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(54) **Elevator without counterweight with a cogged belt and pulley**

Aufzug ohne Gegengewicht mit Zahnriemen und Zahnriemenscheibe

Ascenseur sans contrepoids avec une courroie crantée et une poulie

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(73) Proprietor: **Thyssenkrupp Elevator Manufacturing Spain S.L.**
28935 Madrid (ES)

(72) Inventors:
- **Tzvetkov Martinov, Borislav**
  28935 Mostoles (ES)
- **Blanco Sanchez, Jose Luis**
  28935 Mostoles (ES)

(74) Representative: **Mato Adrover, Ángel Luis**
Protectia Patentes y Marcas
Calle Caleruega 12, 1°C
28033 Madrid (ES)

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Description

Object of the Invention

[0001] The object of the present invention is an elevator without counterweight with a cogged belt and pulley and particularly the elements and distribution thereof, for the purpose of moving the car without there being sliding between the belt and the driving pulley, with a minimum car weight and with a great use of the elevator hoistway.

[0002] The present invention is characterized in the design and arrangement both of the drive and the elements and means forming part of the object of the invention, with the dual objective of achieving a reduction of noise levels generated and a uniform, well balanced translation of the car and with a high comfort level.

[0003] As a result of the present invention moving the car without the belt sliding with respect to the pulley is achieved, even with very low belt tension in the rope passing under the car. In this aspect, it represents a safety improvement. Counterweight elimination offers the possibility of making optimum use of the ground surface of the elevator hoistway for transporting the load. Finally, the use of the cogged belt allows reducing the diameter of the pulleys in comparison with a cable of the same strength which has a circular cross-section.

[0004] Therefore, the present invention is encompassed within the scope of elevators without counterweight, and additionally, among those elevators which have a cogged pulley and belt as transmission means.

Background of the Invention

[0005] Patent WO 2008/000886 is known in the state of the art in which it describes an elevator without counterweight which uses a flat cable or cable having a circular cross-section, using a tensioner which provides a variable tension according to the information given to it by a load cell located in the car to assure the traction and to keep the tension ratio in the two corresponding ropes T1/T2. Since this system does not have cogged pulleys and belts, it does not assure the traction in the entire path, and additionally, it also does not limit the belt movement and compensate for the elongation of the belts subjected to tension over time without keeping the tension T1/T2, the use of a tensioner and of a load cell being necessary.

[0006] Patents WO2004/094287 and WO2004/094289 claim the same hoistway arrangement as patent WO 2008/000886, but the tensioner is not "variable" according to the load of the car. They always provide a constant tension.

[0007] The last two patents do not have cogged pulleys and belts as traction means with the advantages derived therefrom, of being the ideal means to assure the traction, being oriented towards the cables, therefore keeping the tension T1/T2 is necessary.

[0008] Patent WO2004067429 describes an elevator with a more complex deflecting pulleys configuration (suspension 10:1) to maintain the traction by means of the tension ratio T1/T2 without the need of a counterweight. It is essentially envisaged for cables having a circular cross-section. In addition to the improvements listed at the end of this section, simplifying the elevator design by making it less expensive and simpler without needing to keep the tension ratio to maintain the traction is now sought, for which purpose cogged belts and pulleys with non-slip rollers are used in the present invention.

[0009] Another document known in the state of the art is patent WO 2004041704 which describes an elevator without counterweight, but driven by round cables, whereas document WO 2005087647 discloses a method for installing elevators of this type by using pre-assembled structures. Both cases show the difficulty of needing to keep the tension T1/T2, on the other hand, since cogged pulleys and belts are not used, maintaining the traction is not assured.

[0010] Until now cars must have a minimum weight to assure the friction traction capacity between the flat cable or belt and the driving pulley. If there was no said minimum weight, sliding between the flat cable or belt and the driving pulley would occur. This means that the car and accordingly the counterweight become more expensive since more material is needed. This drawback is solved by document ES 2280579 T3 which describes a traction means with counterweight made by means of a cogged pulley on which there is meshed a cogged belt, which although prevents the sliding between the belt and the pulley, has aspects which are susceptible to being improved. US 2010/133046 discloses an elevator according to the preamble of claim 1.

[0011] All those described are systems for moving the car of an elevator, in several cases with a cogged belt and in other cases with a flat belt, however, they have some aspects which are susceptible to being improved such as those explained below.

- On one hand, regardless of whether or not the belt is cogged, the belts do not have any means which allow identifying when they have suffered from any damage, particularly in the steel reinforcement cables embedded in the belt.
- On the other hand, and particularly in the traction systems with a cogged belt, the noise level generated is relatively high, therefore it is considered that it is an aspect which is susceptible to being improved.
- Also, lack of precision in the meshing between the cogged pulley and the cogged belt occurs in the cogged belt systems and particularly those having a cog arrangement in two rows arranged in a V, as a result of the process of manufacturing cogged pulleys, since they are manufactured in two attached halves. This lack of precision results in an increase of the noise level.
- Another difficulty or technical aspect susceptible to improvement is the fact that the car does not trans-

late in the most well balanced way possible, it being convenient to avoid horizontal components on the deflecting pulleys.

- Furthermore, in the elevator systems having counterweight or in which the machine is not located on the projection of the ceiling of the car, the best use is not made of the hoistway since it is subjected to the constructive conditions of the elevator. A fact that results in a lack of balance in the translation of the car.
- Another difficulty susceptible of being improved is the difficulty of preventing the shaft of the driving pulley from not receiving the entire load.
- Also, in the state of the art the elevators without counterweight lacking means to limit the belt movement and compensate for the elongation of the belts subjected to tension over time

[0012] Therefore, the objective of the present invention is to develop an elevator without counterweight overcoming the drawbacks described, i.e.,:

- which prevents the sliding between the cogged cable and the cogged pulley,
- which has means allowing a quick identification of possible damage suffered in the reinforcement of the cogged or non-cogged belt.
- which in the case of cogged belts reduces the noise level generated.
- which the cogged pulley and cogged belt meshes with the greatest precision possible.
- the car translates in the most well balanced way possible.
- which makes the best use of the elevator hoistway.
- which the shaft of the cogged pulley does not receive all the force or torque.
- Having means to limit the belt movement and compensate for the elongation of the belts subjected to tension over time.

[0013] Ultimately, the noise levels generated in the translation is to be reduced, and a well balanced and uniform translation of the car is to be achieved by developing for such purposes an arrangement and means such as those described below which are shown in the essentiality thereof in the first claim.

Description of the Invention

[0014] The object of the invention is an elevator without counterweight with a cogged belt having a particular configuration and arrangement of the drive elements, i.e., of the traction machine, of the cogged belt and of the associated means, such as the deflecting pulleys, a hanger of one end of the cogged pulley and the tensioner of the other end of the cogged belt.

[0015] The car object of the invention moves vertically through the hole of a building known as the elevator hoistway, where the car is intended for transporting people or goods. The car is guided along the hoistway by a group of guides. The car is suspended from a cogged belt system. The assembly is driven by a machine located in the upper portion of the hoistway. The belt system is such that, in a car raising movement, the length of cable drawn in by the machine of the upper portion of the hoistway is returned to the lower portion of the hoistway.

[0016] By dividing the elevator belt system, there are two ropes in which the tension of the belts is different. The rope passing under the car is tension-free and the slightest tension that it has is due to its own weight and to that caused by a belt tensioner. The rope suspending the car owes its tension to the weight of the car itself and to the useful load.

[0017] It is necessary to place a tensioner at one end of the belt system for the purpose of limiting the belt movement, which otherwise would crash against the hoistway itself or against the car. A tensioner is also necessary to compensate for the elongation of the cables subjected to tension over time.

[0018] The car guides are vertically supported on the bottom of the hoistway. The horizontal forces on the guides are transferred to the walls of the hoistway. The horizontal forces on the guides occur when the centre of gravity of (car + load) are horizontally shifted from the centre of suspension of the car (crossed coordinates of the guide).

[0019] It is important to suitably choose the position of the guides and centre of suspension with respect to the geometric centre of the car. Insofar as the horizontal guiding forces are low, the size of the guide will be small and thus there is more space available in the hoistway for the useful load.

[0020] The fact of supporting the machine to a large extent on one of the guides allows transferring the weight of the entire system to the floor of the hoistway. Therefore, the walls of the building do not have to support the weight of the elevator assembly.

[0021] Unlike a conventional elevator, there is no counterweight or mass balancing the weight of the car. Since counterweight is eliminated, more space is available to make the car larger and increase the useful load of the car.

[0022] On the other hand, the use of cogged belts enables moving the car without sliding, even with a very low belt tension in the rope passing under the car. In an elevator with counterweight, the cars (and the counterweights) must have a minimum weight to maintain the traction capacity assured by the very friction between cable and driving pulley. Since the principle of the belts is not based on friction but on the meshing of the cogs, it is already possible to reduce the weight of the empty car as much as possible, and therefore making the car less expensive by using less material.

[0023] It is possible to achieve a great use of the dimensions of the hoistway to thus make the car as big as possible by placing the machine in the projection of the

car ceiling, eliminating the counterweight and adjusting the size of the guides.

[0024] The use of deflecting pulleys in the belt hangers moves the belt lashings out of the car trajectory. Consequently, the height of the hoistway and of the clearance can be reduced.

[0025] Cogged belts are more flexible than round steel cables. Therefore, the deflecting pulleys and the driving pulley of the machine have a smaller diameter (more compact). The torque of the machine is directly proportional to the diameter of the driving pulley .The machine could be made with a smaller section to take advantage of the space intended as clearance.

[0026] As a result of using a cogged pulley and belt, the sliding between both portions and therefore the need of the car and counterweight to have a minimum weight which results in reducing the size of the drive is prevented.

[0027] To achieve a quick identification of the possible damage suffered in the cogged belt reinforcement, embedding the steel reinforcement cables in transparent polyurethane is proposed, thus, if one of the cables of the reinforcement breaks, in addition to being able to visually identify the breakage thereof, an inner bubble facilitating the identification is produced.

[0028] To reduce the noise level generated, constructive variations relating to that which is being made until now are proposed, on one hand, increasing the diameter of the driving pulley for the purpose of reducing the number of revolutions, preventing vibrations and therefore noise.

[0029] On the other hand, and to achieve the aforementioned purpose of reducing the noise levels, the cogs of the driving pulley are helical which assures a uniform meshing with the cogged belt and not a discontinuous meshing, as has been occurring with the pulleys with non helical cogs, which further results in a prolongation of the service life of the cogged belt.

[0030] Furthermore, on the cogged face of the cogged belt there is arranged a textile mesh absorbing and improving the meshing between the pulley and the belt, reducing the noise level.

[0031] Furthermore and for the purpose of reducing the noise levels, in the case of cogged belts with the cogs arranged in two rows of inclined cogs forming a V, the cogged pulley was made of a single part, since until now pulleys were made in two parts assembled to one another, therefore any minimum deviation in the coupling of the two portions of the cogged pulley results in a lack of precision in the meshing and therefore to a higher noise level, manufacturing in a single part therefore assures a perfect meshing between the cogged pulley and belt and prevents the possible deviations which have been occurring up until now.

[0032] To achieve the most well balanced possible translation of the car a vertical attack of the cogged belt with respect to the pulley has been sought using to that end a deflecting pulley integrated with the machine, which prevents any horizontal component in the driving pulleys, and therefore in the car and counterweight, a fact which happens in patent ES 2280579 T3.

[0033] The use of a deflecting pulley integrated with the machine further reduces the forces to those which the shaft of the driving pulley would be subjected in the case of not having the deflecting pulley proposed herein, and therefore, reduces the constructive requirements of the shaft.

[0034] Furthermore and for the purpose of achieving the most well balanced possible translation of the car, there is arranged associated with the driving pulley anti slip wheels, which are placed with their axes perpendicular to the tangent of the entry and exit points of the cogged belt with respect to the cogged pulley.

[0035] The car guides centrally arranged in relation to the centre of masses of the car assembly also collaborates in the well balanced translation of the car.

[0036] Finally, to maintain the tension of the belt and to absorb the elongation which occurs during the car movement, the cogged belt has at one of its ends a tensioner device preventing this effect, and therefore, the vibrations which may be produced in the belt during the elevator operation.

[0037] Therefore, with the constructive improvements proposed herein, two technical effects are basically achieved, such as, on one hand, the reduction of noise level, and on the other hand, a well balanced and uniform translation of the car, the constructive variants described being necessary and that some of them cooperate in the two purposes described, in addition to achieving derived additional technical effects.

Description of the Drawings

[0038] To complement the description that is being made and for the purpose of aiding to better understand the features of the invention according to a preferred practical embodiment thereof, a set of drawings is attached as an integral part of said description in which the following has been depicted with an illustrative and non-limiting character:

Figure 1 shows an elevational view of the elevator object of the invention in terms of its configuration and the arrangement of cogged belts and deflecting pulleys.

Figure 2 shows the plan view of the figure above.

Figure 3 shows the machine assembly together with the cogged pulley and cogged belt.

Figure 4 shows the perspective view of the cogged belt and pulleys.

Figure 5 shows the detail view of the cogged belt.

Figure 6 shows the sectioned view of the cogged belt where its constructive features can be seen.

Figure 7 shows a frontal view of the machine together with the non-slip rollers of the cogged belt and the deflecting pulley.

Figure 8 shows the elements forming part of the tensioner of the cogged belt mounted on the bottom of the hoistway.

Figure 9 shows the belt tensioner assembly which is located in the hoistway.

Figure 10 shows the hanger for the cogged belt.

Figure 11 shows the hanger assembly formed by a belt lashing together with the deflecting pulley.

Figure 12 shows the sectioned view of a deflecting pulley where its constructive features can be seen.

Figure 13 shows the perspective view of the integration of the deflecting pulley with the traction machine.

Preferred Embodiment of the Invention

[0039] In view of the drawings, a preferred embodiment of the proposed invention is described below.

[0040] In can be observed in Figure 1 that the architecture or geometry of the cogged pulleys and belt assembly of the elevator (1) is distributed in the following manner:

- deflecting pulleys (3) and (4) are arranged above and below the car (1). Therefore, the deflecting pulleys (3) are arranged above the car, whereas the deflecting pulleys (4) are arranged below the car (1).
- there is arranged in the upper portion of the hoistway (13), on one hand, a hanger (6) for cogged belt (2), the deflecting pulley (7) associated with the hanger (6) also being depicted, on the other hand, there is arranged a machine (5), together with the cogged driving pulley (8) associated with the machine (5).
- there is arranged in the lower portion of the hoistway, on one hand, a tensioner (9) associated with a deflecting pulley (10) and on the other hand, there is arranged a deflecting pulley (11).

[0041] As is depicted, it can be observed that the cogged belt (2) starting from the hanger (6) and the associated deflecting pulley (7) passes through the upper pulleys (3) of the car (1), followed by the cogged pulley (8) and the deflecting pulley (23) (Figure 7) of the machine (5), going to the bottom of the hoistway (1) until reaching the deflecting pulley of the hoistway (11), continuing through the lower pulleys (4) of the car (1) to finally end in the tensioner (9) and its associated deflecting pulley (10).

[0042] The load is suspended from the cogged belts which are the traction elements replacing the conventional steel cable. The lifting is achieved as a result of meshing the cogs of the belt and those of the pulley which according to the shape thereof can create the traction necessary for lifting the load. Therefore the dependency of the elevator operation on the friction forces between the cable and the driving pulley is eliminated.

[0043] The elevator hoistway (13) and the maximum use thereof can be observed in Figure 2, as a result of a suitable arrangement of the guides (12), the machine (5), and the deflecting pulleys. As can be observed the guides (12) are centrally arranged with relation to the centre of masses of the car assembly.

[0044] Figure 3 shows the machine (5) for applying the traction on the cogged belt (2), the association of the machine (5) with a cogged pulley (8), and in turn, the association of a cogged belt (2) with the latter being able to be observed.

[0045] The machine (5) has a brake (5.1) which will be mounted either on the rear portion or on the front portion on the support (5.2). At least one cogged traction pulley (8) is arranged on the shaft of the machine, which in a possible embodiment may be two cogged pulleys. The pulleys are flanked by discs or flanges which do not allow the belt to come off from its operating position.

[0046] How the cogged belt (2) meshes with a cogged pulley (8) which is generally manufactured from metal in a single part and provided with helical cogs placed in a staggered formation with a channel in the centre, whereas the cogs of the cogged belt are straight can be seen in perspective in Figure 4. This constructive form assures a perfect meshing of the pulley with the cogged belt which results in a reduction of the noise level generated.

[0047] The diameter of the pulley is greater than 100 mm, the cogs that it has are helical, with a passage between 7 and 9 mm, both facts resulting in less vibration and noise. The width of the driving pulley is greater than the width of the cogged belt and it is self-centering, which in a possible embodiment, the driving pulley is 1 mm wider than the cogged belt.

[0048] As a result of the described features an optimum operating speed is achieved, in which the rotation speed is not excessive, such as it would be with a pulley having a smaller diameter, and therefore the vibrations and noise are very low.

[0049] As shown in Figure 5, the cogged belt (2) has two portions attached to one another by means of extrusion which are a plastic portion and several steel cords embedded in the plastic portion. The plastic portion has two faces, a flat face and another cogged face. The cogged portion is formed by inclined cogs placed in a staggered formation. The cogs form an angle of 120°. The passage between the cogs is comprised between 7 and 9 mm. The width of the belt can be of different measurements depending on the power and the load to be transmitted. As observed in Figure 6, the belt (2) has three elements which are the transparent polyurethane (2.2), steel reinforcement cables (2.1) embedded in the transparent polyurethane (2.2) and a textile mesh (2.3), arranged covering the cogged portion. The textile mesh (2.3) improves the operation and the comfort level by increasing the coupling smoothness when moving and therefore the vibration and noise levels are improved, whereas the transparent polyurethane allows a visual inspection of the steel reinforcement cables embedded in the polyurethane.

[0050] The thickness of the cogged belt with cogs is 4 to 6 mm, the non-cogged portion has a thickness less

than 3 mm.

[0051] All the elements forming part of the elevator, particularly the cogged belt and pulley, adopt a high safety coefficients preventing the breakage of the pulley or belt cogs. Driving in both directions in any direction is thus assured. Uncontrolled movement typical for a cable elevator caused by the unbalance between the stress of the two braches or by the lack of adherence are prevented.

[0052] It can be observed in Figure 7 that the machine (4) has at least two non-slip rollers (14) preventing the belt (2) from coming off and are assembled such that their centres of rotation are perpendicular to the tangent of the entry and exit points of the cogged belt with respect to the cogged pulley. The distance between the non-slip rollers (14) and the pinions or cogged pulleys (9) is sufficient so that the belt passes freely in a well meshed manner, but also prevents the cogs of the belt from coming off the cogs of the pinion.

[0053] Traction in both directions is thus assured eliminating the risk of traction loss.

[0054] The machine (5) driving the traction system is mounted on a base (15). This base (15) transmits the forces both to the car guide (12) and to the walls of the elevator hoistway.

[0055] The machine (5) and its base (15) are located in the upper portion of the hoistway in the projection of the car. When the car (1) is in its upper most position, the machine and its base are at a distance from the car ceiling. All the above enables a maximum use of the elevator hoistway, because the machine does not represent a limit to maximize the car area. In other words, for several existing hoistway dimensions, it is possible to transport a greater number of passengers or objects at once.

[0056] It is important to highlight that the traction machine (5) has an associated deflecting pulley (23) improving the operation of the shaft as it does not receive all the load, furthermore, non-slip rollers (14) associated with the machine preventing the cogs of the belt from coming off from those of the pinion or pulley are provided, this in combination with the use of a cogged belt with a cogged pulley assures the traction throughout the entire path.

[0057] On the other hand, as a result of the vertical attack of the cogged belts with respect to the deflecting pulley and the driving pulley of the machine, the horizontal component attempting to tip the car, creating a lack of comfort and greater wear in the friction clamps, as well as a lack of uniformity and balance in the translation of the car, is eliminated.

[0058] Figure 8 where the elements forming part of the tensioner mounted on the bottom of the hoistway are shown, shows the cogged belt lashing by means of a wedge (16), associated with a regulating rod (18) which in turn has a spring (17) mounted thereon at its upper end. This spring (17) has several functions, on one hand, it absorbs the loads of the impact transmitted by the belts, and on the other it keeps the cogged belts (2) with the same tension to prevent the premature failure of some of them due to poor tension distribution. Each belt lashing has a system for regulating the length of the terminal. Therefore the tension of each of the belts can be balanced.

[0059] The tensioner (9) together with the deflecting pulley (10) and a damper (19) can be observed in Figure 9. The deflecting pulleys in the lower area of the hoistway are secured to the car guide (12) by means of a metal structure. This structure is fixed both below the car guide and to the floor and wall of the hoistway.

[0060] Like the upper belt hanger, the deflecting pulley of the hanger allows bringing the car deflecting pulley below the position of the tensioner closer. This allows reducing the height of the hoistway.

[0061] The hanger (6) for cogged belts (2) is observed in Figure 10, where a metal structure (6.1) which supports the lashings of the belts and transmits the tension of the cogged belts to the car guide (12) can be seen. A damper (6.2) located in the car which will impact against the metal structure of the hanger if the car goes beyond the end of the path is shown.

[0062] The guide (12) is centered with respect to the geometric axis of the elevator hoistway.

[0063] Figure 11 shows the assembly of the hanger (6) for cogged belts having elements for lashing the cogged belt (2), associated with a deflecting pulley (7).

[0064] Figure 12 shows the features of the deflecting pulleys which can made of plastic; they are mounted on a shaft (22) at the ends of which there are bearings (21), each of the pulleys has its own channellings separated by a flange (20), the channellings having a convexity or an outwardly dished shape for the purpose of centering the belt in the channelling without the need of bordering with the flanks of the channelling, eliminating the wear of the sides of the belt.

[0065] Finally, the integration of a deflecting pulley (23) with the traction machine (5) is observed in Figure 13, achieving, on one hand, the reduction of tension in the shaft of the pulley (8), and therefore, the constructive requirements of the shaft, and on the other hand, the elimination of the horizontal components in the driving pulleys, resulting in a well balanced and uniform translation of the car.

[0066] Having sufficiently described the nature of the present invention as well as a way of carrying it out to practice, it must be stated that it may be carried out into practice within its essentiality in other embodiments differing in detail from that indicated by way of example.

Claims

1. An elevator without counterweight with a cogged belt and pulley wherein:

   - the cogged pulley (8) is made of a single part

having a groove in the centre, the diameter of the pulley is greater than 100 mm, its cogs are helical cogs and the width of the driving pulley is greater than the cogged belt, it being self-centering and is flanked by discs or flanges (20).
- the cogged belt (2) has two portions attached to one another by means of extrusion which are a plastic portion and several steel cords embedded in the plastic portion, wherein the geometry of the cogged belt has two faces, a flat face and another cogged face formed by inclined cogs placed in a staggered formation and the belt (2) has three elements which are: transparent polyurethane (2.2), steel reinforcement cables (2.1) embedded in the transparent polyurethane (2.2) and a textile mesh (2.3) covering the cogged portion.
- the machine (5) has the cogged driving pulley (8), being located in the projection of the ceiling, it further has at least two non-slip rollers (14) preventing the belt (2) from coming off, and is associated with a deflecting pulley (23);

characterized in that deflecting pulleys (3) (4) are arranged above and below the car (1), respectively; in the upper portion of the hoistway (13) there is arranged, on one hand, a hanger (6) for the cogged belt (2), which hanger is associated with a deflecting pulley (7), on the other hand, a machine (5) is arranged associated with at least one cogged pulley (8), there is further arranged in the lower portion of the hoistway, on one hand, a tensioner (9) associated with a deflecting pulley (10) and on the other hand there is arranged a deflecting pulley (11).

2. The elevator without counterweight with a cogged belt and pulley according to claim 1, **characterized in that** the machine (5) has a brake (5.1) which will be mounted either in the rear portion or in the front portion on a support (5.2).

3. The elevator without counterweight with a cogged belt and pulley according to claim 1 or 2, **characterized in that** the machine is mounted on a base (15) transmitting the forces both to the car guide (12) and to the walls of the elevator hoistway.

4. The elevator without counterweight with a cogged belt and pulley according to claim 1, **characterized in that** the non-slip rollers (14) are assembled such that their centres of rotation are perpendicular to the tangent of the entry and exit points of the cogged belt (2) with respect to the cogged pulley (8).

5. The elevator without counterweight with a cogged belt and pulley according to claim 1, **characterized in that** the deflecting pulleys in the lower area of the hoistway are secured to the car guide (12) by means of a metal structure which is fixed both below the car guide (12) and to the floor and the wall of the hoistway.

6. The elevator without counterweight with a cogged belt and pulley according to claim 1, **characterized in that** the hanger (6) for cogged belts (2) has a metal structure (6.1) which supports the lashings of the belts and transmits the tension of the cables to the car guide (12).

7. The elevator without counterweight with a cogged belt and pulley according to claim 1, **characterized in that** the deflecting pulleys, which are mounted on a support which is fixed to the car guide (12), to the bottom or to the ceiling of the hoistway, have a belt tensioner (9) and a damper (19) which are made of plastic and it has its own channellings separated by a flange (20), the channellings having a convexity or a outwardly dished shape.

8. The elevator with a cogged belt and pulley and without counterweight according to claim 1, **characterized in that** the thickness of the cogged belt with cogs is 4 to 6 mm, the non-cogged portion has a thickness less than 3 mm.

9. The elevator with a cogged belt and pulley and without counterweight according to claim 1, **characterized in that** the cogged pulley (8) has helical cogs with a passage between 7 and 9 mm and with a width which is 1 mm greater than the width of the cogged belt.

Patentansprüche

1. Aufzug ohne Gegengewicht mit Zahnriemen und Zahnriemenscheibe, wobei:

- die Zahnriemenscheibe (8) aus einem einzigen Teil hergestellt ist, welches eine Nut im Mittelpunkt aufweist, der Durchmesser der Riemenscheibe größer als 100 mm ist, ihre Zähne spiralförmige Zähne sind und die Breite der treibenden Riemenscheibe größer als die des Zahnriemens ist, wobei sie selbstzentrierend ist und von Scheiben oder Flanschen (20) flankiert ist,
- der Zahnriemen (2) zwei Teile aufweist, welche miteinander mittels Strangpressen zusammengefügt sind, die ein Kunststoffteil und mehrere in dem Kunststoffteil eingebettete Stahlseile sind, wobei die Geometrie des Zahnriemens zwei Seiten aufweist, eine flache Seite und eine andere verzahnte Seite, welche durch geneigte Zähne gebildet wird, die in einer versetzten Anordnung liegen und wobei der Riemen (2) drei

Elemente aufweist: transparentes Polyurethan (2.2), eine Kabelarmierung (2.1) aus Stahl, welche in dem transparenten Polyurethan (2.2) eingebettet ist, und ein Textilgeflecht (2.3), welches den verzahnten Teil deckt,
- die Maschine (5) die treibende Zahnriemenscheibe (8) aufweist, welche sich in der Verlängerung der Decke befindet, und zusätzlich mindestens zwei gleitfeste Rollen (14) aufweist, die verhindern, dass sich der Riemen (2) ablöst, und mit einer Ablenkungsriemenscheibe (23) verbunden ist,

dadurch gekennzeichnet, dass die Ablenkungsriemenscheiben (3) (4) jeweils über und unter dem Fahrkorb (1) angeordnet sind; dass einerseits in dem oberen Teil des Schachts (13) ein Aufhänger (6) für den Zahnriemen (2) angeordnet ist, wobei der Aufhänger mit einer Ablenkungsriemenscheibe (7) verbunden ist, andererseits eine Maschine (5) angeordnet ist, die mit mindestens einer Zahnriemenscheibe (8) verbunden ist, wobei einerseits zusätzlich in dem unteren Teil des Schachts eine Spannvorrichtung (9) angeordnet ist, welche mit einer Ablenkungsriemenscheibe (10) verbunden ist und andererseits eine Ablenkungsriemenscheibe (11) angeordnet ist.

2. Aufzug ohne Gegengewicht mit Zahnriemen und Zahnriemenscheibe nach Anspruch 1, **dadurch gekennzeichnet, dass** die Maschine (5) eine Bremse (5.1) aufweist, welche entweder in dem hinteren Teil oder in dem vorderen Teil auf ein Lager (5.2) montiert wird.

3. Aufzug ohne Gegengewicht mit Zahnriemen und Zahnriemenscheibe nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die Maschine auf ein Untergestell (15) montiert wird, welches die Kräfte sowohl auf die Fahrkorbführung (12) als auch auf die Wände des Aufzugschachts überträgt.

4. Aufzug ohne Gegengewicht mit Zahnriemen und Zahnriemenscheibe nach Anspruch 1, **dadurch gekennzeichnet, dass** die gleitfeste Rollen (14) so eingebaut sind, dass ihre Drehpunkte zur Tangente der Eingangs- und Ausgangspunkte des Zahnriemens (2) in Bezug auf die Zahnriemenscheibe (8) senkrecht sind.

5. Aufzug ohne Gegengewicht mit Zahnriemen und Zahnriemenscheibe nach Anspruch 1, **dadurch gekennzeichnet, dass** die Ablenkungsriemenscheiben in dem unteren Bereich des Schachts an der Fahrkorbführung (12) mit einer Metallstruktur gesichert sind, welche sowohl unter der Fahrkorbführung (12) als auch an dem Boden und der Wand des Schachts befestigt ist.

6. Aufzug ohne Gegengewicht mit Zahnriemen und Zahnriemenscheibe nach Anspruch 1, **dadurch gekennzeichnet, dass** der Aufhänger (6) für Zahnriemen (2) eine Metallstruktur (6.1) aufweist, welche die Verankerungen der Riemen lagert und die Spannung der Kabel auf die Fahrkorbführung (12) überträgt.

7. Aufzug ohne Gegengewicht mit Zahnriemen und Zahnriemenscheibe nach Anspruch 1, **dadurch gekennzeichnet, dass** die Ablenkungsriemenscheiben, welche auf einem Lager montiert sind, welches an der Fahrkorbführung (12), an dem unteren Teil oder an der Decke des Schachts befestigt ist, eine Riemenspannvorrichtung (9) und einen Dämpfer (19) aufweisen, welche aus Kunststoff hergestellt sind, und eigene Auskehlungen aufweisen, welche durch einen Flansch (20) getrennt sind, wobei die Auskehlungen eine Konvexität oder eine nach außen gewölbte Form aufweisen.

8. Aufzug mit Zahnriemen und Zahnriemenscheibe und ohne Gegengewicht nach Anspruch 1, **dadurch gekennzeichnet, dass** die Dicke des Zahnriemens mit Zähnen 4 bis 6 mm beträgt, und der Teil ohne Zähne eine Dicke kleiner als 3 mm aufweist.

9. Aufzug mit Zahnriemen und Zahnriemenscheibe und ohne Gegengewicht nach Anspruch 1, **dadurch gekennzeichnet, dass** die Zahnriemenscheibe (8) spiralförmige Zähne aufweist, mit einer Steigung zwischen 7 und 9 mm und mit einer Breite, welche 1 mm größer als die Breite des Zahnriemens ist.

Revendications

1. Ascenseur sans contrepoids avec une courroie et une poulie dentées, dans lequel :

- la poulie dentée (8) est réalisée en une seule pièce ayant une rainure au centre, le diamètre de la poulie est supérieur à 100 mm, ses dents sont des dents hélicoïdales et la largeur de la poulie de transmission est supérieure à la courroie dentée, celle-ci étant d'auto centrage et étant flanquée par des disques ou des flasques (20),
- la courroie dentée (2) a deux parties fixées l'une à l'autre par le biais d'extrusion, qui sont une partie en plastique et plusieurs câbles d'acier intégrés dans la partie en plastique, dans lequel la géométrie de la courroie dentée a deux faces, une face plane et une autre face dentée formée par des dents inclinées situées dans une formation en quinconce, et la courroie (2) a trois éléments qui sont : du polyuréthane transparent (2.2), des câbles de renforcement en acier (2.1)

intégrés dans le polyuréthane transparent (2.2) et une maille textile (2,3) couvrant la partie dentée,

- la machine (5) a la poulie de transmission dentée (8), celle-ci étant située dans la projection du plafond, elle a également au moins deux rouleaux antidérapants (14) qui évitent que la courroie (2) ne s'échappe, et elle est associé à une poulie de renvoi (23),

caractérisé en ce que des poulies de renvoi (3) (4) sont disposées au-dessus et au-dessous de la cabine (1), respectivement; dans la partie supérieure de la cage d'ascenseur (13) est disposé, d'une part, un dispositif de suspension (6) pour la courroie dentée (2), dispositif de suspension qui est associé à une poulie de renvoi (7), d'autre part est disposée une machine (5) associée à au moins une poulie dentée (8), et dans la partie inférieure de la cage d'ascenseur est disposé en outre, d'une part, un tendeur (9) associé à une poulie de renvoi (10) et d'autre part est disposée une poulie de renvoi (11).

2. Ascenseur sans contrepoids avec une courroie et une poulie dentées selon la revendication 1, **caractérisé en ce que** la machine (5) a un frein (5.1) qui sera monté soit dans la partie arrière soit dans la partie avant sur un support (5.2).

3. Ascenseur sans contrepoids avec une courroie et une poulie dentées selon la revendication 1 ou 2, **caractérisé en ce que** la machine est montée sur une base (15) transmettant les forces aussi bien au guide de cabine (12) qu'aux parois de la cage d'ascenseur.

4. Ascenseur sans contrepoids avec une courroie et une poulie dentées selon la revendication 1, **caractérisé en ce que** les rouleaux antidérapants (14) sont assemblés de telle sorte que leurs centres de rotation sont perpendiculaires à la tangente des points d'entrée et de sortie de la courroie dentée (2) par rapport à la poulie dentée (8).

5. Ascenseur sans contrepoids avec une courroie et une poulie dentées selon la revendication 1, **caractérisé en ce que** les poulies de renvoi dans la zone inférieure de la cage d'ascenseur sont fixées au guide de cabine (12) au moyen d'une structure métallique qui est fixée aussi bien au-dessous du guide de cabine (12) qu'au plancher et à la paroi de la cage d'ascenseur.

6. Ascenseur sans contrepoids avec une courroie et une poulie dentées selon la revendication 1, **caractérisé en ce que** le dispositif de suspension (6) pour courroies dentées (2) présente une structure métallique (6.1) qui supporte les attaches des courroies et transmet la tension des câbles au guide de cabine (12).

7. Ascenseur sans contrepoids avec une courroie et une poulie dentées selon la revendication 1, **caractérisé en ce que** les poulies de renvoi, qui sont montées sur un support qui est fixé sur le guide de cabine (12), sur le fond ou sur le plafond de la cage d'ascenseur, ont un tendeur (9) de courroie et un amortisseur (19) qui sont réalisés en plastique et il a ses propres canalisations séparées par un flasque (20), les canalisations ayant une convexité ou une forme bombée vers l'extérieur.

8. Ascenseur sans contrepoids avec une courroie et une poulie dentées selon la revendication 1, **caractérisé en ce que** l'épaisseur de la courroie dentée avec des dents est de 4 à 6 mm, la partie non dentée a une épaisseur inférieure à 3 mm.

9. Ascenseur sans contrepoids avec une courroie et une poulie dentées selon la revendication 1, **caractérisé en ce que** la poulie dentée (8) a des dents hélicoïdales avec un pas d'entre 7 mm et 9 mm et d'une largeur qui est 1 mm plus grande que la largeur de la courroie dentée.

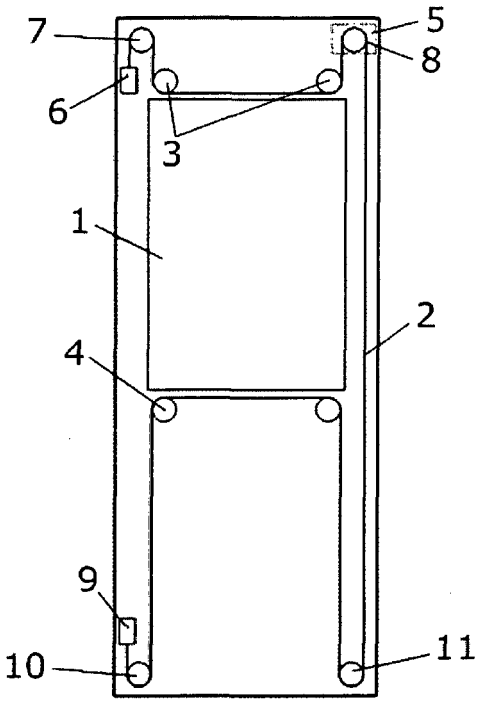

FIG.1

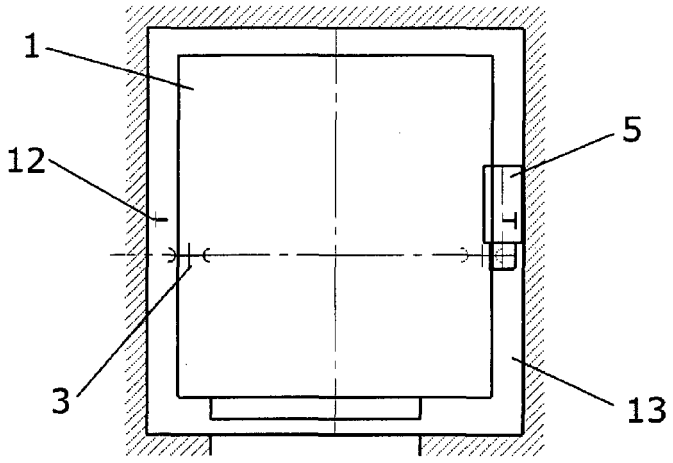

FIG.2

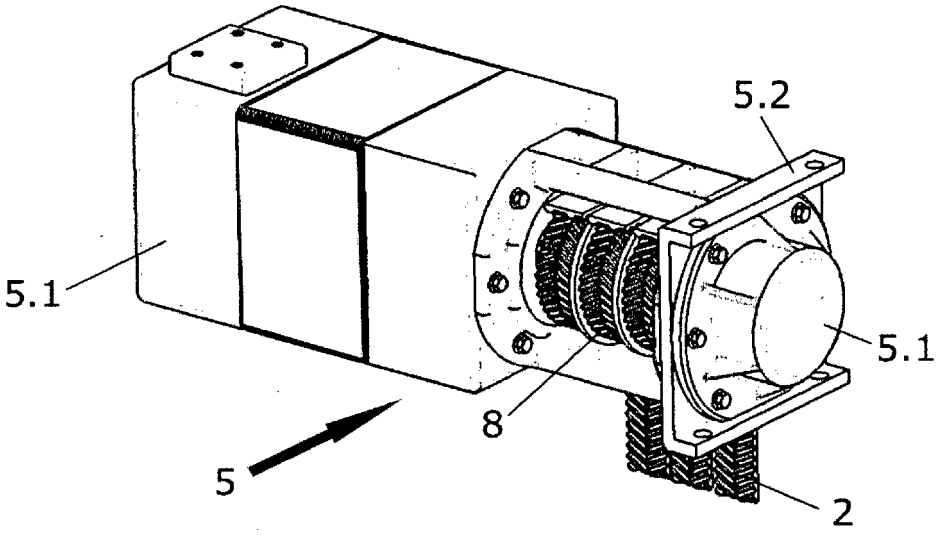

FIG.3

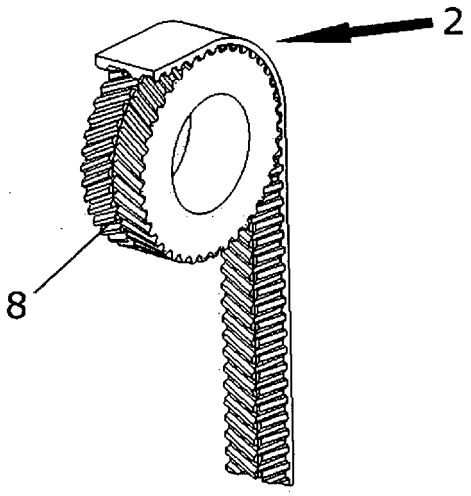

FIG.4

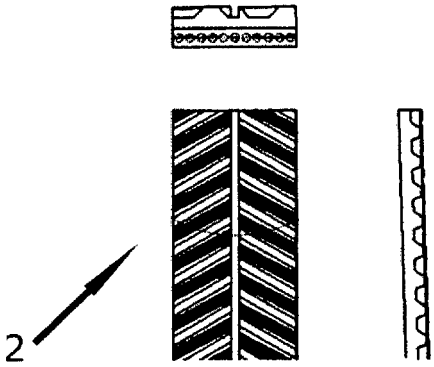

FIG.5

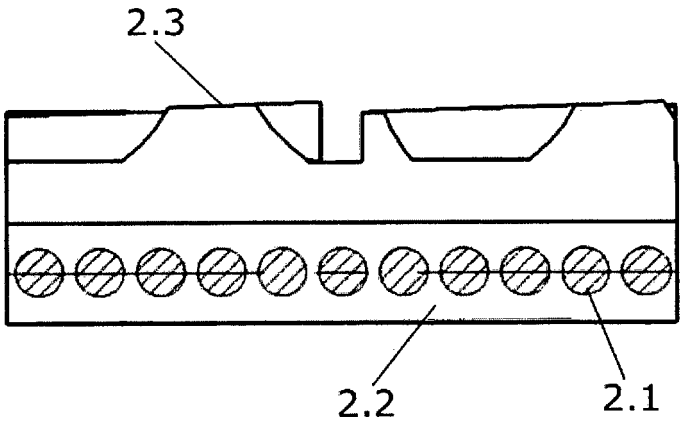

FIG.6

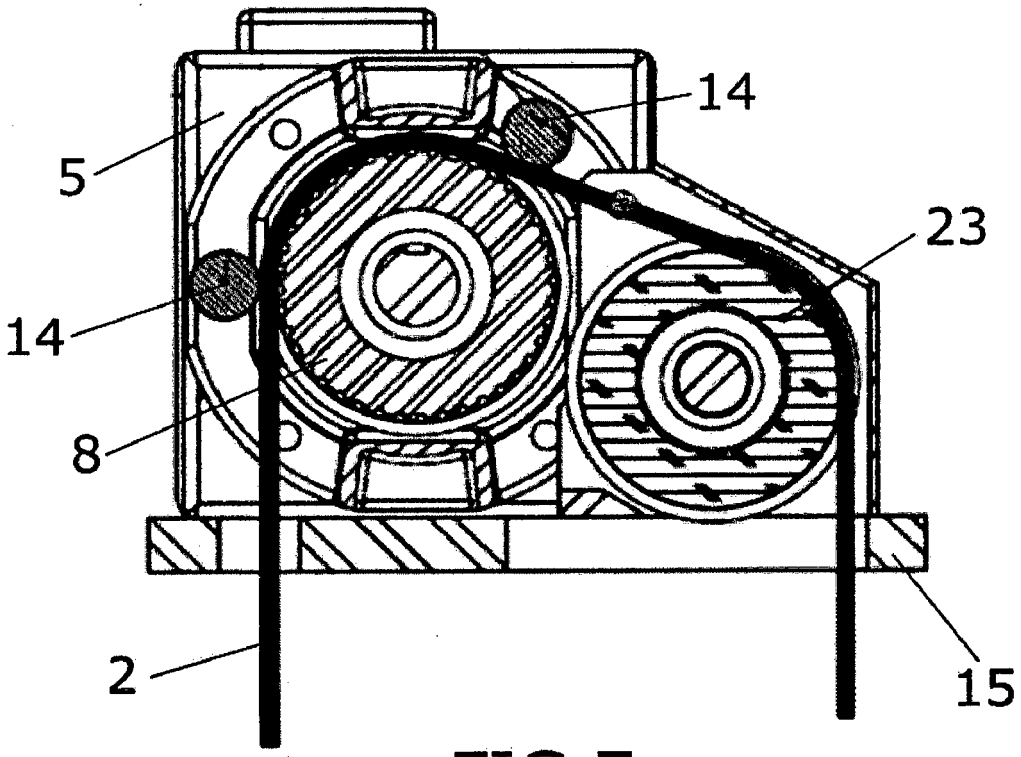

FIG.7

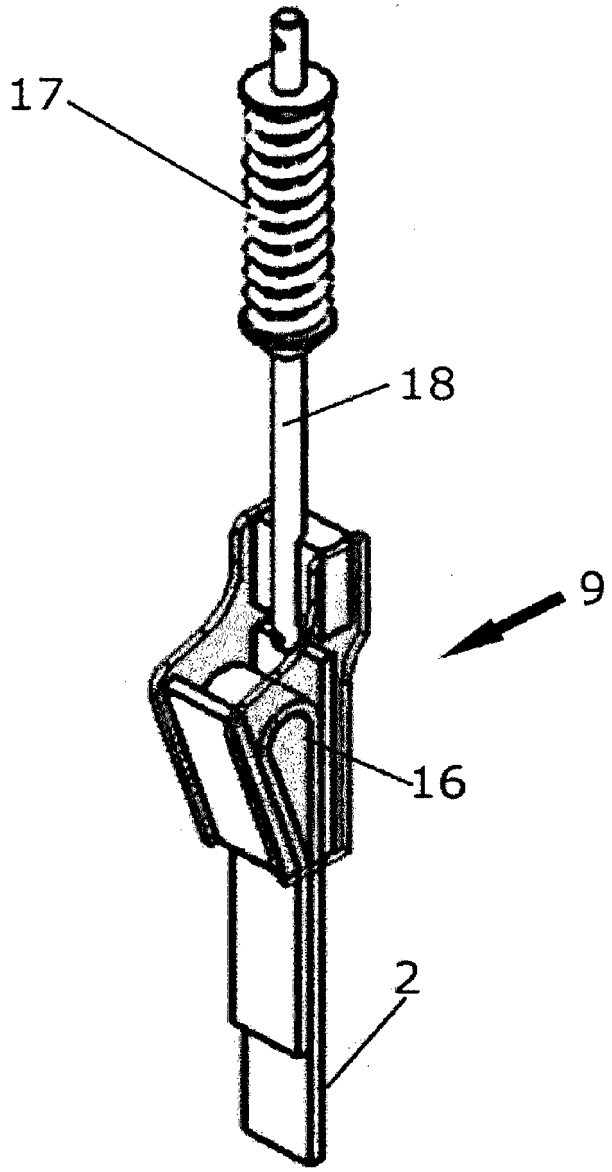

FIG.8

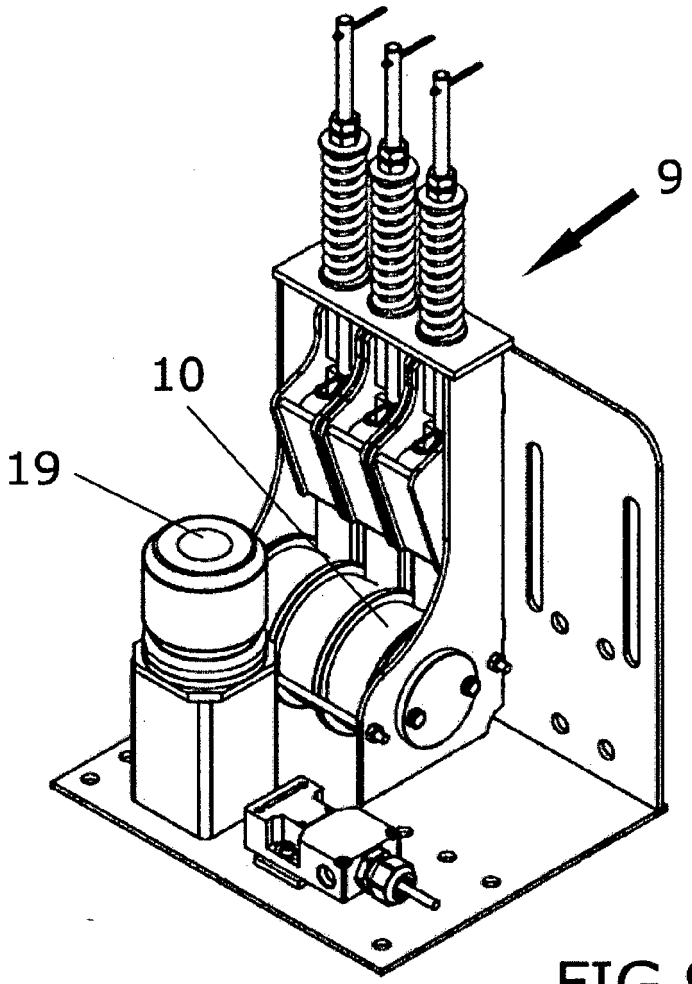

FIG.9

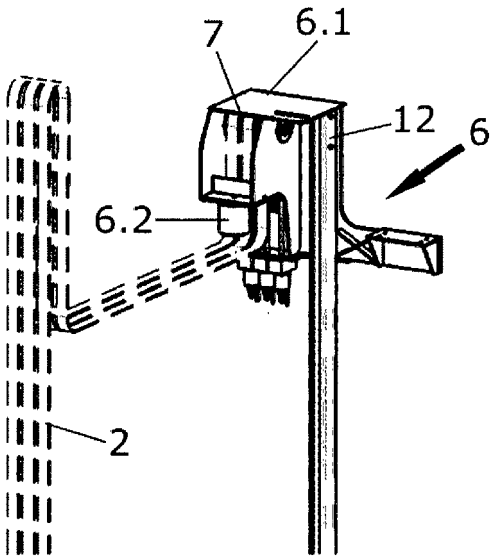

FIG.10

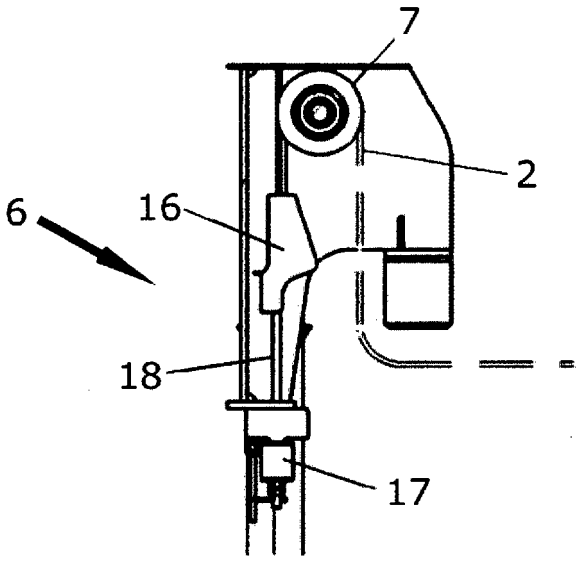

FIG.11

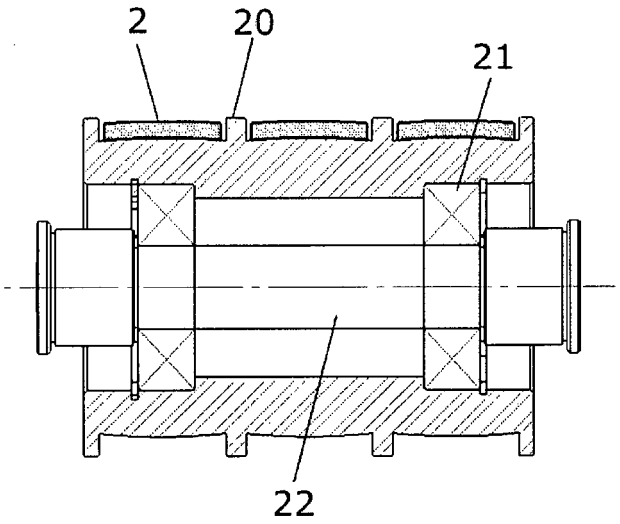

FIG.12

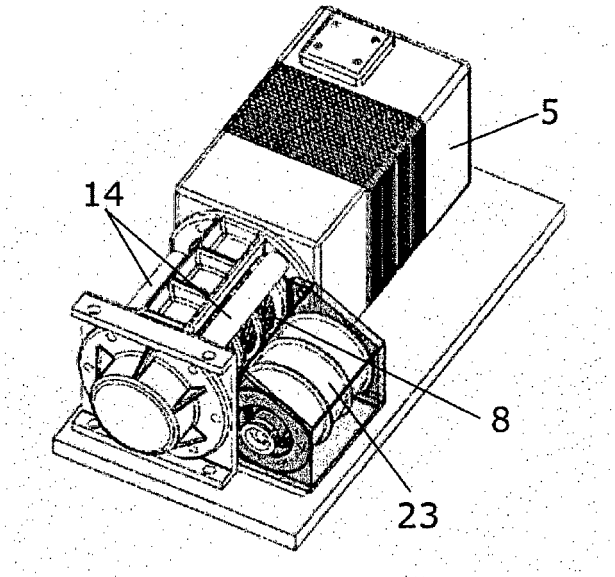

FIG.13

REFERENCES CITED IN THE DESCRIPTION

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