

For horizontal (but not vertical) pneumatic fenders, a sheet-shaped protective member that covers the outer surface of the fender has been proposed (for example, see Patent Document 1). However, this protective member is intended to prevent external damage to the fender caused by contact with a ship hull or the like, rather than being directed against oil-induced swelling degradation as described above.

Citation List Patent Literature

- 10 [0006]
Patent Document 1: JP-A-5-025812

Summary of Invention Technical Problem

- 15 [0007]
The object of the present invention is to provide a protective cover for vertical pneumatic fenders, vertical pneumatic fender, and method of using a vertical pneumatic fender that are capable of suppressing swelling degradation of the fender caused by oil floating on the water surface adhering thereto.

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Solution to Problem

[0008]

- To achieve the object proposed above, a protective cover for vertical pneumatic fenders according to an aspect of the present invention is a protective cover for vertical pneumatic fenders capable of being removably mounted on a vertical pneumatic fender including hemispherical portions having a bowl-like shape linked to upper and lower ends of a body portion having a cylindrical shape; the protective cover includes a protective layer body that covers at least an outer surface of the entirety of the body portion, and an attachment portion configured to dispose the protective layer body at a specific position on the fender. The protective layer body allows a part of the fender covered by the protective layer body to be segregated from oil floating on a water surface when the protective layer body is disposed at the specific position on the fender.

[0009]

- 35 A vertical pneumatic fender according to an aspect of the present invention is a vertical pneumatic fender including a body portion having a cylindrical shape and hemispherical portions having a bowl-liked shape linked to upper and lower ends of the body portion; the vertical pneumatic fender

includes a protective layer body that is removable and covers at least an outer surface of the entirety of the body portion. The protective layer body allows a part of the fender covered by the protective layer body to be segregated from oil floating on a water surface.

5 [0010]

Another vertical pneumatic fender according to an aspect of the present invention is a vertical pneumatic fender including a body portion having a cylindrical shape and hemispherical portions having a bowl-like shape linked to upper and lower ends of the body portion; the vertical pneumatic fender
10 includes a protective layer body that covers at least an outer surface of the entirety of the body portion. The protective layer body is formed by an oil-resistant member, and is integrally provided via vulcanization bonding; and the protective layer body allows a part of the fender covered by the protective layer body to be segregated from oil floating on a water surface.

15 [0011]

A method of using a vertical pneumatic fender according to an aspect of the present invention includes: installing the vertical pneumatic fender described above so that an intermediate position in a vertical direction of the body portion is positioned at a water surface; and, when there is oil floating in
20 an area of water in which the vertical pneumatic fender is installed, segregating a part of the fender covered by the protective layer body from the oil.

Advantageous Effects of Invention

[0012]

25 According to the present invention, a protective layer body that covers at least the outer surface of the entire body portion is provided, and this protective layer body makes it possible to segregate the part of the fender covered by the protective layer body of fender from oil floating on a water surface, thereby enabling prevention of swelling degradation in the part covered by the
30 protective layer body caused by oil floating on the water surface. In addition, because a laminar protective layer body is used, there is substantially no negative influence upon the shock absorption capability, etc., of the fender.

[0013]

If an arrangement is adopted in which the protective layer body covers
35 the outer surface of the entire body portion and the outer surfaces of the entire hemispherical portions, substantially the entire outer surface of the fender is protected from oil floating on the water surface. This is even more advantageous in suppressing swelling degradation of the fender.

[0014]

Forming the protective layer body from an oil-resistant member is advantageous in preventing swelling degradation of the part covered by the protective layer body. For example, an elastic member containing acrylonitrile butadiene rubber is used as the oil-resistant member.

Brief Description of Drawings

[0015]

FIG. 1 is a view illustrating an embodiment of a protective cover for vertical pneumatic fenders according to the present invention as seen from the side.

FIG. 2 is a view illustrating the protective cover for vertical pneumatic fenders of FIG. 1 as seen in plan view.

FIG. 3 is a view illustrating an example of another embodiment of a protective cover for vertical pneumatic fenders according to the present invention as seen from the side.

FIG. 4 is a view illustrating an example of the protective cover for vertical pneumatic fenders of FIG. 3 as seen in plan view.

FIG. 5 is a view illustrating an example of a vertical pneumatic fender according to the present invention as seen from the side.

FIG. 6 is a view illustrating an example of another embodiment of a vertical pneumatic fender as seen from the side.

FIG. 7 is a view illustrating an example of a vertical pneumatic fender as seen in a longitudinal cross-sectional view.

Description of Embodiments

[0016]

The protective cover for vertical pneumatic fenders, vertical pneumatic fender, and method of using a vertical pneumatic fender according to the present invention will now be described with reference to the embodiments illustrated in the drawings.

[0017]

As illustrated in FIG. 7, a conventional vertical pneumatic fender 1A (hereafter referred to as “fender 1A”) is provided with a cylindrical body portion 1a and bowl-shaped hemispherical portions 1b linked to upper and lower ends of the body portion 1a. A fitting 1c is provided on an upper end of the upper hemispherical portion 1b, and a fitting 1d is provided on a lower end

of the lower hemispherical portion 1b. The fender 1A may also be provided with only the one fitting 1c.

[0018]

5 The body portion 1a and hemispherical portions 1b are constituted by members comprising a plurality of reinforcing layers layered between an inner rubber layer and an outer rubber layer. A hollow interior space formed by the body portion 1a and the hemispherical portions 1b is filled with air A, and a prescribed amount of water W is injected therein. In the drawing, the boundaries between the body portion 1a and the hemispherical portions 1b are indicated by the dotted and dashed lines.

[0019]

15 The fitting 1c is provided with an injection port for injecting the air A and the water W, a safety valve for preventing the internal pressure of the fender 1A from becoming excessive, a pressure sensor for measuring the internal pressure, etc. Ends of separate guy chains 5 are connected to the fittings 1c, 1d.

[0020]

20 When installing the fender 1A on a side wall of a dock or on the side of a hull, the other ends of the guy chains 5 connected to the fitting 1c are anchored to the dock or hull. A weight 6 is connected to the other end of the guy chain 5 connected to the fitting 1d. With its hollow interior space containing the air A and water W, the fender 1A is partially submerged in a body of water, such as the sea, and installed so as to float on the sea, etc., in an upright state in which the longitudinal direction thereof (the axial direction of the body portion 1a) is vertically oriented.

[0021]

30 The fender 1A is installed so that an intermediate position in the vertical direction of the body portion 1a is positioned at the surface of the water. Thus, when oil C floats to and pools in the area of the water in which the fender 1A is installed, the oil C floating on the surface of the water constantly contacts the body portion 1a. If the fender 1A is continuously used in this manner, the outer rubber layer forming the body portion 1a swells with the oil C. This swelling causes strength reductions, etc., in the body portion 1a, making the fender 1A unusable.

35 [0022]

Therefore, the protective cover 2 for vertical pneumatic fenders (hereafter referred to as “protective cover 2”) according to the present invention as illustrated in FIGS. 1 and 2 is used. The protective cover 2 is provided with

a protective layer body 3 that covers at least the outer surface of the entire body portion 1a, and an attachment portion 4 configured to dispose the protective layer body 3 at a specific position on the fender 1A.

[0023]

5 The protective layer body 3 is an elastic member of rubber or the like, or a sheet formed from a thin layer of resin or the like, and has a thickness of, for example, 1 mm to 30 mm. The protective layer body 3 is designed so as to be substantially unpenetrated by water. The cylindrical protective layer body 3 is unbroken and continuous in both the circumferential direction and the cylinder
10 axial direction. The protective layer body 3 is manufactured, for example, by integrally molding a member into a cylinder. Alternatively, a plurality of members can be joined together to manufacture a cylindrical protective layer body 3. In this case, the joints between the members are machined so that no spaces are formed therebetween, thereby preventing the passage of the oil C.
15 At least the outer surface of the entire body portion 1a is covered by the cylindrical protective layer body 3 fitted on the outside of the fender 1A.

[0024]

 The protective layer body 3 can be formed using an oil-resistant member or using a non-oil-resistant member. In addition, the protective layer body 3
20 can be formed using an elastic member or a non-elastic member. For example, an elastic member containing acrylonitrile butadiene rubber having superior oil resistance can be used to form the protective layer body 3. Other examples of oil-resistant elastic members include fluororubber, chloroprene rubber, and chlorinated polyethylene rubber.

25 [0025]

 A certain amount of space may be maintained between the inner surface of the protective layer body 3 and the outer surface of the body portion 1a, or the two may be fitted tight with no space therebetween. If the protective layer body 3 is formed from an elastic member, the inner surface of the protective
30 layer body 3 and the outer surface of the body portion 1a can be fitted tight by expanding the cylindrical protective layer body 3 and fitting it over the body portion 1a.

[0026]

 For example, a cord 4b connecting the protective layer body 3 fitted over
35 the fender 1A and the upper hemispherical portion 1b (i.e., an upper cord 4b) and a cord 4b connecting the protective layer body 3 and the lower hemispherical portion 1b (i.e., a lower cord 4b) are used as attachment portions 4. The upper cord 4b directly connects the upper end of the protective layer

body 3 and the surface of the upper hemispherical portion 1b, or connects the upper end of the protective layer body 3 and the fitting 1c provided on the upper hemispherical portion 1b. The lower cord 4b directly connects the lower end of the protective layer body 3 and the surface of the lower hemispherical portion 1b, or connects the lower end of the protective layer body 3 and the fitting 1d provided on the lower hemispherical portion 1b. The lower cord 4b may be omitted if the protective layer body 3 can be stably attached to the fender 1A using only the upper cord 4b.

[0027]

In the present embodiment, the lower end of the upper cord 4b is connected to the edge of the upper opening of the protective layer body 3 via a connecting member 4a. The upper end of the upper cord 4b is connected to the fitting 1c via a fixing member 4c fitted onto the outside of the fitting 1c. The upper end of the lower cord 4b is connected to the edge of the lower opening of the protective layer body 3 via a connecting member 4a. The lower end of the lower cord 4b is connected to the fitting 1d via a fixing member 4c fitted onto the outside of the fitting 1d.

[0028]

Ropes of resin or natural fibers, metal chains, or the like can be used as the cords 4b. Using ropes of resin or natural fibers as the cords 4b is advantageous in preventing scratching of the surfaces of the hemispherical portions 1b by the cords 4b.

[0029]

When using the protective cover 2, the protective cover 2 is attached on land or on board a ship to the fender 1A of which the hollow interior space contains the air A. As illustrated in FIG. 1, the fender 1A is then installed on a wall of a dock or the side of a ship. Water W is then injected into the interior of the fender 1A to set an intermediate position in the vertical direction of the body portion 1a at the position of the surface of the water.

[0030]

When oil C floats into the area of water in which the fender 1A is installed, and the fender 1A is surrounded by the oil C floating on the surface of the water, the oil C remains continuously adhering to the outer surface of the protective layer body 3. The body portion 1a is covered by the protective layer body 3, thereby preventing the adhesion of the oil C thereto, and segregating the body portion 1a from the oil C. The level of the oil C will fluctuate along with the surface of the water; the normal vertical fluctuation of the surface of the water in harbors and the like is about from 1 to 2 meters.

The fender 1A rises and falls to a certain degree in tandem with waves (the surface of the water). Therefore, the range of the vertical fluctuation of the position of the surface of the water is within the range of the body portion 1a. [0031]

5 Even if there is a certain amount of space between the inner surface of the protective layer body 3 and the outer surface of the body portion 1a, the oil C will not enter the space between the two as long as the position of the surface of the water does not surpass the upper end of the protective layer body 3 or fall beneath the lower end of the protective layer body 3. As a result, apart from in
10 special situations, such as when waves are abnormally high, the part of the fender 1A covered by the protective layer body 3 (at least the body portion 1a) is segregated from the oil C, allowing adhesion of the oil C to the fender 1A to be substantially avoided. Thus, using the protective cover 2 of the present invention allows the effective suppression of swelling degradation of the fender
15 1A due to oil C floating on the surface of the water. [0032]

In addition, because a thin, laminar protective layer body 3 is used, the compressive and restorative deformation of the fender 1A will not be greatly inhibited even when the protective cover 2 is attached to the fender 1A.
20 Therefore, the protective cover 2 does not substantially negatively affect the shock absorption capability, etc., of the fender 1A. [0033]

If the protective layer body 3 is formed from a non-oil-resistant member, the oil C adhering to non-oil-resistant member will cause the protective layer
25 body 3 to swell and otherwise degrade soon compared to a case in which the protective layer body 3 is formed from an oil-resistant member. Therefore, the degraded protective layer body 3 is removed from the fender 1A and replaced with a new protective layer body 3 when degradation of the protective layer body 3 is discovered, or after a preset period of time has passed. Alternatively,
30 the protective cover 2 may be replaced with a new one. [0034]

If the protective layer body 3 is formed from an oil-resistant member, swelling degradation of the part covered by the protective layer body 3 can be prevented for a longer length of time than if the protective layer body 3 is
35 formed from a non-oil-resistant member. This eliminates the need for replacement with a new protective layer body 3 (or protective cover 2). Alternatively, the frequency with which the protective layer body 3 (or protective cover 2) is replaced can be reduced.

[0035]

Having the inner surface of the protective layer body 3 and the outer surface of the body portion 1a be tightly fitted together yields the advantage of impeding shifting of the protective layer body 3 with respect to the fender 1A.

5 As a result, the attachment portion 4 need not be as strong. To tightly fit together the inner surface of the protective layer body 3 and the outer surface of the body portion 1a, the protective layer body 3 may be formed from an elastic member capable of conforming to the compressive and restorative deformation of the fender 1A.

10 [0036]

Providing a space between the inner surface of the protective layer body 3 and the outer surface of the body portion 1a yields the advantage that the compressive and restorative deformation of the fender 1A is not easily affected by the protective layer body 3. In addition, the level of stretchability, etc.,
15 needed to conform to the compressive and restorative deformation of the fender 1A decreases, thereby increasing the range of options for members that can be used as the protective layer body 3.

[0037]

In the embodiment described above, the outer surfaces of the
20 hemispherical portions 1b are partially covered by the protective layer body 3, while parts of these portions remain exposed and uncovered by the protective layer body 3. In the embodiment of the protective cover 2 illustrated in FIGS. 3 and 4, the protective layer body 3 covers the outer surface of the entire body portion 1a and the outer surface of the entireties of the hemispherical portions
25 1b.

[0038]

The protective layer body 3 differs from that of the previous embodiment only in shape, and is pouch-shaped. However, an opening is provided through which the lower fitting 1d is inserted. If the fender 1A is not provided with a
30 lower fitting 1d, the protective layer body 3 can be a complete, whole pouch.

[0039]

The attachment portion 4 of the present embodiment is constituted by a tightening band 4d and a tightening metal fitting 4e. The tightening band 4d tightens the upper end opening of the protective layer body 3 and anchors it to
35 the fitting 1c. The tightening metal fitting 4e is used to tighten and anchor the tightening band 4d at a predetermined length, and to release the band.

[0040]

To attach the protective cover 2 to the fender 1A, the fender 1A (body portion 1a and hemispherical portions 1b) is placed into the protective layer body 3, after which the upper end opening of the protective layer body 3 is tightened and attached to the fitting 1c using the attachment portion 4.

5 [0041]

According to the present embodiment, the outer surface of substantially the entire fender 1A is segregated and protected from the oil C floating on the water surface by the protective layer body 3. This is even more advantageous in suppressing swelling degradation of the fender 1A.

10 [0042]

The various arrangements discussed in the previous embodiment can be adopted in the present embodiment as well. The method of usage and replacement can also be as in the previous embodiment.

[0043]

15 The vertical pneumatic fender 1 (hereafter referred to as “fender 1”) of the present invention comprises the various types of protective layer bodies 3 removably provided on a conventional fender 1A.

[0044]

Another embodiment of a fender 1 is illustrated in FIG. 5.

20 [0045]

The fender 1 is provided with a protective layer body 3 that covers at least the outer surface of the entire body portion 1a, the protective layer body 3 being integrated with the fender 1 via vulcanization bonding. Specifically, the inner surface of the protective layer body 3 is tightly fitted and anchored to the facing surface without any space therebetween. It is possible to vulcanization bond an addition protective layer body 3 to the outer surface of a conventional fender 1A, or to replace the outer rubber layer of a conventional fender 1A with a vulcanization bonded protective layer body 3.

[0046]

30 The various arrangements described above can be used for the protective layer body 3. However, because the protective layer body 3 cannot be independently attached and removed in these arrangements, the protective layer body 3 cannot be replaced. Therefore, the protective layer body 3 is formed from an oil-resistant member. Because the protective layer body 3 is required to conform to compressive and restorative deformation, the protective layer
35 body 3 is preferably formed from an elastic member of rubber or the like.

[0047]

The fender 1 is used as in the embodiments described above. In accordance with the present fender 1, the part of the fender 1A covered by the protective layer body 3 (at least the body portion 1a) is segregated from the oil C floating on the surface of the water, allowing adhesion of the oil C to the fender 1 to be substantially avoided. It is thus possible to effectively suppress swelling degradation of the fender 1 due to oil C floating on the surface of the water.

[0048]

The present fender 1 offers the advantage that the attachment portion 4 described above is unnecessary, and the advantage that the protective layer body 3 does not shift.

[0049]

In the embodiment illustrated in FIG. 5, the outer surfaces of the hemispherical portions 1b are partially covered by the protective layer body 3, while parts of these portions remain exposed and uncovered by the protective layer body 3. In the embodiment of the fender 1 illustrated in FIG. 6, the protective layer body 3 covers the outer surface of the entire body portion 1a and the outer surface of the entireties of the hemispherical portions 1b.

[0050]

According to the present embodiment, the outer surface of substantially the entire fender 1 is segregated and protected from the oil C floating on the water surface by the protective layer body 3. This is even more advantageous in suppressing swelling degradation of the fender 1.

Reference Signs List

[0051]

- 1 Vertical pneumatic fender according to the present invention
- 1A Conventional vertical pneumatic fender
- 1a Body portion
- 1b Hemispherical portion
- 1c Fitting (upper)
- 1d Fitting (lower)
- 2 Protective cover
- 3 Protective layer body
- 4 Attachment portion
- 4a Connecting member
- 4b Cord
- 4c Fixing member

4d Tightening band

4e Tightening metal fitting

5 Guy chain

6 Weight

Claims

[Claim 1]

A protective cover for vertical pneumatic fenders capable of being removably mounted on a vertical pneumatic fender including hemispherical portions having a bowl-like shape linked to upper and lower ends of a body portion having a cylindrical shape; the protective cover comprising:

- a protective layer body that covers at least an outer surface of the entirety of the body portion, and
- an attachment portion configured to dispose the protective layer body at a specific position on the fender; wherein

the protective layer body allows a part of the fender covered by the protective layer body to be segregated from oil floating on a water surface when the protective layer body is disposed at the specific position on the fender.

[Claim 2]

The protective cover for vertical pneumatic fenders according to claim 1, wherein the protective layer body covers the outer surface of the entirety of the body portion and outer surfaces of the entireties of the hemispherical portions.

[Claim 3]

The protective cover for vertical pneumatic fenders according to claim 1 or 2, wherein the protective layer body is formed from an oil-resistant member.

[Claim 4]

The protective cover for vertical pneumatic fenders according to claim 3, wherein the oil-resistant member is an elastic member containing acrylonitrile butadiene rubber.

[Claim 5]

A vertical pneumatic fender including a body portion having a cylindrical shape and hemispherical portions having a bowl-like shape linked to upper and lower ends of the body portion, the vertical pneumatic fender comprising:

- a protective layer body that is removable and covers at least an outer surface of the entirety of the body portion, wherein

the protective layer body allows a part of the fender covered by the protective layer body to be segregated from oil floating on a water surface.

[Claim 6]

A vertical pneumatic fender including a body portion having a cylindrical shape and hemispherical portions having a bowl-shaped shape linked to upper and lower ends of the body portion, the vertical pneumatic fender comprising:

a protective layer body that covers at least an outer surface of the entirety of the body portion, wherein

the protective layer body is formed by an oil-resistant member, and is integrally provided via vulcanization bonding, and

the protective layer body allows a part of the fender covered by the protective layer body to be segregated from oil floating on a water surface.

[Claim 7]

The vertical pneumatic fender according to claim 5, wherein the protective layer body is formed from an oil-resistant member.

[Claim 8]

The vertical pneumatic fender according to claim 6 or 7, wherein the oil-resistant member is an elastic member containing acrylonitrile butadiene rubber.

[Claim 9]

The vertical pneumatic fender according to any one of claims 5 to 8, wherein the protective layer body covers the outer surface of the entirety of the body portion and outer surfaces of the entireties of the hemispherical portions.

[Claim 10]

A method of using a vertical pneumatic fender comprising:

installing the vertical pneumatic fender according to any one of claims 5 to 9 so that an intermediate position in a vertical direction of the body portion is positioned at a water surface; and

when there is oil floating in an area of water in which the fender is installed,

segregating a part of the fender covered by the protective layer body from the oil.