

A MOORING SYSTEM

FIELD OF THE INVENTION

The present invention relates to a mooring system for mooring a floating
5 object to another object, the mooring system comprising a hawser and the
hawser comprising two rope segments.

BACKGROUND

Hawser is a nautical term for a thick cable or rope used in mooring or towing.
10 Mooring refers to any means of attaching a vessel to an object such as a
bollard, pier, quay, other floating object/vessel or a mooring. One of the most
important factors in offshore mooring is using a hawser that is long enough to
provide sufficient elastic to allow the vessel to move due to movements in
waves. If a boat is tied with a short and/or stiff hawser while offshore
15 mooring, it cannot move when in large waves and could be swamped or it
could result in excessive loads in the mooring hawsers. A more elastic
hawser will allow movement both up and down as well as significant side
movement to avoid to become swamped or to avoid excessive loads in the
mooring hawser.

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SUMMARY OF THE INVENTION

The object of the present invention is to provide an improved mooring
system. This object is achieved by the mooring system as set forth in the
appended claims.

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The present invention discloses a mooring system comprising a hawser and
a first and a second object, wherein at least said first object is adapted to be
floating. The hawser of the mooring system is provided a first end attached to
said first object, and a second end attached to said second object, such that
30 the hawser thereby moors the two objects to each other. The hawser
comprises at least two rope segments with an intermediate chafing member
arranged between the at least two rope segments, wherein the intermediate

chafing member runs via a fairlead and said fairlead is arranged adjacent a side of said first object, which side facing the second object and said first end being attached to an attachment point on said first object, which attachment point is arranged distanced to said fairlead. The attachment point of the first
5 object is provided at a distance to said fair lead at least corresponding to a length of said chafing member.

With ends of the hawser is meant where the hawser is attached to the first and the second object. The actual rope segment can be extending beyond an
10 attachment point to the objects. An extension of the rope segments beyond the attachment point does however not have any technical benefits in relation to the objects of the present invention.

The rope segments is adapted to have an inner elasticity in relation to said
15 chafing member, whereby the relation between the rope segments elasticity and the chafing members elasticity is such that the chafing member can be considered to be stiff and the rope segments to be elastic.

The chafing member is adapted to have a high friction durability in relation to
20 said rope segments, whereby the relation between the chafing member's friction durability and the rope segments durability is such, that said chafing member can withstand friction loads without any substantial damages, which friction loads would wear down said rope segments.

25 A relation between the length of the intermediate chafing member and the distance between the intermediate chafing member and the attachment point is such, that it allows a stretching of the rope segment compensating for normal motions of the first object and still maintaining the intermediate chafing member within the fairlead.

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Further, the distance between the fairlead and said attachment point is such, that at least the length of the rope segment between the intermediate chafing

member and the attachment point, at least corresponds to the length of the intermediate chafing member. Further, the distance between the intermediate chafing member and the attachment point is such, that it allows a stretching of the rope segment compensating for the stiffness of the chafing member, such that the elasticity of the inventive hawser at least corresponds to single rope hawser with the length corresponding of the first rope segment and the intermediate chafing member of the present invention. However, the construction of the inventive hawser with an intermediate chafing member allows the second rope segment to be longer, due to that it can be attached further away from the side of the first object facing the second object, whereby a greater elasticity in the hawser can be achieved than in previously known hawsers, due to the increased total length of rope segments.

The fairlead creates a joint in which side forces upon the hawser is absorbed when the first and the second objects careers relative each other. The fairlead thereby enables that the rope segments on each side can be subjected to lengthwise directed forces only and further that the first end can be attached at a point of the first object located distanced from the side facing the second object. With distanced is meant; the distance along the second rope segment from the intermediate chafing member to the attachment point, whereby the rope segment might pass guiding points, changing the direction of the rope segment, on its way to the attachment point. The hawser can thereby become an increased length that in most cases is close to twice the length compared to prior art solutions. The rope segments having some elasticity will thus totally give a more elastic mooring in this system. Further, a rope is generally more elastic than a cable or chain and the hawser will thus have added elasticity with two rope segments.

The invention combines the advantages with mooring with a rope, which provides elasticity with the advantages with mooring with a more durable hawser member such as a chain or wire.

As long as the above is fulfilled distance of said attachment point of said first object to said fairlead at least corresponds to half a distance between said fairlead and said second end or at least corresponding to the distance between said fairlead and said second end.

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Further, allowing the intermediate chafing member to transfer tension forces as effectively as possible between the two rope segments the angle the chafing member leaves the fairlead is important. It is therefore foreseen that the fairlead and the attachment point of said first object is arranged such
10 relative each other that said chafing member leaves said fairlead with an angle between 0 and 90 degrees from said fairlead's main opening direction, or preferably with an angle between 0 and 45 degrees from said fairlead's main opening direction, or even more preferably with an angle between 0 and 25 degrees from said fairlead's (6) main opening direction.

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Also the second object can be provided with a fairlead in corresponding manner, whereby the hawser is provided with another intermediate chafing member adapted to run via said fairlead upon the second object and having a
20 third rope segment attached thereto in order to attach to the second object. The elasticity of the hawser can thereby be increased even more due to the added length of stretchable rope.

According to one aspect of the present invention the chafing member of the
25 hawser is a chafing chain. The part of the hawser in contact with the fairlead will apart from the pulling force have a friction load and it will thus be advantageous to have a chain instead of a rope and thereby increasing the lifetime of the hawser. Alternatively the chafing member of the hawser is a chafing cable which will also extend the lifetime as compared to a rope.

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According to a further aspect of the present invention the rope is made from nylon or polyester. Nylon and polyester presents increased elasticity as well as being lighter than a wire or chain.

- 5 According to yet another aspect of the present invention the fair lead is a hawser pipe arranged such that the hawser runs through the pipe. A pipe do not require that much maintenance as for instance with a pulley and a hawser pipe can also be made quite light.
- 10 According to yet a further aspect of the present invention the system comprises two hawsers. This allows for better control of the lateral balance of the object with the main part of the hawser system. If further strength is desired the mooring system could be made using two pairs of hawsers. Further hawsers could of course be added if the required strength is very
- 15 high.

By adding longer or more rope segments a higher elasticity can be achieved, wherein a parallel arrangement of a plurality of inventive hawsers increases the strength of the mooring system. In one aspect of the invention a plurality

20 of inventive hawsers are arranged parallel with each other between the first and second object, especially is a pair of hawsers arranged parallel or a two pairs of hawsers.

According to an additional aspect of the present invention the mooring

25 system comprises a bridle holding the fairlead and that is fastened to the object by using pad eyes or other means of fastening. Pad eyes can be produced using different methods.

According to another additional aspect of the present invention the floating

30 object is a semi-submersible platform. Preferably the bridle holds the fair lead underneath the deck-structure and is at least fastened to columns of the semi-submersible platform located on the side closest to the other object.

According to yet an additional aspect of the present invention the floating object is a ship-shaped structure, such as a ship or a barge. In this case the mooring system is preferably arranged on the sides of ship. Thus, according to one aspect the bow or stern of the floating object is positioned towards the other object, the fairlead is arranged adjacent the end of the ship-shaped structure facing the other object and wherein the hawser run along the side of the ship-shaped structure and having one end attached to the farther half of the ship-shaped structure.

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According to another aspect of the present invention the hawser runs within a pipe along the side of the ship-shaped structure. More preferably is of course to have hawsers on both sides of the ship-shaped structure and thus pipes on both sides.

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The other object is according to one aspect of the present invention also a floating object.

According to one aspect of the present invention the other object is a tension leg platform.

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According to yet another aspect of the present invention the surface of the hawser pipe has a coating for either decreasing the friction or protection against corrosion or both of these. This could for instance be applied using hot spraying the hawser pipe with thermal spraying and zinc/aluminium powder or cold and hot spraying of polymeric solutions.

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BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be further disclosed with reference to the accompanying drawings.

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Figure 1 is a schematic bottom view of a mooring system used in an embodiment with the floating object being a platform.

Figure 2 is a schematic side view of a mooring system according to the
5 invention.

DISCLOSURE OF PREFERRED EMBODIMENTS

Figure 1 shows an inventive mooring system 1 for mooring a floating object 2
10 to another object 3. In the shown embodiment the mooring system comprises the first and the second object 2, 3 and four hawsers 4 which are attached to a first and the second object 2, 3 with their first and second end 13, 14 respectively. In the shown embodiment the floating object 2 is a platform equipped with the fairleads in the form hawser pipes 6. The hawsers 4 run
15 through of hawser pipes 6, thereby creating a joint about which the hawser can bend when the first and the second object 2, 3 moves relative each other. The hawser 4 comprises two rope segments 10, 10' which are made of an elastic material such as a nylon or polyester rope. The two rope segments 10, 10' are separated by a chafing chain 9. The chafing chain 9 is more
20 durable concerning the friction against the hawser pipe 6 than the rope segments 10, 10'. The hawser 4 has its second end 14 attached to the second object 3 and the first end 13 is attached to the first object 2 adjacent the side 8 facing away from the second object 3. Thus, compared to prior art solutions, the hawser 4 of the present invention is longer by as much as the
25 first object allows, i.e. decided by the length of the object 2.

What also is shown in figure 1 is that there are two pairs of parallel hawsers 4 for increased strength of the mooring system. The hawser pipes 6 are held together laterally with bridles 11 and fixed at both sides using pad eyes 12.

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In figure 2 can be seen a side view of the mooring system 1.

The foregoing is a disclosure of an example practicing the present invention. However, it is apparent that modifications and variations of the mooring system will be obvious to one skilled in the art. Inasmuch as the foregoing disclosure is intended to enable one skilled in the art to practice the instant invention, it should not be construed to be limited thereby, but should be construed to include such modifications and variations as fall within the scope of the claims. For instance, the positioning of the mooring system in the shown embodiment is underneath the box bottom of a platform. However, if the floating object is a ship the hawsers will be placed on the sides of the ship or possibly on deck. Further, it is also possible to have arrangements with fairleads on both the floating object and the other object, thus having two chafing members for each hawser leading to an even greater elasticity and flexibility in the mooring system.

CLAIMS

1. A mooring system (1) comprising a hawser (4) and a first and a second object (2, 3), wherein at least said first object (2) is adapted to be floating,
5 and said hawser (4) is provided with a first end (13) attached to said first object (2), and a second end (14) attached to said second object (3) ,
c h a r a c t e r i s e d i n
that the hawser (4) comprises at least two rope segments (10, 10') with
an intermediate chafing member (9) arranged between the at least two
10 rope segments (10, 10'), wherein the intermediate chafing member (9)
runs via a fairlead (6) and said fairlead (6) is arranged adjacent a side (7)
of said first object (2), which side (7) facing the second object (3) and
said first end (13) being attached to an attachment point of said first
object (2), which attachment point is provided at a distance to said
15 fairlead (6) at least corresponding to a length of said chafing member.
2. A mooring system (1) according to claim 1, wherein said distance of said attachment point of said first object (2) to said fairlead (6) further at least corresponds to half a distance between said fairlead (6) and said second
20 end (14) or at least corresponding to the distance between said fairlead (6) and said second end (14).
3. A mooring system (1) according to any of the claims 1 or 2, wherein said fairlead (6) and said attachment point of said first object (2) is arranged
25 such relative each other that said chafing member (9) leaves said fairlead (6) with an angle between 0 and 90 degrees from said fairleads (6) main opening direction, or preferably with an angle between 0 and 45 degrees from said fairleads (6) main opening direction, or even more preferably with an angle between 0 and 25 degrees from said fairleads (6) main
30 opening direction.

4. A mooring system (1) according to any of the preceding claims, wherein said first end (13) is attached to said first object (2) adjacent the opposite side (8) of said first side (7) of the object (2).
5. A mooring system (1) according to any of the preceding claims, wherein the intermediate chafing member (9) is a chafing chain or cable and/or the rope segments (10, 10') are made from nylon or polyester.
- 10 6. A mooring system (1) according to any of the preceding claims, wherein the fairlead (6) is a hawser pipe arranged such that the hawser (4) runs through the hawser pipe.
- 15 7. A mooring system (1) according to any of the preceding claims, wherein the system comprises two parallel arranged hawsers (4) or two pairs of parallel arranged hawsers (4).
- 20 8. A mooring system (1) according to any of the previous claims, wherein one of the first object (2) is a semi-submersible platform.
9. A mooring system (1) according to claim 8, wherein the mooring system is arranged underneath the deck structure of the semi-submersible platform.
- 25 10. A mooring system (1) according to claims 8 and 9, wherein a bridle (11) holds the fairlead (6) underneath the deck-structure and is at least fastened to the columns of the semi-submersible platform located on the side closest to the other object.

11. A mooring system (1) according to any of the claims 1 to 7, wherein the first object (2) is a ship-shaped structure.

5 12. A mooring system (1) according to claim 11, wherein a bow or a stern of the first object (3) is positioned towards the second object (3), the fairlead (6) is arranged adjacent the end of the ship-shaped structure facing the second object (3) and wherein the hawser (4) run along the side of the ship-shaped structure and having one end attached to the half of the ship-shaped structure furthest away from the second object (3).

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13. A mooring system (1) according to claim 11, wherein the hawser (4) runs within a pipe along the side of the ship-shaped structure.

14. A mooring system (1) according to any of the previous claims, wherein
15 the second object (3) also is floating.

15. A mooring system (1) according to any of the previous claims, wherein said second object is a tension leg platform.

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