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(54) Title: SEMI-SUBMERSIBLE ARCTIC WATERS DRILLING VESSEL AND METHOD

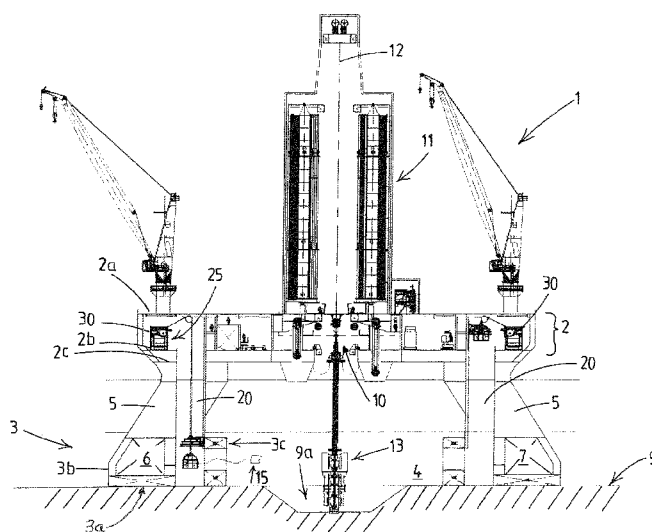


Fig.1

(57) Abstract: A semi-submersible arctic waters drilling vessel, said vessel comprising a deckbox structure (2), a ring pontoon (3), and multiple columns (5) extending upward from the ring pontoon and supporting thereon the deckbox structure. The vessel is provided with at least one ROV system, comprising a subsea remotely operated vehicle (ROV) (15), a dedicated ROV moonpool shaft (20,22), which extends from a bottom end opening (21) of the moonpool shaft upwards to an above waterline ROV maintenance garage (25), and an ROV system winch (30). The ROV moonpool shaft (20,22) is provided with a side opening (23) that is located in the inner circumferential wall (3c) of the ring pontoon, so that the ROV can be launched and recovered via said side opening, e.g. in case the bottom end opening is closed due to the vessel sitting with the bottom (3a) of the ring pontoon on a seabed (9)..

SEMI-SUBMERSIBLE ARCTIC WATERS DRILLING VESSEL AND METHOD

- 5 The present invention relates to a semi-submersible arctic waters drilling vessel and method for performing ROV supported subsea operations with such a drilling vessel.

An example of a semi-submersible arctic waters drilling vessel is disclosed in WO2012/005587. This vessel comprises:

- 10 - a deckbox structure,
- a ring pontoon, which ring pontoon has an annular pontoon body with a bottom, an outer circumferential wall, and an inner circumferential wall forming an eye opening of the ring pontoon, and
- multiple columns extending upward from the ring pontoon and supporting thereon the
15 deckbox structure.

The known vessel has a water ballast system comprising ballast tanks allowing to ballast the vessel, e.g. to place the vessel at distinct ice-breaking and water draft waterlines.

- 20 The deckbox structure of the known vessel is provided with a drilling moonpool and the vessel comprises a drilling installation with a drilling tower to perform drilling operation along one or multiple firing lines through said moonpool and the eye opening of the ring pontoon.

- In the field of drilling vessels it is desirable to provide at least one ROV system on the drilling
25 vessel in order to have the capability to use a subsea ROV.

The present invention aims to provide an ROV system that is specifically suited for integration in a semi-submersible arctic waters drilling vessel of the type wherein the vessel comprises:

- 30 - a deckbox structure;
- a ring pontoon, which ring pontoon has an annular pontoon body with a bottom, an outer circumferential wall, and an inner circumferential wall forming an eye opening of the ring pontoon,
- multiple columns extending upward from the ring pontoon and supporting thereon the
35 deckbox structure;
- a water ballast system comprising ballast tanks allowing to ballast the vessel;

wherein the deckbox structure is provided with a drilling moonpool,

wherein the vessel comprises a drilling installation with a drilling tower to perform drilling operations along one or multiple firing lines through said drilling moonpool and the eye opening of the ring pontoon.

It is believed that existing ROV systems do not offer the desired versatility for such integration.

10 The present invention provides a semi-submersible arctic waters drilling vessel which is characterized in that the vessel is provided with at least one ROV system, said ROV system comprising:

- a subsea remotely operated vehicle (ROV),
- a dedicated ROV moonpool shaft, which extends from a bottom end opening of the moonpool shaft upwards to an above waterline ROV maintenance garage,
- 15 - an ROV system winch allowing the launch and recovery of the ROV,

and in that the ROV moonpool shaft is provided with a side opening that is located in the inner circumferential wall of the ring pontoon, so that the ROV can be launched and recovered via said side opening.

The dedicated moonpool shaft avoids any interference of drilling equipment in the one or more firing lines or associated equipment (e.g. riser tensioner) with the launch and recovery of the ROV.

25 This embodiment of the ROV system allows for use of the ROV when – in shallow water – the vessel is ballasted so as to sit with its bottom of the ring pontoon on the seabed. In this situation the bottom end opening of the ROV moonpool shaft will be closed, yet the side opening will then still be accessible for launch and recovery of the ROV.

30 In an embodiment the moonpool shaft has a vertical shaft section upward from the bottom end opening, and a lateral ROV shaft section connects to said vertical shaft section and extends laterally inward to the side opening. In another embodiment, the lateral shaft is open from below. In yet another embodiment the moonpool shaft extends directly adjacent the inner wall of the ring pontoon, thereby obviating the need for a lateral ROV shaft section. In 35 the latter version one can even envisage that the bottom end opening and the side opening

are combined to form a single continuous opening with a bottom portion in the bottom of the ring pontoon and a side portion in the inner wall of the ring pontoon.

5 In an embodiment the dedicated moonpool shaft extends upward through the ring pontoon, and preferably upward through a column, wherein the maintenance garage is located in the deckbox structure. Preferably the winch is located in or near the maintenance garage.

10 In a preferred embodiment the ROV system comprises a cage with a tether management device including a tether, and the ROV is tethered via said tether to the cage, the cage being adapted to receive the ROV.

15 In a preferred embodiment the cage is a side entry cage having a side entry docking space for the ROV, the system preferably being embodied to align the side entry docking space with the side opening of the moonpool shaft, or the lateral shaft section leading to said side opening, for launch and recovering of the ROV via said side opening.

20 In an embodiment the ROV system comprises a cursor device that travels in the moonpool shaft along one or more vertical guide rails for the cursor device, the cursor device and cage being adapted to mate so that the cursor device positions the cage within the moonpool shaft, preferably at least when passing the water-air interface in the moonpool shaft.

In an embodiment the maintenance garage system comprises one or more mobile hatches that are movable over the moonpool shaft underneath the fully retrieved ROV.

25 In an embodiment the vessel comprises two ROV systems at diametrically opposed position of the ring pontoon.

30 The ring pontoon, columns, and deckbox structure are preferably embodied as described in WO2012/005587 which is herein incorporated by reference. For example the deckbox structure has an ice-breaking portion at the lower end of the deckbox structure, said ice-breaking portion having a closed circular contour that tapers in downward direction. The columns then extend from ring pontoon obliquely upwards and inwards, so as to connect to the ice-breaking portion of the deckbox structure.

35 The present invention also relates to a method for performing ROV supported subsea operations with a semi-submersible arctic waters drilling vessel according to the invention, wherein the ROV is launched and retrieved via the side opening of the moonpool shaft.

In particular the present invention envisages a method performed in shallow arctic water, wherein the vessel is ballasted so as sit with the bottom of the ring pontoon on the seabed so that the bottom end opening of the moonpool shaft is closed by the seabed, and wherein the ROV is launched and retrieved via the side opening of the moonpool shaft in order to perform

5 ROV supported subsea operations.

For example, in an embodiment, the vessel can be set on the seabed in water depths between 12 and 25 meters.

The ring pontoon may be provided with downwardly depending skirt members that increase

10 the lateral resistance when the vessel sits on the seabed, e.g. when ice pushes against the vessel.

In an embodiment the deckbox structure is generally circular, e.g. with between 6 and 10 columns between the deckbox and the ring pontoon, e.g. 8 columns.

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The invention will now be explained with reference to the drawings. In the drawings:

Fig. 1 schematically shows in elevational cross-section an embodiment of a semi-

20 submersible arctic waters drilling vessel according to the invention;

Fig. 2 shows the tween deck layout of the vessel of figure 1,

Fig. 3 shows on an enlarged scale the area of vessel of figure 1 with the ROV system, the ROV being deployed vertically from moonpool shaft of the vessel,

Fig. 4 shows the view of figure 3 with the ROV being deployed via the side opening of the

25 moonpool shaft,

Fig. 5 shows the oppositely located ROV system of the vessel of figure 1 with the ROV fully recovered into the maintenance garage.

30 Figure 1 shows a semi-submersible arctic waters drilling vessel 1, said vessel comprising:

- a deckbox structure 2, here with a main deck 2a, a tween deck 2b, and a lower deck 2c;

- a ring pontoon 3, which ring pontoon has an annular pontoon body with a bottom 3a, an outer circumferential wall 3b, and an inner circumferential wall 3c forming an eye opening 4 of the ring pontoon 3,

- multiple columns 5 extending upward from the ring pontoon 3 and supporting thereon the deckbox structure 2.

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The vessel comprises a water ballast system with ballast tanks 6, 7 allowing to ballast the vessel 1, e.g. allowing to sit the vessel in shallow water on seabed 9 as depicted in figure 1.

The deckbox 2 is provided with a drilling moonpool 10.

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The vessel comprises a drilling installation with a drilling tower 11 to perform drilling operation along one or multiple firing lines 12 through the moonpool 10 and the eye opening 4 of the ring pontoon 3.

10 Here, by way of example, the seabed 9 has been locally provided with a recess 9a with the contour of the ring pontoon 3. A wellhead and BOP 13 (Blow Out Preventer) placed thereon are shown. As is preferred the BOP does not extend higher than the top of the ring pontoon 3 thereby the ring pontoon 3 affording a protected area for the BOP 13.

15 The ring pontoon 3, columns 5, and deckbox structure 2 are preferably embodied as described in WO2012/005587.

The vessel 1 is provided with two similar ROV systems at diametrically opposite positions.

20 Each ROV system comprises:

- a subsea remotely operated vehicle 15 (ROV),
- a dedicated ROV moonpool shaft 20, which extends from a bottom end opening 21 of the moonpool shaft 20 upwards to an above waterline ROV maintenance garage 25,
- an ROV system winch 30 allowing the launch and recovery of the ROV 15.

25

In this example, as is preferred, the moonpool shaft 20 has a vertical shaft section from the bottom opening 21 all the way upward to the garage 25.

30 As can be seen a lateral shaft section 22 connects to the vertical shaft section and extends laterally inward to a side opening 23 of the ROV moonpool shaft that is located in the inner circumferential wall 3b of the ring pontoon 3.

In general the provision of the side opening 23, here with the lateral shaft section 22, allows the ROV 15 to be launched and recovered via said side opening 23, e.g. – as shown in figure 1 - in case the bottom end opening 21 is closed due to the vessel 1 sitting with the bottom of the ring pontoon on the seabed 9 for drilling operations in shallow arctic water.

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The moonpool shaft 20 extends upward through the ring pontoon 3 and upward through a column 5. The maintenance garage 25 is located in the deckbox structure 2.

5 In the figures it is illustrated that the ROV system comprises a cage 26 with a tether management device including a tether 27. The ROV 15 is tethered via said tether 27 to the cage 26. The cage 26 is adapted to receive the ROV 15.

As is preferred the cage 26 is a side entry cage having a side entry docking space 26a for the ROV 15.

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The system is adapted to align the side entry docking space 26a with the side opening 23, here with the shaft section 22, of the moonpool shaft 20 for launch and recovering of the ROV via said side opening 23.

15 It is illustrated here that the ROV system comprises a cursor device 28 that travels in the moonpool shaft 20 along one or more vertical guide rails 29 for the cursor device 28. The cursor device 28 and the cage 26 are adapted to mate so that the cursor device positions the cage 26 within the moonpool shaft 20, preferably at least when passing the water-air interface in the moonpool shaft.

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In an embodiment the maintenance garage system comprises on or more mobile hatches that are movable over the moonpool shaft 20 underneath the fully retrieved ROV (see figure 5).

C L A I M S

1. Semi-submersible arctic waters drilling vessel, said vessel comprising:

- a deckbox structure (2);

5 - a ring pontoon (3), which ring pontoon has an annular pontoon body with a bottom (3a), an outer circumferential wall (3b), and an inner circumferential wall (3c) forming an eye opening (4) of the ring pontoon,

- multiple columns (5) extending upward from the ring pontoon (3) and supporting thereon the deckbox structure (2);

10

- a water ballast system comprising ballast tanks (7,8) allowing to ballast the vessel;

wherein the deckbox structure (2) is provided with a drilling moonpool (10),

15 wherein the vessel comprises a drilling installation with a drilling tower (11) to perform drilling operations along one or multiple firing lines (12) through said drilling moonpool (10) and the eye opening (4) of the ring pontoon,

characterized in that

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the vessel is provided with at least one ROV system, said ROV system comprising:

- a subsea remotely operated vehicle (ROV) (15),

- a dedicated ROV moonpool shaft (20,22), which extends from a bottom end opening (21) of the moonpool shaft upwards to an above waterline ROV maintenance garage (25),

25

- an ROV system winch (30),

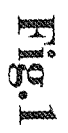
and in that the ROV moonpool shaft (20,22) is provided with a side opening (23) that is located in the inner circumferential wall (3c) of the ring pontoon (3), so that the ROV can be launched and recovered via said side opening (23), e.g. in case the bottom end opening is
30 closed due to the vessel sitting with the bottom (3a) of the ring pontoon (3) on the seabed (9) for drilling operations in shallow arctic water.

2. Vessel according to claim 1, wherein the ROV moonpool shaft has a vertical shaft section (20) upward from the bottom end opening, and wherein a lateral shaft section (22)

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connects to said vertical shaft section and extends laterally inward to the side opening (23).

3. Vessel according to claim 1 or 2, wherein the ROV moonpool shaft (20) extends upward through the ring pontoon, and preferably upward through a column (5), wherein the maintenance garage (25) is located in the deckbox structure (2).
- 5 4. Vessel according to one or more of claims 1-3, wherein the ROV system further comprises a cage (26) with a tether management device including a tether (27), and wherein the ROV (25) is tethered via said tether to the cage (26), the cage being adapted to receive the ROV.
- 10 5. Vessel according to claim 4, wherein the cage (26) is a side entry cage having a side entry docking space for the ROV (25), the system aligning the side entry docking space with the side opening (23) of the moonpool shaft for launch and recovering of the ROV via said side opening.
- 15 6. Vessel according to claim 4 or 5, wherein the ROV system comprises a cursor device (28) that travels in the ROV moonpool shaft (20) along one or more vertical guide rails (29) for the cursor device, the cursor device (28) and cage (26) being adapted to mate so that the cursor device positions the cage within the moonpool shaft, preferably at least when passing the water-air interface in the moonpool shaft.
- 20 7. Vessel according to one or more of claims 1 - 6, wherein the maintenance garage (25) comprises one or more mobile hatches (32) that are movable over the ROV moonpool shaft (20) underneath the fully retrieved ROV (15).
- 25 8. Vessel according to one or more of claims 1 – 7, wherein the vessel (1) comprises two ROV systems with side openings (23) at diametrically opposed positions in the ring pontoon (3).
9. Method for performing ROV supported subsea operations with a semi-submersible arctic waters drilling vessel (1) according to one or more of the preceding claims, wherein the ROV (15) is launched and retrieved via the side opening (23) of the ROV moonpool shaft.
- 30 10. Method according to claim 9, wherein the method is performed in shallow water, and wherein the vessel is ballasted so as sit with the bottom (3a) of the ring pontoon (3) on the seabed (9) so that the bottom end opening of the ROV moonpool shaft is closed by the seabed, and wherein the ROV (15) is launched and retrieved via the side opening (23) of the moonpool shaft in order to perform ROV supported subsea operations.
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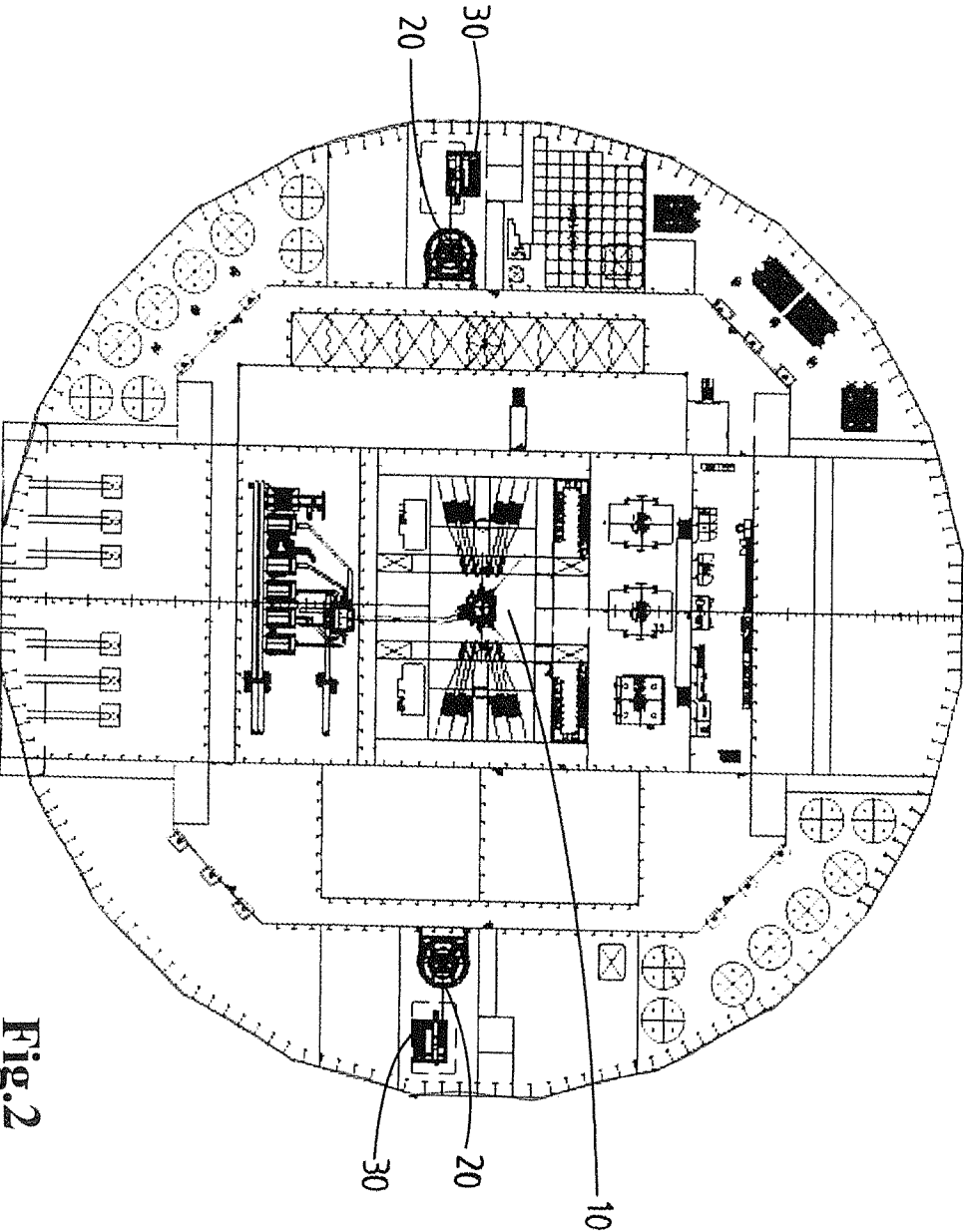
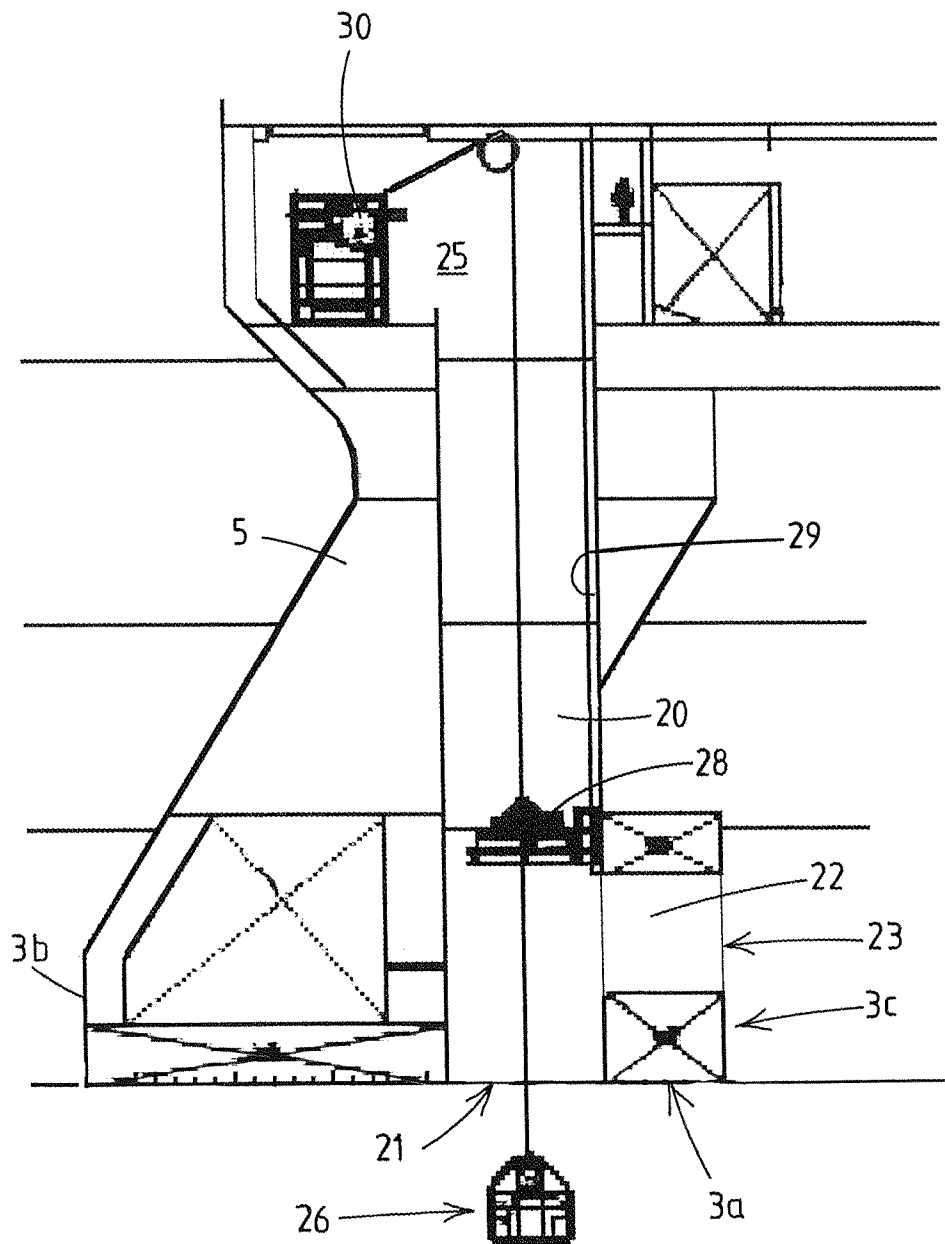
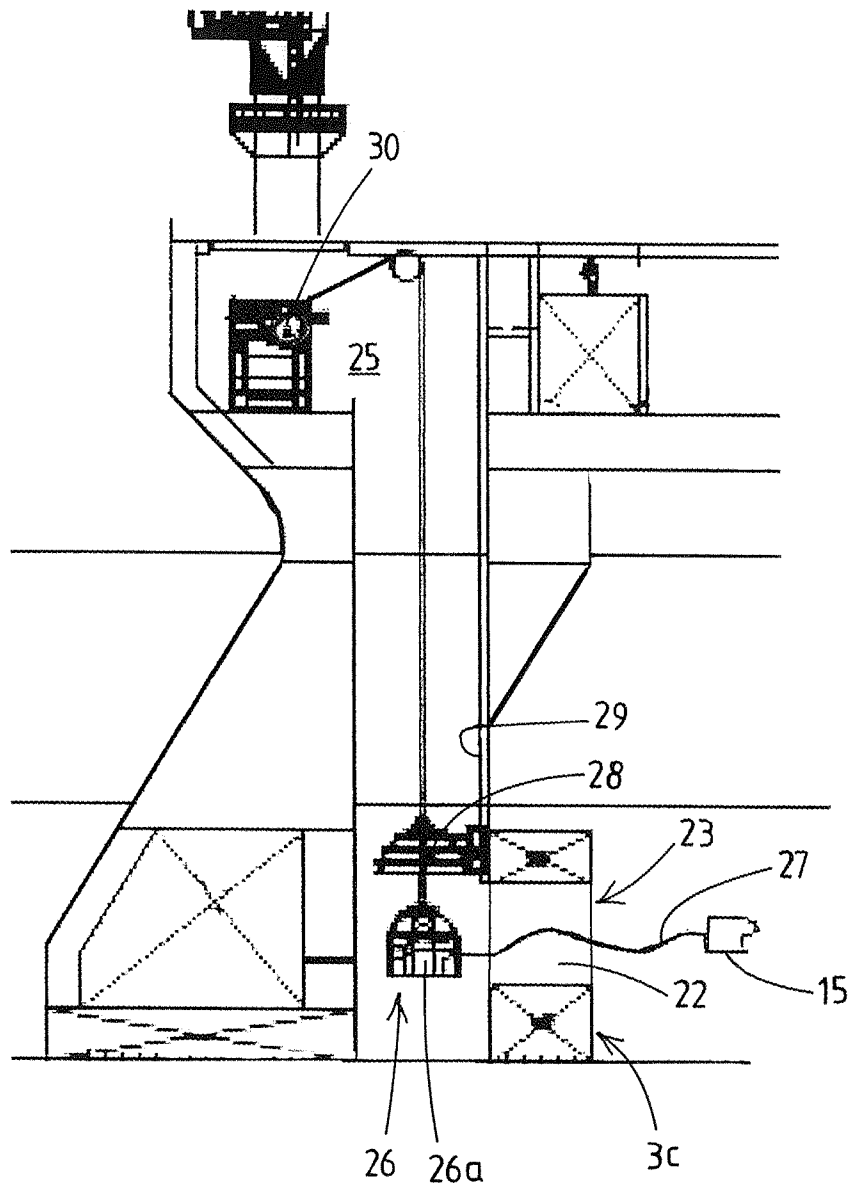
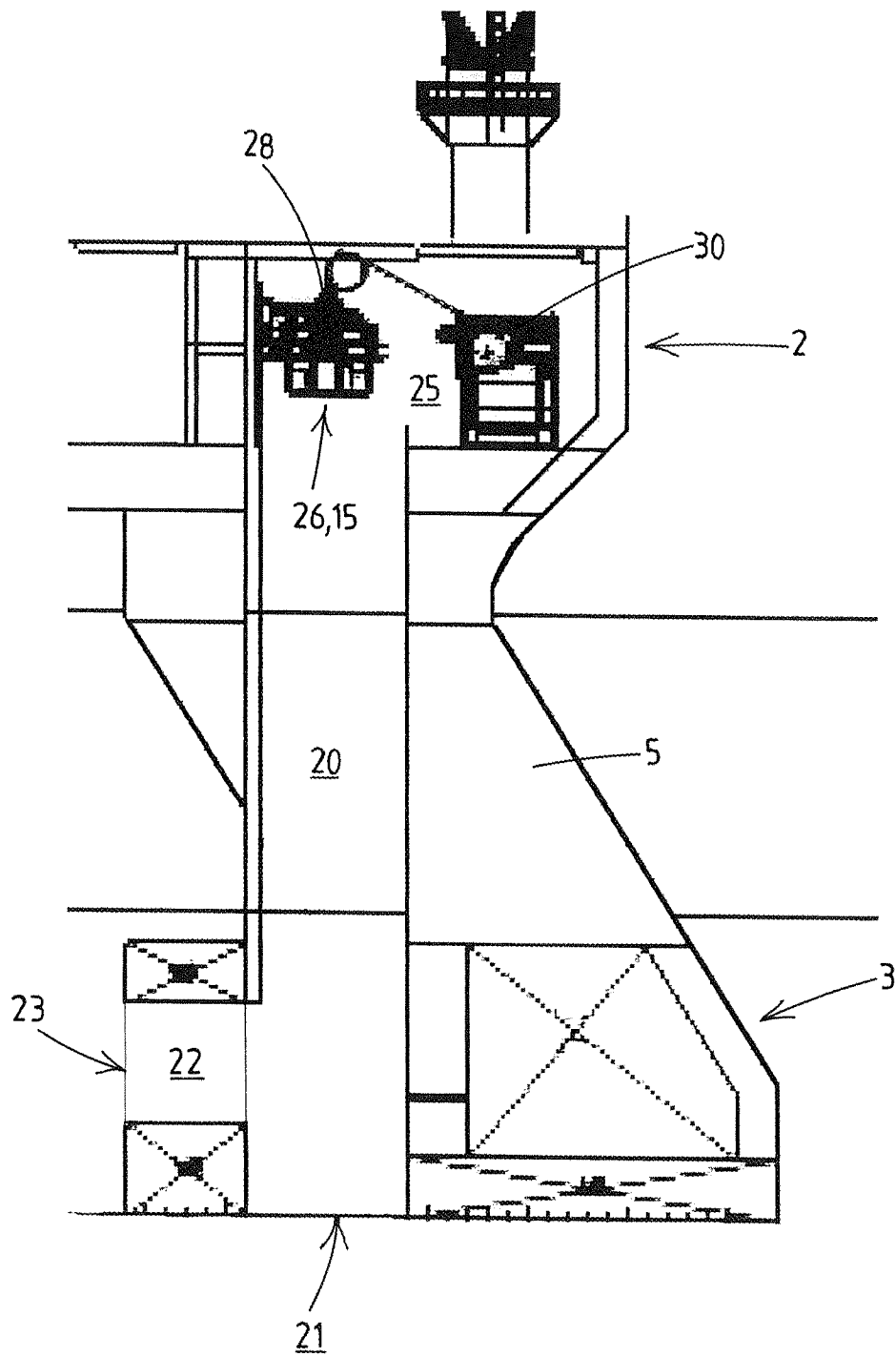


Fig.2

**Fig.3**

**Fig.4**

**Fig.5**

INTERNATIONAL SEARCH REPORT

International application No
PCT/NL2013/050731

A. CLASSIFICATION OF SUBJECT MATTER
INV. B63B3/14 B63B35/4413 B63G8/001
ADD.

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

B. FIELDS SEARCHED

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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)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 99/29566 A1 (ORMEN BREDE A S [NO]; DYBDAHL SVEIN [NO]; REMMEN PER INGE [NO]) 17 June 1999 (1999-06-17) page 5, line 18 - line 19; figures 5-9 -----	1-10
A	GB 2 110 602 A (VO OFFSHORE LIMITED) 22 June 1983 (1983-06-22) page 4, line 28 - line 41; figure 5 -----	1-10
A	EP 2 093 143 B1 (WAERTSILAE SHIP DESIGN GERMANY [DE] WAERTSILAE SHIP DESIGN GERMANY GMB) 27 April 2011 (2011-04-27) paragraph [0038]; figures 2, 3 -----	1-10

☐

Further documents are listed in the continuation of Box C.

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See patent family annex.

* Special categories of cited documents :

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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