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(54) **Traction sheave arrangement**

(57) Elevators are operated with ropes arranged to grooves of a traction sheave. The traction sheave is connected to a motor and the traction sheave has friction high enough so that when the traction sheave rotates the elevator and counterweight move according to the rotation. The friction in traction sheave may be improved by using specific shapes in the rope contact surface in grooves of the traction sheave. The shape of the groove is divided into contact surface for increasing the friction, outer surface for minimizing the space requirement outside the contact surface and bottom of the groove.

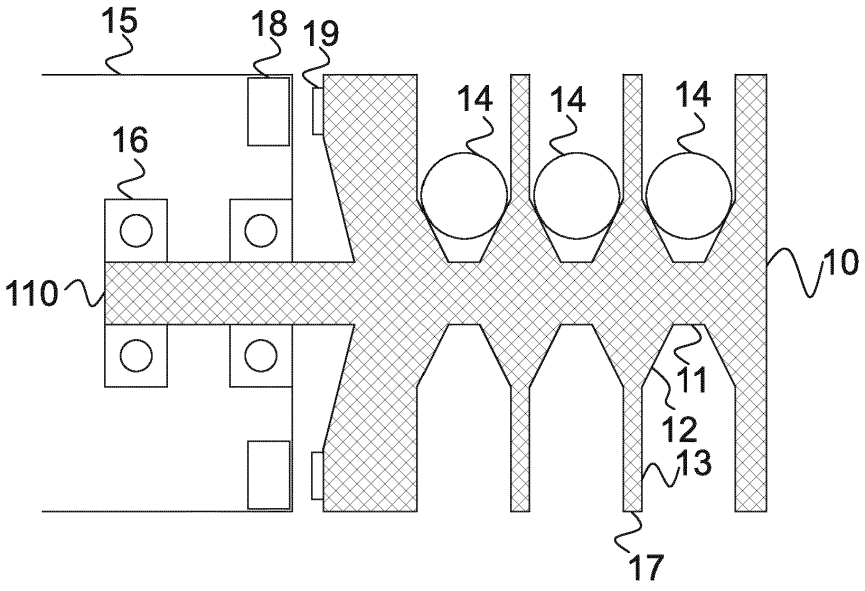

Figure 1

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Description

FIELD OF THE INVENTION

[0001] The invention relates to lifting devices and more particularly a traction sheave arrangement for a lifting device.

BACKGROUND OF THE INVENTION

[0002] In elevators and other lifting devices at least one rope is used for lifting the elevator or other load. Typically these ropes are arranged such that they are operated by a motor that is connected to a traction sheave. In the most typical configurations a gear system is used between the motor and the traction sheave, however, also direct drive is possible. When the traction sheave rotates ropes move such that the elevator or other load is moved up or down. In a typical elevator installation an elevator car is in the other end of the rope and a counter weight in the other end. Because of opposing forces caused by the elevator car and counter weight the rope is tightened and forced against traction sheave. The number of ropes may be regulated so that in passenger elevators more than one rope is typically used.

[0003] The friction of the traction sheave may be increased by using special purpose shapes in the groove of the traction sheave. An example of a typical groove is V-shape, wherein the rope has contact surface on both sides. Furthermore, the contact surface may be hardened. A person skilled in the art knows several different shapes and understands that they have benefits and drawbacks. For example, some shapes may be difficult to manufacture, require too much space, do not provide the best possible friction, have high rope deterioration and similar. Thus, the shape of the groove is always a compromise and the designing engineer must choose the shape according to the application. Examples of different shapes are disclosed, for example, in GB139735.

[0004] The same problem has been address by introducing special purpose ropes. These ropes have a special shape that has been designed particularly for the application. Correspondingly special purpose ropes have similar benefits and drawbacks as special purpose grooves. Furthermore, in order to work optimally, special purpose rope may require a special purpose groove. Thus, also a special purpose rope is a compromise. However, a clear drawback of these special purpose ropes is the costly manufacturing process compared to conventional ropes. Furthermore, the designing engineer might not want to limit to a certain type of rope that cannot be changed without modifications to the traction sheave. Examples of such ropes are discussed, for example, in EP2020398.

[0005] From the description above it is obvious that there is always a need for improvements in elevator, or other lifting device, traction sheaves. Especially in the modern installations environmental efficiency and a reduced space use is often desired. The reduced space is a further variable in the compromise that should be space efficient, gentle to ropes and still able to provide friction high enough.

SUMMARY

[0006] Traction sheave elevators are operated with ropes arranged to grooves of a traction sheave. The traction sheave is connected to a motor and the friction between grooves and ropes is high enough so that when the traction sheave rotates the elevator and counterweight move according to the rotation without slipping. The friction in traction sheave may be improved by using specific shapes in the rope contact surface in grooves of the traction sheave. The shape of the groove is divided into contact surface for increasing the friction, outer surface for securing the guidance of the rope and bottom of the groove.

[0007] In an embodiment of the invention a traction sheave for a lifting device is disclosed. The traction sheave comprises at least one groove for receiving a rope. Each of the grooves of the traction sheave comprise a contact surface, wherein side walls of the contact surface are inclined in order to form opening angle such that when the traction sheave is in use a rope contacts the contact surface on both side walls. Each of the grooves further comprise an outer surface, wherein side walls of the outer surface have an opening angle less than the opening angle of said side walls of said contact surface.

[0008] In an embodiment of the invention the traction sheave is attached to an electric motor that is configured to operate an elevator. In an embodiment an elevator comprising the traction sheave of the embodiment described above is disclosed.

[0009] A benefit of the invention is that the traction sheave described above requires less space. Thus, it can be fitted to smaller space and the space can be used for other purposes. A further benefit of the traction sheave described above is that the ropes can be arranged closer to the electric motor and the support. Thus, the ropes cause smaller forces when the traction sheave, or the axel attached to the traction sheave is supported only from the end attached to the motor. In other words, the traction sheave is thinner and/or the axial part or the axel attached to the traction sheave is shorter. Instead of thinner traction sheave the save space may be used for providing thicker walls between the grooves of the traction sheave. This makes the overall construction stronger and provides a construction that is easier to harden.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The accompanying drawings, which are included to provide a further understanding of the invention and constitute a part of this specification, illustrate embodiments of the invention and together with the description help to explain the principles of the invention. In the draw-

ings:

Fig. 1 is an illustration of an example embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0011] Reference will now be made in detail to the embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

[0012] Figure 1 is an illustration of an example embodiment of the invention. In the embodiment a traction sheave 10 with three grooves is disclosed. The traction is connected to an electric motor 15 and supported by bearings 16 from the first end. It is noted that the support and the attachment between the traction sheave 10 and the electric motor 15 are examples only. The traction sheave 10 of Figure 1 includes an integrated axel structure for attaching the traction sheave 10 to the electric motor 15. A person skilled in the art understands, that there may be other suitable means for attachment.

[0013] In each of the grooves there is a contact surface 12. The side walls of the contact surface are inclined in order to form opening angle such that when the traction sheave is in use, each of the ropes 14 contacts the contact surface 12 on both side walls of the respective groove. Thus, when the electric motor 15 turns the traction sheave the friction is high enough in order to prevent slipping of the rope and an elevator car and counter weight fixed to the ends of the rope move to opposite directions. In the figure three ropes are illustrated, however, the number of ropes may be chosen according to the application requirements. Correspondingly, the traction sheave may comprise any number of grooves. Furthermore, in some applications there may be more than one traction sheave fitted to the same axel.

[0014] Each of the grooves further comprises an outer surface 13. The side walls of the outer surface are inclined in order to form an opening angle less than the opening angle of said side walls of the contact surface. The purpose of the outer surface is to guide the rope into the traction sheave so that it does not get displaced. Typically the distance between side walls of the outer surface is only slightly larger than the diameter of the rope used so that the rope can be easily placed on the contact surface. Also outer surface may be inclined, however, it is not necessary.

[0015] The opening angle discussed above is the angle between, for example contact surfaces in the opposite sides of the groove. A typical opening angle for contact surface is 40 - 50 degrees. Thus, the contact surface opens in V-form. The cross section of each of the side walls of the contact surface is typically straight so that the same opening angle is maintained through the contact area. The opening angle of outer surface is smaller than the opening angle of contact surface. The opening angle of side walls of the outer surface may be as small as zero degrees, in other words, the side walls may be forming a right-angle with the central axis of the traction sheave. Thus, there is an angle between side walls of the contact surface and outer surface.

[0016] The contact surfaces extend as far it is necessary so that the space for the rope 14 is wide enough so that the rope does not touch side walls of the outer surface when the rope is in place and operated. Each of the grooves may further comprise a bottom surface 11. The bottom surface may be inclined, flat, round or any other form, however. Correspondingly to the side walls of the outer surface the bottom surface is arranged such that the rope does not touch the bottom surface of the groove. For example, when ropes with diameter of 8mm are used, the contact surfaces extend so that the distance between them is 8,6mm. Thus, the minimum distance between outer surfaces is in the example 8,6mm. If the opening angle is zero degrees this distance is maintained through outer surface. If the opening angle is, for example ten degrees, the distance increases slightly until the end of the outer surface.

[0017] Each of the grooves may be arranged next to each other so that the length of the axel is minimized and the side wall 17 between two grooves is thin. Instead of thin wall a designing engineer may choose thicker wall when extended strength of the wall is desired. Both of these options are enabled by the fact that the outer surface has smaller opening angle than the contact surface and thus, space is saved for desired used. Furthermore, the form of the top of the side wall may be chosen according to the need. For example, sharp edges may be rounded or chamfered in order to prevent unnecessary rope wearing.

[0018] In the embodiment of Figure 1 thin walls 17 are illustrated. This provides the possibility to reduce the width of the traction sheave 10. As it can be seen from the figure the traction sheave includes an axial part 110 that is supported by bearings 16 from the end of the electric motor 15. Thus, the force applied by the ropes is closer to the support causing reduced leverage. Furthermore, narrower traction sheave 10 requires less space than conventional traction sheaves.

[0019] The electric motor 15 in the embodiment is a conventional electric motor using electric magnets 18, wherein the traction sheave 10 comprises permanent magnets 19. This operating method is an example and any other means for rotating traction sheave 10 may be used. Correspondingly the support on bearings 16 may be constructed according to the need of the application. In the embodiment of figure 1 a direct drive is used, however, between the motor and the traction sheave a gear box or other gear system may be used.

[0020] It is obvious to a person skilled in the art that with the advancement of technology, the basic idea of the invention may be implemented in various ways. The invention and its embodiments are thus not limited to the examples described above; instead they may vary within the scope of the claims.

Claims

1. A traction sheave for a lifting device, wherein said traction sheave comprises at least one groove for receiving a rope and each of the grooves of the traction sheave comprise:

   a contact surface (12), wherein side walls of said contact surface are inclined in order to form opening angle such that when the traction sheave is in use a rope (14) contacts the contact surface on both side walls; and
   an outer surface (13), wherein side walls of said outer surface have an opening angle less than the opening angle of said side walls of said contact surface.

2. A traction sheave according to claim 1, wherein said outer surface (13) having an opening angle less than said contact surface (12) is arranged such that it starts as close the rope (14) as possible without touching it.

3. A traction sheave according to claim 1 or 2, wherein said groove further comprises a bottom (11) surface.

4. A traction sheave according to any of claims 1 - 3, wherein said grooves are arranged to adjacent positions close to each other.

5. A traction sheave according to any of preceding claims 1 - 3, wherein said grooves are arranged to adjacent positions spaced apart from each other.

6. A traction sheave according to any of preceding claims 1 - 5, wherein the cross section of each of said inclined side walls of said contact surface is straight.

7. An electric motor for an elevator, wherein said electric motor (15) is engaged to a traction sheave (10) according to any of claims 1 - 6.

8. An electric motor according to claim 7, wherein said traction sheave (10) is engaged to the electric motor (15) from a first end.

9. The electric motor according to claim 8, wherein the traction sheave (10) is supported from the first end.

10. The electric motor according to claim 9, wherein support includes bearings (16).

11. The electric motor according to any of claims 7 - 10, wherein the second end of said axel is disengaged.

12. The electric motor according to any of preceding claims 7 - 11, wherein said electric motor (15) is engaged to said traction sheave (10) by using a gear box.

13. An elevator comprising an electric motor according to any of preceding claims 7 - 12.

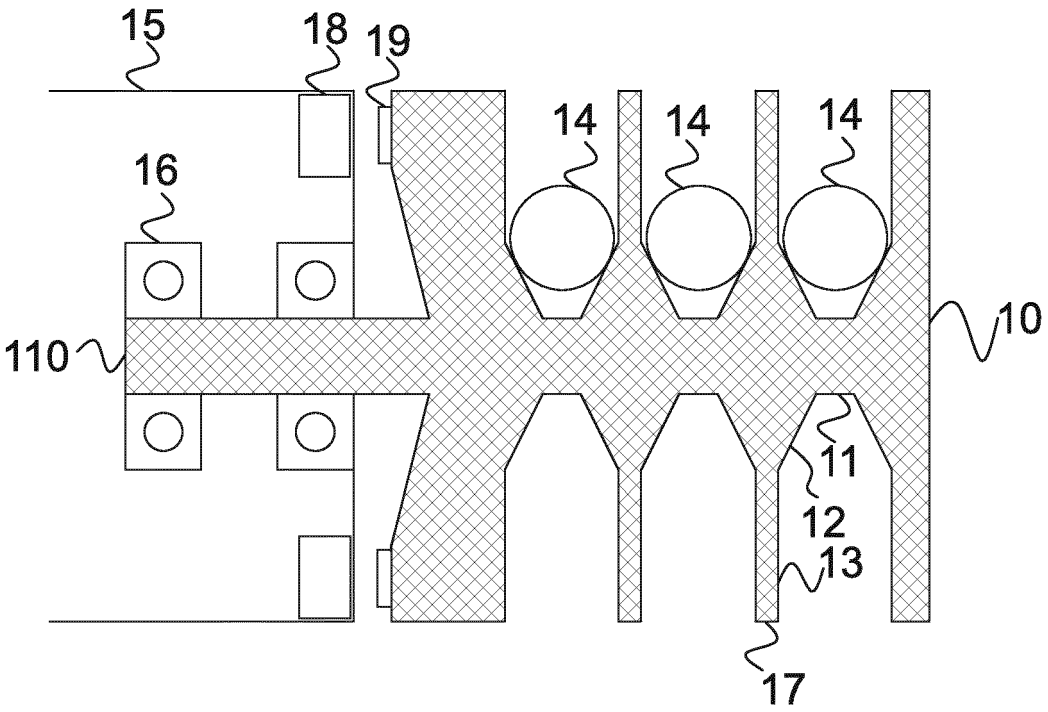

Figure 1

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EUROPEAN SEARCH REPORT

Application Number
EP 13 17 8202

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	WO 2008/061492 A1 (WIDMANN MANUELA [DE]) 29 May 2008 (2008-05-29) * abstract * * page 5, lines 1-41 * * figures 2, 3 *	1-7,13 7-13	INV. B66B15/04 F16H55/50
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X Y	US 1 796 875 A (PETER RADT WILHELM) 17 March 1931 (1931-03-17) * page 1, lines 41-52 * * figures 1-3 *	1-7,13 7-13	
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Y	EP 0 884 267 A2 (WITTUR AUFZUGTEILE GMBH & CO [DE] WITTUR AG [DE]) 16 December 1998 (1998-12-16) * abstract * * column 3, lines 13-23 * * figure 1 *	7-13	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	12 March 2014	Oosterom, Marcel

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)

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Application Number
EP 13 17 8202

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 13 17 8202

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-6

   Details of the groove of a traction sheave.

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2. claims: 1, 7-13

   Electric motor comprising a traction sheave.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 13 17 8202

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
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12-03-2014

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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

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