

METHOD OF MOORING OF SHIP AND ARRANGEMENT TO ACCOMPLISH THE METHOD

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The present invention relates to a method of accomplishing mooring of ship in a definite position at a distance from land and with possibility to make the ship leave its moorage in question.

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For floating vessels Dynamic Positioning (DP) and/or mooring systems are used in order to prevent the vessel from moving, i.e. to keep it in a definite position. Depending on the assignment of the ship and the water depth in question, various demands are made as to the immobility of the ship or, inversely, demands on the maximum allowed deviation from the definite position.

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The capability of the ship of keeping the definite position depends on the reaction time of the DP-system to counteract the environmental forces arising from wind, waves and currents. In certain waters the ship might also be affected by forces caused by drift ice. The DP-system consists of thrusters, i.e. propulsors which can be rotated 360 degrees in the horizontal plane, and one or several reference systems for definition of the definite position. The thrusters generate a resulting force, which counteracts the environmental forces, so that the definite position of the ship is maintained.

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In certain operation areas there might be restrictions concerning emissions. Reduction of the power necessary to keep the ship in the definite position increases the availability by reduced emissions.

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A complication when mooring of for example ships adapted to drill into the sea bed is that certain

situations might require that the ship in question can be disconnected in a controlled way at relatively short notice and leave the definite position, and after some time can be connected to the mooring system again.

5 A further complication is that during certain operations a steel pipe, a so called "riser", is used between a valve at the sea bed and the ship. To take up the "riser" before it is disconnected is too time-consuming, why it is necessary to design the arrangement
10 so that disconnection can be effected without it being necessary to take up the "riser" to the ship.

 The main object of the present invention is, therefore, in the first place to solve among other things said problems in an effective way by means of
15 simple and well working means.

 Said object is reached by means of a method according to the way indicated, which is mainly characterized in that the mooring is accomplished by means of a substantially ring-shaped mooring unit, which can be
20 raised and lowered and which has a gap along the periphery, and which can be connected to and disconnected from the ship, respectively, by means of a connectable part located below the surface of the water, and which mooring unit makes it possible for the ship, with downwards
25 protruding load supported by the ship, to pass by after disconnection and lowering of said mooring unit and to be rotated round an essentially vertical imaginary axis.

 A further problem with the invention is to find means, which can be applied effectively and safely
30 when carrying out a method according to the invention.

 Said means are included by an arrangement, which is mainly characterized in that a substantially ring-shaped mooring unit, which can be raised and lowered

and which has a gap along the periphery, is provided with means so that it can be releasably connected to and disconnected from the ship in question, respectively, below the surface of the water, and so it can be rotated
5 in relation to the ship round an essentially vertical imaginary axis.

The invention is described in the following with reference to the accompanying drawings, in which

Fig. 1 is a perspective view of the invention in active state connected to the underside of the
10 hull of a ship,

Figs. 2-3 illustrate the invention in connected and disconnected state, respectively, seen obliquely from below,

15 Fig. 4 is a perspective view obliquely from above of a disconnected mooring unit,

Fig. 5 is a perspective view obliquely from above of a connectable part, which is disconnected from a ship, and with a mooring unit connected to said
20 part,

Figs. 6-8 illustrate various stages from a connected state to a state, in which said mooring unit and the part, which can be connected to a ship, are separated from each other, and

25 Fig. 9 illustrates a state, in which the connectable mooring unit and the connectable part, which can be connected to a ship, can be reconnected to a ship.

A method of accomplishing safe mooring of a ship 1 in a definite position at a distance from land 2 and with possibility to make the ship 1 in question leave the moorage 3 in question for the ship 1 means that the
30 mooring is accomplished by means of a mooring unit 6, which can be raised 4 and lowered 5 and which has a gap 7

seen along its periphery. Further, said mooring unit 6 is so constituted, that it can be connected to I and disconnected from II the ship 1, respectively, by means of a connectable part 9 located below the surface of the water

5 8. Said mooring unit 6 makes it possible for the ship 1, with downwards protruding load 10 supported by the ship, to pass by said mooring unit 6 after disconnection and lowering of said mooring unit 6, and said unit can rotate in relation to the ship 1 round an essentially vertical

10 imaginary axis 11.

According to the invention said mooring unit 6 is remote-controlled in order to accomplish the desired raising and lowering 4, 5 thereof, and the mooring is accomplished by means of chains 13 or other pulling

15 elements, which are connected to a part 12 anchored in the bottom of the sea. Further, said mooring unit 6, which can be raised and lowered by buoyancy, is releasably connected from below the ship 1 to the moon pool 14 of the ship 1 in question, i.e. an opening of the ship located below the

20 surface of the water, or to another part of the ship 1. Preferably, fastening means 19, 20 are used, which operate with vacuum and excess of displacement. A rotatory bearing 15 adapted to connected mooring unit 6 is received by the connectable part 9.

25 An arrangement 16 for carrying out a method of accomplishing mooring of a ship 1 in a definite position at a distance A from land 2, and with possibility to make the ship 1 leave the moorage in question of the ship 1, comprises an essentially ring-shaped mooring unit

30 6, which can be raised and lowered 4, 5 and which has a gap 7 along the periphery, and which exhibits means 19, 20 so that it can be releasably connected to and disconnected from the ship 1 in question, respectively, below the

surface of the water 8, and so it can be rotated in relation to the ship 1 round an essentially vertically directed imaginary axis 11. Said mooring unit 6 is constituted by a horseshoe-shaped body, which has a gap in the form of a permanently open opening 7, or an opening, which can be closed on desired occasions, and which is arranged to have the function of a mooring buoy, which can be raised to the desired level 19 in the water. Further, the mooring unit 6 is arranged to be connected to a bearing unit 9, which is supported by the ship 1 below the surface of the water 8 and which comprises a rotatory bearing 15 for the connectable mooring unit 6, and whereby locking means 17, which can be remote-controlled, are arranged to lock the mooring unit 6 to a bearing unit 9, which can be connected to the ship 1 in question and which can be adjusted itself depending on arising environmental forces. The mooring unit 6 exhibits chains 13 or other pulling elements, which are connected to a part 12 anchored in the bottom of the sea, and a mechanism 18 for said chains 13, etc., the length of which is adjustable, and said unit is arranged to be anchored with its opening 7 in a definite direction and at the desired level 19 in the water, by means of for instance said chains 13, etc. The mooring unit 6 has adjustable buoyancy and submerging capacity, respectively, owing to air tank and container therein, which can be filled with liquid, whereby also this function is of use when the level is adjusted, especially when the height of the mooring unit 6 is adjusted.

To sum up, it can be mentioned that the invention makes it possible to moor the ship 1 to the bottom of the sea by means of a separate arrangement 16. The arrangement is so designed, that the ship can adjust

itself to the least possible environmental force, so called "weathervaning". The arrangement has a rotary part in order to make "weathervaning" possible. To this rotary part a buoy 6 supporting the mooring system is connected.

5 When all these parts are connected the ship is moored. In certain situations the arrangement is a complement to the DP-system, in other situations the DP-system is a complement to the mooring system. In order to make disconnection possible when for example the riser 10 is mounted, the

10 buoy 6 is provided with an opening 7 to make it possible to move the ship 1 from the definite position without taking up the riser 10 to the ship 1.

The nature and the function of the invention should have been clear from the above description and

15 also from the drawings, which illustrate the nature and the function.

Of course, the invention is not limited to the embodiments described above and illustrated in the accompanying drawings. Modifications are possible,

20 especially as far as the nature of the different parts is concerned, or by using equivalent technique, without departing from the scope of the invention as it is defined in the patent claims.

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PATENT CLAIMS

1. Method of accomplishing mooring of ship
(1) in a definite position at a distance from land (2) and
5 with possibility to make the ship (1) leave its moorage
(3) in question, **characterized in** that the mooring is
accomplished by means of a substantially ring-shaped
mooring unit (6), which can be raised (4) and lowered (5)
and which has a gap (7) along the periphery, and which can
10 be connected to (I) and disconnected from (II) the ship,
respectively, by means of a connectable part (9) located
below the surface of the water (8), and which mooring unit
(6) makes it possible for the ship (1), with downwards
protruding load (10) supported by the ship (1), to pass by
15 after disconnection and lowering of said mooring unit (6)
and to be rotated round an essentially vertical imaginary
axis (11).

2. Method according to Claim 1, **characterized**
20 **in** that said mooring unit (6) is remote-controlled and
that the mooring is arranged to be accomplished by means
of chains (13) or other pulling elements, which are
connected to a part (12) anchored in the bottom of the
sea.

25 3. Method according to Claim 2, **characterized**
in that said mooring unit (6), which can be raised and
lowered by buoyancy, is releasably connected, preferably
by means of vacuum, to said connectable part (9), which
30 can be fastened underneath the moon pool (14) of a ship in
question, or another part of the ship (1), and which is
provided with a rotatory bearing (15) adapted to connected
mooring unit (6).

4. Arrangement (16) for carrying out a method according to anyone of the preceding Claims to accomplish mooring of a ship (1) in a definite position at a distance (A) from land (2), and with possibility to make the ship
5 (1) leave the moorage in question of the ship (1),
characterized in that a substantially ring-shaped mooring unit (6), which can be raised and lowered (4, 5) and which has a gap (7) along the periphery, is provided with means (19, 20) so that it can be releasably connected to and
10 disconnected from the ship (1) in question, respectively, below the surface of the water (8), and so it can be rotated in relation to the ship (1) round an essentially vertical imaginary axis (11).

15 5. Arrangement according to Claim 4
characterized in that said mooring unit (6) is constituted by a body with a gap (7) in the form of a permanently open opening, for example a horseshoe-shaped body or a body with an opening, which can be closed on desired occasions.

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6. Arrangement according to anyone of the Claims 4-5, **characterized in** that the mooring unit (6) is arranged to be connected to a bearing unit (9), which is supported by the ship (1) below the surface of the water
25 (8) and which comprises a rotatory bearing (15) for the connectable mooring unit (6).

7. Arrangement according to Claim 6,
characterized in that locking means (17), which can be
30 remote-controlled, are arranged to lock the mooring unit (6) to a bearing unit (9), which can be connected to the ship (1) in question.

8. Arrangement according to anyone of the Claims 4-7, **characterized in** that the mooring unit (6) exhibits chains (13) or other pulling elements, which are connected to a part (12) anchored in the bottom of the sea, and a mechanism (18) for said chains (13), etc., the length of which is adjustable.

9. Arrangement according to Claim 8, **characterized in** that said mooring unit (6) is arranged to be anchored with its opening (7) in a definite direction by means of said chains (13), etc.

10. Arrangement according to anyone of the Claims 4-9, **characterized in** that the mooring unit (6) has adjustable buoyancy and submerging capacity, respectively, owing to air tank and container therein, which can be filled with liquid.

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