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Cable drum joint connection for a lift device

The invention relates to a rope drum hinge joint for a hoist
10 unit (also known as cable drum joint connection for a lift
device), in which a rope drum is connected via the rope drum
hinge joint to a gearbox of a drive, comprising a gearbox-
side hinge part including a first coupling section and a
rope drum-side hinge part including a second coupling
15 section, wherein, in the installed position of the hinge
parts, the first and second coupling sections are designed
and arranged to provide an operative connection between the
hinge parts for transmitting radial forces and torque.

Such rope drum hinge joints are used in hoist units, in
20 particular in crane hoist units, for transmitting predefined
radial forces and torque. Generic rope drum hinge joints are
disclosed, for example, in the unexamined patent application
DE 30 07 319 A1 and the patent specification DE 10 2006 022
782 B3. These rope drum hinge joints are expediently
25 designed to compensate for misalignment, that is, angular
offset between the hinge parts, during operation, even when
large torque is to be transmitted, and furthermore to
provide a favorable distribution of the radial load, and
thus a long service life, wherein relevant safety
30 specifications for flexural stress and radial peak loads
must be adhered to. However, due to the high operating

forces that occur, wear of the cooperating hinge parts of such a rope drum hinge joint is virtually unavoidable over the course of operation, so that the wear at the rope drum hinge joint must be checked at regular intervals or
5 continuously, and appropriate measures must be taken if necessary, and under certain circumstances the entire rope drum hinge joint must be replaced. Replacing a rope drum hinge joint is no longer in line with the current fundamental effort to conserve resources, so that there is a
10 general need to place greater emphasis on resource conservation, in particular with respect to the use of raw materials and energy, also when it comes to the maintenance of conventional rope drum hinge joints, and additionally to reduce the overall effort that is required to produce and
15 operate such a rope drum hinge joint, and, for example, also to make it more cost-effective.

Proceeding from the described prior art, the present invention is based on the technical problem of at least partially avoiding the described disadvantages of the prior
20 art.

In terms of the device, this object is achieved by a rope drum hinge joint having the features of claim 1. The rope drum hinge joint according to the invention is designed to be used in a hoist unit in which a rope drum is connected
25 via a rope drum hinge joint to a gearbox of a drive, wherein the rope drum hinge joint comprises a gearbox-side hinge part including a first coupling section and a rope drum-side hinge part including a second coupling section, and wherein, in the installed position of the hinge parts, the first and
30 second coupling sections are designed and arranged to provide an operative connection between the hinge parts for transmitting radial forces and torque. The rope drum hinge

joint according to the invention is characterized in that the gearbox-side hinge part comprises a plurality of first coupling sections which are spaced apart or adjacent to one another with respect to an axis, each of which can be brought into an operative connection with the other by way of an assigned relative change in the arrangement of the gearbox-side and the rope drum-side hinge parts with respect to one another.

The rope drum hinge joint according to the invention is based on the idea of providing, on at least one hinge part of the joint connection, in particular the hinge part that represents the largest component of the rope drum hinge joint, a plurality of like first coupling sections, which can be brought into a respective operative connection with a second coupling section of the other hinge part that is adapted thereto, and that in particular acts in a complementary manner, so that, when wear occurs between the coupling sections of the hinge parts that are in operative connection, another coupling section that is designed in an identical manner, in particular functionally and structurally identical, at the aforementioned hinge part can be selected and brought into operative connection with the coupling section of the other hinge part. The functional and structural identity of these like first coupling sections can generally be achieved by way of an assigned relative change in the arrangement of the gearbox-side and rope drum-side hinge parts, for example, by way of a translatory and/or rotatory movement of the one hinge part relative to the other. As a result, this hinge part comprising a plurality of like coupling sections does not need to be replaced when a predefined level of wear occurs, but can instead be brought into a further operative connection between another of the first coupling sections and the

second coupling section of the other hinge part by way of a relative change in the arrangement of the gearbox-side hinge part with respect to the rope drum-side hinge part.

Additional advantageous features and refinements according to the invention are described in the following general description, the accompanying figures, the description of the figures, and the further claims.

Expediently, the plurality of first coupling sections of the gearbox-side hinge part, which can be arranged successively or spaced apart relative to an axis on the gearbox-side hinge part, can have a like design and can each, in cooperation with the second coupling section of the rope drum-side hinge part, be designed to create an identical operative connection with substantially identical torque and radial force transmission. This ensures that, regardless of the selection of the first coupling section on the gearbox-side hinge part for creating an operative connection with the second coupling section of the rope drum-side hinge part, the same operative connection is always provided, so that, when the first coupling section on the gearbox-side hinge part is changed to establish an operative connection with the rope drum-side hinge part, the rope drum hinge joint behaves functionally identically.

Preferably, it may be provided that the gearbox-side hinge part comprises the plurality of axially spaced-apart first coupling sections around an outer circumferential surface, and the rope drum-side hinge part comprises a receptacle having an inner circumferential surface for forming the second coupling section. With such a configuration, the gearbox-side hinge part can be designed as a hub, and the rope drum-side hinge part can be designed as a housing accommodating the hub. The hub can preferably be designed as

a hollow cylindrical hub for accommodating a gear shaft of a hoist unit.

Depending on the embodiment, the gearbox-side hinge part can comprise more than two axially spaced-apart first coupling
5 sections for reuse of the gearbox-side hinge part in the rope drum hinge joint according to the invention. It is particularly expedient when the gearbox-side hinge part comprises exactly two axially adjacent or spaced-apart first coupling sections, which can, for example, be arranged at
10 opposing axial end sections of the gearbox-side hinge part. Such a design measure is in particular especially expedient when the gearbox-side hinge part is configured as a hub, wherein the two axially spaced-apart or adjacent first coupling sections can be arranged at opposing axial end
15 sections of the hub.

So as to provide first coupling sections having a like configuration on the gearbox-side hinge part, it may be expediently provided that the gearbox-side hinge part is designed to be mirror-symmetrical in a plane perpendicular
20 to the axis. This applies in particular to an embodiment in which the gearbox-side hinge part is designed as a hub so that, when the first coupling section of the hub is changed to create an operative connection with the second coupling section of the housing accommodating the hub, the hub is
25 rotated by an angle of 180° with respect to an axis of rotation that is perpendicular to the axis of the hub, so that the other of the two first coupling sections can be brought into an operative connection with the second coupling section of the coupling housing. The aforementioned
30 plane of mirror symmetry can preferably be situated on the longitudinal centerline of the hub.

In another embodiment, it may also be provided that the two

first coupling sections, which are arranged axially adjacent or spaced-apart on the hinge part, can be transferred into a reciprocal arrangement with respect to the second coupling section of the second hinge part by means of a simple
5 translatory movement. In this embodiment, the first coupling sections of the gearbox-side hinge part can be structurally identical in this respect, and the mirror symmetry described above may not be present.

Depending on the embodiment, the coupling sections, which
10 are assigned to one another and designed to form an operative connection, can be designed and arranged so as to engage directly with one another in the installed position of the gearbox-side hinge part and the rope drum-side hinge part, so that no additional components are required at the
15 coupling or power transmission point of the rope drum hinge joint according to the invention.

In a particularly expedient embodiment, however, it may be provided that power transmission elements, in particular in the form of barrel rollers, are arranged between one of the
20 first coupling sections of the gearbox-side hinge part and the second coupling section of the rope drum-side hinge part so as to provide the operative connection between the gearbox-side hinge part and the rope drum-side hinge part. In such an embodiment, first and second coupling sections
25 can, for example, comprise semicircular splines having multiple semicircular receptacles serving as bearing surfaces for the power transmission elements, into which the power transmission elements or the barrel rollers are inserted so as to be longitudinally displaceable.

30 In this embodiment, the gearbox-side hinge part, which is designed as a hub, can, on the outer surface thereof, comprise a plurality of semicircular splines, which are in

particular axially adjacent or axially spaced-apart, to form the semicircular receptacles serving as bearing surfaces for the power transmission elements. In this embodiment of the rope drum hinge joint according to the invention, the use of drum-shaped power transmitting elements allows misalignment between the hinge parts to be compensated for, even when large torque is to be transmitted, wherein it is easy to install and provides optimal distribution of the radial load due to the large contact surface of the power transmission elements or barrel rollers, resulting in a long service life of the rope drum hinge joint according to the invention, which is furthermore designed for reuse with respect to the gearbox-side hinge part due to the option of using a plurality of first coupling sections to create a respective operative connection between the two hinge parts.

In a particularly expedient embodiment, it may be provided that no individual power transmission elements are arranged between the first coupling section and the second coupling section so as to provide the operative connection between the gearbox-side hinge part and the rope drum-side hinge part. Instead, the coupling section of one of the hinge parts can have a circular spline, having drum teeth, formed integrally thereon, and the other hinge part can have a circular spline receptacle formed so as to be complementary thereto, so that in this embodiment of the rope drum hinge joint designed according to the invention, the power transmission elements described above can be dispensed with, and at the same time the described advantages associated with the use of barrel rollers as power transmission elements can be provided. In this embodiment, a gearbox-side hinge part designed as a hub, including a plurality of first coupling sections, in particular two first coupling sections, can comprise several, in particular two, axially

spaced-apart circular splines or several, in particular two, axially spaced-apart circular spline receptacles.

As was already described above, the gearbox-side hinge part of the rope drum hinge joint according to the invention can be designed as a hub, and the rope drum-side hinge part can be designed as a housing accommodating the hub. The hub can expediently be designed as a hollow hub for accommodating a gearbox output shaft. Since, when switching from one of the first coupling sections of the gearbox-side hinge part to another first coupling section of the gearbox-side hinge part for establishing an operative connection with the second coupling section of the rope drum-side hinge part, it is generally expedient or necessary to remove the gearbox output shaft-hub connection, this connection should be designed to be as easy as possible to establish and remove. It may therefore preferably be provided to design the hollow hub with inner surface toothing so as to provide a shaft-hub connection in the form of a spline (slip-fit joint) with the gearbox output shaft designed with outer surface toothing. Depending on the embodiment, this spline can be designed, for example, as an involute spline, as a straight sided spline, or as serration spline.

In embodiments in which the hub is designed as a hollow cylindrical hub, a clamping assembly can be provided, for example, for the force-fit and easily removable coupling of the hub and a gearbox output shaft accommodated by the hub. In this embodiment, in the coupling section, the hub can have a purely cylindrical design at the inner surface thereof, and the gearbox output shaft can also have a purely cylindrical design at the outer surface thereof, wherein the clamping assembly is arranged radially between the hub and the gearbox output shaft.

In a further embodiment, it may be provided that the hub is designed as a hollow cylindrical hub for accommodating a cylindrical gearbox output shaft and can be slotted across the longitudinal extension thereof. The slotted hub can
5 furthermore have a corresponding fit for shrinking onto the gearbox output shaft and is clamped onto the shaft based on its own resilient restoring force. For disassembly, the hub can be easily pushed open by way of pressure screws transversely to the direction of the slot, a taper key in
10 the slot, or a hydraulic pressure cylinder in a receptacle on the outside diameter to push open the slot.

In terms of the method, the present invention achieves the above-described technical object by way of a method for
15 maintaining a rope drum hinge joint, which is designed according to any one of claims 1 to 8, and in which the power transmission point or operative connection between one of the first coupling sections of the gearbox-side hinge part and the second coupling section of the rope drum-side
20 hinge part exhibits a predefined level of wear, that is, the first and second coupling sections that are operatively connected exhibit wear in such a manner that specified technical dimensional accuracy is no longer present. The method according to the invention comprises the following
25 steps:

- removing the worn operative connection or power transmission point between the one of the first coupling sections of the gearbox-side hinge part and the second coupling section of the rope drum-side
30 hinge part;
- replacing the rope drum-side hinge part having a worn second coupling section with a rope drum-side hinge part having an unworn second coupling section; and

- establishing an operative connection or power transmission point between the rope drum-side hinge part having an unworn second coupling section and the gearbox-side hinge part, in which at least the one of the first coupling sections is worn, so that an operative connection or power transmission point is established between the second coupling section of the rope drum-side hinge part and an unworn first coupling section of the gearbox-side hinge part.

10 In embodiments in which the gearbox-side hinge part is designed as a hub and the rope drum-side hinge part is designed as a housing for accommodating the hub, the method according to the invention can be carried out by replacing the housing of the rope drum hinge joint according to the invention, and then by creating the operative connection between the second coupling section of the new coupling housing and an unworn first coupling section of the coupling hub that was not replaced.

In such embodiments, in which power transmission elements, in particular barrel rollers, are used between a first coupling section of the gearbox-side hinge part and the second coupling section of the rope drum-side hinge part to create an operative connection or a power transmission point between the two hinge parts, it may also be provided when carrying out maintenance of the rope drum hinge joint to the invention that not only the rope drum-side hinge part, and in particular not only the coupling housing, but also the power transmission elements, such as the barrel rollers, are replaced.

30 The invention will be explained hereafter by describing an embodiment with reference to the accompanying figures, in which:

FIG. 1: shows a rope drum hinge joint designed according to the invention in a perspective view; and

FIG. 2: shows the rope drum hinge joint according to the invention of FIG. 1 in an exploded view.

5 A barrel coupling 1, along with modifications, will be described hereafter as an exemplary and particularly advantageous rope drum hinge joint according to the invention for a hoist unit; it is particularly suitable for crane hoist units in which a rope drum is connected via the
10 rope drum hinge joint to a gearbox of a drive. Such a hoist unit, which is not shown in the figures, comprises a motor, preferably an electric motor, downstream of which a reducing gear is connected, wherein a rope drum connected to the reducing gear is driven by the same.

15 The barrel coupling 1 shown in FIG. 1 can be arranged between the reducing gear and the rope drum and transmits the torque from the reducing gear to the rope drum, while absorbing radial loads at the same time. A particular advantage of such a barrel coupling 1 lies in the ability to
20 absorb angular misalignments of the axis of the rope drum and of the gearbox output, as well as in the capacity to absorb axial displacements.

The barrel coupling 1 according to the invention shown in FIG. 1 comprises a coupling hub 2 including a hub receptacle
25 20 for accommodating the shaft on the gearbox output side, which is not shown in the figure, wherein, for fixing the shaft in the hub in a form-locked manner, keyways 21 can be provided to partially accommodate a feather key extending in partial sections into both the hub and the accommodated
30 shaft.

In the described embodiment, the coupling hub 2 comprises

two coupling sections K1.1, K1.2 which are spaced apart in the axial direction of the hub. In the representation of Fig. 1, only the aforementioned first coupling section K1.1 is visible since the second coupling section K1.2 is
5 concealed by the rope drum-side hinge part, which here is designed as a coupling housing 4, for creating an operative connection or power transmission between the coupling hub 2 and the coupling housing 4.

On the rope drum side, the coupling housing 4 comprises a
10 mounting flange 40 which has a plurality of circumferentially spaced-apart screw holes 41 for attachment to an assigned mounting flange of the rope drum, which is not shown.

FIG. 2 shows the barrel coupling 1 according to the
15 invention of FIG. 1 in an exploded view, that is, with the operative connection between the coupling sections K1.1, K2 of the coupling hub 2 and the coupling housing 4 being shown in an exploded view in this regard.

The barrel coupling 1 according to the invention comprises a
20 coupling hub 2 which, in the described embodiment, includes two first coupling sections K1.1, K1.2 at the outer lateral surface thereof, wherein these first coupling sections K1.1, K1.2 are designed mirror-symmetrically with respect to one another in a plane perpendicular to the longitudinal axis of
25 the hub. This mirror plane can be located in the longitudinal center of the coupling hub 2.

The first coupling sections K1.1, K1.2 comprise circumferentially consecutive receiving depressions 22.1, 22.2 with outer toothings 23.1, 23.2 delimiting the same. So
30 as to couple the coupling hub 2 to the coupling housing 4, the latter comprises a single second coupling section K2,

which extends axially similarly to the first coupling sections of the hub and which is designed and arranged to cooperate with one of the two first coupling sections K1.1, K1.2 of the coupling hub 2.

5 On the inner surface, the coupling housing 4 has circumferentially consecutive receiving depressions 42, which are separated by assigned inner toothings 43 of the coupling housing 4. As is apparent from FIG. 2, barrel
10 rollers 6 arranged on a pitch circle are provided to create an operative connection or a power transmission between the coupling hub 2 and the coupling housing 4 and are mounted in the rows of receiving depressions 22.2 and 42. The receiving depressions 22.2 are formed at an outer tothing 23.2 on the coupling hub 2, while the receiving depressions 42 are
15 formed at the inner tothing 43 on the coupling housing 4. For clarity of the representation, some of the barrel rollers 6 have been omitted in FIG. 2.

As previously explained, in the arrangement of the barrel coupling 1 according to the invention shown in the figure,
20 the first coupling section K1.2 of the coupling hub 2 is brought into operative connection with the second coupling section K2 of the coupling housing 4 by appropriately aligning the hub 2 and the housing 4 with respect to one another and introducing the barrel rollers 6 so as to come
25 to bear in the receiving depressions 22.2 of the coupling hub 2 and the receiving depressions 42 of the coupling housing 4.

Due to the described mirror symmetry, the barrel coupling 1 according to the invention is designed so that, by rotation
30 of the coupling hub 2 about an axis of rotation extending perpendicular to the axis of the coupling 1, the other first coupling section K1.1 of the coupling hub 2 is arranged to

create an operative connection with the second coupling section K2 of the coupling housing 4 by way of the described arrangement of the barrel rollers 6 in the respective receiving depressions 22.1, 42.

5 So as to axially secure the barrel rollers 6 on the coupling hub 2, a pressure ring 7 and a retaining ring 8 are provided, which can be designed as a laminar retaining ring. On the gearbox side, an outer cover 9 can be provided as a closure, which, when in the mounted state, rests against the
10 gearbox-side end face of the coupling housing 4 and can be attached thereto by means of screw connections.

On the rope drum side, an O-ring (not shown) can be provided as a seal between the coupling hub 2 and the coupling housing 4. When the components of the barrel coupling 1
15 according to the invention shown in FIG. 2 are assembled, the pressure ring 7 engages in a respective groove 24.1 or 24.2 of the coupling hub 2, depending on which of the two first coupling sections K1.1, K1.2 has been operatively connected to the coupling housing 4.

20 The design according to the invention of the described barrel coupling 1 enables resource-efficient maintenance of the barrel coupling 1 since at least the coupling hub 2 is reusable twice in the described embodiment and, depending on wear, only the coupling housing 4 together with the barrel
25 rollers 6, as well as, if necessary, the seals and the pressure ring 7 have to be replaced, so that at least the largest component of the barrel coupling 1 can be reused.

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List of Reference Signs

10	1	rope drum hinge joint, barrel coupling
	2	gearbox-side hinge part, coupling hub
	4	rope drum-side hinge part, coupling housing
	6	barrel roller
	7	pressure ring
15	8	retaining ring
	9	outer cover
	10	double-lip seal
	20	hub receptacle
	21	keyway
20	22.1	receiving depression
	22.2	receiving depression
	23.1	outer toothing
	23.2	outer toothing
	24.1	groove
25	24.2	groove
	40	mounting flange
	41	screw hole
	42	receiving depression
	43	inner toothing
30	K1.1	first coupling section
	K1.2	first coupling section
	K2	second coupling section

Claims

1. A rope drum hinge joint (1) for a hoist unit, in which a
5 rope drum is connected via the rope drum hinge joint (1) to
a gearbox of a drive, comprising a gearbox-side hinge part
(2) including a first coupling section (K1.1, K1.2) and a
rope drum-side hinge part (4) including a second coupling
10 section (K2), with the first and second coupling sections
(K1.1, K1.2, K2), in the installed position of the hinge
parts (2, 4), being designed and arranged to provide an
operative connection between the hinge parts (2, 4) for
transmitting radial forces and torque, characterized in that
the gearbox-side hinge part (2) comprises a plurality of
15 first coupling sections (K1.1, K1.2) which are spaced apart
with respect to an axis, each of which can be brought into
an operative connection between the first and second hinge
parts (2, 4) by way of an assigned relative change in the
arrangement of the gearbox-side and rope drum-side hinge
20 parts (2, 4) with respect to one another.

2. The rope drum hinge joint (1) according to claim 1,
characterized in that the plurality of first coupling
sections (K1.1, K1.2) of the gearbox-side hinge part (2) are
each designed to cooperate with the second coupling section
25 (K2) of the rope drum-side hinge part (4) so as to create an
identical operative connection with substantially identical
torque and radial force transmission.

3. The rope drum hinge joint (1) according to claim 1 or 2,
characterized in that the gearbox-side hinge part (2)
30 comprises the plurality of axially spaced-apart first
coupling sections (K1.1, K1.2) around an outer
circumferential surface, and the rope drum-side hinge part

(4) comprises a receptacle having an inner circumferential surface for forming the second coupling section (K2).

4. The rope drum hinge joint (1) according to any one of claims 1 to 3, characterized in that the gearbox-side hinge part (2) comprises two axially spaced-apart first coupling sections (K1.1, K1.2) which are arranged at opposing axial end sections of the gearbox-side hinge part (2).

5. The rope drum hinge joint (1) according to any one of claims 1 to 4, characterized in that the gearbox-side hinge part (2) is designed to be mirror-symmetrical in a plane perpendicular to the axis.

6. The rope drum hinge joint (1) according to any one of claims 1 to 5, characterized in that power transmission elements, in particular in the form of barrel rollers (6), are arranged between one of the first coupling sections (K1.1, K1.2) of the gearbox-side hinge part (2) and the second coupling section (K2) of the rope drum-side hinge part (4) so as to provide the operative connection between the gearbox-side hinge part (2) and the rope drum-side hinge part (4).

7. The rope drum hinge joint (1) according to any one of claims 1 to 6, characterized in that, so as to provide the operative connection between the gearbox-side hinge part (2) and the rope drum-side hinge part (4), one of the hinge parts (2, 4) has a circular spline, having drum teeth, formed integrally thereon, and the other hinge part (2, 4) has a circular spline receptacle formed so as to be complementary thereto.

8. The rope drum hinge joint (1) according to any one of

claims 1 to 7, characterized in that the gearbox-side hinge part (2) is designed as a hub, and the rope drum-side hinge part (4) is designed as a housing accommodating the hub.

9. The rope drum hinge joint (1) according to claim 8,
5 characterized in that the hub is designed as a hollow hub for accommodating a gearbox output shaft, with inner surface toothing so as to provide a shaft-hub connection in the form of a spline (slip-fit joint) with the gearbox output shaft designed with outer surface toothing.

10. The rope drum joint assembly (1) according to claim 8,
10 characterized in that the hub is designed as a hollow cylindrical hub for accommodating a gearbox output shaft and is slotted across the longitudinal extension thereof.

11. A gearbox-side hinge part (2) of a coupling for use in a
15 rope drum hinge joint (1) according to any one of claims 1 to 10 for a hoist unit, in which a rope drum is connected via the rope drum hinge joint (1) to a gearbox of a drive.

12. A method for maintaining a rope drum hinge joint (1)
20 designed according to any one of claims 1 to 10, in which the operative connection between one of the first coupling sections (K1.1, K1.2) of the gearbox-side hinge part (2) and
25 the second coupling section (K2) of the rope drum-side hinge part (4) exhibits a predefined level of wear, comprising the following steps:

- removing the worn operative connection between the one of the first coupling sections (K1.1, K1.2) of the gearbox-side
30 hinge part (2) and the second coupling section (K2) of the rope drum-side hinge part (4);
- replacing the rope drum-side hinge part (4) having a worn second coupling section (K2) with a rope drum-side hinge

part (4) having an unworn second coupling section (K2); and

- establishing an operative connection between the rope

drum-side hinge part (4) having an unworn second coupling
section (K2) and the gearbox-side hinge part (2), in which

5 at least the one of the first coupling sections (K1.1, K1.2)
is worn, so that an operative connection is established

between the second coupling section (K2) of the rope drum-
side hinge part (4) and an unworn first coupling section

(K1.1, K1.2) of the gearbox-side hinge part (2).

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13. The method according to claim 12, characterized in that,

for maintaining the rope drum hinge joint (1), furthermore

power transmission elements, in particular power

transmission elements in the form of barrel rollers (6),

15 arranged between the first and second coupling sections

(K1.1, K1.2, K2) are replaced.