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(54) TRACTION MEMBER FOR A COUNTERWEIGHTLESS ELEVATOR

ZUGELEMENT FÜR EINEN AUFZUG OHNE GEGENGEWICHT

ELÉMENT DE TRACTION POUR ASCENSEUR SANS CONTREPOIDS

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Description

Field of the invention

[0001] The present invention relates to the technical field of traction members for elevators. More in detail, the invention relates to a self-centering traction member specifically adapted for use in a counterweight-less elevator.

Prior art

[0002] It is know to suspend the cabin of an elevator to a flat traction member, such as a belt, internally reinforced by tensile ropes or wire ropes. The internal tensile ropes are made of a suitable, high-tensile material such as steel or a carbon fibre or similar.

[0003] GB-A-1362514 discloses a traction member for elevators having a number of steel cords encapsulated in a plastic medium. EP-A-1153167 discloses a tension member for an elevator system comprising a car and a counterweight, the tension member having an aspect ratio of greater than one, defined as the ratio of tension member width w to thickness t (w/t), the tension member including load carrying ropes formed from metallic material encased within a common layer of coating, said layer defining an engagement surface for engaging a traction sheave.

[0004] In modern elevators, the aforesaid flat traction members are generally preferred to ropes because they allow reducing the diameter of the traction pulleys. The wires are distributed in the cross section of the flat traction member, instead to be twisted together to form a rope. It should be noted that the applicable law generally prescribe a ratio between the diameter of the pulleys and the diameter of the rope. Is the traction member is a flat belt rather than a rope, the diameter of the pulleys can be smaller with the related advantages. It has been found that the flat traction members, however, pose the following technical problems and suffer the following drawbacks which are not yet completely solved.

[0005] A first problem is that the manufacturing process should preferably ensure that the internal high-tensile wires or strands lie in a plane and in a central region between the two surfaces of the flat traction member. This need makes the production process more complex, given that it implies the need to provide an accurate guide for the high-tensile wires or strands, during the step of melting the plastic material for encapsulation.

[0006] Another point is the need to reduce weight and cost. This is especially important for a low-cost elevator, such as a so-called homelift without counterweight. Small counterweight-less elevators (homelifts) are suitable in particular for installation in residential homes, usually for serving a small number of people and with a capacity limited to few persons. Nevertheless, they have a promising field of application including new buildings under construction as well as renovation of old buildings to meet nowadays requirements of comfort, and where it may be impossible to install a conventional elevator with counterweight.

[0007] Another aspect to take into account is the reliability and duration of the traction member. It has been noted that the internal tensile ropes, during the use, tend to lie in an arc-shaped arrangement, due to contact with the pulleys of the driving system. As a consequence, stress on the tensile ropes is not uniform and may deviate from pure traction, thus being more severe. For example, when a flat plastic belt with internal steel wires is in contact with a sheave, the belt may assume an arched position, resulting in non-uniform stress of the steel wires. As above, this drawback is even more important for a low-cost and counterweight-less elevator, which should require little maintenance to keep the costs at a reasonable level WO2009041970 discloses a flat traction member with two concave outer surface.

Summary of the invention

[0008] The present invention overcomes the above drawbacks of the prior art, providing a traction member according to claim 1.

[0009] The traction member has a plurality of tensile ropes encapsulated in a case, and is characterized in that said case has a substantially flat, non-working surface, and an opposite working surface, for contact with a sheave of the drive assembly of an elevator, said working surface being concave or convex, and in that the tensile ropes of said plurality of tensile ropes lie in a plane which is parallel to said non-working surface.

[0010] The term tensile rope is used with reference to an internal high-tensile reinforcement element of the traction member. The tensile ropes, according to alternative embodiments of the invention, may have a circular cross section (wires) or any non-circular cross section.

[0011] According to preferred embodiments, the tensile ropes are made of metal wires. Preferably the tensile ropes are made of steel wires. In a preferred embodiment, the tensile ropes are steel wires, having a diameter between 0.5 and 3 mm and more preferably they are distanced each other by 0.75 to 5 mm, most preferably 1 to 3 mm. A further aspect of the invention provides that the ratio between the width L of the inventive traction member and height h of the arc formed by the concave working surface is in the range 2 to 100 and preferably in the range 2 to 50. In a preferred embodiment said ratio is close to 5.

[0012] In some embodiments, the working surface may have protrusions adapted to engage corresponding recesses on a sheave. For example a traction member according to the invention may have the form of a toothed belt.

[0013] The case may be made of a suitable plastic material, to provide encapsulation of the internal tensile ropes.

[0014] An object of the invention is also an elevator without counterweight, comprising a cabin, a drive sys-

tem, and a traction member supporting said cabin, the traction member being in accordance with the above disclosure.

[0015] Having only one working surface, namely one contact surface for contact with sheaves or pulleys, the traction member is adapted to use in a system without counterweight, such as a self-supporting home-lift. In fact, the need to support both a car and a counterweight would require two working surfaces, or a twisting of the traction member, which however is not acceptable in practice, as it would cause rapid wearing.

[0016] The fact that the traction member has a smaller cross section in a central area, due to the concave shape of the working surface, reduces the need of plastic material for encapsulation, thus reducing weight and cost. The arrangement of the tensile ropes in a surface parallel to the flat non-working surface is highly advantageous in terms of the manufacturing process, since said tensile ropes need to be positioned in a plane and not in a more complex arrangement. A further and significant advantage is that the tensile ropes remain aligned in a plane, even when the traction member is in use and engaged with sheaves, so that they are subject to a substantially pure traction stress. Moreover, the traction member has a self-centering ability, due to the concave working surface. Another advantage of the inventive traction member is a better adherence to the sheave, compared to ropes or conventional flat belts.

[0017] These and other advantages of the invention will be elucidated hereinbelow with reference to preferred and non-limiting embodiments.

Description of the figures

[0018]

Fig. 1 is a view of a traction member, in the form of a belt, according to a preferred embodiment of the invention.

Fig. 2 is a front view of the belt of Fig. 1.

Fig. 3 is a side view of the belt of Fig. 1.

Fig. 4 shows a traction member in the form of a toothed belt, according to one embodiment of the invention, engaged with a sheave.

Fig. 5 is a sketch of an embodiment of a counterweight-less elevator operable with a traction member according to the invention.

Fig. 6 is a sketch of another embodiment of a counterweight-less elevator operable with a traction member according to the invention.

Detailed description

[0019] Figs. 1 to 3 relate to an embodiment of the invention, where a traction member for an elevator in made as a belt 201 having a non-working flat surface and an opposite concave or convex working surface. The working surface is actually in contact with sheaves or pulleys during operation; the pulleys have preferably a contact surface with a corresponding convex or concave surface respectively, to engage the working surface of the belt.

[0020] Said belt 201 has a working concave surface 202 opposite to a non-working flat surface 203. The belt 201 is internally reinforced with highly resistant wires 204 to 204^n which are disposed in a plane g-g parallel to the non-working plane surface 203.

[0021] Preferably, the ratio between the width ***L*** of the belt 201 and height ***h*** of the arc formed by the concave working surface 202 (Fig. 2) is between 2 and 50. Preferably the trace of the surface 202, as seen in Fig. 2, is an arc of a circle.

[0022] The wires 204 to 204^n are made of a material highly resistant to traction; preferably steel wires having a diameter between 0.5 and 2 mm are used, the distance ***f*** between two of said wires being preferably 1 to 3 mm. In a particularly preferred embodiment, the width ***L*** is between 5 and 200 mm and more preferably in the range 50 to 150 mm, especially for use in an elevator without counterweight.

[0023] Measures to increase the friction between the belt and the pulley can optionally be provided. Fig. 4 show a belt 201 with teeth 205 and 207 and a pulley 206 with teeth 207 adapted to engage teeth 205 of the working surface 202 of the belt 201.

[0024] A process for manufacturing the belt 201 comprises the steps of: arranging the reinforcing wires 204 to 204^n in the plane ***g-g,*** at a mutual distance of ***f,*** and moulding the belt 201 e.g. by injecting molten plastic material. The manufacturing process is easier and less expensive due to the reinforcing wires being disposed in a plane, namely the plane ***g-g*** which is parallel to the flat non-working surface 203, rather than in a curved arrangement.

[0025] Fig. 5 discloses an exemplificative embodiment of a counterweight-less elevator that can be operated with a traction member according to the invention. The elevator has a cabin 1 which is guided on two frame parts 2 and 3, and is provided with two suspension and support belts 4 and 5 passing around groups of coplanar pulleys. A first belt 4 passes around four groups of pulleys 6 to 9, and a second belt 5 passes around another four groups of pulleys 6' to 9'. Said belts 4 and 5 are for example in accordance with the above described embodiment of belt 201.

[0026] Two of these groups of pulleys are fixed to the cabin 1 whereas the other two groups are fixed to the guide elements. The groups 8, 8' and 9, 9' are fixed to the bottom and top portion of the frame parts 2 and 3 respectively.

[0027] In the example of Fig. 1 each group of pulleys is composed of two pulleys. The pulleys of each group are denoted by the indexes a and b, for example the group 6 is formed by pulleys 6a and 6b. The axes of pulleys of each group are parallel so that the pulleys are coplanar. A motor 10 drives the pulleys 8a and 8'a by means of connecting axle 17. The pulley 8a drives the belt 4 and the pulley 8'a drives the opposite belt 5.

[0028] The two support belts 4, 5, according to embodiments of the invention, are symmetrically arranged on one of the lateral walls 11, 12 or of the back wall 13 of the cabin 1.

[0029] The elevator of Fig. 5 is an example of a self-supporting elevator, since the cabin and the motor are supported by the frame parts 2 and 3 and no heavy structure is necessary. Hence the elevator is suitable for installation in small and residential buildings, without invasive civil works.

[0030] Fig. 6 discloses the use of the belt 201 in a single-belt elevator with a cabin 208. The belt is located behind the back wall of the cabin 208 and passed around fixed and moving groups of pulleys.

Claims

1. A traction member (201) for a counterweight-less elevator, comprising a plurality of tensile ropes (204, ...204^n) encapsulated in a case, **characterized in that**:

   - said case of the traction member has a substantially flat, non-working surface (203), and an opposite working surface (202), for contact with a sheave of the drive assembly of an elevator, said working surface (202) being concave, and
   - the tensile ropes of said plurality of tensile ropes lie in a plane (g-g) which is parallel to said non-working surface (203).

2. A traction member according to claim 1, said tensile ropes being metal wires.

3. A traction member according to claim 2, said tensile ropes being steel wires having a diameter between 0.5 and 2 mm.

4. A traction member according to claim 2 or 3, the tensile ropes being distanced each other by 0.75 mm to 5 mm, preferably by 1 mm to 3 mm.

5. A traction member according to any of claims 1 to 4, where the ratio between the width (L) of the traction member and height (h) of the arc formed by said concave working surface is in the range 2 to 100 and preferably 2 to 50.

6. A traction member according to any of claims 1 to 5, the working surface (202) having protrusions (205) adapted to engage corresponding recesses (207) on a traction sheave (206).

7. A counterweight-less elevator, comprising a cabin (1) and a traction member for supporting the cabin, the traction member being in accordance with any of claims 1 to 6.

Patentansprüche

1. Zugelement (201) für einen Aufzug ohne Gegengewicht, aufweisend mehrere Zugseile (204, ..., 204^n), die in einem Gehäuse eingekapselt sind, **dadurch gekennzeichnet, dass**:

   - das Gehäuse des Zugelements eine im Wesentlichen flache, nicht arbeitende Oberfläche (203) aufweist und eine gegenüberliegende, arbeitende Oberfläche (202) für den Kontakt mit einer Rolle der Antriebseinheit eines Aufzugs, wobei die arbeitende Oberfläche (202) konkav ist, und
   - die Zugseile der mehreren Zugseile in einer Ebene (g-g) liegen, die parallel zu der nicht arbeitenden Oberfläche (203) ist.

2. Zugelement nach Anspruch 1, wobei die Zugseile Metallseile sind.

3. Zugelement nach Anspruch 2, wobei die Zugseile Stahlseile mit einem Durchmesser zwischen 0,5 und 2 mm sind.

4. Zugelement nach Anspruch 2 oder 3, wobei die Zugseile zueinander um 0,75 mm bis 5 mm, bevorzugt um 1 mm bis 3 mm, beabstandet sind.

5. Zugelement nach einem der Ansprüche 1 bis 4, wobei das Verhältnis zwischen der Breite (L) des Zugelements und der Höhe (h) des Bogens, der durch die konkave, arbeitende Oberfläche gebildet ist, in dem Bereich 2 bis 100 und bevorzugt 2 bis 50 liegt.

6. Zugelement nach einem der Ansprüche 1 bis 5, wobei die arbeitende Oberfläche (202) Vorsprünge (205) aufweist, die geeignet sind, in korrespondierende Vertiefungen (207) auf einer Zugscheibe (206) einzugreifen.

7. Aufzug ohne Gegengewicht aufweisend einen Fahrkorb (1) und ein Zugelement zum Halten des Fahrkorbs, wobei das Zugelement in Übereinstimmung nach einem der Ansprüche 1 bis 6 ausgebildet ist.

Revendications

1. Elément de traction (201) pour ascenseur sans contrepoids, comportant une pluralité de cordes de traction (204, ... 204^n) encapsulées dans une gaine, **caractérisé en ce que** :

   - la dite gaine de l'élément de traction présente une surface essentiellement plane et non active (203), et une surface opposée active (202), en contact avec une poulie de l'assemblage d'entraînement d'un ascenseur, la dite surface active (202) étant concave, et
   - les cordes de traction de la dite pluralité de cordes de traction sont dans un plan (g-g) qui est parallèle à la dite surface non-fonctionnelle (203).

2. Elément de traction selon la revendication 1, où les dites cordes de traction étant des câbles métalliques.

3. Elément de traction selon la revendication 2, où les dites cordes de traction sont des câbles d'acier ayant un diamètre compris entre 0,5 et 2 mm.

4. Elément de traction selon la revendication 2 ou 3, où les cordes de traction sont écartées les unes des autres de 0,75 mm à 5 mm, de préférence de 1 mm à 3 mm.

5. Elément de traction selon l'une quelconque des revendications 1 à 4, où le rapport entre la largeur (*L*) de l'élément de traction et la hauteur (*h*) de l'arc formé par la dite surface active concave est compris entre 2 et 100 et de préférence entre 2 et 50.

6. Elément de traction selon l'une quelconque des revendication 1 à 5, où la surface active (202) comporte des protubérances (205) adaptées à s'engager dans des creux correspondants (207) sur une poulie de traction (206).

7. Ascenseur sans contrepoids, comprenant une calcine (1) et un élément de traction pour supporter la cabine, l'élément de traction étant en accord avec n'importe laquelle des revendications 1 à 6.

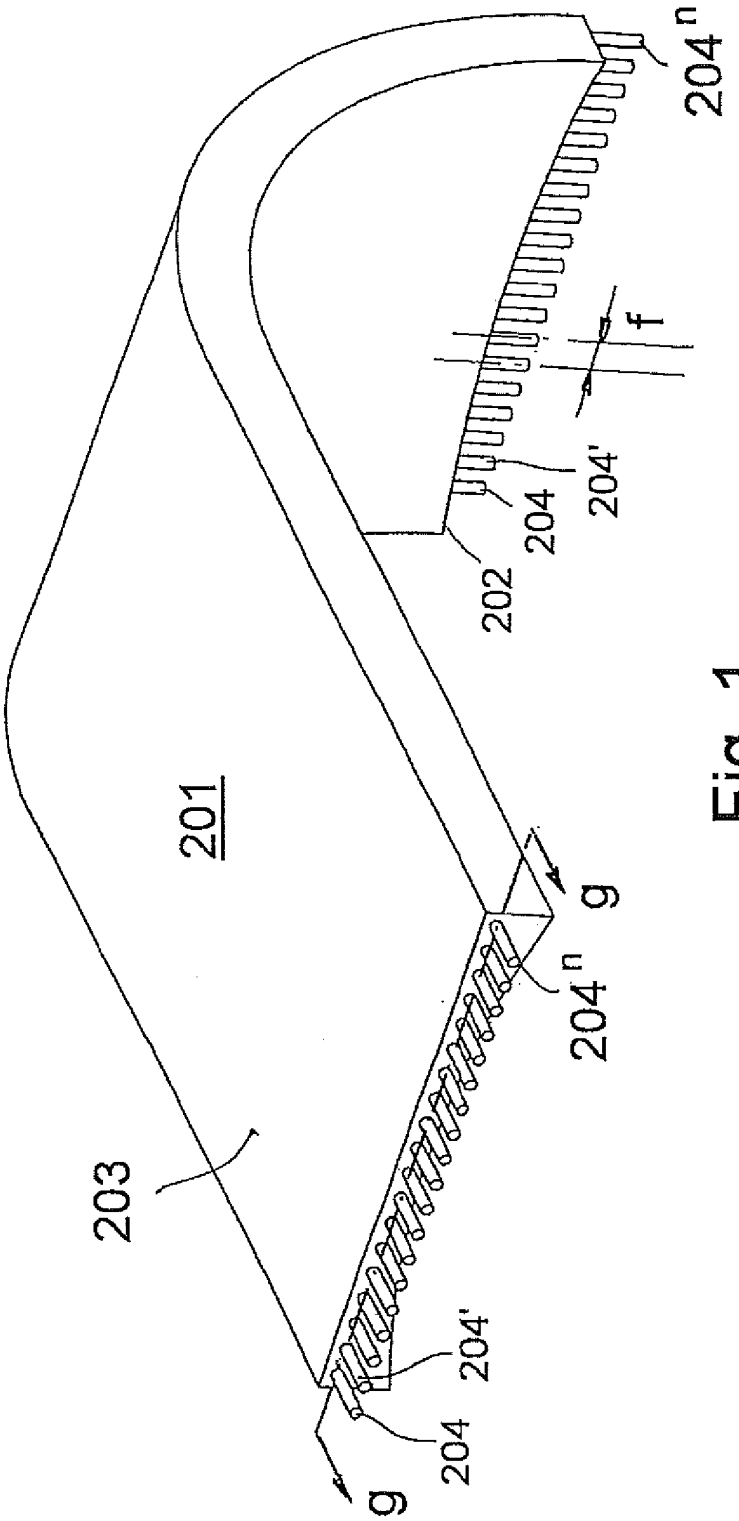


Fig. 1

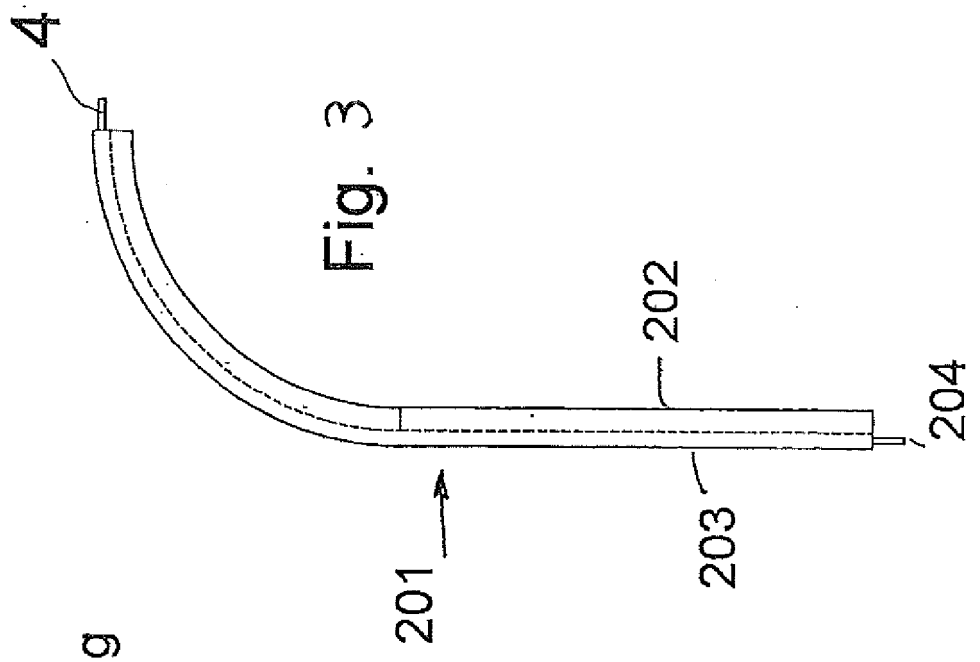


Fig. 3

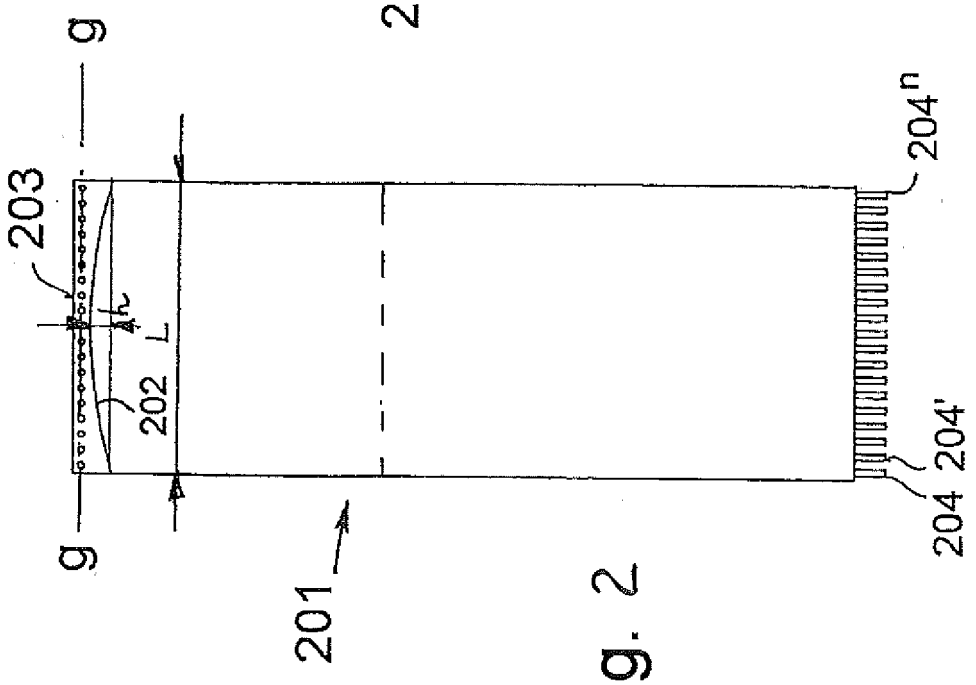


Fig. 2

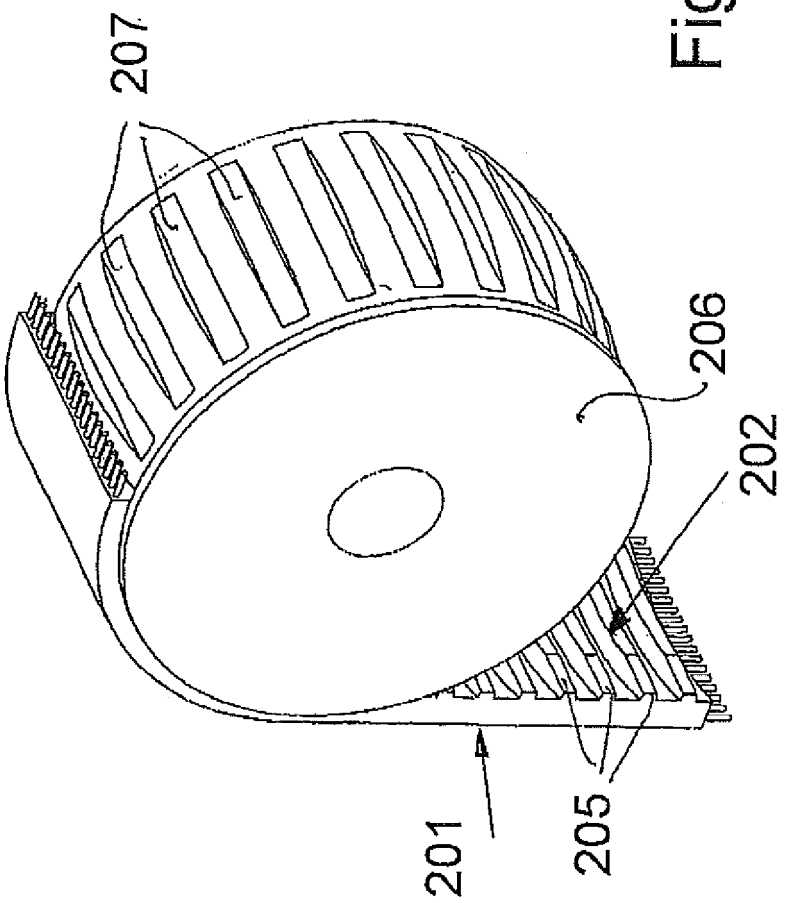


Fig. 4

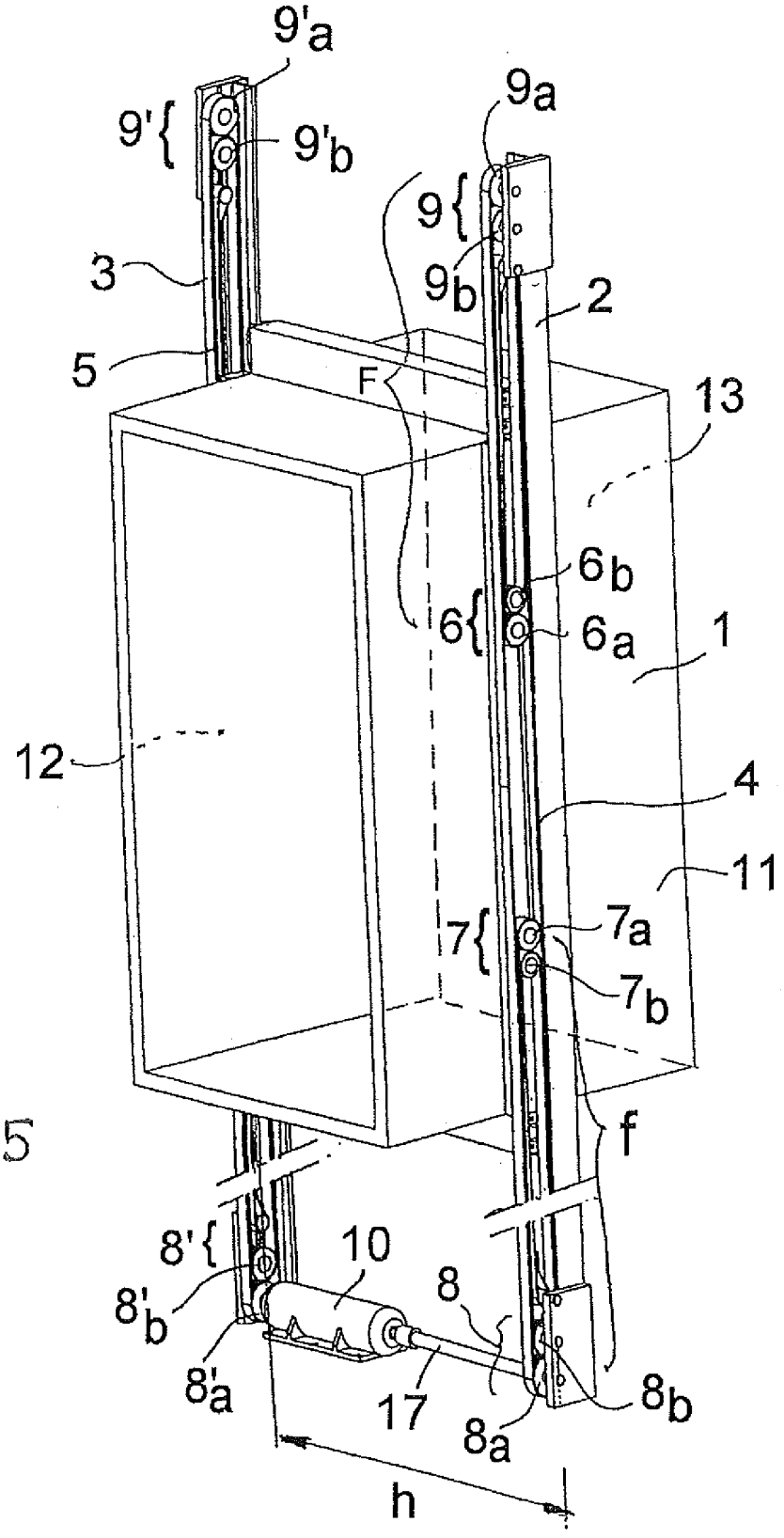


Fig. 5

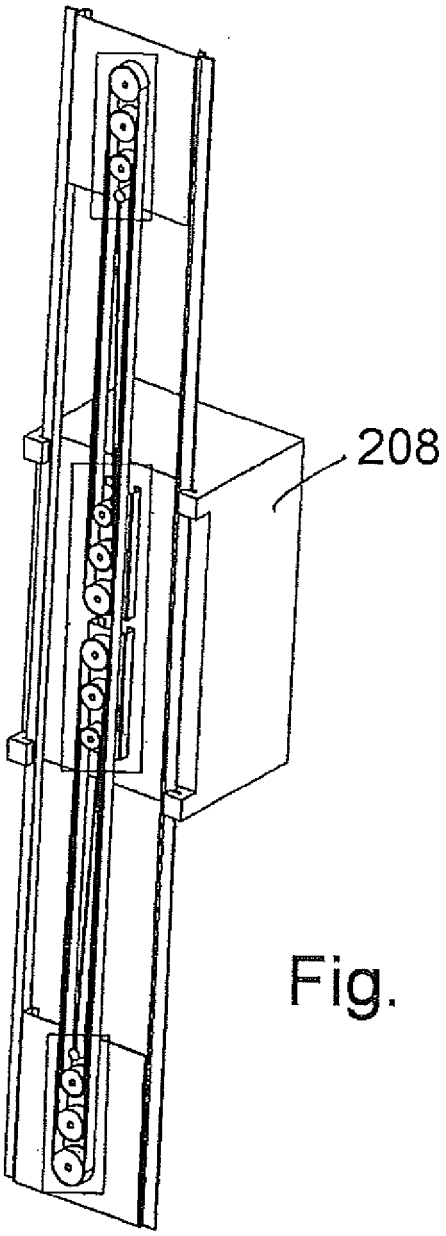


Fig. 6

REFERENCES CITED IN THE DESCRIPTION

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- EP 1153167 A **[0003]**
- WO 2009041970 A **[0007]**