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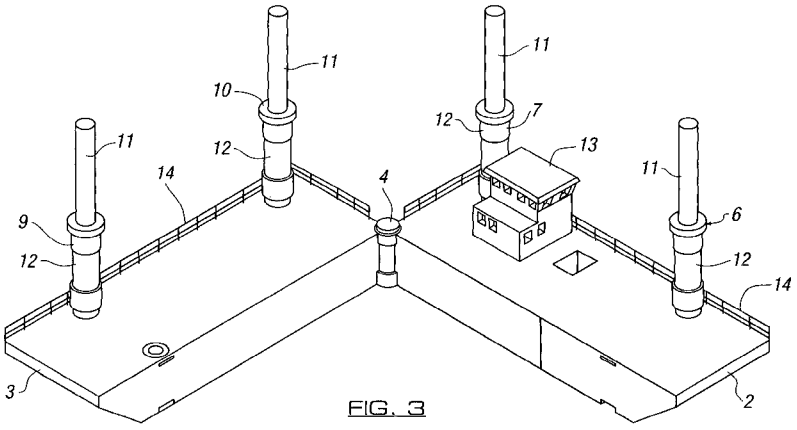

FIG. 3

(57) Abstract: Ajack-up vehicle having a hull including at least two hull sections (2, 3) interconnected in such manner as to be positionable in an end-to-end relationship having a first vehicle width and for the purpose of movement of the vehicle from one location to another location and to be positionable in a side-by- side configuration having a second vehicle width when at said another location, wherein the first vehicle width is less than the second vehicle width. Ajack-up vessel such as this can maintain stability when elevated with square positioning of supporting legs and yet reposition the hull sections to achieve a preferred hull shape for transit from location - to - location at more than twice the usual speed of known jack-up vessels.

FAST TRANSIT SELF-ELEVATING PLATFORMS

This invention relates to jack-ups, self-elevating platforms, lift boats, jack-up barges or the like. For convenience in this specification they will be hereinafter by referred to as jack-up(s).

BACKGROUND

A jack-up generally includes a sea-going hull mounting a plurality of legs capable of being raised or lowered relative to the hull by associated jacking-up mechanisms/units.

Whilst the jacking-up mechanisms/units can take various forms, the common purpose is to enable the legs to be selectively lowered so that the lower ends of the legs can rest upon the bed of a column of water such as a sea bed and so that after engagement of the legs with said bed the hull can be elevated relative to the lowered legs so as to lift the hull out of water, so that the hull is not affected by any substantial water action.

It will be understood that the reverse operation will be possible i.e., the lowering of the hull back into the water followed by the raising of the legs.

It is intended that a jack-up should be moved either by being towed or under its own propulsion arrangements to a selected location of intended use and to then use the jacking-up mechanisms/units to lower the legs so that they rest upon a ground surface such as a sea or river bed and then to elevate the hull above the surface of the water within which it is located.

One of the characteristics of the form of known jack-ups is that it is highly desirable that the hull thereof should be large enough to provide a deck area that affords as much space as possible to mount any equipment such as, for example, seabed drilling apparatus, and/or crane apparatus for handling equipment/materials associated with whatever operation should be required to be carried out at a location of use.

In addition, an important factor in relation to the usage of a jack-up when in its elevated or jacked-up mode is that whilst it is in operational use, it is important that the four legs of the jack-up should be located as near as possible to the corner regions of a substantially square hull arrangement, in order to produce an

operational setting for the legs, when supporting the hull above the surface of the water, that is as stable as possible.

Experience has shown that such a substantially square configuration for the legs is preferable in the event of a local change of support conditions afforded by the sea or river bed in the vicinity of a leg or legs.

This requirement has had a direct consequence in relation to the beam width (i.e. the overall width of the jack-up) of jack-ups as compared with the beam widths of conventional vessels, in that the beam width of the jack-ups adversely affects their movement between locations as compared with movement of conventional vessels. In practice, the wide beam of a conventional jack-up not only significantly reduces the speed at which the jack-up can be moved from location to location, simply because square-shaped hulls do not travel swiftly through water, but additionally affects what may be called its sea keeping, i.e. its response to sea conditions whilst being moved from location to location. Generally, conventional jack-ups are capable of speeds on water of only around 5 knots.

In addition, it is convenient to note that the hull of a jack-up needs to be able to provide adequate storage space for equipment, space for any on-board propulsion unit(s), space for personnel associated with the operation and/or movement of the jack-up and the operation of any equipment required to be operated from the jack-up, and enough space to be able to accommodate the mounting of the legs and any associated jacking-up mechanisms/units.

As a result of factors such as those mentioned above, known jack-ups tend to be broad of beam. In practice, this has been found to introduce handling problems in relation to the positioning of the jack-up at locations where access to a required location of use could involve a relatively narrow channel way for the jack-up.

It is an object of the present invention to provide a jack-up having a construction that facilitates its passage from location to location.

SUMMARY OF THE INVENTION

Broadly according to a first aspect of the invention there is provided a jack-up vehicle having a hull including at least two hull sections interconnected in such manner as to

be positionable in an end-to-end relationship having a first vehicle width and for the purpose of movement of the vehicle from one location to another location and to be positionable in a side-by-side configuration having a second vehicle width when at said another location, wherein the first vehicle width is less than the second vehicle width.

Broadly according to a second aspect of the invention there is provided a method of operating a jack-up vehicle comprising arranging at a first location at least two hull sections of the vehicle in an end-to-end relationship and having a first vehicle width, transporting the vehicle to a second location and, at the second location, moving the at least two hull sections into a side-by-side configuration having a second vehicle width, the first vehicle width being smaller than the second vehicle width.

In a first construction the hull includes two hull sections pivoted/hinged together in such manner as to be relatively rotatable between an end-to-end configuration and a side-by-side configuration for the hull sections.

In a further construction, the jack-up includes three hull sections, of which two are pivoted/hinged to opposite sides of the same end of the remaining hull section in such a manner that in a first relative arrangement, the two hull sections can be arranged side-by-side and adjacent the same end of the remaining hull section and in a second arrangement in which the two hull sections can be arranged one to each of respective opposite sides of the remaining hull section.

The advantage of such constructions is that such jack-up vehicles can achieve speeds of up to around 12 knots which is more than twice the usual speeds of conventional vehicles and which thus greatly improves the time taken to travel from location-to-location. This improvement in speed of transit applies to both self-propelled vessels and towed vessels.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the invention and to show how to carry the same into effect reference will now be made to the accompanying drawings in which;

Figure 1 schematically illustrates a jack-up incorporating a two-section hull when the hull sections have been relatively positioned for operation at a desired location;

Figure 2, schematically illustrates the jack-up of Figure 1 when arranged for transit from one location to another;

Figure 3 very schematically illustrates the relative positions of the sections of the hull during a changeover of their relative configuration to each other;

Figure 4 schematically illustrates a second embodiment of the jack-up incorporating a three-section hull construction when the hull sections are in side-by-side configuration;

Figure 5 schematically illustrates the construction of Figure 4 when in its in-line configuration;

Figure 6 schematically illustrates a further embodiment of a jack-up incorporating a three-part hull, this Figure illustrating the jack-up when arranged for operation at a desired location;

Figure 7 is a side view of Figure 6;

Figure 8 schematically illustrates the jack-up of Figure 6 when arranged for transit from one location to another;

Figure 9 is a side view of the arrangement of Figure 8;

Figure 10 very schematically illustrates the relative positions of the sections of the hull of the jack-up of Figure 6 during a changeover of the relative configuration of the hull sections;

Figure 11 shows a front perspective view of the jack-up of Figures 6 to 10;

Figure 12 is a rear perspective view of the jack-up of Figure 11at an operational location adjacent an off-shore wind turbine; and

Figures 13 and 14 show perspective views of an alternative version of the jack-up of Figure 11 in two respective stages of configuration changeover.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring now to Figures 1 and 2, a jack-up marine vehicle shown therein includes a hull 1 comprising two similarly shaped hull sections 2 and 3 that are hinged/pivotally coupled together by a hinge/pivot arrangement schematically shown at 4. The arrangement shown in Figure 1 can be regarded as a side-by-side arrangement or configuration of the two hull sections.

Figure 2 can be regarded as an in-line arrangement/configuration of the two hull sections 2 and 3, where the hull sections 2 and 3 are arranged end-to-end rather than side-to-side as shown in Figure 1.

As will be seen from these Figures 1 and 2, the hull section 2 incorporates adjacent to the side 5 thereof jack-up leg assemblies 6 and 7, whilst the hull section 3 incorporates adjacent to the side 8 thereof jack-up leg assemblies 9 and 10. Each of the jack-up leg assemblies 6, 7, 9 and 10 has an associated movable leg 11.

As will be seen from Figure 1, when the hull sections 2 and 3 are arranged in their side-by-side relationship, the legs 11 are respectively located in the region of the end zones 15 and 16 traversing the hull sections 2 and 3 and adjacent the sides 5, 8 of the respective hull sections 2 and 3. With such an arrangement, the leg assemblies 6, 7, 9 and 10 are so positioned in their respective hull sections 2 and 3 that when these hull sections are in their side-by-side configuration (as in Figure 1), the leg assemblies are located at the corner regions of a substantially square vessel, such that there is a relatively wide separation of the legs 11 when in the side-by-side configuration.

The leg assemblies 7, 8, 9 and 10 are schematically illustrated and in the Figures and are shown each to include the leg 11 and associated leg position jacking/lifting means 12.

It will be noted that Figures 1 and 2 very schematically illustrate an equipment control/wheel housing 13.

The Figures also very schematically illustrate safety rail arrangements 14.

In the side-by-side configuration of Figure 1 and when the legs 11 have been lowered so that their lower ends (not shown) are in contact with the bed of the column of water within which the jack-up is located, further operation of the

jacking/lifting means 12 in the sense of the lowering of the legs 11 relative to the hull sections can result in the hull sections 2 and 3 being lifted out of the water to such extent that the hull 1 is supported solely by the legs 11.

When in such position of stability, the equipment provided on the hull can be used to carry out any intended operation at the particular location.

When it is required to move the jack-up to another location, the legs 11 are raised relative to the hull sections. This has the effect of initially effectively lowering the hull sections to return them into the water and then, on further raising of the legs 11, to lift the legs 11 sufficiently high enough to bring them into their docked position relative to the hull so as to allow, when required, free movement of the jack-up along the surface of the water.

It will be clear from Figure 1, that when the hull sections 2 and 3 are hinged/pivotally connected to each other side-by-side as shown in Figure 1, the jack-up has a beam width equal to twice the beam width of the individual sections 2 and 3 whereby the beam width of the hull 1 is twice that when the sections 2 and 3 are arranged one behind the other in-line, i.e. end-to-end, as shown in Figure 2.

Whilst it is generally possible to move the jack-up from location to location whilst in the configuration shown in Figure 1, it will be understood that, as a result of the excessive beam width, the jack-up when in this configuration presents excessive drag resisting advancing to movement through the water.

By reason of the double hull section construction the hull sections 2 and 3 in their end-to-end relationship, the drag of the hull is significantly lowered when the jack-up is in transit, so that the speed of possible transit of the jack-up is correspondingly increased.

Thus, with a view to enabling, inter alia, a faster rate of transit to a location or between locations, it is proposed by the present invention to construct the hull sections 2 and 3 such that when they are arranged in end-to-end relationship, as shown in Figure 2, the sections effectively define a conventional boat hull shape.

Referring now to Figure 3, this Figure very schematically illustrates the relative positions of the two hull sections 2 and 3 during, for example, the conversion from

the in-line end-to-end configuration to the side-by-side configuration, or vice versa, during which operation the two hull sections are turning about the substantially vertical pivot_axis of the hinge/pivot 4 towards/away from each other.

As may be noted from Figure 2, when the two hull sections 2 and 3 are arranged in an end-to-end relationship, the leg assemblies 6, 7, 9 and 10 are located to one side of the hull 1. When the sections are in their in-line end-to-end configuration, the leg assemblies 6, 7, 9 and 10 are located to one side of the hull, resulting in the stability of the hull 1 being slightly reduced as compared with that for the side-by-side configuration. However, the construction of the hull sections would be such that overall stability will still be within acceptable safety limits.

In Figures 1 to 3, there is a circular access hole 3a on the upper surface of the hull section 3 which serves as an access hole to a securing mechanism (not shown) for locking the hull sections 2 and 3 together. The hull section 2 includes in its upper surface a rectangular access hole 2a, which serves as access to a moon-pool (not shown).

Referring now to Figures 4 and 5, these Figures very schematically illustrate a possible form for jack-up comprising a hull 20 comprising three hull sections 21, 22, and 23.

Conveniently the hull section 21 can be regarded as the main section of the hull 20 with the hull sections hinged/pivoted to each other.

The configuration shown in Figure 4 is the side-by-side configuration for the three hull sections 21, 22, and 23. In the Figure 4 and 5 arrangements, the leg assemblies 6 and 7 are centrally located lengthways of the hull section 22 and the leg assemblies 9 and 10 are centrally located lengthways of the hull section 23.

It will be noted from Figure 4 that with the leg assemblies so positioned, they are located inboard of the associated hull sections 22 and 23, and in the corner regions of the overall hull 20, thereby providing the required square formation, whilst still enabling a considerable platform space for any equipment required.

As will be seen from Figure 5, when the hull sections 22 and 23 have been moved to their in-line end-to-end positions relative to the main hull section 21 the leg

assemblies 6, 7, 9 and 10 are centrally located lengthways of the hull 20, thereby resulting in a more stable transit condition, as compared with the arrangement of Figures 1, 2 and 3.

In Figures 4 and 5, the dashed arched lines 24, 25, 26 and 27 schematically indicate the movements of the hull sections 22 and 23 about their hinged/pivotal connections 28 and 29 respectively when changing their relative positioning between the in-line and side-by-side arrangement with the main hull section 21.

Referring now to Figure 6, a three hull section embodiment is illustrated having a central main hull section 30 to which are pivotally connected, by way of appropriate hinge/pivot arrangements 31, and 32 at the rear end of the main hull section 30, hull sections 33 and 34. The hull sections 33 and 34 are provided with leg assemblies 6, 7, 9 and 10 each including a leg 11 and associated jacking means 12.

As will be seen from Figure 6, these leg assemblies 6, 7, 9 and 10 are located to one side of the longitudinal centre line of their associated section (in other words a positioning similar to that of Figures 1 to 3) and in such positions that when the three hull sections 30, 33 and 34 are arranged side-by-side, the four leg assemblies 6, 7, 9 and 10 effectively lie at the corner regions of a square.

Figure 7 is a side view of the jack-up when the hull sections are in their side-by-side arrangement as shown in Figure 6, when the legs 11 thereof are in their lowered positions, and whilst the hull is still in the water, as indicated by the water level WL.

The jack-up indicated in Figure 6 incorporates a crane 35. As will be noted the crane 35 is mounted on the hull section 34. The crane 35 is shown in Figure 6 as being in its rest or stowed position.

In practice, the mounting of the crane 35 is such that when it is required for use, it can be raised or lowered as desired and slewed as required. The hull sections can include a deck region(s) having equipment mounting zones thereon for receiving pieces of equipment. Referring now to Figure 8, this Figure illustrates the hull sections 33 and 34 when arranged in their in-line end-to-end positions relative to the main hull section 30. As will be noted, when in this position, the beam width of the resulting arrangement of the jack-up is effectively one half of the beam width of the jack-up when the three sections 30, 33 and 34 are arranged side-by-side.

It can be seen that the crane 35 when in its rest position lies within the overall length of the in-line end-to-end arrangement.

Figure 9 is a side view of the jack-up of Figure 8. As indicated the legsl 1 are in their fully raised positions so that they do not project below the keel region of the in-line hull sections of the jack-up.

Figure 9 also schematically indicates that the section 30 includes appropriately shaped sides adjacent to the end thereof that forms the stem (the very most forward part of a boat or ship's bow) of the jack-up when in transit, and that a propeller 36 is located at the stern of the in-line arrangement of the jack-up. Alternatively, one or more azimuth drives or thrusters could be used and located at the bow and/or stern of the vehicle. In other words the jack-up presents a much narrower beam width with corresponding reduction in drag against transit thereby resulting in a considerable increase in possible transit speed.

Figure 10 very schematically illustrates the relative positions of the hull sections 33 and 34 to the section during conversion between side-by-side and in-line end-to-end hull section arrangements.

In practice, the hull sections 33 and 34 may be turned by providing the hull sections with appropriately located thruster units which when in operation are capable of exerting sufficient side forces upon the hull sections to produce a required direction of movement of the hull sections. Alternatively, the hull sections may be turned by way of cables of a winch or pulley system. Such thrusters can be similar to those conventionally provided on some conventional vessels for the purposes of their handling in confined locations such as required for moving a vessel from a docking position alongside a quay.

Referring to Figure 11, the vessel is similar to that shown in Figures 6 to 10 except that the housing 13 is located at the very front of the vessel and that the crane 35 is located centrally on the deck of the main hull section 30. The crane 35 is shown to be in its rest position with its boom/jib to one side of the jack/lifting means 12. Alternatively the boom/jib could be arranged to lie between the adjacent jack/lifting means 12 nearest the rear end of the main hull section.

Referring to Figure 12, the vessel is shown in a location adjacent an off-shore wind turbine 50. The configuration of the vessel in figure 12 is similar to that shown in Figure 6 with the hull sections 33 and 34 pivoted to their positions at respective opposite sides of the main hull section 30 and with the legs 11 in their lowered seabed-contacting position raising the hull above the surface of the water. The crane boom/jib is telescopically extended to be able to perform necessary maintenance work on the upper section of the turbine 50.

Referring to Figures 13 and 14, the maintenance to one or more turbines 50 may involve the removal and/or replacement of turbine blades 54. The hull sections 33 and 34 may be provided with retaining means 56 to securely hold turbine blades 54. The crane 35 (together with any other desired deck-mounted equipment) would be used to manoeuvre the blades 54.

A vessel such as that shown in Figures 11 to 14 would be substantially 80 metres in length, the main hull section 30 being substantially 45 metres in length and the hull sections 33 and 34 being substantially 35 metres in length. The length of the legs 11 depends on the depth of the seabed, but would be substantially 50 metres to cover the majority of eventualities.

CLAIMS

1. A jack-up vehicle having a hull including at least two hull sections interconnected in such manner as to be positionable in an end-to-end relationship having a first vehicle width and for the purpose of movement of the vehicle from one location to another location and to be positionable in a side-by-side configuration having a second vehicle width when at said another location, wherein the first vehicle width is less than the second vehicle width.

2. A jack-up according to claim 1, wherein the at least two hull sections are interconnected by way of a hinge/pivot arrangement.

3. A jack-up according to claim 2, wherein the hinge/pivot arrangement turns about a substantially vertical hinge/pivot axis.

4. A jack-up according to any preceding claim, wherein a first hull section and a second hull section are interconnected by a first hinge/pivot arrangement located between the first and second sections at respective end regions that form the end-to-end relationship.

5. A jack-up according to any preceding claim, and further comprising a third hull section and a second hinge/pivot arrangement.

5. A jack-up according to claim 5 as appended to claim 4, wherein the second hinge/pivot arrangement is located at an opposite end region to the first hinge/pivot arrangement.

6. A jack-up according to claim 5 as appended to claim 4, wherein the second hinge/pivot arrangement is located at the same end region to the first hinge/pivot arrangement and on the respective opposite side of the respective hull section.

7. A jack-up according to claim 6, and comprising a major hull section and first and second minor hull sections, the arrangement being such that, in the end-to-end relationship, the minor hull sections are adjacent each other, respective adjacent ends of the minor hull sections laying in a face-to-face relationship with a rear end of the main hull section.

8. A jack-up according to claim 6 or 7, wherein in the side-by-side configuration is achieved when the minor hull sections are rotated about the first and second hinge/pivot arrangements and come to lie against respective opposite sides of the main hull section.

9. A jack-up according to any preceding claim, wherein the hull sections include a deck region having equipment mounting zones thereon for receiving pieces of equipment.

10. A jack-up according to any preceding claim, and further comprising a plurality of legs displaceable substantially vertically relative to the hull sections.

11. A method of operating a jack-up vehicle comprising arranging at a first location at least two hull sections of the vehicle in an end-to-end relationship and having a first vehicle width, transporting the vehicle to a second location and, at the second location, moving the at least two hull sections into a side-by-side configuration having a second vehicle width, the first vehicle width being less than the second vehicle width.

12. A method according to claim12, wherein there is one major hull section and two minor hull sections, and in the end-to-end relationship, the minor hull sections are arranged adjacent each other and against the rear end of the main section, and in the side-by-side configuration, the minor hull sections are moved to bear against respective opposite sides of the main hull section.

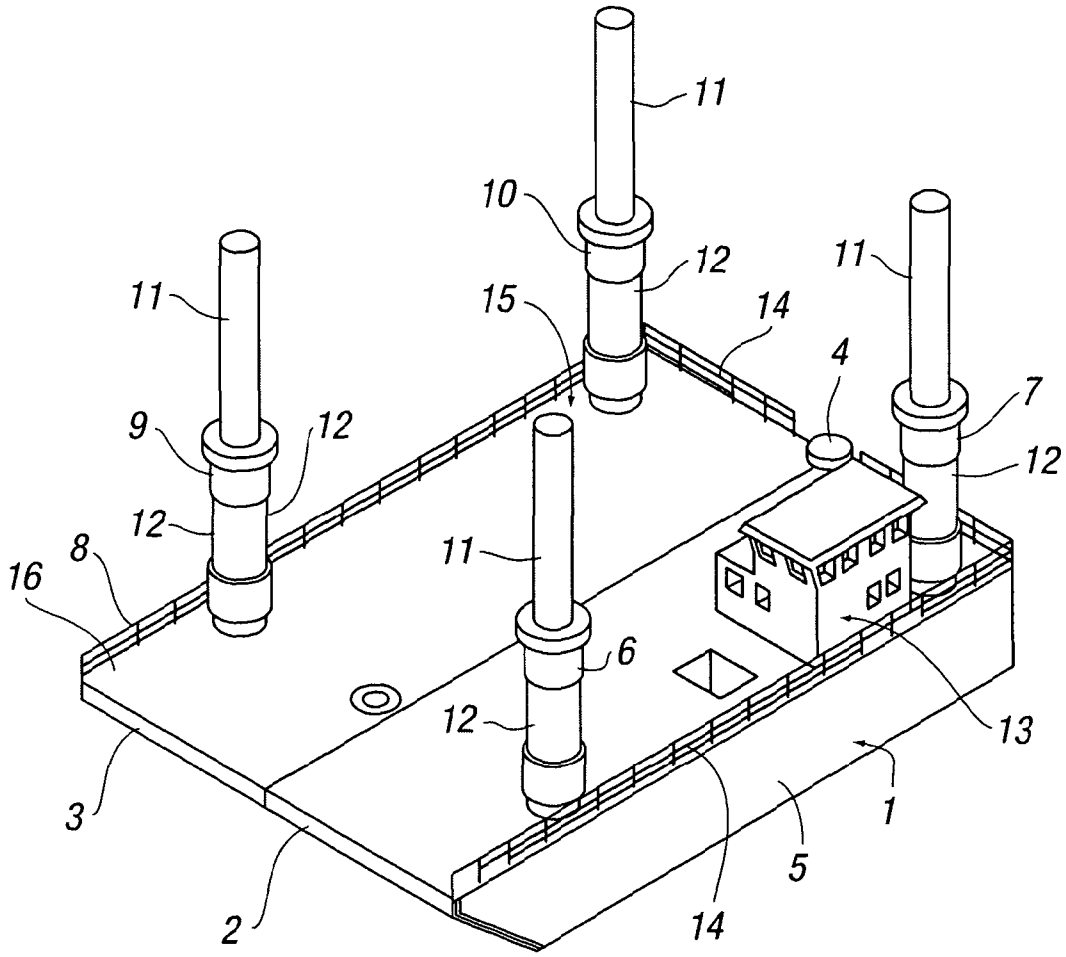

FIG. 1

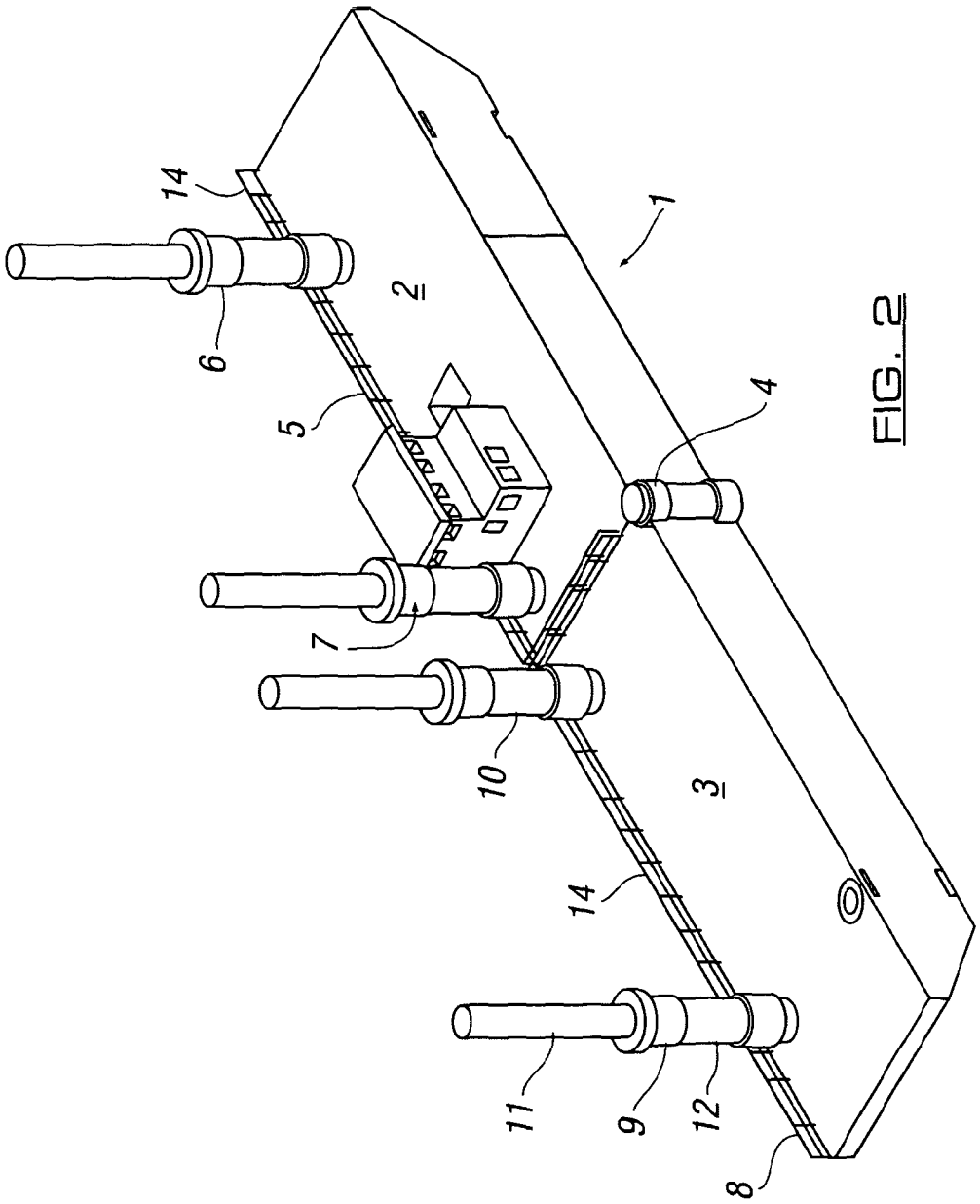

FIG. 2

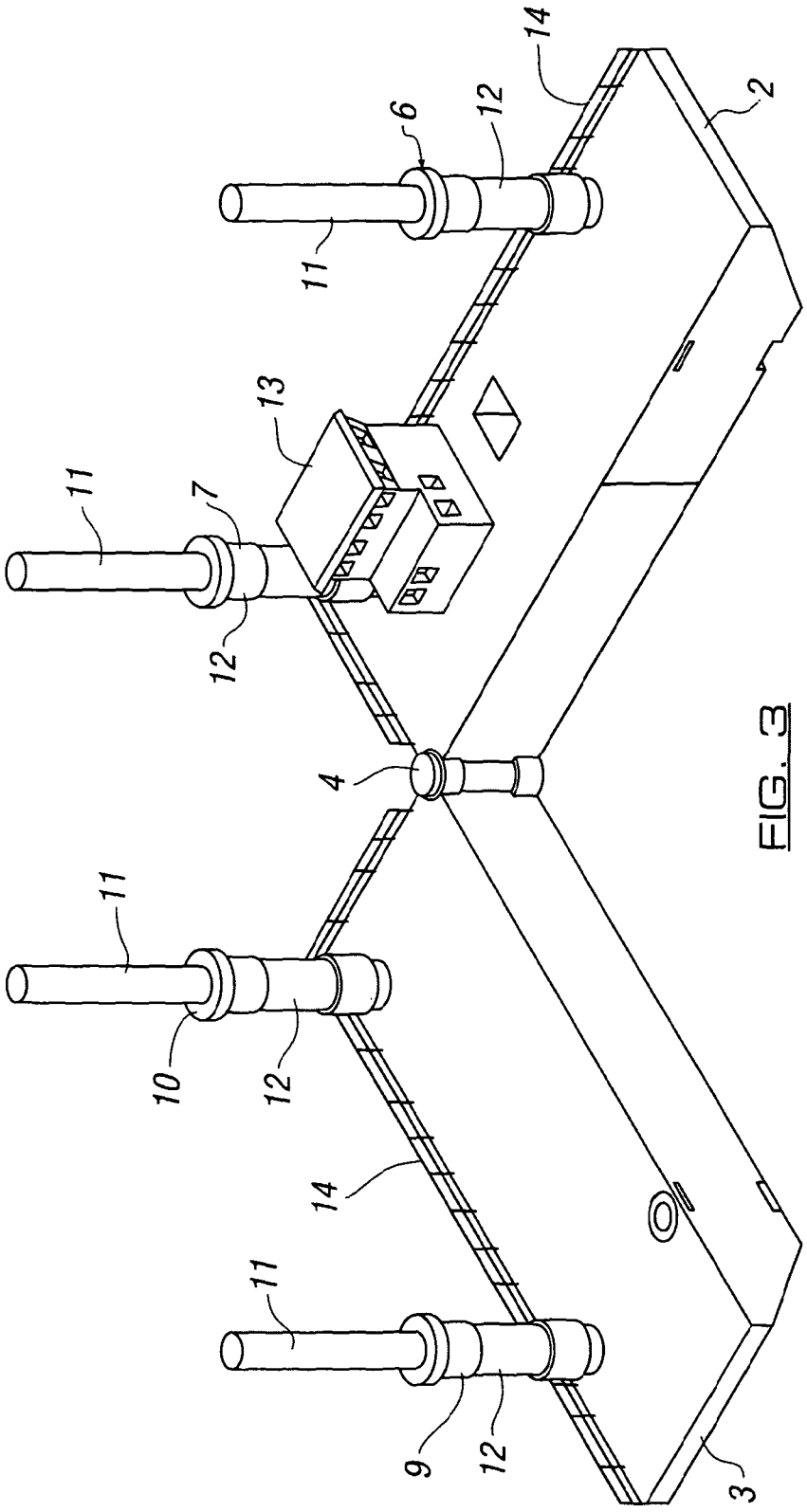

FIG. 3

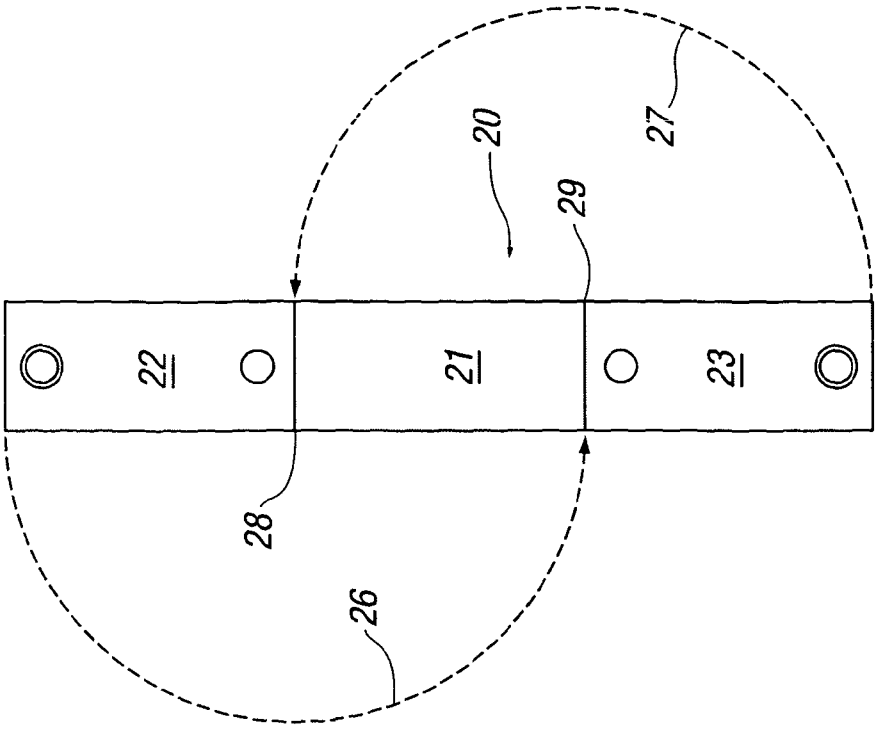

FIG. 5

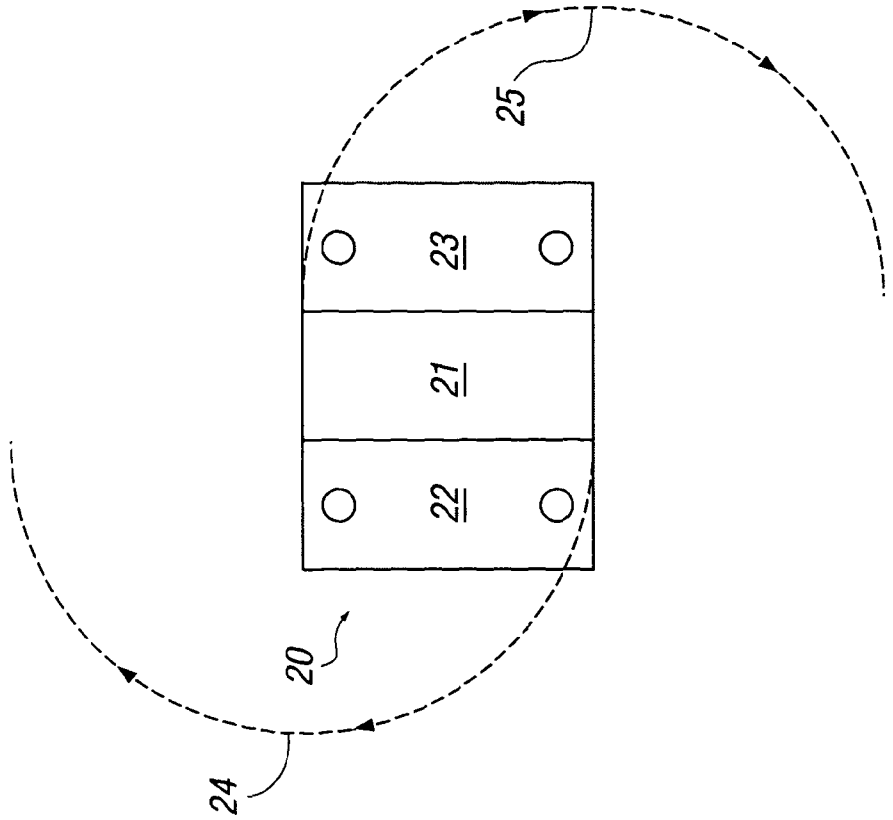

FIG. 4

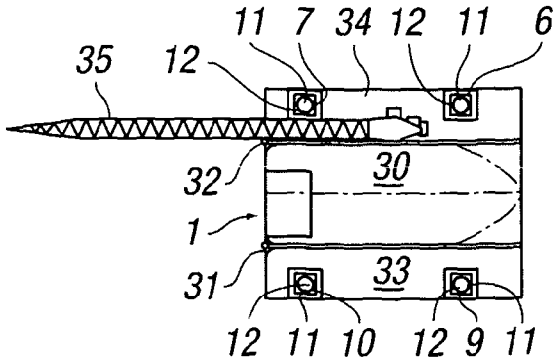

FIG. 6

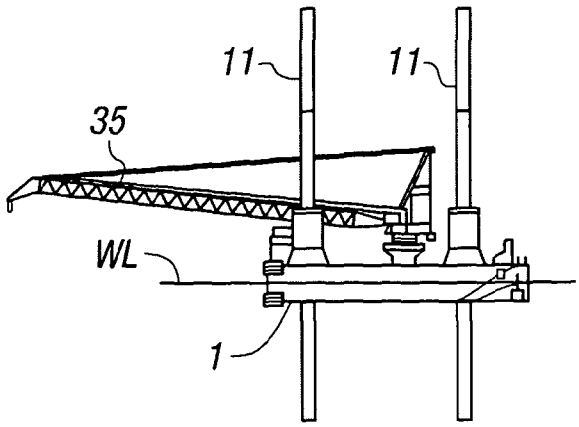

FIG. 7

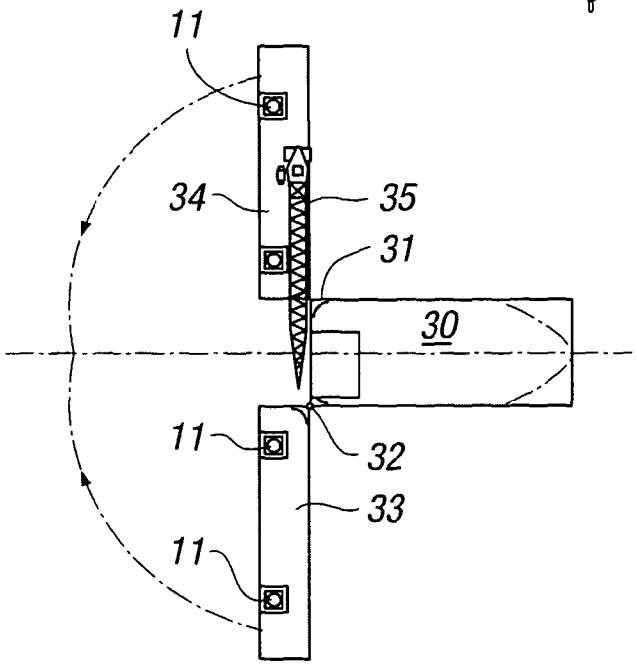

FIG. 10

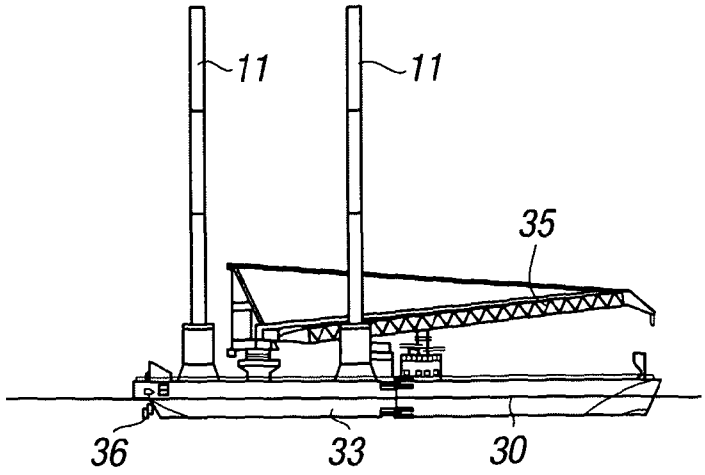

FIG. 9

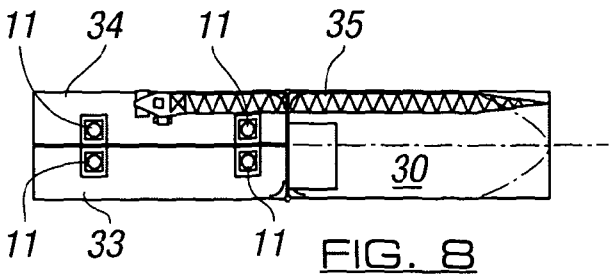

FIG. 8

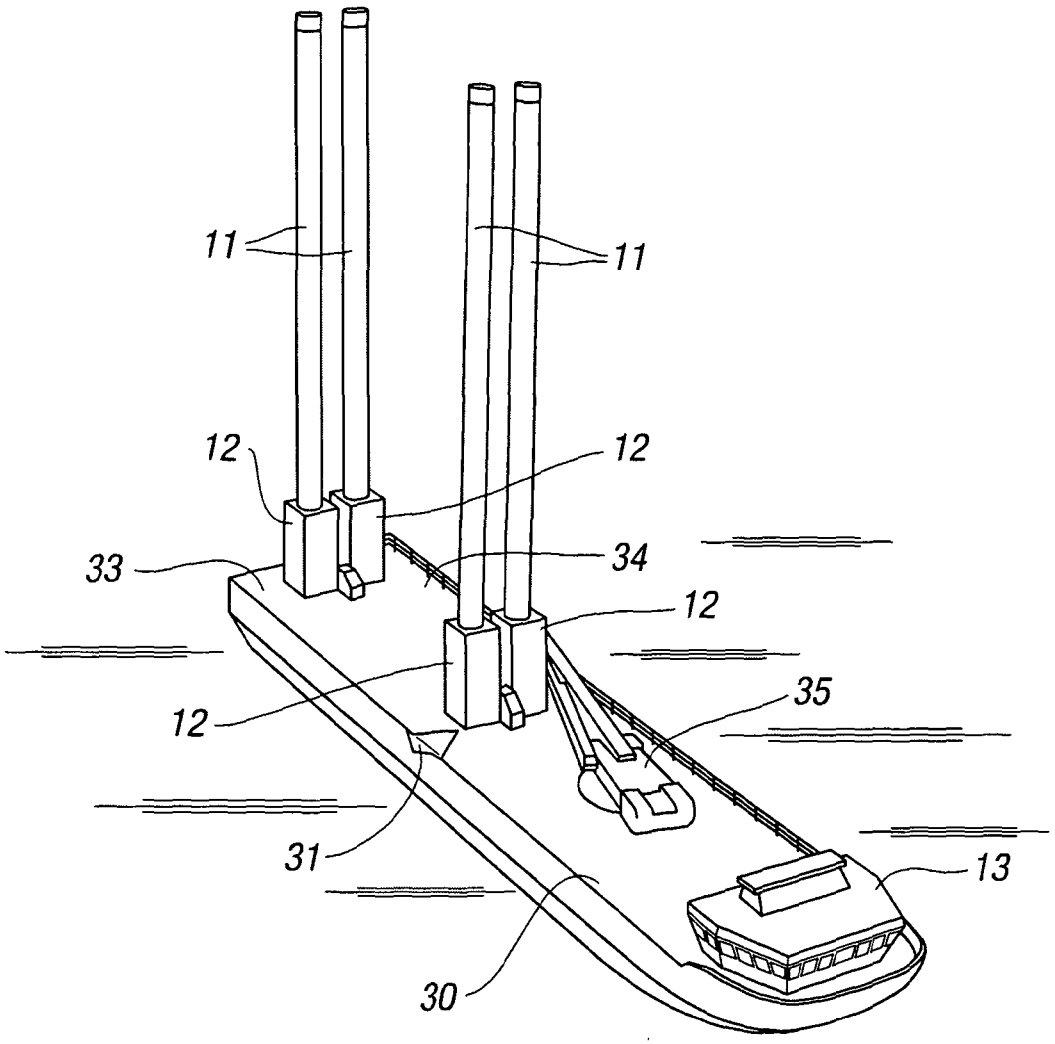

FIG. 11

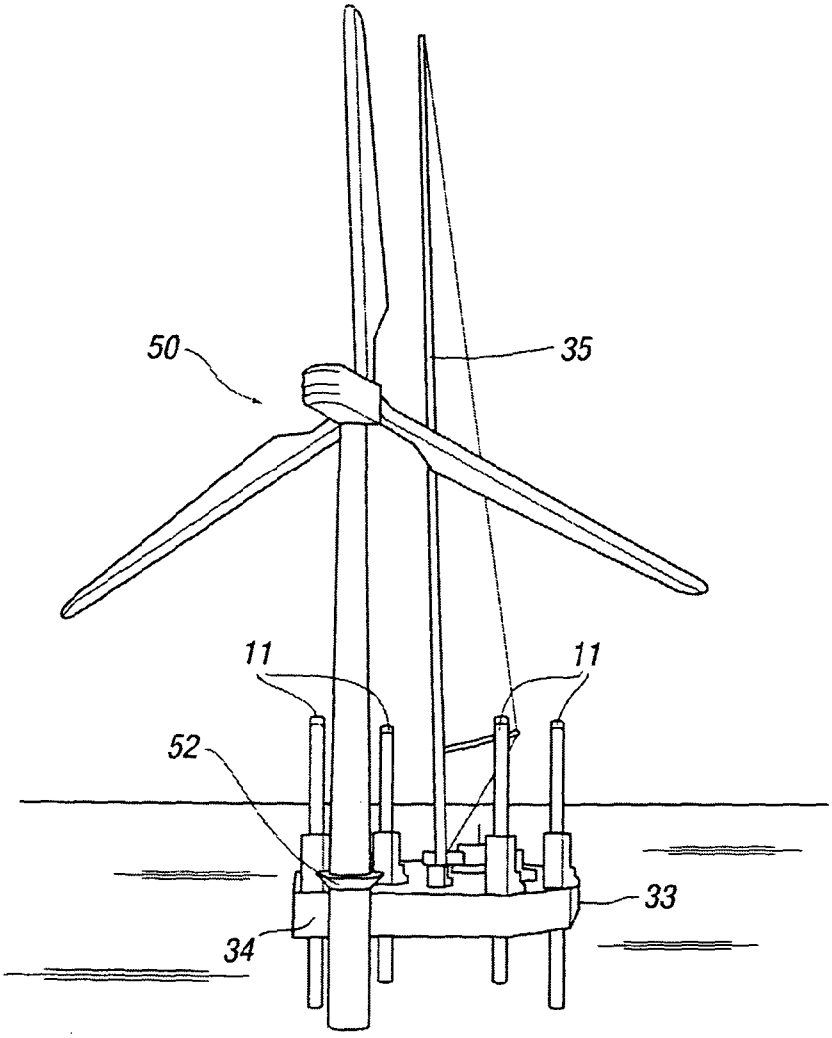

FIG. 12

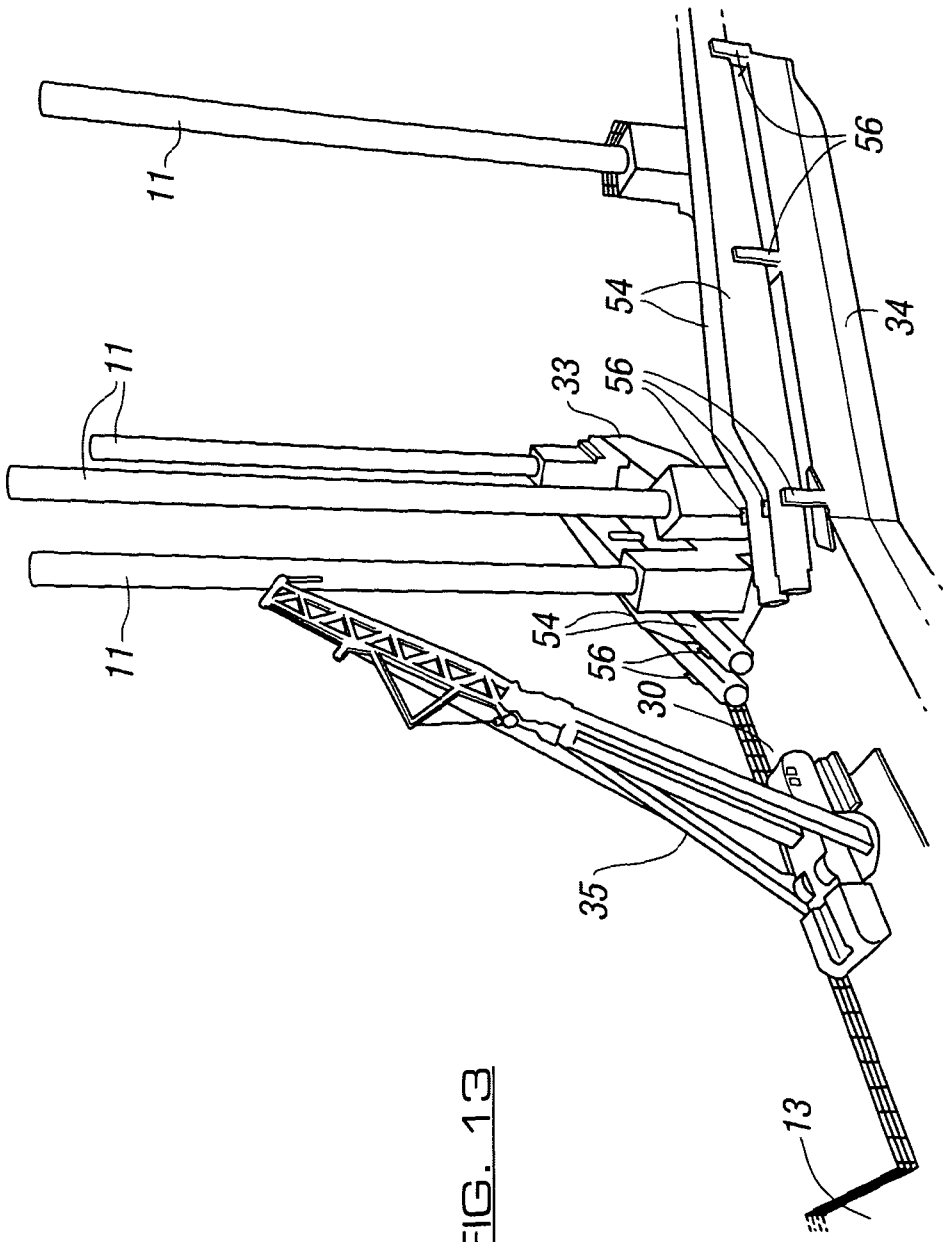

FIG. 13

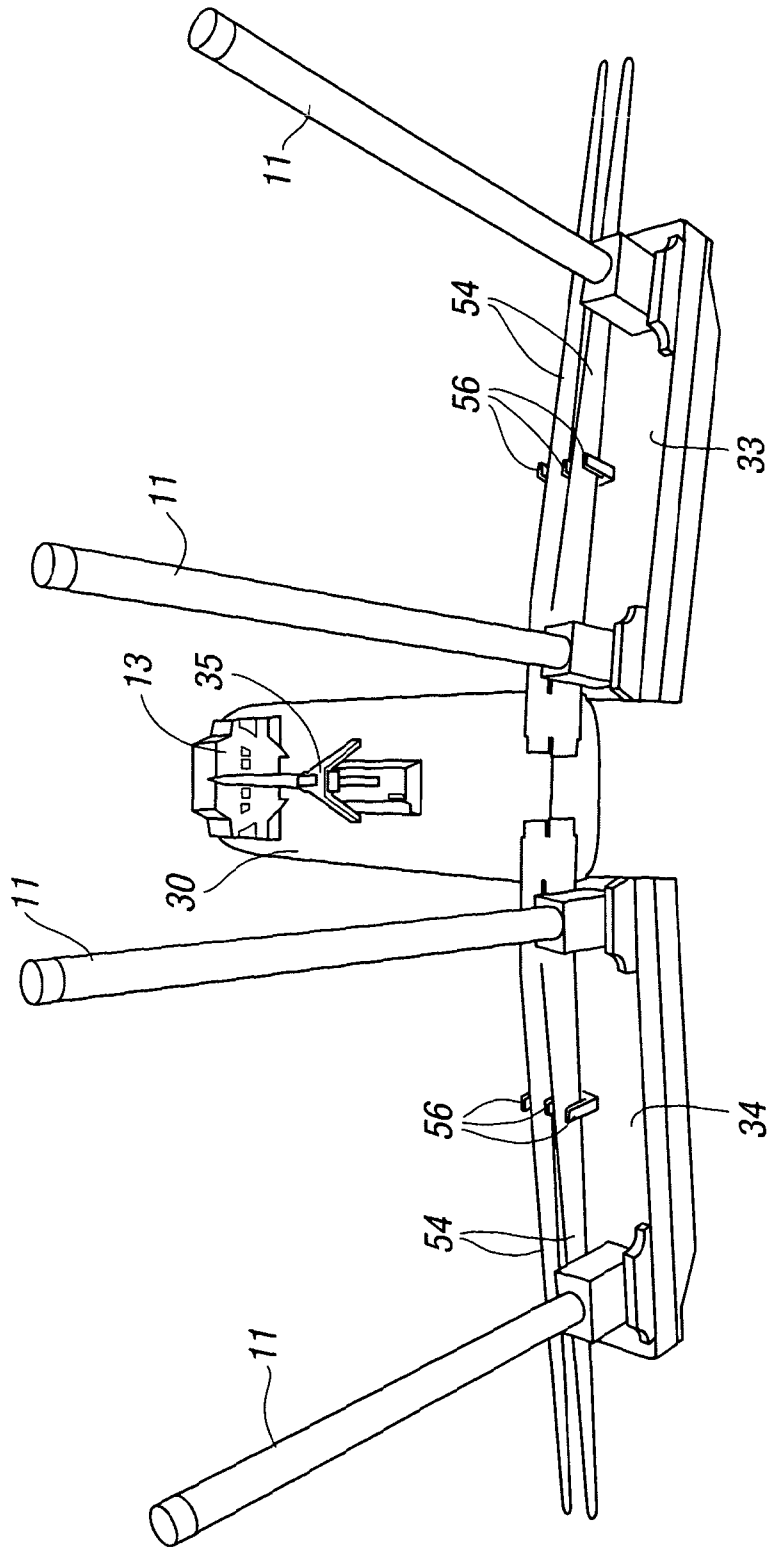

FIG. 14

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2011/0OQ948

A. CLASSIFICATION OF SUBJECT MATTER
INV. B63B7/Q4 B63B35/0Q E02B17/04
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B63B E02B

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 practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2 149 903 A (THOMPSON WI LL E S) 7 March 1939 (1939-03-07)	1-10, 12., 13
A	the whole document	11

X	US 4 366 769 A (LINGEMAN WHITTEN L [US]) 4 January 1983 (1983-01-04)	1-4, 10, 12 , 13
A	the whole document	5-9, 11

X	JP 59 134085 A (UEDA T0MI0) 1 August 1984 (1984-08-01)	1-4, 10, 12 , 13
A	abstract	5-9, 11

A	EP 2 146 006 Al (GE0SEA NV [BE]) 20 January 2010 (2010-01-20) the whole document	1-13

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 October 2011	11/11/2011

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Lindner, Vol ker

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/GB2011/0OQ948

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2149903 A	07-03-1939	NONE	
US 4366769 A	04-01-1983	NONE	
JP 59134085 A	01-08-1984	NONE	
EP 2146006 A1	20-01-2010	NONE	