

【DESCRIPTION】**【Invention Title】**

SUPPORT STRUCTURE OF LARGE FLOATER USING GUIDE PILE
AND METHOD FOR INSTALLING SAME

【Technical Field】

[0001] The present invention relates to a support structure of a large floater located on the sea and a method for installing the same. More particularly, the present invention relates to a support structure of a large floater using a guide pile capable of storing, supplying, and loading and unloading liquefied gases such as liquefied natural gases or liquid materials such as crude oil by installing the large floater on the sea using the guide pile and a method for installing the same.

【Background Art】

[0002] Liquefied gases such as liquefied natural gas (LNG) have drawn much attention as clean energy due to rise of oil price and environmental problems. Natural gas which is a raw material of the LNG as the representative liquefied gas is fossil fuel buried underground in a gas state. The natural gas has methane as a main component and is gas energy which may be used immediately after gas naturally taken directly from a gas field goes through a little preprocessing. Further, the gas energy is similar to oil in that it is chemical fuel created by a change in

organic matters deposited in the ground.

[0003] Like extracting oil, the natural gas is extracted by deeply driving a borehole in the sea or the ground.

[0004] Further, the natural gas is chemical-free clean energy which little generates pollutants upon combustion by removing dusts, sulfur, nitrogen, etc., during the preprocessing and liquefaction process.

[0005] The natural gas is transported in a gas state through a gas pipe on the land or the sea or is transported to remote consumption sites while being stored in an LNG carrier in a liquefied natural gas state. The liquefied natural gas obtained by cooling the natural gas at a very low temperature (approximately, -163°C) has a volume reduced to approximately 1/600 compared to that of the natural gas in a gas state. Therefore, the liquefied natural gas is very suitable for long distance transportation through the sea.

[0006] Recently, the natural gas is produced even in a sedimentary rock. Generally, the natural gas has been processed and liquefied on an onshore terminal. In recent years, a liquefied natural gas-floating production storage offloading (LNG-FPSO) has greatly been developed and thus is becoming more and more popular. The liquefied natural gas is transformed in the onshore terminal, a floating

storage & offloading unit (FSRU), or a fixed offshore terminal.

[0007] For shipping the liquefied natural gas, import and export terminals are essentially provided with a storage unit. For these reasons, a large shipping terminal tends to be built along the coast. Further, a terminal which may supply clean energy like LNG to an engine of a ship will be required in future. For this reason, main ports require an LNG supply terminal and new facilities for supplying LNG to a special vessel which may supply LNG fuel to a personal vessel.

[0008] An offshore LNG terminal has been manufactured in gravity based structures (GBS) until now. As can be appreciated from the name, a terminal having the GBS is fixed by a self gravity force of a sea floor. The GBS is generally manufactured in heavy concrete and needs to be fixed by ballast water or a weight. This may cause a very large problem at a costal area due to various waves which are very frequently changed. Further, there is a problem in that costs of the GBS greatly increase in response to a depth of a seabed surface and complicated structures need to be installed to cope with various waves.

[Disclosure]

[Technical Problem]

[0009] An object of the present invention is to

provide a support structure of a large floater using a guide pile which may absorb shocks due to various waves, have a simple structure, and greatly save costs and a method for installing the same.

【Technical Solution】

[0010] In one general aspect, a support structure of a large floater using a guide pile includes: a large floater floating on the sea; at least one guide pile vertically inserted into the large floater to enable the large floater to move vertically but limit a movement in a horizontal direction; and a base structure installed on the seabed surface, a lower portion of the guide pile being coupled to the base structure, in which the large floater may include a plurality of pile sleeves having the guide piles inserted thereinto and including at least one shock absorbing member.

[0011] The large floater may further include at least one of a storage unit, a system for producing, storing, and loading and unloading liquefied gas, a system for producing, storing, and loading and unloading hydrocarbon, and a system for storing or loading freights.

[0012] The liquefied gas may include at least one of liquefied natural gas, liquefied petroleum gas, natural gas liquid, crude oil, and natural gas.

[0013] The large floater may be made of at least one of metal, high strength concrete, and watertight concrete.

[0014] The base part may be fixed to the seabed surface by at least one base fixing pile and may include at least one guide pile tube to which a lower portion of the guide pile is fixed.

[0015] The large floater may include at least one ballast tank.

[0016] An outer circumferential surface of the guide pile may be provided with an outermost reinforcing member made of a stainless material.

[0017] The pile sleeve may include a sleeve fixing part fixed to the large floater and a pile fixing part into which the guide pile is inserted.

[0018] The pile fixing part may include: a pile hole having the pile sleeve inserted thereinto; an inside guide member located at a portion to which an outer circumferential surface of the guide pile is bonded; an outside guide member forming an appearance of the pile fixing part and located at an outside; and a plurality of shock absorbing members located between the inside guide member and the outside guide member and spaced apart from each other by a predetermined distance.

[0019] The shock absorbing member may be made of an elastic material.

[0020] The support structure of a large floater using a guide pile may further include: a fender located on an

outer circumferential surface of the large floater and absorbing shocks and vibrations from the outside.

[0021] The fender may be made of at least one of steel, high strength concrete, and watertight concrete.

[0022] In another general aspect, a method for installing a support structure of a large floater using a guide pile includes: installing a base fixing a base part to a seabed surface (S10); transporting the floater to transport the large floater and the guide pile manufactured on a land to the sea where the base part is located using a carrier (S20); and fixing the floater to fix the guide pile to the base part (S30).

【Advantageous Effects】

[0023] According to the support structure of a large floater using a guide pile and the method for installing the same according to the exemplary embodiment of the present invention, the base structure may be previously fixed to the seabed surface and the guide pile may couple the large floater with the base structure of the seabed. Since the large floater floats at the water's surface, it may have all the technical merits of the fixed terminal and the floating terminal.

[0024] That is, the present invention may make the installation and movement of the large floater convenient and may be used even in the area where the tidal range is

large. Further, the special protector such as the wave damping wall may be provided in the area where tsunami may be generated. Further, the guide pile may be easily installed and the large floater may not move horizontally, such that the liquefied gas may be safely shipped in the vessel.

【Description of Drawings】

[0025] FIG. 1 is a cross-sectional view of a support structure of a large floater using a guide pile according to an exemplary embodiment of the present invention.

[0026] FIG. 2 is a plan view of the large floater according to the exemplary embodiment of the present invention.

[0027] FIG. 3 is a side view of the large floater according to the exemplary embodiment of the present invention.

[0028] FIG. 4 is a cross-sectional view of a base part according to an exemplary embodiment of the present disclosure.

[0029] FIG. 5 is a cross-sectional view of a pile sleeve according to an exemplary embodiment of the present invention.

[0030] FIG. 6 is a cross-sectional view of the guide pile according to the exemplary embodiment of the present invention.

[0031] FIG. 7 is a flow chart of a method for installing a large floater using a guide pile according to an exemplary embodiment of the present invention.

【Best Mode】

[0032] Hereinafter, a support structure 10 of a large floater using a guide pile according to an exemplary embodiment of the present invention having the above features will be described in detail with reference to the accompanying drawings.

[0033] A configuration and a form of the support structure 10 of a large floater using a guide pile according to the exemplary embodiment of the present invention will be described with reference to FIGS. 1 and 2.

[0034]

[0035] The support structure 10 of a large floater using a guide pile according to the exemplary embodiment of the present invention includes a large floater 100 floating on the sea, a guide pile 400 fixing the large floater 100, and a base part 500 fixing the guide pile 400 to a seabed surface.

[0036] FIG. 1 is a cross-sectional view of the support structure 10 of a large floater according to the exemplary embodiment of the present invention and FIG. 2 is a plan view of the large floater 100 according to the exemplary embodiment of the present invention.

[0037] The large floater 100 forms the overall appearance and includes a storage tank 200 which may store liquefied gas. Further, the large floater 100 may be equipped in a vessel transporting the liquefied gas or may be installed in a gas supply apparatus for transporting the liquefied gas. Further, the large floater 100 includes at least one of a liquid storage unit, a system for producing, storing, and loading and unloading liquefied gas, a system for producing, storing, and loading and unloading hydrocarbon, and a system for storing or loading freights all of which are not illustrated.

[0038] In this case, the liquefied gas includes at least one of liquefied natural gas, liquefied petroleum gas, natural gas liquid, crude oil, and natural gas.

[0039] The storage tank 200 is not limited to a reservoir storing the liquefied gas but may be used a reservoir which may store a material in a liquid state or a solid state. Further, the large floater 100 may be used by installing a system required on the sea at a place where the storage tank 200 is located.

[0040] For example, the large floater 100 may be used at an LNG bunkering terminal, an LNG-FSRU, and an FPSO, etc. Further, the large floater 100 is provided with a desalination system and therefore may be used in a seawater desalination system. In addition, the large floater 100 is

equipped with a storage facility or a loading and unloading system and thus may be used in a mobile harbor. As described above, the large floater 100 may be extended to various systems.

[0041] The large floater 100 is formed to float on the sea. In this case, the large floater 100 may be towed by a tugboat.

[0042] The large floater 100 may be made of at least one of steel, high strength concrete, and watertight coated light weight concrete.

[0043]

[0044] For example, the large floater 100 is formed by locating the watertight coated light weight concrete between sandwich panels for water proof. That is, the large floater is manufactured by making the sandwich panels with a metal material and casting concrete between the sandwich panels.

[0045] The watertight coating may use polymer coating which coats both sides of the light weight concrete with polymer such as epoxy.

[0046] The storage tank 200 is installed in the large floater 100. The storage tank 200 may be coupled to the large floater 100 by being manufactured together with the large floater 100 or separately manufactured from the large floater 100. The large floater 100 may include a plurality

of storage tanks 200. The large floater 100 according to the exemplary embodiment of the present invention may be provided with five storage tanks 200. However, the number of storage tanks 200 is not limited and therefore five or less or five or more storage tanks may be installed.

[0047] When the liquefied gas stored in the storage tank 200 is at a low temperature, the storage tank 200 may include a thermal insulation system. Further, when the liquefied gas is cryogenic liquefied gas, the storage tank 200 is provided with a heat insulation apparatus. For example, when the liquefied natural gas is stored in the storage tank 200, the storage tank 200 may be provided with a barrier wall made of INVAR or stainless steel and thermal insulating materials of polywood board or polyurethane foam.

[0048] The guide pile 400 is installed to permit a vertical movement of the large floater 100 but limit a horizontal movement thereof. In more detail, the guide pile 400 is vertically extended and a lower portion of the guide pile 400 is fixed to a seabed surface or fixed to the seabed surface through the base part 500, such that the large floater 100 moves only in a vertical direction by the guide pile 400.

[0049] The base part 500 is fixed to the seabed surface and is safely installed to increase a restoring force and a stress related to a vertical force applied from

an air flow, a wave, and a vessel.

[0050] The guide pile 400 is installed so that the large floater 100 may vertically move on the sea and the lower portion of the guide pile 400 is fixed to the seabed surface or the base part 500.

[0051] The plurality of guide piles 400 are installed in the large floater 100. A total of 14 guide piles according to the exemplary embodiment of the present invention are installed on an outer circumferential surface of the large floater 100. The number of guide piles 400 may be smaller or larger than 14 according to a size of the large floater 100 and a condition of the sea.

[0052]

[0053] The guide piles 400 are disposed in a length direction of the large floater 100 at a predetermined distance. Further, six guide piles 400 are installed on each of the surfaces in a length direction of the large floater 100 and one guide pile 400 is installed on one surface in a width direction, which is only an exemplary embodiment. Accordingly, the number of guide piles may be larger or smaller and the surface on which the guide piles 400 are installed is not limited to four surfaces of the large floater 100.

[0054] The large floater 100 includes the plurality of pile sleeves 300 to install the guide pile 400.

[0055] In FIG. 2, six pile sleeves 300 are installed on each of the surfaces in a length direction of the large floater 100 and one pile sleeve 300 is installed on both sides, respectively, but the exemplary embodiment of the present invention is not limited thereto but the pile sleeve may be installed to correspond to the guide pile 400.

[0056] The pile sleeve 300 serves to fix the large floater 100 to a vertical surface along the guide pile 400. Further, the large floater 100 vertically moves depending on a tide and a wave and therefore an inside surface of the pile sleeve part 300, that is, a portion to which the guide pile 400 is bonded is easily worn and therefore the pile sleeve may be preferably attached to be easily replaced. Therefore, the pile sleeve 300 is not fixed to the large floater 100 by welding but is coupled to the large floater 100 by a coupling member, which may be easily disassembled, such as a bolt.

[0057] The large floater 100 may be further provided with a fender 600 which may protect an outside surface. The fender 600 is formed on an outer circumferential surface of the large floater 100 to serve to relieve shocks and vibrations from the outside.

[0058] The fender 600 may be made of at least one of steel, high strength concrete, and watertight coated light weight concrete.

[0059]

[0060] Referring to FIG. 4, the base part 500 according to the exemplary embodiment of the present invention will be described below.

[0061] The base part 500 is drawn down to the seabed surface and then may be fixed by driving a base fixing pile 520 in the seabed surface. The base fixing pile 520 may fix a base frame 510 by using a clamping apparatus. The base fixing pile 520 is to provide a horizontal fixing resistance and a sufficient strength to prevent the base frame 510 from moving.

[0062] The base frame 510 includes a plurality of guide pile tubes 511. The guide pile tube 511 is extended vertically and the lower portion of the guide pile 400 is inserted into the guide pile tube 511 to be fixed. Further, the guide pile tube 511 is formed to correspond to the guide pile 400 which is installed in the large floater 100.

[0063] The large floater 100 may further include at least one ballast tank (not illustrated).

[0064] The ballast tank may control a balance of the large floater 100 by the inflow and outflow of seawater. For example, the ballast tank balances vertical or horizontal directions of the large floater 100 when the amounts of materials stored in the storage tank 200 are different.

[0065]

[0066] Referring to FIG. 5, the pile sleeve 300 according to the exemplary embodiment of the present invention will be described below.

[0067] The pile sleeve 300 according to the exemplary embodiment of the present invention includes a sleeve fixing part 310 fixed to the large floater 100 and a pile fixing part 320 into which the guide pile 400 is inserted.

[0068] The pile fixing part 320 includes a pile hole 321, an inside guide member 322, a shock absorbing member 323, and an outside guide member 324.

[0069] The pile hole 321 is a hole into which the guide pile 400 is inserted and is preferably formed to have a diameter larger than that of the guide pile 400.

[0070] Further, when the guide pile 400 is inserted into the pile hole 321, to minimize a friction force between an outside surface of the guide pile 400 and an inside surface of the pile hole 321, the inside surface of the pile hole 321 may also be coated with a material which may reduce the friction.

[0071] To absorb a shock transferred through the guide pile 400, the pile fixing part 320 is formed by positioning a plurality of shock absorbing members 323 between the inside guide member 322 and the outside guide member 32.

[0072] That is, the inside guide member 322 and the

outside guide member 324 are made of a metal material and the plurality of shock absorbing members 323 are inserted between the inside guide member 322 and the outside guide member 324 to manufacture the pile fixing part 320.

[0073] In this case, the shock absorbing member 323 is made of an elastic material like rubber and is positioned in plural. The above-mentioned elastic material means a material selected from the group consisting of polysiloxane, polyurethane, polyester, polyfluorosiloxane, polyolefin, fluoroelastomer, synthetic rubber, natural rubber, and a mixture thereof.

[0074] The shock absorbing members 323 are positioned to be spaced apart from each other at a predetermined distance and when being expanded by being applied with a shock, the shock absorbing member 323 may be preferably manufactured to be expanded toward the spaced space to absorb a shock.

[0075]

[0076] Referring to FIG. 6, the guide pile 400 according to the exemplary embodiment of the present invention will be described below.

[0077] The guide pile 400 may be made of at least one of steel, high strength concrete, and watertight coated light weight concrete.

[0078] The watertight coated light weight concrete is

formed by positioning light weight concrete coated on both sides between the sandwich panels for waterproof. That is, as illustrated in FIG. 6, an outside reinforcing member 420 and an inside reinforcing member 440 made of a metal material are installed and concrete is cast between the outside reinforcing member 420 and the inside reinforcing member 440 to form a concrete part 430.

[0079] The watertight coating may use polymer coating which coats both sides of the light weight concrete with polymer such as epoxy.

[0080] Further, an outside surface of the guide pile 400 contacts seawater and therefore the guide pile 400 may be further provided with the outermost reinforcing member 410 made of a stainless material to prevent a corrosion.

[0081]

[0082] A method for installing a support structure of a large floater using a guide pile according to an exemplary embodiment of the present invention will be described with reference to FIG. 7.

[0083] The method for installing a support structure of a large floater using a guide pile according to the exemplary embodiment of the present invention includes installing the base (S10), transporting the floater (S20), and fixing the floater (S30).

[0084] In the installing of the base (S10), the base

part 500 is fixed on the seabed surface. In more detail, in the installing of the base (S10), the base frame 510 is positioned on the seabed surface and the base frame 510 is fixed on the seabed surface using the base fixing pile 520.

[0085] In the transporting of the floater (S20), the large floater 100 and the guide pile 400 are manufactured on a land and are transported to the sea on which the base part 500 is installed by using a carrier.

[0086] In this case, the large floater 100 and the guide pile 400 may be transported while being coupled to each other on a land and may be each transported to be assembled on the sea.

[0087] In the fixing of the floater (S30), the guide pile 400 is fixed to the base part 500. In more detail, in the fixing of the floater (S30), an upper portion of the guide pile 400 is inserted into the pile sleeve 300 and the lower portion thereof is fixed to the guide pile tube 511 which is formed at the base frame 510.

[0088] In this case, the guide pile 400 is manufacture in a hollow form and therefore may be easily assembled while seawater is introduced into the hollow portion.

[0089]

[0090] The present invention is not limited to the above-mentioned embodiments but may be variously applied, and may be variously modified by those skilled in the art

to which the present invention pertains without departing from the gist of the present invention claimed in the claims.

[0091]

[0092] [Detailed Description of Main Elements]

[0093] 10: Support structure of large floater using guide pile

[0094] 100: Large floater

[0095] 200: Storage tank

[0096] 300: Pile sleeve

[0097] 310: Sleeve fixing part

[0098] 320: pile fixing part

[0099] 321: Pile hole

[00100] 322: Inside guide member

[00101] 323: Shock absorbing member

[00102] 324: Outside guide member

[00103] 400: Guide pile

[00104] 410: Outermost reinforcing member

[00105] 420: Outside reinforcing member

[00106] 430: Concrete part

[00107] 440: Inside reinforcing member

[00108] 500: Base part

[00109] 510: Base frame

[00110] 511: Guide pile tube

[00111] 520: Base fixing pile

[00112] 600: Fender

[00113] S10~S30: Method for installing support
structure of large floater using guide pile

【CLAIMS】**【Claim 1】**

A support structure of a large floater using a guide pile, comprising:

a large floater floating on the sea;

at least one guide pile vertically inserted into the large floater to enable the large floater to move vertically; and

a base structure installed on a seabed surface, a lower portion of the guide pile being coupled to the base structure,

wherein the large floater includes a plurality of pile sleeves having the guide piles inserted thereinto and including at least one shock absorbing member.

【Claim 2】

The support structure of a large floater using a guide pile of claim 1, wherein the large floater further includes at least one of a storage unit, a system for producing, storing, and loading and unloading liquefied gas, a system for producing, storing, and loading and unloading hydrocarbon, and a system for storing or loading freights.

【Claim 3】

The support structure of a large floater using a

guide pile of claim 2, wherein the liquefied gas includes at least one of liquefied natural gas, liquefied petroleum gas, natural gas liquid, crude oil, and natural gas.

【Claim 4】

The support structure of a large floater using a guide pile of claim 2, wherein the large floater is made of at least one of metal, high strength concrete, and watertight coated light weight concrete.

【Claim 5】

The support structure of a large floater using a guide pile of claim 1, wherein the base part is fixed to the seabed surface by at least one base fixing pile and includes at least one guide pile tube to which the lower portion of the guide pile is fixed.

【Claim 6】

The support structure of a large floater using a guide pile of claim 2, wherein the large floater includes at least one ballast tank.

【Claim 7】

The support structure of a large floater using a guide pile of claim 1, wherein an outer circumferential

surface of the guide pile is provided with an outermost reinforcing member made of a stainless material.

【Claim 8】

The support structure of a large floater using a guide pile of claim 1, wherein the pile sleeve includes a sleeve fixing part fixed to the large floater and a pile fixing part into which the guide pile is inserted.

【Claim 9】

The support structure of a large floater using a guide pile of claim 8, wherein the pile fixing part includes:

a pile hole having the pile sleeve inserted thereinto;

an inside guide member located at a portion to which an outer circumferential surface of the guide pile is bonded;

an outside guide member forming an appearance of the pile fixing part and located at an outside; and

the plurality of shock absorbing members located between the inside guide member and the outside guide member and spaced apart from each other by a predetermined distance.

【Claim 10】

The support structure of a large floater using a guide pile of claim 9, wherein the shock absorbing member is made of an elastic material.

【Claim 11】

The support structure of a large floater using a guide pile of claim 1, further comprising:

a fender located on an outer circumferential surface of the large floater and absorbing shocks and vibrations from the outside.

【Claim 12】

The support structure of a large floater using a guide pile of claim 11, wherein the fender is made of at least one of steel, high strength concrete, and watertight coated light weight concrete.

【Claim 13】

A method for installing the support structure of a large floater using a guide pile of any one of claims 1 to 12, comprising:

installing a base fixing the base part to the seabed surface (S10);

transporting the floater to transport the large

floater and the guide pile manufactured on a land to the sea where the base part is located using a carrier (S20); and

fixing the floater to fix the guide pile to the base part (S30).