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(71) Applicant (for all designated States except US): **KOREA ADVANCED INSTITUTE OF SCIENCE AND TECHNOLOGY** [KR/KR]; 373-1, Guseong-dong, Yuseong-gu, Daejeon 305-701 (KR).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **CHANG, Dae Jun** [KR/KR]; 13-1304 Garam Apt. Dunsan 3-dong, Seo-gu, Daejeon 302-123 (KR). **BERGAN, Pal G.** [NO/KR]; N27-3103 Korea Advanced Institute of Science Guseong-dong, Yuseong-gu, Daejeon 305-701 (KR).

(74) Agents: **NAM, Choong Woo** et al.; 3F, Kyungbin Building 517-18, Dogok-dong Gangnam-du, Seoul 135-854 (KR).

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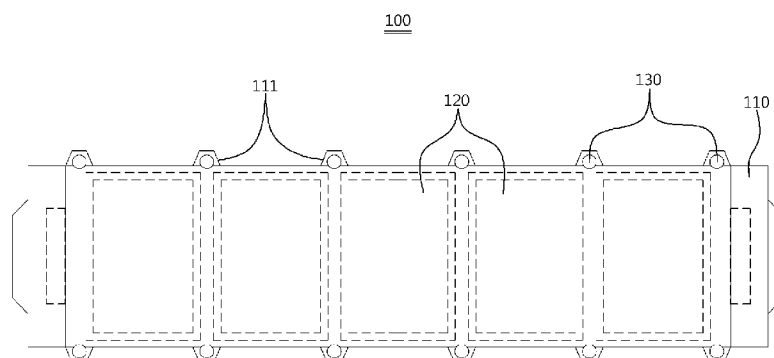
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(54) Title: OFFSHORE PLATFORM USING GUIDE PILE AND METHOD OF INSTALLING THE SAME

[Fig. 1]



(57) Abstract: The present invention relates to an offshore platform using guide piles and a method of installing the offshore platform. The present invention provides an offshore platform including: a platform that floats on the sea; one or more guide piles that are mounted on the platform in the vertical direction and guides vertical motion of the platform floating on the sea; and a base structure that is installed on the sea floor and to which the guide piles are fastened.

Description

Title of Invention: OFFSHORE PLATFORM USING GUIDE PILE AND METHOD OF INSTALLING THE SAME

Technical Field

- [1] The present invention relates to an offshore platform for liquefied gas, storage of other fluids, as well as other functions, using a guide pile and a method of installing the same, and particularly, to an offshore platform for liquefied gas which is installed at sea and can store, supply, and receive liquefied gas such as a liquefied natural gas, and a method of installing the offshore platform.

Background Art

- [2] Liquefied gas such as a liquefied natural gas (LNG) has received much attention as alternative fuel due to increasing oil prices and severe environmental concerns. Natural gas is normally obtained from geological, underground hydrocarbon reservoirs, either in pure gas form or as associated gas produced along with oil. During recent years natural gas has also been produced from shale (sedimentary rock) deposits. The gas can be transported in pressurized form in pipelines or in pressure vessels; however, the most versatile way is to transport on ship, rail or road in liquefied form. At atmospheric pressure liquefaction requires cooling down to about -163 degrees C. Processing and liquefaction is normally performed at special land terminals whereas also floating liquefaction terminals (LNG-FPSO) have recently also been developed. Transported LNG is "re-gasified" at receiving land terminals or at floating (FSRU) or fixed off-shore terminals.
- [3] Shipping of liquid natural gas requires storage at the export as well as import terminals. For many reasons there is a trend towards building the large shipping terminals offshore. Further, there will in the future also be need for special terminals that can supply the future world fleet with LNG as clean fuel for ship engines. This will require a whole new infrastructure with LNG supply terminals at major ports and shuttle fuel tankers that can supply individual ships with LNG fuel. For safety and other good reasons, it may be advantageous to place fuel terminals offshore outside such ports.
- [4] Until now offshore LNG terminals have primarily been built as GBS structures (Gravity Based Structures). As the name indicates such structures sit on the offshore floor kept down from floating up by way of own gravity. Since gas is a light cargo, GBS structures are normally built in heavy concrete and may additionally have to be ballasted or piled to be kept down. This approach becomes particularly problematic in coastal areas with significant tides since buoyancy will change very significantly with

varying tides. Another problem is that costs of GBS structures increase very much with increasing water depth; large water depths and varying tides also make installation more difficult. There is clearly a need for other technical solutions to this problem.

Disclosure of Invention

Technical Problem

- [5] The present invention represents an effort to provide an offshore platform using a guide pile system which has several technical advantages over traditionally moored floating terminals and fixed terminals, and a method of installing such offshore platforms.

Solution to Problem

- [6] The present invention provides an offshore platform including: a platform that floats at sea; one or more guide piles that are mounted and connected with the platform in a way which allows vertical motion and which hold the platform against horizontal motion; and a base structure that is installed on the sea floor and to which the guide piles are fastened.
- [7] Another aspect of the present invention, a method of installing an offshore platform, comprising: towing a platform, which has one or more guide piles and floats on the sea, to installation position; moving down the guide piles and fixing the guide piles to the base structure installed on the sea floor; and allowing the platform to move freely in the vertical direction in relation to the guide piles such that the platform floating on the sea can move freely in the vertical direction along the guide piles which are fixed to the base structure.

Advantageous Effects of Invention

- [8] An offshore platform and a method of installing the offshore platform according to exemplary embodiments of the present invention can provide all the technical advantages of a floating terminal and a fixed terminal, by a platform floating on the sea and guide piles installed and fixed to the base structure.
- [9] That is, it is possible conveniently to move and install the offshore platform and to use the offshore platform in desired areas including areas with a large tidal variation, due to the technical advantages of such floating terminal. In areas where tsunamis can occur, it may be possible to provide special protective measures for the offshore platform such as building wave damping walls or even allowing for detachment and moving to safe areas. Moreover, installation is relatively easy and it is possible to berth a transport ship or a shuttle ship to the offshore platform in a safe and expedient manner since it does not move horizontally.

Brief Description of Drawings

- [10] FIG. 1 is a plan view schematically showing an offshore platform according to an

exemplary embodiment of the present invention.

[11] FIG. 2 is a side view schematically showing an offshore platform according to an exemplary embodiment of the present invention.

[12] FIG. 3 is a plan view schematically showing a base structure according to an exemplary embodiment of the present invention.

[13] FIG. 4 is a side view schematically showing a base structure according to an exemplary embodiment of the present invention.

[14] FIG. 5 is a side view schematically showing a base structure according to another exemplary embodiment of the present invention.

[15] FIG. 6 is an operational view showing constructing of an offshore platform according to an exemplary embodiment of the present invention.

[16] FIG. 7 is an operational view showing launching by way of flooding the dry dock and towing of an offshore platform according to an exemplary embodiment of the present invention.

[17] FIG. 8 is an operational view showing pile-fixing of an offshore platform according to an exemplary embodiment of the present invention.

[18] FIG. 9 is an operational view showing releasing of an offshore platform according to an exemplary embodiment of the present invention.

[19] FIG. 10 is an operational view showing the completed and used states of an offshore platform according to an exemplary embodiment of the present invention.

Mode for the Invention

[20] An offshore platform according to an exemplary embodiment of the present invention will be described hereafter with reference to the accompanying drawings.

[21] FIG. 1 is a plan view schematically showing an offshore platform according to an exemplary embodiment of the present invention. FIG. 2 is a side view schematically showing the offshore platform according to an exemplary embodiment of the present invention.

[22] Referring to FIGS. 1 and 2, the offshore platform 100 according to an exemplary embodiment of the present invention includes a platform 110 and guide piles 130.

[23] The platform 110 forms the entire external shape of the offshore platform 100. The platform 110 may be equipped with the liquefied gas storage tanks 120 and the guide piles 130, which are described below. Further, though not shown, the platform 110 may be equipped with equipment for berth a ship transporting liquefied gas alongside the platform 110, or gas supply equipment for transferring liquefied gas.

[24] The platform may be equipped with the storage, loading or processing system of liquefied gas or hydrocarbon, such as crude oil. In this case, the offshore platform can be used as LNG bunkering terminal, LNG-FSRU, FPSO or the like. The platform may

be also equipped with the desalination system. In this case, the offshore platform can be used as seawater desalination plant. Furthermore, the platform may be equipped with the cargo storage or loading system. In this case, the offshore platform can be used as mobile harbor. Further above mentioned examples, the platform can be equipped with various kinds of systems consistent with its intended use. Below are explained for the convenience; the platform is equipped with liquefied gas storage tanks and the case of use the offshore platform as LNG bunkering terminal.

- [25] Meanwhile, the platform 100 is formed to be able to float on the sea. That is, the offshore platform 100 according to an exemplary embodiment of the present invention may be formed as a type of terminal with the platform 110 that can float on the sea and can be moved by a tugboat or the like.
- [26] The platform 110, in this configuration, may be made of at least one of steel, high strength concrete, and watertight-coated light weight concrete. The watertight-coated light weight concrete may be a structure formed in a sandwich panel by coating the both side of light weight concrete to be watertight. Alternatively the sandwich panels may be formed by constructing the outer skins by a material such as steel and thereafter casting the concrete within these skins. In this way the skins may serve as structural reinforcement of the concrete as well as being a double, fluid tight barrier. Further, the watertight coating may include polymer coating that coats the both side of light weight concrete with a polymer such as epoxy.
- [27] The liquefied gas storage tanks 120 can be mounted in the platform 110. The liquefied gas storage tanks 120 may be manufactured with the platform 110, or manufactured separately from the platform 110 and mounted within the platform 110. A plurality of liquefied gas storage tanks 120 may be mounted in the platform 110. The present exemplary embodiment exemplifies when a total of five liquefied gas storage tanks 120 are mounted in the platform 110. However, the number or the capacity of the liquefied gas storage tanks 120 that are mounted may change, if necessary, is not limited to the example described above.
- [28] Liquefied gas can be stored in the thermally insulated liquefied gas storage tanks 120. The liquefied gas that is stored in this configuration may include at least one of liquefied natural gas (LNG), liquefied petroleum gas (LPG), and natural gas liquid (NGL). When the liquefied gas that is stored is cryogenic liquefied gas, the liquefied gas storage tanks 120 may be equipped with a structure for heat insulation. For example, when a liquefied natural gas is stored, the liquefied gas storage tanks 120 may be equipped with, as a structure for insulation, barriers made of INVAR or stainless steel, and a heat insulator made of a plywood board or polyurethane foam, or the like.
- [29] The guide piles 130 are mounted in the platform 110 and guide vertical motion of the

platform 110. In more detail, the guide piles 130 may extend in the vertical direction and may be mounted in the vertical direction on the platform 110. The lower ends of the guide piles 130 may be piled on the sea floor. Alternatively, the lower ends of the guide piles 130 may be fixed to the sea floor through a base structure 140, which is described below. The purpose of the base structure 140 at the sea floor is to facilitate fast and safe installation and to provide increased strength and stability in relation to long term horizontal loading from ships, waves and current. The guide piles 130 guide the vertical motion of the platform 110 floating on the sea, with the lower ends fixed to the sea floor or the base structure 140.

- [30] Meanwhile, a plurality of guide piles 130 may be mounted on the platform 110. The present exemplary embodiment exemplifies when a total of twelve guide piles 130 are mounted at both sides in the platform 110. However, the number of guide piles 130 may be larger or smaller than this number, if necessary, and is not limited to the example described above.
- [31] The plurality of guide piles 130 may be arranged at a predetermined distance in the longitudinal direction of the platform 110. Further, the plurality of guide piles 130 may be arranged opposite each other at both sides of the platform 110. The present exemplary embodiment exemplifies when six guide piles 130 are mounted at each of the two longitudinal sides of the platform 110, respectively.
- [32] Further, pile sliding portions 111 may be formed at the platform 110 in order to mount the guide piles 130. A plurality of pile sliding portions 111 may be formed. The present exemplary embodiment exemplifies when six pile sliding portions 111 protrude from both sides of the platform 110, respectively, to correspond to the guide piles 130.
- [33] The pile sliding portions 111 which are fixed to the platform 110 and positioned at the outside of the platform 110 serve the function of holding the platform 110 in the horizontal plane in relation to the guide piles 130. At the same time the pile sliding portions 111 allow vertical motion consistent with tides and waves. The fact that the pile sliding portions 111 can be attached at the outside of the platform 110 also facilitate easy replacement of worn or damaged parts. Such design will also enable full detachment of the entire platform 110 in case this is needed for repair at a yard or for emergency detachment in case of tsunamis.
- [34] The pile sliding portions 111 can be placed within the platform 110 itself in another embodiment.
- [35] FIG. 3 is a plan view schematically showing a base structure according to an exemplary embodiment of the present invention. FIG. 4 is a side view schematically showing a base structure according to an exemplary embodiment of the present invention.
- [36] Referring to FIG. 3 and 4, the base structure 140 may be installed on the sea floor

before the platform 110 is moved into place. This may require that the sea floor is prepared by horizontal leveling of the soil in the local region. After the base structure 140 is lowered into position, it will be fixed to the sea floor by ramming down fixing piles 141. The fixing piles 141 may also be further clamped to the base structure 140 after ramming by way of clamping devices 141a. The purpose of the fixing piles 141 is to ensure that the base structure 140 does not move and has sufficient strength and horizontal holding resistance.

- [37] After the process of fixing of the base structure 140 by means of fixing piles 141 has been performed, the sea floor in between and around the base structure 140 may be protected by dropping a layer of cover stones or layer of coarse gravel 10 around and possibly also on top. The layer of cover stones or layer of coarse gravel 10 is to protect the base structure 140 and the foundations including the surface soil against erosion caused by local flow conditions, sea currents, and large waves. The size and weight of the individual stones or gravel in the layer of cover stones or gravel 10 must thus be sufficient to resist against being displaced by fluid drag and lift forces.
- [38] As explained, the guide piles 130 should be fastened to the base structure 140 by way of a pile mounting position 142 after the guide piles 130 have been lowered into the corresponding opening of the base structure 140. The pile mounting position 142 may be formed in the base structure 140 for fastening. The pile mounting position 142 may be included stiff guide tubes 142. The stiff guide tubes 142 formed to extend in vertical direction. It is possible to fasten the guide piles 130 to the base structure 140 by inserting the lower ends into the stiff guide tubes 142, and the lower ends are installed and fixed in the base structure 140. Further, a plurality of stiff guide tubes 142 may be formed. The plurality of stiff guide tubes 142 may be formed to correspond to the plurality of guide piles 130 mounted on the platform 110.
- [39] The present exemplary embodiment exemplifies when total twelve guide piles 130 are provided, and accordingly, exemplifies when the base structure 140 is provided with total twelve stiff guide tubes 142.
- [40] Meanwhile, Referring to FIG. 5, the base structure 140 may include an additional reinforced structure 143 in another embodiment. In this case, the stiff guide tubes 142 can be supported by the additional reinforced structure 143. Thus, structure strength of the stiff guide tubes 142 can be increased. Further, adapted for deep water conditions, the base structure 140 extends to a significant height above the sea floor.
- [41] In addition, though not shown, the offshore platform 100 according to an exemplary embodiment of the present invention may further include a ballast tank.
- [42] The ballast tank may be formed at a side of the platform 110, and if necessary, a plurality of ballast tanks may be formed. The ballast tank can control the balance of the platform 110, using inflow and outflow of the seawater. For example, the ballast tank

may be used to keep the longitudinal or transverse balance of the platform 110, when the levels of filling of the liquefied storage tanks 120 are different from each other. Further, the ballast tank may be used to reduce movement of the platform 110 due to waves by controlling the draft of the platform 110 floating on the sea.

[43] A method of installing an offshore platform according to an exemplary embodiment of the present invention will be described hereafter with reference to the accompanying drawings.

[44] FIG. 6 is an operational view showing constructing in a method of installing an offshore platform according to an exemplary embodiment of the present invention.

[45] Referring to FIG. 6, the method of installing an offshore platform according to an exemplary embodiment of the present invention includes constructing. In the constructing, a platform 110 equipped with liquefied gas storage tanks 120 and guide piles 130 may be constructed. The liquefied gas storage tanks 120, the guide piles 130, and the platform 110 were described above and the detailed description is not provided.

[46] Meanwhile, the liquefied gas storage tanks 120 may be manufactured with the platform 110, or manufactured separately from the platform 110 and then mounted in the platform 110. For example, when a spherical tank of Moss type known in the art is applied to the liquefied gas storage tanks 120, the liquefied gas storage tanks 120 may be manufactured separately from the platform 110 and mounted in the platform 110 in a lifting method using a crane or a skid-in method. On the other hand, when a membrane type known in the art is applied to the liquefied gas storage tanks 120, the liquefied gas storage tanks 120 may be manufactured with the platform 110 in constructing of the platform 110.

[47] Meanwhile, the construction may be performed in a dry dock on land. That is, the offshore platform 100 according to an exemplary embodiment of the present invention may be moved to an installation position, as follows, after the liquefied gas storage tanks 120, the platform 110, and the guide piles 130 are completely constructed at a dry dock on land. In this way the work at sea may be minimized. Further, since the construction is performed at a dry dock on land, the construction is easily performed and the advantages of the work on the land can be used as much as possible.

[48] The construction, however, may be performed on the sea, if necessary. For example, the construction may also be performed on a floating dock at sea and is not limited to the dry dock on the land.

[49] FIG. 7 is an operational view showing launching by way of flooding the dry dock and towing of an offshore platform according to an exemplary embodiment of the present invention.

[50] Referring to FIG. 7, the method of installing an offshore platform according to an exemplary embodiment of the present invention includes launching. In the launching,

the built platform 110 is floated on the sea. In detail, when the platform 110 has been built to desired degree, a wall or gate is opened and seawater flows into the dock, thereby floating the platform 110 on the sea.

[51] Meanwhile, the method of installing an offshore platform for liquefied gas according to an exemplary embodiment of the present invention includes towing. In the towing phase, the platform 110 is moved to the installation position, after the launching. In this process, the platform 110 is floated on the sea and pulled to the installation position by one or more tugboats 20 or the like.

[52] Meanwhile, the launching and the towing may be performed after the guide piles 130 are moved upward from the platform 110. Preferably, the launching and the towing may be performed, with the guide piles 130 not protruding down from the bottom of the platform 110. This is for reducing the draft of the platform 110 in the towing phase and preventing grounding due to the guide piles 130 while the platform 110 is floated on the sea and moved by the tugboat 20 or the like.

[53] The vertical moving part may be used to move vertically or fix the guide piles 130. That is, the guide piles 130 can be moved upward from the platform 110 and may be held in the upward-moved state by being fixed to the platform 110, by the vertical moving part, such as a rack and pinion system.

[54] FIG. 8 is an operational view showing pile-fixing in the method of installing an offshore platform according to an exemplary embodiment of the present invention.

[55] Referring to FIG. 8, the method of installing an offshore platform according to an exemplary embodiment of the present invention includes pile-fixing. In the pile-fixing, a work of fixing the guide piles 130 to the bottom structure and the sea floor is performed. In more detail, when the platform 110 is drawn to the installation position, the guide piles 130 are moved down. In this process, the guide piles 130 may be moved down by a vertical moving part such as the rack and pinion system described above. When the guide piles 130 moves down to the sea floor, the guide piles 130 are lead into corresponding stiff guide tubes 142 in the base structure 140 and mounted the stiff guide tubes 142. In this way the lower ends of the guide piles 130 are fixed or fastened to the base structure 140.

[56] In this case, the method of installing an offshore platform according to an exemplary embodiment of the present invention may further include base-installing that installs the base structure 140. In the base-installing, the base structure 140 may be manufactured and installed. The base-installation may be performed with the towing at the same time or before the towing. More preferably, the base-installing may be performed before the pile-fixing that fixes the guide piles 130 to the base structure 140.

[57] The base structure 140 may be manufactured on the land or the sea and installing of the base structure 140 may include a series of work processes for moving and installing

the base structure 140 onto the sea floor. Further, the installation of the base structure 140 may include a series of work processes of fixing the base structure 140 to the sea floor with the fixing piles 141.

[58] Meanwhile, when the base structure 140 has already been installed on the sea floor, preferably with own piling, the guide piles 130 are fastened to the base structure 140, thereby being fixed to the sea floor.

[59] FIG. 9 is an operational view showing releasing in the method of installing an offshore platform according to an exemplary embodiment of the present invention.

[60] Referring to FIG. 9, the method of installing an offshore platform according to an exemplary embodiment of the present invention includes releasing of the platform 110. Since the guide piles 130 are fixed to the base structure 140 and the sea floor the normal approach will be to detach the external pile sliding portions 111 from the platform 110 and thereafter pull or push out the terminal from between the guide piles 130.

[61] As the guide piles 130 are released from the platform 110, the platform 110 can float on the sea. Further, the guide piles 130 can maintain the vertical position, with the lower ends fixed to the base structure 140. The platform 110 also moves vertically along the guide piles 130. That is, the vertical heave motion of the platform 110 floating on the sea may be guided by the guide piles 130. Further, transverse or longitudinal motion of the platform 110 will be suppressed to a predetermine degree.

[62] That is, a reciprocating motion (Surge) or a rotating motion (Roll) about the longitudinal direction, a reciprocating motion (Sway) or a rotating motion (Pitch) about the width direction may be suppressed to a predetermined amount; thus only the heave motion among the totality of six rigid body degrees of freedom remain totally unconstrained. A rotating motion (Yaw) about the vertical axis will also be suppressed to a predetermined amount. The constraining effect on the five constrained freedoms depends on the actual geometry of the connection between the guide piles 130 and the platform 110 and the flexibility of the guide piles 130 themselves.

[63] As a result, in the case described above, the platform 110 repeats only one major reciprocating motion (heave) in the vertical or the depth direction due to the guide piles 130. In particular, the platform 110 is free to move vertically in accordance with the tides. Therefore, the offshore platform 100 according to an exemplary embodiment of the present invention makes it very easy to berth a transport ship or a shuttle ship alongside the platform 110 or to moor the ships. Further, since the platform 110 repeats only the vertical reciprocating motion, it is possible greatly to reduce sloshing in the liquefied gas storage tanks 120, and accordingly, it is possible to prevent the liquefied gas storage tanks 120 from being damaged.

[64] FIG. 10 is an operational view showing the completed and used states in the method

of installing the offshore platform according to an exemplary embodiment of the present invention.

- [65] Referring to FIG. 10, the installed offshore platform 100 remains in a predetermined position suitable for operations. Further, a transport ship 30 that transports liquefied gas from supply sources or a shuttle ship 40 that transports liquefied gas to demand sources is brought alongside the installed offshore platform 100, thereby facilitating loading and unloading and transportation of the liquefied gas. As described above, since the motions of the platform 110 are strongly limited by the guide piles 130, in the offshore platform 100 according to an exemplary embodiment of the present invention, it is easy to berth the transport ship 30 or the shuttle ship 40 to the offshore terminal 100 and to moor the ships.
- [66] Meanwhile, when the transport ship 30 or the shuttle ship 40 is brought alongside the offshore platform 100, the platform 110 of the offshore platform 100, the transport ship 30, and the shuttle ship 40 can move vertically together whereas they are all held together in the same horizontal position. It is thus preferable to design the guide piles 130 in consideration of not only sustaining the load of the platform 110 or the liquefied gas storage tanks 120, but also the loads transferred from the transport ship 30 and one or several shuttle ships 40.
- [67] As described above, the offshore platform and a method of installing the offshore platform according to exemplary embodiments of the present invention can provide all the technical advantages of a floating terminal and a fixed terminal, by the platform 110 floating on the sea and the guide piles 130 installed and fixed to the sea floor.
- [68] That is, it is possible to conveniently move and install the offshore platform and to apply the offshore platform to areas with a large tidal variation, due to the technical advantages of a floating terminal. Further, an emergency such as a tsunami occurs or in case of need for repair, it is possible to move the terminal away from location. For example, in the offshore platform 100 according to the present exemplary embodiment, it is possible to move the platform 110 to a safe area in an emergency or for repair by allowing the pile fastening portions 111 where the guide piles 130 are fastened to be separated from the platform 110. Meanwhile, mooring is easy and it is rather simple to berth a transport ship or a shuttle ship to the offshore platform, due to the technical advantages of a fixed terminal.
- [69] It should be understood that although exemplary embodiment of the present invention were described above, the present invention may be changed and modified in various ways by adding, changing, or removing components by those skilled in the art without departing from the spirit of the present invention described in claims, which is included in the scope of the present invention.

Claims

- [Claim 1] An offshore platform comprising:
a platform that floats on the sea;
one or more guide piles that are mounted on the platform in the vertical direction and guides vertical motion of the platform floating on the sea;
and
a base structure that is installed on the sea floor and to which the guide piles are fastened.
- [Claim 2] The offshore platform of claim 1, wherein the platform is equipped with at least one of the storage, loading or processing system of liquefied gas, the storage, loading or processing system of hydrocarbon, the cargo storage or loading system.
- [Claim 3] The offshore platform of claim 2, wherein the liquefied gas is at least one of a liquefied natural gas, a liquefied petroleum gas, and a natural gas liquid.
- [Claim 4] The offshore platform of claim 1, wherein the platform is made of at least one of steel, reinforced high strength concrete, and watertight-coated light weight concrete.
- [Claim 5] The offshore platform of claim 1, wherein the guide piles are mounted on the platform to be movable vertically.
- [Claim 6] The offshore platform of claim 1, wherein the guide piles are mounted opposite each other at both sides of the platform.
- [Claim 7] The offshore platform of claim 1, wherein the base structure is installed and fixed to the sea floor by at least one fixing pile and has one or more pile mounting positions to which the guide piles are fastened.
- [Claim 8] The offshore platform of claim 7, wherein the pile mounting positions include stiff guide tubes.
- [Claim 9] The offshore platform of claim 1, adapted for deep water conditions, wherein the base structure extends to a significant height above the sea floor and includes an additional reinforced structure for increasing its capacity towards carrying horizontal forces.
- [Claim 10] The offshore platform of claim 1, further comprising:
one or more ballast tanks formed at the platform.
- [Claim 11] A method of installing an offshore platform, comprising:
towing a platform, which has one or more guide piles and floats on the sea, to installation position;
moving down the guide piles and fixing the guide piles to the base

structure installed on the sea floor; and
allowing the platform to move freely in the vertical direction in relation to the guide piles such that the platform floating on the sea can move freely in the vertical direction along the guide piles which are fixed to the base structure.

[Claim 12]

A method of claim 11, further comprising:
covering the base structure and adjacent area by gravel or stones for protection and prevention of seabed erosion.

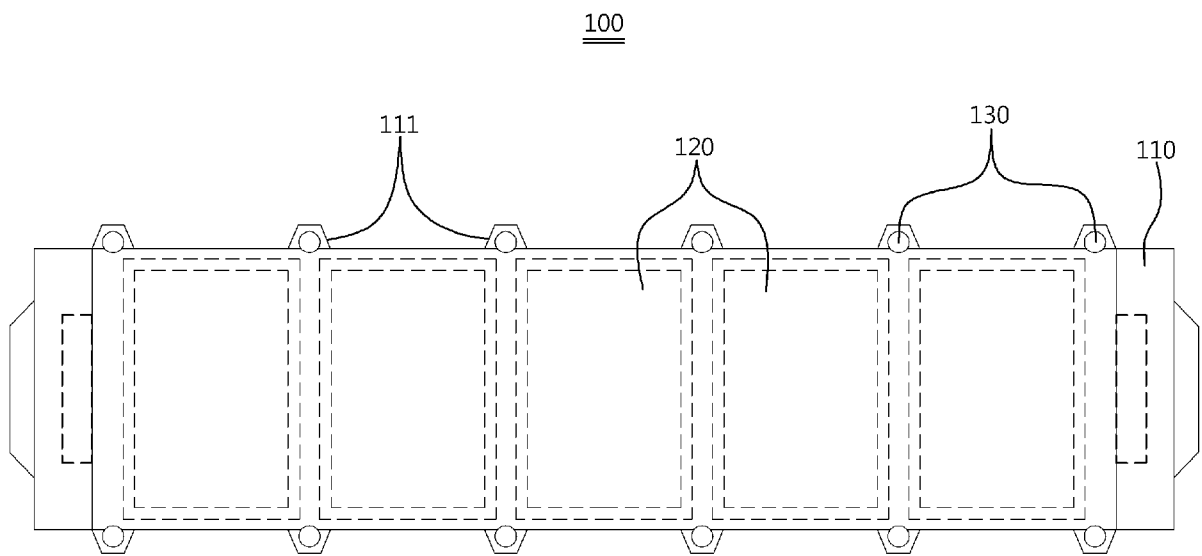
[Claim 13]

A method of claim 11, further comprising:
after installation, releasing some guide piles from the platform or the base structure for repair or replacement of the guide piles.

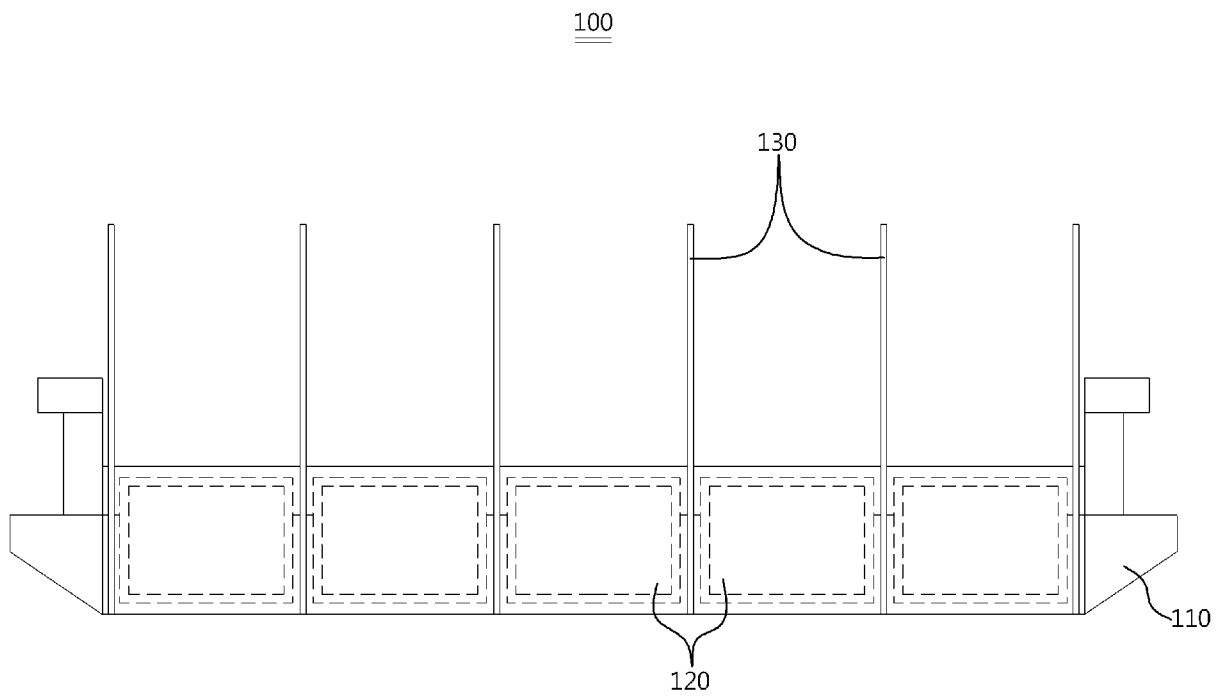
[Claim 14]

A method of claim 11, further comprising:
Releasing all guide piles from the platform or base structure for moving of the platform.

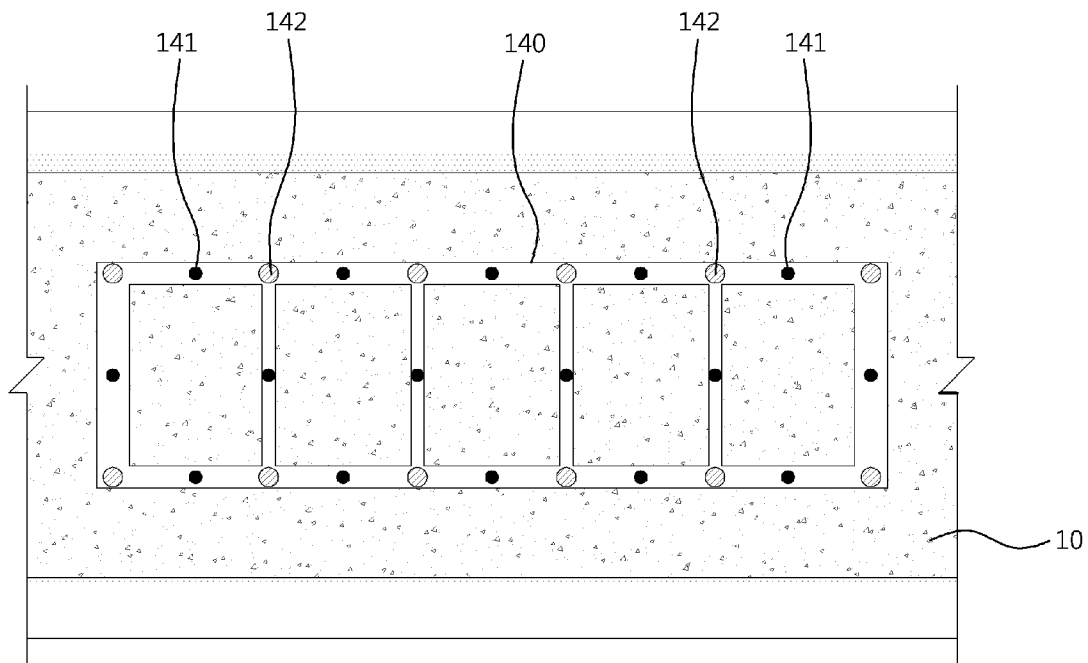
[Fig. 1]



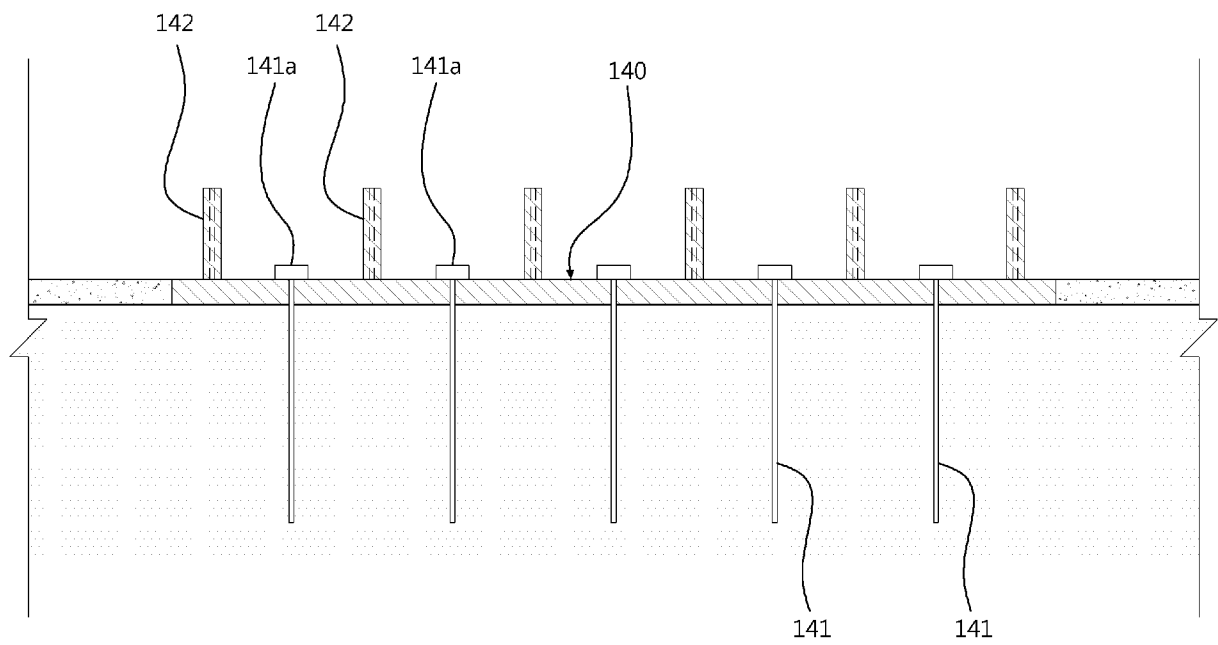
[Fig. 2]



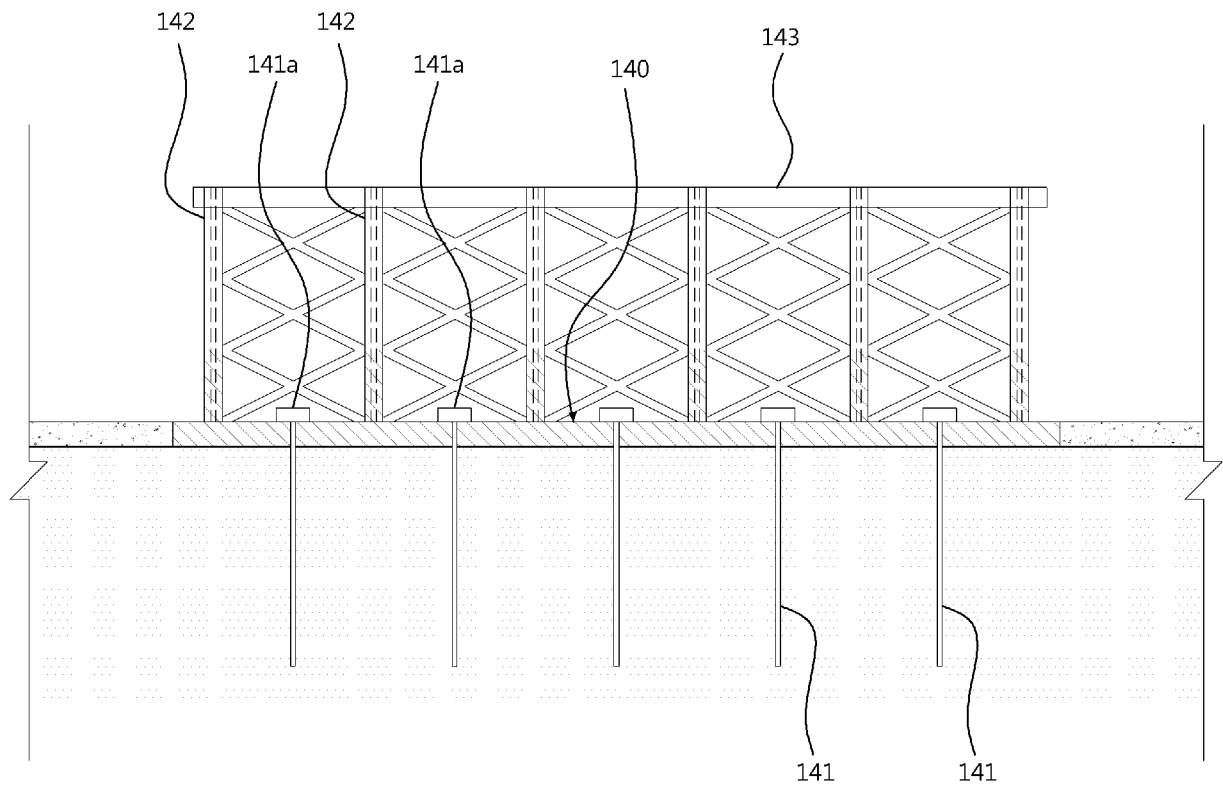
[Fig. 3]



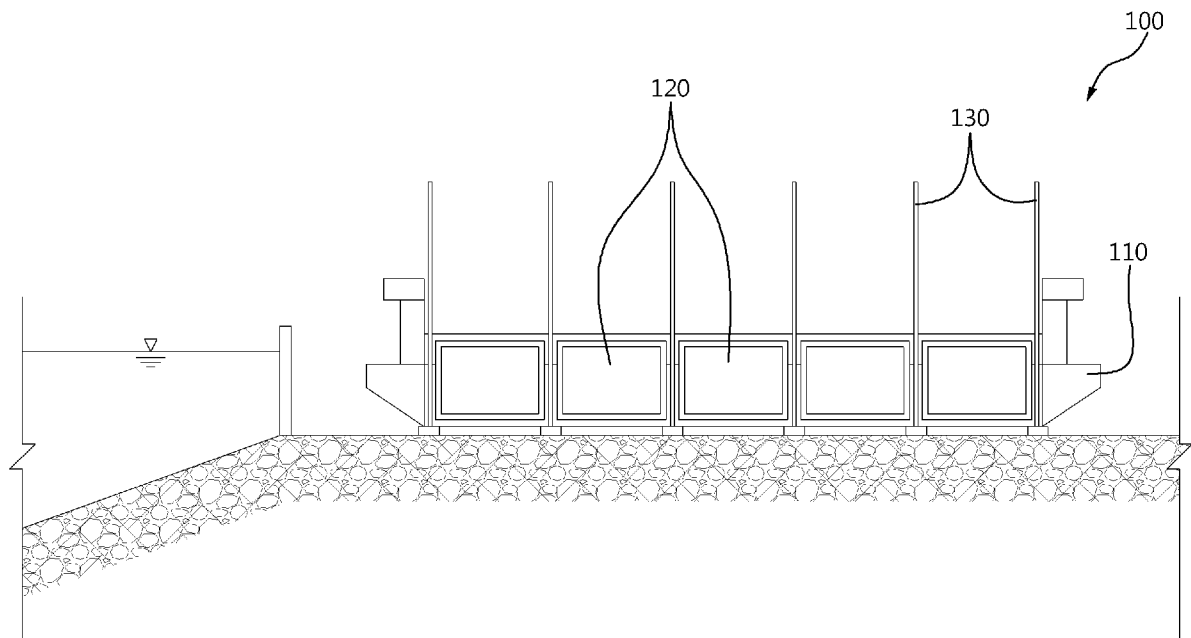
[Fig. 4]



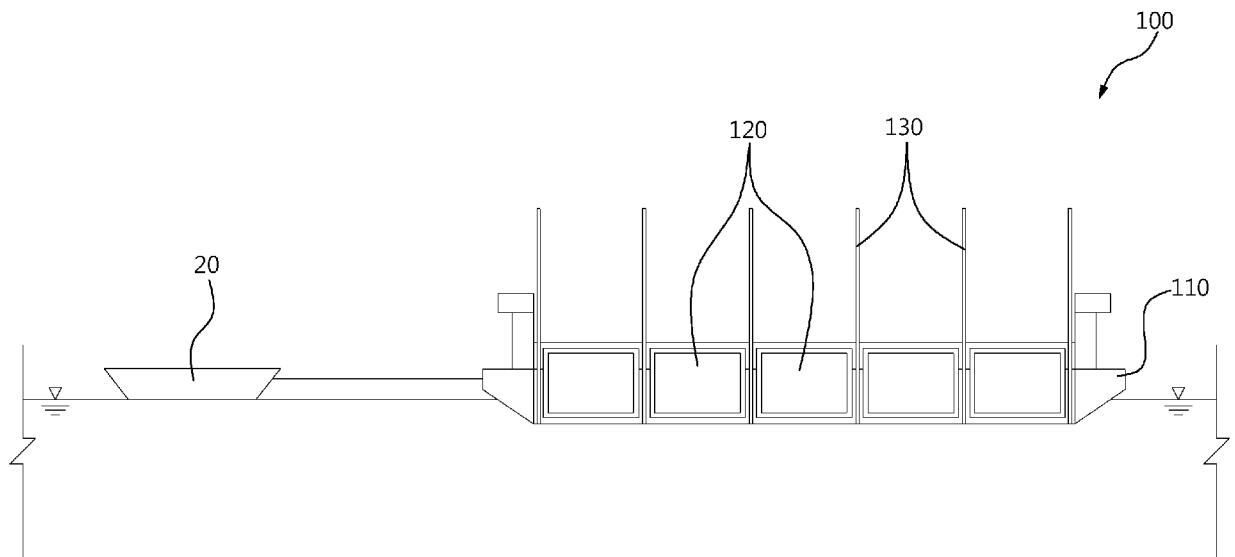
[Fig. 5]



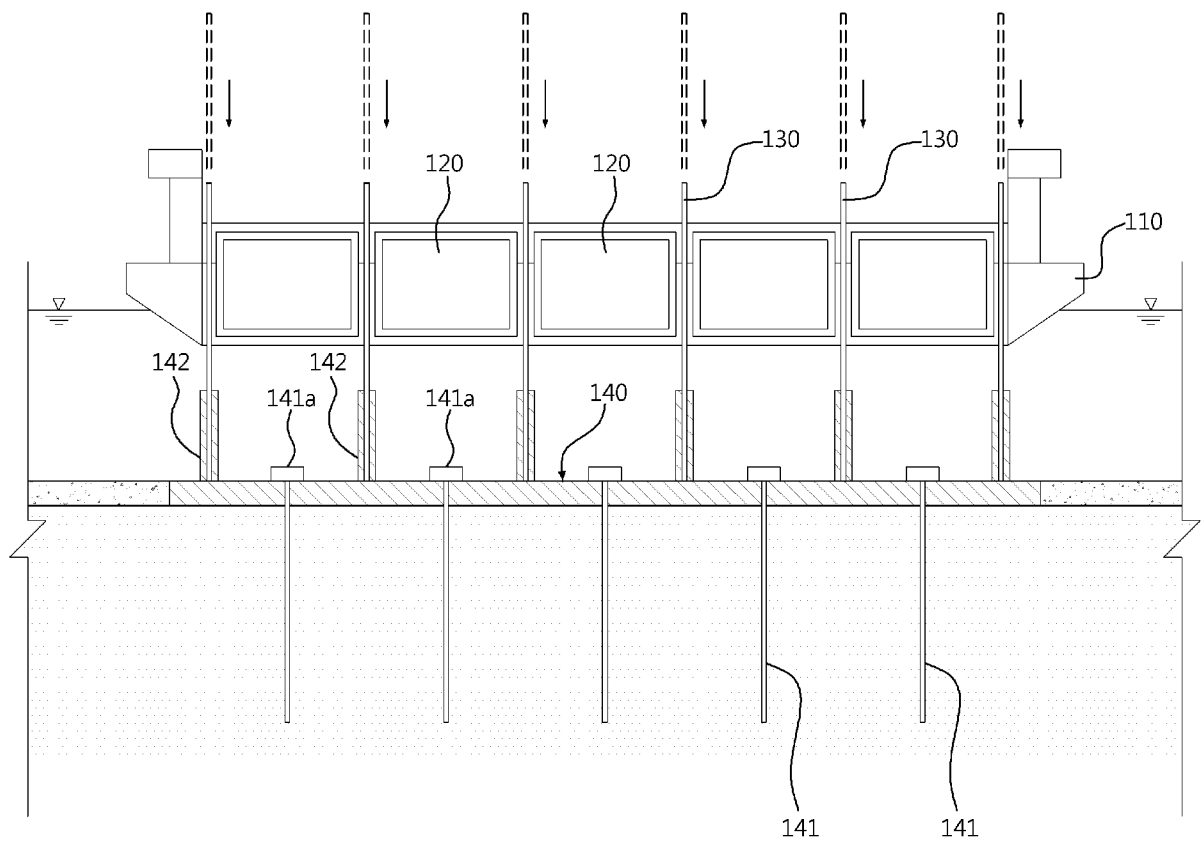
[Fig. 6]



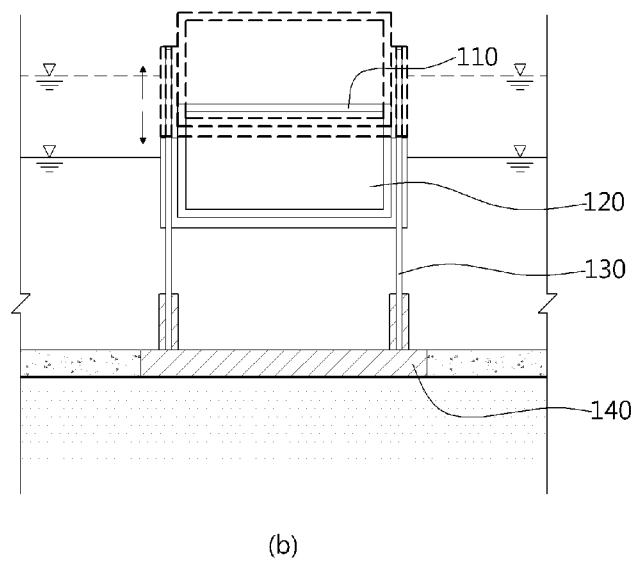
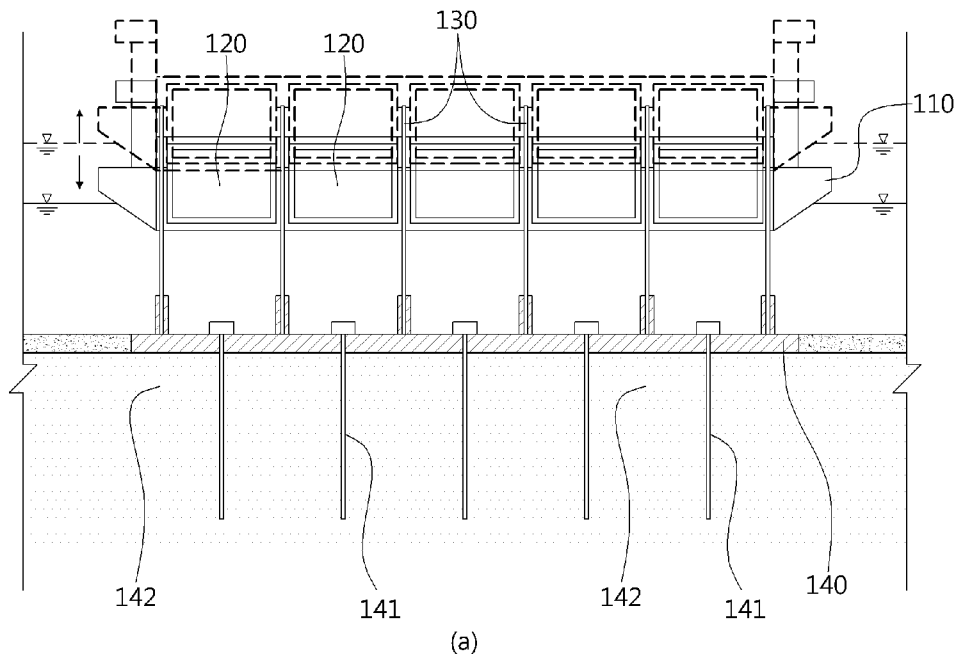
[Fig. 7]



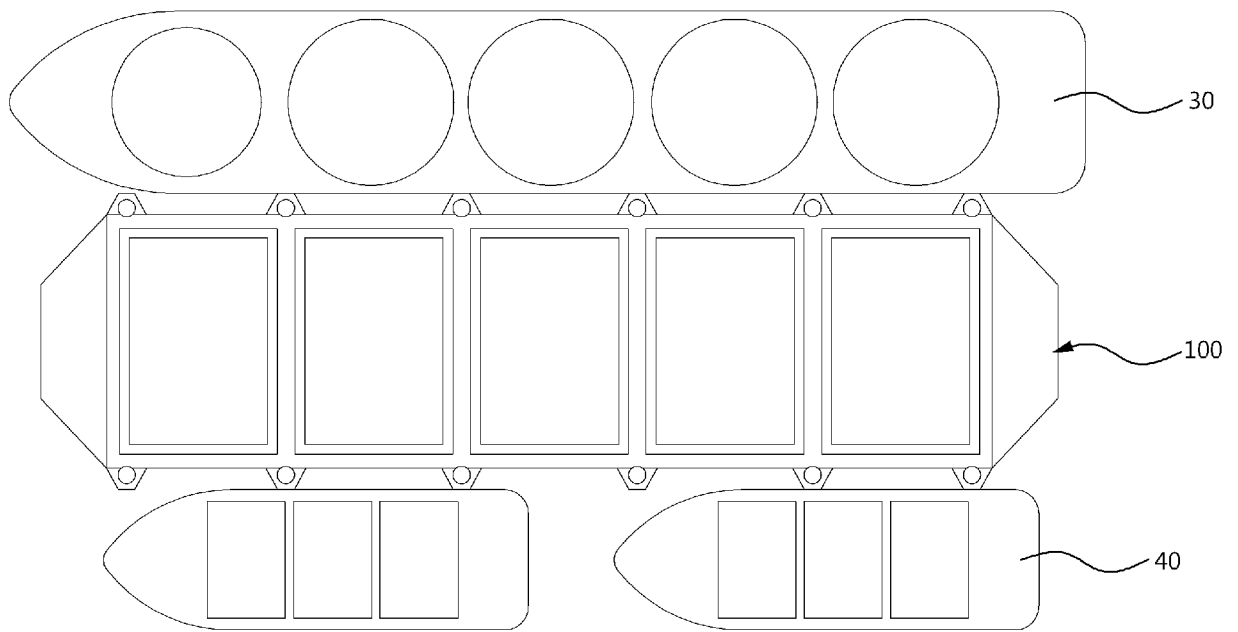
[Fig. 8]



[Fig. 9]



[Fig. 10]



A. CLASSIFICATION OF SUBJECT MATTER***B63B 35/44(2006.01)i, E02B 17/04(2006.01)i, B63B 13/00(2006.01)i, B63B 9/06(2006.01)i***

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 35/44; E02D 5/54; E02B 17/08; B63B 27/34; B63B 21/50; E02B 17/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: offshore platform, liquefied gas, guide pile, base structure and ballast tank

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2009-0208294 A1 (YAO, AIFENG et al.) 20 August 2009 See paragraphs [0027], [0030]-[0031], [0038]-[0047], [0053] and figures 1-2d.	1-14
Y	US 4784529 A (HUNTER, ANDREW F.) 15 November 1988 See column 3, line 65 - column 4, line 66 and figures 1, 6.	1-14
A	US 4285615 A (RADD, FREDERICK J.) 25 August 1981 See column 3, line 10 - column 4, line 64 and figure 1.	1-14
A	KR 10-2010-0114186 A (SAMSUNG HEAVY IND. CO., LTD.) 25 October 2010 See paragraphs [0035]-[0038] and figures 4-6.	1-14
A	JP 59-179483 A (MATSUDA, TOSHIO) 12 October 1984 See page 2 and figures 1-2.	1-14



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

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Date of the actual completion of the international search

14 MARCH 2013 (14.03.2013)

Date of mailing of the international search report

15 MARCH 2013 (15.03.2013)

Name and mailing address of the ISA/KR

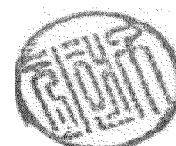
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CHOI, Hyun Goo

Telephone No. 82-42-481-8288



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/KR2012/007314

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009-0208294 A1	20.08.2009	None	
US 4784529 A	15.11.1988	EP 0311396 A1	12.04.1989
		EP 0311396 B1	22.07.1992
		EP 0441413 A1	14.08.1991
		EP 0441413 B1	12.01.1994
		JP 01-233192 A	18.09.1989
		KR 10-1989-0006928 A	16.06.1989
		US 4848970 A	18.07.1989
US 4285615 A	25.08.1981	None	
KR 10-2010-0114186 A	25.10.2010	None	
JP 59-179483 A	12.10.1984	None	