(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 163 469 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
27.10.2010 Bulletin 2010/43

(51) Int Cl.:
B63B 21/16 *(2006.01)*

(21) Application number: **08016061.7**

(22) Date of filing: **11.09.2008**

(54) **Off-shore mooring system and method**

Off-Shore-Vertäuungssystem und Verfahren

Système et procédé d'amarrage en mer

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR

(43) Date of publication of application:
17.03.2010 Bulletin 2010/11

(73) Proprietor: **IMPaC Offshore Engineering GmbH**
20354 Hamburg (DE)

(72) Inventors:
- **Hoog, Sven**
  22179 Hamburg (DE)
- **Koch, Hartmut**
  22397 Hamburg (DE)

(74) Representative: **UEXKÜLL & STOLBERG**
Patentanwälte
Beselerstrasse 4
22607 Hamburg (DE)

(56) References cited:
EP-A- 1 462 358
WO-A-01/34460
WO-A-2008/082306
US-A1- 2005 204 987

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 2 163 469 B1

Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The present invention refers to an off-shore mooring system and method for mooring a transport vessel to a floating terminal vessel which is able to weathervane, i.e. free to align in response to a resulting combination of wind, waves and currents.

[0002] Cargo transport by sea is an inevitable integral part of global economics and logistics. In recent years a demand for stationary floating terminal vessels has arisen in order to provide off-shore hubs for temporary storage of cargo at logistically optimal points which may be located on the open sea. Especially, products conveyed at sea, such as crude oil or natural gas, may be temporarily stored on floating terminal vessels which are anchored off-shore. Transport vessels may then be used to transport the temporarily stored cargo to its intended destination.

[0003] In particular, the vessel transport of liquid natural gas (LNG) to or from off-shore hubs has become economically interesting in recent years. One reason for this is that LNG is a cryogenic fluid, i.e. received from methane gas in a cooled liquid form, which incorporates several risks associated with its handling. Resident initiatives, environmental risks and necessary authority permissions more and more impede on-shore LNG hubs or LNG harbour terminals. An alternative is an off-shore LNG terminal which is far away from populated areas.

[0004] However, an off-shore loading procedure of a transport vessel is technically much more challenging than on-shore loading. This is primarily due to the fact that both the floating terminal vessel and the transport vessel may be exposed to high swell which leads to large relative movements between the floating terminal vessel and the transport vessel.

[0005] In one typical configuration like the one disclosed in US 2005/0204987 A1, the floating terminal vessel is a longitudinal floating structure which is anchored to the sea bed with an anchored windward fore and an opposite leeward stern which is free to align in response to wind, waves and currents. There are basically two known solutions to moor a transport vessel to the floating terminal vessel for loading: in a side-by-side configuration or in a tandem configuration.

[0006] In the side-by-side configuration like the one disclosed in WO 2008/082306 A1, the transport vessel is moored fore-and-aft with a relatively close distance to the portside or starboard side of the floating terminal vessel. A standard loading arm equipped with pipes may then be used for loading the transport vessel. However, this conventional loading manner is only applicable in very mild operational environments. If there is a larger wave motion both the floating terminal vessel and the transport vessel are exposed to the prevailing sea. There is a high risk of large mutual tilts and collisions.

[0007] Alternatively, a tandem configuration may be chosen. The transport vessel approaches the floating terminal vessel from leeward such that terminal vessel and transport vessel are aligned in wind direction. The fore of the transport vessel may then be moored to the aft of the floating terminal vessel such that also the transport vessel with a moored windward fore and a leeward aft is able to weathervane. Thereby, the vessel is sheltered behind the floating terminal vessel. Moreover, such a mooring acts as a hinge which allows rotation around all three axis without large relative lateral movements of those portions which are moored to each other. However, in order to reduce the risk of collisions it is usually necessary to keep a security distance of about 60 or more metres during loading.

[0008] It is known from EP 1 227 971 B1 to provide a system according to the preamble of claim 1 which is suitable for tandem off-shore cryogenic loading, especially to transfer LNG between a transport vessel and a terminal vessel. It is described therein that an LNG transport vessel is moored to an LNG production, storage and offloading terminal vessel by means of a pair of hawsers in a "crowfoot" configuration. The transport vessel and the terminal vessel have a mutual distance of 55 to 65 metres, and the position is maintained in that the vessel keeps a constant astern pushing force. Flexible transport pipes are then used to bridge the distance by means of a large dedicated pivotally mounted crane in form of an A-frame that can be pivoted to reach over towards the vessel.

[0009] The solution described in EP 1 227 971 B1 is very complex and expensive. Due to the large distance between the vessels there is a need for flexible cryogenic liquid pipes with a length of 100 metres or more. To provide the required flexibility the diameter is limited to about 40 cm (app. 16 inch) which limits the maximal loading rate to about 10.000 m^3 per hour. The long pipes which reach over open water are also exposed to harsh weather conditions and need costly surveillance and maintenance to prevent leakage.

[0010] Another system is known from EP 1 462 358 B1 wherein a semi-submersible floating dock is used which is pivotally attached to the floating terminal vessel and adapted to receive the hull of the transport vessel from underneath. Due to the need of a complicated semi-submersible floating dock this is a very costly solution. Moreover, it is very difficult to provide for an immediate disconnection in case of an emergency. The complicated semi-submersible floating dock itself and the rigid underwater setup are exposed to large forces such that costly surveillance and maintenance is necessary to keep the system fit for operation.

[0011] Therefore, it is the object of the present invention to provide an off-shore mooring system and method overcoming the disadvantages of the prior art. In particular, the inventive off-shore mooring system and method should be less complicated and easy to maintain while providing high transfer capacities with a high safety standard.

[0012] This object is solved by the inventive off-shore mooring system and method according to claims 1 and

8, respectively. Advantageous embodiments of the inventive system and method are subject to the respective dependent sub-claims.

[0013] According to a first aspect of the present invention an off-shore mooring system for mooring a transport vessel to a floating terminal vessel having an end portion which is able to a weathervane is provided, **characterised in that** the off-shore mooring system comprises a jaw-shaped receiving portion located at the end portion of the floating terminal vessel and adapted to receive the fore of the transport vessel, wherein the jaw-shaped receiving portion comprises a terminal section, two side sections and an opening, such that the fore of the transport vessel is able to protrude through the opening between the two side sections, and wherein the off-shore mooring system comprises at least three winchable fixing means adapted to moor the transport vessel with respect to the terminal vessel by a first fixing means being attached to the first side section of the receiving portion and adapted to pull the fore of the transport vessel to backwards portside, a second fixing means being attached to the second side section of the receiving portion and adapted to pull the fore of the transport vessel to backwards starboard, and a third winchable fixing means being adapted to pull the fore of the transport vessel forward towards the floating terminal vessel.

[0014] The jaw-shaped receiving portion is typically arranged at the stern of the floating terminal vessel which is able to weathervane. Typically, the fore of the terminal vessel is anchored and the end portion, i.e. the stern, is free to align in response to a resulting combination of wind, waves and currents.

[0015] The terminal section of the jaw-shaped receiving portion may be formed by the rear wall of the aft of the floating terminal vessel, whereas the side sections may be legs extending at either lateral side backwards to create a jaw-shaped receiving portion for receiving the fore of the transport vessel. The legs may be arranged in parallel and in longitudinal direction of the floating terminal vessel such that they form a backward opening for allowing the transport vessel to approach from leeward and to protrude into the jaw-shaped receiving portion.

[0016] It is important to note that the first and the second winchable fixing means, preferably hawsers, are adapted to pull the fore of the transport vessel backwards, i.e. one of them backwards portside and the other one backwards starboard. This is due to the fact that the first and the second winchable fixing means are attached to either side section of the jaw-shaped receiving portion. The term "winchable fixing means" used herein denotes any means which may be rolled on a winch and are suitable for applying adequate pulling forces to a transport vessel, e.g. a hawser, a rope, a chain, a steel cable or combinations of these, etc.

[0017] When the transport vessel is in its loading position, wherein the fore of the transport vessel protrudes through the opening between the side sections of the receiving portion, the attachment points of the first and the second winchable fixing means at the transport vessel is located more forward than the attachment points of the at least two winchable fixing means at the side sections. It is therefore impossible for the transport vessel to move further forward towards the floating terminal vessel such that there is no risk of collisions. The most important advantage is that the necessary distance between the vessel and the terminal vessel can be reduced to 10 metres or less which significantly reduces the complexity and the costs of the loading procedure and the length of the loading pipes.

[0018] As the first and the second winchable fixing means also pull the transport vessel into laterally opposite directions, i.e. one of them backwards portside and the other one backwards starboard, the fore of the transport vessel is also stabilised in an aligned central position in the receiving portion. However, the jaw-shaped receiving portion may also be equipped with fenders in order to prevent damage in case of accidental collisions.

[0019] The third winchable fixing means is adapted to pull the fore of the transport vessel forward towards the floating terminal vessel and preferably attached to the terminal section of the receiving portion. This has the advantage that the transport vessel is also stabilised in a longitudinal position without the need for the transport vessel to keep a steady forward pushing force. A steady forward pushing force would be disadvantageous, because it would push the floating terminal vessel into a windward direction which would lead to an unstable position of the complete system of terminal vessel and vessel. The third winchable fixing means may be used to pull the fore of the transport vessel in a controlled and safe way into the loading position in the receiving portion. Having reached the loading position the at least three winchable fixing means may be arranged in a starlike configuration which stabilises the fore of the transport vessel in basically all horizontal directions. It may be advantageous in certain cases if more fixing means are attached to the terminal section or to a side section of the receiving portion and adapted to pull the fore of the transport vessel. Nevertheless, the important hinge function of the connection which allows for the system to flexibly adapt to the wave motion is still guaranteed.

[0020] In order to keep a high security standard there may be an emergency measure provided allowing an immediate unmooring of the transport vessel in case of an emergency. The winchable fixing means, preferably in form of hawsers, may immediately be loosened or cut to disconnect the transport vessel from the terminal vessel.

[0021] It is known that in harsh conditions the moored transport vessel may perform wiggle motions with its stern. This is on the one hand necessary to flexibly adapt to the wave motions of the sea but may on the other hand lead to intolerable resonant deflections. Therefore, at least one tugboat may be provided for stabilising or controlling the position of the transport vessel. The one or more tugboats may stabilise the stern of the transport vessel during loading while keeping the system flexible

to adapt to the wave motion.

[0022] According to a second aspect of the invention a method for mooring a transport vessel to a floating terminal vessel which is able to weathervane is provided, wherein the method uses a described mooring system and comprises the steps of:

- applying a first pulling force on the fore of the transport vessel directed forward towards the floating terminal vessel,
- applying a second pulling force on the fore of the transport vessel directed to backwards portside by means of a first winchable fixing means attached to a first side section of the receiving portion, and
- applying a third pulling force on the fore of the transport vessel directed to backwards starboard by means of a second winchable fixing means attached to a second side section of the receiving portion.

[0023] The first pulling force is firstly applied on the fore of the transport vessel directed forward towards the floating terminal vessel in order to pull the transport vessel into the receiving portion of the floating terminal vessel. This has the advantage that this procedure is more controlled and safer than the transport vessel approaching under its own forward thrust. On the contrary, it is preferred that the transport vessel keeps an astern thrust when its fore is being pulled into the receiving portion. Such a desirable astern thrust may also, in addition or alternatively, be applied by a tugboat pulling the transport vessel backwards.

[0024] As long as the fore of the transport vessel has not yet reached its loading position the first pulling force may be performed by means of the first and second winchable fixing means in form of hawsers. However, once the transport vessel has reached its loading position the first and second winchable fixing means are used to apply a second and third pulling force directed to backwards portside and backwards starboard, respectively.

[0025] The first pulling force may at this stage be performed by means of a third winchable fixing means in form of a third hawser which is preferably attached to the terminal section of the receiving portion. The third winchable fixing means may also be used to pull the fore of the transport vessel into the receiving portion in the first place.

[0026] As already explained above with reference to the inventive system, the transport vessel is in its loading position secured in a forward and in lateral directions which allows a short distance between the vessel and the terminal vessel. Together with a third winchable fixing means a starlike configuration is created which pulls the fore of the transport vessel into radiating directions in order to stabilise in basically all horizontal directions.

[0027] Preferably, at least one tugboat may be used to stabilise or control the position of the transport vessel, inter alia in order to prevent intolerable lateral deflections of the stern of the transport vessel.

[0028] In the following a preferred embodiment of the invention is discussed in further detail with reference to the accompanying figures.

[0029] Figs. 1 to 3 show a top view of a preferred embodiment of the inventive off-shore mooring system which is used to moor a transport vessel to a floating terminal vessel in three different approaching stages.

[0030] Fig. 1 shows a transport vessel 1 which is connected with its fore 3 by two winchable fixing means in form of hawsers 5, 7 to a weathervaning end portion 9, i.e. the stern, of a floating terminal vessel 11 which is anchored with its fore (not visible). The distance between the transport vessel 1 and the floating terminal vessel 11 is still far with about 90 metres. The hawsers 5, 7 may have been shot over from the floating terminal vessel 11 to the transport vessel 1 or a tugboat 13, 14 may have been used to transfer the ends of the hawsers 5, 7 to the transport vessel 1.

[0031] The weathervaning floating terminal vessel 11 takes automatically an orientation in which its longitudinal axis is parallel to the direction W of a natural external force which results from a combination of wind pressure, wave motions and water currents. The direction W is shown as a hollow arrow in all figures. The transport vessel 1 is coaxially located behind the floating terminal vessel 11 with the same orientation in a tandem configuration. The two tugboats 13, 14 are used to stabilise or control the position and orientation of the transport vessel 1. The first tugboat 13 may be used to apply an astern pulling force to the transport vessel 1 such that the hawsers 5, 7 are tensioned. The second tugboat 14 may be used to control the lateral deflection out of the direction W by applying lateral pushing or pulling forces to the stern of the transport vessel 1.

[0032] At the stern 9 of the floating terminal vessel 11 a jaw-shaped receiving portion 15 is arranged which is adapted to receive the fore 3 of the transport vessel 1. The receiving portion 15 comprises a terminal section 17, two side sections 19, 21 and an opening 23, such that the fore 3 of the transport vessel 1 is able to protrude through the opening 23 between the two side sections 19, 21. The terminal section 17 of the jaw-shaped receiving portion 15 is formed by the rear wall of the aft of the floating terminal vessel 11. The side sections 19, 21 are legs which extend at either lateral side backwards to create the jaw-shaped receiving portion 15 for receiving the fore 3 of the transport vessel 1. The legs 19, 21 are arranged in parallel to each other and in longitudinal direction of the floating terminal vessel 11 such that they form a backward opening 23 for allowing the fore 3 of the transport vessel 1 to approach from leeward and to protrude into the jaw-shaped receiving portion 15.

[0033] The first 5 and the second hawser 7 are attached to the rear end of the first 19 and second side section 21, respectively. As they are connected with the fore 3 of the transport vessel 1 this results in a V-like configuration as shown in Fig. 1 wherein the transport vessel 1 is still far away from the floating terminal vessel

11. The first pulling force is applied on the fore 3 of the transport vessel 1 directed forward towards the floating terminal vessel 11 by means of the two hawsers 5, 7. When the first pulling force overcomes the astern thrust of the transport vessel 1 and/or the astern pulling force of the first tugboat 13, the transport vessel 1 is pulled towards the floating terminal vessel 11 in a controlled and safe way.

[0034] Fig. 2 shows a second approach stage in which the distance between the transport vessel 1 and the floating terminal vessel 11 has reduced to about 35 metres.

[0035] Fig. 3 shows the final loading position of the transport vessel 1 in which the fore 3 of the transport vessel 1 protrudes through the opening 23 between the two side sections 19, 21 into the jaw-shaped receiving portion 15. In this situation the hawsers 5, 7 are used to apply a second and third pulling force on the fore 3 of the transport vessel 1 directed backwards portside and backwards starboard, respectively. The first forward pulling force is now performed by a third winchable fixing means 24 in form of a third hawser. The third hawser 24 is attached to the terminal section 17 of the receiving portion 15 and pulls the fore 3 of the transport vessel 1 forward towards the floating terminal vessel 11. This pulling force, however, does not result in a f,urther approaching movement of the transport vessel 1 towards the floating terminal vessel 11. This is prevented by the second and third pulling forces which are directed backwards portside and backwards starboard, respectively. Thereby, the reached loading position of fore 3 of the transport vessel 1 is secured in basically all horizontal directions by means of a starlike configuration of hawsers 5, 7, 24 applying pulling forces in radiating directions. Additional hawsers 25, 27 can be used to further secure the fore 3 of the transport vessel 1. In the shown loading position of the fore 3 of the transport vessel 1 the safety distance between the transport vessel 1 and the floating terminal vessel 11 is less than 5 metres. This significantly facilitates the loading procedure.

[0036] During loading of the transport vessel 1 only one tugboat 14 may be used to control and stabilise the stern position of the transport vessel 1.

Claims

1. An off-shore mooring system for mooring a transport vessel (1) to a floating terminal vessel (11) having an end portion (9) which is able to weathervane,
the off-shore mooring system comprising a jaw-shaped receiving portion (15) located at the end portion (9) of the floating terminal vessel (11) and adapted to receive the fore (3) of the transport vessel (1), wherein
the jaw-shaped receiving portion (15) comprises a terminal section (17), two side sections (19, 21) and an opening (23), such that the fore (3) of the transport vessel (1) is able to protrude through the opening (23) between the two side sections (19, 21), and wherein
the off-shore mooring system comprises at least three winchable fixing means (5, 7, 24) adapted to moor the transport vessel with respect to the terminal vessel by
a first winchable fixing means (5) being attached to the first side section (19) of the receiving portion (15) and adapted to pull the fore (3) of the transport vessel (1) to backwards portside **characterised in that**
a second winchable fixing means (7) being attached to the second side section (21) of the receiving portion (15) and adapted to pull the fore (3) of the transport vessel (1) to backwards starboard, and
a third winchable fixing means (24) being adapted to pull the fore (3) of the transport vessel (1) forward towards the floating terminal vessel (11).

2. An off-shore mooring system according to claim 1, wherein the third winchable fixing means (24) is attached to the terminal section (17) of the receiving portion (15).

3. An off-shore mooring system according to claim 1 or 2, wherein at least one of the winchable fixing means (5, 7, 24) is a hawser.

4. An off-shore mooring system according to any preceding claim, wherein the jaw-shaped receiving portion (15) is equipped with fenders.

5. An off-shore mooring system according to any of the preceding claims, wherein more fixing means (25, 27) are attached to the terminal section (17) and/or to a side section (19, 21) of the receiving portion (15) and adapted to pull the fore (3) of the transport vessel (1).

6. An off-shore mooring system according to any of the preceding claims, wherein an emergency measure is provided allowing an immediate disconnecting of the transport vessel (1) in case of an emergency.

7. An off-shore mooring system according to any of the preceding claims, wherein at least one tugboat (13, 14) is provided for stabilising or controlling the position of the transport vessel (1).

8. A method for mooring a transport vessel (1) to a floating terminal vessel (11) having an end portion (9) which is able to weathervane, wherein the method uses a mooring system according to any of the preceding claims and comprises the steps of:

- applying a first pulling force on the fore (3) of the transport vessel (1) directed forward towards the floating terminal vessel (11),
- applying a second pulling force on the fore (3)

of the transport vessel (1) directed to backwards portside by means of a first winchable fixing means (5) attached to a first side section (19) of the receiving portion (15), and
- applying a third pulling force on the fore (3) of the transport vessel (1) directed to backwards starboard by means of a second winchable fixing means (7) attached to a second side section (21) of the receiving portion (15).

9. A method according to claim 8, wherein the step of applying a first pulling force on the fore (3) of the transport vessel (1) directed forward towards the floating terminal vessel (11) is performed by means of a third winchable fixing means (24) attached to the terminal section (17) of the receiving portion (15).

10. A method according to claim 8 or 9, wherein an astern pushing force is applied by the transport vessel (1) during the step of applying a first pulling force on the fore (3) of the transport vessel (1) directed forward towards the floating terminal vessel (11).

11. A method according to any of the claims 8 to 10, wherein at least one tugboat (13, 14) is used to stabilise or control the position of the transport vessel (1).

Patentansprüche

1. Off-Shore-Vertäuungssystem zum Vertäuen eines Transportschiffs (1) an einem Anlegeschiff (11) mit einem Endbereich (9), der frei schwenken kann,
wobei das Off-Shore-Vertäuungssystem einen maulförmigen Aufnahmebereich (15) aufweist, der am Endbereich (9) des schwimmenden Anlegeschiffes (11) angeordnet ist und dazu ausgestaltet ist, um den Bug (3) des Transportschiffs (1) aufzunehmen, wobei
der maulförmige Aufnahmebereich (15) einen Endabschnitt (17), zwei Seitenabschnitte (19, 21) und eine Öffnung (23) aufweist, so dass der Bug (3) des Transportschiffes (1) durch die Öffnung (23) zwischen die beiden Seitenabschnitte (19, 21) hineinragen kann, und wobei
das Off-Shore-Vertäuungssystem wenigstens drei mit Winden einziehbare Befestigungseinrichtungen (5, 7, 24) aufweist, die dazu ausgestaltet sind, um das Transportschiff in Bezug auf das Anlegeschiff zu vertäuen durch
eine erste mit einer Winde einziehbare Befestigungseinrichtung (5), die an dem ersten Seitenabschnitt (19) des Aufnahmebereichs (15) befestigt ist und dazu angepasst ist, um den Bug (3) des Transportschiffs nach Rückwärts-Backbord zu ziehen, **dadurch gekennzeichnet, dass**
eine zweite mit einer Winde einziehbare Befestigungseinrichtung (7) an dem zweiten Seitenabschnitt (21) des Aufnahmebereichs (15) befestigt ist und dazu angepasst ist, um den Bug (3) des Transportschiffs (1) nach Rückwärts-Steuerbord zu ziehen, und
eine dritte mit einer Winde einziehbare Befestigungseinrichtung (24) dazu angepasst ist, um den Bug (3) des Transportschiffs (1) vorwärts zu dem schwimmenden Anlegeschiff (11) hin zu ziehen.

2. Off-Shore-Vertäuungssystem nach Anspruch 1, wobei die dritte mit einer Winde versehene Befestigungseinrichtung (24) an dem Endabschnitt (17) des Aufnahmebereichs (15) befestigt ist.

3. Off-Shore-Vertäuungssystem nach Anspruch 1 oder 2, wobei wenigstens eine der mit Winden einziehbaren Befestigungseinrichtungen (5, 7, 24) ein Tau ist.

4. Off-Shore-Vertäuungssystem nach einem der vorhergehenden Ansprüche, wobei der maulförmige Aufnahmebereich (15) mit Fendern ausgerüstet ist.

5. Off-Shore-Vertäuungssystem nach einem der vorhergehenden Ansprüche, wobei weitere Befestigungseinrichtungen (25, 27) an dem Endabschnitt (17) und/oder einem Seitenabschnitt (19, 21) des Aufnahmebereichs (15) befestigt sind und dazu angepasst sind, um den Bug (3) des Transportschiffs (1) anzuziehen.

6. Off-Shore-Vertäuungssystem nach einem der vorhergehenden Ansprüche, wobei Notfallmaßnahmen vorgesehen sind, die die sofortige Freigabe des Transportschiffs (1) im Falle eines Notfalls erlauben.

7. Off-Shore-Vertäuungssystem nach einem der vorhergehenden Ansprüche, wobei wenigstens ein Schlepper (13, 14) vorgesehen ist, um die Position des Transportschiffs (1) zu stabilisieren oder zu kontrollieren.

8. Verfahren zum Vertäuen eines Transportschiffs (1) an einem schwimmenden Anlegeschiff (11) mit einem Endbereich (9), der frei schwenken kann, wobei das Verfahren ein Vertäuungssystem nach einem der vorhergehenden Ansprüche verwendet und die folgenden Schritte aufweist:

- Ausüben einer ersten Zugkraft auf den Bug (3) des Transportschiffs (1) in Vorwärtsrichtung zu dem schwimmenden Anlegeschiff (11) hin,
- Ausüben einer zweiten Zugkraft auf den Bug (3) des Transportschiffs (1) in Rückwärts-Backbord-Richtung durch eine erste mit einer Winde einziehbare Befestigungseinrichtung (5), die an einem ersten Seitenabschnitt (19) des Aufnahmebereichs (15) befestigt ist, und

- Ausüben einer dritten Zugkraft auf den Bug (3) des Transportschiffs (1) in Rückwärts-Steuerbord-Richtung durch eine zweite mit einer Winde einziehbaren Befestigungseinrichtung (7), die an einem zweiten Seitenabschnitt (21) des Aufnahmebereichs befestigt ist.

9. Verfahren nach Anspruch 1, wobei der Schritt des Ausübens einer ersten Zugkraft auf den Bug (3) des Transportschiffs (1) in Vorwärtsrichtung zu dem schwimmenden Anlegeschiff (11) hin durch eine dritte mit einer Winde einziehbare Befestigungseinrichtung (24) durchgeführt wird, die an dem Endabschnitt (17) des Aufnahmebereichs (15) befestigt ist.

10. Verfahren nach Anspruch 8 oder 9, wobei eine Achtern wirkende Schubkraft durch das Transportschiff (1) während des Schrittes der Ausübung einer ersten Zugkraft auf den Bug (3) des Transportschiffs (1) gerichtet in Vorwärtsrichtung zu dem schwimmenden Anlegeschiff (11) hin ausgeübt wird.

11. Verfahren nach einem der Ansprüche 8 bis 10, wobei wenigstens ein Schlepper (13, 14) dazu verwendet wird, um die Position des Transportschiffs (1) zu stabilisieren oder zu kontrollieren.

Revendications

1. Système d'amarrage en mer pour amarrer un navire de transport (1) à un navire terminal flottant (11) ayant une partie d'extrémité (9) qui est apte à suivre un mouvement de girouette,
le système d'amarrage en mer comprenant une partie réceptrice en forme de mâchoire (15) située à la partie d'extrémité (9) du navire terminal flottant (11) et adaptée pour recevoir la proue (3) du navire de transport (1), dans lequel :

la partie réceptrice en forme de mâchoire (15) comprend une section terminale (17), deux sections latérales (19, 21) et une ouverture (23), de sorte que la proue (3) du vaisseau de transport (1) est apte à faire saillie par l'ouverture (23) entre les deux sections latérales (19, 21), et dans lequel :

le système d'amarrage en mer comprend au moins trois moyens de fixation treuillables (5, 7, 24) adaptés pour amarrer le vaisseau de transport au vaisseau terminal par :

un premier moyen de fixation treuillable (5) fixé à la première section latérale (19) de la partie réceptrice (15) et adapté pour tirer la proue (3) du navire de transport (1) vers bâbord arrière,

caractérisé en ce que :

un deuxième moyen de fixation treuillable (7) est fixé à la deuxième section latérale (21) de la partie réceptrice (15) et adapté pour tirer la proue (3) du navire de transport (1) vers tribord arrière, et
un troisième moyen de fixation treuillable (24) est adapté pour tirer la proue (3) du navire de transport (1) en avant vers le navire terminal flottant (11).

2. Système d'amarrage en mer selon la revendication 1, dans lequel le troisième moyen de fixation treuillable (24) est fixé à la section terminale (17) de la partie réceptrice (15).

3. Système d'amarrage en mer selon la revendication 1 ou 2, dans lequel au moins l'un des moyens de fixation treuillables (5, 7, 24) est une amarre.

4. Système d'amarrage en mer selon l'une quelconque des revendications précédentes, dans lequel la partie réceptrice en forme de mâchoire (15) est munie de défenses.

5. Système d'amarrage en mer selon l'une quelconque des revendications précédentes, dans lequel des moyens de fixation supplémentaires (25, 27) sont attachés à la section terminale (17) et/ou à une section latérale (19, 21) de la partie réceptrice (15) et adaptés pour tirer la proue (3) du navire de transport (1).

6. Système d'amarrage en mer selon l'une quelconque des revendications précédentes, dans lequel une mesure d'urgence est prévue, permettant une déconnexion immédiate du navire de transport (1) en cas d'urgence.

7. Système d'amarrage en mer selon l'une quelconque des revendications précédentes, dans lequel au moins un remorqueur (13, 14) est prévu pour stabiliser ou commander la position du navire de transport (1).

8. Procédé d'amarrage d'un navire de transport (1) à un navire terminal flottant (11) ayant une partie d'extrémité (9) qui est apte à suivre un mouvement de girouette, dans lequel le procédé emploie un système d'amarrage selon l'une quelconque des revendications précédentes et comprend les étapes consistant à :

- appliquer une première force de traction sur la proue (3) du navire de transport (1) dirigée en

avant vers le navire terminal flottant (11),
- appliquer une deuxième force de traction sur la proue (3) du navire de transport (1) dirigée vers bâbord arrière à l'aide d'un premier moyen de fixation treuillable (5) fixé à une première section latérale (19) de la partie réceptrice (15), et
- appliquer une troisième force de traction sur la proue (3) du navire de transport (1) dirigée vers tribord arrière à l'aide d'un deuxième moyen de fixation treuillable (7) fixé à une deuxième section latérale (21) de la partie réceptrice (15).

9. Procédé selon la revendication 8, dans lequel l'étape d'application d'une première force de traction sur la proue (3) du navire de transport (1) dirigée en avant vers le navire terminal flottant (11) est exécutée à l'aide d'un troisième moyen de fixation treuillable (24) fixé à la section terminale (17) de la partie réceptrice (15).

10. Procédé selon la revendication 8 ou 9, dans lequel une force de poussée à l'arrière est appliquée par le navire de transport (1) pendant l'étape d'application d'une première force de traction sur la proue (3) du navire de transport (1) dirigée en avant vers le navire terminal flottant (11).

11. Procédé selon l'une quelconque des revendications 8 à 10, dans lequel au moins un remorqueur (13, 14) est utilisé pour stabiliser ou commander la position du navire de transport (1).

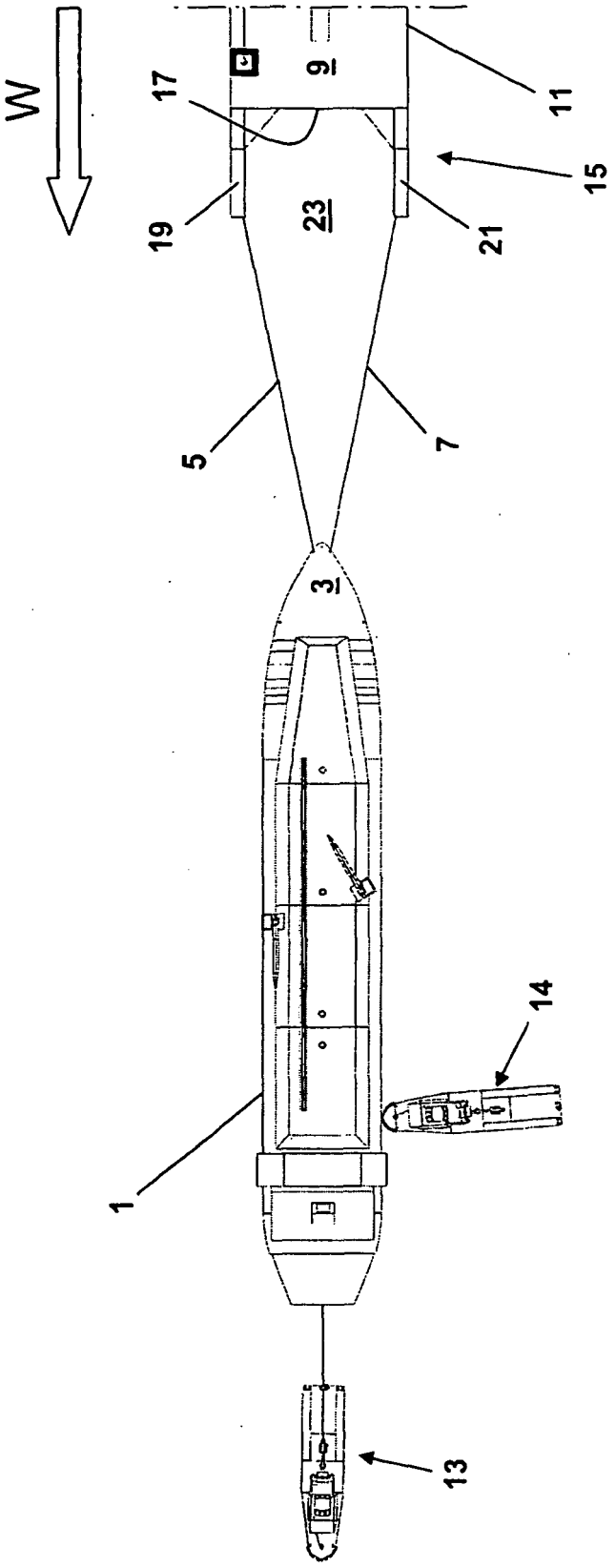


Fig. 1

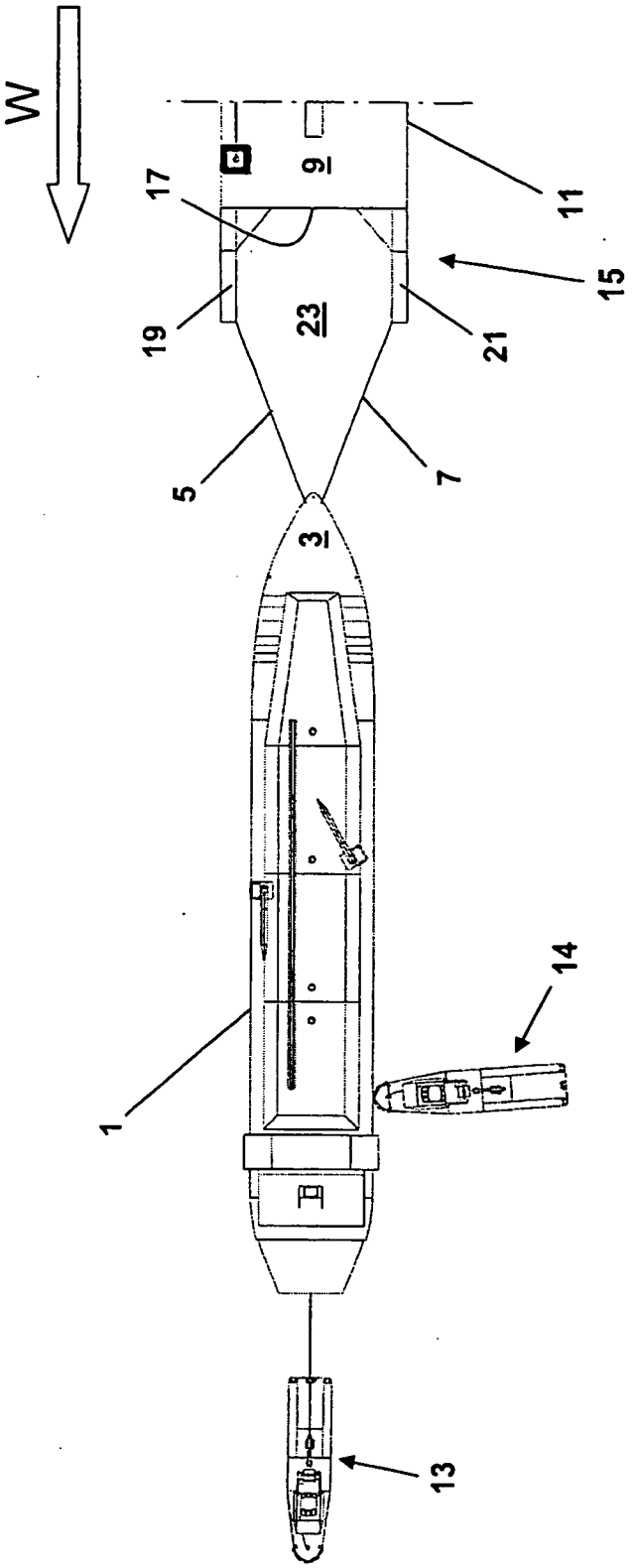


Fig. 2

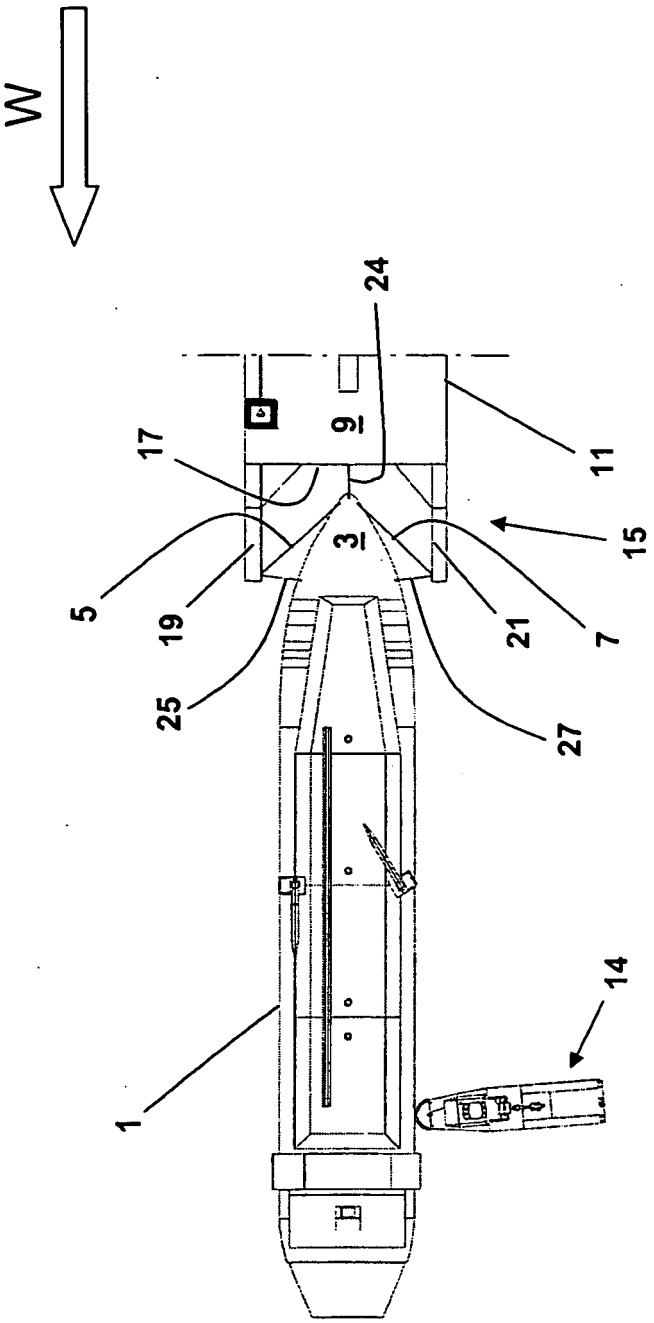


Fig. 3

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 20050204987 A1 **[0005]**
- WO 2008082306 A1 **[0006]**
- EP 1227971 B1 **[0008] [0009]**
- EP 1462358 B1 **[0010]**