



(51) International Patent Classification:
B66B 11/00 (2006.01) **B66B 7/06** (2006.01)

(21) International Application Number:
PCT/FI2010/000044

(22) International Filing Date:
14 July 2010 (14.07.2010)

(25) Filing Language: Finnish

(26) Publication Language: English

(30) Priority Data:
20090280 17 July 2009 (17.07.2009) FI

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK,

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(54) Title: ELEVATOR ARRANGEMENT AND METHOD FOR MOVING AN ELEVATOR CAR IN AN ELEVATOR HOISTWAY

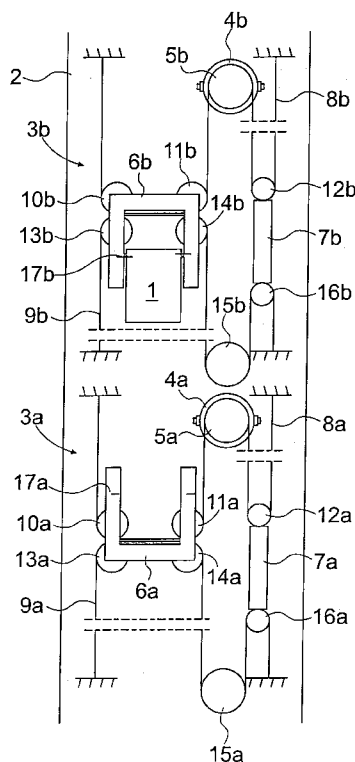


Fig. 1

(57) Abstract: The object of the invention is an elevator arrangement and a method for moving an elevator car (1) in an elevator hoistway. The elevator comprises at least an elevator hoistway (2) and an elevator car (1) fitted to move in essentially the vertical direction in the elevator hoistway (2) as well as at least a first hoisting apparatus (3a) and a second hoisting apparatus (3b), which hoisting apparatuses (3a, 3b) are arranged to move the elevator car (1). The first hoisting apparatus (3a) comprises a first support structure (6a) and the second hoisting apparatus (3b) comprises a second support structure (6b), of which support structures (6a, 6b) one at a time is arranged to support the elevator car (1), and the elevator car (1) is arranged to be transferred from one support structure to the other support structure.

WO 2011/007044 A1



SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, **Published:**
GW, ML, MR, NE, SN, TD, TG).

— *with international search report (Art. 21(3))*

ELEVATOR ARRANGEMENT AND METHOD FOR MOVING AN ELEVATOR CAR
IN AN ELEVATOR HOISTWAY

The object of the invention is an elevator arrangement as
5 defined in the preamble of claim 1 and a method for moving
an elevator car in an elevator hoistway as defined in the
preamble of claim 21.

In elevators with large travel heights, i.e. so-called high-
10 rise or mega-high-rise elevators, the hoisting ropes are
very long and consequently weigh a lot. Generally
compensating ropes must also be used in these types of
elevators, in order to compensate the weight of the hoisting
ropes. The weight of the ropes can be many times the
15 combined weight of the elevator car and the load in the
elevator car. The ropes, thus, weigh a lot and therefore the
mass to be moved increases also to be large. For this reason
high-rise elevators must comprise a powerful and robust
hoisting machine. Rather few high-rise elevators are
20 manufactured and therefore also only a few large hoisting
machines are needed. For this reason large hoisting machines
are extremely expensive. It would be more inexpensive if
smaller and cheaper hoisting machines, which are also used
in other elevators and which are manufactured in larger
25 batches, could be used in high-rise elevators.

Another problem in elevators with large travel heights is
that owing to the large length of the hoisting ropes the
ropes sway rather a lot in the elevator hoistway, e.g. when
30 the wind sways the building. One problem is that swaying of
the ropes can be a safety risk, especially if the ropes fall
into resonance with the building.

It is known in the art that problems caused by long ropes can be solved e.g. such that different elevators are used in high-rise buildings, which elevators operate at different heights in the building. For example, two elevators, of which one operates in the bottom part of the building and the other in the top part. A drawback in this solution, however, is that if a passenger wants, for instance, to move from the bottom part of the building to the top part, he/she must change elevators at some point in between. This reduces the efficiency of the elevator system of the building. A further problem is that it is necessary to completely construct two different elevators, which increases costs and also takes up extra space.

The purpose of this invention is to eliminate the aforementioned drawbacks and to achieve an elevator arrangement and a method for moving an elevator in an elevator hoistway, by means of which elevator arrangement and method the rope masses to be moved can be reduced, particularly in tall buildings. An additional aim is to reduce swaying of the ropes in the elevator hoistway. The arrangement according to the invention is characterized by what is disclosed in the characterization part of claim 1. Correspondingly, the method according to the invention is characterized by what is disclosed in the characterization part of claim 21. Other embodiments of the invention are characterized by what is disclosed in the other claims.

Some inventive embodiments are also discussed in the descriptive section of the present application. The inventive content of the application can also be defined differently than in the claims presented below. The inventive content may also consist of several separate inventions, especially if the invention is considered in the

light of expressions or implicit sub-tasks or from the point of view of advantages or categories of advantages achieved. In this case, some of the attributes contained in the claims below may be superfluous from the point of view of separate
5 inventive concepts. Likewise the different details presented in connection with each embodiment of the invention can also be applied in other embodiments. In addition it can be stated that at least some of the subordinate claims can at least in some situations be deemed to be inventive in their
10 own right.

An advantage of the arrangement according to the invention is that, particularly in elevators with large travel heights, the rope masses to be moved can be reduced, in
15 which case smaller hoisting machines can be used. Another advantage is that the energy efficiency of the elevator system improves. From this follows the advantage that the types of hoisting machines that are used more in other elevators, and which are therefore manufactured in larger
20 batches, can be used, which consequently are also cheaper than large hoisting machines. Yet another advantage is that swaying of the ropes in the elevator hoistway can be reduced and the risk of the ropes falling into resonance with the building is less than earlier. Another advantage is that it
25 is possible to travel with the same elevator from the bottom of the building to the topmost floor. Yet a further advantage is that the arrangement does not take up much space.

30 In the elevator arrangement according to the invention, the elevator comprises at least an elevator hoistway and an elevator car fitted to move in essentially the vertical direction in the elevator hoistway, as well as at least a first hoisting apparatus and a second hoisting apparatus,

which hoisting apparatuses are arranged to move the elevator car. The first hoisting apparatus comprises a first support structure and the second hoisting apparatus comprises a second support structure, (of which support structures one
5 at a time is arranged to support the elevator car), and the elevator car is arranged to be transferred from one support structure to the other support structure.

In one embodiment of the invention the first and the second
10 support structure travel on guide rails, which guide rails continue over the changeover point in parallel and essentially without breaks, at which changeover point the elevator car is arranged to be transferred from one support structure to the other. Thus separate guide rail lines for
15 each support structure are not needed. In this way also the changeover of the elevator car from one support structure to the other is smooth.

In one embodiment of the invention the first and the second
20 support structure each comprise parts that extend to the opposite sides of the elevator car, between which parts the elevator car can be moved when transferring the elevator car from one support structure to the other support structure. Thus a safe and supportive structure is achieved. Guide
25 shoes can be supported on the aforementioned parts, in which case the guiding of the car is simple and rigid.

In one embodiment of the invention the elevator car is arranged to be transferred from inside one support structure
30 to inside the other support structure. Thus a safe and supportive structure can be achieved.

In one embodiment of the invention each of the support structures comprise a hollow that opens towards the elevator

car, inside which hollow the elevator car can be moved when transferring the elevator car to the support of the support structure in question. Thus the support structures can be fitted simply into the elevator hoistway and the change of grip can be implemented safely.

In one embodiment of the invention at least the top part of the elevator car can be guided from below inside the second support structure, and at least the bottom part of the elevator car can be guided from above inside the first support structure. Thus the support structures can be fitted simply into the elevator hoistway and the change of grip can be implemented safely.

15 In one embodiment of the invention the first and the second support structure travel on guide rails belonging to the same guide rail line. Thus a continuous elevator structure in the longitudinal direction of the elevator hoistway can be achieved without discontinuities and without a complex changeover zone.

In one embodiment of the invention the first and the second support structure each comprise guide shoes, such as e.g. slide and/or roller guide shoes, which travel on guide rails belonging to the same guide rail line. In this way the elevator car can be supported with the support structure in the same manner in the lateral direction in the top parts and in the bottom parts of the elevator hoistway.

30 In one embodiment of the invention the first and the second support structure each comprise a plurality of guide shoes, such as e.g. slide and/or roller guide shoes, the guide shoes of which plurality travel on guide rails, and the guide shoes of which plurality are at a horizontal distance

from each other and rigidly fixed to each other via the supporting structures of their support structures.

In one embodiment of the invention each aforementioned guide
5 shoe plurality of a support structure comprises guide shoes
on the opposite sides of the vertical projection of the
elevator car.

In one embodiment of the invention the first hoisting
10 apparatus comprises at least a first hoisting machine, which
is arranged to move the elevator car via a first hoisting
roping, and that the second hoisting apparatus comprises at
least a second hoisting machine, which is arranged to move
the elevator car by means of a second hoisting roping.

15

In one embodiment of the invention a first hoisting
apparatus is arranged to move the elevator car in the first
part of the elevator hoistway, and that a second hoisting
apparatus is arranged to move the same elevator car in the
20 second part of the same elevator hoistway.

In one embodiment of the invention a first hoisting
apparatus is arranged to move the elevator car in the bottom
part of the elevator hoistway, and that a second hoisting
25 apparatus is arranged to move the same elevator car in the
top part of the same elevator hoistway.

In one embodiment of the invention the first support
structure comprises at least fixing means for locking the
30 elevator car into its position in the first support
structure and for detaching the locking from the first
support structure, and that the second support structure
comprises at least fixing means for locking the elevator car

into its position in the second support structure and for detaching the locking from the second support structure.

In one embodiment of the invention at least one or both of
5 the hoisting apparatuses are arranged to move an elevator car essentially securely fixed into at least one or both support structures in the same elevator hoistway along with the elevator car to be transferred from one support structure to another.

10

In one embodiment of the invention the lower support structure is open at its top part, and that the upper support structure is open at its bottom part. In this way the transfer of an elevator car between support structures
15 is simple and is easy to form so as to be safe. The elevator car can be transferred to inside each support structure.

In one embodiment of the invention the height of the lower support structure is essentially smaller than the height of
20 the elevator car, and the height of the upper support structure is essentially smaller than the height of the elevator car.

In one embodiment of the invention the path of movement of
25 the elevator car is straight such that its path of movement continues in the same direction after the change of hoisting apparatus without any lateral shifts.

In one embodiment of the invention the first and the second
30 support structure travel on guide rails.

In one embodiment of the invention the support structures 6a, 6b travel on guide rails, which guide rails preferably continue over the changeover point in parallel and

essentially without breaks. Thus, among other things, it is easy to make their paths of movement meet precisely. Additionally, the guide rails of the zone of the lower hoisting apparatus can support from below the guide rails of the zone of the upper hoisting apparatus above them.

In one embodiment of the invention the guide rails of the zone of the lower hoisting apparatus, i.e. the guide rails on which the lower support structure 6a travels, support from below the guide rails of the zone of the upper hoisting apparatus, i.e. the guide rails on which the upper support structure 6b travels. In this way the elevator car can be guided on guide rails belonging to the same, commonly supported, guide rail line when it is being supported by whichever of the upper or lower hoisting apparatuses.

In the method according to the invention for moving an elevator car in an elevator hoistway, the elevator car is moved in the elevator hoistway by means of a first hoisting apparatus or by means of a second hoisting apparatus. The elevator car is moved in the first part of the elevator hoistway, while fixed into a first support structure, by means of a first hoisting apparatus, and in the second part of the same elevator hoistway, while fixed into a second support structure, by means of a second hoisting apparatus. The supporting of the elevator car is changed over from one hoisting apparatus to the other by driving the elevator car to a determined height by means of one hoisting apparatus, at which determined height the elevator car is fixed into one support structure and after this detached from the second support structure.

In one embodiment of the invention when driving the elevator car from the bottom part of the elevator hoistway to the top

part of the same elevator hoistway, the elevator car is driven in the bottom part of the elevator hoistway, while fixed into the lower support structure, by means of the first hoisting apparatus upwards to the changeover height of
5 the elevator car, at which height the top part of the elevator car is guided from below inside the upper support structure, after which the elevator car is fixed into the upper support structure and detached from the lower support structure, after which the elevator car is driven to the
10 target floor in the top part of the same elevator hoistway by means of the second hoisting apparatus.

In one embodiment of the invention when driving the elevator car from the top part of the elevator hoistway to the bottom
15 part of the same elevator hoistway, the elevator car is driven in the top part of the elevator hoistway, while fixed into the upper support structure, by means of the second hoisting apparatus downwards to the changeover height of the elevator car, at which height the bottom part of the
20 elevator car is guided from above inside the lower support structure, after which the elevator car is fixed into the lower support structure and detached from the upper support structure, after which the elevator car is driven to the target floor in the bottom part of the same elevator
25 hoistway by means of the first hoisting apparatus.

In one embodiment of the invention the changeover of the elevator car from one support structure to the other is performed essentially at the halfway point of the height of
30 the elevator hoistway.

In one embodiment of the invention more than one elevator car one above the other are moved in the same elevator hoistway at essentially the same time.

In one embodiment of the invention one elevator car detachably fixed into a support structure is moved in one part of the elevator hoistway in one direction, and at
5 essentially the same time one elevator car securely fixed into the second support structure is moved in the second part of the same elevator hoistway, either in the aforementioned one direction or in a second direction.

10 In one embodiment of the invention two elevator cars fixed into one support structure one on top of the other are moved in one part of the elevator hoistway in one direction, and at essentially the same time one elevator car securely fixed into the second support structure is moved in the second
15 part of the same elevator hoistway, either in the aforementioned one direction or in a second direction.

In one embodiment of the invention the elevator is arranged to be according to any of the elevator arrangements
20 described above.

In one embodiment of the invention the first and the second support structure travel on guide rails, and that the guide rails of the zone of the lower hoisting apparatus support
25 from below the guide rails of the zone of the upper hoisting apparatus above them.

In one embodiment of the invention the first and the second support structure travel on guide rails, which guide rails
30 continue over the changeover point in parallel and essentially without breaks, at which changeover point the elevator car is transferred from one support structure to the other. Thus the first and the second support structure

can travel on guide rails belonging to the same guide rail line.

5 The invention will be described in the following in more detail by the aid of two examples of its embodiments with reference to the attached drawings, wherein

Fig. 1 presents a simplified and diagrammatic side view of
10 one embodiment of the arrangement according to the invention,

Fig. 2 presents a simplified and diagrammatic side view of a second embodiment of the arrangement according to the invention,

15 Fig. 3 presents a simplified and diagrammatic side view of two different modes of the arrangement according to Fig. 2,

Fig. 4 presents a simplified and diagrammatic side view of two different modes of a third arrangement
20 according to the invention, and

Fig. 5 presents a simplified and diagrammatic side view of two different modes of a fourth arrangement according to the invention.

Fig. 6 presents a simplified and diagrammatic side view of
25 a control arrangement of the support structures.

Fig. 1 presents a simplified and diagrammatic side view of one embodiment of the arrangement according to the invention. The elevator car 1 is fitted to travel in the
30 elevator hoistway 2 in essentially the vertical direction. The elevator comprises two separate hoisting apparatuses, of which the first, i.e. the lower, hoisting apparatus 3a is fitted in the bottom part of the hoistway 2 and the second, i.e. the upper, hoisting apparatus 3b in the top part of the

hoistway 2. The lower hoisting apparatus 3a comprises a first hoisting machine 4a with its traction sheave 5a, a first support structure 6a of the elevator car 1, a first counterweight 7a, a first hoisting roping 8a, first
5 compensating ropes 9a, and diverting pulleys 10a, 11a, 12a, 13a, 14a, 15a and 16a. Correspondingly, the upper hoisting apparatus 3b comprises a second hoisting machine 4b with its traction sheave 5b, a second support structure 6b of the elevator car 1, a second counterweight 7b, a second hoisting
10 roping 8b, second compensating ropes 9b, and diverting pulleys 10b, 11b, 12b, 13b, 14b, 15b and 16b. The lower hoisting apparatus 3a is arranged to move the elevator car 1 in the bottom part of the elevator hoistway 2, and the upper hoisting apparatus 3b in the top part of the hoistway 2.

15

The lower, i.e. the first hoisting roping 8a is fixed at its first end to e.g. some suitable point on the wall of the elevator hoistway 2 at the height of roughly the halfway point of the hoistway. From this fixing point the ropes are
20 led downwards to pass below the diverting pulleys 10a and 11a fixed to the first support structure 6a of the elevator car 1, after which upwards over the traction sheave 5a of the first hoisting machine 4a. The first hoisting machine 4a is fitted at approximately the height of the halfway point
25 of the hoistway 2. From the traction sheave 5a the hoisting roping 8a is led downwards to pass below the diverting pulley 12a on the top end of the first counterweight 7a, after which upwards to its second fixing point on the wall of the elevator hoistway, to which point the first hoisting
30 roping 8a is fixed at its second end.

The lower compensating ropes 9a are fixed at their first ends to the bottom part of the elevator hoistway 2, from where they are led upwards to pass over the diverting

pulleys 13a and 14a fixed to the first support structure 6a of the elevator car, after which downwards below the diverting pulley 15a fitted to the bottom part of the hoistway 2, from where upwards over the diverting pulley 16a
5 on the bottom part of the counterweight 7a, after which again downwards to the fixing point in the bottom part of the hoistway 2, to which point the first compensating ropes 9a are fixed at their second ends.

10 The diverting pulleys and suspension of the second hoisting apparatus 3b are fitted into the top part of the elevator hoistway 2 in essentially the same manner as the diverting pulleys and suspension of the first hoisting apparatus 3a into the bottom part of the hoistway 2. In this case the
15 second hoisting machine 4b is disposed near the roof of the elevator hoistway 2, the lowest diverting pulley 15b of the compensating ropes 9b is disposed near the halfway point of the height of the elevator hoistway 2.

20 When the elevator car 1 travels in the bottom part of the elevator hoistway 2, it is fixed into the lower support structure 6a. The lower support structure 6a is open at its top part and the height of the lower support structure 6a is essentially smaller than the height of the elevator car 1,
25 i.e. the lower support structure 6a is essentially around only the bottom part of the elevator car 1. Correspondingly, when the elevator car 1 travels in the top part of the elevator hoistway 2, it is fixed into the upper support structure 6b. The upper support structure 6b is
30 correspondingly open at its bottom part and the height of the upper support structure 6b is essentially smaller than the height of the elevator car 1, i.e. the upper support structure 6b is essentially around only the top part of the elevator car 1.

When it is desired to transfer the elevator car 1 to travel from the bottom part of the hoistway 2 to the top part of the hoistway, the car is driven to the top end of its lower
5 travel range, where the top end of the elevator car 1 is guided inside the upper support structure 6b. The elevator car 1 is fixed into the upper support structure 6b and after that detached from the lower support structure 6a, after which the elevator car 1 can start to be moved in the top
10 part of the hoistway 2 by means of the upper hoisting apparatus 3b.

Correspondingly, when it is desired to transfer the elevator car 1 to travel from the top part of the hoistway 2 to the
15 bottom part of the hoistway, the car is driven to the bottom end of its upper travel range, where the bottom end of the elevator car 1 is guided inside the lower support structure 6a. The elevator car is fixed into the lower support structure 6a and after that detached from the upper support
20 structure 6b, after which the elevator car 1 can start to be moved in the bottom part of the hoistway 2 by means of the lower hoisting apparatus 3a.

The fixing of the elevator car 1 into the lower support
25 structure 6a is arranged such that the elevator car 1 rests upon its base on the lower support structure 6a and is additionally fixed into the support structure 6a with the lower fixing means 17a, such as e.g. with fixing pins. The fixing of the elevator car 1 into the upper support
30 structure 6b is arranged by means of the upper fixing means 17b, which are also e.g. fixing pins. In the situation of Fig. 1, the elevator car 1 is fixed into the upper support structure 6b.

In addition, the interdimensioning between the elevator car 1 and the support structures 6a and 6b is implemented such that when it is going upwards the elevator car 1 can be driven inside the upper support structure 6b and locked into its position without the lower support structure 6a or any other structure being an obstacle. Correspondingly, when it is going downwards the elevator car 1 can be driven inside the lower support structure 6a and locked into its position without the upper support structure 6b or any other structure being an obstacle.

In this embodiment the suspension ratio of both hoisting apparatuses 3a and 3b is 2:1. Owing to this type of suspension the lower hoisting apparatus 3a does not comprise hoisting ropes above the elevator car 1 (on the path of movement of the car) nor does the upper hoisting apparatus 3b comprise hoisting ropes below the elevator car 1 (on the path of movement of the car), which enables the elevator car to be transferred easily from the lower hoisting apparatus 3a to the upper hoisting apparatus 3b, and vice versa, without the hoisting ropes being in the way.

Fig. 2 presents a simplified and diagrammatic side view of a second embodiment of the arrangement according to the invention. This elevator is otherwise similar, in terms of its suspension and in other respects, to the elevator presented in Fig. 1, except that this elevator comprises two elevator cars. The first elevator car 1 is fitted to travel in either the bottom part or the top part of the elevator hoistway 2 and the car 1 can be changed from the lower support structure 6a to the upper support structure 6b and vice versa in the same manner as in the elevator presented above. In addition to this, the second elevator car 18 is fixed into the upper support structure 6b. The diverting

pulleys 10b, 11b, 13b and 14b of the upper suspension are fixed to the second elevator car 18 instead of to the support structure 6b. This solution makes it possible for the upper hoisting apparatus 3b to transport passengers in the top part of the hoistway 2 in the second elevator car 18, even if the first elevator car 1 would be in use by the lower hoisting apparatus 3a in the bottom part of the hoistway 2. When the first elevator car 1 is fixed to the upper support structure 6b, passengers can be transported at the same time in both elevator cars 1 and 18 by means of the upper hoisting apparatus 3b. In this case the second elevator car 18 travels above the first elevator car 1.

Fig. 3 presents two different modes of an arrangement according to Fig. 2, in the first mode of which the elevator car 1 to be transferred from one support structure to the other is fixed into the upper support structure 6b, above which a second elevator car 18 that moves in the top part of the elevator hoistway 2 is securely fixed, in which case the elevator cars 1 and 18 move at the same time and in the same direction as each other. Correspondingly, in the second mode the elevator car 1 in the figure on the right-hand side is fixed to the lower support structure 6a, in which case the elevator cars 1 and 18 can move at the same time or at different times and in the same direction as each other or in different directions.

Fig. 4 presents two different modes of a third arrangement according to the invention, in the first mode of which the elevator car 1 to be transferred from one support structure to the other is fixed into the upper support structure 6b, and into the support structure 6a below which a second elevator car 19 that moves in the bottom part of the elevator hoistway 2 is securely fixed. In this mode the

elevator cars 1 and 19 can move at the same time or at different times and in the same direction as each other or in different directions. Correspondingly, in a second mode the elevator car 1 is fixed into the lower support structure 5 6a, which now contains two elevator cars 1 and 19 one on top of the other that travel in the same direction and at the same time.

Fig. 5 presents two different modes of a fourth arrangement 10 according to the invention, in the first mode of which the elevator car 1 to be transferred from one support structure to the other is fixed into the upper support structure 6b, to which a second elevator car 18 that moves in the top part of the elevator hoistway is also securely fixed. 15 Correspondingly, a third elevator car 19, which moves in the bottom part of the elevator hoistway 2, is securely fixed into the lower support structure 6a. In this mode the elevator cars 1 and 19 can move at the same time or at different times and in the same direction as each other or 20 in different directions, but the elevator cars 1 and 18 can only move simultaneously and in the same direction as each other. Correspondingly, in a second mode the elevator car 1 is fixed into the lower support structure 6a, which now contains two elevator cars 1 and 19 one on top of the other 25 that travel in the same direction and at the same time, whereas the elevator car 18 securely fixed into the upper support structure 6b can move at the same time as, or at a different time than, the elevator cars 1 and 19 and also in the same direction as, or in a different direction than, the 30 elevator cars 1 and 19.

With the method according to the invention, the elevator car 1 is moved in the elevator hoistway 2 e.g. as follows. The elevator car 1 is e.g. on the ground floor of the building,

and it is desired to drive it to the topmost floor of the building. In this situation the elevator car 1 is fixed into the lower support structure 6a. The elevator car 1 is driven by means of the first hoisting apparatus 3a up to the
5 changeover height, which is e.g. at the point of some floor level roughly at the halfway point of the hoistway 2. The top part of the elevator car 1 is guided inside the upper support structure 6b. After this the elevator car 1 is fixed into the upper support structure 6b and detached from the
10 lower support structure 6a, after which the elevator car 1 is driven to the topmost floor by means of the second hoisting apparatus 3b.

Correspondingly, when driving from the topmost floor to the
15 ground floor, the elevator car 1 is driven by means of the second hoisting apparatus 3b downwards to the changeover height, at which height the elevator car 1 is fixed into the lower support structure 6a, detached from the upper support structure 6b, and driven to the ground floor by means of the
20 first hoisting apparatus 3a.

The aforementioned transfer functions are preferably performed at the changeover point always when the elevator car 1 is moving from the bottom part of the elevator
25 hoistway 2 to the top part, or from the top part to the bottom part, past the changeover point regardless of from where the elevator car 1 started to move and of what the target floor is.

30 The transfer of the elevator car from one hoisting apparatus to the other can be performed on the move or such that the elevator car 1 is stationary for the time it takes to lock it into position with fixing means in the support structure

6a or 6b. The changeover point is preferably always the same.

Fig. 6 presents the control arrangement of the support structures (6a,6b), which is advantageous to use in the solutions of Figs. 1-5. The first and the second support structure (6a,6b) travel on guide rails G, which guide rails G continue over the changeover point C in parallel and essentially without breaks (except for possible seams between guide rail sections), at which changeover point the elevator car 1 is arranged to be transferred from one support structure to the other. In this way uniform guide rail lines form. The guide rails of the zone of the lower hoisting apparatus, i.e. the guide rails on which the lower support structure 6a travels, support from below the guide rails of the zone of the upper hoisting apparatus, i.e. the guide rails on which the upper support structure 6b travels, above them. In this way the elevator car can be guided on guide rails belonging to the same, commonly supported, guide rail line when it is being supported by whichever of the upper or lower hoisting apparatuses. The first and the second support structure (6a,6b) can thus travel on guide rails G belonging to the same guide rail line.

In the control arrangement of Fig. 6 the first and the second support structure (6a,6b) each comprise guide shoes (20a,20b), such as e.g. slide and/or roller guide shoes, which travel on guide rails G belonging to the same guide rail line. More precisely, the first and the second support structure (6a,6b) each comprise a plurality of guide shoes (20a,20b), such as e.g. slide and/or roller guide shoes, the guide shoes of which plurality travel on guide rails G, and the guide shoes (20a,20b) of which plurality are at a horizontal distance from each other and are rigidly fixed to each other via the supporting structures of their support structures (6a,6b). Each aforementioned guide shoe plurality

of a support structure (6a,6b) comprises guide shoes (20a,20b) on the opposite sides of the vertical projection of the elevator car (1), which guide shoes travel on the guide rails on the opposite sides of the elevator car.

5

The elevator presented in this application is most preferably an elevator applicable to passenger transport installed in a building, e.g. in a high-rise building.

10 It is obvious to the person skilled in the art that different embodiments of the invention are not only limited to the examples described above, but that they may be varied within the scope of the claims presented below. Thus, for example, the suspension arrangement of the elevator can also
15 be different to what is presented above. For example, the suspension ratio can also be other than 2:1, e.g. 1:1, and the placement and number of the diverting pulleys can be different to what is presented above, et cetera.

20 It is also obvious to a person skilled in the art that the changeover of an elevator car from one hoisting apparatus to another does not necessarily need to be performed at the halfway point of the elevator hoistway, but instead it can be performed at some other suitable point of the hoistway.

25 It is further obvious that the hoisting apparatuses 3a and 3b can differ from each other, e.g. in relation to suspension ratio, machinery speed, etc. It is also obvious to a person skilled in the art that the fixing of the elevator car into support structures can also be done in a
30 different way than that presented above. It is also obvious that there can be more than two hoisting apparatuses that move the elevator car, such as three, four or even more.

CLAIMS

1. Elevator arrangement, in which the elevator comprises at least an elevator hoistway (2) and an elevator car (1) fitted to move essentially vertically in the elevator hoistway (2), as well as at least a first hoisting apparatus (3a) and a second hoisting apparatus (3b), which hoisting apparatuses (3a, 3b) are arranged to move the elevator car (1), characterized in that the first hoisting apparatus (3a) comprises a first support structure (6a) and the second hoisting apparatus (3b) comprises a second support structure (6b), and in that the elevator car (1) is arranged to be transferred from one support structure to the other support structure.
2. Elevator arrangement according to any of the preceding claims, characterized in that the first and the second support structure (6a,6b) travel on guide rails (G).
3. Elevator arrangement according to any of the preceding claims, characterized in that the guide rails of the zone of the lower hoisting apparatus (3a) support from below the guide rails of the zone of the upper hoisting apparatus (3b) above them.
4. Elevator arrangement according to any of the preceding claims, characterized in that the first and the second support structure (6a,6b) travel on guide rails (G), which guide rails (G) continue over the changeover point (C) in parallel and essentially without breaks, at which changeover point the elevator

car (1) is arranged to be transferred from one support structure to the other.

5. Elevator arrangement according to any of the
5 preceding claims, characterized in that the first and the second support structure (6a,6b) each comprise parts that extend to the opposite sides of the elevator car (1), between which parts the elevator car (1) can be moved when transferring the elevator car (1) from
10 one support structure to the other support structure.

6. Elevator arrangement according to any of the preceding claims, characterized in that the elevator car (1) is arranged to be transferred from inside one
15 support structure to inside the other support structure.

7. Elevator arrangement according to any of the preceding claims, characterized in that the support
20 structures (6a,6b) each comprise a hollow that opens towards the elevator car (1), inside which hollow the elevator car (1) can be moved when transferring the elevator car (1) to the support of the support structure in question.

25
8. Elevator arrangement according to any of the preceding claims, characterized in that at least the top part of the elevator car (1) can be guided from below inside the second support structure (6b), and at
30 least the bottom part of the elevator car (1) can be guided from above inside the first support structure (6a).

9. Elevator arrangement according to any of the preceding claims, characterized in that the first and the second support structure (6a,6b) travel on guide rails (G) belonging to the same guide rail line.
- 5
10. Elevator arrangement according to any of the preceding claims, characterized in that the first and the second support structure (6a,6b) each comprise guide shoes (20a,20b), such as e.g. slide and/or roller guide shoes, which guide shoes of the support structures travel on guide rails (G) belonging to the same guide rail line.
- 10
11. Elevator arrangement according to any of the preceding claims, characterized in that the first and the second support structure (6a,6b) each comprise a plurality of guide shoes (20a,20b), such as e.g. slide and/or roller guide shoes, the guide shoes of which plurality travel on guide rails (G), and the guide shoes (20a,20b) of which plurality are at a horizontal distance from each other and rigidly fixed to each other via the supporting structures of their support structures (6a,6b).
- 15
- 20
- 25
- 30
12. Elevator arrangement according to any of the preceding claims, characterized in that each aforementioned guide shoe plurality of a support structure (6a,6b) comprises guide shoes (20a,20b) on the opposite sides of the vertical projection of the elevator car (1).
13. Elevator arrangement according to any of the preceding claims, characterized in that the first hoisting apparatus (3a) comprises at least a first hoisting

machine (4a), which is arranged to move the elevator car (1) via a first hoisting roping (8a), and in that the second hoisting apparatus (3b) comprises at least a second hoisting machine (4b), which is arranged to move the elevator car (1) by means of a second hoisting roping (8b).

14. Elevator arrangement according to any of the preceding claims, characterized in that the first hoisting apparatus (3a) is arranged to move the elevator car (1a) in the first part of the elevator hoistway (2), and in that the second hoisting apparatus (3b) is arranged to move the same elevator car (1) in the second part of the same elevator hoistway (2).

15. Elevator arrangement according to any of the preceding claims, characterized in that the first hoisting apparatus (3a) is arranged to move the elevator car (1) in the bottom part of the elevator hoistway (2), and in that the second hoisting apparatus (3b) is arranged to move the same elevator car (1) in the top part of the same elevator hoistway (2).

16. Elevator arrangement according to any of the preceding claims, characterized in that the first support structure (6a) comprises at least fixing means (17a) for locking the elevator car (1) into its position in the first support structure (6a) and for detaching the locking from the first support structure (6a), and in that the second support structure (6b) comprises at least fixing means (17b) for locking the elevator car (1) into its position in the second support structure (6b) and for detaching the locking from the second support structure (6b).

17. Elevator arrangement according to any of the preceding claims, characterized in that at least one or both of the hoisting apparatuses (3a, 3b) are arranged to move an elevator car (18, 19) essentially securely fixed into at least one or both support structures (6a, 6b) in the same elevator hoistway (2) along with the elevator car (1) to be transferred from one support structure (6a or 6b) to another.
18. Elevator arrangement according to any of the preceding claims, characterized in that the lower support structure (6a) is open at its top part and the height of the lower support structure (6a) is preferably essentially smaller than the height of the elevator car (1), and in that the upper support structure (6b) is open at its bottom part and the height of the upper support structure (6b) is preferably essentially smaller than the height of the elevator car (1).
19. Method for moving an elevator car in an elevator hoistway, in which method the elevator car (1) is moved in the elevator hoistway (2) by means of a first hoisting apparatus (3a) or by means of a second hoisting apparatus (3b), characterized in that the elevator car (1) is moved in the first part of the elevator hoistway (2), while fixed into a first support structure (6a), by means of the first hoisting apparatus (3a), and in the second part of the same elevator hoistway (2), while fixed into a second support structure (6b), by means of a second hoisting apparatus (3b), and in that the supporting of the elevator car (1) is changed over from one hoisting

apparatus to the other by driving the elevator car (1) to a determined height by means of one hoisting apparatus, at which determined height the elevator car (1) is fixed into one support structure and after this
5 detached from the second support structure.

20. Method according to any of the preceding claims, characterized in that when driving the elevator car (1) from the bottom part of the elevator hoistway (2) to
10 the top part of the same elevator hoistway (2), the elevator car (1) is driven in the bottom part of the elevator hoistway (2), while fixed into the lower support structure (6a), by means of the first hoisting apparatus (3a) upwards to the changeover height of the
15 elevator car (1), at which height the top part of the elevator car (1) is guided from below inside the upper support structure (6b), after which the elevator car (1) is fixed into the upper support structure (6b) and detached from the lower support structure (6a), after
20 which the elevator car (1) is driven to the target floor in the top part of the same elevator hoistway (2) by means of the second hoisting apparatus (3b).

21. Method according to any of the preceding claims,
25 characterized in that when driving the elevator car (1) from the top part of the elevator hoistway (2) to the bottom part of the same elevator hoistway (2), the elevator car (1) is driven in the top part of the elevator hoistway (2), while fixed into the upper
30 support structure (6b), by means of the second hoisting apparatus (3b) downwards to the changeover height of the elevator car (1), at which height the bottom part of the elevator car (1) is guided from above inside the lower support structure (6a), after which the elevator

car (1) is fixed into the lower support structure (6a) and detached from the upper support structure (6b), after which the elevator car (1) is driven to the target floor in the bottom part of the same elevator hoistway (2) by means of the first hoisting apparatus (3a).

22. Method according to any of the preceding claims, characterized in that the changeover of the elevator car (1) from one support structure to the other is performed essentially at the halfway point of the height of the elevator hoistway (2).

23. Method according to any of the preceding claims, characterized in that more than one elevator car (1, 18, 19) one above the other are moved in the same elevator hoistway (2) at essentially the same time.

24. Method according to any of the preceding claims, characterized in that one elevator car (1) detachably fixed into a support structure (6a or 6b) is moved in one part of the elevator hoistway (2) in one direction, and at essentially the same time one elevator car (18, 19) securely fixed into the second support structure (6b or 6a) is moved in the second part of the same elevator hoistway (2), either in the aforementioned one direction or in a second direction.

25. Method according to any of the preceding claims, characterized in that two elevator cars (1 and 18) or (1 and 19) fixed one above the other into one support structure (6a or 6b) are moved in one part of the elevator hoistway (2) in one direction and at essentially the same time one elevator car (18) or (19)

securely fixed into the second support structure (6b or 6a) is moved in the second part of the same elevator hoistway (2) either in the aforementioned one direction or in a second direction.

5

26. Method according to any of the preceding claims, characterized in that the elevator is arranged to be according to any of the preceding claims.

10 27. Method according to any of the preceding claims, characterized in that the first and the second support structure (6a,6b) travel on guide rails (G), and in that the guide rails of the zone of the lower hoisting apparatus (3a) support from below the guide rails of
15 the zone of the upper hoisting apparatus (3b) above them.

28. Method according to any of the preceding claims, characterized in that the first and the second support
20 structure (6a,6b) travel on guide rails (G); which guide rails (G) continue over the changeover point (C) in parallel and essentially without breaks, at which changeover point the elevator car (1) is transferred from one support structure to the other.

25

29. Method according to any of the preceding claims, characterized in that the first and the second support structure (6a,6b) travel on guide rails (G) belonging
30 to the same guide rail line.

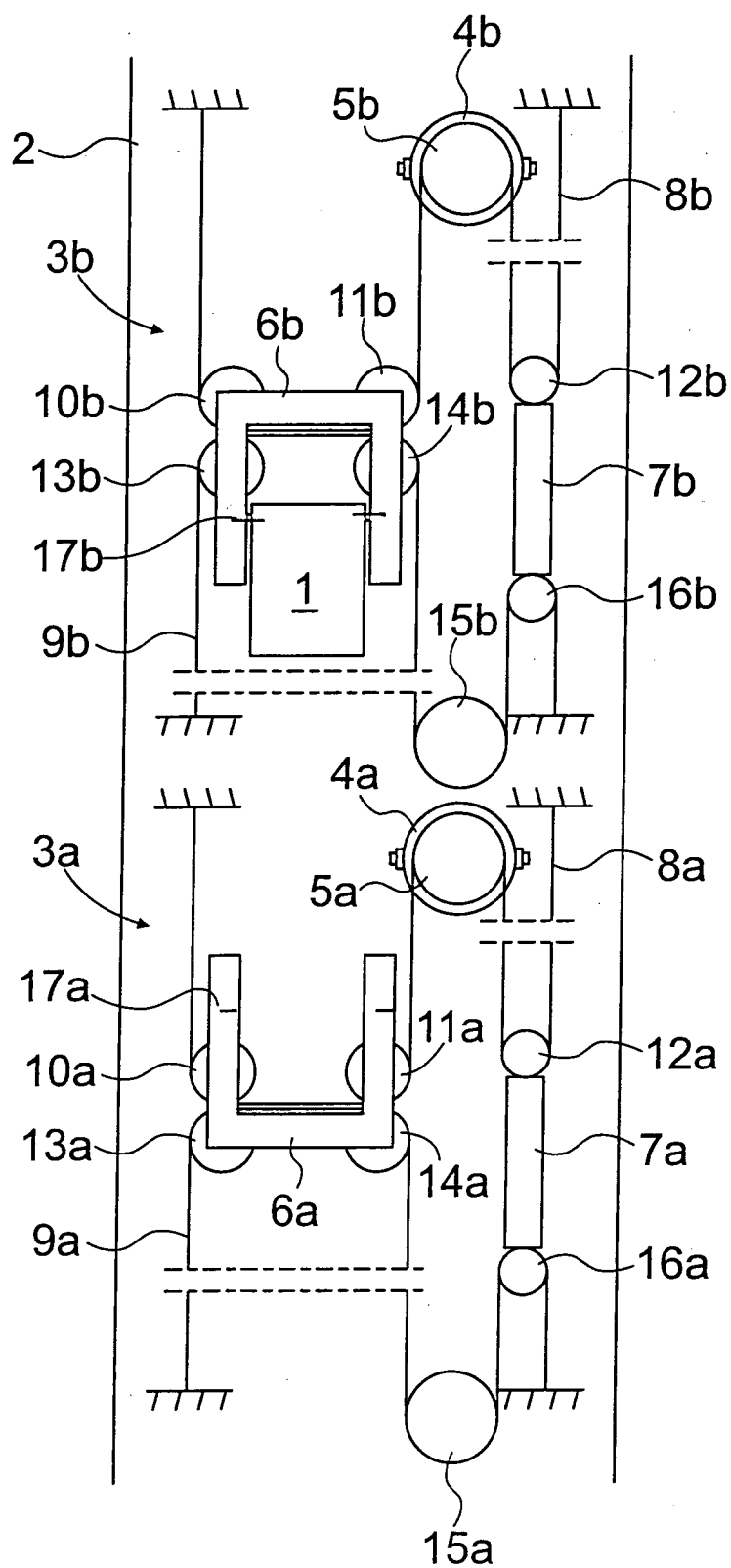


Fig. 1

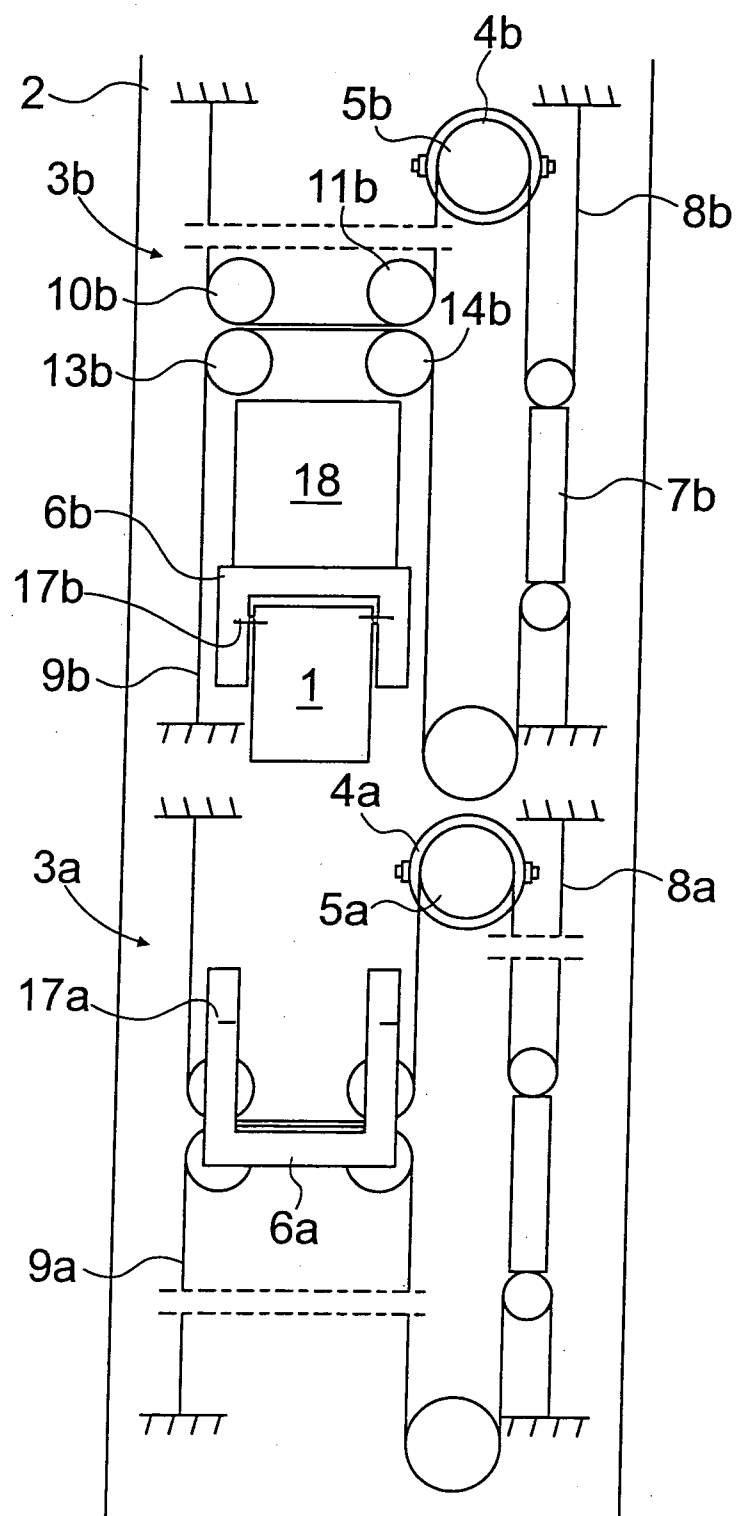


Fig. 2

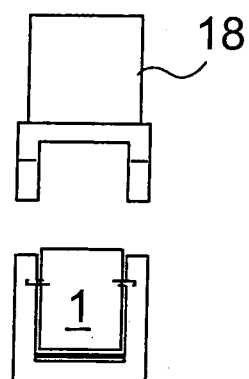
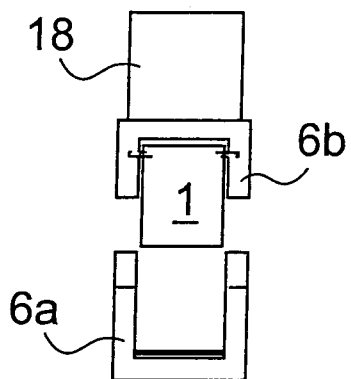


Fig. 3

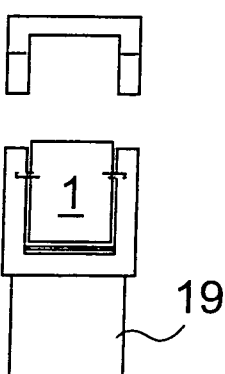
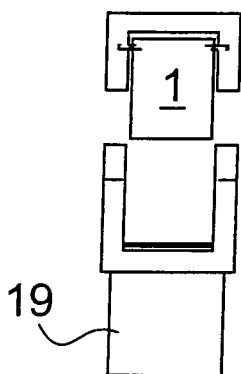


Fig. 4

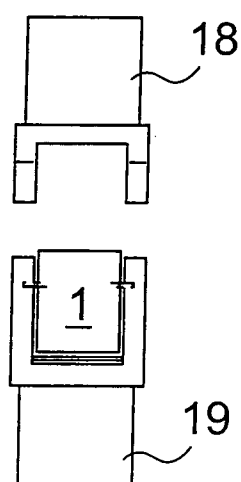
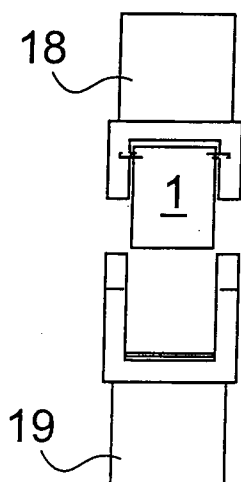
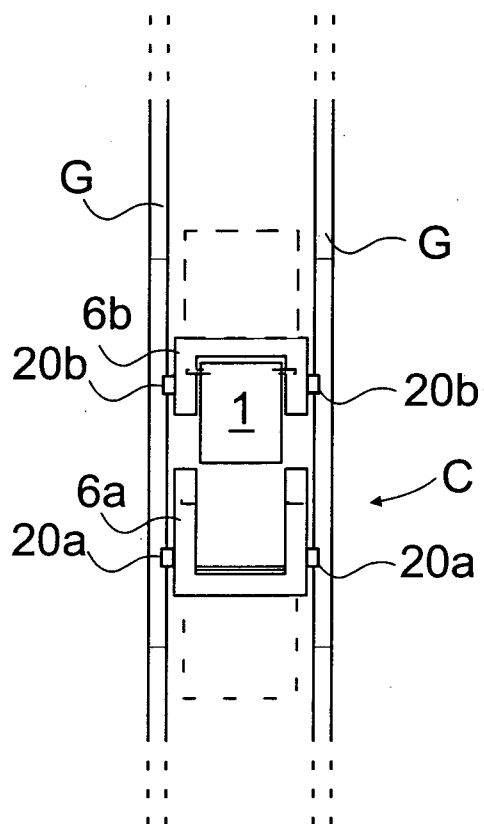


Fig. 5

Fig. 6



INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI2010/000044

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B66B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
FI, SE, NO, DK

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6062344 A (OKABE SUEO et al.) 16 May 2000 (16.05.2000) column 3, line 4 - column 5, line 15; figures 1-4	1-6, 8-22, 26-29
X	EP 0781724 A2 (OTIS ELEVATOR CO) 02 July 1997 (02.07.1997) whole document	1, 19, 23-26
X	US 5857545 A (BARRETT DAVID W et al.) 12 January 1999 (12.01.1999) column 3, line 49 - column 4, line 8; figures 1-6	1, 19
A	WO 2009013389 A1 (KONE CORP et al.) 29 January 2009 (29.01.2009) abstract; figure 1	1-29



Further documents are listed in the continuation of Box C.



See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search

07 October 2010 (07.10.2010)

Date of mailing of the international search report

18 October 2010 (18.10.2010)

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/FI2010/000044

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI2010/000044

CLASSIFICATION OF SUBJECT MATTER

Int.Cl.

B66B 11/00 (2006.01)

B66B 7/06 (2006.01)