

(19)



(11)

EP 2 767 498 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
20.08.2014 Bulletin 2014/34

(51) Int Cl.:
B66B 15/04 (2006.01)

(21) Application number: **13155565.8**

(22) Date of filing: **18.02.2013**

(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

(72) Inventor: **Mäkimattila, Simo**
00330 Helsinki (FI)

(74) Representative: **Kolster Oy Ab**
Iso Roobertinkatu 23
PO Box 148
00121 Helsinki (FI)

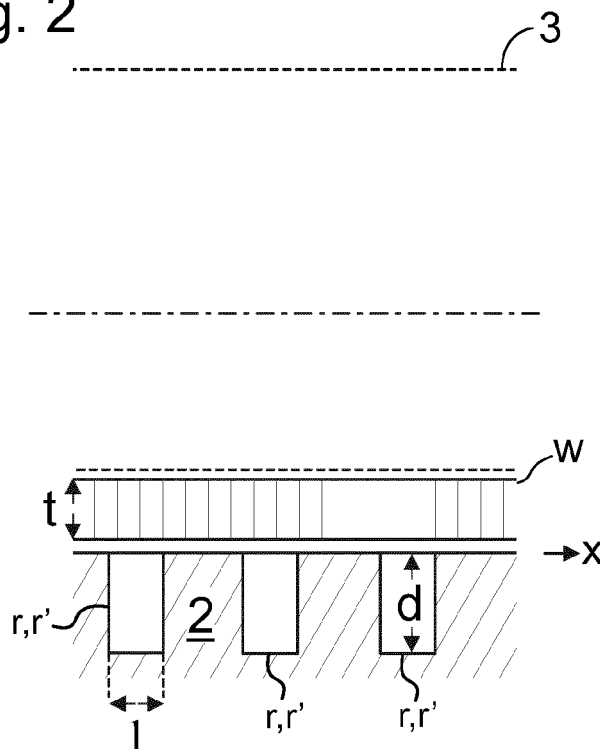
(71) Applicant: **Kone Corporation**
00330 Helsinki (FI)

(54) **Traction sheave**

(57) The invention relates to an elevator comprising an elevator car (1), a traction sheave (2) for driving elevator hoisting ropes (3), at least one metal wire hoisting rope (3) for transmitting force between the elevator car (1) and the traction sheave (2), having metal wires (w) forming at least part of the outer surface of the rope (3), wherein the traction sheave (2) comprises a metallic circumferential traction surface (4, 4') for each of said at

least one rope for transmitting tractive force to the rope (3) which is set to pass against the circumferential traction surface (4, 4'). The circumferential traction surface (4, 4') comprises recesses (r, r') spaced apart in circumferential direction (x) of the traction sheave (2). The invention relates also to a traction sheave for an elevator and a method of making the same.

Fig. 2



EP 2 767 498 A1

Description

Field of the invention

[0001] The invention relates to an elevator and its traction sheave. The elevator is meant for transporting passengers and/or goods.

Background of the invention

[0002] Modern elevators usually have a drive machine which drives the elevator car under control of an elevator control system. The drive machine typically comprises a motor and a traction sheave engaging an elevator roping which is connected to the car. Thus, the driving force is transmitted from the motor to the car via the roping.

[0003] Important factors affecting the traction, when produced by frictional engagement, are the material pair of the rope and the traction sheave as well as lubrication between them. The elevator ropes are normally made of steel wires twisted together. The traction sheaves have a continuous circumferential traction surface for transmitting tractive force to the rope which is set to pass against it. For the purpose of reducing internal friction and wear the ropes have lubricant in them. A problem with these types of known elevators is that the lubricant easily escapes the rope under pressure caused by the rope tension and contact with the traction sheave. At the point of the traction sheave this reduces friction and therefore the force transmitting ability via the rope-sheave contact. Especially, a thick lubricant layer between the traction sheave and the rope could cause slipping. Accordingly, too thick layer of lubricant is harmful. On the other hand it is found out that total elimination of the lubricant layer increases wear of the outermost wires, because of the unavoidable occurrence of slipping between the outermost rope wires and the tractions sheave. This slipping is caused largely by dimension changes occurring in the rope when it passes around the traction sheave. These dimensional changes in of the rope are caused for instance by the rope bending, low elastic coefficient of the rope and non-constant forces affecting the rope during its passage around the traction sheave.

[0004] The traction forces transmitted via frictional engagement between the ropes and the traction sheave depend strongly on the normal forces between the ropes and the sheave. These forces have in the prior art been increased by forming the rope grooves of the traction sheave undercut, i.e. in the form allowing the rope to rest supported by the groove walls and not on the groove bottom. High normal forces have resulted in increased traction but in these solutions it has been difficulties in providing a lubricant layer between the rope and the sheave which reduces rope wear yet does not harm the frictional engagement.

Brief description of the invention

[0005] The object of the invention is, inter alia, to solve previously described drawbacks of known solutions and problems discussed later in the description of the invention. An object of the invention is to introduce an elevator and its traction sheave structure with improved friction properties. An object of the invention is furthermore to introduce an elevator and its traction sheave structure where lubricant layer between the rope and the traction sheave traction surface can be controlled. Embodiments are presented, inter alia, where a lubricant layer can be maintained with high surface pressures. In particular, the thickness of the lubricant layer can be controlled to be more stable. In this way, a strong frictional contact between the rope and the sheave can be achieved, yet being able to provide lubricant between them in such a way that rope wear is not excessive. It is also introduced a method of forming a circumferential traction surface of a traction sheave which method provides improved friction properties for an elevator traction sheave.

[0006] It is brought forward a new elevator, which comprises an elevator car, a traction sheave for driving elevator hoisting ropes, at least one metal wire hoisting rope for transmitting force between the elevator car and the traction sheave, having metal wires forming at least part of the outer surface of the rope. The traction sheave comprises a metallic circumferential traction surface per each of said at least one rope for transmitting tractive force to the rope, which is set to pass against the circumferential traction surface. The circumferential traction surface comprises recesses spaced apart in circumferential direction of the traction sheave. In this way, the surface pressure between the rope wire and the traction surface is adjusted high and thereby to generate high friction. Preferably, the rope has lubrication inside it. Thus, internal wear of the rope is reduced, as well as wear of the areas of the traction sheave and the wires contacting each other. The recesses facilitate formation and maintaining of a thin lubricant film in the contact area between the wires and the traction surface. Thus normal forces can be increased and the interplay between the traction surface and the lubricant inside the rope allows reduced wear yet without losing traction.

[0007] In a preferred embodiment the recesses have a length in circumferential direction which is less than the diameter of said metal wires forming at least part of the outer surface of the rope. In this way the shear forces caused by the hard metallic recess edges on the wire are substantially reduced.

[0008] In a preferred embodiment the recesses have a length in circumferential direction which is less than 1 mm. The recesses are thus short in circumferential direction. In this way the shear forces caused by the hard metallic recess edge are reduced. This has also the benefit that when the rope contains lubricant, the recesses do not receive it too easily. Thereby, the small length of the individual recesses facilitates maintaining the lubri-

cant film thin. This aim is also facilitated by the small length of the recesses because thus they can be positioned densely. Resistance from receiving lubricant excessively facilitates in forming a uniform thin film of lubricant in the contact area between the wires and the traction surface when the rope has lubrication inside it. In a preferred embodiment the recesses have a depth which is less than 1 mm. This limits them from receiving lubricant excessively thereby further facilitating maintaining the lubricant film thin.

[0009] In a preferred embodiment the recesses have a cross section area in the transverse direction relative to the traction sheave circumferential direction less than 1.5 square millimeters. The recesses are thus small in volume or at least their ability to receive rapid volume flow is limited. This limits their ability to receive lubricant which facilitates the forming of a thin film of lubricant in the contact area between the wires and the traction surface.

[0010] In a preferred embodiment each of the recesses extends into the traction surface material and has a bottom and walls surrounding an inside space open towards the rope direction. Accordingly, the inside space is closed in all lateral directions. In this way it can receive a limited volume of lubricant. This makes it more suitable for returning the lubricant back in contact with the rope, and limiting it from receiving excessive amount of lubricant. Also, the lubricant leakage far away from the wires is reduced. For example, in this way, in case of an undercut rope groove, the lubricant does not escape to groove bottom nor spray radially away from the traction sheave due to its rotation.

[0011] In a preferred embodiment the number of recesses per meter is more than 300. The recess area can thus be formed vast, however evenly distributed. In this way, the normal forces can be increased to improve friction. Also, a formation of thin film can be facilitated for the rope with lubrication inside it.

[0012] In a preferred embodiment, said metal wires are steel wires. Preferably, the metallic circumferential traction surface is made of steel or cast iron. In this way, the material pair is well suitable for long-term elevator use.

[0013] In a preferred embodiment the traction sheave comprises a circumferential groove for each of said at least one rope, the groove(s) having said recessed circumferential traction surface(s) for transmitting tractive force to the rope which is set to pass in the groove against the circumferential traction surface. The groove provides guidance for the ropes so the rope passes in a controlled manner against a desired traction surface. Preferably, each groove comprises sidewalls each sidewall having a recessed circumferential traction surface as above defined. Recesses provide an improvement in friction properties as above defined.

[0014] In a preferred embodiment the groove(s) is/are undercut groove(s). In this way, more contact pressure is directed to the sidewalls of the groove as the rope to rests supported by the groove walls and not on the groove

bottom. In this way, the forces can be increased and the traction improved. Furthermore, in this way proportion of unrecessed traction surface can be reduced.

[0015] In a preferred embodiment the recesses are round. This facilitates simple adjusting of their volumes and consequently their ability to receive lubricant. In this way the behavior between the recess and the wires is insensitive to the direction of the wire. The number and density of the recesses can also be very high in this way which facilitates formation thin of a uniformly thin lubricant film.

[0016] In a preferred embodiment said wires form cords and said wires are arranged in spiral in their cords and the cords are arranged in spiral in the rope and the spiral direction of the cords is opposite relative to the spiral direction of the wires. In this way, the direction of the wire can be simply arranged to meet the recesses at least substantially in the length-direction of the rope.

[0017] In a preferred embodiment the recesses are line-shaped in direction transverse to the circumferential direction of the traction sheave. In this way, vast recess area can be formed with a simple method, e.g. by cutting the surface with linear movement of the cutting means.

[0018] Preferably, the recesses are distributed along the whole length of the circumference to form a circular array of recesses. In this way, the whole length of the circumference provides the benefits as disclosed.

[0019] It is also brought forward a new method of forming a circumferential traction surface of a traction sheave for an elevator, which circumferential traction surface is, when being rotated, suitable for transmitting tractive force to a rope, which is set to pass against the circumferential traction surface, in which method

- a traction sheave body with a metallic circumferential surface is provided, and
- recesses are formed on said circumferential surface, which recesses are spaced apart in circumferential direction of the traction sheave.

With this method, friction properties of a traction sheave can be improved considerably. The normal forces can be increased and the interplay between the traction surface and the lubricant inside the rope can be made better so that wear can be reduced without losing traction.

[0020] In a preferred embodiment after the traction sheave body is provided, a circumferential groove is formed on traction sheave body, which has the circumferential surface on which the recesses are later formed. In this way, rope guidance is additionally achieved. The groove form also supports the effect of the recesses. With this process plural grooves are preferably formed which are at later stage recessed. The circumferential surface on which the recesses are later formed is preferably a sidewall of the groove.

[0021] In a preferred embodiment the recesses are formed by removing material from the circumferential surface with laser or water-jet. These are methods which

can provide an accurate result. However, the most preferred method utilizes laser which can produce most easily accurate and very small recesses into a curved shaped as that of a traction sheave, especially when the surface is that of a sidewall of a groove. The laser may, for example, be so called Nd:YAG laser which can efficiently produce the recesses in said metallic surface.

[0022] It is also brought forward a new traction sheave for an elevator, which comprises a metallic circumferential traction surface for a rope for transmitting tractive force to a rope, which is set to pass against the circumferential traction surface. The circumferential traction surface comprises recesses spaced apart in circumferential direction of the traction sheave. The recesses are preferably as defined above or elsewhere in the application.

[0023] In a preferred embodiment the traction sheave is obtained by the method as defined above or elsewhere in the application.

[0024] The elevator as described anywhere above is preferably, but not necessarily, installed inside a building. It is preferably of the type where the car is arranged to serve two or more landings. Then, the car preferably responds to calls from landing and/or destination commands from inside the car so as to serve persons on the landing(s) and/or inside the elevator car. Preferably, the car has an interior space suitable for receiving a passenger or passengers, and the car can be provided with a door for forming a closed interior space. In this way, it is well suitable for serving passengers.

Brief description of the drawings

[0025] In the following, the present invention will be described in more detail by way of example and with reference to the attached drawings, in which

Figure 1 illustrates schematically an elevator according to an embodiment of the invention.

Figure 2 illustrates a cross section of the rope and the traction surface cut along the centerline of the rope at the point of contact between a wire of the rope and the traction surface.

Figures 3 illustrates the recesses as viewed from the direction of the rope according to a first preferred embodiment.

Figures 4 illustrates the recesses as viewed from the direction of the rope according to a second preferred embodiment.

Figure 5 illustrates a cross section of the rope and a part of the traction sheave as viewed in circumferential direction of the traction sheave.

Figure 6 illustrates a cross section of the rope and the traction sheave as viewed in circumferential direction of the traction sheave.

Figure 7 illustrates a preferred structure for the rope.

Figure 8 illustrates a method of forming the circumferential traction surface of the traction sheave.

Detailed description

[0026] Figure 1 illustrates an elevator according to a preferred embodiment. The elevator comprises a hoistway S, an elevator car 1 and a counterweight CW vertically movable in the hoistway S, and a drive machine which drives the elevator car under control of an elevator control system (not shown). The drive machine comprises a motor M and a traction sheave 2 engaging elevator ropes 3 with friction, which ropes 3 are connected to the car 1. Thus, driving force can be transmitted from the motor to the car 1 via the traction sheave 2 and the ropes 3. The ropes 3 connect the elevator car 1 and the counterweight 2 and pass around the traction sheave 2. The traction sheave 2 comprises a metallic circumferential traction surface 4, 4' per each of said at least one rope for transmitting tractive force to the rope 3 which is set to pass against the circumferential traction surface 4, 4'. The hoisting ropes 3 are metal wire ropes. Thus, they have metal wires w forming at least part of the outer surface of the rope 3. In particular, the metal wire ropes are preferably steel wire ropes. The traction surface 4, 4' and a wire w are presented in Figure 2 which illustrates a cross section cut along the centerline of the rope 3 at the point of contact between a wire w and the traction surface 4, 4'. The traction surface is circumferential with a great radius compared to the wire dimensions, so the curved shape does not show in Figure 2. The circumferential traction surface 4, 4' comprises recesses r, r', which are spaced apart in circumferential direction x of the traction sheave 2 which direction also corresponds to that of the rope 3 passing along the circumferential traction surface. In this way, the surface pressure between the rope wire w and the traction surface is adjusted higher and thus to be more preferable with regard to friction. At the area of the recesses, no contact takes place between the rope and the traction sheave 2. This increases the support forces at the areas between the recesses r, r'. These areas between the recesses r, r' support the rope 3, in particular the outer wires thereof, with direct contact apart from the possible lubricant layer therebetween. The recesses r, r' are very short in circumferential direction. In this way the shear forces caused by the hard metallic recess edges are substantially reduced. A generally advantageous length l for the recesses r, r' circumferential direction is less than 1 mm, which is suitable for improving friction of most elevator ropes with reasonable disadvantages caused by shear forces affecting the rope. However, it is particularly preferable, that the recesses r, r' have a length in circumferential direction which is less than the diameter t of said metal wires w, which form part of the outer surface of the rope 3. In this way the shear forces caused by the hard metallic recess edge are substantially reduced.

[0027] It is preferable, that each of said ropes 3 has lubrication inside it, which is in contact at least with the metal wires w. Thus, it can lubricate the wires w, and also escape from within the rope 3 to the contact area between

the wires w and the traction sheave traction surface 4, 4'. Thus, the wear of the wires w , as well as wear of the traction surface 4,4' is reduced. The recesses can each receive lubricant leaking from between the rope and the sheave. The recesses can store lubricant and return it into contact with the rope. The shortness of the recesses r, r' , as earlier specified, has also the benefit that it makes it possible that the recesses can be positioned densely. This leads to that a thin film of lubricant can be uniformly produced. In practice, an advantageous lubricant flow to form a uniform lubricant film can in this way be enabled.

[0028] The recesses r, r' have a small cross section area in the transverse direction relative to the circumferential direction x . In other words, the length l times the depth d is small. This leads to small capacity to receive lubricant. In this way they do not receive excessively easily the lubricant, and can return some lubricant back to contact with the rope. It is advantageous that the recesses have a cross section area in the transverse direction relative to the circumferential direction less than 1.5 square millimeter. It is preferable that the recesses have a depth d which is less than 1 mm. In this way, some wear tolerance can be still maintained but the volume of the recess is not excessive in terms of its capability to return lubricant to contact with the rope 3. Accordingly, the recesses are so small that they do not swallow all the lubricant.

[0029] Figures 3 and 4 illustrate traction surfaces 4 and 4' with alternative shapes for the recesses r, r' as seen in the direction of normal of the traction surface 4,4'. In the figure arrow x illustrates the circumferential direction of the traction sheave 2. In the embodiment as illustrated in Figure 3, the recesses are round. In the embodiment as illustrated in Figure 4, the recesses are line-shaped in direction transverse to the circumferential direction x of the traction sheave 2.

[0030] Figure 5 illustrates a preferred embodiment where the traction sheave 2 comprises a circumferential groove 5 for the rope 3, the groove 5 having a recessed circumferential traction surface 4, 4' for transmitting tractive force to the rope 3 which is set to pass in the groove 5 against the circumferential traction surface 4, 4'. In particular, the groove 5 comprises sidewalls each having a recessed circumferential traction surface 4, 4' of the like as earlier specified. The sidewalls face the rope at an inclined angle which increases the support forces on the rope resting on the sidewalls. The groove 5 is in this case an undercut groove. It is preferable, but not necessary, that the traction surface 4, 4' is curved at least substantially with the same radius as the radius of the rope. In this way, the high contact pressure can be divided to the rope surface more evenly. Also, this facilitates more even wear of the rope 3. Figure 6 illustrates a preferred embodiment where the traction sheave 2 comprises plurality of said circumferential grooves 5 for plurality of ropes 3, each groove being as described in connection with Figure 5.

[0031] The recess r, r' are short but they should be

densely distributed along the circumference of the traction sheave 2. In this way, the effect of increasing the normal force is considerable and the ability to stabilize the lubricant layer thickness is considerable (in case lubricant is used). Good results are achieved when the number of recesses per meter is more than 300.

[0032] The method a circumferential traction surface 4,4' of a traction sheave 2 for an elevator is formed forming, which circumferential traction surface 4,4' is, when being rotated, suitable for transmitting tractive force to a rope 3, which is set to pass against the circumferential traction surface (4,4'). The method comprises a step of providing a traction sheave body b with a metallic circumferential surface and a step of forming recesses r, r' on said circumferential surface, which recesses r, r' are spaced apart in circumferential direction x of the traction sheave 2. The recesses r, r' as well as the traction sheave material are preferably as defined elsewhere in the application. In the method after the traction sheave body b is provided, a circumferential groove is formed on the traction sheave body b , which has the circumferential surface on which the recesses r, r' are later formed. In the step of forming the groove, the groove can be formed by machining (e.g. by rotary cutting method) the traction sheave body b to have said circumferential surface on which the recesses are to be formed. Each groove comprises sidewalls each sidewall having a circumferential surface on which recesses r or r' are to be formed in the later step. Figure 8 illustrates an embodiment of the method step where recesses r, r' are formed. In the method the recesses are formed with device C. In this case the recesses are formed by removing material from the circumferential surface with laser beam(s). Accordingly, device C is a device for laser cutting. In practise, it may be so called Nd:YAG type of laser device, which enables very accurate removal of material by evaporizing. The actual laser cutting of the plural recesses r, r' can be carried out by rotating the sheave body b stepwise around. Thus device C need not move substantially. Alternatively the recesses could be formed by removing material from the circumferential surface with water jet(s). Accordingly, device C could in this alternative solution be a device for water-jet cutting. The outcome of this method is disclosed in Figures 2-6. As illustrated in Figure 6, the traction sheave is preferably prepared to have plurality of said grooves 5 each having side walls which each have a recessed traction surface 4, 4'.

[0033] The traction sheave for an elevator, which comprises a metallic circumferential traction surface 4, 4' for at least one rope 3 for transmitting tractive force to a rope 3, which is set to pass against the circumferential traction surface 4, 4'. The circumferential traction surface 4, 4' comprises recesses r, r' spaced apart in circumferential direction x of the traction sheave 2. The structure of the traction sheave is illustrated in the Figures 1-6 and 8 and described elsewhere in the application. The traction sheave is preferably obtained by the method as described earlier.

[0034] As mentioned earlier, it is preferable that the recesses r , r' have a length in circumferential direction which is less than the diameter t of said metal wires w forming at least part of the outer surface of the rope. One well working solution has the rope(s) 3 with outer wire w from 0.2 mm to 0.3 mm in diameter t and the traction sheave with recesses r , r' from 0.05 mm to 0.2 mm long. For example, the wire can be 0.2 mm in diameter t and the recess 0.1 mm long.

[0035] The metallic circumferential traction surface is may be made for example of steel or cast iron. These materials can be machined relatively easily and accurately with laser or water jet or other means as mentioned. In any case, the traction sheave traction surface is preferably made of metal, which has hardness from 450 HV to 1200 HV. In this way, the recesses r , r' do not wear down quickly and the properties regarding lubricant storage are maintained long enough to give the traction sheave 2 a life-time required for long-term use of the elevator.

[0036] Each of said ropes 3 is preferably essentially round in its cross section. Figure 7 illustrates a preferred structure for the rope 3. The outer wires w may be wound to form cords c surrounding the core of the rope 3. The core may be made of metal, for example from corresponding metal wires as aforementioned outer wires w . Without departing from the idea of the invention, the core of the rope 3 may be also from other material than metal. Likewise, the outer wires w may be arranged to form cords of different structure or amount than what is disclosed in Figure 7. It is preferable that the rope 3 is a twisted wire rope. This type of metal ropes are common in elevators. The spiral configuration of the wires leads to that the wires are often not totally parallel with the circumference of the traction sheave, however the angle of the wires relative to the longitudinal axis of the rope does not with most ropes harm the functioning of the idea. It is preferable that the spiral of wires w in their cords c have opposite spiral direction than the cords c in the rope. In this way the outer wires w can be arranged to meet the recesses essentially in length-direction.

[0037] In the Figures only a portion of the traction sheave surface is illustrated. The recess pattern, however continues completely around the traction sheave. Accordingly, the recesses r , r' are distributed along the whole length of the circumference to form a circular array of recesses r , r' .

[0038] Alternatively, some other methods for forming the recesses can be used. For example, the recesses can be formed by sandblasting or by etching.

[0039] The recesses r , r' are preferably in the form of blind holes extending into the traction surface material. That is, they have a bottom and walls and an inside space open towards the rope 3.

[0040] It is to be understood that the above description and the accompanying Figures are only intended to illustrate the present invention. It will be apparent to a person skilled in the art that the inventive concept can be imple-

mented in various ways. The invention and its embodiments are not limited to the examples described above but may vary within the scope of the claims.

Claims

1. An elevator comprising

- an elevator car (1),
- a traction sheave (2) for driving elevator hoisting ropes (3),
- at least one metal wire hoisting rope (3) for transmitting force between the elevator car (1) and the traction sheave (2), having metal wires (w) forming at least part of the outer surface of the rope (3),

wherein the traction sheave (2) comprises a metallic circumferential traction surface (4, 4') for each of said at least one rope for transmitting tractive force to the rope (3) which is set to pass against the circumferential traction surface (4, 4'), **characterized in that** the circumferential traction surface (4, 4') comprises recesses (r , r') spaced apart in circumferential direction (x) of the traction sheave (2).

2. An elevator according to claim 1, **characterized in that** the recesses (r , r') have a length in circumferential direction which is less than the diameter of said metal wires (w) forming at least part of the outer surface of the rope (3).

3. An elevator according to any one of the preceding claims, **characterized in that** each of the recesses (r , r') has a length in circumferential direction which is less than 1 mm.

4. An elevator according to any one of the preceding claims, **characterized in that** the rope (3) has lubrication inside it.

5. An elevator according to any one of the preceding claims, **characterized in that** each of the recesses (r , r') extends into the traction surface material and has a bottom and walls surrounding an inside space.

6. An elevator according to any one of the preceding claims, **characterized in that** each of the recesses has a cross section area in the transverse direction relative to the circumferential direction less than 1.5 square millimeters.

7. An elevator according to any one of the preceding claims, **characterized in that** each of the recesses has a depth (d) which is less than 1 mm.

8. An elevator according to any one of the preceding

claims, **characterized in that** the number of recesses per meter is more than 300.

9. An elevator according to any one of the preceding claims, **characterized in that** said metal wires (w) are steel wires. 5

10. An elevator according to any one of the preceding claims, **characterized in that** the traction sheave (2) comprises a circumferential groove (5) for each of said at least one rope (3), each groove (5) having a recessed circumferential traction surface (4, 4') as defined for transmitting tractive force to the rope (3) which is set to pass in the groove (5) against the circumferential traction surface (4, 4'). 10 15

11. An elevator according to any claim 10, **characterized in that** each groove (5) comprises sidewalls, each sidewall having a recessed circumferential traction surface (4, 4') as defined. 20

12. An elevator according to any one of the preceding claims 10-11, **characterized in that** each groove (5) is an undercut groove. 25

13. An elevator according to any one of the preceding claims, **characterized in that** the recesses (r, r') are round or line-shaped.

14. Method of forming a circumferential traction surface (4,4') of a traction sheave (2) for an elevator, which circumferential traction surface (4,4') is, when being rotated, suitable for transmitting tractive force to a rope (3), which is set to pass against the circumferential traction surface (4,4'), in which method 30 35
 - a traction sheave body with a metallic circumferential surface is provided, and
 - recesses (r, r') are formed on said circumferential surface, which recesses (r, r') are spaced apart in circumferential direction (x) of the traction sheave (2). 40

15. A method according to any one of the preceding claims, **characterized in that** in the method after the traction sheave body (b) is provided, a circumferential groove (5) is formed on traction sheave body (b), which circumferential groove (5) has the circumferential surface on which the recesses (r, r') are later formed. 45 50

16. A method according to any one of the preceding claims, **characterized in that** the recesses (r, r') are formed by removing material from the circumferential surface with a laser. 55

17. A traction sheave for an elevator, which comprises a metallic circumferential traction surface (4, 4') for

at least one rope (3) for transmitting tractive force to a rope (3), which is set to pass against the circumferential traction surface (4, 4'), **characterized in that** the circumferential traction surface (4, 4') comprises recesses (r, r') spaced apart in circumferential direction (x) of the traction sheave (2).

Fig. 1

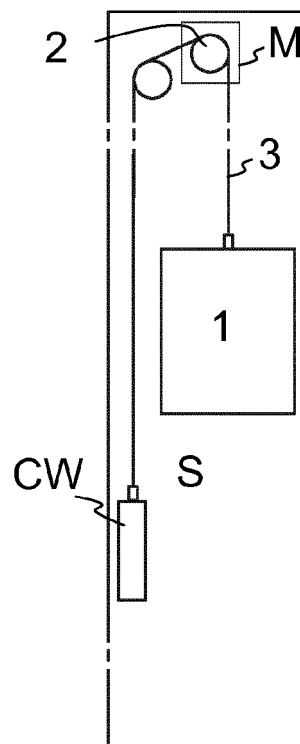


Fig. 2

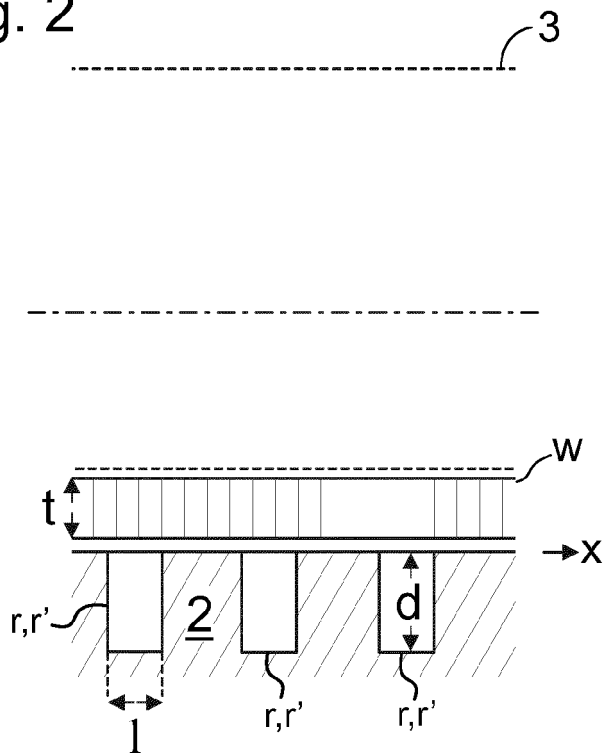


Fig. 3

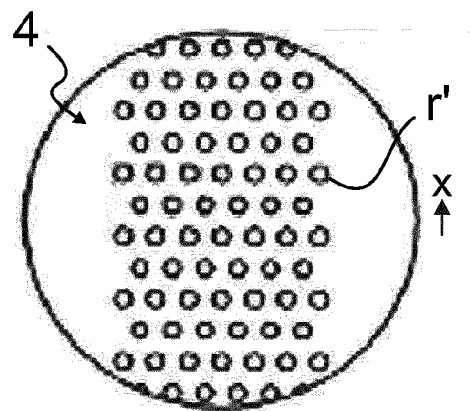


Fig. 4

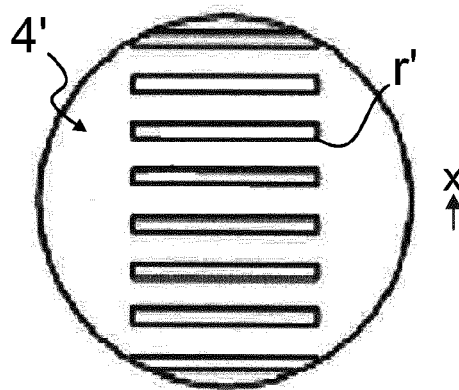


Fig. 5

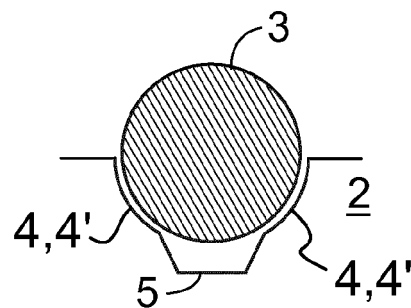


Fig. 6

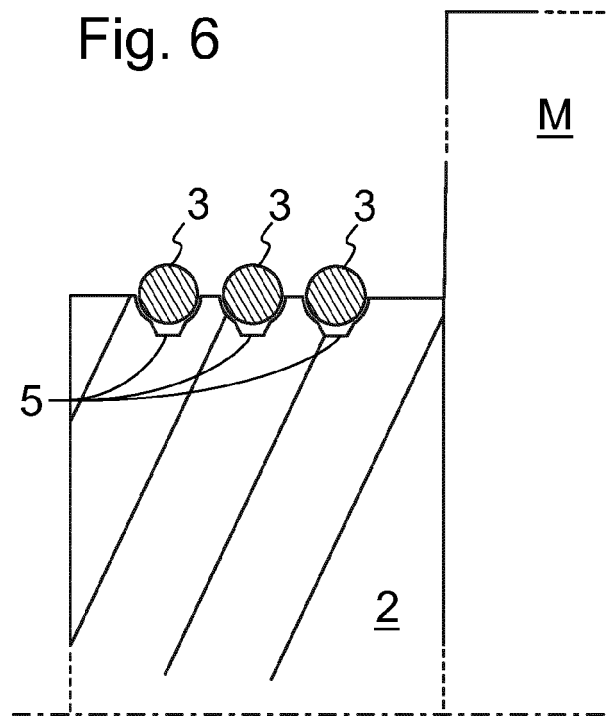


Fig. 7

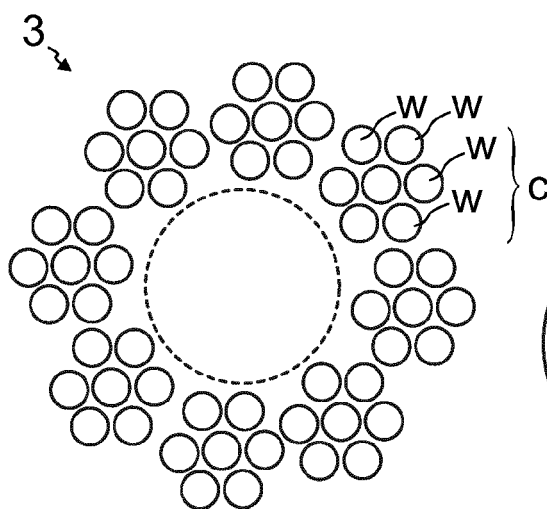
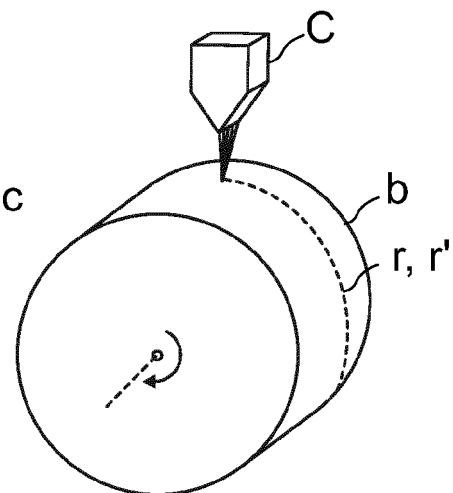


Fig. 8





EUROPEAN SEARCH REPORT

Application Number
EP 13 15 5565

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	US 2012/037460 A1 (ZAPH VOLKER [CH]) 16 February 2012 (2012-02-16) * paragraphs [0011], [0012], [0026], [0027], [0032], [0037]; figures 2,3 *	1-17	INV. B66B15/04
X	JP 2011 173726 A (MITSUBISHI ELECTRIC CORP) 8 September 2011 (2011-09-08) * abstract; figures 1-15 *	1,4,5, 9-15,17	
X	JP S54 81569 U (UNKNOWN) 9 June 1979 (1979-06-09) * figures 1-3 *	1,14,17	
			TECHNICAL FIELDS SEARCHED (IPC)
			B66B
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		10 July 2013	Janssens, Gerd
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 03.02 (P04C01)

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

EP 13 15 5565

5

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.

10-07-2013

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2012037460 A1	16-02-2012	AU 2010206199 A1	11-08-2011
		CA 2748989 A1	29-07-2010
		CN 102307804 A	04-01-2012
		EP 2210847 A1	28-07-2010
		EP 2379437 A1	26-10-2011
		KR 20110105844 A	27-09-2011
		US 2012037460 A1	16-02-2012
		WO 2010084104 A1	29-07-2010

JP 2011173726 A	08-09-2011	NONE	

JP S5481569 U	09-06-1979	JP S5481569 U	09-06-1979
		JP S5640784 Y2	24-09-1981

EPO FORM P0459

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