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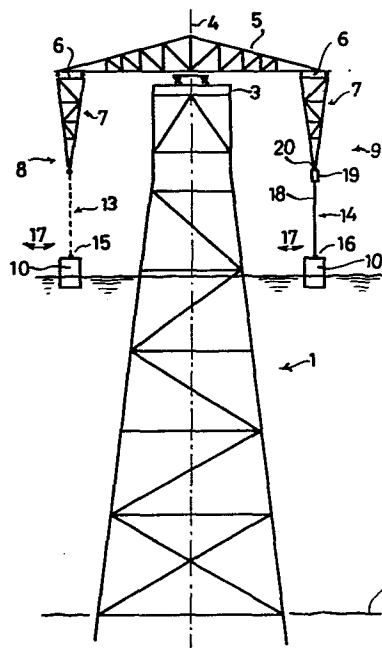
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64 Designated Contracting States: **FR GB NL**

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54 **Mooring device.**

57 A device for mooring a floatable body, such as a ship (12), to a mooring tower (1), comprising two tension members (8, 9), rotatable around a horizontal axis (6) and supported by the tower (1) at both sides thereof and each tensioned by a weight (10), the respective ends of said members each being connected through a rigid arm (11) to the floating body (12), in which each of said members (8, 9) has a smaller stiffness against displacement in the direction of the rigid arm (11) than in the direction perpendicular thereto.



EP 0 152 975 A1

Mooring device.

This invention relates to a device for mooring a floatable body, such as a ship, to a mooring tower, comprising two tension members, rotatable around a horizontal axis and supported by the tower at both sides thereof and each
5 tensioned by a weight, the respective ends of said members each being connected through a rigid arm to the floating body.

Such a mooring device is known from the French Patent Specification 2,420.475. In this known mooring device the
10 tension members are in their whole rigid structures. As a result the moored floating body, such as a tanker, cannot execute movements perpendicular to its longitudinal axis. However, in practice wave movements and currents occur which tend to bring about such movements; preventing them
15 results into a very heavy loading of the total mooring structure.

The European patent application 82201300.9 in the name of applicant discloses a mooring system in which the tension members are supported by the tower in such a way that they
20 can move in all directions sothat the abovementioned heavy

loads cannot occur. However, to prevent damaging of the tower as a result of sideways movements of the tension members the upper ends thereof must lie a considerable distance from the tower which results in a complicated
5 and costly structure.

The invention aims to provide a mooring system having the advantages of the above described known mooring systems but without the disadvantages thereof.

According to the invention each of said members has a smaller
10 stiffness against displacement in the direction of the rigid arm than in the direction perpendicular thereto.

By this measure the dimensions of the mooring device remain limited while the moored floating body can execute movements parallel to itself without the
15 danger of damaging the tower. In a simple and advantageous embodiment each of said tension members is constructed from at least two interconnected parts at least one of which formed or suspended in such a way that this member can exclusively carry out movements in the
20 direction of the rigid arm.

In a preferred embodiment of each of said tension members the upper part, coupled to the tower, is a rigid structure, and the lower part is of such a structure or connected to the upper part in such a way that the end thereof
25 connected to the rigid arm is able to execute movements in the direction to and from the tower.

Preferably the lower parts of the tension members consist of chains or similar members. They can also consist of rigid elements each interconnected through at least
30 one second hinge axis which crosses the first one perpendicularly, to the respective upper part.

Preferably each rigid element can rotate around an axis, coaxially therewith, with respect to the upper part.

In a preferred embodiment the horizontal hinge axis are carried by a jib which, rotatable around a vertical axis, is supported by the tower.

Also an embodiment is possible in which the upper part of each tension member consists of a triangle structure made up by two chains or similar members, interconnected at their lower ends, or an embodiment in which the lower part of each tension member is a rigid structure, connected to the rigid arm via a horizontal pivot axis parallel to the jib.

The invention will be clarified on the hand of the drawing.

Fig. 1a is a front view of the mooring device according to the invention;

Fig. 1b shows another embodiment of the tension member used therein;

Fig. 1c shows an alternate embodiment of said tension member;

Fig. 2 is a side view of this device.

In the figures reference numeral 1 denotes a mooring tower resting on the seabed 2; this tower carries at the upper end 3, rotatable around a vertical axis 4, a jib 5. To this jib 5 are connected, each one rotatable around a horizontal axis 6, the respective upper parts 7 of tension members which are as a whole denoted by reference numerals 8, 9. These upper parts 7 are rigid structures. Each of these tension members carries at the lower end a weight 10 and is furthermore with the lower end connected to one end of a rigid arm 11 of which the other end is

connected to a floating body to be connected to the mooring device, in this case a vessel 12.

According to the invention the tension members 8, 9 each have less stiffness against displacements in the direction of the rigid arms 11 than in the direction perpendicular thereto. To this end in the shown embodiment the lower parts 13, 14 respectively of the tension members 8 and 9 respectively are of such a structure or connected in such a way with the upper part 7 that the lower ends 15, 16 respectively thereof, connected to the rigid arm 11, can execute movements in the direction of the tower and away from the tower, such as indicated by the arrows 17. As a result while retaining a compact structure with a limited length of the jib 5 the ship 12 can execute appreciable movements parallel to its longitudinal axis without the danger of damaging the tower 1.

Fig. 1a shows two possible embodiments of the lower part of the tension members: the lefthand side of the figure shows how the lower part of the tension member 8 consists of a chain or cable 13 while the righthand part of the figure shows an embodiment in which the lower part is a rigid element 18 with at the upper end a coupling 19 permitting movements around an axis coaxial with the axis of the element 18; this coupling 19 hinges around a horizontal axis 20 which crosses the axis 6 perpendicularly and is connected to the rigid upper part 7.

Fig. 1b shows another possible embodiment of the tension members: in this embodiment the tension member 20

consists of an upper triangle 21, made up by chains
or similar members 22, 23 which are interconnected
by their lower ends at 24 to the chain 25 which
carries at its other end the weight 10 and the arm
5 11.

Fig. 1c shows an embodiment in which the lower part
of the tension member 30 consists of a rigid structure
31, connected through a horizontal hinge axis 32 to
the rigid arm 11; the upper part 33 is a chain. Also
10 an embodiment is possible in which this upper part
33 is a rigid element but then couplings permitting
movements as described above must be inserted at the
ends thereof.

C L A I M S

1. A device for mooring a floatable body, such as a ship (12), to a mooring tower (1), comprising two tension members (8,9), rotatable around a horizontal axis (6) and supported by the tower (1) at both sides thereof
5 and each tensioned by a weight (10), the respective ends of said members each being connected through a rigid arm (11) to the floating body (12), characterized in that each of said members (8,9) has a smaller stiffness against displacement in the direction of the rigid
10 arm (11) than in the direction perpendicular thereto.
2. Mooring device according to claim 1, characterized in that each of said tension members (8,9) is constructed from at least two interconnected parts (7, 13, 14; 22, 25; 31, 32) at least one of which formed
15 or suspended in such a way that this member can exclusively carry out movements in the direction of the rigid arm.
3. Mooring device according to claim 2, characterized in that of each of said tension members (8,9) the upper
20 part (7), coupled to the tower (1), is a rigid structure, and the lower part (13,14) is of such a structure or connected to the upper part in such a way that the end thereof connected to the rigid arm is able to execute movements in the direction to and from the tower.
- 25 4. Mooring device according to claim 3 characterized in that the lower parts (13) of the tension members consist of chains or similar members.

5. Mooring device according to claim 3 characterized in that the lower part of the tension members consist of rigid elements (14) each interconnected through at least one second hinge axis (20) which crosses the first one perpendicularly, to the respective upper part.
6. Mooring device according to claim 4 characterized in that each rigid element (14) can rotate around an axis (19), coaxially therewith, with respect to the upper part.
7. Mooring device according to claim 3-6 characterized in that the horizontal hinge axis (6) are carried by a jib (5) which, rotatable around a vertical axis, is supported by the tower (1).
8. Mooring device according to claim 1 characterized in that the upper part of each tension member (20) consists of a triangle structure (21) made up by two chains (22,23) or similar members, interconnected at their lower ends.
9. Mooring device according to claim 1 characterized in that the lower part of each tension member (30) is a rigid structure, (31) connected to the rigid arm via a horizontal pivot axis (32) parallel to the jib (5).

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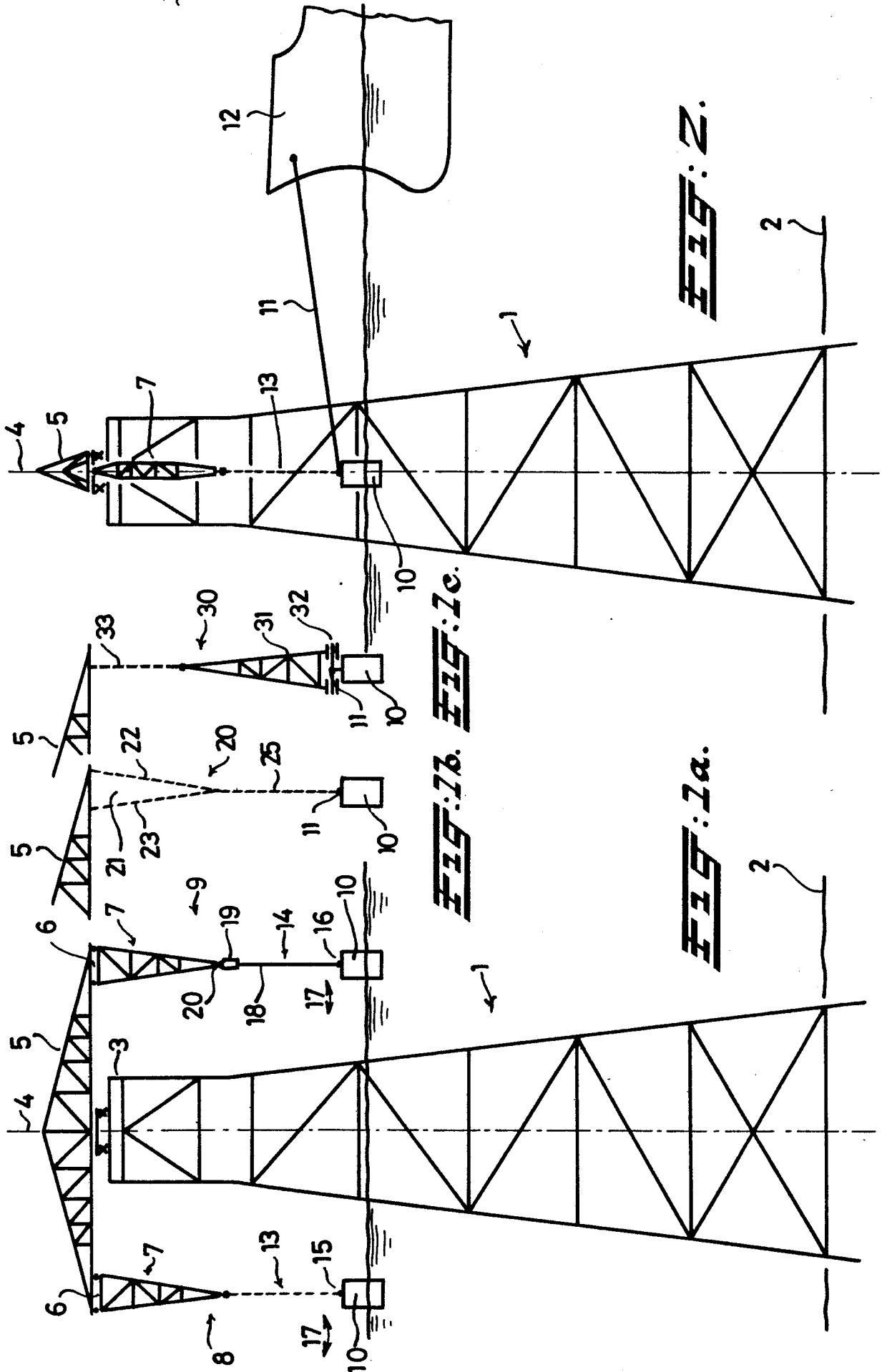


FIG. 1a. FIG. 1b.

FIG. 2.

FIG. 2a.



European Patent
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EUROPEAN SEARCH REPORT

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Application number

EP 85 20 0087

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.4)
A, D	FR-A-2 420 475 (E.M.H.) * Page 3, line 17 - page 4, line 29; page 9, line 37 - page 10, line 4; page 10, line 37 - page 11, line 3; figures 1,2,11,12 *	1,5-7	B 63 B 35/44
A	EP-A-0 096 119 (B.T.S.) * Page 4, line 1 - page 5, line 3; figures 1,2 *	1,4	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			B 63 B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 17-04-1985	Examiner VOLLERING J.P.G.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			