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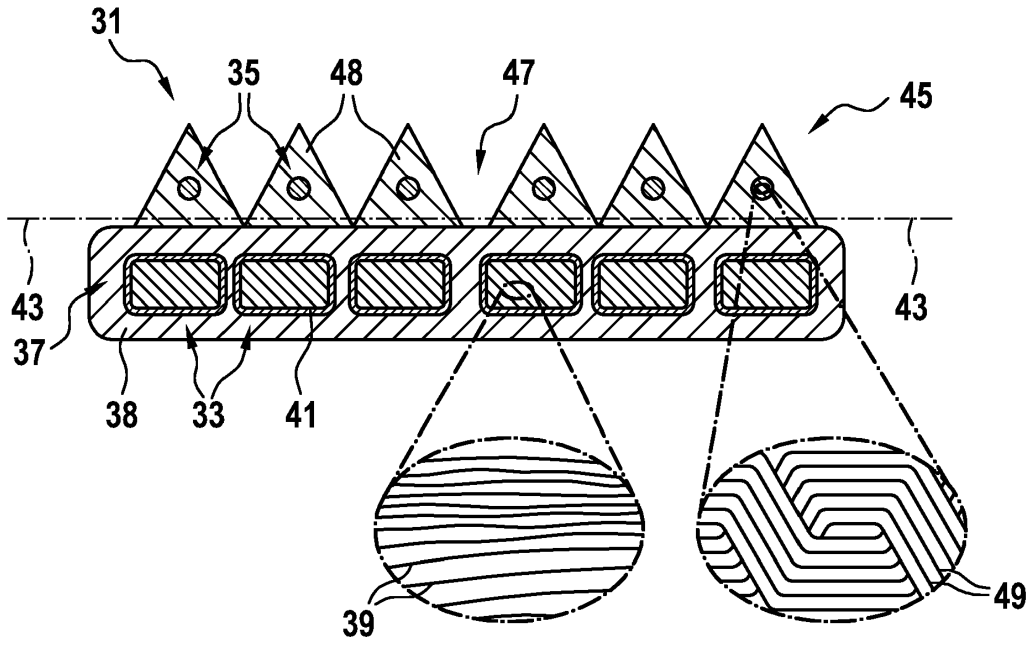
(54) JACKETED SUSPENSION TRACTION MEMBER FOR AN ELEVATOR WITH DIFFERENT CORDS FOR LOAD SUSPENSION AND FOR TRACTION PROVISION

(57) A jacketed suspension traction member (31) for an elevator (1) is proposed. The suspension traction member (STM) (31) comprises two different types of cords, i.e. a first type of cords (33) comprising mainly load suspending strands (39) and a second type of cords (35) comprising mainly traction providing strands (49). The STM (31) further comprises a common jacket (37) made from a bendable jacket material jacketing both the first and second types of cords. Therein, the load suspending strands (39) are comprised within the jacket (37) with a lower adhesion to the jacket (37) than the traction providing strands (49).

By enclosing two different types of cords (33, 35) within a common jacket (37), each type of cords (33, 35) may be either optimised for a suspension function or for a traction function of the STM (31) by e.g. specifically adapting its positional arrangement, physical characteristics, etc.

Fig. 3



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Description

[0001] The present invention relates to a jacketed suspension traction member for an elevator.

[0002] Elevators typically comprise a cabin and, in most cases, a counterweight which may be displaced for example within an elevator hoistway to different levels in order to transport persons or items for example to various levels within a building.

[0003] In a common type of elevator, the cabin and/or the counterweight are supported by a suspension traction member arrangement comprising one or generally more suspension traction members. The suspension traction member is typically an elongate member such as a rope or a belt. On the one hand, the suspension traction member may carry heavy loads in a tension direction and may be bent in a direction transverse to the tension direction. Accordingly, the suspension traction member may suspend the loads of the cabin and/or the counterweight. On the other hand, the cabin and/or the counterweight are generally displaced throughout the elevator hoistway by displacing the suspension traction member suspending these movable components. In most cases, the suspension traction members are wound around a traction sheave being driven into rotation by a drive engine such that due to traction between the traction sheave and the traction suspension member, the latter may be displaced.

[0004] Accordingly, the suspension traction members in an elevator installation have to provide two different functions, i.e. a suspension function and a traction function. Therein, suspension is related to balanced forces in the elevator installation, while traction has to compensate for an unbalance in the elevator installation.

[0005] In today's elevators, the suspension traction member such as a rope or a belt generally comprises a plurality of cords. Each of the cords may comprise a multiplicity of strands. Therein, a strand may be a thin elongate fibre or wire. Conventionally, the strands may be made for example with a metal such as steel. However, modern types of strands may also comprise other materials. For example, strands may be made with heavily loadable fibres such as carbon fibres, glass fibres, aramid fibres, etc.

[0006] Generally, the cords and their strands are embedded into a jacket material. Such jacket material is typically an elastic or at least bendable material which jackets, i.e. fully encloses, the embedded cords. Therein, the jacket, on the one hand, may help in providing a required traction between the suspension traction member and a traction surface of for example the driven traction sheave and/or of a pulley. On the other hand, the jacket may protect the embedded cords against for example mechanical damaging and/or corrosion.

[0007] In conventional suspension traction members, an amount of wire or fibre material in the strands of the cords is generally set considering a sum of both the suspension function and the traction function. Typically, upon such setting, an additional relative safety factor is taken into account. Moreover, the cords and their strands should have a good adhesion to the enclosing jacket material in order to be able to fulfil the traction function.

[0008] In order to fulfill such various requirements, the strands are typically provided in a twisted configuration. Furthermore, the strands are typically placed near to a neutral axis of the suspension traction member's cross section in order to provide better bending flexibility. However, in such configuration, a longitudinal stiffness of the suspension traction member is reduced.

[0009] There may be a need for a jacketed suspension traction member for an elevator at least partly overcoming the above mentioned deficiencies. Particularly, there may be a need for a jacketed suspension traction member which may be optimised for fulfilling both, a suspension function and a traction function, while preferably allowing both, enhanced longitudinal stiffness as well as very good bending flexibility. Furthermore, there may be a need for an elevator arrangement comprising such jacketed suspension traction member.

[0010] Such needs may be met with the subject-matter of the independent claims. Advantageous embodiments are defined in the dependent claims and in the following specification.

[0011] According to an aspect of the present invention, a jacketed suspension traction member (STM) for an elevator is proposed. The STM comprises a first type of cords comprising mainly load suspending strands and a second type of cords comprising mainly traction providing strands. Furthermore, the STM comprises a common jacket made from a bendable jacket material jacketing both the first and second types of cords..

[0012] According to a second aspect of the present invention, an elevator arrangement is proposed comprising an elevator cabin, a drive engine driving a traction sheave and a jacketed suspension traction member according to an embodiment of the above first aspect, the jacketed suspension traction member suspending the elevator cabin and being wound around the traction sheave.

[0013] Ideas underlying embodiments of the present invention may be interpreted as being based, inter alia, on the following observations and recognitions.

[0014] As indicated in the above introductory portion, suspension traction members of a modem traction-type elevator have to fulfil two different functions, i.e. a suspension function and a traction function. In conventional suspension traction members, a single type of cords is generally comprised in a common jacket. Therein, while a plurality of cords is embedded into the jacket material at various locations, each of the cords has same structural and/or functional characteristics. Accordingly, the cords have to be adapted for fulfilling both functional requirements.

[0015] In contrast hereto, it is proposed to provide two different types of cords embedded within a common jacket. Therein, the jacket may comprise an elastic or at least elastically bendable material, preferably a plastic such as polyurethane (PU). The first and second types of cords may significantly differ in their structural and/or functional characteristics. Such differences may result, inter alia, from different physical characteristics of the strands comprised in the cords, from different amounts of strands in each of the cords, from different positional arrangements of strands in the cords and of the cords in the STM, etc.

[0016] The first type of cords comprises strands which are configured such as to be mainly load suspending. In other words, the strands of the first type of cords are specifically adapted for fulfilling the suspension function of the STM, i.e. for carrying the load of the elevator cabin and/or the counterweight to be suspended by the STM. In order to fulfil such suspension function, the strands of these first type cords may be specifically configured and arranged such as to provide a maximum of load bearing capacity and of longitudinal stiffness while at the same time allowing substantial bending flexibility.

[0017] The second type of cords comprises strands which are specifically configured for mainly providing for the traction capability of the STM. In other words, the strands of the second type of cords are specifically adapted for fulfilling the traction function of the suspension traction medium, i.e. for enabling that the STM suspending the cabin and/or the counterweight being displaced upon rotating the traction sheave driven by the drive engine due to traction forces acting between the traction sheave and the STM.

[0018] Accordingly, in contrast to conventional STMs comprising a single type of cords for fulfilling both functional requirements, the STM proposed herein comprises two different types of cords wherein each type of cords may be optimised for fulfilling only one of these two functional requirements, i.e. for fulfilling either the suspension function or the traction function. Such separate optimising of cord characteristics may allow for overall optimised characteristics of the jacketed STM. Particularly, due to separating the fulfilling of different functional requirements, each functional requirements being fulfilled mainly by only one of the two types of cords, an overall load bearing capacity and longitudinal stiffness may be improved while still allowing for very good bending flexibility.

[0019] According to an embodiment, the load suspending strands are comprised within the jacket with a lower adhesion to the jacket than the traction providing strands.

[0020] In other words, while both the load suspending strands as well as the traction providing strands are comprised within the jacket, the load suspending strands may adhere to the material of the jacket only weakly whereas the traction providing strands may strongly adhere to the material of the jacket. Accordingly, upon applying longitudinal forces to the strands, the load suspending strands may be displaced relative to the jacket relatively easily whereas the traction providing strands may hardly be substantially displaced relative to the jacket. Accordingly, the load suspending strands may provide for the load bearing capacity of the suspension traction member without transferring significant forces to the jacket upon displacements relative thereto while the traction providing strands may provide for the traction capacity of the suspension traction member.

[0021] According to an embodiment, the cords of the first type are arranged within the jacket spaced apart from cords of the second type.

[0022] In other words, while the jacket of STM commonly encloses each of the cords of each of the types of cords, the cords of the first type of cords do not extend in direct contact or in direct neighbourhood to the cords of the second type of cords. To the contrary, there is preferably a non-zero distance between a lateral surface of a cord of the first type and a lateral surface of a closest neighbouring cord of the second type. For example, lateral distances between cords of the first type and closest neighbouring cords of the second type may be in a same order of magnitude as cross-sectional dimensions of the cords, i.e. may be in a range e.g. from a few millimetres to a few centimetres. Particularly, the locations of the cords of the first type may be set such as to fulfil a load suspension function of the STM in an optimised manner whereas the location of the cords of the second type may be set such as to fulfil a traction provision function in an optimised manner.

[0023] According to a specific embodiment, portions of the jacket material are interposed between each cord of the first type and each cord of the second type.

[0024] In other words, spaces between cords of the first type and neighbouring cords of the second type may be filled with the jacket material. Accordingly, each of the cords of the first and second types is separately embedded in the jacket material, its lateral surfaces being preferably completely enclosed by the jacket material and being separated by intermediate jacket material from lateral surfaces of neighbouring cords.

[0025] According to an embodiment, the cords of the second type are arranged closer to a neutral axis of the suspension traction member than the cords of the first type.

[0026] Therein, the neutral axis of the suspension traction member may be understood as being an axis or plane within the cross section of the STM along which no longitudinal stresses or strains occur in case the STM is bent. For example, if the STM would be isotropic and not curved before any bending occurs, the neutral axis would be at a geometric centroid. However, as the STM and particularly its jacket are typically not isotropic but, for example, the jacket is provided with a profiled surface, its neutral axis usually does not exactly extend along the geometric centroid but relatively close to it.

[0027] As the main functional purposes of the two types of cords may be substantially different in the STM proposed herein, it may be beneficial to arrange cords of the second type of cords relatively close to the neutral axis of the STM. At such location, the traction providing strands of such second type cords may be in good adhesion to the surrounding jacket material and no excessive longitudinal stresses or strains will be applied by the surrounding jacket material to the embedded second type cords upon bending of the STM. On the other hand, the cords of the first type do not need very good adhesion to any surrounding jacket material as they shall not mainly provide traction capabilities to the STM. Accordingly, these first type cords may be arranged further apart from the neutral axis of the STM.

[0028] According to an embodiment, a sum of all cords of the first type has a larger cross section than a sum of all cords of the second type.

[0029] In other words, taking altogether the cross sections of all first type cords of an STM, these first type cords shall preferably have a substantially larger overall cross section than a sum of all second type cords taken together. Such specifically adapting the overall cross sections of each of the types of cords may take into account that the cords of the STM shall mainly provide for a load bearing capacity of balanced forces in the elevator installation whereas forces for compensating an unbalanced part of forces in the elevator arrangement typically play a minor role.

[0030] Particularly, according to an embodiment, a sum of all cords of the first type may have at least double the cross section of all cords of the second type. Preferably, the sum of all cords of the first type may have at least triple the cross section of all cords of the second type. Expressed in other words, the sum of all cords of the first type may preferably have at least 66%, preferably at least 75% or even more of the overall cross section of all cords comprised in the STM. Accordingly, due to the ability of distinguishing between the two types of cords for providing different functionalities, it may be taken into account that for example in a typical elevator, the suspension function requires roughly 75% of the cross section of all strands, but only 25% thereof are required for the traction function.

[0031] Furthermore, according to an embodiment, the cords of the first type may have a larger cross section than the cords of the second type.

[0032] Thus, not only the overall cross section of the sum of all first type cords may be larger than the overall cross section of the sum of all second type cords, but also each individual first type cord may have a larger cross section than each individual second type cord. Therein, the large first type cords may be optimised for providing the suspension function due to their relatively large cross-section whereas the smaller second type cords may be optimised for providing the traction function due to their relatively small cross section and therefore increased ratio of lateral surface area to volume of the cords allowing for better adhesion to adjacent jacket material.

[0033] According to an embodiment, the traction providing strands may be provided with a twisted strand configuration.

[0034] In other words, the strands of the second type of cords may be optimised for providing for a maximum traction force transmission by being arranged in a twisted configuration. In such twisted configuration, each or at least most of the strands of the second type cords do not extend exactly parallel to an extension direction of the STM. Instead, these strands extend preferably slightly inclined to such extension direction, for example in an inclination angle of between 0.1° and 20°, preferably between 1° and 10°. Particularly, the strands of the second type cords do not extend unidirectional, i.e. all in a same direction. For example, small bundles of strands may be twisted with neighbouring bundles of strands. In such twisted configuration, an overall adhesion or friction between the strands forming the second type of cords and the enclosing jacket material may be increased due to the twisted structure of the strand configuration.

[0035] Furthermore, it may be preferable to arrange the traction providing strands of the second type cords relatively close to a surface of the jacket of the STM, i.e. close to a position where shear stresses due to traction have to be exchanged.

[0036] In contrast hereto, according to an embodiment, the load suspending strands may be provided with a non-twisted strand configuration.

[0037] Expressed differently, the strands of the first type of cords may be optimised for providing for a maximum of load bearing capacity. For such purpose, its load suspending strands may preferably not be arranged in a twisted strand configuration but in a non-twisted strand configuration. In such non-twisted strand configuration, the traction providing strands are preferably arranged unidirectional. Preferably, all strands comprised in a first type cord are arranged substantially in the extension direction of the STM, with angular deviations therefrom being for example smaller than 5°, preferably smaller than 1°. Due to the strands in the first type cords being preferably non-twisted, they may suspend heavy loads at high longitudinal stiffness.

[0038] Furthermore, an adhesion or friction between the load suspending strands of the first type cords and the embedding jacket material may be substantially lower than the adhesion or friction between the traction providing strands of the second type cords and the embedding jacket material. Particularly, the load suspending strands may ideally be left to freely glide in a longitudinal direction. In fact, suspension forces are generally not transmitted as a shear force but as a normal force (shape contact). Therefore, the load suspending strands may be placed also not in an extreme proximity of the neutral axis of the STM.

[0039] For example, according to an embodiment, the load suspending strands of the first type cords may be coated with a friction reducing material such as PTFE.

[0040] Due to such coating with PTFE (polytetrafluoroethylene - Teflon®)), the load suspending strands may easily glide with respect to each other and/or with respect to the enclosing jacket material. Accordingly, due to, inter-alia, reduced adhesion of the load suspending strands to the jacket material, the first type cords formed thereby may easily be displaced in a longitudinal direction with respect to the jacket.

[0041] Thus, while an overall longitudinal stiffness of the STM may be increased by preferably unidirectional fibres forming the load suspending strands of the first type cords, the bending stiffness of the STM may be significantly decreased because a major part of the strands (i.e. for example those 75% of all strands formed by the load suspending strands) may move longitudinally within the jacket.

[0042] Furthermore, according to an embodiment, the load suspending strands may be enclosed in a sheath being interposed between the load suspending strands and the jacket material.

[0043] In other words, the load suspending strands of the first type cords may be arranged for example within a stiff polymer forming a sheath enclosing those strands. Such sheath may be arranged intermediately between the load suspending strands enclosed thereby, on the one side, and the jacket material, on the other side. Accordingly, the load suspending strands may glide along an inner surface of the enclosing sheath upon, for example, the STM being bent. Thereby, a bending stiffness of the STM may be reduced.

[0044] Particularly, according to an embodiment, the sheath may be made from a material having at least one of a higher stiffness and a lower friction coefficient with respect to the enclosed load suspending strands compared to the jacket material.

[0045] Expressed differently, the material forming the sheath may differ from the jacket material. Particularly, the material forming the sheath may be stiffer than the jacket material. Alternatively or additionally, the material forming the sheath may show lower friction with the enclosed load suspending strands than the jacket material would show. Accordingly, due to the enclosing sheath, the load suspending strands may be held within the jacket with very low friction between both components thereby reducing the bending stiffness of the STM.

[0046] According to an embodiment, the load suspending strands may be made with another strand material than the traction providing strands.

[0047] For example, the load suspending strands may be made with a material optimised for load suspension, i.e. having for example great longitudinal stiffness and/or load bearing capacity, whereas the traction providing strands may be made with a material optimised for providing sufficient force transmission between the STM and for example a traction surface of a traction sheave in order to provide sufficient traction functionality.

[0048] For example, the load suspending strands may be made with carbon fibres. Such carbon fibres typically have very small diameters in a range from a few micrometres to a few tens of micrometres, e.g. between 4 and 20 μm Furthermore, carbon fibres typically have very smooth lateral surfaces enabling low friction with neighbouring material. Furthermore, carbon fibres typically have a very low elastic modulus and are therefore very stiff in a longitudinal direction. Accordingly, bundles of carbon fibres forming load suspending strands may provide for high load bearing capacity and longitudinal stiffness as well as low friction with adjacent jacket material.

[0049] Other materials such as glass fibres, aramid fibres may be used for the load suspending strands alternatively.

[0050] The traction providing strands of the second type cords may be provided with a different material. For example, such traction providing strands may be made with metal wires or metal fibres potentially showing higher friction with enclosing jacket material than, for example, carbon or glass fibres.

[0051] It may be noted that the jacketed suspension traction member proposed herein may be provided with various shapes, cross sections and/or contours. For example, the STM may be provided with a profiled surface having elongate grooves extending in a longitudinal direction of the STM. An opposing surface of the STM may be non-profiled, i.e. even. The profiled surface may be designed to cooperate with a mating profiled surface provided for example at a traction surface of the traction sheave or of a pulley. Alternatively, the jacket of the STM may be completely non-profiled but the STM has for example a square shaped cross-section with opposing surfaces being even.

[0052] It shall be noted that possible features and advantages of embodiments of the invention are described herein partly with respect to a jacketed STM and partly with respect to an elevator comprising such STM. One skilled in the art will recognize that the features may be suitably transferred from one embodiment to another and features may be modified, adapted, combined and/or replaced, etc. in order to come to further embodiments of the invention.

[0053] In the following, advantageous embodiments of the invention will be described with reference to the enclosed drawings. However, neither the drawings nor the description shall be interpreted as limiting the invention.

Fig. 1 shows a side view of an elevator arrangement which may comprise a jacketed suspension traction member according to an embodiment of the present invention.

Fig. 2 shows a perspective view of a conventional suspension traction member.

Fig. 3 shows a cross-sectional view through a suspension traction member according to an embodiment of the present invention.

Fig. 4 shows a cross-sectional view through a suspension traction member according to another embodiment of the present invention.

[0054] The figures are only schematic and not to scale. Same reference signs refer to same or similar features.

[0055] Fig. 1 shows a traction-type elevator 1 in which a suspension traction member 11 according to an embodiment of the present invention may be used.

[0056] The elevator 1 comprises a cabin 3 and a counterweight 5 which may be displaced vertically within an elevator shaft 7. The cabin 3 and the counterweight 5 are suspended by a suspension traction member arrangement 9. This suspension traction member arrangement 9 comprises one or more suspension traction members 11. Such suspension traction members 11 may be for example ropes, belts, etc. in which cords are embedded in a jacket. In the arrangement shown in Fig. 1, end portions of the suspension traction members 11 are fixed to supporting structures 12 of the elevator 1 at a top of the elevator shaft 7. The suspension traction members 11 may be displaced using a drive engine 13 driving a traction sheave 15. Therein, the STM 11 may be wound around a traction surface of the traction sheave 15 and may furthermore be wound around pulleys 16 attached to the cabin 3. An operation of the drive engine 13 may be controlled by a control device 17.

[0057] It may be noted that the elevator 1 and particularly its suspension traction member(s) 11 may be configured and arranged in various other ways than those shown in Fig. 1. Conventionally, the suspension traction members 11 to be driven for example by the drive engine 13 may utilize metal cords or ropes to support a suspended load such as the cabin 3 and/or the counterweight 5 that is moved by the drive engine 13.

[0058] Fig. 2 shows an example of an STM 11 which is embodied with a belt 19. The belt 19 comprises a plurality of cords 23 which are arranged parallel to and spaced from each other. The cords 23 are enclosed in a jacket material 21 forming, inter alia, a jacket 25. Such jacket 25 may mechanically couple neighbouring cords 23. Furthermore, the jacket 25 may protect the cords 23 against for example mechanical damages and/or corrosion. The jacket 25 may have a textured or profiled traction surface including longitudinal guiding grooves 27. The cords 23 may typically conventionally consist of or comprise multiple strands formed by wires made from a metal such as steel. The jacket material 21 may consist of or comprises a plastic or elastomeric material such as PU.

[0059] While the conventional suspension traction member 11 shown in figure 2 comprises several cords 23 all having same structural and functional characteristics and all therefore contributing to both suspension functionalities as well as traction functionalities, it is proposed herein to separately address these differing functionalities by providing different types of cords within one and the same the jacket of an STM.

[0060] Embodiments of such modified jacketed STMs 31, 31' are shown in Figs. 3 and 4.

[0061] Fig. 3 shows an embodiment of an STM 31 in which cords 33 of a first type of cords and cords 35 of the second type of cords are comprised within one and the same jacket 37. Jacket material 38 of the jacket 37 encloses each of the first and second type cords 33, 35.

[0062] Therein, the first type cords 33 are adapted for mainly providing for the load bearing capacity of the STM 31. For this purpose, the first type cords 33 comprise mainly load suspending strands 39. A multiplicity of such load suspending strands 39 is shown in the enlarged visualisation in figure 3 in a side view (i.e. a view transverse to the viewing direction of the overall representation of figure 3). The load suspending strands 39 are generally arranged unidirectional in a direction parallel to the longitudinal direction of the STM 31, i.e. in a non-twisted configuration.

[0063] The first type cords 33 may be comprised in a sheath 41 made from a relatively stiff plastic material such as PU elastomer with higher hardness. Within this sheath 41, the load suspending strands 39 of the first type cords 33 may easily glide in a longitudinal direction with respect to each other as well as with respect to the sheath 41. Accordingly, the load suspending strands 39 may be slidingly displaced in the longitudinal direction with respect to the enclosing jacket 37.

[0064] In order to even further reduce adhesion and/or friction, the load suspending strands 39 may be coated with a friction reducing material such as PTFE.

[0065] The load suspending strands 39 may make up a major portion, i.e. significantly more than 50%, preferably more than 70%, of a sum of all strands 39, 49 enclosed in the jacket 37. This fact and the fact that the strands 39 of the first type cords 33 preferably extend unidirectional may result in the first type cords 33 providing for a major portion of the entire load bearing capacity of the STM 31.

[0066] Preferably, the first type cords 33 are arranged laterally distant to a neutral axis 43 of the STM 31. In the example shown in Fig. 3, the first type cords 33 are arranged in a core part of the STM 31, i.e. in a bulk portion being square in cross section and being arranged underneath a profiled surface 45 comprising longitudinal grooves 47.

[0067] The second type cords 35 are adapted for mainly providing for the traction capacity of the STM 31. For this purpose, the second type cords 35 comprise mainly traction providing strands 49. A multiplicity of such traction providing strands 49 is shown in the second enlarged visualisation in Fig. 3 in a side view. The traction providing strands 49 are generally provided in a twisted configuration in which each of the strands 49 is arranged in an inclined direction with respect to the longitudinal direction of the STM 31. Accordingly, the traction providing strands 49 are not unidirectional but multidirectional.

[0068] Inter-alia due to such twisted configuration of the traction providing strands 49, the second type of cords 35 are provided with an increased adhesion or friction with respect to the jacket material 38 when compared to the adhesion or friction occurring between the load suspension strands 39 and the jacket material 38. Due to such increased adhesion or friction, shear stresses resulting from forces between a traction surface of for example a traction sheave and an abutting traction surface of the jacket 37 of the STM 31 may be effectively transmitted to the traction providing strands 49 of the second type cords 35.

[0069] The second type cords 35 may be arranged at or close to the neutral axis 43 of the STM 31. In the example of figure 3, the second type cords 35 are arranged in an upper portion of the jacket 37 at the profiled surface 45, i.e. in the longitudinal protrusions 48 between the longitudinal grooves 47. Preferably, the second type cords 35 are also arranged close to a traction surface of the STM 31 adapted for making contact with a traction surface of e.g. the traction sheave. Due to such configuration, the second type cords 35 may effectively transmit/absorb traction forces acting onto the STM 31.

[0070] Fig. 4 shows an alternative embodiment of an STM 31'. Therein, the STM 31'is provided with a symmetrical profile on both opposing sides of a middle axis forming at the same time the neutral axis 43'. The second type cords 35' are arranged parallel to each other and laterally apart from each other in the plane of this neutral axis 43'. The first type cords 33' are symmetrically arranged at both sides on top and below of the second type cords 35'. In the example shown, the first type cords 35' are provided with a half circle cross section. The load suspending strands 39' of the first type cords 35' are enclosed by a sheath 41'. All first and second type cords 33', 35' are embedded in a jacket 37' made of jacket material 38' such as PU.

[0071] Many of the features described above with respect to the embodiment shown in Fig. 3 may also apply for the embodiment of Fig. 4.

[0072] STMs 31, 31' as proposed herein may allow for less compromise between lifetime and longitudinal stiffness. Furthermore, such STMs may be especially suited in cases where longitudinal stiffness is a main design criterion such as in high-rise elevators.

[0073] Finally, it should be noted that the term "comprising" does not exclude other elements or steps and the "a" or "an" does not exclude a plurality. Also elements described in association with different embodiments may be combined. It should also be noted that reference signs in the claims should not be construed as limiting the scope of the claims.

List of reference signs

[0074]

1	elevator
3	cabin
5	counterweight
7	hoistway
9	suspension traction member arrangement
11	suspension traction member
12	supporting structures
13	drive engine
15	traction sheave
16	pulleys
17	control device
19	conventional belt
21	jacket material
23	cords
25	jacket
27	longitudinal grooves
31	suspension traction member
33	first type cords
35	second type cords
37	jacket
38	jacket material
39	load suspension strands
41	sheath
43	neutral axis
45	profiled surface
47	longitudinal grooves
48	longitudinal protrusions
49	traction providing strands

Claims

1. Jacketed suspension traction member (31, 31') for an elevator (1), comprising:

   a first type of cords (33) comprising mainly load suspending strands (39);
   a second type of cords (35) comprising mainly traction providing strands (49);
   a common jacket (37) made from a bendable jacket material (38) jacketing both the first and second types of cords.

2. Jacketed suspension traction member of claim 1, wherein the load suspending strands (39) are comprised within the jacket (37) with a lower adhesion to the jacket (37) than the traction providing strands (49).

3. Jacketed suspension traction member of claim 1 or 2, wherein cords (33) of the first type are arranged within the jacket (37) spaced apart from cords (35) of the second type.

4. Jacketed suspension traction member of claim 3, wherein portions of the jacket material (38) are interposed between each cord (33) of the first type and each cord (35) of the second type.

5. Jacketed suspension traction member of one of the preceding claims, wherein the cords (35) of the second type are arranged closer to a neutral axis (43) of the suspension traction member (31, 31') than the cords (33) of the first type.

6. Jacketed suspension traction member of one of the preceding claims, wherein a sum of all cords (33) of the first type has a larger cross section than a sum

of all cords (35) of the second type.

7. Jacketed suspension traction member of one of the preceding claims, wherein a sum of all cords (33) of the first type has at least double the cross section of all cords (35) of the second type.

8. Jacketed suspension traction member of one of the preceding claims, wherein the cords (33) of the first type have a larger cross section than the cords (35) of the second type.

9. Jacketed suspension traction member of one of the preceding claims, wherein the traction providing strands (49) are provided with a twisted strand configuration.

10. Jacketed suspension traction member of one of the preceding claims, wherein the load suspending strands (39) are provided with a non-twisted strand configuration.

11. Jacketed suspension traction member of one of the preceding claims, wherein the load suspending strands (39) are coated with a friction reducing material such as PTFE.

12. Jacketed suspension traction member of one of the preceding claims, wherein the load suspending strands (39) are enclosed in a sheath (41) being interposed between the load suspending strands (39) and the jacket material.

13. Jacketed suspension traction member of claim 12, wherein the sheath (41) is made from a material having at least one of a higher stiffness and a lower friction coefficient with respect to the enclosed load suspending strands (39) compared to the jacket material.

14. Jacketed suspension traction member of one of the preceding claims, wherein the load suspending strands (39) are made with another strand material than the traction providing strands (49).

15. Elevator arrangement comprising:

an elevator cabin (3);
a drive engine (13) driving a traction sheave (15); and

jacketed suspension traction member (31, 31') according to one of the preceding claims, the jacketed suspension traction member (31,31') suspending the elevator cabin (3) and being wound around the traction sheave (15).

16. Jacketed suspension traction member (31, 31') of claim 1, the jacketed suspension traction member (31, 31') having a form of a belt,
wherein cords (33) of the first type are arranged within the jacket (37) spaced apart from cords (35) of the second type, portions of the jacket material (38) being interposed between each cord (33) of the first type and each cord (35) of the second type,
wherein the cords (35) of the second type are arranged closer to a neutral axis (43) of the suspension traction member (31, 31') than the cords (33) of the first type,
wherein a sum of all cords (33) of the first type has at least double the cross section of all cords (35) of the second type,
wherein the traction providing strands (49) are provided with a twisted strand configuration, and
wherein the load suspending strands (39) are provided with a non-twisted strand configuration.

Fig. 1

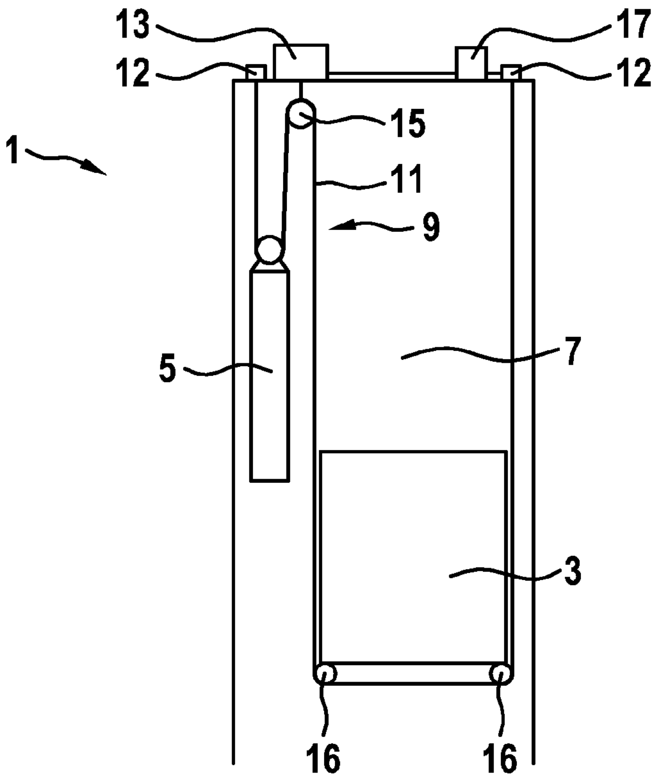


Fig. 2

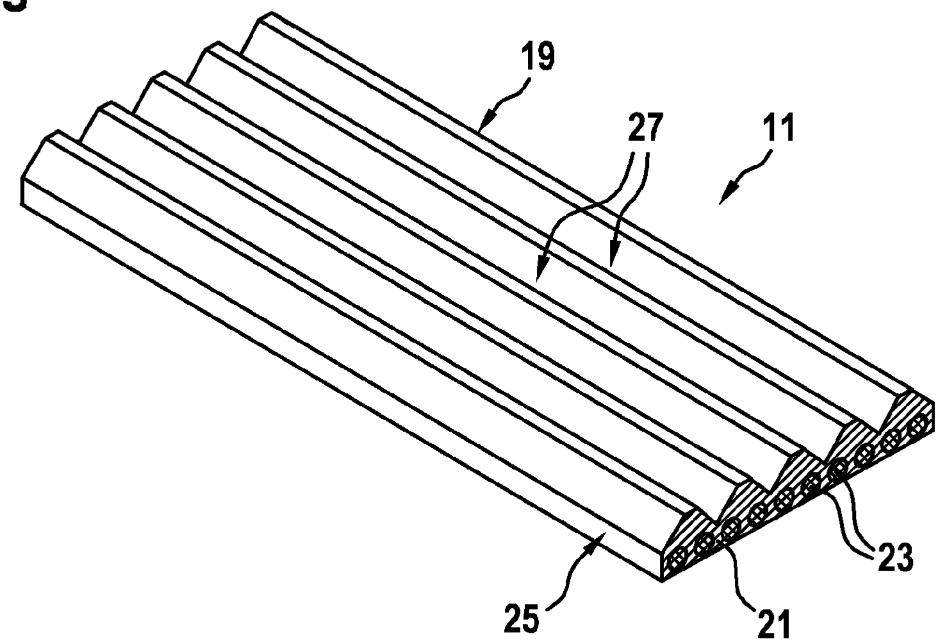


Fig. 3

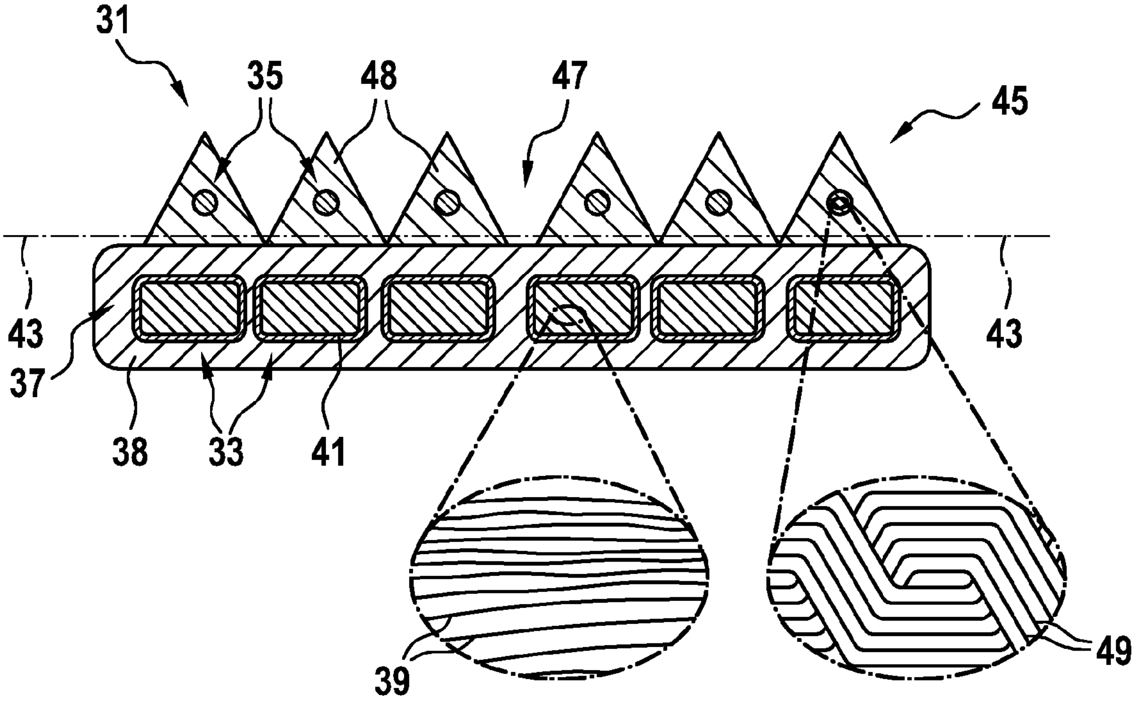
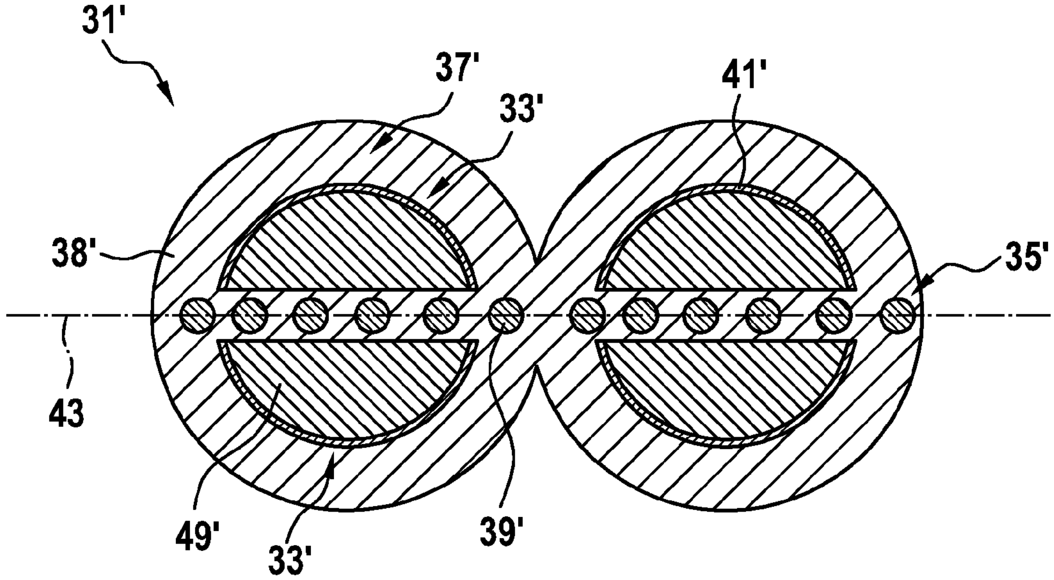


Fig. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 16 18 7686

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The present search report has been drawn up for all claims

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Place of search	Date of completion of the search	Examiner
The Hague	10 March 2017	Oosterom, Marcel

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