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(54) **LANDING STRING ASSEMBLY**
ABSETZSTRANGANORDNUNG
ENSEMBLE RAME SOUS-MARINE

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a landing string assembly, and in particular, but not exclusively, to a landing string assembly for use in exploration and appraisal well operations.

BACKGROUND TO THE INVENTION

[0002] In the oil and gas industry, offshore wells are drilled from specialised platforms, such as floating or semi-submersible drilling rigs, into the earth to intercept hydrocarbon bearing formations or reservoirs. Typically, a marine riser is installed between the drilling platform and a subsea wellhead unit, and a drill string extends through the marine riser to drill the well from the wellhead and into the earth.

[0003] As a wellbore is advanced into the earth it is supported and sealed, in stages, by strings of threaded tubulars known as casing. This is typically achieved by drilling to a first depth, retrieving the drill string, running in a casing string and cementing this in place, and then introducing the drill string back into the cased bore to advance the bore to a second depth. This process is repeated until the required total depth is achieved to intercept a hydrocarbon production zone. The resulting well consists of a number of concentric casing tubing strings cemented within the wellbore.

[0004] During drilling, well control is conventionally achieved by use of a subsea blow out preventor (BOP) which is mounted on the wellhead and includes a number of valves and cutting tools which can be used to isolate the wellbore if required.

[0005] Once the wellbore is constructed and has been appropriately tested and appraised, well completion infrastructure and apparatus are installed, such as production tubing, production Xmas trees, manifolds and the like to fully commission the well and accommodate production of hydrocarbons.

[0006] An example of a well completion structure is given in US Patent 6,227,300 which discloses a slimbore riser connected through the bore of a BOP to a wellhead via a tubing spool and hanger mounted on a landing string and which provides fluid communication for production fluids from the wellhead to the surface. Although this document discusses the use of pumps where there is insufficient natural lift in the well, no disclosure is made as to nature or placement of the pump.

[0007] The early stages of wellbore construction, prior to installation of a completion, may form an exploration and appraisal stage, which focuses on data collection and analysis of, for example, pressure, temperature and flow data, and the proper sampling of fluids and their analysis to determine the characteristics and commercial viability of the well or reservoir. With the increased interest in proving oil and gas reserves, this area of appraisal

well testing is receiving more focus and interest.

[0008] Offshore exploration and appraisal wells are often flow tested by flowing reservoir fluid from the subterranean reservoir formation to the surface via a threaded tubing string which is run into the cased wellbore. This tubing string, which is usually temporary, contains a number of elements or "tools" that allows the flow to be controlled and reservoir data to be collected. The element of this tubing string which extends from the seabed up to the drilling rig is conventionally known as the landing string. The landing string is contained within the marine riser and the drilling BOP, and the tubing through which the reservoir fluid will be produced as part of the well appraisal is landed in the wellhead using a locating device known as the tubing hanger. The tubing hanger typically represents the lowermost part of the subsea landing string.

[0009] The landing string in the arrangement described above therefore provides a temporary flow path from the well for appraisal operations, prior to commissioning of the well for full production via a permanent completion. Of course, if the appraisal operation does not present favourable results then the well may be abandoned.

[0010] The landing string configuration described above can also be used to flow production wells until they have "cleaned-up" (i.e. reached close to their optimum flow performance) prior to suspension and then completion using, for example, a standard vertical-type subsea production Xmas tree.

[0011] However, the flow rate from a newly constructed exploration and appraisal well is often quite low. This may result in, for example, the flow velocity in the tubing being too low to properly clean-up the wells, and/or the clean-up time being excessive resulting a significant rig time being expanded to achieve a reasonable flow performance.

[0012] To address these issues it is known in the art to improve the well flow performance by artificial lift of the flowing wells by in-well techniques. These techniques may include, for example, gas lift, pumping or the like.

[0013] Gas lift techniques involve pumping hydrocarbon gas down the annulus between the tubing and the casing and through a tool in the tubing (called a gas lift valve) so that the low-density hydrocarbon gas is introduced into the denser oil flowing up the tubing. This results in a less dense flowing hydrocarbon column, and lower bottom hole pressure at the reservoir giving a higher flow rate from the reservoir. The main problems with the gas lift, especially using non-permanent facilities such as those used on an exploration and appraisal rig, are establishing sufficient gas flow to deliver to the well, and getting enough gas compression capacity to inject the gas into the well at sufficient depth.

[0014] Artificial lift by pumping is achieved by installing one or more pumps as part of the in-well tubing string to function to pump the reservoir fluids to surface and thus enhance flowing performance. It is well understood in the art that for maximum improved flow performance the

pumps must be located close to the producing formation.

[0015] The pumps installed within the well at the location of the reservoir may be electrically or hydraulically powered, with power being supplied from surface level via power cables or conduits and the like. These power cables and conduits etc. typically extend into the earth to the depth of the in-well pumps through the annulus formed between the tubing string and the casing. This can require significant lengths of cables/conduits, often necessitating multiple cable/conduit lengths to be connected together, which introduces possible failure points within the system. Also, there is a risk that the cables/conduits could be damaged when being run into the cased wellbore.

[0016] Furthermore, and as noted above, in exploration and appraisal wells the tubing string may be temporarily installed in the well, and it is a requirement for the landing string to be detachable from the in-well tubing string. This is also true of well completions where the landing string is used as a conduit for flowing the well to "clean-up" (i.e. optimise) the performance of the production well prior to installation of the subsea Xmas tree, for example. This disconnect may be made in the event of bad weather, operational problems or operational requirements, and so if a pump is installed in the well as described above then it would be necessary to have a breakable power connector. This is a complex piece of equipment that results in lower reliability for landing string connection and for the installed pumps. Known power connectors are relatively large and cause design issues when other components, such as valves and the like, need to be accommodated within the marine riser, especially when the other components must also be powered or controlled from surface. Additionally, the running of the pumps into the well results in significant additional rig time being required to run and secure the power cable/conduit.

[0017] The above discussion is focussed mainly on the use of a landing string in appraisal well testing. However, landing string arrangements may also be used to assist in the deployment and installation of completion infrastructure and apparatus, either temporary or permanent. Furthermore, landing string arrangements may be used to perform intervention or workover operations on an ageing well. That is, once a well has been producing for some time it may be necessary to undertake some kind of intervention work, for example to perform well inspections, repairs, stimulation or the like. When such an intervention is required, production is suspended and the well disconnected from the existing permanent production facilities. A landing string may be used to deploy, accommodate or facilitate intervention operations, tooling and the like.

SUMMARY OF THE INVENTION

[0018] According to a first aspect of the present invention there is provided a landing string assembly comprising:

- a first end adapted to be coupled to a wellhead assembly;
- a second end adapted to be located relative to a surface platform; and
- a pump mounted intermediate the first and second ends.

[0019] When in normal use, the first end may define a lower end of the landing string assembly, and the second end may define an upper end of the landing string assembly.

[0020] In the present invention, when in normal use, a pump is provided in combination with the landing string assembly and thus located above the position of a wellhead assembly. Thus, the pump is not located downhole within the well. This arrangement therefore assists to eliminate problems associated with locating a pump within a well, and accommodating power delivery and the like.

[0021] The pump may be configured to pump fluids from a well, such as hydrocarbon fluids, water or the like produced from a subterranean formation. Alternatively, or additionally, the pump may be configured to pump fluids into a well. For example, the pump may be configured to pump water, gas or the like, or any suitable combination thereof into a well.

[0022] The landing string assembly may be configured for temporary use. The landing string assembly may be retrievable. The landing string assembly may be configured to define or form part of a permanent well infrastructure, such as a completion.

[0023] The landing string assembly may be adapted for use in well testing operations, production operations, intervention operations, deployment operations, well kill and abandoning operations or the like, or any suitable combination thereof.

[0024] The landing string assembly may be configured for use in an exploration and appraisal well. In such a configuration the pump may be adapted to pump well fluids from a well through the landing string assembly and towards a surface platform for subsequent testing, analysis and the like.

[0025] The landing string assembly may be configured for use in a production well. The landing string assembly may be configured for use in an injection well.

[0026] The landing string assembly may be configured for subsea use. The landing string assembly may be adapted to extend through a riser, such as a marine riser.

[0027] The landing string assembly may comprise a plurality of tubular members secured together, for example by end-to-end threaded connections, welded connections or the like.

[0028] The pump may be mounted within a tubular member. Alternatively, or additionally, the pump may be mounted intermediate two tubular members.

[0029] The pump may comprise a centrifugal pump, progressive cavity pump or the like. The pump may comprise a submersible pump. The pump may be configured for pumping single and/or multiphase fluids.

[0030] The pump may be located at any location along the length of the landing string assembly, between the first and second ends. In one embodiment, the pump may be located nearer to the first end than the second end. The pump may be located adjacent the first end of the landing string assembly. This arrangement may be particularly advantageous when used in marine environments, particularly deepwater marine environments. That is, when the pump is located towards the first end, and thus the lower end of the tubing string assembly, and is configured to pump fluids from the well, a discharge side of the pump will be exposed to the hydrostatic pressure of a column of fluid above the pump within the landing string assembly. Locating the pump towards the first end of the landing string assembly will therefore maximise the pressure on the discharge side of the pump. This advantageously minimises the pressure differential across the pump (i.e., the pressure differential between the downhole formation and at the discharge side of the pump).

[0031] The landing string assembly may be configured for use in deep water. In this arrangement the pump may be located towards the first end of the landing string assembly.

[0032] The pump may comprise a pumping portion and a drive portion. The pumping portion may comprise one or more blades, vanes or the like. The drive portion may comprise a motor, such as an electric motor, hydraulic motor or the like. The drive portion may comprise a turbine or the like. The pumping portion and drive portion may be located adjacent each other. The pumping portion and the drive portion may be located remotely of each other.

[0033] The pump may be powered from surface level. For example, the pump may be configured to receive power from a surface platform. The pump may be electrically operated, hydraulically operated, mechanically operated or the like, or any suitable combination thereof. A conduit may extend along the length of the landing string assembly, between the region of the second end and the pump. The conduit may be arranged to communicate power for operation of the pump. The conduit may comprise an electrical cable. The conduit may comprise a fluid passage, such as a hose. In this arrangement the conduit does not extend beyond the pump and the first end. This therefore eliminates the problems associated with transmitting power downhole into a well.

[0034] The conduit may be configured to extend externally of the landing string assembly. The conduit may be secured to an outer surface of the landing string assembly.

[0035] The conduit may be configured to extend internally of the landing string assembly.

[0036] The pump may be operated by a mechanical connection from surface level, such as from a shaft or the like.

[0037] The first end may be adapted to be directly coupled to a wellhead assembly. In this arrangement the first

end may be adapted to be connected at the location of a wellhead assembly. Alternatively, the first end may be adapted to be indirectly coupled to a wellhead assembly. For example, the first end may be adapted to be coupled to an intermediate assembly, such as a tubing string, which is connected to and extends from a wellhead assembly.

[0038] The first end may comprise a connecting arrangement adapted to permit the landing string assembly to be coupled to a wellhead assembly, either directly or indirectly. The connecting arrangement may comprise a releasable connecting arrangement, permitting connection and disconnection of the landing string to and from a wellhead assembly. The connecting arrangement may comprise a latching arrangement.

[0039] The entire landing string assembly may be configured to be releasable from a wellhead assembly.

[0040] At least a portion of the landing string assembly may be configured to be releasable from a wellhead assembly. In this arrangement, components of the landing string assembly may be arranged to remain secured to, or forming part of, a wellhead assembly following release and removal of other components of the landing string assembly.

[0041] The wellhead assembly may comprise a subsea wellhead assembly. The wellhead assembly may comprise a wellhead unit located at ground level, for example at the level of the seabed.

[0042] The wellhead assembly may comprise a fluid control assembly, such as a blow out preventor, a Xmas tree, such as a horizontal or vertical Xmas tree, a test tree or the like.

[0043] The landing string assembly may comprise components arranged to form part of a wellhead assembly. For example, in one arrangement the landing string assembly may comprise a subsea test tree. The subsea test tree may be located adjacent the first end of the landing string assembly. The subsea test tree may be releasably secured to the landing string assembly. This arrangement may permit the subsea tree to remain fixed to the wellhead assembly after the landing string assembly has been released.

[0044] The landing string assembly may comprise a tubing hanger arranged to support a tubing string extending into an associated well. The tubing hanger may be releasable from the landing string such that the tubing hanger may remain within the wellhead assembly following removal of the landing string assembly.

[0045] The wellhead assembly may comprise a manifold or the like.

[0046] The landing string may comprise a valve assembly. The landing string may comprise a valve assembly located adjacent the first end of the valve assembly. The valve assembly may be configured to isolate the landing string assembly in the event of disconnection from the wellhead assembly. This arrangement may conveniently prevent release of well fluids into the environment. The valve assembly may be located below the

pump. The landing string may comprise a retainer valve.

[0047] The landing string may comprise a lubricator valve assembly configured to permit the passage of tooling and the like into the landing string. The lubricator valve may be located more towards the second end than the first end. The lubricator valve may be located adjacent the second end. The lubricator valve may be positioned within the landing string assembly to be located below a floor of a surface-platform, when in use.

[0048] The landing string may be configured to be coupled to a wellhead assembly comprising a blow out Preventor (BOP). The pump may be positioned within the landing string assembly to be located above the BOP. This may prevent damage to the pump in the event of use of the BOP.

[0049] The second end may be coupled at the location of a surface platform. The second end may be coupled to fluid handling equipment, such as a surface flow head or the like.

[0050] The surface platform may comprise a floating vessel, anchored vessel or the like.

[0051] The landing string assembly may be adapted to communicate with a downhole tubing string extending downhole from an associated wellhead assembly. The downhole tubing string may comprise a production tubing string or the like.

[0052] According to a second aspect of the present invention there is provided a method of establishing a flow path between a wellhead assembly and a surface platform, said method comprising the steps of:

incorporating a pump intermediate first and second ends of a landing string assembly;
coupling the first end of the landing string assembly to a wellhead assembly; and
locating the second end of the landing string assembly relative to a surface platform.

[0053] The method may comprise the step of operating the pump to pump fluids to and from a downhole location, that is, a location below the wellhead assembly.

[0054] The method may comprise the step of providing power from surface level to operate the pump.

[0055] The method may comprise the step of detaching the landing string assembly from the wellhead assembly at a location below the pump.

[0056] The landing string assembly according to the method of the second aspect may be provided and used in accordance with the landing string assembly according to the first aspect. Thus, features of the first aspect may be also assumed in this second aspect.

[0057] According to a third aspect of the present invention there is provided a well construction comprising:

a wellhead assembly; and
a landing string having a first end coupled to the wellhead assembly and a second end secured relative to a surface platform, wherein the landing string com-

prises a pump located intermediate the first and second ends.

[0058] The landing string assembly may be provided in accordance with the first aspect.

[0059] According to a fourth aspect of the present invention there is provided a deepwater landing string assembly comprising:

a first end adapted to be coupled to a wellhead assembly;
a second end adapted to be located relative to a surface platform; and
a pump mounted intermediate the first and second ends.

[0060] The deepwater landing string assembly may be configured for use in water depths of greater than 300 m (1000 feet).

[0061] Further aspects of the present invention relate to exploration and appraisal well apparatus and methods which use a landing string assembly according to the first aspect.

BRIEF DESCRIPTION OF THE DRAWINGS

[0062] These and other aspects of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a diagrammatic representation of a landing string assembly, shown in use, in accordance with an embodiment of the present invention; and
Figure 2 is an enlarged diagrammatic representation of a lower end of the tubing string assembly of Figure 1, in the region of a wellhead.

DETAILED DESCRIPTION OF THE DRAWINGS

[0063] A landing string assembly according to an embodiment of the present invention is diagrammatically shown in Figure 1. The landing string assembly, generally identified by reference numeral 10, includes a first or lower end 12 which is secured to a wellhead assembly 14, and a second or upper end 16 which is located relative to a surface platform 18, which in the embodiment shown is a semi-submersible drilling rig 18. The landing string assembly 10 in the embodiment shown may be configured for many operations. However, in the present exemplary embodiment the landing string assembly 10 is for use in an exploration and appraisal well operation. That is, the landing string is in fluid communication with a downhole tubing string 20 which extends through casing 22, wherein fluids from a subterranean formation 24 are carried to surface through the downhole tubing string 20 and the landing string assembly 10 for testing prior to installation of a permanent completion. The upper end 16 of the landing string assembly 10 is secured to a sur-

face flow head 26 which provides control of fluids from the landing string.

[0064] An enlarged view of the landing string assembly 10 is shown in Figure 2, reference to which is additionally made.

[0065] The wellhead assembly 14 includes a subsea wellhead 28 which supports a blow out preventor (BOP) 30. Only the left side of the BOP is shown in Figure 2 for clarity. A marine riser 32 extends from the BOP 30 to surface level, and the landing string assembly 10 extends through the marine riser 30.

[0066] The landing string assembly 10, which is generally tubular in form, includes a pump 34 located intermediate the first and second ends 14, 16, and specifically towards the first end 12, above the wellhead assembly 14. The pump 34 functions to artificially lift fluids through the downhole tubing 20 from the formation 24, and ultimately to surface level. The pump 34 therefore improves the flow rate of produced fluids to be tested.

[0067] In the embodiment shown the pump 34 is an electrical submersible pump and includes an electric motor 36 arranged to drive a pumping component 38. The pump 34 is configured to pump multiphase fluids.

[0068] As noted above, the pump 34 is located towards the first end 12 of the landing string assembly 10. This arrangement advantageously maximises the efficiency of the pump 34 in that a discharge side 40 of the pump will be exposed to the hydrostatic pressure of a column of fluid above the pump 34 within the landing string assembly 10, which advantageously minimises the pressure differential across the pump (i.e., the pressure differential between the downhole formation 24 and at the discharge side 40 of the pump 34). For this reason, the landing string assembly 10 has advantageous application in deepwater environments.

[0069] An umbilical 42 extends from surface level through an annulus 44 formed between the landing string assembly 10 and the marine riser 32. The umbilical 42 is coupled to the pump 34 and is configured to communicate electrical power for operation of the pump 34. The umbilical 42 may also be configured to communicate signals or the like for control, monitoring or other purposes. Providing the umbilical 42 to extend only to the location of the pump 34, which is positioned above the wellhead assembly 14 is particularly advantageous in that the requirement to use specialised coupling arrangements and the like to ensure robust connection and passage of the umbilical past the wellhead is eliminated.

[0070] The landing string assembly 10 further includes a connecting arrangement in the form of a latch 46 located below the pump 34. The latch 46 permits release of the upper portion of the landing string assembly 10, which may be required in an emergency situation, or other need. For example, extensive deviation of the drilling rig 18 may necessitate a quick-release of the landing string assembly 10. It should be noted that the latch 46 is positioned below the location of the pump 34 and the connection of the umbilical 42, which therefore eliminates the require-

ment to utilise complex and often unreliable latching arrangements for disconnection of an umbilical which extends below the location of the latch 46. This provides significant advantages over known systems, such as systems which locate a pump downhole, below the wellhead, and provide umbilical power connection across the wellhead.

[0071] The latch 46 is configured to permit reconnection of the landing string assembly 10.

[0072] A retainer valve 48 is located above the latch 46, and below the pump 34. The retainer valve 48 is configured to be selectively closed to isolate the sections of the landing string assembly 10 above and below the retainer valve 48. Specifically, the retainer valve 48 is configured to be closed to isolate the upper portion of the landing string assembly 10 in the event of a requirement to disconnect at the latch 46. This therefore retains any fluids within the upper portion of the landing string assembly 10.

[0073] A valve arrangement in the form of a subsea test tree 50 forms part of the landing string assembly 10 and is located below the latch 46. The subsea test tree 50 is formed of a tubular element containing a number of valves that allows the well to be safely shut in at the seabed. The large volume of hydrocarbon may therefore be contained some way below the rig floor, for example when disconnection at the latch 46 is required. The subsea test tree 50 may be locked into the drilling BOP 30 by closing the BOPs pressure sealing pipe rams or the like around the upper part of the subsea test tree 50.

[0074] In the embodiment shown, a lowermost portion of the landing string assembly 10 comprises a tubing hanger 52 which functions to support the downhole tubing string 20.

[0075] The landing string assembly 10 also includes a lubricator valve 54 towards the upper end 16 thereof, and positioned below the platform 18. The lubricator valve 54 allows wireline and coiled tubing tools and the like (not shown) to be introduced safely into the well.

[0076] Various elements of the landing string assembly 10 may be remotely controlled from surface via hydraulic or electro-hydraulic umbilicals, for example. These umbilicals (not shown) may be run with the landing string assembly 10 and may be contained within the annulus 44.

[0077] It should be understood that the embodiment described herein is exemplary and that various modifications may be made thereto without departing from the scope of the invention. For example, the landing string assembly is described for use in an exploration and appraisal well operation. However, the landing string assembly may be used in many operations and types of well, such as in completion operations, well clean-up operations and the like.

Claims

1. A tubular landing string assembly (10) comprising:

- a first end (12) adapted to be coupled to a wellhead assembly (14);
a second end (16) adapted to be located relative to a surface platform (18);
and
a pump (34) mounted intermediate the first and second ends to pump fluid through the landing string assembly (10) between the first and second ends (12, 16) to and/or from a well.
2. The assembly (10) according to any preceding claim, adapted to extend through a riser (32).
 3. The assembly (10) according to any preceding claim, comprising a plurality of tubular members secured together, and optionally wherein the pump (34) is mounted at least one of within a tubular member and intermediate two tubular members.
 4. The assembly (10) according to any preceding claim, wherein the pump (34) is located nearer to the first end (12) than the second end (16), and/or wherein the pump (34) is located adjacent the first end (12) of the landing string assembly (10), and/or wherein the pump (34) is adapted to be powered from surface level by at least one of electrical power, hydraulic power, mechanical work and pneumatic power.
 5. The assembly (10) according to any preceding claim, wherein the first end (12) comprises a connecting arrangement (46) adapted to permit the landing string assembly (10) to be coupled to a wellhead assembly (14), either directly or indirectly, and optionally wherein the connecting arrangement (46) comprises a releasable connecting arrangement.
 6. The assembly (10) according to any preceding claim, wherein at least a portion of the landing string assembly (10) is configured to be releasable from a wellhead assembly (14), and/or wherein the entire landing string assembly (10) is configured to be releasable from a wellhead assembly (14).
 7. The assembly (10) according to any preceding claim, wherein the wellhead assembly (10) comprises a subsea wellhead assembly.
 8. The assembly (10) according to any preceding claim, wherein the wellhead assembly (10) comprises a fluid control assembly, such as at least one of a blow out preventor, a Xmas tree, such as a horizontal or vertical Xmas tree and a test tree.
 9. The assembly (10) according to any preceding claim, comprising components arranged to form part of a wellhead assembly (14), and optionally comprising a subsea test tree (50) located adjacent the first end (12) of the landing string assembly (10), and optionally wherein the subsea test tree (50) is configured to be releasably secured to the landing string assembly (10).
 10. The assembly (10) according to any preceding claim, comprising a tubing hanger (52) arranged to support a tubing string (20) extending into an associated well (22), and optionally wherein the tubing hanger (52) is configured to be releasable from the landing string (10).
 11. The assembly (10) according to any preceding claim, comprising a valve assembly (48), wherein the valve assembly (48) is optionally:
 - located adjacent the first end (12) of the landing string assembly (10);
 - configured to isolate the landing string assembly (10) in the event of disconnection from the wellhead assembly (14); and/or
 - located below the pump (34).
 12. The assembly (10) according to any preceding claim, configured to be coupled to a wellhead assembly (14) comprising a blow out Preventor (BOP) (30), wherein the pump (34) is positioned within the landing string assembly (10) to be located above the BOP (30).
 13. The assembly (10) according to any preceding claim, wherein the second end (16) is adapted to be coupled at the location of a surface platform (18).
 14. The assembly (10) according to any preceding claim, adapted to communicate with a downhole tubing string (20) extending downhole from an associated wellhead assembly (14).
 15. A method of establishing a flow path between a wellhead assembly (14) and a surface platform (18), said method comprising the steps of:
 - incorporating a pump (34) intermediate first and second ends (12, 16) of a tubular landing string assembly (10);
 - coupling the first end (12) of the landing string assembly (10) to a wellhead assembly (14);
 - locating the second end (16) of the landing string assembly (10) relative to a surface platform (18);
 - and
 - operating the pump (34) to pump fluid through the landing string assembly (10) between the first and second ends (12, 16) to and/or from a well.

Patentansprüche

1. Absetzrohrstrang-Baugruppe (10), die Folgendes umfasst:

ein erstes Ende (12), das dafür eingerichtet ist, an eine Bohrlochkopf-Baugruppe (14) gekoppelt zu werden,
 ein zweites Ende (16), das dafür eingerichtet ist, im Verhältnis zu einer Oberflächenplattform (18) positioniert zu werden, und
 eine Pumpe (34), die zwischen dem ersten und dem zweiten Ende angebracht ist, um zwischen dem ersten und dem zweiten Ende (12, 16) Fluid durch die Absetzstrang-Baugruppe (10) zu und/oder von einem Bohrloch zu pumpen.

2. Baugruppe (10) nach einem der vorhergehenden Ansprüche, die dafür eingerichtet ist, sich durch eine Steigleitung (32) zu erstrecken.

3. Baugruppe (10) nach einem der vorhergehenden Ansprüche, die mehrere aneinander befestigte Rohrelemente umfasst und wobei die Pumpe (34) wahlweise wenigstens innerhalb eines Rohrelements oder zwischen zwei Rohrelementen angebracht ist.

4. Baugruppe (10) nach einem der vorhergehenden Ansprüche, wobei die Pumpe (34) näher an dem ersten Ende (12) als dem zweiten Ende (16) angeordnet ist und/oder wobei die Pumpe (34) angrenzend an das erste Ende (12) der Absetzstrang-Baugruppe (10) angeordnet ist und/oder wobei die Pumpe (34) dafür eingerichtet ist, vom Oberflächenniveau aus durch wenigstens eines von Elektroantrieb, hydraulischem Antrieb, mechanischer Arbeit und pneumatischem Antrieb angetrieben zu werden.

5. Baugruppe (10) nach einem der vorhergehenden Ansprüche, wobei das erste Ende (12) eine Verbindungsanordnung (46) umfasst, die dafür eingerichtet ist, zu ermöglichen, dass die Absetzstrang-Baugruppe (10), entweder unmittelbar oder mittelbar, an eine Bohrlochkopf-Baugruppe (14) gekoppelt wird, und wobei wahlweise die Verbindungsanordnung (46) eine lösbare Verbindungsanordnung umfasst.

6. Baugruppe (10) nach einem der vorhergehenden Ansprüche, wobei wenigstens ein Abschnitt der Absetzstrang-Baugruppe (10) dafür konfiguriert ist, von einer Bohrlochkopf-Baugruppe (14) gelöst werden zu können und/oder wobei die gesamte Absetzstrang-Baugruppe (10) dafür konfiguriert ist, von einer Bohrlochkopf-Baugruppe (14) gelöst werden zu können.

7. Baugruppe (10) nach einem der vorhergehenden Ansprüche, wobei die Bohrlochkopf-Baugruppe (14)

eine Unterwasser-Bohrlochkopf-Baugruppe umfasst.

8. Baugruppe (10) nach einem der vorhergehenden Ansprüche, wobei die Bohrlochkopf-Baugruppe (14) eine Fluidregelungsbaugruppe, wie beispielsweise wenigstens eines von einer Ausbruchssicherung, einem Steigrohrkopf, wie beispielsweise einem horizontalen oder vertikalen Steigrohrkopf, und einem Testbaum, umfasst.

9. Baugruppe (10) nach einem der vorhergehenden Ansprüche, die Komponenten umfasst, die dafür angeordnet sind, einen Teil einer Bohrlochkopf-Baugruppe (14) zu bilden, und die wahlweise einen Unterwasser-Testbaum (50) umfasst, der angrenzend an das erste Ende (12) der Absetzstrang-Baugruppe (10) angeordnet ist, und wobei wahlweise der Unterwasser-Testbaum (50) dafür konfiguriert ist, lösbar an der Absetzstrang-Baugruppe (10) befestigt zu werden.

10. Baugruppe (10) nach einem der vorhergehenden Ansprüche, die ein Verrohrungsgehänge (52) umfasst, das dafür angeordnet ist, einen Verrohrungsstrang (20) zu tragen, der sich in ein zugeordnetes Bohrloch (22) erstreckt, und wobei wahlweise das Verrohrungsgehänge (52) dafür konfiguriert ist, von dem Absetzstrang (10) gelöst werden zu können.

11. Baugruppe (10) nach einem der vorhergehenden Ansprüche, die eine Ventilbaugruppe (48) umfasst, wobei die Ventilbaugruppe (48) wahlweise:

angrenzend an das erste Ende (12) der Absetzstrang-Baugruppe (10) angeordnet ist, dafür konfiguriert ist, die Absetzstrang-Baugruppe (10) im Fall einer Trennung von der Bohrlochkopf-Baugruppe (14) zu isolieren, und/oder unterhalb der Pumpe (34) angeordnet zu sein.

12. Baugruppe (10) nach einem der vorhergehenden Ansprüche, die dafür konfiguriert ist, an eine Bohrlochkopf-Baugruppe (14) gekoppelt zu werden, die eine Ausbruchssicherung (BOP) (30) umfasst, wobei die Pumpe (34) so innerhalb der Absetzstrang-Baugruppe (10) angeordnet ist, dass sie sich oberhalb der BOP (30) befindet.

13. Baugruppe (10) nach einem der vorhergehenden Ansprüche, wobei das zweite Ende (16) dafür eingerichtet ist, an die Position einer Oberflächenplattform (18) gekoppelt zu werden.

14. Baugruppe (10) nach einem der vorhergehenden Ansprüche, die dafür eingerichtet ist, mit einem Untertage-Verrohrungsstrang (20) in Verbindung zu

stehen, der sich untertägig von einer zugeordneten Bohrlochkopf-Baugruppe (14) erstreckt.

15. Verfahren zum Herstellen einer Durchflussbahn zwischen einer Bohrlochkopf-Baugruppe (14) und einer Oberflächenplattform (18), wobei das Verfahren die folgenden Schritte umfasst:

das Einbauen einer Pumpe (34) zwischen einem ersten und einem zweiten Ende (12, 16) einer Absetzrohrstrang-Baugruppe (10),
das Koppeln des ersten Endes (12) der Absetzstrang-Baugruppe (10) an eine Bohrlochkopf-Baugruppe (14),
das Positionieren des zweiten Endes (16) der Absetzstrang-Baugruppe (10) im Verhältnis zu einer Oberflächenplattform (18) und
das Betätigen der Pumpe (34), um zwischen dem ersten und dem zweiten Ende (12, 16) Fluid durch die Absetzstrang-Baugruppe (10) zu und/oder von einem Bohrloch zu pumpen.

Revendications

1. Ensemble de train de pose tubulaire (10), comprenant:

une première extrémité (12) adaptée pour être accouplée à un ensemble de tête de puits (14);
une seconde extrémité (16) adaptée pour être positionnée par rapport à une plate-forme en surface (18); et
une pompe (34) montée entre les première et seconde extrémités pour pomper un fluide à travers l'ensemble de train de pose (10) entre les première et seconde extrémités (12, 16), vers un puits et/ou depuis un puits.

2. Ensemble (10) selon l'une quelconque des revendications précédentes, adapté pour s'étendre à travers une colonne montante (32).
3. Ensemble (10) selon l'une quelconque des revendications précédentes, comprenant une pluralité d'éléments tubulaires fixés les uns aux autres et, facultativement, dans lequel la pompe (34) est montée au moins à l'intérieur d'un élément tubulaire et/ou entre deux éléments tubulaires.
4. Ensemble (10) selon l'une quelconque des revendications précédentes, dans lequel la pompe (34) est placée plus près de la première extrémité (12) que de la seconde extrémité (16) et/ou dans lequel la pompe (34) est placée adjacente à la première extrémité (12) de l'ensemble de train de pose (10) et/ou dans lequel la pompe (34) est adaptée pour être alimentée depuis le niveau de la surface par au moins

une source parmi l'énergie électrique, l'énergie hydraulique, le travail mécanique et l'énergie pneumatique.

5. Ensemble (10) selon l'une quelconque des revendications précédentes, dans lequel la première extrémité (12) comprend un arrangement de connexion (46) adapté pour permettre à l'ensemble de train de pose (10) d'être accouplé à ensemble de tête de puits (14), directement ou indirectement, et, facultativement, dans lequel l'arrangement de connexion (46) comprend un arrangement de connexion détachable.
6. Ensemble (10) selon l'une quelconque des revendications précédentes, dans lequel au moins une partie de l'ensemble de train de pose (10) est configurée pour pouvoir être détachée d'un ensemble de tête de puits (14) et/ou dans lequel l'ensemble de train de pose (10) tout entier est configuré pour pouvoir être détaché d'un ensemble de tête de puits (14).
7. Ensemble (10) selon l'une quelconque des revendications précédentes, dans lequel l'ensemble de tête de puits (14) comprend un ensemble de tête de puits immergé.
8. Ensemble (10) selon l'une quelconque des revendications précédentes, dans lequel l'ensemble de tête de puits (14) comprend un ensemble de contrôle de fluide, tel au moins un de ces dispositifs: bloc d'obturation de puits, arbre de Noël, tel un arbre de Noël horizontal ou vertical, et tête de production d'essai.
9. Ensemble (10) selon l'une quelconque des revendications précédentes, comprenant des composants adaptés pour faire partie d'un ensemble de tête de puits (14) et, facultativement, comprenant une tête de production d'essai immergée (50) placée adjacente à la première extrémité (12) de l'ensemble de train de pose (10) et, facultativement, dans lequel la tête de production d'essai immergée (50) est configurée pour être fixée de manière détachable à l'ensemble de train de pose (10).
10. Ensemble (10) selon l'une quelconque des revendications précédentes, comprenant une suspension de colonne de production (52) adaptée pour supporter une colonne de production (20) entrant dans un puits associé (22) et, facultativement, dans lequel la suspension de colonne de production (52) est configurée pour pouvoir être détachée du train de pose (10).
11. Ensemble (10) selon l'une quelconque des revendications précédentes, comprenant un ensemble de vanne (48), dans lequel l'ensemble de vanne (48) est, facultativement:

placé adjacent à la première extrémité (12) de l'ensemble de train de pose (10);
configuré pour isoler l'ensemble de train de pose (10) en cas de déconnexion de celui-ci de l'ensemble de tête de puits (14); et/ou
situé en-dessous de la pompe (34).

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12. Ensemble (10) selon l'une quelconque des revendications précédentes, configuré pour être accouplé à un ensemble de tête de puits (14) comprenant un bloc d'obturation de puits (BOP) (30), dans lequel la pompe (34) est positionnée à l'intérieur de l'ensemble de train de pose (10) pour être située au-dessus du BOP (30).

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13. Ensemble (10) selon l'une quelconque des revendications précédentes, dans lequel la seconde extrémité (16) est adaptée pour être accouplée à l'endroit où est située une plate-forme en surface (18).

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14. Ensemble (10) selon l'une quelconque des revendications précédentes, adapté pour communiquer avec une colonne de production de fond de trou (20) s'étendant en fond de trou depuis un ensemble de tête de puits associé (14).

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15. Procédé pour établir un trajet d'écoulement entre un ensemble de tête de puits (14) et une plate-forme en surface (18), ledit procédé comprenant les étapes consistant à:

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incorporer une pompe (34) entre les première et seconde extrémités (12, 16) d'un ensemble de train de pose tubulaire (10);
accoupler la première extrémité (12) de l'ensemble de train de pose (10) à un ensemble de tête de puits (14);
positionner la seconde extrémité (16) de l'ensemble de train de pose (10) par rapport à une plate-forme en surface (18); et
actionner la pompe (34) pour pomper un fluide à travers l'ensemble de train de pose (10) entre les première et seconde extrémités (12, 16), vers et/ou depuis un puits.

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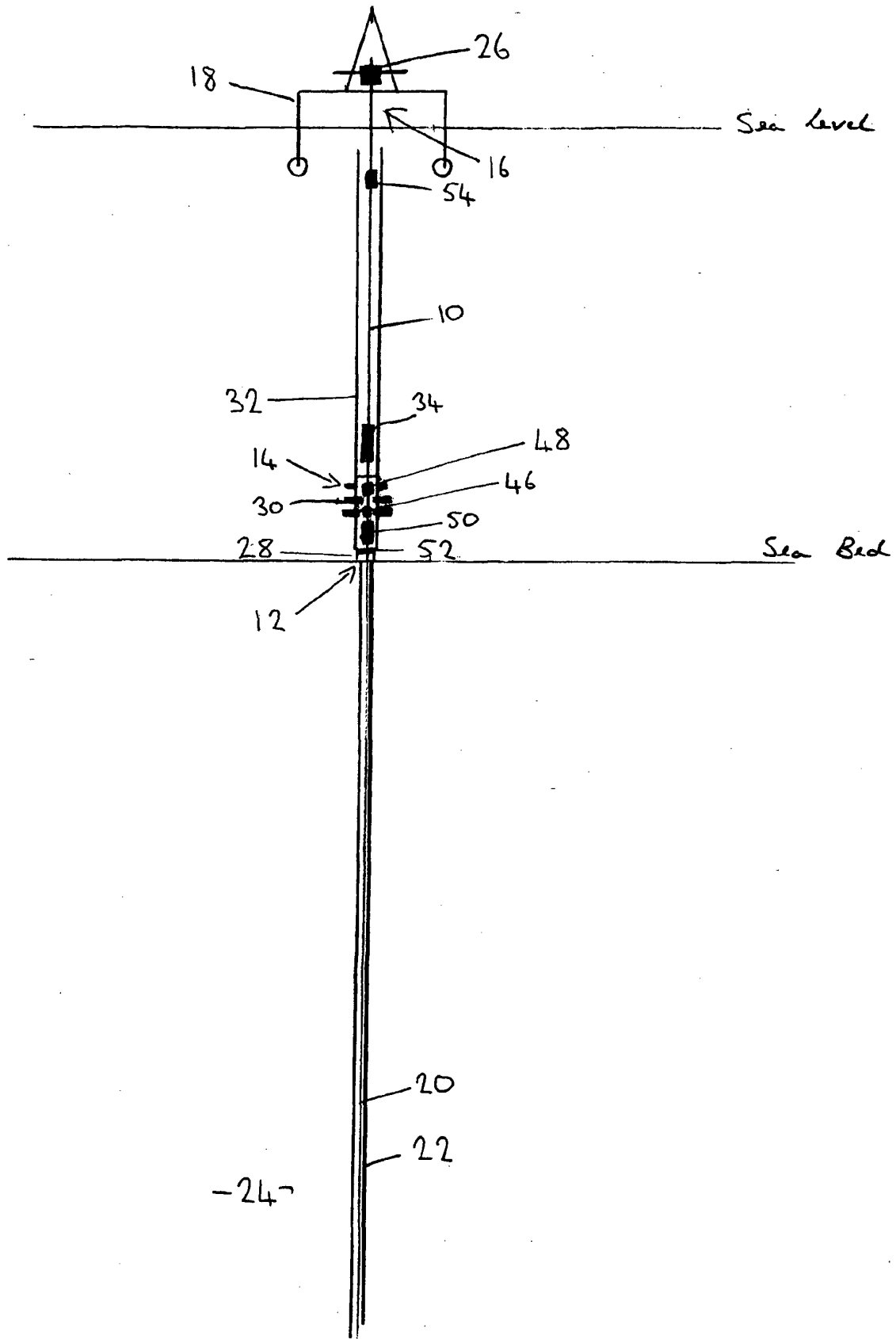
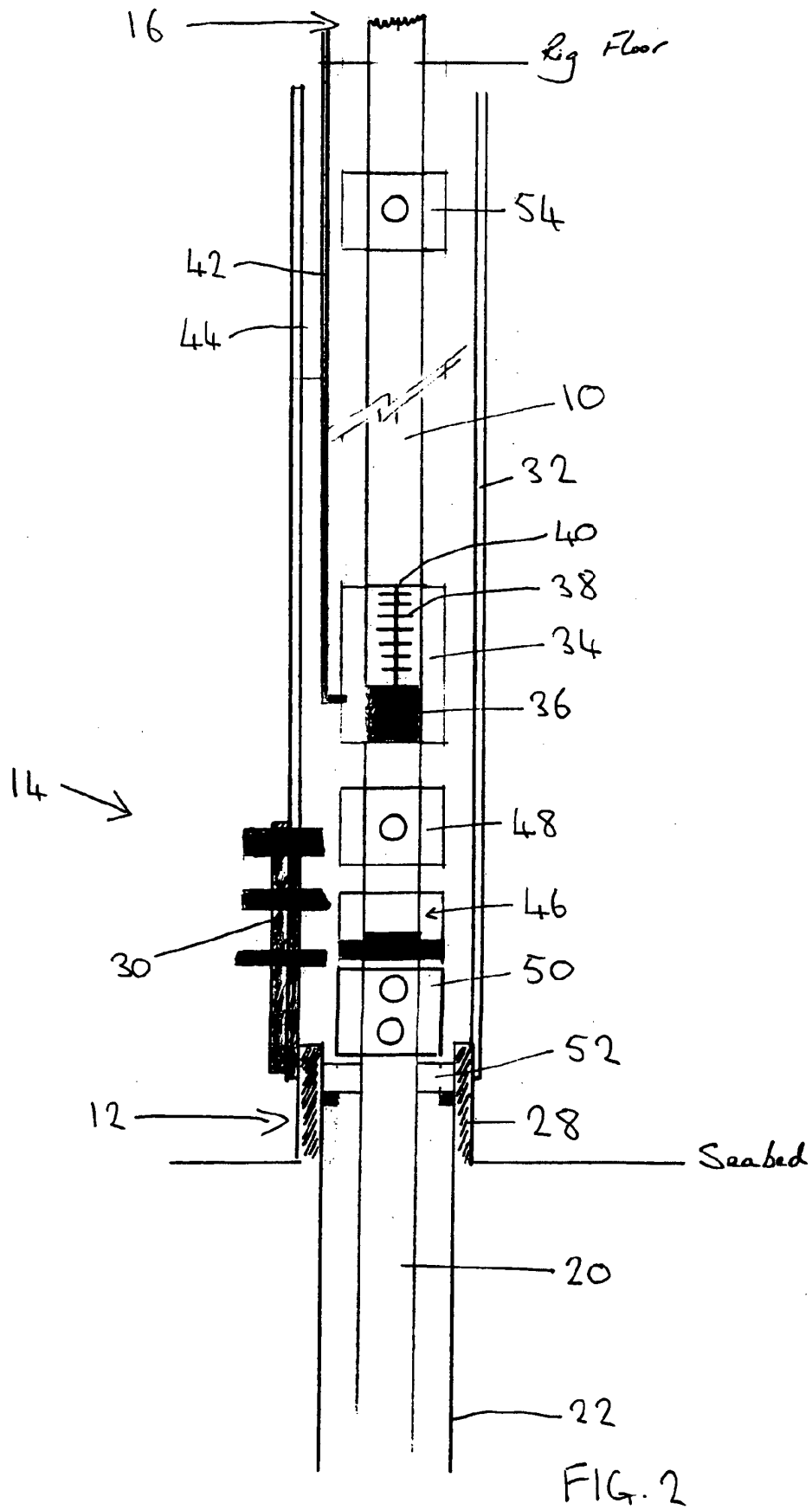


FIG. 1



REFERENCES CITED IN THE DESCRIPTION

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