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(54) Elevator with cogged belt and pulley and with counterweight

(57) The present invention relates to an elevator having deflecting pulleys (3) above or below of a car (1), fastenings (7) and (8) for fastening the ends of the cogged belt (2) are arranged in the upper portion of the hoistway (18), there is also arranged a machine (4) formed by a gearless motor on the shaft of which are assembled at least one cogged pulley (9) made of a single part with helical cogs and with a diameter greater than 100 mm, the machine (4) also has a support, a brake, an integrated deflecting pulley (5), non-slip rollers (14), all these elements mounted on a base, and the machine being in the projection of a counterweight (6), furthermore, the counterweight (6) is arranged on one side of the hoistway (18), wherein the cogged belt has steel reinforcement cables embedded in transparent polyurethane and the cogged portion is covered with a textile mesh, reduction of noise level and uniform translation of the car being achieved.

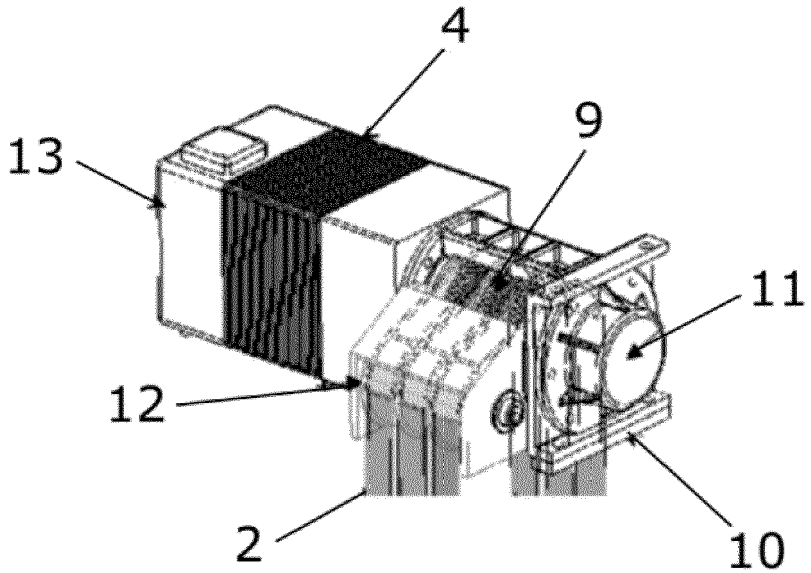

FIG.3

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Description

Object of the Invention

[0001] The object of the present invention is an elevator driven by a cogged belt and pulley system imparting translational movement to the car and counterweight elements of the elevator. The main feature of the system, due to its working principle, is its traction capacity which does not allow the relative movement between the cogged belt and the cogged pulley, even with a very light car. This entails several advantages, such as the possibility of increasing the useful load and reducing the size of the elements of the elevator. Among other objectives of the elements and the distribution thereof is to particularly achieve a greater use of the elevator hoistway, both of its dimensions in length and width and of the heights of the upper and lower areas.

[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 translation of the car and with a high comfort level.

[0003] As a result of the present invention, moving the car without sliding between the belt and the driving pulley is achieved even with a car having a minimum weight which enables lowering its cost, further achieving an optimum use of the dimensions of the hoistway. Finally, the use of cogged belts allows reducing the torque necessary for lifting and lowering the car in comparison with a cable having a circular section of the same strength.

[0004] Therefore, the present invention is encompassed within the scope of elevators and particularly those which are moved by means of a cogged pulley and belt and among elevators with counterweight.

Background of the Invention

[0005] Patent documents disclosing different of types and means for the traction of the car of an elevator are known in the state of the art in which the following must be highlighted.

[0006] Patent ES 2272055 T3 discloses an elevator with counterweight with flat cables. The use of flat cables allows reducing the size of the drive of the motor because the flexural rigidity is much less. The motor is positioned between the wall and the car to allow making use of the entire elevator hoistway along its height, also fixed to the wall or ceiling.

[0007] Traction with flat cables does not prevent the sliding between the pulley and the belt, on the other hand, the fact that the diameter of the pulley is less than 100 mm means that the number of revolutions is high which causes a higher noise level and a reduction of the comfort level.

[0008] Therefore, relating to this invention, an elevator with counterweight is to be designed in which the sliding between the pulley and the belt are prevented using a cogged pulley and cogged belt, and additionally reducing the noise level and improving the comfort levels by making sure that the pulley is greater than 100 mm in diameter.

[0009] Patent application PCT WO 99/43602 discloses an example of an elevator system with a belt type flat transmission means. According to this patent application, the elevator car moves by means of a drive installed in the mass balance weight and moves integrally with the latter. The sliding between the pulley and the belt are not prevented since it has a transmission system by means of flat belt.

[0010] On the other hand, patent application PCT WO 99/43592 discloses another elevator system with a belt type transmission means, where the drive is integrated in the counterweight, and a belt type transmission means fixed to the elevator car serves to transmit the driving force between the counterweight and the elevator car.

[0011] The elevator described in patent ES 2262368 T3 is also known in which the pulley and the type of belt are flat, therefore it has the same problem described for the traction of this type, in which sliding between the pulley and the belt occurs. It also has the drawback that the diameter of the driving pulley is less than 100 mm which entails that the number of revolutions is high causing a higher noise level and comfort reduction.

[0012] Until now cars and counterweights must have a minimum weight to assure the friction traction capacity between the flat cable or belt and the driving pulley. If there is no said minimum weight, sliding between the flat cable or belt and the driving pulley occurs. 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, such as for example the noise level and the comfort level.

[0013] All the systems 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 made of two parts attached to one another. 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 translate in the most well balanced way possible, it being convenient to avoid horizontal components on the deflecting pulleys.

- On the other hand, in the elevators 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 aspect susceptible to being improved is the fact that the shaft of the driving pulley does not receive all the load.

[0014] Therefore, the objective of the present invention is to develop an elevator 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.
- and which the shaft of the cogged pulley does not receive all the force or torque.

[0015] 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.

Description of the Invention

[0016] The object of the invention is an elevator with a cogged belt and pulley 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 and fastenings for fastening the ends of the cogged belt.

[0017] 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 at one of its ends, a counterweight being suspended at the other end of the cogged belt system. The assembly is driven by a machine located in the upper portion of the hoistway screwed to a base located in the upper portion of the hoistway.

[0018] By dividing the elevator belt system, there are two ropes in which the tension of the belts is the same. The rope suspending the car owes its tension to the weight of the car itself and on the useful load, and therefore its tension is variable. On the other hand, the tension of the rope from which the counterweight is suspended from depends on the weight of the counterweight.

[0019] The car guides and counterweight are vertically supported on the bottom of the hoistway and are fixed to the walls by intermediate supports.

[0020] The base together with the machine are inside the hoistway, they can be supported on one of the car guides, on the wall, at the ceiling, on the guides of the counterweight or on any combination of two or three of these four elements. The load distribution will be different in each case. It is possible to transfer the weight of the entire system to the hoistway floor. Therefore, the walls of the building do not have to support the weight of the elevator assembly.

[0021] 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.

[0022] 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.

[0023] 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.

[0024] On the other hand, and to achieve the aforementioned purpose of reducing the noise levels, the cogs of the driving pulley are helical, whereas the cogs of the cogged belt are straight, 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.

[0025] 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.

[0026] 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 by producing two halves attached 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.

[0027] 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 deflecting or driving pulleys, and therefore in the car and counterweight, a fact which happens in patent ES 2280579 T3.

[0028] 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.

[0029] 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.

[0030] 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.

[0031] The machine is solely and exclusively located in the projection of the counterweight, enabling a greater use of the dimensions of the hoistway in the upper areas, in addition to preventing horizontal components and therefore preventing more uniform translation.

[0032] The cogged pulley and belt mesh along their length and if they exceed certain limits, the elevator has limit switches or electrical contacts and a torque limiter assuring that the elevator stops at where it has to stop, not providing the belt with cogs in its entire length not being necessary as in other elevators of the state of the art.

[0033] Therefore, with the constructive improvements proposed herein, two technical effects are basically achieved, such as, on one hand, noise level reduction, and on the other hand, a well balanced and uniform translation of the car, the constructive variants described being necessary to achieve both purposes since the constructive features cooperate in the two purposes described, in addition to achieving additional derived technical effects.

Description of the Drawings

[0034] 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 corresponding to or depicting its configuration and arrangement of cogged belts and deflecting pulleys.

Figure 2 shows the plan view of the figure above.

Figure 3 shows the assembly of the machine together with the cogged pulleys, the cogged belts and the deflecting pulley.

Figure 4 shows the perspective view of the cogged belt, cogged pulleys and the meshing or coupling therebetween.

Figure 5 shows the detail view of the cogged pulley and the cogged belt.

Figure 6 shows the detail view of the cogged belt.

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

Figure 8 shows the sectioned view of the deflecting pulley where its constructive features can be seen.

Preferred Embodiment of the Invention

[0035] In view of the drawings, a preferred embodiment of the proposed invention is described below.

[0036] 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) are arranged below the car (1). The pulleys (3) can be mounted on the ceiling or on the lower portion of the car.
- the fastenings (7) and (8) for fastening the ends of the cogged belt (2) are arranged in the upper portion of the hoistway (18), a machine (4) with an integrated deflecting pulley (5) is also arranged.
- the counterweight (6) is placed on one side of the car (1) below the base of the elevator, and in the projection of the machine

[0037] As depicted, it can be observed that the cogged belt (2) starting from a first fixing end (7) passes through the deflecting pulleys (3) of the car (1), which as has been said, can be arranged in the upper or lower portion of the car (1), followed by the deflecting pulley (5) and by the driving pulley or pinion (9) (Figure 3) of the machine (4), going to the bottom of the hoistway (18) until reaching the suspension pulley (19) of the counterweight (6), continuing in its final section to the second fixing end (8) of the cogged belt.

[0038] 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 as a result of 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.

[0039] The axes of the deflecting pulleys (3) which can be arranged above or below of the car (1) are perpendicular to the plane of the car guides. The location of the pulleys is moved with respect to the middle plane of the car.

[0040] The elevator hoistway and the maximum use thereof can be observed in Figure 2 as a result of a suitable arrangement of the guides, the machine (4), the counterweight (6) and the deflecting pulleys (3).

[0041] Figure 2 shows the position of the cogged belt which is between the car guide (20) and the step (21), which assures a better operation of the elevator as it pulls the centre of masses of the car, compensating the door weight.

[0042] On the other hand, the guide (20) passes through the geometric centre of the car (1), which assures that the forces of the guide during emergency braking are the least possible.

[0043] The driving machine (4) responsible for the traction on the cogged belt (2) is observed in Figure 3, the association of the machine (4) with a cogged pulley (9), and in turn the association of a cogged belt (2) with the latter, being shown.

[0044] The machine (4) has either a brake (11) assembled on a support (10), or a brake (13) mounted in the rear portion. The pulleys are flanked by discs or flanges which do not allow the belt to come off from its operating position. The cogged pulley (9) and the cogged belt (2) are protected by a casing (12) in their point of meshing.

[0045] Since the starting torque required from the machine is not very high, the dimensions of the machine can be reduced, maintaining optimum dimensions between length, width and height.

[0046] How the cogged belt (2) meshes with the cogged pulley (9) which is manufactured from metal of a single part and with a groove in the centre, having a series of helical cogs located in staggered formation, which assures a perfect meshing with the straight cogs of the cogged belt and which results in the reduction of the noise level generated can be seen in perspective in Figures 4 and 5.

[0047] In a preferred embodiment the diameter of the cogged pulleys is greater than 100 mm, having a width greater than the width of the cogged belt, which can be, in a possible embodiment, 1 mm.

[0048] As a result of these constructive features operation improvement is achieved and the comfort level is increased since the coupling smoothness when moving is increased and therefore the vibration and noise are improved. Furthermore, as a result of a cog passage comprised between 7 and 9 mm., an optimum operating speed is achieved, in which the rotation speed is not excessive, such as it would be with a pulley having smaller diameter, and therefore the vibrations and noise are very low.

[0049] As observed in Figure 6, the cogged belt (2) has three elements attached to one another by means of extrusion which are a plastic portion, several steel cords embedded therein and a textile mesh.

[0050] The textile mesh improves the operation and the comfort level by increasing the coupling smoothness when moving and therefore the vibrations and noise.

[0051] The plastic portion has two faces, a flat face and another cogged face. The cogged portion is formed by inclined cogs located in staggered formation and covered by the textile mesh. The cogs form 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 function of the mesh is to reduce the vibrations and noise, whereas the transparent polyurethane allows a visual inspection of the steel reinforcement cables embedded in the polyurethane.

[0052] The thickness of the cogged belt with cogs is 4 to 6 mm, the non-cogged portion has a thickness less than 3 mm.

[0053] 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 tension of the two ropes or by the lack of adherence are prevented.

[0054] 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.

[0055] Additionally, the machine (4) has a gearless motor, a support or base, a brake, the two non-slip rollers (14) and a deflecting pulley (5).

[0056] It is important to emphasize that the deflecting pulley (5) forms the indivisible portion of the machine and prevents the inclination of the belt in the rope going to the car, i.e., the cogged belts connect in a vertical and non-inclined manner to the deflecting pulley and to the driving pulley, such that the horizontal component attempting to tip the car by creating a tug, discomfort and great wear in the friction clamps, as well as a lack of uniformity in the translation of the car is eliminated.

[0057] As a result of integrating the deflecting pulley (5) together with the machine the reactions on the shaft of the machine are reduced, which allows the shaft of the machine to be of smaller size.

[0058] The support (10), which on one hand is fixed to the casing of the machine and on the other to the base, is use for housing a bearing the function of which is to support the free end of the shaft of the machine, the deflecting pulley (5) and as the carrier of the non-slip rollers.

[0059] At least one cogged driving pulley (9) which is flanked by discs or flanges preventing the cogged belts (2) from being able to come off from its position will be arranged on the shaft of the machine.

[0060] The non-slip rollers (14) are assembled such that their centres of rotation are located in an angle which can very between 70° and 190°. Therefore, the angle between the axes of rotation of the roller assemblies will coincide with the angle of contact of the belt, contacting the tangent point thereof with the driving pulley (convergence between the belt and pinion). The distance between the outer diameters of the non-slip pulleys and those of the driving pulleys is sufficient so that the thickness of the driving belt passes, assuring the traction in both directions and eliminating the risk of drive loss due to the cogs of the belt coming off from those of the pinion.

[0061] The machine (4) driving the drive system is mounted on a base .The assembly formed by the machine and the base is fixed to the wall, to the guides of the counterweight, to the ceiling, or to one of the car guides, or in any combination of any of two or three of these four elements. The base together with the machine is solely located in the projection of the counterweight such that it enables the car to pass by the side of the machine-base assembly.

[0062] In an alternative embodiment the base can be fixed to a combination of the elements listed above.

[0063] The integration of the deflecting pulley to the support favors operating and constructing the machine by distributing the loads between two axes. Therefore the shaft of the driving pulley only receives a load component from the car rope which allows reducing the diameters of the shaft and bearing.

[0064] All the above enables a maximum use of the elevator hoistway, allowing maximizing the car area for several existing hoistway dimensions, it is possible to carry a larger number of passengers or objects at once.

[0065] Finally, Figure 8 shows the features of the deflecting pulleys (3), which in a possible embodiment are manufactured from plastic, they are mounted on a shaft (15) at the ends of which there are arranged bearings (17), each of the pulleys has its own chanellings separated by a flange (16), the chanellings having a convexity or an outwardly dished shape for the purpose of keeping the belt centered in the chanelling without the need of bordering with the flanks of the chanelling, eliminating the wear of the sides of the belt.

[0066] The elevator, in the cases of impact caused by an infinite traction situation, can be provided with shock absorbers at both ends of the path, electrical elements, such as limit switches interrupting the movement before the elevator collides with the shock absorbing pads.

[0067] As a result of the constructive features of the elements used, the arrangement thereof and the synergy produced between them, the following is achieved:

- On one hand, the car moves without sliding, the car having a minimum weight, therefore a bigger car with a greater useful load can be made. The car can be made from light materials without the need of having to use steel.
- On the other hand, since the machine is in the projection of the counterweight a greater use in the upper and lower areas of the hoistway is achieved
- The deflecting pulleys and the cogged pulleys can be of a smaller diameter.
- The necessary torque of the machine is much less than that which would be required until now.
- The walls of the building do not have to support the total weight of the elevator.
- The possibility of placing the pulleys and the parachutes both on the ceiling and on the floor.

[0068] Above all, a translation of the car with the minimum noise possible and with the greatest comfort possible since the translation is performed in a uniform and vertical manner.

[0069] 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, which embodiments will also achieve the protection sought provided that the essential principle is not altered, changed or modified.

Claims

1. An elevator with a cogged belt and pulley and with a counterweight **characterized in that** it has deflecting pulleys (3) above or below a car (1), fastenings (7) and (8) for fastening the ends of the cogged belt (2) are arranged in the upper portion of the hoistway (18), a machine (4) formed by a gearless motor is also provided, additionally having a support, a brake, all these elements are mounted on a base, and the machine being in the projection of a counterweight (6) arranged on one side of the hoistway (18);

   - at least one cogged pulley (9) is assembled on the shaft of the machine, the machine (4) having integrated a deflecting pulley (5), and the machine has at least two non-slip rollers (14) preventing the belt (2) from coming off
   - the cogged pulley (9) is made of a single part with a groove in the centre, the diameter is great-

er than 100 mm and it has helical cogs and with a width greater than that of the cogged belt and is self-centring and is flanked by discs or flanges (16)

- the cogged belt (2) has two portions which are a plastic portion and several steel cords embedded therein attached to one another by means of extrusion, the geometry of the cogged belt has two faces, a flat face and another cogged face formed by inclined cogs located in a staggered formation, and it has three elements which are transparent polyurethane (2.2), steel reinforcement cables (2.1) embedded in the polyurethane (2.2) and a textile mesh (2.3) covering the cogged portion.

2. The elevator with a cogged belt and pulley and with counterweight according to claim 1, **characterized in that** the deflecting pulleys (3) which can be arranged above or below the car (1) have axes perpendicular to the plane of the car guides and are placed between the car guide (20) and the step (21).

3. The elevator with a cogged belt and pulley and with counterweight according to claim 1, **characterized in that** the brake (11) is either mounted on a support (10), or is mounted on the rear portion of the motor.

4. The elevator with a cogged belt and pulley and with counterweight according to claim 1, **characterized in that** the thickness of the cogged belt is 4 to 6 mm, the non-cogged portion has a thickness less than 3 mm, the width of the cogged belt is less than 30 mm.

5. The elevator with counterweight with a cogged belt and pulley according to claim 1, **characterized in that** the machine (5) contains 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 (8).

6. The elevator with counterweight with a cogged belt and pulley according to claim 5, **characterized in that** the non-slip rollers (14) are assembled such that their centres of rotation are located in an angle which can very between 70° and 190°.

7. The elevator with counterweight with a cogged belt and pulley according to claim 1, **characterized in that** the deflecting pulleys (3) are mounted on a shaft (15) at the ends of which there are bearings (17), each of the pulleys has its own chanellings separated by a flange (16), the chanellings having a convexity or an outwardly dished shape.

8. The elevator with counterweight with a cogged belt and pulley according to claim 1, **characterized in that** the assembly formed by the machine and the base is fixed to the wall, to the guides of the counterweight, to the ceiling or to one of the car guides, or a combination of two or three of these four elements.

9. The elevator with counterweight with a cogged belt and pulley according to claim 1, **characterized in that** the cogged pulley (9) 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.

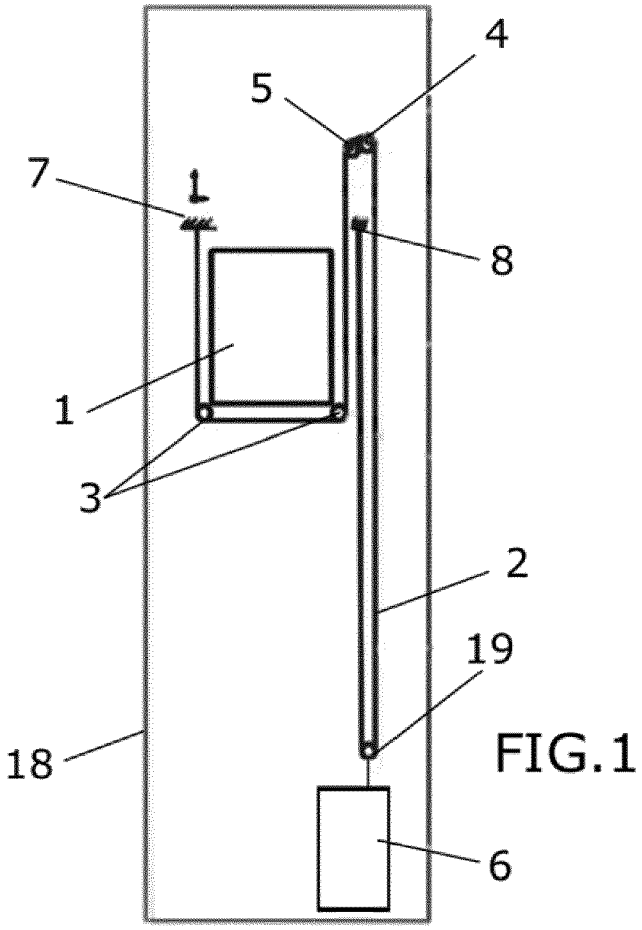

FIG.1

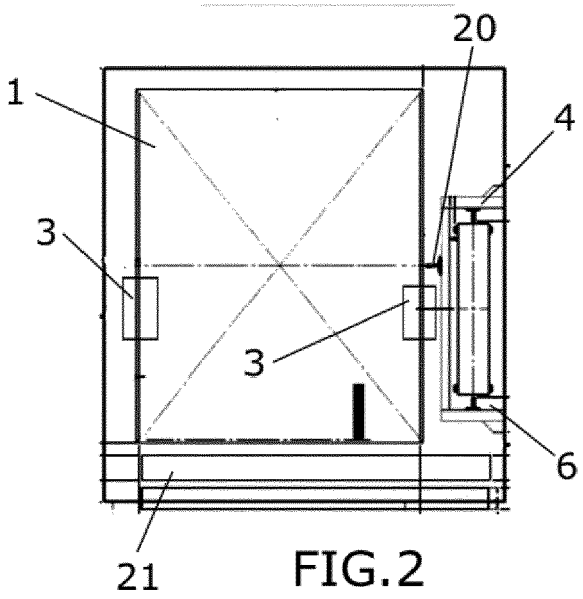

FIG.2

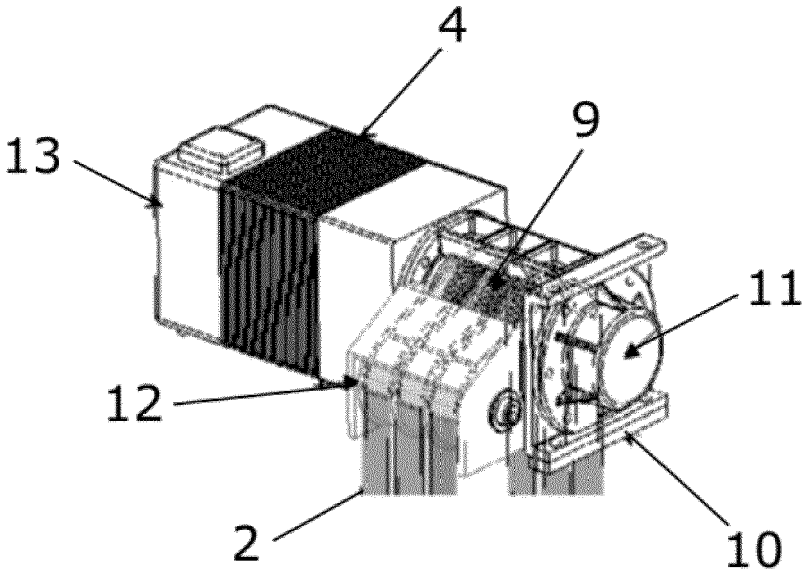

FIG.3

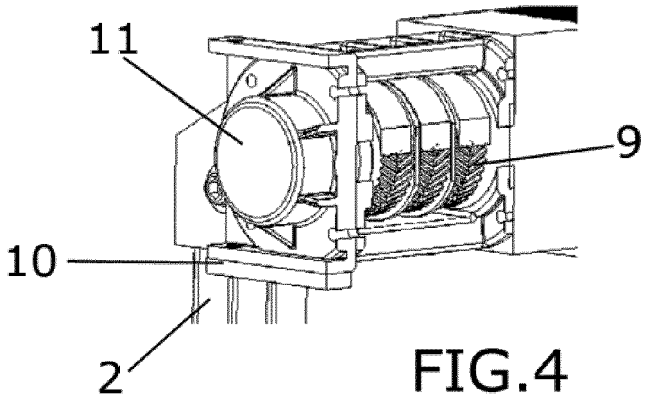

FIG.4

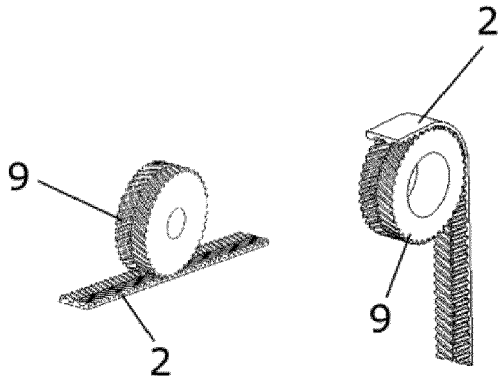

FIG.5

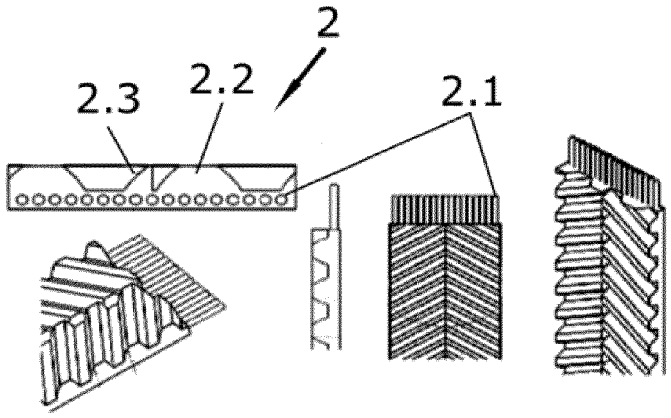

FIG.6

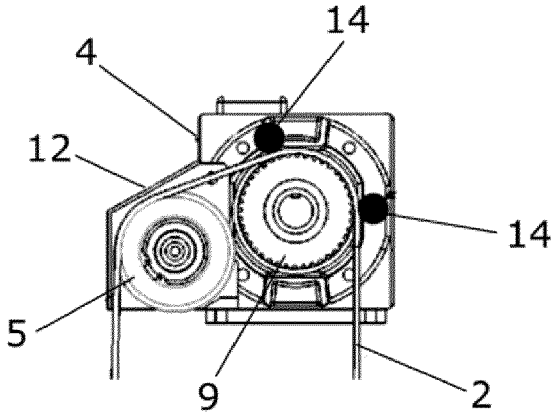

FIG.7

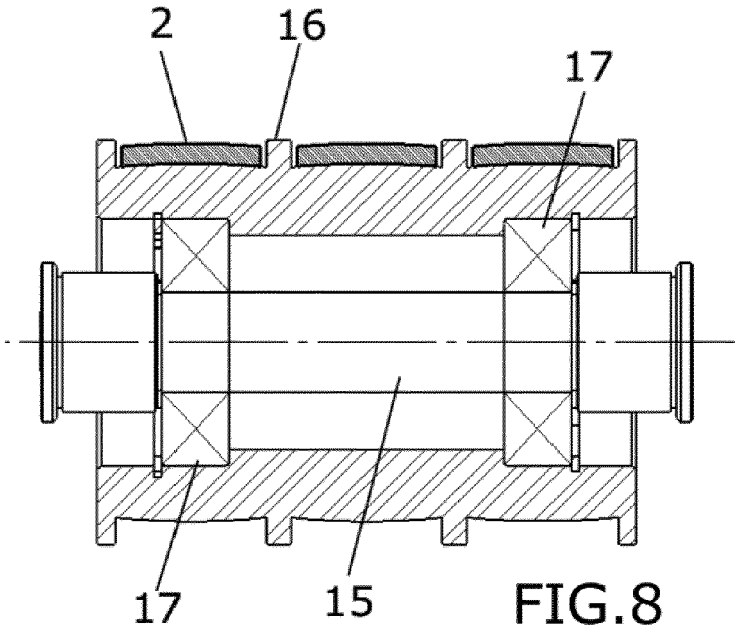

FIG.8

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EUROPEAN SEARCH REPORT

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	4 July 2012	Janssens, Gerd

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