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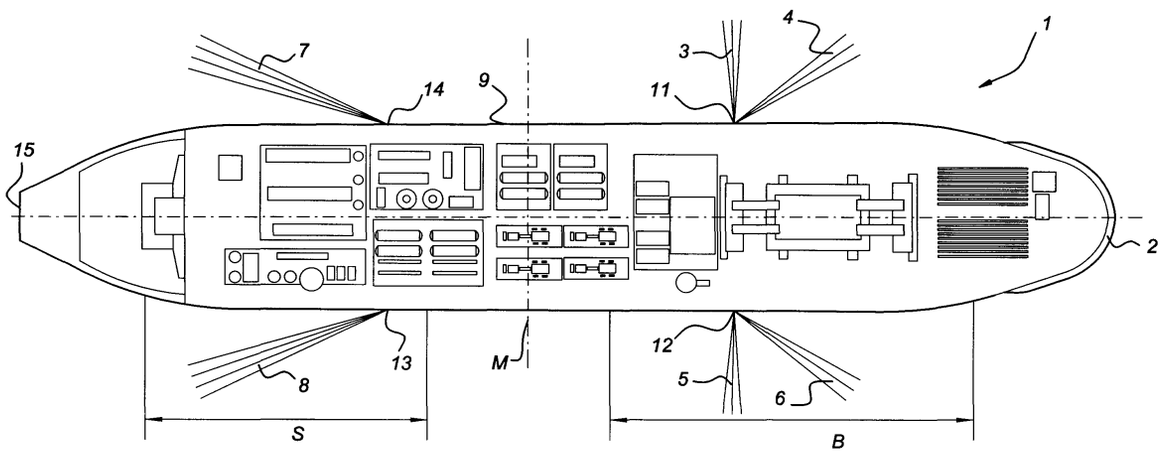
(71) Applicant: **SINGLE BUOY MOORINGS INC.**
CH-1723 Marly (CH)

(72) Inventor: **Schuurmans, Sipke**
06320 La Turbie (FR)

(74) Representative: **de Bruijn, Leendert C. et al**
Nederlandsch Octrooibureau
P.O. Box 29720
2502 LS Den Haag (NL)

(54) Vessel comprising a semi-weathervaning mooring arrangement

(57) The invention relates to a vessel (1) comprising bow and stern anchor lines (3-8) located between 5% and 40% of the vessels total length from the midship position. The anchor lines (3-8) are connected at fairleads (11-14) at the sides of the vessel in fixed positions. The transverse stiffness of the bow anchor lines (3-6) is larger than the transverse stiffness of the stern anchor lines (7,8). The bow anchor lines (3-6) may be of greater stiffness than the rear anchor lines (7,8) by an increased pretensioning load or by addition of clump weights and/or may be located further from midship than the rear anchor lines. Hereby, a relatively simple passive weathervaning system is obtained wherein lateral displacement of the midship area is minimised and in which the moments exerted by environments can be efficiently counteracted.



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Description

[0001] The invention relates to the vessel comprising a hull and a number of anchor lines mooring the vessel to the seabed.

[0002] From WO 98/35874 a passive weathervaning mooring arrangement is known wherein the anchor lines are fixedly attached to the sides of the vessel at the midship position. This allows the ship to weathervane by 180° without the use of a complex turret. However, the restoring moment exerted by the anchor lines is relatively small and a relatively low yaw stiffness is obtained. Therefore, a thruster system is required to return the vessel if it rotates by more than 180° to avoid twisting or winding up of the mooring lines. As the lack of sufficient restoring moment exerted by the anchor line system requires an active thruster-positioning device, the mooring arrangement is relatively expensive.

[0003] From US patent number 3,822,663 a mooring arrangement is known comprising two bow and two stern anchor lines, each anchor line being connected to a carriage which can be moved along the sides of the vessel. This allows the vessel to weathervane by moving the carriages and taking in or paying out the anchor lines along winches connected to said carriages. This system is relatively complex and requires additional decks space for accommodating the movable carriages.

[0004] From WO 99/02394 a spead mooring arrangement is known wherein at positions spaced from the bow and the stern, multiple anchor lines extend from the longitudinal centre line of the vessel. Hereby additional free space along the hull is provided for mooring shuttle tankers against the vessel. No weathervaning capabilities of the system are apparent Furthermore, connection of the anchor lines to a single position on the longitudinal centre line of the vessel results in relatively small restoring moments exerted by the anchoring system of the vessel, and as a result of that reduces yaw stiffness of the anchoring system.

[0005] From WO 97123380 a semi weathervaning anchoring system is known wherein the tension of the anchor lines can be controlled by paying out and taking in the anchor lines, the pretension of the bow anchor lines being larger than the pretension of the rear anchor lines.

[0006] It is an object of the present invention to provide an anchoring system allowing passive weathervaning which is of a relatively simple construction, which requires little deck space and which, when weathervaning, minimises the lateral displacement, such that the tension on risers that may be connected to the vessel between the bow and stern, remains relatively low.

[0007] Hereto, a vessel according to the present invention is characterised in that the vessel comprises at least four anchor lines, two front anchor lines being connected to a respective side of the vessel at a fixed longitudinal position which is spaced from midship between 5 % and 40 % of the vessels total length, preferably between 15 % and 35 % of the vessels total length, the transverse stiffness at the connection points of the front anchor lines being greater than the transverse stiffness at the connection points of the rear anchor lines for allowing passive weathervaning of the vessel.

[0008] By moving the bow anchor lines towards the midship position, the fairleads of the bow anchor lines being located near the sides of the hull, the vessel will be able to weathervane around a rotation point which is located relatively close to the vessel, preferably between bow and midship. Especially when steel risers are connected between the seabed and the vessel, the present invention provides an optimised balance between freedom of movement of the vessel, which allows weathervaning within a limited range, and minimising lateral displacement of the midship area By placing the bow and stern mooring lines closer together, the environmental forces acting on the vessel can lie taken up more efficiently with less tension in said mooring lines. No need for paying out or taking in each mooring line or changing the positions of the fairleads along the vessel is needed for obtaining weathervaning capabilities.

[0009] The bow anchor lines may be of greater stiffness than the rear anchor lines and/or may be placed further from midship than the stern anchor lines to arrive at the greater transverse stiffness of the bow anchor lines. With "transverse stiffness" as used herein, the excursion of the bow or stern is meant upon application of a uniform transverse load on the vessel.

[0010] The difference in transverse mooring stiffness of the bow and stern anchor lines may be varied by the number of anchor lines used, the pretensioning, addition of clump weights, the anchor line angles, etc.

[0011] The stern anchor lines may be connected at the stern position, but are preferably located between 5 % and 40 % of the vessels total length from midship, preferably between 15 % and 35 % of the vessels total length from midship. Preferably the bow anchor lines extend in the direction of the bow at an angle of between 10° and 90°, preferably between 10° and 45° with respect to the longitudinal axis of the vessel in a non-weathervaning equilibrium position. The rear anchor lines extend rearward with respect to the longitudinal axis of the vessel at an angle of between 10° and 60°, preferably between 20° and 35° At these angles the midship area forms a minimal heave area in which risers, rigid (steel) or flexible risers or a drill string or drilling rig may be situated. The angles described above result in sufficient stiffness for accurate station keeping of the vessel while allowing passive weathervaning upon changing wind, wave and current conditions.

[0012] Preferably, the front and stern anchor lines comprise groups of anchor lines connected to substantially the same fairlead position for maintaining accessibility of the vessel.

[0013] The invention will, by way of example be explained with reference to the single accompanying drawing of a vessel comprising a mooring arrangement according to the present invention.

[0014] Figure I shows a vessel I comprising four groups of each three-bow anchor lines 3, 4, 5, 6, and two groups of each four stern anchor lines 7,8. The groups of anchor lines 3-8 are connected to the hull 9 of the vessel at fairlead positions 11,12,13,14. The fairlead positions of the front anchor lines 3-5 are located between midship M and the bow 2 at fixed positions. These fixed fairlead positions may be located along a longitudinal dimension B which may comprise between 0.05 L-0.40 L, wherein L represents the total length of the vessel 1. The fairlead positions 13,14 of the stern anchor lines may be located along a longitudinal dimension S between midship M and the stern 15, wherein S is between 0.05 L-0.40 L.

[0015] At a water depth of 800m the bow anchor lines 3-6 may have a length of 1600m and have and anchor line tension of 150 ton ± 15 ton per anchor line in the group of anchor lines ton. The stern anchor lines 7,8 may have a length of 1600m and an anchor line tension of 80 ton ± 15 ton per anchor line in the group of anchor lines.

[0016] The positions of the bow and stern as used herein may be interchanged, as the requirement to weathervane around the stern may arise for the situation when risers are connected to the vessel of a position between midship and the stern.

Claims

1. Vessel (1) comprising a hull and a number of anchor lines mooring the vessel to the seabed, characterised in that the vessel comprises at least four anchor lines, two front anchor lines being connected to a respective side of the vessel at a fixed longitudinal position which is spaced from midship between 5 % and 40 % of the vessels total length, preferably between 15% and 35 % of the vessels total length, the transverse stiffness at the connection points of the front anchor lines being greater than the transverse stiffness at the connection points of the rear anchor lines for allowing passive weathervaning of the vessel.

2. Vessel according to claim 1, wherein the front anchor lines are of greater stiffness than the rear anchor lines

3. Vessel according to claim 1 or 2 wherein the stern anchor lines are placed closer to midship than the bow anchor lines.

4. Vessel according to claim 1, 2 or 3 characterised in that, the rear anchor lines are connected to a respective side of the vessel at a fixed longitudinal position which is spaced from midship between 5 % and 40 % of the vessels total length, preferably between 15% and 35 % of the vessels total length.

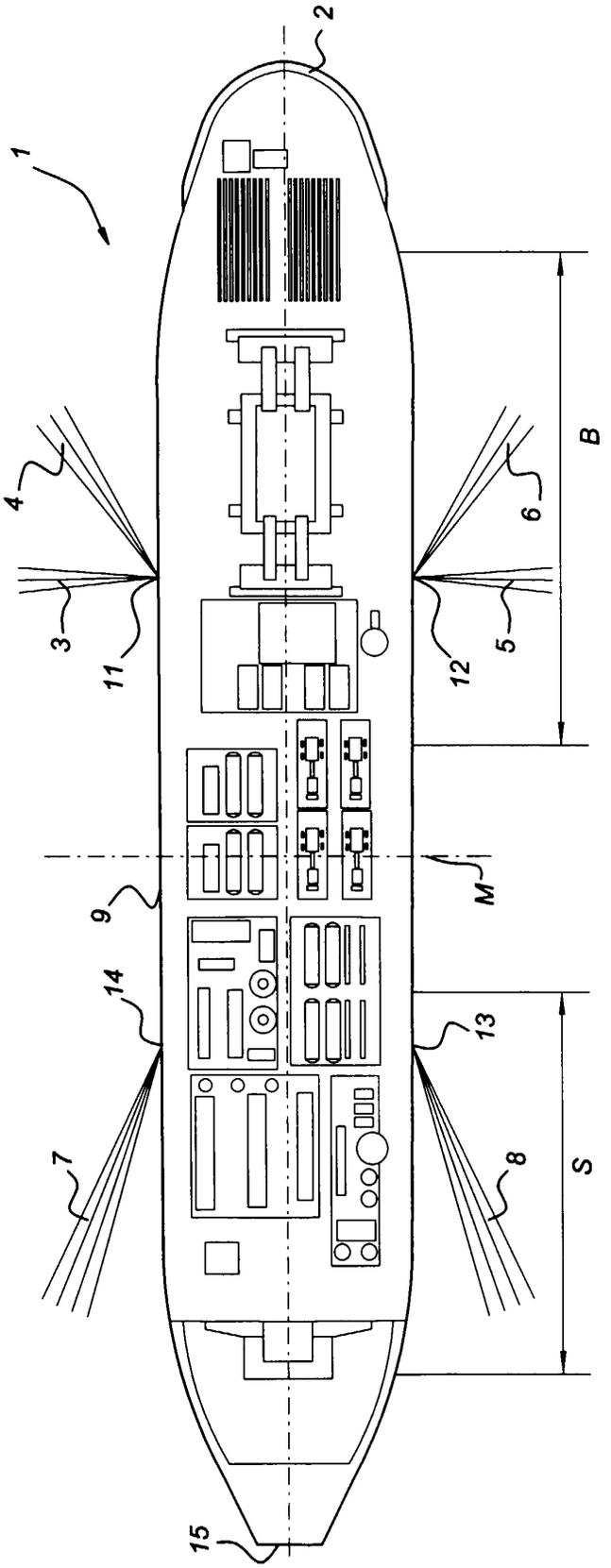
5. Vessel according to claim 1, 2, 3 or 4, wherein the front anchor lines extend at an angle, when seen from bow to stern, of between 10 ° and 90°, preferably between 10° and 45 ° in a non-weathervaning equilibrium position, the rear anchor lines extending rearward at an angle, when seen from stern to bow, of between 10° and 60°, preferably between 20° and 35°.

6. Vessel according to one of the preceding claims, wherein the anchor lines comprise groups of two or more anchor lines, substantially connected to the same point on the vessel.

7. Vessel according to any of the preceding claims, wherein the rotation point of the vessel is located between the bow and midship.

8. Vessel according to any of the preceding claims, wherein risers are connected to the vessel at or near the midship position.

9. Vessel according to claim 8, wherein the risers are spaced from midship between 5% and 40% of the vessel length.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EUROPEAN SEARCH REPORT

Application Number
EP 99 20 1971

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	US 3 715 890 A (LANGNER) 13 February 1973 (1973-02-13) * column 5, line 22 - line 39; figures 1,2 * ---	1,3-6	B63B21/50
A	US 3 552 343 A (SCOTT) 5 January 1971 (1971-01-05) * the whole document * ---	1-5,8,9	
A	FR 2 269 134 A (MITSUI SHIPBUILDING & ENGINEERING CO.,LTD) 21 November 1975 (1975-11-21) * figures 3,5 * -----	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			B63B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	8 November 1999	DE SENA HERNAND.., A

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 99 20 1971

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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08-11-1999

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3715890 A	13-02-1973	NONE	
US 3552343 A	05-01-1971	CA 922116 A	06-03-1973
FR 2269134 A	21-11-1975	JP 1163538 C	26-08-1983
		JP 50146088 A	22-11-1975
		JP 57059113 B	13-12-1982
		JP 1187972 C	30-01-1984
		JP 50146089 A	22-11-1975
		JP 58020831 B	25-04-1983
		DE 2517507 A	30-10-1975
		GB 1493441 A	30-11-1977
		US 3948201 A	06-04-1976

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82