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(54) METHOD AND ARRANGEMENT FOR MODERNIZING AN ELEVATOR

VERFAHREN UND VORRICHTUNG ZUR MODERNISIERUNG EINES AUFZUGS

PROCEDE ET SYSTEME POUR MODERNISER UN ASCENSEUR

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Description

[0001] The present invention relates to a method as defined in the preamble of claim 1 for modernizing the hoisting function of an elevator and to a modernization arrangement as defined in the preamble of claim 5.

[0002] An important aim in elevator development work has been to achieve efficient and economical utilization of building space. In prior-art elevator solutions provided with a machine room or a corresponding space, the placement of the hoisting machine and the space required by it limit the freedom of choice in elevator layout solutions. Additional space is required for the arrangements for rope passage between the machine room and the elevator shaft. The size and weight of especially a machine designed for larger loads, higher speeds and/or greater hoisting heights are a problem in respect of installation because it is not always possible to place the machine and the diverting pulleys in the required positions due to insufficient space.

[0003] Specification WO 99/43589 discloses an elevator suspended using flat belts wherein relatively small belt bending diameters on the drive sheave and diverting pulleys are achieved. Problems with this solution, however, are a limited layout solution, placement of components in the elevator shaft and alignment of the diverting pulleys. Moreover, the alignment of the polyurethane-coated belts used, which have a load-bearing steel component inside them, is problematic e.g. in a situation where the car is tilted. In an elevator implemented in this manner, at least the machine and/or the structures on which it is secured in place must be fairly massive to avoid undesirable vibrations. Also, the massive construction of the rest of the elevator structure needed in order to maintain the mutual alignment of the diverting pulleys and the traction sheave increases the weight and cost of the elevator. In addition, the installation and adjustments of such a system are difficult tasks requiring great precision.

[0004] The WO 02/26611 discloses an elevator having a car and a counterweight which are suspended with a 4:1 ratio whereby the drive machine of that elevator is located in the elevator shaft between the path of the elevator car and the shaft wall.

[0005] In connection with modernization of an elevator it is possible to alter the suspension of the elevator by replacing an earlier 1:1 or 2:1 suspension arrangement with a 4:1 suspension arrangement. This makes it possible to use a hoisting machine and diverting pulleys of a smaller size, which will be easier to place in appropriate positions in respect of elevator layout. In the case of elevators with machine room, however, there is the problem that the number of holes through the bottom of the machine room has to be increased to allow all the new rope passages needed in 4:1 suspension to be implemented. However, making new holes in the bottom of the machine room is expensive and hazardous because there may be reinforcement bars or the like in the bottom structure just where a new hole should be made. In previously known solutions, enlarging the old holes has not been sufficient. Often in the case of a machine room disposed above the shaft, another problem is how to pass the elevator hoisting ropes from the machine room to the elevator car and counterweight in the shaft.

[0006] The object of the present invention is to.overcome the above-mentioned drawbacks and to reduce the size and weight of an elevator machine by providing an economical and simple-and-easy-to-implement possibility of using drive and diverting pulleys of a smaller diameter by changing the elevator suspension in connection with modernization into a 4:1 suspension arrangement. The inventive concept can be applied by replacing 1:1 or 2:2 suspension with suspension other than 4:1, e.g. with 6:1 suspension. The invention also aims at reducing the consumption of electric energy.

[0007] The method of the invention for modernizing the hoisting function of an elevator is characterized by what is disclosed in the characterization part of claim 1, and the modernization arrangement of the invention is characterized by what is disclosed in the characterization part of claim 5. Other embodiments of the invention are characterized by what is disclosed in the other claims.

[0008] By applying the invention, one or more of the following advantages, among others, can be achieved:

- due to thin hoisting ropes and 4:1 suspension, the traction sheave and the diverting pulleys are small and light as compared with those used in conventional elevators
- with a small traction sheave, the operating brakes of the elevator are smaller
- due to the small traction sheave, the torque requirement is lower, and thus both the motor and its operating brakes can be smaller
- due to the smaller traction sheave and 4:1 suspension, a higher rotational speed is needed to achieve a given speed of the elevator car, so the same motor output power is achieved with a smaller motor
- the use of a small traction sheave makes it possible to use an elevator drive motor of smaller size, which means a reduction of the acquisition/manufacturing costs of the drive motor
- the small size and thin ropes allow relatively easy disposition of the elevator machine in the machine room
- in elevators applying the invention, centric suspension of the elevator car and counterweight can be easily arranged, thus reducing the lateral supporting forces imposed on the guide rails

- when the invention is applied, the cross-sectional area of the elevator shaft can be effectively utilized
- the invention reduces the elevator installation time and the total installation costs as compared to a situation where new holes would have to be made in the bottom of the machine room
- the light, thin and easy-to-handle ropes and the possibility to drop the ropes from the machine room into the elevator shaft allow considerably easier and faster installation
- by using ropes of a diameter of about 4 mm, fairly large elevators according to the invention can be achieved
- the invention is applicable in geared and gearless elevator motor solutions.

[0009] The primary sphere of application of the invention is in elevators designed for the transportation of people and/or freight. The elevator solution of the invention uses ropes that are thinner than those used before in elevators to be modernized, preferably substantially thin ropes having a diameter of e.g. about 4 mm or even less. This allows a definite reduction in the size of the traction sheave and diverting pulleys.

[0010] In the following, the invention will be described in detail with reference to an embodiment example and the attached drawings, wherein

Fig. 1 presents a diagrammatic view of an elevator modernized by the method of the invention, seen obliquely from above, in which an earlier 1:1 suspension has been replaced with 4:1 suspension,

Fig. 2 presents a diagrammatic view of an elevator modernized according to another embodiment of the method of the invention, seen obliquely from above, in which an earlier 1:1 suspension has been replaced with 4:1 suspension,

Fig. 3 is a diagrammatic top view illustrating the manner in which the elevator hoisting ropes are installed in Fig. 1 through holes in the floor of the machine room above the elevator shaft,

Fig. 4 is a diagrammatic top view showing the solution of Fig. 1 applied in a different layout solution,

Fig. 5 is a diagrammatic side view illustrating the manner in which the diverting pulley and the hoisting rope anchorage are disposed in the machine room in Fig. 1, and

Fig. 6 is a diagrammatic side view illustrating a second manner in which the diverting pulley and the hoisting rope anchorage are disposed in the machine room as in Fig. 2.

[0011] Fig. 1 presents a typical elevator suspension solution 1 according to the invention, wherein an earlier 1:1 suspension has been changed to a 4:1 suspension by using openings 16a and 16b ready made in the machine room floor 15. The elevator hoisting machine is connected via a traction sheave 10 to a set of hoisting ropes, consisting of mutually parallel hoisting ropes 4 of e.g. substantially round cross-section and supporting the counterweight 3 and elevator car 2 moving along their tracks, i.e. guide rails. For the sake of clarity, only one of the parallel hoisting ropes 4 is shown in the figure.

[0012] The parallel hoisting ropes 4 are attached by their first end to a fixed starting point 5 in the machine room above the elevator shaft, from where the hoisting ropes go downwards through an opening 16a in the machine room floor 15 towards a first diverting pulley 6 connected to the counterweight 3 and disposed e.g. on the top of the counterweight 3. From diverting pulley 6, the elevator hoisting ropes go upwards to a second corresponding diverting pulley 7 disposed in the machine room above the elevator shaft. The ropes going upwards are passed through the opening 16a in the machine room floor 15.

[0013] Having passed around the traction sheave 7, the ropes 4 go again downwards through the opening 16a to a second diverting pulley 8 which is mounted on the top of the counterweight 3 and which is of the same size with the first diverting pulley 6 and is placed right beside the latter, both diverting pulleys 6 and 8 being mounted on the same shaft so as to be freely rotatable with respect to each other and so that diverting pulley 8 and the first diverting pulley 6 rotate about the common shaft in opposite directions in such manner that the mutual circumferential speed of the parallel diverting pulleys of the elevator with 4:1 suspension is 2:1, in other words, the circumferential speed of one of the parallel diverting pulleys is twice that of the other. Having passed around diverting pulley 8, the hoisting ropes 4 go upwards through the opening 16a in the machine room floor to a diverting pulley 9 mounted on the elevator machine in the machine room. Thus, the ropes 4 are passed four times through opening 16a.

[0014] Having passed over diverting pulley 9, the hoisting ropes 4 pass over the traction sheave 10 and go again downwards into the elevator shaft from the machine room through a second opening 16b in the machine room floor 15. The horizontal distance between the ropes passed over diverting pulley 9 and the traction sheave 10 is adjusted by means of the diverting pulley 9 to adapt it to the horizontal distance between the openings 16a and 16b. From the traction sheave 10 the hoisting ropes 4 go downwards to a first diverting pulley 11 placed on the top of the elevator car 2, and having passed around this diverting pulley the ropes go up again through the opening 16b in the machine room floor 15 to a diverting pulley 12 placed in the machine room.

[0015] Having passed around diverting pulley 12, the hoisting ropes 4 go again downwards through opening 16b to a second diverting pulley 13 placed on the top of

the elevator car 2, which diverting pulley is of the same size with the first diverting pulley 11 and is placed right beside the latter, both diverting pulleys 11 and 13 being mounted on the same shaft so as to be freely rotatable with respect to each other and so that diverting pulley 13 and the first diverting pulley 11 rotate about the common shaft in opposite directions in such manner that the mutual circumferential speed of the parallel diverting pulleys of the elevator with 4:1 suspension is 2:1, in other words, the circumferential speed of one of the parallel diverting pulleys is twice that of the other. Having passed around diverting pulley 13, the hoisting ropes 4 go upwards again through the same opening 16b in the machine room floor to a fixed anchorage 14 in the machine room. Thus, the ropes 4 are passed four times through opening 16b as well.

[0016] To make it possible for the hoisting ropes 4 to be passed four times through each opening 16a and 16b in the machine room floor 15, the fixed points 5 and 14, diverting pulleys 7 and 12 and the traction sheave 10 and diverting pulley 9 have to be so disposed that the hoisting ropes running in different directions through the holes 16a and 16b will not hinder each other's passage. According to the invention, the above-mentioned devices are additionally so disposed that the openings 16a and 16b ready made in the machine room floor 15 and designed for 1:1 suspension will be sufficient for all the required rope passages through the floor.

[0017] In this case, for example rope anchorages 5 and 14 and diverting pulleys 7 and 12 are placed mutually on the same adjusting element 17, which is secured by its lower end vertically to the machine room floor and by its upper end to the supporting arm 21 supporting the diverting pulley 7, 12. In the lower part of the adjusting element 17 is a substantially horizontal projection which extends over the opening 16a, 16b and which contains the fixing points 5, 14 of the ends of the hoisting ropes 4. Each diverting pulley 7, 12 is separately suspended on a horizontal beam 18 comprised in the bed-plate structure in the machine room in such manner that the supporting shaft 21 of each diverting pulley is freely rotatable about its center axis in relation to the horizontal beam 18.

[0018] Fig. 2 presents a typical elevator suspension solution 1 according to a preferred embodiment of the invention, which differs from the solution illustrated in Fig. 1 in that the diverting pulleys 7 and 12 are disposed in the upper part of the elevator shaft immediately below the floor of the machine room. The diverting pulleys 7 and 12 are separately suspended on the horizontal beam 18 of the bed-plate structure in the machine room in such manner that the supporting shaft 21 of each diverting pulley is freely rotatable about its center axis in relation to the horizontal beam 18. The difference to the solution according to Fig. 1 is that the supporting shafts 21 of the diverting pulleys have a length extending from the horizontal beam 18 to a level below the machine room floor. This solution allows better space utilization in the openings 16a and 16b because it is now unnecessary to pass the hoisting ropes 4 four times through the openings. Two passes suffice.

[0019] Fig. 3 presents a diagrammatic top view of an elevator with the elevator hoisting ropes installed as in Fig. 1 through openings 16a and 16b in the floor of a machine room placed above the elevator shaft. In this case, the layout solution for the elevator in the elevator shaft 20 is an elevator car 2 with a counterweight 3 installed substantially centrically behind it. The bed-plate 19 is substantially on the same line with the line of mutual alignment of the elevator car and counterweight, and it is so mounted that the horizontal beams 18 placed transversely at each end of the bed-plate structure 19 are above the openings 16a and 16b ready made in the machine room floor. Placed in each opening 16a, 16b is one adjusting element 17, which rests by its rear part vertically on the machine room floor 15 at the very edge of the opening. The adjusting element 17 is rotated in the horizontal plane on its base about the center axis of the diverting pulley supporting shaft 21 going through the horizontal beam 18 so as to allow both the diverting pulleys 7, 12 and the rope anchorages 5, 14 to be set to a desired position relative to the opening 16a, 16b. After this rotation has been performed, the adjusting elements 17 are locked in place, and for these devices this is all that is needed for lead-through of the hoisting ropes. The hoisting ropes running over the traction sheave 10 and diverting pulley 9 are passed through in the traditional manner, yet taking the positions of the diverting pulleys 7, 12 and rope anchorages 5, 14 into account.

[0020] Fig. 4 is a diagrammatic representation of a suspension arrangement wherein the elevator counterweight 3 is placed on one side of the elevator car 2 instead of behind it. In this arrangement, the adjusting elements 17 can be rotated in roughly the same way as in the solution illustrated in Fig. 3, but it is obvious that the angles of rotation may be different due to the mutual positions of the openings 16a and 16b and the elevator car 2 and counterweight 3.

[0021] Fig. 5 presents a side view of the suspension of the diverting pulley 7, 12 and the rope anchorage 5, 14 in conjunction with it. The supporting shaft 21 of the diverting pulley 7, 12 is locked to the horizontal beam 18 of the bed-plate arrangement 19 by means of a locking element 22 in such manner that at least during installation the supporting shaft 21 can be rotated about its center axis. Thus, when the adjusting element 17 is being rotated horizontally, both the rope anchorage 5, 14 and the diverting pulley 7, 12 are rotated by the angle or rotation to their new position. This solution allows fast adjustment that is easy to implement.

[0022] Fig. 6 presents a side view of a suspension arrangement corresponding to Fig. 5, but in this case the supporting shaft 21 of the diverting pulley 7, 12 is longer and extends from the horizontal beam 18 to a level below the machine room floor, the supporting shaft 21 being disposed to extend through the opening 16a, 16b.

[0023] The modernization according to the solution de-

scribed above is carried out in major steps e.g. as follows. After the earlier components have been removed from the machine room, the location and size of the openings 16a and 16b in the machine room floor are checked with respect to the new layout. If the openings are somewhat incorrectly located or if they are too small, the openings will be enlarged as appropriate. Next, a check is performed to ensure that the bed-plate 19 is correctly positioned, and the bed-plate 19 is provided with horizontal beams 18 placed at either end of it, substantially above the openings 16a and 16b, the horizontal beams being provided with one or more holes ready made to allow the supporting shaft 21 of the diverting pulley 7, 12 to be passed through the beam. After this, the adjusting element 17 can be mounted in position by placing the adjusting element in a notch possibly provided for it at the edge of the opening 16a, 16b, and the supporting shaft 21 of the diverting pulley 7, 12, which is secured to the horizontal bracket in the upper part of the adjusting element, is inserted through the hole in the horizontal beam 18 and locked vertically to the horizontal beam 18 by means of a locking element 22.

[0024] After the preliminary installation has been completed, the adjusting element 17 is rotated horizontally to a provisionally correct angle, thereby turning both the plane of rotation of the diverting pulley 7, 12 and the rope anchorage 5, 14 simultaneously to the desired position so that their mutual positions remain continuously the same. After the hoisting ropes have been secured, it is additionally necessary to check that the adjusting element 17 is in a position such that the ropes running through the openings 16a and 16b do not touch each other and that the mutual positions and angles of inclination of the ropes are as optimal as possible.

[0025] It is obvious to the person skilled in the art that different embodiments of the invention are not limited to the example described above, but that they may be varied within the scope of the claims presented below. According to the examples described above, the skilled person can vary the embodiment of the invention e.g. by placing the rope anchorages 5 and 14 and the diverting pulleys 7 and 12 of the machine room in positions differing from the above description. Thus, the various devices can be installed and made ready for operation by an installation procedure differing from that described above. Likewise, the size, number and location of the openings 16a, 16b in the machine room floor may be different from those described above.

[0026] It is further obvious to the skilled person that the shape, size, disposition and direction of the plane of rotation of the aggregates of diverting pulleys 6, 8 and 11, 13 to be installed in connection with the elevator car 2 and counterweight 3 may vary from those described above. Thus, the diverting pulleys may also be disposed at the sides or in the lower part of or under the counterweight and elevator car. Likewise, for example the plane of rotation of the diverting pulleys on the top of the counterweight may be turned through 90º, in which case the diverting pulley aggregate consisting of small and narrow diverting pulleys 6 and 8 rotating freely and independently from each other is narrow and takes up very little space above the counterweight. Similarly, the diverting pulleys 11 and 13 on the elevator car may be oriented either in the same direction with the car frame or transversely to it. This solution provides the advantage that a 4:1 suspension arrangement can be achieved without reducing the size of the safety spaces. Suspension arrangements with other than 4:1 ratio can also be implemented quite easily. In particular, even values of the car suspension ratio are quite simple to implement. For example, by increasing the number of diverting pulleys on the car to three, a 6:1 suspension ratio is obtained, while four diverting pulleys will give a suspension ratio of 8:1 and five diverting pulleys a suspension ratio of 10:1. This of course means that diverting pulleys will have to be added to other parts of the elevator as well and the total length of the ropes is increased. On the other hand, increasing the suspension ratio enables the use of fewer parallel ropes, so the total rope length of the elevator ropes is not necessarily increased very much as the suspension ratio is increased. An additional aim is to enable the elevator ropes to be quickly and easily installed. A further objective is to reduce the consumption of electricity. Likewise, the small diverting pulleys mounted at a suitable position on the car frame of the elevator car do not limit the space above the elevator car. Also, when 1:1 elevators are to be modernized, the diverting pulleys can be installed utilizing the old rope anchorages.

[0027] It is also obvious to the person skilled in the art that, when the car is being moved, the parallel diverting pulleys 6 and 8 connected to the counterweight 3 and the parallel diverting pulleys 11 and 13 connected to the elevator car 2 may rotate either in the same direction or in opposite directions relative to each other, depending on the arrangement of the ropes and diverting pulleys.

[0028] It is further obvious to the skilled person that, although the preferred embodiment of the invention uses fairly thin ropes, the invention is also applicable in the case of elevators in which the new ropes are clearly thicker than these ropes. For example, a modernization wherein earlier 12-mm ropes are replaced with 8-mm ropes may be included in the scope of the invention.

Claims

1. A method for modernizing the hoisting function of an elevator, in the case of an elevator provided with hoisting ropes (4), **characterized in that** the suspension ratio of the elevator car is increased in connection with the modernization and that the rope suspension (1) is provided with at least two diverting pulleys (7, 12), around which the hoisting rope (4) is fitted to run in such manner that, in the running direction of the hoisting rope (4), the first diverting pulley (7) is between diverting pulleys (6) and (8) con-

nected to the counterweight (3), and that, in the running direction of the hoisting rope (4), the second diverting pulley (12) is between diverting pulleys (11) and (13) connected to the elevator car (2).

2. A method according to claim 1, **characterized in that** the rope suspension is implemented as 4:1 suspension and that each elevator rope (4) is fitted in the rope suspension (1) in such manner that, when the elevator car is being moved, the parallel diverting pulleys (6) and (8) connected to the counterweight (3) and the parallel diverting pulleys (11) and (13) connected to the elevator car (2) rotate either in the same direction or in opposite directions, depending on the arrangement of the ropes/diverting pulleys, so that the circumferential speed of the parallel diverting pulleys of the elevator with 4:1 suspension is 2:1.

3. A method according to claim 1 or 2, **characterized in that**, in conjunction with the installation of a rope suspension implementing a larger suspension ratio, all the required rope passages between the machine room and the elevator shaft are passed through openings (16a, 16b) ready made in the floor (15) of the machine room, and that the openings (16a, 16b) are enlarged if necessary.

4. A method according to claim 1, 2 or 3, **characterized in that**, in conjunction with installation, a bed-plate structure (19) in the machine room is provided with at least two horizontal beams (18), to each of which horizontal beams is attached at least one diverting pulley (7, 12) by means of an adjusting element (17) in such manner that that the plane of rotation of the diverting pulley (17) is adjusted as desired by rotating the adjusting element (17) horizontally, and that the hoisting rope (4) anchorages (5, 14) connected to the adjusting element (17) are rotated at the same time.

5. An elevator modernization arrangement, wherein the suspension of an elevator provided with at least one hoisting rope (4) and a machine room is changed into a suspension of a higher suspension ratio, and which arrangement comprises at least diverting pulleys (6, 8) connected to a counterweight (3) and diverting pulleys (11,13) connected to the elevator car (2), whereby at least two diverting pulleys (7,12) are disposed in the rope suspension (1) and the hoisting rope (4) is fitted around said diverting pulleys (7,12) in such manner that the hoisting rope (4) is passed from the first diverting pulley (6) connected to the counterweight around the first diverting pulley (7) in the rope suspension to the second diverting pulley (8) connected to the counterweight, and that the hoisting rope is passed from the first diverting pulley (11) connected to the elevator car around the second diverting pulley (12) in the rope suspension to the second diverting pulley (13) connected to the elevator car, and whereby the ropes have a diameter of about 4 mm or less.

6. An elevator modernization arrangement according to claim 5, **characterized in that** the suspension is a 4:1 suspension and that diverting pulleys (6) and (8) are placed side by side on the same axle on the top of the counterweight (3) and arranged to rotate independently of each other and, depending on the suspension arrangement of the ropes/diverting pulleys, either in the same direction or in opposite directions in such manner that the circumferential speed of the parallel diverting pulleys of the elevator with 4:1 suspension is 2:1, and that diverting pulleys (11) and (13) are placed side by side on the same axle on the top of the elevator car (2) and arranged to rotate independently of each other and, depending on the suspension arrangement of the ropes/diverting pulleys, either in the same direction or in opposite directions in such manner that the circumferential speed of the parallel diverting pulleys of the elevator with 4:1 suspension is 2:1.

7. A modernization arrangement according to claim 5 or 6, **characterized in that** the bed-plate structure (19) in the machine room is provided with at least two horizontal beams (18), to each of which horizontal beams is attached at least one diverting pulley (7, 12) by means of an adjusting element (17) in such manner that that the plane of rotation of the diverting pulley (7, 12) is adjusted as desired by rotating the adjusting element (17) horizontally.

8. A modernization arrangement according to claim 5, 6 or 7, **characterized in that** a supporting shaft (21) supporting the diverting pulley (7, 12) is secured to the upper part of the adjusting element (17) so that said shaft is rotatable together with the adjusting element (17), and that the hoisting rope anchorages (5, 14) are secured to the lower part of the adjusting element (17) so as to be rotatable together with the adjusting element (17) so that the mutual positions of the diverting pulley (7, 12) and the anchorages (5, 14) remain unchanged.

9. A modernization arrangement according to any one of the preceding claims 5-8, **characterized in that** the supporting shaft (21) of the diverting pulley (7, 12) has been passed through an opening (16a, 16b) in the machine room floor in such manner that the diverting pulley (7, 12) is located in the elevator shaft below the floor of the machine room.

Patentansprüche

1. Verfahren zum Modernisieren der Hebefunktion eines Aufzugs in dem Fall eines Aufzuges, der mit Hebeseilen (4) versehen ist, **dadurch gekennzeichnet, dass** das Aufhängungsverhältnis der Aufzugskabine erhöht wird in Verbindung mit der Modernisierung, und dass die Seilaufhängung (1) mit wenigstens zwei Umlenkrollen (7, 12) versehen wird, um welche die Hebeseile (4) derart laufen, dass in Laufrichtung des Hebeseils die erste Umlenkrolle (7) zwischen Umlenkrollen (6) und (8) angeordnet ist, die mit dem Gegengewicht (3) verbunden sind, und dass in Laufrichtung der Hebeseile (4) die zweite Umlenkrolle (12) zwischen den Umlenkrollen (11) und (13) angeordnet ist, die mit der Aufzugskabine (2) verbunden sind.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** die Seilaufhängung implementiert ist als 4:1 Aufhängung, und das jedes Aufzugseil (4) in der Seilaufhängung (1) derart festgelegt ist, dass, wenn die Aufzugskabine bewegt wird, die parallelen Umlenkrollen (6) und (8), die mit dem Gegengewicht (3) verbunden sind, und die parallelen Umlenkrollen (11) und (13), die mit der Aufzugskabine (2) verbunden sind, entweder in der gleichen Richtung oder entgegengesetzten Richtungen entsprechend der Anordnung der Seile/Umlenkrollen rotieren, so dass die Umfangsgeschwindigkeit der parallelen Umlenkrollen des Aufzugs mit einer 4:1 Aufhängung 2:1 beträgt.

3. Verfahren nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** in Verbindung mit der Installation einer Seilaufhängung, die ein größeres Aufhängungsverhältnis verwendet, alle erforderlichen Seildurchgänge zwischen dem Maschinenraum und dem Aufzugsschacht durch Öffnungen (16a, 16b) verlaufen, die bereits in dem Flur (15) des Maschinenraums gemacht sind, und dass die Öffnungen (16a, 16b) bei Bedarf vergrößert werden.

4. Verfahren nach Anspruch 1, 2 oder 3, **dadurch gekennzeichnet, dass** in Verbindung mit der Installation eine Bettplattenstruktur (19) in dem Maschinenraum mit wenigstens zwei horizontalen Streben (18) vorgesehen wird, wobei mit jeder der horizontalen Streben (18) wenigstens eine Umlenkrolle (7, 12) mittels eines Einstellelements (17) derart angebracht ist, dass die Rotationsebene der Umlenkrolle (17) wie gewünscht eingestellt wird, indem das Einstellelement (17) horizontal gedreht wird, und dass die Hebeseil (4) Verankerungen (5, 14), die mit dem Einstellelement (17) verbunden sind, gleichzeitig rotiert werden.

5. Aufzugsmodernisierungsanordnung, in welcher die Aufhängung eines Aufzugs, der mit wenigstens einem Hebeseil (4) und einem Maschinenraum versehen ist in eine Aufhängung mit einem höheren Aufhängungsverhältnis geändert wird, und welche Anordnung wenigstens Umlenkrollen (6, 8) enthält, die mit einem Gegengewicht (3) verbunden sind, und Umlenkrollen (11, 13) die mit der Aufzugskabine (2) verbunden sind, wobei wenigstens zwei Umlenkrollen (7, 12) in der Seilaufhängung (1) angeordnet sind und das Hebeseil (4) dazu konzipiert ist, um diese Umlenkrollen (7, 12) derart zu laufen, dass das Hebeseil (4) von der ersten Umlenkrolle (6), welche mit dem Gegengewicht verbunden ist, um die erste Umlenkrolle (7) in der Seilaufhängung zu der zweiten Umlenkrolle (8), die mit dem Gegengewicht verbunden ist, läuft, und dass das Hebeseil weitergeleitet wird von der ersten Umlenkrolle (11), die mit der Aufzugskabine verbunden ist, um die zweite Umlenkrolle (12) in der Seilaufhängung zu der zweiten Umlenkrolle (13), die mit der Aufzugskabine verbunden ist, und bei welcher die Seile einen Durchmesser von ungefähr 4 mm oder weniger aufweisen.

6. Aufzugsmodernisierungsanordnung nach Anspruch 5, **dadurch gekennzeichnet, dass** die Aufhängung eine 4:1 Aufhängung ist, und dass die Umlenkrollen (6) und (8) nebeneinander auf der gleichen Achse an der Oberseite des Gegengewichts angeordnet sind und vorgesehen sind, unabhängig voneinander zu rotieren entsprechend der Aufhängungsanordnung der Seile/Umlenkrollen, entweder in der gleichen Richtung oder in gegenläufige Richtungen derart, dass die Umlaufgeschwindigkeit der parallelen Umlenkrollen des Aufzugs mit einer 4:1 Aufhängung 2:1 beträgt und das die Umlenkrollen (11) und (13) nebeneinander auf der gleichen Achse an der Oberseite der Aufzugskabine (2) angeordnet sind und vorgesehen sind, unabhängig voneinander zu rotieren entsprechend der Aufhängungsanordnung der Seile/Umlenkrollen entweder in der gleichen Richtung oder in gegenläufigen Richtungen derart, dass die Umfangsgeschwindigkeit der parallelen Umlenkrollen des Aufzugs mit einer 4:1 Aufhängung 2:1 beträgt.

7. Modernisierungsanordnung nach Anspruch 5 oder 6, **dadurch gekennzeichnet, dass** die Bettplattenstruktur (19) in dem Maschinenraum mit wenigstens zwei horizontalen Streben (18) versehen ist, wobei an jeder der horizontalen Streben wenigstens eine Umlenkrolle (7) mittels eines Einstellelement (17) befestigt ist, derart, dass die Rotationsebene der Umlenkrolle (7, 12) wie gewünscht eingestellt wird durch Drehen des Einstellelements (17) in der horizontalen Ebene.

8. Modernisierungsanordnung nach Anspruch 5, 6 oder 7, **dadurch gekennzeichnet, dass** eine Trag-

achse (21), welche die Umlenkrolle (7,12) trägt, mit dem oberen Teil des Einstellelements (17) verbunden ist, so dass die Achse drehbar ist zusammen mit dem Einstellelement (17), und dass die Hebeseilverankerungen (5, 14) an dem unteren Teil des Einstellelements festgelegt sind, um so zusammen mit dem Einstellelement (17) drehbar zu sein, so dass die gegenseitigen Positionen der Umlenkrolle (7, 12) und der Verankerungen (5, 14) unverändert verbleiben.

9. Modernisierungsanordnung nach einem der vorhergehenden Ansprüche 5 - 8, **dadurch gekennzeichnet, dass** die Tragachse (21) der Umlenkrolle (7, 12) durch eine Öffnung (16a, 16b) in dem Maschinenraumboden geführt ist, derart, dass die Umlenkrolle (7, 12) in dem Aufzugsschacht unter dem Boden des Maschinenraums angeordnet ist.

Revendications

1. Procédé destiné à moderniser la fonction de levage d'un ascenseur, dans le cas d'un ascenseur muni de câbles de levage (4), **caractérisé par le fait que** le taux de suspension de la cabine d'ascenseur est augmenté en liaison avec la modernisation et que la suspension de câble (1) est pourvue d'au moins deux poulies de détour (7, 12), autour desquelles le câble de levage (4) est fixé pour défiler de telle sorte que, dans le sens de défilement du câble de levage (4), la première poulie de détour (7) se trouve entre les poulies de détour (6) et (8) reliées au contrepoids (3), et que, dans le sens de défilement du câble de levage (4), la seconde poulie de détour (12) se trouve entre les poulies de détour (11) et (13) reliées à la cabine d'ascenseur (2).

2. Procédé selon la revendication 1, **caractérisé par le fait que** la suspension de câble est mise en oeuvre sous la forme d'une suspension de type 4:1 et que chaque câble d'ascenseur (4) est fixé dans la suspension de câble (1) de telle manière que, quand la cabine d'ascenseur se déplace, les poulies de détour parallèles (6) et (8) reliées au contrepoids (3) et les poulies de détour parallèles (11) et (13) reliées à la cabine d'ascenseur (2) pivotent dans le même sens ou dans des sens opposés, en fonction de la disposition des câbles/poulies de détour, de telle sorte que la vitesse circonférentielle des poulies de détour parallèles de l'ascenseur à suspension de type 4:1 est de 2:1.

3. Procédé selon la revendication 1 ou 2, **caractérisé par le fait que**, conjointement avec l'installation d'une suspension de câble mettant en oeuvre un rapport de suspension plus important, tous les passages de câble nécessaires entre le local des machines et la cage d'ascenseur traversent des orifices (16a, 16b) tout prêts dans le plancher (15) du local des machines, et que les ouvertures (16a, 16b) sont agrandies si nécessaire.

4. Procédé selon la revendication 1, 2 ou 3, **caractérisé par le fait que**, conjointement avec l'installation, une structure de plaque de base (19) dans le local des machines est pourvue d'au moins deux traverses horizontales (18), à chacune desquelles au moins une poulie de détour (7, 12) est fixée au moyen d'un élément de réglage (17) de telle sorte que le plan de rotation de la poulie de détour (17) est réglé comme souhaité en faisant pivoter l'élément de réglage (17) horizontalement, et que les ancrages (5, 14) du câble de levage (4) reliés à l'élément de réglage (17) sont pivotés en même temps.

5. Système de modernisation d'ascenseur, dans lequel la suspension d'un ascenseur muni d'au moins un câble de levage (4) et d'un local des machines est modifiée en une suspension ayant un taux de suspension supérieur, et lequel système comprend au moins des poulies de détour (6, 8) reliées à un contrepoids (3) et des poulies de détour (11, 13) reliées à la cabine d'ascenseur (2), au moins deux poulies de détour (7, 12) étant disposées dans la suspension de câble (1) et le câble de levage (4) étant fixé autour desdites poulies de détour (7, 12) de telle sorte que le câble de levage (4) est passé de la première poulie de détour (6) reliée au contrepoids autour de la première poulie de détour (7) dans la suspension de câble à la seconde poulie de détour (8) reliée au contrepoids, et que le câble de levage est passé de la première poulie de détour (11) reliée à la cabine d'ascenseur autour de la seconde poulie de détour (12) dans la suspension de câble à la seconde poulie de détour (13) reliée à la cabine d'ascenseur, et les câbles ayant un diamètre d'environ 4 mm ou inférieur.

6. Système de modernisation d'ascenseur selon la revendication 5, **caractérisé par le fait que** la suspension est de type 4:1, et que des poulies de détour (6) et (8) sont placées côte à côte sur le même axe sur le haut du contrepoids (3) et conçues pour pivoter indépendamment l'une de l'autre et, en fonction de la disposition de suspension des câbles/poulies de détour, soit dans le même sens, soit dans des sens opposés, de telle sorte que la vitesse circonférentielle des poulies de détour parallèles de l'ascenseur à suspension de type 4:1 1 est de type 2:1, et que des poulies de détour (11) et (13) sont placées côte à côte sur le même axe sur le haut de la cabine d'ascenseur (2) et conçues pour pivoter indépendamment l'une de l'autre et, en fonction de la disposition de suspension des câbles/poulies de détour, soit dans le même sens, soit dans des sens opposés, de

telle sorte que la vitesse circonférentielle des poulies de détour parallèles de l'ascenseur à suspension de type 4:1 1 est de type 2:1.

7. Système de modernisation selon la revendication 5 ou 6, **caractérisé par le fait que** la structure de plaque de base (19) dans le local des machines est pourvue d'au moins deux traverses horizontales (18), à chacune desquelles au moins une poulie de détour (7, 12) est fixée au moyen d'un élément de réglage (17) de telle sorte que le plan de rotation de la poulie de détour (7, 12) est réglé comme souhaité en faisant pivoter l'élément de réglage (17) horizontalement.

8. Système de modernisation selon la revendication 5, 6 ou 7, **caractérisé par le fait qu'**un arbre de support (21) supportant la poulie de détour (7, 12) est arrimé à la partie supérieure de l'élément de réglage (17) de telle sorte que ledit arbre est rotatif conjointement avec l'élément de réglage (17), et que les ancrages de câble de levage (5, 14) sont arrimés à la partie inférieure de l'élément de réglage (17) de manière à être rotatifs conjointement avec l'élément de réglage (17) de telle sorte que les positions mutuelles de la poulie de détour (7, 12) et des ancrages (5, 14) restent inchangées.

9. Système de modernisation selon l'une quelconque des revendications précédentes 5 à 8, **caractérisé par le fait que** l'arbre de support (21) de la poulie de détour (7, 12) a été passé à travers un orifice (16a, 16b) dans le plancher du local des machines de telle sorte que la poulie de détour (7, 12) est située dans la cage d'ascenseur sous le plancher du local des machines.

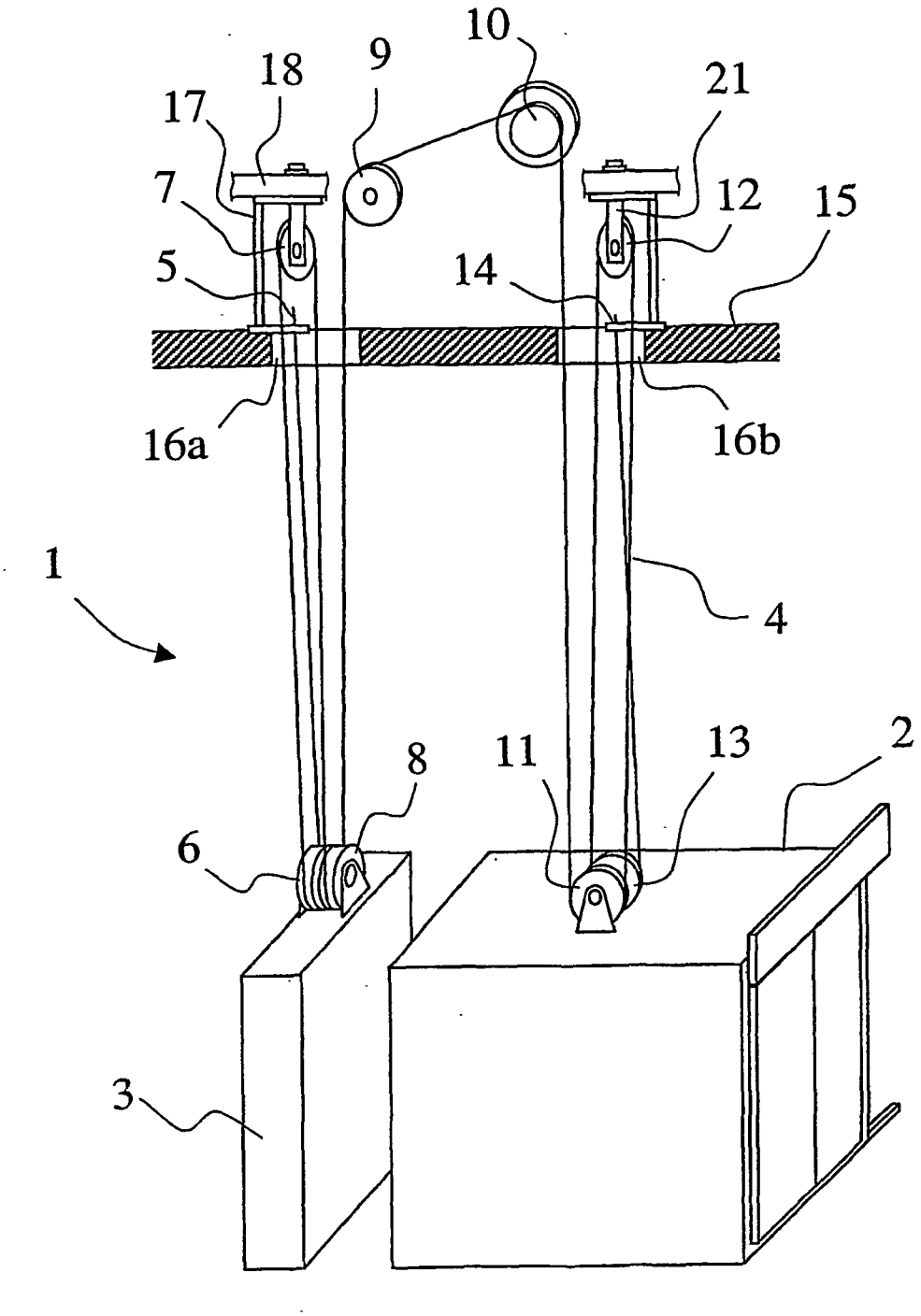

Fig. 1

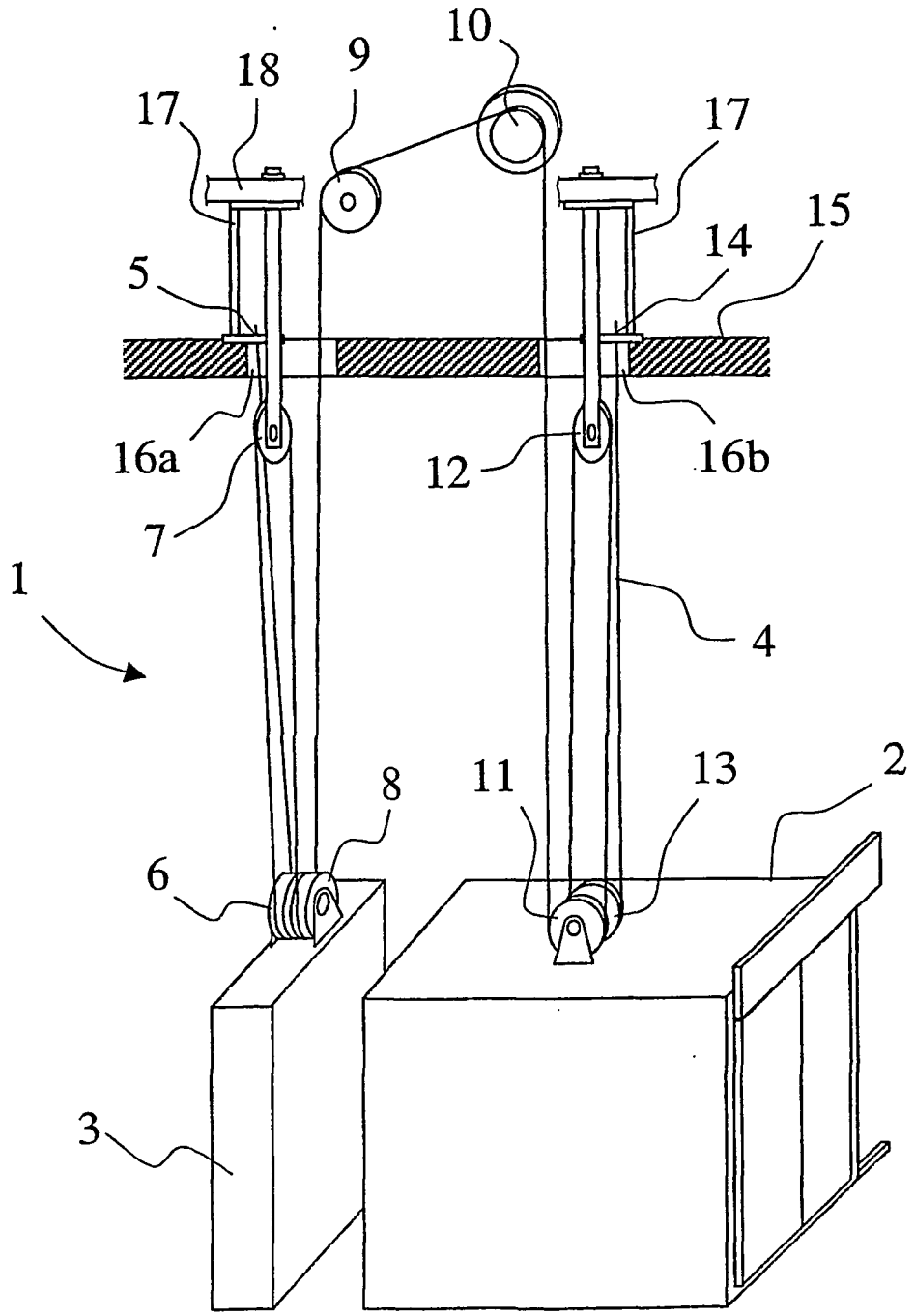

Fig. 2

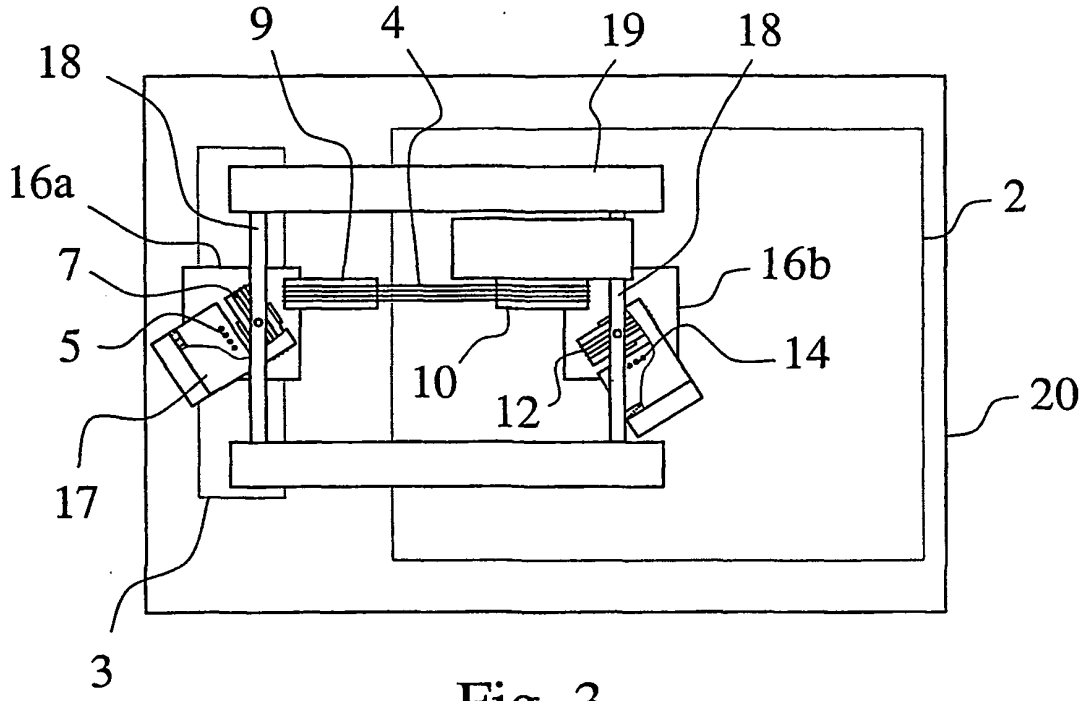

Fig. 3

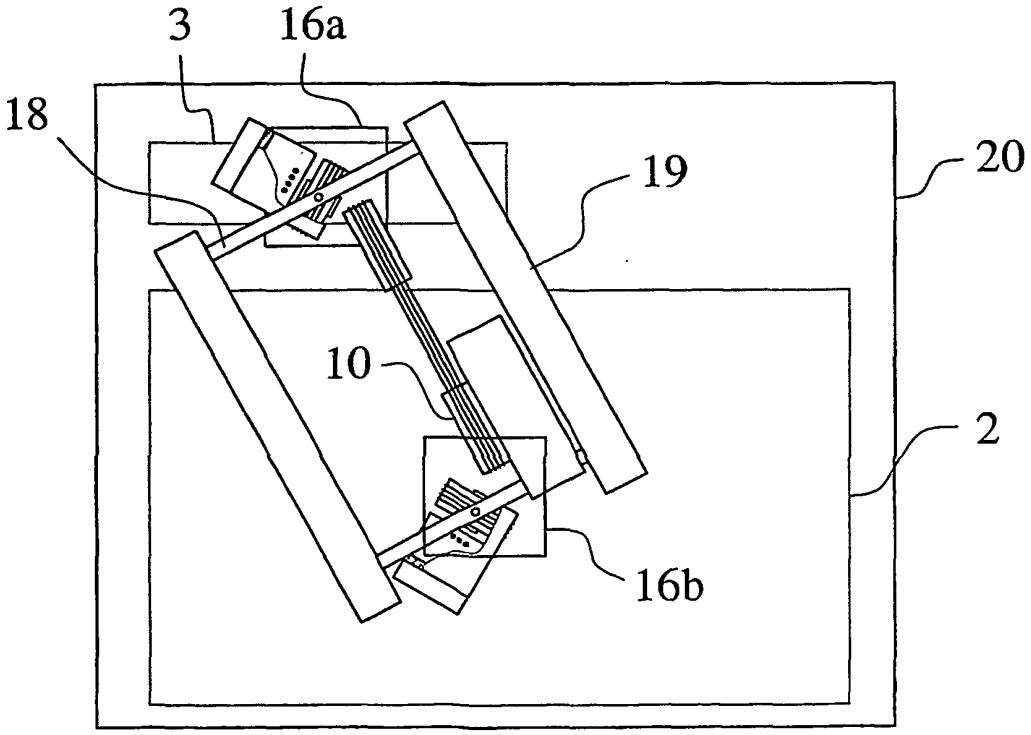

Fig. 4

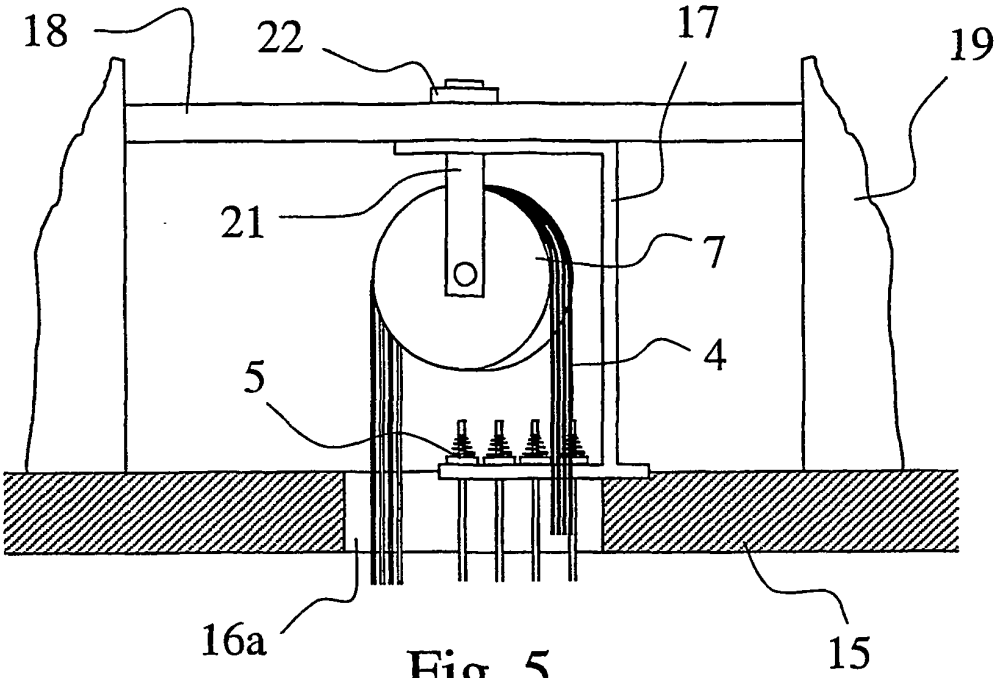

Fig. 5

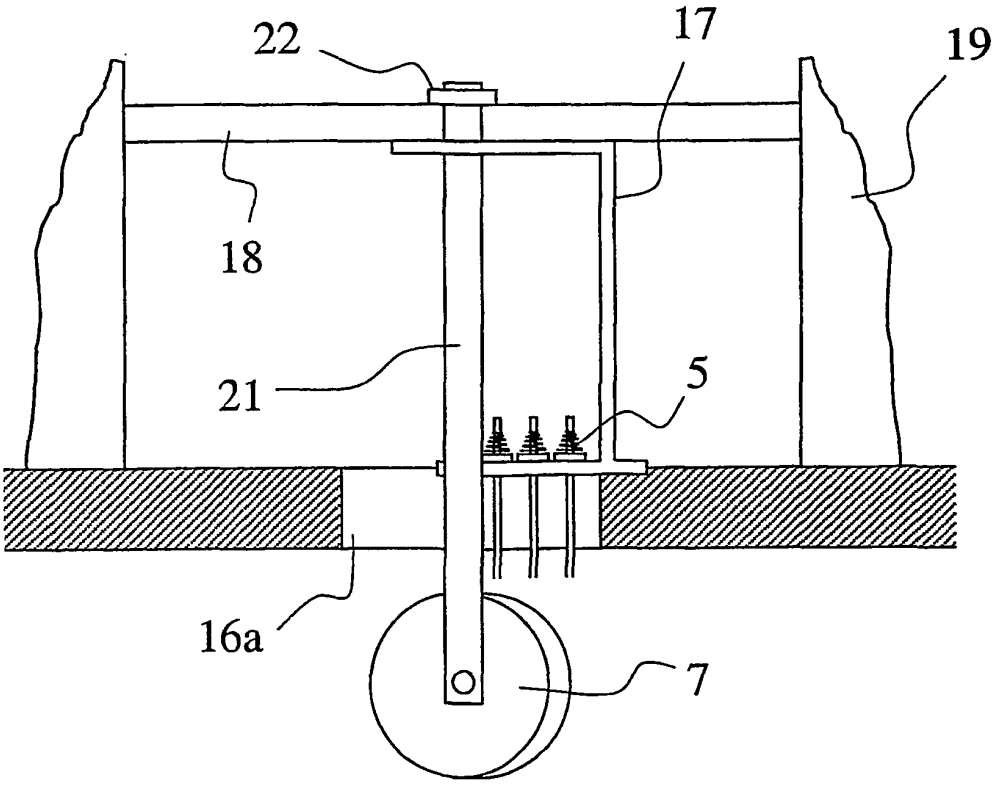

Fig. 6

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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