

Description

The invention relates to an elevator of the type having a linear motor for providing motive force, the elevator comprising:

- (a) an elevator car;
- (b) a counterweight unit;
- (c) and at least one rope guided by a sheave and connected at one end thereof to the elevator car and at the other end thereof to the counterweight unit;
- (d) the linear motor comprising a movable member as a primary side and a stationary member as a secondary side;
- (e) and a cable suspended from the counterweight unit, connecting the movable member of the linear motor to a power source.

Such an elevator is known from the document EP-A1-0 048 847. The movable member of the linear motor is associated to the counterweight unit, and a cable connecting the movable member to a power source is suspended from the counterweight unit. The length of the rope between the sheave and the elevator car varies dependent on the level position of the elevator car. If, for example, the elevator car with a load weight of zero is positioned at its uppermost level, a high output of the linear motor is required for moving upwardly the counterweight unit. As a consequence, the cable for transmitting the required power becomes heavy. Moreover, the braking unit for stopping the elevator car at predetermined positions and when emergencies occur has to be designed for high braking forces.

It is an object of the invention to provide a rope weight compensation.

According to the invention the elevator is characterized by

- (f) by the cable being suspended from the elevator car and the counterweight unit, thereby providing a compensating weight for said at least one rope;
- (g) the cable having a first part leading from the movable member associated to the counterweight unit to the elevator car or leading from the movable member associated to the elevator car to the counterweight unit;
- (h) and the cable having a second part connecting the first part of the cable to the power source.

The invention will be elucidated by means of a preferred embodiment illustrated in the accompanying drawings.

Fig. 1 is a perspective view of a linear motor driven elevator;

Fig. 2 is a schematic diagram of the elevator of Fig. 1.

Referring to Fig. 1, sheaves 1 guide four ropes 2. The sheaves 1 are rotatably mounted on shafts 11 which are in turn fixed to a building.

An elevator car 3 is attached to the one end of the ropes 2 via hooks 5. A counterweight unit 4 is attached to the other end of the ropes 2 via hooks 5. The counterweight unit is comprised of a frame 6, weights 7, a braking unit 8, and a movable member 9 which functions as a primary side of a toroidal linear motor. A vertical stationary column 10, which functions as a secondary side of the linear motor, passes centrally through the movable member 9 with a predetermined clearance therebetween. The column 10 is fixed to the building via support members 12 and 13.

The electromagnetically operated braking unit 8 engages rails 14, 14 fixed to the building when the linear motor is stopped in normal operation or in an emergency such as a power failure. Rollers 15, 15, 15, 15 arranged at the upper end lower end portions of the counterweight unit 4 rotatably engage the rails 14, 14 to guide the counterweight unit 4 therealong. Rollers 16, 16, 16, 16 arranged at both sides of the elevator car rotatably engage rails 17, 17 fixed to the building to guide the elevator car 3 therealong.

A three phase cable 18 is suspended from the counterweight unit 4 by means of a fixing member 19; one end of each strand of cable 18 is connected to the movable member 9 of the linear motor. In addition, the cable 18 is suspended from the elevator car 3 and then connected to a three-phase AC power supply at its other end. In this way, a first part of the length of cable 18 is between the counterweight unit 4 and the elevator car 3, and a remaining second part of the length of cable 18 is between the elevator car and the power supply. Accordingly, the movable member 9 of the linear motor is supplied with three-phase AC through cable 18. The cable 18 can be attached to the bottom end wall of the elevator car 3 by known fixing members such as the fixing member 19 or the like.

Referring to fig. 2, when the movable member 9 moves linearly by means of an electromagnetic force generated between the movable member 9 and the fixed column 10, the counterweight unit 4 moves as well, and the elevator car 3 in turn moves via the ropes 2. Assuming that the counterweight unit 4 and the elevator car 3 are of even weight and that the counterweight unit 4 is positioned at its lowermost level with the elevator car 3 being positioned at its uppermost level, and that no means for compensating the rope weight is provided, a rope weight corresponding to L1-L2 is applied to the counterweight side and must be lifted by the linear motor, thereby requiring the linear motor to utilize corresponding power. On the

contrary, when the cable 18 is provided as shown in fig. 2, the rope weight corresponding to the length L1-L2 is substantially compensated by a cable weight corresponding to length L4-L3 so that the power required by the linear motor is reduced.

L5 is the length of the second part of cable 18, depending from the elevator car 3. It is noted that the cable weight corresponding to length L5 (the lower curved portion thereof makes the actual length of L5 longer than the length L5 shown) is also applied to the elevator car side. Such cable weight provides an imbalance which is minimized by adding a weight to the counterweight unit 4. Such compensating weight corresponds to the weight of length L5 of cable 18 when the elevator car 3 is positioned at half of its entire travel stroke.

In the given embodiment, each of the three strands of cable 18 is constituted of some tens of insulated wires and weighs 1.15 kg/m. On the other hand, each rope weighs 0.55 kg/m. As a consequence, the cable 18 functions properly as a means for compensating essentially the rope weight.

It should be noted that signal lines connecting the movable member 9 of the linear motor and the elevator car 3 to a known control unit as well as lines supplying power to the elevator car lights are preferably combined with cable 18. Even though cable 18 is disposed between the power supply and the counterweight unit 4 via the elevator car 3 in the embodiment as shown, it is alternatively possible to dispose the cable 18 between the power supply and the elevator car 3 via the counterweight unit 4. Even though the linear motor is associated to the counterweight unit 4 in the embodiment as shown, it may alternatively be associated to the elevator car 3.

Claims

1. An elevator of the type having a linear motor (9,10) for providing motive force, the elevator comprising:
 - (a) an elevator car (3);
 - (b) a counterweight unit (4);
 - (c) and at least one rope (2) guided by a sheave (1) and connected at one end thereof to the elevator car (3) and at the other end thereof to the counterweight unit (4);
 - (d) the linear motor comprising a movable member (9) as a primary side and a stationary member (10) as a secondary side;
 - (e) and a cable (18) suspended from the counterweight unit (4), connecting the movable member (9) of the linear motor to a power source,
 characterized by

(f) the cable (18) being suspended from the elevator car (3) and the counterweight unit (4), thereby providing a compensating weight for said at least one rope (2);

(g) the cable (18) having a first part leading from the movable member (9) associated to the counterweight unit (4) to the elevator car (3) or leading from the movable member (9) associated to the elevator car (3) to the counterweight unit (4);

(h) and the cable (18) having a second part connecting the first part of the cable (18) to the power source.

2. The elevator of claim 1 wherein the cable (18) is fixed to a bottom end wall of the elevator car (3).

3. The elevator of claim 1 or 2 comprising a compensating weight disposed on the counterweight unit, the compensating weight corresponding to the weight of the length (L5) of the second part of the cable (18) depending from the elevator car (3) when the elevator car (3) is positioned at a half of its entire travel stroke.

Patentansprüche

1. Aufzug des Typs mit Linearmotor (9,10) zum Liefern der Antriebskraft, wobei der Aufzug aufweist:

(a) eine Aufzugskabine (3);

(b) eine Gegengewichtseinheit (4);

(c) und mindestens ein Seil (2), das über eine Seilscheibe (1) geführt ist und an seinem einen Ende mit der Aufzugskabine (3) und an seinem anderen Ende mit der Gegengewichtseinheit (4) verbunden ist;

(d) wobei der Linearmotor als Primärseite ein bewegliches Teil (9) und als Sekundärseite ein stationäres Teil (10) aufweist;

(e) und ein Kabel (18), das an der Gegengewichtseinheit (4) angehängt ist und das bewegliche Teil (9) des Linearmotors mit einer Stromquelle verbindet,

dadurch gekennzeichnet,

(f) daß das Kabel (18) an der Aufzugskabine (3) und der Gegengewichtseinheit (4) angehängt ist und dadurch ein Ausgleichsgewicht für das mindestens eine genannte Seil (2) schafft;

(g) daß das Kabel (18) einen ersten Teil aufweist, welcher von dem der Gegengewichtseinheit (4) zugeordneten beweglichen Teil (9) zu der Aufzugskabine (3) oder von dem der Aufzugskabine (3) zugeordneten beweglichen Teil (9) zu der Gegengewichts-



contrary, when the cable 18 is provided as shown in fig. 2, the rope weight corresponding to the length L1-L2 is substantially compensated by a cable weight corresponding to length L4-L3 so that the power required by the linear motor is reduced.

L5 is the length of the second part of cable 18, depending from the elevator car 3. It is noted that the cable weight corresponding to length L5 (the lower curved portion thereof makes the actual length of L5 longer than the length L5 shown) is also applied to the elevator car side. Such cable weight provides an imbalance which is minimized by adding a weight to the counterweight unit 4. Such compensating weight corresponds to the weight of length L5 of cable 18 when the elevator car 3 is positioned at half of its entire travel stroke.

In the given embodiment, each of the three strands of cable 18 is constituted of some tens of insulated wires and weighs 1.15 kg/m. On the other hand, each rope weighs 0.55 kg/m. As a consequence, the cable 18 functions properly as a means for compensating essentially the rope weight.

It should be noted that signal lines connecting the movable member 9 of the linear motor and the elevator car 3 to a known control unit as well as lines supplying power to the elevator car lights are preferably combined with cable 18. Even though cable 18 is disposed between the power supply and the counterweight unit 4 via the elevator car 3 in the embodiment as shown, it is alternatively possible to dispose the cable 18 between the power supply and the elevator car 3 via the counterweight unit 4. Even though the linear motor is associated to the counterweight unit 4 in the embodiment as shown, it may alternatively be associated to the elevator car 3.

Claims

1. An elevator of the type having a linear motor (9,10) for providing motive force, the elevator comprising:
 - (a) an elevator car (3);
 - (b) a counterweight unit (4);
 - (c) and at least one rope (2) guided by a sheave (1) and connected at one end thereof to the elevator car (3) and at the other end thereof to the counterweight unit (4);
 - (d) the linear motor comprising a movable member (9) as a primary side and a stationary member (10) as a secondary side;
 - (e) and a cable (18) suspended from the counterweight unit (4), connecting the movable member (9) of the linear motor to a power source,
 characterized by

(f) the cable (18) being suspended from the elevator car (3) and the counterweight unit (4), thereby providing a compensating weight for said at least one rope (2);

(g) the cable (18) having a first part leading from the movable member (9) associated to the counterweight unit (4) to the elevator car (3) or leading from the movable member (9) associated to the elevator car (3) to the counterweight unit (4);

(h) and the cable (18) having a second part connecting the first part of the cable (18) to the power source.

2. The elevator of claim 1 wherein the cable (18) is fixed to a bottom end wall of the elevator car (3).
3. The elevator of claim 1 or 2 comprising a compensating weight disposed on the counterweight unit, the compensating weight corresponding to the weight of the length (L5) of the second part of the cable (18) depending from the elevator car (3) when the elevator car (3) is positioned at a half of its entire travel stroke.

Patentansprüche

1. Aufzug des Typs mit Linearmotor (9,10) zum Liefern der Antriebskraft, wobei der Aufzug aufweist:
 - (a) eine Aufzugskabine (3);
 - (b) eine Gegengewichtseinheit (4);
 - (c) und mindestens ein Seil (2), das über eine Seilscheibe (1) geführt ist und an seinem einen Ende mit der Aufzugskabine (3) und an seinem anderen Ende mit der Gegengewichtseinheit (4) verbunden ist;
 - (d) wobei der Linearmotor als Primärseite ein bewegliches Teil (9) und als Sekundärseite ein stationäres Teil (10) aufweist;
 - (e) und ein Kabel (18), das an der Gegengewichtseinheit (4) angehängt ist und das bewegliche Teil (9) des Linearmotors mit einer Stromquelle verbindet,
 dadurch gekennzeichnet,
 - (f) daß das Kabel (18) an der Aufzugskabine (3) und der Gegengewichtseinheit (4) angehängt ist und dadurch ein Ausgleichsgewicht für das mindestens eine genannte Seil (2) schafft;
 - (g) daß das Kabel (18) einen ersten Teil aufweist, welcher von dem der Gegengewichtseinheit (4) zugeordneten beweglichen Teil (9) zu der Aufzugskabine (3) oder von dem der Aufzugskabine (3) zugeordneten beweglichen Teil (9) zu der Gegengewichts-

einheit (4) führt;

(h) und daß das Kabel (18) einen zweiten Teil aufweist, welcher den ersten Teil des Kabels (18) mit der Stromquelle verbindet.

2. Aufzug nach Anspruch 1, bei dem das Kabel (18) an einer Begrenzungswand am Boden der Aufzugskabine (3) befestigt ist.

3. Aufzug nach Anspruch 1 oder 2, der ein Ausgleichsgewicht aufweist, das an der Gegengewichtseinheit angeordnet ist und dem Gewicht der an der Aufzugskabine (3) hängenden Länge (L5) des zweiten Teils des Kabels (18) entspricht, wenn die Aufzugskabine bei der Hälfte ihres gesamt Bewegungshubs positioniert ist.

Revendications

1. Ascenseur du type ayant un moteur linéaire (9, 10) pour fournir la force motrice, l'ascenseur comprenant :

- (a) une cabine d'ascenseur (3) ;
- (b) une unité de contrepoids (4) ;
- (c) et au moins un câble (2) guidé par une poulie (1) et relié par une de ses extrémités à la cabine d'ascenseur (3) et par son autre extrémité à l'unité de contrepoids (4) ;
- (d) le moteur linéaire comprenant un élément mobile (9) en tant que partie primaire et un élément fixe (10) en tant que partie secondaire ;
- (e) et un câble (18) suspendu à l'unité de contrepoids (4), reliant l'élément mobile (9) du moteur linéaire à une source de puissance,

caractérisé en ce que :

- (f) le câble (18) suspendu à la cabine d'ascenseur (3) et à l'unité de contrepoids (4), fournit ainsi un poids de compensation pour au moins un câble (2) ;
- (g) le câble (18) a une première partie menant de l'élément mobile (9) associé à l'unité de contrepoids (4) à la cabine d'ascenseur (3) ou menant de l'élément mobile (9) associé à la cabine de l'ascenseur (3) à l'unité de contrepoids (4) ;
- (h) et le câble (18) a une seconde partie reliant la première partie du câble (18) à la source de puissance.

2. Ascenseur selon la revendication 1, dans lequel le câble (18) est fixé à la paroi terminale du fond de la cabine d'ascenseur (3).

3. Ascenseur selon la revendication 1 ou 2, comprenant un poids de compensation disposé sur l'unité de contrepoids, le poids de compensation correspondant au poids de la longueur (L5) de la seconde partie du câble (18) suspendue à la cabine d'ascenseur (3) quand la cabine d'ascenseur (3) est positionnée à la moitié de sa course totale.

