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(54) **SYSTEM FOR LOAD DETECTION IN A CABIN OF AN ELEVATOR**

SYSTEM ZUR LASTERFASSUNG IN EINER AUFZUGSKABINE

SYSTÈME DE DÉTECTION DE CHARGE DANS UNE CABINE D'ASCENSEUR

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Description

[0001] The present invention relates to technique of elevators. The invention relates in particular to a system for the detection of the load of the cabin of an elevator.

[0002] An elevator is normally equipped with a system able to detect and measure the load of the cabin, i.e. the presence of one or more persons in the same cabin. Said system is useful for the managing of auxiliary functions, for example actuation of the internal light of the cabin when a person boards, but first of all it is important to detect whether the maximum allowed load is exceeded, for safety reasons. For example a control may be provided to hinder the start of the elevator if the load exceeds the maximum value.

[0003] It is known to make use of a weighing system integrated in the floor of the cabin. Said system in general comprises a plurality of sensors (typically load cells), for example at least one sensor in the central part and another four sensors at the corners of the floor. A single sensor located in a point of the floor could in fact miss the detection of a person standing in a corner of the cabin. A shortcoming of this system is the poor precision and the relatively high cost. The cabin is rendered more complex and costly by the presence of these sensors.

[0004] Other known systems provide for the measurement of the deformation of plates directly connected to the load-bearing cables. Another technique provides for the measure of deflection of a load joint in a load-sensitive position, for example on an arch or on the cables fastening plate. These systems have a low cost but are fairly imprecise and can only be applied to elevators suspended on metal cables; moreover it has been noted that the measure is subject to a considerable hysteresis leading to low precision. One Example of the above mentioned measuring systems is presented in WO 2007/141371.

[0005] The invention relates in particular to elevators of the so called self-supporting type, suitable for serving a limited number of floors and therefore particularly attractive for small homes and/or renovations where it is generally not possible to obtain the room for installation of a conventional elevator.

[0006] A self-supporting elevator essentially comprises a cabin, a frame structure comprising two vertical guides, a drive comprising a motor and at least one suspension means, which is preferably represented by a belt rather than cables with circular section. A self-supporting elevator is preferably without a counterweight, so that the overall dimensions are quite small. The known load detection systems, which have been discussed above, are not suitable and/or are not satisfactory, particularly in this type of elevators.

[0007] The invention aims to devise a system for the measure of the weight transported by an elevator, which is simple and inexpensive to make, and which allows accurate measure.

[0008] The object is achieved with an elevator according to independent claim 1. Some preferred embodiments

of the invention are described in the annexed dependent claims. An aspect of the invention also consists of a method for the detection of the load of a cabin of an elevator, according to independent claim 9.

[0009] According to the invention the load is measured by means of a measure of deformation of an interface plate between the cabin and a carriage. The term plate is meant to refer, for the purpose of the present invention, to a generic support member that may have any form. The measure is made with a suitable device, realized with a technique in itself known. For example a strain gauge associated with said plate can be used.

[0010] Said plate is the interface between the cabin and a carriage which is part of the drive system. The plate in a preferred embodiment comprises at least one first portion which is firmly connected to the cabin, and a second portion which carries a pulley or an assembly of pulleys and therefore is substantially connected to the carriage. The measurement system comprises at least one device for the measure of a relative displacement between the first portion and the second portion of plate. This displacement gives an indirect measure of the load of the cabin.

[0011] The advantages of the invention are essentially the compactness, the simplicity and the reduced installation time, without the need to modify the cabin. More particularly the sensors in the floor of the cabin are no longer required. The cabin is made simpler and consequently the cost is reduced. This advantage is particularly appreciated in self-supporting elevators wherein the overall cost needs to be reduced. The measure is accurate and is not influenced for example by the position of the load inside the cabin.

[0012] The invention is now described in greater detail and with reference to the drawings, which show non-limiting preferred embodiments thereof, in which:

Fig. 1 shows schematically an elevator according to a preferred embodiment of the invention;

Fig. 2 shows a detail of the elevator of Fig. 1;

Fig. 3 illustrates the measurement of the load by means of the deformation of the fastening plate between cabin and carriage, in the elevator of Fig. 1,

according to one of the embodiments,

Fig. 4 shows a variant of embodiment of said plate, and

Fig. 5 shows a further variant of embodiment of said plate.

[0013] Referring to the drawings, an elevator comprises a cabin 1 equipped with guides 2 and suspended on a belt 3 which is wound on pulleys 4. The example shows an elevator without counterweight. More particularly (Fig.

2) the cabin 1 is driven by a carriage 5 comprising a fixed part integral with the cabin and a suspended part. The fixed part is formed substantially by a plate 6 which carries an assembly of pulleys 4. The suspended part is denoted by 7 and comprises another assembly of pulleys 4, and is connected to the fixed part with a system dampened by means of springs 8.

[0014] The load of the cabin 1 is detected and measured essentially through the measurement of a deformation of the plate 6 which represents mechanically the connection member between cabin 1 and carriage 5.

[0015] In the examples of the drawings the plate 6 is substantially two-dimensional and flat.

[0016] According to the embodiment of Fig. 3 said plate 6 essentially comprises a central portion (or core) 10 which carries the respective pulleys 4, and two wings 11 which are bolted to the rear wall of the cabin. As a result the two wings 11 are substantially integral with the cabin, while the part 10 is substantially integral with the carriage 5, i.e. with the assembly of the belt 3 and pulleys 4. The parts 10 and 11 of the plate 6 are connected by ribbings 12 which have a determined flexibility and more particularly allow a displacement between the core 10 and the wings 11.

[0017] A first way of measuring the load of the cabin 1 is to take a measure of the gap distance denoted by 13. Fig. 3 (a) relates to the empty cabin while Fig. 3 (b) relates to the loaded cabin. The weight of the cabin 1 is transmitted as a force L on the wings 11 rigidly connected to the cabin. The structure of the plate 6 is deformed under load, with the effect that the gap distance 13 reduces from a value 13a at rest, to a value 13b under load. Knowing the variables of the system including rigidity of the plate 6 and weight of the empty cabin 1, said distance 13 can be correlated to the overall weight of the cabin in working conditions and therefore to the load.

[0018] In the embodiment of Fig. 4 the plate 6 has an upper bridge portion 14 which is substantially integral with the wings 11. A strain gauge 20 measures the gap distance 13 between the upper portion 15 of the core 10 and the above mentioned bridge portion 14. It shall be noted that the core 10 of the plate is substantially integral with the suspended part (pulleys and belt) of the carriage 5, while the wings 11 and the bridge portion 14 are essentially integral with the fixed part, i.e. with the cabin.

[0019] In Fig. 5 a different embodiment of the plate 6 and position of the strain gauge 20 can be noted. Said strain gauge 20 measures the deflection of a crosspiece 16 of the plate 6. Said crosspiece 16 has two end portions integral with the wings 11, while the central part of said crosspiece 16 is connected to the core 10, via a ribbing 17. Consequently the crosspiece 16 bends under load and the deflection is detected by the sensor 20. The elongation of the everted section of said crosspiece 16 is correlated to a relative displacement between the core 10 and the wings 11 and indirectly to the load of the cabin 1.

[0020] The electrical signal of the device 20 is trans-

mitted to the control system of the elevator to detect the load of the cabin and in particular to detect a possible overload.

[0021] The drive system comprises other assemblies of pulleys integral with the load-bearing frame (Fig. 1) and is not described in detail, being not essential for the purpose of the invention. It is to be noted that the suspension means may comprise a single belt 3 or several belts. The assemblies of pulleys 4 preferably comprise coplanar pulleys and each assembly comprises a series of pulleys of decreasing diameter, as shown in Fig. 2.

Claims

1. Elevator comprising a fixed structure (2) and a cabin (1), a drive system comprising at least one suspension means (3) wound on pulleys (4) and a carriage (5) for driving said cabin (1), said carriage being connected to said cabin (1) by an interface plate (6) and comprising a system for measurement of the load of said cabin by means of at least one measure of deformation of said plate (6), wherein:

- said plate (6) comprises at least a first portion which is firmly connected to the cabin (1) and at least a second portion which is connected to at least one pulley (4) of the carriage (5), and said system of measurement comprises at least one measuring device (20) suitable for measuring a relative displacement between said first (11) and second portion (10) of the plate, consequent to the deformation of said plate, and

- said plate (6) is substantially two-dimensional and flat in shape, said second portion of the plate being represented by a core part (10), which carries said at least one suspension pulley (4) of the cabin, and said first portion being represented by two wings (11) at the sides of said core part and firmly fixed to the cabin.

2. Elevator according to claim 1, the core (10) and the wings (11) being connected by ribbings (12) of said plate.

3. Elevator according to any one of the previous claims, wherein said system of measurement comprises at least one measuring device (20) suitable for measuring a gap distance (13) formed in said plate (6).

4. Elevator according to any one of the previous claims, wherein said system of measurement comprises at least one device (20) suitable for measuring a deflection of a crosspiece portion (16) of said plate, said crosspiece portion (16) having ends connected to the wings (11) of the plate, and a central part connected to the core part (10) of the plate itself

5. Elevator according to any one of the previous claims, said elevator being a self-supporting elevator without counterweight and said at least one suspension means (3) being a belt.
6. Method for the measurement of the load of a cabin (1) of an elevator according to claim 1, wherein the elevator comprises at least a cabin (1) and a drive system comprising a carriage (5) for driving said cabin, the carriage comprising at least one assembly of pulleys whereon a suspension means (3) is wound, the method being **characterised by** measuring the relative displacement between a core part (10) and two wings (11) of a substantially two-dimensional flat plate (6) of connection between the cabin (1) and the carriage (5), said core part (10) of the plate carrying at least one suspension pulley (4) of the carriage (5), and said two wings (11) being located at the sides of said core part and being firmly fixed to the cabin.

Patentansprüche

1. Aufzug, aufweisend eine feststehende Struktur (2) und eine Kabine (1), ein Antriebssystem, das wenigstens ein Aufhängungsmittel (3) umfasst, das um Rollen (4) gewickelt ist, und einen Laufwagen (5) zum Antreiben der Kabine (1), wobei der Laufwagen mit der Kabine (1) durch eine Verbindungsplatte (6) verbunden ist und ein System zur Messung der Last der Kabine anhand von wenigstens einem Maß der Verformung der Platte (6) aufweist, wobei:

- die Platte (6) wenigstens einen ersten Teil aufweist, der fest mit der Kabine (1) verbunden ist, und wenigstens einen zweiten Teil, der mit wenigstens einer Rolle (4) des Laufwagens (5) verbunden ist, und das System zur Messung wenigstens eine Messvorrichtung (20) aufweist, die zur Messung einer relativen Verlagerung zwischen dem ersten (11) und dem zweiten Teil (10) der Platte geeignet ist, die aus einer Verformung der Platte resultiert, und
- die Platte (6) im Wesentlichen zweidimensional und in der Form flach ist, wobei der zweite Teil der Platte durch einen Kernteil (10) verkörpert ist, der die wenigstens eine Aufhängungsrolle (4) der Kabine trägt, und der erste Teil durch zwei Flügel (11) an den Seiten des Kernteils verkörpert und fest an der Kabine befestigt ist.

2. Aufzug nach Anspruch 1, wobei der Kern (10) und die Flügel (11) durch Verrippungen (12) der Platte verbunden sind.
3. Aufzug nach einem der vorhergehenden Ansprüche, wobei das System zur Messung wenigstens eine

Messvorrichtung (20) aufweist, die zur Messung eines Spaltabstands (13) geeignet ist, der an der Platte (6) ausgebildet ist.

4. Aufzug nach einem der vorhergehenden Ansprüche, wobei das Messsystem wenigstens eine Vorrichtung (20) aufweist, die zur Messung einer Biegung eines Querstückabschnitts (16) der Platte geeignet ist, wobei der Querstückabschnitt (16) Enden aufweist, die mit den Flügeln (11) der Platte verbunden sind, und ein Mittelstück, das mit dem Kernteil (10) der Platte selbst verbunden ist.
5. Aufzug nach einem der vorhergehenden Ansprüche, wobei der Aufzug ein selbsttragender Aufzug ohne Gegengewicht und das wenigstens eine Aufhängungsmittel (3) ein Riemen ist.
6. Verfahren zur Messung der Last einer Kabine (1) eines Aufzugs gemäß Anspruch 1, wobei der Aufzug wenigstens eine Kabine (1) und ein Antriebssystem aufweist, das einen Laufwagen (5) zum Antreiben der Kabine (1) aufweist, wobei der Laufwagen wenigstens eine Baugruppe von Rollen aufweist, um die ein Aufhängungsmittel (3) gewickelt ist, wobei das Verfahren durch ein Messen der relativen Verlagerung zwischen einem Kernteil (10) und zwei Flügeln (11) einer im Wesentlichen zweidimensionalen, flachen Platte (6) der Verbindung zwischen der Kabine (1) und dem Laufwagen (5) gekennzeichnet ist, wobei der Kernteil (10) der Platte wenigstens eine Aufhängungsrolle (4) des Laufwagens (5) trägt und die zwei Flügel (11) an den Seiten des Kernteils angeordnet sind und fest an der Kabine befestigt sind.

Revendications

1. Ascenseur comprenant une structure fixe (2) et une cabine (1), un système d'entraînement comprenant au moins un moyen de suspension (3) enroulé sur des poulies (4) et un chariot (5) pour entraîner ladite cabine (1), ledit chariot étant relié à ladite cabine (1) par une plaque d'interface (6), et comprenant un système de mesure de la charge de ladite cabine par l'intermédiaire d'au moins une mesure de déformation de ladite plaque (6), dans lequel :

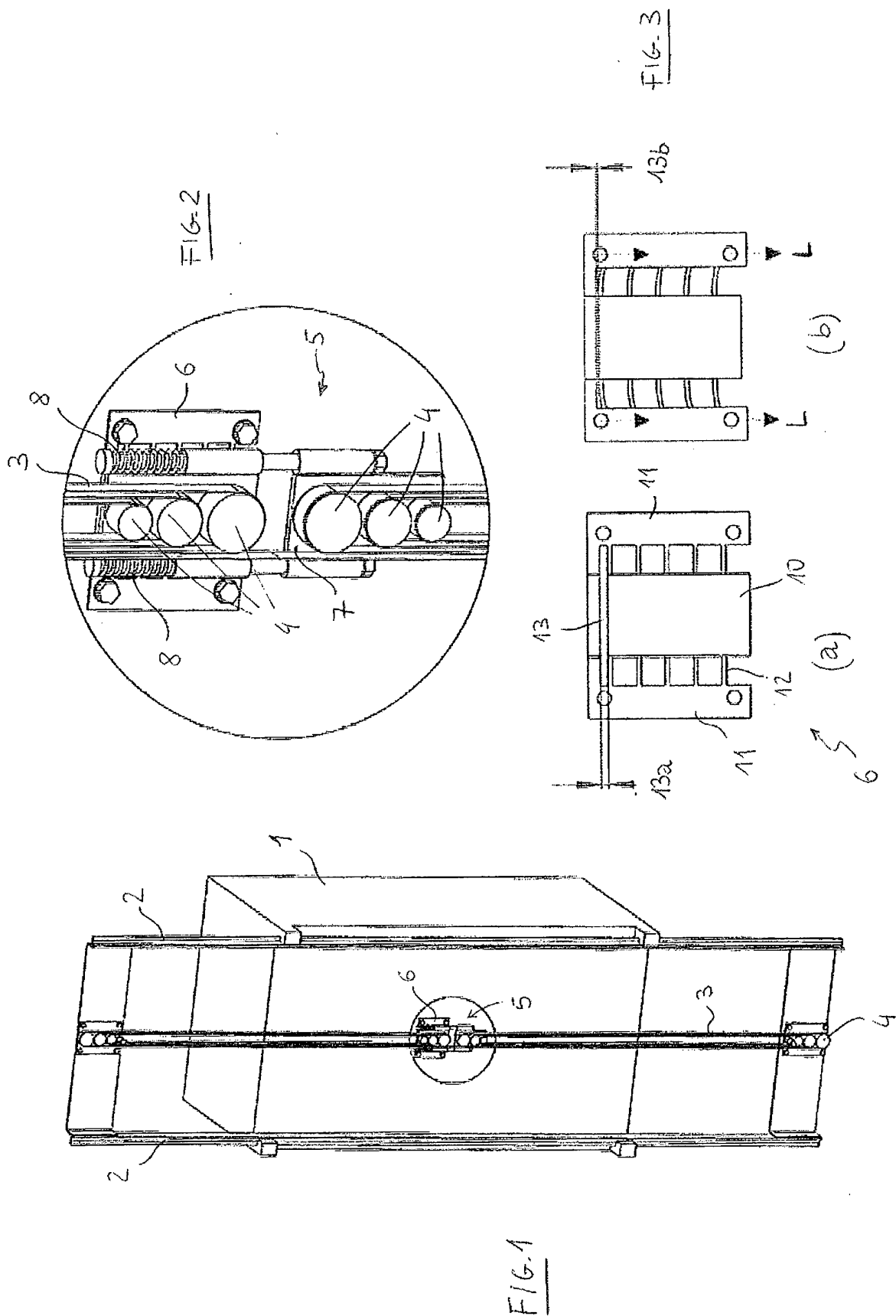
- ladite plaque (6) comprend au moins une première partie qui est fermement reliée à la cabine (1) et au moins une seconde partie qui est reliée à au moins une poulie (4) du chariot (5), et ledit système de mesure comprend au moins un dispositif de mesure (20) adapté pour mesurer un déplacement relatif entre ladite première (11) et ladite seconde partie (10) de la plaque, à la suite de la déformation de ladite plaque, et
- ladite plaque (6) est sensiblement en deux di-

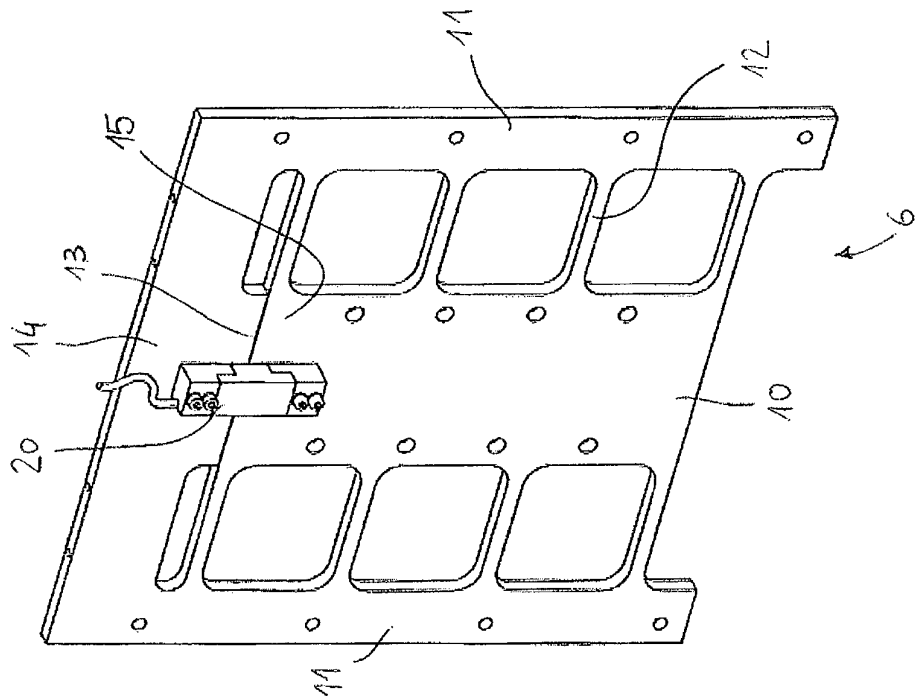
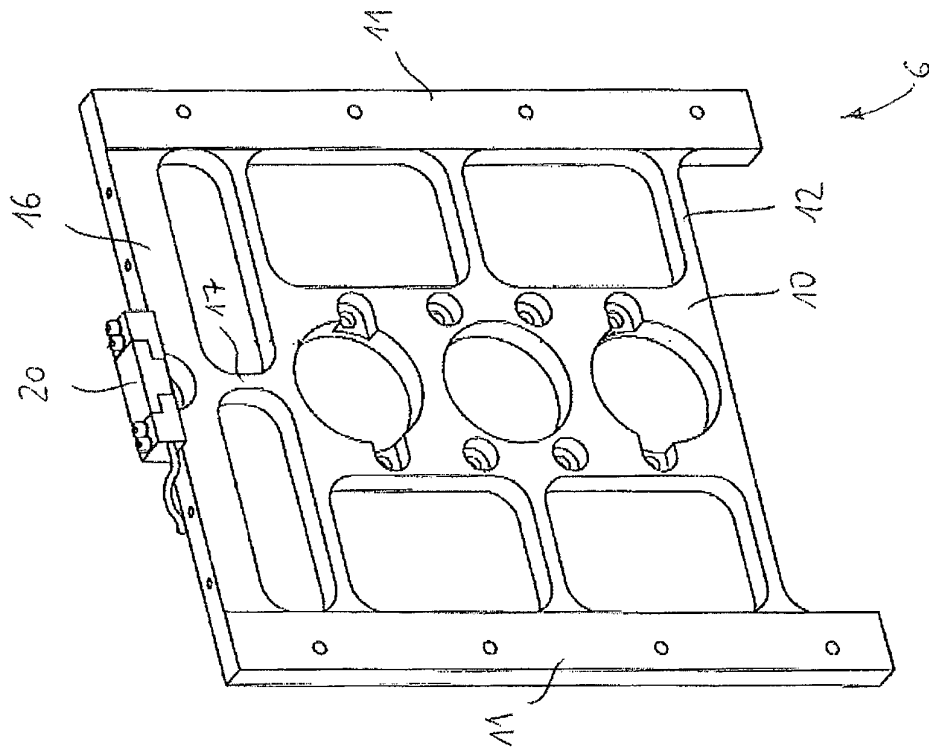
mensions et de forme plate, ladite seconde partie de la plaque étant représentée par une partie de noyau (10) qui supporte ladite au moins une poulie de suspension (4) de la cabine, et ladite première partie étant représentée par deux ailes (11) sur les côtés de ladite partie de noyau et fermement fixées à la cabine. 5

2. Ascenseur selon la revendication 1, le noyau (10) et les ailes (11) étant reliés par des nervures (12) de ladite plaque. 10
3. Ascenseur selon l'une quelconque des revendications précédentes, dans lequel ledit système de mesure comprend au moins un dispositif de mesure (20) adapté pour mesurer une distance d'écartement (13) formé dans ladite plaque (6). 15
4. Ascenseur selon l'une quelconque des revendications précédentes, dans lequel ledit système de mesure comprend au moins un dispositif (20) adapté pour mesurer une déviation d'une partie d'entretoise (16) de ladite plaque, ladite partie d'entretoise (16) ayant des extrémités reliées aux ailes (11) de la plaque, et une partie centrale reliée à la partie de noyau (10) de la plaque elle-même. 20 25
5. Ascenseur selon l'une quelconque des revendications précédentes, ledit ascenseur étant un ascenseur autoportant sans contrepoids et ledit au moins un moyen de suspension (3) étant une courroie. 30
6. Procédé pour la mesure de la charge d'une cabine (1) d'un ascenseur selon la revendication 1, dans lequel l'ascenseur comprend au moins une cabine (1) et un système d'entraînement comprenant un chariot (5) pour entraîner ladite cabine, le chariot comprenant au moins un ensemble des poulies sur lesquelles un moyen de suspension (3) est enroulé, le procédé étant **caractérisé par** la mesure du déplacement relatif entre une partie de noyau (10) et deux ailes (11) d'une plaque plate sensiblement bi-dimensionnelle (6) de connexion entre la cabine (1) et le chariot (5), ladite partie de noyau (10) de la plaque supportant au moins une poulie de suspension (4) du chariot (5), et lesdites deux ailes (11) étant localisées sur les côtés de ladite partie de noyau et étant fermement fixées à la cabine. 35 40 45

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REFERENCES CITED IN THE DESCRIPTION

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