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

(11) EP 1 568 647 B9

(12) **CORRECTED EUROPEAN PATENT SPECIFICATION**

(15) Correction information:
Corrected version no 1 (W1 B1)
Corrections, see
Claims EN 3

(48) Corrigendum issued on:
22.05.2013 Bulletin 2013/21

(45) Date of publication and mention of the grant of the patent:
02.01.2013 Bulletin 2013/01

(21) Application number: **05010304.3**

(22) Date of filing: **27.03.2000**

(51) Int Cl.:
B66B 15/04 (2006.01) ***F16H 55/50*** (2006.01)
F16H 55/38 (2006.01)

(54) **Improved sheave design**

Verbesserter Treibscheibenentwurf

Conception de poulie améliorée

(84) Designated Contracting States:
DE ES FR GB IT

(30) Priority: **01.04.1999 US 283046**

(43) Date of publication of application:
31.08.2005 Bulletin 2005/35

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
00921468.5 / 1 169 256

(73) Proprietor: **Otis Elevator Company**
Farmington, CT 06032-2568 (US)

(72) Inventors:
- **Baranda, Pedro S.**
  Madrid 28036 (ES)
- **Pitts, John T.**
  Avon
  CT 06001 (US)
- **Hollowell, Richard L.**
  Hebron
  CT 06248 (US)
- **Wesson, John P.**
  Vernon
  CT 06066 (US)
- **Logan, Douglas E.**
  Bristol
  CT 06010 (US)

(74) Representative: **Klunker . Schmitt-Nilson . Hirsch**
Patentanwälte
Destouchesstrasse 68
80796 München (DE)

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Description

TECHNICAL FIELD

[0001] The present invention relates to elevators and, more particularly, to a novel sheave design for improved performance and durability.

BACKGROUND AND SUMMARY OF THE INVENTION

[0002] Conventional elevator systems have long utilized standard elevator ropes to suspend and move elevator cars. In order to optimize performance in such areas as traction, durability, ride quality and safety, numerous design parameters have limited various components such as motors, sheaves and rope grade to certain sizes, weights and dimensions.

[0003] A sheave having a corrosion-resistant and a wear-resistant coating is known i.e. from US-A-2413817.

[0004] New generation elevator systems are being developed that eliminate the need for various conventional components, through the implementation of superior performing traction and drive systems and other advancements. These types of systems offer many advantages over traditional elevator systems, including structural versatility and economy, convenient access for servicing and repair, and lighter building loads.

[0005] One particular advancement is the implementation of high-traction, high durability elevator ropes that are smooth running, light in weight and corrosive-resistant. One such type of rope is made of a plurality of tension-carrying cord members contained in a unitary insulation jacket made of, for example, a urethane material. For optimum performance with such ropes, it is desirable to adapt various components such as sheaves to interface closely.

[0006] Conventional elevator sheaves are cast iron and designed to accommodate traditional round, steel wire ropes. With the increasing feasibility of new generation elevator ropes, such as elastomer-coated, flat ropes, new problems related to tracking, traction and durability must be addressed. It is an object of the present invention to provide a sheave design having particular dimensional, geometric, and surface characteristics selected for optimum performance and durability for use with such new generation elevator ropes.

[0007] This object and others are achieved by the present invention sheave design. The present invention sheave design provides a convex contact surface defined by a crown height and crown radius dimension related to rope or belt width for tracking. Another aspect of the invention relates to a sheave design in which sheave groove width is related to belt width for tracking. Another aspect of the invention relates to providing a particular circumferential roughness to the contact surface for traction. Yet another aspect of the invention relates to providing a hard, corrossion-resistant coating on the sheave contact surface for improved durability.

BRIEF DESCRIPTION OF THE DRAWING

[0008]

Fig. 1 is a schematic side view of a multi-rope sheave according to the present invention.
Fig. 2 is a schematic, partial view of the contact surfaces of a multi-rope sheave according to Fig.1.
Fig. 3 is a schematic view of an elevator system according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0009] An elevator system (20) is illustrated in Fig. 3. The system (20) includes an elevator car (22) suspended by ropes (24) having fixed ends (26, 28) that are fixed with respect to a hoistway (not shown). A counterweight (30) is also suspended by the ropes (24) and coupled to the elevator car (22) for relative movement therewith. The elevator car is suspended from the ropes (24) by car idler sheaves (32, 34) and the counterweight is suspended from the ropes (24) by a counterweight idler sheave (36). A drive machine (38) having a traction sheave (40) for engaging and driving the ropes (24) is provided in a fixed relationship with respect to the hoistway.

[0010] A multiple-rope elevator sheave (10), illustrated in Fig.1, is adapted to engage elevator ropes (24) to provide traction and support thereto in an elevator assembly (20). Referring to Fig.s 1 - 2, the sheave (10) comprises a plurality of convex contact surfaces (12, 14, 16) adapted to engage friction surfaces of elevator ropes or belts (18). Each contact surface (12,14, 16) is characterized by groove width (w_g), crown height (h), and crown radius (r_c). Flat rope or belt tracking is controlled by a crown height (h) or crown radius (r_c) groove width (w_g). In contrast to flat contact surfaces on sheaves, the convex surfaces (12,14, 16) provide contour-conforming fit when used with a flat, flexible rope (18). With the use of such convex contact surfaces and flat, flexible ropes, configured in accordance with the present invention, it is not necessary to provide dividers between contact surfaces to maintain rope or belt tracking.

[0011] For a belt (16) having a width (w_b) of 30 mm, the optimum crown height (h) has been determined to be within a range of approximately 0.1mm to 1.0 mm. The optimum radius (r_c) is in the range of approximately 500mm to 1500 mm. Both the crown height (h) and the crown radius (r_c) may be expressed as a function of belt width (w_b). In the preferred embodiment, the crown height (h) is in the range of approximately 0.3 to 3.0 percent of the belt width (w_b). The crown radius (r_c) is preferably in the range of approximately 15 to 50 times the belt width (w_b).

[0012] The groove width (w_g) is in the range of approximately 1.5 and 2.25 times the width of the belt (w_b). This groove width accommodates misalignments that may result from installation or from movement of the elevator car and counterweight. Also, the selection of steering angles for car-mounted sheaves may result in misalignments. Car-mounted sheaves, in contrast to the traction sheave and the counterweight-mounted sheave, have two steering angles - vertical and horizontal. The ideal setting for one angle may result in a less than optimum setting for the other. With proper selection of groove height (h) and width (w_g), sufficient tracking may be achieved such that dividers ordinarily required between adjacent sheave grooves may be eliminated.

[0013] Traction of the traction sheave is now enhanced by providing circumferential roughness to the contact surfaces of the traction sheave. Conventional sheaves are machined in a manner that results in transverse roughness on the contact surface. This type of roughness does not enhance traction. Circumferential roughness provides good traction even in the presence of contaminants on the contact surface. The preferred range of circumferential roughness is approximately 1.0 to 3.0 microns. The preferred method of forming the circumferential roughness is shot peening. Grit blasting may also be used, but it provides more jagged surface texture than shot peening, thereby increasing the rate of belt wear.

[0014] Durability of the sheave is enhanced by applying a corrosion-resistant coating to the contact surface of the sheaves. The coating is a thin layer, less than 10 microns thick, and preferably 1-2 microns thick. The circumferential roughness of 1-3 microns should be present after the application of the coating to the sheave. Using a thin layer of coating permits the surface roughness and the crowning of the substrate to be maintained. The surface morphology of the coating should have an irregular or nodular nature without any sharp cutting features which might damage the surface of the rope. A hard coating is selected having a hardness of greater than 40 HRC. The thin layer of coating permits the surface roughness and the crowning to be maintained. Without the coating, the contact surfaces of the sheave would get worn smooth. The surfaces of the sheave would get worn smooth. The surface morphology of the coating should have an irregular or nodular nature without any sharp cutting features that might damage the surface of the flat rope. The coating is corrosion resistant to enhance the sheaves which are made of steel, rather than conventional cast iron. The coating should be a low temperature coating, *such as* about 25-80°C, so that it can be applied to the sheave in the finished state. The coating may be applied, for example, by a dip process or an electromechanical process.

[0015] For idler sheaves, a low friction coating may be applied to the sheave or the sheave may be formed from a material that exhibits these properties, such as polyurethane. Because the traction is less important for idler sheaves, surface roughness is not essential.

[0016] Another aspect of the invention relates to an elevator rope sheave for engaging a flat elevator rope, said sheave comprising a convex contact surface for engaging said elevator rope, said convex contact surface having a crown height that is a function of the width of said elevator rope.

[0017] Said crown height can be equal to a range of about 0.033 to about 0.003 times the width of the elevator rope.

[0018] The width of the convex contact surface can be in the range of about 1.5 to about 2.25 times the width of said elevator rope.

[0019] Another aspect of the invention relates to an elevator rope sheave for engaging a flat elevator rope, said sheave comprising a convex contact surface for engaging said elevator rope, said convex contact surface having a crown radius that is a function of the width of said elevator rope.

[0020] Said crown radius can be equal to a range of about 15.00 to about 50.00 times the width of the elevator rope.

[0021] The width of the convex contact surface can be in the range of about 1.5 to about 2.25 times the width of the said elevator rope.

[0022] Another aspect of the invention relates to an elevator rope sheave for engaging a flat elevator rope, said sheave comprising a convex contact surface for engaging said elevator rope, said convex contact surface having a width that is in the range of about 1.5 to about 2.25 times the width of said elevator rope.

[0023] Another aspect of the invention relates to an elevator rope sheave for engaging an elevator rope, said sheave comprising a contact surface for engaging said elevator rope, said contact surface having a circumferential surface roughness of about 1.0 to about 3.0 microns.

[0024] Therein, the sheave can comprise a corrosion-resistant surface coating having a hardness of greater than about 40 HRC.

[0025] Another aspect of the invention relates to an elevator rope sheave for engaging an elevator rope, said sheave comprising a contact surface for engaging said elevator rope, said contact surface being formed from a corrosion-resistant material.

[0026] Another aspect of the invention relates to an elevator rope sheave for engaging an elevator rope, said sheave comprising a contact surface for engaging said elevator rope; and a surface coating applied to said contact surface, said coating having a thickness of less than 10 microns.

[0027] Said coating can have a thickness of about 1-2 microns.

[0028] Another aspect of the invention relates to an elevator rope sheave for engaging an elevator rope, said sheave comprising a contact surface for engaging said elevator rope; and a surface coating applied to said contact surface, wherein said coating has a hardness of greater than about 40 HRC.

[0029] Another aspect of the invention relates to an elevator rope sheave for engaging an elevator rope, said sheave comprising a contact surface for engaging said elevator rope; and a surface coating applied to said contact surface, wherein said coating is a corrosion-resistant coating.

[0030] While the preferred embodiments have been herein described, it is understood and acknowledged that modification and variation can be made without departing from the scope of the presently claimed invention.

Claims

1. A combination of an elevator rope (24) and an elevator traction sheave (10, 40) for engaging said elevator rape (24), said elevator rope (24) being a flat rope or belt, said traction sheave (10, 40) being made of steel and comprising : a traction surface for engaging and driving said elevator rope (24) and a surface coating applied to said traction surface, wherein said coating is a corrosion - resistant coating.

2. A combination according to claim 1, the surface coating having a thickness of less than 10 microns.

3. A combination according to claim 2, wherein the surface coating thickness is in a range of approximately 1 micron to approximately 2 microns.

4. A combination according to any of claims 1 to 3, wherein the surface coating has a hardness of greater than approximately 40 HRC.

5. A combination according to any of claims 1 to 4, wherein the traction surface has a circumferential surface roughness of approximately 1.0 to approximately 3.0 microns.

6. Eevator system (20), comprising a combination according to any of claims 1-5.

Patentansprüche

1. Kombination aus einem Aufzugseil (24) und einer Aufzug-Traktionsscheibe (10, 40) zum Zusammenwirken mit dem Aufzugseil (24), wobei das Aufzugseil (24) ein Flachseil oder Gurt ist, wobei die Traktionsscheibe (10, 40) aus Stahl hergestellt ist und Folgendes aufweist: eine Traktionsfläche zum Zusammenwirken mit dem Aufzugseil (24) und zum Antreiben des Aufzugseils (24) sowie eine auf die Traktionsfläche aufgebrachte Oberflächenbeschichtung, wobei die Beschichtung eine korrosionsbeständige Beschichtung ist.

2. Kombination nach Anspruch 1,
wobei die Oberflächenbeschichtung eine Dicke von weniger als 10 μm aufweist.

3. Kombination nach Anspruch 2,
wobei die Dicke der Oberflächenbeschichtung in einem Bereich von ca. 1 μm bis ca. 2 μm liegt.

4. Kombination nach einem der Ansprüche 1 bis 3, wobei die Oberflächenbeschichtung eine Härte von mehr als ca. 40 HRC aufweist.

5. Kombination nach einem der Ansprüche 1 bis 4, wobei die Traktionsfläche eine umfangsmäßige Oberflächenrauheit von ca. 1,0 bis ca. 3,0 μm aufweist.

6. Aufzugsystem (20) mit einer Kombination nach einem der Ansprüche 1 bis 5.

Revendications

1. Association d'un câble d'ascenseur (24) et d'une poulie de traction d'ascenseur (10, 40) adaptée pour entrer en prise avec ledit câble d'ascenseur (24), ledit câble d'ascenseur (24) étant un câble plat ou une courroie plate, ladite poulie de traction (10, 40) étant faite d'acier et comprenant :

   une surface de traction adaptée pour entrer en prise et entraîner ledit câble d'ascenseur (24), et un revêtement de surface appliqué sur ladite surface de traction, dans laquelle ledit revêtement est un matériau résistant à la corrosion.

2. Association selon la revendication 1, le revêtement de surface possédant une épaisseur inférieure à 10 microns.

3. Association selon la revendication 2, dans laquelle l'épaisseur de revêtement de surface est dans une plage allant d'approximativement 1 micron à approximativement 2 microns.

4. Association selon une quelconque des revendications 1 à 3, dans laquelle le revêtement de surface possède une dureté supérieure à approximativement 40 HRC.

5. Association selon une quelconque des revendications 1 à 4, dans laquelle la surface de traction possède une rugosité de surface circonférentielle d'approximativement 1,0 à approximativement 3,0 microns.

6. Système ascenseur (20), comprenant une association selon une quelconque des revendications 1 à 5.

FIG.1

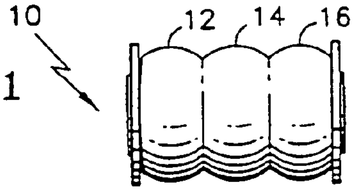


FIG.2

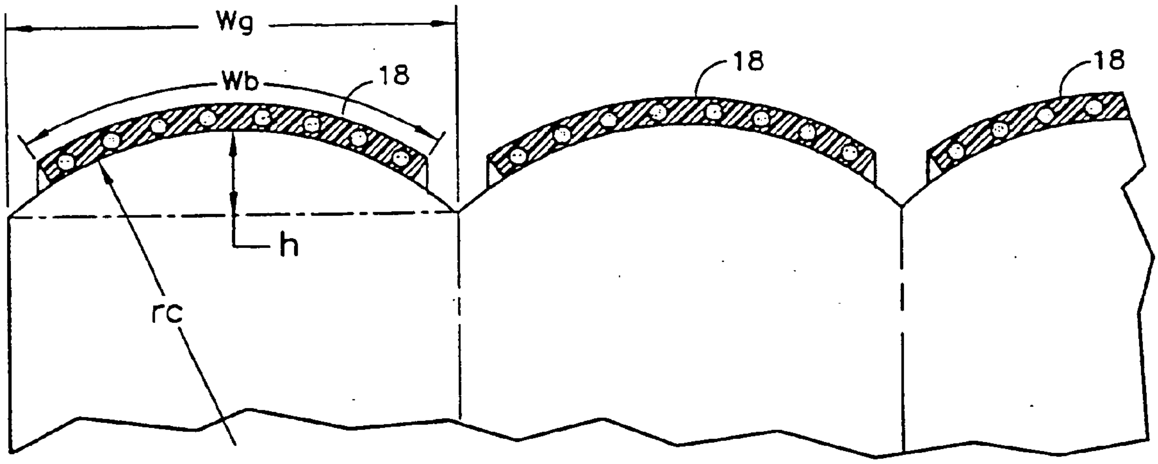
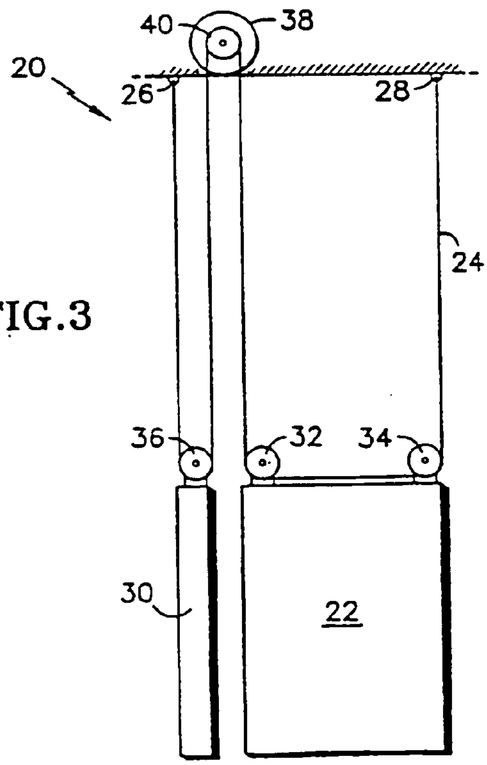


FIG.3



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