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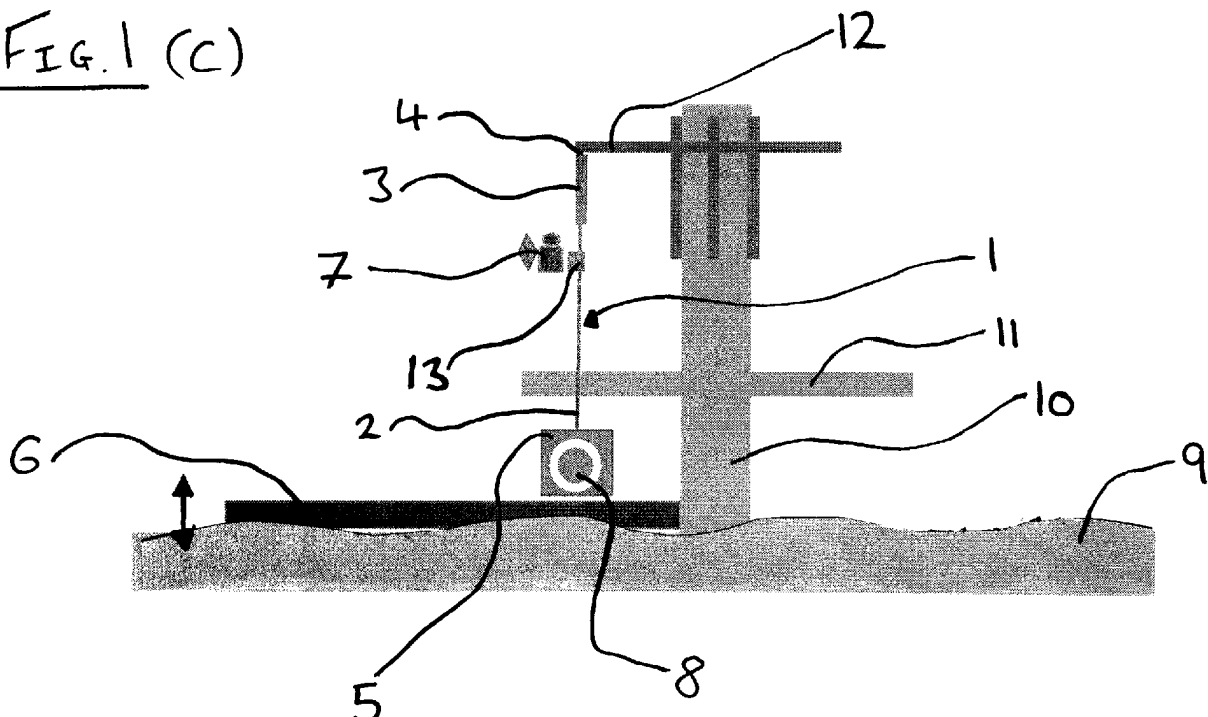
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(54) MARINE TRANSFER APPARATUS AND METHOD OF USING THE SAME

(57) Marine transfer apparatus for transferring a body (7) between a vessel (6) subjected to waves and an offshore structure (10). The apparatus comprises a transfer cable (1) on which the body (7) can ascend and descend in use. A structure coupling (4) connects a first end of the transfer cable (1) to an attachment point (12) provided on the offshore structure. A vessel coupling (5) connects a second end of the transfer cable (1) to the

vessel (6). The transfer cable (1) comprises an elastically extendable region (3) for extending its length when taut between the structure (4) and vessel couplings (5) as the vessel moves in the waves (9). The vessel coupling (5) further comprises a reeling device (8) for reeling the transfer cable (1) between a taut state and a slack state when connected between the structure (4) and vessel couplings (5).

FIG. 1 (C)**EP 3 766 773 A1**

Description

[0001] The present invention concerns a marine transfer apparatus and method for transferring a body between a vessel and an offshore structure and, in particular, a marine transfer apparatus and method for use with a monopile offshore structure, such as a wind turbine generator having a monopile foundation.

[0002] Transferring a body, such as a person or an object, between a marine vessel, such as a boat, and a fixed offshore structure can be a challenging and hazardous process. Waves in the water, caused by wind or swell, act on the vessel, moving its position relative to the offshore structure. In particular, as waves pass through, movements of the vessel can be complex and difficult to predict because the vessel may be simultaneously subjected to both rotational motions, such as pitch, roll and yaw, as well as translational motions, such as heave, sway and surge. In some circumstances it may be possible to minimise motions such as roll, yaw, sway and surge by driving the vessel into an offshore structure's boat landing so that the vessel pushes onto the foundation. However, vertical motions are difficult to mitigate. Such vertical motions are especially hazardous because there is a risk that the person could get caught between the vessel and the structure when they are attempting to transition from the vessel onto, for example, a static ladder provided on the exterior of an offshore structure.

[0003] Various methods have been previously adopted to address the above issues. For example, helicopters can be used in some circumstances, either by landing on a platform on the structure itself or by a person rappelling down from the helicopter onto a platform. However, helicopters are expensive to operate and are only able to land on very large platforms, such as those provided on oil platforms. They are also not suitable in high winds or poor visibility, and these restrictions are even greater in situations where rappelling is necessary. Other solutions involve the use of motion compensated gangways between the vessel and a platform, although these are only feasible for use from larger ships, which consequently adds to the expense and complexity. Finally, various techniques involving the use of cranes and hoists from the offshore platform have also been proposed. In such systems, a cable may be hung down from the offshore platform, and the body may be hoisted from the platform using the cable. Distance control systems are typically used with such arrangements to control the winch or hoisting mechanism to compensate for movements of the vessel by tracking its movements using lasers or ultrasonic sensors. However, such winching or hoisting mechanisms are often complex and not sufficiently responsive to fully mitigate the effects of a vessel's movements.

[0004] The above problems are particularly exacerbated in the case of transfer systems for monopile foundation structures and more particularly in the case of offshore

wind turbine structures. Firstly, monopile foundation structures are smaller, and hence have smaller boat landings and maintenance platforms. This renders larger scale transfer systems used when accessing larger structures, such as an oil platform, unsuitable. Furthermore, because monopile foundation structures are unmanned, it is much more difficult to implement systems which rely on cranes and winches being actively controlled at the platform. For example, controlling such machinery remotely from the vessel results in new safety and maintenance issues being raised.

[0005] Accordingly, there is a need for an improved marine transfer apparatus that seeks to address the above problems, and in particular one that is directed to the specific technical considerations associated with monopile offshore structures.

[0006] According to a first aspect of the present invention, there is provided a marine transfer apparatus for transferring a body between a vessel subjected to waves and an offshore structure, the apparatus comprising: a transfer cable on which the body can ascend and descend in use; a structure coupling for connecting a first end of the transfer cable to an attachment point provided on the offshore structure; a vessel coupling for connecting a second end of the transfer cable to the vessel; and wherein the transfer cable is elastically extendable for extending its length when taut between the structure and vessel couplings as the vessel moves in the waves; and wherein one of the structure and vessel couplings comprises a reeling device for reeling the transfer cable between a taut state and a slack state when connected between the structure and vessel couplings.

[0007] In this way, when the transfer cable is connected between the structure and vessel, the reeling device allows the tension in the cable to be controlled to switch between a taut state and a slack state. This has the effect of switching the movement reference point from the vessel to offshore structure. To explain further, in the taut state, the elastic extendability of the transfer cable allows it to extend and contract with the movements of the vessel in the waves. As such, when a body is coupled to the transfer cable, it moves in unison with the cable's extensions and contractions in length, and hence its movement is coupled with movement of the vessel. In other words, the transfer cable is effectively stationary relative to the reference point of the vessel. As a consequence, a body is able to safely ascend the transfer cable from the vessel, as well as safely descend the transfer cable onto the vessel. Conversely, when the reeling device is operated to place the transfer cable in the slack state, the slack at the cable's second end accommodates the movements of the vessel in the waves, rather than this being accommodated by cable extension. As such, the transfer cable hangs down from the structure's attachment point without being influenced by movements of the vessel. In other words, the transfer cable is effectively stationary relative to the reference point of the offshore structure. As a consequence, a body is able to safely ascend the transfer

cable from the structure's platform, as well as safely descend the transfer cable onto the structure's platform. Here, it will be understood that even when the reeling device is operated to place the transfer cable in the slack state, the section between where the body is connected and its attachment to the structure may nevertheless still be taut in the sense that the body's weight will inherently pull the cable above it tight. However, the transfer cable as a whole is in a slack state in that the movements of the vessel in the waves are accommodated by a surplus of cable, rather than the cable extending in length.

[0008] Accordingly, with the above marine transfer apparatus, safe access to an offshore structure from a vessel can be achieved without needing a boat landing or ladder, and from any sized access vessel. It will be understood that the reeling device may switch the transfer cable between the taut and slack states by paying out or withdrawing sections of the transfer cable, for example by winding the transfer cable onto a cylinder or by drawing the cable through a pulley arrangement using, for instance, a piston actuator.

[0009] Preferably, the transfer cable comprises an extendable region and non-extendable region. In this way, the extendable region of the cable can provide the elastic extension of the transfer cable's overall length, while the non-extendable region is able to move with the vessel when in a taut state and resists stretching when gripped and loaded by a carrier during an ascent operation to allow for an easier ascent.

[0010] Preferably, the extendable region is located at or adjacent the first end of the transfer cable. In this way, the extension of the transfer cable is focussed within the section of the cable closest to its attachment to the structure. At the same time, the non-extendable region adjacent the vessel is able to move with the vessel, whilst providing a non-stretchable material for facilitating an easier ascent.

[0011] Preferably, the extendable region comprises an elastic cable section or a spring. In this way, the transfer cable may be provided in two functional parts joined to form the length of cable. The extendable region may therefore be formed in a straightforward manner using an elastic material or spring. The non-extendable region may then be provided as a steel or polymer cable, or webbed strap, joined to the elastic or spring material of the extendable region.

[0012] Preferably, the reeling device comprises a winch. In this way, retracted sections of the transfer cable may be held in a compact arrangement when wound onto the winch cylinder. At the same time, the rotational position of the winch cylinder may be locked to maintain the transfer cable in a taut state and quickly pay out cable to switch to a slack state.

[0013] Preferably, the vessel coupling comprises the reeling device. In this way, actuation of the switching between the taut and slack states may be provided on the vessel itself, allowing for localised control and maintenance.

[0014] Preferably, the apparatus further comprises a carrier coupled to the transfer cable for moving the body on the transfer cable. In this way, the body may attach to the carrier, which can then in turn be driven to ascend or descend the cable. The carrier may be manually driven, for example, such as a climbing ascender/descender. In other embodiments, the carrier may comprise a lifting mechanism powered autonomously or from the vessel.

[0015] Preferably, the vessel coupling comprises a release device for rapidly releasing tension in the transfer cable. In this way, in the event of an excessive movement of the vessel in the water causing the transfer cable to be subjected to a tension above a tension limit, the release device may operate to rapidly release that tension. To achieve this, the release device may rapidly pay out cable from the reeling device and/or by breaking away the transfer cable from its connection to the vessel. This thereby provides an important safety feature to minimise the risk of injury to personnel, which could otherwise result from damage or failure of components within the apparatus, the vessel and/or the offshore structure.

[0016] Preferably, the structure coupling comprises a remote release mechanism for releasing the transfer cable from a stored position to a released position where the second end of the transfer cable may be attached to the vessel coupling. In this way, the transfer cable may be stored on the offshore structure, coupled to the attachment point, and then released remotely when needed by a vessel. For example, the transfer cable may be stored in a weatherproof box at the attachment point, and then released by actuating a latch to open a door and drop the second end of the transfer cable down.

[0017] Preferably, the offshore structure is a monopile offshore structure. Embodiments of the present invention are especially suitable for use with monopile offshore structures. For example, the apparatus may be used with smaller vessels and, since control may be implemented from the vessel side, there is no need for the platform to be manned.

[0018] In embodiments, the marine transfer apparatus further comprises a secondary rope for hanging from a secondary rope attachment point connected to the offshore structure, the secondary rope for connection to a climb assist device for driving the body to ascend the transfer cable. In this way, the secondary rope can be used to drive ascent operations using a climb assist device, when the transfer cable is in the slack state. Advantageously, this allows a greater variety of climb assist devices to be used with embodiments of the invention because the free end of the secondary rope is not taut. It will be understood that the secondary rope attachment point may be part of the structure coupling or be provided at the same attachment point on the offshore structure to which the transfer cable is coupled. Alternatively, the secondary rope may also attach to the transfer cable itself, and thereby be connected to the offshore structure through the transfer cable. It will also be understood that mechanisms used for driving the body, such as the carrier

and/or climb assist device, may be powered or manually operated.

[0019] According to a second aspect of the present invention, there is provided a method of transferring a body from a vessel subjected to waves to an offshore structure using the apparatus of any preceding claim, comprising: connecting the transfer cable between the structure coupling and the vessel coupling; operating the reeling device to reel the transfer cable to a taut state; operating a carrier coupled to the transfer cable to move the body for ascending the transfer cable from the vessel to an elevated position; operating the reeling device to reel the transfer cable to a slack state; and operating the carrier to move the body from the elevated position to the platform on the offshore structure.

[0020] In this way, when the body first ascends from the vessel, with the transfer cable in the taut state, the elastic extendability of the transfer cable allows it to extend and contract with the movements of the vessel in the waves. As such, the body is able to safely ascend away from the vessel. Once the body has reached the elevated position, which may be above the platform or clear of the platform and above the vessel, the reeling device may then be operated to place the transfer cable in the slack state. In this condition, the transfer cable no longer moves with the vessel, allowing the body to safely descend or further ascend onto the structure's platform. Furthermore, the action of paying out the transfer cable from the reeling device may also be used to elevate the body. In particular, by locking the carrier onto the transfer cable when taut, and then paying out a section of cable from the reeling device, a corresponding contraction of the extendable region will act to lift the body away from the vessel. Once suitably elevated, the carrier may then be operated to allow further ascent of the transfer cable, for example by being directly driven or in combination with a climb assist device engaged with a secondary rope.

[0021] Preferably, the elevated position is above the platform on the offshore structure, and the carrier is operated to move the body to descend the transfer cable from the elevated position to the platform on the offshore structure.

[0022] Preferably, the method further comprises the step of releasing the second end of the transfer cable from the vessel coupling. In this way, the vessel may move away from the structure to complete other operations. The second end of the transfer cable may be released once the reeling device has reeled the transfer cable to a slack state or once the body has descended from the elevated position onto the platform or ascended to the platform.

[0023] According to a third aspect of the present invention, there is provided a method of transferring a body from an offshore structure to a vessel using the above apparatus, comprising: operating a carrier coupled to the transfer cable, when the transfer cable is in a slack state, to move the body on the transfer cable from a platform

on the offshore structure to an elevated position; once the body is in the elevated position, operating the reeling device to reel the transfer cable to a taut state connected between the structure and vessel couplings; and operating the carrier to move the body for descending the transfer cable from the elevated position to the vessel.

[0024] In this way, when the body is to be transferred back to the vessel, it is able to safely climb to the elevated position from the platform, with the transfer cable not moving relative to the platform. Once the body has reached the elevated position, which may be above the platform or clear of the platform and above the vessel, the reeling device may then be operated to place the transfer cable in the taut state. In this condition, the transfer cable moves with the vessel, allowing the body to safely descend onto the vessel. It will be understood that transfer cable may be connected to the vessel coupling either prior to operating the carrier or once the body has ascended to the elevated position.

[0025] Preferably, the elevated position is above the platform on the offshore structure.

[0026] Preferably, the method further comprises releasing the second end of the transfer cable from the vessel coupling. In this way, once the body has safely reached the vessel, the vessel may move away from the structure to complete other operations.

[0027] In embodiments, the above methods may further comprise the steps of: providing a secondary rope hung from a secondary rope attachment point connected to the offshore structure; connecting a climb assist device to the secondary rope; and operating the climb assist device to drive movement of the body on the transfer cable. In this way, the secondary rope can be used to drive ascent operations using a climb assist device. Advantageously, this allows a greater variety of climb assist devices to be used with embodiments of the invention because the free end of the secondary rope is not taut. It will be understood that the secondary rope attachment point may be part of the structure coupling or be provided at the same attachment point on the offshore structure to which the transfer cable is coupled, or on the transfer cable itself.

[0028] Preferably, the offshore structure is a monopile offshore structure. The above methods are particularly applicable to monopile offshore structures.

[0029] Illustrative embodiments of the present invention will now be described with reference to the accompanying drawings, in which:

Figures 1 (a) to (d) show schematic illustrations of the marine transfer apparatus according to an embodiment of the invention during an ascent operation from a vessel to a monopile wind turbine generator; and

Figures 2 (a) to (d) show schematic illustrations of the marine transfer apparatus according to an embodiment of the invention during a descent operation from a monopile wind turbine generator to a vessel;

Figure 3 shows a schematic illustration of a marine transfer apparatus according to a second embodiment of the invention; and

Figure 4 shows a schematic illustration of a marine transfer apparatus according to a third embodiment of the invention.

[0030] Figure 1(a) shows a schematic illustration of a marine transfer apparatus according to an embodiment of the invention. The marine transfer apparatus is used to transfer a body 7, such as a person or object, between a marine vessel 6 and an offshore structure 10, in this case a monopile wind turbine generator. As will be understood, marine vessels 6, such as boats and ships, are subjected to waves in the sea 9, which causes their position to vary dynamically relative to a static reference point, like the monopile wind turbine generator 10.

[0031] The marine transfer apparatus comprises a transfer cable 1 which includes an extendable region 3 and a non-extendable region 2. The extendable region 3 is elastically extendable and is located at a first end of the transfer cable 1 and connects, via coupling 4, to a hook-on arm 12 provided on the body of the wind turbine generator 10 above its platform 11. As such, the hook-on arm 12 provides an attachment point for the wind turbine generator 10. The hook-on arm 12 may be provided as a swing arm to allow for easier access to the platform 11. In this embodiment, the extendable region 3 is provided as a tension spring, although other embodiments may use other arrangements, such as other types of spring, elastic materials, or piston arrangements. The non-extendable region 2 is joined to the extendable region 3 and is located at a second end of the transfer cable 1 and connects, via coupling 5, to the vessel 6. In this embodiment, the non-extendable region 2 is provided as a nylon cable, although other embodiments may use other materials, such as other polymer ropes or steel wire.

[0032] The vessel coupling 5 connects the second end of the transfer cable 1 to the vessel 6 and comprises a reeling device 8 for reeling the transfer cable 1. In this embodiment, the reeling device 8 is provided as a winch, although other mechanisms are also envisaged. The reeling device 8 may retract and pay out sections of the transfer cable 1, such that, when the transfer cable 1 is connected between the structure coupling 4 and vessel coupling 5, it can be switched between a taut state and a slack state.

[0033] When the transfer cable 1 is in the taut state, it is pulled tight between the structure coupling 4 and vessel coupling 5. However, the elastically extendable region 3 is sufficiently extendable to accommodate the movement of the vessel 6 in the sea 9. As such, the elastically extendable region 3 is stretched further when the vessel 6 moves down relative to the wind turbine generator 10, and contracts back when the vessel 6 moves up relative to the wind turbine generator 10. In this state, the non-extendable region 2 therefore moves up and down with the vertical movements of the vessel 6.

[0034] An ascent operation using the illustrative embodiment will now be described in reference to Figures 1 (a) to (d). As shown in Figure 1(a), the vessel 6 may arrive at the wind turbine generator 10, and may optionally also push on to the monopile foundation to minimise its movement. At this stage, a remote trigger may be used to release the transfer cable 1 from a stored position in a weatherproof box provided on the hook-on arm 12. This causes the second end of the transfer cable 1 to drop down to the vessel 6, with the first end connected to the hook-on arm 12 via structure coupling 4, and the hanging cable 1 slack. The second end of the transfer cable 1 may then be connected to the reeling device 8 of vessel coupling 5. It will be understood that, although in this embodiment the transfer cable 1 is retained at the structure coupling 4, other arrangements are also envisaged. For example, in another embodiment, the transfer cable 1 is retained at the vessel coupling 5 and the structure coupling 4 is provided with a guide rope that is used to connect the transfer cable 1. An advantage with such an arrangement is that only one transfer cable 1 and one carrier device 13 is needed per vessel, and the installation and maintenance required at the wind turbine generator 10 is minimised.

[0035] In Figure 1(b), the reeling device 8 is driven to reel in the transfer cable 1 so that it is taut between the vessel coupling 5 and structure coupling 4. In this state, the non-extendable region 2 moves up and down with the vertical movements of the vessel 6, with the elastically extendable region 3 accommodating this movement.

[0036] As shown in Figure 1(c), the body 7, may then ascend the non-extendable region 2 of the transfer cable 1 using a carrier 13, such as a climbing ascender/descender. Once the body 7 has ascended to an elevated position above the platform 11, the reeling device 8 may then be operated to reel out the transfer cable 1 to introduce slack between the body 7 and the vessel 6.

[0037] As shown in Figure 1(d), with the transfer cable 1 slack between the body 7 and the vessel 6, it no longer moves with the vessel 6. As such, the body 7 may safely descend onto the platform 11 by operating the carrier 13.

[0038] A descent operation using the illustrative embodiment will now be described in reference to Figures 2 (a) to (d). As shown in Figure 2(a), the vessel 6 positions itself at the wind turbine generator 10, and may optionally push on to the monopile foundation to minimise its movement. At this initial stage, the transfer cord 1 is in a slack condition, either because it is not yet connected to the reeling device 8 or because the reeling device 8 is operated to place the transfer cord 1 in the slack state. Figure 2(a) shows the situation where the transfer cord 1 is already connected to the reeling device 8 and the reeling device 8 is operated to place the transfer cord 1 in the slack state.

[0039] The carrier 13 is then coupled to the slack transfer cable 1 and, as shown in Figure 2(b), is operated to lift the body 7 to ascending the transfer cable 1 from a platform 11.

[0040] Once the body 7 reaches the elevated position shown in Figure 2(c), the reeling device 8 is operated to reel in the transfer cable 1 to a taut state. It will be understood that, if the transfer cable 1 was not already connected to the reeling device 8, it will need to be connected before it is reeled in.

[0041] As shown in Figure 2(d), with the transfer cable 1 taut, it now moves with the vessel 6, thereby allowing the body 7 to safely descend from the elevated position down to the vessel 6.

[0042] Accordingly, with the above arrangement, the movement reference point for an ascending or descending body 7 can be switched between the vessel 6 and the offshore structure 10. As such, when a body 7 is on the transfer cable 1 adjacent to the vessel 6, it or they move in unison with the vessel 6. Conversely, when body 7 is on the transfer cable 1 adjacent to the structure's platform 11, it isn't influenced by movements of the vessel 6. As a result, a body 7 is able to safely transition between the vessel 6 and the structure's platform 11. Advantageously, this may significantly reduce the risk of injury to personnel, and may be implemented from any sized access vessel 6, without needing a boat landing or ladder to be provided on the offshore structure 10.

[0043] It will be understood that the embodiment illustrated above shows an application of the invention only for the purposes of illustration. In practice the invention may be applied to many different configurations, the detailed embodiments being straightforward for those skilled in the art to implement.

[0044] In this connection, for example, Figure 3 shows a schematic illustration of a second embodiment of the invention. This embodiment is similar to the embodiment shown in Figures 1 and 2, with like reference numerals referencing common features. However, in this embodiment, the apparatus is further provided with a secondary rope 14, which hangs down from its fixture on the hook-on arm 12. The secondary rope 14 is coupled to a climb assist device 15 used to drive the ascent once the transfer cable is in the slack state, rather than this being driven by a mechanism within carrier 13. In particular, the carrier 13 is provided as a fall arrest mechanism to which a body is attached. During an ascent operation, the fall arrest mechanism 13 supports the body's weight when it is not being actively driven. Once the body 7 is clear of the vessel 6 and the transfer cable 1 is in the slack state, the climb assist device 15 may then be engaged with the secondary rope 14 and driven to pull the body 7 upwards. During a descent operation, the fall arrest mechanism 13 and/or the climb assist device 15 may be operated to control the speed of descent. As with the first embodiment, the transfer cable 1 may be switched between the taut and slack states depending on whether the body 7 is adjacent to the vessel 6 or the structure's platform 11. Importantly, with this embodiment, as the secondary rope 14 is not taut below the climb assist device 15, a greater range of ascent devices may thereby be used. For example, some climb assist devices rely on the engaged

rope being driven through a perpendicular path as it passes through the climb assist device's rope guide and tensioner assembly. As such, the provision of a secondary rope 14, hung from the offshore structure with a free end, allows embodiments of the present invention to be used in conjunction with such climb assist devices.

[0045] In the above example, the secondary rope's attachment point on the hook-on arm 12 is separated from the structure coupling 4. However, in other embodiments, these attachment points may be the same or adjacent to one another. Furthermore, the secondary rope's attachment point may also be provided at the joint between the extendable and non-extendable sections of the transfer cable 1, or on the non-extendable section 2 itself.

[0046] In this connection, Figure 4 shows a schematic illustration of a marine transfer apparatus according to a third embodiment of the invention. This third embodiment is substantially identical to the second embodiment shown in Figure 3, except that the secondary rope 14 is attached at the joint of this section to the extendable section 3. That is, the joint between these functional parts comprises a hook-on point for attaching the secondary rope 14. In other embodiments, the secondary rope 14 could be attached further down the non-extendable section 2. For the purposes of simplifying illustration, the secondary rope 14 has been drawn separated from the non-extendable section 2 of transfer cable 1. However, it will be understood that in practice, the secondary rope 14 and non-extendable section 2 may hang down substantially parallel to one another, spaced by the separation between the carrier 13 coupled to the non-extendable section 2 and the climb assist device 15 coupled to secondary rope 14. As with the second embodiment above, because the secondary rope 14 is not connected to the reeling device, it remains slack below the climb assist device 15, independent of whether the transfer cable 1 is in its taut or slack states. This allows a greater range of climb assist devices to be used, whilst advantageously allowing the secondary rope 14 to move with the non-extendable section 2 when the transfer cable 1 is in its taut state.

[0047] As with the transfer cable 1, the secondary rope 14 may be retained at the hook-on arm 12, or may be retained on the vessel and connected to the structure using a guide rope. Furthermore, the secondary rope 14 may be made from, for example, nylon, other polymer ropes and webbing, or from steel wire.

[0048] It will also be understood that safety and/or guide cables may be additionally be used in conjunction with the above arrangements. For example, a fail-safe cable may be provided between the non-extendable section 2 and the hook-on arm 12 to secure the transfer cable 1 in the event that the extendable section 3 were to fail. That is, the fail-safe cable would be sufficiently slack to allow the extendable section 3 to extend in use, but in the event that the extendable section 3 were to break, it provides a bypass connection between the non-extendable section 2 and the hook-on arm 12. This may there-

fore ensure that any personnel climbing the cable are not dropped in the event of a cable failure.

Claims

1. Marine transfer apparatus for transferring a body between a vessel subjected to waves and an offshore structure, the apparatus comprising:

a transfer cable on which the body can ascend and descend in use;
a structure coupling for connecting a first end of the transfer cable to an attachment point provided on the offshore structure;
a vessel coupling for connecting a second end of the transfer cable to the vessel; and
wherein the transfer cable is elastically extendable for extending its length when taut between the structure and vessel couplings as the vessel moves in the waves; and
wherein one of the structure and vessel couplings comprises a reeling device for reeling the transfer cable between a taut state and a slack state when connected between the structure and vessel couplings.

2. Marine transfer apparatus according to claim 1, wherein the transfer cable comprises an extendable region and non-extendable region.

3. Marine transfer apparatus according to claim 2, wherein the extendable region is located at or adjacent the first end of the transfer cable.

4. Marine transfer apparatus according to claim 2 or 3, wherein the extendable region comprises an elastic cable section or a spring.

5. Marine transfer apparatus according to any preceding claim, wherein the reeling device comprises a winch.

6. Marine transfer apparatus according to any preceding claim, wherein the vessel coupling comprises the reeling device.

7. Marine transfer apparatus according to any preceding claim, further comprising a carrier coupled to the transfer cable for moving the body on the transfer cable.

8. Marine transfer apparatus according to any preceding claim, wherein the vessel coupling comprises a release device for rapidly releasing tension in the transfer cable.

9. Marine transfer apparatus according to any preced-

ing claim, wherein the structure coupling comprises a remote release mechanism for releasing the transfer cable from a stored position to a released position where the second end of the transfer cable may be attached to the vessel coupling.

10. Marine transfer apparatus according to any preceding claim, wherein the offshore structure is a monopile offshore structure.

11. Marine transfer apparatus according to any preceding claim, further comprising a secondary rope for hanging from a secondary rope attachment point connected to the offshore structure, the secondary rope for connection to a climb assist device for driving the body to ascend the transfer cable.

12. A method of transferring a body from a vessel subjected to waves to an offshore structure using the apparatus of any preceding claim, comprising:

connecting the transfer cable between the structure coupling and the vessel coupling;
operating the reeling device to reel the transfer cable to a taut state;
operating a carrier coupled to the transfer cable to move the body for ascending the transfer cable from the vessel to an elevated position;
operating the reeling device to reel the transfer cable to a slack state; and
operating the carrier to move the body on the transfer cable from the elevated position to the platform on the offshore structure.

13. A method of transferring a body from an offshore structure to a vessel using the apparatus of any one of claims 1-11, comprising:

operating a carrier coupled to the transfer cable, when the transfer cable is in a slack state, to move the body from a platform on the offshore structure to an elevated position;
once the body is in the elevated position, operating the reeling device to reel the transfer cable to a taut state connected between the structure and vessel couplings; and
operating the carrier to move the body for descending the transfer cable from the elevated position to the vessel.

14. A method according to claim 12 or 13, further comprising the steps of:

providing a secondary rope hung from a secondary rope attachment point connected to the offshore structure;
connecting a climb assist device to the secondary rope; and

operating the climb assist device to drive movement of the body on the transfer cable.

15. A method according to any one of claims 12 to 14, further comprising the step of releasing the second end of the transfer cable from the vessel coupling. 5

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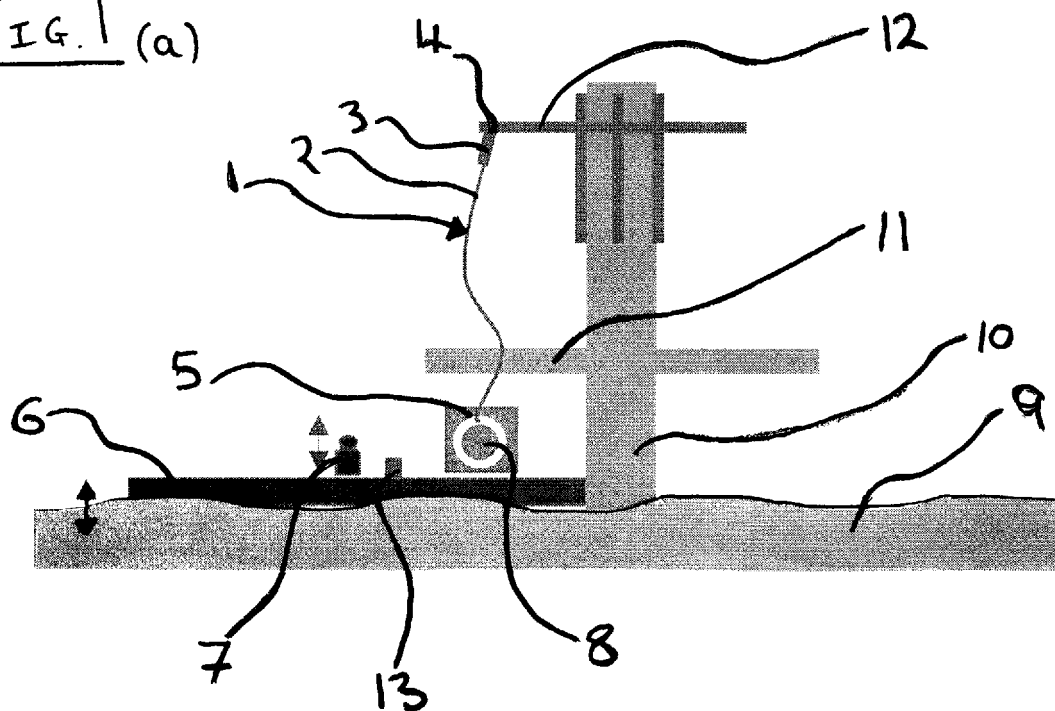
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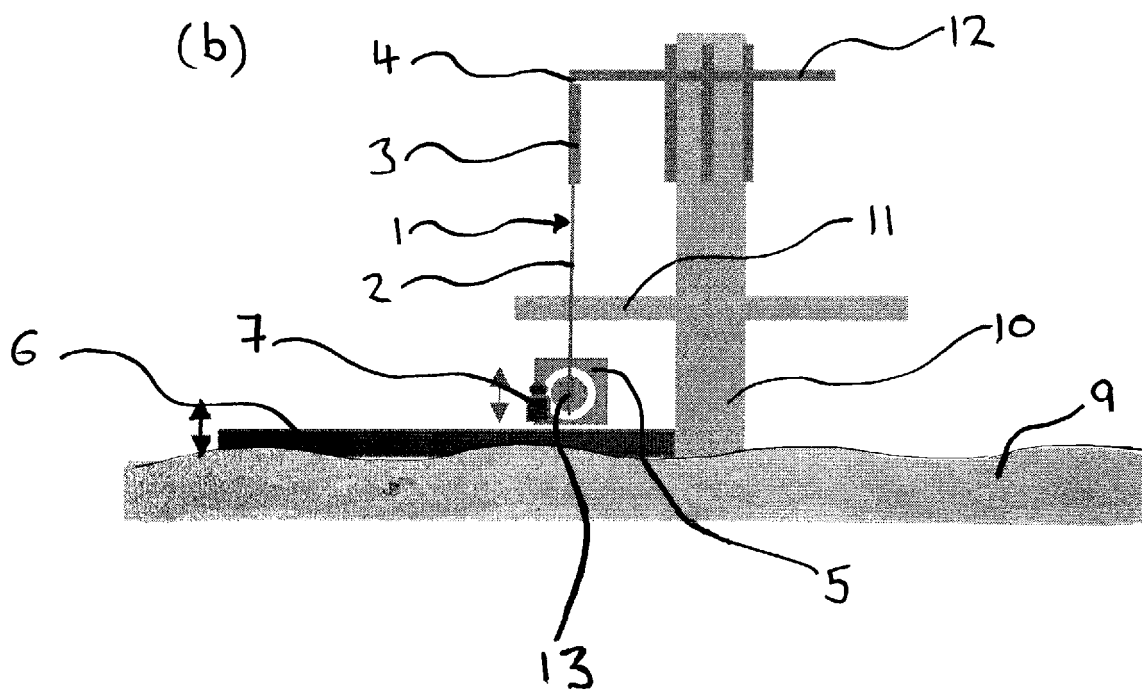
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FIG. 1 (a)



(b)



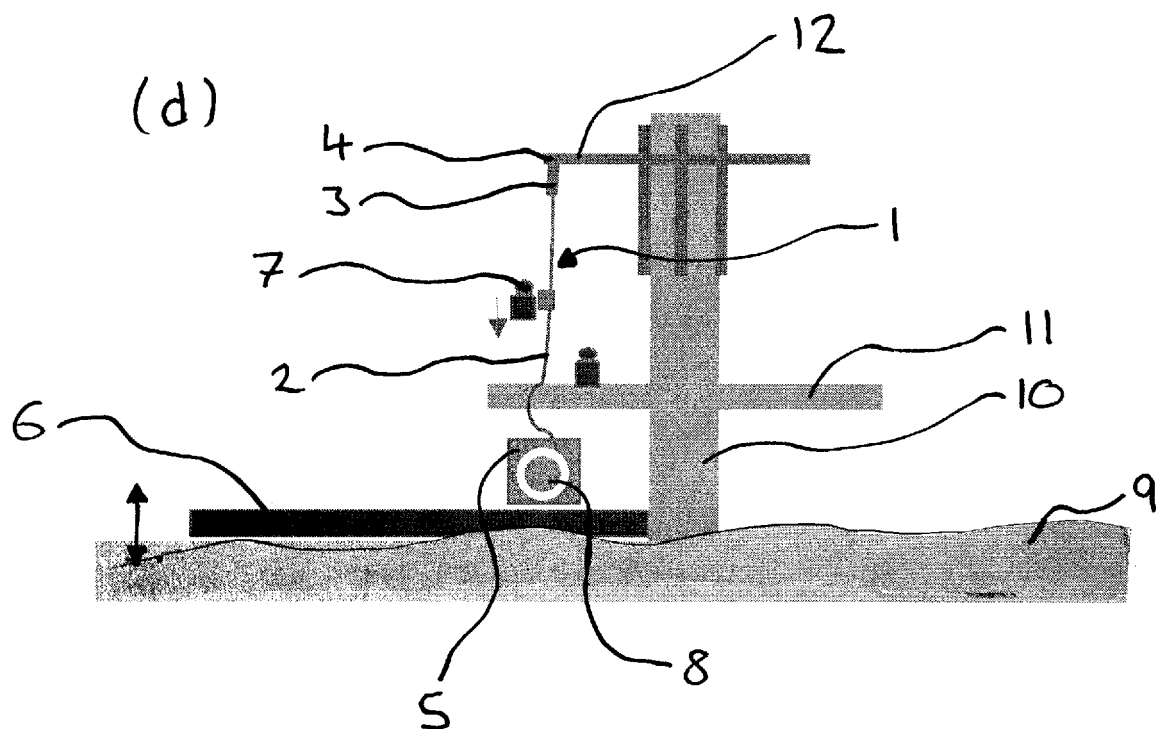
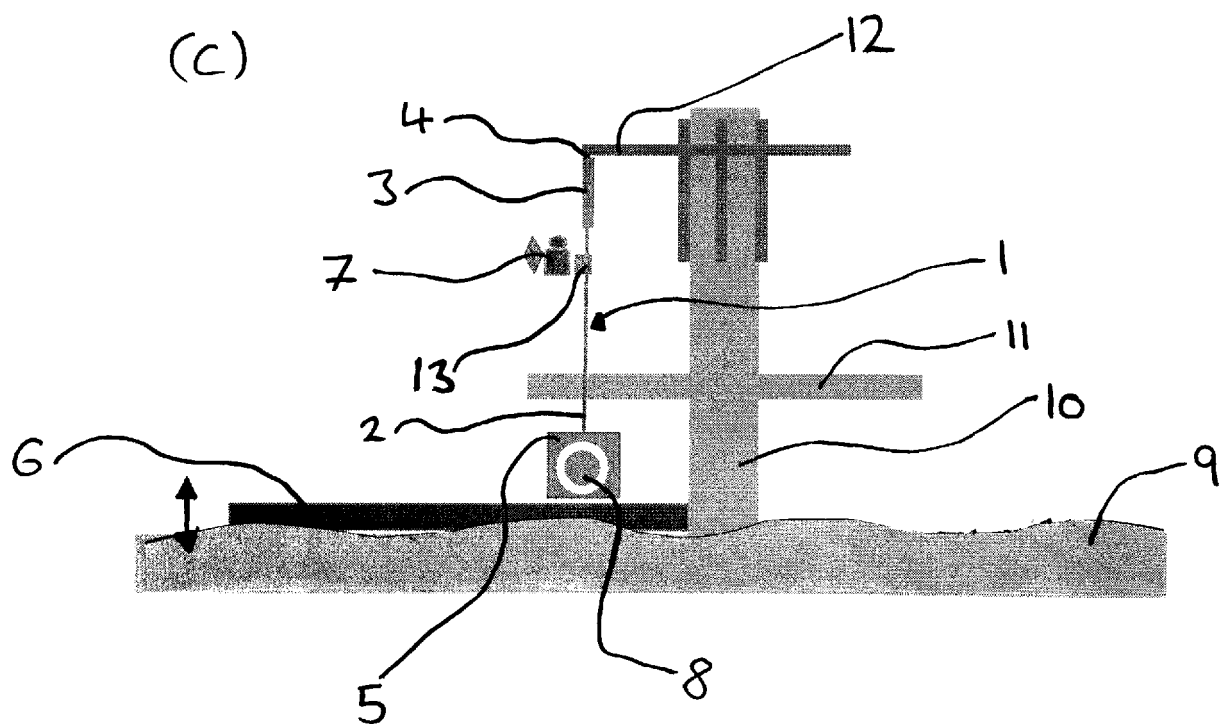
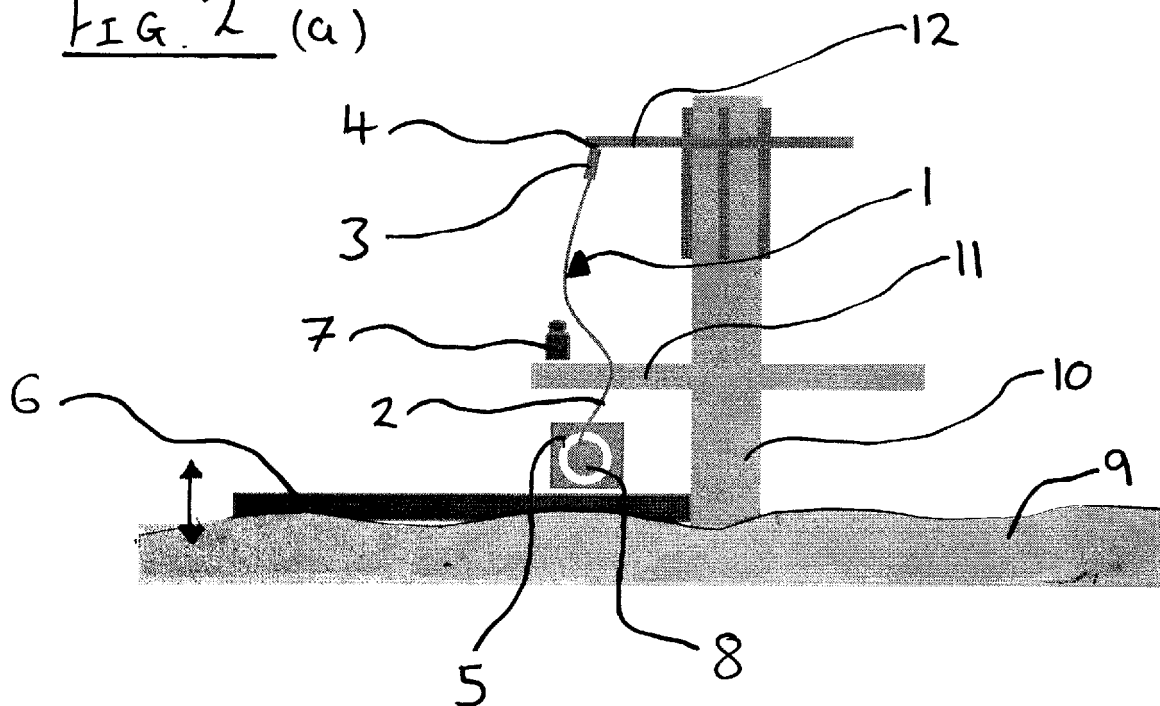
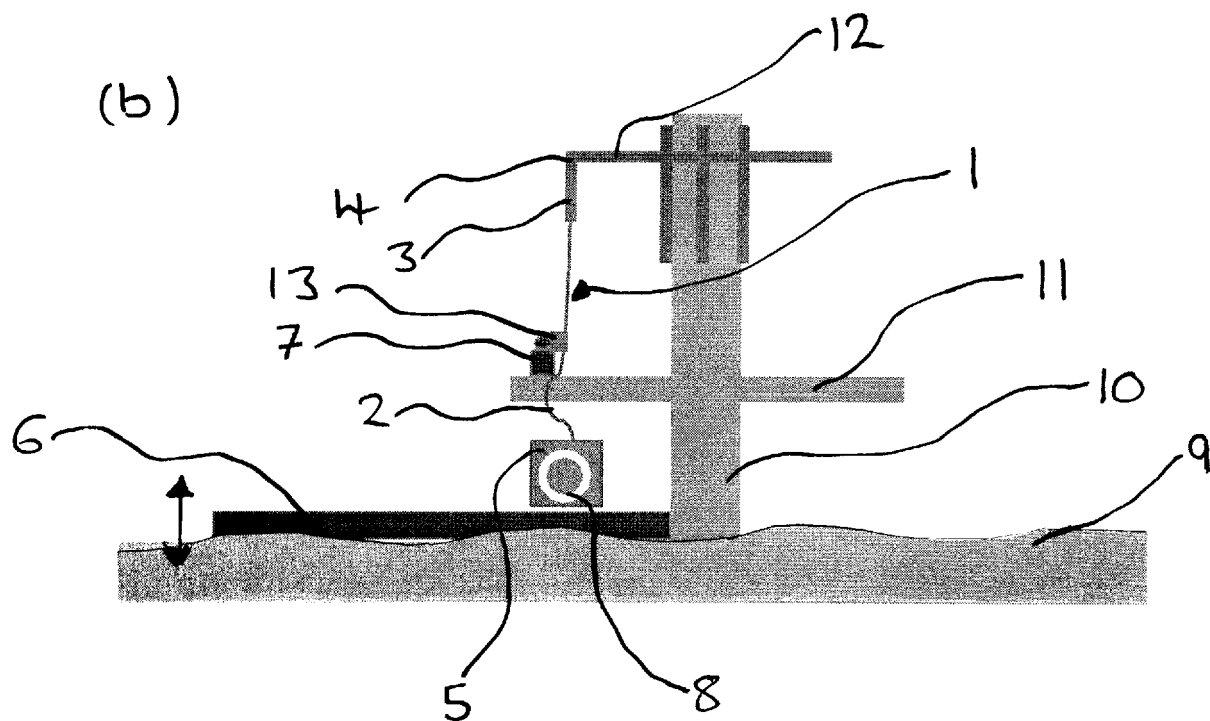


FIG. 2 (a)



(b)



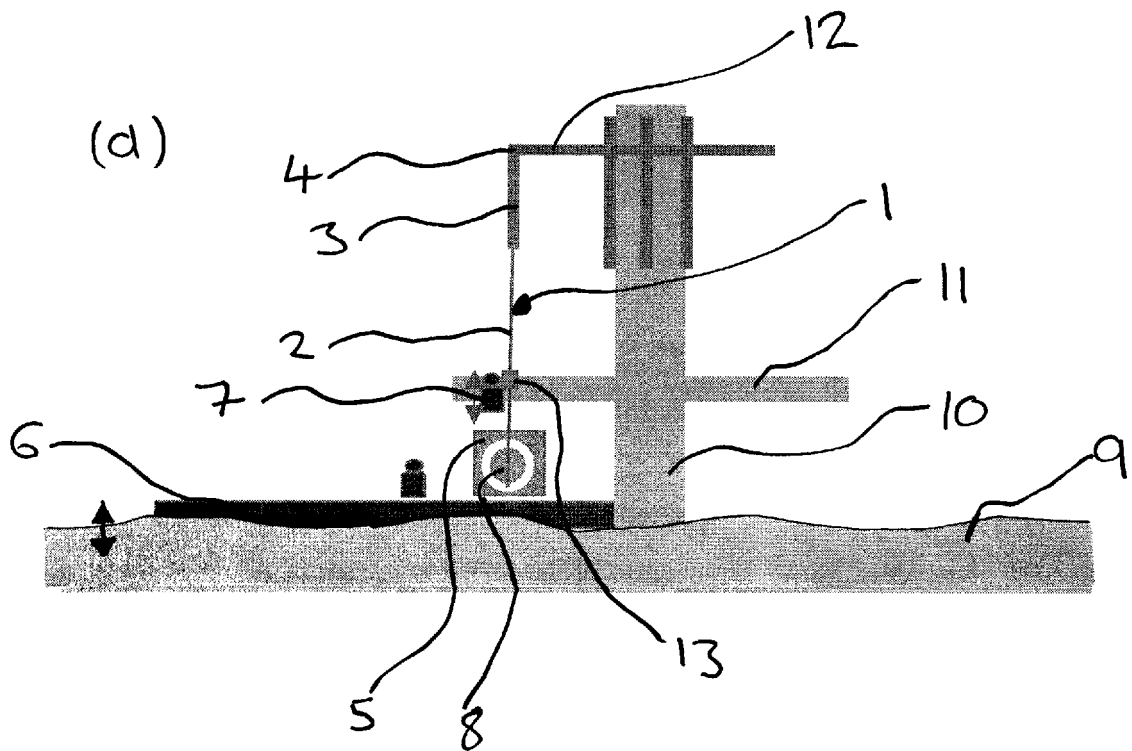
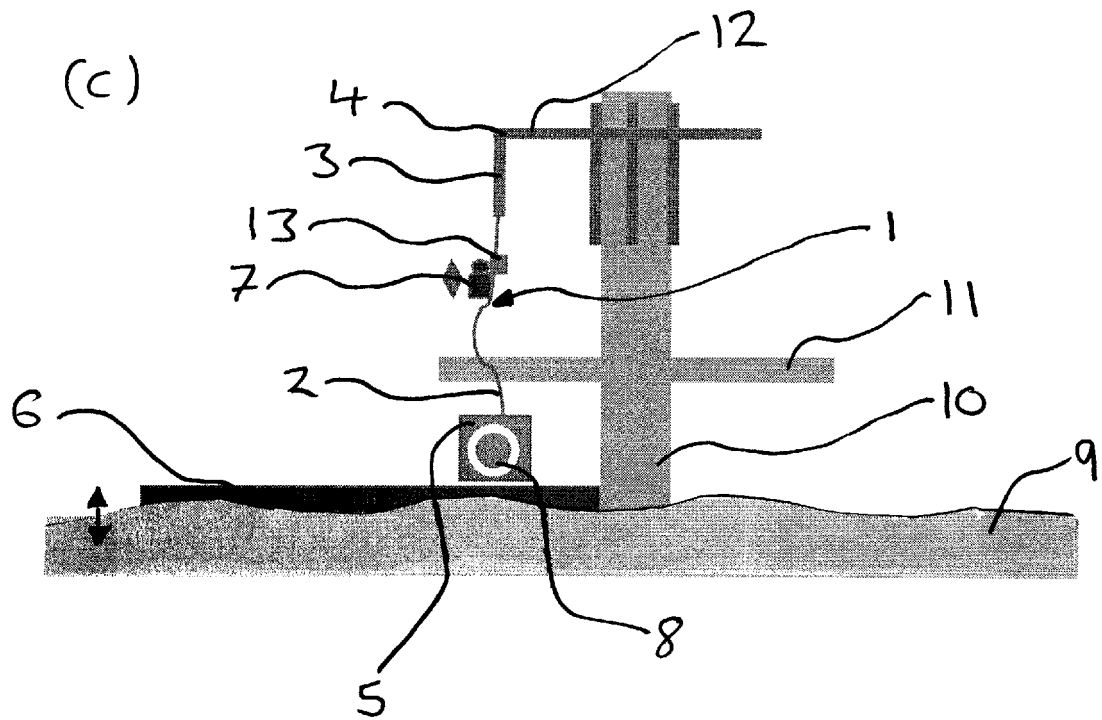


FIG. 3

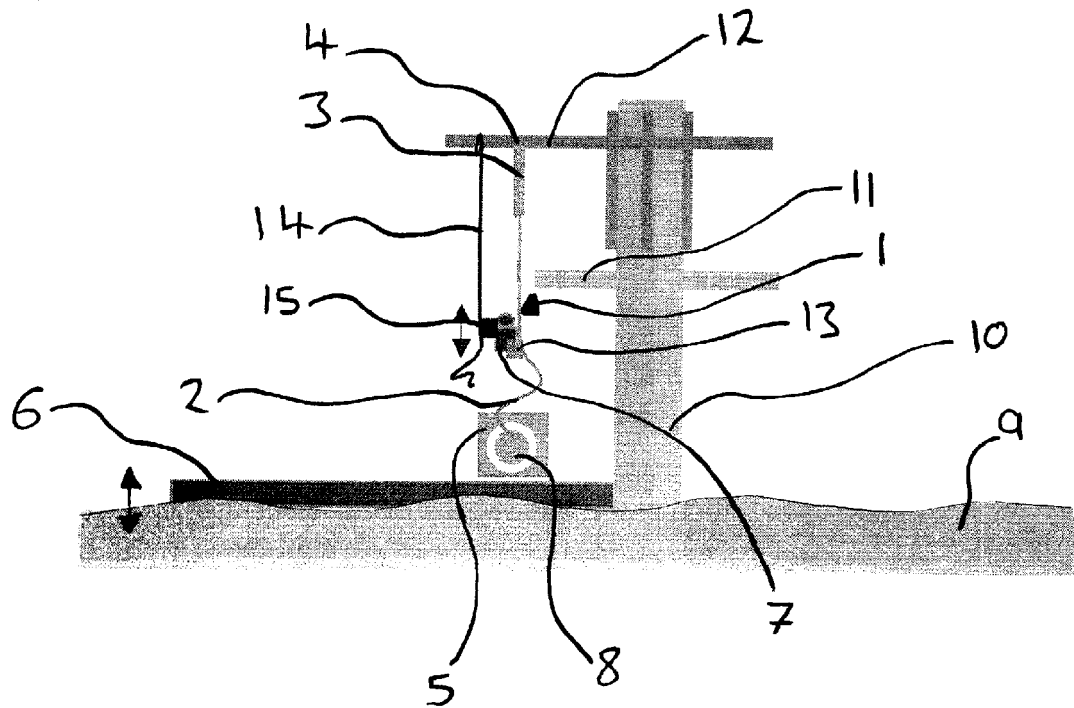
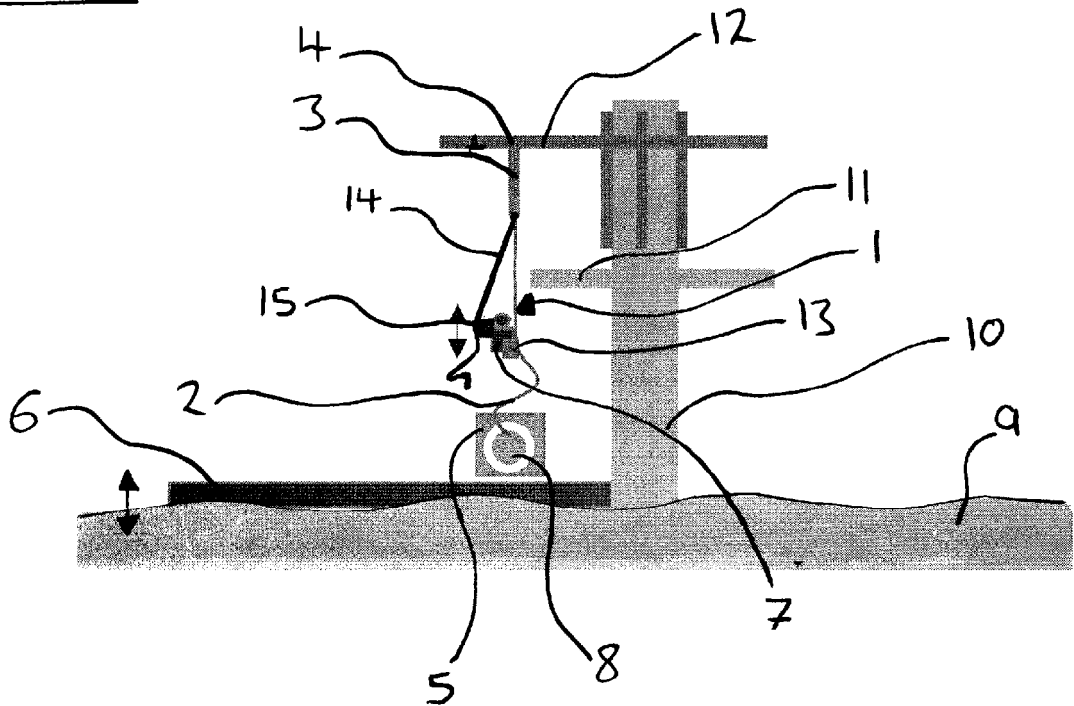


FIG. 4





EUROPEAN SEARCH REPORT

Application Number
EP 19 18 7278

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Place of search The Hague		Date of completion of the search 3 December 2019	Examiner Knoflachner, Nikolaus
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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