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(54) **COMPACT DRIVE SYSTEM FOR LIFTS**

KOMPAKTES ANTRIEBSSYSTEM FÜR AUFZÜGE

SYSTÈME DE TRACTION AYANT DES DIMENSIONS RÉDUITES POUR DES ASCENSEURS

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Description

OBJECT OF THE INVENTION

[0001] The object of the present invention, as stated in the title, is a traction system of reduced dimensions for lifts and the like entirely located between one of the shaft walls and the facing wall of the car, without affecting the overhead clearance, or the lower clearance or pit.

[0002] The special design characteristics of the traction system characterize the present invention making it a traction system which is entirely arranged in a space between one wall of the car and the facing wall of the lift shaft, mounted parallel to both walls, presenting smaller dimensions than those known so far, reaching a depth or total thickness of the order of 14 cm, thus being especially suitable for the installation of lifts in existing buildings with small shafts.

[0003] The main application of this traction system is existing buildings, namely rehabilitations, however, this is not necessarily the only use, and we could also be talking about a new shaft standard, that is, in new constructions, saving space by means of a smaller shaft for the same number of passengers.

[0004] Therefore, the present invention is included in the field of traction systems for lifts and particularly among those which are arranged between the car and one of the walls of the lift shaft way.

BACKGROUND OF THE INVENTION

[0005] One of the problems encountered by lift manufacturers is how to design traction systems as small as possible so that they can be installed in the shafts of existing buildings, in which such shafts have not been designed to accommodate a lift.

[0006] In short, the aim is to optimize the existing shaft, minimizing the dimensions of the traction system to free as much space as possible for the car.

[0007] In the prior art several traction systems are known in which traction and suspension are separate, such as those described below

Patents ES2245189, EP 1,595,840 and JP 2002173281 disclose motorized counterweight traction systems, i.e. bearing the machine on the counterweight. This type of design necessarily involves separate traction and suspension, by definition, as the machine is suspended and located on the counterweight.

[0008] Patent EP1367017A1 discloses a machine mounted on a counterweight.

[0009] Patent EP1439145A1 discloses a system that exerts traction directly on the car.

[0010] Patent EP1595840A1 discloses a brake to control the speed, having no connection with the object now addressed.

[0011] Patent EP2390221A1 discloses a machine mounted on the counterweight.

[0012] Patent ES2245189A1 discloses a traction system with the machine as counterweight or on the car.

[0013] Patent FR2823734A1 discloses a system not related to the object of the invention.

[0014] Patent JP2002173281A discloses a traction system with the machine on the counterweight.

[0015] Patent US1071309A discloses a traction system with pulleys arranged with perpendicular axes, thus requiring much floor space.

[0016] Patent WO03086937A1 discloses a belt tension system with a sort of tensioning pulley.

[0017] Patent WO9829326A1 discloses a traction system for lifts which does not allow for optimization of the lift shaft.

[0018] Patent WO2008125704A1 discloses a system with traction on the car

Patent WO2013079790A1 discloses a system with traction on the car

Patent EP2022743 A1 discloses an elevator device which comprises a counterweight provided with a displacement body that is displaceable with respect to the counterweight. A car and the counterweight are suspended by a main rope connected to the displacement body. The counterweight is provided with a weight-side fixed pulley, and the displacement body is provided with a weight-side movable pulley.

[0019] Patent EP1481934 A1 discloses an elevator system, and more particularly, relates to the configuration of a rope-type elevator. However, none of the solutions described in the aforementioned documents of the prior art addresses or aims to design a traction system that involves an optimized use of the lift shaft both in floor area and height.

[0020] Consequently the solutions of these documents make its application in confined spaces unfeasible.

[0021] Therefore, the object of this invention is to develop a traction system basically achieving to reduce the space required both in floor area and height for the installation of the traction system, allowing an optimization of the surface of the shaft, being a simple system, with reduced installation and maintenance costs, developing a system such as that described below and being reflected in the first claim.

DESCRIPTION OF THE INVENTION

[0022] The object of the present invention is a traction system of reduced dimensions for lifts which is entirely installed between the walls of the shaft and car, without affecting the free space above the shaft, known as overhead clearance or the lower clearance of the shaft, known as pit.

[0023] Because the traction system is entirely located between the walls of the shaft and the car, the use of the shaft area is maximum, and in addition it requires no special dimensions for overhead clearance and pit, making this an ideal traction system for buildings being refurbished in which the existing shafts were not originally designed to accommodate a lift, as well as for new build-

ings with special construction requirements.

[0024] The traction system has a backpack frame, wherein all machinery and guides are on a single side, i.e. in the space between one of the car walls and the facing wall of the shaft, with a design such that the entire traction system has a reduced width, allowing optimal use of the lift shaft.

[0025] The proposed traction system has the following characteristics:

- The traction is exerted directly on the counterweight by means of a closed loop of a belt or cable pulled by adhesion, while the car traction indirectly performed through the counterweight by means of suspension cables.
- Thanks to the separation of functions a more optimized distribution of elements is achieved, thus allowing a larger car surface area for a same shaft.
- The traction is performed on the counterweight by a closed loop system wherein the pulling ratio can be from 1: 1 to 4: 1, using a reduced traction pulley of a reduced size reducing the required torque.
- The tension to be applied to said loop for adhesion can be obtained in different ways, the one in which the weight of the lift itself participates being initially preferred, by means of a cam system; this greatly simplifies the solution and, especially, it does not involve space, as other spring or balance-type alternatives do.
- The cam system has an important specific characteristic. The rotation of the cam has a degree of freedom in one direction, one that provides tension to the belt. In the opposite direction the cam is locked mechanically preventing loss of tension when the lift operates with different loads, i.e., the tension is set for the maximum load in the car and does not slacken when it is empty.
- Moreover, to ensure that the traction system takes up as little space as possible, the motor has small dimensions, particularly a reduced depth, using either a motor whose rotor drives the traction pulley directly (direct traction), or a traction pulley separated from the motor, connected via a parallel axis reduction, such as a toothed belt.
- Reduced compensation factor. In most lifts, a compensation factor of 50% is set, that is, the weight of the counterweight equals the weight of the car (P) plus 50% of the load of people (Q); P + 0.5Q.. This means that in the empty journeys going down (very common), the device consumes maximum power. However, traffic studies show that lower counterbalance, 30-35%, would achieve a better energy balance. In a conventional lift, the adherence depends directly on the P + Q (P is the weight of the car and Q is the load) and the counterweight, so if the compensation factor is low, the adherence conditions worsen. This situation is more critical when working with small lifts having a low P and Q. The system of the invention, wherein adhesion is not directly dependent of P and Q but is also affected by a ratio of the cam system, allows configurations with low counterweight values. Thanks to having a control of adjustable belt tension with respect to the total weight of the lift, we can use lighter and therefore cheaper car materials and designs.
- Moreover, when working with small diameter pulleys, the torque necessary to move the lift is relatively small, so lowering the counterweight factor has a controlled influence on the motor volume to be used and the corresponding impact on the lift architecture.
- The suspension of the elevator is performed by means of two suspension pulleys, which requires a more or less cantered position of the counterweight with respect to the car, so that the required floor area of the traction system is clearly reduced.

[0026] The traction system has the following construction characteristics:

- A traction motor in which the motor shaft and the traction pulley have parallel axes, whereby the motor axis and the traction pulley axis may coincide.
- Means of traction transmission, which may be traction cables or belts and to the extent possible constitutes the preferred embodiment but not being limited thereto, being at least two traction belts, which, starting from an upper fastening point, pass through an upper counterweight pulley, through the traction pulley, running to a return pulley mounted in the lower part of the shaft, then continuing to a lower counterweight pulley and finally being fixed in its end to the bottom of the shaft.
- Suspension of the car by means of two suspension pulleys using suspension cables that run from the counterweight and are connected to the car, passing through the suspension pulleys, wherein the axis of said suspension pulleys is connected to the cam system such that it transmits the weight of the car and of the counterweight thereto.
- A cam system, on which are arranged the suspension pulleys of the car, with the particular characteristic whereby the rotation is in only one direction, which provides the necessary tension to the traction loop to have the necessary adherence on the traction pulley and the motor torque can be transformed into vertical movement of the car.

[0027] Throughout the description and claims the word "comprise" and its variations are not intended to exclude other technical features, additives, components or steps. For those skilled in the art, other objects, advantages and characteristics of the invention will arise partly from the description and partly from practice of the invention.

EXPLANATION OF THE FIGURES

[0028] To complement the description being made and for the sake of a better understanding of the characteristics of the invention according to a preferred practical embodiment thereof, as an integral part of said description a set of drawings is attached by way of illustration and without limiting the scope of this invention, showing the following.

Figure 1 shows a diagram of the proposed traction system.

Figure 2 shows a plan view of the area of the shaft in relation to the car and traction system.

Figure 3 shows a detail of the front view of the motor, the tension regulator system and the counterweight.

Figure 4 shows the preceding figure in perspective.

Figure 5, shows a detail of the guide system and the lower crossbar of the motor.

Figure 6 shows the car in relation to the rest of the traction system.

Figure 7 shows a representation of a possible alternative embodiment to the direct traction machine shown in Figure 1

PREFERRED EMBODIMENT OF THE INVENTION.

[0029] In view of the figures, a preferred embodiment of the invention proposed is described below.

[0030] Figure 1 shows the traction system comprising:

- a motor (1) responsible for transmitting the traction to belts or cables (7) via a traction pulley (4), wherein the belts or cables (7) perform traction on a counterweight (5) and are arranged in a closed loop,
- Car (14) and counterweight (5) suspension cables (8);
- A cam system (6) to apply tension on the car (14) and counterweight (5) suspension cables (8);

wherein

- the traction of the car (14) from the motor (1) is performed indirectly through the counterweight (5), by means of the car (14) and counterweight (5) suspension cables (8);
- the car suspension is carried out by two suspension pulleys (8.1) and by the car (14) and counterweight (5) suspension cables (8) which, running from the counterweight (5) and passing through the suspension pulleys (8), connect with the car (14);
-the suspension pulleys (8.1) are disposed on the cam system (6) wherein said suspension pulleys (8.1) which can only rotate in the direction of providing tension to the car (14) and counterweight (5) suspension cables (8), while in the opposite direction rotation is locked to prevent loss of tension, the tension being set to the maximum car load.

[0031] The motor with the traction pulley (4), the cam system (6), the belts or cables (7), the car (14) and counterweight (5) suspension cables (8), the suspension pulleys (8) and the counterweight (5) are all housed in the space comprised between one of the car walls and the facing wall of the lift shaft.

[0032] The motor (1) whose axis is essentially flat directly moves the traction pulley (4)

The traction assembly in a second embodiment, as shown in Figure 7, consists of a motor (1) that drives through a toothed belt (21) a reducer pulley (22) inside which the traction pulley (4) of the lift is located, whereby the motor pulley (1.1) and the traction pulley of the lift (4) are arranged with their axes parallel and taking up the smallest possible width.

[0033] The belts or cables (7) have a closed loop configuration, which in one possible embodiment, start from a top attachment (9) performed on the cam system (6) responsible for applying the necessary tension to the belts or cables (7). Then, the belts or cables (7) pass through the upper pulley (10) of the counterweight (5) and continue to the traction pulley (4) and then to the return pulley (11) fixed to the lower part of the shaft, running to the lower pulley (12) of the counterweight, finally being attached at its end (13) to the bottom of the shaft.

[0034] In order not to take up more space than absolutely necessary, the traction belt as it runs from the traction pulley (4) to the return pulley (11) fixed at the bottom of the lift shaft, can run inside the counterweight (5) itself, thus avoiding an increase of the required depth for the traction system.

[0035] The suspension cables (8) from which the car (14) and counterweight (5) hang are separated into two groups, of at least two cables each, which are fixed on the sides of the car frame and counterweight, next to the guiding elements thereof, and hang from two upper suspension pulleys (8.1) whose axes of rotation are mutually independent.

[0036] The fact that the suspension is performed with two separate cable branches provides two advantages, the first is that the size of the elements can be reduced and located in an optimized manner. The second is the enhanced centring of the car and counterweight hoisting resulting in better performance of the system by lessening friction as compared to a system wherein hoisting is off-centre. By using two suspension pulleys, the relative floor position of the counterweight and the car is quite centred, resulting in a reduction of the effective floor area required for the lift shaft.

[0037] Figure 2 shows the relative position of car (14) and the traction system (16) relative to the shaft area (15), wherein the traction system has very small dimensions, which is entirely located between one of the shaft

walls and the opposite wall of the car, not directly affecting the overhead clearance or the pit, with a very reduced depth (17) needed to assemble the whole traction system.

[0038] Figure 3 shows the car guides (19) along which the car runs and the counterweight guides (20), along which the counterweight (5) runs (figure 1), whereby the entire traction system is arranged in the space comprised between the one sides of the car and the facing wall of the lift shaft, with a reduced thickness, and preferably with the axes of the pulleys parallel to each other and perpendicular to the guides, thus permitting as traction means not only traction cables, but also traction belts.

[0039] Figure 4 shows in better detail the newly referenced elements, namely the brackets (19.1) of the car guides (19) and the brackets (20.1) of the counterweight guides (20).

[0040] Figure 5 shows the presence of a lower crossbar (5.2) of the counterweight, and onto which the lower pulley (12) of the counterweight is attached.

[0041] Figure 6 shows the presence of the return pulley (11) fixed to the bottom of the shaft.

[0042] Finally, Figure 7 shows an alternative way of traction transmission as compared to that shown in Figure 1, and which falls under the same principles of the invention, wherein the traction of a motor (1) is transmitted from the motor pulley (1.1) to a reducer pulley (22) through a toothed belt (21), wherein the motor pulley (4) is inside the reducer pulley (22) with a smaller diameter. The motor pulley (1.1) must be arranged such that its axis is parallel to the reducer pulley (22).

[0043] The main advantage of this system is the resulting morphology, wherein the engine due to the intermediate reduction, reduces its size and can be placed side-ways, allowing the machine to be seamlessly integrated into the assembly.

[0044] Therefore, thanks to the described traction whereby traction of the car is performed indirectly through the counterweight moved by closed loop belts or cables, using a cam system applying the required tension to said traction and counterweight loop for adhesion, a separation of functions of the various elements involved in traction and suspension of the car is achieved and thus an optimal distribution thereof, being arranged in the space between one of the car sides and the facing shaft wall presenting a reduced width, therefore optimizing the use of the lift shaft area, wherein it the lift shaft does not need to present special considerations for the overhead clearance and for pit.

Claims

1. Lift with a traction system (16), the traction system (16) comprising:

- a motor (1) with a traction pulley (4) responsible for transmitting the movement to belts or cables (7) by adhesion, wherein the belts or cables (7) perform traction on a counterweight (5), the belts or cables (7) being arranged in a closed loop,
- Car (14) and counterweight (5) suspension cables (8);
- a cam system (6) applying tension on the car (14) and counterweight (5) suspension cables (8),

wherein

- the traction of the car (14) from the motor (1) is performed indirectly through the counterweight (5), by means of the car (14) and counterweight (5) suspension cables (8);
- the car suspension is carried out by two suspension pulleys (8.1) and by the car (14) and counterweight (5) suspension cables (8) which running from the counterweight (5) and passing through the suspension pulleys (8) are connected to the car (14);
- **characterized in that**
- the suspension pulleys (8.1) are disposed on the cam system (6) wherein said suspension pulleys (8.1) can only rotate in the direction of providing tension to the car (14) and counterweight (5) suspension cables (8), and in the opposite direction rotation is locked to prevent loss of tension, the tension being set to the maximum car load; and
- the traction system (16) is entirely located in the space comprised between one of the car walls and the facing wall of the lift shaft.

2. Lift with a traction system according to claim 1 **characterized in that** the belts or cables (7) have a pulling ratio from 1: 1 to 1: 4.

3. Lift with a traction system according to claim 2 **characterized in that** the belts or cables (7) have a closed loop configuration that runs from an upper attachment (9) performed on the cam system (6), then, belts or cables (7) pass through an upper pulley (10) of the counterweight (5) and continue to the traction pulley (4) and then to a return pulley (11) fixed to the bottom of the shaft, continuing to a lower pulley (12) of the counterweight, to finally be attached at its end (13) to the bottom of the shaft.

4. Lift with a traction system according to claim 3, **characterized in that** the belts or cables (7) running from the traction pulley (4) to the return pulley (11) fixed at the bottom of the lift shaft, runs through the interior of the counterweight (5) itself.

5. Lift with a traction system according to claim 1, **characterized in that** the car (14) and counterweight (5) suspension cables (8) from which the car (14) and counterweight (5) hang, comprise at least two cables each, which are attached to the sides of the car frame

and counterweight, next to the guide elements thereof, and hang from the two suspension pulleys (8.1) whose axes of rotation are mutually independent.

6. Lift with a traction system according to claim 1, **characterized in that** the motor (1) drives the traction pulley of the lift (4) through a toothed belt (21) reduction, the axes of motor and traction pulley being arranged parallel to each other and essentially perpendicular to the wall of the shaft onto which the entire traction system described is fixed.

Patentansprüche

1. Aufzug mit einem Traktionssystem (16), wobei das Traktionssystem (16) umfasst:

   - einen Motor (1) mit einer Traktionsrolle (4), die für die Übertragung der Bewegung auf Riemen oder Seile (7) durch Adhäsion verantwortlich ist, wobei die Riemen oder Seile (7) eine Traktion auf einem Gegengewicht (5) durchführen, wobei die Riemen oder Seile (7) in einem geschlossenen Kreislauf angeordnet sind,
   - Kabine (14) und Gegengewichttragseile (5) (8);
   - ein Nockensystem (6), das Spannung auf die Kabine (14) und die Gegengewichttragseile (5) (8) ausübt,

   wobei
   - die Traktion der Kabine (14) vom Motor (1) indirekt durch das Gegengewicht (5) mittels der Kabine (14) und der Gegengewichttragseile (5) (8) erfolgt;
   - die Kabinenaufhängung durch zwei Aufhängungsrollen (8.1) und durch die Kabine (14) und Gegengewichttragseile (5) (8) durchgeführt wird, die vom Gegengewicht (5) weg und durch die Aufhängungsrollen (8) hindurch verlaufen und mit der Kabine (14) verbunden sind; **dadurch gekennzeichnet, dass**
   - die Aufhängungsrollen (8.1) auf dem Nockensystem (6) angeordnet sind, wobei sich die Aufhängungsrollen (8.1) nur in Richtung der Bereitstellung von Spannung für die Kabine (14) und die Gegengewichttragseile (5) (8) drehen können, und in der entgegengesetzten Richtung die Drehung verriegelt ist, um Spannungsverluste zu verhindern, wobei die Spannung auf die maximale Kabinenlast eingestellt wird; und
   - das Traktionssystem (16) vollständig in dem Raum zwischen einer der Kabinenwände und der gegenüberliegenden Wand des Aufzugsschachts angeordnet ist.

2. Aufzug mit einem Traktionssystem nach Anspruch 1, **dadurch gekennzeichnet, dass** die Riemen oder Seile (7) ein Zugverhältnis von 1:1 bis 1:4 aufweisen.

3. Aufzug mit einem Traktionssystem nach Anspruch 2, **dadurch gekennzeichnet, dass** die Riemen oder Seile (7) eine geschlossene Schleifenkonfiguration aufweisen, die von einer oberen Befestigung (9) auf dem Nockensystem (6) ausgeht, dann durchlaufen die Riemen oder Seile (7) eine obere Riemenscheibe (10) des Gegengewichts (5) und weiter zur Traktionsscheibe (4) und dann zu einer am Boden der Welle befestigten Umlenkrolle (11), die zu einer unteren Riemenscheibe (12) des Gegengewichts führt, um schließlich an ihrem Ende (13) am Boden der Welle befestigt zu werden.

4. Aufzug mit einem Traktionssystem nach Anspruch 3, **dadurch gekennzeichnet, dass** die von der Traktionsscheibe (4) zu der am Boden des Aufzugsschachts befestigten Umlenkrolle (11) verlaufenden Riemen oder Seile (7) durch das Innere des Gegengewichts (5) selbst verlaufen.

5. Aufzug mit einem Traktionssystem nach Anspruch 1, **dadurch gekennzeichnet, dass** die Kabine (14) und die Gegengewichttragseile (5) (8), an denen die Kabine (14) und das Gegengewicht (5) hängen, mindestens je zwei Seile umfassen, die an den Seiten des Kabinenrahmens und des Gegengewichts neben dessen Führungselementen befestigt sind und an den beiden Tragrollen (8.1) hängen, deren Drehachsen voneinander unabhängig sind.

6. Aufzug mit einem Traktionssystem nach Anspruch 1, **dadurch gekennzeichnet, dass** der Motor (1) die Traktionsscheibe des Aufzugs (4) durch eine Zahnriemenreduktion (21) antreibt, wobei die Achsen von Motor und Traktionsscheibe parallel zueinander und im Wesentlichen senkrecht zur Wand der Welle angeordnet sind, an der das gesamte beschriebene Traktionssystem befestigt ist.

Revendications

1. Ascenseur avec un système de traction (16), le système de traction (16) comprenant :

   - un moteur (1) avec une poulie de traction (4) chargée de transmettre le mouvement à des courroies ou câbles (7) par adhérence, dans lequel les courroies ou câbles (7) effectuent la traction sur un contrepoids (5), les courroies ou câbles (7) étant disposés dans une boucle fermée,
   - des câbles de suspension (8) de la cabine (14) et du contrepoids (5) ;
   - un système de came (6) appliquant une tension sur les câbles de suspension (8) de la cabine (14) et du contrepoids (5)

   dans lequel

- la traction de la cabine (14) à partir du moteur (1) s'effectue indirectement à travers du contrepoids (5), au moyen des câbles de suspension (8) de la cabine (14) et du contrepoids (5) ;
- la suspension de la cabine est réalisée par deux poulies de suspension (8.1) et par les câbles de suspension (8) de la cabine (14) et du contrepoids (5) qui sont reliés à la cabine (14) en partant du contrepoids (5) et en passant à travers des poulies de suspension (7) ; **caractérisé en ce que**
- les poulies de suspension (8.1) sont disposées sur le système de came (6) dans lequel lesdites poulies de suspension (8.1) ne peuvent tourner que dans la direction de fourniture de tension aux câbles de suspension (8) de la cabine (14) et du contrepoids (5), et la rotation dans la direction opposée est bloquée pour empêcher une perte de tension, la tension étant réglée sur la charge maximale de la cabine ; et
- le système de traction (16) est entièrement situé dans l'espace compris entre l'une des parois de la cabine et la paroi frontale de la cage de l'ascenseur.

2. Ascenseur avec un système de traction selon la revendication 1, **caractérisé en ce que** les courroies ou câbles (7) ont un rapport de traction de 1:1 à 1:4.

3. Ascenseur avec un système de traction selon la revendication 2, **caractérisé en ce que** les courroies ou câbles (7) ont une configuration en boucle fermée qui va d'une fixation supérieure (7) réalisée sur le système de came (6), puis les courroies ou câbles (7) passent par une poulie supérieure (10) du contrepoids (5) et continuent vers la poulie de traction (4), puis vers une poulie de retour (11) fixée sur le fond de la cage, continuant vers une poulie inférieure (12) du contrepoids, pour être fixées finalement à son extrémité (13) au fond de la cage.

4. Ascenseur avec un système de traction selon la revendication 3, **caractérisé en ce que** les courroies ou câbles (7) vont de la poulie de traction (4) à la poulie de retour (11) fixée au fond de la cage d'ascenseur, passent à travers de l'intérieur du contrepoids (5) lui-même.

5. Ascenseur avec un système de traction selon la revendication 1, **caractérisé en ce que** les câbles de suspension (8) de la cabine (14) et du contrepoids (5) auxquels la cabine (14) et le contrepoids (5) sont suspendus, comprennent au moins deux câbles chacun, qui sont fixés sur les côtés du châssis de la cabine et du contrepoids, à côté des éléments de guidage de celui-ci, et sont suspendus aux deux poulies de suspension (8.1) dont les axes de rotation sont mutuellement indépendants.

6. Ascenseur avec un système de traction selon la revendication 1, **caractérisé en ce que** le moteur (1) entraîne la poulie de traction de l'ascenseur (4) à travers une réduction de courroie dentée (21), les axes du moteur et de la poulie de traction étant disposés parallèlement l'un à l'autre et essentiellement perpendiculaire à la paroi de la cage sur laquelle est fixé l'ensemble du système de traction décrit.

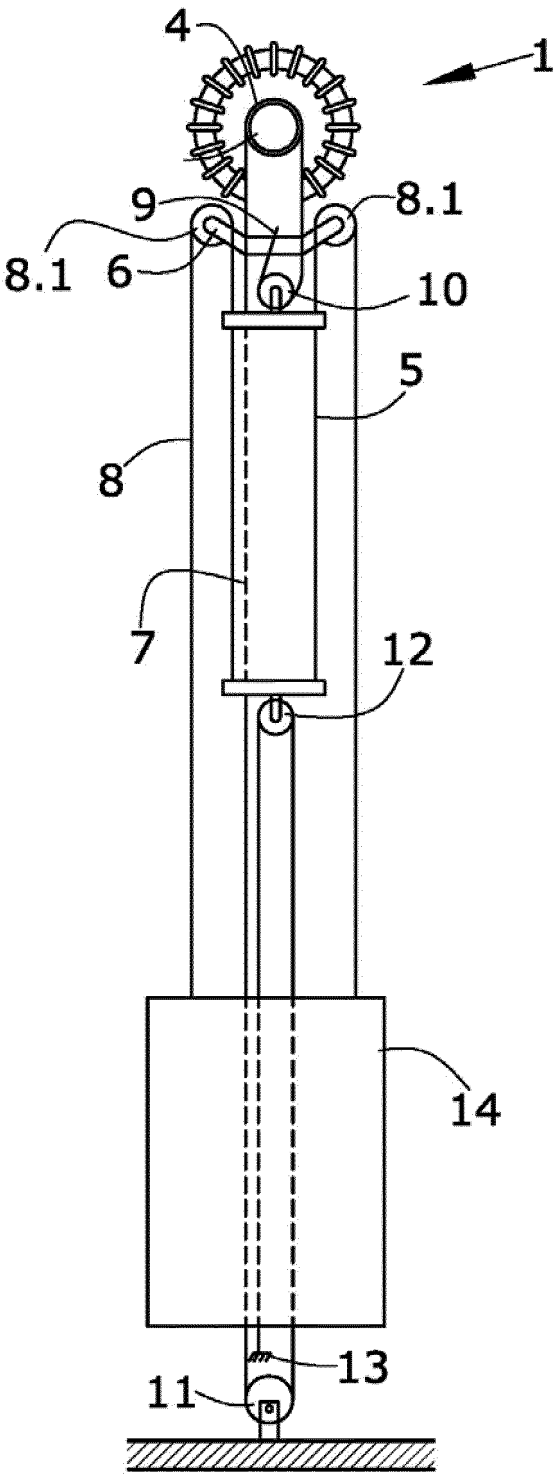

FIG.1

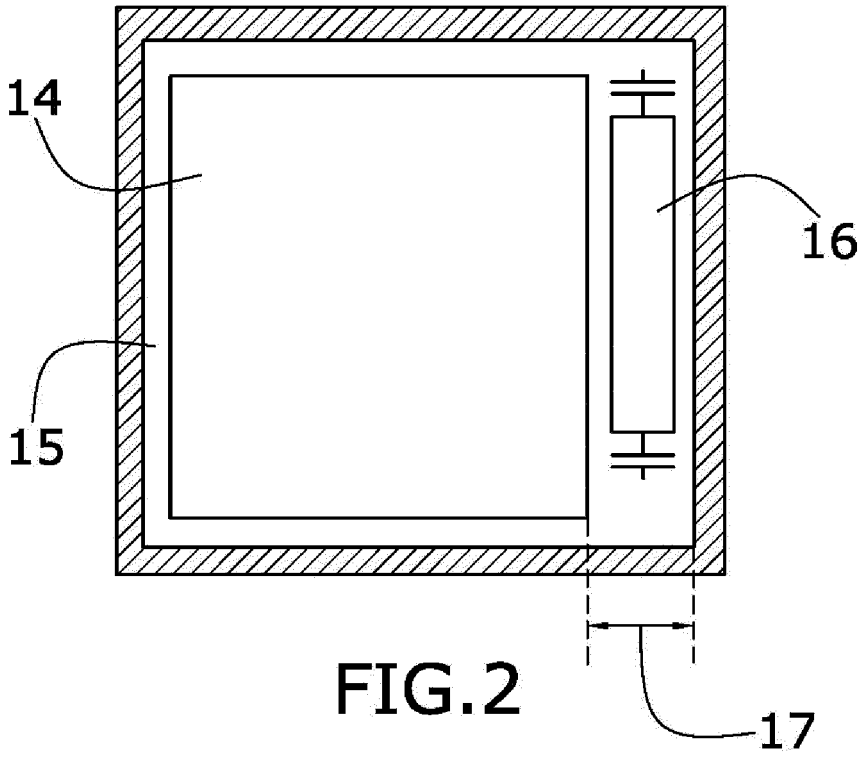

FIG.2

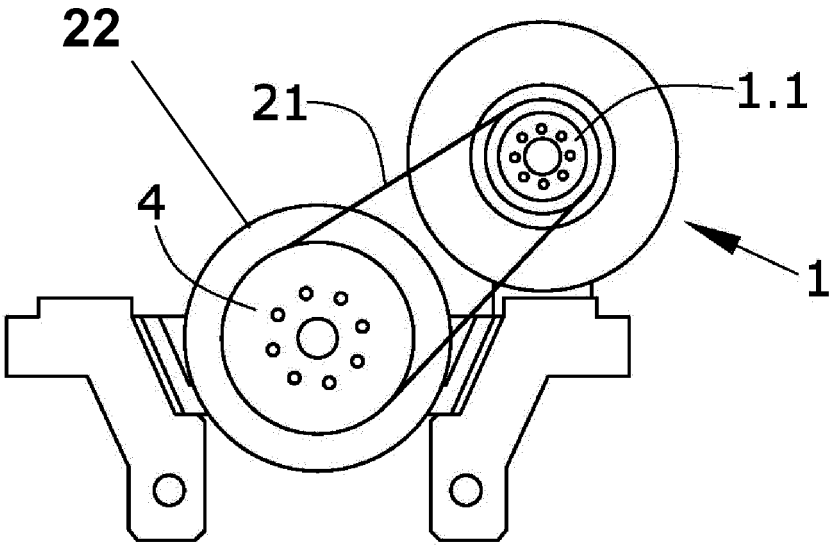

FIG.7

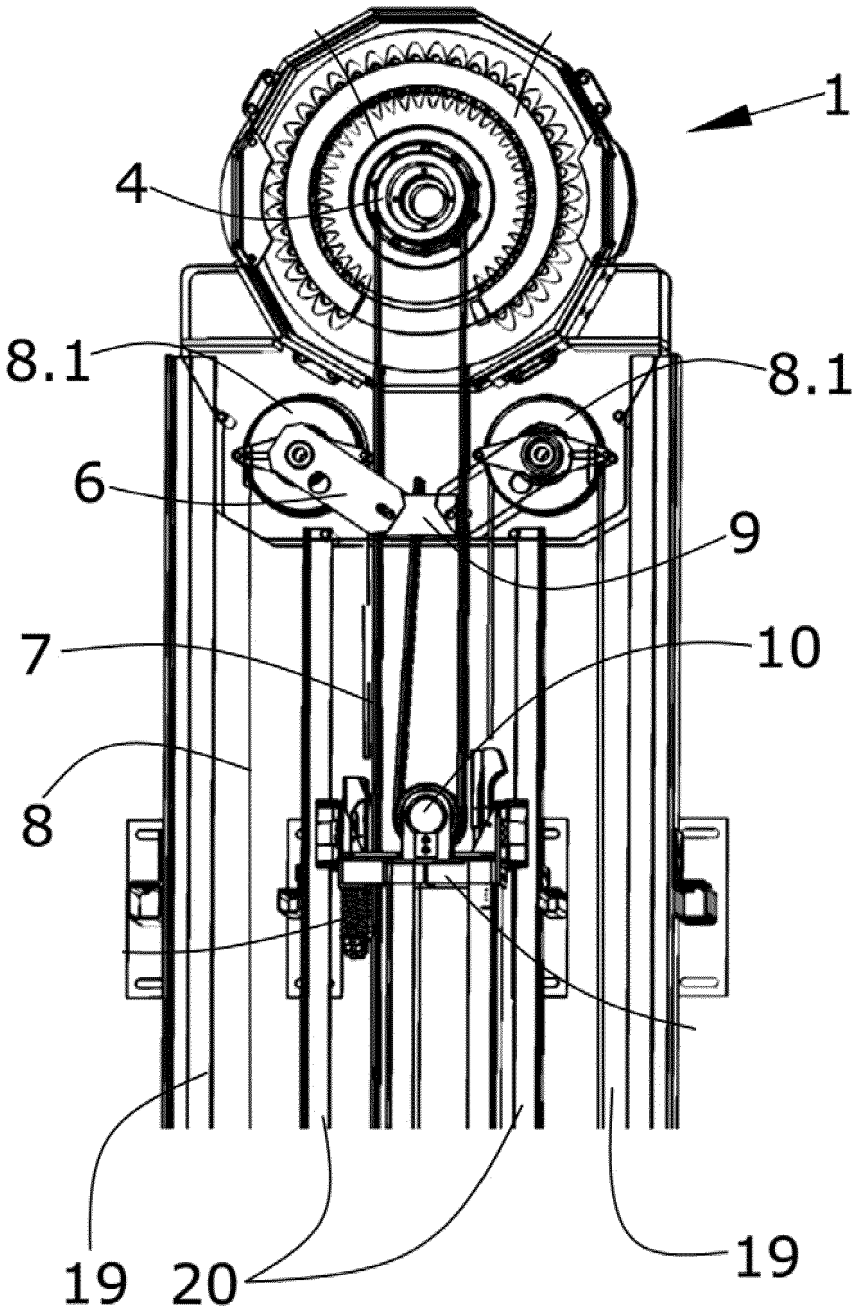

FIG.3

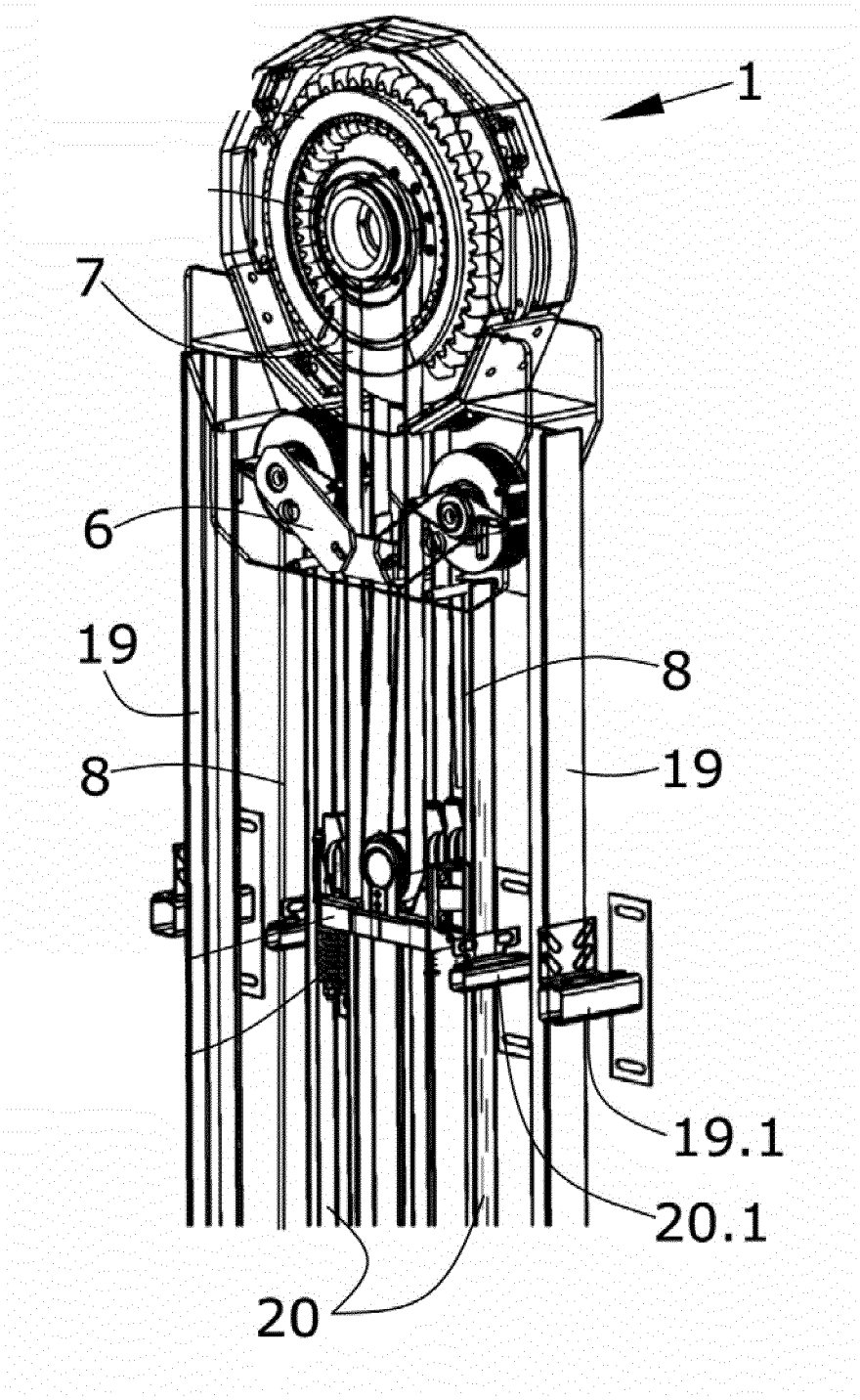

FIG.4

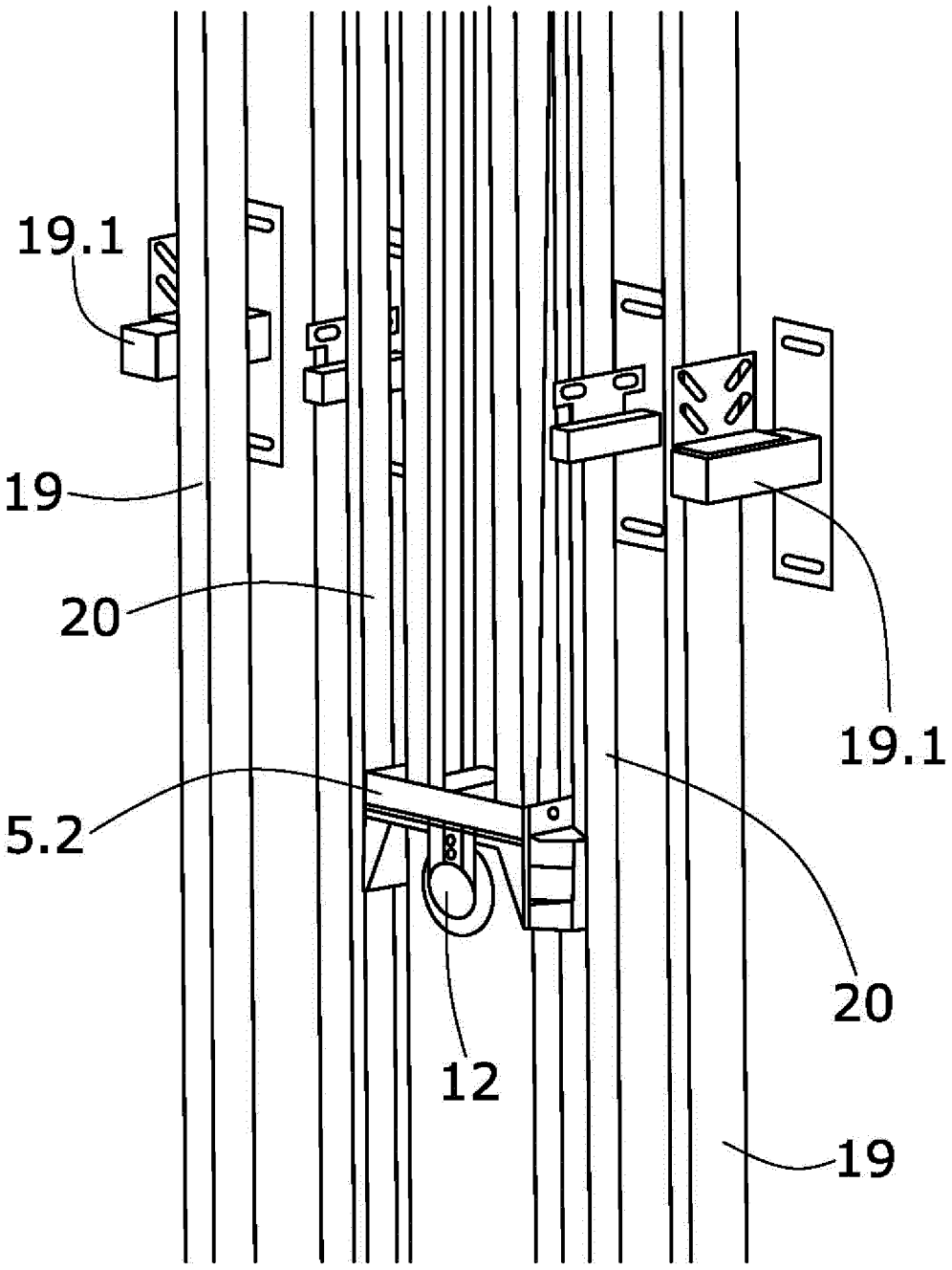

FIG.5

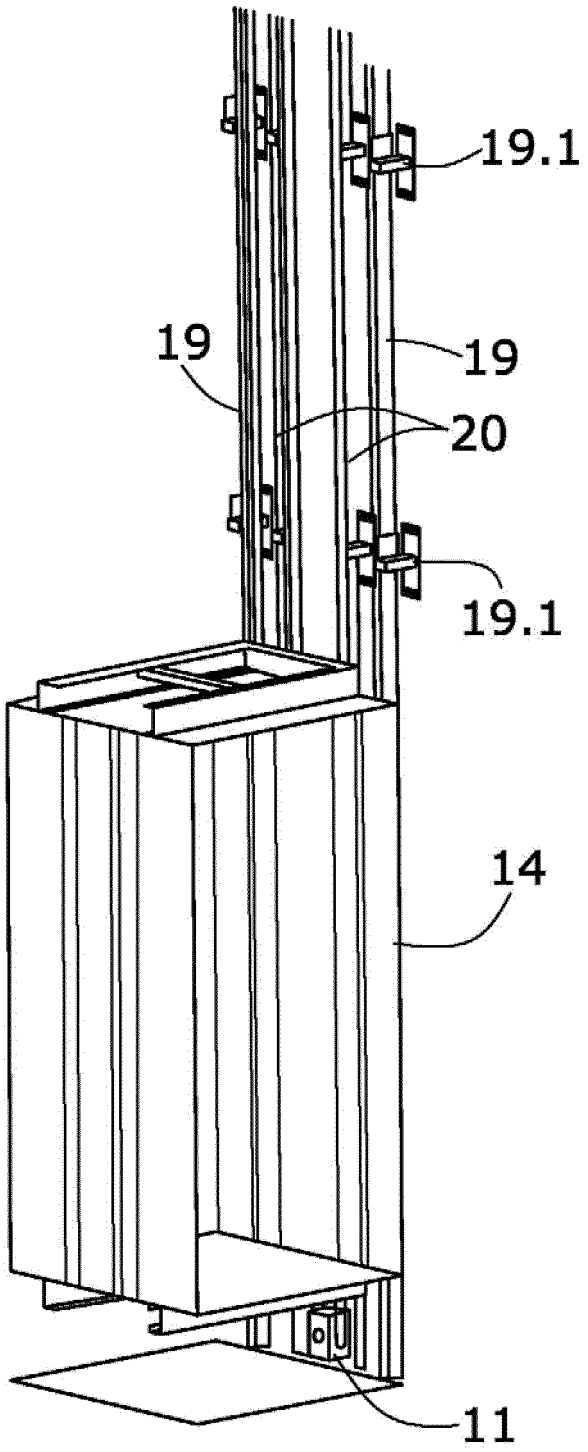

FIG.6

REFERENCES CITED IN THE DESCRIPTION

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