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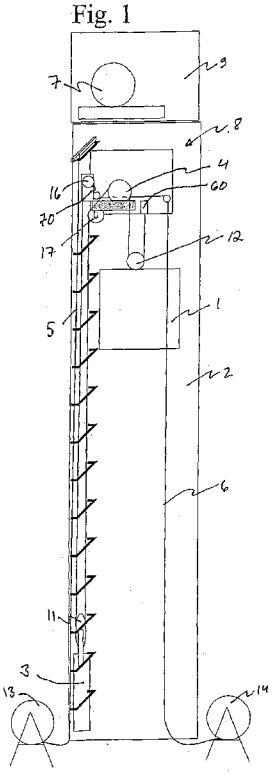
(54) Title: METHOD IN REPLACING THE HOISTING ROPING OF AN ELEVATOR AND METHOD FOR MANUFACTURING AN ELEVATOR

Fig. 1



(57) Abstract: Method in replacing the roping of an elevator, in which method the old hoisting roping of the elevator is removed and a new hoisting roping of the elevator is installed, which old and new hoisting roping each comprise at least one rope, preferably a plurality of ropes. In the method a new hoisting roping of an elevator is installed and the elevator car is arranged to be moved via the new hoisting roping, and the old hoisting roping is fed to the rope collection point (14), to which the old hoisting roping (6) from the elevator car (1) finally travels, by moving the elevator car (1) up and/or down in the elevator hoistway (2) by means of the new hoisting roping (5), to which elevator car the old rope is so connected that the old hoisting roping runs to the rope collection point regulated by the movement of the elevator car (1), towards which rope collection point the old rope is arranged to try to go to under the effect of a tractive force, which rope collection point is e.g. a rope reel or the base of the elevator hoistway, and which tractive force is preferably gravity and/or the tractive force produced by the rope collection point in the old rope such as e.g. the reeling force of a rope reel or a tractive force exerted on the rope by another separate pulling device.

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METHOD IN REPLACING THE HOISTING ROPING OF AN ELEVATOR AND METHOD FOR MANUFACTURING AN ELEVATOR

FIELD OF THE INVENTION

The object of the invention is a method in replacing the hoisting roping of an elevator as defined in the preamble of claim 1 and a method for manufacturing an elevator as defined in the preamble of claim 9.

BACKGROUND OF THE INVENTION

In connection with so-called jump-lifts, the bottom part of an elevator hoistway is taken into operational use of the elevator before the building has actually been completed. In this case the top parts of the building and of the elevator hoistway can be constructed at the same time as an elevator moving in the bottom part of the elevator hoistway already serves people on the lower floors of the building. Generally in jump-lifts the elevator car moving in the lower parts of the elevator hoistway is supported and moved during construction-time use with a hoisting machine supported on a supporting platform in the elevator hoistway, which supporting platform thus forms the machine room platform. When the building and the elevator hoistway that are under construction above the machine room platform have reached a sufficient stage of completion, the completed part of the elevator hoistway can be taken into use. In this case a jump-lift is performed, wherein the machine room platform is raised higher in the elevator hoistway. When a construction-time elevator has reached its final height, and jump-lifts will no longer be performed, the construction-time elevator can be converted into the final elevator. In this case there could be a need to replace the hoisting roping and to change the suspension ratio of the elevator. Replacement of the hoisting roping makes it awkward to change the suspension ratio because the

new roping must travel by a different route than the old roping and, that being the case, threading the new hoisting roping into its route over diverting pulleys and the traction sheave by pulling it with the old roping does not succeed. A particular problem is removing the old roping from its position safely such that neither the ropes nor their parts are able to drop in an uncontrolled manner in the hoistway. Lowering the ropes e.g. down to the base of the elevator hoistway with an auxiliary hoist, the end of the rope of which hoist is fixed to the old hoisting rope, is known in the art. This is, however, awkward in taller buildings because the limited lifting distance of auxiliary hoists has caused problems and a need for special arrangements.

Problems corresponding to those described above have also occurred in situations in which it is desired, for one reason or another, to remove the old roping of an elevator already in use in connection with modernization or maintenance. Problems have arisen particularly when an old rope had to be replaced with a new one, and for one reason or another it was not advantageous to use the old roping to pull the new roping into position. This can be disadvantageous e.g. for the reason that the dimensions of the new roping can be different to those of the old roping. In elevator modernizations also, when changing the suspension ratio of an old elevator, e.g. between suspensions of 1:1 and 1:2, it is generally necessary to remove the old roping from the elevator with a method that is implemented according to prior art, e.g. with the aforementioned auxiliary hoist.

AIM OF THE INVENTION

The aim of the invention is to eliminate, among others, the aforementioned drawbacks of prior-art solutions. More particularly the aim of the invention is to produce an

improved method in replacing the roping of an elevator. The aim of the invention is further to produce one or more of the following advantages, among others:

- A safe method for replacing/removing hoisting roping from an elevator system and for manufacturing an elevator is achieved.
- A method is achieved in which by performing the phases of the method according to the invention the old hoisting roping of an elevator can be threaded in phases out of the elevator system.
- A method for manufacturing an elevator is achieved, in which particularly the final phases of manufacturing the elevator are safe and efficient.
- A method for replacing ropes and for manufacturing an elevator is achieved, wherein the need for separate hoists in changing the hoisting ropes to be replaced is less than before.
- A method for replacing ropes and for manufacturing an elevator is achieved, which is suited to the manufacture/rope replacement/modernization of elevators of very high travel heights (over 100 m), because e.g. the use of auxiliary hoists with a very high lifting height for removing the old hoisting roping (e.g. lowering the tail end) is not necessary.
- A method for replacing ropes and for manufacturing an elevator is achieved, which can be performed by a small number of fitters.

SUMMARY OF THE INVENTION

The method in replacing the hosting roping of an elevator according to the invention can be defined to be characterized by what is disclosed in the characterization part of claim 1. The method according to the invention for manufacturing an elevator can be defined to be characterized by what is disclosed in the characterization part of claim 9. Other embodiments of the invention can be

defined to be characterized by what is disclosed in the other claims. Some inventive embodiments are also presented in the descriptive section and in the drawings 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 inventive concepts. The features of the various embodiments can be applied within the framework of the basic inventive concept in conjunction with other embodiments. The procedures of the invention defined in the non-independent claims could as procedures be regarded separately to an independent claim as separate inventions.

In the method according to the invention in replacing the roping of an elevator, the old hoisting roping of the elevator is removed and a new hoisting roping of the elevator is installed, which old and new hoisting roping each comprise at least one rope, preferably a plurality of ropes. In the method at least the following phases are performed:

- the new hoisting roping of the elevator is installed and the elevator car is arranged to be moved via the new hoisting roping,
- the old hoisting roping is fed to the rope collection point, to which the old hoisting roping from the elevator system (e.g. from the elevator car or from a part in connection with the elevator car directly or via diverting pulleys) travels, by moving the elevator car up and/or down in the elevator hoistway by means of the new hoisting

roping, to which elevator car the old rope is directly or indirectly connected so that the old hoisting roping runs to the rope collection point regulated by the movement of the elevator car, towards which rope collection point the old rope is arranged to try to go to under the effect of a tractive force, which rope collection point is preferably a rope reel or the base of the elevator hoistway or a rope container, and which tractive force is preferably gravity and/or the tractive force produced by the rope collection point in the old rope such as e.g. the reeling force of the rope reel and/or a tractive force exerted on the rope by another separate pulling device.

In one embodiment of the invention the old hoisting roping is fed to the rope collection point by moving the elevator car upwards in the elevator hoistway by means of the new hoisting roping and by allowing the old hoisting roping that travels from the elevator car to the diverting pulley, which is stationary in relation to the building, and that travels over it and onwards from the diverting pulley to the rope collection point, to run so that the old hoisting roping travels freely towards the rope collection point over the aforementioned diverting pulley to the rope collection point pulled by a tractive force.

In one embodiment of the invention, at least the following phases are performed in the method:

- the elevator car is moved to the top end of the elevator hoistway and the counterweight to the bottom end,
- the new hoisting roping is guided over the traction sheave and fixed to the elevator car,
- the new hoisting roping is fixed to the counterweight,

- the diverting pulley, which is suspended with old roping with a 1:2 suspension ratio, of the counterweight is lifted by means of the new roping by driving the elevator car downwards in the elevator hoistway,
- the diverting pulley of the counterweight, via which diverting pulley the old roping travels, is fixed essentially immovably to the elevator hoistway,
- the old hoisting roping is arranged to travel freely movably from the diverting pulley of the counterweight to the rope collection point, e.g. by opening the rope clamps, which rope collection point is preferably essentially at a lower height than the diverting pulley for bringing about the resultant tractive effect of gravity that pulls the hoisting roping out of the elevator system,
- the elevator car is driven upwards so that the old hoisting roping reels onto the rope collection point pulled by the aforementioned tractive force, in which case the elevator car is driven preferably right to its top position.

In one embodiment of the invention the old hoisting roping, the first end of which is fixed into its position in relation to the building with clamp, is fed to the rope collection point by moving the elevator car downwards in the elevator hoistway by means of the new hoisting roping and at the same time the counterweight and the diverting pulley fixed to the counterweight, or to a part of the hoisting roping moving in the same direction with it, is moved upwards, via which diverting pulley the old hoisting roping travels from the elevator car to the diverting pulley that is stationary in relation to the building and is in the top parts of the elevator, and over the diverting pulley onwards to the rope collection point, and the old

hoisting roping is allowed to run so that the old hoisting roping travels freely towards the rope collection point over the aforementioned diverting pulley to the rope collection point pulled by a tractive force.

In one embodiment of the invention the old hoisting roping is fixed to the elevator car, preferably in the proximity of its end, to prevent the free falling of the old hoisting roping, and the old hoisting roping is lowered down by moving the elevator car downwards in the elevator hoistway, to which elevator car the old rope is fixed so that the old hoisting roping runs down in the elevator hoistway regulated by the movement of the elevator car, pulled at least by the force of gravity, to the rope collection point, such as e.g. to a reel or to the base of the elevator hoistway. Before this the elevator car is preferably driven to its top position.

In one embodiment of the invention the end of the old hoisting roping is lowered down in the elevator hoistway such that the elevator car is driven to its top position and the end of the old hoisting roping is arranged to be in connection with the elevator car, and the old hoisting roping is fixed to the elevator car so that the old hoisting roping travels, without traveling via the parts fixed to the elevator hoistway, from its fixing point (72) on the elevator car downwards into the elevator hoistway and onwards to the rope collection point, and the old rope is lowered down by moving the elevator car downwards in the elevator hoistway.

In one embodiment of the invention an elevator is converted with the method, the elevator car and/or counterweight of which elevator is suspended with a 1:2 lifting ratio, into a 1:1 elevator, in which the first end of the new hoisting

roping is fixed to the elevator car and the second end to the counterweight.

In one embodiment of the invention the old hoisting roping is fed to the rope collection point, from which rope collecting point additional rope has been supplied to the elevator system during previous jump-lifts.

In the method according to the invention for manufacturing an elevator the procedures of the invention, or of the invention and at least one embodiment of it, described in the preceding are performed. In the method according to the invention for manufacturing an elevator one or more of the methods described above can thus be utilized separately or jointly for removing the old hoisting roping of the elevator fully or partially, in which case the method described can form just one part of the method for replacing the ropes. In this case the method can be started or the method can be continued to the end with some other method than what is described in this application.

In one embodiment of the invention for manufacturing an elevator the machine room platform has been moved before the replacing of the roping in steps upwards in the hoistway 2 as the construction work progresses, and the elevator car 1 has served the users or constructors of the building.

Returning of rope back to the reels or rope container in connection with the roping replacement may form a separate invention. In that case, in the method for manufacturing an elevator the machine room platform is moved in steps upwards in the hoistway as the construction work progresses, and the elevator car 1 serves (while being supported by the machine room platform) the users or

constructors of the building during the construction phase, after which a roping replacement is carried out, in which roping replacement the old hoisting roping of the elevator is removed and a new hoisting roping of the elevator is installed, which old and new hoisting roping each comprise at least one rope, preferably a plurality of ropes. In the method the old hoisting roping is fed to the rope collection point, to which the old hoisting roping (6) from the elevator system travels, towards which rope collection point the old rope is arranged to try to go to under the effect of tractive force, which rope collection point is preferably a rope reel or the base of the elevator hoistway or a rope container, and which tractive force is preferably gravity and/or the tractive force produced by the rope collection point (14) in the old rope such as e.g. the reeling force of the rope reel and/or a tractive force exerted on the rope by another separate (preferably motorized) pulling device, from which rope collecting point additional rope has been supplied to the elevator system during previous jump-lifts. This results in a simplified method, wherin the roping can be brought to site and removed from the site in similar manner. In other ways the rope replacement can be done by performing steps mentioned in any other embodiments.

In one embodiment of this invention the old rope 6 travels onwards to the rope collection point via an (openable) rope clamp.

In one embodiment of this invention the tractive force produced by the rope collection point is taken from a reel rotating motor arranged in the unity of the rope reel(s) temporarily or permanently. Thus the position of the rope collection point can be chosen as desired.

In one embodiment of this invention the rope collection point is in the unity of the machine room platform or at a landing in the vicinity of the machine room.

In one embodiment of this invention the elevator is converted with the method, the elevator car and/or counterweight of which elevator is suspended with a 1:2 lifting ratio, into a 1:1 elevator, in which the first end of the new hoisting roping is fixed to the elevator car and the second end to the counterweight.

LIST OF FIGURES

In the following, the invention will be described in detail by the aid of some embodiments with reference to the attached drawings, wherein Figs. 1-9 present situations in different phases of the method according to the invention in the sequence in which the method is performed.

DETAILED DESCRIPTION OF THE INVENTION

Fig. 1 presents a phase of the method according to the invention, in which the old hoisting roping 6 is still in its position and can be used for moving the elevator car 1. The elevator car 1 and the counterweight 3 are both suspended with a 1:2 lifting ratio from the old hoisting roping and they can be moved with a traction sheave machine 4 that is on a machine room platform 8. The old hoisting roping is fixed at its first end immovably into its position in relation to the building to a clamp 60, which is in connection with the machine room platform, but could also be elsewhere. From the rope clamp 60 the old roping 6 travels to the elevator car 1, to the diverting pulley 12, passes around the diverting pulley 12 and rises upwards, passes around the traction sheave 4 and descends to pass over the top of the diverting pulley 17 to the

counterweight 3, passes around the diverting pulley 11 of the counterweight and rises upwards to the machine room platform 8 and passes around the diverting pulley 16 that is supported on the machine room platform 8, and travels onwards to the rope clamp 70 that is in connection with the machine room platform, via which rope clamp 70 the old rope 6 travels onwards to the rope collection point 14, which in the figure is a rope reel. From the rope reel 14 it has been possible, e.g. during previous jump-lifts, to supply to the elevator system the additional rope required for a lift of that height by opening the rope clamp 70, via which continuous roping 6 travels. In connection with the removal of the old roping 6, the old roping 6 can correspondingly be guided back to the same rope reel 14. In the phase of the method presented in Fig. 1, the first end of the new hoisting rope 5, lifted to the top parts of the elevator hoistway from the rope reel 13, is also presented. Fig. 2 presents how the first end of the new hoisting roping is lifted inside the final machine room 9 with an auxiliary hoist 10 and guided to travel over the final traction sheave 7. After this, in the method the first end of the new hoisting roping is lowered to the elevator car 1, which is raised to the top end of the elevator hoistway, and fixed to the elevator car in the manner presented in Fig. 3 with a 1:1 suspension. The second end of the new hoisting roping 5 is fixed to the counterweight 3. After this the elevator car 1 can be moved by means of the new hoisting roping. Disassembly of the suspension of the old hoisting roping 6 is started only when the elevator car is suspended to rest on the new hoisting roping 5. In fixing the new hoisting roping 5 to the elevator car 1, it is advantageous to move the diverting pulley 12 of the elevator car away from the point of the center of mass so that the new hoisting roping can be fixed with a clamp 19 to the point of the center of mass of the elevator car as viewed in the horizontal direction. During the move the roping 5 is fixed

with a clamp 71 and the elevator car 1 is locked to the elevator hoistway e.g. with the safety gears. After this the clamp 71 is opened. Alternatively, instead of the move the fixing point 60 of the rope could be moved to the elevator car 1. In this phase of the method also when fixing the new roping 5 to the counterweight 3, it is advantageous to move the diverting pulley 6 of the old roping so that it does not interfere with the new roping 5 that hereafter supports the counterweight 3. The diverting pulley 11 can be kept fixed in connection with the counterweight 3 or it can be completely detached from the counterweight 3 and possibly its own horizontal guidance can be arranged for it to keep it on the desired path of movement in the horizontal direction when it moves in the hoistway. After this the elevator car is driven downwards in the hoistway (to the position of Fig. 4) so that the counterweight 3 and the diverting pulley 11 rise up, the counterweight 3 lifted by the hoisting roping 5 and the diverting pulley 11 lifted by the hoisting roping 6. Preferably the elevator car and the counterweight are driven to the proximity of each other into the situation presented in Fig. 4, most preferably to essentially halfway in the elevator hoistway. In this way work can be done with the counterweight 3 via the elevator car. After this the diverting pulley 11 is detached from the counterweight 3, if this was not already done in an earlier phase, and it is fixed to the elevator hoistway 2 essentially immovably. After this the rope clamp 70 between the diverting pulley 11 and the rope collection point 14 is opened so that the rope 6 travels to (and can be fed to) the rope collection point 14 unhindered by the clamps. The rope collection point 14 is preferably lower than the diverting pulley 11, so that the force of gravity brings about the force driving the unreeling of the rope from the elevator system to the rope collection point. Also a separate rope-pulling device can be used instead of or alongside producing a tractive

force based on gravity, which rope-pulling device produces in the rope/ropes of the roping a force pulling it/them out of the system and towards the rope collection point 14, such as e.g. a rope reel provided with a drive or a separate rope-pulling device pulling the rope through it towards the rope collection point 14.

After the situation presented in Fig. 4, the elevator car 1 is driven with the new hoisting roping 5 upwards in the elevator hoistway 2. As a consequence of this, the old hoisting roping 6 is able to run out of the elevator system towards the rope collection point 14, to which the aforementioned tractive force arranged in the roping 6 pulls the roping 6. When raising the elevator car 1 the diverting pulley 12 moves upwards and the section of roping 6 between the traction sheave 4 and the clamp 60 shortens, and the amount of rope of the shortening is freed as excess rope and moves, pulled by the tractive force, towards the rope collection point 14. The old roping 6 that travels from the elevator car 1 to the diverting pulley (e.g. in this case the diverting pulley 16 and/or the traction sheave 4) that is stationary in relation to the building and onwards to the rope collection point 14 is allowed to run freely towards the rope collection point 14 pulled by the tractive force to the rope collection point (14). A corresponding effect could be brought about with an alternative arrangement if the hoisting roping 6 were led from the elevator car 1 to a diverting pulley that is stationary in relation to the building and in the place of the rope clamp 60, and then onwards to the rope collection point.

Fig. 5 presents the final situation, in which the elevator car has just been driven upwards. During the upward run of the elevator car the diverting pulley 11 has been stationary and the counterweight 3 has moved to the bottom

end of the hoistway. In addition, the old hoisting roping 6 in the figure presented is, after the raising of the elevator car 1, detached from being in connection with the elevator car 1 (by removing it from the diverting pulley 12 and by detaching it from the rope clamp 60 and by fixing it again to the clamp 71 of the machine room platform).

In the method, it is generally speaking arranged so that the elevator car 1 can first be moved via the new hoisting roping 5 (and preferably also via the new hoisting machine 7) and only after that is detachment of the old hoisting roping 6 started and it is fed out of the elevator system. As a consequence of the movement of the elevator car the old hoisting roping 6 runs to the rope collection point regulated by the movement of the elevator car 1, towards which rope collection point the old rope is arranged to try to go to under the effect of tractive force. Thus when the elevator car moves, the old hoisting roping moves simultaneously and when the elevator car 1 is stationary the old hoisting roping does not move because the old hoisting roping is connected directly or indirectly to the elevator car 1. The elevator car 1 is moved in the way that the old hoisting roping 6 travels simultaneously along with the movement of the elevator car towards the rope collection point, more particularly so that the amount of hoisting roping comparable to the distance moved by the elevator car has, during the movement of the elevator car, moved towards the rope collection point. The old hoisting roping 6 is connected so as to be regulated by the movement of the elevator car 1 by connecting the old roping directly to the elevator car 1, or indirectly via a part (e.g. 11 and also 5 or 3) in connection with the elevator car 1, which part moves always when the elevator car moves. The end of the old hoisting roping 6 is preferably in the rope collection point. The rope collection point is preferably disposed at the bottom end of the elevator hoistway or in

its proximity, e.g. on the lowermost landing. The rope collection point 14 can, if necessary, be elsewhere, more particularly if the aforementioned tractive force is arranged alongside gravitational force or instead of gravitational force with the other means referred to in this application.

Fig. 6 presents the final situation of the next phase of the method, in which the elevator car is driven downwards in the elevator hoistway 2 to the proximity of the counterweight 3, in which case work can be done with the counterweight from the elevator car. After this the diverting pulley 11 is detached from the elevator hoistway 2 and fixed to the new hoisting roping 5, more particularly to a part of the hoisting roping 5 (or alternatively to the counterweight) that moves in the same direction as the counterweight 3, with the clamp 73. Thus the diverting pulley 11 is connected so as to be regulated by the movement of the elevator car 1 by connecting it to the elevator car 1 indirectly via the hoisting roping 5 and the movement of the elevator car 1 regulates the movement of the diverting pulley in the elevator hoistway and, that being the case, also the running of the old hoisting roping 6 towards the rope collection point 14 following from the movement of the diverting pulley. After this the rope clamp 70 between the diverting pulley fixed in the elevator hoistway and the rope collection point is opened and the elevator car is driven downwards, in which case the diverting pulley 11 rises upwards in the elevator hoistway and at the same time the old rope reels by means of the aforementioned tractive force freely over the diverting pulley 16 to the rope collection point 14, in which case the situation presented by Fig. 7 is arrived at. The old hoisting roping 6 is no longer in this phase in connection with the elevator car 1 via the diverting pulley but instead the end of it is fixed into position in relation to

the building with the clamp 71, so that lifting the diverting pulley 11 frees rope. After this the rope clamp 70 is fixed between the diverting pulley and the rope collection point 14 and the diverting pulley 11 is detached from the new roping 5 and it is supported on the auxiliary hoist 10.

Fig. 8 presents the final situation of the next phase of the method, in which method phase the elevator car is driven upwards to its top position and the hoisting roping 6 is connected to move regulated by the movement of the elevator car 1 by fixing it directly to the elevator car with the clamp 72, so that the old roping 6 travels, without traveling via the parts fixed to the elevator hoistway 2, from its fixing point 72 on the elevator car downwards into the elevator hoistway 2 and onwards to the rope collection point 14. The figure presents how also the diverting pulley 11 is preferably removed by lifting with an auxiliary hoist 10.

Fig. 9 presents the next phase of the method, in which the hoisting roping 6 is detached from the clamp 71, and the section of hoisting roping 6 between the clamp 71 and 72 is removed, either by cutting it or by reeling it onto the roof of the elevator car 1. The hoisting roping 6 is fixed directly to the elevator car, preferably in the proximity of its end, to prevent the free falling of the hoisting roping. Next, the old hoisting roping 6 is lowered down by moving the elevator car 1 downwards in the elevator hoistway 2, to which elevator car the old hoisting roping 6 is fixed so that the old hoisting roping runs down in the elevator hoistway regulated by the movement of the elevator car, pulled at least by the force of gravity, to the rope collection point 14, which in the figure is a rope reel. Alternatively, e.g. the base of the elevator hoistway can function as the rope collection point. The end of the old

hoisting roping 6 is lowered downwards along with the elevator car 1. In the situation presented in Fig. 9, the elevator car is driven to its bottom position, in which case also the end of the old hoisting roping moves to the bottom part of the elevator hoistway and it can be safely detached from the elevator car. After this also the end of the old hoisting roping 6 detached from the elevator car 1 is moved to the rope collection point 14 and in this way the old hoisting roping 6 collected into one point, e.g. onto a reel, into a coil or in a pile, is removed from the area.

The figures present the final machine room 9 with its hoisting machine 7 separate from the machine room platform, but this type of machine room is not necessary; instead, corresponding procedures can, with a small additional arrangement, be implemented with the means of the machine room platform 8, e.g. by using the traction sheave machine 4 for moving the new hoisting roping and by moving the old hoisting roping to travel alongside the machine 4 over an arranged diverting pulley when the elevator car is locked in the hoistway.

The old hoisting roping 6 is in the embodiment presented connected to the elevator 1 and to the counterweight 3 via the diverting pulleys 11 and 12, but it is obvious that the invention could also be utilized for replacing the hoisting roping of the type of elevator in which one or both ends of the hoisting roping 6 are connected to the elevator car/counterweight by fixing e.g. with a clamp.

The method presented in the figures primarily presents a rope replacement method of the final phase of a jump-lift, wherein the machine room platform has been moved before the stage of Fig. 1 in steps upwards in the hoistway 2 as the construction work progresses, and the elevator car 1 has

served the users or constructors of the building during the construction phase. The same method, however, is suited to utilizing for other than the rope change of jump-lifts, e.g. for rope replacements or modernizations.

A number of method parts/phases of the rope replacement method are described above, by utilizing which the running of the ropes out of the elevator system can be performed. All the parts of the method do not need to be utilized, although it is advantageous to act as described in the preceding. For example, when the rope, regulated by the movement of the elevator car, is fed out of the elevator system to the rope collection point, it can be continued with some other method, e.g. by pulling the ropes out of the system, when the resistance has decreased sufficiently.

In this application the term hoisting roping refers to hoisting roping that comprises at least one rope, chain, belt or some other corresponding and is arranged to move an elevator car and/or a counterweight. The elevator hoistway 2 is formed preferably inside the building and is vertical. It is obvious to the person skilled in the art that the invention is not limited to the embodiments described above, in which the invention is described using examples, but that many adaptations and different embodiments of the invention are possible within the frameworks of the inventive concept defined by the claims presented below.

CLAIMS

1. Method in replacing the roping of an elevator, in which method the old hoisting roping of the elevator is removed and a new hoisting roping of the elevator is installed, which old and new hoisting roping each comprise at least one rope, preferably a plurality of ropes, **characterized** in that in the method at least the following phases are performed:

- the new hoisting roping (5) of the elevator is installed and the elevator car is arranged to be moved via the new hoisting roping,
- the old hoisting roping is fed to the rope collection point (14), to which the old hoisting roping (6) from the elevator system travels, by moving the elevator car (1) up and/or down in the elevator hoistway (2) by means of the new hoisting roping (5), to which elevator car (1) the old rope (6) is directly or indirectly connected so that the old hoisting roping (6) runs to the rope collection point (14) regulated by the movement of the elevator car (1), towards which rope collection point the old rope (6) is arranged to try to go to under the effect of tractive force, which rope collection point (14) is preferably a rope reel or the base of the elevator hoistway or a rope container, and which tractive force is preferably gravity and/or the tractive force produced by the rope collection point (14) in the old rope such as e.g. the reeling force of the rope reel and/or a tractive force exerted on the rope by another separate pulling device.

2. Method according to any of the preceding claims, **characterized** in that the old hoisting roping is fed to the rope collection point by moving the elevator car (1)

upwards in the elevator hoistway (2) by means of the new hoisting roping (5) and by allowing the old roping (6) that travels from the elevator car (1) to the diverting pulley (16), which is stationary in relation to the building, and travels over it onwards from the diverting pulley (16) to the rope collection point (14), to run so that the old hoisting roping (6) travels freely towards the rope collection point (14) over the aforementioned diverting pulley (16) to the rope collection point (14) pulled by a tractive force.

3. Method according to any of the preceding claims, **characterized** in that in the method at least the following phases are performed:

- the elevator car is moved to the top end of the elevator hoistway and the counterweight to the bottom end,
- the new hoisting roping (5) is guided over the traction sheave and fixed to the elevator car (1),
- the new hoisting roping (5) is fixed to the counterweight (3),
- the diverting pulley (11) of the counterweight (3), which diverting pulley is suspended with the old roping with a 1:2 suspension ratio, is lifted by means of the new hoisting roping by driving the elevator car (1) downwards in the elevator hoistway (2),
- the diverting pulley (11) of the counterweight (3), via which diverting pulley (11) the old roping (6) travels, is fixed essentially immovably to the elevator hoistway (2),
- the old hoisting roping (6) is arranged to travel freely movably from the diverting pulley (11) of the counterweight (3) to the rope collection point (14), e.g. by opening the rope clamp (70), which rope collection point (14) is preferably

essentially at a lower height than the diverting pulley (11) for bringing about the resultant tractive effect of gravity that pulls the hoisting roping (6) out of the elevator system,

- the elevator car (1) is driven upwards so that the old hoisting roping (6) reels onto the rope collection point (14) pulled by the aforementioned tractive force, in which case the elevator car (1) is driven preferably right to its top position.

4. Method according to any of the preceding claims, **characterized** in that the old hoisting roping (6), the first end of which is fixed into position in relation to the building with the clamp (71), is fed to the rope collection point (14) by moving the elevator car (1) downwards in the elevator hoistway (2) by means of the new hoisting roping (5) and at the same time the counterweight and the diverting pulley (11) fixed to the counterweight (3), or to a part of the hoisting roping (5) that moves in the same direction as it, is moved upwards, via which diverting pulley (16) the old hoisting roping (6) travels from the elevator car (1) to the diverting pulley (11) that is stationary in relation to the building and is in the top parts of the elevator, and over it onwards to the rope collection point (14), and the old hoisting roping (6) is allowed to run so that the old hoisting roping (6) travels freely towards the rope collection point (14) over the aforementioned diverting pulley (16) to the rope collection point (14) pulled by a tractive force.

5. Method according to any of the preceding claims, **characterized** in that

- the old hoisting roping is fixed to the elevator car, preferably in the proximity of its end, to

prevent the free falling of the old hoisting roping,
the old hoisting roping is lowered down by moving the elevator car downwards in the elevator hoistway, to which elevator car the old hoisting roping is fixed so that the old hoisting roping runs down in the elevator hoistway regulated by the movement of the elevator car, pulled at least by the force of gravity, to the rope collection point, such as e.g. to a reel or to the base of the elevator hoistway.

6. Method according to any of the preceding claims, **characterized** in that the end of the old hoisting roping (6) is lowered down in the elevator hoistway (2) such that the elevator car (1) is driven to its top position and the end of the old hoisting roping (6) is arranged to be in connection with the elevator car (1), and the old hoisting roping (6) is fixed to the elevator car (1) so that the old hoisting roping (6) travels, without traveling via the parts fixed to the elevator hoistway (2), from its fixing point (72) on the elevator car (1) downwards into the elevator hoistway (2) and onwards to the rope collection point (14), and the old hoisting roping (6) is lowered down by moving the elevator car (1) downwards in the elevator hoistway (2).

7. Method according to any of the preceding claims, **characterized** in that with the method an elevator is converted, the elevator car (1) and/or counterweight (3) of which elevator is suspended with a 1:2 lifting ratio, into a 1:1 elevator, in which the first end of the new hoisting roping (5) is fixed to the elevator car and the second end to the counterweight (3).

8. Method according to any of the preceding claims, **characterized** in that the old hoisting roping (6) is fed to the rope collection point (14), from which rope collecting point (14) additional rope has been supplied to the elevator system during previous jump-lifts.

9. Method for manufacturing an elevator, **characterized** in that the procedures according to any of claims 1-8 are performed.

10. Method according to the previous claim, **characterized** in that the machine room platform (8) has been moved before the replacing of the roping in steps upwards in the hoistway (2) as the construction work progresses, and the elevator car (1) has served the users or constructors of the building.

Fig. 1

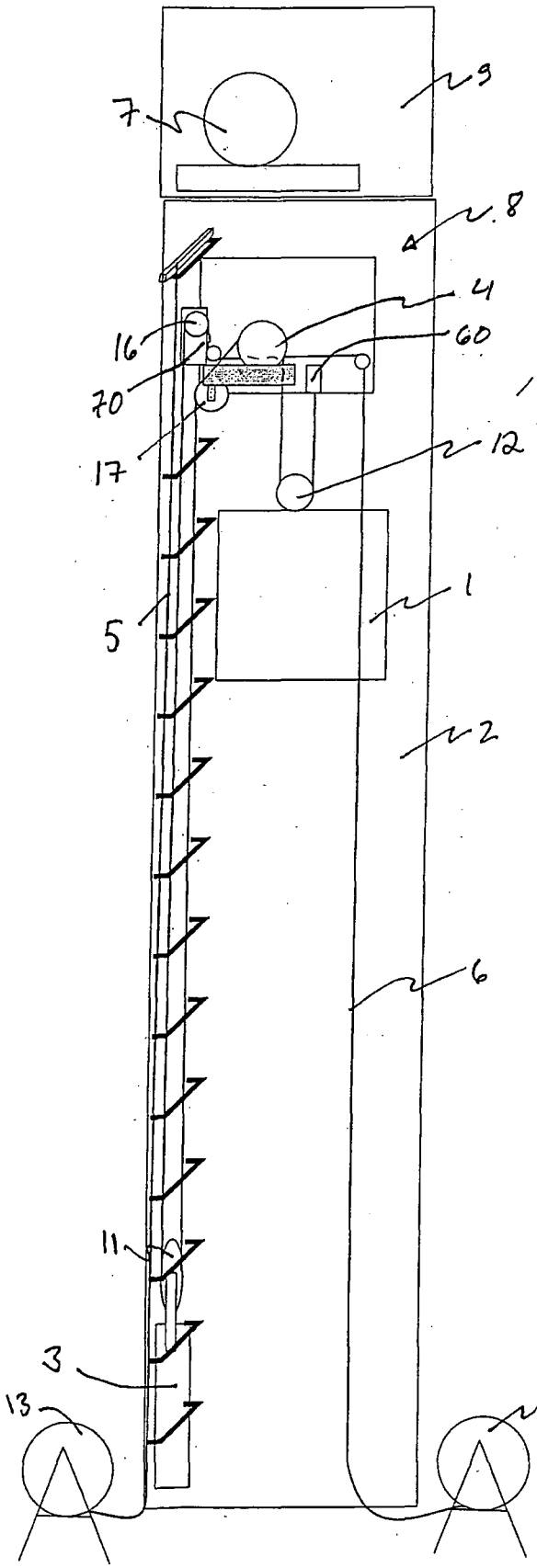


Fig. 2

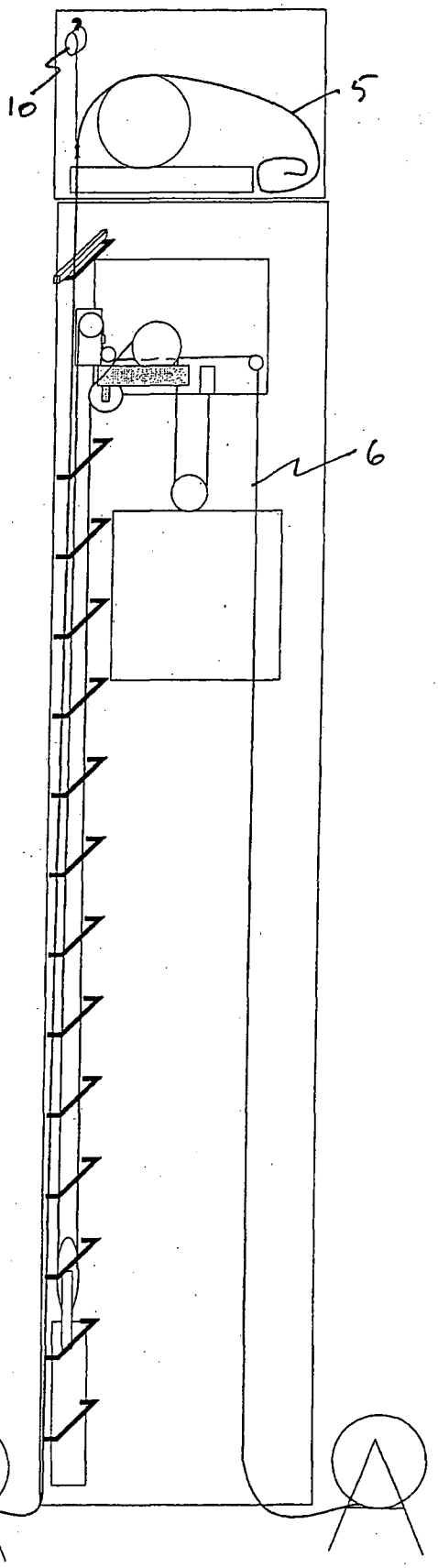


Fig. 3

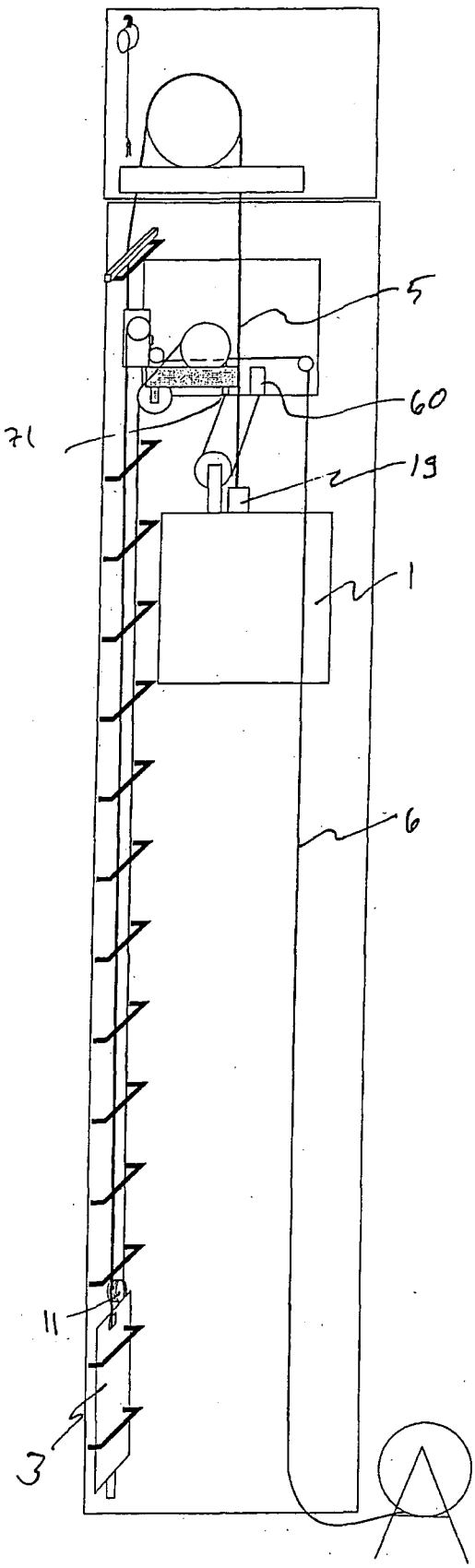


Fig. 4

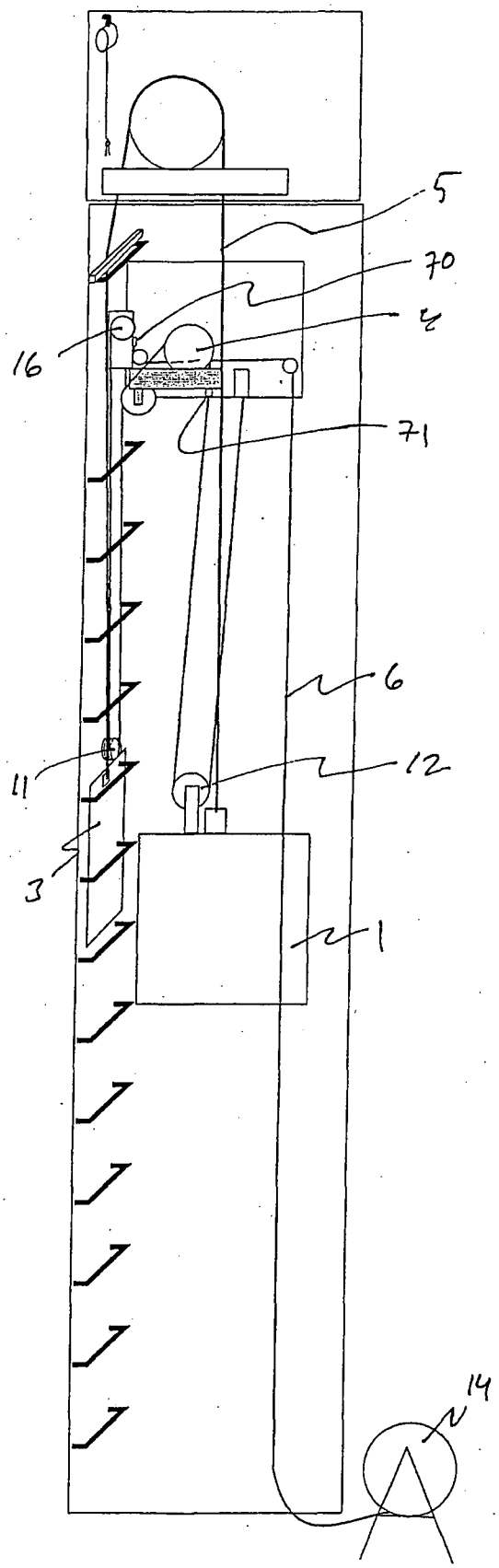


Fig. 5

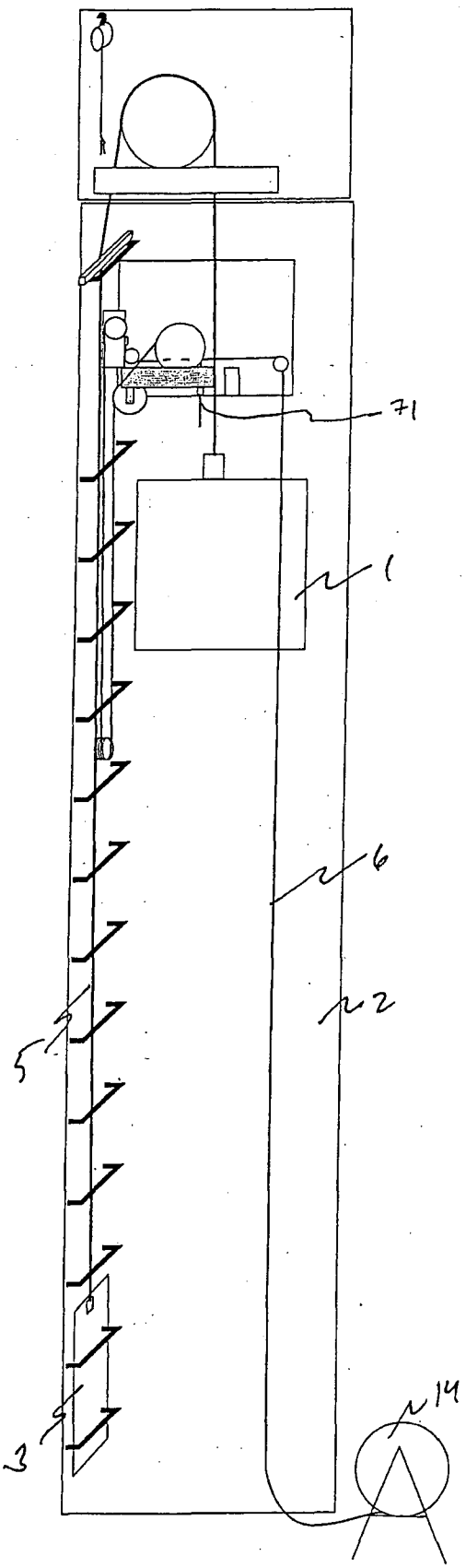


Fig. 6

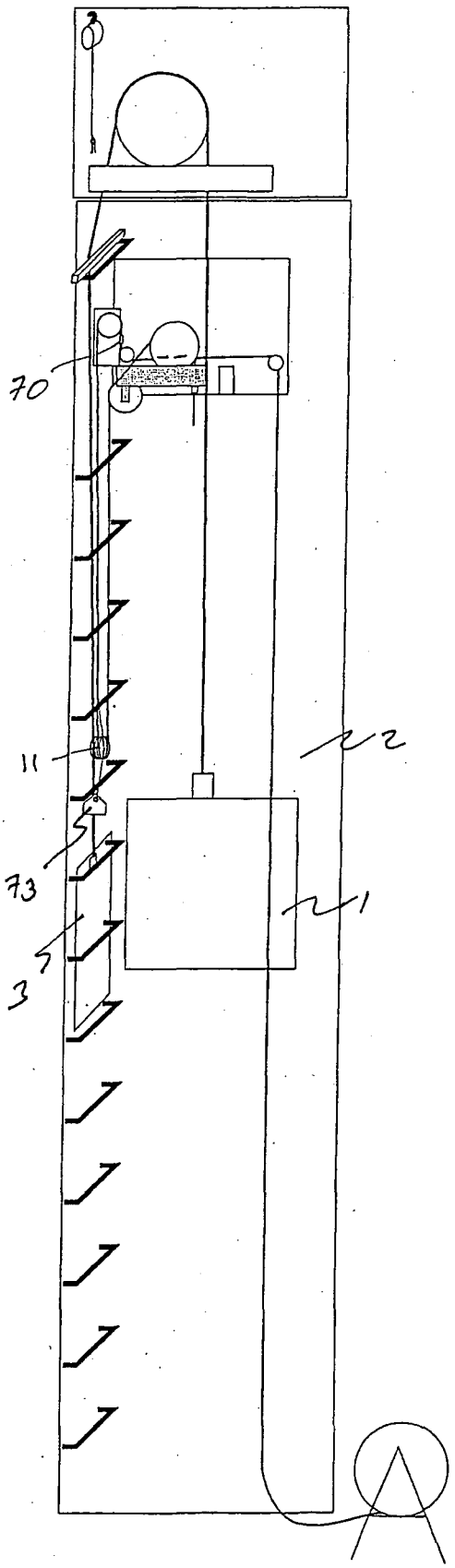


Fig. 7

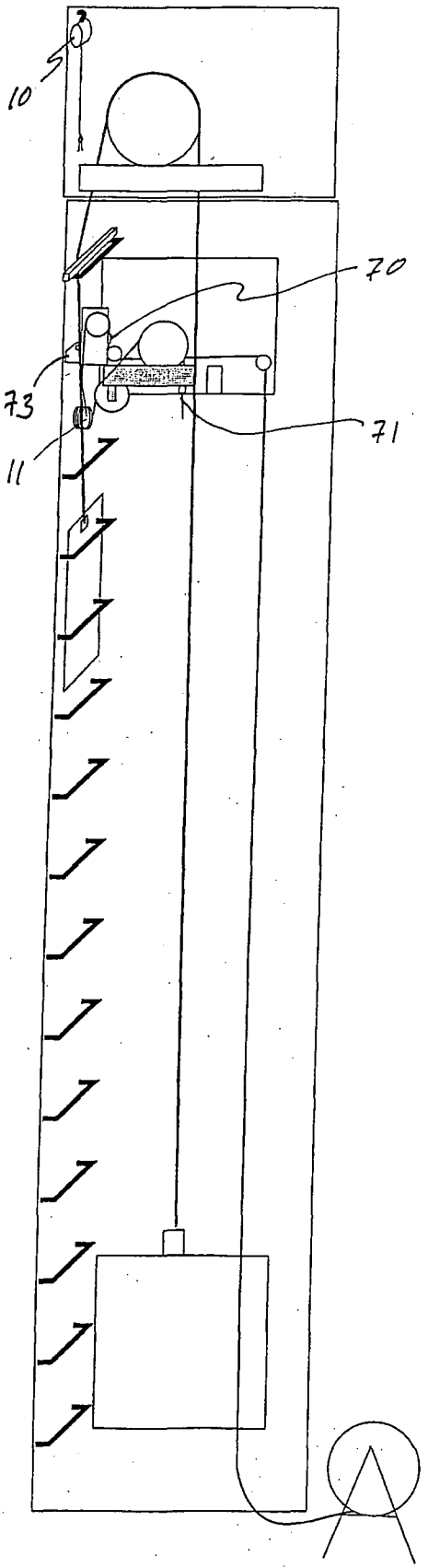


Fig. 8

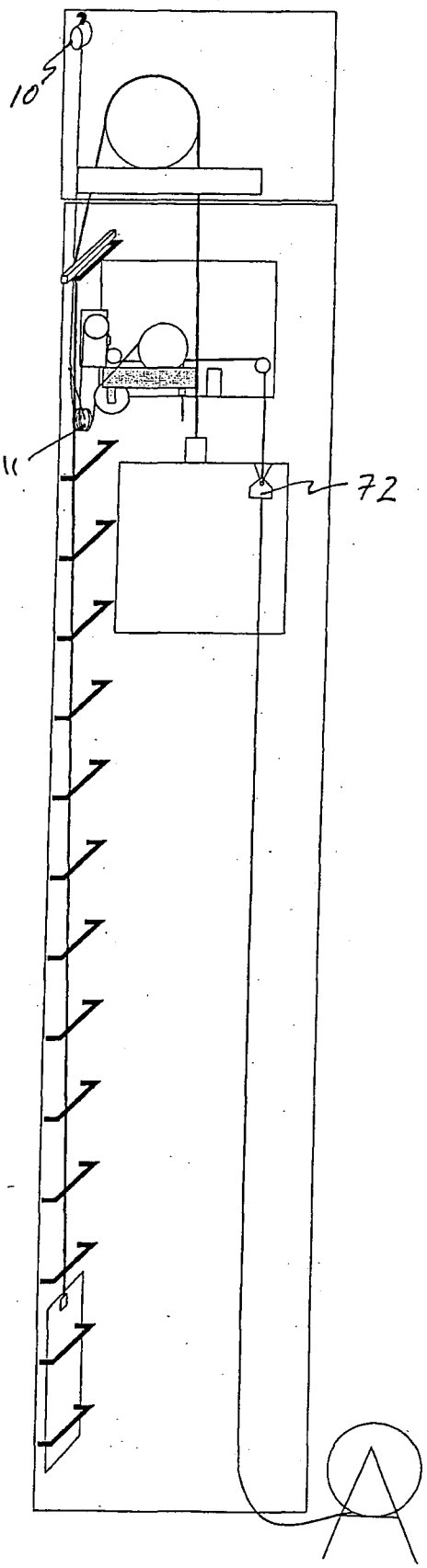
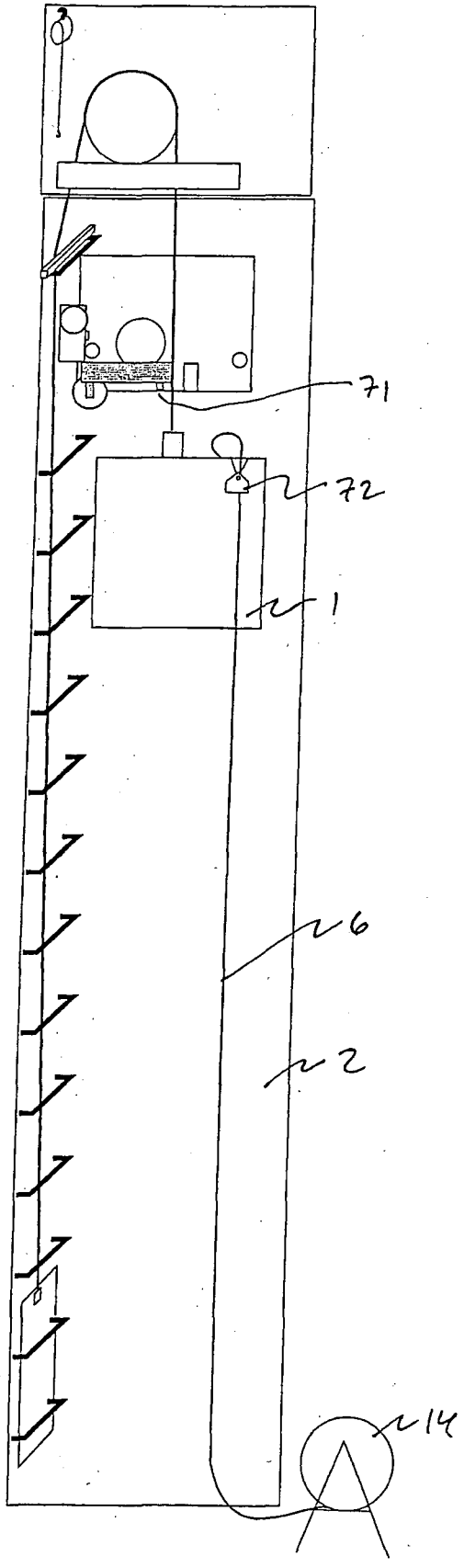


Fig. 9



INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI2010/000038

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	JP 2117582 A (HITACHI ELEVATOR ENG & SERVICE) 02 May 1990 (02.05.1990) abstract [online] EPOQUENET PAJ and figures 1-3	1-3, 5, 6, 8-10
X	JP 2062389 A (HITACHI ELEVATOR ENG & SERVICE) 02 March 1990 (02.03.1990) abstract [online] EPOQUENET PAJ and figures 2-4	1-3, 5, 6, 8-10
X	JP 10338437 A (MITSUBISHI ELECTRIC BILL TECH) 22 December 1998 (22.12.1998) abstract [online] EPOQUENET PAJ and figures 1 and 9	1, 3-6, 8-10
A	FI 108431 B (KONE CORP) 31 January 2002 (31.01.2002) whole document	1-10

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/FI2010/000038

Patent document cited in search report	Publication date	Patent family members(s)	Publication date
JP 2117582 A	02/05/1990	None	
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JP 10338437 A	22/12/1998	None	
FI 108431 B	31/01/2002	HK 1040690 A1	28/04/2006
		WO 0050328 A2	31/08/2000
		EP 1154947 A1	21/11/2001
		DE 60027547T T2	05/04/2007
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		AU 2808800 A	14/09/2000
		AU 745619B B2	28/03/2002

INTERNATIONAL SEARCH REPORT

International application No.
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CLASSIFICATION OF SUBJECT MATTER

Int.Cl.
B66B 7/06 (2006.01)