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(54) **CRANE, MARINE VESSEL OR RIG, AND METHOD**

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Description

[0001] The present invention relates in particular to the handling of equipment on an offshore vessel or rig, in particular for performing operations relating to wells. Particular embodiments relate to a crane for running equipment into or out of a well slot in a deck of a marine vessel or rig, a rig or vessel provided with the crane, and a method of running equipment into or out of the well slot. The equipment in such embodiments may typically be a string of tubing such as drill tubing, casing, and/or lining.

[0002] In the exploration and production of oil and gas offshore, a marine vessel or rig is conventionally employed at the sea surface for constructing, servicing, and/or accessing a well beneath the seabed. The marine vessel or platform may be used in a number of different operations. A riser pipe extending from a wellhead at the seabed may for instance extend between the wellhead and the vessel, and fluid being circulated in or produced from the wellbore of the well may travel through the riser pipes and onto the vessel and then be processed. Equipment may be delivered from the vessel into the wellbore, e.g. inside a riser pipe. The equipment can often include elongate tubing strings including end-to-end connected sections of drill pipe or casing. Typical vessels include floating production storage and offloading (FPSO) vessels, or drilling vessels, such as drilling ships or platforms. The document GB763864 A shows an example relevant to the present specific technical field.

[0003] On a drilling vessel, equipment may be provided for drilling a wellbore below the seabed. This can require equipment to be put in place on the seabed or handled on the vessel depending on the stage reached within the drilling process, and heavy-lift cranes are often required to allow such equipment to be deployed or installed. Dedicated crane barges fitted with heavy-lift cranes may then typically be commissioned. Heavy-lift cranes may also be provided on the drilling vessel, such as for instance BOP handling cranes. These heavy-lift cranes have high load capacities, for instance in the region of 500 metric tonnes or more. The use of a crane barge can be expensive and time consuming, and can result in increased costs and time associated with commissioning the drilling vessel and constructing the well.

[0004] On a drilling ship, drilling is conventionally performed with the assistance of a derrick which is a fixed structure towering high above deck on the ship. The derrick provides height for connecting together long sections of tubing and lowering or hoisting the connected sections through a well slot in the deck of the vessel in order for instance to insert the tubing sections into or extract the tubing sections from a well. Hoisting equipment, e.g. a top drive connected to a winch on cables passed over a crown block near the top of the derrick, may then be utilised and connected to a tubing string in order to deploy the tubing string through the well slot and into the wellbore. The hoisting equipment is typically arranged inside the derrick. Derricks of this type have been in wide use

to provide a stable and capable structure suited for the handling of drill strings in drilling operations where the loads exerted on the derrick can be in the magnitude of a thousand tonnes. An example of a prior art drilling ship fitted with a derrick of this kind is illustrated in Figure 1.

[0005] The present inventors recognise that the structure of a derrick can be very substantial in size, costly to construct, and can occupy large amounts of deck space. The inventors have also identified a need for reducing the time associated with drilling and commissioning drill ships and/or other vessels in connection with drilling operations. In particular, the inventors have recognised limitations in traditional drill ship design in that scaling up the derrick beyond a certain point in size can increase costs dramatically and can be cost prohibitive and/or not realistically feasible when measured against any benefits of the increase in size. As a result, derricks on drilling ships today may only be able to accommodate stands of two or perhaps three end-to-end connected standard drill pipe sections within the derrick when performing drilling.

[0006] The patent publication US2889898 describes a combination oil well derrick and tilting construction boom.

[0007] An aim of the invention is to obviate or at least mitigate drawbacks and difficulties as may be experienced in prior art techniques such as described above.

[0008] According to a first aspect of the invention there is provided a rig or vessel comprising: a deck; at least one well slot in the deck; a crane comprising an upright orientable boom and a track; and a travel unit which is conveyable along the boom on the track in the upright boom orientation to run attached wellbore drilling or casing equipment into or out of the well slot..

[0009] The track may comprise at least one rail, channel, or slot disposed on the boom.

[0010] The travel unit may include a fitting for attaching the equipment to the travel unit.

[0011] By way of the travel unit, the fitting may be positioned in an exit/entry aligned with, and preferably substantially vertically above, the well slot on an outside of the boom.

[0012] The equipment may comprise at least one section of a wellbore string. The travel unit may include a top drive for rotating the wellbore string or said section thereof. The wellbore string may comprise end-to-end connected tubular sections. The string may comprise sections of drill pipe, casing, or liner tubing.

[0013] By way of the track, the travel unit may be arranged to be guided between first and second locations along the boom. The track may preferably be provided on an exterior of the boom.

[0014] The track may comprise at least one guider for guiding the travel unit along the boom. The guider may comprise at least one slot, channel, rail, engager, or guide wheel. The guider may be mounted on an exterior of the boom.

[0015] The travel unit may typically be configured to be coupled to the boom such that rotation or lateral movement therebetween may be restricted or substantially

prevented or blocked.

[0016] The travel unit may be coupled to the boom via a first member and a complementary second member in an interference relationship whereby either or both of the first and second members may cooperate to restrict or block movement of the travel unit laterally with respect to the boom.

[0017] The track may comprise a guider including the first and second members.

[0018] The travel unit may typically comprise a dolly arranged to run along at least one slot, channel, or rail extending along the boom. The dolly may comprise an engager or guide wheel for engaging with the slot, channel, or rail.

[0019] The boom may typically comprise a lattice frame. The boom and/or lattice frame may extend between a base at a lower end of the boom and a neck at an upper end of the boom.

[0020] The crane may further comprise at least one cable for supporting the travel unit, or the travel unit and the equipment when connected thereto. The crane may further comprise draw works, which may include at least one winch, for controlling the cable for either or both of moving and supporting the travel unit via the cable, optionally with or without equipment attached thereto. Thus, the travel unit may be lowered or raised along the track by operation of the cable, once the boom is in position.

[0021] The crane typically has a rotary coupling through which the boom can be rotatably connected to a base. This may be for allowing the boom and/or crane to rotate or "swivel" about a vertical axis of rotation with respect to the base.

[0022] The boom may typically be rotatable relative to a base. The boom typically extends from the base.

[0023] The elongate boom may be arranged to rotate about a vertical axis of rotation relative to the vessel or rig and/or the base.

[0024] The boom may be arranged to pivot, swivel, or rotate e.g. for configuring the boom in a configuration so that the boom is upright and operable for moving the equipment into or out of the well slot and/or for configuring the boom in another configuration wherein the boom is rotated and may be operable to perform lifting and handling of other equipment, e.g. with an end of the boom reaching over a side of the vessel or rig.

[0025] The boom may be selectively positioned over different well slots. The crane may therefore be used for running equipment into or out of a first well slot in one configuration, and for running in equipment into or out of a second well slot in another configuration. The boom may be manipulated, e.g. by rotation about horizontal and/or vertical axes of rotation, in order to move the boom from one configuration to another. In another configuration, the boom may be positioned for performing general lifting, away from the well slots, e.g. over the side of the vessel or rig.

[0026] The rig or vessel may typically be a drilling ship.

[0027] According to a second aspect of the invention,

there is provided a method of using a crane on a rig or vessel which has at least one well slot in a deck thereof, the crane having an upright orientable boom and a track on which a travel unit is conveyable along the boom in upright orientation, the method comprising the steps of: providing the boom in the upright orientation; providing the travel unit on the track; attaching wellbore drilling or casing equipment to the travel unit.

[0028] The method may further comprise: conveying the travel unit vertically along the boom; running the wellbore drilling or casing equipment into or out of the well slot.

[0029] The attached equipment may comprise a drill string or casing string, and the method may then further comprise drilling the wellbore using the attached equipment. The string may extend through the well slot, and the method may further comprise: rotating the string about its axis to perform drilling and advance the wellbore, the travel unit travelling along the boom on the track together with the attached string.

[0030] The method may comprises operating the crane in at least one configuration wherein the boom is upright-orientated, the travel unit is provided on the track, and wellbore drilling or casing equipment is attached to the travel unit, to run the attached equipment into or out of the well slot, the travel unit travelling on the track along the boom; and further operating the crane in a further configuration to suspend a load from the boom with an end of the boom extending over a side of the vessel or rig.

[0031] The method may further comprise: lowering the travel unit and attached equipment along the boom to insert the equipment into the well slot.

[0032] The method may further comprise: elevating the travel unit and attached equipment along the boom to remove the equipment out of the well slot.

[0033] The method may further comprise: using the crane in a further configuration to suspend a load from the boom with an end of the boom extending over a side of the vessel.

[0034] The method may further comprise rotating the boom about either or both of a vertical axis of rotation and a horizontal axis of rotation, to move the crane from the first configuration to the further configuration.

[0035] The method may further comprise: locating the travel unit in a parking location; when the travel unit is in the parking location, rotating the boom about either or both a vertical or a horizontal axis of rotation to use the crane in the second configuration.

[0036] The method may further comprise moving the travel unit along the boom into the parking location, the travel unit travelling on the track. The equipment may be attached to the travel unit when parked.

[0037] The method may further comprise, when in the further configuration, using the boom to handle other equipment.

[0038] According to a third aspect of the invention, there is provided a crane for use on the rig or vessel in accordance with the first aspect of the invention or in the

method in accordance with the second aspect of the invention, the crane comprising an upright orientable boom and a track, and being provided with a travel unit which is conveyable along the boom on the track in the upright boom orientation to run attached wellbore drilling or casing equipment into or out of the well slot in the deck of the rig or vessel.

[0039] Any of the above aspects of the invention may include further features as described in relation to any other aspect, wherever described herein. Features described in one embodiment may be combined in other embodiments. For example, a selected feature from a first embodiment that is compatible with the arrangement in a second embodiment may be employed, e.g. as an additional, alternative or optional feature, e.g. inserted or exchanged for a similar or like feature, in the second embodiment to perform (in the second embodiment) in the same or corresponding manner as it does in the first embodiment.

[0040] Various advantages of the invention and its features are described and will be apparent from the specification throughout.

[0041] There will now be described, by way of example only, embodiments of the invention with reference to the accompanying drawings, in which:

- Figure 1 is a representation of a prior art drilling ship with a derrick;
- Figure 2 is an end on part-sectional view of a drilling ship in accordance with an embodiment of the invention, configured for a drilling operation with a drill string connected to a top drive suspended from a crane;
- Figure 3 is an overhead representation of the top drive on the crane of the embodiment of Figure 2 in close up;
- Figure 4 is an end on part-sectional view of the drilling ship of Figure 2, in use in a heavy lift operation according to an embodiment of the invention;
- Figure 5 is an overhead representation of the drilling ship of Figure 2 in accordance with an embodiment of the invention;
- Figure 6 is an overhead plan view representation of a jack-up rig with a crane on a cantilever for performing a drilling operation; and
- Figure 7 is a side view of the crane on the cantilever of Figure 6 during the drilling operation.

[0042] With reference to Figure 2, there is generally exemplified a drilling ship 1 which has a well slot 2 through which equipment is passed to insert or retrieve the equipment from a wellbore in the subsurface beneath the seabed. In order to run the equipment into or pull the equipment out of the well slot 2, the drilling ship 1 is fitted with a crane 3. By means of the crane 3, equipment in the form of a drill string 20 can be suspended and can be lowered into or lifted out of the wellbore (below the ship)

through the well slot 2.

[0043] The crane 3 has an elongate boom 4 which at a lower end is connected to a base. The base is in the form of a pedestal 5. The boom 4 consists of an elongate lattice framework and is fixed-length.

[0044] In Figure 2, the boom 4 is upright, so that it towers substantially vertically upward from the pedestal 5 and allows for suspending the drill string 20, or drill string sections or tools, from a supporting cable 12 which passes over sheaves 31 disposed on a neck arranged high up at a top end 4x of the boom 4. The neck allows the cable 12 at the point of leaving the sheaves 31 to be positioned vertically above the well slot 2.

[0045] The pedestal 5 is mounted in fixed position on a deck of the ship 1 and comprises a rotary coupling, by means of which the boom 4 can be rotated (with respect to the pedestal and the deck) about a vertical axis of rotation in order to orient the boom 4 in different lateral rotational positions. The boom 4 is also rotatably and pivotally connected to the base 5 so as to be able to be tilted about a horizontal axis of rotation when performing other operations, into different angles of inclination for raising or lowering a far end of the boom 4. The crane 3 includes draw works including a drum 11 from which the cable 12 is spooled out. The cable 12 is secured to the drum 11 at one end while the opposite "free" end is passed over and suspended from the sheaves 31. On the end of the cable at the free end, the cable 12 has a connector 13 for connecting a load to the cable.

[0046] The crane 3 in this example is a heavy-lift crane with a lift capacity in the region of 500 to 1500 metric tonnes. The length of the boom is between 70 and 100 m but in general can be provided in other lengths.

[0047] In order to facilitate running the drill string 20 into or out of the well slot 2, the crane 3 is provided with a travel unit 7. The travel unit 7 is arranged to travel up or down along the boom 4 on a track which in this example is provided by way of guide rails 10 which extend along the boom 4.

[0048] The guide rails 3 are mounted on the outside of the boom 4, and extend from the top end 4x to a bottom end 4y of the boom 4. The travel unit 7 is coupled to the guide rails 10, such that as it travels, the travel unit 7 is guided from location to location along the boom.

[0049] In addition, the travel unit 7 is attached to the suspending end of the cable 12 via the connector 13. In this way, the cable 12 is utilised to support and suspend the travel unit 7 from the cable 12. For instance, by paying out the cable from the drum 11, the travel unit 7 [e.g. in use together with equipment attached to the travel unit] can be controllably lowered along the boom under gravity. Conversely, by spooling the cable back onto the drum 11 a lifting force can be applied by the cable and the travel unit 7 [e.g. in use together with equipment attached to the travel unit] can be pulled and lifted upward along the boom 4.

[0050] In this particular example, the travel unit 7 has a rotary fitting 17 arranged to fit onto the upper end of

the drill string 20 for attaching the drill string 20 to the travel unit 7. The travel unit 7 also includes a top drive 8 which can operate to rotate the drill string 20 about its longitudinal axis for using the string to perform drilling in the wellbore. The rotary fitting 17 is thus adapted to permit the top drive 8 to apply rotation to the connected drill string 17 when it operates.

[0051] Due to being attached to the drill string 20 via the fitting 17, while drilling takes place and the drill string progresses further through the well slot 2, the travel unit 7 travels downward along the boom 4 together with the drill string 20. When pulling the string out of the wellbore, the travel unit 7 travels upward along the boom 4 together with the connected string 20.

[0052] The travel unit 7 comprises a dolly 9 for coupling the travel unit 7 to the guide rails 10. The dolly 9 follows the guide rails 10 along the boom 4. In this way, the top drive 8 is carried on the travel unit 7 downward along the boom 4 of the crane 3, guided by the guide rails 10, while the drill string 20 advances into the subsurface or in order to reconnect to the drill string 20 after a section of the drill string 20 has been removed. Conversely, the top drive 8 is carried on the travel unit 7 upward along the boom 4 to an elevated position in order to insert a new section in the drill string, or while hoisting the drill string upward to allow a section of the drill string to be removed. While travel is permitted up or down the boom, displacement of the travel unit 7 laterally is restricted. The travel unit 7 is kept in the desired lateral position and is retained with respect to the boom by way of the coupling provided by the dolly 9 between the travel unit 7 and the guide rails 10. It will be appreciated nonetheless that rotation of the drill string 20 can still take place by operating the top drive 8 and rotary fitting 17 during translation of the travel unit 7 along the boom 4.

[0053] Figure 2 shows the crane 3 positioned so that the guide rails 10 are vertical providing a vertical path for the top drive 8 along the boom 4 during use. The drill string 20 is aligned and extends longitudinally vertically through the well slot 2. As can be seen, the travel unit 7 with the fitting 17 operates in an exit/entry corridor aligned with the well slot 2 for extracting and inserting sections of the drill string. The fitting 17 is arranged vertically above the well slot 2. Thus, sections of the drill string 20 can enter or be retrieved from the well slot in vertical orientation held at the top end by the fitting 17 [and travel unit 7 and/or cable 12]. Sections can then be connected or disconnected accordingly. Thus, by arrangement of the crane 3 in this manner, essential functions in allowing sections to be removed and added to a drill string can be obtained, but without requiring the extensive derrick structure traditionally applied. Moreover, the boom can readily be made higher so at more reasonable cost, and may accommodate for instance stand lengths consisting of 3 or more, e.g. 4, 5, 6, 7 or more joints of standard 10 m drill pipe lengths. It will be appreciated that each such stand could be arranged with long axis vertically above the well slot 2, be held on the travel unit (using the fitting

17), and be connected or disconnected from the string 20 as a unit. This can make drilling operations more efficient, as the number of connections needed to be made up or broken during the run in or pull out of the string 20 may be reduced. By way of implementation with a crane, other lifting or handling operations for instance at either end of a drilling trip may be conveniently performed with the crane, as will be described further below, which can facilitate time efficiency and reduced costs in completing drilling and other drilling ship operations offshore.

[0054] With further reference to Figure 3, the travel unit 7 and the manner in which it is coupled to the outside of the boom 4 of the crane 3 can be seen in further detail. First it can be noted that the travel unit 7 with the top drive 8 is arranged over the well centre 2, the projection of the well centre position being indicated in the figure.

[0055] A track is provided by two guide rails 10 extending in parallel along the boom 4 each having a slot or channel 21 in which a roller wheel 33 of the dolly 9 is received. The roller wheel 33 of the dolly 9 interlocks with the guide rail 10, providing a coupling between the travel unit 7 and the guide rail 10. With the wheel 33 in the track 21, the travel unit 7 travels up or down the boom 4. The wheel 33 is retained in the channel 21 by a side surface of the channel 21. This keeps the dolly 9 engaged with the rail 10 while allowing the travel unit 2 to travel along the track. Thus, the travel unit 7 and connected drill string 20 can be advantageously kept in correct lateral orientation with respect to the boom 4. The dolly 9 in this case has struts 24 on which the roller wheels 33 are mounted. The struts 24 extend to maintain a certain lateral distance between the fitting 17 and the outside of boom 4, such that the fitting 17 and top drive 8 of the travel unit 7 is positioned in the exit/entry corridor vertically above the well slot. The lateral distance between the fitting 17 and the outside of the boom 4 is maintained to be substantially constant between locations as the travel unit 7 travels along the boom 4 in the exit/entry corridor.

[0056] It can also be noted that the travel unit 7 can include circulating equipment for circulating drilling fluid into and out of the wellbore during drilling and/or during disconnection of the top drive 8 for insertion or removal of sections of the drill string. Such circulating equipment may be mounted to the travel unit 7 in the region 41 in Figure 3. It can also be seen in Figure 3 that the guide rails 10 are mounted and affixed to the outside of the crane boom 4 via rigid support members 22a-d and bracing 23.

[0057] The crane 3 is positioned eccentrically to one side of the well centre 2, with the exit/entry corridor on the outside of the boom 4. On an opposite side of the well slot 2 the drilling ship 1 is equipped with a setback tower 14 in which stands 16 of end-to-end connected drill string sections 15a-15f are stored ready to be accessed and incorporated into the drill string 20. Although typically the setback tower is positioned opposite to the top-drive guide tracks (i.e. the crane boom) as explained above, any other position can also be utilized.

[0058] In use, when extending the wellbore by drilling, a penetrating end of the drill string 20 is advanced into the wellbore whilst being connected to the top drive 8 and the crane 3. The drill string 20 extends through the well slot 2 in the deck of the drilling ship. The travel unit 7 travels along the boom 4 following the guide rails 10, downward until eventually it arrives close to the aperture of the well slot 2 in the drill deck. In order to advance further into the subsurface, the drill string 20 is temporarily secured in position using for example slips arranged near the well slot, the top drive 8 is disconnected from the drill string 20, and is then moved back up to the top of the boom 4 of the crane 3, along the guide rails 10, e.g. by operating the draw works to spool in the cable 12 onto the drum 11 (e.g. a winch drum) and pull the travel unit 7 upward along the boom 4. When near the top of the boom 4, a new stand 16 of drill pipe from the setback tower 14 is presented, in the exit/entry corridor, to the top drive 8 by a racking machine. The new stand 16 is attached at its top end to the fitting 17 on the travel unit so as to connect it to the top drive 8, and is attached at its bottom end to the top of the drill string 20 which is held and supported in the slips. Once attached, the slips are disengaged, pumps are operated to pump drilling fluid through the drill string, and the top drive 8 is restarted once again to rotate the drill string 20. Drilling then progresses and results in extending the wellbore into the subsurface. The top drive 8 travels correspondingly downward along the boom 4, guided by the guide rails 10, with the cable 12 supporting the connected top drive 8 and drill string 20.

[0059] In order to pull out the string from the wellbore, the above process is performed in reverse. With the drill string 20 attached to the travel unit 7, the travel unit 7 runs upward along the boom until near the top of the boom at which point movement it is halted. This can be carried out by operating the draw works to pull and hoist the travel unit 7 with drill string attached upward (spooling in on the drum 11). The drill string 20 extends through the well slot 2 in the drill deck, and slips are activated to hold onto the drill string near the foot of the boom. A stand of drill pipe is disconnected by breaking the connection in the exit /entry corridor above and adjacent to the slips. The racking machine is used to hold onto the stand to be removed, and the top of the stand of drill pipe is detached from the fitting 17 and the top drive 8. The racking machine is then operated to place the stand in the setback tower 14. The travel unit 7 travels back downward along the boom [e.g. by controlled lowering by the draw works] and is connected to the top of the drill string being held by the slips. The slips are then disengaged, and the travel unit with the drill string attached is once again hosted upward along the boom for disconnection and removal of the next section of drill pipe.

[0060] When not engaged in operations over the well centre 2, the crane 3 can conveniently be employed for other purposes such as for general handling such as lifting, lowering, and/or suspending an item.

[0061] Figure 4 illustrates the use of the crane 3 in connection with a heavy lifting operation where the boom 4 is rotated with respect to the pedestal 5 about a vertical axis and tilted (about a horizontal axis) to bring the boom 4 over the side of the ship 1 to lift and manoeuvre a module 50 for installation of the module 50 on a nearby rig 60. The module 50 exemplified here is a plug and abandonment module including a BOP for installation over a well slot 52 on the rig 60.

[0062] Figure 5 illustrates the ship 1 where the boom 4 of the crane 3 is being rotated so as to extend over the side of the hull of the ship for use in the configuration of Figure 4.

[0063] In order to change the mode of configuration of the crane between a first, well centre configuration as illustrated in Figures 2 and 3 and a second, general lifting configuration as illustrated by Figures 4 and 5, the top unit 7 for the drill string 20 is run to the base of the crane and is parked. In Figure 4, the drill string 20 remains connected to the travel unit 7 while it is parked, and the crane 3 is used to suspend the module 50 with an inclined boom 4. For this purpose, it can be seen in Figure 4 that the guide rails 10 each have first and second sections 10a, 10b with the first section 10a provided on the boom 4 and the second section 10b provided on an outside of the pedestal 5. In the configuration of Figures 2 and 3, the two guide rail sections 10a, 10b are fully aligned to provide a continuous track along the boom and across any join between the two sections 10a, 10b. In the configuration of Figures 4 and 5, the boom 4 is pivoted to the other side of the pedestal 5 which brings the first guide rail section 10a out of alignment with the other as the boom 4 is utilised for the lifting operation, while the travel unit is parked on the second guide rail section 10b. The travel unit 7 may be secured to the pedestal 5 on the second section 10b, for instance by clamping the travel unit 7 onto the second guide rail section 10b.

[0064] When the travel unit 7 arrives and is positioned at the pedestal 5 on the second guide rail section 10b, it is disconnected from the end of the cable 12, e.g. by disconnecting from the connector 13. Another connector, e.g. a hook or the like, configured for the general lifting application, may then be provided on the end of cable 12 in place of the connector 13. The crane 3 can then be operated to rotate the boom 4 with respect to the pedestal 5 and manoeuvre the module 50 as in Figure 4.

[0065] Referring to Figures 6 and 7, an example of use of the crane 3 on a jack-up rig 101 is described. The jack-up rig has legs 103a-c which support a hull 102 of the jack-up rig 101 on the seabed. This provides a stable platform for supporting the crane 3 upon the hull 102. The jack-up rig 101 has a cantilever 104 which reaches over the side of the rig 101 and is movable horizontally in x and y directions with respect to the hull 102, to allow alignment with a particular well slot in a well pattern. The crane 3 is mounted on the cantilever 104 and in this example supports the drill string 20 via the top unit 7 on the cable 12 in a corresponding manner to that described in

relation to Figures 2 and 3. In this case however, the drill string 20 passes through a slot 162 in the cantilever 104. In Figure 7, the cantilever 104 of the jack-up rig 101 is applied to the nearby platform 60 and is positioned over the well slot 62 of the platform 60 such that the suspended drill string 20 on the crane 3 penetrates through the well slot 62. It will be appreciated that the crane 3 when in use on the jack-up rig 101 could be employed in other configurations with the boom 4 tilted and rotated into suitable orientations for general lifting, e.g. when not engaged for an operation via the well slot 162 in the cantilever.

[0066] The solutions described in embodiments of the invention herein can be advantageous in that lifting barges may not be required since heavy lifts can be performed from the drilling ship. In addition, through the use of the crane, considerably longer stands, e.g. 2 to 3 times longer than normal, can be handled without the need of a derrick as may be used in the prior art. Furthermore, some heavy lift equipment on the vessel (such as BOP or Xmas tree handling cranes) might be omitted. In addition, a more efficient use of deck space may also result. Access to equipment such as winches and the deck space in and around the well centre can be relatively open for facilitating ease of access, service and maintenance.

[0067] Various modifications and improvements may be made without departing from the scope of the invention herein described. For example, although the above embodiments have been described with reference to using cable 12 to suspend and lift the travel unit, with or without the drill string 20 attached thereto where applicable, it should be appreciated that the travel unit 7 can take other forms in other variants. For instance, the travel unit 7 may have a motorized coupling with the outside of the boom 4 to operate to move up and down on the boom. For instance the boom may be fitted with a track comprising a tooth rack extending along the boom, and the travel unit 7 may have motor which drives a pinion up or down along the tooth rack, so as to allow the travel unit 7 to be moved up or down the boom and lower or lift the attached drill string 20 as appropriate.

[0068] The travel unit may also in other variants be utilised with other types of equipment such as one or more tubulars including any of coiled tubing, lining, or casing. The equipment may also be in the form of elongate tool strings, or tools arranged to be incorporated with such tubulars or tool string. Such equipment may be conveniently deployed or retrieved by passage through the well slot to access and/or perform operations in a wellbore or well head on the seabed.

[0069] The vessel may be of any kind described herein, including for instance a drilling ship, FPSO, floating platform or the like. The crane may be a heavy lift crane as described anywhere herein.

Claims

1. A rig or vessel (1, 101) comprising:

a deck;
at least one well slot (2) in the deck; and

characterised in that the rig or vessel (1, 101) further comprises:

a crane (3) comprising an upright orientable boom (4) and a track (10); and
a travel unit (7) which is conveyable along the boom (4) on the track (10) in the upright boom orientation to run attached wellbore drilling or casing equipment (20) into or out of the well slot.

2. A rig or vessel as claimed in claim 1, wherein the travel unit (7) comprises a top drive (8) for rotating equipment comprising wellbore drill string or section thereof about its long axis.

3. A rig or vessel as claimed in claim 1 or 2, wherein the crane (3) has a rotary coupling by which the boom (4) is rotatable about a vertical axis.

4. A rig or vessel as claimed in claim 3, wherein the well slot (2) is located laterally outside of the rotary coupling.

5. A rig or vessel as claimed in claim 3 or 4, wherein the boom (4) is rotatable about the vertical axis into or out of a position in which the boom (4) in upright orientation is configured to allow the attached equipment (20) to be run into or out of the well slot (2) using the travel unit (7).

6. A rig or vessel as claimed in any of claims 3 to 5, wherein the rig or vessel (1, 101) has first and second well slots (2), and the boom (4) is rotatable about the vertical axis from a first position in which the boom (4) in upright orientation is configured to allow attached equipment (20) to be run into or out of the first well slot (2) using the travel unit (7) to a second position in which the boom (4) in upright orientation is configured to allow attached equipment (20) to be run into or out of the second well slot (2) using the travel unit (7).

7. A rig or vessel as claimed in any of claims 3 to 6, wherein the boom (4) is rotatable about the vertical axis relative to any one or more of:

the well slot (2);
the deck; and
a setback tower (14).

8. A rig or vessel as claimed in any preceding claim,

wherein the travel unit (7) is arranged to be coupled to the boom (4) for restricting or substantially preventing or blocking lateral displacement therebetween during conveyance along the boom.

9. A rig or vessel as claimed in any preceding claim, wherein the crane (3) further comprises at least one cable (12) for supporting the travel unit (7), or the travel unit (7) and the attached equipment (20).

10. A rig or vessel crane as claimed in claim 9, wherein the crane (3) further comprises at least one winch for controlling the cable (12) for either or both of moving and supporting the travel unit (8) on the track via the cable.

11. A rig or vessel as claimed in any preceding claim, wherein the crane (3) has first and second modes, wherein in the first mode the crane (3) is operable to run wellbore drilling or casing equipment (20) into or out of the well slot, and wherein in the second mode the crane is operable to perform lifting and handling over a side of the rig or vessel (1, 101).

12. A rig or vessel as claimed in claim 11, wherein in the first mode the casing or drilling equipment (20) is attached to a travel unit (7) coupled to the boom (4) and operable to be conveyed along the boom (4) of the crane (3).

13. A rig or vessel as claimed in claim 11 or 12, wherein in the first mode the crane (3) supports a top drive (8) which with the wellbore drilling or casing equipment (20) attached is operable perform rotary drilling of the wellbore.

14. A rig or vessel as claimed in claim 13, wherein the top drive (8) is disposed on the travel unit (7) which is coupled to the boom (4) and is conveyable along the boom (4) on the track (10) for preventing lateral displacement of the top drive (8) relative to the boom (4) during drilling progress.

15. A method of using a crane (3) on a rig or vessel (1, 101) which has at least one well slot (2) in a deck thereof, the crane (3) having an upright orientable boom (4) and a track (10) on which a travel unit (7) is conveyable along the boom (4) in upright orientation, the method comprising the steps of:

providing the boom (4) in the upright orientation; providing the travel unit (7) on the track (10); and attaching wellbore drilling or casing equipment (20) to the travel unit (7).

16. A method as claimed in claim 15, which further comprises:

conveying the travel unit (7) vertically along the boom (4);
running the wellbore drilling or casing equipment (20) into or out of the well slot (2).

17. A method as claimed in claim 16, wherein the attached equipment (20) comprises a drill string or casing string, and the method further comprises drilling the wellbore using the attached equipment (20).

18. A method as claimed in claim 17, wherein the string extends through the well slot, and the method further comprises rotating the string about its axis to perform drilling and advance the wellbore, the travel unit (7) travelling along the boom (4) on the track together with the attached string.

19. A method as claimed in any of claims 15 to 18, which comprises operating the crane (3) in at least one configuration wherein the boom (4) is upright-orientated, the travel unit (7) is provided on the track (10), and wellbore drilling or casing equipment (20) is attached to the travel unit (7), to run the attached equipment (20) into or out of the well slot (2), the travel unit (7) travelling on the track (10) along the boom (4); and further operating the crane (3) in a further configuration to suspend a load from the boom (4) with an end of the boom (4) extending over a side of the vessel or rig.

20. A method as claimed in claim 19, which further comprises rotating the boom (4) about a vertical axis of rotation and/or a horizontal axis of rotation to move the crane (3) from the configuration in which the crane (3) is used to run the equipment into or out of the well slot (2) to the further configuration in which the crane (3) is used to suspend the load from the boom (4) with the end of the boom (4) extending over the side of the vessel or rig (1, 101).

21. A method as claimed in claim 19 or 20, which further comprises:

locating the travel unit (7) in a parking location; when the travel unit (7) is in the parking location, rotating the boom (4) about either or both a vertical or a horizontal axis of rotation to use the crane (3) in the further configuration.

22. A method as claimed in claim 21, which further comprises moving the travel unit (7) along the boom into the parking location, the travel unit (7) travelling on the track (10).

23. A method as claimed in any of claims 19 to 22, which further comprises rotating the boom (4) about a vertical axis of rotation and/or a horizontal axis of rotation to move the crane (3) from a first configuration

in which the crane (3) is used to run the equipment into or out of a first well slot (2) to a second configuration in which the crane (3) is used to run the equipment (20) into or out of a second well slot (2), wherein in both the first and second configurations the boom (4) is upright-orientated, the travel unit (7) is provided on the track (10), and equipment (20) is attached to the travel unit vertically above the well slot (2), the travel unit (7) travelling on the track (10) along the boom (4).

24. A crane (3) for use on the rig or vessel (1, 101) as claimed in any of claims 1 to 14 or in the method of any of claims 15 to 23, the crane (3) comprising an upright orientable boom (4) and a track (10), and being provided with a travel unit (7) which is conveyable along the boom (4) on the track (10) in the upright boom orientation to run attached wellbore drilling or casing equipment (20) into or out of the well slot (2) in the deck of the rig or vessel (1, 101).

Patentansprüche

1. Bohranlage oder Schiff (1, 101), aufweisend:

ein Deck;
mindestens einen Bohrschlitz (2) im Deck; und
dadurch gekennzeichnet, dass die Bohranlage oder das Schiff (1, 101) ferner aufweist:
einen Kran (3) aufweisend einen senkrecht ausrichtbaren Ausleger (4) und eine Schiene (10);
und eine Bewegungseinheit (7), welche entlang des Auslegers (4) auf der Schiene (10) befördert werden kann in Richtung des senkrechten Auslegers, um befestigte Bohr- oder Auskleidungsausrüstung (20) für das Bohrloch in den Bohrschlitz (2) hinein oder aus dem Bohrschlitz (2) hinaus zu führen.

2. Bohranlage oder Schiff (1, 101) gemäß Anspruch 1, wobei die Bewegungseinheit (7) einen Top-Drive Antrieb (8) aufweist zur Drehung von Ausrüstung aufweisend einen Bohrloch-Bohrstrang oder einen Abschnitt davon um die Längsachse davon.
3. Bohranlage oder Schiff (1, 101) gemäß Anspruch 1 oder 2, wobei der Kran (3) eine Drehkopplung aufweist, mittels welcher der Ausleger (4) um eine Vertikalachse herum drehbar ist.
4. Bohranlage oder Schiff (1, 101) gemäß Anspruch 3, wobei der Bohrschlitz (2) seitlich ausserhalb der Drehkopplung angeordnet ist.
5. Bohranlage oder Schiff (1, 101) gemäß Anspruch 3 oder 4, wobei der Ausleger (4) um die Vertikalachse herum drehbar ist in eine Position oder aus einer

Position heraus, in welcher der Ausleger (4) in senkrechter Ausrichtung derart konfiguriert ist, dass es unter Verwendung der Bewegungseinheit (7) der befestigten Ausrüstung (20) ermöglicht wird, in den Bohrschlitz (2) hinein oder aus dem Bohrschlitz (2) hinausgeführt zu werden.

6. Bohranlage oder Schiff (1, 101) gemäß einem der Ansprüche 3 bis 5, wobei die Bohranlage oder das Schiff (1, 101) einen ersten und einen zweiten Bohrschlitz (2) aufweist, und wobei der Ausleger (4) um die Vertikalachse herum drehbar ist von einer ersten Position, in welcher der senkrecht ausgerichtete Ausleger (4) ausgebildet ist, es unter Verwendung der Bewegungseinheit (7) der befestigten Ausrüstung (20) zu ermöglichen, in den ersten Bohrschlitz (2) hinein oder aus dem ersten Bohrschlitz (2) hinaus geführt zu werden, in eine zweite Position, in welcher der Ausleger (4) in senkrechter Ausrichtung derart ausgebildet ist, es unter Verwendung der Bewegungseinheit (7) der befestigten Ausrüstung (20) zu ermöglichen, in den zweiten Bohrschlitz (2) hinein oder aus dem zweiten Bohrschlitz (2) hinaus geführt zu werden.

7. Bohranlage oder Schiff (1, 101) gemäß einem der Ansprüche 3 bis 6, wobei der Ausleger (4) um die Vertikalachse herum drehbar ist in Bezug zu einem oder mehreren der folgenden:

den Bohrschlitz (2);
das Deck; und
einen Rückschlagturm (14).

8. Bohranlage oder Schiff (1, 101) gemäß einem der vorhergehenden Ansprüche, wobei die Bewegungseinheit (7) zur Verbindung mit dem Ausleger (4) ausgebildet ist, zur Einschränkung oder im Wesentlichen Verhinderung oder Blockierung der seitlichen Verschiebung zwischen ihnen während der Beförderung entlang des Auslegers.
9. Bohranlage oder Schiff (1, 101) gemäß einem der vorhergehenden Ansprüche, wobei der Kran (3) ferner mindestens ein Kabel (12) aufweist zur Stützung der Bewegungseinheit (7) oder der Bewegungseinheit (7) und der daran befestigten Ausrüstung (20).
10. Bohranlage oder Schiff (1, 101) gemäß Anspruch 9, wobei der Kran (3) ferner mindestens eine Winde aufweist, zur Steuerung des Kabels (12) zur Bewegung und/oder Stützung der Bewegungseinheit (8) auf der Schiene mittels des Kabels.
11. Bohranlage oder Schiff (1, 101) gemäß einem der vorhergehenden Ansprüche, wobei der Kran (3) einen ersten und zweiten Modus aufweist, wobei im ersten Modus der Kran (3) bedienbar ist, um Bohr-

- loch-Bohrungs- oder Auskleidungsausrüstung in den Bohrschlitz (2) hinein oder aus dem Bohrschlitz (2) hinaus zu führen, und wobei im zweiten Modus der Kran bedienbar ist, um Heben und Handhaben über eine Seite der Bohranlage oder des Schiffs (1, 101) auszuführen.
- 12.** Bohranlage oder Schiff (1, 101) gemäß Anspruch 11, wobei im ersten Modus die Bohrloch-Bohr- oder Auskleidungsausrüstung (20) an einer Bewegungseinheit (7) befestigt ist, welche mit dem Ausleger (4) gekoppelt ist und bedienbar ist, um entlang des Auslegers (4) des Krans (3) befördert zu werden.
- 13.** Bohranlage oder Schiff (1, 101) gemäß Anspruch 11 oder 12, wobei in dem ersten Modus der Kran (3) einen Top-Drive Antrieb (8) stützt, welcher mit befestigter Bohrloch-Bohr- oder Auskleidungsausrüstung (20) derart steuerbar ist, dass er eine Drehbohrung des Bohrlochs ausführt.
- 14.** Bohranlage oder Schiff (1, 101) gemäß Anspruch 13, wobei der Top-Drive Antrieb (8) auf der Bewegungseinheit (7) angeordnet ist, welche mit dem Ausleger (4) gekoppelt ist und entlang des Auslegers (4) auf der Schiene (10) beförderbar ist zur Verhinderung der seitlichen Verschiebung des Top-Drive Antriebs (8) in Bezug auf den Ausleger (4) während des Bohrablaufs.
- 15.** Verfahren zur Nutzung eines Krans (3) auf einer Bohranlage oder einem Schiff (1, 101), welche(s) mindestens einen Bohrschlitz (2) in ihrem/seinem Deck aufweist, wobei der Kran (3) einen senkrecht ausrichtbaren Ausleger (4) und eine Schiene (10) aufweist, auf welcher eine Bewegungseinheit (7) entlang des senkrecht ausgerichteten Auslegers (4) befördert werden kann, wobei das Verfahren die folgenden Schritte beinhaltet:
- Bereitstellen des Auslegers (4) in der senkrechten Ausrichtung;
 - Bereitstellen der Bewegungseinheit (7) auf der Schiene (10); und
 - Befestigen der Bohrloch-Bohr- oder Auskleidungsausrüstung (20) an der Bewegungseinheit (7).
- 16.** Verfahren gemäß Anspruch 15, ferner beinhaltend:
- Befördern der Bewegungseinheit (7) in vertikaler Richtung entlang des Auslegers (4);
 - Führen der Bohrloch-Bohr- oder Auskleidungsausrüstung (20) in den Bohrschlitz (2) hinein oder aus dem Bohrschlitz (2) hinaus.
- 17.** Verfahren gemäß Anspruch 16, wobei die befestigte Ausrüstung (20) einen Bohrstrang oder Auskleidungsstrang aufweist, und wobei das Verfahren ferner beinhaltet, das Bohrloch unter Verwendung der befestigten Ausrüstung (20) zu bohren.
- 18.** Verfahren gemäß Anspruch 17, wobei der Strang sich durch den Bohrschlitz (2) hindurch erstreckt, und wobei das Verfahren ferner beinhaltet, den Strang um seine Achse zu drehen, um die Bohrung durchzuführen und das Bohrloch voranzubringen, wobei die Bewegungseinheit (7) sich zusammen mit dem befestigten Strang entlang des Auslegers (4) auf der Schiene bewegt.
- 19.** Verfahren gemäß einem der Ansprüche 15 bis 18, welches beinhaltet, den Kran (3) in mindestens einer Anordnung zu bedienen, in welcher der Ausleger (4) senkrecht ausgerichtet ist, die Bewegungseinheit (7) auf der Schiene (10) angeordnet ist, und die Bohrloch-Bohr- oder Auskleidungsausrüstung (20) an der Bewegungseinheit (7) befestigt ist, um die befestigte Ausrüstung (20) in den Bohrschlitz (2) hinein oder aus dem Bohrschlitz (2) hinaus zu führen, wobei die Bewegungseinheit (7) sich entlang des Auslegers (4) auf der Schiene (10) bewegt; und ferner den Kran (3) in einer weiteren Anordnung zu bedienen, um mit dem Ausleger (4) eine Last zu halten, wobei ein Ende des Auslegers (4) sich über eine Seite des Schiffs oder der Bohranlage hinaus erstreckt.
- 20.** Verfahren gemäß Anspruch 19, welches ferner beinhaltet, den Ausleger (4) um eine vertikale Drehachse und/oder eine horizontale Drehachse zu drehen, um den Kran (3) von der Anordnung, in welcher der Kran (3) verwendet wird, um die Ausrüstung in den Bohrschlitz (2) hinein oder aus dem Bohrschlitz (2) hinaus zu führen, in die weitere Anordnung zu bewegen, in welcher der Kran (3) verwendet wird, um die Last mit dem Ausleger (4) zu halten, wobei das Ende des Auslegers (4) sich über die Seite des Schiffs oder der Bohranlage (1, 101) hinaus erstreckt.
- 21.** Verfahren gemäß Anspruch 19 oder 20, ferner beinhaltend:
- Lokalisieren der Bewegungseinheit (7) in einer Parklage;
 - wenn sich die Bewegungseinheit (7) in der Parklage befindet, Drehen des Auslegers (4) um eine vertikale und/oder eine horizontale Drehachse, um den Kran (3) in der weiteren Anordnung zu verwenden.
- 22.** Verfahren gemäß Anspruch 21, welches ferner ein Bewegen der Bewegungseinheit (7) entlang des Auslegers in die Parklage beinhaltet, wobei die Bewegungseinheit (7) auf der Schiene (10) läuft.

23. Verfahren gemäss einem der Ansprüche 19 bis 22, welches ferner ein Drehen des Auslegers (4) um eine vertikale Drehachse und/oder eine horizontale Drehachse beinhaltet, zur Bewegung des Krans (3) von einer ersten Anordnung, in welcher der Kran (3) verwendet wird, um die Ausrüstung in einen ersten Bohrschlitz (2) hinein oder aus einem ersten Bohrschlitz (2) hinaus zu führen, in eine zweite Anordnung, in welcher der Kran (3) verwendet wird, um die Ausrüstung (20) in einen zweiten Bohrschlitz (2) hinein oder aus einem zweiten Bohrschlitz (2) hinaus zu führen, wobei sowohl in der ersten als auch in der zweiten Anordnung der Ausleger (4) senkrecht ausgerichtet ist, die Bewegungseinheit (7) auf der Schiene (10) angeordnet ist, und Ausrüstung (20) an der Bewegungseinheit vertikal oberhalb des Bohrschlitzes (2) befestigt ist, wobei die Bewegungseinheit (7) auf der Schiene (10) entlang des Auslegers (4) läuft.
24. Kran (3) zur Verwendung auf der Bohranlage oder auf dem Schiff (1, 101) gemäss einem der Ansprüche 1 bis 14, oder in dem Verfahren gemäss einem der Ansprüche 15 bis 23, wobei der Kran (3) einen senkrecht ausrichtbaren Ausleger (4) und eine Schiene (10) aufweist, und mit einer Bewegungseinheit (7) ausgestattet ist, welche entlang des Auslegers (4) auf der Schiene (10) in Richtung des senkrechten Auslegers befördert werden kann, um befestigte Bohrloch-Bohr- oder Verkleidungsausrüstung (20) in den Bohrschlitz (2) im Deck der Bohranlage oder des Schiffs (1, 101) hinein oder aus dem Bohrschlitz (2) hinaus zu führen.

Revendications

1. Une plate-forme ou un navire (1, 101) comprenant :

un plancher;
au moins une fente de puits (2) dans le plancher;
et

caractérisée / caractérisé en ce que la plate-forme ou le navire (1, 101) comprend en outre:

une grue (3) comprenant un bras de levage orientable droit (4) et un rail (10); et
une unité de déplacement (7) qui peut être entraînée le long du bras de levage (4) sur le rail (10) dans une orientation droite du bras de levage afin de transporter de l'équipement de tubage ou forage de trou de puits attaché (20) dans ou hors de la fente de puits.

2. Une plate-forme ou un navire comme revendiquée / revendiqué dans la revendication 1, dans laquelle / lequel l'unité de déplacement (7) comprend un entraînement supérieur (8) pour faire tourner l'équipe-

ment comprenant un train de forage de trou de puits ou une section de celui-ci entourée son axe longitudinal.

3. Une plate-forme ou un navire comme revendiquée / revendiqué dans la revendication 1 ou 2, dans laquelle / lequel la grue (3) a un couplage rotatif par lequel le bras de levage (4) peut être tourné autour d'un axe vertical.
4. Une plate-forme ou un navire comme revendiquée / revendiqué dans la revendication 3, dans laquelle / lequel la fente de puits (2) est située latéralement en dehors du couplage rotatif.
5. Une plate-forme ou un navire comme revendiquée / revendiqué dans la revendication 3 ou 4, dans laquelle / lequel le bras de levage (4) peut être tourné autour l'axe vertical dans ou hors d'une position dans laquelle le bras de levage (4) dans une orientation droite est configuré pour permettre à l'équipement attaché (20) d'être transporté dans ou hors de la fente de puits (2) en utilisant l'unité de déplacement (7).
6. Une plate-forme ou un navire comme revendiquée / revendiqué dans la revendication 3 à 5, dans laquelle / lequel la plate-forme ou le navire (1, 101) ont une première et une deuxième fente de puits (2), et le bras de levage (4) peut être tourné autour l'axe vertical depuis une première position dans laquelle le bras de levage (4) dans une orientation droite est configuré pour permettre à l'équipement attaché (20) d'être transporté dans ou hors de la première fente de puits (2) en utilisant l'unité de déplacement (7) vers une deuxième position dans laquelle le bras de levage (4) dans une orientation droite est configuré pour permettre à l'équipement attaché (20) d'être transporté dans ou hors de la deuxième fente de puits (2) en utilisant l'unité de déplacement (7).
7. Une plate-forme ou un navire comme revendiquée / revendiqué dans l'une quelconque des revendications 3 à 6, dans laquelle / lequel le bras de levage (4) peut être tourné autour de l'axe vertical par rapport à l'un ou plusieurs parmi :
- la fente de puits (2);
le plancher; et
la tour de plancher (14).
8. Une plate-forme ou un navire comme revendiquée / revendiqué dans l'une quelconque des revendications précédentes, dans laquelle / lequel l'unité de déplacement (7) est disposée pour être couplée au bras de levage (4) pour restreindre ou sensiblement prévenir ou bloquer le mouvement latéral entre ceux-ci durant l'entraînement du bras de levage.

9. Une plate-forme ou un navire comme revendiquée / revendiqué dans l'une quelconque des revendications précédentes, dans laquelle / lequel la grue (3) comprend en outre au moins un câble (12) pour supporter l'unité de déplacement (7), ou l'unité de déplacement (7) et l'équipement attaché (20). 5
10. Une plate-forme ou un navire comme revendiquée / revendiqué dans la revendication 9, dans laquelle / lequel la grue (3) comprend en outre au moins un treuil pour commander le câble (12) pour un ou les deux parmi le déplacement et le support de l'unité de déplacement (8) via le câble sur le rail. 10
11. Une plate-forme ou un navire comme revendiquée / revendiqué dans l'une quelconque des revendications précédente, dans laquelle / lequel la grue (3) comprend un premier et un second mode, dans lequel dans le premier mode la grue (3) est opérable pour transporter de l'équipement de tubage ou forage de trou de puits (20) dans ou hors de la fente de puits, et dans lequel le deuxième mode la grue est opérable pour effectuer un levage et la manipulation sur un côté latéral de la plate-forme ou du navire (1, 101). 15 20 25
12. Une plate-forme ou un navire comme revendiquée / revendiqué dans la revendication 11, dans laquelle / lequel dans le premier mode, l'équipement de tubage ou forage (20) est attaché à l'unité de déplacement (7) couplée au bras de levage (4) et opérable pour être entraînée le long du bras de levage (4) de la grue (3). 30
13. Une plate-forme ou un navire comme revendiquée / revendiqué dans la revendication 11 ou 12, dans laquelle / lequel dans le premier mode la grue (3) supporte un entraînement supérieur (8) qui avec l'équipement de tubage ou forage (20) attaché, est opérable pour effectuer un forage rotatif du trou de forage. 35 40
14. Une plate-forme ou un navire comme revendiquée / revendiqué dans la revendication 13, dans laquelle / lequel l'entraînement supérieur (8) est disposé sur l'unité de déplacement (7) qui est couplée au bras de levage (4) et qui est entraînable le long du bras de levage (4) sur le rail (10) afin de prévenir le déplacement latéral de l'entraînement supérieur (8) par rapport au bras de levage (4) durant le progrès du forage. 45 50
15. Un procédé pour utiliser une grue (3) sur une plate-forme ou un navire (1, 101) qui a au moins une fente de puits (2) dans un plancher de celle-ci / celui-ci, la grue (3) ayant un bras de levage orientable droit (4) et un rail (10) sur lequel une unité de déplacement (7) peut être entraînée le long du bras de levage (4) dans une orientation droite, le procédé comprenant les étapes de: 55
- prévoir le bras de levage (4) dans une orientation droite,
prévoir l'unité de déplacement (7) sur le rail (10);
et
attacher l'équipement de tubage ou forage (20) de trou de puits à l'unité de déplacement (7).
16. Un procédé comme revendiqué dans la revendication 15, qui comprend en outre:
entraîner l'unité de déplacement (7) verticalement le long du bras de levage (4);
transporter l'équipement de tubage ou forage (20) de trou de puits dans ou hors de la fente de puits (2).
17. Un procédé comme revendiqué dans la revendication 16, dans lequel l'équipement (20) attaché comprend un train de forage ou un train de tubage, et le procédé comprend en outre forer le trou de puits en utilisant l'équipement (20) attaché.
18. Un procédé comme revendiqué dans la revendication 17, dans lequel le train s'étend à travers la fente de puits, et le procédé comprend en outre faire tourner le train autour de son axe afin d'effectuer un forage et avancer le trou de puits, l'unité de déplacement (7) se déplaçant le long du bras de levage (4) sur le rail ensemble avec le train attaché.
19. Un procédé comme revendiqué dans l'une quelconque des revendications 15 à 18, qui comprend opérer la grue (3) dans au moins une configuration dans laquelle le bras de levage (4) est orienté droit, l'unité de déplacement (7) est prévue sur le rail (10), et l'équipement de tubage ou forage (20) est attaché à l'unité de déplacement (7), afin de transporter l'équipement (20) attaché dans ou hors de la fente de puits (2), l'unité de déplacement (7) se déplaçant sur le rail (10) le long du bras de levage (4); et en outre opérer la grue (3) dans une configuration supplémentaire pour suspendre une charge au bras de levage (4) avec une extrémité du bras de levage (4) s'étendant latéralement sur un côté du navire ou de la plate-forme.
20. Un procédé comme revendiqué dans la revendication 19, qui comprend en outre la rotation du bras de levage (4) autour d'un axe vertical de rotation et /ou d'un axe horizontal de rotation afin de déplacer la grue (3) de la première configuration dans laquelle la grue (3) est utilisée pour transporter l'équipement dans ou hors de la fente de puits (2) vers la configuration supplémentaire dans laquelle la grue (3) est utilisée pour suspendre la charge au bras de levage

(4) avec une extrémité du bras de levage (4) s'étendant latéralement sur le côté du navire ou de la plate-forme (1, 101).

21. Un procédé comme revendiqué dans la revendication 19 ou 20, qui comprend en outre: 5

localiser l'unité de déplacement (7) dans un emplacement de stationnement;
lorsque l'unité de déplacement (7) est dans l'emplacement de stationnement, faire tourner le bras de levage (4) autour d'un, ou des, axe(s) de rotation vertical ou horizontal ou pour utiliser la grue (3) dans la configuration supplémentaire. 10

22. Un procédé comme revendiqué dans la revendication 21, qui comprend en outre le déplacement de l'unité de déplacement (7) le long du bras de levage jusqu'à l'emplacement de stationnement, l'unité de déplacement (7) se déplaçant sur le rail (10). 15 20

23. Un procédé comme revendiqué dans l'une quelconque des revendications 19 à 22, qui en outre comprend faire tourner le bras de levage (4) autour d'une axe vertical de rotation et/ou un axe horizontal de rotation afin de déplacer la grue (3) depuis une première configuration dans laquelle la grue (3) est utilisée pour transporter l'équipement dans ou hors d'une première fente de puits (2), vers une deuxième configuration dans laquelle la grue (3) est utilisée pour transporter l'équipement (20) dans ou hors d'une deuxième fente de puits (2), dans lequel dans la première configuration ainsi que dans la deuxième configuration le bras de levage (4) est orienté droit, l'unité de déplacement (7) est prévue sur le rail (10), l'équipement (20) est attaché à l'unité de déplacement verticalement au-dessus de la fente de puits (2), l'unité de déplacement (7) se déplaçant sur le rail (10) le long du bras de levage (4). 25 30 35 40

24. Une grue (3) pour utilisation sur la plate-forme ou le navire (1, 101) comme revendiqué dans l'une quelconque des revendications 1 à 14, ou dans un procédé selon l'une quelconque des revendications 15 à 23, la grue (3) comprenant un bras de levage orientable droit (4) et un rail (10), et étant pourvue d'une unité de déplacement (7) qui peut être entraînée le long du bras de levage (4) sur le rail (10) dans l'orientation droite du bras de levage afin de transporter l'équipement de tubage ou forage de trou de puits attaché (20) dans ou hors de la fente de puits (2) dans le plancher de la plate-forme ou du navire (1,101). 45 50

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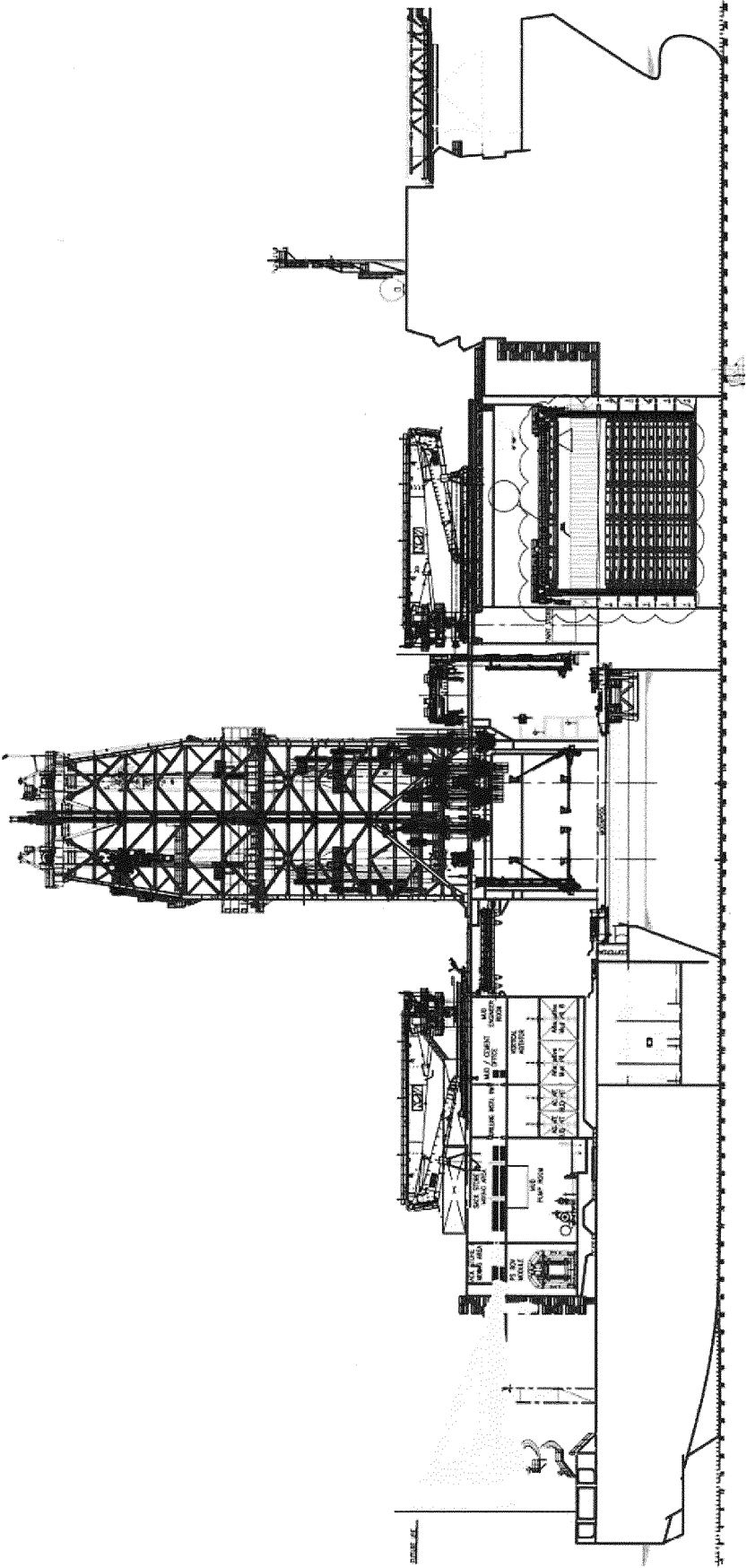


FIG. 1

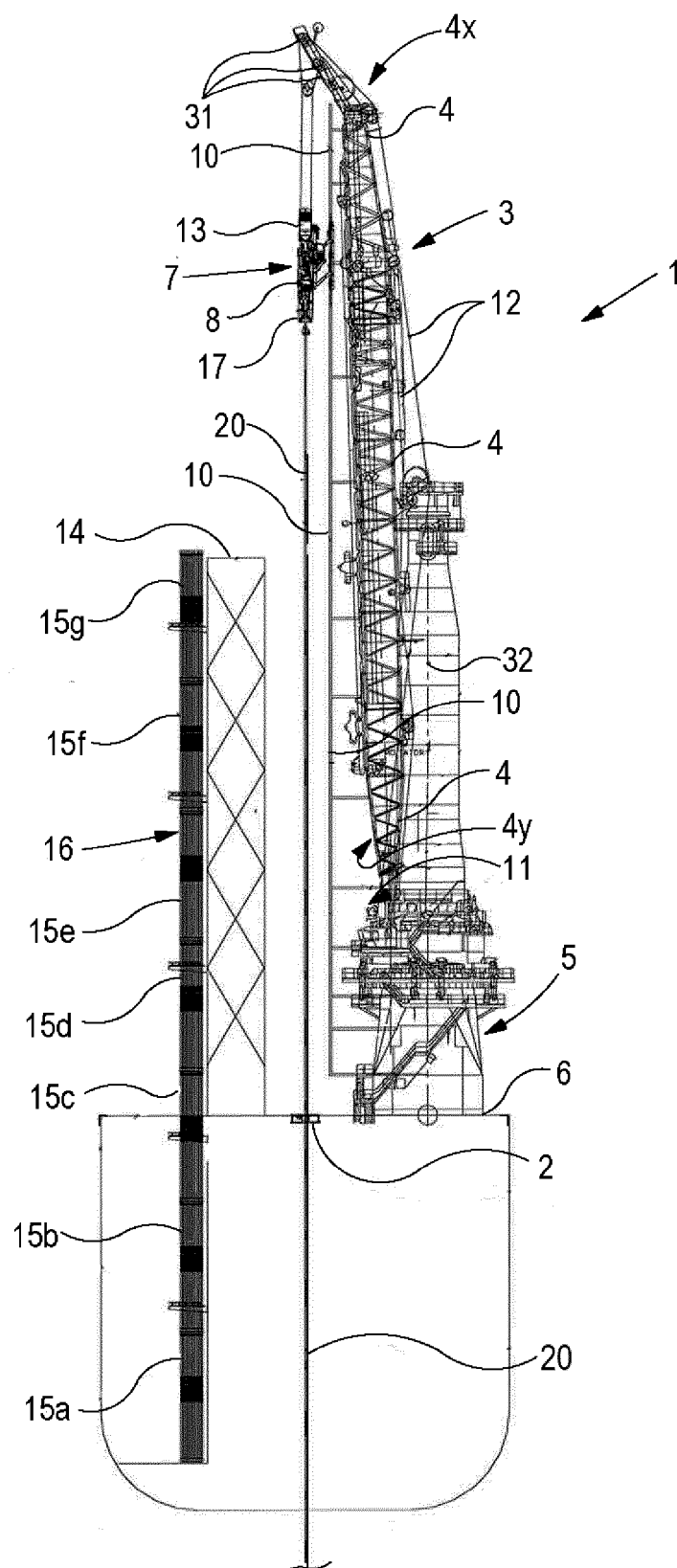


FIG. 2

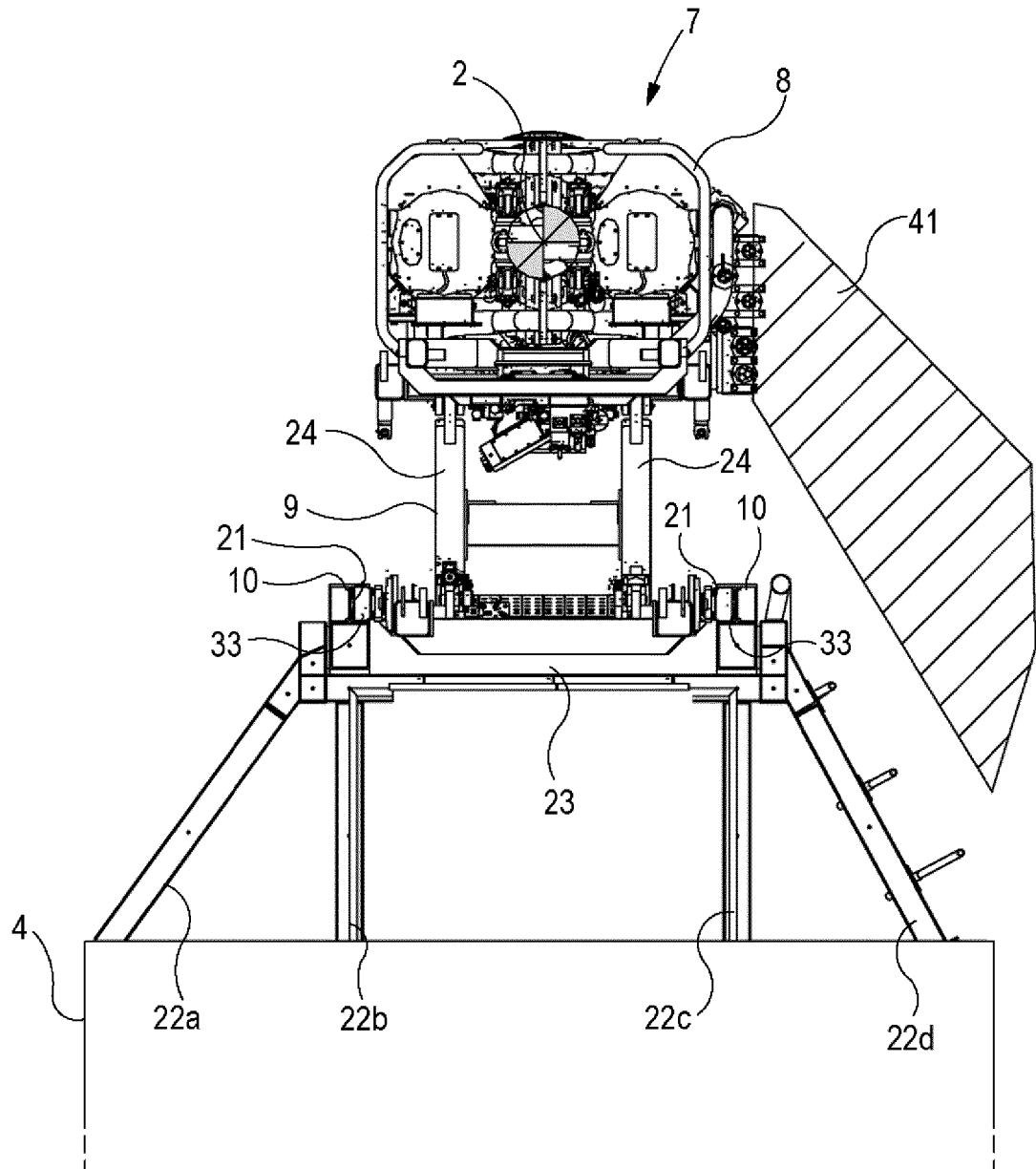


FIG. 3

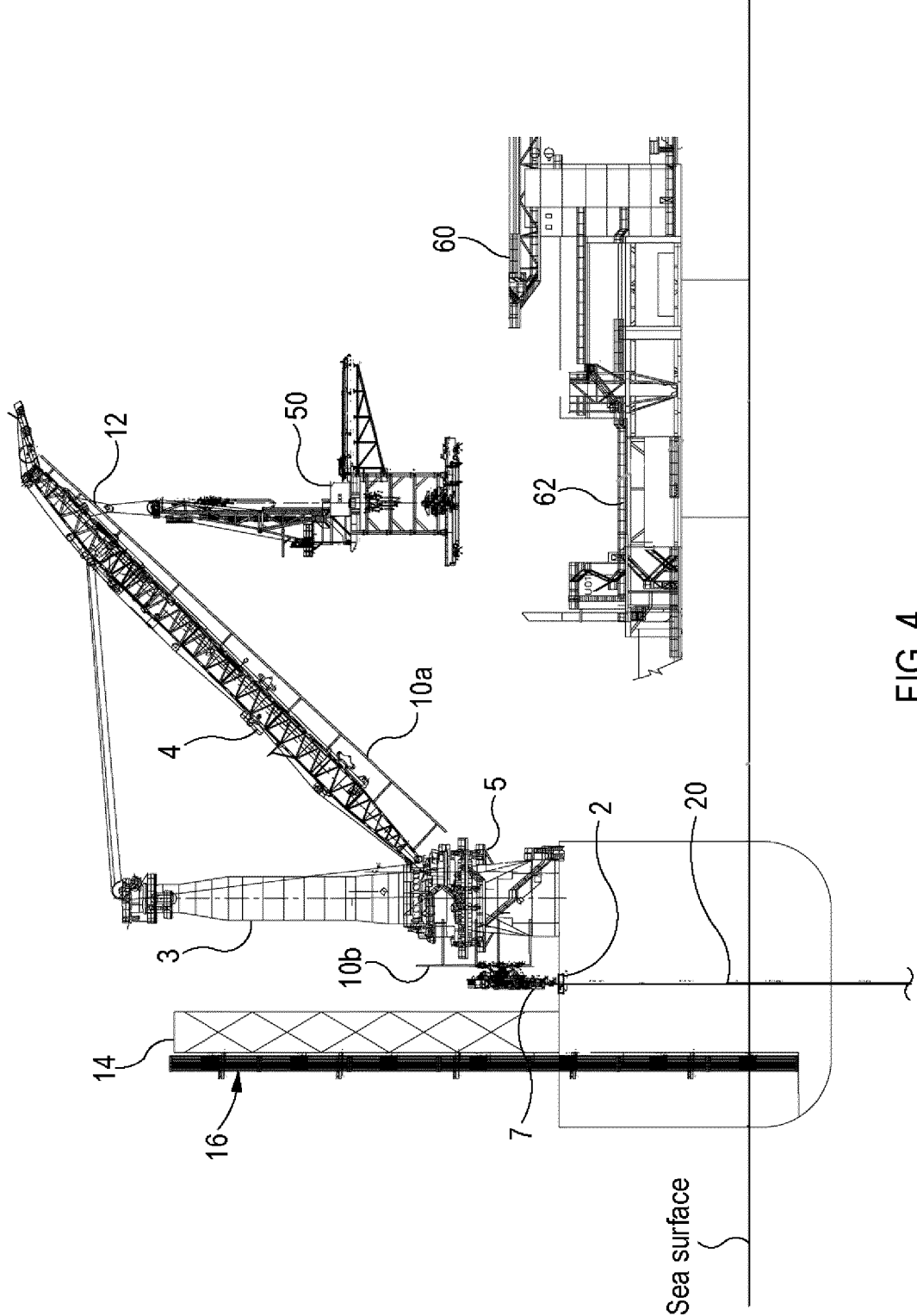


FIG. 4

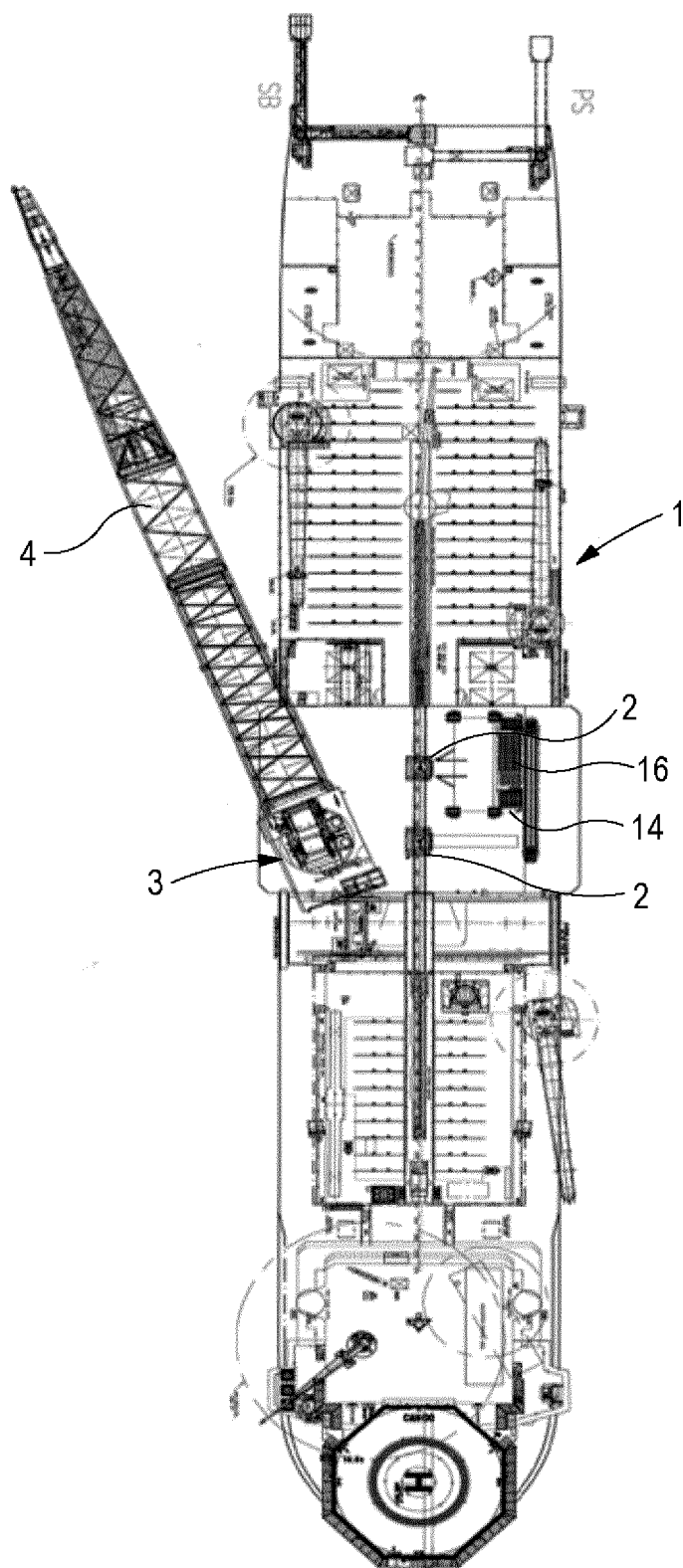


FIG. 5

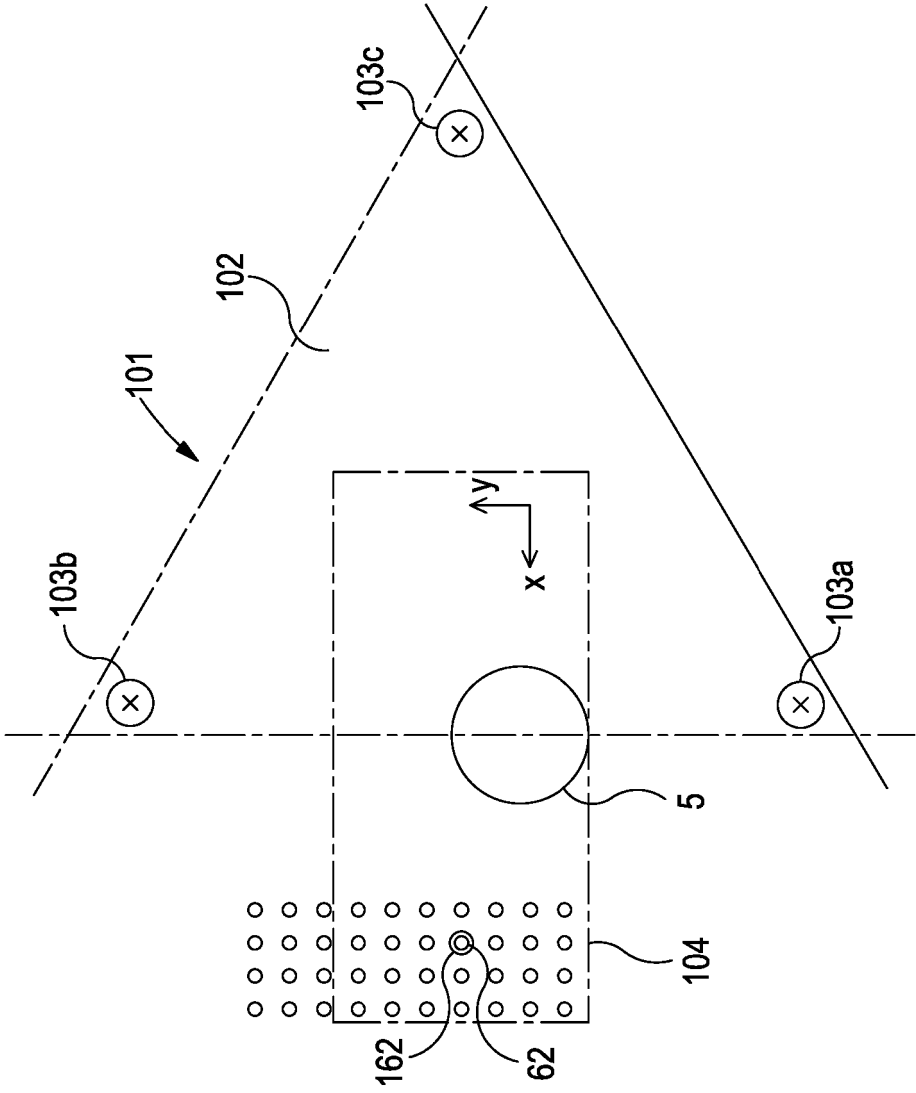


FIG. 6

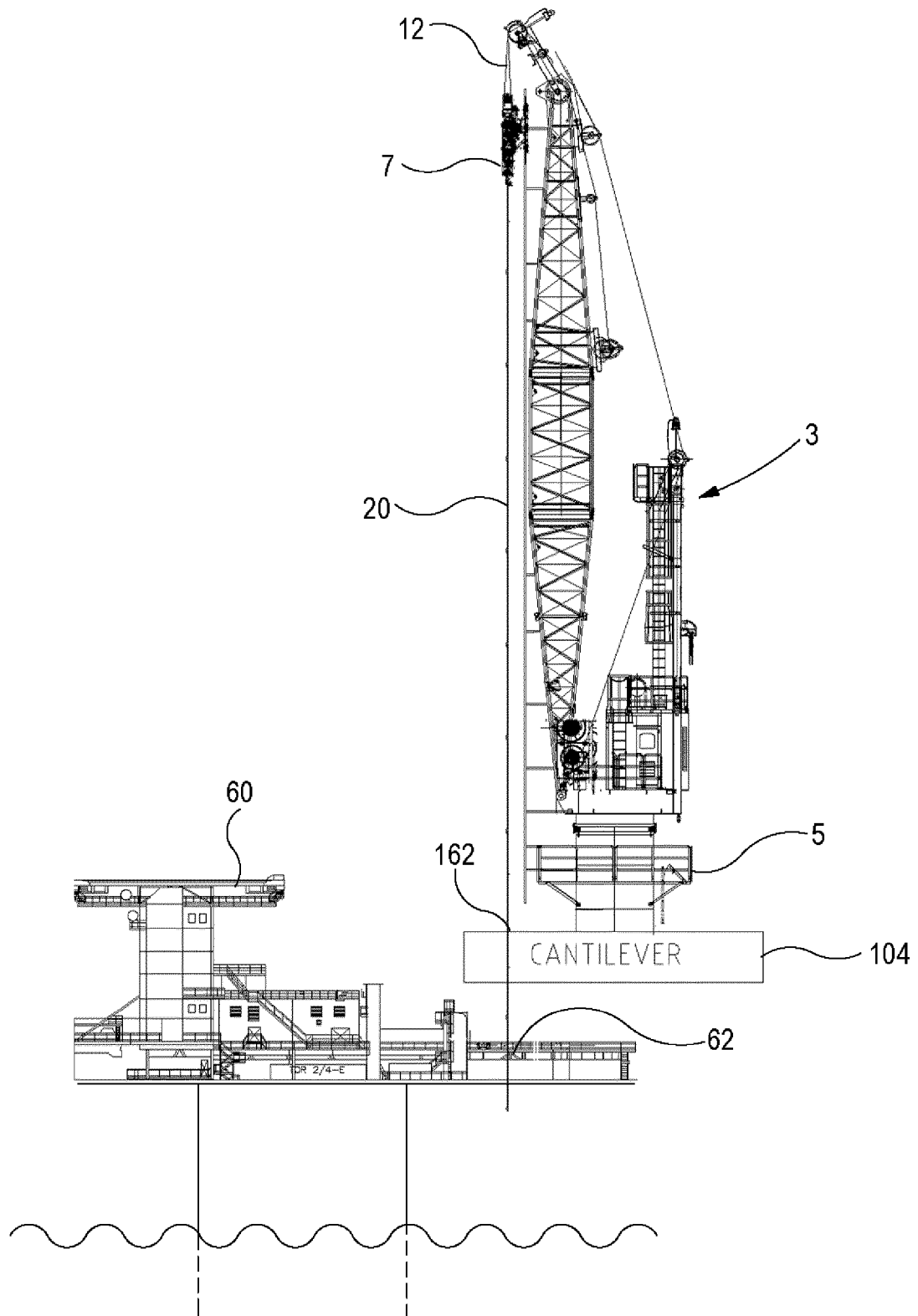


FIG. 7

REFERENCES CITED IN THE DESCRIPTION

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