(19) DANMARK

(10) DK/EP 3526411 T3

(12) Oversættelse af europæisk patentskrift

Patent- og Varemærkestyrelsen

(51) Int.Cl.: *E 02 B 17/00 (2006.01)* *B 63 B 21/50 (2006.01)* *B 63 B 27/30 (2006.01)*
B 63 B 35/00 (2020.01) *B 63 B 35/44 (2006.01)* *B 63 B 75/00 (2020.01)*
F 03 D 13/10 (2016.01) *F 03 D 13/25 (2016.01)*

(45) Oversættelsen bekendtgjort den: **2022-01-03**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2021-10-06**

(86) Europæisk ansøgning nr.: **18854180.9**

(86) Europæisk indleveringsdag: **2018-08-03**

(87) Den europæiske ansøgnings publiceringsdag: **2019-08-21**

(86) International ansøgning nr.: **US2018045193**

(87) Internationalt publikationsnr.: **WO2019050645**

(30) Prioritet: **2017-09-05 US 201715695802**

(84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

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(54) Benævnelse: **OFFSHORE STRUKTURSAMMENKOBLINGSSYSTEM OG INSTALLATIONSMETODE**

(56) Fremdragne publikationer:
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DESCRIPTION

BACKGROUND OF THE INVENTION

1. Field of the Invention.

[0001] The present invention as defined by the independent claims relates to a method and system for installing equipment offshore on a floating hull, and more particularly relates to installing a wind turbine generator on a floating hull offshore without using a large offshore crane.

2. Description of the Related Art.

[0002] In the field of floating offshore alternative energy projects, installation costs are significant enough to drive the project away from being economically feasible in certain environments. Typical installation of a topside component, such as a wind turbine, on a floating hull, such as a spar buoy, requires the use of a very expensive large offshore crane. The limited numbers of such cranes along with their operational and mobilization costs combine to drive up their expense and drive down their availability on demand.

[0003] The use of a standard barge/fork-type vessel for installation of the wind turbine can save substantial costs. However, the motion response to the wave environment of a spar buoy and a barge are very different. As a result, large relative motions between the spar buoy and the barge with the wind turbine generator may exist during installation, making it very difficult and dangerous to mate the wind turbine generator to the spar buoy.

[0004] Assignee's U.S. Patent No. 9,725,870 B2 (corresponding to US 2016/160836A1) discloses an assembly and method of mating a wind turbine generator to a spar buoy without using a large offshore crane. The patent discloses two large trusses (one on the wind turbine generator and one on the spar buoy) containing stabbing guides and shock absorbers to reduce the loading forces during mating. Although a workable solution, the assembly is often too expensive because of the required adaptations to the spar buoy and wind turbine structure, which is an additional cost for every wind turbine generator installed on a spar buoy.
WO 2010/032044 discloses an offshore vessel mooring and riser inboarding system. The mooring system incorporates a mooring element latching assembly for releasably latching a mooring element to a gimbal arrangement. The latching assembly is supported by a cantilever connector assembly mounted in the region of the vessel bow. The mooring system includes an outer gimbal member in the form of a gimbal ring which is rotatably coupled to the cantilever connector assembly via trunnions. An inner gimbal member in the form of a gimbal ring is also provided, and is mounted within the outer gimbal and rotatably coupled to the outer gimbal via

trunnions.

[0005] It is desirable to have an installation system and method of installing equipment offshore on a floating hull, such as a spar buoy, without using a large offshore crane. It is further desirable that the system and method be adapted for installing a wind turbine generator on the spar buoy. It is desirable that the system and method is cost effective, safe, is reusable and able to be performed in larger sea states.

SUMMARY OF THE INVENTION

[0006] According to one aspect of the present invention there is provided a system for mating equipment offshore on a floating hull, such as a spar buoy, as defined in claim 1.

[0007] According to another aspect of the invention there is provided a method of installing equipment offshore on a floating hull, such as a spar buoy, as defined in claim 11.

[0008] Preferred features of the invention are recited in the dependent claims.

[0009] The present invention is a system and method of installing equipment offshore on a floating hull, such as a spar buoy, without using a large offshore crane. The system and method is suitable for installing a wind turbine generator on a spar buoy in a cost effective, safe and timely manner. The invention makes use of a gimbal table that grips the spar buoy from the bow or stern of a fork-type vessel and thereby isolates the roll and pitch motions of the vessel from the spar buoy. This greatly reduces the relative motions and loads during mating and thereby reduces risks. It may also be configured to handle larger installation environments.

[0010] The preferred embodiment of the present invention also includes a support frame assembly that supports the wind turbine generator on the vessel during transport to the spar buoy. The support frame assembly is mounted on a spring system to allow the angular relative motions of the spar buoy to be absorbed between the support frame assembly and vessel during mating of the wind turbine generator to the spar buoy. The wind turbine generator can be lowered onto the spar buoy in a very controlled manner with greatly reduced relative motions and loads. This decreases the installation risks and enables installation in larger sea states.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0011] The invention is better understood by reading the detailed description of embodiments which follow and by examining the accompanying drawings, in which:

Fig. 1 is a perspective view of an exemplary embodiment of a fork-type transport vessel

according to the invention;

Fig. 2 is a plan view of a portion of the transport vessel showing the forks, a gimbal table and a spar locking collar in an open position;

Fig. 3 is a plan view similar to Fig. 2 and showing the spar locking collar in a closed position secured to a spar buoy;

Fig. 4 is a partial elevation view of the vessel forks, gimbal table, spar locking collar and spar buoy;

Fig. 5 is a partial elevation view of a support frame mounted on the vessel forks supporting a wind turbine generator being positioned above the spar buoy;

Fig. 6 is a section view taken along lines 6--6 of Fig. 5; and

Fig. 7 is a partial elevation view showing the mating of a final alignment guide/connector of the wind turbine generator and the spar buoy.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0012] The preferred embodiments of the present invention will now be described in detail with reference to the figures. Figure 1 shows an exemplary embodiment of a transport vessel 10 according to the invention. The transport vessel 10 includes a hull 12 having a deck 14. A pair of forks 18 defining a slot 16 are formed in the hull 12 or extend from the hull 12. The forks 18 and slot 16 are preferably at the bow or stern of the fork-type vessel 10.

[0013] In a preferred embodiment of the present invention, a gimbal table 20 is positioned within the slot 16 between the forks 18 as shown in Figs. 2, 3 and 4. The gimbal table 20 includes two nested tables 30, 40 that are open-ended and located between (or on top of) the vessel forks 18. An outer table 30 is generally U-shaped in plan view as shown in Figs. 2 and 3. The outer table 30 has outer first and second legs 32 and 34, substantially parallel to one another, extending generally transversely from an outer base segment 36. As shown in Figs. 2, 3 and 4, preferably the outer table 30 fits within the slot 16 with a space existing between the outer legs 32, 34 and the forks 18.

[0014] The gimbal table 20 includes first and second mounting members 22 and 24, respectively, connected to the vessel 10. The mounting members 22 and 24 may be connected to the hull 12 and/or the forks 18 of the vessel 10. As shown in Fig. 3, the mounting members 22 and 24 each include an angled surface 22a and 24a, respectively, relative to a long axis of the vessel 10. Preferably, the angled surfaces 22a and 24a are parallel to each other and at a 45 degree (45°) angle with respect to the vessel long axis. Additionally, the outer table 30 includes first and second angled surfaces 32a and 34a, parallel to one another and in

opposing relationship to angled surfaces 22a and 24a of the mounting members 22 and 24, respectively, as shown in Fig. 3.

[0015] Referring to Figs. 2, 3 and 4, the outer table 30 is mounted to the vessel 10/forks 18 with a pair of outer shafts and bushings 38. The pair of outer shafts and bushings 38 are axially aligned with one another and in a horizontal plane.

[0016] Referring to Figs. 2 and 3, an inner table 40, generally U-shaped in plan view, defines an opening 41. The inner table 40 has inner first and second legs 42 and 44, substantially parallel to one another, extending generally transversely from an inner base segment 46. As shown in Fig. 2, preferably the inner table 40 fits within the outer table 30 with a space existing between the inner and outer legs 42, 44 and 32, 34 respectively, and the inner and outer base segments 46 and 36, respectively.

[0017] As shown in Fig. 3, the outer table 30 includes third and fourth angled surfaces 32b and 34b, respectively, relative to the long axis of the vessel 10. Preferably, the third and fourth angled surfaces 32b and 34b are parallel to each other and perpendicular to the first and second angled surfaces 32a and 34a of the outer table 30. Additionally, the inner table 40 includes first and second angled surfaces 42a and 44a, parallel to one another and in opposing relationship to third and fourth angled surfaces 32b and 34b, respectively, of the outer table 30 as shown in Fig. 3.

[0018] Referring to Figs. 2, 3 and 4, the inner table 40 is mounted to the outer table 30 with a pair of inner shafts and bushings 48. The pair of inner shafts and bushings 48 are axially aligned with one another and in a horizontal plane. Preferably, the axially aligned pair of inner shafts and bushings 48 is in the same horizontal plane as the axially aligned pair of outer shafts and bushings 38 and perpendicular with respect to one another.

[0019] As above described, the inner table 40 can articulate about two horizontal axis joints to allow gimballing of the inner table 40 with respect to the vessel 10. The first set of two shafts and bushings 38 along one horizontal axis is between the vessel 10 and the outer table 30. The second set of two shafts and bushings 48 along a horizontal axis perpendicular to the first axis is between the outer table 30 and the inner table 40.

[0020] Mounted beneath the inner table 40 is a spar locking collar 60 used to releasably attach the inner table 40 to the spar buoy 100 within the receptacle 41. Preferably, the spar locking collar 60 includes a fixed gripper 62 (Figs. 2 and 3) affixed to the inner base segment 46 of the inner table 40 and two pivoting grippers 64 that are actuated with hydraulic cylinders 66 to capture the spar buoy 100 in the spar locking collar 60. The pivoting grippers 64 are pivotably attached to the inner legs 42, 44 via pivot pins 65. The hydraulic cylinders 66 are attached at one end to the inner legs 42, 44 and are attached at a second end to the pivoting grippers 64. Figure 2 shows the pivoting grippers 64 of the spar locking collar 60 in an open position and Fig. 3 shows the pivoting grippers 64 in a closed position.

[0021] Referring to Fig. 4, the spar locking collar 60 defines a female-shaped receptacle 68 that grabs the male toroid-shape mating feature 102 on the spar buoy 100. This attachment takes place with relative motions between the spar buoy 100 and the inner table 40; therefore, the shape of the receptacle 68 accommodates these motions so that the inner table 40 will follow the motions of the spar buoy 100 during attachment. Fenders may be placed at this interface to absorb some of the initial impact energy. Once the spar locking collar 60 is closed, the inner table 40 is attached to the spar buoy 100 and the vertical relative motions between the spar buoy 100 and the inner table 40 are fixed. The vessel 10 can still roll and pitch without driving these angular motions into the spar buoy 100. Heave motion is driven, but the spar buoy 100 response to heave is relatively soft.

[0022] In the preferred embodiment as shown in Fig. 5, the vessel 10 includes a support frame assembly 82 for securing a wind turbine generator 80 during transportation of the wind turbine generator 80 to the offshore location of the spar buoy 100. In the preferred embodiment, the support frame assembly 82 is also used for lowering and attaching the wind turbine generator 80 to the spar buoy 100. Preferably, the wind turbine generator 80 is attached to the support frame assembly 82 with a plurality of releasable generator locking collars 84 that each include one fixed portion 86 and two actuated arms 88 that are actuated with hydraulic cylinders 87 to capture and fix the wind turbine generator 80 to the support frame 82 as shown in Fig. 6. It is to be understood that alternate locking mechanisms may be used.

[0023] Referring to Fig. 5, the lower end of the support frame assembly 82 is connected to a plurality of frame hydraulic mating units 90. In the embodiment as shown in Figs. 5 and 6, four frame hydraulic mating units 90 are positioned between the support frame assembly 82 and the vessel forks 18. Each frame hydraulic mating unit 90 includes a series of cylinder jacks 92 and springs 94 to lower the support frame 82 and allow and dampen the relative rotational motions between the spar buoy 100 and the vessel 10.

[0024] Typically, the final connection of the wind turbine generator 80 to the spar buoy 100 is made by a bolted flange connection. The wind turbine generator 80 is lowered onto the spar buoy 100 in a controlled manner to reduce the impact load on the flanges 72 and 74 (Fig. 7). The flange 72 is preferably positioned inside a shell plate 81 of the wind turbine generator 80 and the flange 74 is preferably positioned inside a shell plate 101 of the spar buoy 100. This is accomplished with two main component assemblies: the plurality of frame hydraulic mating units 90 (Fig. 5) and a plurality of final alignment guide/connectors 50 (Figs. 5 and 6). It is to be understood that while only one final alignment guide/connector 50 is shown, preferably a plurality of guide/connectors 50 are used in the system.

[0025] The main functions of the plurality of frame hydraulic mating units 90 are:

- Locking or fixing the support frame assembly 82 to the vessel 10 during transportation;
- Resisting overturning of the wind turbine generator 80;
- Lowering the wind turbine generator 80 onto the spar buoy 100 and transferring the weight of the wind turbine generator 80 to the spar buoy 100;

- Absorbing relative motions of the spar buoy 100 and vessel 10 during and after mating of the wind turbine generator 80 to the spar buoy 100;
- Working in unison with the final alignment guide/connectors 50 to transfer motions of the spar buoy 100 to the support frame assembly 82 during mating; and
- Spring stiffness is stiff early in the mating process and soft once the wind turbine generator 80 is mated to the spar buoy 100. The springs 94 become softer after weight transfer of the wind turbine generator 80 to the spar buoy 100. The preferred embodiment uses a compound spring system with a dual slope force deflection curve.

[0026] Preferably, there are four final alignment guide/connectors 50 placed outside the flanges 74, 72 on the spar buoy 100 and wind turbine generator 80, respectively. The final alignment guide/connectors 50 will absorb the impact loading between the wind turbine generator 80 and the spar buoy 100 upon initial contact. Referring to Fig. 7, the final alignment guide/connector 50 includes a pair of mating (male and female) final alignment cones 52a and 52b. Preferably, an upper portion 50a of the final alignment guide/connector 50 includes a connector engagement cylinder 54 and a male connector 56a. A lower portion 50b of the final alignment guide/connector 50 includes a female connector 56b, an uplift spring 57 and a main spring 58. The main spring 58 reduces impact load and may be an elastomeric spring. The male and female connectors 56a and 56b, respectively, may be of the rotary latch connector type. For example, the connector engagement cylinder 54 is "pushed" and reaches down and extends to engage the latch and pulls up to lock. When the connector engagement cylinder 54 is "pushed" again it reaches down and extends to unlock and disengage the latch. It is to be understood that other forms and types of connectors known to persons of ordinary skill in the art may be used.

[0027] The main functions of the final alignment guide/connectors 50 are:

- Transitioning load and motion of the wind turbine generator 80 from the vessel 10 to the spar buoy 100;
- Providing guided alignment of the wind turbine generator 80 to the spar buoy 100;
- Containing shock absorbers to eliminate/reduce flange 72 to flange 74 impact load;
- Working in unison with the frame hydraulic mating units 90 to transfer load and motions; and
- Containing locking mechanism to attach the wind turbine generator 80 to the spar buoy 100 and drive spar buoy 100 angular motions into the frame hydraulic mating units 90.

[0028] The mating process is summarized in the following steps:

1. 1. The vessel 10 arrives on site with the wind turbine generator 80 attached to the mounting/support frame assembly 82 in transit mode.
2. 2. The vessel 10 approaches spar buoy 100 with the spar locking collar 60 in the open

position, attaches a hawser (not shown) and pulls the vessel 10 to the spar buoy 100 in proper orientation and draft. The spar buoy 100 and vessel 10 are pulled together so that the spar locking collar receptacle 68 engages with the corresponding feature 102 on the spar buoy 100.

3. 3. Once contact between the spar locking collar 60 and spar buoy 100 is obtained, the locking collar pivoting grippers 64 are closed and the spar buoy 100 is fixed to the gimbal inner table 40. The ability to align and make this initial contact is a key feature of the gimbal table 20. The spar locking collar 60 and inner table 40 aligns itself with the spar buoy 100 during locking/engagement.
4. 4. The wind turbine generator support frame assembly 82 is removed from transit lock condition and is lowered with the plurality of frame hydraulic mating units 90 to obtain contact of the wind turbine generator 80 to the spar buoy 100.
5. 5. The final alignment guide/connectors 50 make first contact and absorb initial impact loading. The connectors 50 are engaged and the weight of the wind turbine generator 80 is transferred to the spar buoy 100 and inner table 40.
6. 6. Flange bolting is installed and tensioned.
7. 7. The spar buoy 100 and vessel 10 are ballasted so that the spar buoy 100 takes the weight of the wind turbine generator 80.
8. 8. The wind turbine generator locking collars 84 are released. It may be desired at this point to move the frame toward the center of the vessel 10 and away from the tower in order to avoid clashing.
9. 9. The spar locking collar 60 is released.
10. 10. The vessel 10 releases the hawser and backs away from the spar buoy 100.

[0029] As discussed above, the mating of a wind turbine generator 80 to a spar buoy 100 is a difficult and expensive offshore installation task. The use of the fork-type vessel 10 is more economical than a vessel with a large offshore crane, but the motion response to the wave environment of the spar buoy 100 and a ship shape vessel 10 are radically different. The invention makes use of a gimbal table 20 that grips the spar buoy 100 from the bow or stern of the fork-type vessel 10 and eliminates the relative vertical motion between the spar buoy 100 and the vessel 10 while allowing the vessel 10 to roll and pitch freely without driving the effects of the angular motions into the spar buoy 100.

[0030] The support frame assembly 82 that supports the wind turbine generator 80 is preferably mounted on a spring system to allow the angular relative motions of the spar buoy 100 to be absorbed between the support frame assembly 82 and vessel 10 during mating of the wind turbine generator to the spar buoy 100. The wind turbine generator 80 is lowered onto the spar buoy 100 in a very controlled manner with greatly reduced relative motions and loads. This decreases the installation risks and enables installation in larger sea states.

[0031] This invention includes an installation method and mating system to install a wind turbine generator 80 to a floating hull such as a spar buoy 100. The system consists of a

gimbal table 20 to allow connection of the vessel 10 to the spar buoy 100 and a mounting/support frame assembly 82 to secure the wind turbine generator 80 and lower the wind turbine generator 80 onto the spar buoy 100. The support frame assembly 82 is attached to the vessel 10 by means of a frame support mating unit 90 that can lower the frame assembly 82 and isolate the motions of the spar buoy 100 from the vessel 10 during and after connection. Also, final alignment stabbing guide/connectors 50 are used to absorb initial contact between the spar buoy 100 and the wind turbine generator 80 and provide final alignment and connection so that flange bolting can be installed.

REFERENCES CITED IN THE DESCRIPTION

Cited references

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US9725870B2 **[0004]**
- US2016160836A1 **[0004]**
- WO2010032044A **[0004]**

Patentkrav

1. System til sammenkobling af udstyr (80) offshore på et flydende skrog, såsom en bøje, uden brug af en stor offshore-kran, hvilket system omfatter:

   et flydende fartøj (10) med et par gafler (18), der definerer en spalte (16); et kardanbord (20) placeret inden i spalten (16) og forbundet med fartøjet (10), kardanbordet (20) definerer en åbning (41), hvor kardanbordet (20) omfatter:

      et ydre bord (30) i det væsentlige U-formet set ovenfra, hvor det ydre bord (30) er drejeligt forbundet med beholderen (10); og et indre bord (40) i det væsentlige U-formet set ovenfra, hvor det indre bord (40) passer ind i det ydre bord (30) og er drejeligt forbundet med det ydre bord (30),

   en låsekrave (60) monteret på kardanbordet (20), og
   et sammenkoblingselement (102) fastgjort til et flydende skrog (100), hvor når det flydende skrog (100) er placeret inden i kardanbordåbningen (41), er låsekraven (60) arrangeret og designet til at fastgøres udløseligt til sammenkoblingselementet (102) for at begrænse relativ lodret bevægelse mellem det flydende skrog (100) og fartøjet (10), mens kardanbordet (20) tillader det flydende fartøj (100) at rulle og stige uden at køre disse bevægelser ind i det flydende skrog (100).

2. System ifølge krav 1, hvor låsekraven (60) omfatter:

   et fast gribeelement (62) fastgjort til kardanbordet (20); og
   mindst ét drejeligt gribeelement (64) fastgjort til kardanbordet (20) arrangeret og designet til at fange det flydende skrog (100) ved lukning af låsekraven (60).

3. System ifølge krav 1 eller 2, hvor det sammenpassende element (102) er et han-toroideformet element, og låsekraven (60) indbefatter en hun-formet beholder (68) til at passe med det han-toroideformede
   element (102).

4. System ifølge et hvilket som helst af de foregående krav, hvor låsekraven (60) er monteret på det indre bord (40).

5. System ifølge et hvilket som helst af de foregående krav, yderligere omfattende en støtterammekonstruktion (82) monteret på fartøjet (10), støtterammekonstruktionen (82) arrangeret og designet til at understøtte udstyret
   (80) over kardanbordet (20).

6. System ifølge krav 5, yderligere omfattende en flerhed af hydrauliske rammeenheder (90) placeret mellem støtterammekonstruktionen (82) og
   gaflerne (18), flerheden af rammens hydrauliske sammenkoblingsenheder
   (90) arrangeret og designet til at sænke støtterammekonstruktionen (82).

7. System ifølge krav 6, hvor hver af flerheden af ramme hydrauliske sammenkoblingsenheder (90) omfatter en række cylinderdonkrafte (92) og fjedre (94) til at

sænke støtterammesamlingen (82) og dæmpe de relative rotationsbevægelser mellem det flydende skrog (100) og fartøjet (10).

8. System ifølge krav 5, 6 eller 7, hvor understøtningsrammekonstruktionen (82) indbefatter mindst én udløselig generatorlåsekrave (84), der er arrangeret og designet til at fastgøres udløseligt til udstyret (80) og begrænse relativ lodret bevægelse mellem udstyret (80) og støtterammekonstruktionen (82).

9. System ifølge et hvilket som helst af de foregående krav, yderligere omfattende en flerhed af endelige justeringsstyr og konnektorer (50) omfattende en øvre del (50a) arrangeret og designet til at passe sammen med en nedre del (50b), den øvre del (50a) af de endelige justeringsstyre og konnektorer (50) fastgjort til udstyret (80) og den nedre del (50b) fastgjort til det flydende skrog (100).

10. System ifølge krav 9, hvor hver af de endelige justeringsstyr og konnektorer (50) omfatter en hovedfjeder

(58) arrangeret og designet til at absorbere stødbelastning mellem udstyret (80) og det flydende skrog (100) ved første kontakt, og en låsemekanisme (56a, 56b, 54) arrangeret og designet til at fastgøre udstyret (80) til det flydende skrog (100).

11. Fremgangsmåde til at installere udstyr (80) offshore på et flydende skrog, såsom en sparbøje, uden brug af en stor offshore-kran, hvilken fremgangsmåde omfatter:

at udstyre et fartøj af gaffeltypen (10) med et kardanbord (20) og en støtterammekonstruktion (82), hvor kardanbordet (20) omfatter:

et ydre bord (30) i det væsentlige U-formet set ovenfra, hvor det ydre bord (30) er drejeligt forbundet med beholderen (10); og et indre bord (40) i det væsentlige U-formet set ovenfra, hvor det indre bord (40) passer ind i det ydre bord (30) og er drejeligt forbundet med det ydre bord (30),

lastning og sikring af udstyret (80) på fartøjet af gaffeltypen (10),
at transportere udstyret (80) til det flydende skrog (100) ved anvendelse af fartøjet af gaffeltypen (10); manøvrering af fartøjet (10) af gaffeltypen for at bringe det flydende skrog (100) ind i en åbning (41) af kardanbordet (20); at lukke en låsekrave (60), monteret på kardanbordet (20), til låsende indgreb med det flydende skrog (100),
sænkning af udstyret (80) for at opnå kontakt med det flydende skrog (100); at forbinde udstyret (80) til det flydende skrog (100),
justering af en ballast påmindst ér af gaffeltypefartøjerne (10) og det flydende skrog (100), således at det flydende skrog (100) understøtter vægten af udstyret (80),
frigørelse af udstyret (80) fra støtterammekonstruktionen (82),
åbning af låsekraven (60) for at frigive det flydende skrog (100), og
manøvrering af gaffeltypefartøjet (10) væk fra det flydende skrog (100).

12. Fremgangsmåde ifølge krav 11, hvor trinnet med at lukke låsekraven (60) til låsende indgreb med det flydende skrog (100) omfatter en låsekravebeholder (68), der går i indgreb med en tilsvarende sammenkoblingsfunktion (102) på flydende skrog (100).

13. Fremgangsmåde ifølge krav 11 eller 12, hvor trinnet med at sænke udstyret (80) omfatter

sænkning af understøtningsrammekonstruktionen (82) via en flerhed af hydrauliske rammeenheder (90).

14. Fremgangsmåde ifølge krav 11, 12 eller 13, hvor trinnet med at frigøre udstyret (80) fra støtterammekonstruktionen (82) omfatter oplåsning af en flerhed af generatorlåsekraver (84) på støtterammen (82).

15. Fremgangsmåde ifølge krav 11, 12, 13 eller 14, hvor trinnet med at forbinde udstyret (80) til det flydende skrog (100) omfatter:
indgreb med en øvre del (50a) af en flerhed af sidste justeringsstyr og konnektorer (50) monteret på udstyret (80) til en nedre del (50b) af flerheden af endelige justeringsstyr og konnektorer (50) monteret på det flydende skrog (100).

DRAWINGS

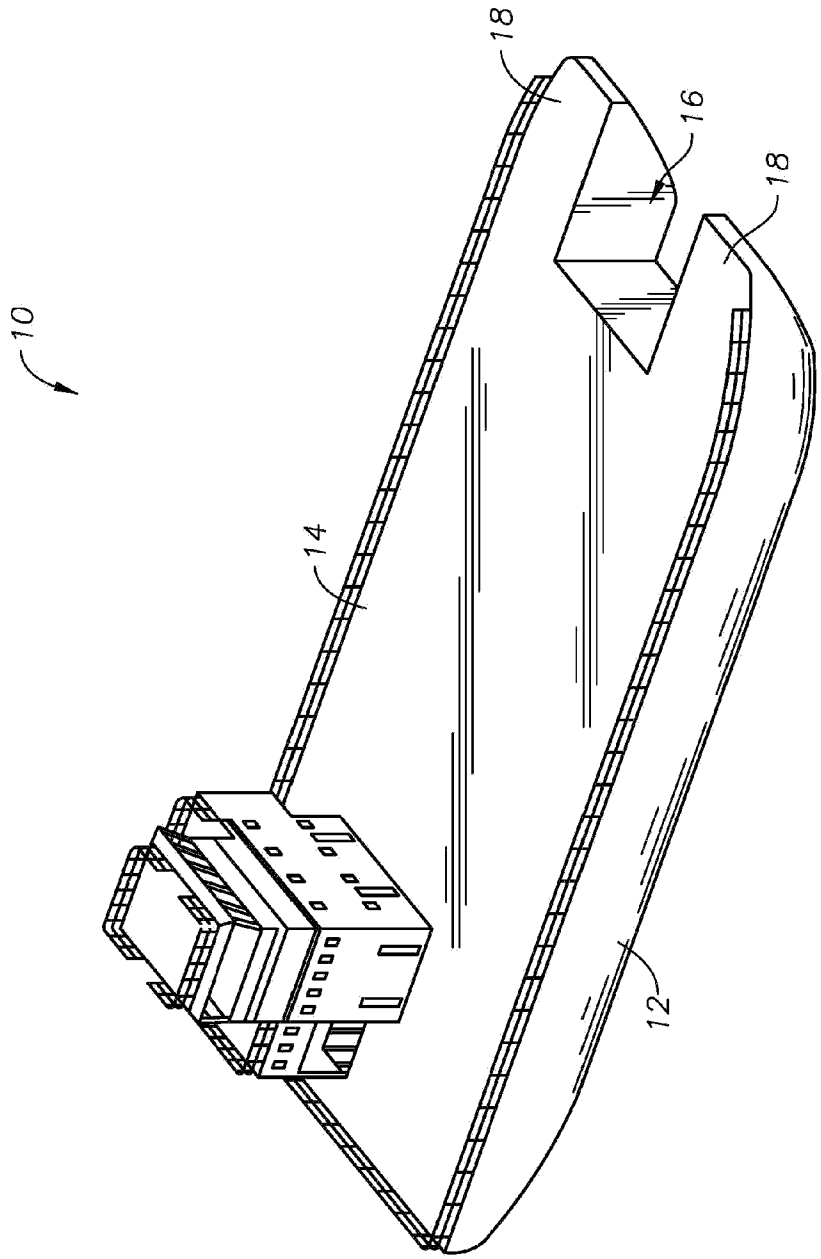


FIG. 1

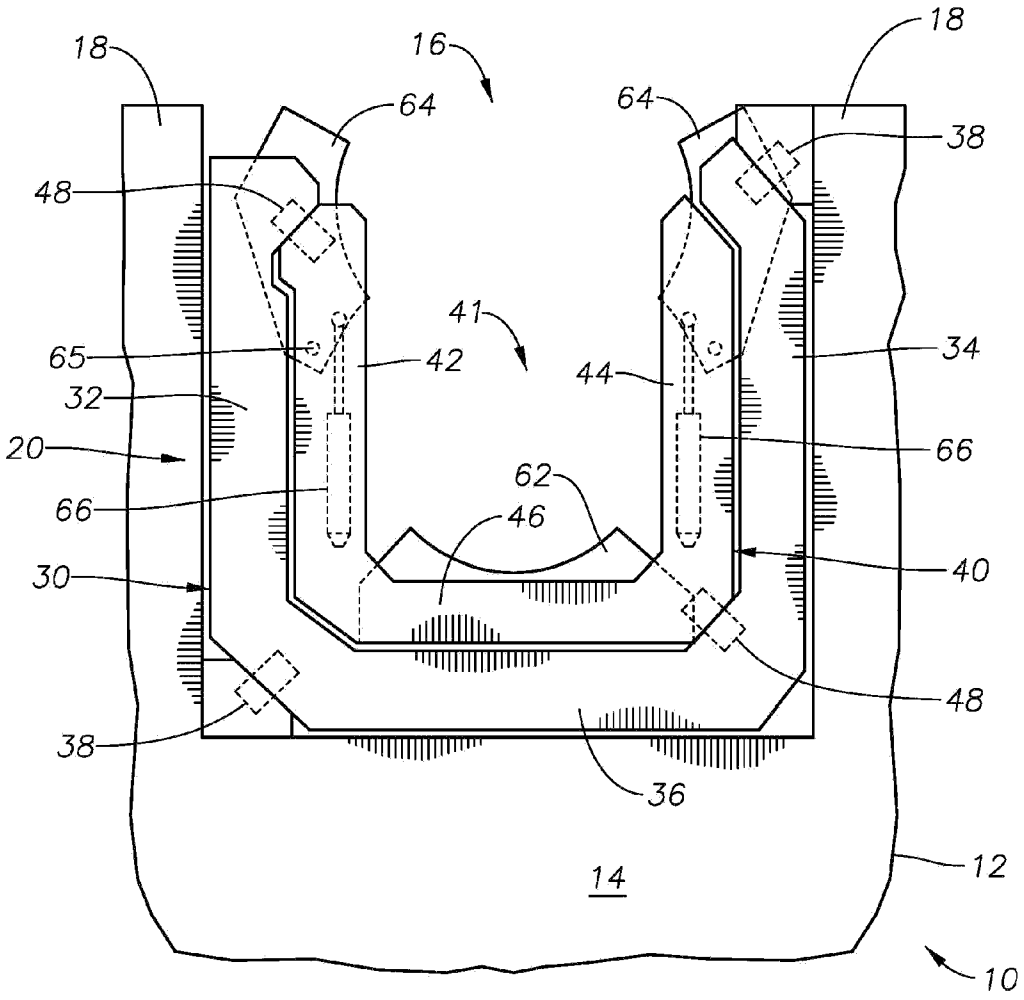

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FIG. 2

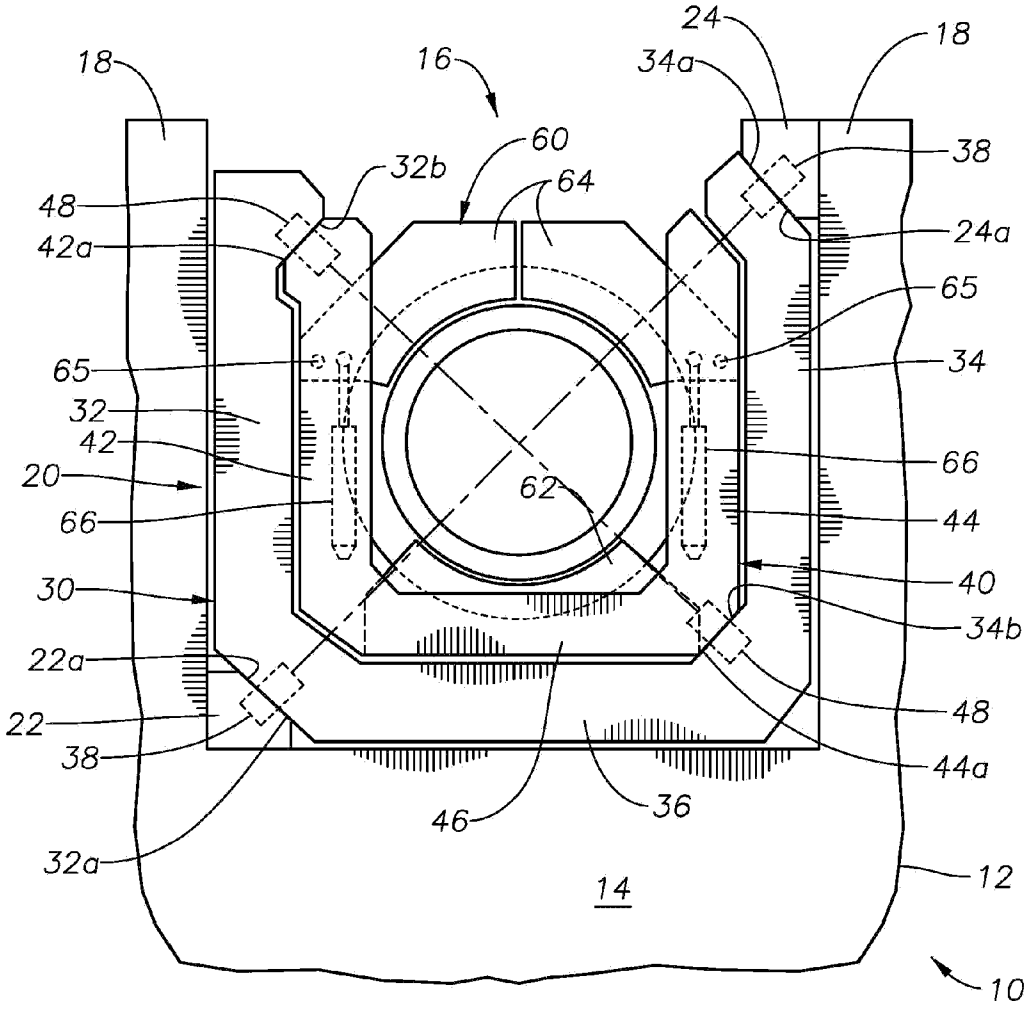

18
16
24
34a
18
60
32b
64
38
48
42a
24a
65
65
34
32
42
66
20
62
66
44
40
30
34b
22a
48
22
38
44a
46
36
32a
12
14
10

FIG. 3

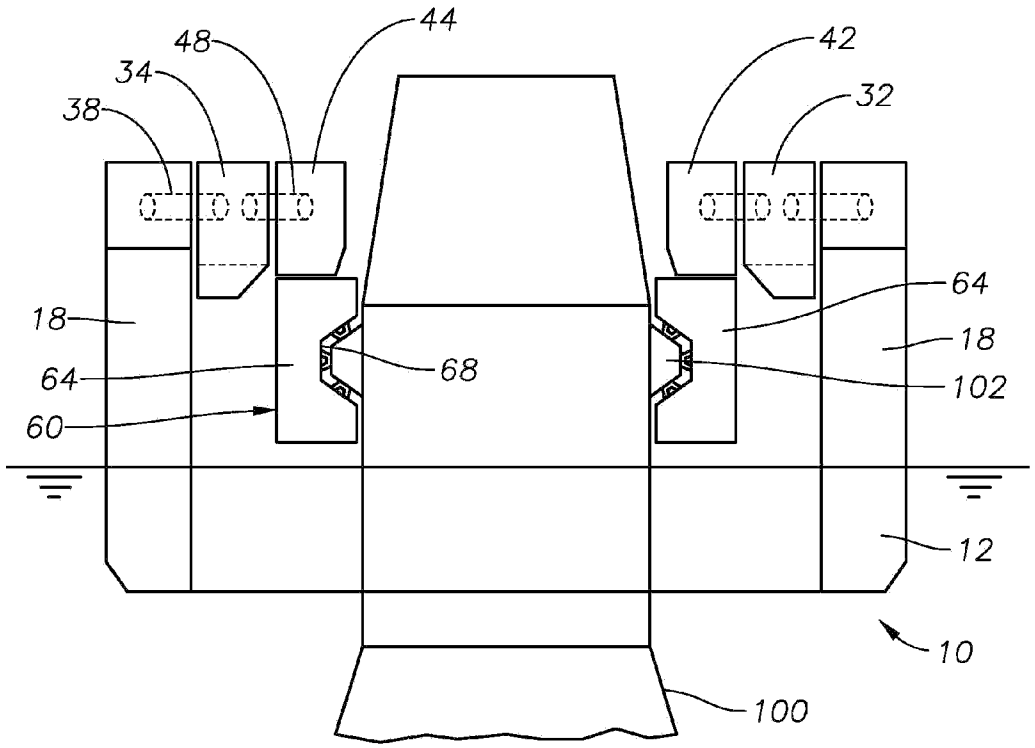


FIG. 4

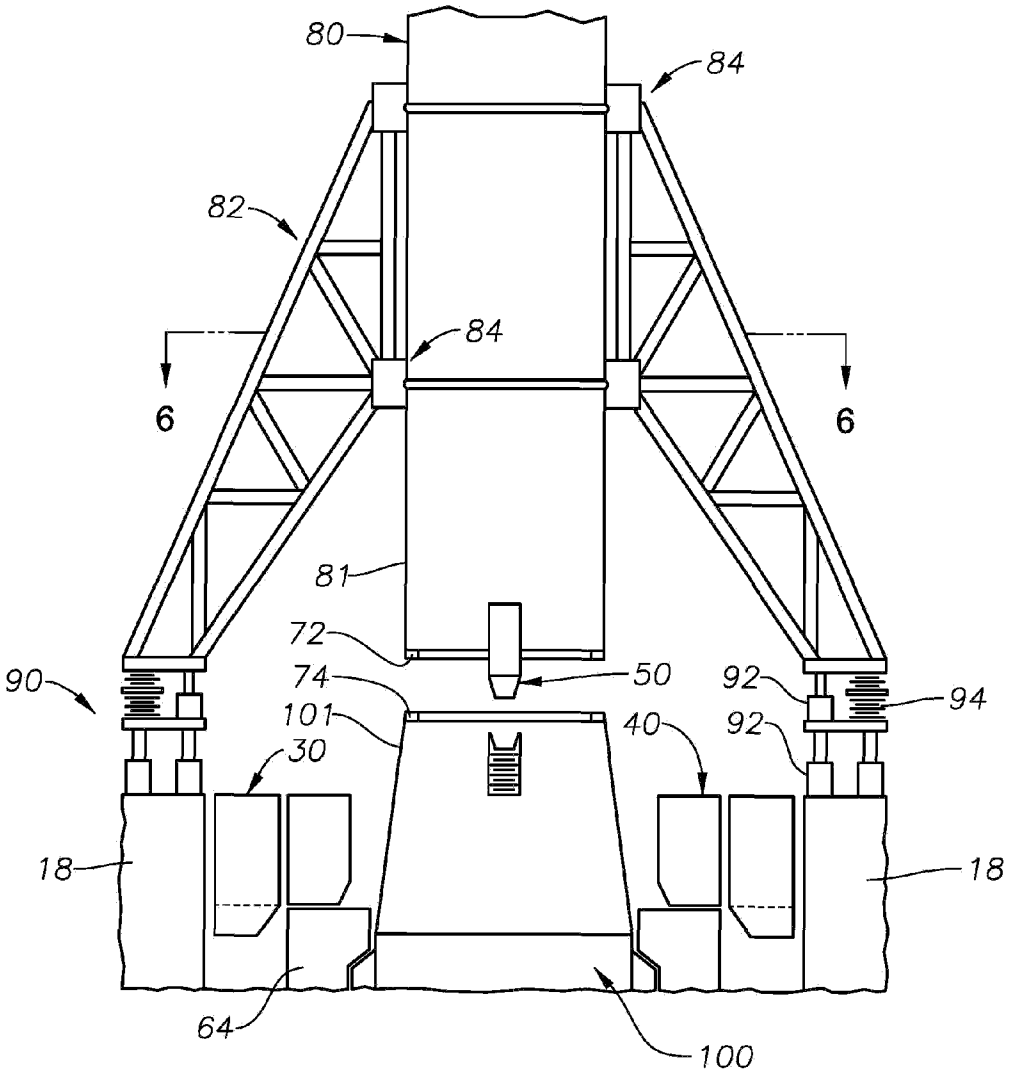


FIG. 5

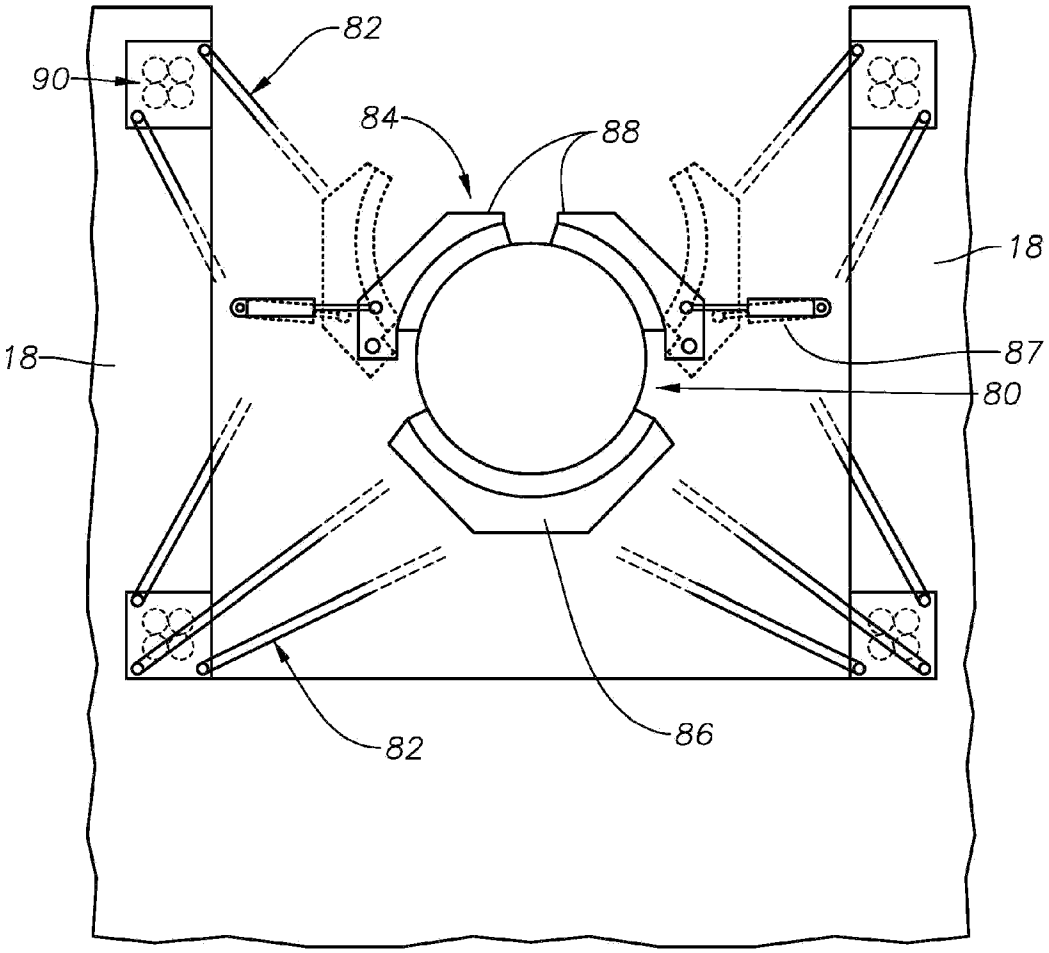


FIG. 6

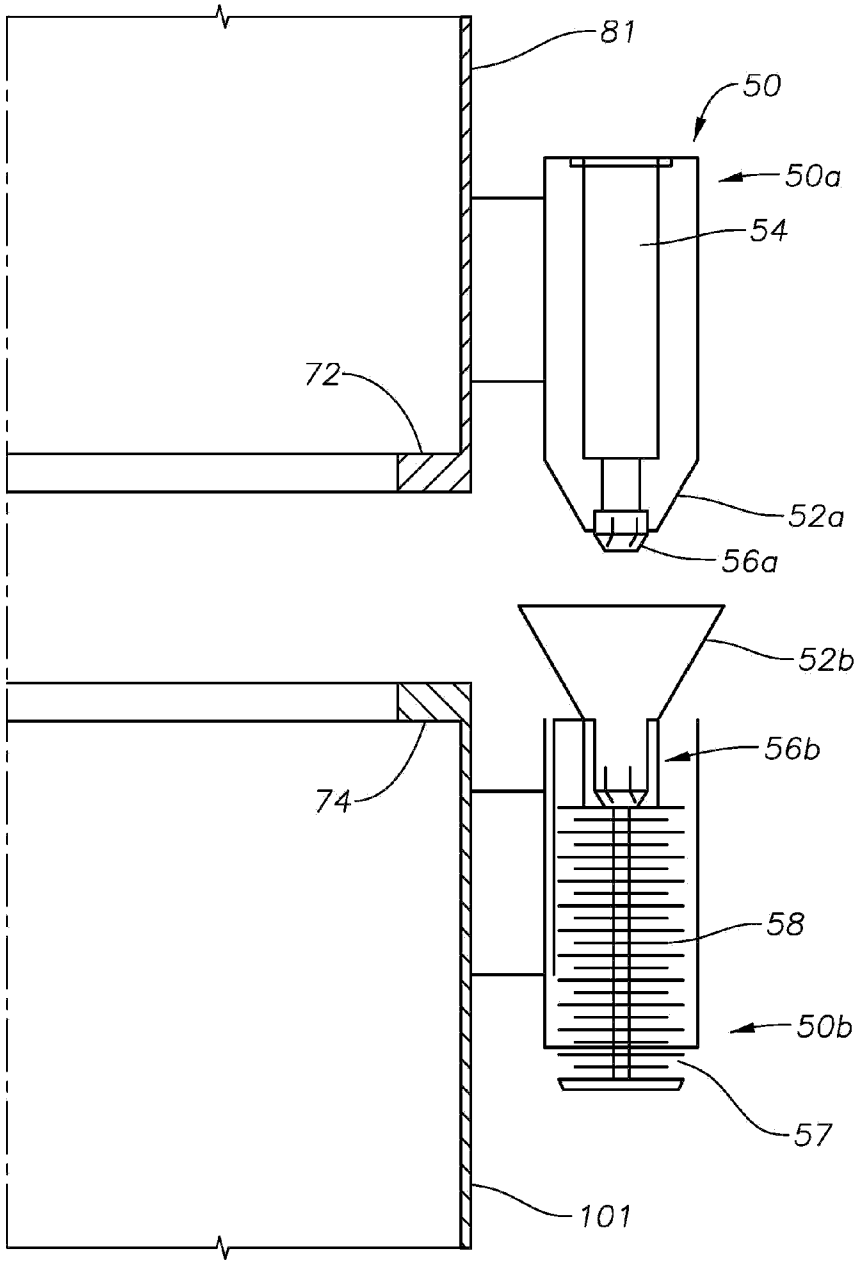


FIG. 7