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- (54) Title: DECK ARRANGEMENT ON A VESSEL OR PLATFORM FOR PERFORMING SUBSEA OPERATIONS

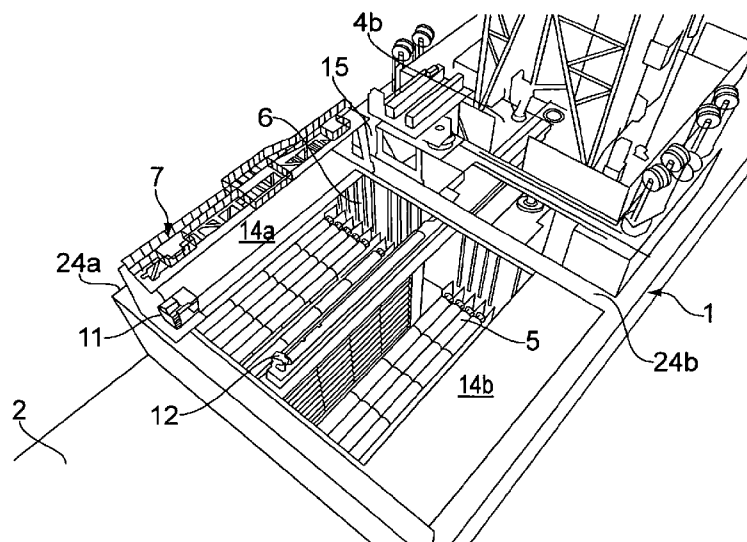


FIG. 2

(57) Abstract: A deck arrangement for a vessel or platform (1) configured for performing subsea operations, the vessel or platform having a main deck (2) and a working station (4a) and facilities (9b, 6, 28) for supporting activities in the working station, the working station further comprising a working area (4b). One or more deck elements (14a,b, 15) are arranged at an elevation different from than of the main deck (2) and at an elevation where upper surfaces of the deck elements (14a,b, 15) and the upper surface of the working area (4b) are on the same, or substantially same, level. Preferably, the deck elements are arranged above the main deck (2) and above one or more of the facilities (9b, 6, 28). The facilities may be a riser storage compartment, a BOP area and/or a pipe deck.

**Deck arrangement on drilling vessel.****Field of the invention**

The invention concerns a vessel or platform for performing subsea operations. More specifically, the invention relates to a deck arrangement as specified in the preamble  
5 of the independent claim 1.

**Background of the invention**

Drill ships and semi-submersible drilling rigs are often used for subsea well  
intervention operations. The deck layout on the known vessels serving such multiple  
functions is primarily designed for drilling operations, while less attention has been  
10 given to optimizing equipment handling related to well intervention work.

An example of a prior art multi-purpose (drilling, well intervention) ship is  
illustrated in figure 1 (partly shown). The ship 1 has a drilling module 4a  
comprising a drilling derrick 3 placed on a drill floor 4b above a moon pool (not  
shown). The ship also comprises a blow-out preventer (BOP) 9a, a BOP deck 9b,  
15 and a riser storage compartment 6 for holding a number of risers 5. A riser crane 7  
with an operator's cabin 11 hoists the individual riser up from the riser storage  
compartment, where they are stored horizontally, and positions it on the riser  
transporter 12, which transports the riser into the derrick and upends the riser on the  
drill floor. A pipe deck 28 is arranged forward of the drilling module.

20 In a normal mode of operation, intervention equipment (not shown) is placed on the  
main deck 2, from where it is lifted up and onto the elevated drill floor 4b by the  
deck crane 8 as and when this equipment is being used for subsea well intervention.  
Equipment has to be transported into the drill floor or surrounding area from the  
main deck in a time consuming, piece-by-piece basis, and much of the rigging for  
25 these operations requires operations in well-centre (online) to be stopped.

The present applicant has devised and embodied this invention in order to overcome  
shortcomings of the prior art, and to obtain further advantages.

**Summary of the invention**

The invention is set forth and characterized in the main claim, while the dependent  
30 claims describe other characteristics of the invention.

It is thus provided a deck arrangement for a vessel or platform configured for  
performing subsea operations, the vessel or platform having a main deck and a  
working station and facilities for supporting activities in the working station, the  
working station further comprising a working area, characterized in that one or  
35 more deck elements are arranged at an elevation different from than of the main  
deck and at an elevation where upper surfaces of the deck elements and the upper  
surface of the working area are on the same, or substantially same, level.

In one embodiment, the deck elements are arranged above the main deck and above one or more of the facilities. The deck elements comprise min one embodiment motive means arranged for movably supporting the respective deck element on corresponding supports.

- 5 In one embodiment, the deck elements comprise first and second deck elements arranged above a first facility, and wherein the combined surface area of the first and second deck elements is less than the opening of the first facility.

- 10 In one embodiment, the deck elements comprise a third deck element arranged above a second facility, and wherein the surface area of the third deck element is less than the opening above the second facility.

The deck elements are individually movable and comprise propulsion means adapted and arranged for interaction with the supports on the vessel or platform.

- 15 In one embodiment, the propulsion means comprises a wheel assembly having a driver wheel connected to the propulsion means and being rotatably connected to a first wheel and a second wheel which are spaced apart and configured for interaction with the supports.

In one embodiment, the working area comprises a drill floor, the first facility comprises a riser storage compartment, and the second facility comprises a BOP deck. In one embodiment, a third facility comprises a pipe deck.

- 20 The propulsion means may also comprise a winch-and-cable arrangement, or similar, for moving the deck elements back and forth.

- 25 The invented deck arrangement enables accommodation of well intervention and workover equipment and service deck area close to the drill floor. This enables (offline) preparation of the entire well intervention and workover package, such as coiled tubing or wireline equipment; while other operations in well centre are ongoing (online).

- 30 With the invention, the available deck area is increased, and accessibility to the drill floor made easier. Well intervention and workover/service can be performed using the equipment standing on the decks according to the invention, with no need for moving this equipment. The invention provides for a more flexible multi-purpose vessel than the vessels of the prior art, saving operational time and costs. This significantly extends the operational window of the vessel, as there is no need for hoisting equipment using platform cranes (The use of platform cranes might be limited by the response movements of the vessel). The invented decks may be  
35 retrofitted to existing vessels.

**Brief description of the drawings**

These and other characteristics of the invention will be clear from the following description of a preferential form of embodiment, given as a non-restrictive example, with reference to the attached drawings wherein:

5           Figure 1 is a perspective view of a part of a combined drill ship and well intervention ship, illustrating a deck arrangement according to the prior art;

          Figure 2 is a perspective view of a part of a combined drill ship and well intervention ship, illustrating an embodiment of the deck arrangement according to the invention, in a first position;

10          Figure 3 is a perspective view of a part of a combined drill ship and well intervention ship, illustrating the embodiment of the deck arrangement in a second position;

          Figure 4 is a perspective view, illustrating the deck arrangement in the second position;

15          Figure 5 is a perspective view of a part of the deck arrangement and riser storage area;

          Figure 6 is a side view of a part of a combined drill ship and well intervention ship, illustrating an embodiment of the deck arrangement according to the invention;

20          Figure 7 is an enlargement of the region "A" in figure 6;

          Figures 8a-c are schematic plan views of an embodiment of a rack-and-pinion drive unit according to the invention; and

          Figures 9 and 10 are perspective views of a part of a combined drill ship and well intervention ship, illustrating the deck arrangement according to the invention in a second position and carrying equipment units.

25

**Detailed description of a preferential embodiment**

Referring initially to figure 2 and figure 3, a pair of first and second deck plates 14a, 14b is arranged above the riser storage compartment 6 and a third deck plate 15 is arranged above the BOP deck 9b. The deck plates are arranged such that the decks' upper surfaces are flush with each other and with the drill floor 4b. The deck plates and the drill floor are at the same elevation. The skilled person will understand that although they are referred to as deck plates, operational load bearing requirements dictate that they in fact are designed with sufficient strength and stiffness in order to support the equipment units which they are intended to carry.

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Referring additionally to figure 6, the first and second deck plates 14a,b straddle the riser storage compartment and are supported on top of the wall structures 24a,b

defining the riser storage compartment 6. The third deck plate 15 straddle the BOP bay (and the moon pool 10) and is supported on the wall structure 24b separating the riser storage compartment and the BOP deck, and on structural elements adjacent to the drill floor. The deck plates are supported by rails 16, such that each  
5 deck plate is movable back and forth on these rails. This arrangement is illustrated on figure 7, identifying the rail 16 on top of the wall structure 24a, a wheel 19 rotatably connected to the deck plate and configured for rolling on the rail 16. Although not shown in the drawing, each deck plate has a number of wheels, arranged in a manner which is known in the art. A propulsion unit 17, e.g. a  
10 hydraulic motor, on the deck plate provides power to a cog wheel assembly 20 which engages with a pitch rack 25 attached to the rail. Thus, each deck plate 14a,b, 15 are movable back and forth on the support rails 16 by means of a rack-and-pinion configuration. Alternative motion means are conceivable, e.g. a winch-and-cable arrangement.

15 The first and second deck plate 14a,b are preferably each designed with such area that they do not block access to the riser storage compartment, i.e. the total area is less than the upward opening of the riser storage compartment. Figure 2 illustrates the deck plates in a first position, giving access to the central part of the riser compartment, while figures 3 and 4 illustrate the deck plates in a second position,  
20 giving access to the outer parts of the riser compartment. In this second position, the plates 14a,b, are moved up against the riser transporter 12.

The movement of the riser crane 7 back and forth across the riser compartment does not interfere with the movement of the deck plates 14a,b; and vice versa. The riser crane support rails 18 are indicated on e.g. figures 2 and 7. The movable decks  
25 14a,b, 15 are conveniently controlled by the operator in the riser crane cabin 11.

The third movable deck plate 15 is also movable back and forth in the same manner as for the first and second deck plates, and can thus be moved in order to accommodate handling of the BOP.

Figures 9 and 10 illustrate how the movable deck plates are used as storage area for  
30 various intervention equipment units 27, from where the equipment units may be rolled or skidded onto the drill floor 4b.

The above mentioned rack-and-pinion configuration will no be described in more detail, with reference to figures 8a-c, which are schematic plan views showing the cog wheel assembly 20 in three positions along the rail 16 and pitch rack 25, and to  
35 the perspective view of figure 5.

When the risers are hoisted up from horizontal storage in the riser compartment 6, the riser ends are guided by respective guide grooves 26. Therefore, in order not to impede the riser movement, the deck plate support rails 16 comprise individual rails pieces 16a, separated by gaps 16b, each of which corresponding to the width of the

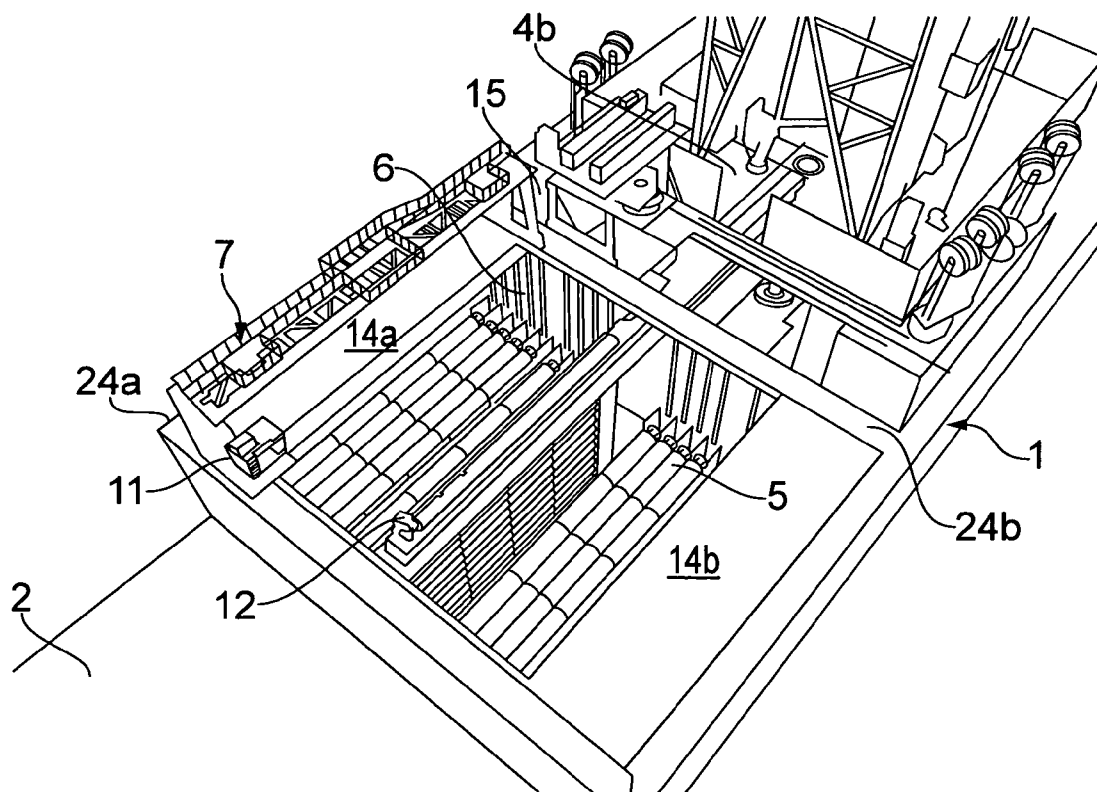
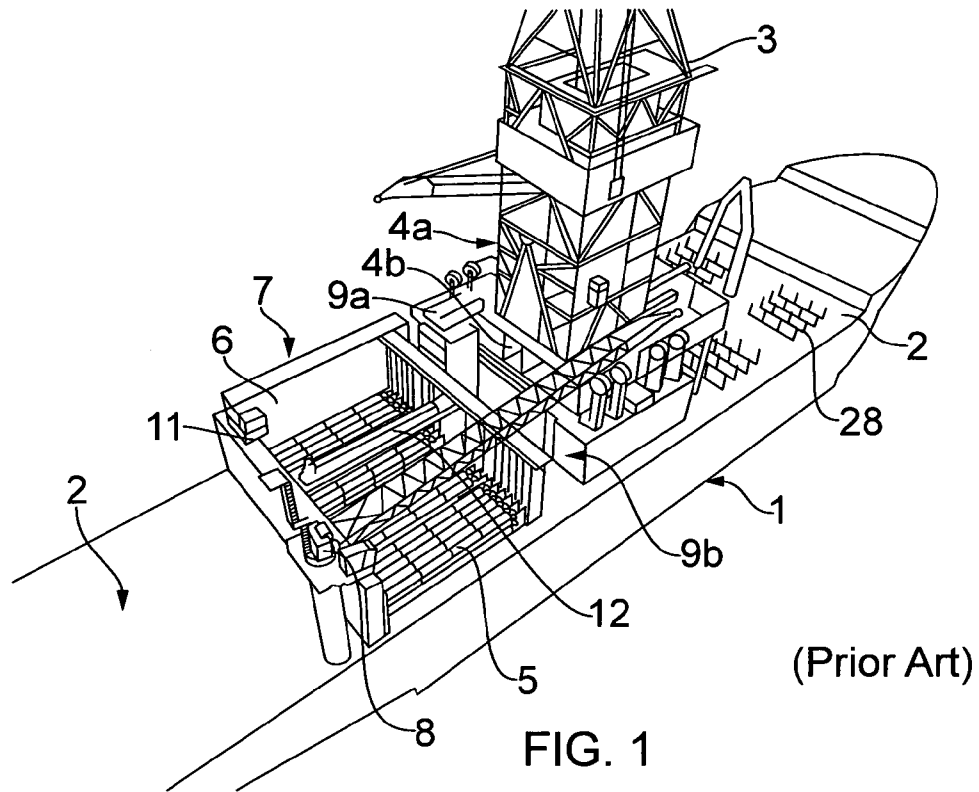
groove 26. In order to ensure that the deck plate is continually movable event across the gaps 16b, the cog wheel assembly 20 comprises a first cog wheel 21 and a second cog wheel 23, both rotatably arranged on a frame (illustrated schematically at 26) which is connected to the deck plate. The first and second cog wheels 21, 23 are arranged with a spacing which is greater than the width of the gap 16b, hence enabling the assembly 20 to straddle the gap 16b. A driver cog wheel 22, which is drivingly connected to the propulsion unit 17 (shown in figure 7), is rotatably connected to the first and second cog wheels 21, 23. The arrow  $R_2$  indicates the rotation of the driver wheel 22, while arrows marked  $R_1$  indicate the rotation of the first and second wheels. Thus, rotation of the first and second wheels 21, 23 is synchronized by the rotation of the driver wheel 22.

Although not illustrated, it should be understood that a similar inventive deck arrangement as described above, may be arranged above the pipe deck 28, i.e. forward of the drilling module.

## Claims

1. A deck arrangement for a vessel or platform (1) configured for performing subsea operations, the vessel or platform having a main deck (2) and a working station (4a) and facilities (9b, 6; 28) for supporting activities in the working station,  
5 the working station further comprising a working area (4b), **characterized in that** one or more deck elements (14a,b, 15) are arranged at an elevation different from than of the main deck (2) and at an elevation where upper surfaces of the deck elements (14a,b, 15) and the upper surface of the working area (4b) are on the same, or substantially same, level.
- 10 2. The deck arrangement of claim 1, wherein the deck elements are arranged above the main deck (2) and above one or more of the facilities (9b, 6, 28).
3. The deck arrangement of claim 1 or claim 2, wherein the deck elements comprise motive means (19, 20) arranged for movably supporting the respective deck element on corresponding supports (16, 16a).
- 15 4. The deck arrangement of any one of claims 1 – 3, wherein the deck elements comprise first and second deck elements (14a,b) arranged above a first facility (6), and wherein the combined surface area of the first and second deck elements is less than the opening of the first facility.
- 20 5. The deck arrangement of any of claims 1 – 3 wherein the deck elements comprise a third deck element (15) arranged above a second facility (9b), and wherein the surface area of the third deck element is less than the opening above the second facility.
6. The deck arrangement of any one of claims 1 – 5, wherein the deck elements are individually movable.
- 25 7. The deck arrangement of any one of claims 1 – 6, wherein the deck elements comprise propulsion means (17) adapted and arranged for interaction with the supports (16) on the vessel or platform.
8. The deck arrangement of any one of the preceding claims, wherein the propulsion means (17) comprises a wheel assembly (20) having a driver wheel (22)  
30 connected to the propulsion means and being rotatably connected to a first wheel (21) and a second wheel (23) which are spaced apart and configured for interaction with the supports (16).
9. The deck arrangement of any one of the preceding claims, wherein the working area (4b) comprises a drill floor, the first facility (6) comprises a riser storage compartment, and the second facility (9b) comprises a BOP deck.  
35
10. The deck arrangement of any one of the preceding claims, wherein a third facility (28) comprises a pipe deck.

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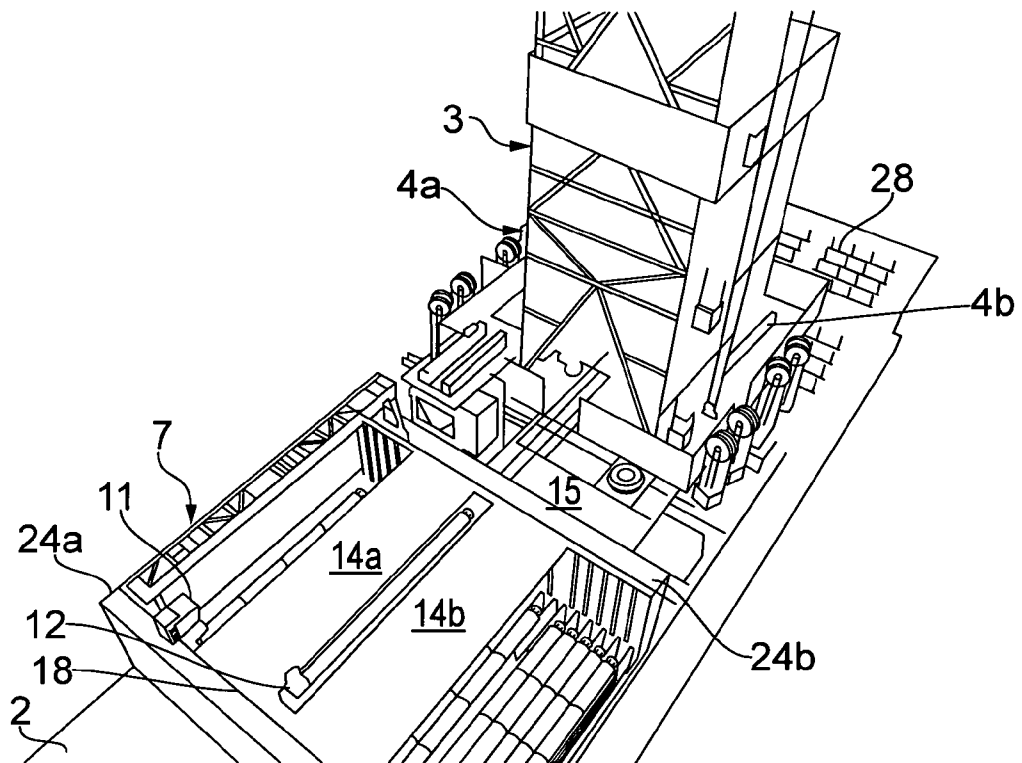


FIG. 3

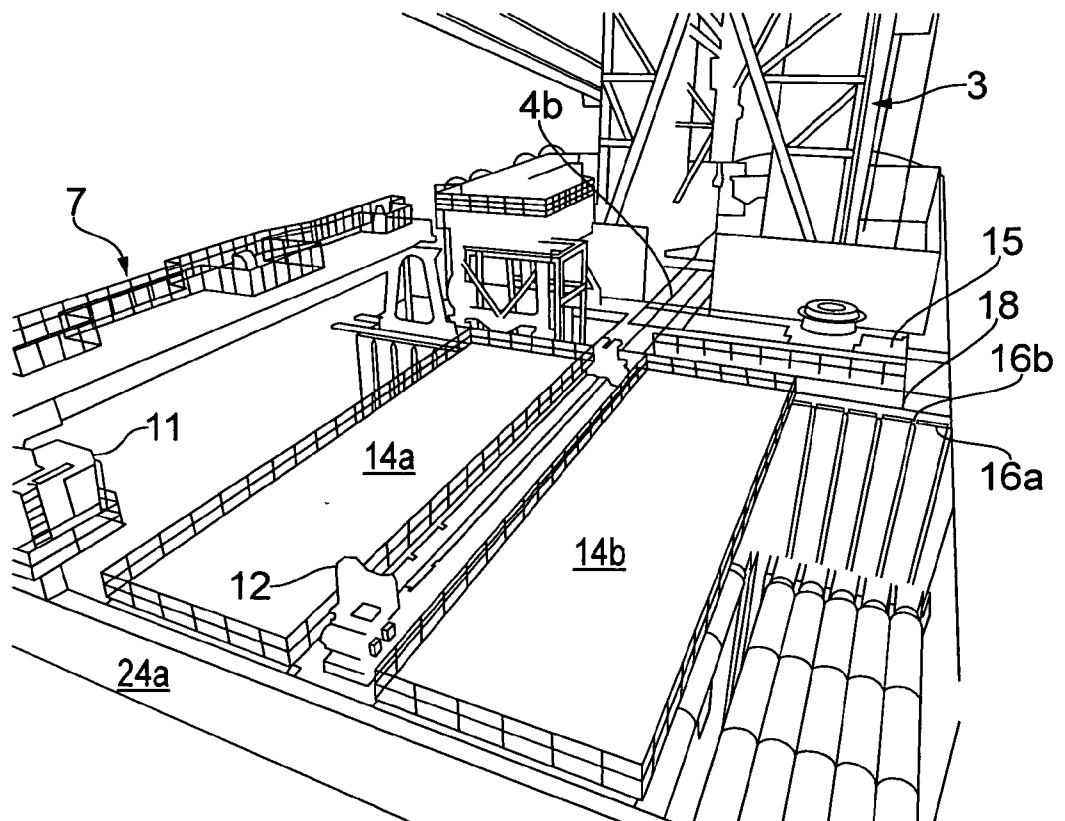


FIG. 4

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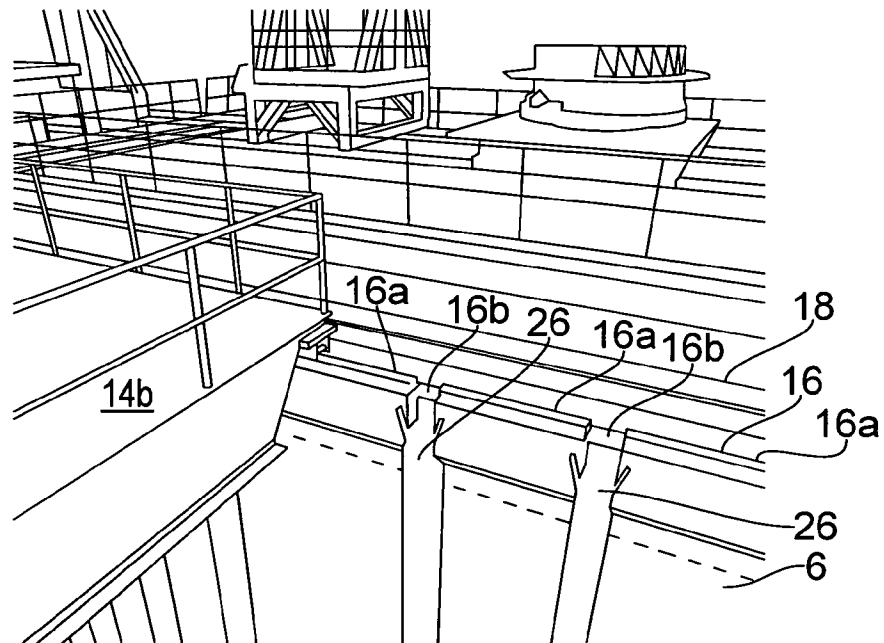


FIG. 5

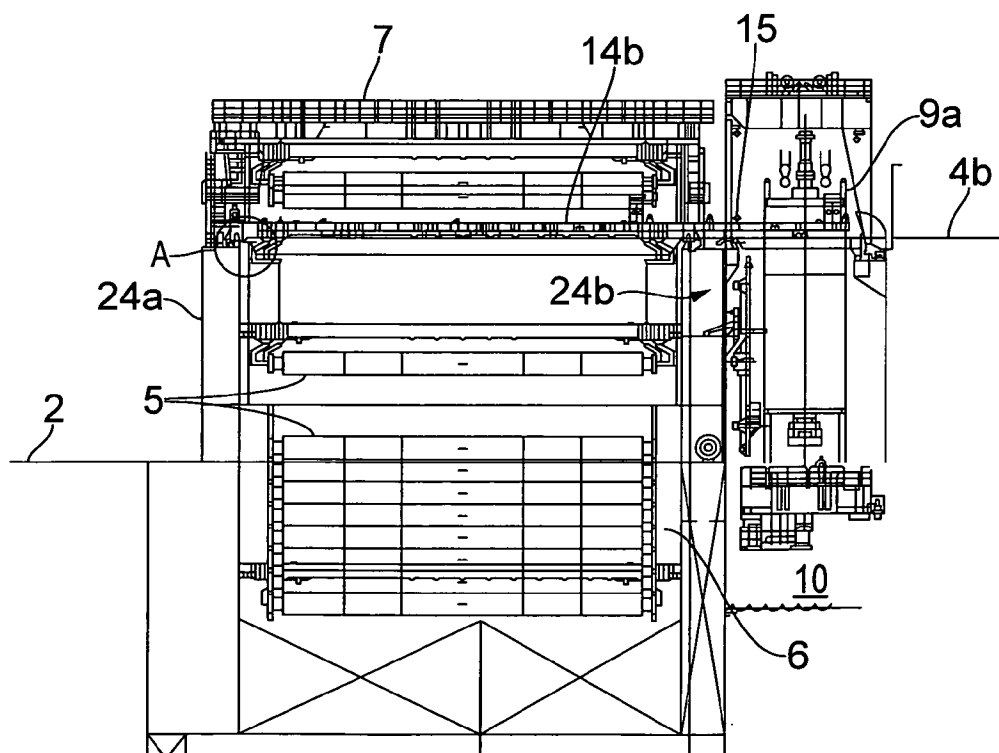


FIG. 6

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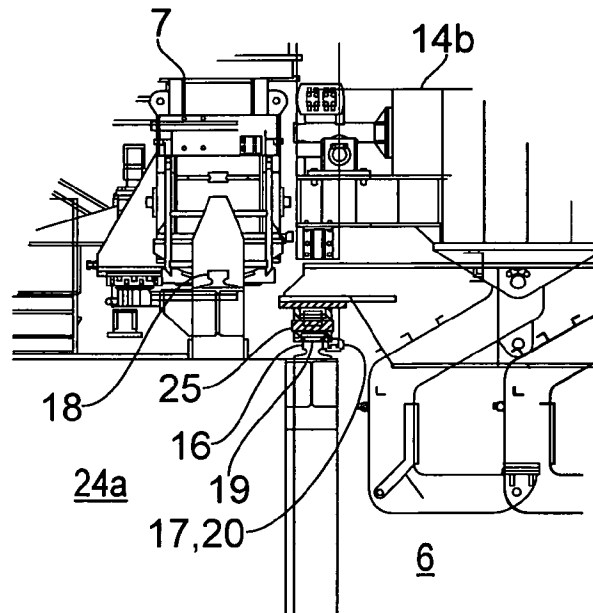


FIG. 7

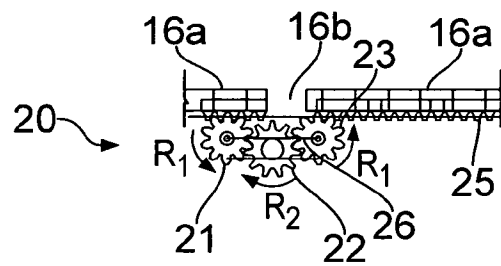


FIG. 8a

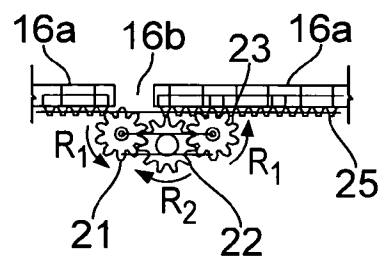


FIG. 8b

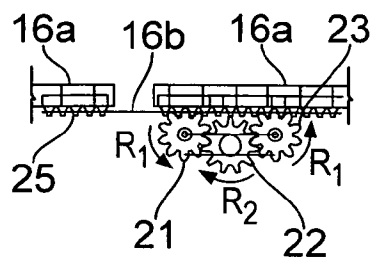
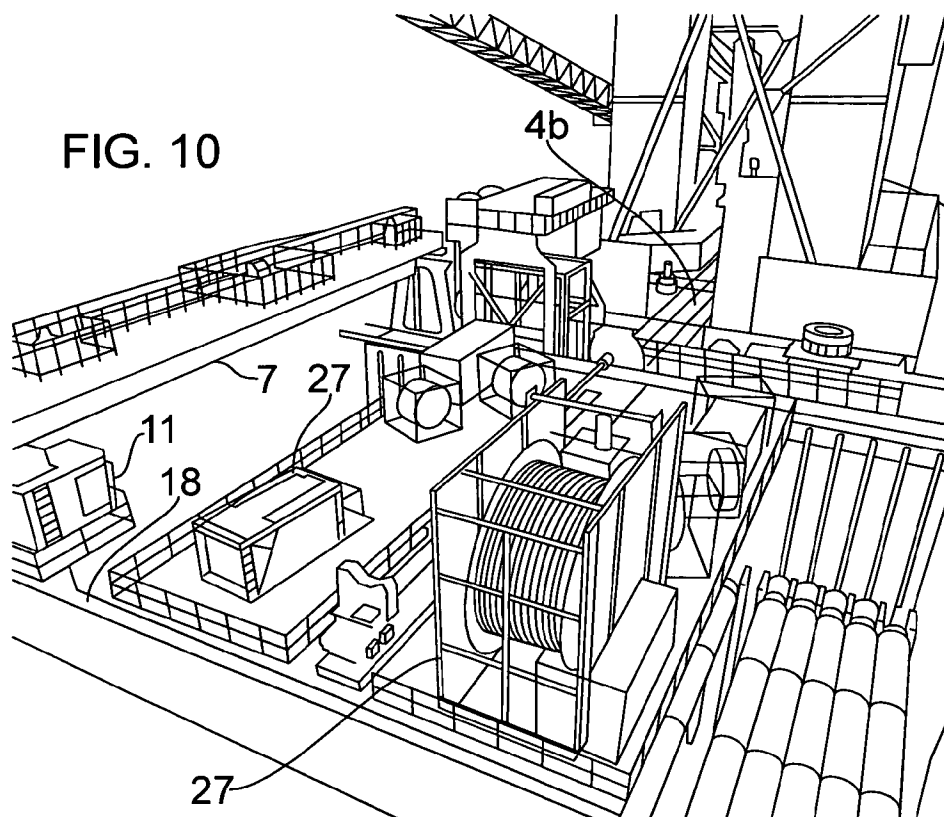
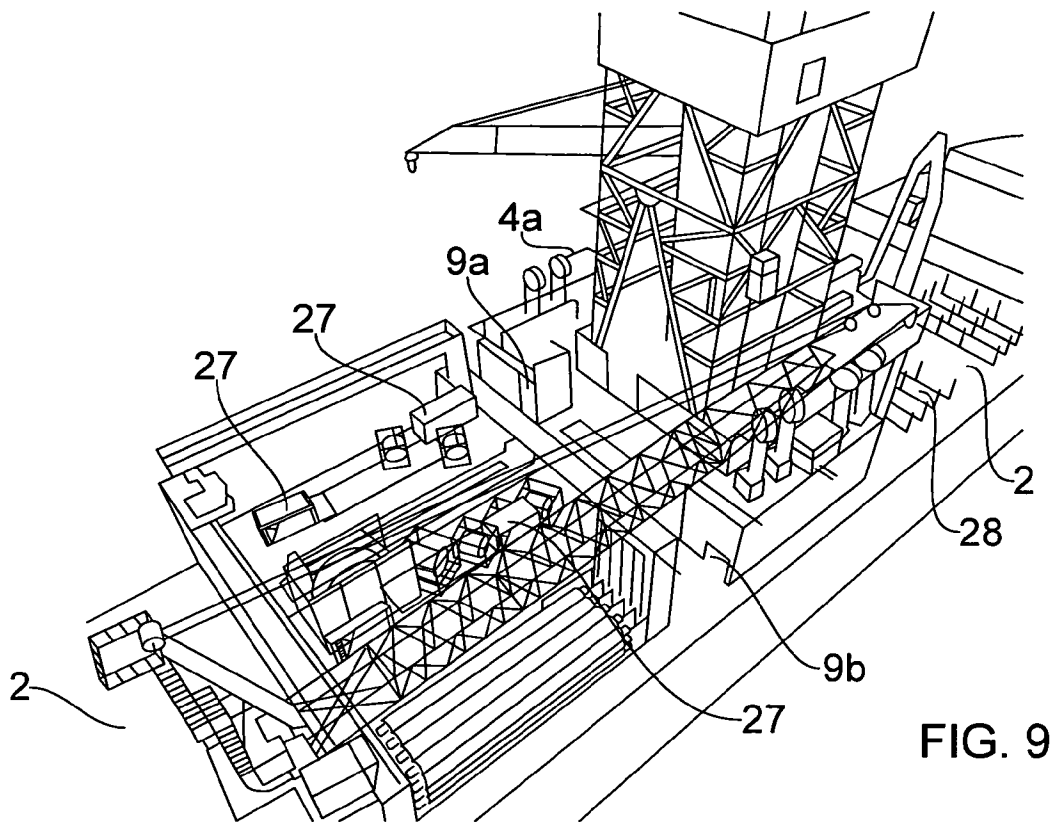


FIG. 8c

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# INTERNATIONAL SEARCH REPORT

International application No  
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A. CLASSIFICATION OF SUBJECT MATTER  
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ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
B63B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                             | Relevant to claim No. |
|-----------|--------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| X         | US 4 063 650 A (HOMER JOSEPH F)<br>20 December 1977 (1977-12-20)<br>column 2, line 18 - column 3, line 13;<br>figures 1,3      | 1-10                  |
| X         | US 2009/151955 A1 (BAMFORD ANTHONY STEPHEN<br>[GB] ET AL) 18 June 2009 (2009-06-18)<br>paragraphs [0068] - [0072]; figures 1-4 | 1-10                  |
| X         | US 6 761 124 B1 (SRINIVASAN NAGAN [US])<br>13 July 2004 (2004-07-13)<br>column 6, line 42 - column 8, line 65;<br>figures 1-6  | 1                     |
|           | -----<br>-/--                                                                                                                  |                       |



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

13 September 2012

Date of mailing of the international search report

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## INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2012/060891

| C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT |                                                                                                                                                                                                                                                                                                |                       |
|------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Category*                                            | Citation of document, with indication, where appropriate, of the relevant passages                                                                                                                                                                                                             | Relevant to claim No. |
| X                                                    | <p>GADDY D H ET AL: "JACK RYAN DRILLSHIP TO USE RETRACTABLE THRUSTERS, MUX CONTROL SYSTEMS",<br/>OIL AND GAS JOURNAL, PENNWELL, HOUSTON, TX, US,<br/>vol. 98, no. 48,<br/>27 November 2000 (2000-11-27), pages 38-42, XP001048880,<br/>ISSN: 0030-1388<br/>the whole document</p> <p>-----</p> | 1,3,6                 |

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2012/060891

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s) | Publication<br>date                                        |
|-------------------------------------------|---------------------|----------------------------|------------------------------------------------------------|
| US 4063650                                | A                   | 20-12-1977                 | NONE                                                       |
| US 2009151955                             | A1                  | 18-06-2009                 | US 2009151955 A1 18-06-2009<br>WO 2007093787 A1 23-08-2007 |
| US 6761124                                | B1                  | 13-07-2004                 | NONE                                                       |