



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
03.02.2016 Bulletin 2016/05

(51) Int Cl.:
B66D 1/38 (2006.01)

(21) Application number: **15179102.7**

(22) Date of filing: **30.07.2015**

(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
Designated Extension States:
BA ME
Designated Validation States:
MA

(71) Applicant: **Harken Italy S.p.A.**
22070 Limido Comasco (CO) (IT)

(72) Inventor: **CAZZARO, Michele**
I-21023 Besozzo (VA) (IT)

(74) Representative: **Checacci, Giorgio et al**
Porta, Checacci & Associati S.p.A.
Via Trebbia 20
20135 Milano (IT)

(30) Priority: **30.07.2014 IT MI20141389**

(54) **Winch with a cable-guiding device**

(57) This captive winch (1) comprises: a pulling drum (10) which can be rotatably operated around a respective longitudinal axis (A) to wind/unwind a cable (2) subjected to traction from a direction substantially parallel to the longitudinal axis (A) of the pulling drum (10); a guide track (33) parallel to the longitudinal axis (A) and spaced therefrom; and a cable-guiding device (20), arranged side-by-side the pulling drum (10) and comprising a body (21), slidably engaged along a guide track (33) parallel to the

longitudinal axis (A) and adapted to translate on the guide track (33) upon rotation of the pulling drum (2) in order to guide the winding/unwinding of the cable (2) on/from the pulling drum (10). The cable-guiding device (20) comprises a supporting shoulder (25), which rests on the pulling drum (10), on one side (14) thereof. The winch (1) is thus able to support axial loads that are even quite heavy, thanks to the resting of the supporting shoulder (25) on the side (14) of the pulling drum.

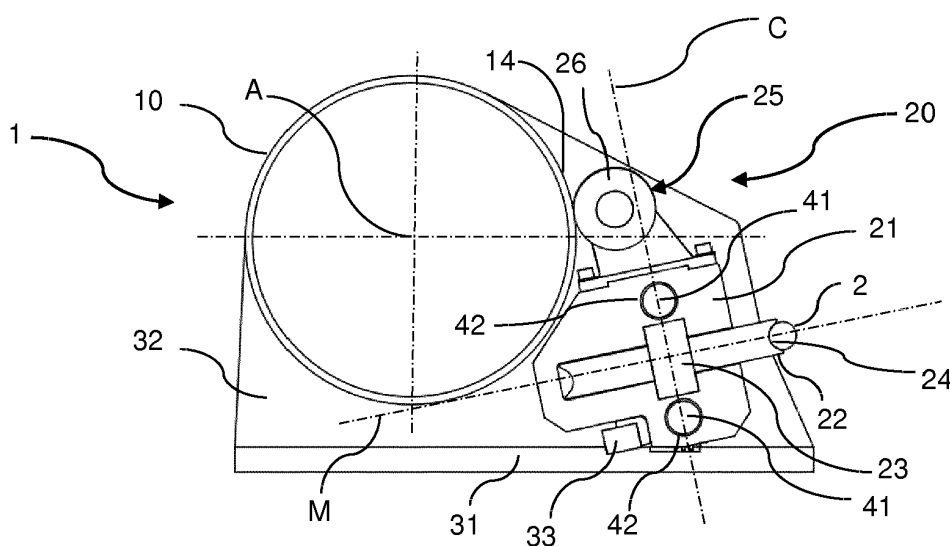


Fig. 2

Description

[0001] The present invention refers to a captive winch, preferably but not exclusively intended for the nautical field.

[0002] In the present description and subsequent claims, with the term "cable" it is generically intended to indicate any flexible elongated element adapted to support traction loads and be wound on a reel, such as a wire, a cord, a rope, a tape, a chain, a line, a sheet, etc. made of metallic, textile or composite material or combinations thereof.

[0003] In cable collecting winches, also known as captive winches, the recovered cable is entirely collected and wound on the drum of the winch. These winches are normally motorized and are capable of supporting static and dynamic loads that are even quite heavy (even greater than 20 tons). In the nautical field, for example, these are typically employed for driving sheets on sailboats of large size.

[0004] The captive winches essentially comprise a pulling drum which can be rotatably operated around a respective longitudinal axis to wind/unwind the cable and a cable-guiding device in order to guide the winding/unwinding of the cable on the pulling drum.

[0005] The cable-guiding device ensures that the cable is distributed on the pulling drum in a uniform manner. In particular, particularly important if the cable is made of textile material, the cable-guiding device avoids overlapping which can obstruct a subsequent driving of the winch and/or damage the cable. For such purpose, the cable-guiding device is kinematically connected with the pulling drum in such a way that a complete rotation of the pulling drum corresponds to a movement of the cable-guiding device along a direction parallel to the longitudinal axis of the pulling drum for a section of a predetermined length, typically equal to the diameter of the cable to be wound/unwound.

[0006] Different structural solutions are known for providing the kinematic connection between the pulling drum and the cable-guiding device, each of which reflects on the features and performances of the captive winch that incorporates them.

[0007] In a first known structural solution, the cable-guiding device is arranged side-by-side the pulling drum and comprises a screw-nut assembly, wherein the screw is arranged parallel to the pulling drum and kinematically connected thereto by means of a gear or chain/belt transmission; the nut screw supports a guide element. By means of a suitable sizing of the transmission ratio between the pulling drum and the screw of the screw-nut assembly, it is possible to obtain the desired correspondence between rotation of the pulling drum and translation of the cable-guiding device.

[0008] In these winches, configurations can be easily obtained with return of the cable exiting from the winch in axial direction, parallel to the longitudinal axis of the pulling drum. Captive winches of this type are capable

of supporting heavy loads that are purely axial or in any case that have a major axial component. These configurations can be advantageous in some applications, since the outlet direction of the cable remains fixed and independent from the point of winding/unwinding on the pulling drum, and the operative space necessary around the winch is reduced to the minimum.

[0009] In a second known structural solution, the pulling drum is provided with a helical groove at its external surface and the cable-guiding device - arranged side-by-side the pulling drum - comprises a slider element that is engaged with such helical groove and is free to translate along a guide track parallel to the longitudinal axis of the pulling drum. In this manner, it is obtained that a complete rotation of the pulling drum directly corresponds to a translation of the cable-guiding device equal to the pitch of the helical groove, without using an intermediate transmission.

[0010] This second structural solution overcomes the drawbacks of the previously described solution with regard to the bulk and structural complexity, but due to the slide engagement between the pulling drum and the cable-guiding device, it is not suitable for supporting heavy axial loads on its own. Therefore, a configuration with outlet of the cable in axial direction or with a major axial component is only achievable in this case with the use of further suitable return elements that are separate from the winch and adapted to support the axial load. This, however, is to the detriment of the operative space that must be arranged around the winch.

[0011] A further structural solution, described in EP 2151411-A1, provides that the pulling drum and the cable-guiding device form a screw-nut assembly, in which more precisely the pulling drum and the cable-guiding device are the screw and the nut screw respectively; therefore the cable-guiding device completely surrounds the pulling drum.

[0012] With this structural solution, it is possible to provide a captive winch that is structurally simple, with limited bulk and, simultaneously, capable of supporting relatively heavy loads, even with outlet of the cable in axial direction.

[0013] Nevertheless, for very heavy loads, especially in the case of outlet of the cable in axial direction, none of the previously described solutions is truly effective.

[0014] Object of the present invention is to provide a captive winch which ensures the capacity of supporting very heavy loads.

[0015] The invention therefore relates to a captive winch according to claim 1. Preferred features of such captive winch are set forth in the dependent claims.

[0016] More particularly, a captive winch according to the invention comprises:

- a pulling drum which can be rotatably operated around a respective longitudinal axis to wind/unwind a cable subjected to traction from a direction substantially parallel to the longitudinal axis of the pulling

drum,

- a guide track parallel to the longitudinal axis and spaced therefrom, and
- a cable-guiding device, arranged side-by-side the pulling drum and comprising a body, slidably engaged along the guide track parallel to the longitudinal axis and adapted to translate on the guide track upon rotation of the pulling drum in order to guide the winding/unwinding of the cable on/from the pulling drum,

characterized in that the cable-guiding device comprises a supporting shoulder, which rests on the pulling drum on one side thereof.

[0017] The winch is thus capable of supporting axial loads that are even very heavy, thanks to the shoulder resting just on the side of the pulling drum. Indeed, the load in axial direction on the cable under traction generates a thrust that tends to force the cable-guiding device towards the pulling drum, in radial direction with respect thereto; the presence of the supporting shoulder that rests directly on the side of the pulling drum allows distributing this radial load between the guide track and the resting on the side of the pulling drum.

[0018] Preferably, the supporting shoulder comprises at least one roller, with which the shoulder rests on the side of the pulling drum. The roller ensures a wide and safe support, with relatively limited contact pressures; two or more rollers can be provided, side-by-side or successive, in order to supply a greater distribution of the stresses.

[0019] Preferably, the roller has a rotation axis which is tilted at an angle with respect to the longitudinal axis. Preferably, the angle coincides with the winding angle imposed on the cable by the cable-guide, translated by the transmission which connects it to the rotation of the pulling drum. This angle will be such to orient the rolling direction of the roller substantially according to the winding direction of the cable, in such a way that lateral sliding of the roller is avoided, which under load would be a source of friction such to obstruct the rotation of the pulling drum, increasing the stresses. In a non-illustrated embodiment, the roller can be self-aligning, i.e. freely mounted to be oriented according to the stresses applied thereto (by the cable).

[0020] Preferably, the cable-guiding device comprises at least one return pulley for the cable, in order to guide the orientation of the cable with low friction from the arrival direction in the cable-guiding device (direction which can also be completely axial) to the winding direction on the pulling drum, tangential to the pulling drum.

[0021] Preferably, the roller and the return pulley are arranged in such a way that a plane P, which is orthogonal to the longitudinal axis A and passes through a center K of the roller, contains the rotation axis C of the return pulley, in such a way that the resulting force discharged by the cable and not supported by the other supports of the cable-guiding device (guide track and transmission)

is discharged on the center of the roller. In this manner, a well-balanced arrangement is obtained, capable of at best supporting stresses that are even very high.

[0022] Preferably, the winch comprises a transmission between the pulling drum and the cable-guiding device, such that with a rotation of 360° of the pulling drum, there is a corresponding movement of the cable-guiding device along the guide track for a length section corresponding to the winding pitch of the cable on the pulling drum. When the loads provided on the cable are very heavy, the synchronization assured by such a transmission reduces sliding and consequent friction, which would further increase the stresses.

[0023] The supporting shoulder can be rested on the side of the pulling drum downstream and/or upstream of a winding position of the cable on the pulling drum. In general, a downstream support will be preferable, i.e. directly on the pulling drum, so as not to involve the cable. Nevertheless, in some cases, an upstream support could be provided, i.e. on the cable already wound on the pulling drum, so as to minimize the bulk in axial direction; if maximum support is desired, a support upstream and one downstream could be provided, so as to have two resting areas on the two sides of the cable that is wound, i.e. of the area where the thrust of the cable-guiding device against the pulling drum is concentrated.

[0024] Preferably, the winding of the cable on the pulling drum proceeds from the end of the pulling drum which is remote with respect to the traction direction of the cable.

[0025] Further features and advantages of the present invention will be clearer from the following detailed description of a preferred embodiment thereof, made with reference to the attached drawings. In such drawings:

- figure 1 is a side view of a captive winch in accordance with the invention;
- figure 2 is a cross-section view of the winch of fig. 1, taken along the line II-II of fig. 1.

[0026] In the figures, reference number 1 overall indicates a captive winch according to the invention.

[0027] As shown in figure 1, the winch 1 essentially comprises a pulling drum 10, which can be rotatably operated by means of motor means 11 around a longitudinal axis A to wind/unwind a cable 2 (represented in section in figure 2 and only schematically in figure 1, so as to allow an improved visibility of the parts at the back) subjected to traction and axially oriented (i.e. in a direction parallel to the longitudinal axis A), and a cable-guiding device 20, arranged side-by-side the pulling drum and adapted to guide the winding/unwinding of the cable 2 on the pulling drum 10.

[0028] The pulling drum 10 and the cable-guiding device 20 are preferably mounted on a frame 30 essentially comprising a base 31 and support walls 32 for the pulling drum 10 and for the motor means 11. The base 31 can be suitably configured in accordance with the mounting

requirements of the winch 1. The support walls 32 are adapted to rotatably support the pulling drum 10 at its opposite longitudinal ends 12 and 13, in such a way that the longitudinal axis A lies substantially parallel to the base 31.

[0029] In the embodiment illustrated herein, the motor means 11, typically electric or hydraulic and in any case of known type, are provided at the single longitudinal end 13 of the pulling drum 10. In a non-illustrated embodiment, motor means could be provided at both ends, in order to reduce the stresses on the pulling drum 10, especially the twisting stresses during the winding of the cable 2 when the latter is subject to a high tension.

[0030] The cable-guiding device 20 is slidably mounted on the frame 30 in a direction parallel to the longitudinal axis A, alongside the pulling drum 10. For such purpose, the cable-guiding device 20 comprises a body 21, slidably engaged along a fixed guide track 33 arranged in the frame 30 of the winch 1, in a position parallel to the longitudinal axis A of the pulling drum 10 and spaced therefrom.

[0031] The cable-guiding device 20 comprises a return pulley 22 of the cable 2, rotatably and idly mounted in the body 21 around a pin 23, arranged according to a rotation axis C, perpendicular to and not coplanar with the longitudinal axis A, as shown in the drawings. The cable 2, during the winding, enters into the pulley 22 from an axial direction parallel to the longitudinal axis A and exits therefrom in a direction towards the pulling drum 10. The return pulley 22 has a peripheral groove 24, of section suitable for receiving the cable 2, and is arranged with its centerline plane M substantially tangent to the pulling drum 10, in such a way that the cable 2 exiting from the return pulley 22 and during winding/unwinding on the pulling drum 10 does not stress the sides of the groove 24.

[0032] The pulling drum 10 and the cable-guiding device 20 are kinematically connected with each other with a prefixed timing, such that with every rotation of 360° of the pulling drum 10, there is a corresponding movement of the cable-guiding device 20 along a direction parallel to the longitudinal axis A of the pulling drum 10 for a predetermined length section, equal to the winding pitch of the cable 2 on the pulling drum 10; typically, this pitch is equal to the diameter of the cable 2. For such purpose, a transmission 40 is provided.

[0033] The transmission 40 comprises a pair of identical threaded bars 41, rotatably supported on the walls 32 of the frame 30 in a position parallel to the longitudinal axis A, and a corresponding pair of threaded bushings 42 fixedly mounted in the body 21 of the cable-guiding device 20. A gear train 43 kinematically connects the pulling drum 10 and the bars 41. The pitch of the threads of the bars 41 and the transmission ratio of the gear train 43 are selected in such a way as to obtain the desired timing between the rotation of the pulling drum 10 and the translation of the cable-guiding device 20.

[0034] The cable-guiding device 20 also comprises a

supporting shoulder 25, which is fixed on the body 21 and is provided with a roller 26, idly mounted; the supporting shoulder 25 is rested on a side 14 of the collection roller 10 by means of the roller 26. The roller 26 has a rotation axis D, which is tilted with respect to the longitudinal axis A and is not coplanar thereto; in addition, the roller 26 has a center K equidistant from the opposite ends of the roller. The tilt angle_ of the rotation axis D with respect to the longitudinal axis A (intended as the angle between the longitudinal axis A and the projection of the axis D in a vertical plane containing the longitudinal axis A, i.e. in the plane of fig. 1) is prefixed, in such a way as to orient the rolling direction of the roller 26 substantially according to the winding direction of the cable 2 on the pulling drum 10, so as to avoid lateral sliding of the roller 26 on the side 14 of the pulling drum 10.

[0035] The positioning on the body 21 of the cable-guiding device 20 and of the return pulley 22 is such that a plane P, which is orthogonal to the longitudinal axis A and passes through the center K of the roller 26 (i.e. the plane of fig. 2), contains the rotation axis C of the return pulley 22.

[0036] As stated, the supporting shoulder 25 is rested -by means of its roller 26- on the side 14 of the pulling drum 10; the support area is preferably downstream of the winding position of the cable 2 on the pulling drum 10, in such a way that the resting occurs directly on the pulling drum 10 and not on the cable 2 wound thereon. The winding of the cable 2 on the pulling drum 10 proceeds from the end 12 of the pulling drum 10 which is remote with respect to the traction direction of the cable 2 towards the other and 13.

[0037] The materials for the above-described components can be selected based on the use provided for the winch 1. For example, for nautical use, light and saline corrosion resistant materials are preferred. In particular, in this case, the pulling drum 10 and/or the cable-guiding device 20 are preferably made of light metallic alloys, e. g. aluminum alloys that have been surface-treated against saline corrosion. Alternatively, one or both such components can be made of composite material, e.g. of carbon fiber in a polymer matrix.

[0038] The mode of operation of the winch 1 is quite clear from the above-described structural features.

[0039] The cable 2 is wound and unwound on the pulling drum 10 by driving the motor means 11, which control both the rotation of the pulling drum 10 and the rotation of the threaded bars 41; the rotation of these threaded bars 41, thanks to the engagement with the threaded bushings 42, causes the translation of the cable-guiding device 20 along the guide track 33, with the desired timing with respect to the rotation of the pulling drum 10. In this step, the stress imparted by the tension of the cable 2 (in axial direction, according to the longitudinal axis A) is discharged on the return pulley 22 and from this on the cable-guiding device assembly 20, hence tending to thrust the cable-guiding device 20 radially towards the pulling drum 10. This thrust is counteracted both by the

guide track 33, and by the pulling drum 10 itself, thanks to the supporting shoulder 25. It has to be noted that the rests provided by the guide track 23 and by the supporting shoulder 25 are on opposite parts with respect to the cable 2, hence they ensure an optimal equilibrium of the thrusts.

[0040] Thanks to the above-described structural and functional features, the winch 1 has a preferred, though not exclusive, use for driving sheets on boats of large size, especially sailboats but also motorboats.

Claims

1. Captive winch, comprising:

- a pulling drum (10), which can be rotatably operated around a respective longitudinal axis (A) to wind/unwind a cable (2) subjected to traction from a direction substantially parallel to the longitudinal axis (A) of the pulling drum (10),
- a guide track (33) parallel to the longitudinal axis (A) and spaced therefrom, and
- a cable-guiding device (20), arranged side-by-side the pulling drum (10) and comprising a body (21), slidingly engaged along the guide track (33) which is parallel to the longitudinal axis (A), and adapted to translate on the guide track (33) upon rotation of the pulling drum (10) in order to guide winding/unwinding of the cable (2) on/from the pulling drum (10) on one side (14) thereof,

characterized in that the cable-guiding device (20) comprises a supporting shoulder (25), which rests on the side (14) of the pulling drum (10).

2. Winch according to claim 1, wherein the supporting shoulder (25) comprises at least one roller (26), with which the supporting shoulder (25) rests on the pulling drum (10).

3. Winch according to claim 2, wherein said at least one roller (26) has rotational axis (D) which is tilted at a prefixed angle () with respect to the longitudinal axis (A).

4. Winch according to claim 3, wherein the prefixed angle () is equal to the winding angle of the cable (2) on the pulling drum (10).

5. Winch according to any of claims 2-4, wherein said at least one roller comprises at least two rollers, which are arranged side by side or aligned one to the other.

6. Winch according to any of claims 2-5, wherein said at least one roller is self-aligning.

7. Winch according to any of the preceding claims, wherein the cable-guiding device (20) comprises at least one return pulley (22) of the cable (2).

8. Winch according to claim 7 when depending on claim 2, wherein said at least one roller (26) and the return pulley (22) are arranged in such a way that a plane (P), which is orthogonal to the longitudinal axis (A) and passes through a center (K) of the roller (26), contains the rotational axis (C) of the return pulley (22).

9. Winch according to any of the preceding claims, wherein the supporting shoulder (25) rests on the side (14) of the pulling drum (10) downstream of a winding position of the cable (2) on the pulling drum (10).

10. Winch according to any of the preceding claims, wherein the supporting shoulder rests on the side (14) of the pulling drum upstream of a winding position of the cable on the pulling drum.

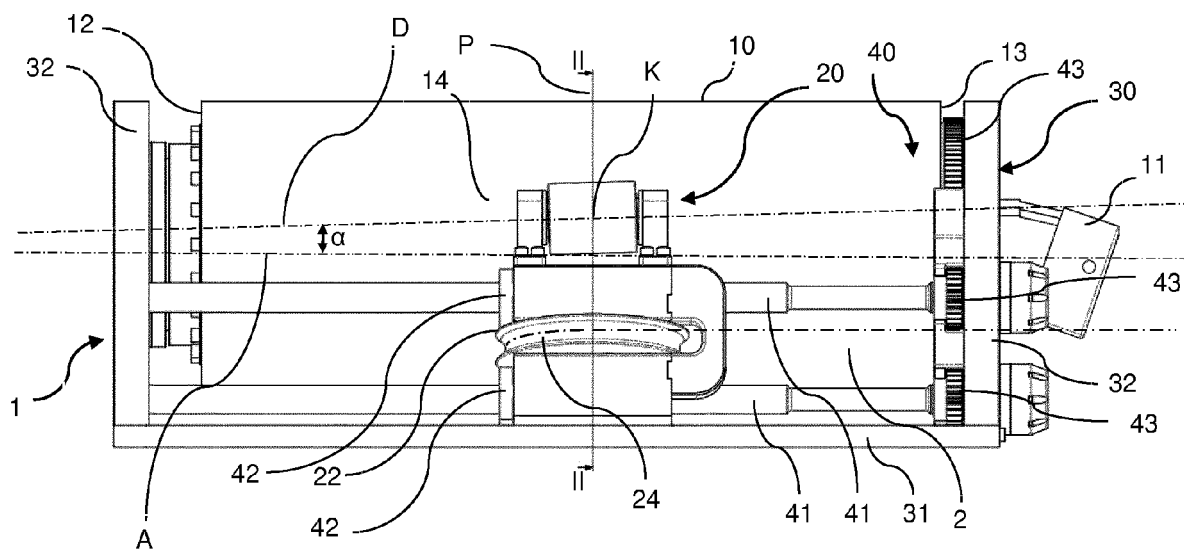


Fig. 1

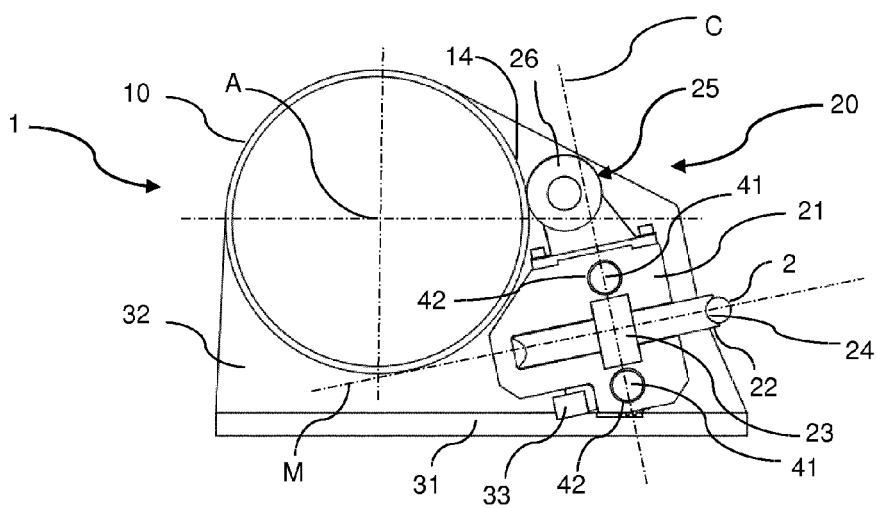


Fig. 2



EUROPEAN SEARCH REPORT

 Application Number
EP 15 17 9102

5

10

15

20

25

30

35

40

45

1

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 2 151 411 A1 (HARKEN ITALY SPA [IT]) 10 February 2010 (2010-02-10) * figures * * paragraph [0030] - paragraph [0040] * * claim 1 *	1,7,8	INV. B66D1/38
A	DE 11 56 212 B (ASEA AB) 24 October 1963 (1963-10-24) * page 1, left-hand column, line 42 - right-hand column, line 34 * * see the roll (11) !; figures *	1,2	
A	KR 2013 0059907 A (HYUNDAI STEEL CO [KR]) 7 June 2013 (2013-06-07) * figures *	1,2,5,7	
A	US 1 973 446 A (RESENQUIST BRER A E) 11 September 1934 (1934-09-11) * figures * * page 1, right-hand column, line 71 - page 2, left-hand column, line 69 *	1,2	
A	JP S56 121087 U (-----) 16 September 1981 (1981-09-16) * figures *	1,7,8	TECHNICAL FIELDS SEARCHED (IPC) B66D B65H
A	US 2 926 867 A (NARDONE ROMEO M) 1 March 1960 (1960-03-01) * figures * * column 1, line 60 - column 2, line 71 *	1	
A	DE 10 2012 003855 A1 (DB NETZ AG [DE]) 29 August 2013 (2013-08-29) * figures * * claims *	1	
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 5 October 2015	Examiner Guthmuller, Jacques
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	

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 15 17 9102

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

05-10-2015

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 2151411 A1	10-02-2010	AT 529370 T	15-11-2011
		AU 2009202583 A1	25-02-2010
		EP 2151411 A1	10-02-2010
		NZ 577872 A	25-02-2011
		SI 2151411 T1	29-02-2012
		US 2010032509 A1	11-02-2010
DE 1156212 B	24-10-1963	NONE	
KR 20130059907 A	07-06-2013	NONE	
US 1973446 A	11-09-1934	NONE	
JP S56121087 U	16-09-1981	JP S5935504 Y2	01-10-1984
		JP S56121087 U	16-09-1981
US 2926867 A	01-03-1960	NONE	
DE 102012003855 A1	29-08-2013	NONE	

EPO FORM P0459

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

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

- EP 2151411 A1 [0011]