

DESCRIPTION

FAIRING COVER

5 TECHNICAL FIELD

[0001] The present invention relates to a protruding structure for hooking-up risers, mooring lines and the like, which is arranged below the waterline of a floating facility having a hull form.

10 BACKGROUND ART

[0002] A Floating Production Storage and Offloading installation (FPSO Installation) and a Tension Leg Platform (TLP) are equipped with a number of riser pipes that interconnect the seabed and the marine facility so that fluid
15 such as crude oil, gas, sea water, etc., is transported through the riser pipes. The riser pipes have flexibility and are lead in through a guide provided on a shell plate near a keel and fixed in the horizontal direction (see Patent Document 1).

20 PRIOR ART DOCUMENT

PATENT DOCUMENT

[0003] PATENT DOCUMENT 1: NATIONAL PUBLICATION OF THE
TRANSLATED VERSION No. 2006-519137

SUMMARY OF THE INVENTION

25 PROBLEMS TO BE SOLVED BY THE INVENTION

[0004] After construction, an FPSO Installation is transported on the ocean to a facility installation site (e.g., undersea oil well). However, a guide for a riser pipe increases the ship's resistance since it has a structure that protrudes from a shell plate of the hull near the bilge. Thereby, problems such as increasing the size of a propulsion engine, prolonging a period of time required for transportation, and increasing the transportation cost arise. A chain fairlead, which is provided below the waterline for guiding a mooring line used in mooring the FPSO Installation, also raises the same problem.

[0005] The present invention aims at reducing any additional resistance caused by a protruding structure provided below the waterline on the floating facility having a hull form for hooking up risers, mooring lines and the like.

MEANS TO SOLVE THE PROBLEMS

[0006] A fairing cover of the present invention covers a protruding structure provided for hooking-up a riser or a mooring line under the waterline to the hull of a floating facility having a hull form, and thereby reducing fluid resistance in the propulsive direction caused by the protruding structure.

[0007] The above-mentioned fairing cover preferably comprises a cover member removable from the protruding structure. The removable cover member preferably comprises a buoyant body.

Preferably, cover members covering the front portion and the rear portion of the protruding structure are permanently attached to the protruding structure, while the removable cover member is composed of a cover member covering the central portion of the protruding structure, such that
5 excluding the cover members covering the front portion and the rear portion. Further, the removable cover member has a membrane structure or panel structure, for example.

[0008] All of the cover members are integrally configured with the protruding structure, and a top face and a bottom face of the fairing cover may comprise an opening where a riser pipe penetrates corresponding to each of the guide pipes.
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[0009] A floating facility of the present invention comprising any features of the fairing cover mentioned above.
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EFFECT OF THE INVENTION

[0010] Accordingly, the present invention is able to reduce any additional resistance caused by a protruding structure provided below the waterline on the floating facility having a hull form for hooking-up risers, mooring lines and the like.
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BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

[Fig. 1] A side elevational view of a floating production storage and offloading installation (FPSO Installation) as a first embodiment.
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[Fig. 2] A partially enlarged view of a riser guide viewed (a) from the stern, (b) from the side, and (c) from the top.

[Fig. 3] A perspective view of the riser guide.

[Fig. 4] A perspective view of the riser guide with a fairing cover attached thereto. Further, Fig. 6 provides an exploded view of the fairing cover.

[Fig. 5] A perspective view of the riser guide and guide pipes inside the fairing cover, which are transparently illustrated.

10 [Fig. 6] A perspective view of the exploded fairing cover.

[Fig. 7] A perspective view of a fairing cover of a second embodiment.

DESCRIPTION OF THE EMBODIMENTS

[0012] Embodiments of the present invention are described below with references to the drawings.

Fig. 1 is a side elevational view of a floating production storage and offloading installation (FPSO Installation), which is a first embodiment of a floating facility of the present invention.

20 [0013] The FPSO Installation 10 of the first embodiment has a hull form and is equipped with processing plants for processing, for example, hydrocarbons such as crude oil or gas. After construction, the FPSO Installation 10 is transported to an installation sea area (or water area), by
25 self-propulsion or by towing, and then moored in the sea area

(or water area).

[0014] A number of flexible riser pipes 12 (only two pipes are shown in Fig. 1) are installed on the FPSO Installation 10, which is moored in the installation sea area, and hydrocarbons such as crude oil and gas are drawn up from the seabed to processing plants 11 and processed. The hydrocarbons processed in the processing plants 11 are, for example, stored in a tank (not shown) provided in the hull.

[0015] The riser pipes 12 are led from the processing plants 11 to the seabed along a side shell plate 13. For example, a pair of riser guides 14 and 15, for fixing the position of each riser pipe 12, are provided on the side of the hull. The riser guide 14 is arranged on the upper side of the side shell plate 13 along the longitudinal direction of the hull so that a portion of each riser pipe 12 close to the processing plants 11 is fixed to the hull. On the other hand, the riser guide 15 is arranged along the bilge, in an area near the bilge below the waterline L so that the riser pipes 12, which are hanging down into the sea, are attached to the hull.

[0016] With reference to Figs. 2 and 3, the structure of the riser guide 15, which is provided under the waterline L in the present embodiment, will be described. Note that a fairing cover is not attached to the upper riser guide 14.

[0017] Fig. 2 (a) is a figure illustrating the riser guide 15,

for example, as viewed from the stern side of Fig. 1, along the longitudinal direction of the hull. Fig. 2 (b) is an enlarged side elevational view of a stern side end portion of the riser guide 15 illustrated in Fig. 1. Further, Fig. 2 (c) is a plan view of Fig. 2 (b) as viewed from above. Fig. 3 is a perspective view of the riser guide 15 illustrated in Figs. 2 (b) and 2 (c), which is viewed obliquely from the stern side.

[0018] The main body of the riser guide 15 has a box-shaped structure having a long length in the longitudinal direction of the hull and protruding outward from the side shell plate 13 near the bilge. Guide pipes 16 for guiding the respective riser pipes 12 in the vertical direction may be arranged at predetermined intervals along the longitudinal direction on the riser guide 15 of the first embodiment. The guide pipe 16 is a pipe which passes through the main body of the riser guide 15 in the vertical direction. For example, the diameter of the upper end of the pipe is expanded to form a trumpet shape for ease of insertion of the riser pipe 12 from above, and the diameter of the lower end of the pipe is expanded to form a trumpet shape in consideration of drift induced by the mooring of the floating body.

[0019] Next, with reference to Figs. 4 to 6, a fairing cover of the first embodiment for reducing the fluid resistance of the riser guide 15 will be described.

[0020] Figs. 4 to 6 are perspective views showing the configuration of the fairing cover 20 of the first embodiment, and in each figure, about the same portion corresponding to Fig. 3 is depicted. Fig. 4 shows an external appearance when the fairing cover 20 is attached to the riser guide 15, and Fig. 5 transparently illustrates the riser guide 15 inside the fairing cover 20. Further, in Fig. 6, a disassembled view of the fairing cover 20 is illustrated.

[0021] As shown in Figs. 4 to 6, the shape of the riser guide 15 is box-shaped at the front and rear portions (bow side and stern side) of the riser guide 15, such that step-like portions appear in the front and rear portions of the riser guide 15 and take place with a factor of increasing resistance. Therefore, front and rear cover members 20C having an inclined member are provided integrally with the hull and the riser guide 15 for relieving an increase in resistance. A top cover member 20U and a bottom cover member 20D for respectively covering the guide pipes 16 projecting upward and downward from the main body of the riser guide 15 are attached above and below the riser guide 15, respectively.

[0022] The top cover member 20U and the bottom cover member 20D are cover members that are removed after transportation and installation of the FPSO Installation 10, and each of the cover members may be configured by a panel member having an L-shaped cross section. Therefore, after the installation of

the FPSO Installation 10, the top cover member 20U and the bottom cover member 20D are removed as shown in Fig. 6. Between the top cover member 20U and the bottom cover member 20D, which are attached to the riser guide 15, a connection is formed by a side surface 15S of the main body of the riser guide 15 configuring a plane parallel to the side shell plate 13. Further, in this situation, the top face of the top cover member 20U covers the upper openings of the guide pipes 16 and configures a plane having the same level as the top faces of the front and rear cover members 20C. The bottom face of the bottom cover member 20D covers the lower openings of the guide pipes 16 and configures a plane having the same level as the bottom faces of the front and rear cover members 20C.

[0023] As for the example shown in Fig. 6, the top cover members 20U and the bottom cover members 20D are provided in the same number as corresponding to each of the guide pipes 16. Further, at about the central position between the guide pipes 16, a frame plate 21 having a profile corresponding to the cross-sectional profile of the fairing cover 20 is perpendicularly provided on the side shell plate of the hull. The top cover member 20U and the bottom cover member 20D can be fixed to the frame plates 21 via a predetermined installation method. Further, on the top of the box-shape riser guide 15, along the side shell plate 13, there is

provided a retaining member 22 for attaching the top cover member 20U thereto along the side shell plate. Incidentally, a similar retaining member 22 (not shown) is provided on a portion where the bottom cover member 20D contacts with the side shell plate.

[0024] The top cover members 20U and the bottom cover members 20D are attached to the riser guides 15 and the side shell plate 13, for example, using bolts, by lashing with cords or annealing wires, or by applying local welds; and after the installation of the FPSO Installation 10 they are removed by drivers. In the present embodiment, a panel that forms the top cover member 20U and the bottom cover member 20D, for example, is formed of a steal plate and the like. Namely, due to its weight, underwater removal work is difficult.

Therefore, in the present embodiment, each of the top cover members 20U and the bottom cover members 20D is provided with a buoyant body (or void) 23 as illustrated by broken lines in Fig. 6, thereby, the top cover members 20U and the bottom cover members 20D may be configured to have neutral buoyancy in the water.

[0025] The buoyant body 23 is provided at a position that corresponds to a dead space inside the fairing cover 20 when the top cover members 20U and the bottom cover members 20D are installed on the riser guide 15. Namely, as shown in Fig. 6, it is arranged in a space between neighboring guide pipes

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[0026] Note that although in the above description of the present embodiment, the top cover member 20U and the bottom cover member 20D are described as panel members made of steel, both of the cover members or one of the cover members may be formed of canvas (membrane structure), which has less weight underwater than a panel member formed of a steel plate, etc., and good operability. In such case, the canvas fabric is attached to the retaining member 22 and its fairing cover shape is maintained by the frame plate 21.

[0027] As described above, according to the present embodiment, the fluid resistance of the FPSO Installation is reduced and the transport efficiency is improved, since the riser guide and the guide pipes are covered by the fairing cover when transporting the FPSO Installation. Further, after transporting and installing the FPSO Installation, the fairing cover can be easily removed by a diver. Furthermore, the number of the cover members to be removed after installation is reduced and the working time is shortened since a fixed type is employed for the front and rear cover members.

[0028] Next, the structure of a fairing cover 25 of a second embodiment will be explained with reference to Fig. 7. Fig. 7 is a perspective view corresponding to Fig. 4 of the first embodiment.

[0029] In the second embodiment, the fairing cover 25 and the riser guide 15 (protruding structure) are integrated. An appearance of the fairing cover 25 of the second embodiment is the same as that of Fig. 4, however, a top face 25T and a bottom face 25B are provided with openings 16A and 16B into which the riser pipes penetrate as corresponding to each of the guide pipes 16. During the transportation, for example, lid-like cover members are fitted into each of the openings 16A and 16B, and after installing the FPSO Installation 10, only these lid-like cover members are removed. However, when allowing a small increase in the resistance, the lid-like cover member may be abandoned.

[0030] As described above, according to the second embodiment, the same effect as that of the first embodiment can also be obtained. Further, in the second embodiment, since only the lid-like cover members need to be removed, the work volume of the diver is further reduced.

[0031] Note that in the present embodiment, the riser guide of the floating production storage and offloading (FPSO) installation was explained as an example. However, the present invention can also be applied to a protruding structure provided for hooking-up a mooring line to a hull, such as a fairlead for a chain, and a floating facility having a hull form other than an FPSO, such as a Floating Storage and Offloading (FSO) installation.

EXPLANATION OF REFERENCES

[0032]

10 floating production storage and offloading installation
(FPSO Installation)

5 11 processing plants

12 riser pipe

13 side shell plate

15 riser guide (below waterline L)

15S riser guide side wall

10 16 guide pipe

16A and 16B opening

20 and 25 fairing cover

20C front and rear cover members

20D bottom cover member

15 20U top cover member

21 frame plate

22 retaining member

23 buoyant body (void)

L waterline

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CLAIMS

1. A fairing cover covering a protruding structure provided for hooking-up a riser or a mooring line under the waterline
5 to the hull of a floating facility having a hull form, and thereby reducing fluid resistance in the propulsive direction caused by the protruding structure.
2. A fairing cover according to claim 1, comprising a cover member removable from the protruding structure.
- 10 3. A fairing cover according to claim 2, wherein the removable cover member comprises a buoyant body.
4. A fairing cover according to one of claims 2 and 3, wherein cover members covering the front portion and the rear portion of the protruding structure are permanently attached
15 to the protruding structure, while the removable cover member is composed of a cover member covering a central portion of the protruding structure, such that excluding the cover members covering the front portion and the rear portion.
5. A fairing cover according to one of claims 2 to 4, wherein
20 the removable cover member has a membrane structure or panel structure.
6. A fairing cover according to claim 1, wherein all of the cover members are integrally configured with the protruding structure and a top face and a bottom face of the fairing
25 cover comprise an opening where a riser pipe penetrates

corresponding to each of the guide pipes.

7. A floating facility comprising the fairing cover according to one of claims 1 to 6.