(19) Europäisches Patentamt / European Patent Office / Office européen des brevets

(11) EP 3 722 242 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
14.10.2020 Bulletin 2020/42

(51) Int Cl.:
***B66B 11/02** (2006.01)* ***B66B 5/00** (2006.01)*
***B66B 5/28** (2006.01)*

(21) Application number: **20164681.7**

(22) Date of filing: **20.03.2020**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **20.03.2019 DE 202019101607 U**

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(54) ELEVATOR FOR PARTICULARLY SMALL ELEVATOR SHAFTS

(57) Elevator with a car consisting of a car frame suspended from a supporting means and carrying a platform or an elevator cabin, with a counterweight suspended from the supporting means and with guide rails along which the car and the counterweight can be moved up and down in an elevator shaft, and at least one folding maintenance support, which can be brought into a vertical working position in which it defines a protective space between the car and the bottom of the shaft, and which can be brought into a horizontal rest position in which it releases the car's path until the car lands on the buffer or buffers in the shaft floor, whereas the car frame has at least one lower, horizontally extending cross beam which has at least one first recess on its lower flank which forms a free space into which the at least one maintenance support located in its horizontal rest position can be inserted.

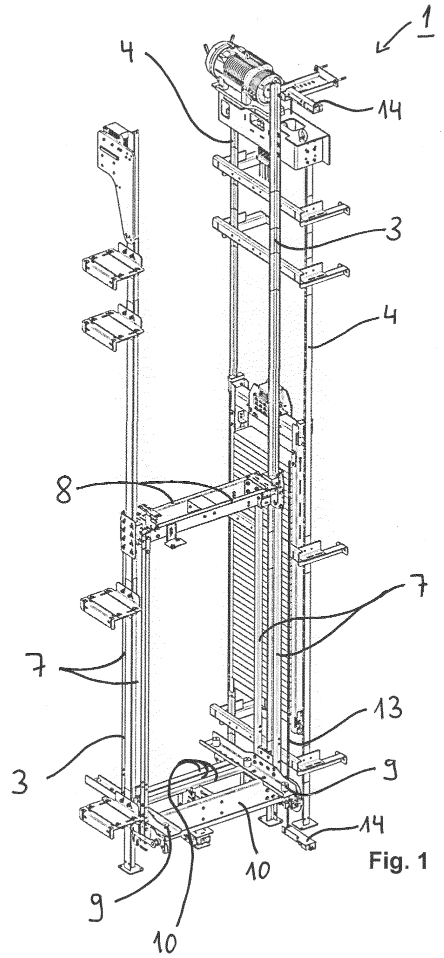

Fig. 1

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Description

[0001] The invention concerns a machine room-less elevator for the transport of persons or goods along a vertical elevator shaft, which is designed according to the generic term of the corresponding patent claim.

TECHNICAL BACKGROUND

[0002] Until about two decades ago, elevators usually had a separate machine room, which required a lot of additional space in the building.

[0003] Modern elevators are designed without a machine room. For this purpose, the drive is positioned together with the car in the shaft. This, however, makes it necessary to pay more attention to making the best possible use of the space available in the elevator shaft. This is the only way to realise elevator cars with an appealingly large floor area.

[0004] In the meantime, the development has gone one step further. There is an increasing demand not only to make optimum use of the cross-section of the elevator shaft, but also to reduce the length of the elevator shaft. The elevator houses on the roof of the building, which create the necessary free space in the shaft head and were therefore ubiquitous in the past, have long been undesirable. In addition, there is an increasing need to keep the depth of the shaft pit as low as possible. This is because modern residential and office buildings are increasingly being constructed without basements for cost reasons.

TECHNICAL PROBLEM OF THE INVENTION

[0005] It is the object of the invention to provide an elevator that makes better or the best possible use of the installation space available in the elevator shaft in the transverse and longitudinal directions.

THE INVENTIVE SOLUTION

[0006] The solution according to the invention is realised in a first step with the characteristics of claim 1.

[0007] Accordingly, an elevator with a car is proposed which consists of a car frame suspended from a suspension device. At this stage, the means of suspension may be at least one belt, i.e. a structure which is less elongated in the direction in which it is bent over the deflection pulleys and/or the driving pulley than in the direction perpendicular thereto and/or whose main supporting structure is not made of steel. However, even at this stage of the invention, at least one classic steel rope, which is usually essentially round, is preferably used as a suspension device.

[0008] The supporting frame carries an elevator car or - in the rare cases of an elevator open towards the shaft - a platform, which is not discussed separately in the following. The elevator has at least one counterweight suspended from a suspension device. The elevator has guide rails along which the car and the counterweight can move up and down in an elevator shaft.

[0009] In addition, the inventive elevator has at least one, preferably two folding maintenance supports. Each of the maintenance supports can be brought into a vertical working position, where it defines a protective space between the car and the shaft floor. In addition, each of the maintenance supports can be brought into a horizontal rest position, where it releases the car's path until the car lands on the buffer or buffers in the shaft floor.

[0010] The elevator according to the invention is characterized by the fact that the car frame has at least one lower, horizontally running cross member, which has at least one first recess on its lower flank, which forms a free space. The at least one maintenance support can be inserted into this free space if it is in its horizontal rest position.

[0011] A recess in the sense of the invention means that the cross member has no constant extension along its longitudinal axis perpendicular to it. Instead, it rejuvenates itself at at least one point. This position corresponds to the position of a maintenance support in the rest position. This gives the cross member more distance to the bottom of the shaft - "more" means if one advances (in thought) from the front ends of the cross beam to its centre when looking at it.

[0012] In this way, the underside of the car frame is prevented from sitting on the maintenance support(s) before it rests on the buffers or elastomer buffers attached to the bottom of the shaft. Instead, even in the event of a hard contact with the buffers under elastic compression, it is ensured that there is still sufficient clearance between the car frame and the inactive maintenance support(s).

OTHER INVENTIVE ASPECTS

[0013] A solution is particularly preferred in which the lower cross beam - viewed in the direction along its longitudinal axis - has a second recess on both sides between its at least one first recess and the respective front end to accommodate a load sensor.

[0014] The second recess is usually oriented in the opposite direction to the first recess. Thus the second recess creates a local distance between the underside of the car floor and the cross member in which it is formed. This local distance can be used to accommodate a load sensor with which the car floor is supported on the cross member.

[0015] This has the advantage that the installation of load sensors between the cross member and the underside of the car floor only increases the overall height of the car by a smaller amount than the nominal height of the load sensor.

[0016] A particularly preferred solution - for which protection is sought with or without reference to another claim, i.e. also independently - looks as follows.

[0017] According to the invention, an elevator with a car is proposed. The latter consists of a car frame suspended from a suspension means. It has a counterweight suspended from the suspension means.

[0018] In addition, guide rails belong to the elevator, along which the car and the counterweight can be moved up and down in an elevator shaft.

[0019] In addition, an overspeed governor is provided for detecting an impermissible driving condition of the elevator car. The invention-based elevator is characterised by the fact that the overspeed governor comprises an overspeed monitoring device, i.e. a displacement, velocity and/or acceleration sensor which normally operates incrementally. The overpeed monitoring device travels with the car. It evaluates the movement of the car relative to a belt tensioned along the route through the shaft along which it (i. e. the overspeed monitoring device) rolls.

[0020] The belt is pre-tensioned by at least one belt tensioner. This generates a pre-tensioning force which acts in the horizontal direction at the end of the belt. The belt tensioner has a deflecting element. The belt then leaves the belt tensioner (seen in relation to the belt's longitudinal axis) in a vertical direction into the elevator shaft.

[0021] This further minimizes the space required by the invented elevator in the area of the shaft head and/or shaft bottom. The car can be moved up to a distance of 15 cm to 40 cm from the shaft ceiling and/or the bottom of the shaft. Problems with insufficient space for the belt tensioner(s) at both ends of the belt do not occur. Because the belt tensioners, which are quite long in themselves, extend mainly in a horizontal direction, although they act in a forceful vertical direction.

[0022] A particularly preferred solution - for which protection is sought with or without reference to another claim, i.e. also independently - looks as follows.

[0023] According to the invention, a traction sheave elevator with a car is proposed. The latter consists of a car frame suspended from a suspension device. It has a counterweight suspended from the suspension device. In addition, guide rails belong to the elevator, along which the car and the counterweight can be moved up and down in an elevator shaft. The car frame surrounds the car cabin or car platform on four sides, usually in the form of a sling.

[0024] The parallel rails of the car span a first plane. This first plane runs outside the car's centre of gravity. Preferably a design is chosen which is such that between 1/3 and 1/5 of the car is on one side of said first plane and between 2/3 and 4/5 of the car is on the other side of said first plane.

[0025] The parallel rails of the counterweight span a second plane. The latter is arranged at an angle of - essentially - 90° to the first plane. In this way, the load of the car is well absorbed even when loaded, although the car hangs asymmetrically in the sling formed by the car frame and is arranged more asymmetrically, sometimes essentially rucksack-like, relative to its pair of guide rails.

[0026] On the other hand, such a design saves a lot of installation space, because the guide rails of the car are located in an area that is clearly outside the area potentially required by the drive and the guide rails for the counterweight, which are usually located directly below it. In this way, it is possible for the drive and the associated traction sheave to move particularly close to the car. This enables the space-saving rotary axis arrangement of the traction sheave and the deflection pulleys, which will be explained in more detail later.

[0027] It is particularly preferred in the above design that the extension of the first plane in the direction of the rails of the counterweight intersects the second plane in the area between the opposite rails of the counterweight.

[0028] Ideally, the car should be suspended in the bottom block and tackle arrangement (in German: "Unterflasche") and the suspension ropes underneath the car should not intersect the perpendicular of the car centre of gravity.

[0029] The traction sheave elevator described above is ideally designed such, that the car and the counterweight are hanging in a "block and tackle arrangement" (i. e. in German "in Unterflasche"), so that a 2:1 effect is realized. The axis of rotation of the traction sheave is parallel to that of the shaft wall closest to the traction sheave. The rotation axes of all deflection pulleys are arranged parallel to the rotation axis of the traction sheave.

[0030] The suspension means consists of a rope strand of several steel round ropes which are not connected to each other and run parallel to each other. The counterweight is guided in the shaft in such a way that the first section of the rope strand leading from the deflection pulley of the counterweight to the shaft end of the rope strand extends through the shaft at an angle A to the vertical. At the same time, the first section of the rope strand, which extends from the end of the rope strand to the deflection pulleys of the counterweight, runs regionally between the second section of the rope strand and a third section of the rope strand. The latter extends from the traction sheave to the deflection pulleys of the car.

[0031] In this way, the car and the counterweight can be positioned particularly close to each other in an elevator car suspended in a loop-like manner in the car frame - despite the special position of the rotary axes of the driving wheels and the deflection pulleys. This saves a great deal of installation space in the shaft. The inventive measure or package of measures thus benefits the size of the maximum possible car base area.

[0032] A particularly preferred solution, which can be used as an alternative to the rail arrangement described above, looks as follows - whereby protection is also sought for such a solution with or without reference to another requirement, i.e. also in a unique position.

[0033] In line with the invention, a traction sheave elevator with a car is also proposed as part of this alternative solution.

[0034] In this case, the latter also consists of a car frame suspended from a suspension means. This elevator also has a counterweight suspended from the suspension means. In addition, guide rails belong to the elevator, along which the car and the counterweight can be moved up and down in an elevator shaft. The inventive elevator is designed as a backpack elevator.

[0035] The car frame preferably has an L-shaped layout or design. The car usually sits on its short L-beams. With all this, the parallel guide rails of the car are arranged so that they span one car guide rail plane. At the same time, the parallel guide rails of the counterweight are arranged so that they span a counterweight guide rail plane.

[0036] The inventive solution is characterised by the fact that the car guide rail plane and the counterweight guide rail plane are parallel to each other and spaced apart from each other.

[0037] The distance between the parallel guide rails of the car is greater than the distance between the parallel guide rails of the counterweight.

[0038] In this way, the guide rails of the car and the counterweight can move particularly close together, which saves installation space in the shaft. In addition, the arrangement of the rotary axes of the traction sheave and the deflection pulleys, which will be described in more detail at a later stage, is made possible in this way and, if necessary, further of the optional additional measures described below.

[0039] As part of a particularly preferred embodiment, it is provided that the drive, seen in its projection along the travel direction of the car in the shaft, is arranged between the guide rails of the car - preferably asymmetrically. The majority of the plane spanned by the guide rails of the counterweight is located within said projection of the drive.

[0040] Ideally, this variant of the inventive elevator is designed so that the car and the counterweight hang "in Flasche" or with other words in "block and tackle arrangement", so that a 2:1 effect is realized. The design is such that the axis of rotation of the traction sheave is parallel to plane spanned by the shaft wall closest to the traction sheave.

[0041] At the same time, the rotation axes of all deflection pulleys are arranged parallel to the rotation axis of the traction sheave.

[0042] The suspension means consists of a rope strand of several steel round ropes which are not connected to each other and run parallel to each other.

[0043] The counterweight is guided in the shaft in such a way that the second section of the rope strand, which leads from the traction sheave to the deflection pulleys of the counterweight, extends through the shaft at an angle B relative to the vertical. At the same time, the first section of the rope strand, which extends from the end of the rope strand to the deflection pulleys of the counterweight, extends regionally between said second section of the rope strand and a third section of the rope strand. The latter extends from the traction sheave to the deflection pulleys of the car.

[0044] In this way, the car and the counterweight can be positioned very close to each other for rucksack elevators - despite the special position of the rotary axes of the traction wheels and the deflection pulleys. This saves a great deal of installation space in the shaft. The inventive measure or package of measures thus benefits the size of the maximum possible car base area. Further useful technical effects, advantages and inventive design possibilities of the depicted constructions result from the following description of the preferred embodiments on the basis of the figures.

FIGURAL LIST

[0045]

Fig. 1 shows a general view of a first example of the invention

Fig. 2 shows a detail section from Fig. 1, from a slightly different angle.

Fig. 3 shows a schematic view of the embodiment according to Fig. 1, in plan view from above.

Fig. 4 shows the suspension rope course of the embodiment according to Fig. 1.

Fig. 5 is not provided for, what is indicated by showing an empty box.

Fig. 6 shows a schematic view of the embodiment to Fig. 8, in plan view from above.

Fig. 7 shows the carrying rope course of the embodiment according to Fig. 8.

Fig. 8 shows a general view of a second embodiment of the invention.

Fig. 9 shows a general view of a second embodiment from an angle different from that of Fig. 8.

Fig. 10 shows a detail section from Fig. 8 from a different angle.

Fig. 11 shows a detail section from Fig. 8 from another changed angle of view.

PREFERRED EMBODIMENTS

FIRST PREFERRED EMBODIMENT

[0046] Figure 1 provides a good overview of a first embodiment.

[0047] The inventive elevator 1 is shown here in an elevator shaft 2. The guide rails 3 of the car and the guide rails 4 of the counterweight 5 are clearly visible. The car frame is here provided with the reference number 6.

[0048] The car frame 6 is designed to accommodate an elevator cabin (itself not shown here) in a sling-like holding configuration. Sling-like here means that the car frame surrounds the elevator cabin on four different sides when assembled and usually forms a closed ring.

[0049] It is also easy to see that the car frame 6 consists of several vertical beams 7. These are connected to each other on their upper side by several or a pair of horizontal beams 8. In a similar way, several horizontal beams 9 are also provided on the underside of the car frame, which in turn connect the pairs of vertical beams 7. In addition, vertical cross beams 10 are provided on the underside, which are supported here by the lower horizontal beams 9.

[0050] It is noteworthy that the lower horizontal beams 9 are preferably not designed symmetrically in pairs. Instead, the lower horizontal beams 9 form preferably an uneven pair. This pair is formed on one side by several horizontal beams 9, in this case three beams running parallel to each other, which together form one beam of the pair. In contrast, the other beam of the pair thus formed on the opposite side is only a single horizontal beam 9. The several horizontal beams 9 running parallel to each other form a particularly solid base for fixing the deflection pulleys, which are attached under the car here.

[0051] The drive can be clearly seen in Figure 1. It's in the head of the shaft. A bracket 11, which is supported on the upper end faces of the guide rails 4 of the counterweight 5, is preferably provided for this purpose. At the same time, a horizontal support 12 is provided between the bracket 11 and the shaft wall. It prevents the drive from moving inwards towards the shaft centre or from being prone to tilt in that direction under the influence of the rope forces.

[0052] The specially designed overspeed governor used here can also be seen quite clearly. This consists of an overspeed governor rope 13 running vertically through the shaft. Another component of the overspeed governor is the overspeed monitoring device 15. This moves along with the car, see also Fig. 3. It rolls along the stationary overspeed governor rope 13. This drives its encoder or incremental encoder. If an overspeed governor belt is used instead, the same applies mutatis mutandis, which is not emphasized separately below.

[0053] In this case, the overspeed governor rope 13 is fixed directly to the shaft floor or shaft ceiling, both in the shaft bottom and in the shaft head, using a rope tensioner 14. Each of these rope tensioners 14 consists, among other things, of a spring element. The spring element is usually a coil spring extending along the horizontal and located within the housing of the rope tensioner shown in Figure 1. The end of the overspeed governor rope 13 is attached to this coil spring. The respective rope tensioner 14 releases the overspeed governor rope 13 held by it into the shaft after deflection via a pulley provided for this purpose in the vertical direction.

[0054] In this way, the respective rope tensioner 14 can be mounted horizontally, as shown in Figure 1. This saves considerable installation space, as the car can be moved close to the horizontal rope tensioner 14.

[0055] As you can see from figure 1, the traction sheave diameter D is extremely small. It is preferably less than 230 mm and is ideally in the range of 180 mm. Preferably the deflection pulleys, which are not shown here, are also equipped with a remarkably small diameter. Their diameter is preferably less than 160 mm. In the ideal case given here, the diameter of the deflection pulleys is in the range of 135 mm.

[0056] Typically, a round or essentially round steel cable not shown here is used. Its diameter d is preferably less than 7.5 mm, ideally in the range of 6.5 mm. Typically, several such steel cables are arranged side by side without being directly connected to each other in any way, as would be the case, for example, with a belt with reinforcements in the form of usually thinner steel cores.

[0057] This means that the quotient of the traction sheave diameter D and the rope diameter d is normally less than 26.5. In the ideal case presented here, the quotient D/d is in the range of 24.6.

[0058] Figure 3 shows a schematic view from above into the shaft, in which the drive and the car guided on one pair of rails as well as the counterweight guided on another pair of rails are located.

[0059] Figure 3 illustrates how effectively the installation space in the shaft is used by this inventive embodiment.

[0060] It is easy to see how the pair of guide rails 3 of the car spans a first plane E1 and the pair of guide rails of the counterweight spans a second plane E2. It is also easy to see that plane E1 does not intersect the car's centre of gravity S but runs outside the car's centre of gravity S. The plane E1 does not intersect the car's centre of gravity S but runs outside the car centre of gravity S. Plane E1 is strongly eccentrically positioned in relation to the car's centre of gravity S. The Plane E1 is positioned in relation to the car's centre of gravity S. It is such that the dimension M1 is between 1/3 and 1/6 of the sum of the dimensions M1 and M2. As a result, the car is suspended in a similar way to a rucksack ("back-pack") elevator car, with the only difference that both guide rails do not face the same side wall of the car.

[0061] The car is suspended in block and tackle arrangememt, 2: 1. The suspension cable underneath the car does not cut the imaginary vertical line of the car's centre of gravity S either. Instead, the suspension cable strand underneath the car lies completely in the space between the plane stretched by the rails 3 of the car and the parallel plane running vertically through the car centre of gravity.

[0062] As can be seen, planes E1 and E2 are perpendicular to each other and the extension of plane E1 intersects plane E2 preferably in an area between the two guide rails 4 of the counterweight. The majority of the drive is located in the area between the opposing guide rails 4 of the counterweight.

[0063] In all cases, the rotation axes of the traction sheave 16 and the deflection pulleys 17 on the car and of at least one deflection pulley 18 on the counterweight are all aligned parallel to each other and to the plane spanned by the wall of the car or shaft wall closest to the traction sheave - the latter assuming a rectangular shaft cross-section.

[0064] This makes it possible to guide the central strand - viewed as a whole - as shown in Figure 4.

[0065] The car guide rails and the suspension means are designed so that the car can be moved in its uppermost position up to the horizontal plane or even a little beyond it, which defines the underside of the traction sheave.

[0066] The free end of the suspension means strand on the car side is not fixed to the shaft ceiling but to the shaft (side)wall, preferably in a position below the top edge of the car, which occupies this in the highest travel position of the car.

[0067] It is remarkable that the first section of the rope strand, which runs from the deflection pulley of the counterweight to the shaft end of the rope strand above the counterweight, runs through the shaft at an angle A to the vertical. The angle A is typically less than 10°.

[0068] In this way, the free end of the rope strand can be located above the counterweight, called the first section of the rope strand, in the following range: In the area between the second section of the rope extending from the at least one deflection pulley of the counterweight to the traction sheave and the third section of the rope train extending from the traction sheave to the deflection pulley of the car. There the end of the rope line can be attached to the console of the drive.

[0069] This is very effective from a structural point of view and also extremely space-saving - compared with the previous solutions in which the said first section of the rope strand runs between the second section of the rope strand and the shaft wall, i.e. not exactly below the traction sheave. In this way it is possible for the drive 19 to move extremely close to the car when viewed from above.

SECOND EMBODIMENT

[0070] Figures 8 and 9 provide a good overview of a second embodiment.

[0071] Here, too, the invention of elevator 1 is depicted in an elevator shaft 2. Once again the guide rails 3 of the car and the guide rails 4 of the counterweight 5 are clearly visible. Here too the car frame is provided with the reference number 6.

[0072] The car frame 6 here is designed as an L-shaped car frame for a backpack lift / Rucksackaufzug. A backpack lift is characterised by the fact that both car guide rails are located directly in front of one and the same side wall of the car.

[0073] Here too the car frame 6 consists of several vertical beams 7, the latter usually forming the long leg of the L-shaped car frame. The short leg of the L-shaped car frame is formed by the lower horizontal beams 9. These are connected with each other by several, here for example two horizontal cross beams 10.

[0074] The elevator cabin - blanked out in Fig. 8 and 9 - sits on the car frame 6 via load sensors 20. Load sensors 20 can be used to determine the current load in the car.

[0075] In addition, the two vertical beams 7 of the L-shaped car frame are connected to each other by a yoke 21. The yoke 21 can be mounted at variable height along the vertical beams 7 where it is needed. The yoke 21 carries the deflection pulleys of the car, which are not shown here, and which also hangs in 2:1 block and tackle arrangement in this embodiment.

[0076] This variant of the inventive elevator also has at least one, preferably two, folding maintenance supports 22. Here too, each of the maintenance supports can be brought into a vertical working position in which it defines a protective space (or "Schutzraum") between the elevator car and the shaft floor. In addition, each of the maintenance supports 22 can be brought into the horizontal rest position shown in particular in Figure 9, in which it releases the car's path until it lands on the buffer or buffers 23 in the shaft bottom.

[0077] The drive 19 can be clearly seen in figure 8. It is also positioned here in the shaft head. Here, too, a console 11 is provided for this purpose. As a rule, console 11 in this embodiment will rest on the guide rails 3 of the car. Optionally, it can also rest on the guide rails 4 of the counterweight, but this is not absolutely necessary. In this embodiment, a horizontal support is also provided, as a rule a pair of horizontal supports 12 is installed.

[0078] The overspeed governor described in the previous embodiment is also used here. Figure 8 shows its rope tensioner 14 and the overspeed governor rope 13.

[0079] The exact nature and operation of the overspeed governor is as described above. Therefore, unnecessary repetitions are avoided at this point. The only point to be made is that in this design example, too, the overspeed governor monitoring device is attached to the car frame itself and travels with the car.

[0080] What has already been said about the traction sheave diameter D, the rope diameter d and the ratio D/d in connection with the first embodiment also applies to this second embodiment. This embodiment also uses a not-shown round or essentially round steel cable. The same applies to this round steel cable.

[0081] Figure 6 illustrates how effectively the installation space in the shaft is used by this inventive embodiment.

[0082] Figure 6 clearly shows that the plane E1 spanned by the parallel guide rails 3 of the car is arranged parallel to the plane E2 spanned by the guide rails 4 of the counterweight 5. The parallel guide rails 4 of the counterweight are arranged at a smaller distance from each other than the parallel guide rails 3 of the car. In this way, the guide rails 4 for the counterweight can move closer to the guide rails 3 for the car. This is because the counterweight 5 protruding horizontally over the guide rails can also use the space between the parallel guide rails 3 for the car.

[0083] Also in this embodiment, the rotation axes of the traction sheave 16 and the deflection pulleys 17 on the car as well as of the at least one deflection pulley 18 on the counterweight are all parallel to each other. They are arranged parallel to the wall of the car or shaft wall closest to the traction sheave - the latter requiring a rectangular shaft cross-section.

[0084] This makes it possible to guide the central (rope or belt) strand as a whole as shown in Figure 7. Here, too, the car guide rails and the strand are designed in such a way that the car can be moved in its uppermost position up to the horizontal plane or even a little beyond it, which defines the underside of the traction sheave.

[0085] Here, too, the free end of the suspension rope (strand) is not fastened to the shaft ceiling on the car side, but to the shaft wall. Preferably, the attachment is also positioned below the upper edge of the car, which occupies it in the highest position.

[0086] It is noteworthy that the first section of the rope strand, which runs from the deflection pulley of the counterweight to the shaft end of the rope strand above the counterweight, usually runs vertically through the shaft. On the other hand, the second section of the rope strand, which extends from the deflection pulley of the counterweight to the traction sheave, is generally inclined at an angle B to the vertical. The angle B is regularly less than 10°.

[0087] In this way, enough space is created to be able to attach the first section of the rope strand with its free end underneath the drive, usually to its console 11. This is very effective in terms of construction and also extremely space-saving.

[0088] Because the first end of the rope strand comes between the second section of the rope strand and the third section of the rope strand, both of which are suspended from the traction sheave. It's space-saving.

PARTICULARLY SPACE-SAVING DESIGN OF THE CAR FRAME

[0089] Figures 10 and 11 show a particularly space-saving way of designing the car frame. Such a designing is shown here using the example of the L-shaped car frame for the second embodiment in the form of the back-pack elevator.

[0090] But the invention is not limited to this. The same measure can also be applied to a car frame which holds the car in a sling-like fashion according to what has been explained for the first embodiment.

[0091] The figures 10 and 11 clearly show the lower horizontal beams 9 of the car frame already explained. These are connected with each other by horizontal cross beams 10, here two pieces.

[0092] Also clearly visible in figures 10 and 11 are the maintenance supports 22, which are shown "floating" but which are in reality fixed to the bottom of the shaft.

[0093] The decisive point now is that the lower horizontal cross beams 10 of the car frame have at least a first recess 24 at their lower flank facing the shaft bottom. As can best be seen from Figure 8, this recess 24 creates a sufficient safety distance SI to the maintenance supports 22, which are horizontally aligned on the shaft floor.

[0094] As can be clearly seen, the recess 24 is arranged in the middle area of each horizontal cross beam 10. It is framed here by the free ends 25 of the cross beam 24, which are not recessed in the same sense. Of course, instead of a single continuous recess 24, which accommodates both maintenance supports 22, a pair of two separately arranged individual recesses 24, each of which accommodates a single maintenance support 22, can also be provided, for example.

[0095] On the basis of the figures 8 and 9 there is still another inventive feature to be recognized.

[0096] The cross beam 10 each carry a second recess 26 at their free ends 25. This recess 25 is made in the upper flank of the free end 25, which faces the floor of the elevator car.

[0097] If more than two cross-beams 10 are provided, then at least two of these cross-beams 10 will carry such a second recess.

[0098] The second recess 26 is used as installation space for a load sensor 20. The load of the car can be determined with the help of the load sensor 20, or from the interaction of all load sensors 20. The second recess 26 gives the respective load sensor 20 space without the car having to build noticeably higher in the vertical direction.

MISCELLANEOUS

[0099] Independent from what has been said before we reserve the option to formulate the claims according to one of the following paragraphs, too - potentially combined with additional technical features disclosed by the text before or by the explicitly defined claims comprised by today's claim set:

[0100] An Elevator with an elevator car consisting of an elevator car frame which is suspended from a supporting means and carries a platform or an elevator car, with a counterweight suspended from the supporting means and with guide rails along which the elevator car and the counterweight can be moved up and down in an elevator shaft, with a speed limiter for detecting an inadmissible travel condition of the elevator car, characterized in that the speed limiter comprises a speed monitoring element which travels which the car and evaluates the speed of the car relative to a belt which is tensioned along the route through the shaft and along which it rolls, the belt being pre-stressed by at least one belt tensioner which generates a pre-stressing force which acts in the horizontal direction at the end of the belt and which has a deflecting element via which the belt leaves the belt tensioner in the vertical direction into the lift shaft.

[0101] A traction sheave elevator, preferably according to one of the preceding claims, having a car which is suspended from a supporting means, having a counterweight suspended from the supporting means, and having guide rails along which the car and the counterweight can be moved up and down in an elevator shaft, the car frame surrounding the car cabin or car platform on four sides, characterized in that the parallel rails of the car span a first plane which extends outside the car's centre of gravity in such a way that between 1/3 and 1/5 of the car lie on one side of this first plane and between 2/3 and 4/5 of the car lie on the other side of this first plane, and the parallel rails of the counterweight span a second plane which is arranged at an angle of substantially 90° to the second plane.

[0102] A traction sheave elevator having a car which is suspended from a suspension means, having a counterweight suspended from the suspension means, and having guide rails along which the car and the counterweight can be moved up and down in an elevator shaft, the elevator being designed as a backpack elevator and the parallel guide rails of the car being arranged in such a way, that they span a car guide rail plane and the parallel guide rails of the counterweight are arranged to span a counterweight guide rail plane, characterized in that the car guide rail plane and the counterweight guide rail plane are parallel to each other and spaced from each other and the distance of the parallel guide rails of the car from each other is greater than the distance of the parallel guide rails of the counterweight from each other.

LISTING OF REFERENCE NUMBERS

[0103]

1 Elevator
2 Elevator shaft
3 Car guide rails
4 Guide rails of the counterweight
5 Counterweight
6 Car frame
7 Vertical supports of the car frame
8 Upper horizontal supports of the car frame
9 Lower horizontal supports of the car frame
10 Horizontal cross members of the car frame (bottom)
11 Console
12 Horizontal support
13 Overspeed governor rope
14 Rope tensioner
15 Overspeed governor monitoring device
16 Traction sheave
17 Deflection pulley of car
18 Deflection pulley of counterweight
19 Drive
20 Load sensors
21 Yoke
22 Maintenance support
23 Buffer in the shaft bottom
24 First recess
25 Free end of a horizontal cross beam
26 Second recess
27 Car

D Traction sheave Diameter
d its diameter
E1 Level 1 between the car guide rails
E 2 Level 2 between the guide rails of the counterweight
A Angle
B Angle
SI Safety distance
M1 Dimension 1
M2 Dimension 2

Claims

1. Elevator with a car consisting of a car frame suspended from a supporting means and carrying a platform or an elevator cabin, with a counterweight suspended from the supporting means and with guide rails along which the car and the counterweight can be moved up and down in an elevator shaft,
and at least one folding maintenance support, which can be brought into a vertical working position in which it defines a protective space between the car and the bottom of the shaft,
and which can be brought into a horizontal rest position in which it releases the car's path until the car lands on the buffer or buffers in the shaft floor,
characterized in that
the car frame has at least one lower, horizontally extending cross beam which has at least one first recess on its lower flank which forms a free space into which the at least one maintenance support located in its horizontal rest position can be inserted.

2. Elevator according to claim 1, **characterized in that** the lower cross beam has on both sides, in addition to its first recess, on its upper flank in each case a second recess for receiving a load sensor.

3. Elevator according to one of the preceding claims, **characterized in that** the car carries a telescopic car apron.

4. Elevator according to one of the preceding claims, with an elevator car consisting of an elevator car frame which is suspended from a supporting means and carries a platform or an elevator car, with a counterweight suspended from the supporting means and with guide rails along which the elevator car and the

counterweight can be moved up and down in an elevator shaft, with a speed limiter for detecting an inadmissible travel condition of the elevator car, **characterized in that** the speed limiter comprises a speed monitoring element which travels which the car and evaluates the speed of the car relative to a belt which is tensioned along the route through the shaft and along which it rolls, the belt being pre-stressed by at least one belt tensioner which generates a pre-stressing force which acts in the horizontal direction at the end of the belt and which has a deflecting element via which the belt leaves the belt tensioner in the vertical direction into the lift shaft.

5. Traction sheave elevator, according to one of the preceding claims, having a car which is suspended from a supporting means, having a counterweight suspended from the supporting means, and having guide rails along which the car and the counterweight can be moved up and down in an elevator shaft, the car frame surrounding the car cabin or car platform on four sides, **characterized in that** the parallel rails of the car span a first plane which extends outside the car's centre of gravity in such a way that between 1/3 and 1/5 of the car lie on one side of this first plane and between 2/3 and 4/5 of the car lie on the other side of this first plane, and the parallel rails of the counterweight span a second plane which is arranged at an angle of substantially 90° to the second plane.

6. Traction sheave elevator according to claim 5, **characterized in that** the extension of the first plane in the direction towards the rails of the counterweight intersects the second plane in the region between the opposing rails of the counterweight.

7. Traction sheave elevator according to claim 5 or 6, **characterized in that** the car is suspended in block and tackle arrangement 2:1 and the suspension cable strand below the car does not intersect the imaginary vertical line extending from the car's centre of gravity.

8. Traction sheave elevator according to one of claims 5 or 6, **characterized in that** the elevator car and the counterweight are suspended in block and tackle 2:1 arrangement, **in that** the axis of rotation of the traction sheave lies parallel to the shaft wall closest to the traction sheave and the axes of rotation of all deflection pulleys are arranged parallel to the axis of rotation of the traction sheave, **in that** the suspension means consists of a rope strand of a plurality of unconnected steel round ropes running parallel to one another, the counterweight being guided in the shaft in such a way, **in that** the first section of the rope strand, which leads from the deflection pulley of the counterweight to the shaft-mounted end of the rope strand, extends through the shaft at an angle A with respect to the vertical, and **in that** the first section of the rope strand, which leads from the end of the rope strand to the deflection pulleys of the counterweight, extends between the second section of the rope strand and a third section of the rope strand, which extends from the traction sheave to the deflection pulleys of the car.

9. Traction sheave elevator according to one of the preceding claims, having a car which is suspended from a suspension means, having a counterweight suspended from the suspension means, and having guide rails along which the car and the counterweight can be moved up and down in an elevator shaft, the elevator being designed as a backpack elevator and the parallel guide rails of the car being arranged in such a way, that they span a car guide rail plane and the parallel guide rails of the counterweight are arranged to span a counterweight guide rail plane, **characterized in that** the car guide rail plane and the counterweight guide rail plane are parallel to each other and spaced from each other and the distance of the parallel guide rails of the car from each other is greater than the distance of the parallel guide rails of the counterweight from each other.

10. Traction sheave elevator according to claim 5 or 9, **characterized in that** the drive, seen in its projection along the travel direction of the car in the shaft, is arranged between the guide rails of the car, and the predominant part of the plane spanned by the guide rails of the counterweight is arranged within said projection of the drive.

11. Traction sheave elevator according to claim 5, 6, 9 or 10, **characterized in that** the elevator car and the counterweight hang in block and tackle arrangement, **in that** the axis of rotation of the traction sheave lies parallel to the shaft wall closest to the traction sheave and the axes of rotation of all deflection pulleys are arranged parallel to the axis of rotation of the traction sheave, **in that** the supporting means consists of a rope strand of a plurality of unconnected steel round ropes running parallel to one another and the counterweight is guided in the shaft in such a way, **in that** the second portion of the rope strand, which extends from the traction sheave to the deflection pulleys of the counterweight, extends through the shaft at an angle B with respect to the vertical, and **in that** the first portion of the rope strand, which extends from the end of the rope strand to the deflection pulleys of the counterweight, extends between said second portion of the rope train and a third portion of the rope strand, which extends from the traction sheave to the deflection pulleys of the car.

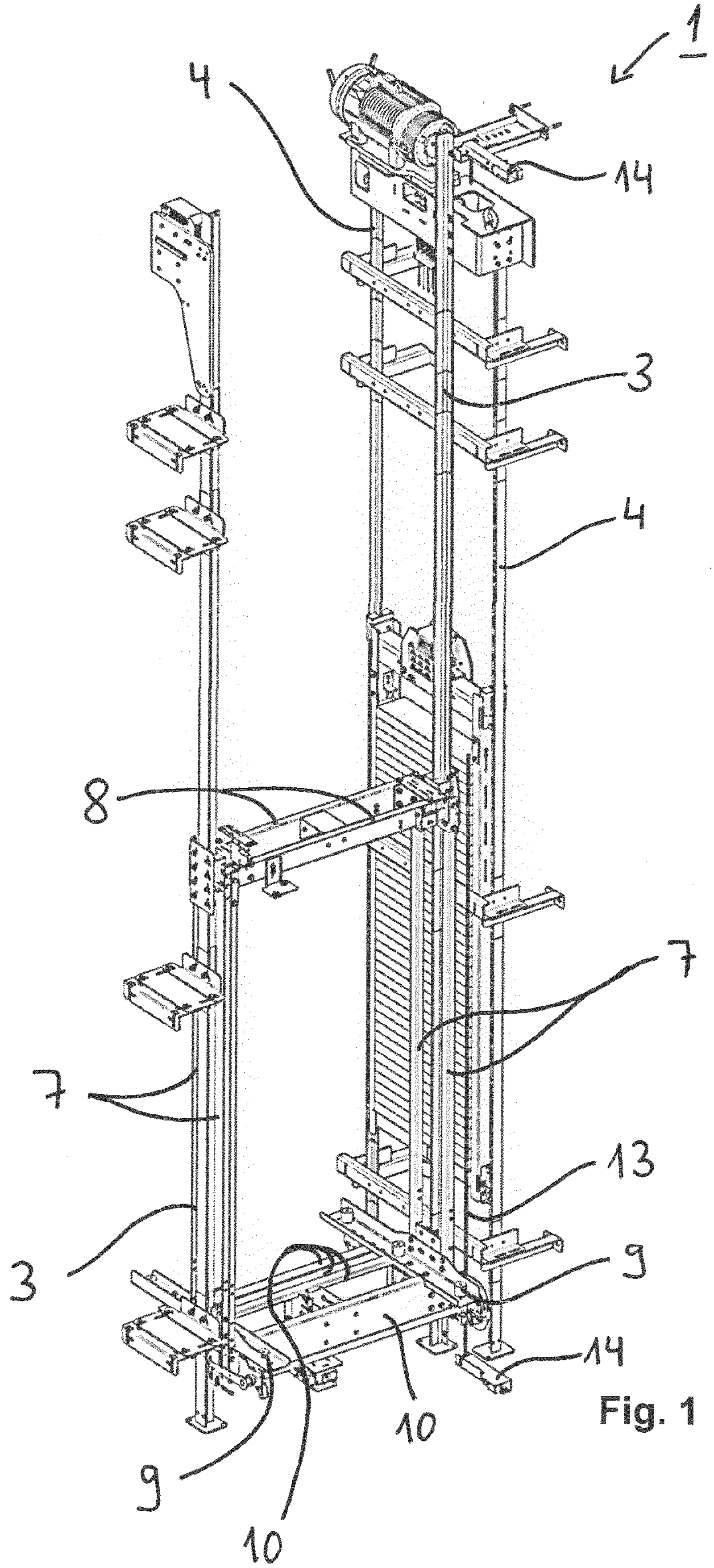

Fig. 1

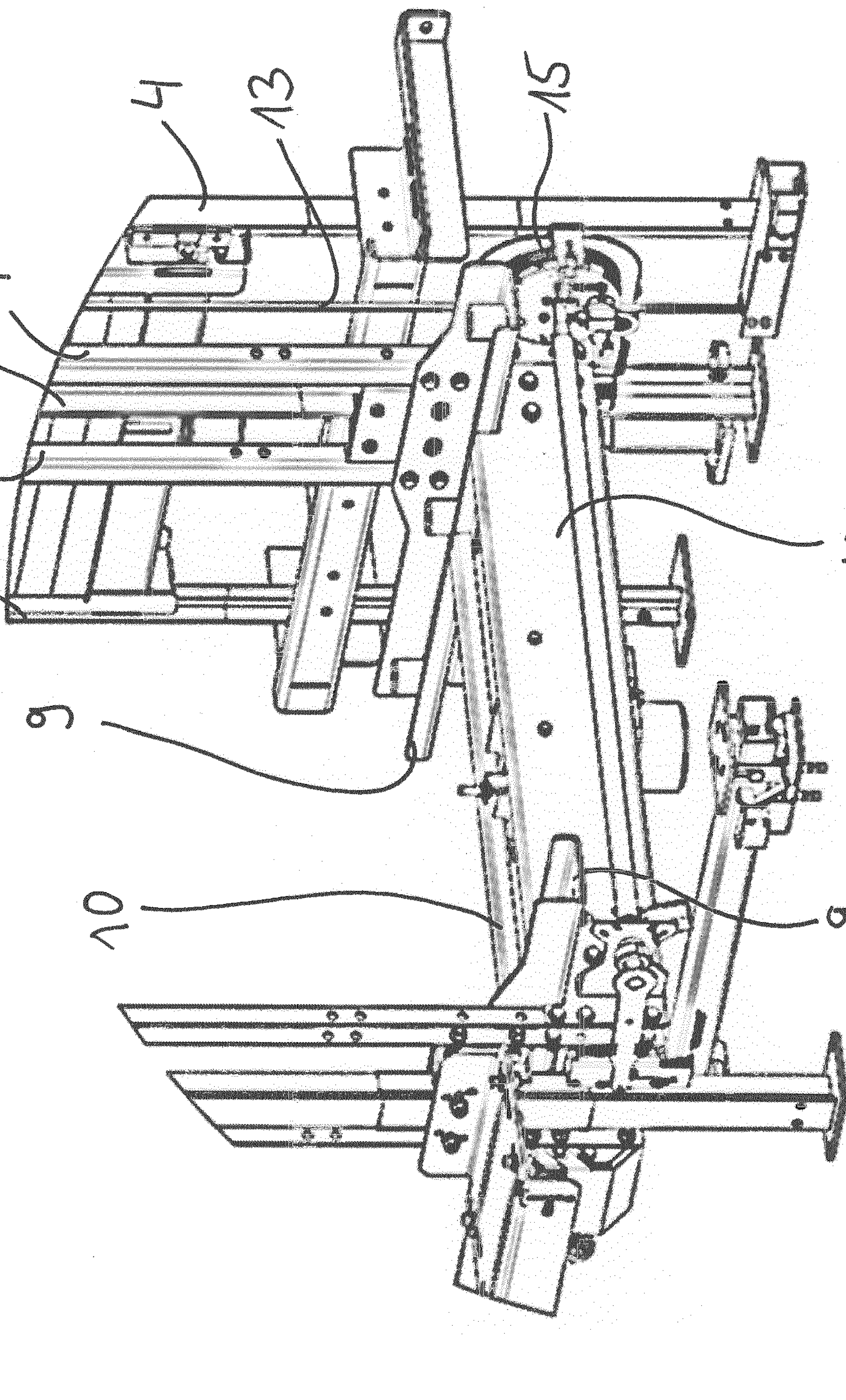

Fig. 2

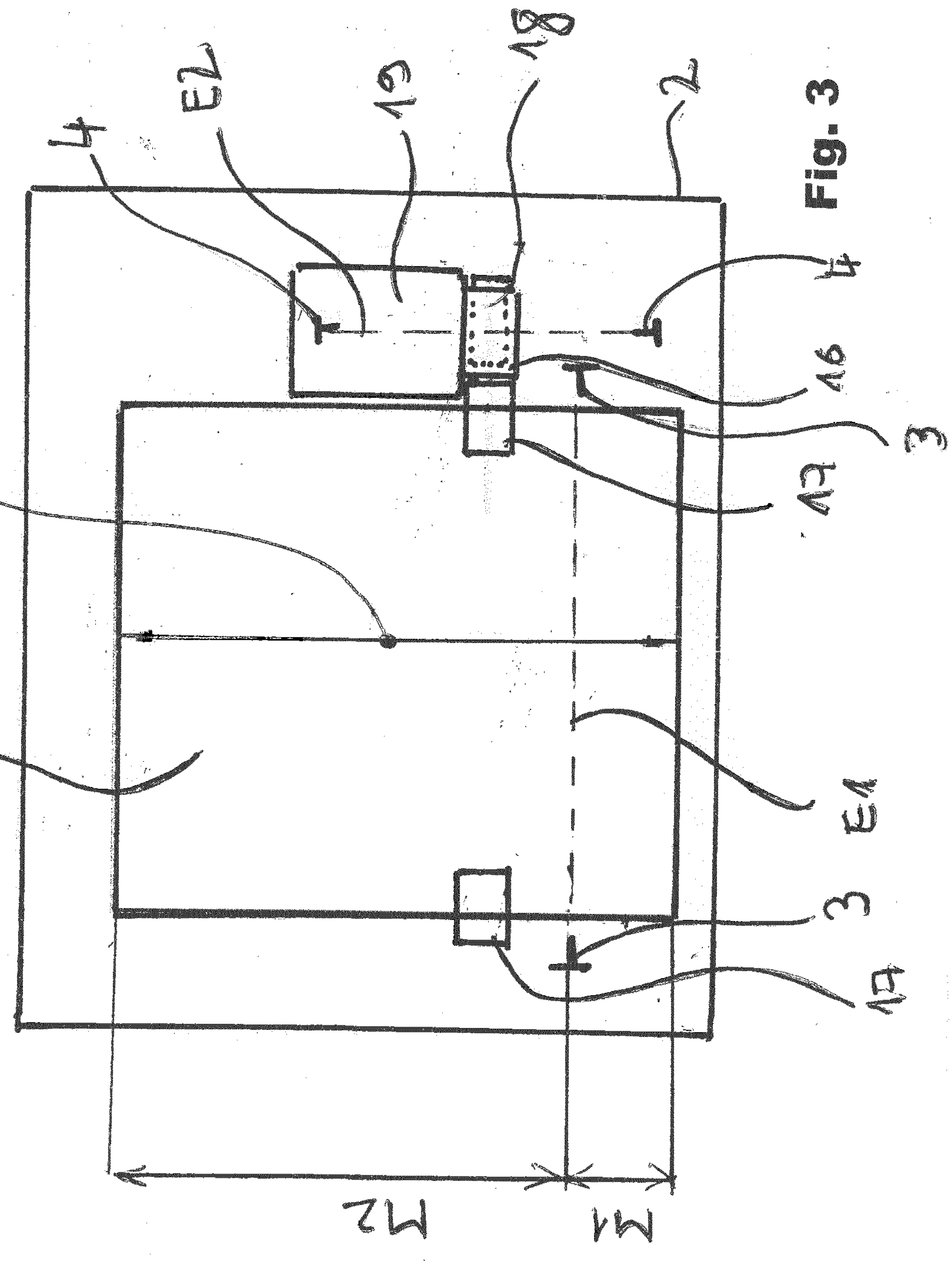

Fig. 3

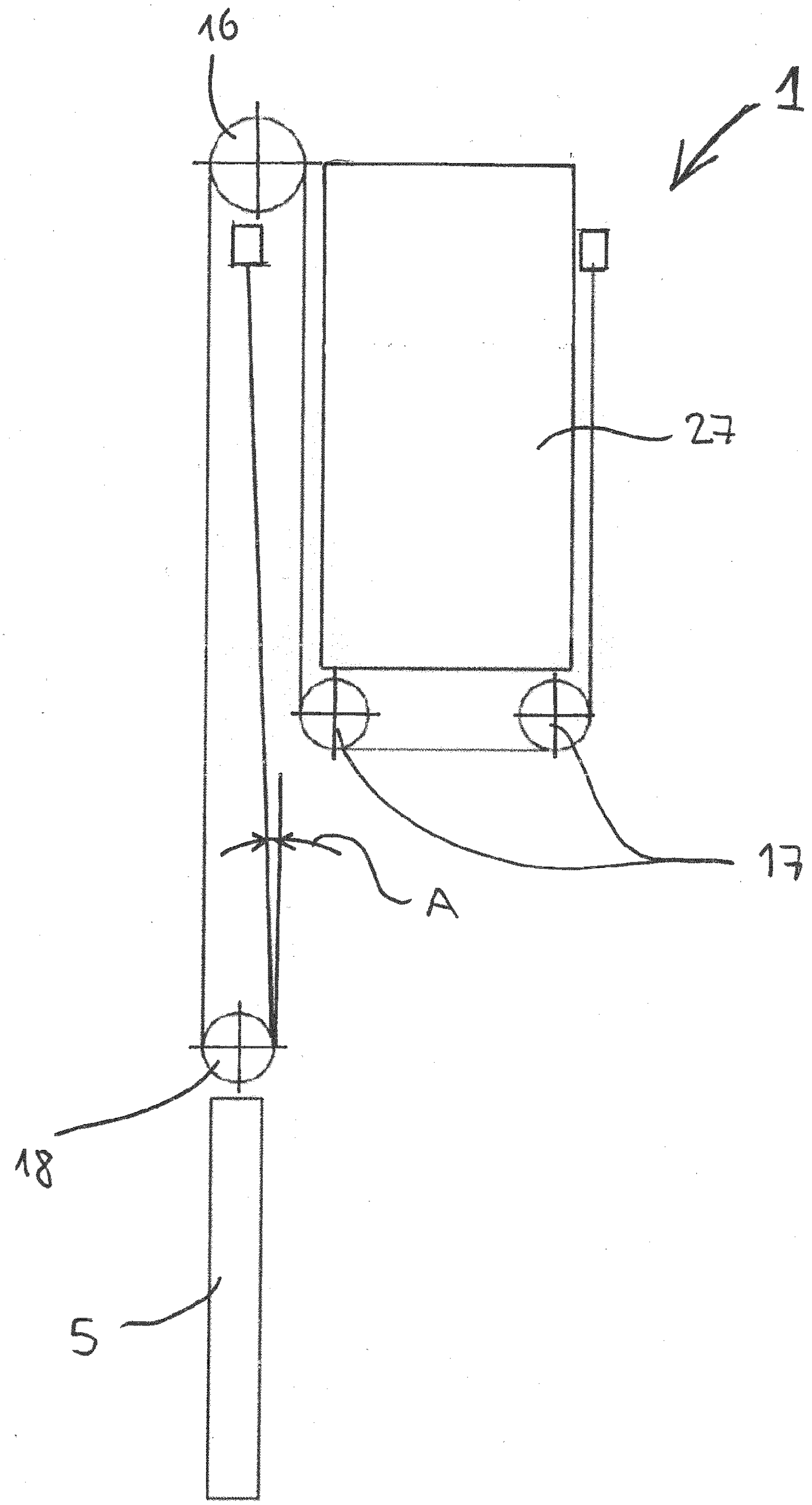

Fig. 4

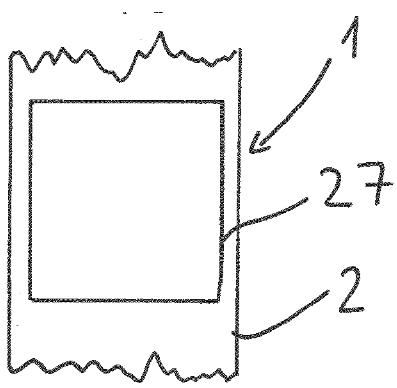

Fig. 5

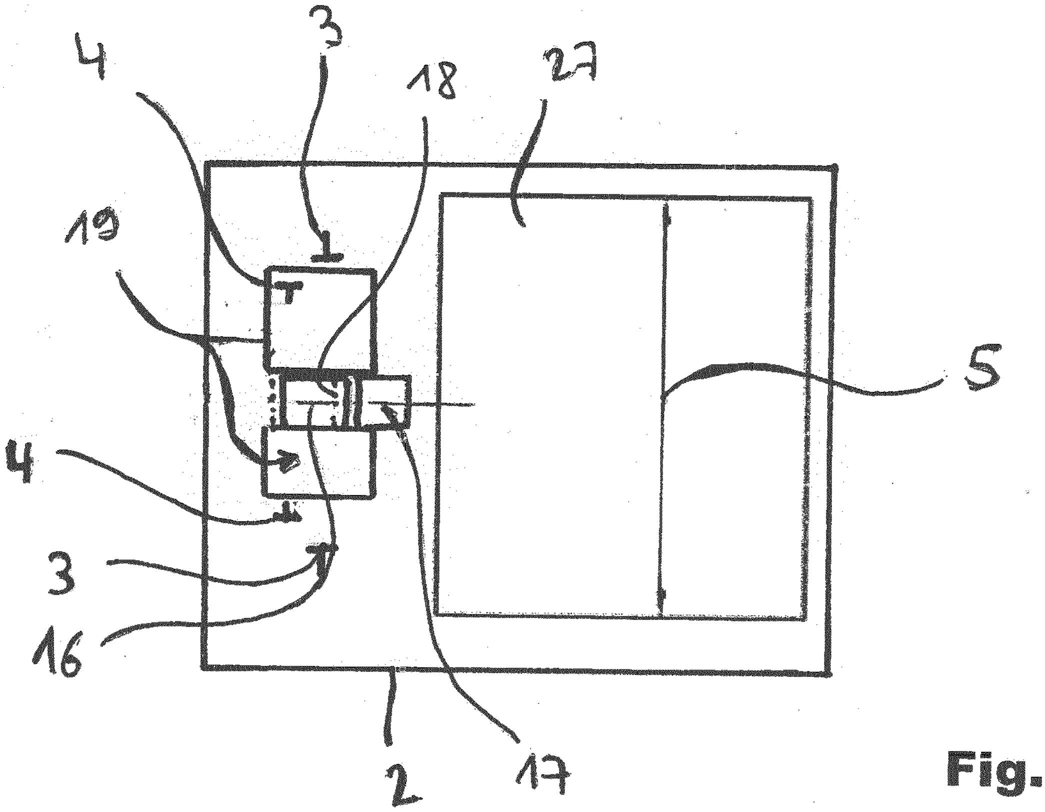

Fig. 6

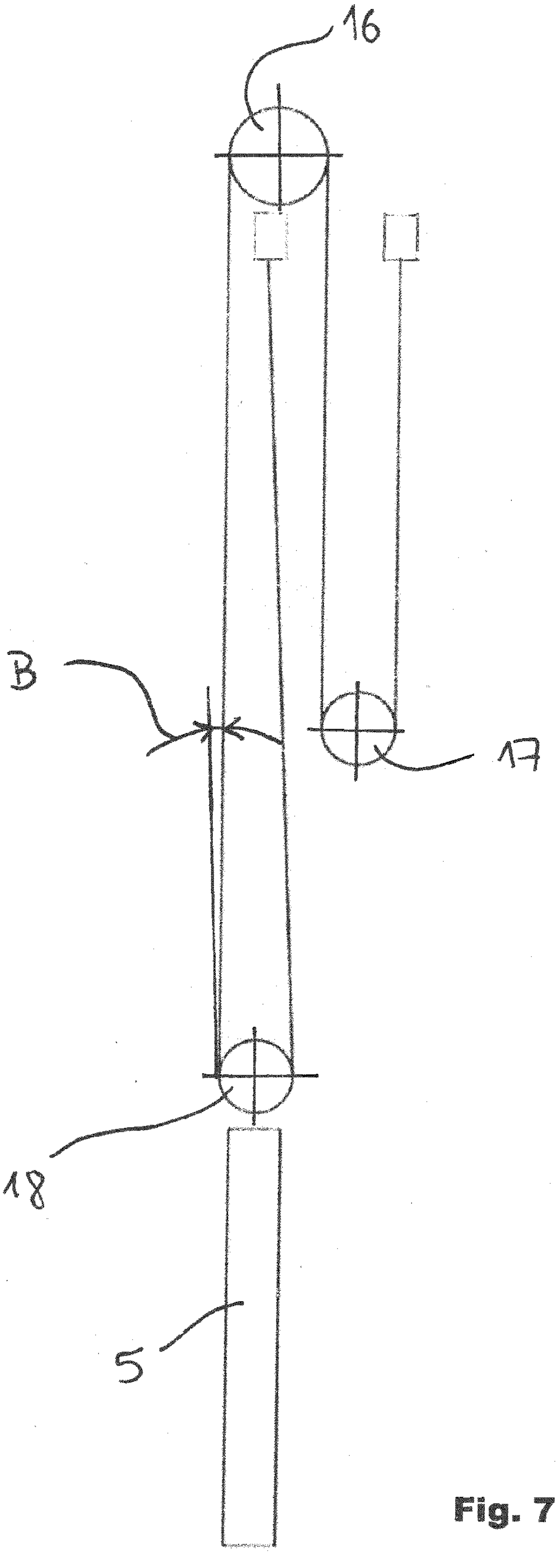

Fig. 7

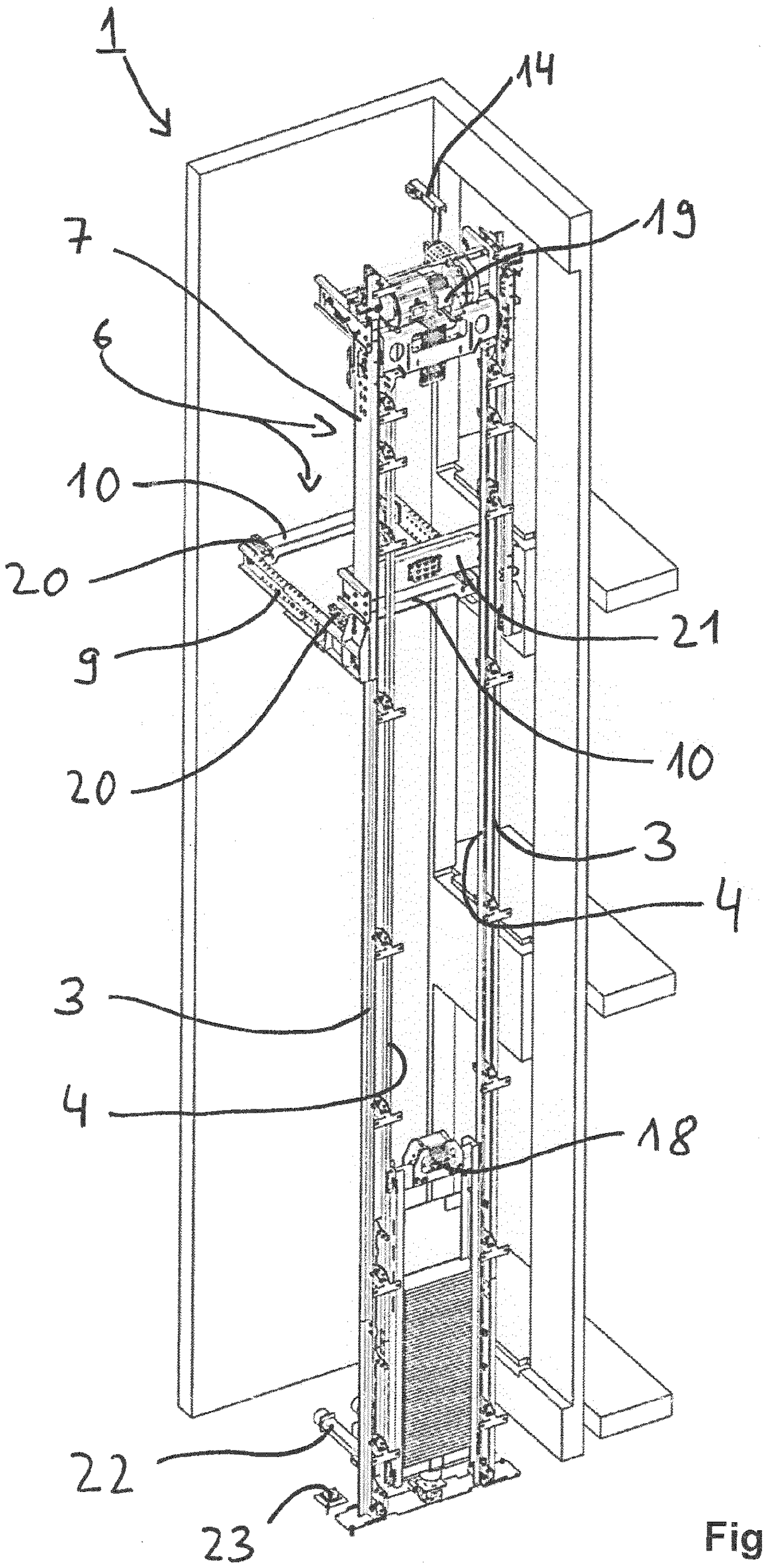

Fig. 8

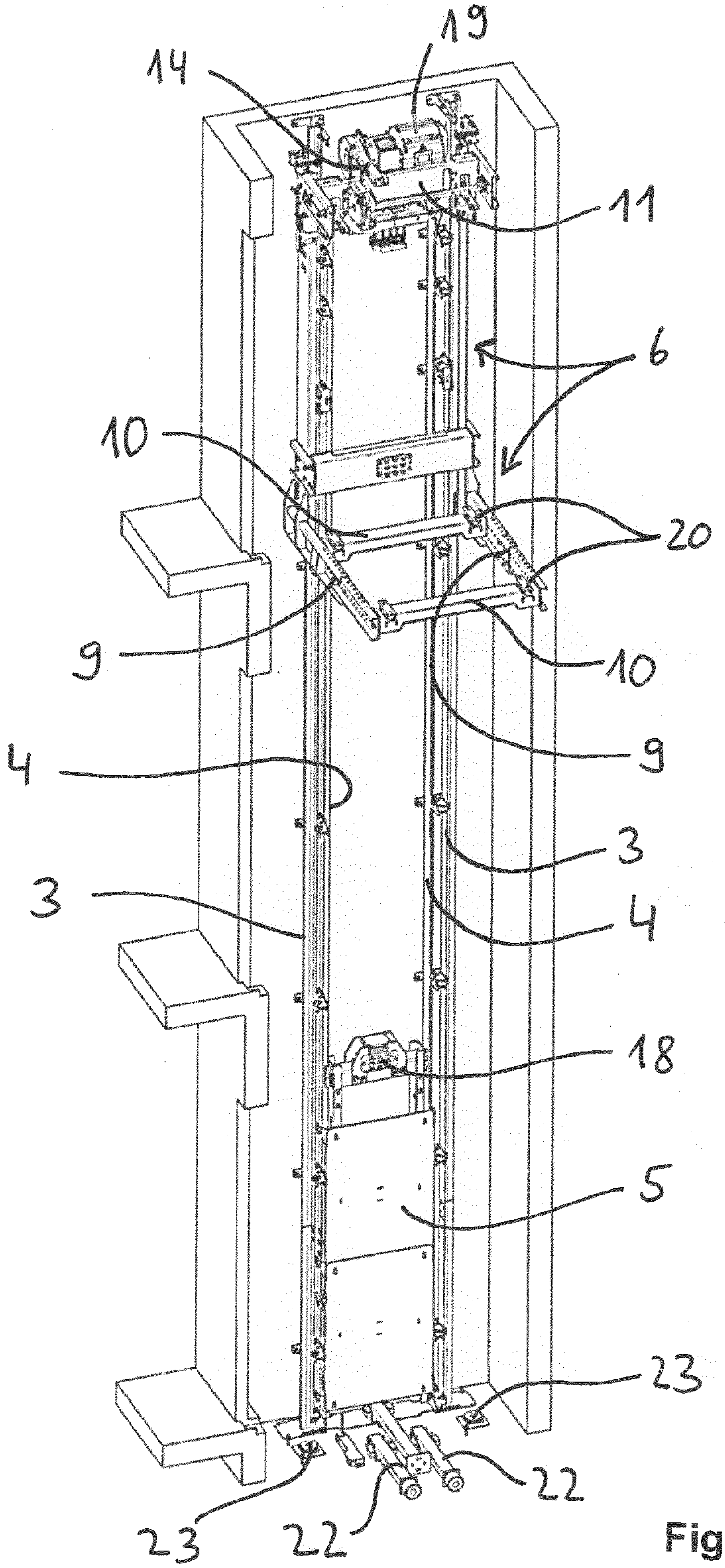

Fig. 9

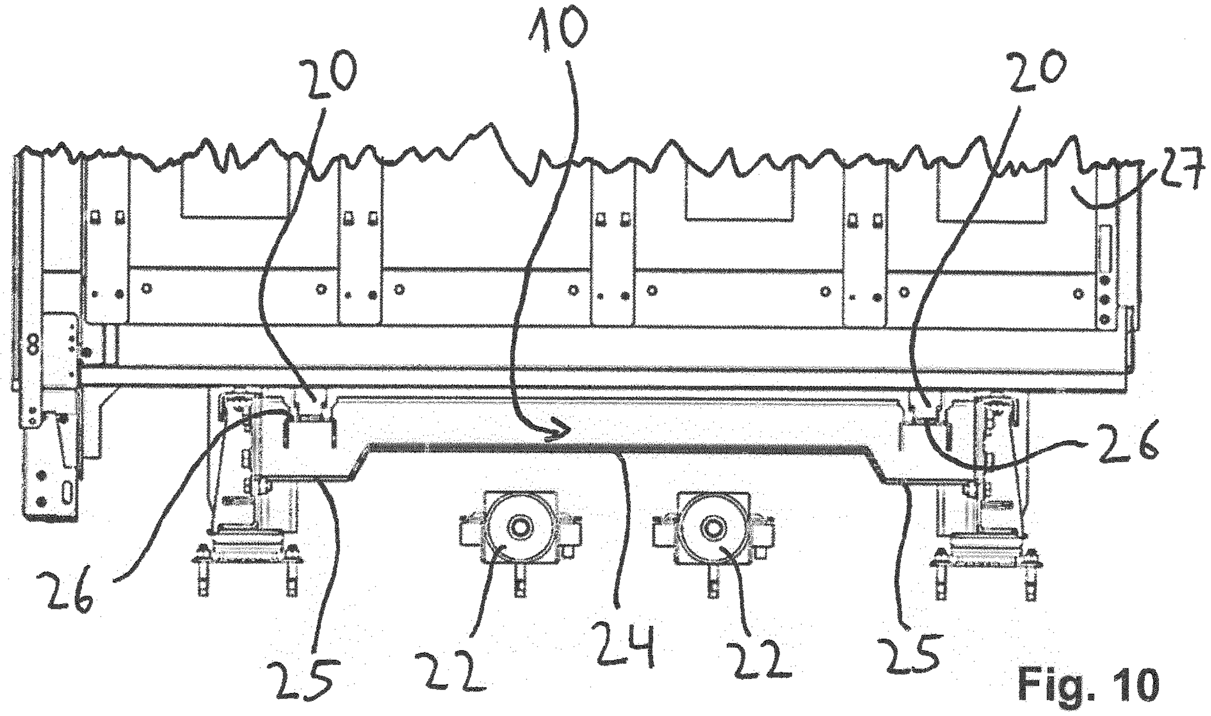

Fig. 10

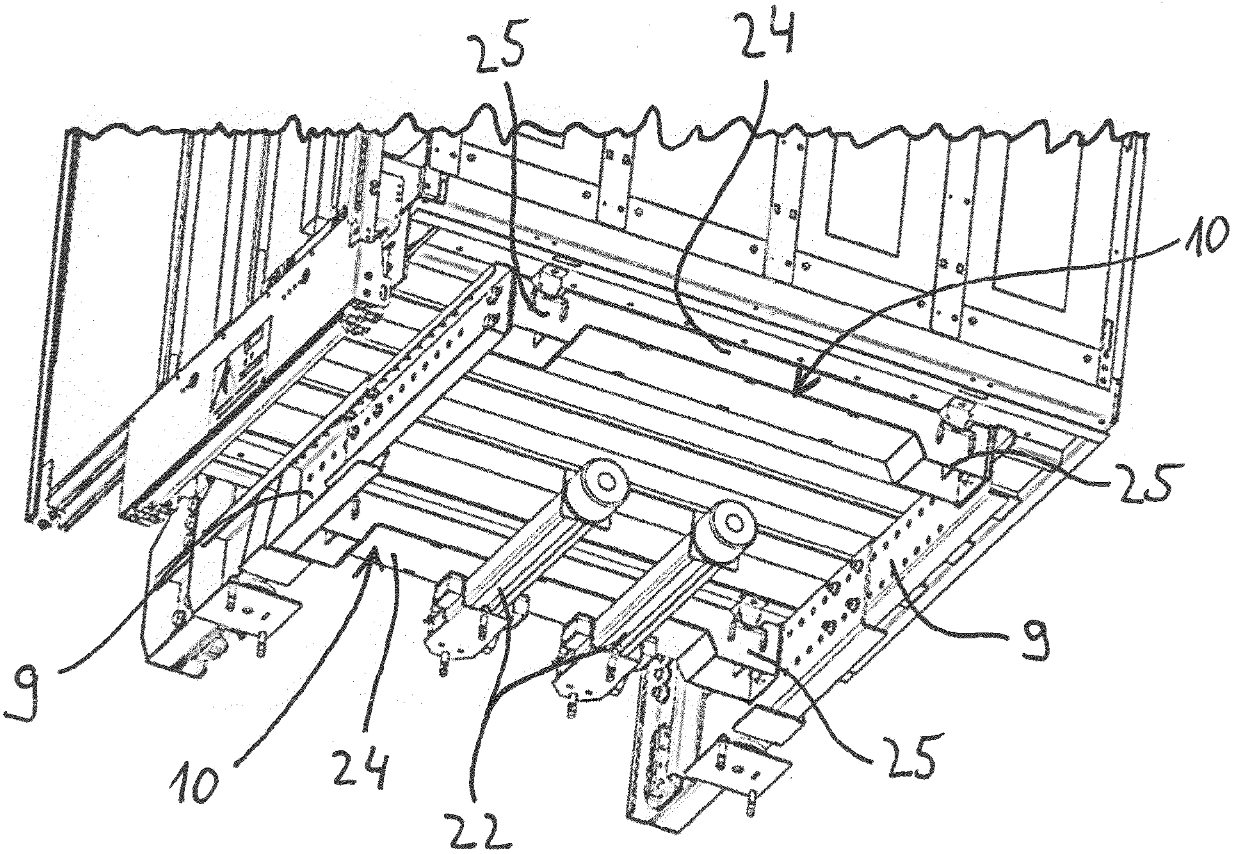

Fig. 11