Summary of the invention

According to a first aspect of the present invention, there is provided a floating hydrocarbon processing and storage structure with a first and a second assembly each comprising a hull having spaced-apart side walls, one or more storage tanks and a deck structure, a connection structure interconnecting the first and second hulls, processing equipment being situated on the hull deck structures, at least one hydrocarbon riser extending from the processing equipment or from the storage tanks of the structure to a subsea hydrocarbon well, and with a mooring system connecting the hydrocarbon processing and storage structure to the sea bed, wherein

- each hull comprises a respective main hull deck structure bridging the side walls and having a width corresponding with a width W of each hull,
- the connection structure comprises a central deck extending at or near the height of the hull main deck structures along at least 70 % of the length of the hulls, the central deck having a width corresponding

with the distance between the hulls, the central deck supporting one of the following features or a combination thereof:

- a number of risers vertically extending from the central deck between the hulls to the sea bed, along a length of at least one third of the length of the central deck, preferably along half of the length of the central deck,
- a number of fluid ducts horizontally supported on the central deck along at least one third of the length of the central deck, preferably along half of the length of the central deck, and
- at least one drilling or work-over rig or crane.

By constructing the first and second assemblies of hull and deck, and subsequently interconnecting both hull-deck assemblies via the connection structure -which may comprise intermediate beams, intermediate decks, trusses, bulkheads, beams at mid-ship positions and near the bottom, and the like-, a large part of the hydrocarbon processing equipment can be placed on each respective deck prior to interconnection, in conventional construction facilities that are tailored to the width of a single assembly of hull and deck, which may be formed by known FPSO's, FSRU's, hydrocarbon carriers and the like. After interconnecting both hull-deck assemblies via the connection structure of the vessel according to the invention and providing a central deck, this central deck can be utilised for supporting vertical risers at an offshore site. Alternatively, the central deck is used for carrying a number of hydrocarbon ducts extending lengthwise across the deck structure. The ducts may be accommodated in a pipe rack assembly. In another embodiment, the central deck is used for the installation of one or more cranes that may be stationary on the central deck structure or that may be mobile along the central deck structure. A drilling or work-over rig may also be accommodated on the central deck. In this case, pipe segments forming the drill string may be accommodated on the central deck in a pipe rack construction.

The bow deck structure may be connected to the hull deck structures along the width of the first and second hulls so as to provide a continuous perimeter of the floating structure. A bow structure may extend from the bow deck structure to below the water line, and interconnects the outer side walls of the hull to form a substantially closed bow for improved sea going characteristics.

According to some examples of the present invention, there is provided a floating hydrocarbon processing and storage structure with a first and a second assembly each comprising a hull having spaced-apart side walls, one or more storage tanks and a deck structure bridging the side walls, a connection structure interconnecting the first and second hulls, the connection structure comprises a central deck extending at or near the height of the hull deck structures along at least along 70 % of the length of the hulls, processing equipment being situated on the deck structures, at least one hydrocarbon riser connected to a subsea hydrocarbon well and to the processing equipment and/or to the storage tanks, and with a mooring system connecting the structure to the sea bed, characterised in that the structure comprises a track along the outer side of at least one hull and along the central deck, movable supports displaceable along each track, a lifting member extending between the supports and being displaceable over the respective deck structure.

According to a second aspect of the present invention, there is provided a method of constructing a floating hydrocarbon processing and storage structure as disclosed herein. The method comprises the steps of:

- providing a first and a second assembly each having a hull with spaced-apart side walls, one or more storage tanks and a hull deck structure bridging the side walls,
- Interconnecting the assemblies via a connection structure that comprises a central deck extending at or near the height of the hull deck structures substantially along the length of the hulls, providing a bow module having a turret for carrying the risers, and connectors for mooring lines that are moored to the sea bed, and a bow deck structure rotatably connected to the turret and
- connecting the bow module to the hull deck structures and to the central deck structure at or near the height of said deck structures.

In this way a modular construction is obtained in which each of the hull-deck assemblies and bow module can be completed at different sites to be brought together for assembly at the most suitable location.

Brief description of the drawings

Some embodiments of a floating hydrocarbon processing and storage structure according to the invention will by way of example be explained in detail with reference to the accompanying drawings. In the drawings:

Fig. 1 shows a side view of a floating LNG plant according to the invention,
Fig. 2 shows a top view of the floating LNG plant of fig. 1,
Fig. 3 shows a schematic transverse cross-sectional view of a floating structure according to the invention,

Claims

1. Floating hydrocarbon processing and storage structure (1) with a first and a second assembly (2,2') each comprising a hull (3,3') having spaced-apart side walls (5,6;5',6'), one or more storage tanks (7,7') and a deck structure (4,4'), a connection structure interconnecting the first and second hulls (3,3'), processing equipment (10,10') being situated on the hull deck structures (4,4'), at least one hydrocarbon riser (15) extending from the processing equipment (10,10') or from the storage tanks (7,7') of the structure (1) to a subsea hydrocarbon well, and with a mooring system (8,13, 35,35') connecting the hydrocarbon processing and storage (1) structure to the sea bed (12), wherein

- each hull (3,3') comprises a respective main hull deck structure (4,4') bridging the side walls (5,6;5',6') and having a width corresponding with a width W of each hull (3,3'),
- the connection structure comprises a central deck (20) extending at or near the height of the hull main deck structures (4,4') along at least 70 % of the length of the hulls (3,3'), the central deck (20) having a width corresponding with the distance between the hulls (3,3'), the central deck (20) supporting one of the following features or a combination thereof:
- a number of risers (54,54') vertically extending from the central deck (20) between the hulls (3,3') to the sea bed, along a length of at least one third of the length of the central deck, preferably along half of the length of the central deck,
- a number of fluid ducts (31) horizontally supported on the central deck along at least one third of the length of the central deck, preferably along half of the length of the central deck, and
- at least one drilling or work-over rig or crane (51,52).

2. Floating hydrocarbon processing and storage structure (1) according to claim 1, comprising between the hulls (3,3') an intermediate bottom hull part (32), a bow hull part (34) and an aft hull part (33) and at least one fluid storage tank (26) comprised within the space between the two hull parts (3,3') underlying the central deck (20).

3. Floating hydrocarbon processing and storage structure (1) according to claim 1 or 2, wherein the central deck (20) has a width between 0.2 and 0.5 of the width W of the hulls.

4. Floating hydrocarbon processing and storage structure (1) according to claim 1,2 or 3, wherein at least one hull (3,3') is provided along its outer wall with an outboard riser supporting structure (40,53,53') , supporting a number of risers (41,54,54').

5. Floating hydrocarbon processing and storage structure (1) according to any of claims 1 to 4, the central deck (20) supporting a number of risers (54,54') vertically extending from the central deck between the hulls (3,3') to the sea bed, along at least one third of the length of the central deck, preferably along half of its length, and/or a number or risers and/or pipe elements (31) horizontally supported on the central deck (20) along at least one third of the length of the central deck, preferably along half of its length, the structure (1) comprising a track (43,43') along the outer side of each hull (3,3'), movable supports (44,44') displaceable along each track, a lifting member (42) extending between the supports and being displaceable over the central area (20), for lifting of the risers and/or pipe elements.

6. Floating hydrocarbon processing and storage structure (1) according to claim 1, characterised in that the structure (1) comprises a track (43,43') along the outer side of at least one hull (3,3') and along the central deck (20), movable supports (44,44') displaceable along each track, a lifting member (42) extending between the supports and being displaceable over the respective deck structure.

7. Floating hydrocarbon processing and storage structure (1) according to any of the preceding claims, the mooring system comprising a turret (57) carrying the risers, and connected to mooring lines (58,59,60) that are moored to the sea bed, the connection structure comprising a bow deck structure (56) rotatably connected to the turret (57) and connected to the hull deck structures (4,4') and to the central deck (20) at or near the height of said hull deck structures (4,4').

8. Floating hydrocarbon processing and storage structure (1) according to claim 7, the bow deck structure (56) being connected to the hull deck structures (4,4') along the combined width of the first and second hulls (3,3') and the central deck (20).

9. Floating hydrocarbon processing and storage structure (1) according to claim 7 or 8, a bow structure (55) extending from the bow deck structure (56) to below the water line, and interconnecting with the outer side walls (5,6') of the hull to form a substantially closed bow.

10. Method of constructing a floating hydrocarbon processing and storage structure according to any of the preceding claims, comprising the steps of:

- providing a first and a second assembly (2,2') each having a hull (3,3') with spaced-apart side walls (5,6;5',6'), one or more storage tanks (7,7') and a hull deck structure (4,4')bridging the side walls,
- interconnecting the assemblies via a connection structure that comprises a central deck (20) extending at or near the height of the hull deck structures (4,4') along a length of at least 70% of the length of the hulls (3,3'), providing a
- bow module (55) having a turret (57) for carrying the risers, and connectors for mooring lines that are to be moored to the sea bed, and a bow deck structure (56) rotatably connected to the turret and
- connecting the bow module (55) to the hull deck structures (4,4') and to the central deck (20) at or near the height of said hull deck structures and central deck.