configuration in view of possible side collisions, with for example a shuttle tanker. Such side collisions would directly damage the gas process equipment in the projecting hull structures.

Summary of the Invention

The object of the present ~~invention~~ disclosure is to provide a floating LNG plant with an overall design which provides more safety then the floating LNG plants known from the prior art.

According to a first aspect of the ~~invention~~disclosure, the ~~invention~~ disclosure relates to a floating LNG plant (1, 1', 100) comprising a converted LNG carrier
with a hull and a plurality of LNG storage tanks (4, 104) wherein the floating LNG plant (1, 1', 100) comprises:

- at least one sponson (2, 2', 3, 3', 102, 103) on the side of the hull, for creating additional hull volume,
- process equipment (110) for LNG processing on the floating LNG plant (1, 1', 100), and
- a reservoir for storing fluids separated during the LNG processing, wherein said reservoir is formed by the ballast tank or in the space reserved for the ballast tank of the original LNG carrier.

In the present text the phrase 'floating LNG plant' is used. This phrase refers to any LNG carrier that has been converted in order to be used for LNG processing and storage.

Once the original LNG carrier has been converted, the result is a floating LNG plant which for instance can be used as a FPSO, FSRU or a FPGU.

In the present text, the phrase "LNG carrier" is used. This means a vessel that has originally been constructed for transporting LNG. When in the text reference is made to an "original LNG carrier", reference is made to the LNG carrier prior to the converting of the LNG carrier to a floating LNG plant.

In the present text the word "sponson" is used. The word sponson refers to any projecting hull structure in order to provide additional hull volume. The sponson normally extends along the length of a vessel. Optionally the top side of the sponson can be made flat. The top side could be adapted to be flush the vessel's main deck. However, it should be noted that the top side of a sponson does not need to be flat and does not need to be flush with the vessel's main deck. It is very well possible to connect a sponson to the hull below the main deck. This is in fact preferable both for constructability and for reducing stress concentrations at the connections.

A first technical effect of the ~~invention~~ disclosure is the fact that the addition of a sponson allows the vessel to carry more cargo overall. Any vessel will require, under statutory codes, a certain amount of reserve ballast spaces by which to control weight and draft of the vessel in both normal and damage scenarios. In the in the case of a normal LNG carrier this ballast space is provided by the side (wing) tanks which make up the double hull space.

According to the ~~invention~~ disclosure the volume added by the sponson enable the conversion of those reserve ballast spaces, that previously would only have been permitted to carry ballast water or to be void, into tanks for

storage of fluids such as oil, condensates or other waste products that result from the LNG processing on board of the floating LNG plant. According to the ~~invention~~ disclosure the ballast tanks of the original LNG carrier could be used for storing of those fluids . Alternatively, the space that was available for the original ballast tanks can be used to partially house newly constructed tanks for the fluids wherein those tanks extend, for their remaining part into the space crated by the adding of a sponson.

A second advantage of the configuration of the floating LNG plant, according to the ~~invention~~disclosure, is the fact that the adding of a sponson will increase the separation distance of the LNG storage area of the vessel from the side of the vessel, which represents the point of impact in a possible side collision by another vessel like a LNG carrier or supply vessel. Therefore, this increase of the separation distance will add additional collision safety.

As the floating LNG plants moored to the seabed, sponsons will make the moored vessel more stable; the uptime of the high process towers is depending on vessels (roll) motions and a more stable vessel will increase the process uptime.

Yet a further advantage of the presence a sponson is that it will increase the overall strength of the hull. Hull deformations, like hogging and sagging, are therefore limited and more deck load can be added to a vessel that is provided with sponsons.

According to a preferred embodiment of the ~~invention~~disclosure, the sponson of the floating LNG plant provides double hull protection.

According to a preferred embodiment of the ~~invention~~disclosure, the vessel comprises a new ballast tank for the floating LNG plant in the additional hull volume created by the adding of the sponson to the side of the hull.

According to a preferred embodiment of the ~~invention~~disclosure, the process equipment for LNG processing on the floating LNG plant is installed on the additional deck space created by the adding of the at least one sponson on the side of the hull. To be able to have all the LNG processing equipment on the open deck area which is created by the adding of the sponson, the process modules need to be "stretched" as the width of the process modules must be adjusted to the available width of the sponson.

The effect is that the sizes of the process modules are in general longer but also smaller compared to normal modules for LNG processing.

According to a preferred embodiment of the ~~invention~~disclosure, the sponson is used for supporting LNG transfer devices.

According to a preferred embodiment of the ~~invention~~disclosure, the LNG FPSO is provided with two sponsons (2, 2', 3, 3', 102, 103) each on one side of the vessel, the first sponson (2, 2', 102) is used for supporting LNG transfer devices (111) and the second sponson (3, 3', 103) is used for supporting LNG process equipment (110).

According to a preferred embodiment of the ~~invention~~disclosure, the sponson is used for storage of a floating offloading hose. An effect of this measure is the fact that the link of the sponson can be used for the storage of the floating LNG offloading hose, for instance in a gutter on the sponson, for a tandem of loading configuration of two vessels. In that case, no hose real would be needed at the haft of the floating LNG plant.

According to a preferred embodiment of the disclosure~~invention~~, a power generation unit is placed within the sponson.

According to a preferred embodiment of the disclosure~~invention~~, the floating LNG plant further comprises a mooring system and a fluid transfer system, the fluid transfer system including a swivel and piping connecting the swivel to process equipment for liquefaction on the floating LNG plant.

It is possible that the floating LNG plant comprises an external turret in order to allow the LNG FPSO to be weathervaning moored to the seabed via said external turret.

Alternatively, the floating LNG plant comprises an offloading buoy in order to allow the floating LNG plant to be weathervaning moored to the seabed via said offloading buoy.

According to a preferred embodiment of the disclosure~~invention~~ the outer shell of the at least one sponson is provided with a collision protection.

It is possible that the outer shell of the at least one sponson is protected against collision damage using SPS.

As the vessel is moored to the seabed, sponsons will make the moored vessel more stable; the uptime of the high process towers is depending on vessels motions and a more stable vessel will increase the process uptime. This is why just side deck extensions instead of sponson are not a preferred solution.

According to a second aspect of the disclosure~~invention~~, there is provided a method for converting a LNG carrier into a Floating LNG plant (1, 1', 100), wherein the LNG carrier comprises at least a hull, a plurality of LNG storage tanks (4, 104) and at least one ballast tank for stabilizing the LNG carrier and wherein the method comprises the steps of:

- adding at least one sponson (2, 2', 3, 3', 102, 103) on the side of the hull, for creating additional hull volume,
- installing process equipment (110) for LNG processing on the vessel,
- using the ballast tank or the space reserved for the ballast tank of the original LNG carrier to create a reservoir for storing fluids separated during the LNG processing, and
- using the additional hull volume created by the adding of the sponson (2, 2', 3, 3', 102, 103) to create a new ballast tank for the floating LNG plant (1, 1', 100).

According to an embodiment, the disclosure~~invention~~ relates to method for converting a LNG carrier into a floating LNG plant, wherein the LNG carrier comprises at least a hull, a plurality of LNG storage tanks and at least one ballast tank for stabilizing the LNG carrier and wherein the method comprises the steps of:

- adding at least one sponson on the side of the hull, for creating additional hull volume,
- installing process equipment for LNG processing on the vessel,

- using the ballast tank or the space reserved for the ballast tank of the original LNG carrier to create a reservoir for storing hydrocarbons separated during the LNG processing, and
- using the additional hull volume created by the adding of the sponson to create a new ballast tank for the floating LNG plant.

According to a preferred embodiment of the disclosure~~invention~~, the method comprises the step of installing process equipment for LNG processing on the vessel on the additional deck space created by the adding of the at least one sponson on the side of the hull.

According to a preferred embodiment of the disclosure~~invention~~ the method comprises the step of providing the outer shell of the at least one sponson with a collision protection.

According to a further aspect of the disclosure~~invention~~, there is provided a natural gas distribution system for supplying natural gas to users where said natural gas has been transported as LNG by a LNG carrier (50) that has sailed from a liquefying station to a coastal gas receiving facility (17) located at a sea coast in the vicinity, comprising:

- at least a floating LNG plant (1 , 1', 100) as described herein, having production storage and offloading capability, and
- a LNG FSRU (floating storage regas unit) (85) that lies at said coastal gas receiving facility (70), and that heats LNG to produce gaseous natural gas and that is connected to said facility to carry said gaseous natural gas through said facility (70).

According to an embodiment, the disclosure~~invention~~ relates to a natural gas distribution system for supplying natural gas to users where said natural gas has been transported as LNG by a LNG carrier that

has sailed from a liquefying station to a coastal gas receiving facility located at a sea coast in the vicinity, comprising:

- at least a converted floating LNG plant having production storage and offloading capability and provided with at least one sponson on the side of the hull, for creating additional hull volume, and

- a LNG FSRU (floating storage regas unit) (85) that lies at said coastal gas receiving facility, and that heats LNG to produce gaseous natural gas and that is connected to said facility to carry said gaseous natural gas through said facility.

According to a preferred embodiment the natural gas distribution system comprises a floating LNG plant, wherein the floating LNG plant is a floating LNG plant according to the disclosure~~invention~~.

Brief description of the drawings

The invention and the advantages thereof will be better understood, after the description below, which makes reference to the drawings, wherein:

Figure 1 shows a side and a top view of a possible embodiment of a floating LNG plant according to the present invention, which is moored via an external turret;

Figure 2 shows a cross section of the floating LNG plant according to figure 1;

CLAIMS

1. Floating LNG plant (1, 1', 100) comprising a converted LNG carrier with a hull and a plurality of LNG storage tanks (4, 104) wherein in that the floating LNG plant (1, 1', 100) comprises:

- at least one sponson (2, 2', 3, 3', 102, 103) on the side of the hull, for creating additional hull volume,
- process equipment (110) for LNG processing on the floating LNG plant (1, 1', 100), and
- a reservoir for storing fluids separated during the LNG processing, wherein said reservoir is formed by the ballast tank or in the space reserved for the ballast tank of the original LNG carrier.

2. Floating LNG plant (1, 1', 100) according to claim 1, wherein the sponson of the floating LNG plant (1, 1', 100) provides double hull protection.

3. Floating LNG plant (1, 1', 100) according to claim 1 or 2, comprising a new ballast tank for the floating LNG plant in the additional hull volume created by the adding of the sponson to the side of the hull.

4. Floating LNG plant (1, 1', 100) according to any of claims 1-3, wherein the process equipment (110) for LNG processing on the floating LNG plant (1, 1', 100) is installed on the additional deck space created by the adding of the at least one sponson (2, 2', 3, 3', 102, 103) on the side of the hull .

5. Floating LNG plant (1, 1', 100) according to claim 4, wherein the sponson (2, 2', 3, 3', 102, 103) is used for supporting LNG transfer devices (111) for loading or unloading LNG.

6. Floating LNG plant (1, 1', 100) according to claim 5, wherein the LNG FPSO is provided with two sponsons (2, 2', 3, 3', 102, 103) each on one side of the vessel, the first sponson (2, 2', 102) is used for supporting LNG transfer devices (111) and the second sponson (3, 3', 103) is used for supporting LNG process equipment (110).

7. Floating LNG plant (1, 1', 100) according to claim 5 or 6, wherein the sponson (2, 2', 3, 3', 102, 103) is used for storage of a floating offloading hose (19).

8. Floating LNG plant (1, 1', 100), according to any of the claim 1-7, wherein a power generation unit is placed within the sponson (2, 2', 3, 3', 102, 103).

9. Floating LNG plant (1, 1', 100) according to any of the claims 1-8, wherein the LNG FPSO (1, 1', 100) further comprises a mooring system and a fluid transfer system, the fluid transfer system including a swivel and piping connecting the swivel to process equipment for LNG processing.

10. Floating LNG plant (1, 1', 100) according to claim 9, comprising an external turret (10) in order to allow the floating LNG plant (1, 1', 100) to be weathervaning moored to the seabed via said external turret (10).

11. Floating LNG plant (1, 1', 100) according to claim 9, comprising an offloading buoy in order to allow the floating LNG plant (1, 1', 100) to be weathervaning moored to the seabed via said offloading buoy.

12. Floating LNG plant (1, 1', 100) according to any proceeding claims wherein the outer shell of the at least one sponson (2, 2', 3, 3', 102, 103) is provided with a collision protection (40).

13. Floating LNG plant (1, 1', 100) according to claim 12, wherein the outer shell of the at least one sponson (2, 2', 3, 3', 102, 103) is protected against collision damage using SPS.

14. Method for converting a LNG carrier into a Floating LNG plant (1, 1', 100), wherein the LNG carrier comprises at least a hull, a plurality of LNG storage tanks (4, 104) and at least one ballast tank for stabilizing the LNG carrier and wherein the method comprises the steps of:

- adding at least one sponson (2, 2', 3, 3', 102, 103) on the side of the hull, for creating additional hull volume,
- installing process equipment (110) for LNG processing on the vessel,
- using the ballast tank or the space reserved for the ballast tank of the original LNG carrier to create a reservoir for storing fluids separated during the LNG processing, and
- using the additional hull volume created by the adding of the sponson (2, 2', 3, 3', 102, 103) to create a new ballast tank for the floating LNG plant (1, 1', 100).

15. Method according to claim 14, wherein the method comprises the step of installing process equipment (110) for LNG processing on the vessel on the additional deck space created by the adding of the at least one sponson (2, 2', 3, 3', 102, 103) on the side of the hull.

16. Method according claim 14 or 15, wherein the method comprises the step of providing the outer shell of the at least one sponson (2, 2', 3, 3', 102, 103) with a collision protection (40).

17. A natural gas distribution system for supplying natural gas to users where said natural gas has been transported as LNG by a LNG carrier (50) that has sailed from a liquefying station to a coastal gas receiving facility (17) located at a sea coast in the vicinity, comprising:

- at least a converted floating LNG plant (1, 1', 100) having production storage and offloading capability and provided with at least one sponson (2, 2', 3, 3', 102, 103) on the side of the hull, for creating additional hull volume, and

- a LNG FSRU (floating storage regas unit) (85) that lies at said coastal gas receiving facility (70), and that heats LNG to produce gaseous natural gas and that is connected to said facility to carry said gaseous natural gas through said facility (70).

18. A natural gas distribution system as claimed in claim 17 wherein the floating LNG plant (1, 1', 100) is a floating LNG plant (1, 1', 100) according to any of the claims 1 to 12.

CLAIMS

1. Floating LNG plant (1, 1', 100) comprising a converted LNG carrier with a hull and a plurality of LNG storage tanks (4, 104) wherein in that the floating LNG plant (1, 1', 100) comprises:

   - at least one sponson (2, 2', 3, 3', 102, 103) on the side of the hull, for creating additional hull volume,
   - process equipment (110) for LNG processing on the floating LNG plant (1, 1', 100), and
   - a reservoir for storing fluids separated during the LNG processing, wherein said reservoir is formed by the ballast tank or in the space reserved for the ballast tank of the original LNG carrier.

2. Floating LNG plant (1, 1', 100) according to claim 1, wherein the sponson of the floating LNG plant (1, 1', 100) provides double hull protection.

3. Floating LNG plant (1, 1', 100) according to claim 1 or 2, comprising a new ballast tank for the floating LNG plant in the additional hull volume created by the adding of the sponson to the side of the hull.

4. Floating LNG plant (1, 1', 100) according to any of claims 1-3, wherein the process equipment (110) for LNG processing on the floating LNG plant (1, 1', 100) is installed on the additional deck space created by the adding of the at least one sponson (2, 2', 3, 3', 102, 103) on the side of the hull.

5. Floating LNG plant (1, 1', 100) according to claim 4, wherein the sponson (2, 2', 3, 3', 102, 103) is used for supporting LNG transfer devices (111) for loading or unloading LNG.

6. Floating LNG plant (1, 1', 100) according to claim 5, wherein the LNG FPSO is provided with two sponsons (2, 2', 3, 3', 102, 103) each on one side of the vessel, the first sponson (2, 2', 102) is used for supporting LNG transfer devices (111) and the second sponson (3, 3', 103) is used for supporting LNG process equipment (110).

7. Floating LNG plant (1, 1', 100) according to claim 5 or 6, wherein the sponson (2, 2', 3, 3', 102, 103) is used for storage of a floating offloading hose (19).

8. Floating LNG plant (1, 1', 100), according to any of the claim 1-7, wherein a power generation unit is placed within the sponson (2, 2', 3, 3', 102, 103).

9. Floating LNG plant (1, 1', 100) according to any of the claims 1-8, wherein the floating LNG plant (1, 1', 100) further comprises a mooring system and a fluid transfer system, the fluid transfer system including a swivel and piping connecting the swivel to process equipment for LNG processing.

10. Floating LNG plant (1, 1', 100) according to claim 9, comprising an external turret (10) in order to allow the floating LNG plant (1, 1', 100) to be weathervaning moored to the seabed via said external turret (10).

11. Floating LNG plant (1, 1', 100) according to claim 9, comprising an offloading buoy in order to allow the floating LNG plant (1, 1', 100) to be weathervaning moored to the seabed via said offloading buoy.

12. Floating LNG plant (1, 1', 100) according to any preceding claims wherein the outer shell of the at least one sponson (2, 2', 3, 3', 102, 103) is provided with a collision protection (40).

13. Floating LNG plant (1, 1', 100) according to claim 12, wherein the outer shell of the at least one sponson (2, 2', 3, 3', 102, 103) is protected against collision damage using SPS.

14. Method for converting a LNG carrier into a Floating LNG plant (1, 1', 100), wherein the LNG carrier comprises at least a hull, a plurality of LNG storage tanks (4, 104) and at least one ballast tank for stabilizing the LNG carrier and wherein the method comprises the steps of:

- adding at least one sponson (2, 2', 3, 3', 102, 103) on the side of the hull, for creating additional hull volume,
- installing process equipment (110) for LNG processing on the vessel,
- using the ballast tank or the space reserved for the ballast tank of the original LNG carrier to create a reservoir for storing fluids separated during the LNG processing, and
- using the additional hull volume created by the adding of the sponson (2, 2', 3, 3', 102, 103) to create a new ballast tank for the floating LNG plant (1, 1', 100).

15. Method according to claim 14, wherein the method comprises the step of installing process equipment (110) for LNG processing on the vessel on the additional deck space created by the adding of the at least one sponson (2, 2', 3, 3', 102, 103) on the side of the hull.

16. Method according claim 14 or 15, wherein the method comprises the step of providing the outer shell of the at least one sponson (2, 2', 3, 3', 102, 103) with a collision protection (40).

17. A natural gas distribution system for supplying natural gas to users where said natural gas has been transported as LNG by a LNG carrier (50) that has sailed from a liquefying station to a coastal gas receiving facility (17) located at a sea coast in the vicinity, comprising:

- at least a floating LNG plant (1 , 1', 100) according to any of the claims 1 to 12, having production storage and offloading capability, and
- a LNG FSRU (floating storage regas unit) (85) that lies at said coastal gas receiving facility (70), and that heats LNG to produce gaseous natural gas and that is connected to said facility to carry said gaseous natural gas through said facility (70).