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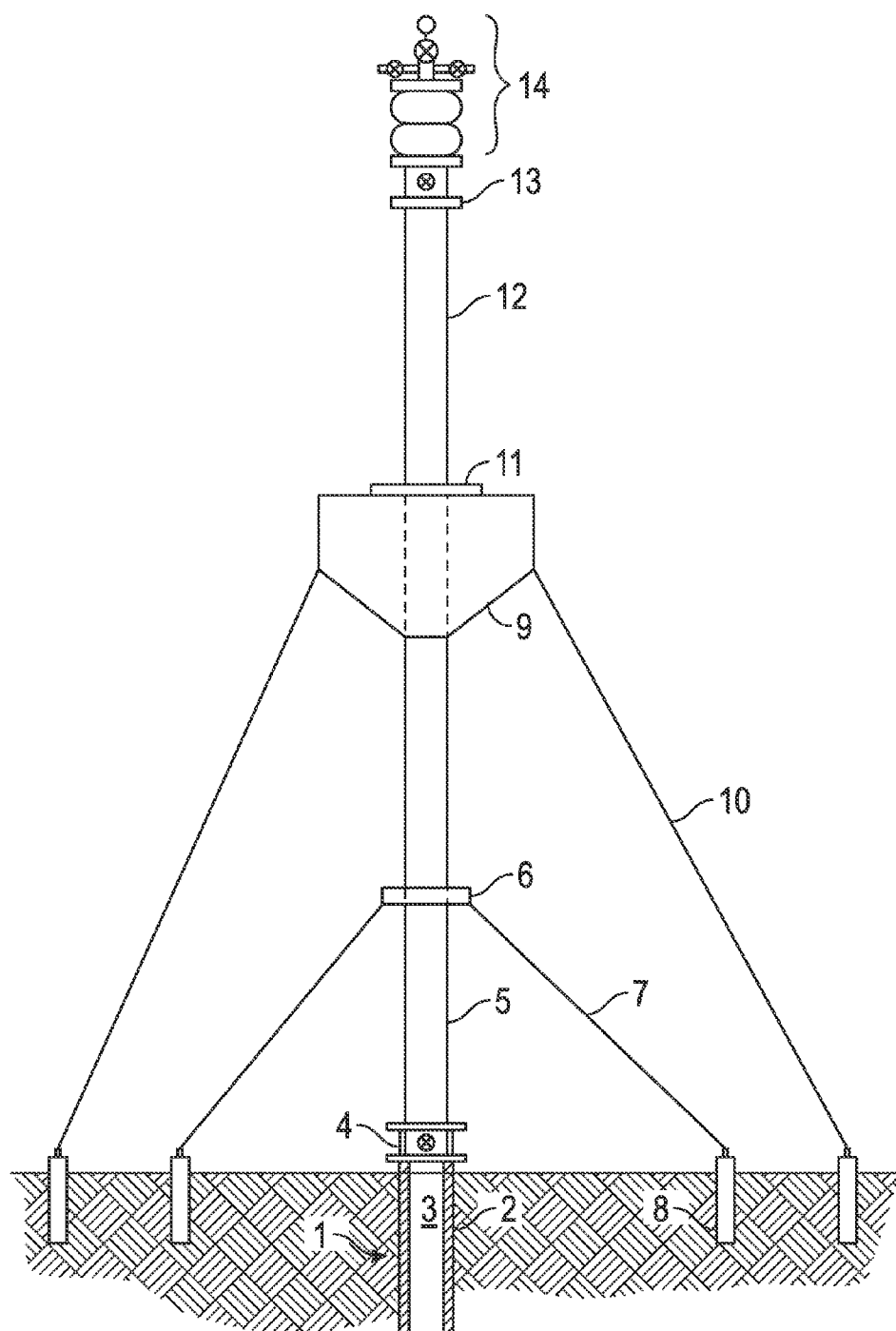


FIG. 1A

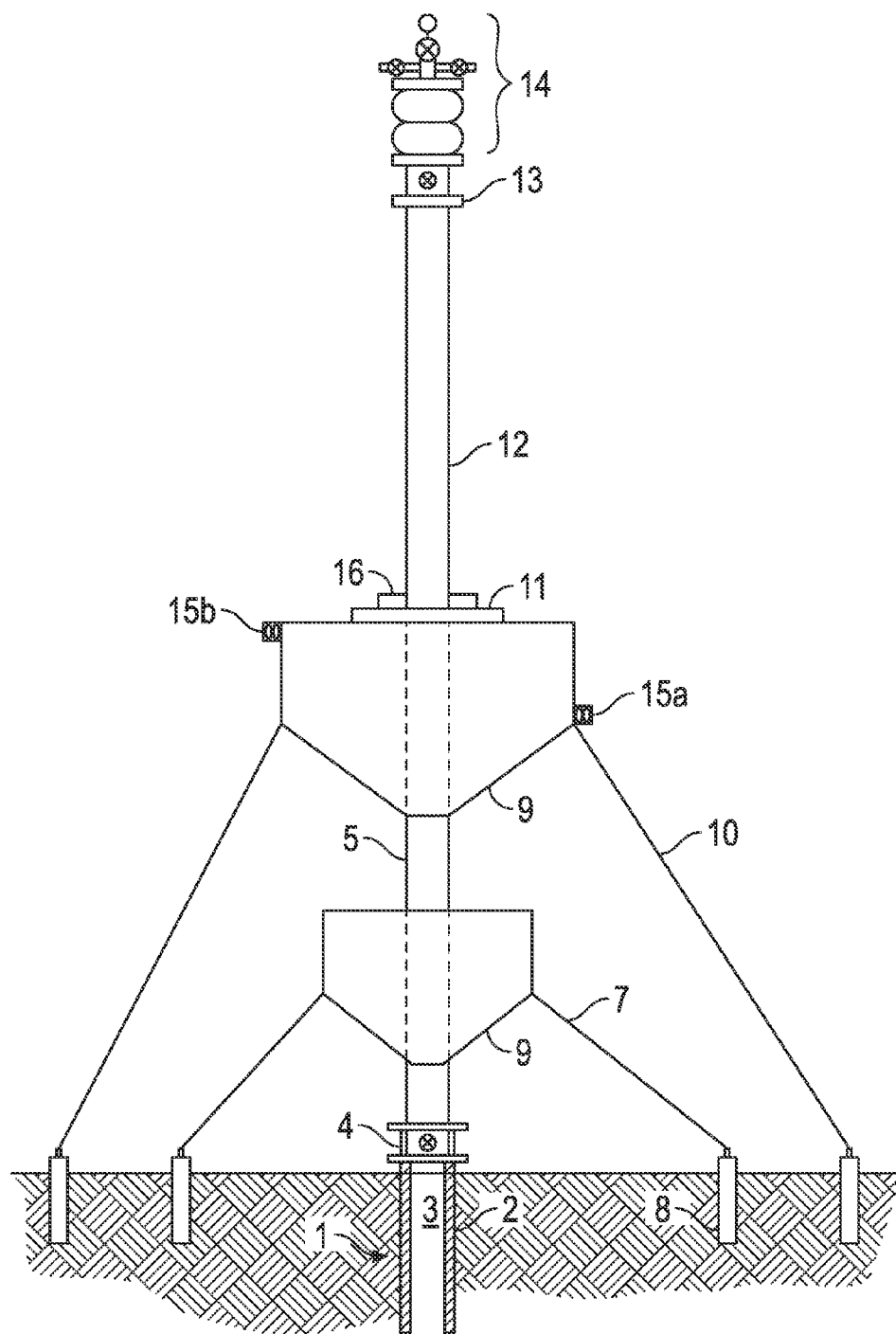


FIG. 1B

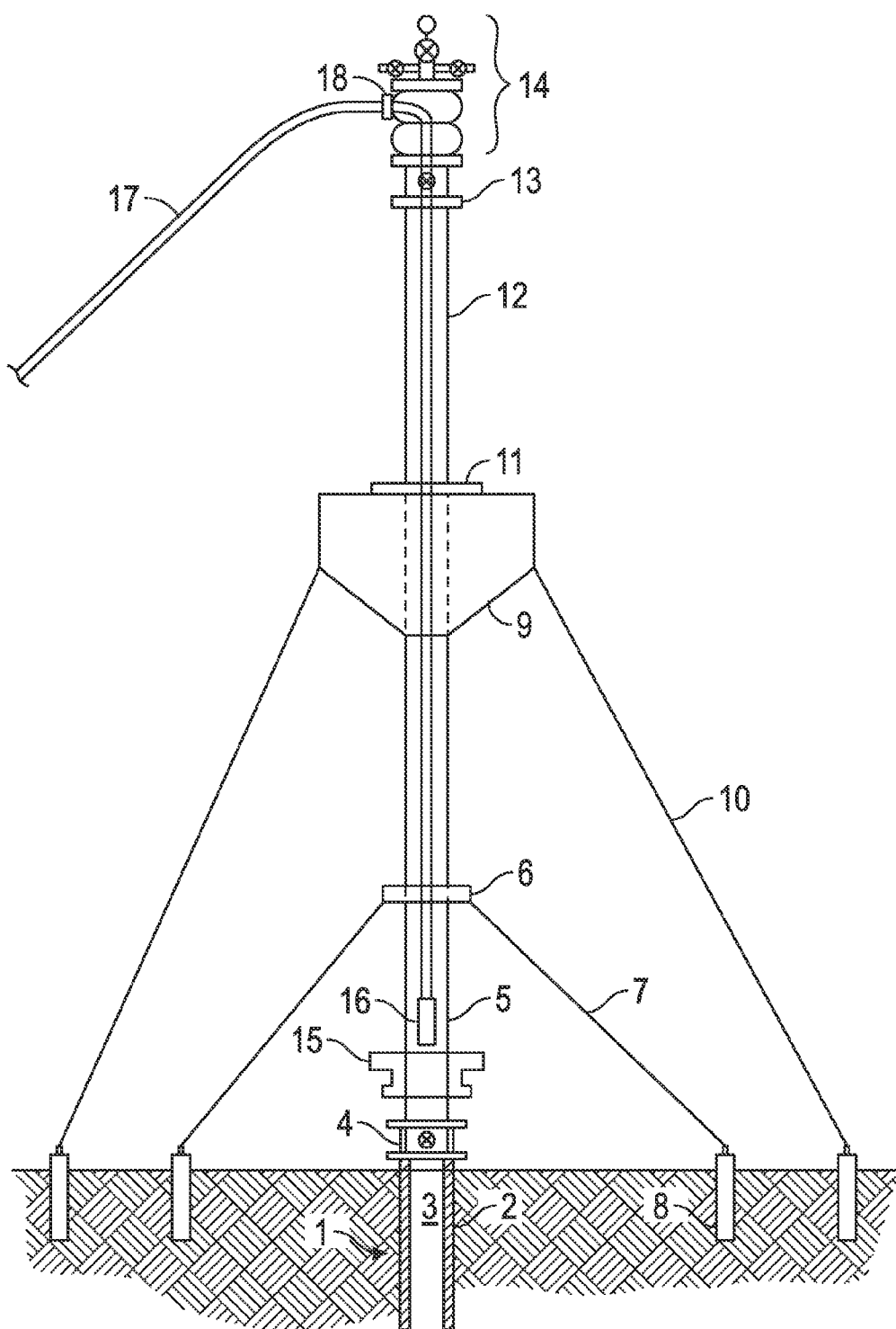


FIG. 2A

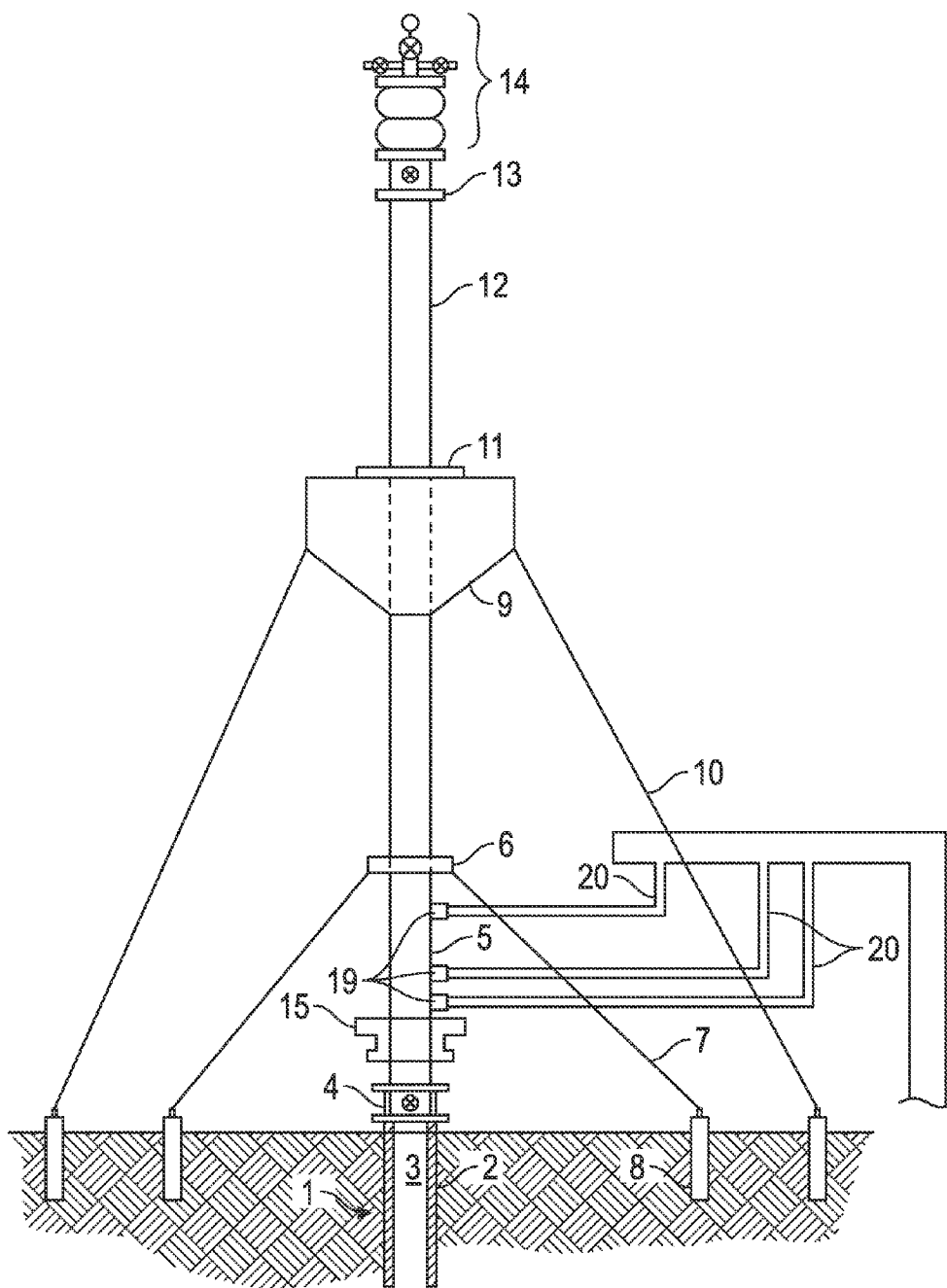


FIG. 2B

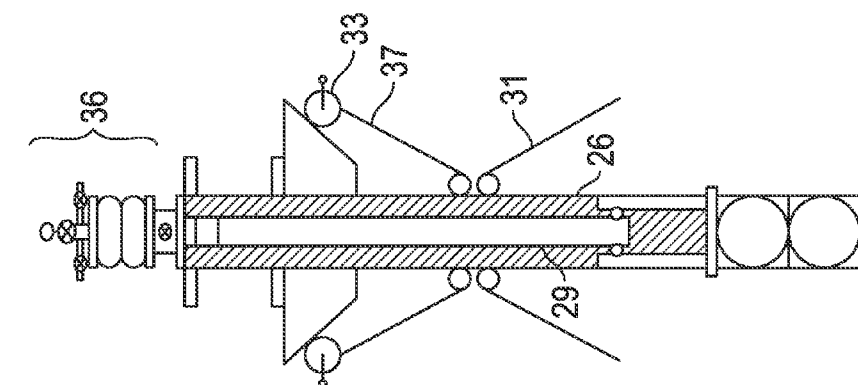


FIG. 3B

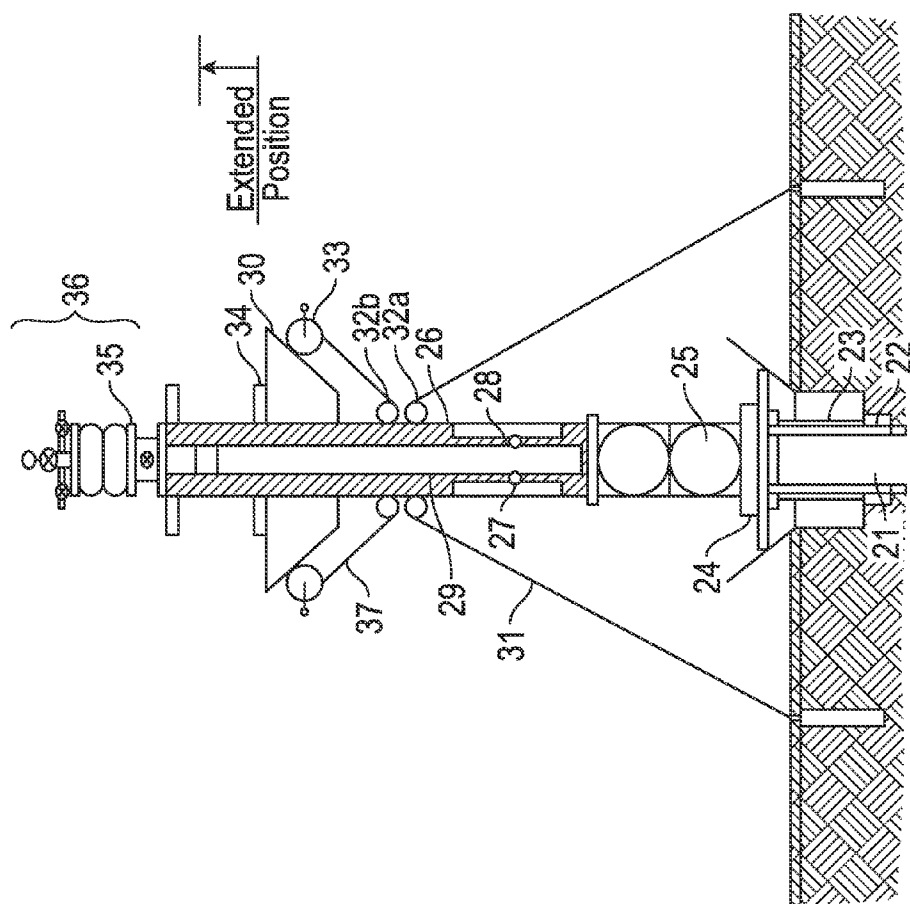


FIG. 3A

SELF-STANDING RISER WITH ARTIFICIAL LIFT SYSTEM

FIELD OF THE INVENTION

[0001] The present invention relates generally to oil and gas exploration and production, and in a specific, non-limiting embodiment, to an artificial lift device used in conjunction with a self-standing riser assembly designed for use in various offshore environments.

BACKGROUND OF THE INVENTION

[0002] Innumerable systems and methods have been employed in efforts to find and recover hydrocarbon reserves around the world. At first, such efforts were limited to land operations involving simple but effective drilling methods that satisfactorily recovered reserves from large, productive fields. As the number of known producing fields dwindled, however, it became necessary to search in ever more remote locales, and to move offshore, in the search for new resources. Eventually, sophisticated drilling systems and advanced signal processing techniques enabled oil and gas companies to search virtually anywhere in the world for recoverable hydrocarbons.

[0003] Initially, deepwater exploration and production efforts consisted of expensive, large scale drilling operations supported by tanker storage and transportation systems, due primarily to the fact that most offshore drilling sites are associated with difficult and hazardous sea conditions, and thus large scale operations provided the most stable and cost-effective manner in which to search for and recover hydrocarbon reserves. A major drawback to the large-scale paradigm, however, is that explorers and producers have little financial incentive to work smaller reserves, since potential financial recovery is generally offset by the lengthy delay between exploration and production (approximately 3 to 7 years) and the large capital investment required for conventional platforms and related drilling and production equipment. Moreover, complex regulatory controls and industry-wide risk aversion have led to standardization, leaving operators with few opportunities to significantly alter the prevailing paradigm. As a result, offshore drilling operations have traditionally been burdened with long delays between investment and profit, excessive cost overruns, and slow, inflexible recovery strategies dictated by the operational environment.

[0004] More recently, deepwater sites have been found in which much of the danger and instability present in such operations is avoided. For example, off the coast of West Africa, Indonesia and Brazil, potential drilling sites have been identified where surrounding seas and weather conditions are relatively mild and calm in comparison to other, more volatile sites such as the Gulf of Mexico and the North Sea. These recently discovered sites tend to have favorable producing characteristics, yield positive exploration success rates, and admit to production using simple drilling techniques similar to those employed in dry land or near-shore operations.

[0005] However, since lognormal distributions of recoverable reserves tend to be spread over a large number of small fields, each of which yield less than would normally be required in order to justify the expense of a conventional large-scale operation, these regions have to date been under-explored and under-produced relative to their potential. Consequently, many potentially productive smaller fields have

already been discovered, but remain undeveloped due to economic considerations. In response, explorers and producers have adapted their technologies in an attempt to achieve greater profitability by downsizing the scale of operations and otherwise reducing expense, so that recovery from smaller fields makes more financial sense, and the delay between investment and profitability is reduced.

[0006] For example, in published Patent Application No. US 2001/0047869 A1 and a number of related pending applications and patents issued to Hopper et al., various methods of drilling deepwater wells are provided in which adjustments to the drilling system can be made so as to ensure a better recovery rate than would otherwise be possible with traditional fixed-well technologies. However, the Hopper system cannot be adjusted during completion, testing and production of the well, and is especially ineffective in instances where the well bore starts at a mud line in a vertical position. The Hopper system also fails to support a variety of different surface loads, and is therefore self-limiting with respect to the flexibility drillers desire during actual operations.

[0007] In U.S. Pat. No. 4,223,737 to O'Reilly, a method is disclosed in which the problems associated with traditional, vertically oriented operations are addressed. The method of O'Reilly involves laying out a number of interconnected, horizontally disposed pipes in a string just above the sea floor (along with a blow out preventer and other necessary equipment), and then using a drive or a remote operated vehicle to force the string horizontally into the drilling medium. The O'Reilly system, however, is inflexible in that it fails to admit to practice while the well is being completed and tested. Moreover, the method utterly fails to contemplate functionality during production and workover operations. In short, the O'Reilly reference is helpful only during the initial stages of drilling a well, and would therefore not be looked to as a systemic solution for establishing and maintaining a deepwater exploration and production operation.

[0008] Other offshore operators have attempted to solve the problems associated with deepwater drilling by effectively "raising the floor" of an underwater well by disposing a submerged wellhead above a self-contained, rigid framework of pipe casing that is tensioned by means of a gas filled, buoyant chamber. For example, as seen in prior U.S. Pat. No. 6,196,322 B1 to Magnussen, the Atlantis Deepwater Technology Holding Group has developed an artificial buoyant seabed (ABS) system, which is essentially a gas filled buoyancy chamber deployed in conjunction with one or more segments of pipe casing disposed at a depth of between 600 and 900 feet beneath the surface of a body of water. After the ABS wellhead is fitted with a blowout preventer during drilling, or with a production tree during production, buoyancy and tension are imparted by the ABS to a lower connecting member and all internal casings. The BOP and riser (during drilling) and production tree (during production), are supported by the lifting force of the buoyancy chamber. Offset of the wellhead is reasonably controlled by means of vertical tension resulting from the buoyancy of the ABS.

[0009] The Atlantis ABS system is deficient, however, in several practical respects. For example, the '322 Magnussen patent specifically limits deployment of the buoyancy chamber to environments where the influence of surface waves is effectively negligible, i.e., at a depth of more than about 500 feet beneath the surface. Those of ordinary skill in the art will appreciate that deployment at such depths is an expensive and relatively risk-laden solution, given that installation and

maintenance can only be carried out by deep sea divers or remotely operated vehicles, and the fact that a relatively extensive transport system must still be installed between the top of the buoyancy chamber and the bottom of an associated recovery vessel in order to initiate production from the well.

[0010] The Magnusen system also fails to contemplate multiple anchoring systems, even in instances where problematic drilling environments are likely to be encountered. Moreover, the system lacks any control means for controlling adjustment of either vertical tension or wellhead depth during production and workover operations, and expressly teaches away from the use of lateral stabilizers that could enable the wellhead to be deployed in shallower waters subject to stronger tidal and wave forces.

[0011] Another issue encountered with deepwater wells is that there is difficulty in maintaining a flow of water, gas, and oil from the well hole to a production facility such as an FP50, or young distances to a central processing center. A large percentage of subsea wells have been equipped with either production or injection trees, which are often referred to as "Christmas Trees." Typical injection wells have injection lines that transmit oil, gas, water and other fluids into a central gathering location, and then subsequently toward shore or a production facility on the water surface. An advantage of utilizing a subsea injection well is that it can be positioned far away from a central production facility while maintaining ongoing operations. However, one of the disadvantages of using a subsea injection well with a production tree is the challenge of maintaining a flow of water, gas, and oil from the reservoir to a production facility or a central processing facility.

[0012] As the reservoir pressure drops because of depletion, there is not enough pressure to retain the well production, and the flow rate drops until the flow completely ceases.

[0013] Thus, there is plainly a widespread need for a system and method of disposing an offshore wellhead in a manner such that drillers can adjust both the depth of a wellhead and the vertical tension applied to associated pipe casing throughout the duration of exploration and production operations. There is also a need for an adjustable buoyancy chamber system capable of maintaining approximately constant vertical tension on an associated drilling or production string, and adjusting either the height of a wellhead at any time during exploration and production by releasing additional lengths of tension line from a buoyancy chamber height adjustment member. There is also a need for an offshore exploration and production system that flexibly admits to use in connection with both deepwater and shallow target horizons, without necessarily being configured to conform to any particular operational depth.

[0014] There is also a long-standing but unmet need for devices and methods of adding energy to the flow stream from the well to the production facility, so as to continue production.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIGS. 1A and 1B are side views of an offshore exploration and production system in which an adjustable buoyancy chamber is employed to adjust the height or depth of an associated well terminal member.

[0016] FIGS. 2A and 2B are side views of an offshore exploration and production system, in which an artificial lift device is employed to increase the flow rate of fluids.

[0017] FIGS. 3A and 3B are side views of an offshore exploration and production system, in which lateral and vertical forces on an adjustable buoyancy chamber are held approximately constant while the height of an associated well terminal member is adjusted by releasing additional lengths of tension line.

SUMMARY

[0018] A system and method of establishing an offshore exploration and production system is provided, in which a well casing is disposed in communication with an adjustable buoyancy chamber and a well hole bored into the floor of a body of water. A lower connecting member joins the well casing and the chamber, and an upper connecting member joins the adjustable buoyancy chamber and a well terminal member. A lift device is disposed in communication with the lower connecting member to increase the flow of fluids to the well terminal member and production facility. The chamber's adjustable buoyancy enables an operator to vary the height or depth of the well terminal member, and to vary the vertical tension imparted to drilling and production strings throughout exploration and production operations.

DETAILED DESCRIPTION

[0019] The description that follows includes exemplary systems, methods, and techniques that embody various aspects of the presently inventive subject matter. However, it will be readily understood by those of ordinary skill in the art that the described embodiments may be practiced without one or more of these specific details. In other instances, well-known manufacturing equipment, protocols, structures and techniques have not been shown in detail in order to avoid obfuscation in the description.

[0020] In example embodiments, a self-standing riser assembly (SSR) is disposed in communication with one or more well heads and/or production trees(s). Such SSRs are, by design, self-supporting, and provide all of the necessary risers, casing, buoyancy chambers, and other associated equipment required for exploration and production of oil, gas, and other hydrocarbons. SSRs also provide the requisite safety features to ensure that the produced hydrocarbons do not escape from the system out into surrounding waters. In further example embodiments, SSRs support both surface-based and semi-submersible platform interfaces, blow-out preventers, production trees, and other common exploration and production installations.

[0021] According to example embodiments, an SSR is disposed in communication with an artificial lift device. In certain embodiments, the lift device provides energy to the flow stream of water, gas, and/or oil through the SSR, to maintain or increase the flow.

[0022] In certain embodiments, the lift device comprises at least one electric submersible pump (ESP). In still further embodiments, power is supplied to the ESP via electric cables. The ESP provides lifting power to the fluids being moved from the production tree(s) to the production facility and/or central processing facility.

[0023] In certain embodiments, the ESP is located at the base of the SSR. In still other embodiments, the ESP is lowered using a wench to a desired depth in the well hole.

[0024] In further embodiments, the lift device comprises a gas lift device. In example embodiments utilizing a gas lift device, gas is supplied to gas valves located on the SSR which

open and close, supplying gas energy to the fluid column, allowing the gas to assist in "lifting" the fluids and increasing the flow rate to the production facility.

[0025] In certain embodiments, the lift device improves a well's performance. In particular embodiments, the lift device improves well performance in situations where there are long flow lines to the production facility.

[0026] Referring now to the embodiment depicted in FIGS. 1A and 1B, an offshore exploration and production system is provided, comprising a well casing 2 installed in communication with a submerged well 1 and an adjustable buoyancy chamber 9, wherein a lower connecting member 5 is disposed between the well casing and the adjustable buoyancy chamber.

[0027] In an example embodiment, the well 1 is accessed from above by means of a well hole 3 that has been bored into an associated sea floor surface. In a typical embodiment, a well casing 2 is set into the hole in a firm and secure manner, and then cemented into place using known downhole technology.

[0028] In other embodiments, a well casing is securely set into the well hole 3, and a fluid transport member, such as a smaller-diameter pipe or pipe casing, is inserted into well casing 2. Once a desired fit has been achieved, the outer surface of the fluid transport member is cemented or set with a packer to the inner surface of the well casing. Those of ordinary skill in the art will appreciate that while the embodiment described above refers to but a single well, the offshore exploration and production system disclosed herein can be readily adapted to simultaneously work multiple neighboring wells without departing from the scope or spirit of the invention.

[0029] In the example embodiment depicted in FIG. 1A, a well isolation member 4 is disposed between well casing 2 and a lower connecting member 5. In some embodiments, well isolation member 4 comprises one or more ball valves, which, if lower connecting member 5 is removed, can be closed so that the well is effectively shut in. In further embodiments, well isolation member 4 comprises a blowout preventer or a shear ram that can be maintained in either an open or closed position in order to provide access to, or to instead shut in, the contents of well 1.

[0030] In other embodiments, lower connecting member 5 further comprises one or more receiving members disposed to receive an attachment member disposed on well isolation member 4. In an alternative embodiment, lower connecting member 5 comprises an attachment member for attaching said lower connecting member 5 to a receiving member disposed on well isolation member 4. Methods and means of securely fastening lower connecting member 5 to well isolation member 4 are known to those of ordinary skill in the art, and may comprise one or more of a wide variety of fastening techniques, e.g., hydraulic couplers, various nut and bolt assemblies, welded joints, pressure fittings (either with or without gaskets), swaging, etc., without departing from the scope or spirit of the present invention.

[0031] Likewise, lower connecting member 5 may comprise any known connecting means appropriate for the specific application contemplated by operators. For example, in various embodiments, lower connecting member 5 comprises one or more of segments of riser, riser pipe, and/or pipe casing. In some embodiments, lower connecting member 5 comprises a concentric arrangement, for example, a fluid

transport member having a smaller outer diameter than the inner diameter of a pipe casing in which the fluid transport member is housed.

[0032] In further embodiments, lower connecting member 5 is disposed in communication with one or more lateral stabilizers 6, which, when deployed in conjunction a plurality of tension lines 7, effectively controls horizontal offset of the system. By utilizing the buoyant forces of adjustable buoyancy chamber 9, lower connecting member 5 is drawn taut and held in a stable position.

[0033] In an alternative embodiment, one or more stabilizers 6 control horizontal offset of lower connecting member 5, and the height or depth of an associated well terminal member 14 is adjusted by varying the length of upper connecting member 12. In some embodiments, the vertical tension of lower connecting member 5 is held approximately constant while the height or depth of well terminal member 14 is adjusted. In further embodiments, the height or depth of well terminal member 14 is held approximately constant, while the vertical tension imparted by adjustable buoyancy chamber 9 on lower connecting member 5 is adjusted. In still further embodiments, the height or depth of well terminal member 14 and the vertical tension applied to lower connecting member 5 are held approximately constant, while lateral adjustments are performed using lateral stabilizer 6 and one or more of tension lines 7.

[0034] In certain embodiments, one or more lateral tension lines 7 are individually adjustable, whereas in other embodiments, the tension lines 7 are collectively adjustable. In further embodiments, one or more tension lines 7 are both individually and collectively adjustable. In still further embodiments, the one or more lateral stabilizers 6 are disposed in communication with a tension measuring means, so that a fixed or predetermined amount of lateral tension can be applied to lower connecting member 5 in order to better control system offset. In some embodiments, the tension lines 7 are anchored to the sea floor by means of an anchoring member 8, for example, a suction type anchor, or alternatively, a mechanical or conventional deadweight type anchor.

[0035] In a further embodiment, adjustable buoyancy chamber 9 is approximately annular in shape, so that lower connecting member 5 can be passed through a void longitudinally disposed in a central portion of the device. In further embodiments, adjustable buoyancy chamber 9 further comprises a plurality of inner chambers. In still further embodiments, each of the chambers is independently operable, and different amounts of air or gas (or another fluid) are disposed in the chambers to provide greater adjustable buoyancy control. In one example embodiment, adjustable buoyancy chamber 9 further comprises a fluid ballast that can be ejected from the chamber, thereby achieving greater chamber buoyancy and lending additional vertical tension to lower connecting member 5. Those of ordinary skill in the art will appreciate that many appropriate fluid ballast can be used to increase or retard buoyancy; for example, compressed air is an appropriate fluid that is both inexpensive and readily available.

[0036] In some embodiments, adjustable buoyancy chamber 9 further comprises a ballast input valve 15a, so that a fluid ballast can be injected into the chamber from an external source, for example, through an umbilical line run to the surface or a remote operated vehicle, so that an operator can deliver a supply of compressed gas to the chamber via the umbilical, thereby adjusting buoyancy characteristics as desired. In other embodiments, the fluid input valve is dis-

posed in communication with one or more pumps or compressors, so that the fluid ballast is delivered to the chamber under greater pressure, thereby effecting the desired change in buoyancy more quickly and reliably.

[0037] In other embodiments, adjustable buoyancy chamber 9 further comprises a ballast output valve 15b, so that ballast can be discharged from the chamber. In instances where air or another light fluid is injected into the chamber while water or another heavy liquid is discharged, the chamber will become more buoyant and increase vertical tension on lower connecting member 5. Conversely, if water or another heavy liquid is injected into the chamber while air is bled out, the chamber will lose buoyancy, thereby lessening vertical tension on lower connecting member 5.

[0038] In alternative embodiments, the ballast output valve is disposed in communication with one or more pumps or compressors, so that ballast is ejected from the chamber in a more reliable and controlled manner. In some embodiments, the ballast output valve is disposed in communication with an umbilical, so that ballast ejected from the chamber can be recovered or recycled at the surface. In any event, a principle advantage of the present invention is that adjustments to the chamber's buoyancy and tensioning properties, and the ability to control the height of the well terminal member 14, can be performed at any time during either exploration or production, due to the various ballast input and output control means disposed about the body of the chamber.

[0039] In further embodiments, adjustable buoyancy chamber 9 is further disposed in communication with one or more tension lines 10 provided to anchor the adjustable buoyancy chamber to the sea floor. As before, tension lines 10 are anchored to the sea floor using known anchoring technology, for example, suction anchors or dead weight type anchors, etc. The one or more tension lines 10 can also provide additional lateral stability for the system, especially during operations in which more than one well is being worked. In one embodiment, the one or more tension lines 10 are run from the adjustable buoyancy chamber 9 to the surface, and then moored to other buoys or a surface vessel, etc., so that even greater lateral tension and system stability are achieved. In further embodiments, the tension lines 10 are individually adjustable, whereas in other embodiments, the tension lines 10 are collectively controlled. In still further embodiments, the one or more tension lines 10 are both individually and collectively adjustable.

[0040] In one example embodiment, adjustable buoyancy chamber 9 is disposed in communication with a vertical tension receiving member 11. In another embodiment, the vertical tension receiving member 11 is equipped with a tension measuring means (e.g., a load cell 16, strain gauge, etc.), so that vertical tension applied to lower connecting member 5 is imparted in a more controlled and efficient manner. In another embodiment, the buoyant force applied to tension receiving member 11 is adjusted by varying the lengths of tension lines 10, while the buoyancy of adjustable buoyancy chamber 9 is held approximately constant. In a further embodiment, the buoyancy of adjustable buoyancy chamber 9 is controlled by means of one or more individually selectable ballast exhaust ports disposed about the body of the chamber, which vent excess ballast fluid to the surrounding sea. In still further embodiments, the open or closed state of the ballast exhaust ports are individually controlled using port controllers known to those of ordinary skill in the art (e.g., plugs, seacocks, etc.)

[0041] In a presently preferred embodiment, the system is disposed so that a well terminal member 14 installed above buoyancy chamber 9 is submerged to a depth at which maintenance and testing can be carried out by SCUBA divers using lightweight, flexible diving equipment, for example, at a depth of about 100 to 300 feet beneath the surface. In some embodiments, the well terminal member 14 is submerged only to the minimum depth necessary to provide topside access to the hulls of various surface vessels servicing the well, meaning that well terminal member 14 could also be disposed at a much shallower depth, for example, a depth of about 50 to 100 feet. In alternative embodiments, well terminal member 14 is disposed at depths of less than 50 feet, or greater than 300 feet, depending upon the actual conditions surrounding operations. In still further embodiments, well terminal member 14 is disposed either at the surface or above the surface of the water, and a blowout preventer or a production tree is installed by workers operating aboard a service platform or surface vessel. This "damp tree" model avoids the need to assemble long subsurface riser stacks, as would generally be required during deepwater operations. Moreover, disposing the well terminal member at or near the surface also permits testing and maintenance to be carried out by SCUBA divers or surface crews, without the need for expensive and time-consuming remote operated vehicle operations.

[0042] In some embodiments, well terminal member 14 further comprises either a blowout preventer or a production tree. In a further embodiment, well terminal member 14 further comprises a combined blowout preventer and production tree assembly configured so as to facilitate simplified well intervention operations.

[0043] In some embodiments, lower connecting member 5 terminates within the void formed in a center portion of the annular chamber 9, at which point an upper connecting member 12 becomes the means by which fluids are transported up to the wellhead. In other embodiments, lower connecting member 5 does not terminate within the void formed in a center portion of the annular chamber, but instead runs through the void and is subsequently employed as an upper connecting member 12 disposed between the chamber and the wellhead. In other embodiments, a vertical tension receiving member 11 is disposed between the buoyancy chamber 9 and upper connecting member 12, so that the chamber's buoyant forces are transferred to the vertical tension receiving means 11, thereby applying vertical tension to the drilling or production string extended below the chamber.

[0044] In further embodiments, upper connecting member 12 further comprises a well isolation member 13, e.g., one or more ball valves or blowout preventers, used to halt fluid flow in the event that well terminal member 14 is either removed or disabled, for example, during testing and maintenance operations. Those of ordinary skill in the art will appreciate that the precise types and exact locations of isolation valves 13 employed in the system are variable and flexible, the only real requirement being that the valves are capable of allowing or preventing fluid flow from the well 1 during periods in which testing or maintenance, or even an emergency safety condition, are present.

[0045] For example, well terminal member 14 can be equipped with a production tree so that a production hose disposed on a surface vessel can be attached to the system and production can commence. Alternatively, well terminal member 14 can terminate in a blowout preventer, so that the well will not blow out during drilling operations. In other embodi-

ments, well terminal member **14** terminates in a combined production tree and blowout preventer assembly to facilitate simplified well intervention operations.

[0046] Turning now to FIGS. 2A and 2B, in further example embodiments, a lower production tree **15** is disposed in communication with the lower connecting member **5**.

[0047] In other example embodiments, the lower connecting member **5** comprises one or more stress joints.

[0048] In still other embodiments, as shown in FIG. 2A, an electric submersible pump (ESP) **16** is anchored inside of the lower connecting member **5**. In further embodiments, the ESP is located at the base of the lower connecting member **5**.

[0049] In still other embodiments, the ESP is located inside of the well hole **3**. In certain embodiments, the ESP is lowered into the well hole **3** using a wench or the like.

[0050] In example embodiments, power is supplied to the ESP **16** via electric cables **17**. In certain embodiments, the electric cables **17** are connected to a power source, and pass through an electric cable head **18** connected to the well terminal member **14**. In further embodiments, the electric cables **17** pass through the upper connecting member **12** and lower connecting member **5**, until they reach the ESP **16**.

[0051] When in use, the ESP provides lifting power to the fluids flowing from the well hole **3**, to the lower connecting member **5**, up through the well terminal member **14**. This additional lifting power assists in moving the fluids ultimately through the production lines to the production facility.

[0052] In still other embodiments, as shown in FIG. 2B, gas lift valves **19** are disposed in communication with the lower connecting member **5**.

[0053] In example embodiments, gas is supplied to the gas lift valves via gas injection lines **21**, connected to a gas source.

[0054] When in the open position, in certain embodiments, the gas lift valves **19** provide lifting power to the fluids flowing from the well hole **3**, to the lower connecting member **5**, up through the well terminal member **14**. This additional lifting power assists in moving the fluids ultimately through the production lines to the production facility.

[0055] Turning now to the embodiments depicted in FIGS. 3A and 3B, a system and method of establishing a height-variable well terminal member is provided, comprising a lower fluid transport pipe **21**, an inner well casing **22**, an outer well casing **23**, and a wellhead **24**. In some embodiments, a well isolation member **25** is disposed above the wellhead **24**, so that the well can be closed off or shut in if desired.

[0056] In the example embodiment depicted in FIG. 3A, well isolation member **25** further comprises one or more ball valves that can be adjustably opened or closed as desired by an operator. A lower connecting member **26** having one or more interior seals **27** and an interior polished bore **28** houses a fluid transport member **29** such that the height of fluid transport member **29** is variably adjustable within a body portion of lower connecting member **26** in response to vertical lifting forces imparted by adjustable buoyancy chamber **30**. Various lengths of pipe define the height of an upper connecting member disposed between the buoyancy chamber **30** and a well terminal member **36**. In some embodiments, an upper well isolation member **35**, such as a ball valve or a blowout preventer, is disposed in communication with the upper connecting member between buoyancy chamber **30** and well terminal member **36**.

[0057] In some embodiments, the system is moored to the sea floor using one or more mooring lines **31** connected to a first vertical tension receiving means **32a**, while buoyancy

chamber **30** is raised or lowered by either spooling-out or reeling-in lengths of one or more tension lines **37** disposed between a second vertical tension receiving means **32b** and a chamber height adjustment means **33**. As adjustable buoyancy chamber **30** rises, vertical tension is applied to vertical tension receiving member **34**, which in turn lifts well terminal member **36** up toward the surface.

[0058] As seen in the example embodiment depicted in FIG. 3B, the height of both the well terminal member **36** and fluid transport member **29** are vertically adjusted by increasing the length of tension lines **37** using chamber height adjustment means **33**, even as vertical and lateral tension on mooring lines **31** and tension lines **37** remains approximately constant. In one embodiment, vertical tension on lower connecting member **26** is also kept approximately constant during this process, since fluid transport member **29** is moved vertically within a body portion of lower connecting member **26**. In another embodiment, a second, lower adjustable buoyancy chamber is added to the system to maintain tension on lower connecting member **26**, while the height of the well terminal member is adjusted as described above.

[0059] The foregoing specification is provided for illustrative purposes only, and is not intended to describe all possible aspects of the present invention. Moreover, while the invention has been shown and described in detail with respect to several exemplary embodiments, those of ordinary skill in the pertinent arts will appreciate that minor changes to the description, and various other modifications, omissions and additions may also be made without departing from either the spirit or scope thereof.

1. An offshore exploration and production system, the system comprising:

- a well casing disposed in communication with an offshore well;
- one or more approximately annular adjustable buoyancy chambers;
- a lower connecting member disposed between said well casing and said one or more approximately annular adjustable buoyancy chambers; and
- a lift device disposed in communication with said lower connecting member.

2. The system of claim 1, further comprising an electrical submersible pump disposed in communication with said lower connecting member.

3. The system of claim 1, further comprising a gas lift device disposed in communication with said lower connecting member.

- 4. A self-standing riser system, said system comprising:
 - a subsurface well disposed in communication with a self-standing riser assembly; and
 - a lift device disposed in communication with said self-standing riser assembly.

5. The system of claim 4, further comprising an electrical submersible pump disposed in communication with said self-standing riser assembly.

6. The system of claim 4, further comprising a gas lift device disposed in communication with said self-standing riser assembly.

7. A method of installing and maintaining a self-standing riser system, the method comprising:

- disposing a subsurface well in communication with a self-standing riser assembly; and
- disposing a lift device in communication with said self-standing riser assembly.