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

(11) **EP 2 872 439 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
06.09.2017 Bulletin 2017/36

(21) Application number: **13759826.4**

(22) Date of filing: **08.07.2013**

(51) Int Cl.:
B66D 1/39 *(2006.01)*

(86) International application number:
PCT/NL2013/050512

(87) International publication number:
WO 2014/014344 (23.01.2014 Gazette 2014/04)

(54) **MARINE WINCH ASSEMBLY**

SCHIFFSWINDENANORDNUNG

ENSEMBLE TREUIL MARIN

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

(30) Priority: **16.07.2012 NL 1039735**

(43) Date of publication of application:
20.05.2015 Bulletin 2015/21

(73) Proprietor: **Itrec B.V.**
3115 HH Schiedam (NL)

(72) Inventors:
- **ROODENBURG, Joop**
  3115 HH SCIEDAM (NL)
- **WETERINGS, Hendrikus Jacobus**
  3115 HH SCHIEDAM (NL)

(74) Representative: **EP&C**
P.O. Box 3241
2280 GE Rijswijk (NL)

(56) References cited:
FR-A1- 2 417 466
GB-A- 1 028 551
US-A- 3 456 899
US-A- 4 218 025

EP 2 872 439 B1

Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The invention relates to a winch assembly according to the preamble of claim 1, comprising:

- a supporting rail;
- a carriage movably supported on said supporting rail;
- a cable drum having a cylindrical core, drum walls on the sides and a longitudinal axis, said longitudinal axis parallel to the supporting rail and said cable drum rotatably supported on said carriage;
- a first drive unit supported by the carriage for rotating the cable drum;
- a second drive unit for moving the carriage relative to the supporting rail to displace the cable drum along the supporting rail; and
- wherein the supporting rail extends through the carriage and through the cable drum.

[0002] Winch assemblies are used extensively in hauling, pulling and hoisting machines for raising and lowering loads, particularly heavy loads. For example, they are commonly used in well drilling rigs to raise and lower drilling tools and/or sensing instruments. Winch assemblies include a cable drum that supports a spool of cable that runs to the load, usually through one or more sheaves. The cable is taken in and payed out by rotating the drum.

[0003] The winch typically includes a high torque first drive unit for rotating the cable drum. This first drive unit can for example comprise an electric motor with high torque gear reduction or a hydraulic motor. A brake or clutch can be provided to prevent unwanted slippage of the cable drum and to avoid damaging the first drive unit. When the cable drum turns, the cable winds onto the drum and creates tension in the cable. As long as the cable is fed perpendicular, or with an angle preferably not exceeding 1°, to the rotational axis of the drum, the cable will generally wind evenly on the drum. This can generally be achieved by increasing the distance between cable and the first guide element (e.g. sheave) to which the cable extends.

[0004] However, it is more common that it is not possible for the cable to be fed perpendicular to the rotational axis of the drum. During spooling, as a result the subsequent turns will not lie next to each other, and as a result no even distribution of wire in layers is achieved, and a new turn may then be pulled between the cables of a previous layer. Possibly, the cable winds over itself, it jams (and possibly becomes damaged), whereby the cable must be unjammed and manually guided onto the drum evenly. The process may be repeated several times before the cable is completely wound on the drum. This method is not only time consuming and annoying, but also may significantly reduce the life of the cable. In addition, there is always the danger that the cable will break or become significantly weakened unknowingly.

[0005] Upon using a winch assembly, it is thus required to ensure that the cable is wound (e.g., spooled) evenly about the circumference of the winch drum in multilayers, and unwound smoothly therefrom. This is particularly true when it is critical that the load to which the cable is connected be moved smoothly and without any sudden jerks. Therefor, winch assemblies are designed which allow an even distribution of its cable along the length of the winch drum, and allow unwinding of the cable perpendicular to the drum axis.

[0006] US 3,456,899 for example discloses an apparatus for aligning a winch drum with respect to a guide pulley so that a cable is wound uniformly onto and off of the drum. The drum is mounted on a carriage driven along a pair of rails to keep the cable being wound onto or off the drum aligned with the guide pulley over which said cable passes. A cam having a cable-sensor thereon is swingably mounted on a frame between the drum and the pulley so that as the angle between pulley and the point of contact between the drum and the cable leaving or approaching the drum starts to increase, said cam will actuate the carriage drive to keep said point and pulley aligned.

[0007] GB1028551 discloses a rope or cable winch with a mechanism for displacing the winch on a rail track. The winch comprises a rotatable drum mounted on the exterior of a carriage. The rail track extends through the carriage and the drum along the axial direction of the drum. Bearing pulleys and supporting rollers to movably support the carriage on said rail track are provided in the interior of the carriage.

[0008] It is an object of the present invention to provide an improved design of a winch assembly.

[0009] This object is achieved according to the characterizing portion of claim 1, in that the carriage comprises a first and a second carriage part, said first and second carriage parts both provided adjacent a drum wall of the cable drum.

[0010] An advantage of this configuration is that the ends of the supporting rail can easily be connected, e.g. via a pin construction. This allows an improved interplay of forces, allowing the forces on the supporting rail to be transferred to the construction. In particular, the present design allows the winch assembly to support hoist cables for a crane capable of supporting loads up to a few hundred tons.

[0011] Another advantage of such a movable carriage is that winding and unwinding essentially perpendicular to the rotational axis of the drum can be achieved without increasing the distance between the winch and the first guide element to which the cable extends, and that the entire configuration can be more compact, resulting in improved and more flexible design options.

[0012] The marine winch assembly is in particular suitable for appliances situated on board of vessels intended for handling submerged loads which are hooked onto the end of the cable. Conventional cable lengths may vary between a few hundred metres up to a few kilometres, e.g. 500 meter - 5km.

[0013] The cable used in the marine winch assembly according to the invention can be a massive steel cable or a rope, which can be made from natural or synthetic fibers, in particular polymer fibers. Possibly, aromatic polyamids (aramids) are applied, such as Twaron, Kevlar and Nomex, which thermally degrade at high temperatures and do not melt. These fibers have strong bonding between polymer chains, resulting in a high-performance man-made fiber. The material of the cable may be dependent from environmental conditions. It is conceivable that in some instances, electrical signal conductors, optical conductors etc. may form part of the cable, such as for example in umbilical cables.

[0014] The dimensions of the marine winch assembly according to the invention when a rope is being wound and unwound from the cable drum are large, having a stroke of the cable drum in the longitudinal direction of 2 - 5 meter, in particular 3 - 4 meter, and a diameter of 3 - 5 meter without rope, and up to 6 - 7 meter including the rope.

[0015] In an embodiment, it is envisaged that the winch is used for spooling pipelines to be laid on the seabed. In this embodiment, the cable is thus embodied as a pipeline, which can be a rigid or a flexible pipeline, with a diameter up to 50 cm. The cable drum is then the same as what is frequently called a 'reel', in the context of 'reel-lay pipelaying'. The dimensions of the marine winch assembly will then be much larger than indicated above: the reel (cable drum) having a stroke in the longitudinal direction of 7-15 meter, in particular 10 meter, and a diameter of 15-20 meter without pipeline, and up to 30 - 40 meter including the pipeline.

[0016] The winch assembly according to the present invention can be used in combination with any type of sensor system to accurately drive the second drive unit. A tangle-free winding of a cable about the cable drum is preferably relied on an electromechanical sensing device used to control the traverse movements of the carriage in accordance with a desired lag angle and a desired manner and rate of coiling of the cable about the cable drum.

[0017] The invention is further elucidated in relation to the attached drawings, in which:

Fig. 1 shows a side view of a winch assembly according to the present invention;
Fig. 2 shows a top view of the winch assembly of fig. 1;
Fig. 3 shows a detail of the winch assembly of fig. 1;
Fig. 4 shows part of the winch assembly of fig. 1 in cross section;
Fig. 5 shows a detail of the winch assembly of fig. 1;
Figs. 6a and 6b show a winch assembly according to the invention mounted in the hull of a vessel in perpendicular side views.

[0018] In figs. 1-3 a marine winch assembly 1 according to the present is shown in various views. The marine winch assembly 1 comprises a supporting rail 2, a carriage 3 which is movably supported on said supporting rail 2 and a cable drum 4. The cable drum has a longitudinal axis 5, parallel to the supporting rail 2.

[0019] According to the present invention, the supporting rail 2 extends through the carriage 3 and through the cable drum 4, while the cable drum 4 is rotatably supported on said carriage 3.

[0020] The supporting rail 2 is here embodied as an essentially square, elongated beam. In the shown embodiment, the rail is composed of welded plates, alternatively it is conceivable that the rail is of a massive construction. Corners 2a-2d of the beam act as a bearing surface for the carriage 3, which is movably supported by this supporting rail 2. In a possible embodiment, the bearing surfaces are machined planar surfaces.

[0021] Other configurations of the supporting rail are also conceivable. The functions of the rail are carrying the weight of the carriage and the cable drum, providing a bearing surface for the carriage and withstanding torsion forces exerted by the first drive unit. As the carriage supports the first drive unit it should at all times be prevented that the carriage can rotate, which is inherently achieved by a cross-section of the supporting rail not allowing rotation, i.e. a non-circular cross-section. Any configuration, either hollow or massive of the rail is possible. Polygonal cross sections are preferred, e.g. pentagonal or octagonal cross-sections.

[0022] In fig. 2 one end of the supporting rail 2 is visible, which in this embodiment is provided with an end plate 8. This end plate 8 is suitable for mounting the marine winch assembly. In the embodiment of fig. 2, pins 9 are used to mount the supporting rail 2 to a support 10, which can e.g. be a structure mounted on a deck of a vessel, or a pedestal of a crane, or the hull of a vessel, etc. etc.

[0023] The cable drum 4 may also be referred to as a reel, having a cylindrical core 4a and drum walls 4b on the sides, to retain the material wound around the core 4a. Reinforcement plates 4c are additionally provided in this embodiment, visible in detail in fig. 5. According to the invention the core 4a is hollow, to allow the supporting rail 2 to extend through it.

[0024] The carriage 3 in the shown embodiment is configured such that it comprises two carriage parts 3a and 3b, provided adjacent both drum walls 4b of the cable drum 4. It is conceivable, but not necessary, that the carriage parts 3a and 3b are connected to each other inside the hollow core 4a of the cable drum.

[0025] A second drive unit 30 is provided for moving the carriage 3 relative to the supporting rail 2, to displace the cable drum 4 along the supporting rail 2. The second drive unit 30 in this embodiment is based on a rack and pinion principle. A rack 31 is provided, here extending on top of and parallel to the supporting rail 2, over which a set of pinions 33 is movable, provided opposite of each other on either side of the rack 31. In fig. 2 three different positions of the sets of pinions 33 are visible. It is noted that alternative drive systems, e.g. based on a gears in

transmission or a hydraulically or pneumatically controlled cylinders or winches and wires, or spindles are also conceivable.

[0026] As visible in fig. 1, in the shown embodiment the second drive unit 30 comprises two sets of pinions 33, for each carriage part 3a, 3b. Each set of pinions 33 is driven by its own motor 32.

[0027] The carriage 3 is thus moveable relative to the supporting rail 2 by the second drive unit 30, which in the shown embodiment is supported by the carriage. Alternatively, it is also conceivable that the motor of the second drive unit is provided adjacent the marine winch assembly, and not supported by the carriage.

[0028] As visible in fig. 4, the carriage 3 is movably supported by the supporting rail 2 at the corners 2a-2d, acting as a bearing surface for the carriage 3. Any type of bearing between the supporting rail 2 and the carriage 3 is conceivable, e.g. wheels, rollers, skid pads, etc.

[0029] In the shown embodiment a carriage part 3a is shown, of which only the upper left part is shown in detail in fig. 4. The carriage part 3a comprises a support plate 27, supporting wheels 25a, 25b which roll over these bearing surfaces of the supporting rail 2. In particular, in the shown embodiment each corner 2a-2d of the supporting rail 2 is provided with two perpendicular bearing surfaces, over each one at least one wheel 25a, 25b is moveable. Although in fig. 3 only 2 wheels are visible, four corners each having two bearing surfaces result in at least 8 wheels per carriage part 3a, 3b. The wheels 25a, 25b are mounted via the support plate 27 to the frames of the carriage parts.

[0030] In the shown embodiment, not just one wheel is provided to roll over the corners, but pairs of wheels known as 'bogies', having parallel rotation axes and suspended behind each other from a single suspension point. In the upper view of fig. 2 corners 2c and 2d are visible, and here the 'bogies' (sets of wheels) 25a'and 25a" are visible rolling over one of the bearing surfaces of corner 2d. An advantage of using bogies is that the position of the wheels is adjustable to arrive at an optimized load distribution with the supporting rail 2, thus contributing to an improved suspension of the carriage 3 with the cable drum 4. Using bogies the load of the drum is spread over a larger surface of the rail, which is advantageous to prevent stress concentrations in the rail.

[0031] In fig. 3 a detail of such a bogie 25 is visible having wheels 25a' and 25a". Here another improvement is visible: the rotation axles 26' and 26" of the wheels 25a'and 25a" are mounted on an excenter 28', 28", for adjusting the distance of the wheel to the rail bearing surface. This also contributes to an optimized load distribution of the carriage 3 on the supporting rail 2, as the load is spread more equally over the wheels.

[0032] Not visible, but yet another advantageous option to further optimize the fit of the carriage on the supporting rail is to adjust the position of the support plate 27 of the bogies, to minimize the bending moment introduced in the carriage by the forces on the drum..

[0033] In this embodiment, the support plate 27 is embodied as an end plate of the carriage essentially adjacent to the drum, as is visible in fig. 1.

[0034] Preferably, the support plate 27 is provided with a knife edge bearing on which the bogie is mounted.

[0035] A first drive unit 20 for rotating the drum is according to the invention supported by the carriage 3. In the shown embodiment, the first drive unit 20 comprises 12 motors 21, each carriage part 3a, 3b supporting 6 motors, all extending to the drum walls 4b of the cable drum 4.

[0036] In the shown embodiment, the first drive unit is based on a meshing gear principle. Other transmission principles are also conceivable, which may be in particular dependent on the type of motor being applied. The transmission of the rotational forces is in this embodiment achieved by providing the motors 21 with pinions 22 , meshing with an outer ring gear 29 provided on the drum .

[0037] The cable drum 4 is rotatably supported by the carriage 3 via a bearing. In the shown embodiment a roller bearing is being applied, in particular visible in fig. 5, comprising a horizontal carriage bearing surface 35 is provided, opposite a horizontal cable drum bearing surface 36, between which rollers 37 are positioned. In this embodiment, as is preferred, but not required, the cable drum bearing surface 36 is formed integral with the outer ring gear 29.

[0038] Preferably, the marine winch assembly is provided with a sensor for measuring a cable angle of a cable being spooled onto or off the cable drum is provided, which sensor is coupled with actuating means for driving the second drive unit to control the position of the carriage based on the input of the sensor.

[0039] Figs. 6a and 6b show a winch assembly 100 according to the invention, suitable for hoisting loads with a crane 101. The crane 101 is mounted on a pedestal 102, mounted on deck 103 of a vessel 105. in the hull of a vessel 106 the winch assembly 100 is mounted, wherein the ends of the rail 110 are connected to portions of the hull 106.

Claims

1. Marine winch assembly (1), comprising:

- a supporting rail (2);
- a carriage (3) movably supported on said supporting rail;
- a cable drum (4) having a cylindrical core (4a), drum walls (4b) on the sides and a longitudinal axis (5), said longitudinal axis parallel to the supporting rail and said cable drum rotatably supported on said carriage;
- a first drive unit supported by the carriage for rotating the cable drum;
- a second drive unit (30) for moving the carriage relative to the supporting rail to displace the ca-

ble drum along the supporting rail;
- wherein the supporting rail extends through the carriage and through the cable drum

characterized in that
the carriage comprises a first and a second carriage part (3a; 3b); said first and second carriage parts both provided adjacent a drum wall of the cable drum.

2. Marine winch assembly according to claim 1, wherein the cable drum is rotatably supported on the first carriage part (3a) via a first bearing and on the second carriage part (3b) via a second bearing.

3. Marine winch assembly according to one or more of the preceding claims , wherein
the supporting rail has a polygonal, preferably a square or pentagonal, cross-section, and wherein the corners of the supporting rail are configured as bearing surfaces for the carriage.

4. Marine winch assembly according to one or more of the preceding claims, wherein
the supporting rail is provided with at least one end plate (8) for mounting the supporting rail and the marine winch assembly to a support (10).

5. Marine winch assembly according to one or more of the preceding claims, wherein
the second drive unit (30) comprises one or more pinions (33), interacting with a rack (31) provided on the supporting rail.

6. Marine winch assembly according to one or more of the preceding claims, wherein
the carriage is movably supported on said supporting rail via bogies (25), which bogies are supported by the carriage and roll on a bearing surface provided on the supporting rail.

7. Marine winch assembly according to claim 6, wherein the rotation axles of the bogies are mounted on an excenter.

8. Marine winch assembly according to one or more of the preceding claims, wherein
the marine winch assembly is provided with a sensor for measuring a cable angle of a cable being spooled onto or off the cable drum is provided, which sensor is coupled with actuating means for driving the second drive unit to control the position of the carriage based on the input of the sensor.

9. Marine winch assembly according to one or more of the preceding claims, wherein
the second drive unit is supported by the carriage.

10. Marine winch assembly according to one or more of the preceding claims, wherein
the cable drum is rotatably supported by the carriage via a bearing, comprising a cable drum bearing surface, and wherein the drum is provided with an outer gear ring for receiving the transmission of the first drive unit, wherein the cable drum bearing surface is formed integral with the outer ring gear.

Patentansprüche

1. Marinewindenaufbau (1) umfassend:

- eine Tragschiene (2);
- ein Traggestell (3), welches beweglich auf der Tragschiene gelagert ist;
- eine Kabeltrommel (4), einen zylindrischen Kern (4a), Trommelwände (4b) an den Seiten und eine longitudinale Achse (5) aufweisend, wobei die longitudinale Achse parallel zur Tragschiene verläuft und die Kabeltrommel drehbar auf dem Traggestell gelagert ist;
- eine erste Antriebseinheit gestützt von dem Traggestell, um die Kabeltrommel zu drehen;
- eine zweite Antriebseinheit (30), um das Traggestell relativ zur Tragschiene zu bewegen um die Kabeltrommel entlang der Tragschiene zu verschieben;
- wobei die Tragschiene sich durch das Traggestell und die Kabeltrommel erstreckt,

dadurch gekennzeichnet, dass
das Traggestell ein erstes und zweites Traggestellteil (3a; 3b) umfasst; wobei das erste und das zweite Traggestellteil benachbart zu einer Trommelwand der Kabeltrommel bereitgestellt sind.

2. Marinewindenaufbau nach Anspruch 1, wobei die Kabeltrommel mittels eines ersten Lagers auf dem ersten Teil des Traggestells (3a) und auf dem zweiten Traggestellteil (3b) mittels eines zweiten Lagers drehbar getragen ist.

3. Marinewindenaufbau nach einem oder mehreren der vorhergehenden Ansprüche, wobei die Tragschiene ein polygonales, vorzugsweise ein quadratisches oder fünfeckiges, Profil aufweist und wobei die Ecken der Tragschiene als Lagerflächen für das Traggestell ausgelegt sind.

4. Marinewindenaufbau nach einem oder mehreren der vorhergehenden Ansprüche, wobei die Tragschiene mit mindestens einer Endplatte (8) ausgestattet ist, um die Tragschiene und den Marinewindenaufbau an einem Träger (10) anzubringen.

5. Marinewindenaufbau nach einem oder mehreren der vorhergehenden Ansprüche, wobei die zweite

Antriebseinheit (30) ein oder mehrere Zahnräder (33) umfasst, welche mit einer Zahnstange (31), die auf der Führungsschiene bereitgestellt ist, wechselwirken.

6. Marinewindenaufbau nach einem oder mehreren der vorhergehenden Ansprüche, wobei das Traggestell beweglich auf der genannten Stützschiene mittels Fahrgestellen (25) gestützt ist, wobei die Fahrgestelle vom Traggestell gestützt werden und auf einer von der Tragschiene bereitgestellten Lagerfläche laufen.

7. Marinewindenaufbau nach Anspruch 6, wobei die Drehachsen der Rollenpaare auf einem Exzenter angebracht sind.

8. Marinewindenaufbau nach einem oder mehreren der vorhergehenden Ansprüche, wobei der Marinewindenaufbau mit einem Sensor zur Messung eines Kabelwinkels eines Kabels, welches auf die Kabelwinde auf oder von der Kabelwinde abgespult wird, ausgestattet ist, wobei dieser Sensor mit einer Antriebssteuerung zur Steuerung der zweiten Antriebseinheit verbunden ist, um die Position des Traggestells basierend auf dem Sensoreingangssignal zu regeln.

9. Marinewindenaufbau nach einem oder mehreren der vorhergehenden Ansprüche, wobei die zweite Antriebseinheit von dem Traggestell gestützt wird.

10. Marinewindenaufbau nach einem oder mehreren der vorhergehenden Ansprüche, wobei die Kabeltrommel drehbar mittels eines Lagers auf dem Traggestell angebracht ist, umfassend eine Lagerfläche für die Kabeltrommel, und wobei die Trommel mit einem äußeren Zahnkranz ausgestattet ist, um die Kraftübertragung der ersten Antriebseinheit zu erhalten, wobei die Auflagefläche der Kabeltrommel und der äußere Zahnkranz als ein Bauteil gestaltet sind.

Revendications

1. Ensemble de treuil marin (1) comprenant :

un rail de support (2) ;
un chariot (3) supporté, de manière mobile, sur ledit rail de support ;
un tambour de câble (4) ayant un noyau cylindrique (4a), des parois de tambour (4b) sur les côtés et un axe longitudinal (5), ledit axe longitudinal étant parallèle au rail de support et audit tambour de câble supporté, de manière rotative sur ledit chariot ;
une première unité d'entraînement supportée par le chariot pour faire tourner le tambour de câble ;
une seconde unité d'entraînement (30) pour déplacer le chariot par rapport au rail de support afin de déplacer le tambour de câble le long du rail de support ;
dans lequel le rail de support s'étend à travers le chariot et à travers le tambour de câble, caractérisé en ce qui :

le chariot comprend une première et une seconde partie de chariot (3a ; 3b) ; lesdites première et seconde parties de chariot étant toutes deux prévues de manière adjacente à une paroi de tambour du tambour de câble.

2. Ensemble de treuil marin selon la revendication 1, dans lequel le tambour de câble est supporté, en rotation, sur la première partie de chariot (3a) via un premier palier et sur la seconde partie de chariot (3b) via un second palier.

3. Ensemble de treuil marin selon une ou plusieurs des revendications précédentes, dans lequel le rail de support a une section transversale polygonale, de préférence carrée ou pentagonale, et dans lequel les coins du rail de support sont configurés comme des surfaces de palier pour le chariot.

4. Ensemble de treuil marin selon une ou plusieurs des revendications précédentes, dans lequel le rail de support est prévu avec au moins une plaque d'extrémité (8) pour monter le rail de support et l'ensemble de treuil marin sur un support (10) .

5. Ensemble de treuil marin selon une ou plusieurs des revendications précédentes, dans lequel la seconde unité d'entraînement (30) comprend un ou plusieurs pignons (33), interagissant avec une crémaillère (31) prévue sur le rail de support.

6. Ensemble de treuil marin selon une ou plusieurs des revendications précédentes, dans lequel le chariot est supporté, de manière mobile, sur ledit rail de support, via des bogies (25), lesquels bogies sont supportés par le chariot et roulent sur une surface de palier prévue sur le rail de support.

7. Ensemble de treuil marin selon la revendication 6, dans lequel les essieux de rotation des bogies sont montés sur un excentrique.

8. Ensemble de treuil marin selon une ou plusieurs des revendications précédentes, dans lequel l'ensemble de treuil marin est prévu avec un capteur pour mesurer un angle de câble d'un câble qui est enroulé sur et déroulé du tambour de câble, lequel capteur

est couplé avec des moyens d'actionnement pour entraîner la seconde unité d'entraînement afin de contrôler la position de chariot en fonction du résultat du capteur.

9. Ensemble de treuil marin selon une ou plusieurs des revendications précédentes, dans lequel la seconde unité d'entraînement est supporté par le chariot.

10. Ensemble de treuil marin selon une ou plusieurs des revendications précédentes, dans lequel le tambour de câble est supporté en rotation par le chariot via un palier, comprenant une surface de palier de tambour de câble, et dans lequel le tambour est prévu avec une couronne dentée externe pour recevoir la transmission de la première unité d'entraînement, dans lequel la surface de palier de tambour de câble est formée de manière solidaire avec la couronne dentée externe.

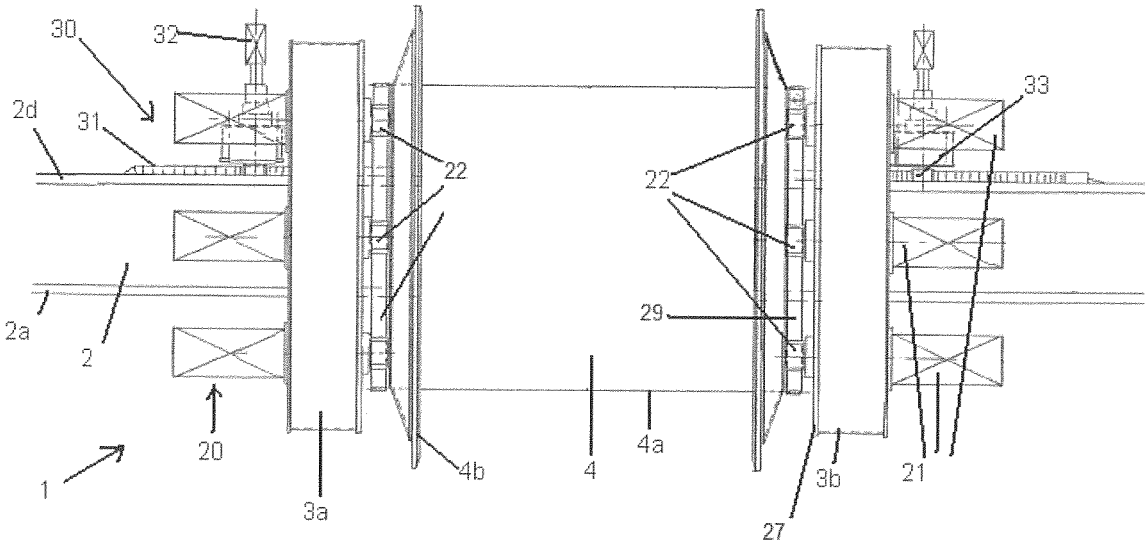
30
32
2d
31
22
22
33
29
2a
2
20
1
3a
4b
4
4a
3b
21
27

Fig. 1

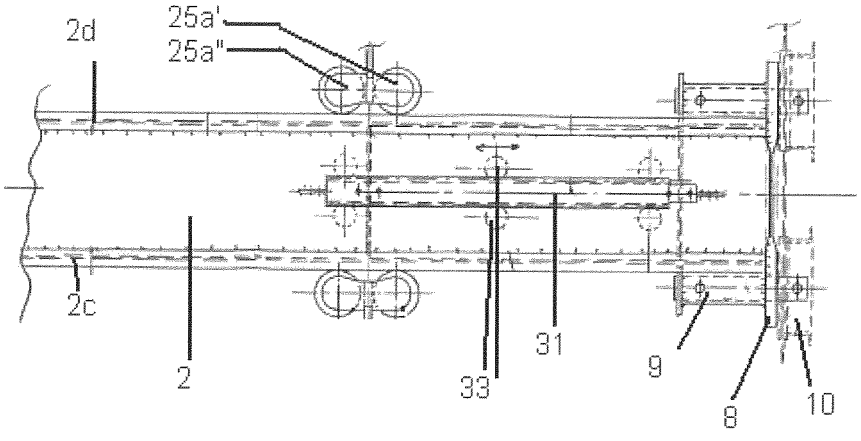
2d
25a'
25a"
2c
2
33
31
9
8
10

Fig. 2

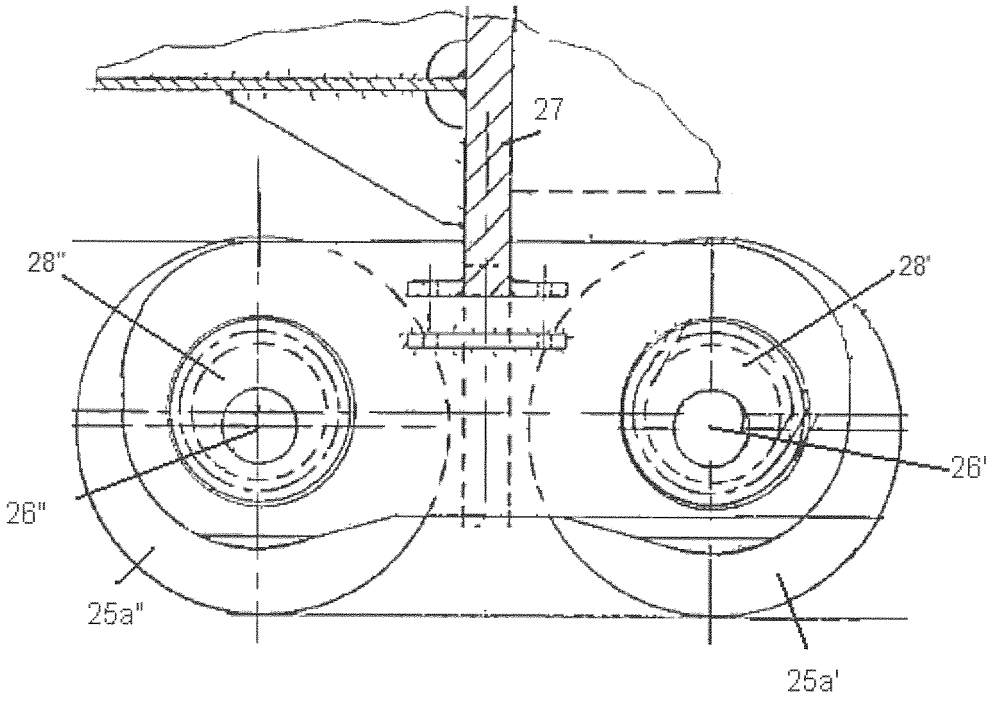

Fig. 3

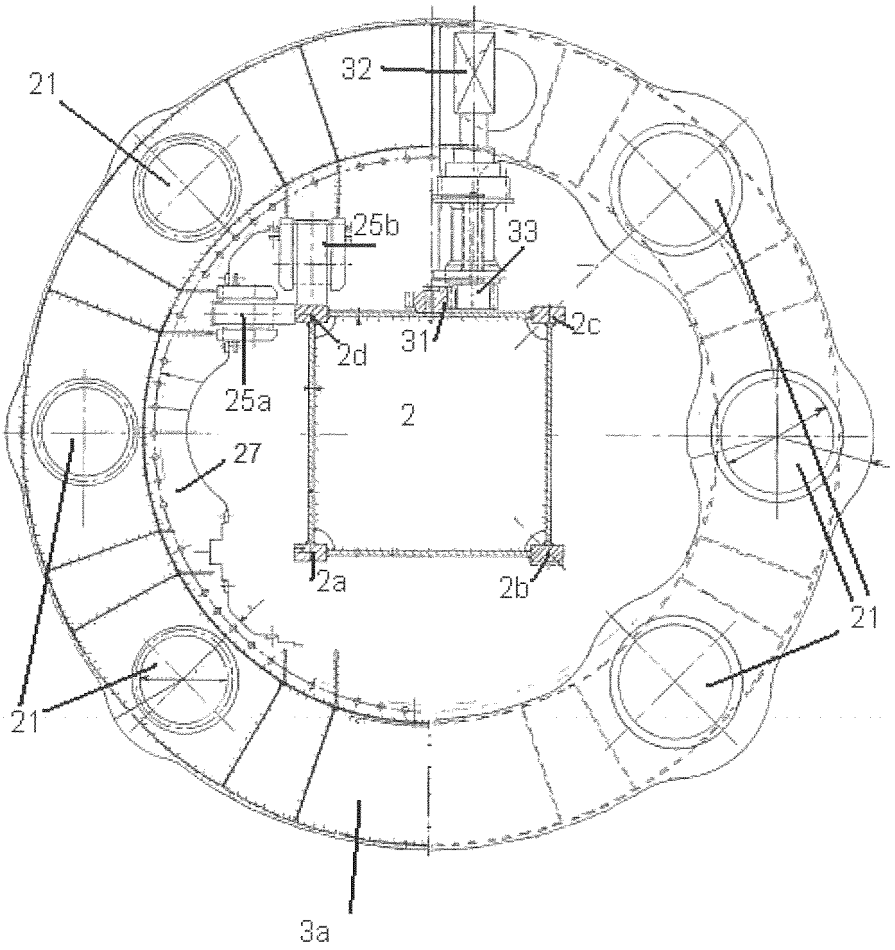

Fig. 4

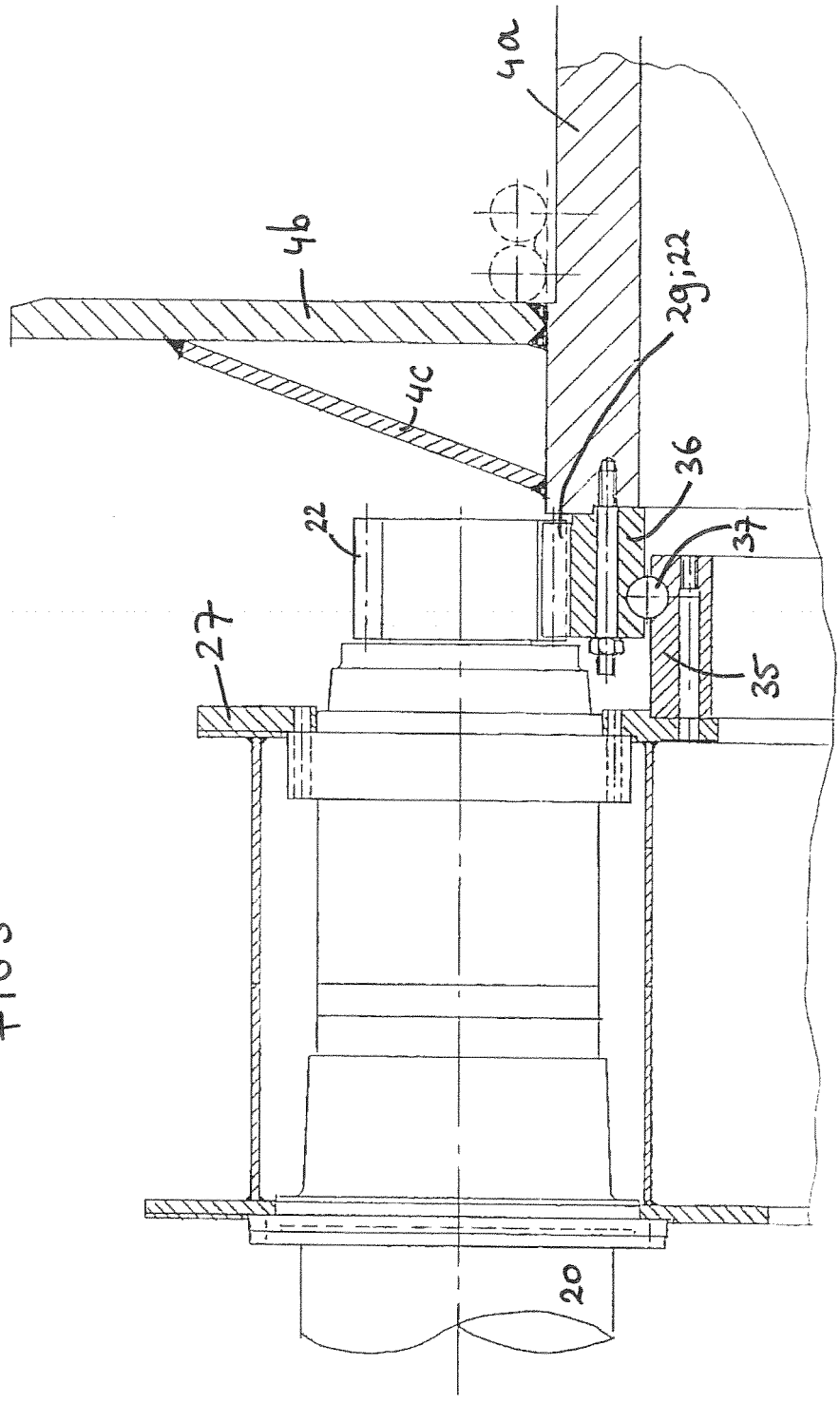

FIG 5

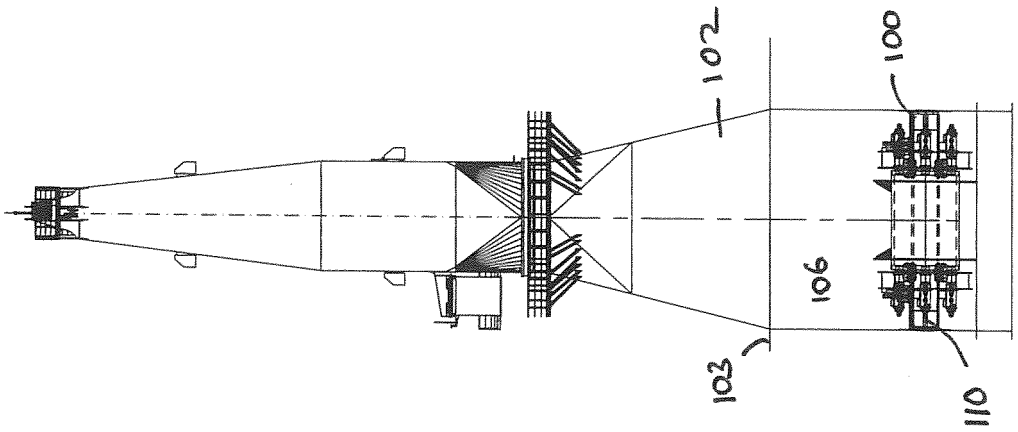

FIG6B

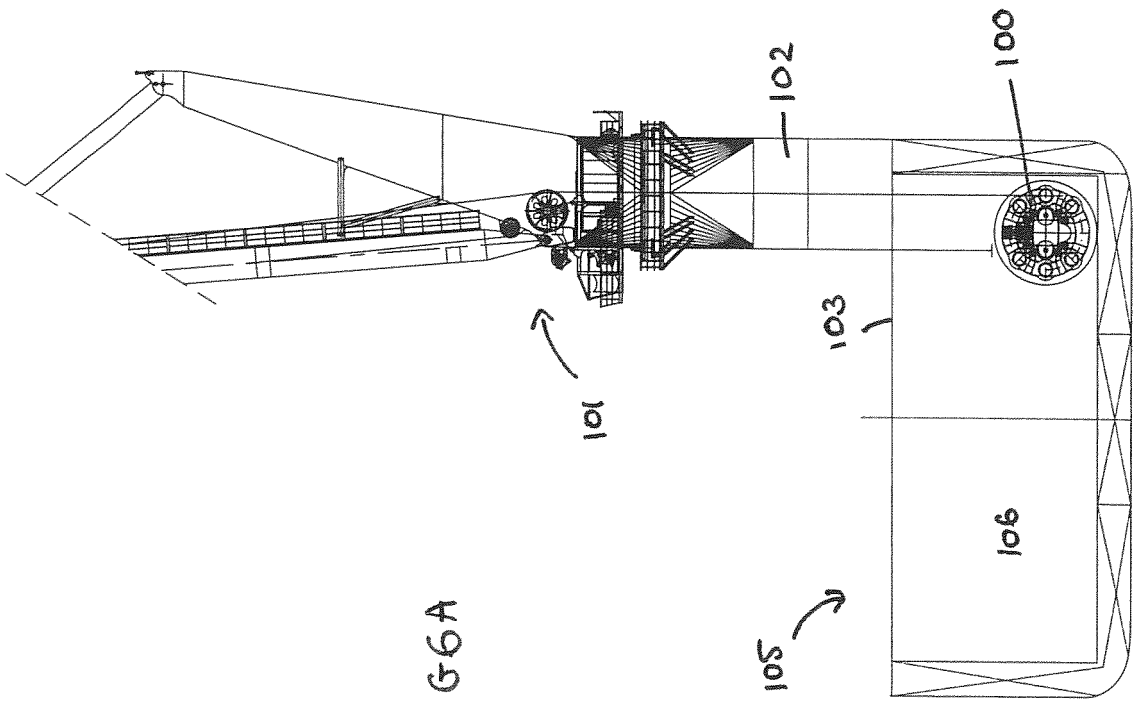

FIG6A

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 3456899 A **[0006]**
- GB 1028551 A **[0007]**