into the bed of the body of water, said multi-activity drilling assembly including:
>
> a drilling superstructure operable to be mounted upon a drilling deck for simultaneously supporting drilling operations for a well and operations auxiliary to drilling operations for the well;
>
> a first tubular advancing station connected to said drilling superstructure for advancing tubular members to the seabed and into the bed of body of water;
>
> a second tubular advancing station connected to said drilling superstructure for advancing tubular members simultaneously with said first tubular advancing station to the seabed and into the body of water to the seabed; and
>
> an assembly positioned adjacent to said first and second tubular advancing stations operable to transfer tubular assemblies between said first tubular advancing station and said second tubular advancing station to facilitate simultaneous drilling operations auxiliary to said drilling operations, wherein drilling activity can be conducted for the well from said drilling superstructure by said first or second tubular advancing stations and auxiliary drilling activity can be simultaneously conducted for the well from said drilling superstructure by the other of said first or second tubular advancing stations.

(A112:17:13-42.)

C. Industry Skepticism

Despite Transocean's invention of a dual-activity rig, industry leaders doubted it could work. A 1997 presentation on new drilling technology by Transocean's competitor Global Marine Drilling Company ("GMDC") identified simultaneous operation as a dubious, "radical departure" from ordinary practices, due to the potential for ocean currents to cause underwater collisions between the rotating drill string and auxiliary casing pipe. (A5026-28.) This concern was borne from the fact that the two stations would operate only forty feet apart, while their respective string and pipe were being lowered one to two miles below the ocean surface. (*Id.*) A 1998 GMDC article stated that ocean currents would cause "clashing" between the drill strings, resulting in repair- and replacement-related delays, not cost-savings. GMDC thus concluded that time savings from a dual-activity rig were "less sure, and requires some risk" because "[h]aving two strings of tubulars beneath the rig adds risk and complication to an already difficult task of deepwater drilling," and that the "damage caused by an underwater collision of these strings could greatly reduce the projected efficiencies of dual drilling operations." (A5030, A5033-34.)

A 1998 presentation by Thomas Duhen likewise identified dual-activity operations as "not being realistic" in deep water, citing the risk of clashing from "two strings up to 10,000 ft. long only distant by a few feet, particularly if one is rotating." (A5037-38.)

Customers and competitors alike expressed concerns about clashing. Transocean's competitor GlobalSantaFe indicated that the potential clashing problem was "frequent[ly]" cited by its customers. (A5223-25.) Maersk itself expressed concerns about the "collision risk of two strings," even after Transocean ultimately proved the technology successful. (A5049-51.)

D. Transocean Proves the Skeptics Wrong

Transocean's first dual-activity rig, the Discoverer Enterprise, was completed in 1999. It quickly proved successful. (A4632-34.) Quoting the industry journal *Drilling Contractor*: "In little over a year of operation, the Transocean [] drillship Discoverer Enterprise proved the efficiency of dual-activity drilling with up to 20% time savings on exploration wells and up to 40% on development wells." (A4632.) The article identified a specific, record-setting Gulf of Mexico well that Transocean was able to drill 16 days faster than a single-activity rig; a top British Petroleum executive noted this same success and called Transocean's dual-activity rig "unique . . . [the] first of its kind in the world and a major step forward in drilling capability." (A4632; A5076-77.)

In 2004, *Offshore* magazine named the Discoverer Enterprise one of the 50 key technologies that "shaped the offshore industry": It recognized "Transocean's drillship *Discoverer Enterprise* [as] the first ultra-deepwater drillship with dual activity drilling technology to conduct drilling operations simultaneously rather than sequentially via two full capability drilling rigs under a single huge derrick," thus reducing the time and costs for such deepwater drilling. (A4636-39.)

E. Transocean's Success Spawns Copycats and Imitators; Transocean Successfully Protects and Licenses Its Technology

Transocean's more-efficient technology has allowed it to charge a premium daily rate for use of its dual-activity rigs. For example, when Transocean contracted a patented dual-activity rig and a conventional rig to the same customer for otherwise similar terms, Transocean received $50,000 (or 12%) more per day for the dual activity rig. (A5010-16.) Moreover, if the dual-activity features are removed or temporarily inoperable, oil companies receive a discount on the daily rate, of between 8% to 15% on average. (A4491-A5008; A5018-A5024.) Oil companies willingly pay these higher daily rates, because the dual-activity drillship results in fewer drilling days, and thus lower overall costs despite the premium paid. (*See*, *e.g.*, A3153:2:24-31.)

Transocean's success drew copycats. Its then-largest competitor, GlobalSantaFe, recognized that the "Discoverer Enterprise has demonstrated conclusively" that "deepwater dual-activity capability provides a substantial reduction in dead time." (A5061-63.) Thus, GlobalSantaFe determined that "any new build must incorporate this feature," and demanded that its rig design "include the most effective drilling costs reductions achieved by the new deepwater units . . . typified by *innovations such as Transocean's dual-derrick* [sic] *concept*, designed to enable continuous drilling, potentially improving productive time by 25% to 40%." (*Id.*; A5068, A5070-71.) In fact, 34 of the 93 floating deepwater rigs under construction as of early 2009 are dual-activity. (A5043-44 (showing 93 new-build drill ships and semi-submersible rigs, and total number of such rigs with dual activity).)

After GlobalSantaFe built two "innovati[ve]" dual-activity rigs, Transocean sued GlobalSantaFe for infringement of its dual-activity patents. After the court found infringement, a jury rejected GlobalSantaFe's invalidity defenses, and awarded Transocean $5 million in damages for a single infringing rig. (A4868, 5180-84.) The *GlobalSantaFe* court then issued a curative injunction ordering GlobalSantaFe to disable its rig's ability to perform dual-activity operations by attaching a plate to the rig that inhibited the second tubular advancing station's ability to lower tubulars to the seabed. (A4686-88.) Because the barrier could be easily removed, the court also ordered GlobalSantaFe not to remove the plate except during specific, limited circumstances, and required GlobalSantaFe to provide Transocean with regular monitoring reports. (*Id.*; A4690-99, A5894, A7651, A7655.)

Promptly after being enjoined, GlobalSantaFe agreed to pay Transocean $15 million and a 3% royalty on future revenue for a license covering its first three dual-activity rigs, and 5% for future rigs. (A5227-32.) Several other competitors, and even oil companies, have likewise negotiated world-wide licenses for dual-activity rigs at significant royalty rates, with up-front royalties of between $4 and $15 million, and ongoing royalties of between 5% and 8% of revenue. (A5234-53). Given the day rates charged for these rigs, each licensed rig can generate several million dollars per year in royalties to Transocean. (A5256 (showing greater than $500,000 payment for just one month of royalty).)

Today, Transocean and its competitors are building over 30 new dual-activity rigs, representing many billions of dollars of investment in rigs featuring the invention. (*See* A4953, A5043-46.)

F. Maersk's Parent Corporation Enters the Deepwater Market and Decides to Copy and Market Transocean's Dual-Activity Design

[

]

Maersk's parent corporation ultimately contracted with a Singapore shipyard to build a dual-activity rig. (A5686-89.) The rig, as ordered, contained all of the claim elements of Transocean's invention. (A5653-55 (referencing A5663, A5668, A5686, A5696, A5699, A5704, A5707-23, A5724, A5727, A5736, A5742-51, A5756.1-A5756.5).) Maersk's parent corporation marketed the rig, and eventually Maersk itself, a Delaware corporation, contracted to provide the rig to Statoil Gulf of Mexico LLC, a Texas-based corporation, for [ ] (A7161, A7166-67, A7211, A7253, A7663.) Both Maersk and Statoil were represented by their respective foreign parents during the formal negotiation of the contract, and the contract was executed abroad. (A5828-29, A5925-27.) The contract itself, however, was expressly made between two United States corporations, for the use of the infringing rig in the United States, [ ] (A7161, A7165-67, A7205.)

G. Maersk Recognizes Its Potential Infringement, and Later Attempts to Modify Its Rig Following The *GlobalSantaFe* Injunction

[

]

Maersk and Statoil signed their contract after Transocean had received a favorable jury verdict in *GlobalSantaFe*, but before the injunction had issued. (*Compare* A7206 *with* A4656, A4683-84, *and* A5180-84.) After the injunction issued, Maersk then elected to adopt some, but not all, of the requirements of the injunction. (A3816-18, A7817-21.) Maersk added a plate to its second tubular advancing station to prevent operations to the seabed, as was ordered in *GlobalSantaFe*, but unlike the *GlobalSantaFe* injunction, no court order or other obligation prevented Maersk from removing the plate, and Transocean had no ability to monitor Maersk's compliance. (*See id.*)

As of the district-court judgment here, Maersk's rig had not arrived in the U.S. pursuant to the Statoil contract. Accordingly, Transocean based its infringement claim solely on the Statoil contract. Maersk reports that the rig has since arrived in the Gulf of Mexico.

H. The Prior-Art Evidence and Previous Rejections of Obviousness Challenges

On July 24, 2007, Transocean brought patent-infringement claims against Maersk. (A36.) In response, Maersk claimed that Transocean's patents were obvious, specifically citing to the *Horn* (A5198-A5204) and *Lund* patents (A3146-A3159) as having disclosed Transocean's apparatus claims. (*See* A4037.) These obviousness claims had been considered and rejected twice before. The PTO considered this prior art, and the jury in *GlobalSantaFe* found that Transocean's rig was not obvious in light of this same prior art. (*See* A53, A94-95, A5180-84.)[1]

Prior to Transocean's dual-activity rig, conventional rigs used a single drilling station for drilling a well. Neither *Horn* nor *Lund*, alone or in combination, taught the elements of Transocean's patents: a single derrick, supporting two tubular advancing stations for simultaneous seabed operations on a single well, with a transfer system between the stations.

[1] The jury in *GlobalSantaFe* reached its decision prior to the Supreme Court's decision in *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398 (2007), but the parties considered the potential effect of that pending decision, and the jury instructions correctly anticipated *KSR*'s ruling, instructing that juries "may" consider the motivation, teachings, and suggestions of the art in determining obviousness, without *requiring* such a finding. (A5188, A5192.)

1. *Horn*: U.K. Patent GB 2 041 836

In 1980, Lars Horn applied for a British patent for a drilling rig consisting of two drilling stations in one derrick for simultaneous drilling of *two wells* to speed up the production from “exploitable” oil deposits. (A5202:1:7-100.) Prior to this litigation, Maersk described such a rig as “dual drilling,” **[**

] (A5050.)

Horn does not teach an apparatus for simultaneous drilling of *a single well* using two stations, or teach any time-savings in completing *a single well*. Rather, *Horn* teaches that a single well should be drilled conventionally: its invention “may originally be delivered with only *one set* of drilling equipment for customary test drilling,” but only if “at a later time it is desirable to use the drilling rig for advance drilling of production wells one can relatively quickly and with simple means install the necessary equipment for further drill strings.” (A5202:1:94-100.)

Horn also does not disclose or teach the transfer of tubulars between its two drilling stations. (*See generally* A5198-5204.) In examining Transocean’s patent application, the PTO distinguished Transocean’s invention over other references to rigs containing two stations within a single derrick (*i.e.*, rigs like *Horn*) based on the lack of a such a transfer system. (A1442, A1444, A1447.)

2. *Lund*: U.S. Patent 4,850,439

In 1986, Thomas Lund applied for a U.S. patent for a method and a rig for drilling a bore well. *Lund* teaches the interconnection of two or three pipe sections at a location separate from the main drilling opening, through the use of a second hoist above a "preparation opening" in the drill floor. (A3154:3:47-4:47.) *Lund* also teaches using a rail-mounted mechanism for transferring tubular sections between a storage area, and either the drill opening or preparation opening. (A3155:6:3-17.)

Lund does not teach, however, that this second hoist and preparation opening is a second station capable of advancing tubulars to the seabed; to the contrary: "While the drilling hoist should be able to carry very heavy loads, such as a complete drill string, the preparation hoist should normally only be able to carry a drill string or well casing stand or a bottomhole assembly part, having a length in the order of 20 m. . . ." (A3155:6:62-A3156:7:2.) The PTO agreed that *Lund* did not contain a second tubular advancing station. (A7974, A7991-92; A7994, A7996.) As *Lund* only discloses one tubular advancing station, it does not teach transfer between two tubular advancing stations.

SUMMARY OF ARGUMENT

I. The district court erred by granting summary judgment of obviousness. Both this Court and the Supreme Court have required district courts to apply the *Graham v. John Deere Co.* factors when assessing obviousness arguments, so as to avoid improper invalidation of patents based on hindsight. The dangers of hindsight reasoning are particularly high where, as here, the asserted patent is a novel combination of pre-existing elements.

The court's decision rested upon classic hindsight reasoning. It recited that the elements of Transocean's combination were present in *Horn* and *Lund*, and stated that the industry need for time-savings and efficiency would inevitably lead to combining the two into Transocean's invention. The court failed to even mention *Graham*, let alone analyze the *Graham* factors.

Under a proper analysis of the record, viewed in the light most favorable to Transocean, the patents are not obvious. Maersk's claim that *Horn*'s dual-drilling rig could be used as a dual-activity rig is classic hindsight. *Horn* is a dual-drilling rig for drilling two different wells simultaneously; Transocean claims a dual-activity rig for simultaneous operations on a single well. Indeed, *Horn* itself teaches away from dual activity, by outfitting the derrick with only a single drilling station when drilling one well. *Lund* teaches transfer between a preparation station and a drilling station, and does not teach transfer between two stations capable of advancing tubulars to the seabed. Moreover, Maersk provided only lawyer argument, not evidence, that the ordinarily skilled artisan would combine *Horn* and *Lund*. Finally, the record contains substantial evidence, ignored by the district court, of secondary considerations, including skepticism, commercial success, and industry praise showing why no one else thought to create Transocean's design during the many years after *Horn* and *Lund* were published.

II. Summary judgment of non-enablement was also improper. The enablement requirement is satisfied if a person of ordinary skill could practice the invention without "undue experimentation." Maersk claimed that the patent did not enable the means for transferring tubulars between two new points—two advancing stations. But the patent disclosed that rail-mounted pipe handlers and overhead cranes (well-known mechanical devices) could be used for this purpose, and these devices did not have to be further described in the patent. Indeed, Maersk's own expert said it would be "trivial" to modify known systems, already capable of moving pipe between two locations, so that they moved pipe between the two new locations disclosed in the patent. Transocean's experts confirmed the same, but the district court made no mention of these facts.

The district court's opinion failed to mention or follow this Court's rules for assessing "undue experimentation," in particular the *In re Wands* factors. To the extent that the court's decision rested on alleged difficulties in preparing a specific commercial embodiment of the modification, that is irrelevant: The patent need only enable *any* mode of making and using the invention.

III. Summary judgment of non-infringement was also erroneous.

First, Maersk's contract with another U.S. corporation, for use of its infringing rig in the "U.S. Gulf of Mexico," represented a sale or offer to sell "within the United States," despite the fact that their foreign parent corporations negotiated and executed the contract overseas.

Second, Transocean is not collaterally estopped from asserting infringement based on Maersk's installation of the same plate required by the curative injunction in *GlobalSantaFe*. For one, Maersk decided to modify the rig *after* it already infringed by contracting the unmodified dual-activity rig to Statoil.

For another, Maersk did not fully comply with the *GlobalSantaFe* injunction and therefore may not use it as a safe harbor. Maersk is not obligated to keep the plate in place and does not have the monitoring system required in *GlobalSantaFe* to prevent cheating.

Finally, Fifth Circuit law does not permit collateral estoppel if the legal standards are different. Here, the *GlobalSantaFe* injunction was a curative order meant to ameliorate the effects of GlobalSantaFe's infringement—the product of traditional, equitable, discretionary principles applied to a specific, adjudicated violation. These are different from the nondiscretionary legal standards applicable to finding infringement.

IV. The district court should have granted summary judgment of infringement for Transocean. There is no genuine fact issue that the rig identified in the Statoil contract embodies all four limitations of claim 17 of the ‘069 patent. Maersk admits that its rig contains the first and second limitations (a drilling superstructure and a first tubular advancing station.) The record conclusively establishes that Maersk’s rig contains the third and fourth limitations—a second tubular advancing station, and an assembly operable to transfer tubular assemblies between the first and second tubular advancing station.

V. Finally, the district court erred in granting summary judgment of “no willfulness” in favor of Maersk. The record contains copious evidence that Maersk knowingly and deliberately copied Transocean’s successful design, with full knowledge of Transocean’s patents. Transocean warned Maersk in writing, and the Maersk-Statoil contract itself recognized Maersk’s potential infringement liability. Maersk’s decision to install a plate inhibiting seabed operations *after* it already made a infringing sale and offer for sale neither erased its past willful infringement, nor refuted a finding of objective recklessness.

STANDARDS OF REVIEW

An order granting or denying summary judgment is reviewed *de novo*, and should be affirmed only when “there is no genuine issue as to any material fact and that the moving party is entitled to a judgment as a matter of law.” *Crown Operations Int’l v. Solutia Inc.*, 289 F.3d 1367, 1375 (Fed. Cir. 2002).

The "ultimate judgment of obviousness is a legal determination," *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 427 (2007), based on underlying factual findings. *Dennison Mfg. Co. v. Panduit Corp.*, 475 U.S. 809, 811 (1986). "Because patents are presumed to be valid, an alleged infringer seeking to invalidate a patent on obviousness grounds must establish its obviousness by facts supported by clear and convincing evidence." *Kao Corp. v. Unilever U.S., Inc.*, 441 F.3d 963, 968 (Fed. Cir. 2006) (citation omitted). Where the issue of obviousness arises on summary judgment, all reasonable inferences from the underlying facts must be construed in the patentee's favor. *See Crown Operations*, 289 F.3d at 1376-78.

"Whether a claim satisfies the enablement requirement" is likewise "a question of law, reviewed *de novo*, based on underlying facts." *Sitrick v. Dreamworks, LLC*, 516 F.3d 993, 999 (Fed. Cir. 2008). A party alleging non-enablement must satisfy its factual burden with "clear and convincing evidence." *Id*. Where the enablement issue arises on summary judgment, all reasonable inferences from the underlying facts must be construed in the patentee's favor. *Crown Operations*, 289 F.3d at 1378-81.

Infringement requires a two-step analysis. First, the claims are construed as a matter of law, then the properly construed claims are applied to the facts to determine if the accused device falls within the scope of the claims. *See Research*

Plastics, Inc. v. Fed. Packaging Corp., 421 F.3d 1290, 1295 (Fed. Cir. 2005). "[W]here the factual inferences are all material to the grant of a summary judgment, [this Court] review[s] them to ascertain whether there is a genuine issue of material fact." *Id.*

ARGUMENT

I. THE DISTRICT COURT ERRED IN GRANTING SUMMARY JUDGMENT OF OBVIOUSNESS.

Section 103(a) of Title 35 provides that a patent may not be obtained "if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." In assessing obviousness, this Court has repeatedly warned courts not to "succumb to hindsight claims." *In re Kubin*, 561 F.3d 1351, 1359 (Fed. Cir. 2009). That risk is particularly acute when an invention is a combination of prior art: "[A] patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art." *KSR*, 550 U.S. at 418.

To "guard against slipping into use of hindsight and to resist the temptation to read into the prior art the teachings of the invention in issue,'" this Court has insisted that district courts undertake the obviousness analysis of *Graham v. John Deere Co.*, 383 U.S. 1. (1966). *Abbott Labs. v. Sandoz, Inc.*, 544 F.3d 1341, 1348

(Fed. Cir. 2008) (quoting *Graham*, 383 U.S. at 36). *Graham* instructs that a reviewing court assess "the scope and content of the prior art," "differences between the prior art and the claims at issue," "the level of ordinary skill in the pertinent art," and "secondary considerations" such as "commercial success, long felt but unsolved needs, failure of others, etc. . . . [a]s indicia of obviousness or nonobviousness." *Graham*, 383 U.S. at 17-18. Indeed, a court "must make *Graham* findings before invalidating a patent for obviousness" and the "district court's failure to base its obviousness inquiry on the explicit findings relating to the *Graham* factors can require that the judgment be vacated and the case remanded for those findings to be made." *Ruiz v. A.B. Chance Co.*, 234 F.3d 654, 663-64 (Fed. Cir. 2000). A court must therefore analyze secondary considerations, which are "often . . . the most probative and cogent evidence in the record" and "may often establish that an invention appearing to have been obvious in light of the prior art was not." *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 1538 (Fed. Cir. 1983); *see also Ruiz*, 234 F.3d at 667.

The district court's summary-judgment opinion reads like a textbook example of such hindsight reasoning. It started by reciting how prior subcomponents of Transocean's apparatus were present in prior art, and finished with the conclusory assertion that because the "industry recognized the need for timesaver innovations," "the state of the industry would lead inevitably to utilization of two drilling centers working simultaneously on a single well." (A21.) The Court neither mentioned nor applied the *Graham* factors.

This flaw is glaring. Nowhere in the court's decision can one understand how a reasonable jury would be compelled to conclude that the combination of elements in two prior-art references—published *seven* and *sixteen* years before Transocean's patent—would have been obvious, yet somehow, despite the great need for improved efficiency and the millions of dollars in profits to be reaped from such an "obvious" combination, *no one* created it before Transocean's team did. Nor did the court even advert to all of the powerful secondary considerations of nonobviousness: widespread industry skepticism, massive commercial success, unqualified industry praise, and widespread copying. The grant of summary judgment should be reversed.

A. A Person of Ordinary Skill Would Not Have Viewed Transocean's Invention as an Obvious Combination

A proper, hindsight-free analysis of obviousness, with respect to an invention combining prior-art elements, requires a "court [to] ask whether the improvement is more than the predictable use of prior art elements according to their established functions." *KSR*, 550 U.S. at 417. Courts must consider factors such as the "teachings of multiple patents; the effects of demands . . . present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue." *Id.* at 418.

This Court has further clarified that "[a]lthough predictability is a touchstone of obviousness, the 'predictable result' discussed in *KSR* refers not only to the expectation that prior art elements are capable of being physically combined, but also that the combination would have worked for its intended purpose." *Depuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 567 F.3d 1314, 1326 (Fed. Cir. 2009). "[I]f the prior art indicated that the invention would not have worked for its intended purpose or otherwise taught away from the invention," then the invention is not obvious. *Id.*

Here, Maersk's motion failed to provide *any* evidence of the knowledge or motivation of a person of ordinary skill at the time of the invention, but rather based its argument on the text of the seven- and sixteen-year-old prior-art patents, and generic reference to the industry's use of automatic pipe handlers. (*See generally* A4035, A4050-58.) This failure to produce any evidence beyond such hindsight-infected attorney argument should itself be dispositive for summary-judgment purposes. *See, e.g.*, *Oracle Corp. v. Parallel Networks, LLP*, 588 F. Supp. 2d 549, 580-82 (D. Del. 2008). In any event, none of the prior art teaches a single, dual-activity derrick for simultaneous operations on a single well, nor would someone with access to that prior art find that combination obvious.

Maersk's obviousness argument on the apparatus claims relied entirely upon two references: *Horn* and *Lund*.[2] (A4050-58.) Its argument was that (1) *Horn* discloses every element of Transocean's invention except a means to transfer tubulars; (2) *Lund* teaches the transfer of tubulars between an auxiliary station and a drilling station; and (3) because both *Horn* and *Lund* address the same problem of time-savings, it would have been obvious to combine the time-savings elements of each, and such a combination would be Transocean's invention. (*See id.*)

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[2] The district court's background discussion also mentioned U.S. Patent 4,819,730 (*Williford*) and U.K. Patent GB 2 291 664 A (*Heerema*), which had been raised with respect to the method claims which Transocean later dropped. (A6-7; A1104-18; A4506-33.) The district court's obviousness analysis mentioned neither patent—and for good reason, as neither *Williford* nor *Heerema* suggest that the combination of *Horn* and *Lund* results in Transocean's invention.

Williford teaches two separate derricks, each with its own drilling stations working on two wells simultaneously. (A1113:4:46-56.) It does not discuss simultaneous dual-activity operations on a single well, or transfer between two advancing stations on a single derrick. (*See* A1107 (showing two wells).)

Heerema teaches a method and device which, like *Lund*, involves the pre-assembly of pipe at a different location from the derrick. (A4506, A4519:2:24-A4521:4:17.) The pre-assembly station is not a station that advances tubulars into the seabed; while one embodiment calls for pre-assembly of "at most so many riser pipes that the length of the sub-assembly is 90% or more of the desired final length of the riser string," it teaches that such a sub-assembly must be "still manoeuvrable in the drilling rig in order to move the sub-assembly above the borehole and place it thereon *after the addition* of a limited number of riser pipes." (A4521:4:7-17; *accord* A4522:5:1-17, A4522:5:34-A4523:6:18 (describing required "conveyor means" between pre-assembly area and drilling derrick).) Like *Lund*, *Heerema* does not teach a single derrick with two advancing stations, nor did it teach means of tubular transfer between two tubular advancing stations.

Fatal to this argument is that it relied on factual inferences to which Maersk was not entitled on summary judgment. *First*, despite Maersk's claim that *Horn* is capable of dual-activity drilling, this is pure hindsight. A person of ordinary skill, at the time of Transocean's invention, would have read *Horn* for what it teaches: an apparatus with two drilling stations in one derrick for parallel drilling of *two* wells—*i.e.,* the sort of rig which, pre-litigation, Maersk correctly identified as **[**

] (A5050.) Indeed, *Horn* itself would have diverted a person of ordinary skill *away* from building a dual-activity rig, as it specifies that a single well be completed by a rig containing "only one set of drilling equipment," and that a second set of drilling equipment could be added "at a later time" if the user wished to drill *multiple* wells. (A5202:1:94-100.)

To use this Court's words, Transocean's novel dual-activity rig is simply not "performing the same function [*Horn*] had been known to perform and yield[ing] no more than one would expect from such an arrangement." *Depuy Spine*, 567 F.3d at 1326 (internal quotation marks omitted). In short, Maersk is not entitled to summary judgment of obviousness when one of its two underlying premises—that *Horn* all but describes Transocean's rig—is contrary to the teachings of that patent.

Second, Maersk's other underlying premise—that *Lund* teaches transfer between two stations capable of advancing tubulars, just like Transocean's rig—is likewise incorrect. *Lund* teaches using a preparation area to pre-assemble pipe stands, and transferring those stands to the drilling station, for the purpose of speeding up the operations of that single drill site. (A3146.) *Lund* teaches that the pipe stands are preassembled at a preparation station, which is not itself a location capable of conducting operations to the seabed. (A3154:3:47-4:47, A3155:6:3-17, A3155:6:62-A3156:7:2.) Thus, *Lund* teaches transfer of tubulars from a preparation area to a single drilling station, not the transfer of tubulars between two tubular advancing stations. (*Id.*)

Third, Maersk's conclusion that *Horn* plus *Lund* equals Transocean's invention is based on factual inferences improper on summary judgment. *Horn* teaches an apparatus for parallel drilling of *two wells*, and does not teach any method of transfer between the drilling stations. *Lund* teaches transfer between a preparation station and a drilling station, in order to increase the time-efficiency of a single drilling station. A logical combination of the two elements would thus result in two drilling stations, and two *Lund* preparation areas—one per drilling station—to increase the speed with which its drilling stations simultaneously completed two wells. Such a combination would effectively merge the specific time-savings elements taught by *Horn* and *Lund*, and might be useful in increasing time-savings for a dual-drilling rig, but it would *not* include transfer between tubular advancing stations, nor would it be Transocean's claimed dual-activity apparatus.

Maersk argued that this logical combination, which results in a dual-*Lund* rig, as opposed to Transocean's design, would only result from "an automaton or an extraordinarily unskilled person," but that was just attorney argument. (A5462-64.) It offered no evidence (expert or otherwise) that a person of ordinary skill would reject a dual-*Lund*, dual-drilling rig out of hand.[3] Instead, without record support, Maersk simply asserted that a person of ordinary skill in the art would have instead found it obvious to make the creative leap in transforming *Horn* from a dual-drilling rig working on two wells, to a dual-activity rig working on one well, *and* would then modify a *Lund* transfer system to operate between two tubular advancing stations instead of between a drilling station and its preparation area. (*See id.*)

On summary judgment, Transocean was entitled to all inferences, and Maersk could not prevail without clear-and-convincing evidence of invalidity. Maersk's only evidence of how a person of ordinary skill would have viewed the

[3] Indeed, the *Heerema* reference also contradicts Maersk's lawyer argument. Like *Lund*, *Heerema* taught one drilling station with one pre-assembly station. *See supra* n.2. When, in an article, *Heerema* added a second drilling station in a second derrick, it also added a second *Lund*-like preparation area to service it. (*See* A4540 (describing two drilling derricks and two cranes), A4546 (illustrating same).) It did *not* disclose or suggest transfer between the two derricks or tubular advancing stations.

prior art came from the language of the prior art itself—but that art plainly raises an inference that it would *not* "obviously" be combined into Transocean's rig. The grant of summary judgment is unsustainable.

B. Transocean's Strong Evidence of Secondary Considerations Also Precludes Summary Judgment As To Obviousness

Secondary considerations "often establish that an invention appearing to have been obvious in light of the prior art was not." *Stratoflex*, 713 F.2d at 1538. This "probative and cogent evidence" is one of the most powerful tools a court has to guard against hindsight reasoning. *Id.* So it is here. Here, secondary considerations show how, a decade-plus after the asserted prior art was published, this supposedly "obvious" apparatus overcame industry skepticism, earned praise as one of the top innovations in offshore drilling history, was widely copied, and became the industry standard, reaping millions in profit and significant cost-savings for the technology's adopters.

First, there was considerable skepticism that Transocean's dual-activity rig would work. Indeed, the dual-activity design was labeled a "radical departure" from conventional rigs, and several experts opined that two strings being lowered simultaneously would clash together and become damaged, defeating the time-saving purpose of the invention. (A5026-28, A5033-34, A5037-38.) Even after Transocean proved that the technology worked, competitors—Maersk included—still expressed concern over potential clashing problems. (A5049-51, A5223-25.)

Transocean's "proceed[ing] contrary to the accepted wisdom . . . is strong evidence of unobviousness." *In re Hedges*, 783 F.2d 1038, 1041 (Fed. Cir. 1986) (internal quotation omitted); *see also, e.g., United States v. Adams*, 383 U.S. 39, 51-52 (1966) (finding invention non-obvious when invention's successful operation was "unexpected" and experts had expressed doubt that invention could work).

Second, Transocean's dual-activity rig received significant industry praise. (A4632-34, A4636-39, A5076-77.) As embodied in the Discoverer Enterprise, Transocean's invention was praised as one of the top 50 innovations in offshore-drilling history. (A4639.) It has also received high praise from clients and competitors, including Maersk itself. (A5050-51, A5061-63, A5068, A5070-71.) Such "contemporaneous recognition of the achievements of the [patented] system, including articles in trade journals" and "[a]ppreciation by contemporaries skilled in the field of the invention is a useful indicator of whether the invention would have been obvious to such persons at the time it was made." *Vulcan Eng'g Co. v. Fata Aluminium, Inc.*, 278 F.3d 1366, 1373 (Fed. Cir. 2002).

Third, Transocean's invention has been an overwhelming commercial success. Dual-activity rigs command a premium price (A4991-5024), and Transocean has been able to license its patented design to several sophisticated drilling and petroleum companies at premium rates. (A5233-54.) Indeed, over one-third of all new deepwater vessels and semi-submersible platforms under construction are now dual-activity. (A5043-44.) The "commercial success of the invention at issue" is powerful evidence of nonobviousness. *Procter & Gamble Co. v. Teva Pharms. USA, Inc.*, 566 F.3d 989, 998 (Fed. Cir. 2009).

Fourth, and finally, the success of Transocean's invention led multiple competitors, including Maersk, to copy it. (A5050-51, A5061-63.) In fact, when Maersk decided to enter the deepwater market, it declared **[**

] (A5050-51.) This evidence of "prompt adoption of the claimed feature [by competitors] soon after the patent issued" is yet another relevant indicator of nonobviousness. *DePuy Spine*, 567 F.3d at 1329; *see also Stratoflex*, 713 F.2d at 1541 ("[A] finding that a claimed invention has or has not been appropriated by the alleged infringer may carry substantial weight … .").

Given this significant evidence of non-obviousness, which went unmentioned by the district court, summary judgment was inappropriate. Transocean is entitled to a trial on the issue of whether its successful and praiseworthy invention, designed over a decade after the so-called "obvious" prior-art references, is invalid. The Court should remand for those proceedings.

II. THE DISTRICT COURT ERRED IN GRANTING SUMMARY JUDGMENT ON ENABLEMENT BECAUSE THE PATENT DESCRIBES THE TRANSFER MEANS AS KNOWN EQUIPMENT MODIFIED TO EXTEND BETWEEN TWO TUBULAR ADVANCING STATIONS

Section 112 of Title 35 provides that a patent must "contain a written description of the invention . . . in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains . . . to make and use the same." The specification need only "enable one of ordinary skill in the art to practice the *claimed* invention without undue experimentation." *Nat'l Recovery Techs., Inc. v. Magnetic Separation Sys., Inc.*, 166 F.3d 1190, 1196 (Fed. Cir. 1999). The undue-experimentation inquiry is based on factors such as the quantity of experimentation needed, the presence of working examples, the nature of the invention, the state of the prior art, and the skill of those in the art. *Warner-Lambert Co. v. Teva Pharms. USA, Inc.*, 418 F.3d 1326, 1337 (Fed. Cir. 2005); *In re Wands*, 858 F.2d 731, 736-37 (Fed. Cir. 1988).

Here, Maersk argued that Claim 10 of the '851 Patent and Claims 10-13 and 30 of the '781 Patent, which recite a "means . . . for transferring tubular assemblies" and Claim 17 of the '069 Patent, which recites an "assembly . . . operable to transfer tubular assemblies," are not enabled. Construing all factual inferences in Transocean's favor, however, there is at a minimum a genuine factual dispute over whether the record contains clear-and-convincing evidence that undue experimentation would be required to practice the invention. The grant of summary judgment was erroneous.

A. The Claims Describe A Modification of Known Equipment That a Person Ordinarily Skilled in the Art Could Make and Use Without Undue Experimentation

Maersk's enablement challenge was directed at one particular aspect of the invention: the means for transferring tubular assemblies between the first and second means for advancing tubulars; *i.e.*, a machine for moving pipe between the two stations on a single derrick. (A3862-63.) Transocean did not claim any new tubular handling equipment, but rather a *modification* of existing equipment such that tubulars could be moved between two stations under a single derrick. (*See, e.g.*, A56-58, A65:7:41-64, A98-100, A107:7:39-62, A117-19, A126:7:26-49.) This is a critical distinction.

The patents specify the use of both rail-mounted pipe handlers and overhead cranes as means to transfer tubulars between two tubular advancing stations. (*See id.*) Rail-mounted pipe handlers and overhead cranes were well known in the prior art for moving pipe from Point A to Point B on a rig, as recognized even by the district court and Maersk's own expert George Boyadjieff. (*See, e.g.*, A11 (recognizing that "means . . . for transferring tubular assemblies" describes "*known pipe handling equipment* that otherwise enables a person skilled in the art to make and use the invention"), A815). The patent need not describe such known equipment in exhaustive detail. *See Spectra-Physics, Inc. v. Coherent, Inc.*, 827 F.2d 1524, 1534 (Fed. Cir. 1987) ("A patent need not teach, and preferably omits, what is well known in the art.").

Rather, the question is whether a person of ordinary skill in the art could accomplish the claimed *modification*—using known equipment to transfer pipe between two new locations on a derrick—without undue experimentation. The record evidence shows that it could. Maersk's expert Boyadjieff described an existing rail-mounted pipe handler that was capable of transferring tubulars between two positions—a drilling station and a "mouse hole"—on the same rig.[4] (A4897 at 18:2-19:16.) He admitted that the same equipment could instead be used to transfer tubulars between two tubular advancing stations, as described in the patent, simply by "locat[ing] the rails between the[se] two positions." Such a modification, Boyadjieff admitted, would not be "complex," would not "take a lot of time" or "engineering effort," and in fact would be "trivial." (*Id.* at 19:17-20:1.)

Transocean's witness likewise confirmed that pre-existing equipment could be modified to transfer tubulars between the new locations discussed by the patent. (A4891-93 at 62:25-63:23, 104:23-105:3 (describing pre-existing "pipe-handling systems that we could use that could" act as the transfer means).)

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[4] A "mouse hole" is a hole in the floor of a drilling rig that can hold a pipe upright in preparation for pipe assembly, as *Lund* discusses. (A3153 at 2:31-54.)

A reasonable jury thus could have found that Transocean's patent discloses the novel modification of transfer between two tubular advancing stations, and that undue experimentation is not needed to enable that modification. *See, e.g.*, *Bruning v. Hirose*, 161 F.3d 681, 686 (Fed. Cir. 1998) (finding enablement based on "relative ease of developing a suitable lens assembly" with "known . . . materials" and a "commercially available lens design computer program"); *Lindemann Maschinefabrik GmbH v. Am. Hoist & Derrick Co.*, 730 F.2d 1452, 1463 (Fed. Cir. 1984) (finding enablement where "the selection and connection of the elements of [known] systems [is] simply a matter of plumbing."). That should have been sufficient to defeat Maersk's motion; indeed, it should be dispositive of the enablement question on remand.

B. The District Court's Stated Reasons for Finding a Lack of Enablement Are Inconsistent With the Law's Requirements

Despite the record evidence, the district court granted summary judgment to Maersk with only brief discussion. (A8-12.) It analyzed none of the facts necessary for an enablement ruling, confused the scope of Maersk's challenge, and faulted Transocean for not describing a "programming" element not called out by the claims.

1. The District Court Failed to Analyze the Factual Considerations Necessary for an Enablement Determination

The court concluded that "a person skilled in the art would not be able to make and use the invention described without undue experimentation," without *any* analysis (or even mention) of the factual considerations this Court has found necessary to an undue-experimentation analysis. *See, e.g., Wands*, 858 F.2d at 736-37. As described above, the court ignored evidence, for example, that the "experimentation necessary" to enable the disclosed modification was trivial, that there were generic pipe-handlers which could be modified to transfer tubulars between the two new locations disclosed in the patent, or that the pipe-handling equipment was a predictable mechanical variation on the prior art. *Id.*; *see also* A57-58; A65:7:21-64.

Nonetheless, while the court acknowledged that Transocean raised certain factual arguments (A9), it never stated those facts, nor analyzed what those facts showed about the ability of a person of ordinary skill to make and use the challenged means. Those facts were plainly relevant to showing a lack of undue experimentation; the court's failure to address them, by itself, merits reversal. *See, e.g., Warner-Lambert Co.*, 418 F.3d at 1337 (reversing summary judgment where patentee had provided "fact-based arguments in support of its enablement defense" that were never analyzed by the district court).

2. The District Court's Reference to "Programming" Indicates That It Erroneously Believed That the Patent Must Enable A Commercial Embodiment

The court's opinion also faulted Transocean's patents for not describing the "programming" of tubular handling equipment such that a person of ordinary skill would know "how to make and use the known equipment in a timesaving manner." (A12.) There is no reference to "programming" in the claims. The only apparent basis for this finding is the court's earlier reference to Maersk's argument that there was no enablement because Varco, a contractor hired to build some equipment for the Discoverer Enterprise, did not have pre-existing pipe-handling equipment suitable to the drillship's specifications, and, though they built it, "[i]t wasn't easy for them." (A10, A4025-26 at 152:6-153:2.) This reasoning was flawed.

First, the court's requirement that the *tubular transfer equipment* be "use[d] . . . in a timesaving manner" was inappropriate. Transocean's invention is a novel combination of known equipment that reduces the overall drilling time of a well, with the *combination itself* creating time-savings compared to existing drilling rigs. (*See, e.g.*, A127:10:16-A128:11:49 (describing time-savings).) It does not claim some improvement on the speed or efficiency with which tubular transfer equipment itself operates. Thus, the alleged failure of the patents to detail how to transfer tubulars "in a timesaving manner" is irrelevant.

Second, to the extent that the "programming" reference relied on Varco's efforts to build Transocean's drillship, that too is irrelevant. As this Court has held, enablement "does not require that a patent disclosure enable one of ordinary skill in the art to make and use a perfected, commercially viable embodiment absent a claim limitation to that effect." *CFMT, Inc. v. Yieldup Int'l Corp.*, 349 F.3d 1333, 1338 (Fed. Cir. 2003). Rather, "[t]he enablement requirement is met if the description enables any mode of making and using the claimed invention." *Engel Indus., Inc. v. Lockformer Co.*, 946 F.2d 1528, 1533 (Fed. Cir. 1991). Thus, where "an invention claims a general system to improve [a] cleaning process," and the claims do not call for "some standard for cleanliness," then the invention is enabled if the "patents would enable a person of skill in the art to make and use a system or apparatus to achieve *any* level of contaminant removal without undue experimentation." *CFMT*, 349 F.3d at 1338.

CFMT is directly on point. Here, the challenged portion of the claim relates to "means . . . for transferring tubular assemblies" between different positions on a drill floor. None of the "means" set forth in the specification requires any "programming" of any kind. (*See, e.g.*, A129:14:32-44.) Thus, the claims are enabled if a person of ordinary skill could construct means to transfer tubular assemblies between the new points disclosed by the patent. *See CFMT*, 349 F.3d at 1338. As discussed above, the record contains evidence that the ordinarily skilled artisan could do so without undue experimentation. No more is needed for enablement; the fact that particular commercial embodiments might require a more elegant, difficult-to-engineer solution has no bearing. *See id*. At minimum, there is a factual dispute.

III. THE DISTRICT COURT ERRED IN GRANTING MAERSK'S MOTION FOR SUMMARY JUDGMENT OF NONINFRINGEMENT AND DENYING TRANSOCEAN'S MOTION FOR SUMMARY JUDGMENT OF INFRINGEMENT

The district court based its noninfringement rulings on these grounds:

(1) With respect to Transocean's claims of past infringement—*i.e.*, Maersk's execution of a contract with Statoil to provide the accused rig for use in the United States—that act did not constitute a sale or offer for sale "within the United States" under 35 U.S.C. § 271(a). (A3 n.1; A23-32.)[5]

(2) With respect to Transocean's so-called "present and future" infringement claims—*i.e.*, the use of the accused rig in the United States—Transocean is collaterally estopped from asserting such an infringement claim based on Maersk's modification of the rig to bring it into partial compliance with the district court's permanent-injunction order in the *GlobalSantaFe* case. (A13-14.)

Both rulings were legally erroneous. The Statoil contract constitutes a sale, as well as an offer for sale, "within the United States," as a matter of law.

[5] The court said that Transocean's motion for summary judgment of infringement "was sufficiently addressed by the Court in an earlier Memorandum and Order (#142) that addressed [willful infringement]." (A3 n.1.) While the court did not explicitly address Transocean's motion for summary judgment of infringement in that order (A23-32), it nevertheless appears that the district court concluded in that order that the contract did not constitute a sale or offer for sale within the United States under 35 U.S.C. § 271(a). (A29-32.)

Furthermore, the record establishes that no reasonable jury could find that the rig in the contract does not embody all of the limitations in Claim 17 of the '069 Patent. The district court's summary-judgment orders on infringement should be reversed.

A. Maersk's Contracting With Another U.S. Company to Provide a Dual-Activity Rig for Use in U.S. Waters Is an Infringing Sale or Offer to Sell Within the United States

In late 2006, Maersk entered into a contract to provide a dual-activity rig for Statoil's use in U.S. waters in the Gulf of Mexico. (A7161-7253.) The district court erroneously ruled that this contract between two U.S. companies for the delivery of a rig to U.S. waters did not constitute an act of infringement under 35 U.S.C. § 271(a), holding that it was not a sale or offer for sale "within the United States" because it was negotiated and executed abroad. (A28-32.)

Transocean's infringement claim, however, is not based on the negotiations preceding the contract; rather, it is based on the sale evidenced by that contract. That contract conclusively establishes, without factual dispute, that:

(1) Both signatories to the contract are U.S. companies. (A7166, A7663.)

(2) The contract grants Statoil the right to use the rig in U.S. waters in the Gulf of Mexico. (A7211 **[**

].); and

(3) The contract is **[**

] (A7173-75, A7193, A7205.)

These three factors establish that a sale, and offer to sell, "within the United States," occurred here. In *Litecubes, LLC v. Northern Light Products, Inc.*, 523 F.3d 1353, 1357 (Fed. Cir. 2008), defendant GlowProducts—a Canadian company operating from offices in Canada without offices, facilities, or assets in the United States—moved for JMOL on the ground that it did not sell or import the infringing products into the United States. GlowProducts urged that because their products were shipped "f.o.b.," title was transferred while the products were still in Canada, thereby defeating a claim that the sale took place "within the United States." *Id*. at 1369. This Court rejected GlowProducts' "formalistic" approach, that a sale occurs at a "single point at which some legally operative act took place." *Id.* at 1369-70. Instead, this Court looked to "the more familiar places of contracting and performance" as in personal-jurisdiction cases, concluding that the sales were made "within the United States":

> [H]ere it is undisputed that GlowProducts sold the products directly to customers in the United States. Since the American customers were in the United States when they contracted for the accused cubes, and the products were delivered directly to the United States, . . . there is substantial evidence to support the jury's conclusion that GlowProducts sold the accused cubes within the United States.

Id. at 1371.

This Court cited *Litecubes* in *TransCore, LP v. Electronic Transaction Consultants Corp.*, 563 F.3d 1271, 1278 (Fed. Cir. 2009), for the proposition that "a sale 'to' the United States is sufficient to support infringement liability." In

TransCore, the parties disputed who formally sold the infringing products—a U.S. company made the offer, but its Canadian sister company filled and shipped the order. *Id*. This Court noted that the products were "sold and shipped" to a U.S. entity in Illinois, establishing "the essential fact that the transaction as a whole ultimately occurred 'to' the United States." *Id.*

Because there is no dispute that Maersk and Statoil—two U.S. companies located in Delaware and Texas, respectively—contracted for the delivery of the infringing rig to Statoil for use in U.S. waters in the Gulf of Mexico, that contract constitutes a sale under Section 271(a).

The district court nonetheless placed controlling weight on the locus of the negotiations and physical execution of the contract (Maersk's foreign parent in Denmark submitted Maersk's bid package to Statoil's foreign parent's office in Norway, and the contract was signed in Norway). (A31.) But that is precisely the formalism that *Litecubes* and *TransCore* rejected. Indeed, the same concerns that animate *Litecubes* and *TransCore* apply here as well: U.S. companies seeking to sell infringing products in the U.S. should not be able to avoid infringement by having their foreign agents negotiate their contracts, and executing those contracts abroad. That would impair patentees' ability to enforce their rights against territorial acts of infringement, contrary to Section 271(a)'s plain language and intent.

B. Transocean's Infringement Claim Is Not Barred By Collateral Estoppel

The court also erroneously concluded that Transocean's "present and future" infringement claim is barred by collateral estoppel based on Maersk's installation of a plate inhibiting seabed operations on one of the two tubular advancing stations of the accused rig, which in the court's view was identical to the remedy ordered by the *GlobalSantaFe* court, which ruled that the installation of a plate on the infringing rig was appropriate injunctive relief for the adjudicated infringement there. (A14; A4686-99.)

This was an inappropriate use of collateral estoppel. To begin, the infringing sale or offer to sell, as evidenced by the contract, was for an unmodified rig because Maersk contracted the rig before considering the modification. (*Compare* A7165, A7206 *with* A7817 (showing contract signature date of December 18, 2006, and requested modification **[** **]**.) Maersk's collateral-estoppel argument thus ought to have been immaterial to this act of infringement.

Even when considered against the "modified" Maersk rig, however, collateral estoppel was still inappropriate. Under the governing law of the Fifth Circuit, as stated in *Applied Med. Res. Corp. v. U.S. Surgical Corp.*, 435 F.3d 1356, 1359-60 (Fed. Cir. 2006), collateral estoppel only applies if:

> (1) the issue under consideration is identical to that litigated in the prior action; (2) the issue was fully and vigorously litigated in the prior action; (3) the issue was necessary to support the judgment in the prior case; and (4) there is [no] special circumstance that would make it unfair to apply the doctrine.

Baros v. Tex. Mexican Ry. Co., 400 F.3d 228, 232-33 (5th Cir. 2005). With respect to the first requirement, both the facts and legal standards used to assess those facts must be the same in both proceedings. *Id.* at 233. Furthermore, collateral estoppel may not apply even when the two issues in question are "formulated in nearly identical language" if "the disparate policies underlying each inquiry [result] in definite differences in application and result." *Brister v. A.W.I., Inc.*, 946 F.2d 350, 354 & n.1 (5th Cir. 1991).

Here, the *GlobalSantaFe* injunction cannot collaterally estop Transocean's infringement claims against Maersk because, *inter alia*:

(1) Maersk is not acting in full accord with the permanent injunction order in the *GlobalSantaFe* litigation because it has not adopted any of the safeguards in that order that prevented cheating; thus, the facts in the two cases are not "identical";

(2) The applicable law and policy considerations regarding injunctive relief differ from those in an infringement determination; thus, the legal standards in the two cases are impermissibly different.

In *GlobalSantaFe*, the court ruled that GlobalSantaFe's adjudicated infringement would be remedied by a permanent injunction that: (1) prevented GlobalSantaFe from making, using, selling, offering for sale, or importing its infringing rigs unless it attached a plate to the casing sleeve to the bottom of the rotary table of the auxiliary well center, with a welded plate attached to prevent its removal (thereby preventing the advancement of tubular members into the water to the seabed through the auxiliary well center); (2) specifically detailed when and under what limited circumstances the plate could be removed; and (3) required GlobalSantaFe to provide Transocean with monthly reports showing daily activity on the accused rig to ensure compliance with the injunction. (A7647-49.)

The district court ruled that Transocean was collaterally estopped from accusing Maersk of infringement once Maersk indicated that it would install a plate on the casing sleeve on the second tubular advancing station of the Statoil rig. (A14.) But Maersk declined, and is under no court-enforced obligation, to implement the other two essential features of the *GlobalSantaFe* permanent injunction. Maersk—unlike GlobalSantaFe—has not been ordered to attach the plate, is not subject to court limitations on the circumstances in which it can remove the plate, and is not required to provide Transocean with regular compliance reports. Consequently, the first requirement for collateral estoppel—that the factual issues in the present action and the previous litigation be identical—has not been satisfied. *Cf. Applied Med. Res. Corp.*, 435 F.3d at 1361 (declining to apply remedy of 7% royalty rate through collateral estoppel, where different acts of infringement with different products happened at different times, thus requiring a different assessment of a proper remedy).

The issues also are not identical to those in *GlobalSantaFe* because the legal standards are profoundly different. Injunctive relief involves traditional, discretionary, equitable principles—not automatic rules—and must be narrowly tailored to the specific adjudged violations. *eBay Inc. v. MercExchange, L.L.C.*, 547 U.S. 388, 391-94 (2006). By contrast, infringement determinations rendered on the merits involve no such discretion or balancing, and consider only the patent claims and accused device. *See, e.g.*, *Warner-Lambert Co.*, 418 F.3d at 1340. Collateral estoppel therefore does not apply because the legal standards are different. *See, e.g.*, *Baros*, 400 F.3d at 233-34 (collateral estoppel did not apply where finding in prior proceeding was made under preliminary-injunction legal standard); *Copeland v. Merrill Lynch & Co.*, 47 F.3d 1415, 1422-23 (5th Cir. 1995) (no collateral estoppel where balancing required in a bankruptcy proceeding differed from contract-law principles).

C. The Record Conclusively Establishes That the Rig Maersk Sold or Offered to Sell Meets Every Limitation of Claim 17 of the ‘069 Patent

This Court should reverse the district court’s order denying Transocean’s motion for summary judgment of infringement, and order summary judgment that the rig infringes Claim 17 of the ‘069 Patent.

The district court did not address Transocean’s arguments in support of summary judgment, but instead denied Transocean’s motion as an inevitable consequence of its grant of summary judgment for Maersk. (A3 n.1.) The reasons for that ruling were erroneous, as shown above. Maersk's only additional argument against Transocean's motion for summary judgment was that there was a genuine issue of material fact whether the accused rig embodies every limitation of Claim 17 of the '069 Patent. Claim 17 is directed to a drilling assembly that is capable of simultaneously conducting drilling and auxiliary drilling activity on one well. (A112:17:13-42.) It provides:

> A multi-activity drilling assembly operable to be supported from a position above the surface of a body of water for conducting drilling operations to the seabed and into the bed of the body of water, said multi-activity drilling assembly including:
>
> [1] a *drilling superstructure* operable to be mounted upon a drilling deck for simultaneously supporting drilling operations for a well and operations auxiliary to drilling operations for the well;
>
> [2] a *first tubular advancing station* connected to said drilling superstructure for advancing tubular members to the seabed and into the bed of body of water;
>
> [3] a *second tubular advancing station* connected to said drilling superstructure for advancing tubular members simultaneously with said first tubular advancing station to the seabed and into the body of water to the seabed; and
>
> [4] an *assembly* positioned adjacent to said first and second tubular advancing stations *operable to transfer tubular assemblies* between said first tubular advancing station and said second tubular advancing station to facilitate simultaneous drilling operations auxiliary to said drilling operations, wherein drilling activity can be conducted for the well from said drilling superstructure by said first or second tubular advancing stations and auxiliary drilling activity can be simultaneously conducted

> for the well from said drilling superstructure by the other of said first or second tubular advancing stations.

Id. (numbers added for ease of reference).

In the district court, Maersk did not dispute that Limitations 1 and 2 applied to the rig it sold or offered for sale;[6] rather, it disputed only (1) the "second tubular advancing station" (Limitation 3); and (2) the "assembly . . . operable to transfer" (Limitation 4). No reasonable jury could agree.

1. The Maersk Rig Has a First and Second Tubular Advancing Station (Limitation 3)

Maersk urged that its rig lacked a second tubular advancing station because it added a plate to the second station to inhibit operations to the seabed as in the *GlobalSantaFe* injunction, which Maersk claimed collaterally estopped Transocean "from asserting that such a configuration infringes." (A6726, A6740-41.) Transocean has already shown that Maersk's collateral-estoppel argument fails; but more importantly, Maersk did not modify its rig until *after* it had already infringed.

[6] There is no dispute that, at the time of the contract, Maersk had already contracted to build—and had created construction drawings for—the rig identified in the Contract. (A7166 (defining "drilling unit" as Hull No. B280 under construction at Keppel FELS in Singapore), A5686-87 (construction contract dated May 27, 2005, between Keppel FELS of Singapore and A.P. Moller-Maersk A/S for Hull No. B280), A5757-65 (showing drawings for Hull No. B280 as it existed at time of contract), A6720, A732 (Maersk admission that when contract was executed in December 2006, rig was still under construction; casing sleeve attached when Maersk took possession in January 2009).)

Transocean's infringement claim is based on the rig that was the subject of the sale or offer for sale between Maersk and Statoil—the version of the rig ***before*** the *GlobalSantaFe* injunction issued and Maersk decided to add the plate. *See supra* p. 49. Maersk did not dispute that the accused rig would meet Limitation 3 if no plate were installed. Thus, it is immaterial for the purpose of determining infringement whether Maersk subsequently added a plate to the second station of the accused rig. Infringement is measured by what was actually sold or offered for sale, not by what might be sold or offered for sale in the future. *Cf. Revolution Eyewear, Inc. v. Aspex Eyewear, Inc.*, 556 F.3d 1294, 1297 (Fed. Cir. 2009) ("an actual controversy cannot be based on a fear of litigation over . . . potentially modified products that [are] not yet in existence and that [are] not included in the charge of infringement") (internal quotation marks omitted).

Indeed, what Maersk proposes—that it be allowed to generate commercial interest by offering to sell, and selling, an infringing product, but then avoid liability by delivering a modified, allegedly non-infringing product—is exactly the sort of gambit which led Congress to outlaw "offer[s] to sell" in the first place. *See 3D Systems, Inc. v. Aarotech Labs., Inc.*, 160 F.3d 1373, 1379 (Fed. Cir. 1998); *accord Beloit Corp. v. Valmet Corp.*, No. 96-C-0087-C, 44 U.S.P.Q.2d 1792, 1997 WL 745040, at *3-4, 8-10 (W.D. Wisc. Jul. 15, 1997) (noting that "offer to sell" language prohibits "commercial advantage similar to that enjoyed by a party who baits a buyer with a patented invention in order to obtain an agreement with that party"). Maersk gained commercial advantage by agreeing to supply Statoil an infringing dual-activity rig; after-the-fact modifications are irrelevant.[7]

2. The Maersk Rig Has an Assembly Adjacent to the Tubular Advancing Stations to Transfer Tubular Assemblies Between the First and Second Tubular Advancing Stations (Limitation 4)

Maersk also urged that the accused rig did not satisfy Limitation 4 on two grounds. *First*, Maersk claimed, "assembly . . . to transfer" in Limitation 4 requires the pipe-transferring equipment *itself* to be "within the derrick," but the pipe-transferring equipment on the accused rig is located outside the derrick. (A6743.) This argument, however, is a plain distortion of the district court's claim construction ruling, which held that the "assembly to transfer" term "simply refer[s] to the necessary equipment for moving *tubular members* from place-to-place within the derrick." (A3712.) In other words, it is the pipe which must start and finish in the derrick; the entire assembly itself need not be located within the derrick's periphery. (*See id.*) Properly understood, Maersk's rig satisfies this limitation. (A5654-55.) The court's claim-construction ruling rejected Maersk's attempts to narrow Claim 17 by reading in limitations from the '069 patent's

[7] Maersk also incorrectly argued that Transocean failed to present any affirmative evidence that the accused rig has "two well centers that can advance tubulars into the water, let alone 'to the seabed and into the body of water to the seabed' as required by that claim." (A6741-42.) Transocean did present such evidence in support of its motion. (A5653-55.)

figures and specification, yet this is precisely what Maersk's argument seeks to do.

Second, Maersk claimed that the "assembly to transfer" on the accused rig did not satisfy the district court's construction of "positioned adjacent to" the advancing stations, *i.e.*, "near enough to interact with." (A6744.) According to Maersk, the assembly is "is far removed from the hoisting system." (*Id*.) The assembly, however, includes any equipment that can pass tubular segments between the tubular advancing stations. (A3712.) The assembly on Maersk's rig includes (1) rail-mounted pipe handling/racking machines; (2) **[ ]**; and (3) the **[ ]**, all of which are adjacent to the tubular advancing stations, and interact with the stations. (A5654-55.) Indeed, the second and third elements are essentially within the advancing stations, and all the equipment is within the drill floor area. (*Id*.) Therefore, the "assembly" for transfer, considered as a whole, met the "positioned adjacent to" limitation. (*Id*.)

IV. THE DISTRICT COURT ERRED IN GRANTING MAERSK'S MOTION FOR SUMMARY JUDGMENT OF NO WILLFUL INFRINGEMENT

Finally, the district court erred in granting Maersk's motion for summary judgment of no willful infringement. (A23-32.) To prove willful infringement, a plaintiff must prove by clear-and-convincing evidence that the defendant acted with objective recklessness. *In re Seagate Tech., LLC*, 497 F.3d 1360, 1371 (Fed. Cir. 2007) (*en banc*). A plaintiff must show that the defendant: (1) acted despite an objectively high likelihood that its actions constituted infringement of a valid patent; and (2) knew or should have known this risk existed. *Id*.

A reasonable jury could have found that Transocean satisfied both requirements. *First*, a reasonable jury could have found that Maersk acted despite an objectively high likelihood that its actions infringed a valid patent based on the language of the contract itself, in which Maersk **[** **]** Indeed, the high risk of infringement is acknowledged repeatedly throughout Maersk's contract with Statoil.

Second, a reasonable jury also could have found that Maersk actually knew or should have known of the risk of infringement. The Maersk-Statoil contract, discussed *supra*, is itself powerful evidence of Maersk's knowledge of the risk, and Maersk's improper actions in advance of that contract confirm Maersk's willful activity. The undisputed evidence establishes that Maersk studied and copied Transocean's patented dual-activity technology in designing the rig that it sold or offered for sale in the contract. For example, a **[** **]** memorandum shows that Maersk deliberately set out to copy Transocean's patented technology when designing its own rig:

[

]

(A4643-44.) While *Seagate* unquestionably changed the willful infringement analysis, knowing copying of a competitor's patented apparatus still evidences willful infringement. A reasonable jury could have found that this blatant copying of Transocean's patented technology, along with its contract with Statoil, established that Maersk knew or should have known of the risk of infringement, yet forged ahead nonetheless. *See Depuy Spine*, 567 F.3d at 1336-37 (evidence of copying relevant to subjective prong of test for willful infringement); *Mass Engineered Design, Inc. v. Ergotron, Inc.*, 633 F. Supp. 2d 361, 379 (E.D. Tex. 2009) (upholding verdict of willful infringement where defendant was aware of and researching plaintiff's products when developing infringing product).[8]

Additionally, in a September 27, 2005 letter, Transocean informed Maersk of its patents, that Maersk's rig appeared to infringe those patents, and that litigation with GlobalSantaFe over those patents was ongoing. (A4654.) Transocean's warning to Maersk could not have been clearer:

[8] Other courts, ruling post-*Seagate*, have found copying to satisfy the objective prong of the willful-infringement test. *See Arlington Indus., Inc. v. Bridgeport Fittings, Inc.*, 610 F. Supp. 2d 370, 389 n.24 (M.D. Pa. 2009); *GSI Group, Inc. v. Sukup Mfg. Co.*, No. 05-3011, 2008 WL 4545347, at *4 (C.D. Ill. Oct. 9, 2008).

> We have reviewed the publicly available drawings of the new semisubmersible drilling rigs ordered by Maersk from Keppel Fels. It is apparent to us in reviewing the drawings that the arrangement and design of the drilling equipment is remarkably similar to that on the semisubmersible rigs recently constructed by Keppel Fels for Global Santa Fe. Those rigs are the subject of our pending litigation against GSF for patent infringement … .

(*Id*.) Despite the warning, Maersk continued to build the infringing rig and subsequently executed the contract with Statoil to use the rig. (*See supra*.) This behavior warrants a willful-infringement finding. *See Creative Internet Advertising Corp. v. Yahoo! Inc.*, No. 6:07cv354, 2009 WL 2382132, at *6 (E.D. Tex. July 30, 2009) (upholding willful-infringement finding where, *inter alia*, defendant continued to infringe patent after notice was given, ignored the substantial similarity between the claimed invention and the accused program, and made no effort to avoid infringement).

If Maersk had any doubts as to whether the rig might have infringed Transocean's patents, a reasonable jury could have found that any such doubts were or should have been erased when the GlobalSantaFe drillship—which Transocean had already informed Maersk to be "remarkably similar" to the Maersk rig—was found in the *GlobalSantaFe* litigation to infringe the same Transocean patents at issue in this case. (A4656-84.) As a result, Maersk knew or should have known that the contract to sell or offer to sell the "remarkably similar" rig was an act of infringement.

Maersk's post-contracting decision to add a plate (similar to the one required by the *GlobalSantaFe* court's injunction) did not, as the district court believed (A31-32), defeat Transocean's willful-infringement claim. *First*, that modification did not obviate Maersk's willful actions *prior to* that installation—the copying and design of the infringing rig, and the execution of the Statoil contract. *Cf. Krippelz v. Ford Motor Co.*, 636 F. Supp. 2d 669, 671 (N.D. Ill. 2009) ("Claims of willful infringement are governed by time and circumstance at each stage of the defendant's infringement."). A reasonable jury could find Maersk's infringement willful at least during that period of time. *Second*, Maersk's selective adoption of some of the terms of the *GlobalSantaFe* injunction did not render the rig noninfringing. The *GlobalSantaFe* injunction imposed restrictions specifically detailing when the plate could be removed and required GlobalSantaFe to provide regular compliance reports. (A7648-49.) ***No*** such court-ordered and court-enforced restrictions or reporting requirements apply to Maersk's rig. A reasonable jury could have found that Maersk's *post hoc* installation of what is in effect a removable Band-Aid® does not defeat willful infringement.

CONCLUSION

The judgment of the district court should be reversed.

Dated: December 9, 2009

Respectfully submitted,

____

CHARLES B. WALKER, JR.
MICHAEL S. MCCOY
WARREN S. HUANG
FULBRIGHT & JAWORSKI L.L.P.
1301 McKinney, Suite 5100
Houston, Texas 77010-3095
(713) 651-5151

GREGORY A. CASTANIAS
THOMAS J. DAVIS
JONES DAY
51 Louisiana Avenue, N.W.
Washington, D.C. 20001
(202) 879-3939

Attorneys for Plaintiff-Appellant Transocean Offshore Deepwater Drilling, Inc.

ADDENDUM

ADDENDUM TABLE OF CONTENTS

UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF TEXAS
HOUSTON DIVISION

TRANSOCEAN OFFSHORE DEEPWATER DRILLING, INC.,	§	
	§	
Plaintiff/Counter-Defendant,	§	**Case No. H-07-02392**
	§	
v.	§	**JUDGE KENNETH M. HOYT**
	§	
MAERSK CONTRACTORS USA, INC.,	§	
	§	
Defendant/Counter-Plaintiff.	§	

FINAL JUDGMENT

In accordance with this Court's July 28, 2009 Memorandum and Opinion (Dkt. No. 148), its July 28, 2009 Minute Order (Dkt. No. 148), and its May 14, 2009 Memorandum and Order (Dkt. No. 142), the Court issues the following Order of Final Judgment:

1. Judgment is entered in favor of Defendant Maersk Contractors USA, Inc. ("Maersk") and against Plaintiff, Transocean Offshore Deepwater Drilling Inc. ("Transocean"), on all counts, claims and prayers for relief set forth in Transocean's Second Amended Complaint (Dkt. No. 30).

2. Maersk shall recover its costs of court from Transocean.

3. It is hereby adjudged and declared that claim 10 of U.S. Patent No. 6,085,851, claims 10-13 and 30 of US Patent No. 6,047,781, and claim 17 of US Patent No. 6,068,069, are invalid and not infringed by Maersk.

5. All other counterclaims and affirmative defenses that Maersk has raised and plead in this litigation, including its claim of inequitable conduct, are dismissed without prejudice, as moot in view of, and based upon, the Court's above-referenced Minutes and Orders. This dismissal without prejudice does not apply to Maersk's request for attorney

fees and an exceptional case determination under 35 U.S.C. 285, which issues are expressly reserved by Maersk for presentation to the Court within the time limits set by the Federal and Local Rules.

6. The Court enters Final Judgment in this case for Maersk and against Transocean.

IT IS SO ORDERED:

SIGNED at Houston, Texas, this 18th day of August, 2009.

Kenneth M. Hoyt

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF TEXAS
HOUSTON DIVISION

TRANSOCEAN OFFSHORE DEEPWATER DRILLING, INC.,	§	
	§	
Plaintiff,	§	
VS.	§	CIVIL ACTION NO. H-07-2392
	§	
MAERSK CONTRACTORS USA INC., *et al*,	§	
	§	
Defendants.	§	

MEMORANDUM AND OPINION

I. INTRODUCTION

Before the Court are the plaintiff, Transocean Offshore Deepwater Drilling, Inc.'s ("Transocean") motion for partial summary judgment for infringement (# 117)[1], and Maersk Contractors USA, Inc.'s ("Maersk USA") motion for summary judgment for non-infringement (# 113). Also pending are Maersk USA's motion for partial summary judgment for invalidity concerning certain apparatus claims of Transocean's several patents for lack of enablement (# 85), and its motion for summary judgment for invalidity of the several patents based on anticipation and obviousness (# 87). The Court has at its disposal the several responses, replies, sur-replies and attachments in support of the several motions for summary judgment. After a careful review of the pleadings and oral presentations, the Court is of the opinion that Transocean's motion should be denied; Maersk USA's motion for non-infringement should be granted; its motion for invalidity for lack of enablement should be granted; and, its motion for invalidity based on anticipation and obviousness should be granted.

[1] The Court is of the opinion that Transocean's motion for partial summary judgment based on allegations of infringement was sufficiently addressed by the Court in an earlier Memorandum and Order (# 142) that addressed willfulness. To the extent that there is room for disagreement concerning the scope of the Court's earlier Memorandum, any remaining claims of infringement are denied.

II. FACTUAL BACKGROUND

Transocean brought suit against Maersk USA in 2007 for infringement of several apparatus and method claims associated with four of its patents; U. S. Patent 6,085,851 ("the '851"); U. S. Patent 6,047,781 ("the '781"); U. S. Patent 6,056,071 ("the 071"); and, U. S. Patent 6,068,069 ("the '069"). These patents disclose an offshore drilling structure with two tubular advancing stations, each of which is designed to supporting tubulars that extend to the seabed.

By way of background, in early 1996, Transocean conceived of a drilling rig that would permit a well to be drilled faster and more efficiently. At the time, Transocean was aware of other inventions that contained two drill stations. As well, the technology for pipe handling systems that transfers tubulars on the drill floor of the rig to facilitate off-line stand building capacities, were known. Transocean's invention combined the concepts of two tubular advancing stations with automated pipe handling to transfer tubulars from one advancing station to the other. This technology resulted in the issuance of the '851 patent on July 11, 2000. Three other related applications were pending near the time that the '851 patent issued [the '071, '781 and '069 patents] and they were also issued. Transocean is now the assignee of the four patents.

III. PRIOR ART - DUAL ACTIVITY RIGS

A. The Trend in Technology

Certain facts concerning the state of the prior art are not in dispute. The parties do not dispute that by May 3, 1996, the date of the application of the '851 patent, deep water drilling was moving toward automated pipe handling on newly built rigs. In fact, the trend was recognized by George Boyadjieff in 1981. *See* [*Trends in Rig-floor Technology*, Oil & Gas Journal, 1981]. Top-drive drilling systems were also commonplace and automated pipe handling was anticipated. By 1989, at least one country, Norway, required that rigs be equipped with automated pipe handling for safety purposes. During the same timeframe, pipe handling equipment was being mounted on rails built into the derrick set on a defined path, capable of travel only to the rotary table and back to the pipe area. The first patent to partially address this technology was the GB Horn 2.041.836A ("GB Horn"). By 1995, automated pipe handling on a floating rig was not uncommon in the industry. The discussion that follows addresses the state of the technology and prior art at the time that the '851 patent was conceived.

B. The Prior Art

On February 20, 1980, Inventor Lars Horn filed UK Patent Application GB 2.041.836A, ("the GB Horn"). The GB Horn describes:

> a vessel for drilling hydrocarbon wells in the sea floor, such as a drill ship or a semisubmersible platform, is provided with a drilling tower which is dimensioned and constructed to receive at least two drill strings. Preferably, the mutual spacing between the drill strings is substantially equal to an integral multiple of the desired spacing between neighbouring wells and is at least equal to the spacing required to enable the drill strings to be operated concurrently.

The sum of the GB Horn invention is that it boasted of a semisubmersible platform drilling system that featured a single derrick, two tubular advancing stations, two drill strings to the seabed, and possible two riser pipes, albeit, for the purpose of drilling two wells. The GB Horn configuration was designed to shorten the time between the decision to put an oil field in production and the start of production. Notably, the patent configuration permits the advancing of two drill strings to the seabed concurrently and common use of auxiliary equipment.

C. The Lund '439 Patent

On October 29, 1986, Thomas A. Lund submitted an application to the United States Patent Office that claimed the invention of automation of pipe handling equipment. *See* (U. S.

Patent No. 4,850,439) ("the Lund"). The Lund patent boasted of two tubular assembly stations and automated pipe handling equipment that permitted the building of stands of pipe simultaneously with drilling operations. As well, it disclosed a means for transporting tubulars between the tubular assembly stations and a tubular advancing station. The invention also revealed a first and second transporting means for tubulars mounted on upper and lower tracks or "other suitable transporting mechanism." Hence, automated pipe handling equipment, with the view that tubulars are made up in advance and available for use in drilling operations without delay, was the focus of the invention.

D. The Williford Patent

In July of 1987, inventors, including Frank B. Williford, presented an application to the United States Patent Office that disclosed a "floating drilling platform that contained dual work stations for performing deepwater drilling." A patent was issued on April 11, 1989. According to the invention, the platform "may be outfitted with dual drilling derricks," and, "various expedients . . . [would] permit the equipment of one work station to be used in conjunction with the equipment of the other . . . such as subsea equipment manipulation." Specifically, this invention permitted its dual drilling fluid systems [to acts in a] crossover [fashion] . . . in order that the mud pumps of one of the work stations [could] provide pumped fluid to the other work station as planned or [as] emergency needs arise." According to the summary of the invention, one rig could perform one function of the operation while the other performed a different or related function. The Williford configuration, thereby, permitted simultaneous support drilling operations "auxiliary" to the drilling operations.

E. The Heerema Patent

On or about July 22, 1994, the Heerema Group Services BV filed UK Patent Application GB 2.29 1 .664A ("the GB Heerema"). The GB Heerema was issued on January 31, 1996, prior to the date that Transocean claims conception of its invention, March 7, 1996. The invention claims a method for pre-assembly of "one or more parts of the casing string, the riser string or the drill string on the drilling rig at one or more pre-assembly points away from the drilling derrick" Hence, part of the activities for assembling a casing or riser string is carried out simultaneously with other activities resulting in a considerable saving of time. The object of the GB Heermea invention was to provide a method whereby the time necessary for completing a drilling was reduced. This savings was accomplished when the sub-assemblies, the casing string, are extended to the seabed by a crane at the same time that drilling operations are being performed. Like the Williford patent, the Heerema patent permitted simultaneous support drilling operations auxiliary to the drilling operations. With these inventions in mind, the Court moves to address the parties' motions for summary judgment.

IV. SUMMARY JUDGMENT STANDARD

Summary judgment is appropriate if no genuine issue of material fact exists and the moving party is entitled to judgment as a matter of law. Fed. R. Civ. P. 56. A fact is "material" if its resolution in favor of one party might affect the outcome of the suit under governing law. *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 248 (1986). "Factual disputes that are irrelevant or unnecessary will not be counted." *Id.* at 248. An issue is "genuine" if the evidence is sufficient for a reasonable jury to return a verdict for the nonmoving party. *Id.* If the evidence rebutting the motion for summary judgment is only colorable or not significantly probative, summary judgment should be granted. *Id.* at 249-50; *see also Shields v. Twiss*, 389 F.3d 142, 149-50 (5th Cir. 2004).

Under Rule 56(c) of the Federal Rules of Civil Procedure, the moving party bears the initial burden of "informing the district court of the basis for its motion and identifying those portions of [the record] which it believes demonstrate the absence of a genuine issue for trial." *Matsushita Elec. Ind. Co. v. Zenith Radio Corp.*, 475 U.S. 574, 586 - 87 (1986); *Adams v. Travelers Indem. Co. of Connecticut*, 465 F.3d 156, 163 (5th Cir. 2006). Where the moving party has met its Rule 56(c) burden, the nonmovant must come forward with "specific facts showing that there is a *genuine issue for trial.*" *Matsushita*, 475 U.S. at 586-87 (quoting Fed. R. Civ. P. 56(e)) (emphasis in original); *Celotex Corp. v. Catrett*, 477 U.S. 317 (1986); and *Adams*, 465 F.3d at 164. To sustain the burden, the nonmoving party must produce evidence admissible at trial showing that reasonable minds could differ regarding a genuine issue of material fact. *Anderson*, 477 U.S. at 250-51; 255; *Morris v. Covan World Wide Moving, Inc.*, 144 F.3d 377, 380 (5th Cir. 1998). In deciding a summary judgment motion, "[t]he evidence of the nonmovant is to be believed, and all justifiable inferences are to be drawn in his favor." *Anderson*, 477 U.S. at 255.

V. CLAIM CONTENTIONS OF THE PARTIES

A. Maersk USA's Lack of Enablement Contention

1. Contentions

Maersk USA seeks summary judgment for invalidity of Transocean's apparatus claims found in its '851, '781 and '069 patents. The relevant claims are claim 10 of the '851 patent, claims 10-13 and 30 of the '781 patent and claim 17 of the '069 patent. Maersk USA contends that Transocean has failed to provide an enabling disclosure for its claimed transferring equipment. Maersk USA also contends that Transocean cannot point to a single element in any of its claims that constitutes an invention apart from the prior history present in the industry in 1996. Further, Maersk USA contends that, as it relates to automated pipe handling, designed to transfer pipe from station to station: (a) top drives are the result of over 15 years of improvements and progress in technology and are not presented for the first time in Transocean's invention; (b) the use of columns, rail mounted pipe handlers that off-line build tubulars during drilling operations, as well, is not an invention; and, (c) rigs equipped with a drilling center capable of lowering tubulars to the seabed is not an invention. Finally, Maersk USA contends, earlier designed rigs were equipped to transfer tubulars from the right-hand side of the derrick to the left-hand side of the derrick in a north to west direction, [auxiliary drilling operations] for the purpose of shortening the "critical path" to the well. Therefore, nothing new is invented by Transocean's patents-in-suit.

Transocean asserts that its patents enable the invention because: (a) the mechanical arts require only a minimal description of the claimed equipment; (b) Maersk USA erroneously focuses on the effort necessary to produce a commercially viable embodiment as opposed to the effort required to make and use the invention based on the patent disclosure; (c) the drilling industry expects to customize individual equipment when meeting customer requirements; (d) the inventors contemplated modifying known tubular handling systems not inventing a new system; and, (e) a fact issue exists as to whether the claimed tubular handling system could be built without excessive experimentation.

Maersk USA counters that the inventors and Transocean’s expert witness acknowledge that Transocean's patents are not about designing or making an operable automated pipe handling apparatus and that the patents do not describe a pipe handling assembly. Moreover, Maersk USA points out, the company chosen to develop the necessary software found the task quite challenging. “It wasn’t easy for them” according to witnesses for Transocean. Therefore, Maersk USA asserts, no disputed fact issue exists concerning the need for excessive experimentation. The contentions guide our discussion on enablement.

2. Law of Enablement

Enablement is a question of law that is based either on found or undisputed facts. Title 35 U.S.C. § 112 governs enablement and requires that the patentee "enable" his invention. Hence, the patent specification must disclose “in full, clear, concise and exact terms [so] as to enable any person skilled in the art to which it pertains . . . to make and use the [invention].” *See Nat’l Recovery Techs. Inc., v. Magnetic Separation Sys., Inc.*, 166 F.3d 1190, 1195-96 [Fed. Cir. 1999]. Therefore, in order to prevail on its claim of lack of enablement Maersk USA must show by clear and convincing evidence found in the discovery or undisputed facts that unduly excessive experimentation would be necessary to practice Transocean's invention. *Koito Mfg. Co. v. N Am. Lighting, Inc.*, 381 F.3d 1142, 1155 (Fed. Cir. 2004). Some experimentation is permitted; however, “unduly laborious” experimentation renders the invention invalid for lack of enablement. *Id.* A court begins its enablement analysis with the patent specification. *See Sitrick v. Dreamworks, LLC.*, 516 F.3d., 993, 999-1000 (Fed. Cir. 2008).

3. Analysis -- Enablement

There is no dispute that Transocean’s patent specifications, associated with claim 10 of the ‘851 patent, claims 10-13 and 30, of the ‘781 patent, and claim 17 of the '069 patent do not fully and concisely disclose how to make the claimed transferring equipment. The issue, according to Transocean is whether that disclosure is necessary to the invention since it focuses on the mechanics and not art. Transocean asserts that the specifications disclose a new configuration of known pipe handling equipment that enables one of ordinary skill to practice the invention. The Court agrees that the transferring equipment is not the invention. However, the Court is also of the opinion that a disclosure of the novel aspects of the claimed invention is necessary, and that the specification fails to make the necessary disclosure. The patent specifications contain references to three embodiments as the claimed transferring equipment: (a) rail supported pipe handlers; (b) overhead derrick crane (structure); and (c) equivalent structure. These references do not teach beyond the prior art

In claim 10 of the '851 patent and claims 10 - 13 and 30 of the '781 patent, Transocean patents utilizes the phrase, a "means . . . for transferring tubular assemblies between. . . . "Claim 17 of the '069 patent, in like manner, utilizes the phrase ". . . assembly . . . operable to transfer tubular assemblies between. . .." In each instance, the specification does not fully, clearly, concisely and exactly disclose the ". . . means . . . for transferring." The same is true for the phrase ". . . assembly . . . to transfer . . ." Each of these phrases describes known pipe handling equipment that otherwise enables a person skilled in the art to make and use the invention. However, Transocean does not claim its pipe handling equipment as its invention. It claims that the pipe handling equipment has been rearranged in an "assembly" that facilitates utilization and advancing of tubulars. Yet, the specifications fail to inform as to how this new arrangement works such that a person skilled in the art may take advantage of the objective of the invention - timesaving.

It is the Court's view that a person skilled in the art would not be able to make and use the invention described without undue experimentation. *See Magnetic Separation Sys., Inc.*, 166 F.3d at 1195-96. This is so because the full scope of the means for transferring is not disclosed by the specifications, as required by § 112(1). The specification protocol for accomplishing the timesavings events claimed by Transocean in the production of a well does not and should not include the known equipment that is necessary to the drilling of any well. This is so because the same or essentially the same equipment is used in all well productions. Transocean might counter that location is everything in their protocol. To the extent that this argument exists in its briefing, it can be argued only that location is part of the invention, or at most a tool that helps effectuate the protocol for the invention, the invention being a timesaver event. In truth, it is how the known equipment is programmed, the mechanical modifications that constitute the invention. And, that programming must be presented in the specification in full, clear, concise and exact terms so as to inform a person skilled in the art of oil well production how to make and use the known equipment in a timesaving manner. Therefore, from an enablement perspective, the invention fails to satisfy the statutory mandate, and summary judgment is appropriate as to these claims.

B. Maersk USA's Claim of Non-Infringement

The Court previously addressed Transocean's claim that Maersk USA infringed its patents by an "offer-of-sale" or by the "sale" of an infringing item. The Court concluded that Transocean's evidence failed to prove that Maersk USA made, used, sold or offered for sale, within the United States, the accused rig. Moreover, it is undisputed that the activities that formed the basis of Transocean's claim of infringement occurred outside the United States.

Hence, for that reason as well, no infringement by "offer-of-sale" or "sale" can be proved. *See Roter Indus., Inc. v. Mitsubishi Corp.*, 215 F.3d 1246, 1251 (Fed. Cir. 2000). Transocean argues, nevertheless, that soon Maersk USA's rig will be located in United States Gulf waters. And, as a result, Maersk USA will, or cause another to engage in infringing conduct because, in truth, the rig sold to Statoil is a copy of its rig. Against Transocean's motion for summary judgment of infringement, Maersk USA seeks a determination that its conduct in all respects is non-infringing.

1. Contentions

Maersk USA argues that, even if its rig were used in United States waters, its conduct is non-infringing because Transocean is collaterally estopped from making an infringement argument, citing to the judgment in *Transocean v. GlobalSantaFe* [No. H-03-2910 SDTX]. Transocean's claims of infringement are directed to apparatus claim 10 of the '851 patent, apparatus claims 10 - 13 and 30 of the '781 patent and apparatus claims 9, 10 and 17 of the '069 patent. Each of these claims contain essentially the same claim language limitations featuring two tubular advancing stations both capable of advancing tubulars to the seabed.

Transocean concedes that in *Transocean v. GlobalSantaFe* the identical claims of infringement were litigated against GlobalSantaFe and were resolved by the court in a permanent injunction requiring GlobalSantaFe to modify its rigs by adding a casing sleeve to one of the two drill centers. The effect of installing the casing sleeve was to resolve and avoid infringement. *See* [No. H-03-2910, Dkt. No. 248]. Nevertheless, Transocean argues here that Maersk USA's ability to modify its rig(s) in the future does not address Maersk USA's future ability to infringe.[2]

[2] The Court addressed past infringement in a previous Memorandum and Order [#142].

Transocean also argues that Maersk USA's motivation in copying its rig was to gain a commercial advantage *i.e.*, agreeing to supply an infringing dual activity rig, and after obtaining the contract, modifying the rig. Hence, the modifications made to the rig by Maersk USA should be considered irrelevant as to whether its rig is capable now or in the future of being used in an infringing manner.

2. Analysis -- Non-Infringement

In the Court's view, Maersk USA's claim of collateral estoppel or issue preclusion carries the day on Transocean's claims of present or future infringement. The undisputed evidence shows that the identical issues were actually litigated by Transocean against GlobalSantaFe, and that resolution of those issues was a necessary part of the judgment. *See Next Level Commc'ns LP. v. DSC Commc'ns Corp.*, 179 F.3d 244, 250 (5th Cir. 1999). Hence, collateral estoppel applies. On the other hand, the essential feature of Transocean's invention is that the second or auxiliary drill center is capable of extending tubulars to the seabed. In Transocean's prior litigation it conceded that the structural modifications effected by the addition of the casing sleeve avoided infringement of Transocean's apparatus claims, both at that time and in the future. Maersk USA attached a similar casing sleeve to its rig after learning of the outcome of Transocean/GlobalSantaFe litigation. In the Court's view, this modification was sufficient to avoid infringement of each of Transocean's apparatus claims.

Therefore, for the reasons stated herein and those stated in its previous Memorandum and Order (Inst. No. 142), the Court concludes that there is no disputed fact issue that Transocean's apparatus claims are not infringed by Maersk USA due to collateral estoppel. Hence, summary judgment is appropriate.

C. Anticipation and Obviousness

1. Parties' Contentions

In a second motion for summary judgment, Maersk USA seeks to establish invalidity of Transocean's '851, '781, '071 and '069 patents as they disclose an offshore drilling structure with "two tubular advancing stations" based on anticipation and obviousness. Transocean has withdrawn its method claims from consideration.[3] Therefore, the Court will not address infringement based on the method(s) described in the claim language. Hence, the discussion will focus on the contentions of the parties as they relate to the apparatus claims.

Maersk USA contends, by its motion, that Transocean's apparatus claims are invalid in light of the prior art. Specific reference is made to the GB Horn, the Lund, the Williford and the Heerema patents. In addition, Maersk USA contends that each of Transocean's method claims is taught or rendered obvious by the Heerema patent reference disclosed in the Heerema patent. Again, the Court will address only Maersk USA's apparatus claim assertions based on obviousness and anticipation.

2. Status of Prior Art and Record

Transocean concedes that the GB Horn, the Lund, the Williford and the Heerema patents and related references, together, are capable of conducting simultaneous auxiliary operations on one well. Moreover, Transocean admits that its patent claims contain, in large measure, the same

[3] *See* [Transcript of Summary Judgment Arguments, April 23, 2009, at page 68, Lines1-4. The Court is of the opinion, however, that summary judgment concerning Transocean's apparatus claims based on collateral estoppel renders moot Transocean's method claim contentions. Once the casing sleeve is added, Transocean's method claims fall squarely into the prior art inventions and no longer have efficacy. Moreso, the Heerema patent discloses each of the methods described in Transocean's claim 23 of the '071 patent and claims 9 and 10 of the '069 patent. The Heerema patent addresses problems associated with a single well, simultaneously running a blowout preventer and riser to the seabed up to 90% of the final riser string length.

structural elements as described in the prior arts. However, it claims that its innovation is in the combination of all the previous timesavings designs into a single design. Bearing on this discussion is the testimony of Inventor Scott concerning the prior art, which testimony is instructive. During his testimony concerning the invention of the '851 patent, Inventor Scott, admitted the following:

(a) the GB Horn application reveals two tubular advancing stations capable of advancing tubulars to the seabed. As well, it discloses two drawworks for raising and lowering tubulars to the seabed, and is capable of working simultaneously from two drill centers on a single well. It discloses a derrick for supporting drilling operations through a drilling deck, capable of operating auxiliary to the drilling operations. A rotary table is also disclosed capable of advancing tubular members to the seabed. And, a second rotary table capable also of advancing tubular members to the seabed. Like Transocean's invention, the GB Horn is capable of advancing a second drill string through the drilling deck to the seabed. The invention also claims to drill a well faster and more efficiently and, therefore, located its first and second places for the storage of drilling pipe adjacent to the tubular advancing stations. Therefore, Scott testified that had the GB Horn disclosed the ability to transfer tubulars from one station to the other, the Transocean invention would be, "in part," disclosed. And, with 15 years of improvements in the technology, the GB Horn would have included top drives instead of Kellys and would have included automated pipe handling instead of manual pipe handling;

(b) the GB Horn, reveals transferring equipment for advancing tubulars from one advancing station to the other. And, except for automated pipe handling to transfer tubulars from one advancing station to the other, . . . [the GB Horn describes] essentially Transocean's invention; and,

(c) Transocean's innovation is not the many parts that admittedly constitute the make-up of prior art, but the combination of those parts in a new configuration that results in timesavings that did not exist in the previous separate designs. Hence, Transocean admits that it did not invent a single piece of equipment contained in its invention.

Scott also conceded that the Williford discloses a "dual activity" rig. The Williford patent was issued by the Patent Office in 1989, eleven (11) years prior to the issuance of the Transocean's '851 patent. Scott admitted that the Williford includes two derricks on a single platform, both capable of advancing tubular strings to the seabed. Like the GB Horn, the Williford discloses a twin driller arrangement. With dual work stations, the drillers permit one workstation to assist in the operations of the other, particularly subsea equipment manipulation auxiliary to the drilling operations.

Transocean was also familiar with the Lund '439 patent that was issued by the United States Patent Office. Inventor Scott does not dispute the following facts concerning the Lund:

(a) the Lund patent discloses two stations within a derrick. The derrick is located above a drilling deck that extends over an opening in the drilling deck;

(b) the Lund rig consists of two hoists, one positioned above a tubular advancing station while the other is positioned above a tubular assembly station. While the tubular assembly station is building stands of pipe, drilling operations are being simultaneously conducted. Both the drilling and preparation openings are associated with a drawworks and are capable of advancing and hoisting tubulars auxiliary to drilling operations;

(c) a drawworks is disclosed in the Lund. It is connected to a "traveling block" that is located inside the derrick. Like earlier inventions, the drawworks supported drilling operations on a single well through the drilling deck. Stands of pipe could be assembled simultaneous to drilling operations. Hence, auxiliary drilling operations are conducted while drilling operations are ongoing. The stands of pipe are stored in setback areas to be advanced at the appropriate time. The stands of pipe are transferred between the tubular assembly station and the tubular advancing station along a track-mounted transporting mechanism; and,

d) the Lund also discloses a tubular handling and transporting mechanism that moves tubulars between the drilling opening and the preparation opening. As well, there is a second tubular handling apparatus that operates on a rail. It facilitates auxiliary drilling operations. Transocean admits that it has the same "above and below" pipe handling rail mounted pipe handler as the Lund. What Transocean claims as a distinguishing feature in its inventions is "the position of the rail [along] an east-west divide."

Finally, there is the Heerema patent application, published on January 31, 1996, that discloses a method for shortening the time to drill a well. Earlier in 1994, a paper was published presenting the concept(s) later disclosed in the Heerema patent. In this regard, Transocean does not dispute that the Heerema patent discloses the practice of making up tubulars [sub-assemblies] at a separate station away from the "critical path" of drilling and simultaneously with drilling operations. Nor does Transocean dispute that the sub-assembly station is capable of assembling bottom-hole assemblies, casing sub-assemblies, and capable of extending a BOP and riser string to 90% of its desired final length. As well, Transocean recognizes that the invention claims that the build-strings [assemblies] may be "hung off the stern of the vessel . . . " and extended in proximity to the seabed, further, in order to substantially reduce drilling time. Finally, Transocean admits that a BOP stack and riser must reach the seabed, and does not dispute that the Heerema invention uses its crane to send and retrieve tubulars to the seabed, including the BOP.

3. Law of Obviousness and Anticipation

"Section 103 forbids issuance of a patent when 'the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious, at the time the invention was made, to a person of ordinary skill in the art to which said subject matter pertains." *See* 35 U.S.C. § 102 and 103; *see also KSR International Co. v. Teleflex, Inc.*, 550 U.S. 398, 127 S. Ct. 1727, 1734 (2007). The analysis that a court undertakes in making a § 103 assessment requires a court to determine: (a) the differences between the prior art and the claims at issue; and (b) the level of ordinary skill required in the pertinent art. *Id.* (citing to *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1 (1966)). *See also, Cross Medical Products, Inc. v. Medtronic Sofamor Danek, Inc.,* 424 F.3d 1293,1321 (Fed. Cir. 2005).

4. Analysis and Discussion

Maersk USA argues that the prior art teaches that one of ordinary skill in the art would combine the teachings of the GB Horn and the Lund patents if the objective or motivation is to increase the efficiency of the drilling process. Hence, it argues, the structure of the Transocean patents is simply a combination of the dual-activity rig from the GB Horn patent with the tubular transfer equipment from the Lund patent.

Generally, the Transocean apparatus claims require a drilling assembly with two tubular advancing stations and the necessary equipment to transfer tubulars between the tubular advancing stations. Transocean admits that each of its claim elements, except the means to transfer tubulars, is disclosed in the GB Horn and the Lund patents. A comparison of Transocean's claims to those of the GB Horn and the Lund patents informs.[4] Disclosed in the prior art is a drilling deck that supports drilling operations to the seabed. The structure reveals two fully equipped and functional tubular advancing stations, each of which is capable of lowering and raising tubulars and rotating the drill string. Hence, the tubular advancing stations in the prior art are capable of, simultaneously, supporting drilling and auxiliary operations.

The Lund patent also discloses "rail-mounted" tubular transfer equipment package. The equipment is designed to transport tubulars between the drilling and preparation openings. The drilling and preparation openings are used to advance tubulars to the drawworks that hoists and advance tubulars. Transocean does not deny that the Lund patent discloses equipment for pipe handling equivalent to its apparatus claims. In addition, Transocean admits [the inventor of the ‘851 patent], as between the GB Horn and the ‘851 patents, the GB Horn is missing only automated pipe handling capability. And, if one were to add automated pipe handlers as

[4] The Court followed the model presented by Maersk USA in its Memorandum in addressing Maersk USA's motion for summary judgment. [*See* Instrument No. 88].

transferring equipment, the GB Horn patent would be the same or equivalent of the '851 patent. *See* [Scott Deposition at pp. 212-213].

The Court determines that at the time of the application of the '851 patent, Transocean was aware of pipe handling systems that could be used to transfer tubulars. In fact, Transocean admits that it did not invent any of the equipment that constitutes the structure or protocol for its several patents. And, it admits that the GB Horn patent, as disclosed, is capable of working simultaneous from two drilling centers on a single well. What Transocean claims as its invention is "a design that could do things that were never done before, if you combine all of the timesavings of all of the previous designs into one different and new design." The Court is convinced that the combination of all previous timesavers by Transocean from prior art does not constitute an invention. To be an invention, the combining of the timesavings element would need to be expressed in a manner that distinguishes, mathematically or scientifically, the time saved by comparing a Transocean rig from the time saved using other rigs that also claim timesaving features.

When determining the patentability of a claimed invention that combines known elements, "the question is whether there is something in the prior art as a whole to suggest the desirability . . . of making the combination". *See In re Rouffet*, 149 F.3d 1350, 1356 (Fed. Cir. 1998). Clearly, the reason or motivation to combine the prior art is found in the prior art. For example, the use of automated pipe handling equipment recognized as early as 1981. *See* [George Boyadjieff, *Trends in Rig-Floor Technology*, Oil and Gas Journal, 1981]. Top drive systems were also commonplace by 1992; and, remote-controlled pipe handling equipment had become mandatory in Norway as early as 1979 [Ex. 5, Translated Oslo Dec.]. Finally, pipe handling equipment was mounted on rails so that tubulars could travel to the rotary table. Hence, automation was the order of things in the industry, both as a time-saver, for efficiency and for safety at the time of Transocean's invention. The timesaver problems that the ‘851 patent addresses are identified by the inventors of the GB Horn and the Lund patents as the object of their invention. Except for distinctions in the method by which those problems were addressed, the combination of the GB Horn and Lund patents teach claim 10 of the ‘851 patent.

The Court is of the opinion that the state of the industry would lead inevitably to utilization of two drilling centers working simultaneously on a single well. The prior art supports the conclusion that the state of the industry recognized the need for timesaver innovations before May 3, 1996. Hence, the idea of parallel operations, performing two procedures at the same time to shorten the drilling time for a well, was addressed before the Patent Office issued Transocean's patents. The industry’s response has been automation as seen in combining top-drives with advanced technology pipe handling systems. Hence, a person skilled in the art would be motivated to combine the teachings of the two, more so, to improve drilling efficiency. *See Tec. Air, Inc. v. Denso Mfg. Michigan, Inc*., 192 F.3d 1353, 1359-60 (Fed. Cir. 1999); *see also Ruiz v. A. B. Chance Co*. 234 F.3d 654, 665 (Fed. Cir. 2000) (citing to P*ro-Mold & Tool Co. v. Great Lakes Plastics, Inc.*, 75 F.3d 1568, 1572). Hence, combining known equipment with no measurable change in their respective functions merely withdraws what is already known into the field of monopoly and, thereby, diminishes the resources available to skillful men. *KSR*, 127 S.Ct. at 1739. Therefore, an undefined, unspecified timesaving event is not an invention.

VI. CONCLUSION

The Court concludes that the combination of known equipment, as embodied in Transocean's, claim 10 of its '851, claims 10 - 13 and 30 of the '781 patent and claim 17 of the '069 patent, is obvious. The Court is persuaded that the combination of the GB Horn, the Lund, the Williford and the Heerema patents with other teachings toward automation, entitles Maersk USA to a judgment as a matter of law that Transocean's apparatus claims are invalid as anticipated and obvious. Therefore, the Court DENIES Transocean's motion for summary judgment for infringement and GRANTS Maersk USA's motions for summary judgment for non-infringement. The Court also GRANTS Maersk USA's motions for summary judgment for lack of enablement and lack of validity based on anticipation and obviousness.

It is so Ordered.

SIGNED at Houston, Texas this 28th day of July, 2009.

Kenneth M. Hoyt
United States District Judge

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF TEXAS
HOUSTON DIVISION

TRANSOCEAN OFFSHORE DEEPWATER DRILLING, INC.,	§	
	§	
Plaintiff,	§	
VS.	§	CIVIL ACTION NO. H-07-2392
	§	
MAERSK CONTRACTORS USA INC., *et al*,	§	
	§	
Defendants.	§	

MEMORANDUM AND ORDER

I. INTRODUCTION

Before the Court are the motion for summary judgment of no willfulness brought by Maersk Contractors USA, Inc., (Maersk USA) (#81), and Transocean Deepwater Drilling, Inc. ("Transocean") (#91) response to Maersk USA's motion. Also, before the Court are Maersk USA's reply and Transocean's sur-reply and supporting case law. The Court has reviewed the motion, response and replies and determines that Maersk USA's motion should be granted.

II. FACTUAL SUMMARY

The underlying factual history shows that the United States Patent Trademark Office ("PTO) issued United States Patent Nos. 6,047,781 ("the '781 Patent"); 6,056,071 ("the '071 Patent); 6,068,069 ("the '069 Patent"); and 6,085,851 ("the '851 Patent") to Transocean on or about July 11, 2000. The invention is described as Multi-Activity Offshore Exploration and/or Development Drilling Method and Apparatus. Transocean's Patents generally presents an offshore drilling assembly that includes a superstructure or derrick, a first and second tubular advancing station, and an assembly adjacent to the stations capable of transferring tubular assemblies between the stations allowing simultaneous drilling and auxiliary activities for a single well. As a drilling contractor, Transocean provides drilling rigs to oil companies with the pledge that its invention saves drilling time through the cooperation of the two drilling stations under a single derrick.

On May 27, 2005, A.P. Moller-Maersk A/S negotiated and contracted with Koppel FELS Limited to build a DSS-21, an Ultra Deepwater Development Semisubmersible drilling rig. Maersk A/S is a Denmark corporation and the parent of the defendant Maersk USA in this case. Maersk USA entered into a contract on November 22, 2006, to utilize the DSS-21 to fulfill its drilling obligations to Statoil Gulf of Mexico, LLC. And, although the contract between Maersk A/S and Keppel FELS was between two foreign corporations, Transocean contends that Maersk USA's parent corporation, Maersk A/S acted in behalf of Maersk USA, permitting Maersk USA to contract with Statoil to supply a dual activity rig to Statoil that infringes Claim 17 of its '069 Patent.

At the time that Maersk USA contracted with Statoil, Transocean was involved in a suit with GlobalSantaFe Drilling Co. (GSF), that involved similar allegations of apparatus infringement of the same or similar claims as those asserted in the patents-in-suit. A permanent injunction was granted in behalf of Transocean against GSF in January 2007, enjoining GSF's use of its Development Drillers I and II auxiliary well centers to reach seabed and for drilling or auxiliary drilling operations.

In the case at bar, the parties acknowledge that the Contract between Maersk USA and Statoil was executed before the rig was completed. Likewise, the parties agree that the terms of the contract permit Maersk USA to modify the rig as necessary to avoid infringement of

Transocean's patents-in-suit. And, finally, the parties do not dispute that the prior art discloses rigs that are capable of conducting dual operations simultaneously on more than one well.

III. CONTENTIONS OF THE PARTIES

A. Transocean's Contentions

Transocean contends that Maersk willfully infringed Claim 17 of the '069 Patent when it entered into the Statoil Contract. In this regard, Transocean asserts that the Contract was negotiated between two United States companies in the United States and calls for the use of the dual activity rig built by Keppel FELS in the Gulf of Mexico which, according to Transocean, infringes its '069 Patent. Transocean contends that the Contract describes a rig, the specification of which, infringes Claim 17 of its '069 Patent. Finally, Transocean contends that the Contract, alone, between Maersk USA and Statoil is an act of infringement as it constitutes an "offer to sell" its rig to Statoil.

Transocean also contends that Maersk A/S copied Transocean's patented dual activity technology and, in the face of warnings from Transocean, Maersk USA contracted with Statoil to provide drilling activities in the Gulf of Mexico. In this regard, Transocean argues that Maersk A/S's conduct is the conduct of Maersk USA. Specifically, Transocean contends that Maersk A/S copied Transocean's technology and, as well, through Maersk USA, executed a contract with Statoil to perform drilling operations in the Gulf establishes Maersk's willfulness to infringe Transocean's Patents. In sum, Transocean asserts that Maersk USA violated 35 U.S.C. § 271(a), by "offering to sell" an infringing item in violation of Claim 17 of the '069 Patent and by copying its technology.

B. Maersk's Contentions

Maersk USA asserts that it is entitled to summary judgment on Transocean's willfulness claim because the relevant facts are undisputed. It is undisputed that: (a) Maersk's rig has a casing sleeve configuration identical to that constructed by GSF attached to the auxiliary rotary, which design was approved by this Court in related litigation between GSF and Transocean.[1] *See* [Cause No. H-03-2910, *Transocean v. Global Santa Fe*; modified Final Judgment]; (b) Maersk USA only took possession of the DSS-21 Rig on January 2, 2009; (c) the DSS-21 Rig has never entered United States waters; (d) Transocean's willfulness arguments are based on waived infringement theories; (e) the act of contracting is not an act of infringement; and, (f) Transocean's claim of an infringing "offer to sell" is not pled, therefore, has been waived.

IV. STATEMENT OF THE RELEVANT LAW

A. Summary Judgment Standard

Summary judgment is appropriate if no genuine issue of material fact exists and the moving party is entitled to judgment as a matter of law. Fed. R. Civ. P. 56. A fact is "material" if its resolution in favor of one party might affect the outcome of the suit under governing law. *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 248 (1986). "Factual disputes that are irrelevant or unnecessary will not be counted." *Id.* at 248. An issue is "genuine" if the evidence is sufficient for a reasonable jury to return a verdict for the nonmoving party. *Id.* If the evidence rebutting the motion for summary judgment is only colorable or not significantly probative, summary judgment should be granted. *Id.* at 249-50; *see also Shields v. Twiss*, 389 F.3d 142, 149-50 (5th Cir. 2004).

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[1] A casing sock or sleeve is a hollow metal pipe that has a sealed bottom installed on the DSS-21 rig's auxiliary drill center that prevents the drill center from being able to advance tubulars, drilling pipe *et. seq.* into the water and/or the seabed.

Under Rule 56(c) of the Federal Rules of Civil Procedure, the moving party bears the initial burden of "informing the district court of the basis for its motion and identifying those portions of [the record] which it believes demonstrate the absence of a genuine issue for trial." *Matsushita Elec. Ind. Co. v. Zenith Radio Corp.,* 475 U.S. 574, 586 - 87 (1986); *Adams v. Travelers Indem. Co. of Connecticut,* 465 F.3d 156, 163 (5th Cir. 2006). Where the moving party has met its Rule 56(c) burden, the nonmovant must come forward with "specific facts showing that there is a *genuine issue for trial.*" *Matsushita*, 475 U.S. at 586-87 (quoting Fed. R. Civ. P. 56(e)) (emphasis in original); *Celotex Corp. v. Catrett*, 477 U.S. 317 (1986); and *Adams*, 465 F.3d at 164. To sustain the burden, the nonmoving party must produce evidence admissible at trial showing that reasonable minds could differ regarding a genuine issue of material fact. *Anderson*, 477 U.S. at 250-51; 255; *Morris v. Covan World Wide Moving, Inc.,* 144 F.3d 377, 380 (5th Cir. 1998). In deciding a summary judgment motion, "t]he evidence of the nonmovant is to be believed, and all justifiable inferences are to be drawn in his favor." *Anderson,* 477 U.S. at 255.

B. Willful Infringement Standard

By its motion for summary judgment, Maersk USA seeks to foreclose Transocean's opportunity for treble infringement damages. Title 35 U.S.C. § 284 permits a court to "increase the damages up to three times the amount found or assessed" where there has been willful infringement. *In re SEAGATE TECHNOLOGY, LLC*, 497 F.3d 1360, 1370 (Fed. Cir. 2007). Generally, the issue of infringement is reserved to a jury and only then after a finding of infringement. Patent infringement, while a tort, is not an intentional tort. Hence, there is no need to prove intent in a patent case. On the other hand, a claim for willful infringement does require a showing of intent.

The Supreme Court recently addressed the meaning of willfulness in *Safeco Ins. Co. of Am v. Burr*, 127 S.Ct. 2201 (2007). There, the Court stated that willfulness requires a showing of "reckless conduct" or a showing of reckless disregard for the rights of another. *Id.* at 2209. A person acts recklessly when he acts "in the face of an unjustifiably high risk of harm that is either known or so obvious that it should be known." *See Farmer v. Brennan*, 511 U.S. 825, 836 (1994). On the other hand, it is legitimate to deliberately design around another's patent. *See Read Corp. v. Portec, Inc.,* 970 F.2d 816, 828 (Fed. Cir. 1992). Therefore, Transocean must show by clear and convincing evidence that Maersk USA acted recklessly despite an objectively high likelihood that its actions constituted infringement of a valid patent. *See In Re SEAGATE*, 497 F.3d at 1371, [*citing Safe Co*., 1275 S.Ct. at 2215]. In the face of such an allegation of willful infringement, Maersk USA need only show that there is a reasonable basis for it to believe its actions were legitimate. *See SRI Intern., Inc. v. Adv. Tech Lab., Inc.,* 127 F.3d 1462, 1464 (Fed. Cir. 1997).

V. DISCUSSION AND ANALYSIS

A.

Transocean advances two bases upon which its willfulness claim rests. First, Transocean asserts that construction of the DSS-21 constitutes infringement because Maersk A/S simply copied Transocean's patent design. Next, Transocean asserts that the executed contract between Maersk USA and Statoil constituted an "offer to sell" or a "sale" as those terms are intended in § 271(a). This assertion is supported by Transocean's claim that both Maersk USA and Statoil are United States corporations and negotiated and executed the Statoil Contract in the United States.

The evidence establishes that construction of the DSS-21 was the result of a contract between Kappel FELS Limited, a company organized under the laws of the Republic of

Singapore, and Maersk A/S a Denmark company. Construction occurred at Keppel FELS' yard in Singapore. There is no evidence that the contract to build the DSS-21 was negotiated or consummated by either Maersk USA or Statoil or the two jointly. Therefore, the Court is of the opinion that as far as Transocean's claim of willfulness concerns the construction of the DSS-21, Maersk USA did not engage in willful conduct by the actions of its parent corporation Maersk A/S. Transocean's patents are legitimately contested. And, the fact that one court has recently ruled favorable to Transocean on one or more apparatus claims does not resolve the challenges that Maersk USA makes that nothing was invented by Transocean's several patents.

Moreover, the fact that Maersk A/S modified its rig in the face of past and current litigations means that willfulness is defeated even if Maersk A/S copied Transocean's patent design. *See SRI Intern, Inc.* 127 F3d 1464. Article 15.12 of the Maersk USA/Statoil Contract provides: "Notwithstanding the foregoing…[Statoil] accepts that if intellectual property rights pertaining to Transocean's US patents…are determined…to be infringed…its [the rig's] use may be altered." It is apparent that Maersk A/S met with its engineers and perhaps Statoil when it became apparent that Transocean's patents would be sustained in order to avoid infringement. The Contract permitted alterations and the changes were incorporated. *See Read Corp.* 970 F.2d at 828.

B.

Resolution of the issue regarding the manufacture of the DSS-21, however, does not resolve the issue of whether Maersk USA offered to sell or sold infringing technology by way of the Statoil Contract. In this regard, Transocean argues that: (a) the Contract between Maersk USA and Statoil was negotiated and consummated in the United States; and, (b) Maersk USA's use of the DSS-21 in the Gulf of Mexico to fulfill its contractual obligations with Statoil will constitute infringement.

Maersk USA argues that Transocean has not met its burden on willfulness by clear and convincing evidence that the Contract constitutes a willful "offer to sell" an infringing product. *See* Safeco, 127 S.Ct. at 2215. Maersk USA argues that this is so because it acted objectively reasonable in the manner that it contracted with Statoil. In fact, it argues that it was cautious, anticipating the possibility that Transocean's patents could be held valid. Along these lines, Maersk USA asserts it took a position with regard to the DSS-21 that was consistent with the court's ruling in the Transocean/GSF litigation. In that litigation, the presiding judge held that modification to an infringing rig rendered it non-infringing. Hence, Maersk USA argues, the facts and ruling in that litigation negates the existence of "objective recklessness" on its part.

Maersk USA also argues that simply entering into an *executory* contract is not an act of infringement. First, it is non-infringing because Transocean's pleadings fail to allege the infringing item. In its pleadings Transocean alleges that it notified Maersk USA of its infringing activities. However, Maersk USA points out that Transocean's pleadings are lacking in allegations of any notice or alleged infringing conduct. Maersk points out that Transocean's Second Amended Complaint fails to assert sufficient facts constituting a claim for willfulness under an "offer to sell" theory. Transocean disputes this claim. Nevertheless, Maersk USA asserts, contrary to Transocean's argument, the Contract between Maersk USA and Statoil provides for unilateral changes in the DSS-21 to avoid infringement. Equally, Maersk USA argues, Transocean's "offer to sell" infringement theories were dropped from its case. Finally, Maersk USA argues that Transocean's pleadings fail to identify a single infringing activity that has taken place in the United States.

The Court is of the opinion that Maersk USA's act of contracting with Statoil in the manner and place that it did does not constitute an act of willful infringement. The undisputed evidence shows that Maersk Drilling submitted its bid package to Statoil ASA's Norwegian office and that the Contract was executed in Stravanger, Norway. The evidence also shows that the DSS-21 is capable of modification and was, in fact, modified in a manner that makes it non-infringing, pursuant to the court's ruling in the Transocean/GSF litigation. Although Maersk A/S constructed the DSS-21 that, arguably, infringes Transocean's patents, subsequent modifications to the rig's auxiliary drill center removes any basis for a finding of willfulness on Maersk USA's part even though grounds remain upon which arguments of infringement may rest.

Transocean does not refute the fact that Maersk A/S made modifications to the DSS-21. Instead, it argues that Maersk USA's willfulness is established by the fact that it was aware of Transocean's patents-in-suit prior to entering into the Maersk USA/Statoil Contract. As well, Transocean argues, Maersk USA knew that Maersk A/S copied Transocean's design. Maersk USA then contracted with Statoil to utilize the DSS-21 in the Gulf of Mexico, all in the face of the Transocean/GSF litigation and direct communications from Transocean to Maersk USA concerning its conduct.

The copying of another's patented technology alone may constitute the requisite level of intent to constitute willful infringement. *See GSI Group, Inc. v. Sukup Mfg. Co.,* 591 F.3d Supp. 2d 977 (C.D. Ill. 2008). However, here there is no evidence of any act of infringement occurring in the United States. *See* § 271(a); *Rotec Indus., Inc. v. Mitsubishi Corp.,* 215 F.3d 1246, 1254 (Fed. Cir. 2000). The alleged act of infringement, an offer to sell an infringing rig in the United States, is not supported by the terms of the Contract. In fact, the terms of the Contract permit modifications to the rig that would make the rig non-infringing. Hence, the fact that Maersk A/S copied Transocean's patents, if it did, does not advance Transocean's claim of willfulness against Maersk USA because the rig was modified. *See Hilgraeve Corp. v. Symantic Corp.*, 265 F.3rd 1336, 1343, (Fed. Cir. 2001)(citing to *High Tech Med. Instrumentation, Inc. v New Image Indus., Inc.,* 49 F.3rd 1551, 1556 (Fed. Cir. 1995).

It is Ordered that Maersk's motion for summary judgment of no willfulness is GRANTED in all respects.

SIGNED and ENTERED this 14th day of May, 2009.

Kenneth M. Hoyt
United States District Judge

US006047781A

United States Patent [19]

Scott et al.

[11] **Patent Number: 6,047,781**

[45] **Date of Patent: *Apr. 11, 2000**

[54] **MULTI-ACTIVITY OFFSHORE EXPLORATION AND/OR DEVELOPMENT DRILLING METHOD AND APPARATUS**

[75] Inventors: **Robert J. Scott**, Sugarland; **Robert P. Herrmann**; **Donald R. Ray**, both of Houston, all of Tex.

[73] Assignee: **Transocean Offshore Inc.**, Houston, Tex.

[*] Notice: This patent is subject to a terminal disclaimer.

[21] Appl. No.: **09/057,466**

[22] Filed: **Apr. 9, 1998**

Related U.S. Application Data

[63] Continuation of application No. 08/642,417, May 3, 1996.

[51] **Int. Cl.**[7] **E21B 19/20**

[52] **U.S. Cl.** **175/5**; 175/7; 175/8

[58] **Field of Search** 175/5, 7, 8, 9, 175/85, 161, 162; 405/195.1, 224, 223.1

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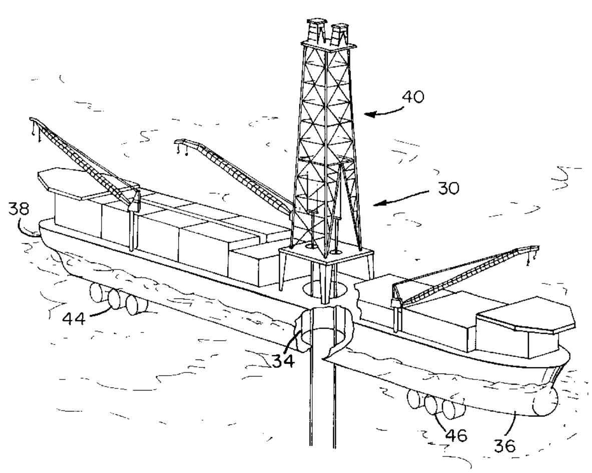
Primary Examiner—William Neuder

Attorney, Agent, or Firm—Kile McIntyre Harbin & Lee LLP; Bradford E. Kile; Richard A. Sterba

[57] **ABSTRACT**

A multi-activity drillship, or the like, method and apparatus having a single derrick and multiple tubular activity stations within the derrick wherein primary drilling activity may be conducted from the derrick and simultaneously auxiliary drilling activity may be conducted from the same derrick to reduce the length of the primary drilling activity critical path.

30 Claims, 8 Drawing Sheets



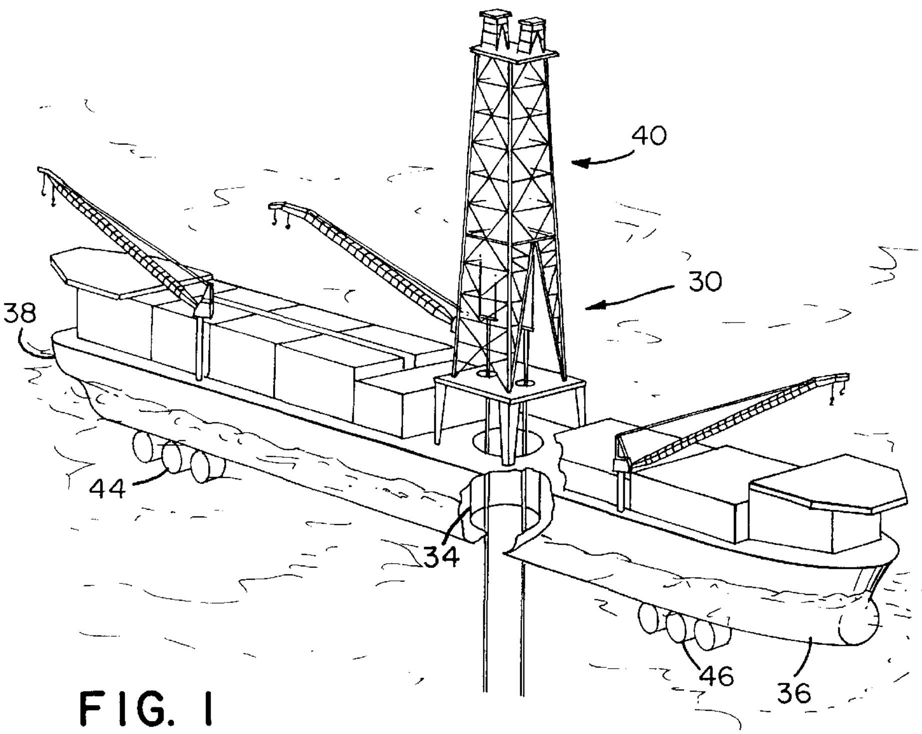

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FIG. 1

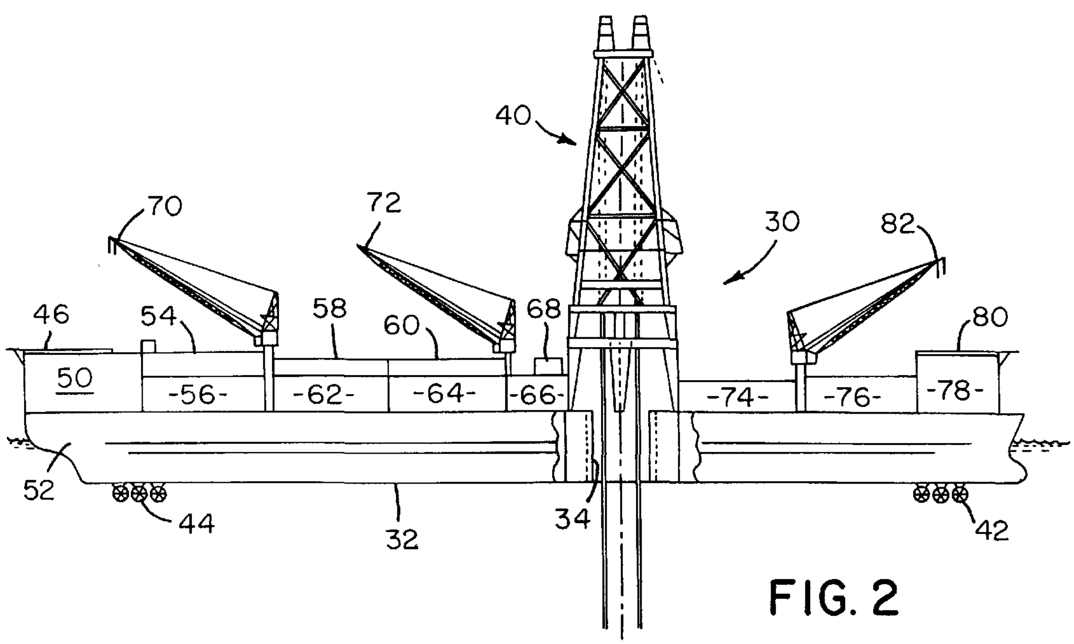
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FIG. 2

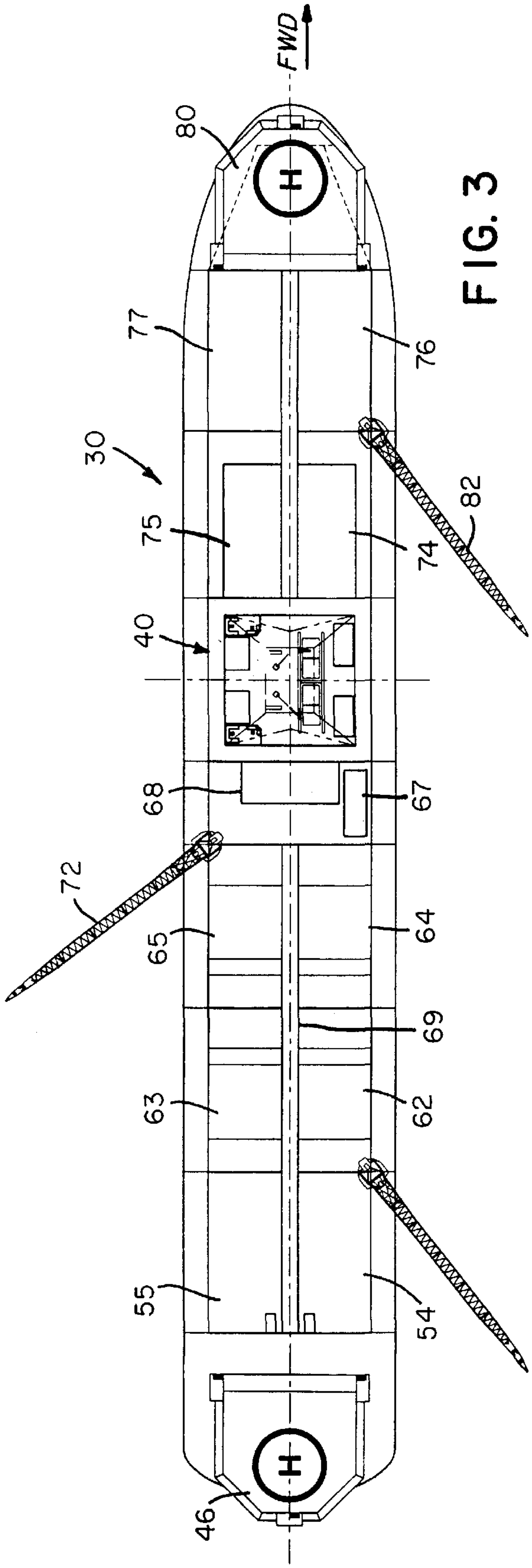
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FIG. 3

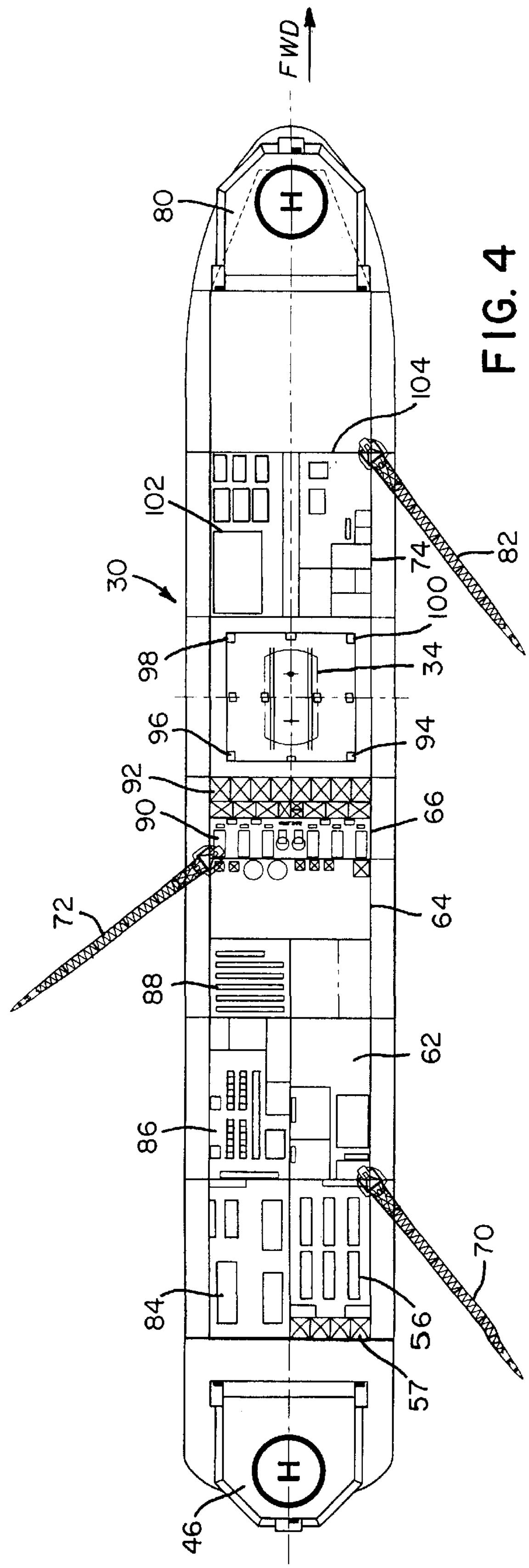
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FIG. 4

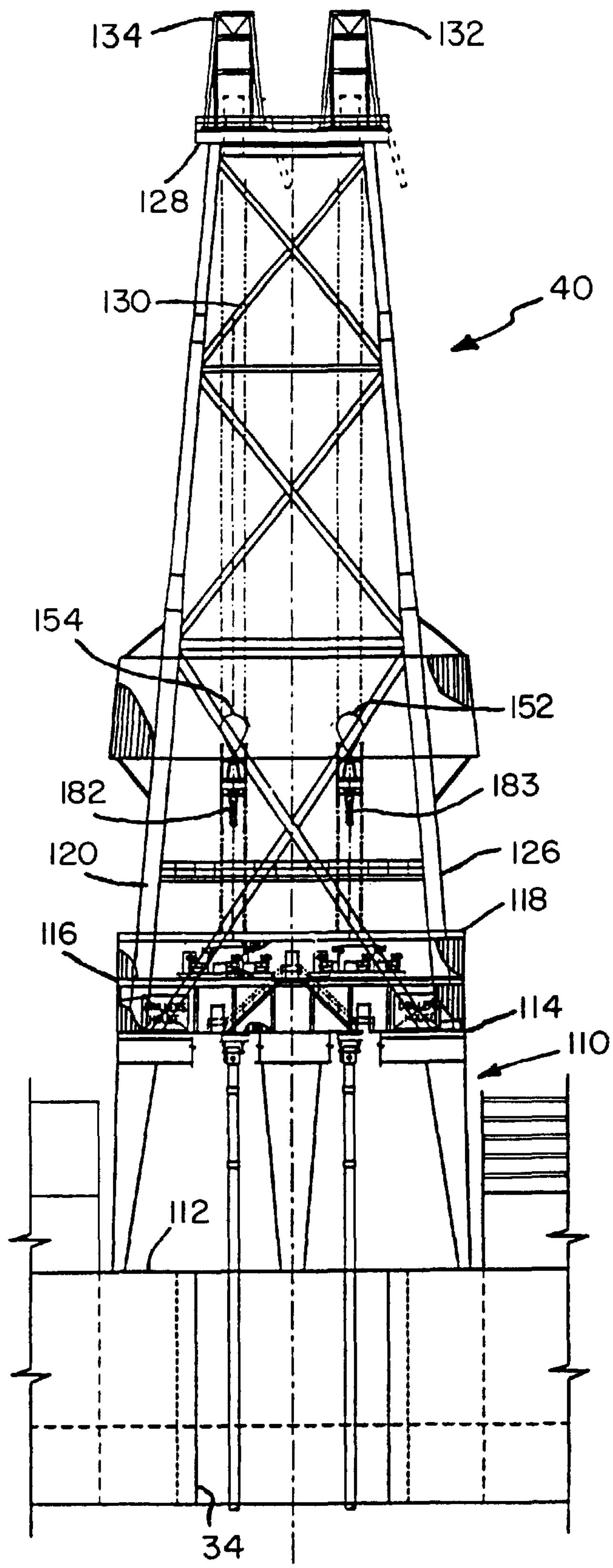

FIG. 5

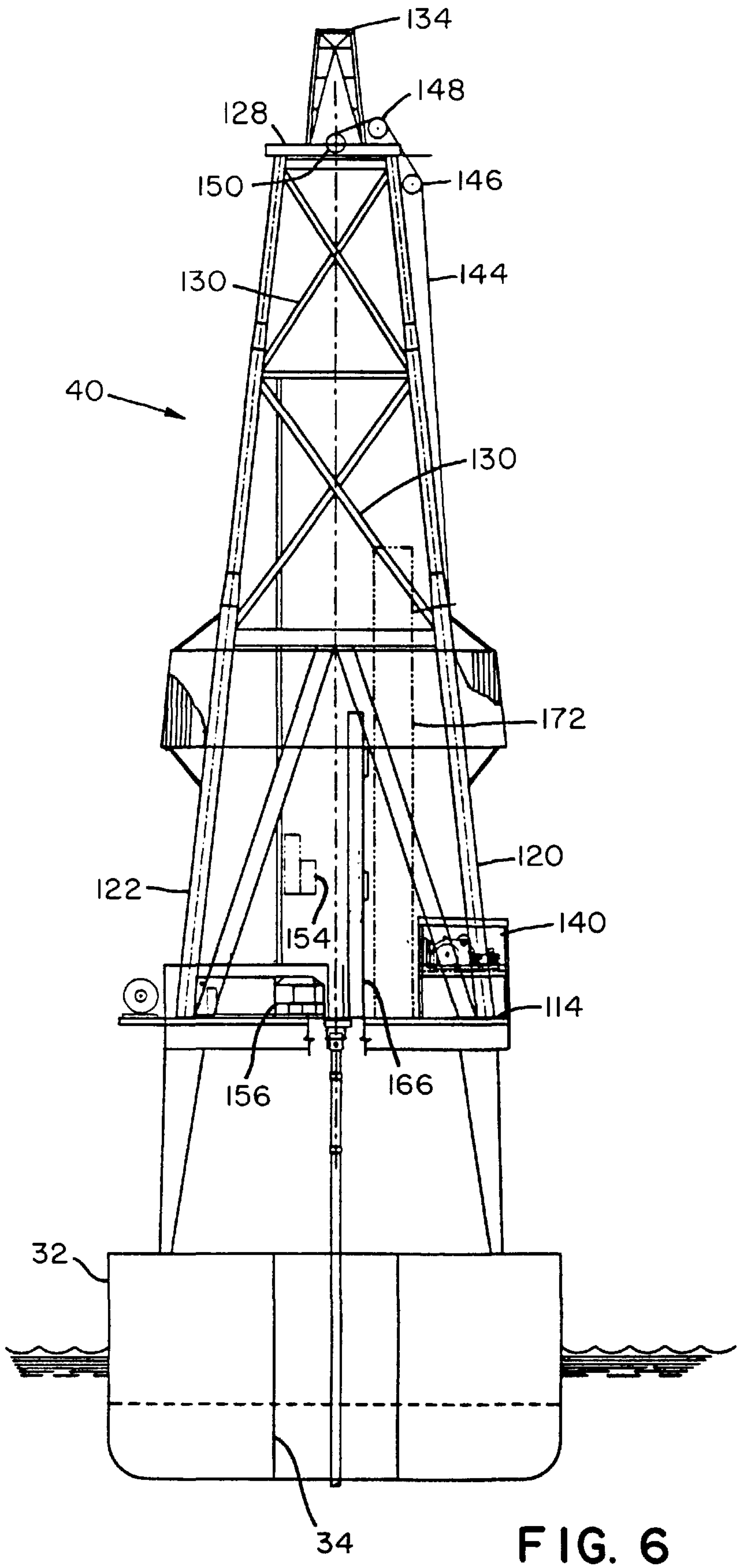
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FIG. 6

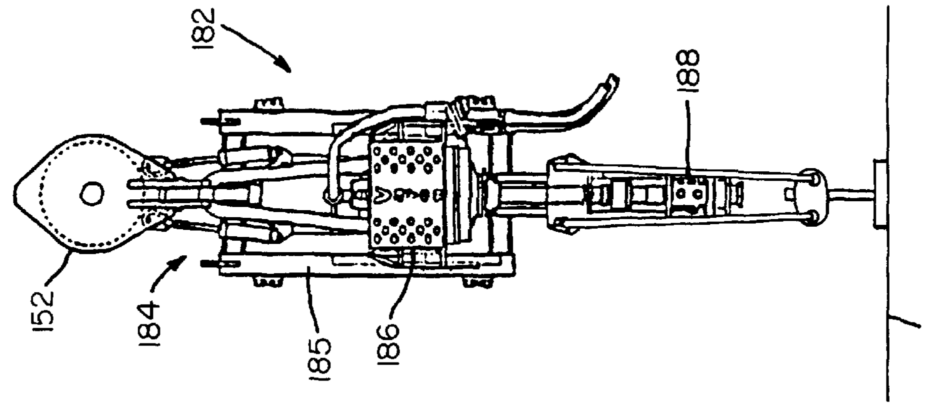
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FIG. 8

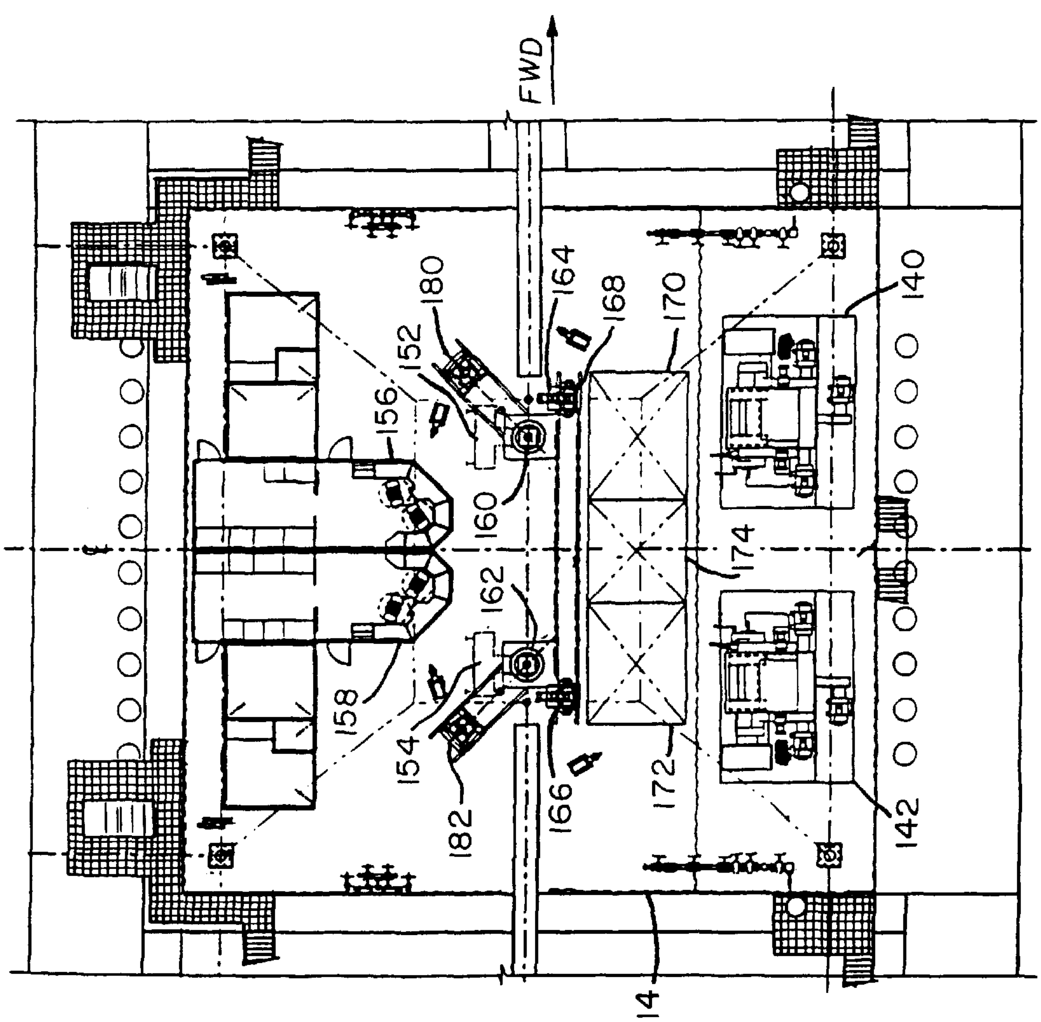
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FIG. 7

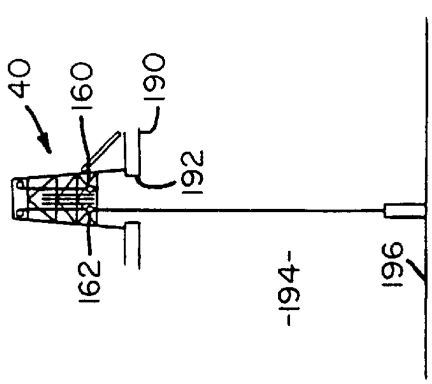

FIG. 9

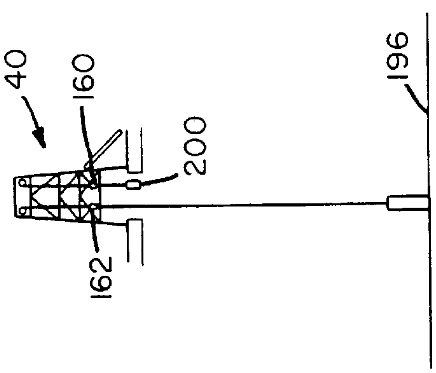

FIG. 10

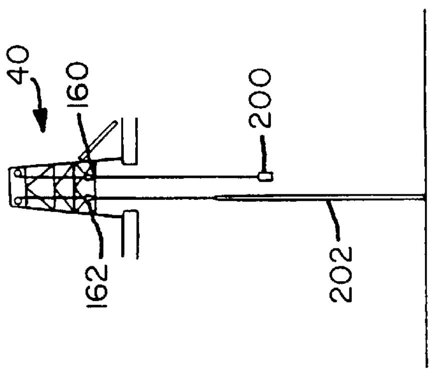

FIG. 11

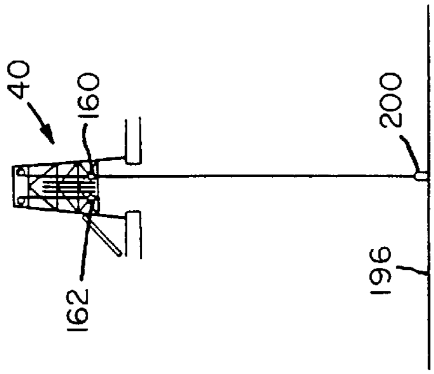

FIG. 12

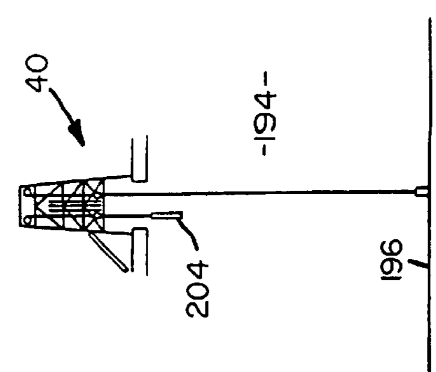

FIG. 13

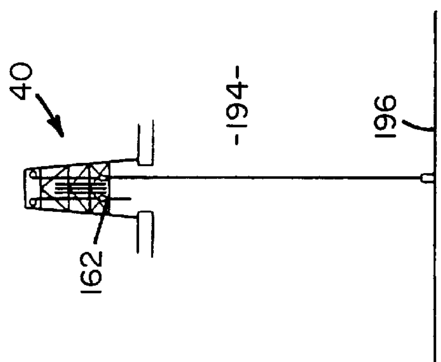

FIG. 14

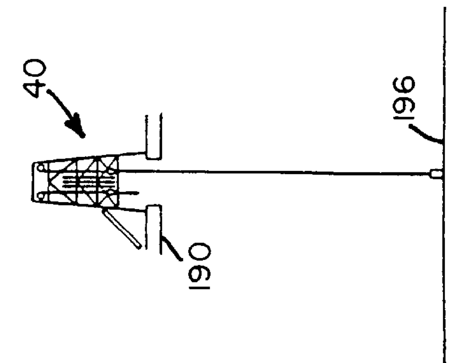

FIG. 15

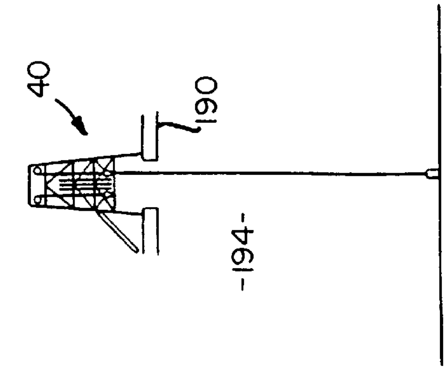

FIG. 16

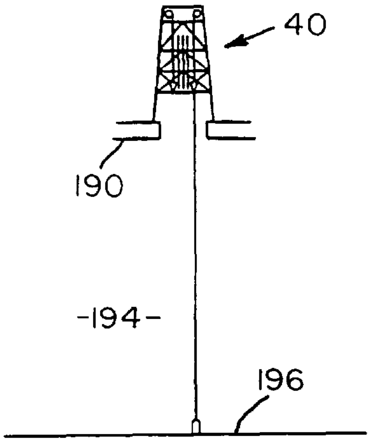

FIG. 17

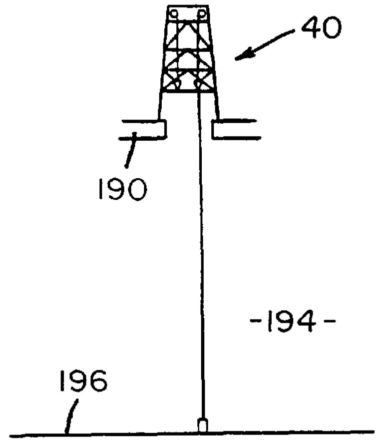

FIG. 18

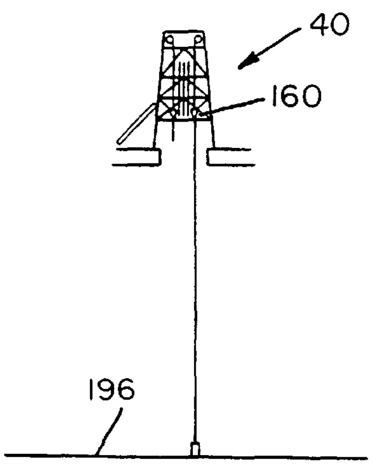

FIG. 19

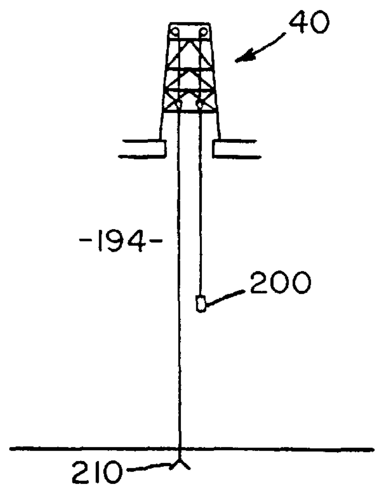

FIG. 20

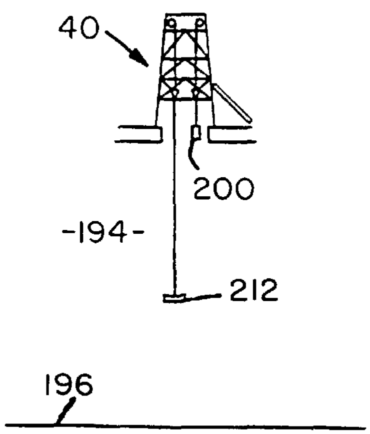

FIG. 21

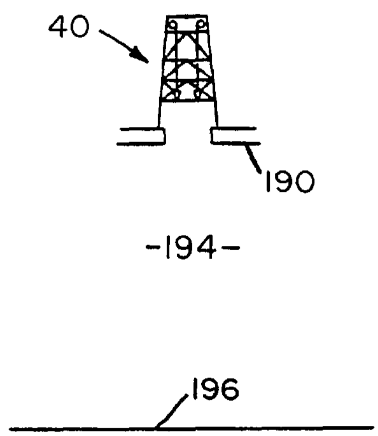

FIG. 22

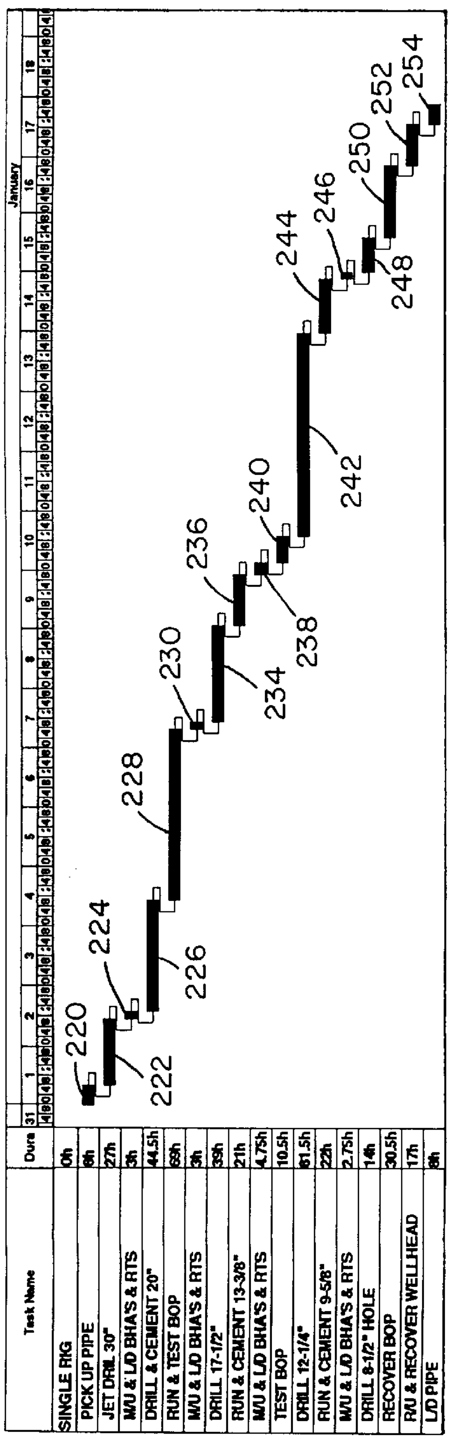

FIG. 23a

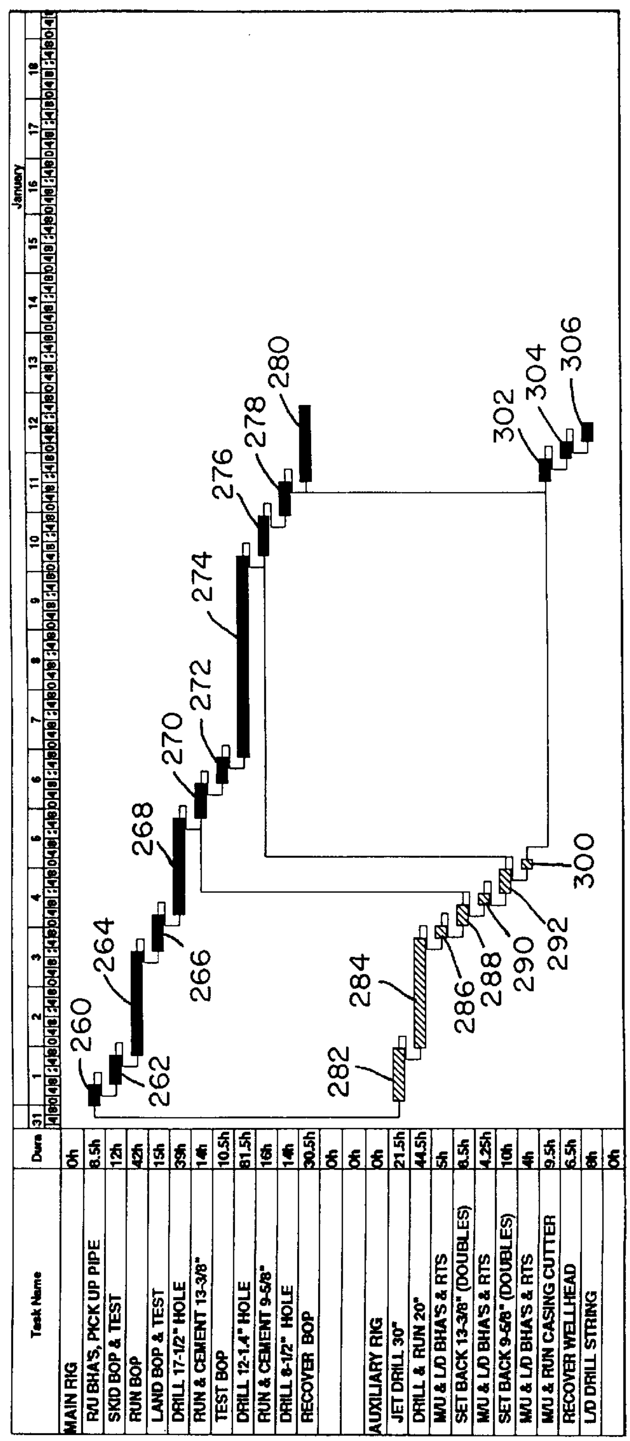

FIG. 23b

MULTI-ACTIVITY OFFSHORE EXPLORATION AND/OR DEVELOPMENT DRILLING METHOD AND APPARATUS

RELATED PATENT

This application is a continuation of application Ser. No. 08/642,417 filed May 3, 1996, entitled "Multi-Activity Offshore Exploration and/or Development Drilling Method and Apparatus" now pending of common inventorship and assignment as the subject application.

BACKGROUND OF THE INVENTION

This invention relates to a novel method and apparatus for offshore drilling operations. More specifically, this invention relates to a method and apparatus for conducting exploration drilling offshore, with a single derrick wherein primary and auxiliary exploration drilling operations may be performed simultaneously to shorten the critical path of primary drilling activity. In addition, this invention relates to a method and apparatus wherein a single derrick is operable to perform multiple drilling, development, and work over operations simultaneously.

In the past, substantial oil and gas reserves have been located beneath the Gulf of Mexico, the North Sea, the Beaufort Sea, the Far East regions of the world, the Middle East, West Africa, etc. In the initial stages of offshore exploration and/or development drilling, operations were conducted in relatively shallow water of a few feet to a hundred feet or so along the near shore regions and portions of the Gulf of Mexico. Over the years, the Gulf and other regions of the world have been extensively explored and known oil and gas reserves in shallow water have been identified and drilled. As the need for cost effective energy continues to increase throughout the world, additional reserves of oil and gas have been sought in water depths of three to five thousand feet or more on the continental shelf. As an example, one actively producing field currently exists off the coast of Louisiana in two thousand eight hundred feet of water and drilling operations off New Orleans are envisioned in the near future in approximately three thousand to seven thousand five hundred feet of water. Still further, blocks have been leased in fields of ten thousand feet and by the year 2000 it is anticipated that a desire will exist for drilling in twelve thousand feet of water or more.

Deep water exploration stems not only from an increasing need to locate new reserves, as a general proposition, but with the evolution of sophisticated three dimensional seismic imaging and an increased knowledge of the attributes of turbidities and deep water sands, it is now believed that substantial high production oil and gas reserves exist within the Gulf of Mexico and elsewhere in water depths of ten thousand feet or more.

Along the near shore regions and continental slope, oil reserves have been drilled and produced by utilizing fixed towers and mobile units such as jack-up platforms. Fixed towers or platforms are typically fabricated on shore and transported to a drilling site on a barge or self floating by utilizing buoyancy chambers within the tower legs. On station, the towers are erected and fixed to the seabed. A jack-up platform usually includes a barge or self-propelled deck which is used to float the rig to station. On site legs at the corners of the barge or self-propelled deck are jacked down into the seabed until the deck is elevated a suitable working distance above a statistical storm wave height. An example of a jack-up platform is disclosed in Richardson U.S. Pat. No. 3,412,981. A jack-up barge is depicted in U.S. Pat. No. 3,628,336 to Moore et al.

Once in position fixed towers, jack-up barges and platforms are utilized for drilling through a short riser in a manner not dramatically unlike land based operations. It will readily be appreciated that although fixed platforms and jack-up rigs are suitable in water depths of a few hundred feet or so, they are not at all useful for deep water applications.

In deeper water, a jack-up tower has been envisioned wherein a deck is used for floatation and then one or more legs are jacked down to the seabed. The foundation of these jack-up platforms can be characterized into two categories: (1) pile supported designs and (2) gravity base structures. An example of a gravity base, jack-up tower is shown in United States Herrmann et al. Pat. No. 4,265,568. Again, although a single leg jack-up has advantages in water depths of a few hundred feet, it is still not a design suitable for deep water sites.

For deep water drilling, semi-submersible platforms have been designed, such as disclosed in United States Ray et al. Pat. No. 3,919,957. In addition, tension leg platforms have been used such as disclosed in United States Steddum Pat. No. 3,982,492. A tension leg platform includes a platform and a plurality of relatively large legs extending downwardly into the sea. Anchors are fixed to the seabed beneath each leg and a plurality of permanent mooring lines extend between the anchors and each leg. These mooring lines are tensioned to partially pull the legs, against their buoyancy, into the sea to provide stability for the platform. An example of a tension leg platform is depicted in United States Ray et al. Pat. No. 4,281,613.

In even deeper water sites, turret moored drillships and dynamically positioned drillships have been used. Turret moored drillships are featured in United States Richardson et al. Pat. Nos. 3,191,201 and 3,279,404.

A dynamically positioned drillship is similar to a turret moored vessel wherein drilling operations are conducted through a large central opening or moon pool fashioned vertically through the vessel amid ships. Bow and stern thruster sets are utilized in cooperation with multiple sensors and computer controls to dynamically maintain the vessel at a desired latitude and longitude station. A dynamically positioned drillship and riser angle positioning system is disclosed in United States Dean Pat. No. 4,317,174.

Each of the above-referenced patented inventions are of common assignment with the subject application.

Notwithstanding extensive success in shallow to medium depth drilling, there is a renewed belief that significant energy reserves exist beneath deep water of seven thousand to twelve thousand feet or more. The challenges of drilling exploratory wells to tap such reserves, however, and follow on developmental drilling over a plurality of such wells, are formidable. In this it is believed that methods and apparatus existing in the past will not be adequate to economically address the new deep water frontier.

As drilling depths double and triple, drilling efficiency must be increased and/or new techniques envisioned in order to offset the high day rates that will be necessary to operate equipment capable of addressing deep water applications. This difficulty is exacerbated for field development drilling where drilling and completion of twenty or more wells is often required. In addition, work over or remedial work such as pulling trees or tubing, acidifying the well, cementing, recompleting the well, replacing pumps, etc. in deep water can occupy a drilling rig for an extended period of time.

Accordingly, it would be desirable to provide a novel method and apparatus that would be suitable for all offshore applications but particularly suited for deep water exploration and/or developmental drilling applications that would utilize drillships, semi-submersible, tension leg platforms, and the like, with enhanced efficiency to offset inherent increases in cost attendant to deep water applications.

OBJECTS OF THE INVENTION

It is, therefore, a general object of the invention to provide a novel S method and apparatus for exploration and/or field development drilling of offshore oil and gas reserves, particularly in deep water sites.

It is a specific object of the invention to provide a novel method and apparatus utilizing a multi-activity derrick for offshore exploration and/or field development drilling operations which may be utilized in deep water applications with enhanced efficiency.

It is another object of the invention to provide a novel offshore exploration and/or field development drilling method and apparatus where a is single derrick can be utilized for primary, secondary and tertiary tubular activity simultaneously.

It is a related object of the invention to provide a novel offshore exploration drilling method and apparatus wherein multi-drilling activities may be simultaneously performed within a single derrick, and thus certain tubular operations are removed from a critical path of primary drilling activity.

It is a further object of the invention to provide a novel method and apparatus where multi-tubular operations may be conducted from a single derrick and primary drilling or auxiliary tubular activity may be performed simultaneously through a plurality of tubular handling locations within a single derrick.

It is yet another object of the invention to provide a novel derrick system for offshore exploration and/or field development drilling operations which may be effectively and efficiently utilized by a drillship, semi-submersible, tension leg platform, jack-up platform, fixed tower or the like, to enhance the drilling efficiency of previously known systems.

It is yet another object of the invention to provide a novel method and apparatus for deep water exploration and/or production drilling applications with enhanced reliability as well as efficiency.

It is a further object of the invention to provide a novel method and apparatus for deep water field development drilling or work over remedial activity where multiple wells may be worked on simultaneously from a single derrick.

BRIEF SUMMARY OF A PREFERRED EMBODIMENT OF THE INVENTION

A preferred embodiment of the invention which is intended to accomplish at least some of the foregoing objects comprises a multi-activity drilling assembly which is operable to be mounted upon a deck of a drillship, semi-submersible, tension leg platform, jack-up platform, offshore tower or the like for supporting exploration and/or development drilling operations through a deck and into the bed of a body of water.

The multi-activity drilling assembly includes a derrick for simultaneously supporting exploration and/or production drilling operations and tubular or other activity auxiliary to drilling operations through a drilling deck. A first tubular station is positioned within the periphery of the derrick for conducting drilling operations through the drilling deck. A second tubular station is positioned adjacent to but spaced from the first and within the periphery of the derrick for conducting operations auxiliary to the primary drilling function.

With the above multi-activity derrick, primary drilling activity can be conducted through the first tubular station and simultaneously auxiliary drilling and/or related activity can be conducted within the same derrick through the second tubular station to effectively eliminate certain activity from the primary drilling critical path.

THE DRAWINGS

Other objects and advantages of the present invention will become apparent from the following detailed description of a preferred embodiment thereof, taken in conjunction with the accompanying drawings, wherein:

FIG. **1** is an axonometric view of a drillship of the type that is suitable to advantageously utilize the multi-activity method and apparatus of exploration and/or field development drilling in accordance with the subject invention;

FIG. **2** is a side elevational view of the multi-activity drillship disclosed in FIG. **1** with a moon pool area broken away to disclose dual tubular strings extending from a single drilling derrick;

FIG. **3** is a plan view of the drillship as disclosed in FIGS. **1** and **2** which comprise a preferred embodiment of the invention;

FIG. **4** is a plan view of a mechanical deck of the drillship depicted in FIG. **3** disclosing several operational features of the subject invention;

FIG. **5** is a starboard elevational view of the multi-activity drilling derrick in accordance with a preferred embodiment of the subject invention mounted upon a drillship substructure or cellar deck;

FIG. **6** is an aft elevation view of the multi-activity derrick depicted in FIG. **5**;

FIG. **7** is a plan view of a drilling floor for the multi-activity drilling derrick in accordance with a preferred embodiment of the invention;

FIG. **8** is an illustrative elevation view of a top drive operable to rotate and drive tubulars in accordance with a preferred embodiment of the invention;

FIGS. **9** through **22** depict a schematic sequence of views illustrating primary and auxiliary tubular activity being performed in accordance with one sequence of exploration drilling utilizing the subject method and apparatus; and

FIGS. **23***a* and **23***b* disclose a time line for an illustrative exploratory drilling operation wherein a critical path of activity for a conventional drilling operation is depicted in FIG. **23***a* and a similar critical path time line for the same drilling activity in accordance with a method and apparatus of the subject invention, is depicted in FIG. **23***b*. FIG. **23***b* discloses a dramatic increase in exploration drilling efficiency with the subject invention.

DETAILED DESCRIPTION

Context of the Invention

Referring now to the drawings wherein, like numerals indicate like parts, and initially to FIG. **1** there will be seen an axonometric view of an offshore drillship in accordance with a preferred embodiment of the subject invention. This dynamically positioned drillship discloses the best mode of practicing the invention currently envisioned by the applicants for patent. More specifically, the subject multi-activity drillship **30** comprises a tanker-type hull **32** which is fabricated with a large moon pool **34** between the bow **36** and stern **38**. A multiactivity derrick **40** is mounted upon the drillship substructure above a moon pool **34** and operable to conduct primary tubular operations and simultaneously operations auxiliary to primary tubular operations from a single derrick through the moon pool. In this application the term tubular is used as a generic expression for conduits used in the drilling industry and includes relative large riser conduits, casing and drillstrings of various diameters.

The drillship **30** may be maintained on station by being moored, or by being turret moored such as disclosed, for example, in the above-referenced Richardson U.S. Pat. Nos. 3,191,201 and 3,279,404. In a preferred embodiment the drillship **30** is accurately maintained on station by being dynamically positioned. Dynamic positioning is performed by utilizing a plurality of bow thrusters **42** and stern thrusters **44** which are accurately controlled by computers utilizing input data to control the multiple degrees of freedom of the floating vessel in varying environmental conditions of wind, current, wave swell, etc. Dynamic positioning is relatively sophisticated and by utilizing satellite references is capable of very accurately maintaining a drillship at a desired latitude and longitude, on station, over a well-head.

Multi-Activity Drillship

Referring now to FIGS. **1** through **4**, there will be seen a plurality of views which disclose, in some detail, a multi-activity drillship in accordance with a preferred embodiment of the invention. In this, FIG. **2** discloses a starboard elevation of the multi-activity drillship which includes an aft heliport **46** above ship space **50** and a main engine room **52**. Riser storage racks **54** are positioned above an auxiliary engine room **56**. First **58** and second **60** pipe racks are positioned in advance of the riser storage area **54** and above an auxiliary machine room **62**, warehouse and sack stores **64** and mud rooms **66**. A shaker house **68** extends above the mud room **66** and adjacent to an aft portion of the multi-activity derrick **40**. A first **70** and second **72** 75-ton crane, with 150-foot booms, are mounted aft of the multi-activity derrick **40** and operably are utilized, for example, in connection with the riser and pipe handling requirements of the operating drillship.

A machinery room and well testing area **74** is constructed adjacent to a forward edge of the multi-activity drill derrick **40** and an additional riser storage area **76** and crew quarters **78** are positioned forward of the well testing area as shown in FIG. **2**. Another 75-ton crane **82**, with a 150-foot boom, is positioned forward of the multi-activity derrick **40** and operably services a forward portion of the drillship.

Referring to FIGS. **3** and **4**, there will be seen plan views of a pipe deck and a machinery deck of a preferred embodiment of the drillship **30**. Looking first at FIG. **3**, a plan view of the drillship **30**, an aft heliport **46** is shown above ship space **50** and aft of a riser storage area **54**. A second riser storage area **55** is positioned adjacent storage **54** and in a similar vein pipe racks **63** and **65** are positioned adjacent to previously noted pipe racks **62** and **64** respectively. The shaker house **68** is forward of the pipe racks and adjacent to the multi-activity derrick **40** and a mudlogger **67** is shown above the mud room **66**. A catwalk **69** extends between the riser and pipe rack to facilitate transport of riser lengths, casing and drillpipe from the storage areas to the multi-purpose derrick **40**.

A well testing area **74** and **75** is shown adjacent to the derrick **40** and aft of approximately 10,000 additional feet of tubular storage racks **76** and **77**. A forward heliport **80** is shown positioned above crew quarters **78**, as previously discussed, and the forward tubular area is serviced by a 75-ton crane **82** as noted above.

A plan view of the machinery deck is shown in FIG. **4** and includes an engine room **56** having fuel tanks on the starboard side and a compressed air and water maker system **84** on the port side. Auxiliary machinery **62** such as a machine shop, welding shop, and air conditioning shop are shown positioned adjacent to switching gear, control modules and SCR room **86**. In front of the SCR room, in the machinery deck is an air conditioning warehouse **88** and stack stores **64** as previously noted. The mudpump rooms **66** include a plurality of substantially identical drilling mud and cement pumps **90** and mixing and storage tanks **92**.

The derrick footprint **94**, **96**, **98**, and **100** is shown in the cellar deck and is symmetrically positioned about a moon pool area **34**. A parallel runway extends over the moon pool and is laid between an aft subsea tree systems area and a fore subsea room area. A riser compressor room **102** is shown in a position adjacent to the forward machinery area **74** which includes a blowout preventer control area **104**.

The drilling bull may be eight hundred and fifty feet in length and of a design similar to North Sea shuttle tankers. The various modularized packages of components are facilely contained within a ship of this capacity and the dynamically positioned drillship provides a large stable platform for deep water drilling operations. The foregoing multi-activity drillship and operating components are disclosed in an illustrative arrangement and it is envisioned that other equipment may be utilized and positioned in different locations, another ship design or platform designs. However, the foregoing is typical of the primary operating facilities which are intended to be included with the subject multi-activity drillship invention.

Multi-Activity Derrick

Referring now to FIGS. **5** through **7**, there will be seen a multi-activity derrick **40** in accordance with a preferred embodiment of the invention. The derrick **40** includes a base **110** which is joined to the drillship substructure **112** symmetrically above the moon pool **34**. The base **110** is preferably square and extends upwardly to a drill floor level **114**. Above the drill floor level is a drawworks platform **116** and a drawworks platform roof **118**. Derrick legs **120**, **122**, **124**, and **126** are composed of graduated tubular conduits and project upwardly and slope inwardly from the drill floor **114**. The derrick terminates into a generally rectangular derrick top structure or deck **128**. The legs are spatially fixed by a network of struts **130** to form a rigid drilling derrick for heavy duty tubular handling and multi-activity functions in accordance with the subject invention.

As particularly seen in FIG. **5**, the derrick top **128** serves to carry a first **132** and second **134** mini-derrick which guide a sheave and hydraulic motion compensation system.

As shown in FIGS. **5** through **7**, the multi-activity derrick **40** preferably includes a first **140** and second **142** drawworks of a conventional design. A cable **144** extends upwardly from the drawworks **140** over sheaves **146** and **148** and motion compensated sheaves **150** at the top of the derrick **40**. The drawwork cabling extends downwardly within the derrick to first **152** and second **154** travelling blocks, note again FIG. **5**. Each of the drawworks **140** and **142** is independently controlled by distinct driller consoles **156** and **158** respectively.

The foregoing described drawworks and other functionally equivalent systems, including specific structural components not yet envisioned, provide a means for hoisting tubular members for advancing and retrieving tubular members during drilling, work over or completion operations and the like.

The derrick drilling floor **114** includes, first and second tubular advancing stations **160** and **162** which in one embodiment, comprises a first rotary table and a second, substantially identical, rotary table. The rotary tables are positioned in a mutually spaced relationship, symmetrically, within the derrick **40** and, in one embodiment, along a center line of the drillship **30**.

Other envisioned embodiments include rotary tables positioned from side-to-side across the ship or even on a bias. The drawworks **140** is positioned adjacent to the first tubular **160** and drawworks **142** is positioned adjacent to the second tubular advanced station **162** and operably serves to conduct drilling operations and/or operations auxiliary to drilling operations through the moon pool **34** of the drillship. Each tubular advancing station includes, in one embodiment, a rotary machine, rotary drive, master bushings, kelly drive bushings and slips. In addition, each tubular advancing station **160** and **162** operably include an iron roughneck, a pipe tong, a spinning chain, a kelly and a rotary swivel for making up and tearing down tubulars in a conventional manner.

A first pipe handling apparatus **164** and a second pipe handling apparatus **166** is positioned, in one embodiment, upon a rail **168** which extends from a location adjacent to the first tubular advancing station **160** to the second tubular advancing station **162**. A first conduit setback envelope **170** is located adjacent to said first pipe handling apparatus **164** and a second pipe setback envelope **172** is positioned adjacent to the second pipe handling apparatus **166**. A third conduit setback envelope **174** may be positioned between the first setback envelope **170** and the second setback envelope **172** and is operable to receive conduits from either of said first conduit handling apparatus **164** or said second conduit handling apparatus **166** as they translate upon the rail **168**. Positioned adjacent the first tubular advancing station **160** is a first iron roughneck **180** and a second iron roughneck **181** is positioned adjacent to the second tubular advancing station **162**. The iron roughnecks are operably utilized in cooperation with the rotary stations **160** and **162**, respectively to make-up and break down tubulars.

It will be seen by reference particularly to FIG. **7** that the rail **168** permits the first tubular handling assembly **164** to setback and receive conduit from any of the tubular setback envelopes **170**, **172**, and **174**. The primary utilization for pipe handling assembly **164**, however, will be with respect to setback envelopes **170** and **174**. In a similar manner the rail **168** permits the second tubular handling assembly **166** to transfer conduits such as riser, casing or drill pipe between the second rotary station **162** and tubular setback envelopes **172**, **174**, and **170**, however, the tubular handling assembly **166** will be utilized most frequently with conduit setback envelopes **172** and **174**. Although rail supported pipe handling systems are shown in FIG. **7**, other tubular handling arrangements are contemplated by the subject invention such as a rugged overhead crane structure within the derrick **40**. A common element however, among all systems will be the ability to make-up and break down tubulars at both the first and second tubular stations for advancing tubulars through the moon pool. In addition, a characteristic of tubular handling systems will be the ability to pass tubular segments back and forth between the first station for advancing tubulars through the moon pool and the second station for advancing tubulars and the setback envelopes as discussed above.

In a presently preferred embodiment, the rotary function is applied to tubulars performed by a first **182** and second **183** top drive device, note again FIG. **5**. Each top drive device is similar and the unit **182** is shown more particularly in FIG. **8**. The top drive is connected to traveling block **152** and is balanced by hydraulic balancing cylinders **184**. A guide dolly **185** supports a power train **186** which drives a tubular handling assembly **188** above drill floor **114**.

Although a rotary table system of tubular advancement and top drive have both been disclosed and discussed above, the top drive system is presently preferred. In certain instances, both systems may even be installed on a drillship. Still further, other systems may ultimately be envisioned, however, an operational characteristic of all tubular advancing systems will be the ability to independently handle, make-up or break down, set back, and advance tubulars through multi-stations over of a moon pool and into the seabed.

It will be appreciated by referring to and comparing FIGS. **5**, **6**, and **8** that the multi-activity derrick **40** comprises two identical top drives and/or separate rotary tables, drawworks, motion compensation and travelling blocks positioned within a single, multi-purpose derrick. Accordingly, the subject invention enables primary drilling activity and auxiliary activity to be conducted simultaneously and thus the critical path of a drilling function to be conducted through the moon pool **34** may be optimized. Alternatively, units are envisioned which will not be identical in size or even function, but are nevertheless capable of handling tubulars and passing tubulars back and forth between tubular advancing stations within a single derrick. Further, in a preferred embodiment, the multi-activity support structure is in the form of a four sided derrick. The subject invention, however, is intended to include other superstructure arrangements such as tripod assemblies or even two adjacent upright but interconnected frames and superstructures that are operable to perform a support function for more than one tubular drilling or activity for conducting simultaneous operations through the deck of a drillship, semi-submersible tension leg platform, or the like.

Method of Operation

Referring now specifically to FIGS. **9** through **22**, there will be seen a sequence of operation of the subject multi-activity derrick and drillship wherein a first or main tubular advancing station is operable to conduct primary drilling activity and a second or auxiliary tubular advancing station is utilized for functions critical to the drilling process but can be advantageously removed from the drilling critical path to dramatically shorten overall drilling time.

Turning specifically to FIG. **9**, there is shown by a schematic cartoon a multi-activity derrick **40** positioned upon a drilling deck **190** of a drillship, semi-submersible, tension leg platform, or the like, of the type discussed above.

A moon pool opening in the drilling deck **192** enables tubulars such as risers, casing or drill pipe to be made up within the derrick **40** and extended through a body of water **194** to conduct drilling activity and/or activity associated with drilling within and upon the seabed **196**.

The main drilling station **160** is utilized to pick up and make up a thirty inch jetting assembly for jetting into the seabed and twenty six inch drilling assemblies and places them within the derrick setback envelopes for the auxiliary station **162** to run inside of thirty inch casing. The main rig then proceeds to makeup eighteen and three fourths inch wellhead and stands it back in the derrick for the twenty inch tubular casing run.

At the same time the auxiliary station **162** is used to pick up the thirty inch casing and receives the jetting assembly from the main rig and runs the complete assembly to the seabed where it begins a thirty inch casing jetting operation.

Referring to FIG. **10**, the main rig skids a blowout preventer stack **200** under the rig floor and carries out a functioning test on the stack and its control system. At the same time the auxiliary rig and rotary station **162** are used to jet in and set the thirty inch casing. The auxiliary rig then disconnects the running tool from the wellhead and drills ahead the twenty six inch hole section.

In FIG. **11** the main rig is utilized to start running the blowout preventer stack **200** and drilling riser to the seabed. Simultaneously the auxiliary rig, including second rotary station **162**, is utilized to complete drilling of the twenty six inch hole section and then pulls the twenty six inch drilling assembly to the surface. The auxiliary station then rigs up and runs twenty inch tubular casing **202** and after landing the twenty inch casing in the wellhead the auxiliary rig then hooks up cement lines and cements the twenty inch casing in place. The auxiliary rig then retrieves the twenty inch casing landing string.

In FIG. **12** the main rig and rotary station **160** lands the blowout preventer **200** onto the wellhead and tests the wellhead connection. At the same time, the auxiliary rotary station **162** is utilized to lay down the thirty inch jetting and twenty six inch drilling assembly. After this operation is complete the auxiliary rotary station **162** is utilized to makeup a seventeen and one half inch bottom hole assembly and places the assembly in the derrick for the primary or main rotary assembly to pick up.

In FIG. **13** the main rotary assembly picks up the seventeen and one half inch hole section bottom hole assembly **204**, which was previously made up by the auxiliary rig, and runs this and drillpipe in the hole to begin drilling the seventeen and one half inch section. At the same time, the auxiliary rotary station picks up single joints of thirteen and three eighths inch casing from the drillship pipe racks, makes them up into one hundred and twenty five foot lengths and then stands the lengths back in the derrick envelopes in preparation for the thirteen and three eighths inch casing run.

In FIG. **14** the main rotary station **160** completes drilling the seventeen and one half inch hole section. The drilling assembly is then retrieved back to the surface through the moon pool and the main rotary station then proceeds to rig up and run the thirteen and three eighths inch casing segments which were previously made up and set back within the derrick. After landing the casing in the wellhead, the rig cements the casing in place. At the same time the auxiliary rotary station **162** picks up single joints of nine and drive eights inch casing from the drillship pipe racks, makes them up into triples and then stands them back in the derrick tubular handling envelopes in preparation for a nine and five eights inch casing run.

In FIG. **15** the primary rotary station tests the blowout preventer stack after setting the thirteen and three eighths inch seal assembly and the auxiliary rotary station changes the bottom hole assembly from seventeen and one half inches to twelve and one quarter inch assembly. The twelve and one quarter inch assembly is then set back in the derrick conduit handling envelopes in a position where they can be picked up by the main rotary station.

In FIG. **16** the primary rotary station **160** is used to run in the hole with twelve and one quarter inch bottom hole assembly and begins drilling the twelve and one quarter inch hole section. At the same time the auxiliary rotary station is utilized to make up nine and five eights inch casing running tool and cement head and then stands both of these complete assemblies back in the conduit handling envelopes of the derrick in preparation for a nine and five eights inch casing run.

In FIG. **17** the primary rotary station **160** is utilized to complete drilling the twelve and one quarter inch hole section and retrieves the twelve and one quarter inch assembly back to the surface. The primary rotary station then rigs up and runs the nine and five eighths inch casing in the hole and cements the casing in place. At the same time the auxiliary rotary station changes the bottom hole assembly from twelve and one quarter inch to eight and one half-inch and stands the eight and one half-inch assemblies back in the derrick to be picked up by the primary rotary station.

In FIG. **18** the primary rotary station is shown running in the hole with eight and one half-inch drilling assemblies and begins to drill the eight and one half-inch hole with the first rotary top drive. During this operation the auxiliary rotary station is used to make up a casing cutter.

In FIG. **19** the primary rotary station **160** completes drilling the eight and one quarter inch hole section and retrieves the drilling assembly back to the surface. The primary rotary station then proceeds to rig down the riser and begins to recover the blowout preventer stack **200**.

As shown in FIG. **20**, once the blowout preventer **200** is clear of the wellhead, the auxiliary rotary station runs in the hole with a casing cutter **210** and cuts the casing.

In FIG. **21** the primary rotary station is used to continue recovering the blowout preventer stack **200** and the auxiliary rotary station is used to recover the wellhead **212**.

In FIG. **22** the primary rotary station prepares for moving the drillship and the auxiliary rotary station assists in that operation.

COMPARATIVE ANALYSIS

Referring now specifically to FIG. **23***a*, there will be seen an illustrative time chart of typical drilling activity for an offshore well in accordance with a conventional drilling operation. The filled in horizontal bars represent time frames along an abscissa and tubular activity is shown along an ordinate. As an initial operation, eight hours, note bar **220**, are utilized to pick up pipe and twenty seven hours, note bar **222**, are then required to jet drill thirty inch casing in place. Three hours are then used to make up and lay down bottom hole assemblies and running tools, see time bar **224**. Next, forty four and one half hours, note bar **226**, are required to drill and cement twenty inch casing. Sixty-nine hours **228** are necessary to run and test a blowout preventer. Three hours are required to make up and lay down bottom hole assemblies and running tools see time bar **230**. Next, in sequence thirty nine hours, note bar **234**, and twenty one hours, note bar **236**, are used to run and cement thirteen and three eighths inch casing. Four and three quarter hours are used to make up and lay down bottom hole assemblies and running tools, note bar **238**, and ten and one half hours are used to test the blowout preventer, note bar **240**. Next, eighty one and one half hours, note bar **242**, are utilized to drill twelve and one quarter inch drill string and twenty two hours are used to run and cement nine and five eights inch casing, note bar **244**. Two and three quarter hours are then necessary to make up and lay down bottom hole assemblies and running tools, note bar **246**, and fourteen hours, note bar **248**, are utilized to drill eight and one half-inch hole. Next, thirty and one half hours are spent recovering the blowout preventer, note bar **250**, seventeen hours are used to run up and recover the wellhead, as depicted by time bar **252**, and finally the drill pipe is laid down requiring eight hours, see time bar **254**.

In contrast to a conventional drilling sequence, an identical drilling operation is depicted by a time chart in FIG. **23***b* in accordance with the subject invention, where a main and auxiliary tubular station are simultaneously utilize in a preferred embodiment of the subject invention, to dramatically decrease the overall drilling time and thus increase efficiency of the drilling operation. More specifically, it will be seen that the main drilling operation can be conducted through a first tubular advancing station and the critical path of the drilling sequence is depicted with solid time bars whereas auxiliary activity through a second tubular advancing station is shown by crossed hatched time bars.

Initially eight and one half hours are utilized by the primary rotary station to rig up a bottom hole assembly an d pick up pipe, note time bar **260**. Next, the blowout preventer is skidded to position and tested which utilizes twelve hours, as shown by time bar **262**. Forty two hours are then required to run the blowout preventer to the seabed as shown by time bar **264** and **15** hours, as shown by time bar **266**, are used to land and test the blowout preventer. Next, the seventeen and one half inch hole is drilled by the primary rotary station and rotary table **160** for 39 hours as depicted by time bar **268**. Subsequently, the thirteen and three eighths inch casing is run and cemented in place utilizing fourteen hours as depicted by time bar **270**.

The next operation requires ten and one half hours to test the blowout preventer as shown by time bar **272**. Eighty one and one half hours are used by the primary rotary station and rotary table **160** to drill the twelve and one quarter inch hole as depicted by time bar **274**. Time bar **276** discloses sixteen hours to run and cement the nine and five eighths inch casing. An eight and one half inch drill hole then consumes fourteen hours as depicted by time bar **278** and finally the main rig utilizes thirty and one half hours as depicted by time bar **280** to recover the blowout preventer.

During this same time sequence the second or auxiliary tubular advancing station **162** is used to jet drill the thirty inch casing in twenty one and one half hours as shown by hashed time bar **282**. Then the twenty inch casing is drilled and run during a period of forty four and one half hours as shown by time bar **284**. The auxiliary rig is then used for five hours to make up and lay down bottom hole assemblies and running tools for five hours as shown by time bar **286**. Eight and one half hours are used to set back thirteen and three eighths inch doubles as shown in time bar **288**. Time bar **290** illustrates the use of four and one quarter hours to make up and lay down bottom hole assemblies and running tools, and ten hours are required, as shown in time bar **292**, to set back nine and five eights inch doubles. Four hours are then required as shown by time bar **300** to make up and lay down bottom hole assemblies and running tools and then nine and one half hours are used to make up and run a casing cutter as depicted by time bar **302**. The wellhead is then recovered in six and one half hours as shown on time bar **304** and finally eight hours are utilized as depicted in time frame **206** to lay down the drill string.

By comparing the identical sequence of events from a conventional drilling operation to the subject multi-activity drilling method and apparatus, it will be appreciated that the critical path has been substantially reduced. In this particular example of exploration drilling activity, the time saving comprises twenty nine percent reduction in time for a drilling operation. In other instances, and depending upon the depth of the water, this time sequence could be longer or shorter, but it will be appreciated by those of ordinary skill in the art that as the depth of water increases, the advantage of a multi-activity drilling method and apparatus in accordance with the subject invention increases.

The above example is illustrated with respect to an exploration drilling program. Developmental drilling actively may be required which would involve twenty or more wells. In this event, the subject invention can advantageously conduct multiple well developmental drilling activity, or work over activity, simultaneously on multiple wells, and again dramatically reduce the amount of time the drillship will be required to stay on site.

SUMMARY OF MAJOR ADVANTAGES OF THE INVENTION

After reading and understanding the foregoing description of preferred embodiments of the invention, in conjunction with the illustrative drawings, it will be appreciated that several distinct advantages of the subject multi-activity drilling method and apparatus are obtained.

Without attempting to set forth all of the desirable features and advantages of the instant method and apparatus, at least some of the major advantages of the invention are depicted by a comparison of FIG. **23***a* and FIG. **23***b* which visually illustrates the dramatic enhancement in efficiency of the subject invention. As noted above, even greater time efficiencies will be realized in developmental drilling or well remedial works over activity.

The enhanced drilling time, and thus cost savings, is provided by the multi-activity derrick having substantially identical tubular advancing stations wherein primary drilling activity can be conducted within the derrick and auxiliary activity concomitantly conducted from the same derrick and through the same moon pool.

The derrick includes dual rotary stations, and in a preferred embodiment top drives and a dual tubular handling system. A plurality of tubular set back envelopes are positioned adjacent the dual rotary station, and first and second conduit handling assemblies operably transfer riser segments, casing, and drillpipe assemblies between the first and second tubular advancing stations and any of the set back envelopes. The dual derrick drawworks are independently controlled by substantially identical drill consoles mounted upon the drilling floor of the derrick such that independent operations can be performed simultaneously by a main drilling rotary station through a moon pool while auxiliary operations can be simultaneously conducted through a second rotary station and the moon pool.

The multi-station derrick enables a driller to move many rotary operations out of the critical path such as blowout prevention and riser running while drilling a top hole; making up bottom hole assemblies or running tools with an auxiliary rotary while drilling with a primary rotary station; making up and standing back casing with the auxiliary rotary while drilling with the primary rotary assembly; test running; measurements while drilling while continuing primary drilling activity; and deploying a high-pressure second stack/riser outside of primary rig time. Still further, the subject invention permits an operator to rig up to run trees with the auxiliary rotary station while carrying out normal operations with a primary rotary station; running a subsea tree to the bottom with the auxiliary rotary station while completing riser operations and simultaneously running two subsea trees, bases, etc.

In describing the invention, reference has been made to preferred embodiments and illustrative advantages of the invention. In particular, a large, tanker dimension drillship **30** has been specifically illustrated and discussed which is the presently envisioned preferred embodiment. It will be appreciated, however, by those of ordinary skill in the art, that the subject single derrick with multi-rotary structure may be advantageously utilized by other offshore platform systems such as jack-ups, semi-submersibles, tension leg platforms, fixed towers, and the like, without departing from the subject invention. Those skilled in the art, and familiar with the instant disclosure of the subject invention, may also recognize other additions, deletions, modifications, substitutions, and/or other changes which will fall within the purview of the subject invention and claims.

What is claimed is:

1. A drillship having a bow, a stern and an intermediate moon pool between the bow and stern and being fitted to conduct offshore drilling operations through the moon pool and into the bed of a body of water, said drillship including:

a derrick positioned upon the drillship and extending above the moon pool for simultaneously supporting drilling operations and operations auxiliary to drilling operations through the moon pool;

a first means connected to said derrick for advancing tubular members through the moon pool, to the seabed and into the bed of the body of water;

first means, connected to said derrick, for handling tubular members as said tubular members are advanced through the moon pool by said first means for advancing;

a second means connected to said derrick for advancing tubular members through the moon pool, to the seabed and into the bed of the body of water;

second means, connected to said derrick, for handling tubular members as said tubular members are advanced through the moon pool by said second means for advancing for conducting operations extending to the seabed auxiliary to said drilling operations; and

means positioned within said derrick for transferring tubular assemblies between said first means for advancing tubular members and said second means for advancing tubular members to facilitate simultaneous drilling operations and operations auxiliary to said drilling operations, wherein said drilling activity can be conducted from said derrick by said first or second means for advancing and said first or second means for handling tubular members and auxiliary drilling activity can be simultaneously conducted from said derrick by the other of said first or second means for advancing and the other of said first or second means for handling tubular members.

2. A drillship as defined in claim **1** wherein said first and second means for advancing tubular members comprises:

a first and second top drive assembly respectively.

3. A drillship as defined in claim **1** wherein said first and second means for advancing tubular members comprises:

a first and second rotary table positioned within said derrick.

4. A drillship as defined in claim **1** wherein said means for transferring includes:

a rail assembly operably extending between a position adjacent to said first means for advancing tubular members and a position adjacent to said second means for advancing tubular members;

said first means for handling tubular members being mounted to traverse upon said rail wherein conduit assemblies may be operably transferred between said first means for advancing tubular members and said second means for advancing tubular members to facilitate simultaneous drilling operations and operations auxiliary to said drilling operations.

5. A drillship as defined in claim **3** wherein:

said first rotary table and said second rotary table being mutually spaced along a center line of the drillship and within the periphery of said derrick.

6. A drillship as defined in claim **1** and further including:

a first driller's console operable to control said first means for advancing tubular members; and

a second driller's console substantially similar to said first driller's console and being operable to independently control said second means for advancing tubular members.

7. A drillship as defined in claim **1** and further including:

a first tubular setback envelope positioned adjacent to said first means for advancing tubular members; and

a second tubular setback envelope positioned adjacent to said second means for advancing tubular members.

8. A drillship as defined in claim **7** and further including:

a third tubular setback envelope positioned between said first tubular setback envelope and said second tubular setback envelope.

9. A drillship as defined in claim **7** and further including:

a tubular handling system for transferring tubular members between said first tubular setback envelope and said second tubular setback envelope and

said first means for advancing tubular members and said second means for advancing tubular members.

10. A multi-activity drilling assembly operable to be mounted upon a drilling deck of a drillship, semi-submersible, tension leg platform, jack-up-platform, or offshore tower and positioned above the surface of a body of water for supporting drilling operations through the drilling deck, to the seabed and into the bed of the body of water, said multi-activity drilling assembly including:

a derrick operable to be positioned above a drilling deck and extending over an opening in the drilling deck for simultaneously supporting drilling operations and operations auxiliary to drilling operations through the drilling deck;

a first top drive positioned within the periphery of said derrick;

a first drawworks positioned adjacent to said derrick and operably connected to a first traveling block positioned within said derrick adjacent to said top drive for conducting drilling operations on a well through the drilling deck;

a second top drive positioned within the periphery of said derrick;

a second drawworks positioned adjacent to said derrick and operably connected to a second traveling block positioned within said derrick adjacent to said second top drive for conducting drilling operations or operations auxiliary to said drilling operations extending to the seabed for the well; and

means positioned within said drilling derrick for transferring tubular assemblies between a first top drive station and a second top drive station to facilitate simultaneous drilling operations and operations to the seabed auxiliary to said drilling operations, wherein drilling activity can be conducted within said derrick with said first or second top drive, said first or second drawworks and said first or second traveling block and auxiliary drilling activity extending to the seabed can be simultaneously conducted within said derrick with the other of said first or second top drive, the other of said first or second drawworks and the other of said first or second traveling block.

11. A multi-activity drilling assembly as defined in claim 10 wherein said means for transferring includes:

a rail assembly operably extending between a position adjacent to said first top drive station and a position adjacent to said second top drive station;

a first tubular handling apparatus mounted to traverse upon said rail; and

a second tubular handling apparatus mounted to traverse upon said rail, wherein tubular assemblies may be operably transferred between said first top drive and said second top drive to facilitate simultaneous drilling operations and operations auxiliary to said drilling operations.

12. A multi-activity drilling assembly as defined in claim 11 and further including:

a first tubular setback envelope positioned adjacent to said first top drive station; and

a second tubular setback envelope positioned adjacent to said second top drive station.

13. A multi-activity drilling assembly as defined in claim 12 and further including:

a tubular handling system for transferring tubular assemblies between said first tubular setback envelope and said second tubular setback envelope and said first top drive station and said second top drive station.

14. A multi-activity drilling assembly as defined in claim 10 wherein said pipe handling system includes:

a rail assembly operably extending between a position adjacent to said first top drive station and a position adjacent to said second top drive station; and

at least one tubular handling apparatus operable for traveling upon and along said rail assembly.

15. A method for conducting offshore drilling operations for a single well from a drillship having a moon pool and a derrick positioned above the moon pool and a first tubular station and a second tubular station, the method including the steps of:

advancing tubular members from the first tubular station through the moon pool, through the body of water and into the bed of a body of water for drilling a well;

advancing tubular members from the second tubular station through the moon pool and into the body of water to the seabed for conducting operations auxiliary to drilling the well; and

transferring tubular members between the first tubular station and the second tubular station wherein primary drilling activity for the well can be conducted from the derrick by advancing tubular members from the first tubular station and auxiliary drilling activity for drilling the well can be simultaneously conducted to the seabed from the derrick by advancing tubular members from the second tubular station.

16. A method for conducting offshore drilling operations as defined in claim 15 wherein said step of advancing the tubular members from the first tubular station functions includes:

rotating the tubular members with a first top drive supported from the derrick.

17. A method for conducting offshore drilling operations as defined in claim 11 wherein said step of advancing the tubular members from the second tubular stations includes:

rotating the tubular members with a second top drive supported from the derrick.

18. A method for conducting offshore drilling operations as defined in claim 15 wherein said step of advancing tubular members from the second station includes:

making up new drilling assemblies with a rotary table and drawworks.

19. A method for conducting offshore drilling operations as defined in claims 18 wherein said step of advancing tubular members includes:

running a blowout prevention unit from the first tubular advancing station while simultaneously drilling and running casing from the second tubular advancing station.

20. A method for conducting offshore drilling operations with a multi-activity drilling assembly operable to be mounted upon a drilling deck positioned above the surface of a body of water and having a first tubular station and a second tubular station, the method including the steps of:

advancing tubular members from the first tubular station and into the bed of a body of water for conducting drilling operations for a well;

advancing tubular members from the second tubular station and into the body of water to the seabed for conducting activity auxiliary to drilling activity for the well; and

transferring tubular members between the first tubular station and the second tubular station wherein primary drilling activity can be conducted by advancing tubular members from the first tubular station and auxiliary drilling activity can be conducted simultaneously for the well by advancing tubular members to the seabed from the second tubular station.

21. A method for conducting offshore drilling operations as defined in claim 20 wherein said step of advancing the tubular members from the first tubular station functions includes:

rotating the tubular members with a first top drive supported from an upright superstructure.

22. A method for conducting offshore drilling operations as defined in claim 21 wherein said step of advancing the tubular members from the second tubular stations includes:

rotating the tubular members with a second top drive supported from an upright superstructure.

23. A method for conducting offshore drilling operations as defined in claim 20 wherein said step of advancing tubular members from the first second tubular stations includes:

rotating tubular members at said first tubular station with a rotary table; and rotating tubular members at said second tubular station with a second rotary table.

24. A method for conducting drilling operations as defined in claim 20 wherein said steps of advancing first and second tubular members includes:

hoisting tubular members from a first tubular station; and

hoisting tubular members from a second tubular station respectively.

25. A multi-activity assembly operable to be positioned above the surface of a body of water for conducting at least one of work over and completion operations from a drilling deck, to the seabed and into the bed of the body of water, said multi-activity assembly including:

a superstructure operable to be mounted upon a drilling deck for simultaneously supporting at least one of a work over and completion operation for a well and supporting operations to the seabed auxiliary to said at least one of said work over and completion operations for the well;

first means connected to said drilling superstructure for advancing tubular members to the seabed and into a well at the bed of the body of water;

second means connected to said superstructure for advancing tubular members, simultaneously with said first means into the body of water to the seabed; and

means for transferring tubular members between said first means for advancing tubular members and said second means for advancing tubular members, wherein at least one of said work over and completion activity can be conducted for a well from said superstructure by said first means for advancing tubular members to the seabed and auxiliary activity can be simultaneously conducted to the seabed for the well from said superstructure by said second means for advancing tubular members.

26. A multi-activity assembly operable to be supported from a drilling deck and positioned above the surface of a body of water, as defined in claim **25**, wherein said first and second means for advancing tubular members include:

a first and second top drive assembly respectively.

27. A multi-activity assembly operable to be supported from a drilling deck and positioned above the surface of a body of water, as defined in claim **25**, wherein said first and second means for advancing tubular members include:

a first and second rotary table respectively.

28. A multi-activity assembly operable to be supported from a drilling deck and positioned above the surface of a body of water, as defined in claim **25**, wherein said first and second means for advancing tubular members include:

a first and second means for hoisting tubular members respectively.

29. A method for conducting at least one of work over and completion offshore operations with a multi-activity drilling assembly operable to be positioned above the surface of a body of water, the method including the steps of:

advancing tubular members from a first tubular station to the seabed and into a well at the bed of the body of water for conducting activity for at least one of said work over and completion operations for a well;

advancing tubular members from a second tubular station into the body of water to the seabed for conducting activity for at least one of said work over and completion operations for the well; and

transferring tubular members between the first tubular station and the second tubular station wherein primary activity can be conducted to the seabed by advancing tubular members from the first tubular station and auxiliary activity can be conducted to the seabed simultaneously for the well by advancing tubular members from the second tubular station.

30. A multi-activity drilling assembly operable to be supported from a position above the surface of a body of water for conducting drilling operations into the bed of the body of water, said multi-activity drilling assembly including:

a drilling superstructure operable to be mounted upon a drilling deck for simultaneously supporting drilling operations for a well and operations auxiliary to drilling operations for the well;

first means connected to said drilling superstructure for advancing tubular members into the bed of body of water, wherein said first means includes a first means for hoisting tubular members;

second means connected to said drilling superstructure for advancing tubular members simultaneously with said first means into the body of water to the seabed, wherein said second means includes a second means for hoisting tubular members; and

means positioned adjacent to said first and second means for advancing tubular members for transferring tubular assemblies between said first means for advancing tubular members and said second means for advancing tubular members to facilitate simultaneous drilling operations auxiliary to said drilling operations, wherein drilling activity can be conducted for the well from said drilling superstructure by said first means for advancing tubular members and auxiliary drilling activity can be simultaneously conducted for the well from said drilling superstructure by said second means for advancing tubular members.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 6,047,781

DATED : April 11, 2000

INVENTOR(S) : Robert J. Scott, et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the drawings, Sheet 5, Fig. 7, the reference numeral "182" should read --181--.

Column 3, line 8, delete "S".

Column 3, line 18, delete "is".

Column 6, line 19, "bull' should read --hull--.

Column 6, line 37, "syn-" should read --sym- --.

Column 9, line 49, "drive" should read --five--.

Column 11, line 4, "utilize" should read --utilized--.

Column 11, line 14, "an" should read --and--.

Column 11, line 15, delete "d".

Claim 10, line 3, "jack-up-platform" should read --jack-up platform--.

Claim 17, line 2, "claim 11" should read --claim 16--.

Claim 19, line 2, "claims 18" should read --claim 18--.

Signed and Sealed this

Twenty-seventh Day of March, 2001

Attest:

Nicholas P. Godici

NICHOLAS P. GODICI

Attesting Officer

Acting Director of the United States Patent and Trademark Office

US006068069A

United States Patent [19]

Scott et al.

[11] **Patent Number: 6,068,069**

[45] **Date of Patent: *May 30, 2000**

[54] **MULTI-ACTIVITY OFFSHORE EXPLORATION AND/OR DEVELOPMENT DRILLING METHOD AND APPARATUS**

[75] Inventors: **Robert J. Scott**, Sugarland; **Robert P. Herrmann**; **Donald R. Ray**, both of Houston, all of Tex.

[73] Assignee: **Transocean Offshore Inc.**, Houston, Tex.

[*] Notice: This patent is subject to a terminal disclaimer.

[21] Appl. No.: **09/291,483**

[22] Filed: **Apr. 14, 1999**

Related U.S. Application Data

[63] Continuation of application No. 09/057,466, Apr. 9, 1998, which is a continuation of application No. 08/642,417, May 3, 1996.

[51] **Int. Cl.**[7] **E21B 7/12**

[52] **U.S. Cl.** **175/5**; 175/52; 175/85

[58] **Field of Search** 175/52, 57, 85, 175/161, 167, 170; 166/77.5

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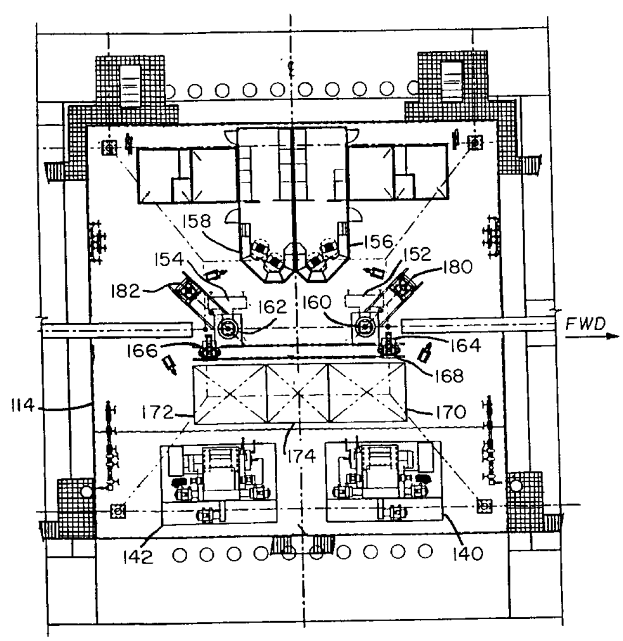
Primary Examiner—William Neuder

Attorney, Agent, or Firm—Kile McIntyre Harbin & Lee LLP; Bradford E. Kile; Richard A. Sterba

[57] **ABSTRACT**

A multi-activity drillship, or the like, method and apparatus having a single derrick and multiple tubular activity stations within the derrick wherein primary drilling activity may be conducted from the derrick and simultaneously auxiliary drilling activity may be conducted from the same derrick to reduce the length of the primary drilling activity critical path.

26 Claims, 8 Drawing Sheets



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4,762,185	8/1988	Simpson .
4,819,730	4/1989	Williford et al. .
4,850,439	7/1989	Lund .
5,181,798	1/1993	Gilchrist, Jr. .
5,381,750	1/1995	Pollack .
5,647,443	7/1997	Broeder .

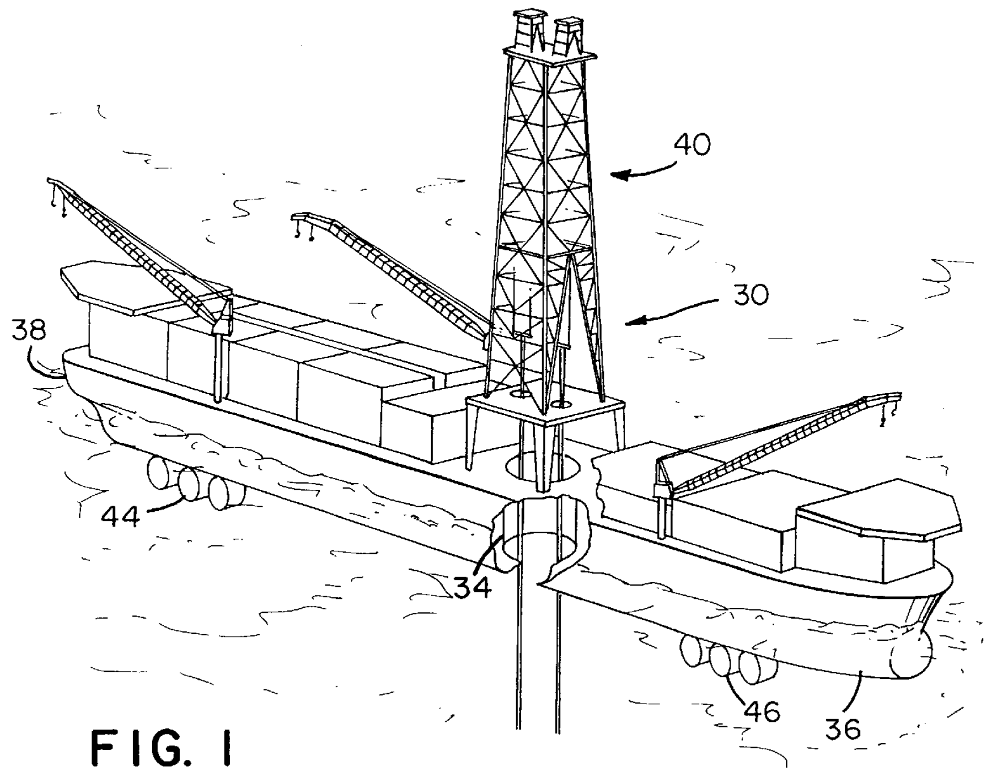
40
30
38
44
34
46
36

FIG. 1

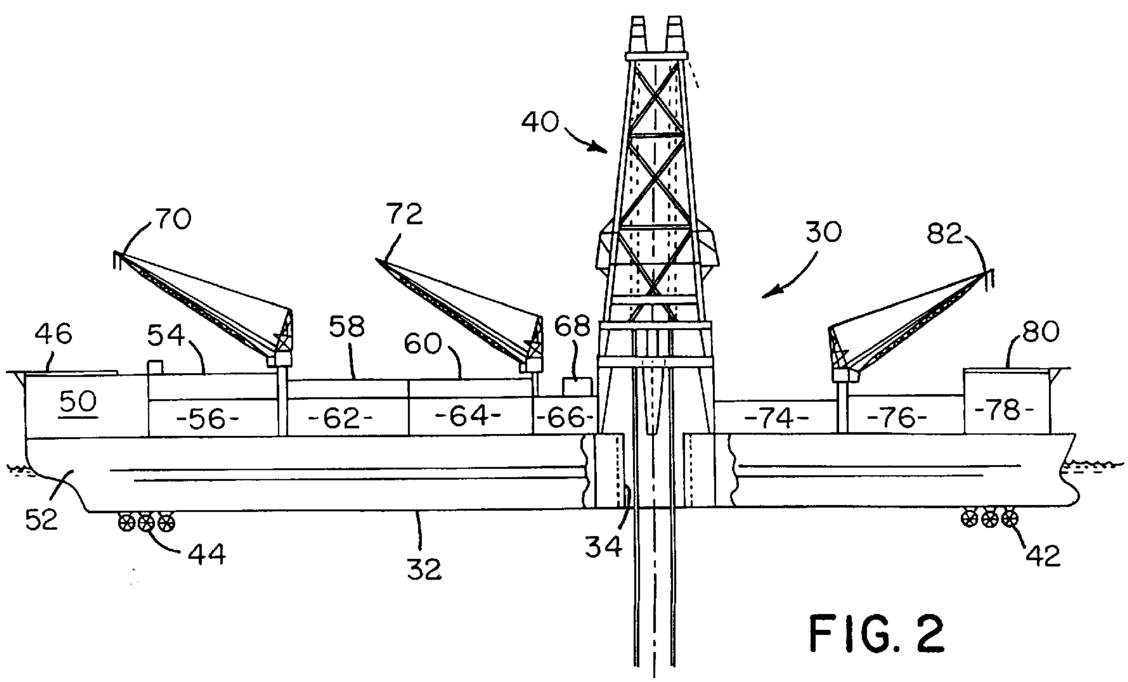
40
70
72
30
82
46
54
58
60
68
80
50
-56-
-62-
-64-
-66-
-74-
-76-
-78-
52
44
32
34
42

FIG. 2

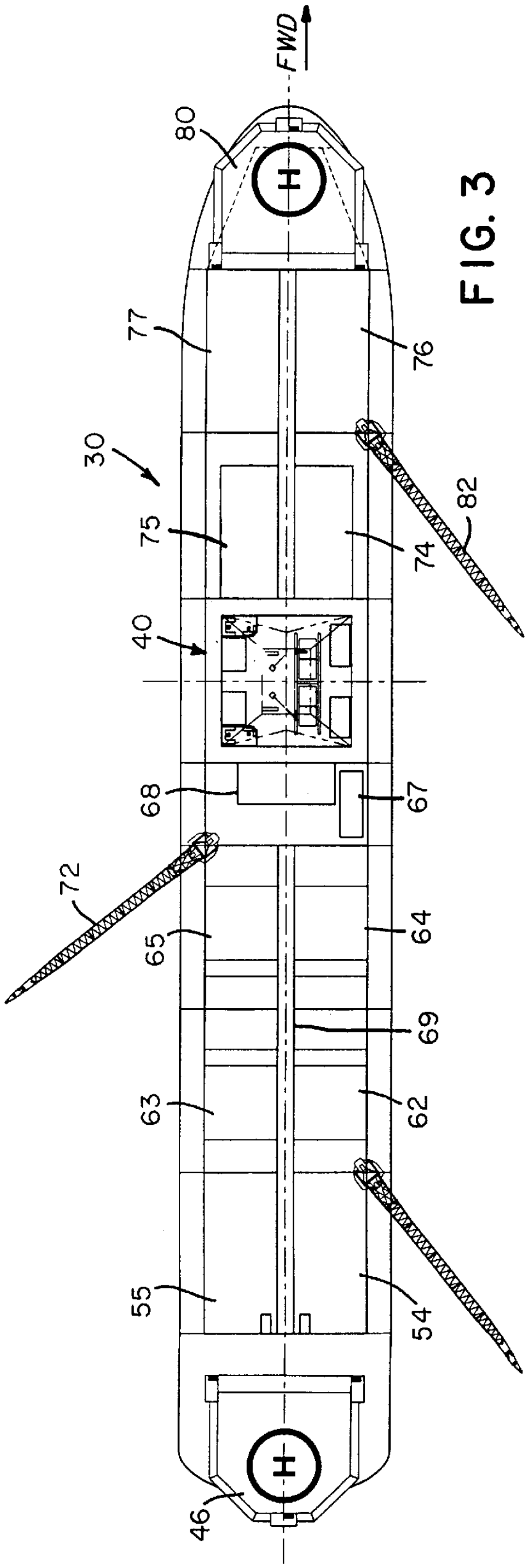
FWD
80
77
76
30
75
74
82
40
68
67
72
65
64
69
63
62
55
54
46

FIG. 3

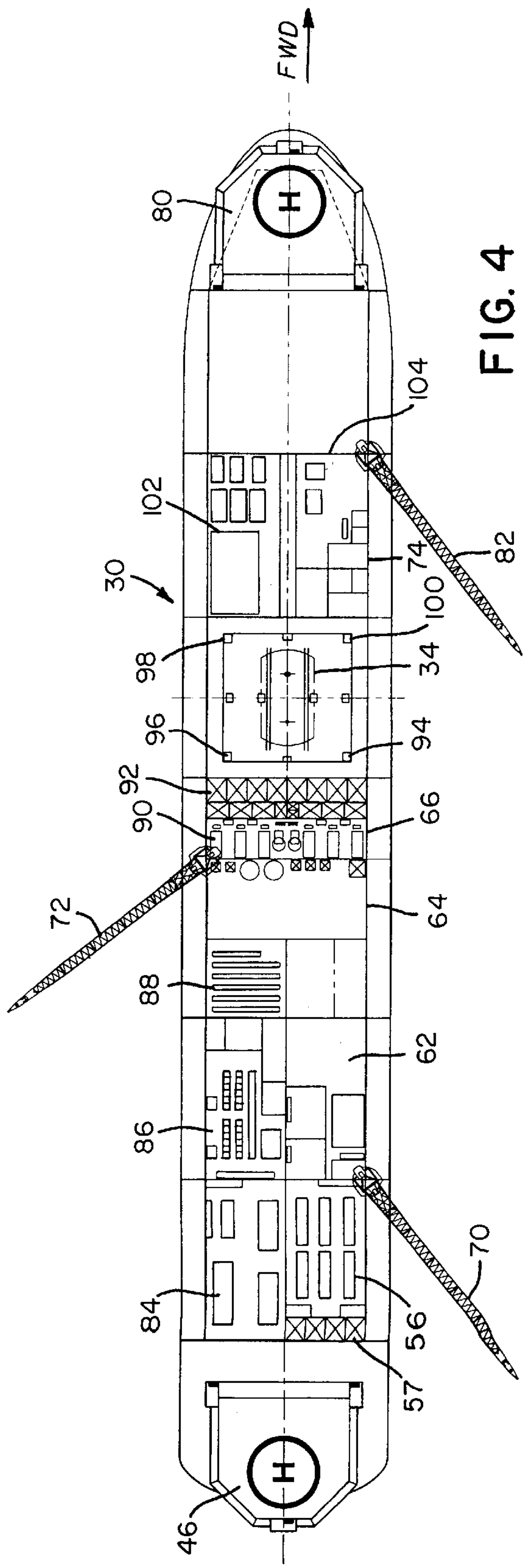
FWD
80
104
102
30
74
82
100
98
34
96
94
92
90
66
72
64
88
62
86
84
70
56
57
46

FIG. 4

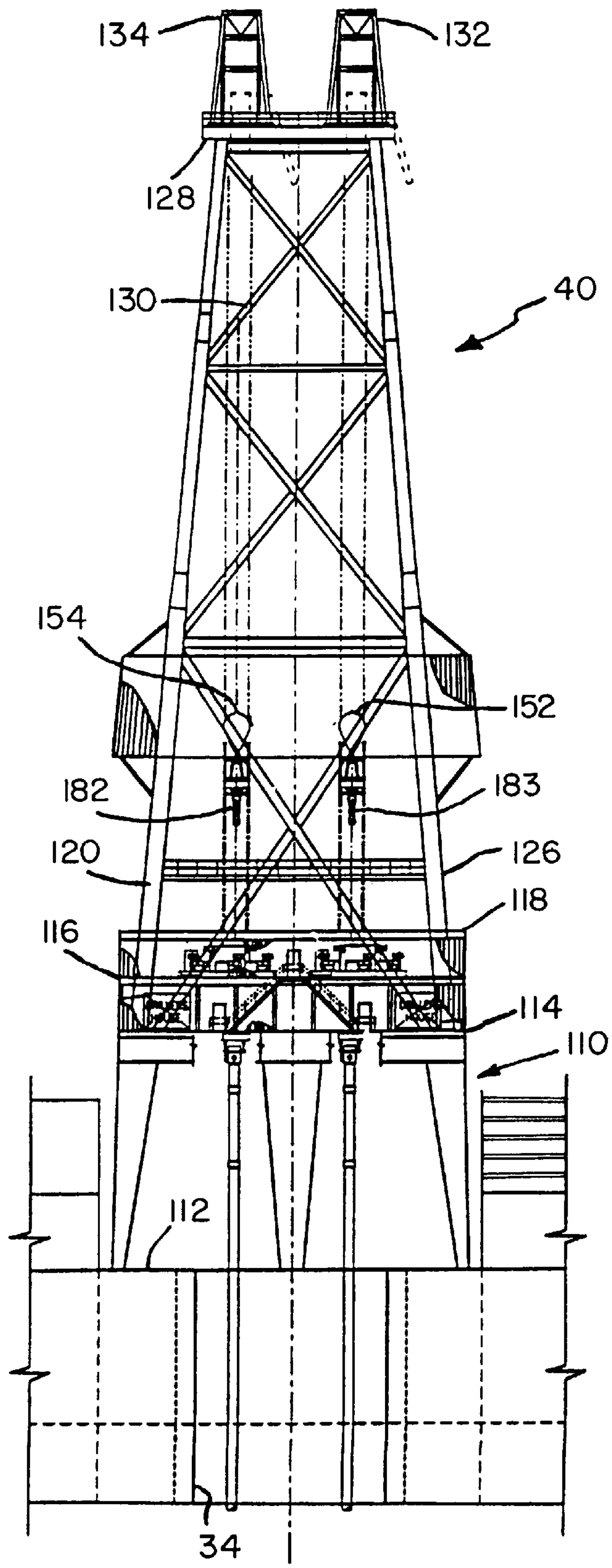

FIG. 5

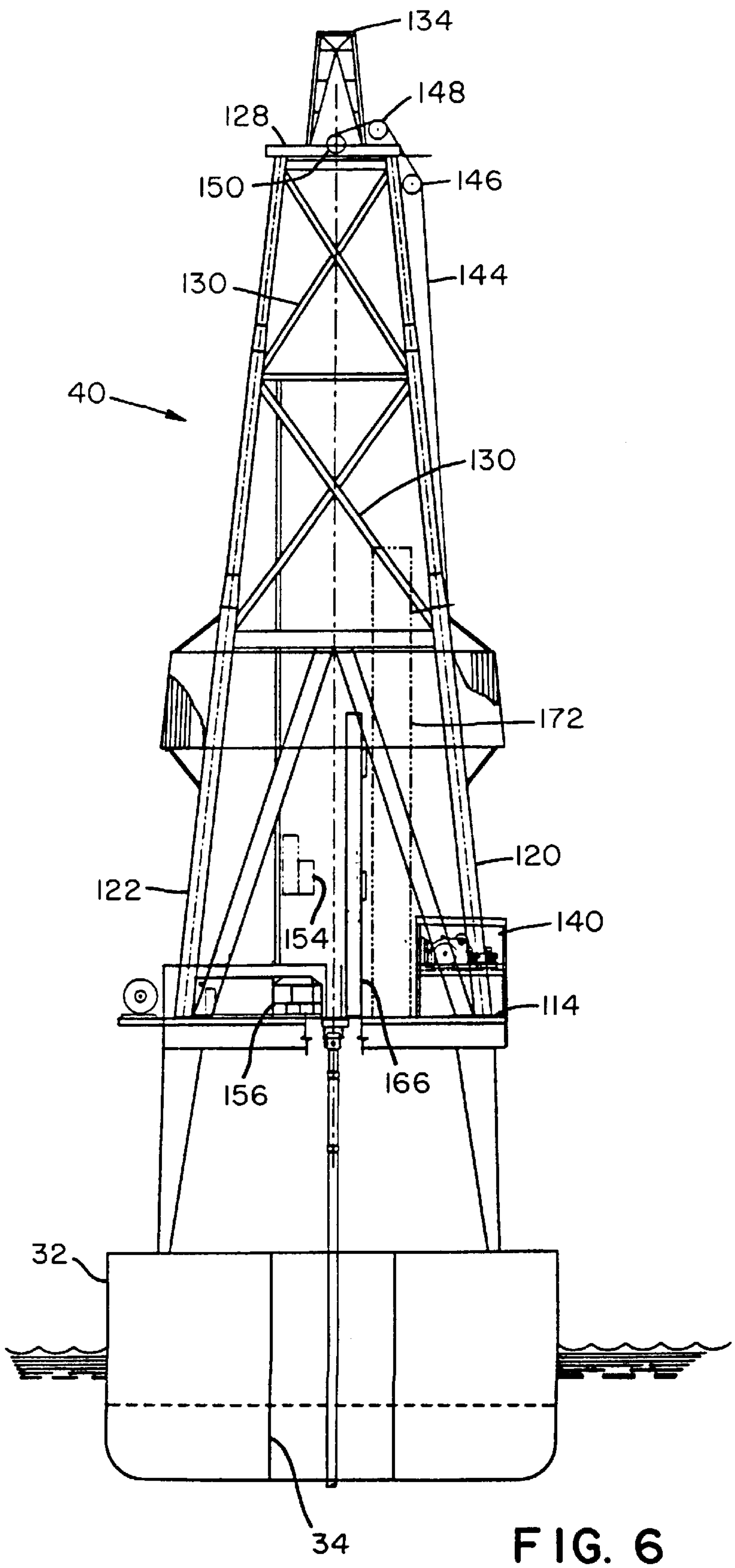
134
148
128
150
146
130
144
40
130
172
120
122
140
154
114
156
166
32
34

FIG. 6

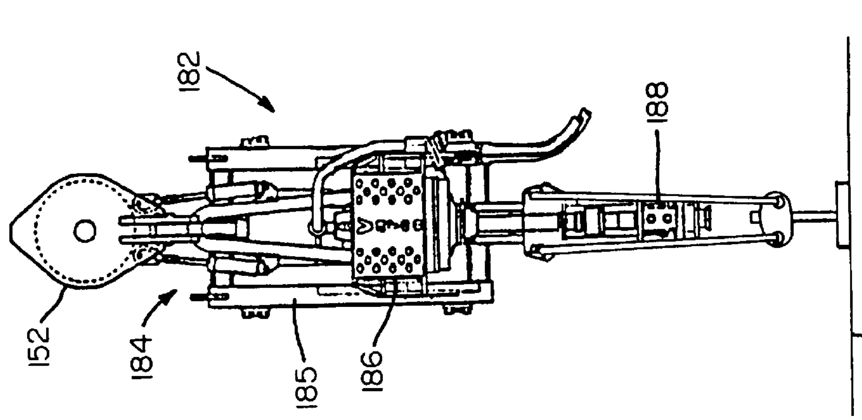
182
188
152
184
185
186
114

FIG. 8

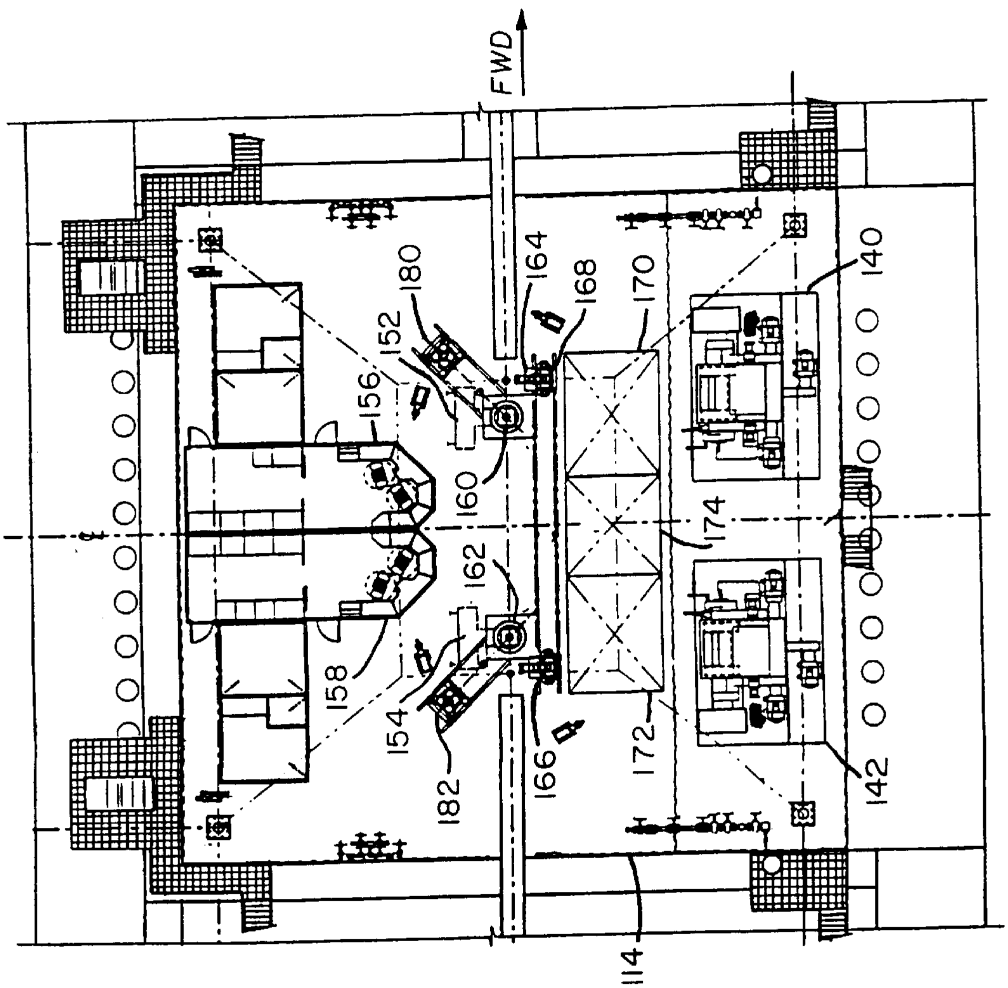
FWD
164
180
168
170
152
140
156
160
174
162
158
154
182
166
172
142
114

FIG. 7

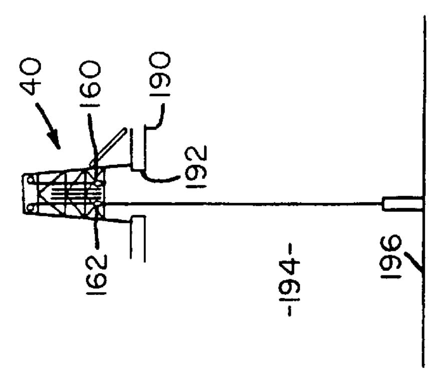

FIG. 9

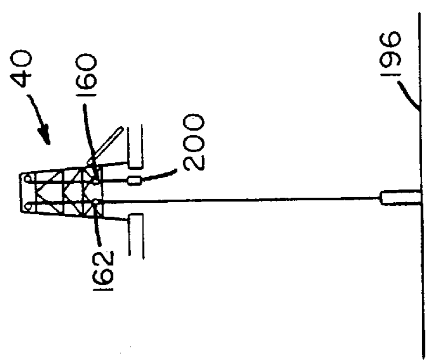

FIG. 10

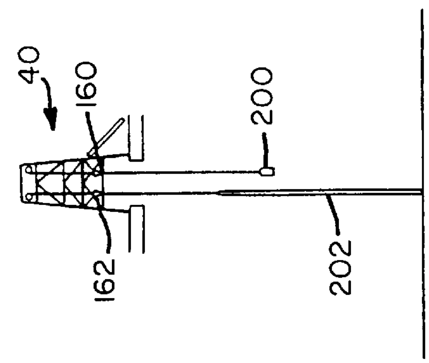

FIG. 11

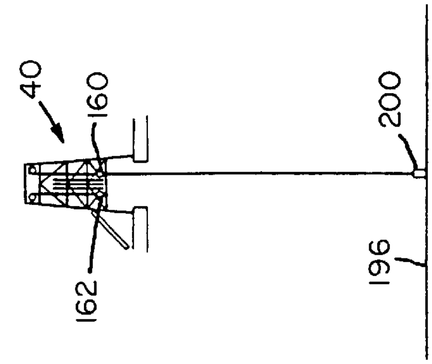

FIG. 12

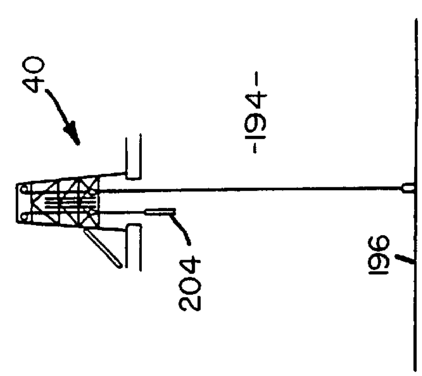

FIG. 13

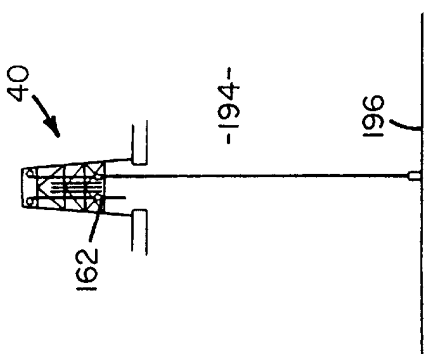

FIG. 14

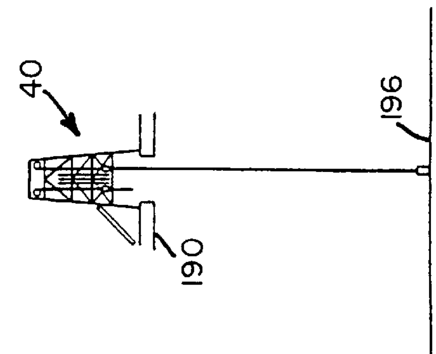

FIG. 15

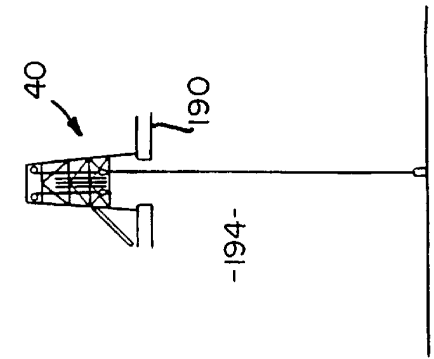

FIG. 16

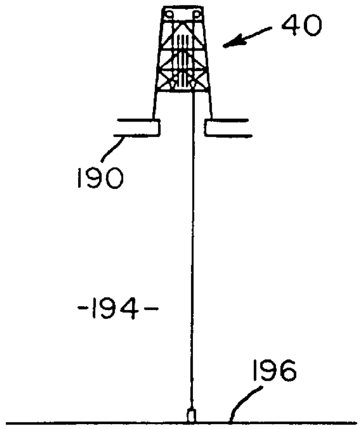

FIG. 17

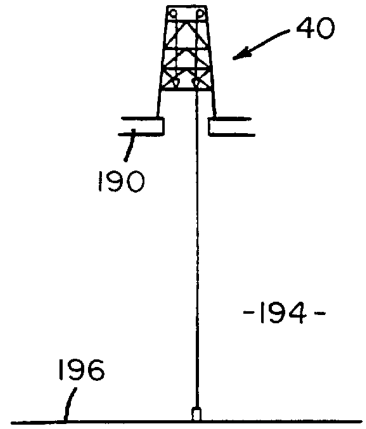

FIG. 18

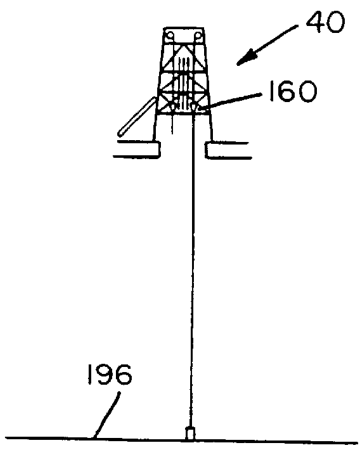

FIG. 19

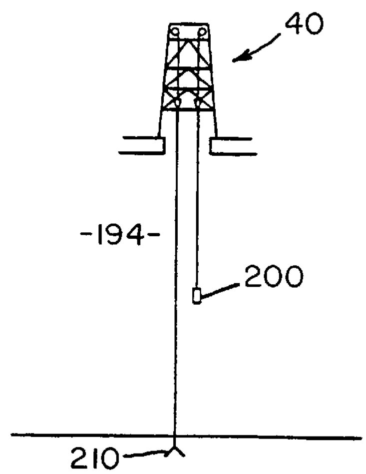

FIG. 20

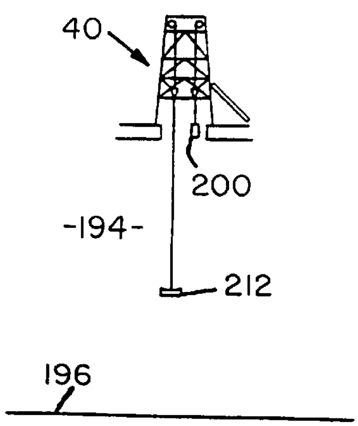

FIG. 21

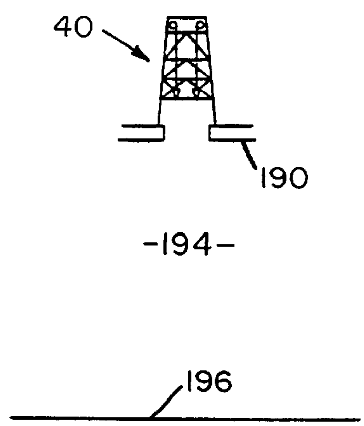

FIG. 22

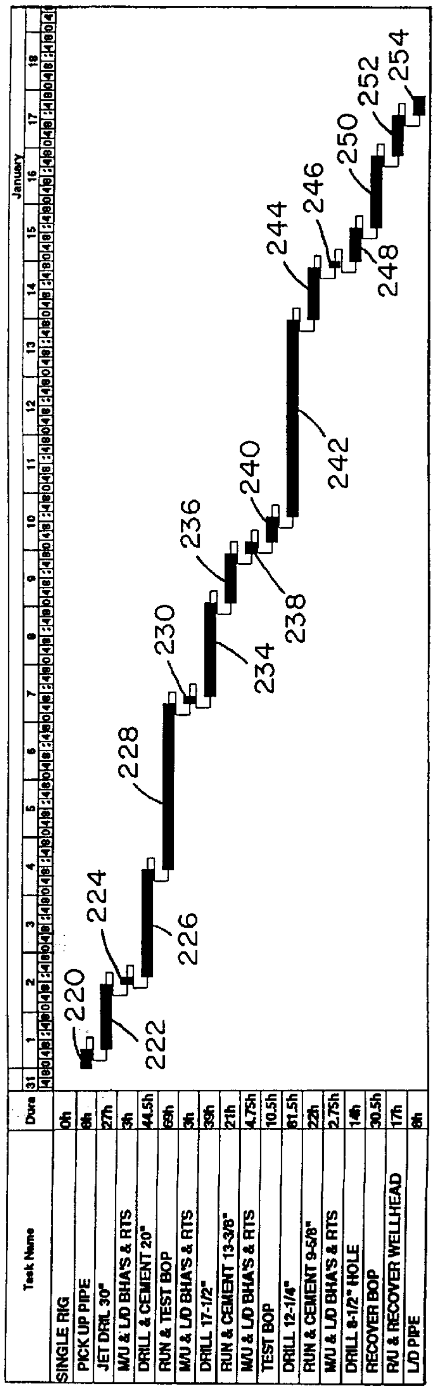

FIG. 23a

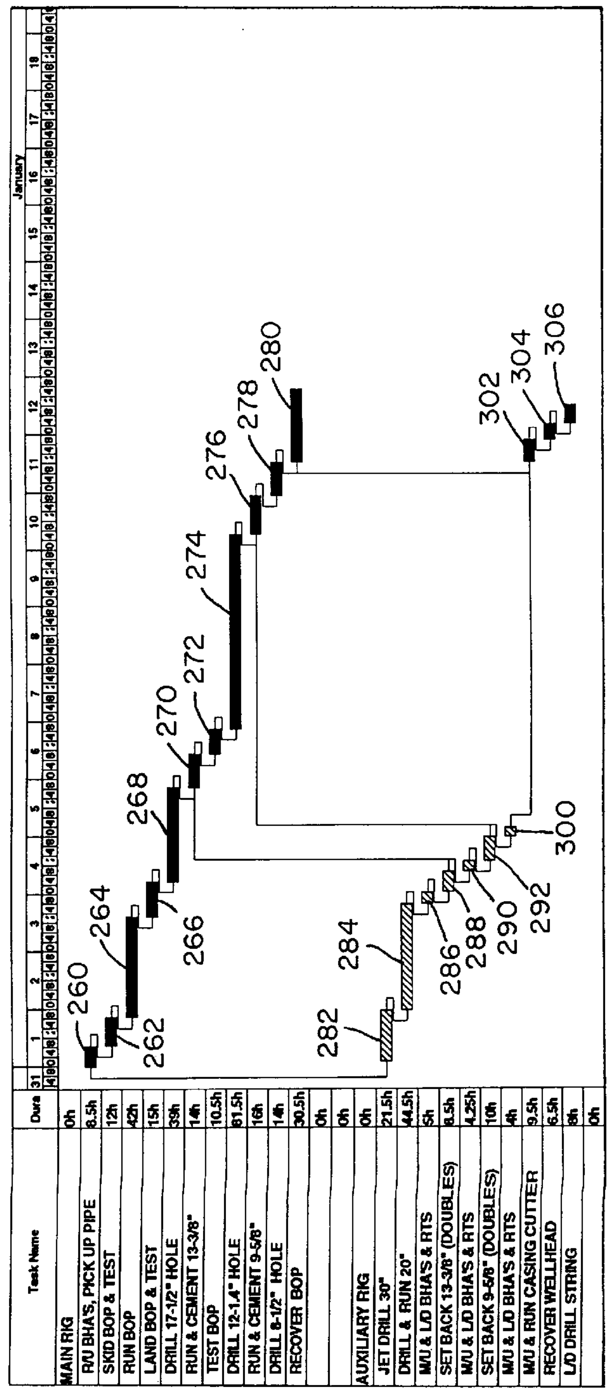

FIG. 23b

MULTI-ACTIVITY OFFSHORE EXPLORATION AND/OR DEVELOPMENT DRILLING METHOD AND APPARATUS

RELATED PATENTS

This application is a continuation of application Ser. No. 09/057,466 Apr. 9, 1998, which is a continuation of application Ser. No. 08/642,417 May 3, 1996 entitled Multi-Activity Offshore Exploration and/or Development Drilling Method and Apparatus," of common inventorship and assignment as the subject application.

BACKGROUND OF THE INVENTION

This invention relates to a novel method and apparatus for offshore drilling operations. More specifically, this invention relates to a method and apparatus for conducting exploration drilling offshore, with a single derrick wherein primary and auxiliary exploration drilling operations may be performed simultaneously to shorten the critical path of primary drilling activity. In addition, this invention relates to a method and apparatus wherein a single derrick is operable to perform multiple drilling, development, and work over operations simultaneously.

In the past, substantial oil and gas reserves have been located beneath the Gulf of Mexico, the North Sea, the Beaufort Sea, the Far East regions of the world, the Middle East, West Africa, etc. In the initial stages of offshore exploration and/or development drilling, operations were conducted in relatively shallow water of a few feet to a hundred feet or so along the near shore regions and portions of the Gulf of Mexico. Over the years, the Gulf and other regions of the world have been extensively explored and known oil and gas reserves in shallow water have been identified and drilled. As the need for cost effective energy continues to increase throughout the world, additional reserves of oil and gas have been sought in water depths of three to five thousand feet or more on the continental shelf. As an example, one actively producing field currently exists off the coast of Louisiana in two thousand eight hundred feet of water and drilling operations off New Orleans are envisioned in the near future in approximately three thousand to seven thousand five hundred feet of water. Still further, blocks have been leased in fields of ten thousand feet and by the year 2000 it is anticipated that a desire will exist for drilling in twelve thousand feet of water or more.

Deep water exploration stems not only from an increasing need to locate new reserves, as a general proposition, but with the evolution of sophisticated three dimensional seismic imaging and an increased knowledge of the attributes of turbidities and deep water sands, it is now believed that substantial high production oil and gas reserves exist within the Gulf of Mexico and elsewhere in water depths of ten thousand feet or more.

Along the near shore regions and continental slope, oil reserves have been drilled and produced by utilizing fixed towers and mobile units such as jack-up platforms. Fixed towers or platforms are typically fabricated on shore and transported to a drilling site on a barge or self floating by utilizing buoyancy chambers within the tower legs. On station, the towers are erected and fixed to the seabed. A jack-up platform usually includes a barge or self-propelled deck which is used to float the rig to station. On site legs at the corners of the barge or self-propelled deck are jacked down into the seabed until the deck is elevated a suitable working distance above a statistical storm wave height. An example of a jack-up platform is disclosed in Richardson U.S. Pat. No. 3,412,981. A jack-up barge is depicted in U.S. Pat. No. 3,628,336 to Moore et al.

Once in position fixed towers, jack-up barges and platforms are utilized for drilling through a short riser in a manner not dramatically unlike land based operations. It will readily be appreciated that although fixed platforms and jack-up rigs are suitable in water depths of a few hundred feet or so, they are not at all useful for deep water applications.

In deeper water, a jack-up tower has been envisioned wherein a deck is used for floatation and then one or more legs are jacked down to the seabed. The foundation of these jack-up platforms can be characterized into two categories: (1) pile supported designs and (2) gravity base structure. An example of a gravity base, jack-up tower is shown in U.S. Pat. No. 4,265,568 to Herrmann et al. Again, although a single leg jack-up has advantages in water depths of a few hundred feet, it is still not a design suitable for deep water sites.

For deep water drilling, semi-submersible platforms have been designed, such as disclosed in Ray et al. U.S. Pat. No. 3,919,957. In addition, tension leg platforms have been used such as disclosed in Steddum U.S. Pat. No. 3,982,492. A tension leg platform includes a platform and a plurality of relatively large legs extending downwardly into the sea. Anchors are fixed to the seabed beneath each leg and a plurality of permanent mooring lines extend between the anchors and each leg. These mooring lines are tensioned to partially pull the legs, against their buoyancy, into the sea to provide stability for the platform. An example of a tension leg platform is depicted in Ray et al. U.S. Pat. No. 4,281,613.

In even deeper water sites, turret moored drillships and dynamically positioned drillships have been used. Turret moored drillships are featured in Richardson et al. U.S. Pat. Nos. 3,191,201 and 3,279,404.

A dynamically positioned drillship is similar to a turret moored vessel wherein drilling operations are conducted through a large central opening or moon pool fashioned vertically through the vessel amid ships. Bow and stern thruster sets are utilized in cooperation with multiple sensors and computer controls to dynamically maintain the vessel at a desired latitude and longitude station. A dynamically positioned drillship and riser angle positioning system is disclosed in Dean U.S. Pat. No. 4,317,174.

Each of the above-referenced patented inventions are of common assignment with the subject application.

Notwithstanding extensive success in shallow to medium depth drilling, there is a renewed belief that significant energy reserves exist beneath deep water of seven thousand to twelve thousand feet or more. The challenges of drilling exploratory wells to tap such reserves, however, and follow on developmental drilling over a plurality of such wells, are formidable. In this it is believed that methods and apparatus existing in the past will not be adequate to economically address the new deep water frontier.

As drilling depths double and triple, drilling efficiency must be increased and/or new techniques envisioned in order to offset the high day rates that will be necessary to operate equipment capable of addressing deep water applications. This difficulty is exacerbated for field development drilling where drilling and completion of twenty or more wells is often required. In addition, work over or remedial work such as pulling trees or tubing, acidifying the well, cementing, re-completing the well, replacing pumps, etc. in deep water can occupy a drilling rig for an extended period of time.

Accordingly, it would be desirable to provide a novel method and apparatus that would be suitable for all offshore applications but particularly suited for deep water exploration and/or developmental drilling applications that would utilize drillships, semi-submersible, tension leg platforms, and the like, with enhanced efficiency to offset inherent increases in cost attendant to deep water applications.

OBJECTS OF THE INVENTION

It is, therefore, a general object of the invention to provide a novel method and apparatus for exploration and/or field development drilling of offshore oil and gas reserves, particularly in deep water sites.

It is a specific object of the invention to provide a novel method and apparatus utilizing a multi-activity derrick for offshore exploration and/or field development drilling operations which may be utilized in deep water applications with enhanced efficiency.

It is another object of the invention to provide a novel offshore exploration and/or field development drilling method and apparatus where a single derrick can be utilized for primary, secondary and tertiary tubular activity simultaneously.

It is a related object of the invention to provide a novel offshore exploration drilling method and apparatus wherein multi-drilling activities may be simultaneously performed within a single derrick, and thus certain tubular operations are removed from a critical path of primary drilling activity.

It is a further object of the invention to provide a novel method and apparatus where multi-tubular operations may be conducted from a single derrick and primary drilling or auxiliary tubular activity may be performed simultaneously through a plurality of tubular handling locations within a single derrick.

It is yet another object of the invention to provide a novel derrick system for offshore exploration and/or field development drilling operations which may be effectively and efficiently utilized by a drillship, semi-submersible, tension leg platform, jack-up platform, fixed tower or the like, to enhance the drilling efficiency of previously known systems.

It is yet another object of the invention to provide a novel method and apparatus for deep water exploration and/or production drilling applications with enhanced reliability as well as efficiency.

It is a further object of the invention to provide a novel method and apparatus for deep water field development drilling or work over remedial activity where multiple wells may be worked on simultaneously from a single derrick.

BRIEF SUMMARY OF A PREFERRED EMBODIMENT OF THE INVENTION

A preferred embodiment of the invention which is intended to accomplish at least some of the foregoing objects comprises a multi-activity drilling assembly which is operable to be mounted upon a deck of a drillship, semi-submersible, tension leg platform, jack-up platform, offshore tower or the like for supporting exploration and/or development drilling operations through a deck and into the bed of a body of water.

The multi-activity drilling assembly includes a derrick for simultaneously supporting exploration and/or production drilling operations and tubular or other activity auxiliary to drilling operations through a drilling deck. A first tubular station is positioned within the periphery of the derrick for conducting drilling operations through the drilling deck. A second tubular station is positioned adjacent to but spaced from the first and within the periphery of the derrick for conducting operations auxiliary to the primary drilling function.

With the above multi-activity derrick, primary drilling activity can be conducted through the first tubular station and simultaneously auxiliary drilling and/or related activity can be conducted within the same derrick through the second tubular station to effectively eliminate certain activity from the primary drilling critical path.

THE DRAWINGS

Other objects and advantages of the present invention will become apparent from the following detailed description of a preferred embodiment thereof, taken in conjunction with the accompanying drawings, wherein:

FIG. **1** is an axonometric view of a drillship of the type that is suitable to advantageously utilize the multi-activity method and apparatus of exploration and/or field development drilling in accordance with the subject invention;

FIG. **2** is a side elevational view of the multi-activity drillship disclosed in FIG. **1** with a moon pool area broken away to disclose dual tubular strings extending from a single drilling derrick;

FIG. **3** is a plan view of the drillship as disclosed in FIGS. **1** and **2** which comprise a preferred embodiment of the invention;

FIG. **4** is a plan view of a mechanical deck of the drillship depicted in FIG. **3** disclosing several operational features of the subject invention;

FIG. **5** a starboard elevational view of the multi-activity drilling derrick in accordance with a preferred embodiment of the subject invention mounted upon a drillship substructure or cellar deck;

FIG. **6** is an aft elevation view of the multi-activity derrick depicted in FIG. **5**;

FIG. **7** is a plan view of a drilling floor for the multi-activity drilling derrick in accordance with a preferred embodiment of the invention;

FIG. **8** is an illustrative elevation view of a top drive operable to rotate and drive tubulars in accordance with a preferred embodiment of the invention;

FIGS. **9** through **22** depict a schematic sequence of views illustrating primary and auxiliary tubular activity being performed in accordance with one sequence of exploration drilling utilizing the subject method and apparatus; and

FIGS. **23***a* and **23***b* disclose a time line for an illustrative exploratory drilling operation wherein a critical path of activity for a conventional drilling operation is depicted in FIG. **23***a* and a similar critical path time line for the same drilling activity in accordance with a method and apparatus of the subject invention, is depicted in FIG. **23***b*. FIG. **23***b* discloses a dramatic increase in exploration drilling efficiency with the subject invention.

DETAILED DESCRIPTION

Context of the Invention

Referring now to the drawings wherein, like numerals indicate like parts, and initially to FIG. **1** there will be seen an axonometric view of an offshore drillship in accordance with a preferred embodiment of the subject invention. This dynamically positioned drillship discloses the best mode of practicing the invention currently envisioned by the applicants for patent. More specifically, the subject multi-activity drillship **30** comprises a tanker-type hull **32** which is fabricated with a large moon pool **34** between the bow **36** and stern **38**. A multi-activity derrick **40** is mounted upon the drillship substructure above a moon pool **34** and operable to conduct primary tubular operations and simultaneously operations auxiliary to primary tubular operations from a single derrick through the moon pool. In this application the term tubular is used as a generic expression for conduits used in the drilling industry and includes relative large riser conduits, casing and drillstrings of various diameters.

The drillship **30** may be maintained on station by being moored, or by being turret moored such as disclosed, for example, in the above-referenced Richardson U.S. Pat. Nos. 3,191,201 and 3,279,404. In a preferred embodiment the drillship **30** is accurately maintained on station by being dynamically positioned. Dynamic positioning is performed by utilizing a plurality of bow thrusters **42** and stern thrusters **44** which are accurately controlled by computers utilizing input data to control the multiple degrees of freedom of the floating vessel in varying environmental conditions of wind, current, wave swell, etc. Dynamic positioning is relatively sophisticated and by utilizing satellite references is capable of very accurately maintaining a drillship at a desired latitude and longitude, on station, over a well-head.

Multi-Activity Drillship

Referring now to FIGS. **1** through **4**, there will be seen a plurality of views which disclose, in some detail, a multi-activity drillship in accordance with a preferred embodiment of the invention. In this, FIG. **2** discloses a starboard elevation of the multi-activity drillship which includes an aft heliport **46** above ship space **50** and a main engine room **52**. Riser storage racks **54** are positioned above an auxiliary engine room **56**. First **58** and second **60** pipe racks are positioned in advance of the riser storage area **54** and above an auxiliary machine room **62**, warehouse and sack stores **64** and mud rooms **66**. A shaker house **68** extends above the mud room **66** and adjacent to an aft portion of the multi-activity derrick **40**. A first **70** and second **72** 75-ton crane, with 150-foot booms, are mounted aft of the multi-activity derrick **40** and operably are utilized, for example, in connection with the riser and pipe handling requirements of the operating drillship.

A machinery room and well testing area **74** is constructed adjacent to a forward edge of the multi-activity drill derrick **40** and an additional riser storage area **76** and crew quarters **78** are positioned forward of the well testing area as shown in FIG. **2**. Another 75-ton crane **82**, with a 150-foot boom, is positioned forward of the multi-activity derrick **40** and operably services a forward portion of the drillship.

Referring to FIGS. **3** and **4**, there will be seen plan views of a pipe deck and a machinery deck of a preferred embodiment of the drillship **30**. Looking first at FIG. **3**, a plan view of the drillship **30**, an aft heliport **46** is shown above ship space **50** and aft of a riser storage area **54**. A second riser storage area **55** is positioned adjacent storage **54** and in a similar vein pipe racks **63** and **65** are positioned adjacent to previously noted pipe racks **62** and **64** respectively. The shaker house **68** is forward of the pipe racks and adjacent to the multi-activity derrick **40** and a mudlogger **67** is shown above the mud room **66**. A catwalk **69** extends between the riser and pipe rack to facilitate transport of riser lengths, casing and drillpipe from the storage areas to the multi-purpose derrick **40**.

A well testing area **74** and **75** is shown adjacent to the derrick **40** and aft of approximately 10,000 additional feet of tubular storage racks **76** and **77**. A forward heliport **80** is shown positioned above crew quarters **78**, as previously discussed, and the forward tubular area is serviced by a 75-ton crane **82** as noted above.

A plan view of the machinery deck is shown in FIG. **4** and includes an engine room **56** having fuel tanks on the starboard side and a compressed air and water maker system **84** on the port side. Auxiliary machinery **62** such as a machine shop, welding shop, and air conditioning shop are shown positioned adjacent to switching gear, control modules and SCR room **86**. In front of the SCR room, in the machinery deck is an air conditioning warehouse **88** and stack stores **64** as previously noted. The mudpump rooms **66** include a plurality of substantially identical drilling mud and cement pumps **90** and mixing and storage tanks **92**.

The derrick footprint **94**, **96**, **98**, and **100** is shown in the cellar deck and is symmetrically positioned about a moon pool area **34**. A parallel runway **101** extends over the moon pool and is laid between an aft subsea tree systems area and a fore subsea room area. A riser compressor room **102** is shown in a position adjacent to the forward machinery area **74** which includes a blowout preventer control area **104**.

The drilling hull may be eight hundred and fifty feet in length and of a design similar to North Sea shuttle tankers. The various modularized packages of components are facilely contained within a ship of this capacity and the dynamically positioned drillship provides a large stable platform for deep water drilling operations. The foregoing multi-activity drillship and operating components are disclosed in an illustrative arrangement and it is envisioned that other equipment may be utilized and positioned in different locations, another ship design or platform designs. However, the foregoing is typical of the primary operating facilities which are intended to be included with the subject multi-activity drillship invention.

Multi-Activity Derrick

Referring now to FIGS. **5** through **7**, there will be seen a multi-activity derrick **40** in accordance with a preferred embodiment of the invention. The derrick **40** includes a base **110** which is joined to the drillship substructure **112** symmetrically above the moon pool **34**. The base **110** is preferably square and extends upwardly to a drill floor level **114**. Above the drill floor level is a drawworks platform **116** and a drawworks platform roof **118**. Derrick legs **120**, **122**, **124**, and **126** are composed of graduated tubular conduits and project upwardly and slope inwardly from the drill floor **114**. The derrick terminates into a generally rectangular derrick top structure or deck **128**. The legs are spatially fixed by a network of struts **130** to form a rigid drilling derrick for heavy duty tubular handling and multi-activity functions in accordance with the subject invention.

As particularly seen in FIG. **5**, the derrick top **128** serves to carry a first **132** and second **134** mini-derrick which guide a sheave and hydraulic motion compensation system.

As shown in FIGS. **5** through **7**, the multi-activity derrick **40** preferably includes a first **140** and second **142** drawworks of a conventional design. A cable **144** extends upwardly from the drawworks **140** over sheaves **146** and **148** and motion compensated sheaves **150** at the top of the derrick **40**. The drawwork cabling extends downwardly within the derrick to first **152** and second **154** travelling blocks, note again FIG. **5**. Each of the drawworks **140** and **142** is independently controlled by distinct driller consoles **156** and **158** respectively.

The foregoing described drawworks and other functionally equivalent systems, including specific structure components not yet envisioned, provide a means for hoisting tubular members for advancing and retrieving tubular members during drilling, work over or completion operations and the like.

The derrick drilling floor **114** includes, first and second tubular advancing stations **160** and **162** which in one embodiment, comprises a first rotary table and a second, substantially identical, rotary table. The rotary tables are positioned in a mutually spaced relationship, symmetrically, within the derrick **40** and, in one embodiment, along a center line of the drillship **30**.

Other envisioned embodiments include rotary tables positioned from side-to-side across the ship or even on a bias. The drawworks **140** is positioned adjacent to the first tubular **160** and drawworks **142** is positioned adjacent to the second tubular advanced station **162** and operably serves to conduct drilling operations and/or operations auxiliary to drilling operations through the moon pool **34** of the drillship. Each tubular advancing station includes, in one embodiment, a rotary machine, rotary drive, master bushings, kelly drive bushings and slips. In addition, each tubular advancing station **160** and **162** operably include an iron roughneck, a pipe tong, a spinning chain, a kelly and a rotary swivel for making up and tearing down tubulars in a conventional manner.

A first pipe handling apparatus **164** and a second pipe handling apparatus **166** is positioned, in one embodiment, upon a rail **168** which extends from a location adjacent to the first tubular advancing station **160** to the second tubular advancing station **162**. A first conduit setback envelope **170** is located adjacent to said first pipe handling apparatus **164** and a second pipe setback envelope **172** is positioned adjacent to the second pipe handling apparatus **166**. A third conduit setback envelope **174** may be positioned between the first setback envelope **170** and the second setback envelope **172** and is operable to receive conduits from either of said first conduit handling apparatus **164** or said second conduit handling apparatus **166** as they translate upon the rail **168**. Positioned adjacent the first tubular advancing station **160** is a first iron roughneck **180** and a second iron roughneck **181** is positioned adjacent to the second tubular advancing station **162**. The iron roughnecks are operably utilized in cooperation with the rotary stations **160** and **162**, respectively to make-up and break down tubulars.

It will be seen by reference particularly to FIG. **7** that the rail **168** permits the first tubular handling assembly **164** to setback and receive conduit from any of the tubular setback envelopes **170**, **172**, and **174**. The primary utilization for pipe handling assembly **164**, however, will be with respect to setback envelopes **170** and **174**. In a similar manner the rail **168** permits the second tubular handling assembly **166** to transfer conduits such as riser, casing or drill pipe between the second rotary station **162** and tubular setback envelopes **172**, **174**, and **170**, however, the tubular handling assembly **166** will be utilized most frequently with conduit setback envelopes **172** and **174**. Although rail supported pipe handling systems are shown in FIG. **7**, other tubular handling arrangements are contemplated by the subject invention such as a rugged overhead crane structure within the derrick **40**. A common element however, among all systems will be the ability to make-up and break down tubulars at both the first and second tubular stations for advancing tubulars through the moon pool. In addition, a characteristic of tubular handling systems will be the ability to pass tubular segments back and forth between the first station for advancing tubulars through the moon pool and the second station for advancing tubulars and the setback envelopes as discussed above.

In a presently preferred embodiment, the rotary function is applied to tubulars performed by a first **182** and second **183** top drive device, note again FIG. **5**. Each top drive device is similar and the unit **182** is shown more particularly in FIG. **8**. The top drive is connected to traveling block **152** and is balanced by hydraulic balancing cylinders **184**. A guide dolly **185** supports a power train **186** which drives a tubular handling assembly **188** above drill floor **114**.

Although a rotary table system of tubular advancement and top drive have both been disclosed and discussed above, the top drive system is presently preferred. In certain instances, both systems may even be installed on a drillship. Still further, other systems may ultimately be envisioned, however, an operational characteristic of all tubular advancing systems will be the ability to independently handle, make-up or break down, set back, and advance tubulars through multi-stations over of a moon pool and into the seabed.

It will be appreciated by referring to and comparing FIGS. **5**, **6**, and **8** that the multi-activity derrick **40** comprises two identical top drives and/or separate rotary tables, drawworks, motion compensation and travelling blocks positioned within a single, multi-purpose derrick. Accordingly, the subject invention enables primary drilling activity and auxiliary activity to be conducted simultaneously and thus the critical path of a drilling function to be conducted through the moon pool **34** may be optimized. Alternatively, units are envisioned which will not be identical in size or even function, but are nevertheless capable of handling tubulars and passing tubulars back and forth between tubular advancing stations within a single derrick. Further, in a preferred embodiment, the multi-activity support structure is in the form of a four sided derrick. The subject invention, however, is intended to include other superstructure arrangements such as tripod assemblies or even two adjacent upright but interconnected frames and superstructures that are operable to perform a support function for more than one tubular drilling or activity for conducting simultaneous operations through the deck of a drillship, semi-submersible tension leg platform, or the like.

Method of Operation

Referring now specifically to FIGS. **9** through **22**, there will be seen a sequence of operation of the subject multi-activity derrick and drillship wherein a first or main tubular advancing station is operable to conduct primary drilling activity and a second or auxiliary tubular advancing station is utilized for functions critical to the drilling process but can be advantageously removed from the drilling critical path to dramatically shorten overall drilling time.

Turning specifically to FIG. **9**, there is shown by a schematic cartoon a multi-activity derrick **40** positioned upon a drilling deck **190** of a drillship, semi-submersible, tension leg platform, or the like, of the type discussed above.

A moon pool opening in the drilling deck **192** enables tubulars such as risers, casing or drill pipe to be made up within the derrick **40** and extended through a body of water **194** to conduct drilling activity and/or activity associated with drilling within and upon the seabed **196**.

The main drilling station **160** is utilized to pick up and make up a thirty inch jetting assembly for jetting into the seabed and twenty six inch drilling assemblies and places them within the derrick setback envelopes for the auxiliary station **162** to run inside of thirty inch casing. The main rig then proceeds to makeup eighteen and three fourths inch wellhead and stands it back in the derrick for the twenty inch tubular casing run.

At the same time the auxiliary station **162** is used to pick up the thirty inch casing and receives the jetting assembly from the main rig and runs the complete assembly to the seabed where it begins a thirty inch casing jetting operation.

Referring to FIG. **10**, the main rig skids a blowout preventer stack **200** under the rig floor and carries out a functioning test on the stack and its control system. At the same time the auxiliary rig and rotary station **162** are used to jet in and set the thirty inch casing. The auxiliary rig then disconnects the running tool from the wellhead and drills ahead the twenty six inch hole section.

In FIG. **11** the main rig is utilized to start running the blowout preventer stack **200** and drilling riser to the seabed. Simultaneously the auxiliary rig, including second rotary station **162**, is utilized to complete drilling of the twenty six inch hole section and then pulls the twenty six inch drilling assembly to the surface. The auxiliary station then rigs up and runs twenty inch tubular casing **202** and after landing the twenty inch casing in the wellhead the auxiliary rig then hooks up cement lines and cements the twenty inch casing in place. The auxiliary rig then retrieves the twenty inch casing landing string.

In FIG. **12** the main rig and rotary station **160** lands the blowout preventer **200** onto the wellhead and tests the wellhead connection. At the same time, the auxiliary rotary station **162** is utilized to lay down the thirty inch jetting and twenty six inch drilling assembly. After this operation is complete the auxiliary rotary station **162** is utilized to makeup a seventeen and one half inch bottom hole assembly and places the assembly in the derrick for the primary or main rotary assembly to pick up.

In FIG. **13** the main rotary assembly picks up the seventeen and one half inch hole section bottom hole assembly **204**, which was previously made up by the auxiliary rig, and runs this and drillpipe in the hole to begin drilling the seventeen and one half inch section. At the same time, the auxiliary rotary station picks up single joints of thirteen and three eighths inch casing from the drillship pipe racks, makes them up into one hundred and twenty five foot lengths and then stands the lengths back in the derrick envelopes in preparation for the thirteen and three eighths inch casing run.

In FIG. **14** the main rotary station **160** completes drilling the seventeen and one half inch hole section. The drilling assembly is then retrieved back to the surface through the moon pool and the main rotary station then proceeds to rig up and run the thirteen and three eighths inch casing segments which were previously made up and set back within the derrick. After landing the casing in the wellhead, the rig cements the casing in place. At the same time the auxiliary rotary station **162** picks up single joints of nine and five eights inch casing from the drillship pipe racks, makes them up into triples and then stands them back in the derrick tubular handling envelopes in preparation for a nine and five eights inch casing run.

In FIG. **15** the primary rotary station tests the blowout preventer stack after setting the thirteen and three eighths inch seal assembly and the auxiliary rotary station changes the bottom hole assembly from seventeen and one half inches to twelve and one quarter inch assembly. The twelve and one quarter inch assembly is then set back in the derrick conduit handling envelopes in a position where they can be picked up by the main rotary station.

In FIG. **16** the primary rotary station **160** is used to run in the hole with twelve and one quarter inch bottom hole assembly and begins drilling the twelve and one quarter inch hole section. At the same time the auxiliary rotary station is utilized to make up nine and five eighths inch casing running tool and cement head and then stands both of these complete assemblies back in the conduit handling envelopes of the derrick in preparation for a nine and five eights inch casing run.

In FIG. **17** the primary rotary station **160** is utilized to complete drilling the twelve and one quarter inch hole section and retrieves the twelve and one quarter inch assembly back to the surface. The primary rotary station then rigs up and runs the nine and five eighths inch casing in the hole and cements the casing in place. At the same time the auxiliary rotary station changes the bottom hole assembly from twelve and one quarter inch to eight and one half-inch and stands the eight and one half-inch assemblies back in the derrick to be picked up by the primary rotary station.

In FIG. **18** the primary rotary station is shown running in the hole with eight and one half-inch drilling assemblies and begins to drill the eight and one half-inch hole with the first rotary top drive. During this operation the auxiliary rotary station is used to make up a casing cutter.

In FIG. **19** the primary rotary station **160** completes drilling the eight and one quarter inch hole section and retrieves the drilling assembly back to the surface. The primary rotary station then proceeds to rig down the riser and begins to recover the blowout preventer stack **200**.

As shown in FIG. **20**, once the blowout preventer **200** is clear of the wellhead, the auxiliary rotary station runs in the hole with a casing cutter **210** and cuts the casing.

In FIG. **21** the primary rotary station is used to continue recovering the blowout preventer stack **200** and the auxiliary rotary station is used to recover the wellhead **212**.

In FIG. **22** the primary rotary station prepares for moving the drillship and the auxiliary rotary station assists in that operation.

Comparative Analysis

Referring now specifically to FIG. **23***a,* there will be seen an illustrative time chart of typical drilling activity for an offshore well in accordance with a conventional drilling operation. The filled in horizontal bars represent time frames along an abscissa and tubular activity is shown along an ordinate. As an initial operation, eight hours, note bar **220**, are utilized to pick up pipe and twenty seven hours, note bar **222**, are then required to jet drill thirty inch casing in place. Three hours are then used to make up and lay down bottom hole assemblies and running tools, see time bar **224**. Next, forty four and one half hours, note bar **226**, are required to drill and cement twenty inch casing. Sixty-nine hours **228** are necessary to run and test a blowout preventer. Three hours are required to make up and lay down bottom hole assemblies and running tools, see time bar **230**. Next, in sequence thirty nine hours, note bar **234**, and twenty one hours, note bar **236**, are used to run and cement thirteen and three eighths inch casing. Four and three quarter hours are used to make up and lay down bottom hole assemblies and running tools, note bar **238**, and ten and one half hours are used to test the blowout preventer, note bar **240**. Next, eighty one and one half hours, note bar **242**, are utilized to drill twelve and one quarter inch drill string and twenty two hours are used to run and cement nine and five eights inch casing, note bar **244**. Two and three quarter hours are then necessary to make up and lay down bottom hole assemblies and running tools, note bar **246**, and fourteen hours, note bar **248**, are utilized to drill eight and one half-inch hole. Next, thirty and one half hours are spent recovering the blowout preventer, note bar **250**, seventeen hours are used to run up and recover the wellhead, as depicted by time bar **252**, and finally the drill pipe is laid down requiring eight hours, see time bar **254**.

In contrast to a conventional drilling sequence, an identical drilling operation is depicted by a time chart in FIG. **23***b* in accordance with the subject invention, where a main and auxiliary tubular station are simultaneously utilized in a preferred embodiment of the subject invention, to dramatically decrease the overall drilling time and thus increase efficiency of the drilling operation. More specifically, it will be seen that the main drilling operation can be conducted through a first tubular advancing station and the critical path of the drilling sequence is depicted with solid time bars whereas auxiliary activity through a second tubular advancing station is shown by crossed hatched time bars.

Initially eight and one half hours are utilized by the primary rotary station to rig up a bottom hole assembly and pick up pipe, note time bar **260**. Next, the blowout preventer is skidded to position and tested which utilizes twelve hours, as shown by time bar **262**. Forty two hours are then required to run the blowout preventer to the seabed as shown by time bar **264** and 15 hours, as shown by time bar **266**, are used to land and test the blowout preventer. Next, the seventeen and one half inch hole is drilled by the primary rotary station and rotary table **160** for 39 hours as depicted by time bar **268**. Subsequently, the thirteen and three eighths inch casing is run and cemented in place utilizing fourteen hours as depicted by time bar **270**.

The next operation requires ten and one half hours to test the blowout preventer as shown by time bar **272**. Eighty one and one half hours are used by the primary rotary station and rotary table **160** to drill the twelve and one quarter inch hole as depicted by time bar **274**. Time bar **276** discloses sixteen hours to run and cement the nine and five eighths inch casing. An eight and one half inch drill hole then consumes fourteen hours as depicted by time bar **278** and finally the main rig utilizes thirty and one half hours as depicted by time bar **280** to recover the blowout preventer.

During this same time sequence the second or auxiliary tubular advancing station **162** is used to jet drill the thirty inch casing in twenty one and one half hours as shown by hashed time bar **282**. Then the twenty inch casing is drilled and run during a period of forty four and one half hours as shown by time bar **284**. The auxiliary rig is then used for five hours to make up and lay down bottom hole assemblies and running tools for five hours as shown by time bar **286**. Eight and one half hours are used to set back thirteen and three eighths inch doubles as shown in time bar **288**. Time bar **290** illustrates the use of four and one quarter hours to make up and lay down bottom hole assemblies and running tools, and ten hours are required, as shown in time bar **292**, to set back nine and five eights inch doubles. Four hours are then required as shown by time bar **300** to make up and lay down bottom hole assemblies and running tools and then nine and one half hours are used to make up and run a casing cutter as depicted by time bar **302**. The wellhead is then recovered in six and one half hours as shown on time bar **304** and finally eight hours are utilized as depicted in time frame **206** to lay down the drill string.

By comparing the identical sequence of events from a conventional drilling operation to the subject multi-activity drilling method and apparatus, it will be appreciated that the critical path has been substantially reduced. In this particular example of exploration drilling activity, the time saving comprises twenty nine percent reduction in time for a drilling operation. In other instances, and depending upon the depth of the water, this time sequence could be longer or shorter, but it will be appreciated by those of ordinary skill in the art that as the depth of water increases, the advantage of a multi-activity drilling method and apparatus in accordance with the subject invention increases.

The above example is illustrated with respect to an exploration drilling program. Developmental drilling actively may be required which would involve twenty or more wells. In this event, the subject invention can advantageously conduct multiple well developmental drilling activity, or work over activity, simultaneously on multiple wells, and again dramatically reduce the amount of time the drillship will be required to stay on site.

SUMMARY OF MAJOR ADVANTAGES OF THE INVENTION

After reading and understanding the foregoing description of preferred embodiments of the invention, in conjunction with the illustrative drawings, it will be appreciated that several distinct advantages of the subject multi-activity drilling method and apparatus are obtained.

Without attempting to set forth all of the desirable features and advantages of the instant method and apparatus, at least some of the major advantages of the invention are depicted by a comparison of FIG. **23***a* and FIG. **23***b* which visually illustrates the dramatic enhancement in efficiency of the subject invention. As noted above, even greater time efficiencies will be realized in developmental drilling or well remedial works over activity.

The enhanced drilling time, and thus cost savings, is provided by the multi-activity derrick having substantially identical tubular advancing stations wherein primary drilling activity can be conducted within the derrick and auxiliary activity concomitantly conducted from the same derrick and through the same moon pool.

The derrick includes dual rotary stations, and in a preferred embodiment top drives and a dual tubular handling system. A plurality of tubular set back envelopes are positioned adjacent the dual rotary station, and first and second conduit handling assemblies operably transfer riser segments, casing, and drillpipe assemblies between the first and second tubular advancing stations and any of the set back envelopes. The dual derrick drawworks are independently controlled by substantially identical drill consoles mounted upon the drilling floor of the derrick such that independent operations can be performed simultaneously by a main drilling rotary station through a moon pool while auxiliary operations can be simultaneously conducted through a second rotary station and the moon pool.

The multi-station derrick enables a driller to move many rotary operations out of the critical path such as blowout prevention and riser running while drilling a top hole; making up bottom hole assemblies or running tools with an auxiliary rotary while drilling with a primary rotary station; making up and standing back casing with the auxiliary rotary while drilling with the primary rotary assembly; test running; measurements while drilling while continuing primary drilling activity; and deploying a high-pressure second stack/riser outside of primary rig time. Still further, the subject invention permits an operator to rig up to run trees with the auxiliary rotary station while carrying out normal operations with a primary rotary station; running a subsea tree to the bottom with the auxiliary rotary station while completing riser operations and simultaneously running two subsea trees, bases, etc.

In describing the invention, reference has been made to preferred embodiments and illustrative advantages of the invention. In particular, a large, tanker dimension drillship **30** has been specifically illustrated and discussed which is the presently envisioned preferred embodiment. It will be appreciated, however, by those of ordinary skill in the art, that the subject single derrick with multi-rotary structure may be advantageously utilized by other offshore platform systems such as jack-ups, semi-submersibles, tension leg platforms, fixed towers, and the like, without departing from the subject invention. Those skilled in the art, and familiar with the instant disclosure of the subject invention, may also recognize other additions, deletions, modifications, substitutions, and/or other changes which will fall within the purview of the subject invention and claims.

What is claimed is:

1. A drillship having a bow, a stern and an intermediate moon pool between the bow and stern and being fitted to conduct offshore drilling operations through the moon pool and into the bed of a body of water, said drillship including:

a unitary derrick having four sides joined at their edges and having a central opening within the derrick, said unitary derrick being positioned upon the drillship and extending above the moon pool for simultaneously supporting drilling operations for a wellhole and operations auxiliary to drilling operations for the wellhole through the moon pool;

a first means within and connected to said unitary derrick for advancing tubular members through the moon pool, to the seabed and into the bed of the body of water;

first means, within and connected to said unitary derrick, for handling tubular members as said tubular members are advanced through the moon pool by said first means for advancing;

a second means within and connected to said unitary derrick for advancing tubular members through the moon pool to the seabed and into the bed of the body of water; and

second means, within and connected to said unitary derrick, for handling tubular members as said tubular members are advanced through the moon pool by said second means for advancing for conducting operations for the wellhole extending to the seabed auxiliary to said drilling operations for the wellhole, wherein said drilling activity can be conducted from said unitary derrick by said first or second means for advancing and said first or second means for handling tubular members and auxiliary drilling activity can be simultaneously conducted from said unitary derrick by the other of said first or second means for advancing and the other of said first or second means for handling tubular members.

2. A drillship as defined in claim **1** wherein said first and second means for advancing tubular members comprise:

a first and second top drive assembly respectively.

3. A drillship as defined in claim **1** wherein said first and second means for advancing tubular members comprise:

a first and second rotary table positioned within said unitary derrick.

4. A drillship as defined in claim **3** wherein:

said first rotary table and said second rotary table being mutually spaced along a center line of the drillship and within the periphery of said unitary derrick.

5. A drillship as defined in claim **1** and further including:

a first driller's console operable to control said first means for advancing tubular members; and

a second driller's console substantially similar to said first driller's console and being operable to independently control said second means for advancing tubular members.

6. A drillship as defined in claim **1** and further including:

a first tubular setback envelope positioned adjacent to said first means for advancing tubular members; and

a second tubular setback envelope positioned adjacent to said second means for advancing tubular members.

7. A drillship as defined in claim **6** and further including:

a third tubular setback envelope positioned between said first tubular setback envelope and said second tubular setback envelope.

8. A drillship as defined in claim **6** and further including:

a tubular handling system for transferring tubular members between said first tubular setback envelope and said second tubular setback envelope and said first means for advancing tubular members and said second means for advancing tubular members.

9. A method for conducting offshore drilling operations into the bed of a body of water, for a single well, from a drilling deck operable to be positioned above the surface of the body of water, said method being conducted, at least partially, from a first station for advancing tubular members and, at least partially, from a second station for advancing tubular members, the method including the steps of:

(a) drilling a well bore comprising at least a portion of a wellhole into the bed of the body of water from the first or second station for advancing tubular members;

(b) running at least one casing from the first or second station for advancing tubular members into the at least a portion of the wellhole;

(c) simultaneously during at least a portion of the time period utilized for performing steps (a) and (b), running a blowout preventer and riser into the body of water from the other of said first or second station for advancing tubular members to a position in proximity to the at least a portion of the wellhole in the seabed, wherein the events of step (c) are performed independently of and during at least a portion of the same time period as the events of steps (a) and (b) to reduce the overall time necessary to perform steps (a) through (c) for conducting offshore drilling operations from the drilling deck on a single well being drilled into the bed of the body of water;

(d) laterally repositioning the drilling deck until the other of said first or second station for advancing tubular members and the blowout preventer and riser are positioned over the well bore comprising at least a portion of a wellhole; and

(e) connecting the blowout preventer and the riser extending from the other of said first or second tubular station onto the at least one casing in the well bore comprising at least a portion of a wellhole at a location in proximity to the seabed.

10. A method for conducting offshore drilling operations into the bed of a body of water, for a single well, from a drilling deck operable to be positioned above the surface of the body of water as defined in claim **9** and further comprising the steps of:

(f) making-up extended lengths of tubular members at the first or second station for advancing tubular members;

(g) transferring the extended lengths of tubular members made up at the first or second station for advancing tubular members to the other of said first or second station for advancing tubular members; and

(h) using the extended lengths of tubular members, made up at the first or second station for advancing tubular members, conducting drilling operations coaxially through the riser and into the single wellhole from the other of said first or second station for advancing tubular members.

11. A method for conducting offshore drilling operations into the bed of a body of water, for a single well, from a drilling deck operable to be positioned above the surface of the body of water as defined in claim **9**, said drilling deck being mounted upon a floating vessel, wherein said step (d) of laterally repositioning the drilling deck until the other of said first or second station for advancing tubular members is positioned over the well bore comprising at least a portion of a wellhole comprises the step of:

laterally repositioning the vessel supporting the drilling deck, said vessel floating generally upon the surface of the body of water.

12. A method for conducting offshore drilling operations into the bed of a body of water, for a single well, from a drilling deck operable to be positioned above the surface of the body of water, said method being conducted, at least partially, from a first station for advancing tubular members and at least partially from a second station for advancing tubular members, the method including the steps of:

(a) drilling a well bore comprising a first portion of a wellhole into the bed of the body of water from one of said first or second stations for advancing tubular members;

(b) running a first casing from one of said first or second stations for advancing tubular members into the first portion of the wellhole;

(c) drilling at least a second portion of the wellhole having a diameter smaller than the diameter of the first portion of the wellhole into the bed of the body of water coaxially through the first casing from one of said first or second stations for advancing tubular members to a depth greater than the depth of the first portion of the wellhole;

(d) running a second, smaller diameter, casing from one of said first or second stations for advancing tubular members coaxially through the first casing and into the second, smaller diameter, portion of the wellhole drilled in step (c); and

(e) simultaneously during at least a portion of the time period utilized for performing steps (a) through (d), making-up and running a blowout preventer and riser into the body of water from one of said first or second stations for advancing tubular members not then occupied performing at least one of one of steps (a) through (d) to a position in proximity to the wellhole in the seabed, wherein the events of step (e) are performed independently of and during at least a portion of the same time period as the events of steps (a) through (d) to reduce the overall time necessary to perform steps (a) through (e) for conducting offshore drilling operations from the drilling deck, on a single well, being drilled into the bed of the body of water;

(f) following completion of the events of steps (a) through (d) laterally repositioning the drilling deck until the blowout preventer and riser is positioned over the well bore of the wellhole; and

(g) connecting the blowout preventer and the riser onto the second casing in the single wellhole approximately at the seabed of the body of water.

13. A method for conducting offshore drilling operations into the bed of a body of water, for a single well, from a drilling deck operable to be positioned above the surface of the body of water, as defined in claim **12**, and further comprising the steps of:

during at least a portion of the period of step (e) using said one of said first or second stations for advancing tubular members to make-up a bottom hole assembly for use in conducting drilling operations through the riser.

14. A method for conducting offshore drilling operations into the bed of a body of water, for a single well, from a drilling deck operable to be positioned above the surface of the body of water as defined in claim **12** and further comprising the steps of:

(h) making up extended lengths of tubular conduits at one of said first or second stations; and

(i) using the extended lengths of tubular conduits at the one of said first or second stations and using the extended lengths of tubular members for conducting drilling operations coaxially through the riser and into the single wellhole.

15. A method for conducting offshore drilling operations into the bed of a body of water, for a single well, from a drilling deck operable to be positioned above the surface of the body of water, said method being conducted, at least partially, from a first station for advancing tubular members and at least partially from a second station for advancing tubular members, the method including the steps of:

(a) making up and running to the seabed a first casing from the first station for advancing tubular members and making up a first bottom hole assembly, running a drillstring to the seabed and drilling a first section of a wellhole from the second stations for advancing tubular members, at least a portion of the activity of each station for advancing tubular members being performed simultaneously;

(b) re-aligning the first station for advancing tubular members so that it is positioned above the wellhole drilled by the second station for advancing tubular members in step (a);

(c) landing the first casing on the wellhole, cementing and testing and, with the second station for advancing tubular members, making up a second bottom hole assembly and running said second bottom hole assembly to the seabed;

(d) re-aligning the second station for advancing tubular members so that it is positioned above the wellhole;

(e) making up and running to the seabed a second casing from the first station for advancing tubular members and drilling a second section of a wellhole from the second station for advancing tubular members, at least a portion of the activity of each station advancing tubular members being performed simultaneously;

(f) re-aligning the first station for advancing tubular members so that it is positioned above the wellhole;

(g) landing the second casing on the wellhole, cementing and testing and, with the second station for advancing tubular members, making up a third bottom hole assembly and running said third bottom hole assembly to the seabed;

(h) re-aligning the second station for advancing tubular members so that it is positioned above the wellhole;

(i) rigging up and running a blowout preventer and a marine riser to the seabed from the first station for advancing tubular members and drilling a third section of a wellhole, retrieving the drillstring, making up and running to the seabed a third casing from the second station for advancing tubular members, landing, cementing and testing said third casing;

(j) re-aligning the first station for advancing tubular members so that it is positioned above the wellhole;

(k) landing and latching the blowout preventer to the wellhead from said first station for advancing tubular members and making up and standing back a bottom hole assembly for the next wellhole section from the second station for advancing tubular members; and

(l) picking up the bottom hole assembly for the next wellhole section, running to the seabed, and drilling the next wellhole section from the first station and making up and setting back stands of casing for the next wellhole section from the second station for advancing tubular members, at least a portion of the activity being performed simultaneously.

16. The method for conducting offshore drilling operations as defined in claim **15**:

wherein the step of re-aligning the first or second station for advancing tubular members includes laterally repositioning the drilling deck.

17. A multi-activity drilling assembly operable to be supported from a position above the surface of a body of water for conducting drilling operations to the seabed and into the bed of the body of water, said multi-activity drilling assembly including:

a drilling superstructure operable to be mounted upon a drilling deck for simultaneously supporting drilling operations for a well and operations auxiliary to drilling operations for the well;

a first tubular advancing station connected to said drilling superstructure for advancing tubular members to the seabed and into the bed of body of water;

a second tubular advancing station connected to said drilling superstructure for advancing tubular members simultaneously with said first tubular advancing station to the seabed and into the body of water to the seabed; and

an assembly positioned adjacent to said first and second tubular advancing stations operable to transfer tubular assemblies between said first tubular advancing station and said second tubular advancing station to facilitate simultaneous drilling operations auxiliary to said drilling operations, wherein drilling activity can be conducted for the well from said drilling superstructure by said first or second tubular advancing stations and auxiliary drilling activity can be simultaneously conducted for the well from said drilling superstructure by the other of said first or second tubular advancing stations.

18. A multi-activity drilling assembly as defined in claim **17** and further including:

a first tubular setback station positioned adjacent to said first tubular advancing station; and

a second tubular setback stationed positioned adjacent to said second tubular advancing station.

19. A multi-activity drilling assembly as defined in claim **17** wherein said first and second tubular advancing stations comprise:

a first and second top drive assembly connected to said drilling superstructure.

20. A multi-activity drilling assembly as defined in claim **17** wherein said first and second tubular advancing stations comprise:

a first and second rotary table positioned adjacent to said drilling superstructure for assisting in performing drilling operations and for simultaneously assisting in performing operations auxiliary to drilling operations through the drilling deck.

21. A multi-activity drilling assembly as defined in claim **17** wherein said first tubular advancing station and said second tubular advancing station include:

a first drawworks for hoisting tubular members; and

a second drawworks for hoisting tubular members respectively.

22. A method for conducting offshore drilling operations with a multi-activity drilling assembly operable to be mounted upon a drilling deck positioned above the surface of a body of water and having a first tubular station and a second tubular station, the method including the steps of:

advancing tubular members from the first tubular station and into the bed of a body of water to the seabed for conducting drilling operations for a well;

advancing tubular members from the second tubular station and into the bed of a body of water to the seabed for conducting activity auxiliary to drilling activity for the well; and

transferring tubular members between the first tubular station and the second tubular station wherein primary drilling activity can be conducted by advancing tubular members from the first or second tubular station and auxiliary drilling activity can be conducted simultaneously for the well by advancing tubular members to the seabed from the other of the first or second tubular station.

23. A method for conducting offshore drilling operations as defined in claim **22** wherein said step of advancing the tubular members from the first tubular station functions includes:

rotating the tubular members with a first top drive supported from an upright superstructure.

24. A method for conducting offshore drilling operations as defined in claim **23** wherein said step of advancing the tubular members from the second tubular stations includes:

rotating the tubular members with a second top drive supported from an upright superstructure.

25. A method for conducting offshore drilling operations as defined in claim **22** wherein said step of advancing tubular members from the first second tubular stations includes:

rotating tubular members at said first tubular station with a rotary table; and

rotating tubular members at said second tubular station with a second rotary table.

26. A method for conducting drilling operations as defined in claim **22** wherein said steps of advancing first and second tubular members includes:

hoisting tubular members from a first tubular station; and

hoisting tubular members from a second tubular station respectively.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 6,068,069
DATED : May 30, 2000
INVENTOR(S) : Scott et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Title page,
Drawing, the reference numeral 182 should read -- 181 --.

Drawings,
Sheet 1,
Fig. 1, the reference numeral 46 should read -- 42 --.

Sheet 3,
Fig. 5, the reference numeral 182 should read -- 183 --.

Sheet 3,
Fig. 5, the reference numeral 183 should read -- 182 --.

Sheet 4,
Fig. 6, the reference numeral 140 should read -- 142 --.
Fig. 6, the reference numeral 156 should read -- 158 --.

Sheet 5,
Fig. 7, the reference numeral 182 should read -- 181 --.

Column 1,
Line 63, between "site" and "legs" insert -- , --.

Column 2,
Line 41, "amid ships" should read -- amidships --.

Column 5,
Line 3, after "above" delete "a" insert -- the --.
Line 3, after "and" insert -- is --.
Line 33, "sack" should read -- stack --.

Column 6,
Line 14, delete -- 101 --.
Line 53, "140" should read -- 142 --.

Column 7,
Line 8, after "tubular" insert -- advancing station --.
Line 10, "advanced" should read -- advancing --.

US006085851A

United States Patent [19]

Scott et al.

[11] **Patent Number: 6,085,851**

[45] **Date of Patent: Jul. 11, 2000**

[54] **MULTI-ACTIVITY OFFSHORE EXPLORATION AND/OR DEVELOPMENT DRILL METHOD AND APPARATUS**

[75] Inventors: **Robert J. Scott**, Sugarland; **Robert P. Herrmann**; **Donald R. Ray**, both of Houston, all of Tex.

[73] Assignee: **Transocean Offshore Inc.**

[21] Appl. No.: **08/642,417**

[22] Filed: **May 3, 1996**

[51] **Int. Cl.**[7] **E21B 15/02**; B63B 35/44

[52] **U.S. Cl.** **175/7**; 405/195.1

[58] **Field of Search** 175/5, 6, 7, 8, 175/9; 405/195.1, 224, 223.1

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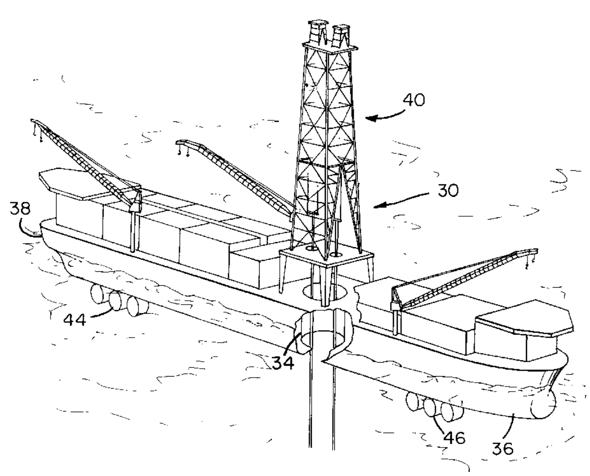
Primary Examiner—David J Bagnell
Attorney, Agent, or Firm—Bradford Kile

[57] **ABSTRACT**

A multi-activity drilliship, or the like, method and apparatus having a single derrick and multiple tubular activity stations within the derrick wherein primary drilling activity may be conducted from the derrick and simultaneously auxiliary drilling activity may be conducted from the same derrick to reduce the length of the primary drilling activity critical path.

13 Claims, 8 Drawing Sheets



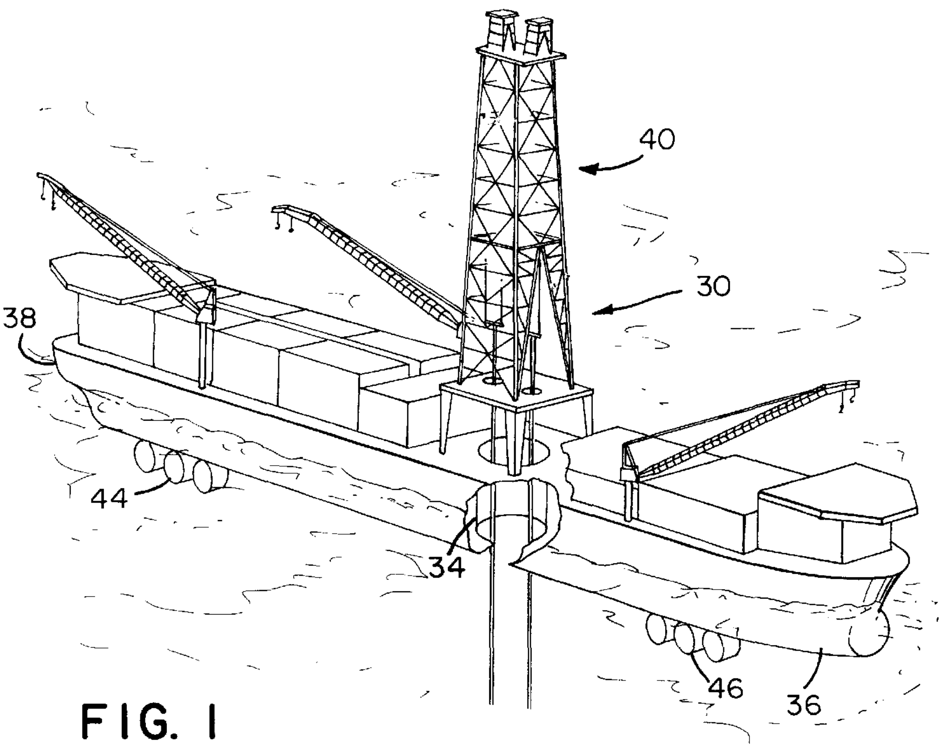

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FIG. 1

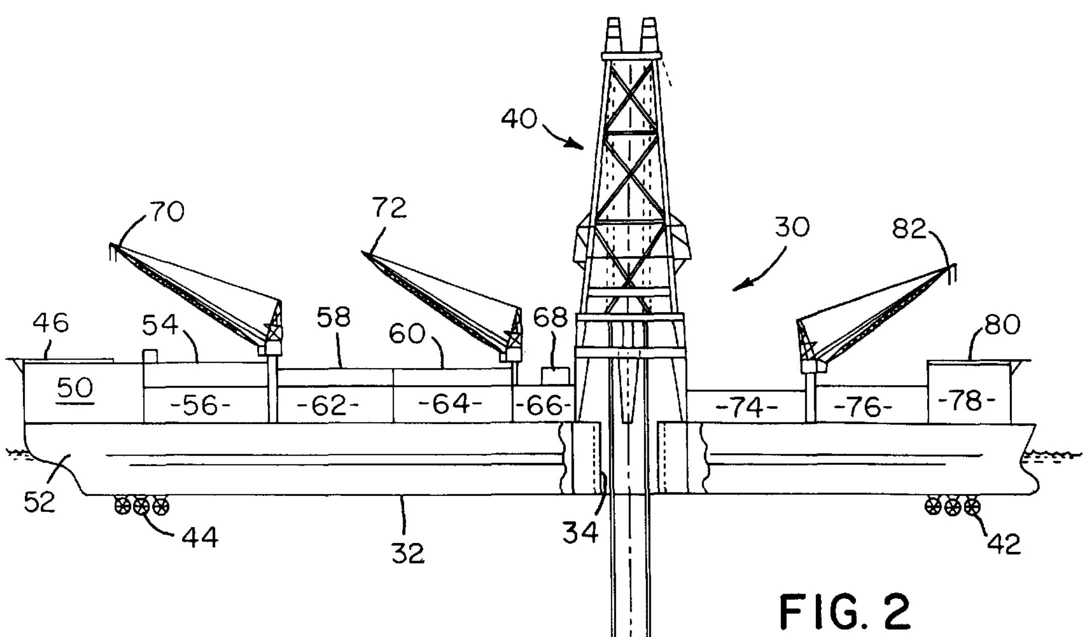
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FIG. 2

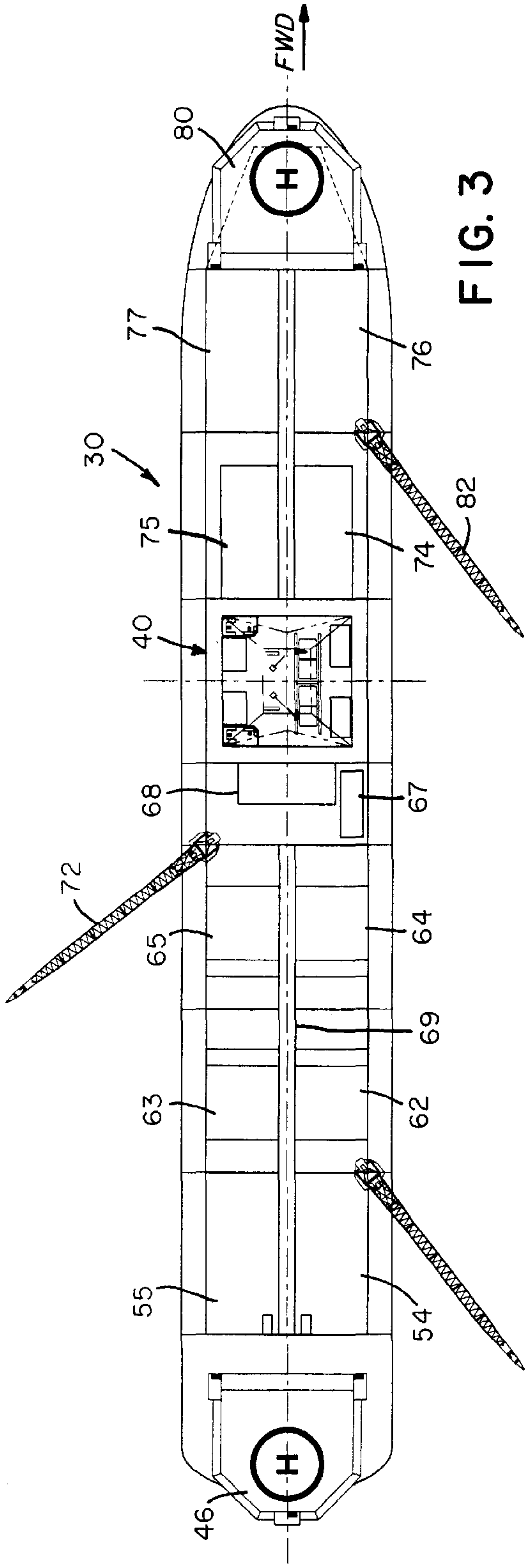
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FIG. 3

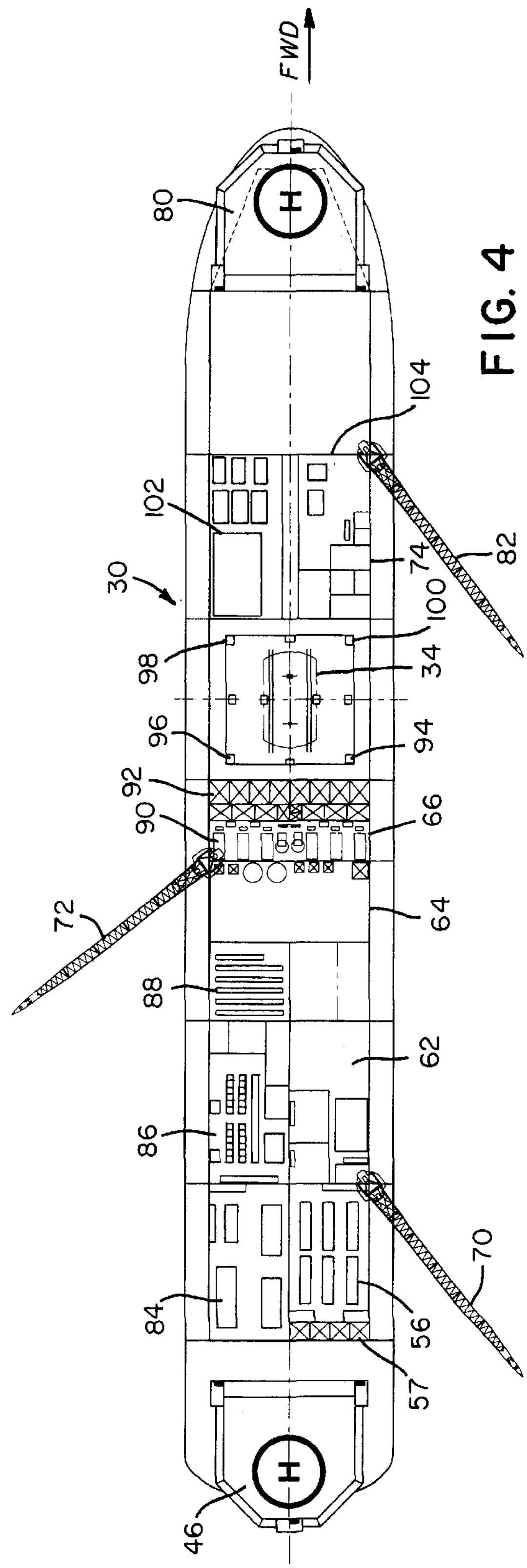
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FIG. 4

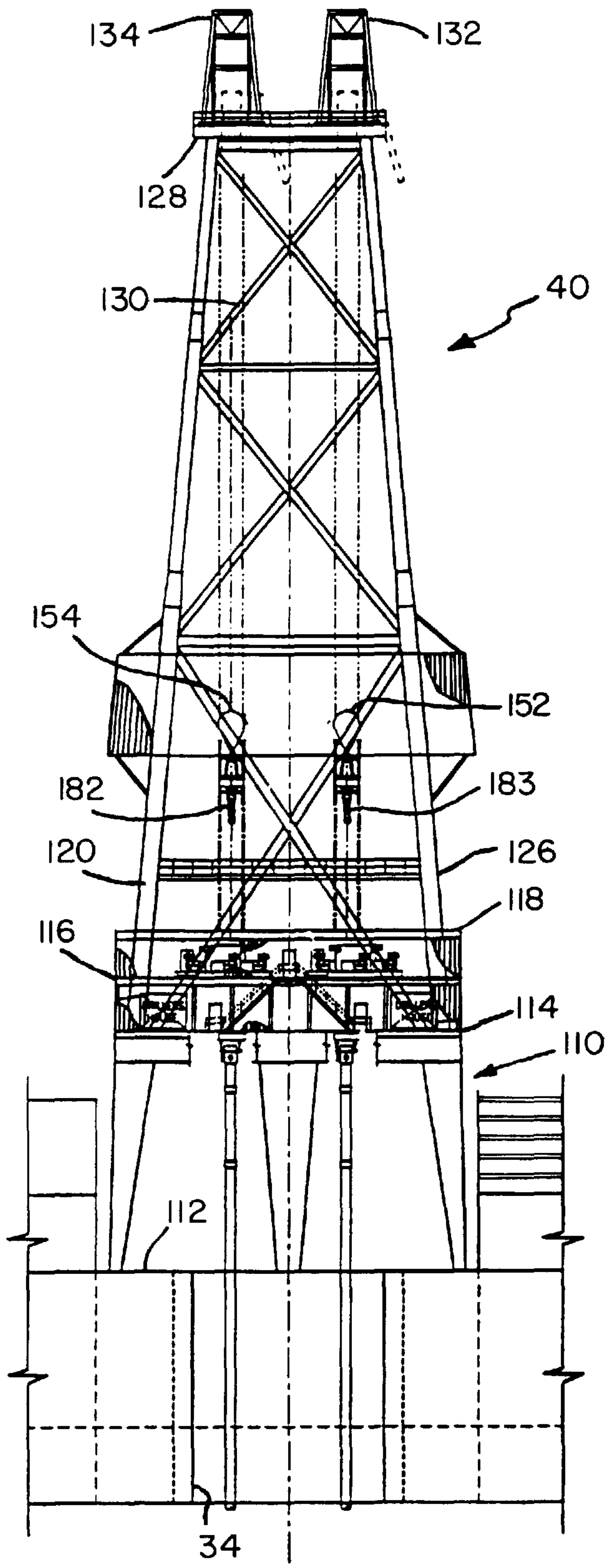

FIG. 5

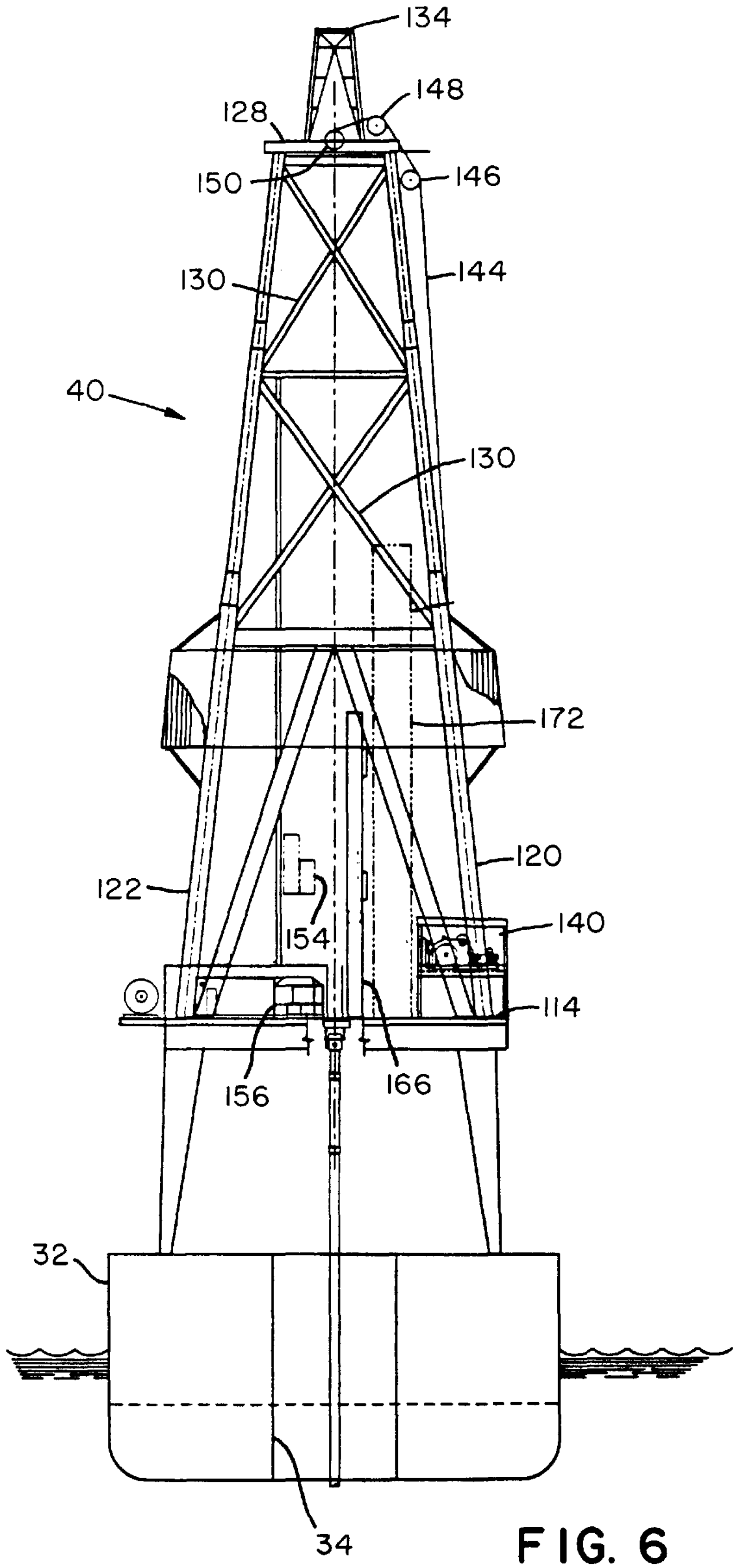
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FIG. 6

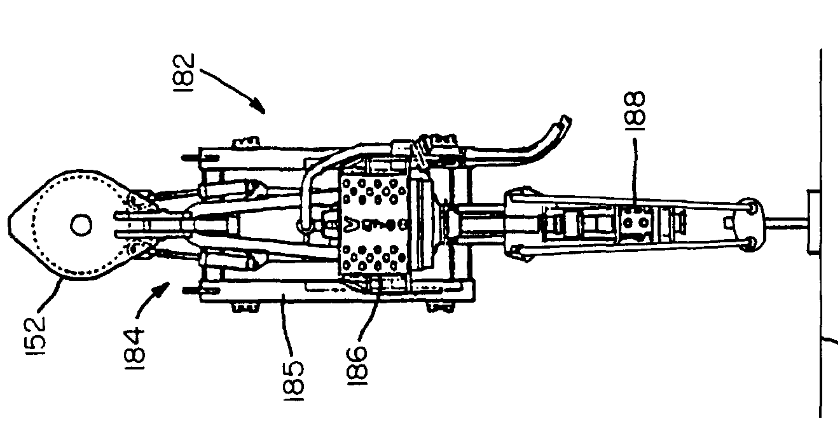
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FIG. 8

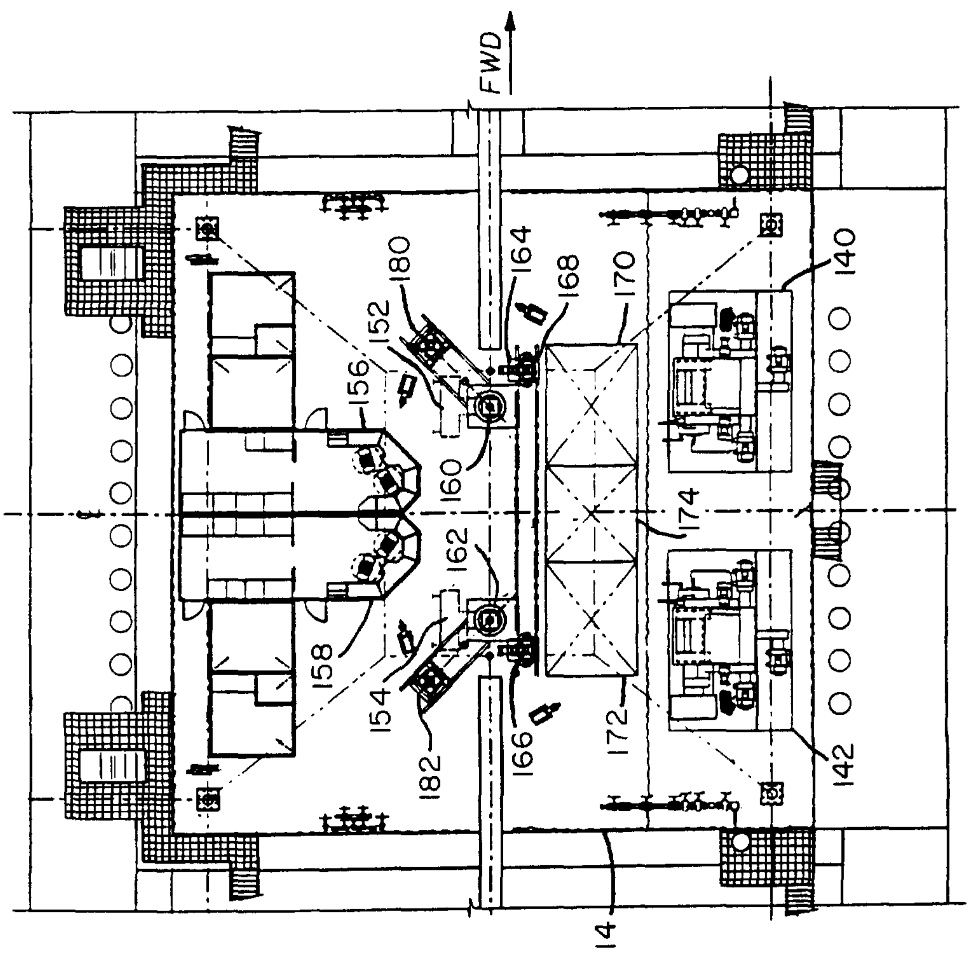
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FIG. 7

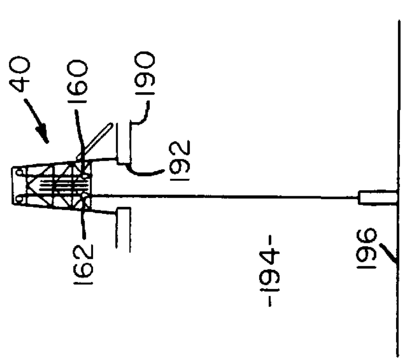

FIG. 9

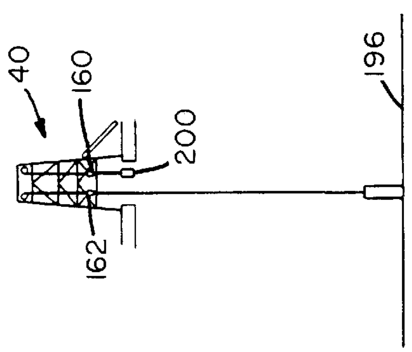

FIG. 10

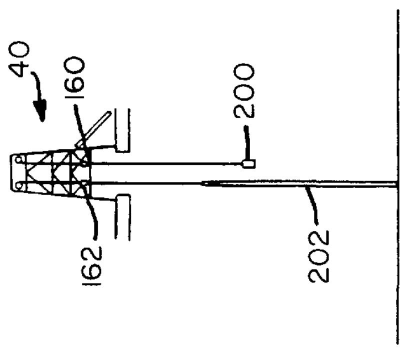

FIG. 11

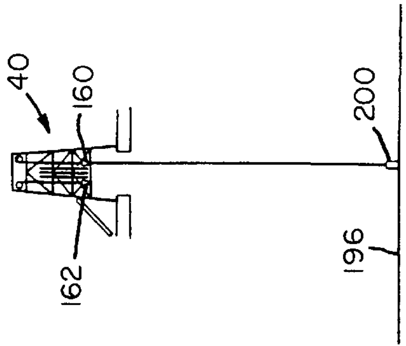

FIG. 12

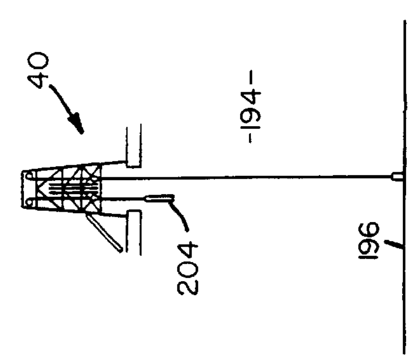

FIG. 13

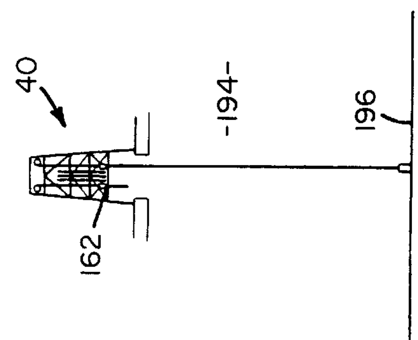

FIG. 14

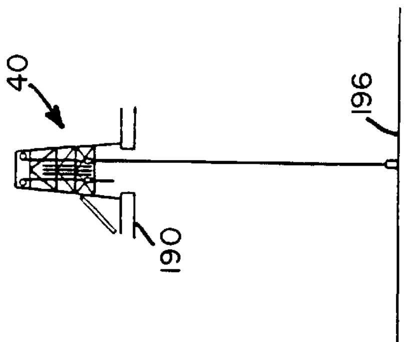

FIG. 15

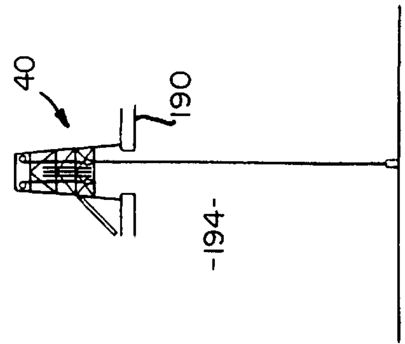

FIG. 16

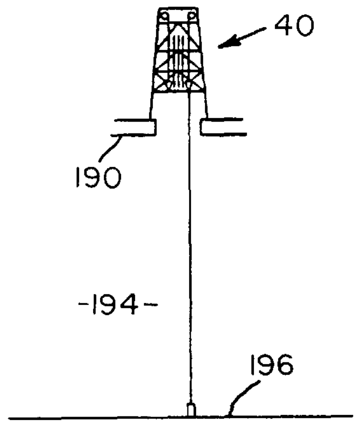

FIG. 17

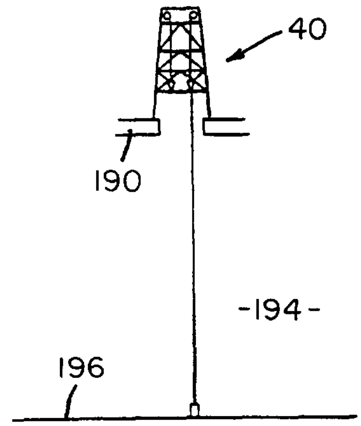

FIG. 18

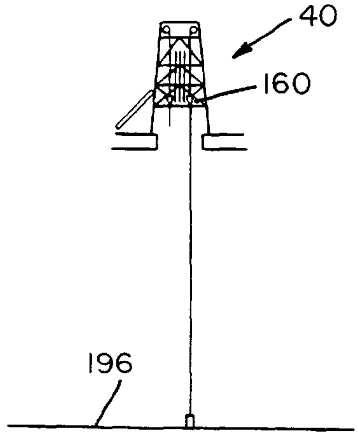

FIG. 19

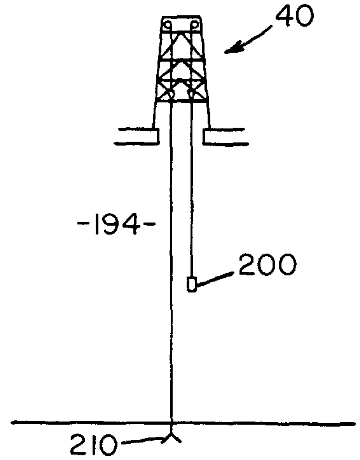

FIG. 20

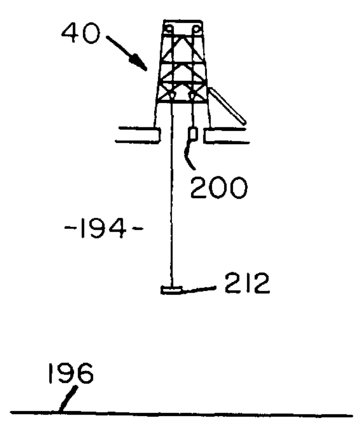

FIG. 21

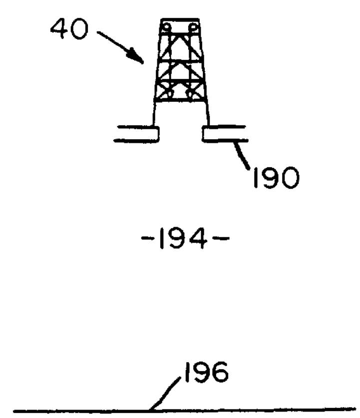

FIG. 22

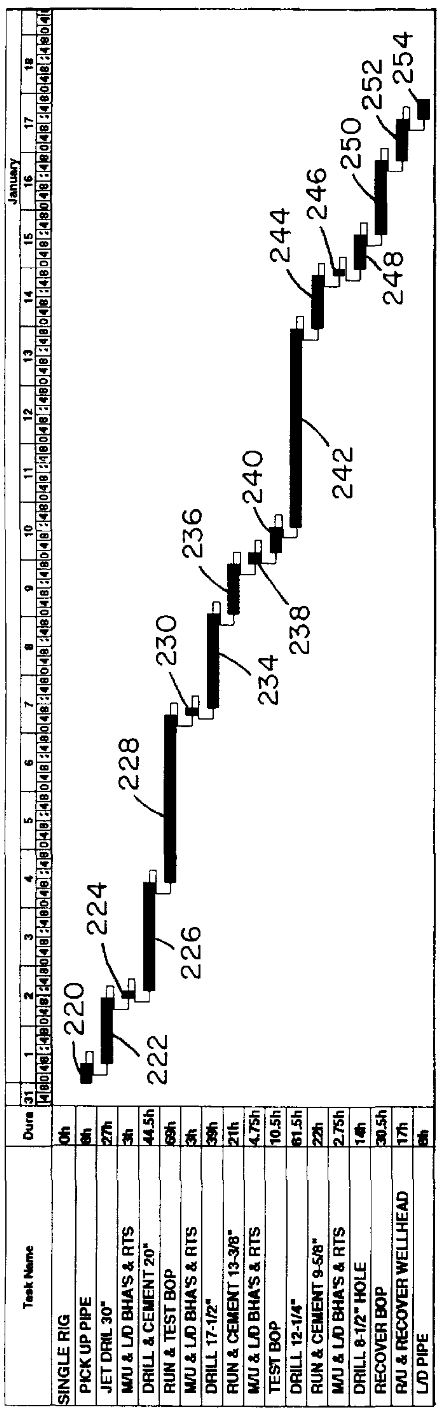

FIG. 23a

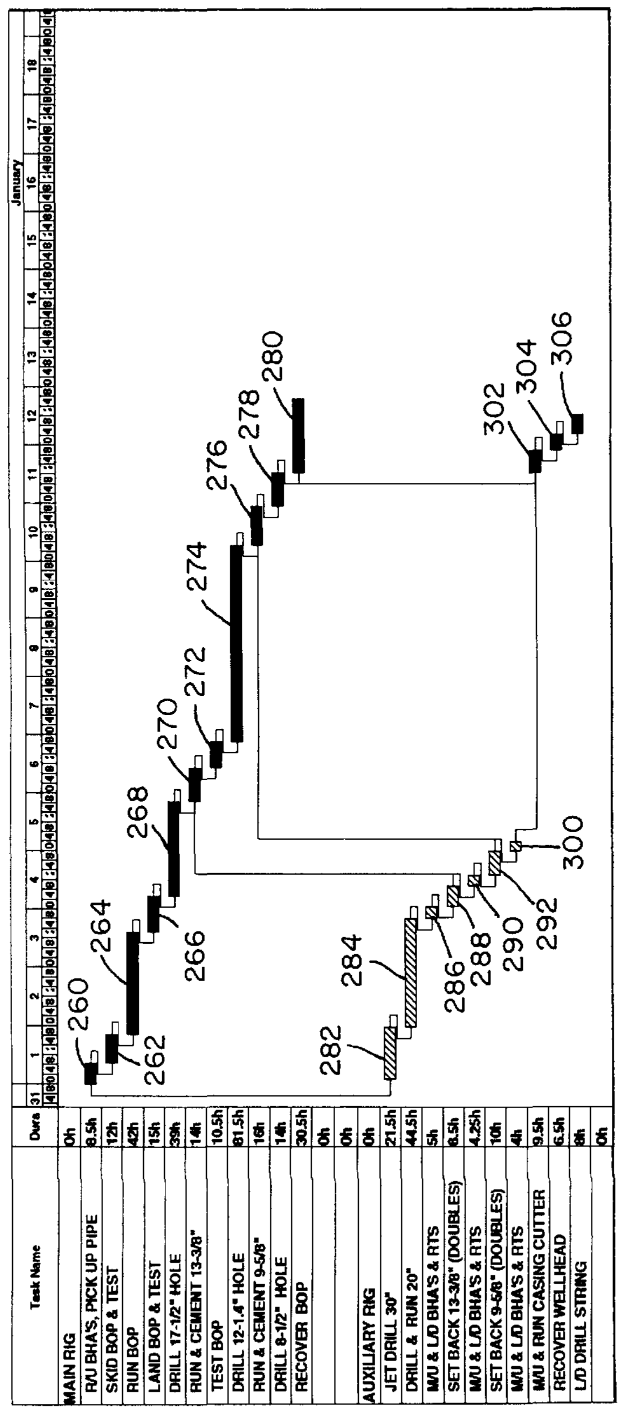

FIG. 23b

MULTI-ACTIVITY OFFSHORE EXPLORATION AND/OR DEVELOPMENT DRILL METHOD AND APPARATUS

BACKGROUND OF THE INVENTION

This invention relates to a novel method and apparatus for offshore drilling operations. More specifically, this invention relates to a method and apparatus for conducting exploration drilling offshore, with a single derrick wherein primary and auxiliary exploration drilling operations may be performed simultaneously to shorten the critical path of primary drilling activity. In addition, this invention relates to a method and apparatus wherein a single derrick is operable to perform multiple drilling, development, and work over operations simultaneously.

In the past, substantial oil and gas reserves have been located beneath the Gulf of Mexico, the North Sea, the Beaufort Sea, the Far East regions of the world, the Middle East, West Africa, etc. In the initial stages of offshore exploration and/or development drilling, operations were conducted in relatively shallow water of a few feet to a hundred feet or so along the near shore regions and portions of the Gulf of Mexico. Over the years, the Gulf and other regions of the world have been extensively explored and known oil and gas reserves in shallow water have been identified and drilled. As the need for cost effective energy continues to increase throughout the world, additional reserves of oil and gas have been sought in water depths of three to five thousand feet or more on the continental shelf. As an example, one actively producing field currently exists off the coast of Louisiana in two thousand eight hundred feet of water and drilling operations off New Orleans are envisioned in the near future in approximately three thousand to seven thousand five hundred feet of water. Still further, blocks have been leased in fields of ten thousand feet and by the year 2000 it is anticipated that a desire will exist for drilling in twelve thousand feet of water or more.

Deep water exploration stems not only from an increasing need to locate new reserves, as a general proposition, but with the evolution of sophisticated three dimensional seismic imaging and an increased knowledge of the attributes of turbidities and deep water sands, it is now believed that substantial high production oil and gas reserves exist within the Gulf of Mexico and elsewhere in water depths of ten thousand feet or more.

Along the near shore regions and continental slope, oil reserves have been drilled and produced by utilizing fixed towers and mobile units such as jack-up platforms. Fixed towers or platforms are typically fabricated on shore and transported to a drilling site on a barge or self floating by utilizing buoyancy chambers within the tower legs. On station, the towers are erected and fixed to the seabed. A jack-up platform usually includes a barge or self-propelled deck which is used to float the rig to station. On site legs at the corners of the barge or self-propelled deck are jacked down into the seabed until the deck is elevated a suitable working distance above a statistical storm wave height. An example of a jack-up platform is disclosed in Richardson U.S. Pat. No. 3,412,981. A jack-up barge is depicted in U.S. Pat. No. 3,628,336 to Moore et al.

Once in position fixed towers, jack-up barges and platforms are utilized for drilling through a short riser in a manner not dramatically unlike land based operations. It will readily be appreciated that although fixed platforms and jack-up rigs are suitable in water depths of a few hundred feet or so, they are not at all useful for deep water applications.

In deeper water, a jack-up tower has been envisioned wherein a deck is used for floatation and then one or more legs are jacked down to the seabed. The foundation of these jack-up platforms can be characterized into two categories: (1) pile supported designs and (2) gravity base structures. An example of a gravity base, jack-up tower is shown in U.S. Herrmann et al. Pat. No. 4,265,568. Again, although a single leg jack-up has advantages in water depths of a few hundred feet it is still not a design suitable for deep water sites.

For deep water drilling, semi-submersible platforms have been designed, such as disclosed in U.S. Ray et al. U.S. Pat. No. 3,919,957. In addition, tension leg platforms have been used such as disclosed in U.S. Steddum U.S. Pat. No. 3,982,492. A tension leg platform includes a platform and a plurality of relatively large legs extending downwardly into the sea. Anchors are fixed to the seabed beneath each leg and a plurality of permanent mooring lines extend between the anchors and each leg. These mooring lines are tensioned to partially pull the legs against their buoyancy, into the sea to provide stability for the platform. An example of a tension leg platform is depicted in U.S. Ray et al. U.S. Pat. No. 4,281,613.

In even deeper water sites, turret moored drillships and dynamically positioned drillships have been used. Turret moored drillships are featured in Richardson et al. U.S. Pat. Nos. 3,191,201 and 3,279,404.

A dynamically positioned drillship is similar to a turret moored vessel wherein drilling operations are conducted through a large central opening or moon pool fashioned vertically through the vessel amid ships. Bow and stern thruster sets are utilized in cooperation with multiple sensors and computer controls to dynamically maintain the vessel at a desired latitude and longitude station. A dynamically positioned drillship and riser angle positioning system is disclosed in Dean U.S. Pat. No. 4,317,174.

Each of the above-referenced patented inventions are of common assignment with the subject application.

Notwithstanding extensive success in shallow to medium depth drilling, there is a renewed belief that significant energy reserves exist beneath deep water of seven thousand to twelve thousand feet or more. The challenges of drilling exploratory wells to tap such reserves, however, and follow on developmental drilling over a plurality of such wells are formidable. In this it is believed that methods and apparatus existing in the past will not be adequate to economically address the new deep water frontier.

As drilling depths double and triple, drilling efficiency must be increased and/or new techniques envisioned in order to offset the high day rates that will be necessary to operate equipment capable of addressing deep water applications. This difficulty is exacerbated for field development drilling where drilling and completion of twenty or more wells is often required. In addition, work over or remedial work such as pulling trees or tubing, acidifying the well, cementing, recompleting the well, replacing pumps, etc. in deep water can occupy a drilling rig for an extended period of time.

Accordingly, it would be desirable to provide a novel method and apparatus that would be suitable for all offshore applications but particularly suited for deep water exploration and/or developmental drilling applications that would utilize drillships, semi-submersible, tension leg platforms, and the like, with enhanced efficiency to offset inherent increases in cost attendant to deep water applications.

OBJECTS OF THE INVENTION

It is, therefore, a general object of the invention to provide a novel method and apparatus for exploration and/or field development drilling of offshore oil and gas reserves, particularly in deep water sites.

It is a specific object of the invention to provide a novel method and apparatus utilizing a multi-activity derrick for offshore exploration and/or field development drilling operations which may be utilized in deep water applications with enhanced efficiency.

It is another object of the invention to provide a novel offshore exploration and/or field development drilling method and apparatus where a single derrick can be utilized for primary, secondary and tertiary tubular activity simultaneously.

It is a related object of the invention to provide a novel offshore exploration drilling method and apparatus wherein multi-drilling activities may be simultaneously performed within a single derrick, and thus certain tubular operations are removed from a critical path of primary drilling activity.

It is a further object of the invention to provide a novel method and apparatus where multi-tubular operations may be conducted from a single derrick and primary drilling or auxiliary tubular activity may be performed simultaneously through a plurality of tubular handling locations within a single derrick.

It is yet another object of the invention to provide a novel derrick system for offshore exploration and/or field development drilling operations which may be effectively and efficiently utilized by a drillship, semi-submersible, tension leg platform, jack-up platform, fixed tower or the like, to enhance the drilling efficiency of previously known systems.

It is yet another object of the invention to provide a novel method and apparatus for deep water exploration and/or production drilling applications with enhanced reliability as well as efficiency.

It is a further object of the invention to provide a novel method and apparatus for deep water field development drilling or work over remedial activity where multiple wells may be worked on simultaneously from a single derrick.

BRIEF SUMMARY OF THE PREFERRED EMBODIMENT OF THE INVENTION

A preferred embodiment of the invention which is intended to accomplish at least some of the foregoing objects comprises a multi-activity drilling assembly which is operable to be mounted upon a deck of a drillship, semi-submersible, tension leg platform, jack-up platform, offshore tower or the like for supporting exploration and/or development drilling operations through a deck and into the bed of a body of water.

The multi-activity drilling assembly includes a derrick for simultaneously supporting exploration and/or production drilling operations and tubular or other activity auxiliary to drilling operations through a drilling deck. A first tubular station is positioned within the periphery of the derrick for conducting drilling operations through the drilling deck. A second tubular station is positioned adjacent to but spaced from the first and within the periphery of the derrick for conducting operations auxiliary to the primary drilling function.

With the above multi-activity derrick, primary drilling activity can be conducted through the first tubular station and simultaneously auxiliary drilling and/or related activity can be conducted within the same derrick through the second tubular station to effectively eliminate certain activity from the primary drilling critical path.

THE DRAWINGS

Other objects and advantages of the present invention will become apparent from the following detailed description of a preferred embodiment thereof, taken in conjunction with the accompanying drawings, wherein:

FIG. **1** is an axonometric view of a drillship of the type that is suitable to advantageously utilize the multi-activity method and apparatus of exploration and/or field development drilling in accordance with the subject invention;

FIG. **2** is a side elevational view of the multi-activity drillship disclosed in FIG. **1** with a moon pool area broken away to disclose dual tubular strings extending from a single drilling derrick;

FIG. **3** is a plan view of the drillship as disclosed in FIGS. **1** and **2** which comprise a preferred embodiment of the invention;

FIG. **4** is a plan view of a mechanical deck of the drillship depicted in FIG. **3** disclosing several operational features of the subject invention;

FIG. **5** is a starboard elevational view of the multi-activity drilling derrick in accordance with a preferred embodiment of the subject invention mounted upon a drillship substructure or cellar deck;

FIG. **6** is an aft elevation view of the multi-activity derrick depicted in FIG. **5**;

FIG. **7** is a plan view of a drilling floor for the multi-activity drilling derrick in accordance with a preferred embodiment of the invention;

FIG. **8** is an illustrative elevation view of a top drive operable to rotate and drive tubulars in accordance with a preferred embodiment of the invention;

FIG. **9** through **22** depict a schematic sequence of views illustrating primary and auxiliary tubular activity being performed in accordance with one sequence of exploration drilling utilizing the subject method and apparatus; and

FIGS. **23***a* and **23***b* disclose a time line for an illustrative exploratory drilling operation wherein a critical path of activity for a conventional drilling operation is depicted in FIG. **23***a* and a similar critical path time line for the same drilling activity in accordance with a method and apparatus of the subject invention, is depicted in FIG. **23***b*. FIG. **23***b* discloses a dramatic increases in exploration drilling efficiency with the subject invention.

DETAILED DESCRIPTION

Context of the Invention

Referring now to the drawings wherein, like numerals indicate like parts, and initially to FIG. **1** there will be seen an axonometric view of an offshore drillship in accordance with a preferred embodiment of the subject invention. This dynamically positioned drillship discloses the best mode of practicing the invention currently envisioned by the applicants for patent. More specifically, the subject multi-activity drillship **30** comprises a tanker-type hull **32** which is is fabricated with a large moon pool **34** between the bow **36** and stern **38**. A multi-activity derrick **40** is mounted upon the drillship substructure above a moon pool **34** and operable to conduct primary tubular operations and simultaneously operations auxiliary to primary tubular operations from a single derrick through the moon pool. In this application the term tubular is used as a generic expression for conduits used in the drilling industry and includes relative large riser conduits, casing and drillstrings of various diameters.

The drilship **30** may be maintained on station by being moored, or by being turret moored such as disclosed, for example, in the above-referenced Richardson U.S. Pat. Nos. 3,191,201 and 3,279,404. In a preferred embodiment the drillship **30** is accurately maintained on station by being dynamically positioned. Dynamic positioning is performed by utilizing a plurality of bow thrusters **42** and stern thrusters **44** which are accurately controlled by computers utilizing input data to control the multiple degrees of freedom of the floating vessel in varying environmental conditions of wind, current, wave swell, etc. Dynamic positioning is relatively sophisticated and by utilizing satellite references is capable of very accurately maintaining a drillship at a desired latitude and longitude, on station, over a well-head.

Muffi-Activity Drillship

Referring now to FIGS. **1** through **4**, there will be seen a plurality of views which disclose, in some detail, a multi-activity drilship in accordance with a preferred embodiment of the invention. In this, FIG. **2** discloses a starboard elevation of the multi-activity drillship which includes an aft heliport **46** above ship space **50** and a main engine room **52**. Riser storage racks **54** are positioned above an auxiliary engine room **56**. First **58** and second **60** pipe racks are positioned in advance of the riser storage area **54** and above an auxiliary machine room **62**, warehouse and sack stores **64** and mud rooms **66**. A shaker house **68** extends above the mud room **66** and adjacent to an aft portion of the multi-activity derrick **40**. A first **70** and second **72** 75-ton crane, with 150-foot booms, are mounted aft of the multi-activity derrick **40** and operably are utilized, for example, in connection with the riser and pipe handling requirements of the operating drillship.

A machinery room and well testing area **74** is constructed adjacent to a forward edge of the multi-activity drill derrick **40** and an additional riser storage area **76** and crew quarters **78** are positioned forward of the well testing area as shown in FIG. **2**. Another 75-ton crane **82**, with a 150-foot boom, is positioned forward of the multi-activity derrick **40** and operably services a forward portion of the drillship.

Referring to FIGS. **3** and **4**, there will be seen plan views of a pipe deck and a machinery deck of a preferred embodiment of the drillship **30**. Looking first at FIG. **3**, and a plan view of the drillship **30**, an aft heliport **46** is shown above ship space **50** and aft of a riser storage area **54**. A second riser storage area **55** is positioned adjacent storage **54** and in a similar vein pipe racks **63** and **65** are positioned adjacent to previously noted pipe racks **62** and **64** respectively. The shaker house **68** is forward of the pipe racks and adjacent to the multi-activity derrick **40** and a mudlogger **67** is shown above the mud room **66**. A catwalk **69** extends between the riser and pipe rack to facilitate transport of riser lengths, casing and drillpipe from the storage areas to the multi-purpose derrick **40**.

A well testing area **74** and **75** is shown adjacent to the derrick **40** and aft of approximately 10,000 additional feet of tubular storage racks **76** and **77**, A forward heliport **80** is shown positioned above crew quarters **78**, as previously discussed, and the forward tubular area is serviced by a 75-ton crane **82** as noted above.

A plan view of the machinery deck is shown in FIG. **4** and includes an engine room **56** having fuel tanks on the starboard side and a compressed air and water maker system **84** on the port side. Auxiliary machinery **62** such as a machine shop, welding shop, and air conditioning shop are shown positioned adjacent to switching gear, control modules and SCR room **86**. In front of the SCR room, in the machinery deck is an air conditioning warehouse **88** and stack stores **64** as previously noted. The mudpump rooms **66** include a plurality of substantially identical drilling mud and cement pumps **90** and mixing and storage tanks **92**.

The derrick footprint **94**, **96**, **98**, and **100** is shown in the cellar deck and is symmetrically positioned about a moon pool area **34**. A parallel runway **101** extends over the moon pool and is laid between an aft subsea tree systems area and a fore subsea room area. A riser compressor room **102** is shown in a position adjacent to the forward machinery area **74** which includes a blowout preventer control area **104**.

The drilling hull may be eight hundred and fifty feet in length and of a design similar to North Sea shuttle tankers. The various modularized packages of components are facilely contained within a ship of this capacity and the dynamically positioned drillship provides a large stable platform for deep water drilling operations. The foregoing multi-activity drillship and operating components are disclosed in an illustrative arrangement and it is envisioned that other equipment may be utilized and positioned in different locations, another ship design or platform designs. However, the foregoing is typical of the primary operating facilities which are intended to be included with the subject multi-activity drillship invention.

Multi-Activity Derrick

Referring now to FIGS. **5** through **7**, there will be seen a multi-activity derrick **40** in accordance with a preferred embodiment of the invention. The derrick **40** includes a base **110** which is joined to the drillship substructure **112** symmetrically above the moon pool **34**. The base **110** is preferably square and extends upwardly to a drill floor level **114**. Above the drill floor level is a drawworks platform **116** and a drawworks platform roof **118**. Derrick legs **120**, **122**, **124**, and **126** are composed of graduated tubular conduits and project upwardly and slope inwardly from the drill floor **114**. The derrick terminate into a generally rectangular derrick top structure or deck **128**. The legs are spatially fixed by a network of struts **130** to form a rigid drilling derrick for heavy duty tubular handling and multi-activity functions in accordance with the subject invention.

As particularly seen in FIG. **5**, the derrick top **128** serves to carry a first **132** and second **134** mini-derrick which guide a sheave and hydraulic motion compensation system.

As shown in FIGS. **5** through **7**, the multi-activity derrick **40** preferably includes a first **140** and second **142** drawworks of a conventional design. A cable **144** extends upwardly from the drawworks **140** over sheaves **146** and **148** and motion compensated sheaves **150** at the top of the derrick **40**. The drawwork cabling extends downwardly within the derrick to first **152** and second **154** travelling blocks, note again FIG. **5**. Each of the drawworks **140** and **142** is independently controlled by distinct driller consoles **156** and **158** respectively.

The foregoing described drawworks and other functionally equivalent systems, including specific structural components not yet envisioned, provide a means for hoisting tubular members for advancing and retrieving tubular members during drilling, work over or completion operations and the like.

The derrick drilling floor **114** includes, first and second tubular advancing stations **160** and **162** which in one embodiment, comprises a first rotary table and a second, substantially identical, rotary table. The rotary tables are positioned in a mutually spaced relationship, symmetrically, within the derrick **40** and, in one embodiment, along a center line of the drillship **30**.

Other envisioned embodiments include rotary tables positioned from side to-side across the ship or even on a bias. The drawworks **140** is positioned adjacent to the first tubular **160** and drawworks **142** is positioned adjacent to the second tubular advanced station **162** and operably serves to conduct drilling operations and/or operations auxiliary to drilling operations through the moon pool **34** of the drillship. Each tubular advancing station includes, in one embodiment, a rotary machine, rotary drive, master bushings, kelly drive bushings and slips. In addition, each tubular advancing station **160** and **162** operably include an iron roughneck, a pipe tong, a spinning chain, a kelly and a rotary swivel for making up and tearing down tubulars in a conventional manner.

A first pipe handling apparatus **164** and a second pipe handling apparatus **166** is positioned, in one embodiment, upon a rail **168** which extends from a location adjacent to the first tubular advancing station **160** to the second tubular advancing station **162**. A first conduit setback envelope **170** is located adjacent to said first pipe handling apparatus **164** and a second pipe setback envelope **172** is positioned adjacent to the second pipe handling apparatus **166**. A third conduit setback envelope **174** may be positioned between the first setback envelope **170** and the second setback envelope **172** and is operable to receive conduits from either of said first conduit handling apparatus **164** or said second conduit handling apparatus **166** as they translate upon the rail **168**. Positioned adjacent the first tubular advancing station **160** is a first iron roughneck **180** and a second iron roughneck **181** is positioned adjacent to the second tubular advancing station **162**. The iron roughnecks are operably utilized in cooperation with the rotary stations **160** and **162**, respectively to make-up and break down tubulars.

It will be seen by reference particularly to FIG. **7** that the rail **168** permits the first tubular handling assembly **164** to setback and receive conduit from any of the tubular setback envelopes **170**, **172**, and **174**. The primary utilization for pipe handling assembly **164**, however, will be with respect to setback envelope **170** and **174**. In a similar manner the rail **168** permits the second tubular handling assembly **166** to transfer conduits such as riser, casing or drill pipe between the second rotary station **162** and tubular setback envelopes **172**, **174**, and **170**, however, the tubular handling assembly **166** will be utilized most frequently with conduit setback envelopes **172** and **174**. Although rail supported pipe handling systems are shown in FIG. **7**, other tubular handling arrangements are contemplated by the subject invention such as a rugged overhead crane structure within the derrick **40**. A common element however, among all systems will be the ability to make-up and break down tubulars at both the first and second tubular stations for advancing tubulars through the moon pool. In addition, a characteristic of tubular handling systems will be the ability to pass tubular segments back and forth between the first station for advancing tubulars through the moon pool and the second station for advancing tubulars and the setback envelopes as discussed above.

In a presently preferred embodiment, the rotary function is applied to tubulars performed by a first **182** and second **183** top drive device, note again FIG. **5**. Each top drive device is similar and the unit **182** is shown more particularly in FIG. **8**. The top drive is connected to traveling block **152** and is balanced by hydraulic balancing cylinders **184**. A guide dolly **185** supports a power train **186** which drives a tubular handling assembly **188** above drill floor **114**.

Although a rotary table system of tubular advancement and top drive have both been disclosed and discussed above, the top drive system is presently preferred. In certain instances, both systems may even be installed on a drilship. Still further, other systems may ultimately be envisioned, however, an operational characteristic of all tubular advancing systems will be the ability to independently handle, make-up or break down, set back, and advance tubulars through multi-stations over of a moon pool and into the seabed.

It will be appreciated by referring to and comparing FIGS. **5**, **6**, and **8** that the multi-activity derrick **40** comprises two identical top drives and/or separate rotary tables, drawworks, motion compensation and travelling blocks positioned within a single, multi-purpose derrick. Accordingly, the subject invention enables primary drilling activity and auxiliary activity to be conducted simultaneously and thus the critical path of a drilling function to be conducted through the moon pool **34** may be optimized. Alternatively, units are envisioned which will not be identical in size or even function, but are nevertheless capable of handling tubulars and passing tubulars back and forth between tubular advancing stations within a single derrick. Further, in a preferred embodiment, the multi-activity support structure is in the form of a four sided derrick. The subject invention, however, is intended to include other superstructure arrangements such as tripod assemblies or even two adjacent upright but interconnected frames and superstructures that are operable to perform a support function for more than one tubular drilling or activity for conducting simultaneous operations through the deck of a drillship, semi-submersible tension leg platform, or the like.

Method of Operation

Referring now specifically to FIGS. **9** through **22**, there will be seen a sequence of operation of the subject multi-activity derrick and drillship wherein a first or main tubular advancing station is operable to conduct primary drilling activity and a second or auxiliary tubular advancing station is utilized for functions critical to the drilling process but can be advantageously removed from the drilling critical path to dramatically shorten overall drilling time.

Turning specifically to FIG. **9**, there is shown by a schematic cartoon a multi-activity derrick **40** positioned upon a drilling deck **190** of a drillship, semi-submersible, tension leg platform, or the like, of the type discussed above.

A moon pool opening in the drilling deck **192** enables tubulars such as risers, casing or drill pipe to be made up within the derrick **40** and extended through a body of water **194** to conduct drilling activity and/or activity associated with drilling within and upon the seabed **196**.

The main drilling station **160** is utilized to pick up and make up a thirty inch jetting assembly for jetting into the seabed and twenty six inch drilling assemblies and places them within the derrick setback envelopes for the auxiliary station **162** to run inside of thirty inch casing. The main rig then proceeds to makeup eighteen and three fourths inch wellhead and stands it back in the derrick for the twenty inch tubular casing run.

At the same time the auxiliary station **162** is used to pick up the thirty inch casing and receives the jetting assembly from the main rig and runs the complete assembly to the seabed where it begins a thirty inch casing jetting operation.

Referring to FIG. **10**, the main rig skids a blowout preventer stack **200** under the rig floor and carries out a functioning test on the stack and its control system. At the same time the auxiliary rig and rotary station **162** are used to jet in and set the thirty inch casing. The auxiliary rig then disconnects the running tool from the wellhead and drills ahead the twenty six inch hole section.

In FIG. **11** the main rig is utilized to start running the blowout preventer stack **200** and drilling riser to the seabed. Simultaneously the auxiliary rig, including second rotary station **162**, is utilized to complete drilling of the twenty six inch hole section and then pulls the twenty six inch drilling assembly to the surface. The auxiliary station then rigs up and runs twenty inch tubular casing **202** and after landing the twenty inch casing in the wellhead the auxiliary rig then hooks up cement lines and cements the twenty inch casing in place. The auxiliary rig then retrieves the twenty inch casing landing string.

In FIG. **12** the main rig and rotary station **160** lands the blowout preventer **200** onto the wellhead and tests the wellhead connection. At the same time, the auxiliary rotary station **162** is utilized to lay down the thirty inch jetting and twenty six inch drilling assembly. After this operation is complete the auxiliary rotary station **162** is utilized to makeup a seventeen and one half inch bottom hole assembly and places the assembly in the derrick for the primary or main rotary assembly to pick up.

In FIG. **13** the main rotary assembly picks up the seventeen and one half inch hole section bottom hole assembly **204**, which was previously made up by the auxiliary rig, and runs this and drillpipe in the hole to begin drilling the seventeen and one half inch section. At the same time, the auxiliary rotary station picks up single joints of thirteen and three eighths inch casing from the drillship pipe racks, makes them up into one hundred and twenty five foot lengths and then stands the lengths back in the derrick envelopes in preparation for the thirteen and three eighths inch casing run.

In FIG. **14** the main rotary station **160** completes drilling the seventeen and one half inch hole section. The drilling assembly is then retrieved back to the surface through the moon pool and the main rotary station then proceeds to rig up and run the thirteen and three eighths inch casing segments which were previously made up and set back within the derrick. After landing the casing in the wellhead, the rig cements the casing in place. At the same time the auxiliary rotary station **162** picks up single joints of nine and five eights inch casing from the drillship pipe racks, makes them up into triples and then stands them back in the derrick tubular handling envelopes in preparation for a nine and five eights inch casing run.

In FIG. **15** the primary rotary station tests the blowout preventer stack after setting the thirteen and three eighths inch seal assembly and the auxiliary rotary station changes the bottom hole assembly from seventeen and one half inches to twelve and one quarter inch assembly. The twelve and one quarter inch assembly is then set back in the derrick conduit handling envelopes in a position where they can be picked up by the main rotary station.

In FIG. **16** the primary rotary station **160** is used to run in the hole with twelve and one quarter inch bottom hole assembly and begins drilling the twelve and one quarter inch hole section. At the same time the auxiliary rotary station is utilized to make up nine and five eights inch casing running tool and cement head and then stands both of these complete assemblies back in the conduit handling envelopes of the derrick in preparation for a nine and five eights inch casing run.

In FIG. **17** the primary rotary station **160** is utilized to complete drilling the twelve and one quarter inch hole section and retrieves the twelve and one quarter inch assembly back to the surface. The primary rotary station then rigs up and runs the nine and five eigths inch casing in the hole and cements the casing in place. At the same time the auxiliary rotary station changes the bottom hole assembly from twelve and one quarter inch to eight and one half-inch and stands the eight and one half-inch assemblies back in the derrick to be picked up by the primary rotary station.

In FIG. **18** the primary rotary station is shown running in the hole with eight and one half-inch drilling assemblies and begins to drill the eight and one half-inch hole with the first rotary top drive. During this operation the auxiliary rotary station is used to make up a casing cutter.

In FIG. **19** the primary rotary station **160** completes drilling the eight and one quarter inch hole section and retrieves the drilling assembly back to the surface. The primary rotary station then proceeds to rig down the riser and begins to recover the blowout preventer stack **200**.

As shown in FIG. **20**, once the blowout preventer **200** is clear of the wellhead, the auxiliary rotary station runs in the hole with a casing cutter **210** and cuts the casing.

In FIG. **21** the primary rotary station **160** is used to continue recovering the blowout preventer stack **200** and the auxiliary rotary station is used to recover the wellhead **212**.

In FIG. **22** the primary rotary station prepares for moving the drilship and the auxiliary rotary station assists in that operation.

COMPARATIVE ANALYSIS

Referring now specifically to FIG. **23***a*, there will be seen an illustrative time chart of typical drilling activity for an offshore well in accordance with a conventional drilling operation. The filled in horizontal bars represent time frames along an abscissa and tubular activity is shown along an ordinate. As an initial operation, eight hours, note bar **220**, are utilized to pick up pipe and twenty seven hours, note bar **222**, are then required to jet drill thirty inch casing in place. Three hours are then used to make up and lay down bottom hole assemblies and running tools, see bar **224**. Next, forty four and one half hours, note bar **226**, are required to drill and cement twenty inch casing. Sixty-nine hours **228** are necessary to run and test a blowout preventer. Three hours are required to make up and lay down bottom hole assemblies and running tools, see time bar **230** Next, in sequence thirty nine hours, note bar **234**, and twenty one hours, note bar **236**, are used to run and cement thirteen and three eighths inch casing. Four and three quarter hours are used to make up and lay down bottom hole assemblies and running tools, note bar **238**, and ten and one half hours are used to test the blowout preventer, note bar **240**. Next, eighty one and one half hours, note bar **242**, are utilized to drill twelve and one quarter inch drill string and twenty two hours are used to run and cement nine and five eights inch casing, note bar **244**. Two and three quarter hours are then necessary to make up and lay down bottom hole assemblies and running tools, note bar **246**, and fourteen hours, note bar **248**, are utilized to drill eight and one half-inch hole. Next, thirty and one half hours are spent recovering the blowout preventer, note bar **250**, seventeen hours are used to run up and recover the wellhead, as depicted by time bar **252**, and finally the drill pipe is laid down requiring eight hours, see time bar **254**.

In contrast to a conventional drilling sequence, an identical drilling operation is depicted by a time chart in FIG. **23***b* in accordance with the subject invention, where a main and auxiliary tubular station are simultaneously utilized in a preferred embodiment of the subject invention, to dramatically decrease the overall drilling time and thus increase efficiency of the drilling operation. More specifically, it will be seen that the main drilling operation can be conducted through a first tubular advancing station and the critical path of the drilling sequence is depicted with solid time bars whereas auxiliary activity through a second tubular advancing station is shown by crossed hatched time bars.

Initially eight and one half hours are utilized by the primary rotary station to rig up a bottom hole assembly and pick up pipe, note time bar **260**. Next, the blowout preventer is skidded to position and tested which utilizes twelve hours, as shown by time bar **262**. Forty two hours are then required to run the blowout preventer to the seabed as shown by time bar **264** and 15 hours, as shown by time bar **266**, are used to land and test the blowout preventer. Next, the seventeen and one half inch hole is drilled by the primary rotary station and rotary table **160** for 39 hours as depicted by time bar **268**. Subsequently, the thirteen and three eighths inch casing is run and cemented in place utilizing fourteen hours as depicted by time bar **270**.

The next operation requires ten and one half hours to test the blowout preventer as shown by time bar **272**. Eighty one and one half hours are used by the primary rotary station and rotary table **160** to drill the twelve and one quarter inch hole as depicted by time bar **274**. Time bar **276** discloses sixteen hours to run and cement the nine and five eighths inch casing. An eight and one half inch drill hole then consumes fourteen hours as depicted by time bar **278** and finally the main rig utilizes thirty and one half hours as depicted by time bar **280** to recover the blowout preventer.

During this same time sequence the second or auxiliary tubular advancing station **162** is used to jet drill the thirty inch casing in twenty one and one half hours as shown by hashed time bar **282**. Then the twenty inch casing is drilled and run during a period of forty four and one half hours as shown by time bar **284**. The auxiliary rig is then used for five hours to make up and lay down bottom hole assemblies and running tools for five hours as shown by time bar **286**. Eight and one half hours are used to set back thirteen and three eighths inch doubles as shown in time bar **288**. Time bar **290** illustrates the use of four and one quarter hours to make up and lay down bottom hole assemblies and running tools, and ten hours are required, as shown in time bar **292**, to set back nine and five eights inch doubles. Four hours are then required as shown by time bar **300** to make up and lay down bottom hole assemblies and running tools and then nine and one half hours are used to make up and run a casing cutter as depicted by time bar **302**. The wellhead is then recovered in six and one half hours as shown on time bar **304** and finally eight hours are utilized as depicted in time frame **206** to lay down the drill string.

By comparing the identical sequence of events from a conventional drilling operation to the subject multi-activity drilling method and apparatus, it will be appreciated that the critical path has been substantially reduced. In this particular example of exploration drilling activity, the time saving comprises twenty nine percent reduction in time for a drilling operation. In other instances, and depending upon the depth of the water, this time sequence could be longer or shorter, but it will be appreciated by those of ordinary skill in the art that as the depth of water increases, the advantage of a multi-activity drilling method and apparatus in accordance with the subject invention increases.

The above example is illustrated with respect to an exploration drilling program. Developmental drilling actively may be required which would involve twenty or more wells. In this event, the subject invention can advantageously conduct multiple well developmental drilling activity, or work over activity, simultaneously on multiple wells, and again dramatically reduce the amount of time the drillship will be required to stay on site.

SUMMARY OF MAJOR ADVANTAGES OF THE INVENTION

After reading and understanding the foregoing description of preferred embodiments of the invention, in conjunction with the illustrative drawings, it will be appreciated that several distinct advantages of the subject multi-activity drilling method and apparatus are obtained.

Without attempting to set forth all of the desirable features and advantages of the instant method and apparatus, at least some of the major advantages of the invention are depicted by a comparison of FIG. **23***a* and FIG. **23***b* which visually illustrates the dramatic enhancement in efficiency of the subject invention. As noted above, even greater time efficiencies will be realized in developmental drilling or well remedial works over activity.

The enhanced drilling time, and thus cost savings, is provided by the multi-activity derrick having substantially identical tubular advancing stations wherein primary drilling activity can be conducted within the derrick and auxiliary activity concomitantly conducted from the same derrick and through the same moon pool.

The derrick includes dual rotary stations, and in a preferred embodiment top drives and a dual tubular handling system. A plurality of tubular set back envelopes are positioned adjacent the dual rotary station and first and second conduit handling assemblies operably transfer riser segments, casing, and drillpipe assemblies between the first and second tubular advancing stations and any of the set back envelopes. The dual derrick drawworks are independently controlled by substantially identical drill consoles mounted upon the drilling floor of the derrick such that independent operations can be performed simultaneously by a main drilling rotary station through a moon pool while auxiliary operations can be simultaneously conducted through a second rotary station and the moon pool.

The multi-station derrick enables a driller to move many rotary operations out of the critical path such as blowout prevention and riser running while drilling a top hole; making up bottom hole assemblies or running tools with an auxiliary rotary while drilling with a primary rotary station; making up and standing back casing with the auxiliary rotary while drilling with the primary rotary assembly; test running; measurements while drilling while continuing primary drilling activity; and deploying a high-pressure second stack/riser outside of primary rig time. Still further, the subject invention permits an operator to rig up to run trees with the auxiliary rotary station while carrying out normal operations with a primary rotary station; running a subsea tree to the bottom with the auxiliary rotary station while completing riser operations and simultaneously running two subsea trees, bases, etc.

In describing the invention, reference has been made to preferred embodiments and illustrative advantages of the invention. In particular, a large, tanker dimension drillship **30** has been specifically illustrated and discussed which is the presently envisioned preferred embodiment. It will be appreciated, however, by those of ordinary skill in the art, that the subject single derrick with multi-rotary structure may be advantageously utilized by other offshore platform systems such as jack-ups, semi-submersibles, tension leg platforms, fixed towers, and the like, without departing from the subject invention. Those skilled in the art, and familiar with the instant disclosure of the subject invention, may also recognize other additions, deletions, modifications, substitutions, and/or other changes which will fall within the purview of the subject invention and claims.

What is claimed is:

1. A multi-activity drilling assembly mounted above an opening of a drillship, semi-submersible, tension leg platform, jack-up platform, or offshore tower and being operable to be positioned above the surface of a body of water for supporting drilling operations through a drilling deck and into the bed of the body of water, said multi-activity drilling assembly including:

a derrick positioned above the opening and extending above the drilling deck for simultaneously supporting drilling operations and operations auxiliary to drilling operations through the drilling deck;

a first means connected to said derrick for advancing tubular members through the drilling deck and into the bed of the body of water;

first means, connected to said derrick, for handling tubular members as said tubular members are advanced through the drilling deck by said first means for advancing;

second means connected to said derrick for advancing tubular members through the drilling deck and into a body of water to the seabed; and

second means, connected to said derrick, for handling tubular members as said tubular members are advanced through the drilling deck by said second means for advancing for conducting operations auxiliary to said drilling operations; and

means positioned within said derrick for transferring tubular assemblies between said first means for advancing tubular members and said second means for advancing tubular members to facilitate simultaneous drilling operations and operations auxiliary to said drilling operations, wherein drilling activity can be conducted from said derrick by said first means for advancing and said first means for handling tubular members and auxiliary drilling activity can be simultaneously conducted from said derrick by said second means for advancing and said second means for handling tubular members.

2. A multi-activity drilling assembly as defined in claim **1** wherein said first and second means for advancing tubular members comprises:

a first and second top drive assembly positioned within said derrick.

3. A multi-activity drilling assembly as defined in claim **1** wherein said first and second means for advancing tubular members comprises:

a first and second rotary table positioned within said derrick.

4. A multi-activity drilling assembly as defined in claim **3** wherein:

said first rotary table and second rotary table being spaced within the periphery of said derrick.

5. A multi-activity drilling assembly as defined in claim **1** wherein said means for transferring includes:

a rail assembly operably extending between a position adjacent to said first means for advancing tubular members and a position adjacent to said second means for advancing tubular members;

said first means for handling tubular members being mounted to traverse upon said rail wherein conduit assemblies may be operably transferred between said first means for advancing tubular members and said second means for advancing tubular members to facilitate simultaneous drilling operations and operations auxiliary to said drilling operations.

6. A multi-activity drilling assembly as defined in claim **1** and further including:

a first driller's console operable to control said first means for advancing tubular members; and a second driller's console substantially similar to said first driller's console and being operable to independently control said second means for advancing tubular members.

7. A multi-activity drilling assembly as defined in claim **1** and further including:

a first tubular setback envelope positioned adjacent to said first means-for advancing tubular members; and

a second tubular setback envelope positioned adjacent to said second means for advancing tubular members.

8. A multi-activity drilling assembly as defined in claim **7** and further including:

a third tubular setback envelope positioned between said first tubular setback envelope and said second tubular setback envelope.

9. multi-activity drilling assembly as defined in claim **7** and further including:

a tubular handling system for transferring tubular members between said first tubular setback envelope and said second tubular setback envelope and said first means for advancing tubular members and said second means for advancing tubular members.

10. A multi-activity drilling assembly operable to be supported from a position above the surface of a body of water for conducting drilling operations into the bed of the body of water, said multi-activity drilling assembly including:

a drilling superstructure operable to be mounted upon a drilling deck for simultaneously supporting drilling operations for a well and operations auxiliary to drilling operations for the well;

first means connected to said drilling superstructure for advancing tubular members into the bed of body of water;

second means connected to said drilling superstructure for advancing tubular members simultaneously with said first means into the body of water to the seabed, and

means positioned adjacent to said first and second means for advancing tubular members for transferring tubular assemblies between said first means for advancing tubular members and said second means for advancing tubular members to facilitate simultaneous drilling operations auxiliary to said drilling operations, wherein drilling activity can be conducted for the well from said drilling superstructure by said first means for advancing tubular members and auxiliary drilling activity can be simultaneously conducted for the well from said drilling superstructure by said second means for advancing tubular members.

11. A multi-activity drilling assembly as defined in claim **10** and further including:

a first tubular setback station positioned adjacent to said first means for advancing tubular members; and

a second tubular setback station positioned adjacent to said second means for advancing tubular members.

12. A multi-activity drilling assembly as defined in claim **10** wherein said first and second means for advancing tubular members comprises:

a first and second top drive assembly connected to said drilling superstructure.

13. A multi-activity drilling assembly as defined in claim **10** wherein said first and second means for advancing tubular members comprises:

a first and second rotary table positioned adjacent to said drilling superstructure for assisting in performing drilling operations and for simultaneously assisting in performing operations auxiliary to drilling operations through the drilling deck.

* * * * *

CERTIFICATE OF SERVICE

The undersigned counsel hereby certifies that two copies of the Non-Confidential Brief for Plaintiff-Appellant Transocean Offshore Deepwater Drilling, Inc. was served by UPS (overnight delivery) and e-mail on December 9, 2009, upon the following:

Lee L. Kaplan, Esq.
SMYSER KAPLAN & VESELKA, L.L.P.
700 Louisiana
Houston, Texas 77002-2700
Email: lkaplan@skv.com
(Counsel for Appellee)

William H. Frankel, Esq.
BRINKS HOFER GILSON & LIONE
NBC Tower, Suite 3600
455 North Cityfront Plaza Drive
Chicago, Illinois 60611-5599
Email: wfrankel@brinkshofer.com
(Counsel for Appellee)

____
Thomas J. Davis
Attorney For Plaintiff-Appellant

CERTIFICATE OF COMPLIANCE

1. This brief complies with the type-volume limitation of Federal Rule of Appellate Procedure 32(a)(7)(B), because it contains 13,675 words, excluding the parts of the brief exempted by Federal Rule of Appellate Procedure 32(a)(7)(B)(iii) and Federal Circuit Rule 32(b).

2. This brief complies with the typeface requirements of Federal Rule of Appellate Procedure 32(a)(5) and the type style requirements of Federal Rule of Appellate Procedure 32(a)(6), because it has been prepared in a proportionally spaced typeface using Microsoft Word 2003 in Times New Roman 14 point font.

Dated: December 9, 2009

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Thomas J. Davis
Attorney for Plaintiff-Appellant