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(54) **MARINE PIPELAYING SYSTEM AND METHOD**

SYSTEM UND VERFAHREN FÜR UNTERWASSERROHRVERLEGUNG

SYSTEME ET PROCEDE DE POSE DE CANALISATION EN MER

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EP 2 276 957 B9

Description

[0001] The present invention relates to laying of an offshore pipeline. In offshore pipelaying several laying techniques are available. One of those techniques is referred to as the J-lay technique. In this technique pipe sections are added to the previously launched pipeline in a vertical or near vertical orientation.

[0002] Many designs for J-lay pipelaying devices are known in the art. These designs comprise in general a launch tower including pipe laying equipment defining a firing line. The pipe laying equipment may include one or more welding stations, a line-up tool, etc.

[0003] A hang off module, often embodied as a clamp, is commonly arranged at or near the lower end of the tower for holding the launched pipeline. During pipelaying the lower end of the new pipe section is connected to the upper end of the previously launched pipeline. After the new pipe section is connected to the previously launched pipeline - usually by welding - the hang off clamp is released and the pipeline is lowered by suitable lowering means, e.g. including a travel block, one or more lowering wires and one or more associated winches. Next, the hang off clamp engages again on the launched pipeline, the travel block is released and moved upwardly after which a new pipe section can be connected to the pipeline.

[0004] The launch tower is in many designs pivotable such that it can launch the pipeline under an angle with the vertical. Also designs where the launch tower is fixed in an upright vertical position, thus non-pivotable, are known in the art.

[0005] In the art of pipelaying a stinger is also known. In a known design the stinger is fitted to the lower end of the tower or to the hull of the vessel. The stinger in general serves to provide guidance and/or support for the pipeline. An example thereof is found in EP 0 094 698.

[0006] In practice it is often desirable to connect to the upper end of the already launched pipeline a so called accessory, such as an inline structure (ILS) or a pipeline end terminal (PLET). Such accessories have in general dimensions deviating significantly from a common pipe section.

[0007] It has been found that stinger equipped pipelaying systems are rather unpractical when it is desired to lay pipeline provided with one or more accessories.

[0008] WO2006/085739 discloses a marine pipelaying method and system for installing an offshore pipeline that includes one or more accessories. In an embodiment, the installation comprises a vessel with a tower and wherein a hang off clamp is provided to engage an upper part of the pipeline. The pipeline is launched to the seabed along a firing line. A stinger is provided which is pivotally connected to the tower by connecting means, and which can be pivoted away from the firing line.

[0009] The present invention has for an object to provide an alternative pipe laying system and method which allows launching of a pipeline via a stinger, wherein the

pipeline can be provided with accessories.

[0010] The invention provides a marine pipelaying vessel for laying an offshore pipeline according to claim 1.

[0011] The displacement of the stinger to a remote non-active position, away from its operational position during pipelaying of the pipeline, e.g. allows for the unhindered passage of an accessory when such an accessory has been fitted to the upper end of the launched pipeline at an earlier stage.

[0012] In a method according to the invention for laying an offshore pipeline provided with an accessory using the above marine pipelaying system, said system comprising an accessory handling system for positioning in the firing line an accessory which is to be connected to the already launched pipeline, the method comprises the following steps:

- launching the pipeline in the tower firing line into the sea via the stinger,
- stopping the launch of pipeline, and hanging off the launched pipeline in the hang off module,
- positioning the accessory in the firing line by means of the accessory handling system,
- attaching the accessory to the launched pipeline in the hang off module and to the lowering means,
- releasing the hang off module from the launched pipeline and suspending the accessory and the launched pipeline from the lowering means,
- displacing the stinger out of the firing line,
- displacing the hang off module out of the firing line,
- lowering the accessory with the launched pipeline by the lowering means beyond the position of the hang off module in the firing line,
- repositioning the hang off module in the firing line,
- hanging off the launched pipeline with accessory in the hang off module.

[0013] Preferably the stinger is translatable, e.g. skid-dable, to its remote non-active position.

[0014] In a particularly preferred embodiment of the pipelaying system, the stinger at its upper end is pivotable about a horizontal axis such that it is liftable between an uppermost position and a lowermost position. It is also considered advantageous if the stinger is rotatable about a vertical axis.

[0015] As will follow from the claims and the description the stinger is translatable, pivotable up and down and also rotatable about a vertical axis.

[0016] Preferably the hang off module and the stinger are mounted to a common, moveable support member.

[0017] Further details of the invention will be described in the following description with reference to the drawing.

Fig. 1 shows a side view in perspective of a part of a semi-submersible vessel provided with a pipelaying system according to the invention,

Fig. 2 shows in a perspective view a moonpool of the vessel of Fig. 1 from below with a stinger in its

operational position,

Fig. 3 shows the moonpool of Fig. 2, wherein the stinger is lifted to a lifted position,

Fig. 4 shows the moonpool of Fig. 2, wherein the lifted stinger is rotated around a vertical axis,

Fig. 5 shows the moonpool of Fig. 2, wherein the stinger is skidded sideways,

Fig. 6a -6e shows in a side view the pivoting of the stinger with simultaneous pivoting of the hang off clamp,

Fig. 7 shows a front view of a semi-submersible vessel with another embodiment of a pipelaying system according to the invention;

Figs. 8a-t show an example of a vessel according to the invention as well as a method for pipelaying wherein use is made of said vessel.

[0018] In Fig. 1 is shown a twin hull semi-submersible vessel 1 having a non-submerging structure 2 and a submerging structure 3. The submerging structure 3 has two parallel hulls 4. The non-submerging structure 2 has multiple decks and is supported by columns 5 located on the hulls 4.

[0019] On the upper deck 2a of the non-submerging structure 2 is arranged a pipeline launch tower 6, which in the embodiment shown is in fact a drilling tower of the so called "Multiple Purpose Tower" (MPT) type. The launch tower 6 comprises pipe laying equipment defining a tower firing line. The launch tower 6 is mounted stationary in a vertical position on the vessel 1. Next to the tower 6 is located a loader 7 for loading new pipe sections to the tower 6. The loader 7 is tiltable and skiddable to deliver pipe sections to the tower firing line.

[0020] The loader 7 is provided with a line-up tool for lining up the new pipe section with the upper end of the already launched pipeline.

[0021] The pipe laying equipment may include welding stations, line-up tools, etc.

[0022] As is common the tower preferably includes a travel block that is displaceable up and down by one or more associated lowering wires and one or more winches, the travel block and lowering wire(s) and winch(es) being adapted to support and lower/raise the pipeline when released by the hang off module.

[0023] Referring to Fig. 2, the lower deck 2b of the non-submerging structure 2 with a moonpool 9 is visible. The moonpool 9 extends through the non-submerging structure 2. The launch tower 6 is mounted at or above the moonpool 9 to launch a pipeline (not shown).

[0024] At the lower end of the moonpool 9 is located a stinger 10 which is used during pipe laying for guiding and providing lateral support for the launched pipeline. Thereto the stinger 10 is provided with guiding members 11, e.g. sets of rollers. The guiding members preferably form a curved path for the pipeline.

[0025] The stinger 10 is here suspended at its upper end from a stinger support ring 12. The support ring 12 here is substantially horseshoe-shaped, in other words

is shaped as an open ring as is best visible in Fig. 4.

[0026] In this embodiment the stinger 10 is connected to the stinger support ring 12 by two opposing pivot connections 13, which define a horizontal pivot axis. Furthermore the stinger 10 is connected to the stinger support ring 12 by means of hydraulic actuators 14. In Fig. 2 the stinger 10 is in its operational angular orientation position. By retracting the hydraulic actuators 14 the stinger 10 can be lifted to a lifted position as is illustrated in Fig. 3.

[0027] In the operational position, the stinger 10 defines a guiding curve for the launched pipeline. The stinger 10 in this example comprises two portions which are connected by hinges 18 and actuators 19. The radius of the guiding curve of the stinger 10 can be adjusted by extending or retracting the actuators 19. Alternatively or additionally the guiding curve of the stinger 10 can be adapted by moving the guiding members 11.

[0028] The pipelaying equipment also comprises a hang off module comprising a hang off clamp 15. In the preferred embodiment as shown in the figures, the hang off clamp 15 is mounted on the stinger support ring 12.

[0029] The stinger support ring 12 is here rotatable around a vertical axis by means of a rotational driving means (not shown). Thus by rotating the stinger supporting ring 12 both the stinger and the hang off clamp 15 are rotated about a vertical axis.

[0030] In Fig. 4 is shown the state wherein the stinger support ring 12 is rotated over an angle of 90° with respect to the state shown in Fig. 3.

[0031] The hang off clamp 15 is preferably pivotable about a horizontal pivot axis. This horizontal pivot axis is preferably the same pivot axis as the pivot axis defined by the pivot connections 13 of the stinger 10. In this way the hang off clamp 15 can be pivoted when the stinger 10 is lifted towards the lifted position such that the launched pipeline is kept as straight as possible and is prevented from buckling.

[0032] Preferably the stinger 10 and the hang off clamp 15 are pivotable about the common horizontal pivot axis simultaneously as is shown in Figs 6a-6e.

[0033] On opposite sides of the lower end of the moonpool 9 are provided guide tracks 16 which in this example extend in transverse direction of the vessel 1, so that the remote non-active position here is to port side and/or starboard side of the operational position.

[0034] The stinger support ring 12 is connected to a stinger skidcart 17 (see Fig. 5) which in the specific embodiment shown is substantially U-shaped, wherein the portions 17a that form the legs of the U-shape are each able to travel along one of the guide tracks 16. The stinger 10 and the hang off clamp 15 are thus skiddable in transverse direction away from the firing line defined by the pipelaying equipment of the tower 6.

[0035] In use the vessel 1 with the tower 6 is used for the J-lay pipelaying technique. With this technique the previously launched pipeline is hanging off the hang off module comprising the hang off clamp 15 that engages the upper end of the already launched pipeline. The upper

section of the already launched pipeline, which in Figs 6a - 6e is indicated by reference numeral 20, is guided by the stinger 10 with its guiding members 11 (cf. Fig. 6a). A new pipe section is brought to the tower fire line by the loader 7. The line-up tool is used to line up the lower end of the new pipe section to the upper end of the previously launched pipeline. The lower end of the new pipe section is connected to the previously launched pipeline by welding or in any other suitable manner. After the new pipe section is connected to the previously launched pipeline the upper end of the new pipe section is connected to lowering means such as a moveable travel block and/or lowering wires.

[0036] In the specific embodiment shown in the figures, the MPT has a hoisting or travel block. The lowering wires are in this specific embodiment advantageously connected to the travel block. Next, the hang off clamp 15 can be released and the pipeline is lowered by a controlled lowering of the lowering means. Next, the hang off clamp 15 engages again on the launched pipeline, the lowering means is released and moved upwardly after which a new pipe section can be connected to the pipeline.

[0037] When an accessory such as an inline structure (ILS) or a pipeline end terminal (PLET) is to be attached to the upper end of the already launched pipeline, the method described below is preferably used:

[0038] The accessory is brought into the tower firing line by the loader 7. Next the accessory is connected to the upper end of the launched pipeline hanging from the hang off clamp 15, and the accessory is connected to the lowering means. The hang off clamp 15 can now be released from the launched pipeline whereby the accessory and the launched pipeline are suspending from the lowering means.

[0039] The stinger 10 is lifted from the lowermost position (cf. Fig. 2 and Fig. 6a) to the uppermost position (cf. Fig. 3 and Fig. 6e) by rotating it around the horizontal pivot axis by means of the actuators 14. With the rotation of the stinger 10 around the horizontal axis also the hang off clamp 15 is rotated around the horizontal pivot axis. The stinger 10 thus rolls off the suspending pipeline 20 as can be seen in Figs 6a - 6e.

[0040] Next, the stinger support ring 12 is rotated around the vertical axis over 90° (cf. Fig. 4) thereby rotating the stinger 10 and the hang of clamp 15 over 90°. The hang off clamp 15 is opened to such an extent that the inclined launched pipeline (cf. Fig. 6e) is not impeding the rotation of the hang off clamp 15 around the vertical axis.

[0041] Next, the lifted and rotated stinger 10 together with the hang off clamp 15 is skidded out of the firing line by means of the stinger skidcart 17 which is driven along the guiding tracks 16. Because the stinger 10 is lifted and rotated, in some vessel designs the stinger 10 can extend between the columns 5 of one of the hulls 4 without colliding with the corresponding hull 4 when it is skidded aside to the position as is illustrated in Fig. 5.

[0042] The accessory with the launched pipeline is low-

ered by the lowering means through the moonpool 9 beyond the position of the hang off module in the firing line. Then the hang off clamp 15 and the stinger 10 are skidded back towards the firing line (cf. Fig. 4), and are rotated around the vertical axis towards the position as is shown in Fig. 3.

[0043] The hang off clamp 15 engages the launched pipeline at the upper end of the accessory. A new pipe section is brought in the firing line and connected by welding to the upper end of the accessory. The lowering means are connected to the upper end of the new pipe section, and the hang off clamp 15 is released from the upper end of the already launched pipeline thereby suspending the pipeline from the lowering means. The pipeline is then lowered by means of the lowering means.

[0044] After the pipeline is lowered and gripped again by the hang off clamp 15 (cf. Fig. 6e), the stinger 10 is lowered by actuating the actuators 14 into its operational position as is shown in Fig. 2 and Fig. 6a and in which it can guide the launched pipeline. In the preferred embodiment the hang off clamp 15 and the stinger 10 have the same horizontal pivot axis as was mentioned above. Thus the stinger 10 and the hang off clamp 15 can be pivoted back simultaneously to the operational position as is shown in Figs. 6e to 6a. In this manner the stinger 10 forms the launched pipeline into the desired shape when the stinger 10 and the hang off clamp 15 are be pivoted back. Although the stinger 10 and the hang off clamp 15 are rotatable simultaneously around the horizontal axis, it is preferable that they can be moved independently from each other.

[0045] In Fig. 7 is shown a semi-submersible vessel 101 provided with a so called "dual Multi Purpose Tower" (dual MPT) 106 as pipe launching tower. The vessel 101 has two firing lines indicated with 109a and 109b respectively. The firing lines 109a, 109b extend next to the tower 106. The vessel 101 has a stinger 110 which can be rotated, pivoted and skidded as is described in the above with regard to stinger 10 shown in Figs 1-6. The vessel 101 furthermore has a cart 102 from which a riser string 103 hangs off. The cart 102 can be skidded aside from the firing line 109b towards the side of the vessel 101. By displacing the riser string 103 enough space is created such that the lifted and rotated stinger 110 can be skidded from the other firing line 109a to a position more or less in the centre of the vessel 101, between the firing line 109a and the hung off riser string 103. This embodiment has the advantage that a riser string 103 does not have to be disengaged from the vessel 101 in order to be able to displace the stinger 110 from the other firing line 109a.

[0046] It should be noted that the launch tower 6 and 106 in the embodiments shown are mounted stationary in a vertical position on the vessel 1, 101. This is however not necessary. It is for instance conceivable to have a launch tower which is tiltably mounted on the deck, wherein the pipeline is launched by the tilted tower and bended by the stinger in a direction transverse to the plane of the tower.

[0047] Figures 8a-t show an example of a vessel according to the invention as well as a method for pipelaying wherein use is made of said vessel. Parts that are identical or similar to parts described with reference to figures 1-7 have been denoted with the same reference numerals. Not shown in the figures 8a-t is the launch tower 6, which is considered to be mounted at or above the moonpool, preferably a vertical fixed orientation tower, preferably including one or more of the details explained with reference to tower 6. Depicted here is the vertical tower firing line 6a.

[0048] Also not shown in figures 8a-e is the launched pipeline, which will follow the path of the stinger 10 during those stages.

[0049] In figure 8a the loader 7 is shown in its lowered receiving position and an ILS 100 with a section of pipe fitted to its upper and lower end has been placed on the loader. The ILS here is depicted as a cubic object but this is merely to show possible extreme dimensions of such an ILS.

[0050] In fig. 8b the loader 7 has been pivoted upwards, e.g. with associated hydraulic cylinders, and reach an erected position, wherein the extremity to be connected to the launched pipeline is positioned above the upper end of said launched pipeline.

[0051] In fig. 8c the ILS 100 is suspended from the travel block and lowered onto the previously launched pipeline. Then the weld is made.

[0052] In fig. 8d the loader 7 has been retracted by translating the loader 7 away from the firing line 6a. The ILS 100 is lowered using the travel block as the hang off clamp has been opened temporarily.

[0053] In fig. 8e it is shown that the loader 7 includes an arrangement of an or more sheaves 7a, b along which a lowering wire 6b that has been detached from the travel block has been passed so as to connect said lowering wire to the pipe section and/or accessory 100 on the loader.

[0054] Now (see fig. 8f) the loader 7 with ILS 100, as well as the hang off module 15 and stinger 10 are pivoted to assume a rectilinear state (here referred to as the departure angle) of the launched pipeline through and below the hang off clamp 15, the ILS being in angular orientation aligned with the angle of the launched pipeline 20. The weight of the launched pipeline can now be carried by the lowering wire(s) so that the hang off clamp 15 can be released.

[0055] In figure 8g the stinger 10 is pivoted further upwards and in fig. 8h the stinger 10 (with the hang off clamp) is then rotate about a vertical axis, here so as to be oriented transverse with respect to the longitudinal axis of the vessel.

[0056] Then the stinger with hang off module are skidded to the port side of the vessel (see figure 8i).

[0057] The pipeline 20 with the ILS 100 is then lowered using the lowering wires 6b (fig. 8j), so that the ILS passes through the moonpool 9, unhindered by the stinger and hang off clamp which are in their remote non-active po-

sition.

[0058] The lowering is performed until the hang off module 15 can be brought to engage on the pipe section fitted to the upper end of the ILS, and then the stinger and hang off module are moved to the operation position again (fig. 8k) and the hang off module is made to engage on the pipe section (see figure 8i and 8m) by rotating the stinger and the hang off module along the vertical axis. The load is then transferred to the hang off module and the loader is being brought down to pick up the pipe (fig. 8m).

[0059] Now the lowering wire 6b is detached from the pipeline and the loader 7 can be used to pick up a new pipe section to be welded to the upper end of the ILS pipe section. (fig. 8n). The lowering wire 6b is connected to the upper end of said new pipe section.

[0060] By transferring the load to the lowering wire 6b, the hang off clamp can be released and the pipeline lowered further so that the ILS is now lowered to a level below the stinger 10. (see fig. 8o).

[0061] By pivoting and rotating the stinger 10 (fig. 8p and 8q) as well as engaging the clamp 15 with the pipeline the lowering wire can be released (fig. 8r) as well as the pipelaying operation continued as shown in the figures 8q-t. In fig. 8s it is shown that normal pipe lay operations may be resumed, and a pipe may be positioned in the loader. In fig. 8t the loader is upended, an ELUT lowered and the pipe being welded.

Claims

1. A marine pipelaying vessel (1) for laying an offshore pipeline, the vessel comprising:

- a pipeline launch tower (6) comprising pipe laying equipment,
- a hang off module (15) for supporting the weight of a previously launched pipeline,
- a stinger (10) for guiding the launched pipeline generally below the hang off module, said stinger being supported at its upper end by a stinger support assembly,

wherein the stinger support assembly is adapted to allow for displacement of the stinger to a remote non-active position,

characterized in that the stinger support assembly further includes a rotary connection (12) for the upper end of the stinger, so that the stinger is rotatable about a vertical rotation axis.

2. The vessel according to claim 1, wherein the stinger support assembly is adapted to allow for substantially horizontal displacement of the upper end of the stinger to the remote non-active position.

3. The vessel according to claim 1 or 2, wherein the

stinger support assembly further includes one or more of:

- a pivot connection (13) for the upper end of the stinger, such that the stinger is pivotable up and down between an uppermost position and a lowermost position, wherein preferably at least one actuator (14) is connected to the stinger to cause said up and down pivoting motion; 5
 - one or more guide tracks (16) mounted on the vessel, and further includes a stinger support member (12) which is displaceable along the one or more guide tracks, e.g. skiddable; 10
 - a stinger support ring (12), which stinger support ring is open on one side and rotatable around a vertical axis, preferably by means of an associated rotational drive means. 15
4. The vessel according to any one of the preceding claims, wherein the vessel is provided with a moonpool (9) through which the pipeline is launched, and wherein preferably the stinger support assembly includes one or more guide tracks mounted on the vessel on opposed sides of the moonpool, and further includes a stinger support member which is displaceable along the one or more guide tracks, e.g. skiddable. 20 25
 5. The vessel according to any one of the preceding claims, wherein the hang off module is carried by the stinger support assembly such that the hang off module is displaceable along with the stinger to a remote non-active position, wherein preferably the hang off module is pivotally carried by the stinger support assembly, preferably such that the upper end of the stinger and the hang off module are pivotable about a common substantially horizontal pivot axis, preferably the pivoting of the hang off module being independent from the pivoting of the stinger, and wherein preferably the hang off module and the stinger are mounted to a common support member. 30 35 40
 6. The vessel according to any one of the preceding claims, wherein the vessel further includes one or more of: 45
 - an accessory handling system for positioning an accessory above the launched pipeline suspended from the hang off module, which accessory is to be connected to the launched pipeline; 50
 - a movable loader (7) that allows to receive a pipe section and/or an accessory in a receiving position of the loader and allows to bring said pipe section and/or accessory such that the pipe section and/or accessory is connectable to the upper end of the launched pipeline supported by the hang off module, wherein preferably the loader is pivotable about a horizontal pivot axis 55

allowing to move the loader between a lowered receiving position and an erected position;
 - a welding station arranged and adapted to weld a pipe section to the upper end of the previously launched pipe section held by the hang off module.

7. The vessel according to any one of the preceding claims, wherein the vessel is a twin-hull semi-submersible vessel.
8. The vessel according to any one of the preceding claims, wherein the stinger support assembly is adapted to allow for displacement of the stinger to a remote non-active position that is located to the port side or starboard side of the active position.
9. The vessel according to any one of the preceding claims, wherein the launch tower includes a travel block that is displaceable up and down by one or more associated lowering wires and one or more winches, the travel block and lowering wire(s) and winch(es) being adapted to support and lower/raise the pipeline when released by the hang off module, and wherein preferably the vessel further includes a movable loader that allows to receive a pipe section and/or an accessory in a receiving position of the loader and allows to bring said pipe section and/or accessory such that the pipe section and/or accessory is connectable to the upper end of the launched pipeline supported by the hang off module, wherein the loader includes an arrangement of an or more sheaves along which a lowering wire that has been detached from the travel block can be passed so as to connect said lowering wire to the pipe section and/or accessory on by the loader.
10. The vessel according to any one of the preceding claims, wherein the tower is mounted stationary in vertical orientation on the vessel, wherein preferably the tower includes two hoisting devices each including a travel block, one or more lowering wires and one or more associated winches, the travel blocks being arranged on opposite sides of the tower, and wherein preferably the tower is a mast, the travel blocks being mounted on opposed exterior sides of the mast.
11. A method for laying an offshore pipeline, **characterized in that** use is made of a vessel according to any one of the preceding claims, wherein preferably the method comprising the following steps:
 - launching the pipeline into the sea via the stinger into the sea,
 - stopping the launch of pipeline, and hanging off the launched pipeline in the hang off module,
 - positioning the accessory above the upper end

of the launched pipeline by means of an accessory handling system,

- attaching the accessory to the launched pipeline when held in the hang off module and to attaching the accessory to lowering means, 5
- releasing the hang off module from the launched pipeline and suspending the accessory and the launched pipeline from the lowering means,
- displacing the stinger to the remote non-active position, 10
- displacing the hang off module to a remote non-active position,
- lowering the accessory with the launched pipeline by the lowering means to a position below the normal active position of the hang off module, 15
- repositioning the hang off module in its active position,
- hanging off the launched pipeline with accessory in the hang off module, 20
- provide a new pipe section and attach it to the upper end of the accessory,
- connect the lowering means to the new pipe section, 25
- releasing the hang off module and suspending the pipeline from the lowering means,
- lower the pipeline by means of the lowering means, 30
- reposition the stinger in its operational position; and wherein preferably the stinger is displaced in the following way:
- the stinger is lifted,
- rotating the lifted stinger around a vertical axis, preferably over 90°, and 35
- translating the lifted and rotated stinger to the remote non-active position.

12. The method according to claim 11, wherein the stinger is repositioned in its operational position by: 40

- translating the lifted and rotated stinger to its active position below the launch tower,
- rotating the stinger back around said vertical axis, and 45
- lowering the stinger from the lifted position to the operational angular orientation.

13. The method according any one of the claims 11-12, wherein the stinger and the hang off clamp are pivoted simultaneously about the horizontal pivot axis. 50

14. The method according to any one of the claims 11-13, wherein the stinger and the hang off module are translated, e.g. skidded simultaneously. 55

15. A marine pipelaying system for mounting on a marine pipelaying vessel, said system including:

- a hang off module for supporting the weight of a previously launched pipeline,
- a stinger for guiding the launched pipeline generally below the hang off module, said stinger being supported at its upper end by a stinger support assembly,

wherein the stinger support assembly is adapted to allow for displacement of the stinger to a remote non-active position,

characterized in that the stinger support assembly further includes a rotary connection (12) for the upper end of the stinger, so that the stinger is rotatable about a vertical rotation axis.

Patentansprüche

1. Unterwasserrohrleitungs-Verlegeschiff (1) zum Verlegen einer Hochseerohrleitung, wobei das Schiff umfasst:

- einen Rohrleitungsabföhrurm (6), der eine Rohrleitungsverlegevorrichtung umfasst,
- ein Abhängmodul (15) zum Tragen des Gewichtes einer zuvor abgeföhrten Rohrleitung, und
- einen Ausleger (10) zum Föhren der abgeföhrten Rohrleitung im wesentlichen unter dem Abhängmodul, wobei der Ausleger an seinem oberen Ende durch eine Auslegerträgeranordnung gehalten ist,

wobei die Auslegerträgeranordnung dazu eingerichtet ist, eine Verstellung des Auslegers in eine entfernte, inaktive Stellung zu gestatten,

dadurch gekennzeichnet, dass die Auslegerträgeranordnung weiterhin eine Drehverbindung (12) für das obere Ende des Auslegers umfasst, so dass der Ausleger um eine vertikale Drehachse gedreht werden kann.

2. Schiff nach Anspruch 1, bei dem die Auslegerträgeranordnung dazu eingerichtet ist, eine im wesentlichen horizontale Verstellung des oberen Endes des Auslegers in die entfernte, inaktive Stellung zu gestatten.

3. Schiff nach Anspruch 1 oder 2, bei dem die Auslegerträgeranordnung weiterhin wenigstens eines der folgenden Elemente umfasst:

- eine Schwenkverbindung (13) für das obere Ende des Auslegers, so dass der Ausleger zwischen einer obersten Stellung und einer untersten Stellung nach oben und unten geschwenkt werden kann, wobei vorzugsweise wenigstens ein Stellantrieb (14) mit dem Ausleger verbun-

- den ist, um die Schwenkbewegung nach oben und nach unten zu bewirken;
 - wenigstens eine Führungsschiene (16), die an dem Schiff angebracht ist und weiterhin ein Auslegerträgererelement (12) umfasst, das entlang der wenigstens einen Führungsschiene verstellbar, wie etwa verschiebbar ist; und
 - einen Auslegerträggerring (12), wobei der Auslegerträggerring auf einer Seite geöffnet ist und um eine vertikale Achse vorzugsweise mit Hilfe zugehöriger Rotationsantriebseinrichtungen drehbar ist.
4. Schiff nach einem der vorhergehenden Ansprüche, wobei das Schiff mit einer Lukenöffnung (9) versehen ist, durch die die Rohrleitung abgeführt wird, wobei vorzugsweise die Auslegerträgeranordnung eine oder mehrere Führungsschienen umfasst, die an dem Schiff auf gegenüberliegenden Seiten der Lukenöffnung angebracht sind, und weiterhin ein Auslegerträgererelement umfasst, das entlang der einen oder mehreren Führungsschienen verstellbar, wie etwa verschiebbar ist.
5. Schiff nach einem der vorhergehenden Ansprüche, bei dem das Abhängmodul von der Auslegerträgeranordnung derart gehalten ist, dass das Abhängmodul zusammen mit dem Ausleger in eine entfernte, inaktive Stellung verstellbar ist, wobei das Abhängmodul von der Auslegerträgeranordnung vorzugsweise derart schwenkbar gehalten ist, dass das obere Ende des Auslegers und das Abhängmodul um eine gemeinsame im wesentlichen horizontale Schwenkachse schwenkbar sind, wobei vorzugsweise das Schwenken des Abhängmoduls von dem Schwenken des Auslegers unabhängig ist und vorzugsweise das Abhängmodul und der Ausleger an einem gemeinsamen Trägererelement angebracht sind.
6. Schiff nach einem der vorhergehenden Ansprüche, wobei das Schiff weiterhin wenigstens eines der folgenden Elemente umfasst:
- ein Anbauteilhandhabungssystem zum Positionieren eines Anbauteils über der abgeführten Rohrleitung, die an dem Abhängmodul hängt, wobei das Anbauteil mit der abgeführten Rohrleitung zu verbinden ist;
 - eine bewegliche Zuführeinrichtung (7), die es gestattet, einen Rohrabschnitt und/oder ein Anbauteil in einer Aufnahmestellung der Zuführeinrichtung aufzunehmen, und es gestattet, diesen Rohrabschnitt und/oder das Anbauteil derart zuzuführen, dass der Rohrabschnitt und/oder das Anbauteil mit dem oberen Ende der abgeführten Rohrleitung verbunden werden können, die von dem Abhängmodul gehalten ist,
- wobei vorzugsweise die Zuführeinrichtung um eine horizontale Schwenkachse schwenkbar ist, wodurch es möglich ist, die Zuführeinrichtung zwischen einer abgesenkten Aufnahmestellung und einer aufrechten Stellung zu bewegen; und
 - eine Schweißstation, die angeordnet und dazu eingerichtet ist, einen Rohrabschnitt mit dem oberen Ende des zuvor abgeführten Rohrabschnittes zu verschweißen, der von dem Abhängmodul gehalten ist.
7. Schiff nach einem der vorhergehenden Ansprüche, wobei das Schiff ein halbversenkbares Doppelrumpfschiff ist.
8. Schiff nach einem der vorhergehenden Ansprüche, bei dem die Auslegerträgeranordnung dazu eingerichtet ist, eine Verstellung des Auslegers in eine entfernte inaktive Stellung zu gestatten, die sich backbord oder steuerbord der aktiven Stellung befindet.
9. Schiff nach einem der vorhergehenden Ansprüche, bei dem der Abfuhrturm einen Verschiebblock umfasst, der durch wenigstens ein zugehöriges Absenkseil und wenigstens eine Winde nach oben und unten verschoben werden kann, wobei der Verschiebblock und das Absenkseil (die Absenkseile) und die Winde (Winden) dazu eingerichtet sind, die Rohrleitung anzuheben/abzusenken, wenn sie von dem Abhängmodul freigegeben wird, und das Schiff vorzugsweise weiterhin eine bewegliche Zuführeinrichtung umfasst, die es gestattet, einen Rohrabschnitt und/oder ein Anbauteil in einer Aufnahmestellung der Aufnahmeeinrichtung aufzunehmen, und es gestattet, den Rohrabschnitt und/oder das Anbauteil derart zuzuführen, dass der Rohrabschnitt und/oder das Anbauteil mit dem oberen Ende der abgeführten Rohrleitung verbunden werden können, die von dem Abhängmodul gehalten wird, wobei die Zuführeinrichtung eine Anordnung wenigstens einer Seilrolle umfasst, entlang derer ein Absenkseil, das von dem Verschiebblock gelöst wurde, von der Zuführeinrichtung weitergeleitet werden kann, so dass das Absenkseil mit dem Rohrabschnitt und/oder dem Anbauteil verbunden wird.
10. Schiff nach einem der vorhergehenden Ansprüche, bei dem der Turm in der vertikalen Ausrichtung fest an dem Schiff angebracht ist, wobei der Turm vorzugsweise zwei Hebevorrichtungen, die jeweils einen Verschiebblock aufweisen, wenigstens ein Absenkseil und wenigstens eine zugehörige Winde umfasst, die Verschiebblöcke auf gegenüberliegenden Seiten des Turmes angeordnet sind und der Turm vorzugsweise ein Mast ist und die Verschiebblöcke auf gegenüberliegenden Außenseiten des Mastes angebracht sind.

11. Verfahren zum Verlegen einer Hochseerohrleitung, **dadurch gekennzeichnet, dass** ein Schiff nach einem der vorhergehenden Ansprüche verwendet wird, wobei das Verfahren vorzugsweise die folgenden Schritte umfasst:

- Abführen der Rohrleitung in die See über den Ausleger in die See,
 - Stoppen des Abführens der Rohrleitung und Abhängen der abgeführten Rohrleitung in dem Abhängmodul,
 - Positionieren des Anbauteils über dem oberen Ende der abgeführten Rohrleitung mit Hilfe eines Anbauteilhandhabungssystems,
 - Anbringen des Anbauteils an der abgeführten Rohrleitung, wenn sie in dem Abhängmodul gehalten ist, und anbringen des Anbauteils an der Absenkeinrichtung,
 - Lösen des Abhängmoduls von der abgeführten Rohrleitung und Aufhängen des Anbauteils und der abgeführten Rohrleitung an der Absenkeinrichtung,
 - Verstellen des Auslegers in die entfernte, nicht aktive Stellung,
 - Verstellen des Abhängmoduls in eine entfernte, nicht aktive Stellung,
 - Absenken des Anbauteils mit der abgeführten Rohrleitung durch die Absenkeinrichtung in eine Stellung unter der normalen aktiven Stellung des Abhängmoduls,
 - erneutes Positionieren des Abhängmoduls in seiner aktiven Stellung,
 - Abhängen der abgeführten Rohrleitung mit dem Anbauteil in dem Abhängmodul,
 - Bereitstellen eines neuen Rohrabschnittes und Anbringen desselben an dem oberen Ende des Anbauteils,
 - Verbinden der Absenkeinrichtung mit dem neuen Rohrabschnitt,
 - Lösen des Abhängmoduls und Aufhängen der Rohrleitung an der Absenkeinrichtung,
 - Absenken der Rohrleitung mit Hilfe der Absenkeinrichtung und
 - erneutes Positionieren des Auslegers in seiner Betriebsstellung;
 wobei der Ausleger vorzugsweise in der folgenden Art und Weise verstellt wird:
 - Anheben des Auslegers,
 - Drehen des angehobenen Auslegers um eine vertikale Achse vorzugsweise über 90° und
 - Verschieben des angehobenen und gedrehten Auslegers in die entfernte, nicht aktive Stellung.

12. Verfahren nach Anspruch 11, bei dem der Ausleger erneut in seiner Betriebsstellung positioniert wird durch:

- Verschieben des angehobenen und gedrehten

Auslegers in seine aktive Stellung unter den Abföhrturm,

- Drehen des Auslegers zurück um seine vertikale Achse, und
 - Absenken des Auslegers aus der angehobenen Stellung in die Betriebswinkelausrichtung.

13. Verfahren nach einem der Ansprüche 11 bis 12, bei dem der Ausleger und die Abhängklaue gleichzeitig um die horizontale Schwenkachse geschwenkt werden.

14. Verfahren nach einem der Ansprüche 11 bis 13, bei dem der Ausleger und das Abhängmodul verstellt, d.h. gleichzeitig verschoben werden.

15. Unterwasserrohrleitungs-Verlegesystem (1) zum Anbringen an einem Unterwasserrohrleitungs-Verlegeschiff, wobei das System umfasst:

- ein Abhängmodul zum Tragen des Gewichtes einer zuvor abgeführten Rohrleitung und
 - einen Ausleger zum Führen der abgeführten Rohrleitung im wesentlichen unter dem Abhängmodul, wobei der Ausleger an seinem oberen Ende von einer Auslegerträgeranordnung gehalten ist,

wobei die Auslegerträgeranordnung dazu eingerichtet ist, ein Verstellen des Auslegers in eine entfernte, inaktive Stellung zu gestatten,

dadurch gekennzeichnet, dass die Auslegerträgeranordnung weiterhin eine Drehverbindung (12) für das obere Ende des Auslegers umfasst, so dass der Ausleger um eine vertikale Drehachse gedreht werden kann.

Revendications

1. Navire de pose de pipeline marin (1) pour poser un pipeline au large, le navire comprenant :

- une tour de lancement de pipeline (6) comprenant un équipement de pose de pipeline,
 - un module de suspension (15) pour supporter le poids d'un pipeline précédemment lancé,
 - un guide (10) pour guider le pipeline lancé généralement au-dessous du module de suspension, ledit guide étant supporté à son extrémité supérieure par un ensemble de support de guide,

dans lequel l'ensemble de support de guide est conçu pour permettre un déplacement du guide à une position non active à distance,

caractérisé en ce que l'ensemble de support de guide comprend en outre une liaison rotative (12)

pour l'extrémité supérieure du guide, de sorte que le guide puisse tourner autour d'un axe de rotation vertical.

2. Navire selon la revendication 1, dans lequel l'ensemble de support de guide est conçu pour permettre un déplacement sensiblement horizontal de l'extrémité supérieure du guide à une position non active à distance. 5
3. Navire selon la revendication 1 ou 2, dans lequel l'ensemble de support de guide comprend en outre l'un ou plusieurs : 10
 - d'une liaison pivotante (13) pour l'extrémité supérieure du guide, de sorte que le guide soit capable de pivoter vers le haut et vers le bas entre une position la plus haute et une position la plus basse, dans lequel, de préférence, au moins un actionneur (14) est relié au guide pour provoquer ledit mouvement pivotant vers le haut et vers le bas ; 15
 - d'un ou de plusieurs rails de guidage (16) montés sur le navire, et comprend en outre un élément de support de guide (12) qui peut être déplacé le long desdits un ou plusieurs rails de guidage, par exemple par glissement ; 20
 - d'une bague de support de guide (12), laquelle bague de support de guide est ouverte d'un côté et peut tourner autour d'un axe vertical, de préférence à l'aide de moyens d'entraînement en rotation associés. 25
4. Navire selon l'une quelconque des revendications précédentes, dans lequel le navire est pourvu d'un puits central (9) à travers lequel le pipeline est lancé, et dans lequel, de préférence, l'ensemble de support de guide comprend un ou plusieurs rails de guidage montés sur le navire sur des côtés opposés du puits central, et comprend en outre un élément de support de guide qui peut être déplacé le long desdits un ou plusieurs rails de guidage, par exemple par glissement. 30
5. Navire selon l'une quelconque des revendications précédentes, dans lequel le module de suspension est supporté par l'ensemble de support de guide de sorte que le module de suspension puisse être déplacé avec le guide vers une position non active à distance, dans lequel, de préférence, le module de suspension est supporté de manière pivotante par l'ensemble de support de guide, de préférence de sorte que les extrémités supérieures du guide et du module de suspension soient capables de pivoter autour d'un axe de pivotement sensiblement horizontal commun, de préférence le pivotement du module de suspension étant indépendant du pivotement du guide, et dans lequel, de préférence, le mo- 35

dule de suspension et le guide sont montés sur un élément de support commun.

6. Navire selon l'une quelconque des revendications précédentes, dans lequel le navire comprend en outre l'un ou plusieurs :
 - d'un système de gestion d'accessoire pour positionner un accessoire au-dessus du pipeline lancé suspendu au module de suspension, lequel accessoire doit être relié au pipeline lancé ;
 - d'un chargeur mobile (7) qui permet de recevoir une section de pipeline et/ou un accessoire dans une position de réception du chargeur et qui permet d'amener ladite section de pipeline et/ou ledit accessoire de sorte que la section de pipeline et/ou l'accessoire puissent être reliés à l'extrémité supérieure du pipeline lancé supporté par le module de suspension, dans lequel, de préférence, le chargeur est capable de pivoter autour d'un axe de pivotement horizontal permettant de déplacer le chargeur entre une position de réception abaissée et une position redressée ;
 - d'un poste de soudage agencé et conçu pour souder une section de pipeline à l'extrémité supérieure de la section de pipeline précédemment lancée maintenue par le module de suspension.
7. Navire selon l'une quelconque des revendications précédentes, dans lequel le navire est un navire semi-submersible à coque double.
8. Navire selon l'une quelconque des revendications précédentes, dans lequel l'ensemble de support de guide est conçu pour permettre un déplacement du guide vers une position non active à distance qui est située vers bâbord ou tribord de la position active. 40
9. Navire selon l'une quelconque des revendications précédentes, dans lequel la tour de lancement comprend un bloc de déplacement qui peut être déplacé vers le haut et vers le bas par un ou plusieurs câbles d'abaissement associés et un ou plusieurs treuils, le bloc de déplacement et le ou les câbles d'abaissement et le ou les treuils étant conçus pour supporter et abaisser/élever le pipeline lorsqu'il est libéré par le module de suspension, et dans lequel, de préférence, le navire comprend en outre un chargeur mobile qui permet de recevoir une section de pipeline et/ou un accessoire dans une position de réception du chargeur et qui permet d'amener ladite section de pipeline et/ou ledit accessoire de sorte que la section de pipeline et/ou l'accessoire puissent être reliés à l'extrémité supérieure du pipeline lancé supporté par le module de suspension, dans lequel le chargeur comprend un agencement d'une ou de plu- 45

sieurs poulies à gorge le long desquelles un câble d'abaissement qui a été détaché du bloc de déplacement peut être passé de manière à relier ledit câble d'abaissement à la section de pipeline et/ou à l'accessoire par le chargeur.

10. Navire selon l'une quelconque des revendications précédentes, dans lequel la tour est montée fixement dans une orientation verticale sur le navire, dans lequel, de préférence, la tour comprend deux dispositifs de levage comprenant chacun un bloc de déplacement, un ou plusieurs câbles d'abaissement et un ou plusieurs treuils associés, les blocs de déplacement étant agencés sur des côtés opposés de la tour, et dans lequel, de préférence, la tour est un mât, les blocs de déplacement étant montés sur des côtés extérieurs opposés du mât.

11. Procédé pour poser un pipeline au large, **caractérisé en ce qu'un** navire selon l'une quelconque des revendications précédentes est utilisé, dans lequel de préférence le procédé comprend les étapes suivantes :

- de lancement du pipeline dans la mer par l'intermédiaire du guide dans la mer,
- d'arrêt du lancement du pipeline, et de suspension du pipeline lancé dans le module de suspension,
- de positionnement de l'accessoire au-dessus de l'extrémité supérieure du pipeline lancé au moyen d'un système de gestion d'accessoire,
- de fixation de l'accessoire au pipeline lancé lorsqu'il est maintenu dans le module de suspension et de fixation de l'accessoire à des moyens d'abaissement,
- de libération du module de suspension du pipeline lancé et de suspension de l'accessoire et du pipeline lancé aux moyens d'abaissement,
- de déplacement du guide vers la position non active à distance,
- de déplacement du module de suspension à une position non active à distance,
- d'abaissement de l'accessoire avec le pipeline lancé par les moyens d'abaissement à une position au-dessous de la position active normale du module de suspension,
- de repositionnement du module de suspension dans sa position active,
- de suspension du pipeline lancé avec un accessoire dans le module de suspension,
- de fourniture d'une nouvelle section de pipeline et de fixation de celle-ci à l'extrémité supérieure de l'accessoire,
- de liaison des moyens d'abaissement à la nouvelle section de pipeline,
- de libération du module de suspension et de suspension du pipeline aux moyens d'abaisse-

ment,

- d'abaissement du pipeline à l'aide des moyens d'abaissement,
 - de repositionnement du guide dans sa position de fonctionnement ;
- et dans lequel, de préférence, le guide est déplacé de la manière suivante :
- le guide est levé,
 - le guide levé est tourné autour d'un axe vertical, de préférence de 90°, et
 - le guide levé et tourné est translaté vers la position non active à distance.

12. Procédé selon la revendication 11, dans lequel le guide est repositionné dans sa position de fonctionnement en :

- translatant le guide levé et tourné vers sa position active au-dessous de la tour de lancement,
- tournant le guide en arrière autour dudit axe vertical, et
- abaissant le guide de la position levée vers l'orientation angulaire de fonctionnement.

13. Procédé selon l'une quelconque des revendications 11 - 12, dans lequel le guide et la pince de suspension sont pivotés simultanément autour de l'axe de pivotement horizontal.

14. Procédé selon l'une quelconque des revendications 11 - 13, dans lequel le guide et le module de suspension sont translattés, par exemple glissés simultanément.

15. Système de pose de pipeline marin destiné à être monté sur un navire de pose de pipeline marin, ledit système comprenant :

- un module de suspension pour supporter le poids d'un pipeline lancé précédemment,
- un guide pour guider le pipeline lancé généralement au-dessous du module de suspension, ledit guide étant supporté à son extrémité supérieure par un ensemble de support de guide,

dans lequel l'ensemble de support de guide est conçu pour permettre un déplacement du guide vers une position non active à distance,

caractérisé en ce que l'ensemble de support de guide comprend en outre une liaison rotative (12) pour l'extrémité supérieure du guide, de sorte que le guide puisse tourner autour d'un axe de rotation vertical.

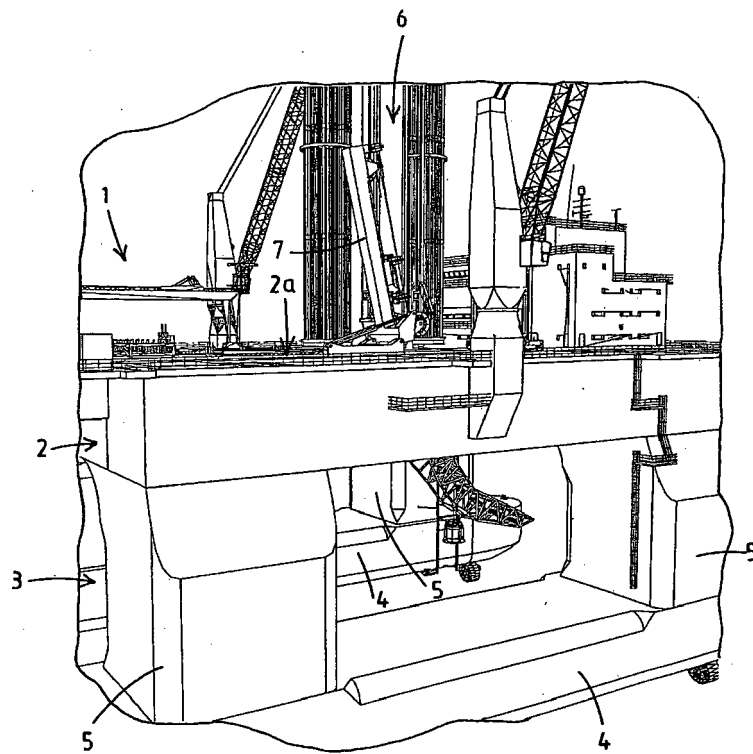


Fig.1

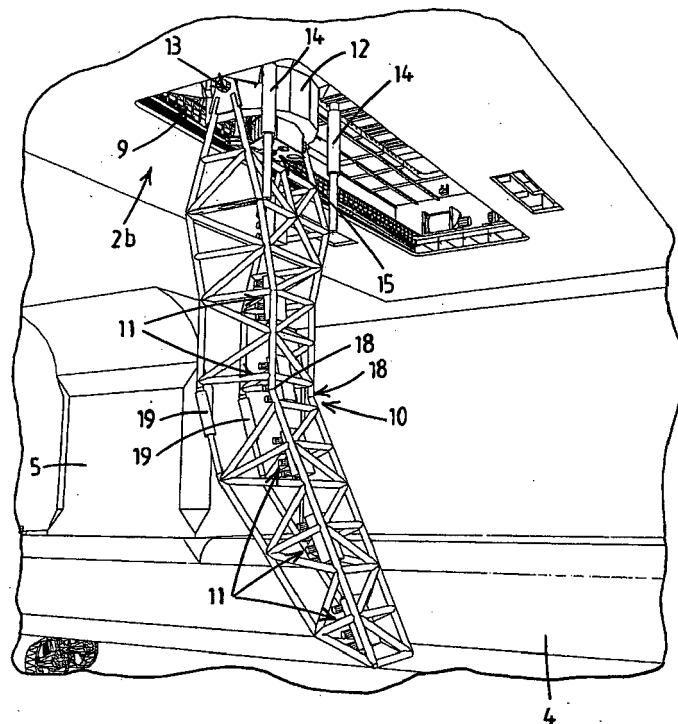


Fig.2

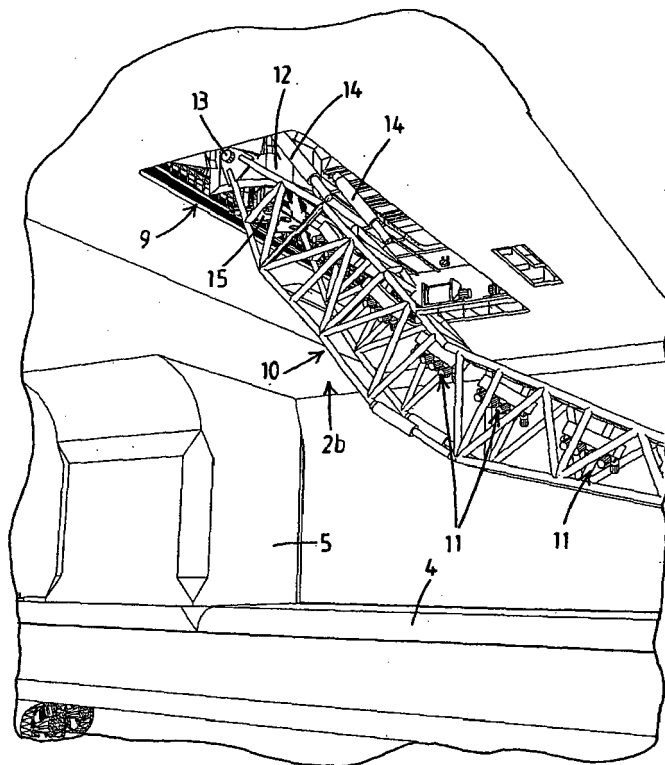


Fig.3

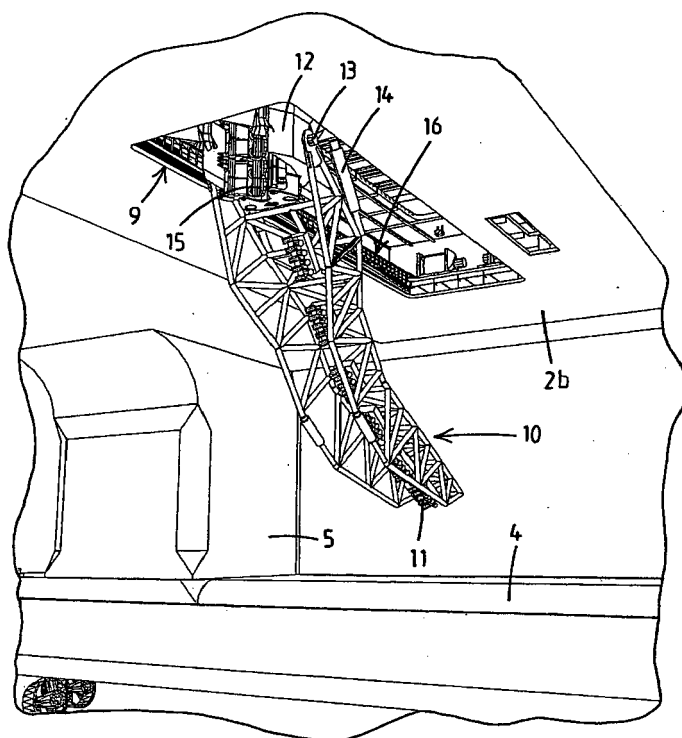


Fig.4

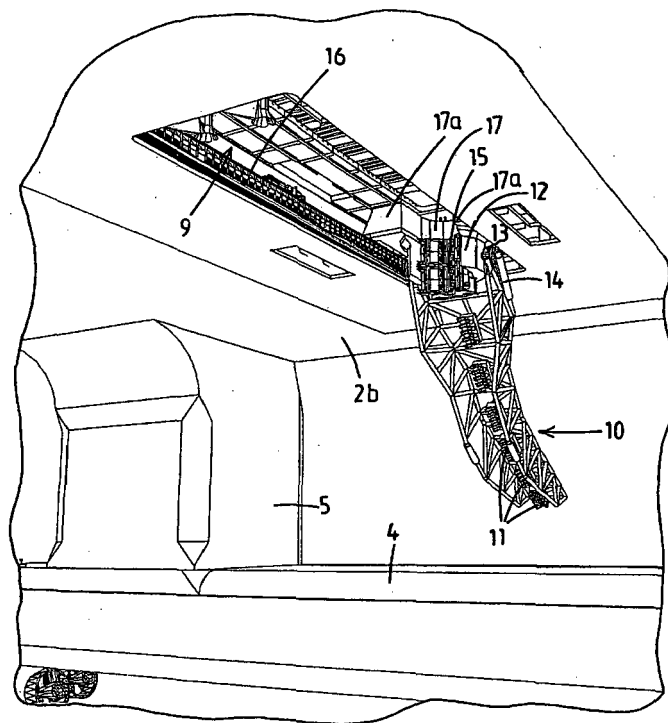


Fig.5

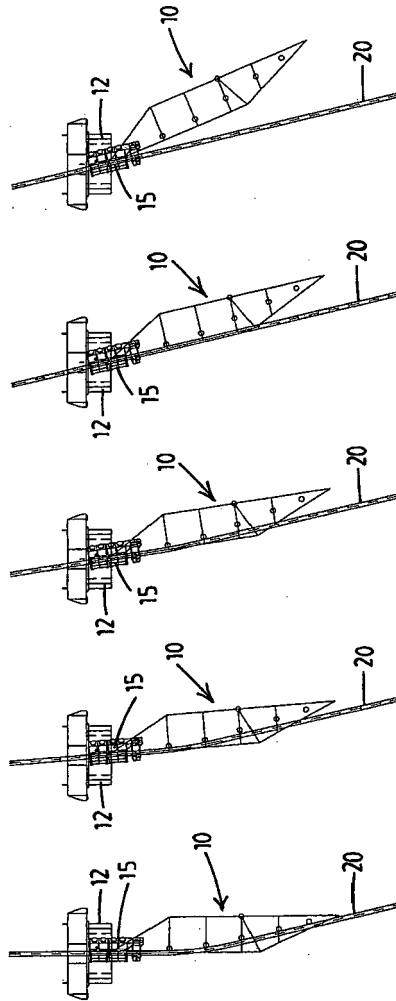


Fig.6e

Fig.6d

Fig.6c

Fig.6b

Fig.6a

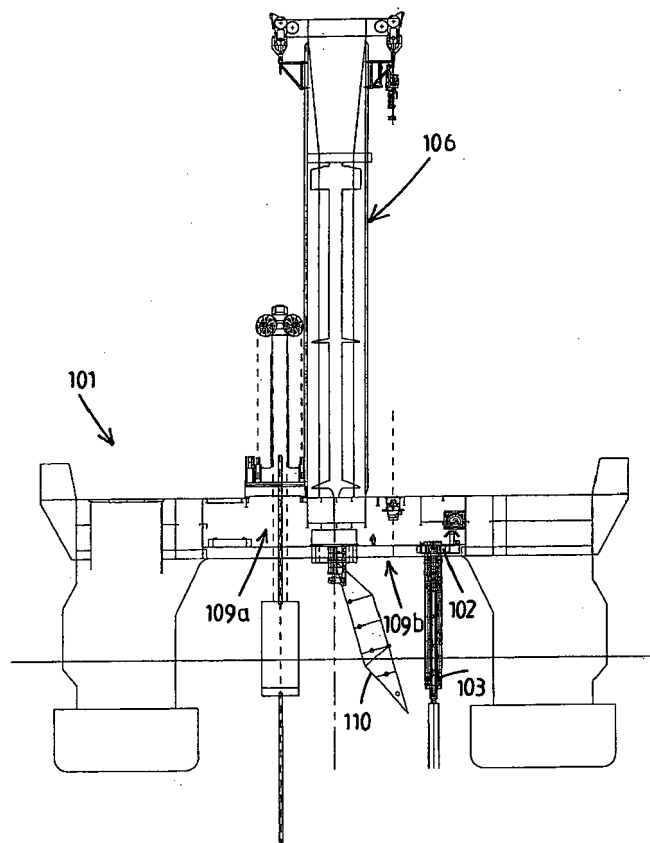


Fig.7

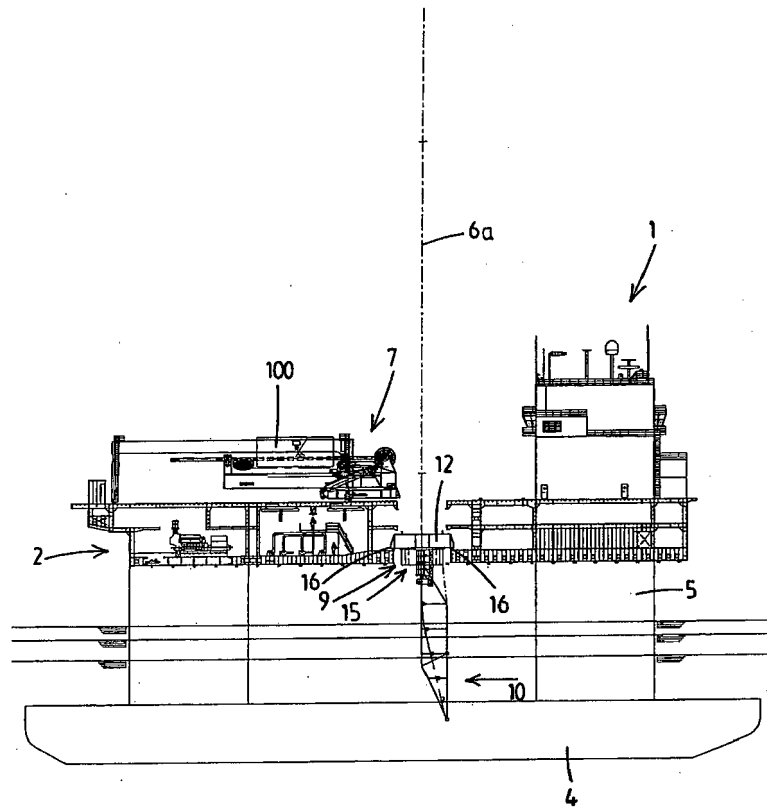


Fig.8a

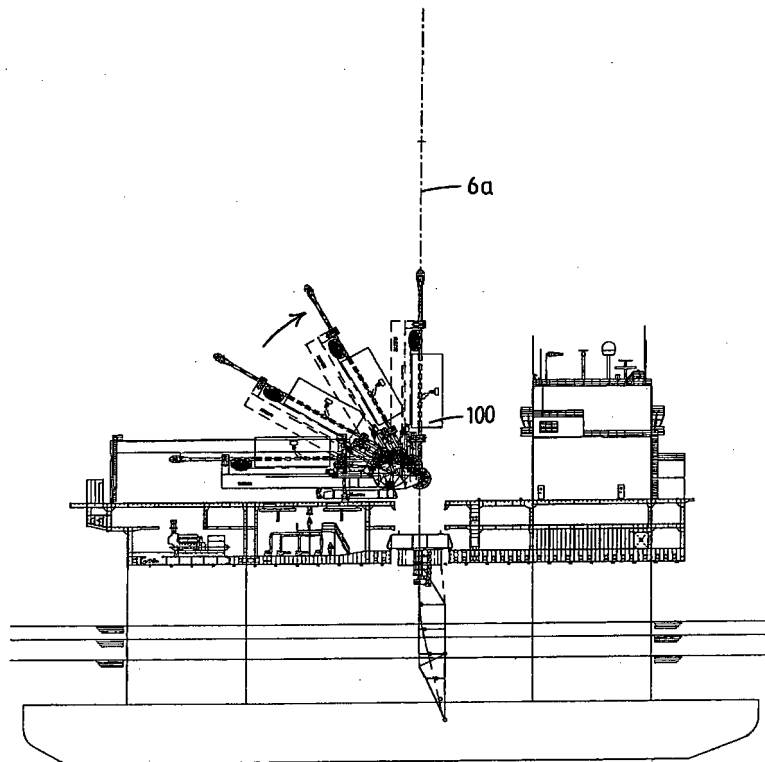


Fig.8b

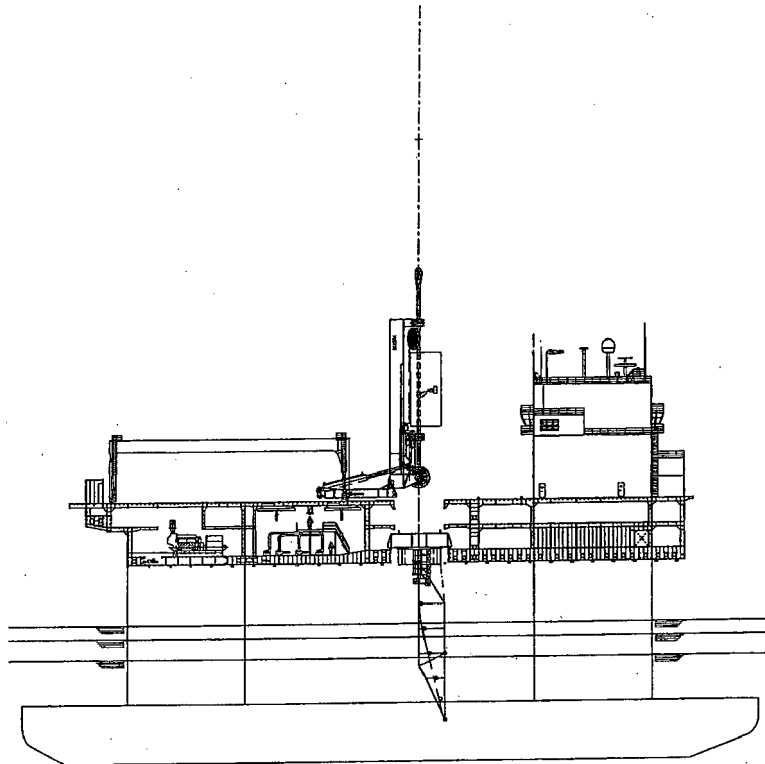


Fig.8c

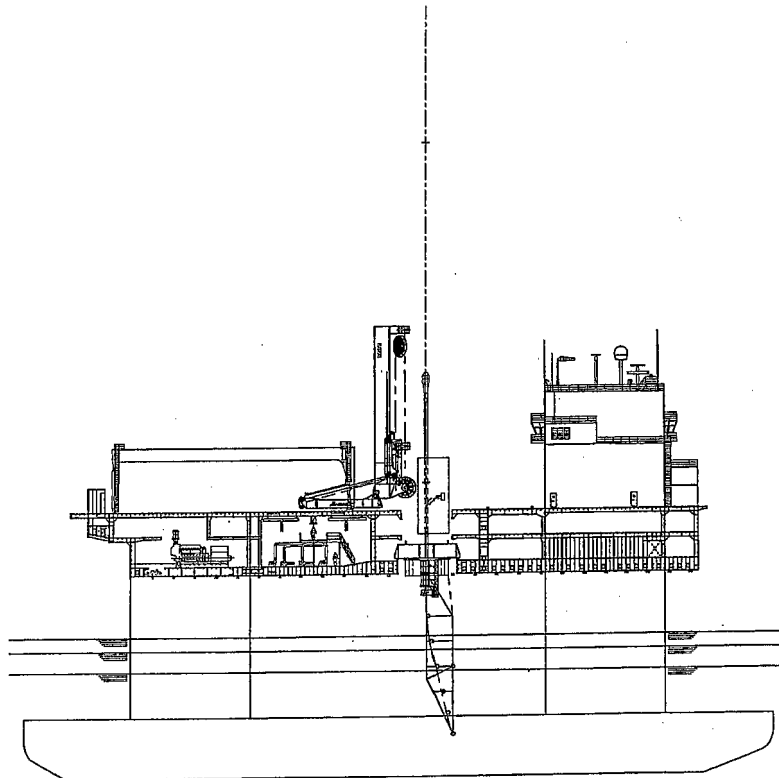


Fig.8d

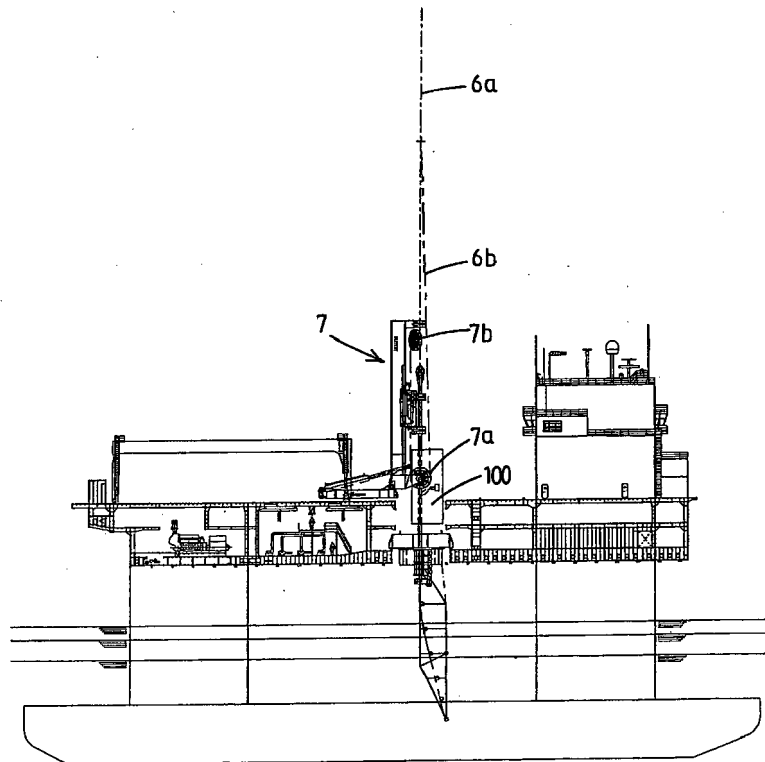


Fig.8e

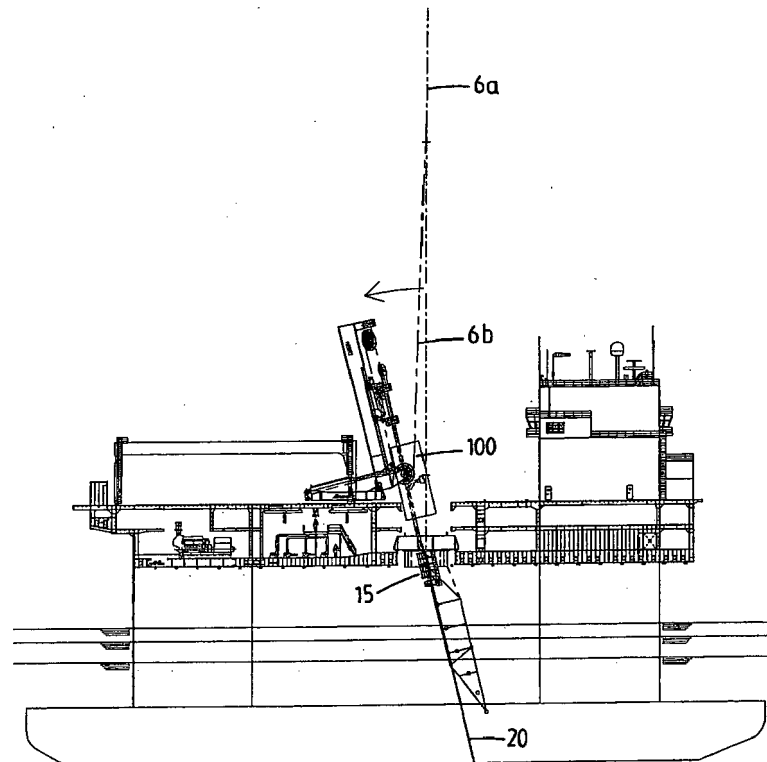


Fig.8f

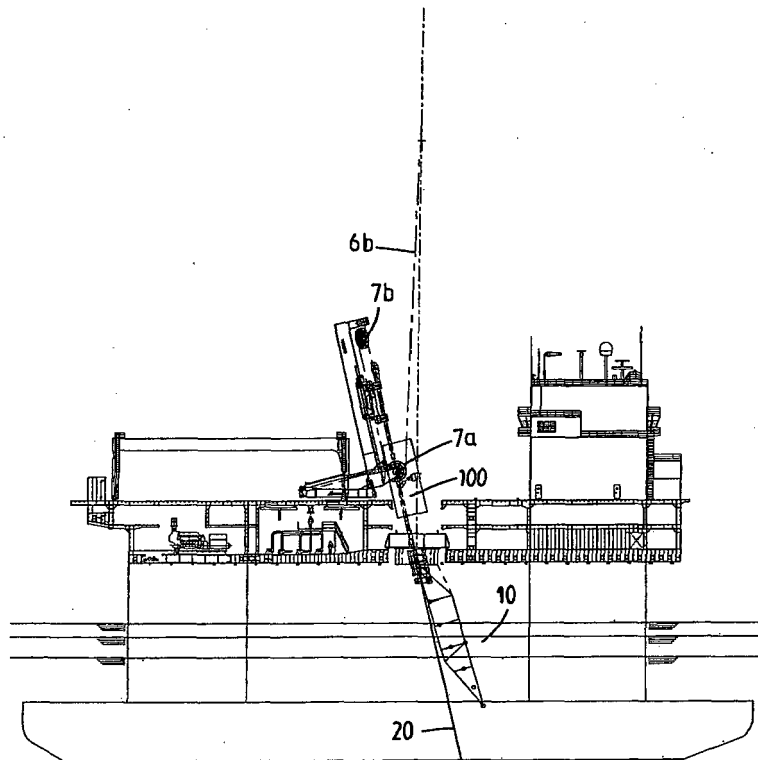


Fig.8g

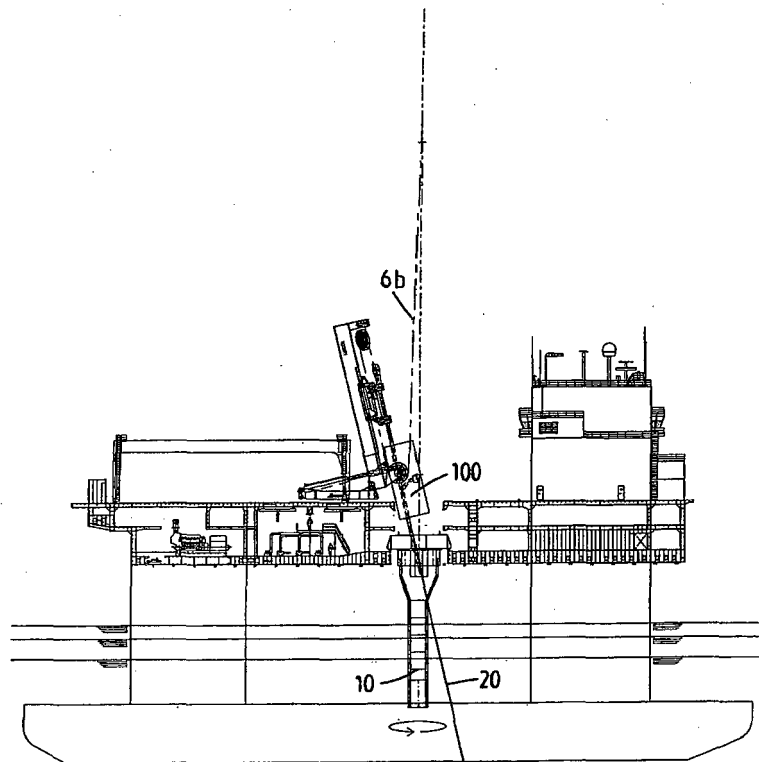


Fig.8h

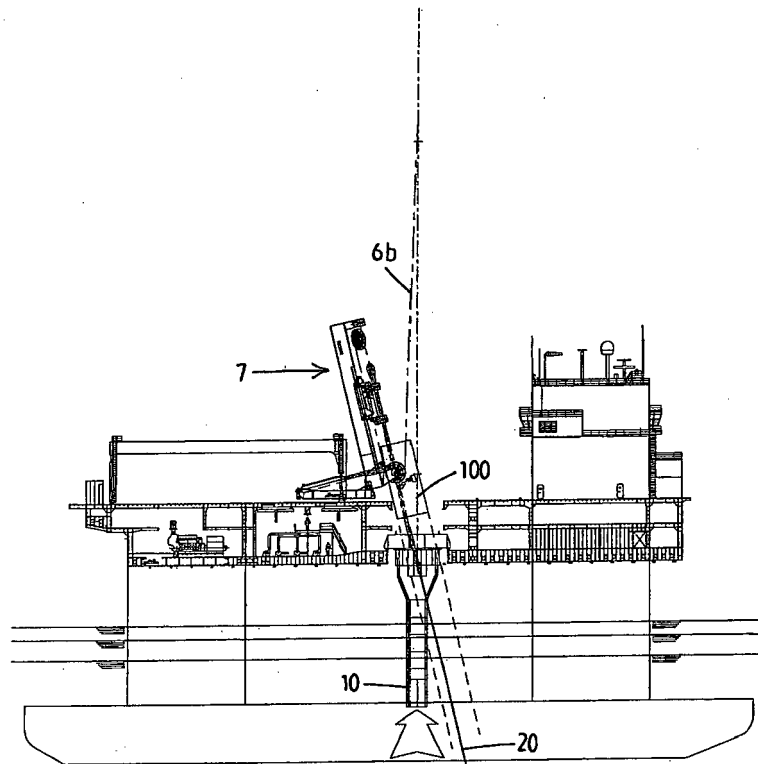


Fig.8i

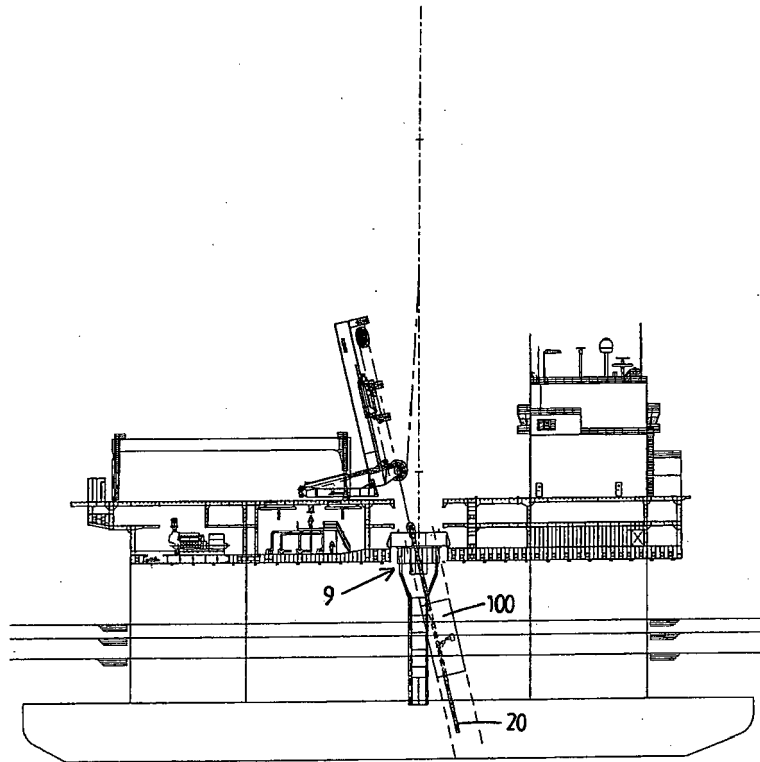


Fig.8j

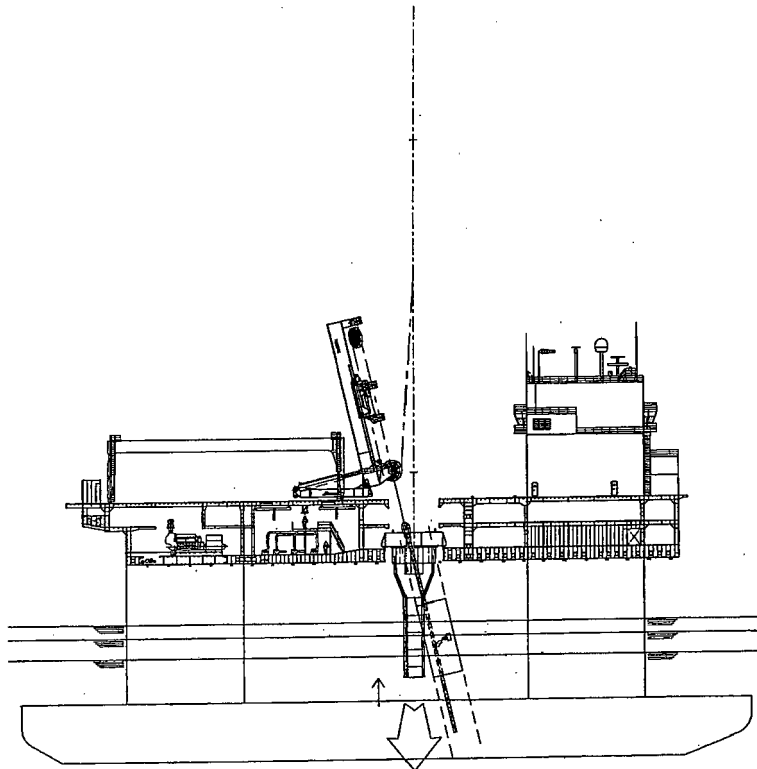


Fig.8k

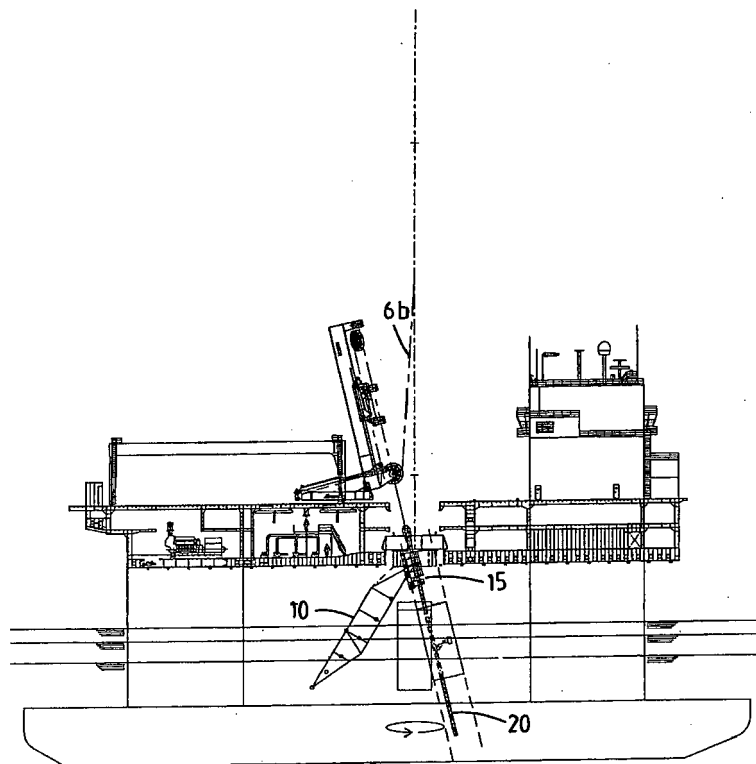


Fig.81

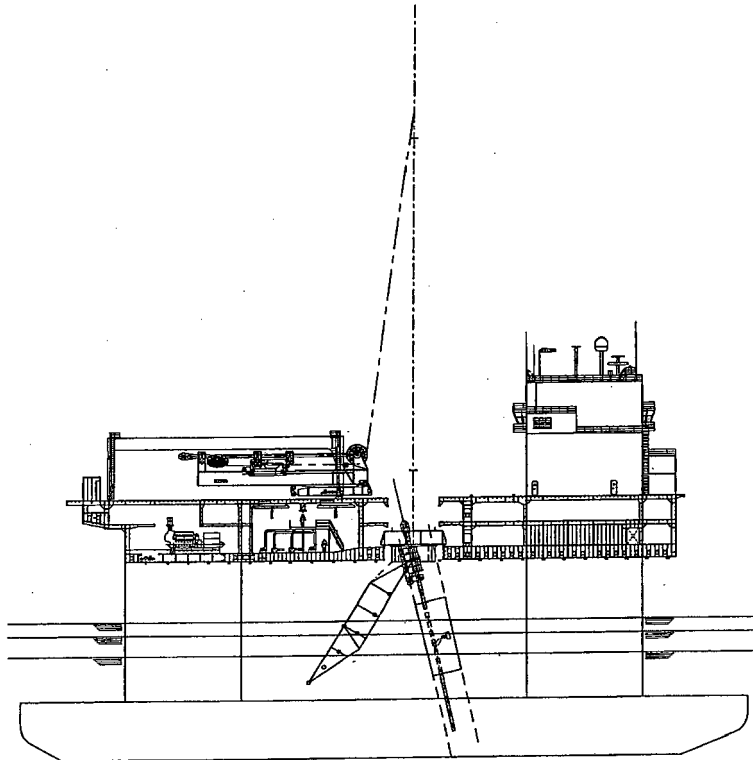


Fig.8m

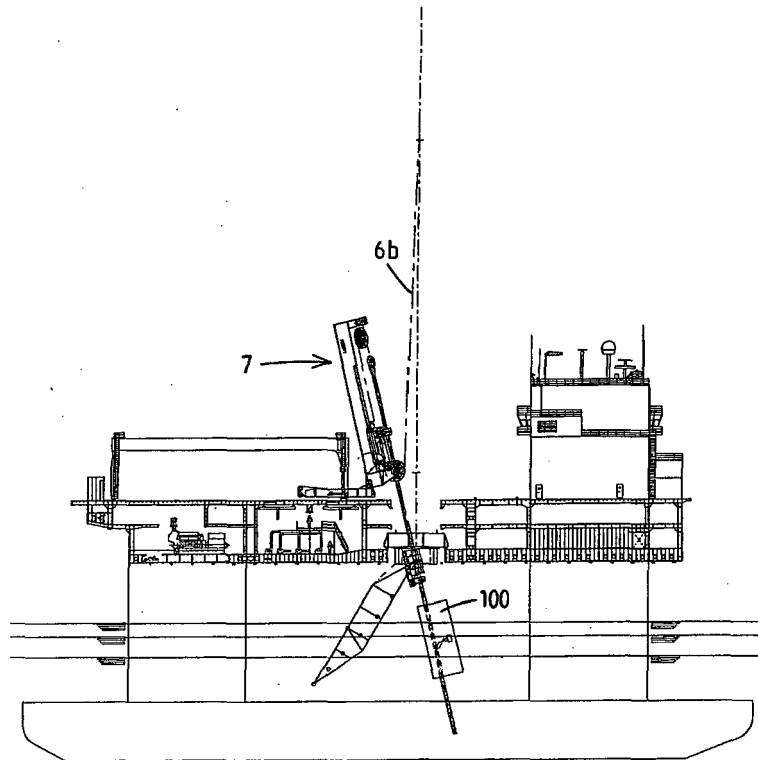


Fig.8n

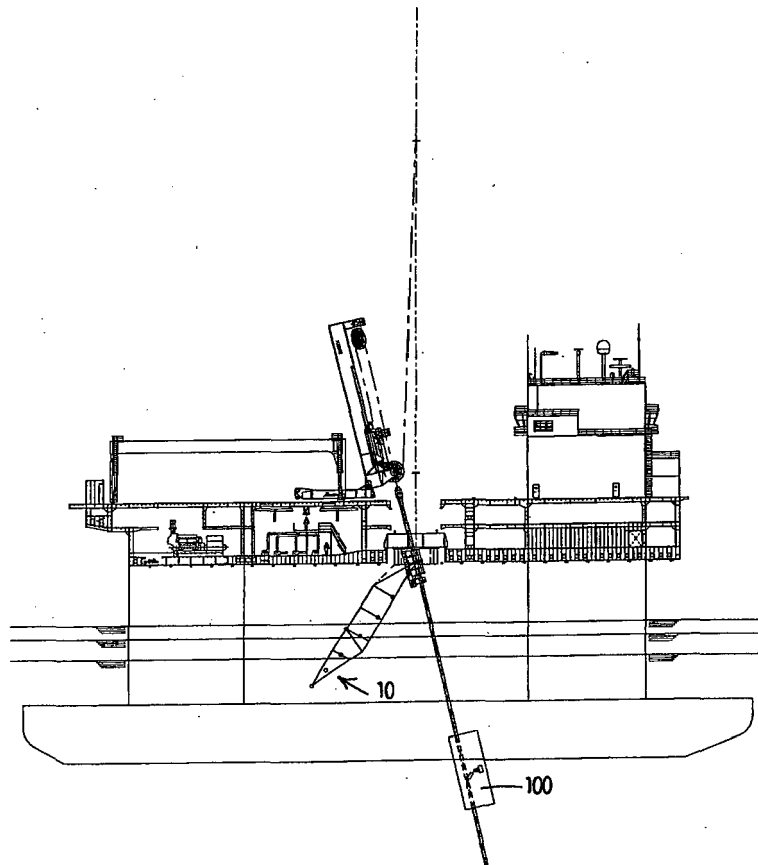


Fig.8o

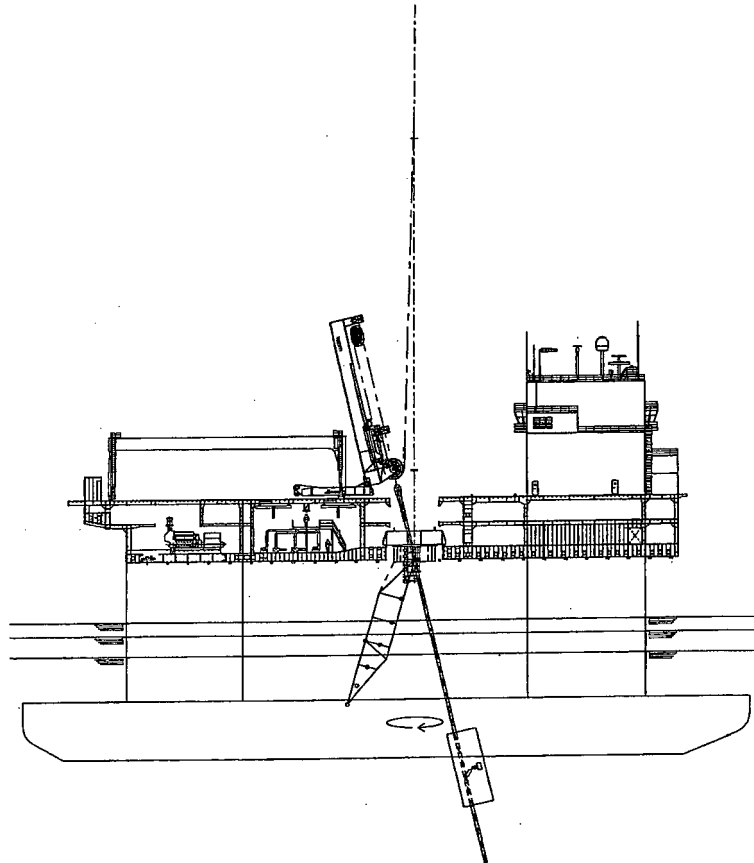


Fig.8p

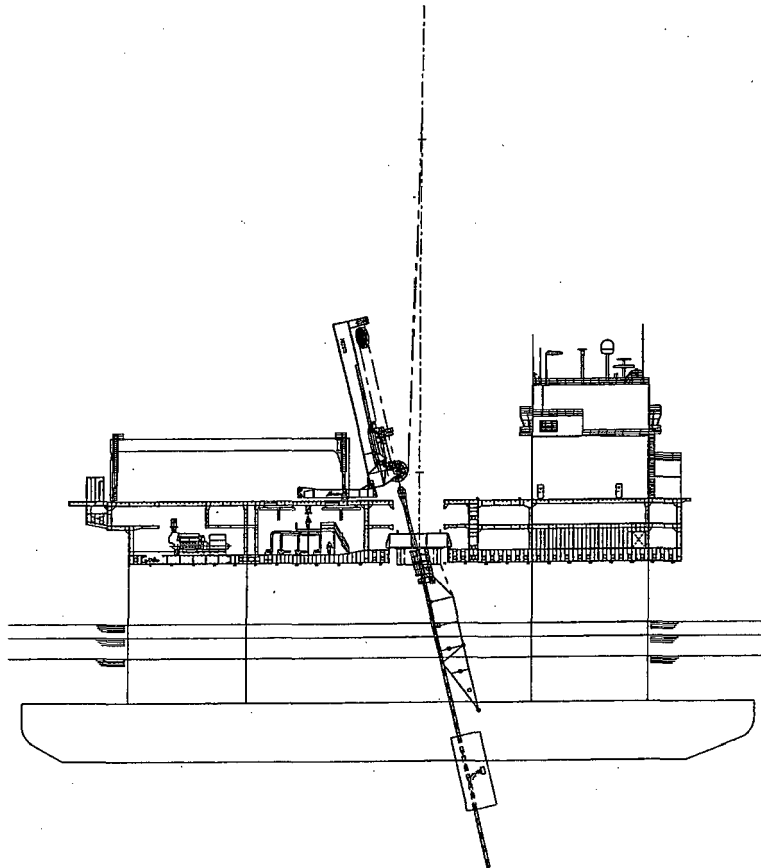


Fig.8q

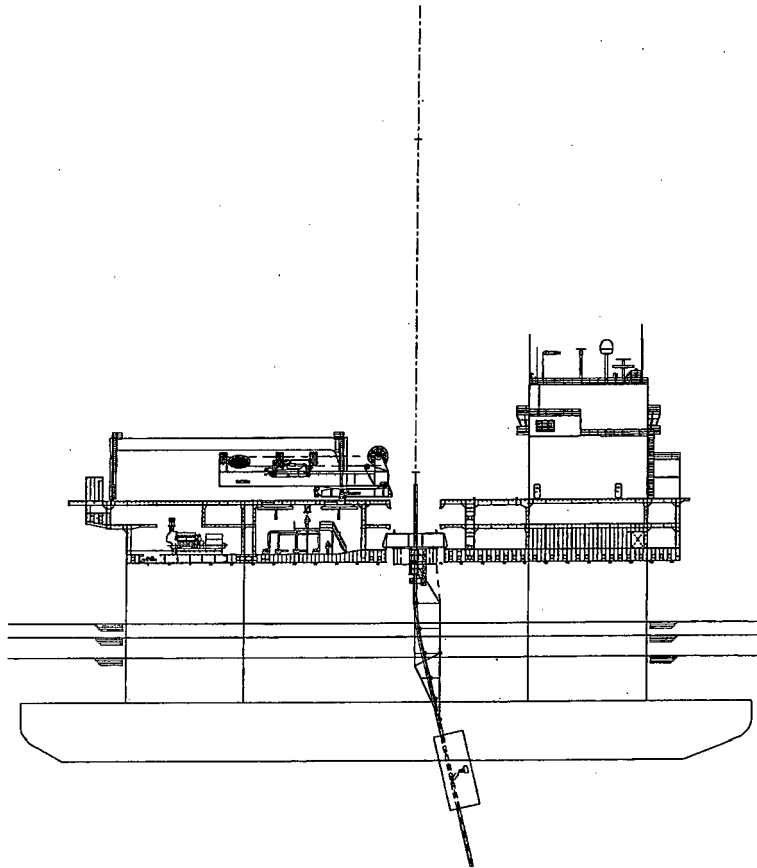


Fig.8r

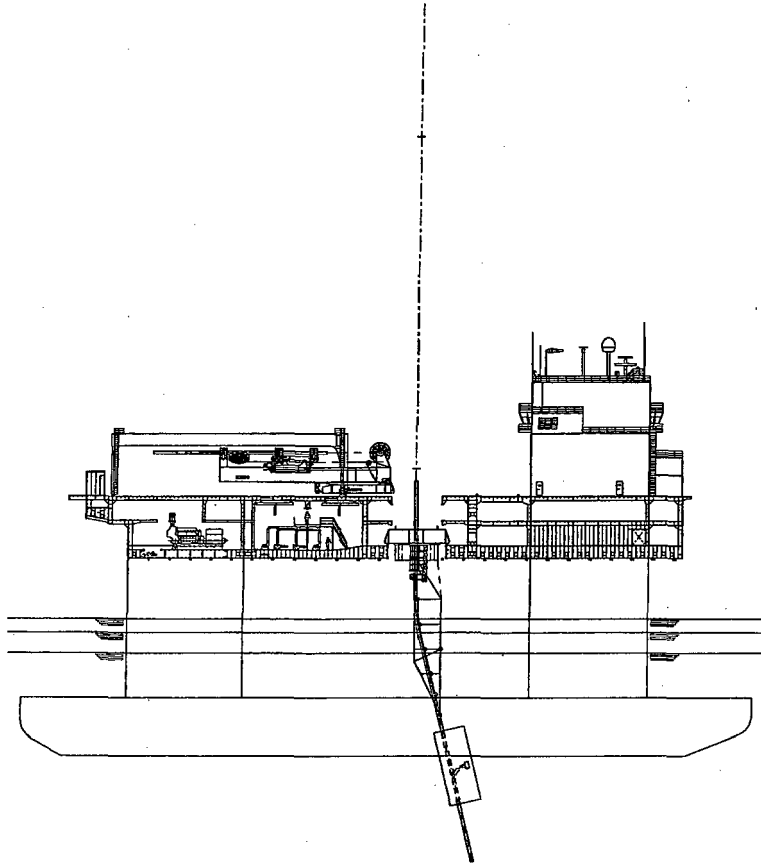


Fig.8s

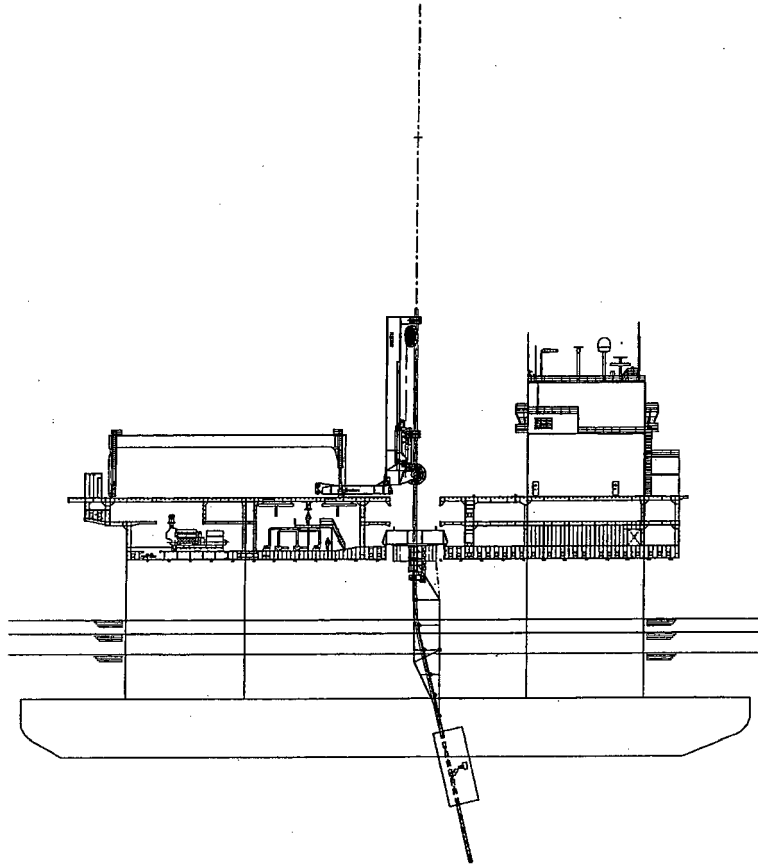


Fig.8t

REFERENCES CITED IN THE DESCRIPTION

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