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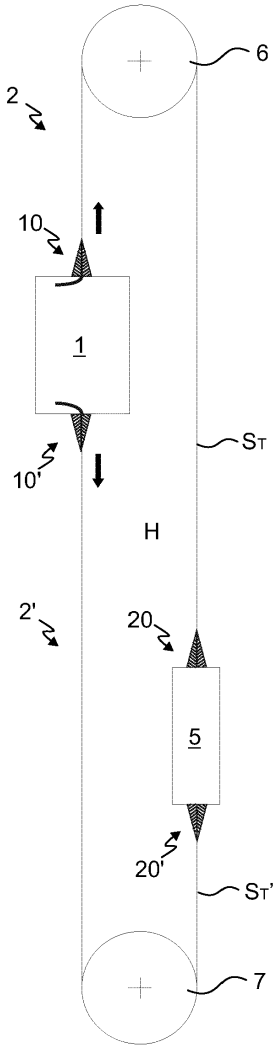
(54) ELEVATOR ARRANGEMENT AND METHOD

(57) The invention relates to an elevator arrangement comprising an elevator car (1); a rope (2,2') connected with the elevator car (1); a first terminal device (10,10') for gripping a rope section of the rope (2,2'); a second terminal device (20,20') for gripping a rope section of the rope (2,2'); wherein the rope (2,2') is arranged to have a first section (S1) gripped by the first terminal device (10,10'); and an intermediate section (ST) that is under tension produced by pull directed on the rope in longitudinal direction thereof (particularly by the load(s) suspended with the rope) and extends between the first and second terminal device (10,20;10',20'); and a second section (S2) gripped by the second terminal device (20,20'); and a tail section (S3) extending on opposite side with respect to the first rope terminal (10,10') than the intermediate section (ST), wherein the tail section (S3) is at least as long as the first section (S1) gripped by the first terminal device (10,10'). The invention further relates to a method for servicing said elevator arrangement.

Fig. 1



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Description

FIELD OF THE INVENTION

[0001] The invention relates to an elevator arrangement and a method for servicing an elevator arrangement. Said elevator arrangement is preferably an elevator arrangement for vertically transporting passengers and/or goods.

BACKGROUND OF THE INVENTION

[0002] In elevators, ropes are typically used as the means by which the elevator car is suspended. Most commonly, the ropes interconnect the elevator car and a counterweight with each other. In elevators, ropes can also be used as so called compensation ropes, which hang from the car and counterweight.

[0003] Each rope end needs to be fixed to a fixing base, which is typically either the load to be lifted or a stationary structure, depending on the type of suspension chosen for the elevator. The rope ends can be fixed directly to the load, such as the car or counterweight, which is the case when these are to be suspended with 1:1 ratio. Alternatively, the rope ends can be fixed to a stationary structure of the building, which is the case when the car and counterweight are to be suspended with 2:1 ratio, for instance.

[0004] Ropes of an elevator ropes are normally either belt-shaped or round in cross section. Each elevator rope typically includes one or more load bearing members that are elongated in the longitudinal direction of the rope, each forming a structure that continues unbroken throughout the length of the rope. Load bearing members are the members of the rope which are able to bear together the load exerted on the rope in its longitudinal direction. The load, such as a weight suspended by the rope, causes tension on the load bearing member, which tension can be transmitted by the load bearing member in question all the way from one end of the rope to the other end of the rope. Ropes may further comprise non-bearing components, such as a coating, which cannot transmit tension in the above described way. The coating can be utilized for protection of the load bearing members and/or facilitating contact with rope wheels and/or for positioning adjacent load bearing members relative to each other, for example.

[0005] In prior art, elevator ropes have been fixed to the fixing base with a rope terminal device. Such rope terminal devices have been proposed, wherein the rope end is compressed in a gap defined by two compression members. Such rope terminal device has been disclosed for example in US2014/0182975A1. The compression members are movable relative to each other such that the gap between them is narrowed so as to cause compression on the rope section placed between in the gap between them. Thereby, the rope section is subjected to compression in its transverse direction as well as tensile loading in its longitudinal direction due to the load exerted on the rope. In prior art, at least one of the compression members movable, whereby said relative movement is achieved. Reliability of this sort of arrangement relies largely on the grip produced by the compression between the rope surface and the compression member. The rope end should be firmly gripped such that it is not able to slide out of the compression gap, because this would mean that the suspension of the particular rope would be lost. Therefore, for facilitating safety, it is advantageous to ensure good grip.

[0006] The kind of rope terminal device described above has the drawback that a reliable grip is difficult to provide permanently particularly when the surface of the rope of material sensitive to deformation under stress, such as polymer materials, like polyurethane or rubber, for instance. The surface material is subjected to continuous compression and shear stress, which may cause increasing deformation over time (creep). In long term, the creep phenomenon can lead to slipping which might result, in the worst case, in unexpected loss of suspension of the particular rope fixed by the rope terminal solution.

[0007] During the lifetime of the elevator, a need to service the ropes and/or components of the rope terminal devices eventually rises. The servicing may involve dismantling one or more parts from the rope system for replacement, modification, modernization, repair or mere inspection. For example, the compression members may need to be repaired or replaced with new ones. If creep occurred in the compression gap has been excessive, this has to be reacted to, e.g. by replacing the rope.

[0008] A drawback of the elevators of prior art has been that after dismantling and reassembly the remaining service life of the rope system is not as long as desired if the rope is not replaced with a new one.

BRIEF DESCRIPTION OF THE INVENTION

[0009] An object is to introduce a solution by which one or more of the above defined problems of prior art and/or problems discussed or implied elsewhere in the description can be solved. An object of the invention is particularly to introduce an elevator arrangement and a method by which capacity to achieve a long service life of the rope system can be improved without replacing the used rope with a new one. Embodiments are presented, inter alia, where one or more of the above objects are realized with simple technical overall structure and good reliability. Embodiments are presented, inter alia, which are well suitable for ropes containing brittle members that cannot be sharply bent.

[0010] It is brought forward a new elevator arrangement comprising an elevator car; a rope connected with the elevator car and having two ends; a first terminal device for gripping a rope section of the rope; a second terminal device for gripping a rope section of the rope; wherein the rope is arranged to have a first 'gripped' sec-

tion gripped by the first terminal device; and an intermediate section that is under tension produced by pull directed on the rope in longitudinal direction thereof and extends between the first and second terminal device; and a second 'gripped' section gripped by the second terminal device; and a tail section extending on opposite side with respect to the first rope terminal than the intermediate section, wherein the tail section is at least as long as the first section gripped by the first terminal device. With this solution one or more of the above mentioned objects are achieved. The capacity to achieve a long remaining service life of the rope system after dismantling and reassembly without replacing the used rope with a new one has been facilitated by designing the rope system such that a pristine rope section can be gripped after dismantling. Thus, it can be avoided that the mere process of dismantling and subsequent reassembly of the rope system do not have an adverse effect on the rope section being gripped. Moreover, in this way technical problems related to any creep deformation already present in the rope section previously used for gripping, irrespective of whether it is already detectable or still undetectable, are overcome as the pristine rope section is free of creep. Preferable further details are introduced in the following, which further details can be combined with the device individually or in any combination.

[0011] A further advantage is that the solution has potential to be implemented such that there is no need to considerably rearrange position of terminal device relative to the fixing base thereof. A further advantage is that the solution has potential to be implemented such that there is no need to considerably change buffer positions of the elevator arrangement. A further advantage is that the solution has potential to be implemented such that there is no need to considerably change relative position of the elevator car and counterweight.

[0012] In a preferred embodiment, the tail section is at least as long as the second section gripped by the second terminal device.

[0013] In a preferred embodiment, the surface material of the rope comprises polymer, such as polyurethane, rubber or silicon, for example.

[0014] In a preferred embodiment, the tail section is not under tension produced by pull directed on the rope in longitudinal direction of the rope.

[0015] In a preferred embodiment, the rope is a belt-shaped rope. It is preferably substantially larger in its width direction than in its thickness direction. Preferably, the width/thickness ratio of the rope is more than two, preferably more than 4.

[0016] In a preferred embodiment, the rope comprises one or more elongated load bearing members extending parallel with the longitudinal direction of the rope unbroken throughout the length of the rope. Thus, they are able to transmit tension with good tensile stiffness. The load bearing members are preferably made of composite material comprising reinforcing fibers embedded in polymer matrix, said reinforcing fibers preferably being carbon fibers. The load bearing members are preferably embedded in a coating forming the outer surface of the rope. Then, the coating comprises polymer, such as polyurethane, rubber or silicon.

[0017] In a preferred embodiment, the reinforcing fibers are distributed at least substantially evenly in polymer matrix m and bound to each other by the polymer matrix.

[0018] In a preferred embodiment, preferably, over 50% of the cross-sectional square area of the load bearing member consists of said reinforcing fibers. Thereby, a high tensile stiffness can be facilitated. Preferably, the load bearing members cover together at least a 25-75% proportion of the cross-section of the rope, most preferably over 50% proportion of the cross-section of the rope.

[0019] In a preferred embodiment, the reinforcing fibers are not twisted together. Instead, it is preferable that the reinforcing fibers of each load bearing member are parallel with the longitudinal direction of the load bearing member. Thereby the fibers are also parallel with the longitudinal direction of the rope as each load bearing member is oriented parallel with the longitudinal direction of the rope. This facilitates further the longitudinal stiffness of the rope.

[0020] In a preferred embodiment, the gripping length of the first terminal device, and preferably also that of the second terminal device, is more than 10 cm and less than 1 meter. Most preferably, the gripping length of the first terminal device is in the range 15-50 cm. The first and second terminal device are preferably identical at least in terms of their gripping length. This long contact length provides that a rope can be firmly and gently gripped with gripping faces that are straight and parallel in longitudinal direction of the rope such that the rope compressed by them is not bent into a curved form.

[0021] In a preferred embodiment, the length of the first 'gripped' section gripped by the first terminal device, and preferably also the length of the second 'gripped' section gripped by the second terminal device is more than 10 cm and less than 1 meter. Most preferably, the length of the first 'gripped' section gripped by the first terminal device, and preferably also the length of the second 'gripped' section gripped by the second terminal device is in the range 15-50 cm. It is preferable that the tail section is however not unnecessarily long in addition to the length needed for providing a pristine length of rope to be gripped. For this reason, it is preferable that the tail section is less than 2 meters long, more preferably less than 1 meter long.

[0022] In a preferred embodiment, the tail section is at least 10 cm longer than the first section gripped by the first terminal device.

[0023] In a preferred embodiment, the tail section is less than 2 meters long, more preferably less than 1 meter long.

[0024] In a preferred embodiment, the rope is a suspension rope of the elevator arrangement. Preferably, the rope passes around one or more rope wheels mounted in a fixed location in a building above the elevator car.

Said one or more rope wheels can comprise a drive wheel mounted in a machine room. The machine room forms the permanent machine room of the elevator arrangement. The elevator arrangement comprises a motor for rotating the drive wheel. The drive wheel rests on a floor of the machine room that floor is a permanent floor structure of the building, preferably made of reinforced concrete, wherein the reinforcements are preferably metal members such as steel members.

[0025] In a preferred embodiment, said first and/or second terminal device comprises a first and a second compression member each comprising a compression face delimiting a compression gap between them, which compression gap is narrowable for causing compression on the rope with the compression faces, and widenable for releasing said compression caused on the rope, by movement of the first and a second compression member relative each other.

[0026] In a preferred embodiment, the first and the second compression member are movable relative to each other (by movement of one or both of the compression members) such that the gap is narrowed and the rope between them is compressed by the compression faces, and such that the gap is widened and the rope between them is released from said compression by the compression faces.

[0027] In a preferred embodiment, the compression face of the first and/or the second compression member comprises an uneven surface pattern comprising plurality of protrusions arranged to penetrate into the surface of the rope such that an impression is caused in the surface of the rope, when the compression face in question is compressed against the rope. The protrusions are arranged to force the surface shape of the rope to deform such that recesses are formed into the surface of the rope at the points of the protrusions when the compression face in question is compressed against the rope. Preferably, said uneven surface pattern comprises plurality of grooves between the protrusions. Preferably, height of said protrusions is less than 2.0 mm, most preferably within range 0.5 mm - 1.5 mm. Preferably, said grooves are between said protrusions in longitudinal direction of the rope.

[0028] In a preferred embodiment, uneven surface pattern is a knurling - pattern.

[0029] In a preferred embodiment, the rope is belt-shaped.

[0030] In a preferred embodiment, the compression faces are straight and parallel in longitudinal direction of the rope such that the rope compressed by them is not bent into a curved form. Owing to this construction of the compression faces, a long contact area and thereby a gentle gripping can be established between the rope and the compression members. This construction is particularly advantageous when the rope is coated and unable to withstand great point loads, but also if the load bearing members are brittle and thereby sensitive to point loads as well. Moreover, this provides that the rope can be fixed gently without bending it, which would be disadvantageous if the rope has rigid and/or brittle elements, such as load bearing members made of composite material. Moreover, the rope is preferably belt shaped and the compression faces are planar. Planar construction is particularly advantageous as it provides a very vast contact area without bending the rope.

[0031] In a preferred embodiment, the compression members are arranged to be movable by wedging relative to each other such that a compression gap between them is narrowed for causing compression on the rope with the compression faces. Preferably, said first and/or second terminal device comprise each a rope terminal frame comprising a tapering nest accommodating a section of the rope and the compression members.

[0032] In a preferred embodiment, the rope comprises a rope end block mounted on the tail section at a distance from the first terminal device, which distance is measured along the tail section, and which distance is at least as long as the first section gripped by the first terminal device. Preferably, the rope end block comprises one or more electrical contactors connected electrically with one or more load bearing members of the rope. Preferably, the elevator arrangement furthermore comprises a rope condition monitoring system for monitoring electrical properties of one or more load bearing members of the rope which rope condition monitoring system is connected electrically with said one or more electrical contactors.

[0033] In a preferred embodiment, the rope comprises a rope end block mounted on the tail section in contact with the first terminal device or at a distance from the first terminal device, which distance is measured along the tail section and shorter than 5 cm. Preferably, the rope end block comprises one or more electrical contactors connected electrically with one or more load bearing members of the rope. Preferably, the elevator arrangement furthermore comprises a rope condition monitoring system for monitoring electrical properties of one or more load bearing members of the rope which rope condition monitoring system is connected electrically with said one or more electrical contactors.

[0034] It is also brought forward a new method for servicing an elevator arrangement wherein the elevator arrangement is as defined in any of the preceding claims, and which method comprises reducing said tension of the intermediate section; and releasing the grip of the first terminal device; and moving the rope relative to the first terminal device to be positioned such that the tail section can be gripped with the first terminal device; and gripping the tail section with the first terminal device. With this solution one or more of the above mentioned objects are achieved. The capacity to achieve a long remaining service life of the rope system after dismantling and reassembly without replacing the used rope with a new one has been facilitated by designing the rope system such that a pristine rope section can be gripped after dismantling. Thus, it can be avoided that the mere process of dismantling and subsequent reassembly of the rope sys-

tem do not have an adverse effect on the rope section being gripped. Moreover, in this way technical problems related to any creep deformation already present in the rope section previously used for gripping, irrespective of whether it is already detectable or still undetectable, are overcome as the pristine rope section is free of creep. Preferable further details are introduced in the following, which further details can be combined with the device individually or in any combination.

[0035] A further advantage is that the solution has potential to be implemented such that there is no need to considerably rearrange position of terminal device relative to the fixing base thereof. A further advantage is that the solution has potential to be implemented such that there is no need to considerably change buffer positions of the elevator arrangement. A further advantage is that the solution has potential to be implemented such that there is no need to considerably change relative position of the elevator car and counterweight.

[0036] In a preferred embodiment, in said moving the rope relative to the first terminal device to be positioned such that the tail section can be gripped with the first terminal device the rope is moved such that the tail section replaces the first section.

[0037] In a preferred embodiment, in said moving the rope relative to the first terminal device to be positioned such that the tail section can be gripped with the first terminal device the rope is moved such that the tail section replaces the first section and the first section becomes part of the intermediate section extending between the first and second terminal device.

[0038] In a preferred embodiment, the method further comprises releasing the grip of the second terminal device; and moving the rope relative to the second terminal device to be positioned such that a section of the intermediate section can be gripped with the second terminal device; and gripping said section of the intermediate section with the second terminal device.

[0039] In a preferred embodiment, in said moving the rope relative to the second terminal device to be positioned such that a section of the intermediate section can be gripped with the second terminal device the rope is moved such that a section of the intermediate section replaces the second section.

[0040] In a preferred embodiment, in said moving the rope relative to the second terminal device to be positioned such that a section of the intermediate section can be gripped with the second terminal device the rope is moved such that a section of the intermediate section replaces the second section and the second section becomes to extend on opposite side with respect to the second rope terminal than the intermediate section.

[0041] In a preferred embodiment, the method comprises replacing one or more of the components of the first terminal device and/or second terminal device with new ones. The method then preferably comprises replacing one or more compression members of the first terminal device and/or second terminal device with new ones. Disadvantages of dismantling of the configuration to make this kind of replacement possible can be substantially alleviated with the elevator arrangement /method described.

[0042] In a preferred embodiment, the method comprises before the aforementioned steps using the elevator arrangement for transporting passengers and/or goods inside an elevator car thereof; and removing the elevator arrangement from said use for transporting passengers and/or goods inside an elevator car thereof. The method further comprises after the aforementioned steps taking the elevator arrangement back to the use for transporting passengers and/or goods inside an elevator car thereof.

[0043] The elevator arrangement is preferably such that the car thereof is arranged to serve two or more landings. The elevator arrangement preferably controls movement of the car in response to signals from user interfaces located at landing(s) and/or 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.

BRIEF DESCRIPTION OF THE DRAWINGS

[0044] 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 an embodiment of elevator arrangement.

Figure 2 illustrates schematically the rope and the terminal devices of Figure 1.

Figure 3 illustrates the elevator of Figure 1 after a method wherein the terminal devices have been released for servicing the elevator.

Figure 4 illustrates schematically the rope and the terminal devices of Figure 3.

Figure 5 illustrates preferred details of the compression faces of the rope terminal devices.

Figure 6 illustrates a preferred cross-section the rope and the terminal device when the rope is being gripped.

Figure 7 illustrates a side view of the embodiment of Figure 6 when the rope is not gripped.

Figure 8 illustrates a side view of the embodiment of Figure 6 when the rope is being gripped.

Figure 9 illustrates a preferred cross section of the rope.

Figure 10 illustrates preferred further details for the rope and the terminal device.

Figures 11 and 12 illustrate preferred details of the load bearing member of the rope. The foregoing aspects, features and advantages of the invention will be apparent from the drawings and the detailed description related thereto.

DETAILED DESCRIPTION

[0045] Figure 1 illustrates an elevator arrangement comprising an elevator car 1 arranged to travel vertically in a hoistway H, and a rope 2 connected with the elevator car 1 and having two ends. The rope 2 is a suspension rope. In the presented embodiment the rope 2 interconnects the elevator car 2 and a counterweight 5 and passes around one or more rope wheels 6 (in this case one) mounted in a fixed location in a building above the elevator car 1. The elevator arrangement further comprises a further rope 2' connected with the elevator car 1 and having two ends. The rope 2' is a compensation rope. In the presented embodiment the rope 2' interconnects the elevator car 2 and a counterweight 5 and hangs from the car and counterweight in the hoistway H. The rope 2' passes around one or more rope wheels 7 (in this case one) mounted in the hoistway H below the elevator car 1.

[0046] The elevator arrangement comprises a first terminal device 10 arranged to grip a first rope section S1 of the hoisting rope 2 and a second terminal device 20 arranged to grip a second rope section S2 of the hoisting rope 2. The suspension rope 2 is arranged to have a first 'gripped' section S1 gripped by the first terminal device 10, and an intermediate section ST that is under tension produced by pull directed on the rope in longitudinal direction thereof, particularly by the load(s) suspended with the rope, and extends between the first and second terminal device 10,20, and a second 'gripped' section S2 gripped by the second terminal device 20, and a tail section S3 extending on opposite side with respect to the first rope terminal 10 than the intermediate section ST, wherein the tail section S3 is at least as long as the first section S1 gripped by the first terminal device 10. Thus, the tail section S3 can be moved relative to the first terminal device 10 to be positioned such that the tail section S3 can be gripped with the first terminal device 10. The tail section provides a pristine length of rope to be gripped by the first terminal device 10 after dismantling of the gripping thereof. The tail section S3 is likewise preferably at least as long as the second section S2 gripped by the second terminal device 20, whereby when the tail section S3 is moved to be gripped by the first terminal device 10, the rest of the rope can be moved such an amount that a section S4 of the intermediate section ST moves relative to the second terminal device 20 such that it can be gripped with the second terminal device 20. Thus, a pristine length of rope to be gripped by the second terminal device 20 is provided, and a need for changing positioning of components relative to each other (the terminal devices, the counterweight, the car, or buffers thereof) as a result of the process can be avoided. The first and second terminal device 10,20 are preferably identical, whereby the gripping lengths thereof are equal. In the presented case, said load(s) include said elevator car 1 and the counterweight 5. The tail section S3 is not under tension produced by pull directed on the rope 2 in longitudinal direction of the rope 2 by the load(s) suspended with the rope 2.

[0047] The elevator arrangement can have corresponding provisions also for the compensation rope 2'. In this case, correspondingly as with the suspension rope 2, the elevator arrangement comprises a first terminal device 10' arranged to grip a first rope section S1 of the compensation rope 2' and a second terminal device 20' arranged to grip a second rope section S2 of the compensation rope 2'. The compensation rope 2' is arranged to have a first 'gripped' section S1 gripped by the first terminal device 10', and an intermediate section ST that is under tension produced by pull directed on the rope in longitudinal direction thereof and extends between the first and second terminal device 10',20', and a second 'gripped' section S2 gripped by the second terminal device 20', and a tail section S3 extending on opposite side with respect to the first rope terminal 10' than the intermediate section ST, wherein the tail section S3 is at least as long as the first section S1 gripped by the first terminal device 10'. The tension can be produced particularly by the weight of the very long section of rope 2' hanging in the hoistway H between the terminal devices 10',20' and/or by possible tightening means (not presented) arranged to urge the rope wheel 7 downwards for tightening the compensation rope 2'. The tail section S3 can be moved relative to the first terminal device 10' to be positioned such that the tail section S3 can be gripped with the first terminal device 10'. Thus, the tail section provides a pristine length of rope to be gripped by the first terminal device 10' after dismantling of the gripping thereof. The tail section S3 is likewise preferably at least as long as the second section S2 gripped by the second terminal device 20', whereby when the tail section S3 is moved to be gripped by the first terminal device 10', the rest of the rope 2' can be moved such an amount that a section S4 of the intermediate section ST moves relative to the second terminal device 20' such that it can be gripped with the second terminal device 20. Thus, a pristine length of rope to be gripped by the second terminal device 20' is provided, and a need for changing positioning of components relative to each other (the terminal devices, counterweight, car, or buffers thereof) as a result of the process can be avoided. The first and second terminal device 10,20 are preferably identical, whereby the gripping lengths thereof are equal. The tail section S3 of the compensation rope 2' is not under substantial tension produced by pull directed on the rope 2' in longitudinal direction of the rope 2'.

[0048] The gripping length of the first terminal devices 10,10';20,20' is more than 10 cm and less than 1 meter. Most preferably, the gripping length of the first terminal device 10,10';20,20' is in the range 20-50 cm. This long contact length provides that a rope 2,2' can be firmly and gently gripped with gripping faces F that are straight and parallel in longitudinal direction of the rope 2,2' such that the rope compressed by them is not bent into a curved form. If follows from this design of the terminal devices that the length of the first 'gripped' section S1 gripped by

the first terminal device 10,10', and the length of the second 'gripped' section S2 gripped by the second terminal device 20,20' is more than 10 cm and less than 1 meter. Most preferably, the length of the first 'gripped' section S1 gripped by the first terminal device 10,10', and preferably also the length of the second 'gripped' section S2 gripped by the second terminal device 20,20' is in the range 20-50 cm. It is preferable that the tail section S3 is however not unnecessarily long in addition to the length needed for providing a pristine length of rope to be gripped. For this reason, it is preferable that the tail section S3 is less than 2 meters long, more preferably less than 1 meter long. Generally, it is preferable that the tail section S3 is at least 10 cm longer than the first section S1 gripped by the first terminal device 10,10', and likewise at least 10 cm longer than the first section S1 gripped by the second terminal device 20,20'. The extra length is preferable to give adequate tolerance for performing the work and positioning the rope with the terminal devices easily.

[0049] The terminal devices 10,20;10',20' are illustrated in Figures 1-4 schematically. Figures 6 and 10 illustrate further preferred details for the terminal devices 10,20;10',20'. Each of said first and second terminal device 10,20;10',20' comprises a first and a second compression member 10a,10b;20a,20b; 10a',10b';20a',20b' each comprising a compression face F delimiting a compression gap G between them, which compression gap G is narrowable for causing compression on the rope with the compression faces, and widenable for releasing said compression caused on the rope by movement of the first and a second compression member 10a,10b;20a,20b; 10a',10b';20a',20b' relative each other. The first and the second compression member 10a,10b;20a,20b; 10a',10b';20a',20b'are movable relative to each other by movement of one or both of the compression members 10a,10b;20a,20b; 10a',10b';20a',20b' such that the gap G is narrowed and the rope 2,2' between them is compressed by the compression faces F and such that the gap G is widened and the rope 2,2' between them is released from said compression by the compression faces F. The gripping faces F are straight and parallel in longitudinal direction of the rope 2,2' such that the rope 2,2' compressed by them is not bent into a curved form. The compression members 10a,10b;20a,20b; 10a',10b';20a',20b' are thus shaped to minimize bending of the rope 2,2'. The rope 2,2' is preferably belt-shaped whereby the gripping faces F are furthermore preferably planar, albeit they can comprise an uneven surface pattern such as an uneven surface pattern P for facilitating the grip.

[0050] The compression members 10a,10b;20a,20b;10a',10b';20a',20b' are preferably arranged to be movable by wedging relative to each other such that the compression gap G between them is narrowed for causing compression on the rope with the compression faces F.

[0051] Figures 5 to 8 illustrate details of the compression faces F. The rope in this example is belt-shaped as preferred. The compression face F of the first and/or the second compression member 10,10b;20a,20b comprises an uneven surface pattern P for facilitating the grip, the uneven surface pattern P comprising plurality of protrusions p arranged to penetrate into the surface of the rope such that an impression is caused in the surface of the rope, when the compression face F in question is compressed against the rope 2,2'. The protrusions p are arranged to force the surface shape of the rope 2,2' to deform such that recesses are formed into the surface of the rope at the points of the protrusions when the compression face in question is compressed against the rope. Preferably, said uneven surface pattern comprises plurality of protrusions for penetrating into the surface of the rope and plurality of grooves between the protrusions. Figures 7 and 8 illustrate from the side how the protrusions p penetrate into the surface of the rope 2,2' when the rope 2,2' is brought to be compressed by the compression faces F. Preferably, height of said protrusions is less than 2.0 mm, most preferably within range 0.5 mm - 1.5 mm. In this case, said uneven surface pattern P is a knurling -pattern. With height of this range, the protrusions can engage to the rope 2,2' without damaging its iternal structures, such as its load bearing members 30. Preferably, said grooves are between said protrusions in longitudinal direction of the rope. In the example presented, the grooves g are oriented to extend transversely relative to longitudinal direction 1 of the rope 2,2', as preferred so as to facilitate hold of the gripping. More specifically, the grooves g are straight and parallel with each other. The presented form of knurling pattern is a straight knurling pattern. Alternatively, the knurling pattern can of course have some other design. Said uneven surface pattern P could be a diamond knurling pattern, for example.

[0052] Figure 9 illustrates preferred structure of the rope 2,2'. The rope 2,2' is belt-shaped. It is substantially larger in its width direction w than in its thickness direction t. The rope 2,2' has two opposite wide sides facing in thickness direction t of the rope 2,2'. These wide sides are engageable with the terminal devices 10,10',20,20', in particular by the compression members 10a10b;20a,20b;10a',10b';20a',20b' thereof The width/thickness ratio of the rope 2,2' is preferably at least 2 more preferably at least 4, or even more. Thus, a vast contact area is simply achieved. In this way, also a large cross-sectional area for the rope 2,2' is achieved, the bending capacity around the width-directional axis being favorable also with rigid materials of the load bearing member, such as composite material. Owing to the wide shape, the rope 2,2' suits very well to be used in hoisting appliances, in particular in elevators, wherein the rope 2,2' needs to be guided around rope wheels. The surface material 31 of the rope 2,2' comprises polymer, such as polyurethane, rubber or silicon. With the polymer-based surface material 31 of the rope 2,2', the rope 2,2' is provided with a surface via which the rope 2,2' can effectively

engage frictionally with a drive wheel of an elevator, for instance. Also, hereby the friction properties and/or other surface properties of the rope are adjustable, independently of the load bearing function, such that the rope perform wells in the intended use, for instance in terms of traction for transmitting force in longitudinal direction of the rope so as to move the rope with a drive wheel. Furthermore, the load bearing members 30 embedded therein are thus provided with protection. For example polyurethane provides the rope 2,2' the desired frictional properties simply, good wear resistance as well as efficient protection for the load bearing members 2. Polyurethane is in general well suitable for elevator use, but also materials such as rubber or silicon or equivalent elastic materials are suitable for the surface material of the rope 2,2'. Despite its advantageous properties, the polymer material in the surface or the rope 2,2' is sensitive for creep and fractures as well as detachment of load bearing elements of the rope 2,2'. For this reason, the presented solution enabling use of pristine rope section is particularly advantageous in context of fixing the rope 2,2'.

[0053] In the preferred embodiment, the rope 2,2' comprises one or more, in this case plurality of elongated load bearing members 30 adjacent each other in width direction of the rope 2,2', elongated load bearing member 30 being embedded in a coating 31 forming the outer surface of the rope 2,2' and extending parallel with the longitudinal direction 1 of the rope 2,2' unbroken throughout the length of the rope 2,2'. The coating 31 forms the surface material of the rope, and it comprises polymer, such as polyurethane, rubber or silicon. The load bearing members 2,2' are preferably, although not necessarily, made of composite material comprising reinforcing fibers f embedded in polymer matrix m, said reinforcing fibers f preferably being carbon fibers. With this kind of structure, the rope 2,2' has especially advantageous properties in elevator use, such as light weight and good tensile stiffness in longitudinal direction. The load bearing members of this kind are being relatively brittle, e.g. when compared to steel, and require gentle fixing. For this reason, the rope terminal devices 10,10',20,20' as presented are particularly advantageous in fixing of the rope 2,2'.

[0054] In the present case, there are particularly four of said load bearing members 2 embedded adjacently in said coating 31, but the rope 2,2' could alternatively any other number of load bearing members 30 e.g. from 2 to 10. The rope 2,2' could also be made to have only one load bearing member 30. It is preferable that each load bearing member 30 is shaped wide, as illustrated. Accordingly, each load bearing member 30 is preferably larger in its width direction w than in its thickness direction t of the rope 2,2'. Particularly, the width/thickness ratio of each of said one or more load bearing members is then preferably more than 2. Thereby, the bending resistance of the rope 2,2' is small but the load bearing total cross sectional area is vast with minimal non-bearing areas.

[0055] Figure 11 illustrates a preferred inner structure for said load bearing member 30, showing inside the circle an enlarged view of the cross section of the load bearing member 30 close to the surface thereof, as viewed in the longitudinal direction 1 of the load bearing member 30. The parts of the load bearing member 30 not showed in Figure 11 have a similar structure. Figure 12 illustrates the load bearing member 30 three dimensionally. The load bearing member 30 is made of composite material comprising reinforcing fibers f embedded in polymer matrix m. The reinforcing fibers f are more specifically distributed at least substantially evenly in polymer matrix m and bound to each other by the polymer matrix. This has been done e.g. in the manufacturing phase by immersing them together in the fluid material of the polymer matrix which is thereafter solidified. The load bearing member 30 formed is a solid elongated rod-like one-piece structure. Said reinforcing fibers f are most preferably carbon fibers, but alternatively they can be glass fibers, or possibly some other fibers. Preferably, the reinforcing fibers f of each load bearing member 30 are parallel with the longitudinal direction of the load bearing member 30. Thereby, the fibers f are also parallel with the longitudinal direction of the rope 2,2' as each load bearing member 30 is oriented parallel with the longitudinal direction of the rope 2,2'. This is advantageous for the rigidity as well as behavior in bending. Owing to the parallel structure, the fibers in the rope 2,2' will be aligned with the force when the rope 2,2' is pulled, which ensures that the structure provides high tensile stiffness. The fibers f used in the preferred embodiments are accordingly substantially untwisted in relation to each other, which provides them said orientation parallel with the longitudinal direction of the rope 2,2'. This is in contrast to the conventionally twisted elevator ropes, where the wires or fibers are strongly twisted and have normally a twisting angle from 15 up to 40 degrees, the fiber/wire bundles of these conventionally twisted elevator ropes thereby having the potential for transforming towards a straighter configuration under tension, which provides these ropes a high elongation under tension as well as leads to an unintegral structure. The reinforcing fibers f are preferably long continuous fibers in the longitudinal direction of the load bearing member 30, preferably continuing for the whole length of the load bearing member 30.

[0056] All the reinforcing fibers f are preferably distributed in the aforementioned load bearing member 30 evenly. The fibers f are then arranged so that the load bearing member 30 would is as homogeneous as possible in the transverse direction thereof. An advantage of the structure presented is that the matrix m surrounding the reinforcing fibers f keeps the interpositioning of the reinforcing fibers f substantially unchanged. It equalizes with its slight elasticity the distribution of force exerted on the fibers, reduces fiber-fiber contacts and internal wear of the rope, thus improving the service life of the rope 2,2'. Owing to the even distribution, the fiber density in the cross-section of the load bearing member 30 is

substantially constant. The composite matrix m, into which the individual fibers f are distributed, is most preferably made of epoxy, which has good adhesiveness to the reinforcement fibers f and which is known to behave advantageously with reinforcing fibers such as carbon fiber particularly. Alternatively, e.g. polyester or vinyl ester can be used, but any other suitable alternative materials can be used.

[0057] The matrix m has been applied on the fibers f such that a chemical bond exists between each individual reinforcing fiber f and the matrix m. Thereby a uniform structure is achieved. To improve the chemical adhesion of the reinforcing fiber to the matrix m, in particular to strengthen the chemical bond between the reinforcing fiber f and the matrix m, each fiber can have a thin coating, e.g. a primer (not presented) on the actual fiber structure between the reinforcing fiber structure and the polymer matrix m. However, this kind of thin coating is not necessary. The properties of the polymer matrix m can also be optimized as it is common in polymer technology. For example, the matrix m can comprise a base polymer material (e.g. epoxy) as well as additives, which fine-tune the properties of the base polymer such that the properties of the matrix are optimized. The polymer matrix m is preferably of a hard non-elastomer, such as said epoxy, as in this case a risk of buckling can be reduced for instance. However, the polymer matrix need not be non-elastomer necessarily, e.g. if the downsides of this kind of material are deemed acceptable or irrelevant for the intended use. In that case, the polymer matrix m can be made of elastomer material such as polyurethane or rubber for instance.

[0058] As above mentioned, the matrix m of the load bearing member 30 is most preferably hard in its material properties. A hard matrix m helps to support the reinforcing fibers f, especially when the rope bends, preventing buckling of the reinforcing fibers f of the bent rope, because the hard material supports the fibers f efficiently. To reduce the buckling and to facilitate a small bending radius of the load bearing member 30, among other things, it is therefore preferred that the polymer matrix m is hard, and in particular non-elastomeric. The most preferred materials for the matrix are epoxy resin, polyester, phenolic plastic or vinyl ester. The polymer matrix m is preferably such that its module of elasticity (E) is over 2 GPa, most preferably over 2.5 GPa. In this case the module of elasticity E is preferably in the range 2.5-10 GPa, most preferably in the range 2.5-4.5 GPa. There are commercially available various material alternatives for the matrix m which can provide these material properties. Preferably over 50% proportion of the surface area of the cross-section of the load bearing member 30 is of the aforementioned reinforcing fiber, preferably such that 50%-80% proportion is of the aforementioned reinforcing fiber, more preferably such that 55%-70% proportion is of the aforementioned reinforcing fiber, and substantially all the remaining surface area is of polymer matrix m. Most preferably, this is carried out such that approx. 60% of the surface area is of reinforcing fiber and approx. 40% is of matrix material (preferably epoxy material). In this way a good longitudinal stiffness for the load bearing member 30 is achieved. As mentioned carbon fiber is the most preferred fiber to be used as said reinforcing fiber due to its excellent properties in hoisting appliances, particularly in elevators. However, this is not necessary as alternative fibers could be used, such as glass fiber, which has been found to be suitable for the hoisting ropes as well. The load bearing members 30 are preferably each completely non-metallic, i.e. made not to comprise metal.

[0059] In the illustrated embodiments, the load bearing members 30 are substantially rectangular and larger in width direction than thickness direction. However, this is not necessary as alternative shapes could be used. Likewise, it is not necessary that the number of the load bearing members is four which is used for the purpose of the example. The number of the load bearing members 30 can be greater or smaller. The number can be one, two or three for instance, in which cases it may be preferably to shape it/them wider than what is shown in Figures.

[0060] The rope 2,2' is furthermore such that the aforementioned load bearing member 30 comprised in the rope or the plurality of load bearing members 30 comprised in the rope 2,2' together, cover majority, preferably 70% or over, more preferably 75% or over, most preferably 80% or over, most preferably 85% or over, of the width of the cross-section of the rope 2,2' for essentially the whole length of the rope 2,2'. Thus the supporting capacity of the rope 2,2' with respect to its total lateral dimensions is good, and the rope 2,2' does not need to be formed to be thick.

[0061] Figure 10 illustrates preferred details for the first and/or second terminal device 10,20;10',20'. The compression members 10a,10b;20a,20b;10a',10b';20a',20b' are preferably arranged to be movable by wedging relative to each other such that the compression gap G between them is narrowed for causing compression on the rope with the compression faces F. Said first and/or second terminal device 10,20;10',20' comprise each a rope terminal frame F comprising a tapering nest N accommodating a section S1,S2 of the rope R and the compression members 10a,10b;20a,20b; 10a',10b';20a',20b'. The compression members 10a,10b;20a,20b; 10a',10b';20a',20b' are preferably wedge-shaped.

[0062] Figure 10 also presents other preferred further details , in particular that the rope 2,2' comprises a rope end block B2 mounted on the tail section at a distance from the first terminal device 10,10', which distance is measured along the tail section S3, and which distance is at least as long as the first section S1 gripped by the first terminal device 10,10'. Thus, the rope end block is correctly positioned also after the tail section S3 has been moved to be gripped by the first terminal device 10,10'. The rope 2,2' also comprises a rope end block B2 mounted on the tail section in contact with the first terminal

device 10,10' or at a distance from the first terminal device 10,10', which distance is measured along the tail section and shorter than 5 cm.

[0063] Each rope end block B1,B2 can be used to serve as a means for making the system mechanically more safe. For this purpose, the rope end block B2 is preferably arranged to push the compression members 10a,10b;20a,20b; 10a',10b';20a',20b' towards the narrow end of the tapering nest N if the rope 2,2' moves in the rope gap G towards the narrow end of the tapering nest N. Thus, it increases the wedging effect protect the system from slippage. The rope end block B1 that is in proximity of the the first terminal device 10,10' serves the function prior to dismantling and the rope end block B2 serves the function after the dismantling and regripping.

[0064] Each rope end block B1,B2 can be used to serve as a means for making the system more safe by serving as an information interface. Each rope end block B1,B2 can then comprise one or more electrical contactors C connected electrically with one or more electrically conductive load bearing members 30 of the rope 2,2'. The load bearing members can be made electrically conductive for example by constructing them to comprise electrically conductive reinforcing fibers (e.g. carbon fibers). The elevator arrangement preferably comprises a rope condition monitoring system 90 for monitoring electrical properties of one or more load bearing members 30 of the rope which rope condition monitoring system 90 is connected electrically with said one or more electrical contactors C of the rope end block B1 or B2. Mounting of a rope end block afterwards would be difficult in site conditions. Thus, it is advantageous to construct the system as defined with the rope end blocks B1,B2 before the need rises for dismantling and rearranging the configuration.

[0065] In the method for servicing an elevator arrangement according to a preferred embodiment, the elevator arrangement is serviced. The steps of the method are illustrated in Figures 1-4. The elevator arrangement has been constructed to be in accordance to what is described earlier above. The Figures 1 and 2 illustrate a configuration prior the method and Figures 3-4 after the method. The arrows illustrate movement of the rope 2,2'. The elevator arrangement comprises an elevator car 1; a rope 2,2' connected with the elevator car 1 and having two ends; a first terminal device 10,10' for gripping a rope section of the rope 2,2'; a second terminal device 20,20' for gripping a rope section of the rope 2,2'; wherein the rope 2,2' is arranged to have a first 'gripped' section S1 gripped by the first terminal device 10,10'; and an intermediate section ST that is under tension produced by pull directed on the rope in longitudinal direction thereof (particularly by the load(s) suspended with the rope) and extends between the first and second terminal device 10,20;10',20'; and a second 'gripped' section S2 gripped by the second terminal device 20,20'; and a tail section S3 extending on opposite side with respect to the first rope terminal 10,10' than the intermediate section ST, wherein the tail section S3 is at least as long as the first section S1 gripped by the first terminal device 10,10'. The method comprises, preferably in the following order, reducing said tension of the intermediate section ST; and releasing the grip of the first terminal device 10,10'; and moving the rope 2,2' relative to the first terminal device 10,10' to be positioned such that the tail section S3 can be gripped with the first terminal device 10,10'; and gripping the tail section S3 with the first terminal device 10,10'. The tail section S3 can be gripped with the first terminal device 10,10' particularly when it is positioned within a compression gap G of the first terminal device 10,10'. In case the rope in question is a hoisting rope 2, the tension can be reduced by parking one of the car and counterweight stationary and thereafter lifting the other such that the rope 2 is substantially slackened. The rope 2 is thus substantially slackened in particular in proximity of each terminal device 10;20 the grip of which is to be released. The lifting can be performed with an auxiliary hoisting appliance, for example. There are also other alternative ways known which can reduce the tension of an elevator suspension rope temporarily. In case the rope in question is a compensation rope, the tension can be reduced by gripping the rope with a gripper of an auxiliary hoisting appliance, and thereafter lifting the rope 2' such that the rope 2' is substantially slackened. The rope 2' is thus substantially slackened in particular in proximity of each terminal device 10';20' the grip of which is to be released. There are also other alternative ways known which can reduce the tension of an elevator compensation rope temporarily. In each case, in said reducing the tension, it is preferable that the tension is completely or at least substantially removed.

[0066] Preferably, in said moving the rope 2,2' relative to the first terminal device 10,10' to be positioned such that the tail section S3 can be gripped with the first terminal device 10,10' the rope 2,2' is moved such that the tail section S3 replaces the first section S1. In said moving the rope 2,2' relative to the first terminal device 10,10' to be positioned such that the tail section S3 can be gripped with the first terminal device 10,10', the rope 2,2' is moved such that the tail section S3 replaces the first section S1 and the first section S1 becomes part of the intermediate section ST extending between the first and second terminal device 10,20;10',20'.

[0067] The method further comprises, preferably in the following order, releasing the grip of the second terminal device 20,20'; and moving the rope 2,2' relative to the second terminal device 20,20' to be positioned such that a section S4 of the intermediate section ST can be gripped with the second terminal device 20,20'; and gripping said section S4 of the intermediate section ST with the second terminal device 20,20'. The section S4 of the intermediate section ST can be gripped with the second terminal device 20,20' particularly when it is positioned within a compression gap G of the second terminal device 20,20'.

[0068] Preferably, in said moving the rope (2,2') rela-

tive to the second terminal device 20,20' to be positioned such that a section S4 of the intermediate section ST can be gripped with the second terminal device 20,20' the rope 2,2' is moved such that a section S4 of the intermediate section ST replaces the second section S2.

[0069] Preferably, in said moving the rope 2,2' relative to the second terminal device 20,20' to be positioned such that a section S4 of the intermediate section ST can be gripped with the second terminal device 20,20' the rope 2,2' is moved such that a section S4 of the intermediate section ST replaces the second section S2 and the second section S2 becomes to extend on opposite side with respect to the second rope terminal 20,20' than the intermediate section ST.

[0070] The method comprises before the aforementioned steps using the elevator arrangement for transporting passengers and/or goods inside an elevator car 1 thereof; and removing the elevator arrangement from said use for transporting passengers and/or goods inside an elevator car 1 thereof. Correspondingly, the method further comprises after said aforementioned steps taking the elevator arrangement back to the use for transporting passengers and/or goods inside an elevator car 1 thereof.

[0071] In the preferred embodiments, an advantageous structure for the rope 2,2' has been disclosed. However, the invention can be utilized with also other kind of ropes such as with other kinds of belt-shaped ropes having different materials. Also, the outer shape of the rope 2,2' could be contoured otherwise than disclosed, such as to have a polyvee shape or toothed shape.

[0072] In the illustrated examples, the rope is smooth and shaped without a macro scale surface pattern, such as a polyvee pattern or a tooth pattern. However, this is not necessary as the rope could alternatively be provided with such such a surface pattern such as a polyvee pattern or a tooth pattern as it is common in belt design. In this case, the compression members can also be provided with a macro scale surface pattern forming a counterpart for the macro scale surface pattern of the rope, which macro scale pattern can be in addition to the knurling pattern mentioned earlier, the knurling pattern serving as a micro scale pattern due to its scale. Thereby these patterns can coexist.

[0073] In the presented preferred embodiments, the compression is achieved by wedging. This is not, however, not necessary as the compression could alternatively be achieved by some other principle, such as by tightening the compression members towards each other with releasable tightening means, such as screw-type tightening means.

[0074] When referring to a suspension rope arranged to suspend the elevator car, it is meant that the rope either alone or together with other suspension ropes suspends the elevator car.

[0075] It is to be understood that the above description and the accompanying Figures are only intended to teach the best way known to the inventors to make and use the invention. It will be apparent to a person skilled in the art that the inventive concept can be implemented in various ways. The above-described embodiments of the invention may thus be modified or varied, without departing from the invention, as appreciated by those skilled in the art in light of the above teachings. It is therefore to be understood that 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 arrangement comprising
   an elevator car (1);
   a rope (2,2') connected with the elevator car (1);
   a first terminal device (10,10') for gripping a rope section of the rope (2,2');
   a second terminal device (20,20') for gripping a rope section of the rope (2,2');
   wherein the rope (2,2') is arranged to have
   a first section (S1) gripped by the first terminal device (10,10'); and
   an intermediate section (ST), which is under tension produced by pull directed on the rope (2,2') in longitudinal direction thereof, and extends between the first and second terminal device (10,20;10',20'); and
   a second section (S2) gripped by the second terminal device (20,20'); and
   a tail section (S3) extending on opposite side with respect to the first rope terminal (10,10') than the intermediate section (ST), wherein the tail section (S3) is at least as long as the first section (S1) gripped by the first terminal device (10,10').

2. An elevator arrangement according to claim 1, wherein the tail section (S3) is at least as long as the second section (S2) gripped by the second terminal device (20,20').

3. An elevator arrangement according to any of the preceding claims, wherein the surface material of the rope (2,2') comprises polymer.

4. An elevator arrangement according to any of the preceding claims, wherein the tail section (S3) is not under tension produced by pull directed on the rope (2,2') in longitudinal direction of the rope (2,2').

5. An elevator arrangement according to any of the preceding claims, wherein the rope (2,2') comprises one or more elongated load bearing members (30) embedded in a coating (31) forming the outer surface of the rope (2,2') and extending parallel with the longitudinal direction (1) of the rope (2,2') unbroken throughout the length of the rope (2,2'), the load bearing members (2,2') preferably being made of com-

posite material comprising reinforcing fibers (f) embedded in polymer matrix (m), said reinforcing fibers (f) preferably being carbon fibers.

6. An elevator arrangement according to any of the preceding claims, wherein the length of the first section (S1) gripped by the first terminal device (10,10'), and preferably also the length of the second section (S2) gripped by the second terminal device (20,20'), is more than 10 cm and less than 1 meter.

7. An elevator arrangement according to any of the preceding claims, wherein the tail section (S3) is at least 10 cm longer than the first section (S1) gripped by the first terminal device (10,10').

8. An elevator arrangement according to any of the preceding claims, wherein the tail section (S3) is less than 2 meters long, more preferably less than 1 meter long

9. An elevator arrangement according to any of the preceding claims, wherein the rope (2,2') is a suspension rope of the elevator arrangement.

10. An elevator arrangement according to any of the preceding claims, wherein said first and/or second terminal device (10,20;10',20') comprises a first and a second compression member (10a,10b;20a,20b;10a',10b'; 20a',20b') each comprising a compression face (F) delimiting a compression gap (G) between them, which compression gap (G) is narrowable and widenable by movement of the first and a second compression member (10a,10b;20a,20b;10a',10b'; 20a',20b') relative each other.

11. An elevator arrangement according to any of the preceding claims, wherein the compression face (F) of the first and/or the second compression member (10a,10b;20a,20b; 10a',10b';20a',20b') comprises an uneven surface pattern (P) comprising plurality of protrusions (p) arranged to penetrate into the surface of the rope (2,2') such that an impression is caused in the surface of the rope (2,2'), when the compression face (F) in question is compressed against the rope (2,2').

12. An elevator arrangement according to any of the preceding claims, wherein the rope (2,2') is belt-shaped.

13. An elevator arrangement according to any of the preceding claims, wherein the compression faces (F) are straight and parallel in longitudinal direction of the rope (2,2') such that the rope (2,2') compressed by them is not bent into a curved form.

14. An elevator arrangement according to any of the preceding claims, wherein the rope (2,2') comprises a rope end block (B2) mounted on the tail section at a distance from the first terminal device (10,10'), which distance is measured along the tail section (S3), and which distance is at least as long as the first section (S1) gripped by the first terminal device (10,10') and/or a rope end block (B1) mounted on the tail section in contact with the first terminal device (10,10') or at a distance from the first terminal device (10,10'), which distance is measured along the tail section and shorter than 5 cm.

15. A method for servicing an elevator arrangement wherein the elevator arrangement is as defined in any of the preceding claims, and which method comprises

reducing said tension of the intermediate section (ST); and

releasing the grip of the first terminal device (10,10'); and

moving the rope (2,2') relative to the first terminal device (10,10') to be positioned such that the tail section (S3) can be gripped with the first terminal device (10,10'); and

gripping the tail section (S3) with the first terminal device (10,10').

16. A method according to claim 15, the method further comprising releasing the grip of the second terminal device (20,20'); and

moving the rope (2,2') relative to the second terminal device (20,20') to be positioned such that a section (S4) of the intermediate section (ST) can be gripped with the second terminal device (20,20'); and

gripping said section (S4) of the intermediate section (ST) with the second terminal device (20,20').

Fig. 1

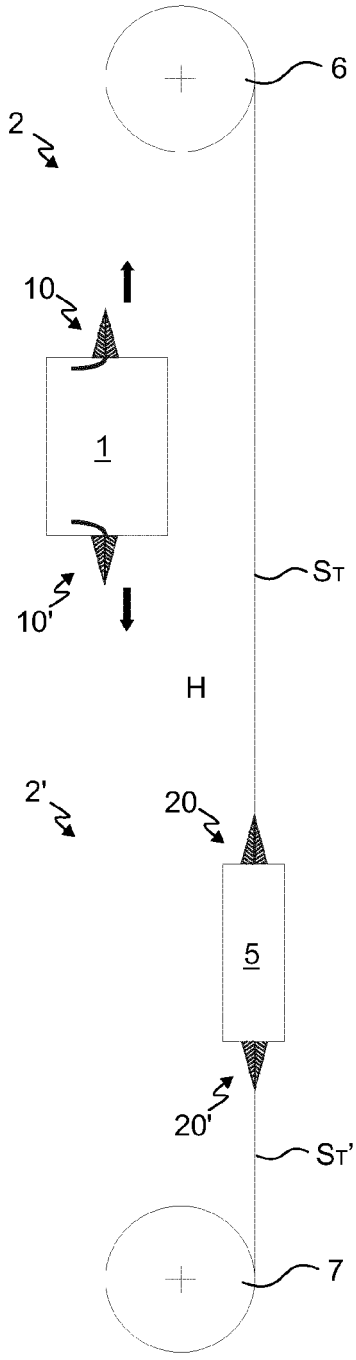

6
2
10
1
10'
ST
H
2'
20
5
20'
ST'
7

Fig. 2

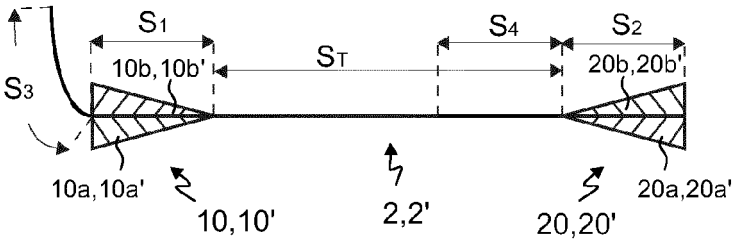

S1
S4
S2
ST
10b,10b'
20b,20b'
S3
10a,10a'
10,10'
2,2'
20,20'
20a,20a'

Fig. 3

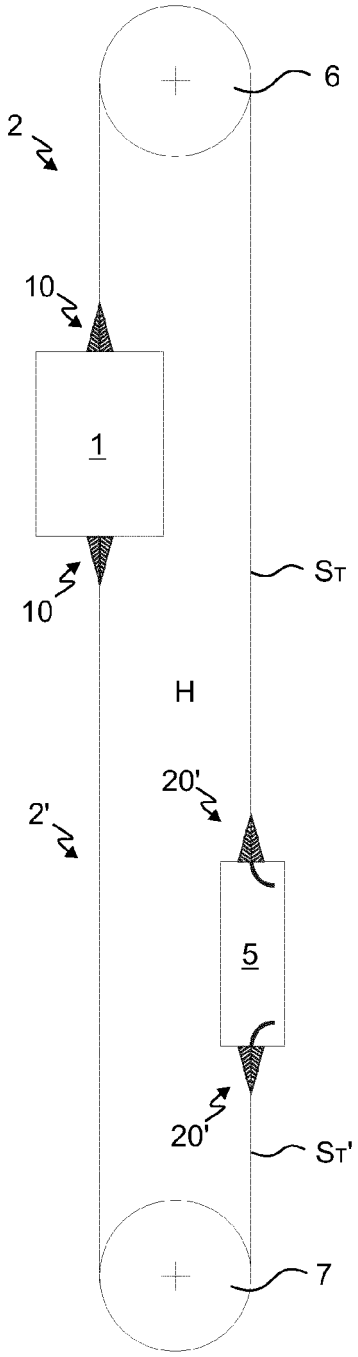

6
2
10
1
10
ST
H
20'
2'
5
20'
ST'
7

Fig. 4

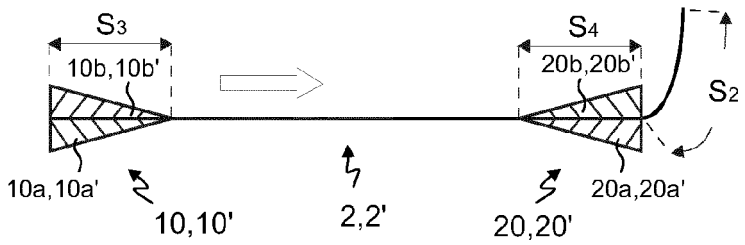

S3
10b,10b'
S4
20b,20b'
S2
10a,10a'
10,10'
2,2'
20,20'
20a,20a'

Fig. 5

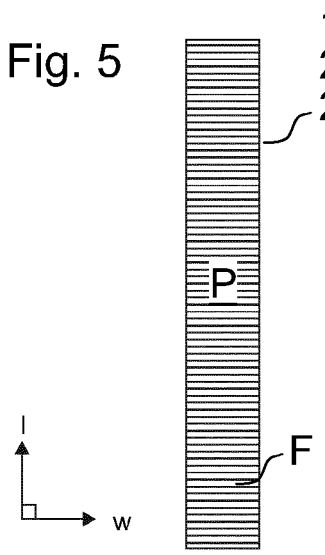


Fig. 6

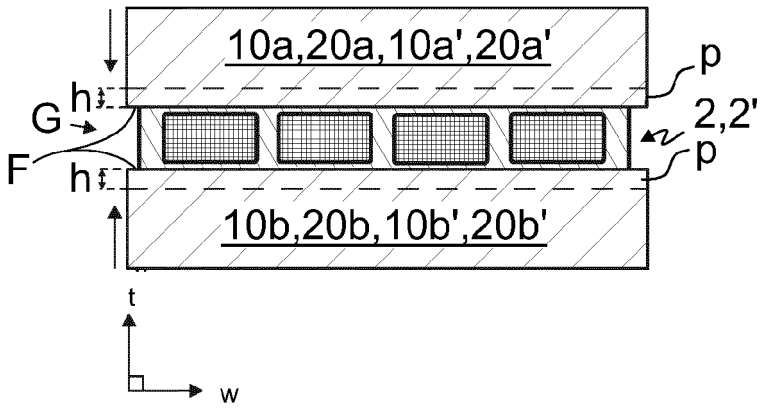


Fig. 7

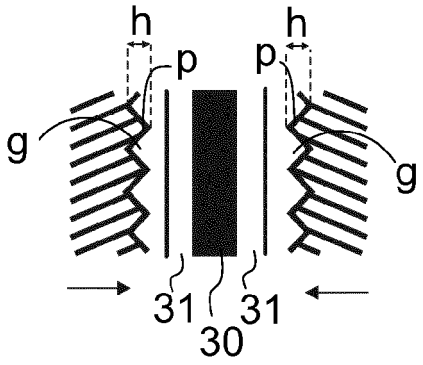


Fig. 8

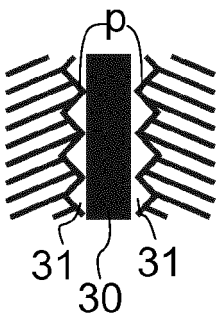


Fig. 9

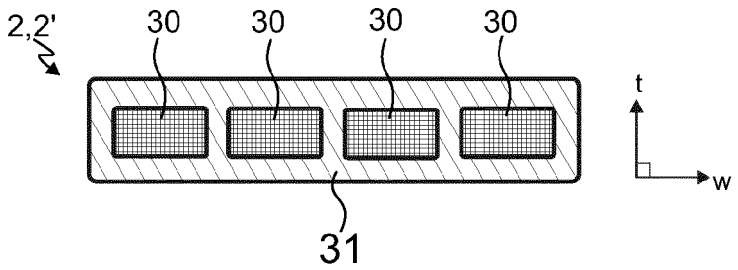


Fig. 10

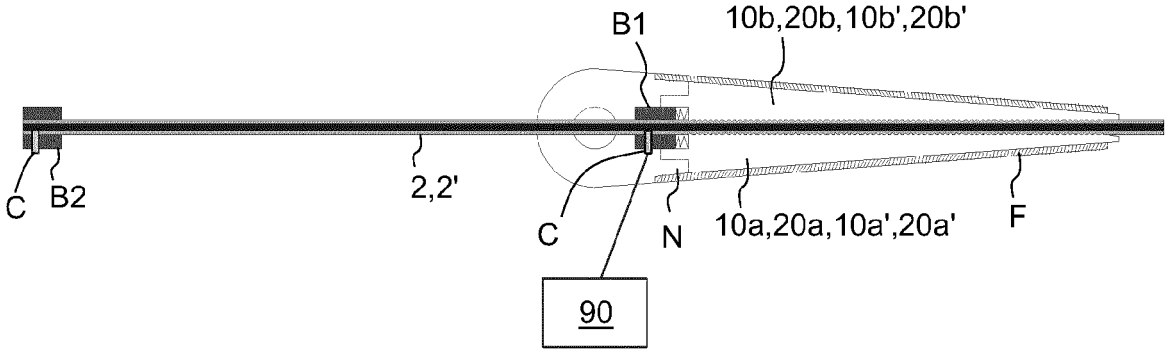


Fig. 11

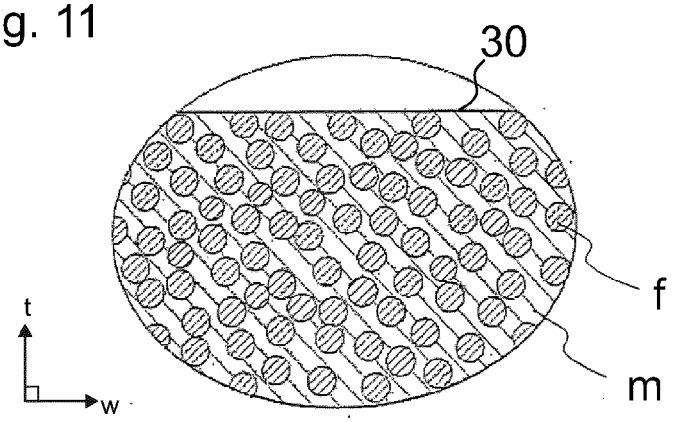
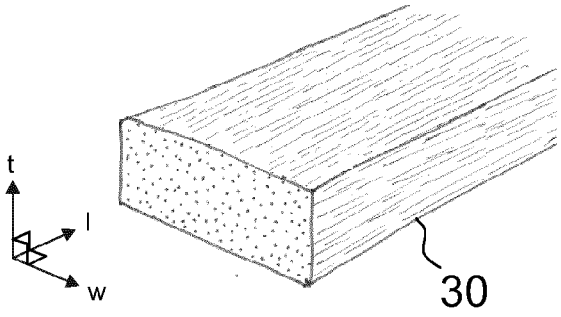


Fig. 12



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Place of search	Date of completion of the search	Examiner
The Hague	26 October 2016	Fiorani, Giuseppe

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