

PROTECTIVE COVER FOR HORIZONTAL PNEUMATIC FENDER,
HORIZONTAL PNEUMATIC FENDER, AND METHOD FOR USING
HORIZONTAL PNEUMATIC FENDER

Technical Field

[0001]

The present invention relates to a protective cover for a horizontal pneumatic fender, a horizontal pneumatic fender, and a method for using a horizontal pneumatic fender, and particularly relates to a protective cover for a horizontal pneumatic fender capable of suppressing adherence of oil that floats on a water surface, which causes swelling and deterioration of the fender, a horizontal pneumatic fender, and a method for using a horizontal pneumatic fender.

Background Art

[0002]

There have been known pneumatic fenders that are designed to prevent damage to hulls and a pier when boats and ships come alongside the pier. These pneumatic fenders are installed on a wall face of the pier or on the ship side. The pneumatic fender is a hollow body formed from a rubber in which a reinforcing material is embedded. Air is encapsulated in this hollow interior and, when a boat or a ship comes alongside the pier, the shock is absorbed by an elastic force produced by the encapsulated air.

[0003]

The modes of the pneumatic fender can be broadly classified into two types: horizontal and vertical. The horizontal pneumatic fender is used with the fender floating on the water and the longitudinal direction positioned horizontally. The vertical pneumatic fender is used with the fender floating on the water and the longitudinal direction positioned vertically, with a portion of the fender submerged in the water by storage of a predetermined amount of water in the hollow interior.

[0004]

However, when oil drifts and accumulates in a water area where the pneumatic fender is installed, the oil that floats on the water surface adheres to the outer surface of the pneumatic fender. When this state lasts for a long period of time with a conventional pneumatic fender, which does not take into consideration such oil, the rubber in the portion where the oil adhered swells and deteriorates. As a result, the problem arises that the pneumatic fender can no longer be used and the service life is shortened.

[0005]

For horizontal pneumatic fenders, there has been proposed a sheet-shaped protective member that covers the outer surface of the fender (refer to Patent Document 1, for example). Nevertheless, this protective member is designed to prevent outer damage to the fender caused by contact with the hull or the like, and is not intended to address the swelling and deterioration caused by the oil described above. Then, when this protective member is mounted on the fender, there are seams in a circumferential direction and breaks on both left and right end portions. The horizontal pneumatic fender rotates about a center axis of a hemispherical portion during use and thus, even when this protective member is mounted, the oil that floats on the water surface passes through the seams and breaks and adheres to the outer surface of the fender. This makes it difficult to suppress the swelling and deterioration of the fender using this protective member.

Citation List Patent Literature

[0006]

Patent Document 1: Japanese Unexamined Patent Application Publication No. H5-25812A

Summary of Invention Technical Problem

[0007]

An object of the present invention is to provide a protective cover for a horizontal pneumatic fender capable of suppressing adherence of oil that floats on a water surface, which causes swelling and deterioration of a fender, a horizontal pneumatic fender, and a method for using a horizontal pneumatic fender.

Solution to Problem

[0008]

A protective cover for a horizontal pneumatic fender according to the present invention for achieving the above-described object is a protective cover removably mounted on a horizontal pneumatic fender including bowl-shaped hemispherical portions connected to both left and right ends of a body portion having a cylindrical shape. The protective cover for a horizontal pneumatic fender includes a protective layer body having a cylindrical shape and an attachment portion. The protective layer body is disposed on an outer side of the body portion and each of the hemispherical portions with gaps provided between the body portion and an outer surface of each of the hemispherical portions, and covers the body portion and a

portion of a range of an outer surface of each of the hemispherical portions in a vertical direction. The attachment portion disposes the protective layer body in a predetermined position on the fender. When the protective layer body is disposed in the predetermined position of the fender, the protective layer body enables separation of oil that floats on a water surface and the range of the body portion and each of the hemispherical portions covered with the protective layer body.

[0009]

A horizontal pneumatic fender according to the present invention is a horizontal pneumatic fender including a body portion having a cylindrical shape, and bowl-shaped hemispherical portions connected to both left and right ends of the body portion. The horizontal pneumatic fender further includes a protective layer body having a cylindrical shape that is disposed on an outer side of the body portion and each of the hemispherical portions with gaps provided between the body portion and an outer surface of each of the hemispherical portions, and covers the body portion and a portion of a range of an outer surface of each of the hemispherical portions in a vertical direction. The protective layer body enables separation of oil that floats on a water surface and the range of the body portion and each of the hemispherical portions covered with the protective layer body.

[0010]

A method for using a horizontal pneumatic fender according to the present invention includes installing the horizontal pneumatic fender described above with a position midway in a vertical direction of the protective layer body set at a water surface position and thus, when oil that floats in a water area where the fender is installed, separating the oil and the range of the body portion and each of the hemispherical portions covered with the protective layer body by the protective layer body.

Advantageous Effects of Invention

[0011]

According to the present invention, a protective layer body having a cylindrical shape is provided that is disposed on an outer side of the body portion and each of the hemispherical portions with gaps provided between the body portion and an outer surface of each of the hemispherical portions, and covers the body portion and a portion of the range of an outer surface of each of the hemispherical portions in a vertical direction. The protective layer body enables separation of oil that floats on the water surface and the range of the body portion and each of the hemispherical portions covered with the protective layer body, thereby making it possible to prevent the range covered with the protective layer body from swelling and deteriorating due

to the oil that floats on the water surface, even when the body portion and each of the hemispherical portions integrally rotate about a center axis of the hemispherical portions. Further, this protective layer body only covers the body portion and a portion of the range of the outer surface of each of the hemispherical portions in the vertical direction, resulting in the advantage of reducing the amount of material used to form the protective layer body.

[0012]

In the protective cover according to the present invention, the protective layer body may have buoyancy that allows the protective cover to independently float on the water. According to this configuration, the protective layer body independently moves vertically with a vertical motion of the water surface, allowing the protective layer body to more readily protect the body portion and the outer surface of each of the hemispherical portions from the oil that floats on the water surface.

[0013]

In a front view from the hemispherical portion side, the body portion may protrude further outward than the protective layer body attached to the fender. According to this configuration, when a boat or ship comes alongside the fender, the protective layer body comes into contact with the boat, ship, or pier earlier than the protective layer body, resulting in the advantage of preventing damage to the protective layer body.

[0014]

The attachment portion is, for example, composed of a cord that connects the protective layer body and each of the hemispherical portion sides connected to both left and right ends of the body portion. According to this configuration, it is possible to dispose the protective layer body in a predetermined position on the fender in a stable manner.

[0015]

When the protective layer body is composed of an oil resistant member, the protective layer body is effective in preventing the swelling and deterioration of the range of the fender covered with the protective layer body. Examples of the oil resistant member include an elastic member that contains acrylonitrile butadiene rubber.

Brief Description of Drawings

[0016]

FIG. 1 is an explanatory view illustrating an embodiment of a protective cover for a horizontal pneumatic fender according to the present invention as viewed from the side.

FIG. 2 is an explanatory view illustrating the protective cover for a horizontal pneumatic fender in FIG. 1 when a boat or ship comes alongside a pier, as viewed from the front from a hemispherical portion side.

FIG. 3 is an explanatory view illustrating the protective cover for a horizontal pneumatic fender in FIG. 1 when a boat or ship comes alongside a pier, when viewed planarly.

FIG. 4 is an explanatory view illustrating another embodiment of the protective cover for a horizontal pneumatic fender according to the present invention as viewed from the side.

FIG. 5 is an explanatory view illustrating the protective cover for a horizontal pneumatic fender in FIG. 4 as viewed from the front from the hemispherical portion side.

FIG. 6 is an explanatory view illustrating the horizontal pneumatic fender as viewed from a vertical cross section.

Description of Embodiments

[0017]

Hereinafter, a protective cover for a horizontal pneumatic fender, a horizontal pneumatic fender, and a method for using a horizontal pneumatic fender according to the present invention will be described with reference to embodiments illustrated in the drawings.

[0018]

A conventional horizontal pneumatic fender 1A (hereinafter referred to as the “fender 1A”) includes a body portion 1a having a cylindrical shape, and hemispherical portions 1b having a bowl shape and connected to both left and right ends of the body portion 1a, as illustrated in FIG. 6. The hemispherical portions 1b on the left and right sides are respectively provided with a fitting 1c and a fitting 1d. The fitting 1c only may be provided in the hemispherical portion 1b on one side.

[0019]

The body portion 1a and the hemispherical portion 1b are composed of a member obtained by layering a plurality of reinforcing layers between an inner layer rubber and an outer layer rubber. The hollow internal space formed by the body portion 1a and the hemispherical portions 1b is inflated with an air A. In the drawings, the boundaries between the body portion 1a and the hemispherical portions 1b are each indicated by an alternate long and two short dashed line.

[0020]

The fitting 1c is provided with an injection port for injecting the air A, a safety valve that prevents an internal pressure of the fender 1A from becoming excessive, a

pressure sensor that measures this internal pressure, and the like. Respective first end portions of separate guy chains 5 are connected to the fittings 1c, 1d.

[0021]

When the fender 1A is installed on the wall face of the pier or on the ship side, each of second end portions of the guy chains 5 connected to the fittings 1c, 1d is fixed to the pier or the hull. Then, the fender 1A in which the air A is stored in the hollow internal space is made to float on the ocean or the like and installed with the longitudinal direction (axial direction of the body portion 1a) set horizontally.

[0022]

As a result, when an oil C drifts and accumulates in the water area where the fender 1A is installed, the oil C floating on the water surface always comes into contact with the body portion 1a and the hemispherical portions 1b. When the fender 1A is continuously used as is, the outer layer rubber that forms the body portion 1a and the hemispherical portions 1b swells due to the oil C. This swelling causes a decrease in the strength and the like of the body portion 1a and the hemispherical portions 1b, making the fender 1A no longer usable.

[0023]

Here, a protective cover 2 for a horizontal pneumatic fender (hereinafter referred to as the “protective cover 2”) according to the present invention illustrated in FIGS. 1 to 3 is used. This protective cover 2 is disposed on an outer side of the body portion 1a and each of the hemispherical portions 1b, with gaps provided between the body portion 1a and the outer surface of each of the hemispherical portions 1b, and includes a protective layer body 3 having a cylindrical shape and an attachment portion 4. The protective layer body 3 covers the body portion 1a and a portion of a range of the outer surface of each of the hemispherical portions 1b in a vertical direction. The attachment portion 4 disposes the protective layer body 3 in a predetermined position on the fender 1A.

[0024]

The protective layer body 3 is a sheet obtained by forming an elastic material such as a rubber, or a resin into a thin layer, and has a thickness of, for example, from 1 mm to 30 mm, and a length in the vertical direction of, for example, 1 m to 3 m. The protective layer body 3 has specifications that substantially prevent water seepage. The protective layer body 3 having a cylindrical shape is continuous in both the circumferential direction and the axial direction, without breaks. The protective layer body 3 is manufactured by integrally molding a member into a cylindrical shape. Alternatively, the protective layer body 3 having a cylindrical shape is manufactured by bonding a plurality of members together. In this case, the bonded seams of each member are made to have specifications that prevent the passage of the oil C by

machining without generation of gaps. The protective layer body 3 having a cylindrical shape and outserted on the fender 1A covers the body portion 1a and a portion of the range of the outer surface of each of the hemispherical portions 1b in the vertical direction.

[0025]

According to this embodiment, the protective layer body 3 has buoyancy that allows the protective layer body 3 to float on the water independently. This protective layer body 3 is composed of an elastic cylindrical member having a bubble structure and outserted on the body portion 1a. As the protective layer body 3, for example, a resin, or a rubber having an independent bubble structure may be used. Alternatively, the protective layer body 3 having buoyancy that allows the protective layer body 3 to independently float on the water may be obtained by adding a buoyant portion 3a made from a resin, a rubber, or the like and having an independent bubble structure to a solid member.

[0026]

The protective layer body 3 may be formed using an oil resistant member, or may be formed using a non-oil resistant member. Further, the protective layer body 3 may be formed using an elastic member, or may be formed using a non-elastic member. For example, the protective layer body 3 may be formed using an elastic member that contains acrylonitrile butadiene rubber superior in oil resistance. Other examples of an elastic member having oil resistance include fluororubber, chloroprene rubber, and chlorinated polyethylene rubber.

[0027]

Examples of the buoyant portion 3a used include a resin, and a rubber having an independent bubble structure. The buoyant portion 3a may be formed using an oil resistant member, or may be formed using a non-oil resistant member. Further, the buoyant portion 3a may be formed using an elastic member, or may be formed using a non-elastic member. The buoyant portion 3a may be provided continuously in the circumferential direction around the entire circumference of the protective layer body 3, or may be provided intermittently in the circumferential direction.

[0028]

Examples of the attachment portion 4 used include a cord 4b (right-side cord 4b) that connects the protective layer body 3 disposed on the fender 1A and the hemispherical portion 1b on the right side, and a cord 4b (left-side cord 4b) that connects the protective layer body 3 and the hemispherical portion 1b on the left side. With the right-side cord 4, an upper right end portion of the protective layer body 3 and the fitting 1c provided in the hemispherical portion 1b on the right side are connected. With the left-side cord 4, an upper left end portion of the protective layer

body 3 and the fitting 1d provided in the hemispherical portion 1b on the left side are connected.

[0029]

In this embodiment, a first end portion of the right-side cord 4b is connected to an upper right edge portion of the protective layer body 3 via a connecting member 4a. A second end portion of the right-side cord 4b is connected to the fitting 1c via a fixing member 4c fitted on the fitting 1c. A first end portion of the left-side cord 4b is connected to an upper left end opening edge portion of the protective layer body 3 via the connecting member 4a. A second end portion of the left-side cord 4b is connected to the fitting 1d via the fixing member 4c fitted on the fitting 1d.

[0030]

Each of the fixing members 4c is a rotary joint like mechanism that does not follow the revolution of the fittings 1c, 1d centered about a cylinder center line of the fender 1A. Thus, even when the fender 1A rotates about the cylinder center line, the cords 4b almost never get wrapped around the fittings 1c, 1d, and the protective layer body 3 is constantly disposed in a position that covers the outer surface of a lower end portion of the fender 1A.

[0031]

As the cord 4b, a rope made from a resin or a natural fiber, a metal chain, or the like may be used. Use of a rope made from a resin or a natural fiber as the cord 4b is effective in preventing the occurrence of scratches on the surface of the hemispherical portions 1b caused by the cord 4b.

[0032]

When this protective cover 2 is used, the protective cover 2 is attached on the ground or on the ship to the fender 1A in which the air A is stored in the hollow internal space. Subsequently, as illustrated in FIG. 1, the fender 1A is installed on the wall face of the pier or on the ship side. The position of the protective layer body 3 that is midway in the vertical direction is set at the water surface position.

[0033]

When the oil C drifts to the water area where the fender 1A is installed and a periphery of the fender 1A is surrounded by the oil C floating on the water surface, the oil C continuously adheres to the outer surface of the protective layer body 3. The body portion 1a and a certain amount of the region on the outer surface of each of the hemispherical portions 1b in the vertical direction (the region of the lower end portion of the fender 1A) are constantly covered with the protective layer body 3, and are therefore separated from the oil C without the oil C adhering thereto, even when the fender 1A rotates about the cylinder center line. While the oil C fluctuates with the water surface, the vertical fluctuation of the water surface during normal periods in a

harbor or the like is about from 1 to 2 m. While the fender 1A moves vertically in synchrony with the waves (water surface), the protective layer body 3 having buoyancy also moves vertically in synchrony with the waves (water surface). Thus, the vertical fluctuation range of the water surface position is generally within the vertical range of the protective layer body 3.

[0034]

As long as the water surface position does not exceed the upper end position of the protective layer body 3, the oil C never enters between the fender 1A and the protective layer body 3. Thus, excluding when the waves are higher than normal, the range of the fender 1A covered with the protective layer body 3 is separated from the oil C, making it possible to avoid the adherence of the oil C on the fender 1A during normal periods. During non-normal periods (when the waves are high), use of the fender 1A may be avoided. Thus, use of the protective cover 2 according to the present invention makes it possible to effectively suppress the swelling and deterioration of the fender 1A caused by the oil C floating on the water surface. Further, the protective layer body 3 only covers the body portion 1a and a portion of the range of the outer surface of each of the hemispherical portions 1b in the vertical direction, resulting in the advantage of reducing the amount of material used to form the protective layer body 3.

[0035]

As illustrated in FIG. 2, the body portion 1a protrudes further outward than the protective layer body 3 disposed in a predetermined position on the fender 1A in a front view from the hemispherical portion 1b side. Thus, when a boat or ship comes alongside a pier, the protective layer body 3 is never strongly pressed between the fender 1A and a pier S or between the fender 1A and a hull B. Further, the protective layer body 3 is disposed on the outer side of the body portion 1a and each of the hemispherical portions 1b with gaps provided between the body portion 1a and each of the hemispherical portions 1b, and thus compaction and restoration deformation of the fender 1A are not difficult even when the protective cover 2 is attached to the fender 1A. As a result, the shock absorbing performance and the like of the fender 1A are not substantially adversely affected by the protective cover 2.

[0036]

When the protective layer body 3 is composed of a non-oil resistant member, the protective layer body 3 deteriorates by swelling and the like due to the adhered oil C in earlier stages, compared to when composed of an oil resistant member. Thus, when deterioration of the protective layer body 3 is discovered, or after a preset period of time has elapsed, the deteriorated protective layer body 3 is removed from the

fender 1A and replaced with a new protective layer body 3. Alternatively, the protective cover 2 may be replaced with a new protective cover 2.

[0037]

When the protective layer body 3 is composed of an oil resistant member, swelling and deterioration of the fender 1A in the range covered with the protective layer body 3 can be prevented over an extended period of time compared to when formed by a non-oil resistant member. This eliminates the need for replacement with a new protective layer body 3 (protective cover 2). Alternatively, the frequency of replacement with a new protective layer body 3 (protective cover 2) can be decreased.

[0038]

When the protective layer body 3, which is disposed in a predetermined position on the fender 1A, protrudes further outward than the body portion 1a in a front view from the hemispherical portion 1b side, the protective layer body 3 comes into contact with the hull B earlier than the fender 1A when a boat or ship come alongside the pier. Thus, the protective layer body 3 may be formed from a member having flexibility and capable of deforming in the same manner as the body portion 1a or further inward than body portion 1a after coming into contact with the hull B and being further pressed.

[0039]

FIGS. 4 and 5 illustrate an embodiment of the protective cover 2 that includes the protective layer body 3. This protective layer body 3 does not have buoyancy that allows the protective layer body 3 to float on the water independently.

[0040]

In this embodiment, a frame 4d having an annular shape is provided along an upper end opening edge of the protective layer body 3. As the frame 4d, a wire member made from a resin, a metal, or the like may be used. The thin layer-shaped protective layer body 3 is suspended from the frame 4d into the water. A frame or the like that supports the protective layer body 3 may be added at a suitable location as needed.

[0041]

When this protective cover 2 is installed on the wall face of the pier or on the ship side, the protective cover 2 is installed in a position where the protective layer body 3 covers the body portion 1a and a portion of the range of the outer surface of each of the hemispherical portions 1b in the vertical direction (the range of the lower end portion of the fender 1A). The cord 4b connected to the protective layer body 3 is connected to the fixing member 4c that functions as a rotary joint. While the fender 1A moves vertically in synchrony with the waves (water surface), the protective layer body 3 also moves vertically following the fender 1A. Thus, the

vertical fluctuation range of the water surface position is generally within the vertical range of the protective layer body 3.

[0042]

In this embodiment as well, the various configurations described in the previous embodiment can be adopted. In addition, usage and replacement can also be performed in the same way as in the previous embodiment.

[0043]

Further, a horizontal pneumatic fender 1 according to the present invention removably includes the various protective layer bodies 3 described above for the conventional fender 1A.

Reference Signs List

[0044]

1 Horizontal pneumatic fender according to present invention

1A Conventional horizontal pneumatic fender

1a Body portion

1b Hemispherical portion

1c Fitting (right side)

1d Fitting (left side)

2 Protective cover

3 Protective layer body

3a Buoyant portion

4 Attachment portion

4a Connecting member

4b Cord

4c Fixing member

4d Frame

5 Guy chain

Claims

[Claim 1]

A protective cover for a horizontal pneumatic fender removably mounted on a horizontal pneumatic fender including bowl-shaped hemispherical portions connected to both left and right ends of a body portion having a cylindrical shape, the protective cover for a horizontal pneumatic fender comprising:

a protective layer body having a cylindrical shape that is disposed on an outer side of the body portion and each of the hemispherical portions with gaps provided between the body portion and an outer surface of each of the hemispherical portions, and covers the body portion and a portion of a range of an outer surface of each of the hemispherical portions in a vertical direction; and

an attachment portion that disposes the protective layer body in a predetermined position on the fender;

the protective layer body enabling separation of oil that floats on a water surface and the range of the body portion and each of the hemispherical portions covered with the protective layer body when the protective layer body is disposed in the predetermined position of the fender.

[Claim 2]

The protective cover for a horizontal pneumatic fender according to claim 1, wherein the protective layer body has buoyancy that allows the protective layer body to float on the water independently.

[Claim 3]

The protective cover for a horizontal pneumatic fender according to claim 1 or 2, wherein the body portion protrudes further outward than the protective layer body disposed in a predetermined position on the fender, in a front view from the hemispherical portion side.

[Claim 4]

The protective cover for a horizontal pneumatic fender according to any one of claims 1 to 3, wherein the attachment portion is composed of a cord that connects the protective layer body and each of the hemispherical portion sides connected to both left and right ends of the body portion.

[Claim 5]

The protective cover for a horizontal pneumatic fender according to any one of claims 1 to 4, wherein the protective layer body is composed of an oil resistant member.

[Claim 6]

The protective cover for a horizontal pneumatic fender according to claim 5, wherein the oil resistant member is an elastic member that contains acrylonitrile butadiene rubber.

[Claim 7]

A horizontal pneumatic fender comprising:

a body portion having a cylindrical shape;

bowl-shaped hemispherical portions connected to both left and right ends of the body portion; and

a protective layer body having a cylindrical shape that is disposed on an outer side of the body portion and each of the hemispherical portions with gaps provided between the body portion and each of the hemispherical portions, and covers the body portion and a portion of a range of an outer surface of each of the hemispherical portions in a vertical direction;

the protective layer body enabling separation of oil that floats on a water surface and the range of the body portion and each of the hemispherical portions covered with the protective layer body.

[Claim 8]

The horizontal pneumatic fender according to claim 7, wherein the body portion protrudes further outward than the protective layer body in a front view from the hemispherical portion side.

[Claim 9]

The horizontal pneumatic fender according to claim 7 or 8, wherein the protective layer body is composed of an oil resistant member.

[Claim 10]

The horizontal pneumatic fender according to claim 9, wherein the oil resistant member is an elastic member that contains acrylonitrile butadiene rubber.

[Claim 11]

A method for using a horizontal pneumatic fender, the method comprising installing the horizontal pneumatic fender according to any one of claims 7 to 10 with a position midway in a vertical direction of the protective layer body set at a water surface position and thus, when oil that floats in a water area where the fender is installed, separating the oil and the range of the body portion and each of the hemispherical portions covered with the protective layer body by the protective layer body.