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

(11) EP 4 433 404 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
16.04.2025 Bulletin 2025/16

(21) Application number: **21815948.1**

(22) Date of filing: **16.11.2021**

(51) International Patent Classification (IPC):
B66B 5/02 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
B66B 5/027

(86) International application number:
PCT/EP2021/081787

(87) International publication number:
WO 2023/088534 (25.05.2023 Gazette 2023/21)

(54) SELECTION OF TRAVEL DIRECTION OF AN ELEVATOR CAR

AUSWAHL DER FAHRTRICHTUNG EINER AUFZUGSKABINE

SÉLECTION DE DIRECTION DE DÉPLACEMENT D’UNE CABINE D’ASCENSEUR

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

(43) Date of publication of application:
25.09.2024 Bulletin 2024/39

(73) Proprietor: **KONE Corporation**
00330 Helsinki (FI)

(72) Inventors:
- **NIKANDER, Juhamatti**
  00330 HELSINKI (FI)
- **AITAMURTO, Juha-Matti**
  00330 HELSINKI (FI)
- **STOLT, Lauri**
  00330 HELSINKI (FI)

(74) Representative: **Berggren Oy**
P.O. Box 16
Eteläinen Rautatiekatu 10A
00101 Helsinki (FI)

(56) References cited:
GB-A- 2 017 346
JP-A- 2005 126 171
US-A1- 2008 202 859
US-A1- 2012 085 593

Processed by Luminess, 75001 PARIS (FR)

Description

TECHNICAL FIELD

[0001] The invention concerns in general the technical field of conveyor systems. More particularly, the invention concerns elevator systems.

BACKGROUND

[0002] Elevator service gets interrupted due to a failure in a power supply to an elevator system. In an unfavorable situation an elevator car with passengers gets stuck between two floors and the situation needs to be solved somehow especially if the failure in the power supply continues a long period of time.

[0003] In some implementations the elevator system may be equipped with energy storages, such as batteries, configured to store an amount of energy allowing a transport of the elevator car to a floor under so-called rescue drive operation. The size of the energy storage is optimized, and the goal is to apply as small energy storages as possible to minimize their size and cost as well as to minimize their effect in overall design of the elevator system.

[0004] In a document JP 2005-126171 A it is disclosed a prior art solution for operating an elevator in an event of power failure.

[0005] In order to enable the optimization of the energy storages there is a need to introduce novel approaches targeting to select an optimal path for rescue drive in view of an energy consumption at least in part.

SUMMARY

[0006] The following presents a simplified summary in order to provide basic understanding of some aspects of various invention embodiments. The summary is not an extensive overview of the invention. It is neither intended to identify key or critical elements of the invention nor to delineate the scope of the invention. The following summary merely presents some concepts of the invention in a simplified form as a prelude to a more detailed description of exemplifying embodiments of the invention.

[0007] An object of the invention is to present a method, an apparatus, an elevator system, and a computer program for selecting a travel direction of an elevator car.

[0008] The objects of the invention are reached by a method, an apparatus, an elevator system, and a computer program for selecting a travel direction of an elevator car as defined by the respective independent claims.

[0009] According to a first aspect, a method for selecting a travel direction of an elevator car for a rescue drive is provided, the method comprises:

generating a first estimate indicative of a total energy consumption of the elevator car to travel from its estimated position to a next landing in a first direction by:

determining an amount of energy required to cause the elevator car to move to the first direction by controlling the elevator car to move a first reference distance to the first direction,

estimating an amount of energy required to move the elevator car from its estimated position to the next landing in the first direction,

summing up the amount of energy required to cause the elevator car to move to the first direction and the amount of energy required to move the elevator car from its estimated position to the next landing in the first direction for generating the first estimate,

generating a second estimate indicative of a total energy consumption of the elevator car to travel from its estimated position to a next landing in an opposite direction to the first direction by:

determining an amount of energy required to cause the elevator car to move to the opposite direction to the first direction by controlling the elevator car to move a second reference distance to the opposite direction to the first direction,

estimating an amount of energy required to move the elevator car from its estimated position to the next landing in the opposite direction to the first direction,

summing up the amount of energy required to cause the elevator car to move to the opposite direction to the first direction and the amount of energy required to move the elevator car from its estimated position to the next landing in the opposite direction to the first direction for generating the second estimate,

comparing the first estimate and the second estimate, and
selecting the travel direction for the rescue drive corresponding to an estimate being smaller among the first estimate and the second estimate.

[0010] The amount of energy required to cause a movement of the first reference distance or a movement of the second reference distance may be derived from data indicative of an input current of an electric motor configured to cause the respective movement.

[0011] Further, the estimated position of the elevator car may be determined based on at least one of the following: data indicative of a position of the elevator car obtained from at least one sensor; position data of the elevator car stored in data storage. For example, the estimated position of the elevator car may be determined from the position data stored in the data storage by selecting the piece of data as the data for the estimated position which is stored to the data storage most recently prior to an event that caused the rescue drive.

[0012] The estimating of the amount of energy required to move the elevator car from its estimated position to the next landing in the first direction or to the next landing in the opposite direction to the first direction may be performed by estimating an amount of energy needed to generate a torque to the traction sheave to move the elevator car to respective directions.

[0013] The step of estimating the amount of energy required to move the elevator car from its estimated position to the next landing in the first direction or in the opposite direction to the first direction may comprise a determination of information indicative a change in balance of the elevator system over a first path from the estimated position of the elevator car to the next landing in the first direction and over a second path from the estimated position of the elevator car to the next landing in the opposite direction to the first direction.

[0014] The method may further comprise:

determining an amount of energy available from an energy source for the rescue drive,

determining if the amount of energy available from the energy source for the rescue drive exceeds an estimate indicative of the total energy consumption corresponding to the selected travel direction, and

generating, in response to a detection that the amount of energy available from the energy source for the rescue drive exceeds an estimate indicative of the total energy consumption corresponding to the selected travel direction, an indication of an allowance to initiate the rescue drive to the selected travel direction.

[0015] Still further, the method may further comprise:

determining a first peak power required by elevator car to travel from its estimated position to the next landing in the first direction and determining a second peak power required by elevator car to travel from its estimated position to the next landing in the opposite direction to the first direction,

comparing the determined first peak power and the determined second peak power to a reference value,

confirming the travel direction selected based on the comparison of the first estimate and the second estimate for the rescue drive upon a detection that a determined peak power to a same travel direction as the selected travel direction is below the reference value,

preventing the travel direction selected based on the comparison of the first estimate and the second estimate for the rescue drive upon a detection that a determined peak power to a same travel direction as the selected travel direction exceeds the reference value.

[0016] The selection of the travel direction may comprise a generation of a control signal to an elevator drive to cause a generation of a control signal to the electric motor.

[0017] According to a second aspect, an apparatus for selecting a travel direction of an elevator car for a rescue drive is provided, the apparatus is configured to execute the method according to the first aspect as defined above.

[0018] According to a third aspect, an elevator system is provided the elevator system comprising an apparatus according to the second aspect as defined above.

[0019] According to a fourth aspect, a computer program is provided, the computer program comprising instructions to cause the apparatus according to the second aspect as defined above to carry out the method according to the first aspect as defined above.

[0020] The expression "a number of" refers herein to any positive integer starting from one, e.g. to one, two, or three.

[0021] The expression "a plurality of" refers herein to any positive integer starting from two, e.g. to two, three, or four.

[0022] Various exemplifying and non-limiting embodiments of the invention both as to constructions and to methods of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific exemplifying and non-limiting embodiments when read in connection with the accompanying drawings.

[0023] The verbs "to comprise" and "to include" are used in this document as open limitations that neither exclude nor require the existence of unrecited features. The features recited in dependent claims are mutually freely combinable unless otherwise explicitly stated. Furthermore, it is to be understood that the use of "a" or "an", i.e. a singular form, throughout this document does not exclude a plurality.

BRIEF DESCRIPTION OF FIGURES

[0024] The embodiments of the invention are illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings.

Figure 1 illustrates schematically an elevator system according to an example.

Figure 2 illustrates schematically a method according to an example.

Figure 3 illustrates schematically further aspects of a method according to an example.

Figure 4 illustrates schematically an apparatus according to an example.

DESCRIPTION OF THE EXEMPLIFYING EMBODIMENTS

[0025] The specific examples provided in the description given below should not be construed as limiting the scope and/or the applicability of the appended claims. Lists and groups of examples provided in the description given below are not exhaustive unless otherwise explicitly stated.

[0026] Figure 1 illustrates schematically an elevator system 1000 according to an example embodiment into which a functionality according to the present invention may implemented to. The elevator system 1000 as disclosed in Figure 1 may comprise an elevator car 110 arranged to be moved or movable in an elevator shaft 120 e.g. along guide rails mounted in the elevator shaft 120. The moving of the elevator car 110 may be implemented by a hoisting rope or belt 130 in connection with a counterweight 140 over a traction sheave 150 or the like. The operation of the elevator system 1000 may be achieved by controlling a rotation of the traction sheave 150 with an electric motor 160 and elevator brakes 170. Moreover, the electric motor 160 may be controlled with a frequency converter 180 configured to provide an input current to the electric motor 160 to cause the electric motor 160 to operate in a controlled manner. An overall controlling of the elevator system may be performed by an apparatus 200 corresponding e.g. to an elevator controller which, among other functionalities, receives a feedback from other elevator entities, such as from call giving devices and so on, so as to generate the control signals to the frequency converter 180 in accordance with the feedback.

[0027] For the purpose of describing at least some embodiments of the present invention the elevator system may also comprise a number of sensors 190 residing in the elevator shaft 120 and/or in elevator car 110, for example. The sensors 190 may be of any type suitable for generating measurement data from which it is possible to derive an estimation of a position of the elevator car 110 in the elevator shaft 120. The estimation of the position shall be understood in a broad manner, and it may mean either an exact position or some inaccurate estimation of the position for the purpose of the present invention as is discussed in the forthcoming description. Some non-limiting examples of the sensors 190 applicable for generating the measurement data indicative of the position of the elevator car 110 may be contact sensors mounted in the shaft configured to interact mechanically, electrically, magnetically, or optically with a counterpart residing in the elevator car 110 in response to that the elevator car 110 passes by the respective sensors 190. Alternatively or in addition, the number of sensors 190 may be mounted to the hoisting machine system, such as to the electric motor 160. For example, measurement data may be obtained from the motor encoder based on which the estimate on the position may be determined. A non-limiting example of a sensor 190 associated to the elevator car 110 may be a barometer providing measurement data indicative of a pressure experienced in varied locations in the elevator shaft 120 from which it is possible to generate the estimate. Any other sensor type may also be applied in the context of the present invention for obtaining measurement data indicative, either directly or indirectly, of the position of the elevator car 110.

[0028] The elevator system 1000 is supplied with power from mains current in normal operation situations. In order to secure power supply to the elevator system 1000 the elevator system in accordance with the present invention may be equipped with an energy storage 195 which may be arranged to supply power to the elevator system 1000, or at least to at least some entities of it, in special situations, such as in an emergency situation. The energy storage 195 suitable to store electrical energy may e.g. be a battery implemented in any known manner. The supply of the energy source 195 may be arranged so that the supply of the electrical energy may be automatically initiated in response to a detection that the power supply from the mains fails or the supply may be arranged by implementing a predefined functionality to the energy storage, or to the elevator system, so as to enable the supply of energy at a predefined event. The supply of the electrical energy may be arranged to a power network of the elevator system, or only to critical entities of the elevator system in order to perform a method as is described in the forthcoming description. In Figure 1 the power supply is arranged through the frequency converter 180 so that at least the frequency converter 180 and the electric motor 160 are energized.

[0029] As already mentioned, the elevator system 1000 comprises an apparatus 200 configured to perform at least part of a control operations of the elevator system 1000 wherein the apparatus 200 may refer to an elevator controller. The apparatus 200 is communicatively connected to at least some entities of the elevator system 1000 so as to deliver control signals thereto and receive data from the elevator system 1000, such as the sensor data. The apparatus 200 is at least configured to control an operation of the elevator drive system comprising at least both the frequency converter 180 and the electric motor 160. The apparatus 200 is also arranged to receive power from the energy storage 195 in case of a power failure from the mains. For sake of completeness it shall be understood that even if the apparatus 200 and the frequency converter 180 are described and illustrated in Figure 1 as separate entities and devices, their functionalities may also be integrated into a single device if seen convenient from an implementation point of view.

[0030] As known, the elevator system is arranged to travel between a plurality of landings 10, or floors, so as to transport passengers and any other load between the landings 10 served by the elevator system 1000. An energy consumption of the elevator system 1000 during a ride is also dependent on so-called balancing of the elevator system 1000 in question. The balancing refers to a selection of an elevator car 110 and the respective counterweight 140 as well as the effect of the weight of the rope 130 on both sides divided by the traction sheave 150. The elevator system 1000 may be in balance at some position of the elevator car 110 in the elevator shaft 120 i.e. when the weights on both sides with respect to the traction sheave 150 are equal i.e. the elevator car 110 does not move even if elevator brakes are inactivated. On the other hand, from the perspective of the elevator car 110, the balancing situation may be overbalanced or underbalanced at some other position of the elevator car 110 in the elevator shaft 120 due to the different portion of the rope 130 on each side divided by the traction sheave 150. The overbalanced situation refers to that the elevator car 110 travels downwards if it is allowed to move freely and in the underbalanced situation the elevator car 110 travels upwards. Moreover, the elevator system 1000 may be designed so that the system is in balance only at one end of the travel path in the elevator shaft 120, or even so that there is no position in which the elevator system 1000 is in balance. The balancing situation may be manipulated with so-called compensation ropes mounted below the elevator car 110 and the counterweight, respectively. By applying the compensation ropes it is possible to manipulate an amount of power needed to cause the movement of the system in various positions in the elevator shaft in a known manner. Still further, in at least some elevator implementations an effect of a weight of an elevator travelling cable may be taken into account in the consideration of the balancing together with the above mentioned other items, i.e. the elevator car 130, the counterweigh 140, the elevator rope 130, and the compensation ropes if any.

[0031] The present invention provides a solution for selecting an optimal direction for a rescue drive in case the operation of the elevator system 1000 is halted due to a power failure. A method according to an example embodiment is schematically illustrated in Figure 2 wherein the method provides a solution for selecting a travel direction of an elevator car 110 for a rescue drive, or similar. In accordance with the example embodiment the method may be performed by a computing unit, such as a controller, as is described in the forthcoming description. For example, the entity configured to perform at least part of the method may be the apparatus 200 configured to perform at least part of the control operations of the elevator system 1000. The method may be initiated by generating a first estimate 210 indicative of a total energy consumption of causing the elevator car 110 to travel from its estimated position to a next landing in a first direction and by generating a second estimate 220 indicative of a total energy consumption of causing the elevator car 110 to travel from its estimated position to a next landing in an opposite direction to the first direction. In other words, the apparatus 200 may determine, based on any applicable data it has access to, an estimated position of the elevator car 110 in the elevator shaft 120 where the elevator car 110 has stopped due to a specific situation, such as due to a power failure. In response to knowing the estimated position of the elevator car 110, the apparatus 200 may be configured to generate a first estimate 210 indicative of a total energy consumption of causing the elevator car 110 to travel from its estimated position to a next landing in a first direction. Further, the apparatus 200 is configured to generate the second estimate indicative of a total energy consumption of causing the elevator car 110 to travel from its estimated position to a next landing in the opposite direction to the first direction. In other words, the apparatus 200 is configured to generate the first and the second estimation by utilizing the information on the estimated position of the elevator car 110 at least in part. The term total energy consumption in the context of the estimations shall be understood to cover a selected number of sources included in the generation of the total energy consumption as is described in the forthcoming description. Further, the first direction and the second direction opposite to the first direction in the context of the elevator system 1000 substantially refer to vertical directions the elevator car 110 is arranged to travel in the elevator shaft 120. For example, the first direction may be vertically upwards whereas the second direction may then be vertically downwards, or vice versa. The generations of the first estimate and the second estimate 210, 220 may be performed concurrently at least in part or subsequently to each other.

[0032] In response to that the first estimate and the second estimate are generated 210, 220 the apparatus 200 is configured to compare 230 the first estimate and the second estimate together. The aim of the comparison 230 is to determine the travel direction to the elevator car 110 to the next landing wherein an energy consumption of the travel is minimized. For sake of clarity, the comparison step 230 may be implemented so that the first estimation and the second estimation is compared together and the information on the one being smaller is obtained.

[0033] In response to the comparison 230 the apparatus 200 is arranged to select 240 the travel direction for the rescue drive corresponding to an estimate being smaller among the first estimate and the second estimate. Hence, the apparatus 200 maintains the information linking the total energy consumption to each of the direction and the respective travel direction and generates as an output of the selection step 240 data indicative of the travel direction. For example, the apparatus 200 may be configured to generate a control signal to power generation means, such as to a frequency converter 180 so as to control an electric motor of the elevator system 1000, to cause a travel of the elevator car 110 to the selected travel direction in the elevator shaft 120.

[0034] In the forthcoming description it is provided further details on the generation of the estimate 210, 220 indicative of the total energy consumption for causing the elevator car 110 to travel from its estimated position to the next landing. The details provided herein, and as illustrated in Figure 3, are applicable to both the generation of the first estimate 210 and the generation of the second estimate 220. In accordance with the invention the total energy consumption may consists of at least two aspects. For the first aspect an amount of energy required to cause the elevator car 110 to move to a selected direction is determined 310 and the determination is performed by controlling the elevator car 110 to move a reference distance to the selected direction. In addition, a second aspect related to the total energy consumption in accordance with the example embodiment is that an amount of energy required to move the elevator car 110 from its estimated position to the next landing in the selected direction is estimated 320. Regarding the first aspect and its implementation the apparatus 200 may be configured to generate a control signal to the power generation means to instruct the power generation means to generate a force to move the elevator car 110 the reference distance to the selected direction wherein the selected direction may first be the first direction or the second direction. In response to the movement of the elevator car 110 the reference distance to the first direction the apparatus 200 may be configured to generate another control signal to the power generation means to instruct the power generation means to generate a force to move the elevator car 110 another reference distance to the second direction opposite to the first direction. The movement of a reference distance to the second direction may be initiated from the position the elevator car 110 resides after the movement of a reference distance to the first direction, or the elevator car 110 may be returned to the starting position, or a reference position, i.e. to the position from where the movement to the first direction was initiated, before the movement to the second direction is instructed. Advantageously, the selection of the starting point for the second direction is taken into account in the estimation of the energy consumption in the manner as described in the forthcoming description. In other words, the elevator car 110 is caused to travel to both directions opposite to each other reference distances defined for the travel directions. The reference distance in the first direction and in the second direction may be the same or differ from each other. At least one aim of the movement of the elevator car 110 to the first direction and to the second direction is to determine how much energy is required to initiate the travel to the respective directions. As a non-limiting example of the reference distance may be some centimeters which allows a determination of the required energy e.g. by deriving it from data indicative of an input current of an electric motor configured to cause the force for the respective movement. For example, the derivation of the input current of the electric motor may be based on measurements of one or more signal values indicative of current and/or voltage applied in the elevator drive system. In other words, commonly known equations may be applied to the determination of the required energy. Further, advantageously the reference distances are small in order to avoid an unnecessary consumption of the energy in the context of determining

As regards to the second aspect an estimation is made 320 on an amount of energy required to move the elevator car 110 from its estimated position to the next landing. Such an estimation is performed both to the first direction and to the second direction, separately. The estimations may be performed mathematically e.g. based on the estimated position of the elevator car 110 and its travel distance to the next landing in the first direction and in the second direction. Naturally, at least some parameters of the power generation means, such as input current and the duration of provision the input current to reach the respective landings may be applied to. Alternatively or in addition, the estimations may be based on information obtained from a travel history of the elevator car 110 e.g. so that a corresponding section from the travel path of the elevator car 110 is determined and the energy consumption used for the respective section, or sections, are determined and obtained so as to receive the estimations of the amount of energy required to cause the elevator car 110 to move to the respective landings.

[0035] In response to the generation of the results from the steps 310 and 320 to the first direction and to the second direction as described the apparatus 200 may be arranged to sum up 330 the amount of energy required to cause the elevator car to move to the selected direction and the amount of energy required to move the elevator car 110 from its estimated position to the next landing in the same selected direction for generating the respective estimate. For sake of clarity, the sum up 330 is performed separately to the determined terms in the steps 310 and 320 with respect to the first direction and to the second direction. Hence, the apparatus 200 may be configured to associate the terms with respect to the travel directions so that the amount of energy required to cause the elevator car 110 to travel in a direction is summed up 330 with the estimation of an amount of energy required to travel to the next landing in the same direction so as to generate the first estimate and the second estimate for the comparison 230.

[0036] In some example embodiments of the invention the determination of the estimated amount of energy required to move the elevator car 110 to the landing in question is performed by taking into account information indicative of a balance of the elevator system 1000 at the position the elevator car 110 resides. Further, preferable the information of the balance of the elevator system 1000 is taken into account over the travel to the respective distances. This may be advantageous since the balance changes during the travel since the mutual positions of the elevator car 110 and the counterweight 140 change during the run. This is due to that the weight of the hoisting rope 130 on both sides of the traction sheave 150 changes as the length of the rope 130 varies in the respective sides. In other words, the balance may vary during the travel which, in turn, may have effect on the required energy to move the elevator car 110 to the respective landings.

[0037] As a non-limiting example the information on the balance may, in accordance with an embodiment, be taken into account in the evaluation of the required energy to cause the elevator car 110 to move from its estimated position to the next landing in the first direction or in the second direction by estimating mathematically an energy needed to generate a cumulative torque of a traction sheave 150 of the elevator over the distance from the position of the elevator car 110 to the landings in both directions. The cumulative torque may be mathematically estimated by obtaining a load information of the elevator car 110 (e.g. from weight sensors positioned in the floor of the elevator car 110), a position of the elevator car 110 as well as weights of any other relevant entities, such as a changing weight of the elevator rope with respect to the position of the elevator car 110 on both sides of the traction sheave 150 as well as changing weights of compensation ropes on both sides in accordance with the position of the elevator car 110 and take such pieces of information into account over the travel path to the evaluated directions to evaluate the cumulative torque, and, thus, the energy consumption to both directions. For example, the energy needed to generate the cumulative torque may e.g. be derived from an input current needed to be supplied to the electric motor 160 to generate the cumulative torque to the traction sheave 150 as estimated. Naturally, the same may be evaluated based on control signals generatable by the drive system, such as the frequency converter 180.

[0038] As disclosed in the foregoing description the estimation of the amount of energy required to move the elevator car to the respective landing is based on an estimated position of the elevator car 110 in the elevator shaft 120. The estimation of the position, i.e. the estimated position, may refer to an exact position of the elevator car 110 or to an estimation of the position with an acceptable accuracy, such as at least a knowledge of the landings between which the elevator car 110 resides. For example, the estimated position of the elevator car 110 may be obtained from a sensor configured to generate data indicative of the position of the elevator car 110 or from data storage configured to store position data of the elevator car 110. In the former case, the sensor may be provided with power from energy storage even during the power failure from the mains in order to receive data indicative of the position of the elevator car 110. In the latter case a processing entity of the apparatus 200 may be configured to determine the estimated position of the elevator car 110 from position data stored in the data storage. The determination may be performed by selecting the piece of data as the data for the estimated position which is stored to the data storage most recently prior to an event that caused the rescue drive. Such an approach is based on an arrangement that in response to the power failure an input of data to the data storage is canceled and only the data stored prior to the power failure, or a similar event, may be found from the data storage and the last stored piece of data may be identified. For example, the stored data may origin from one or more sensors suitable of generating data indicative of the position of the elevator car 110, or may store data obtained from the electric motor, such as from an encoder therefrom, based on which data the position of the elevator car 110 may be determined. The data may e.g. be indicative of the position, a speed, or an acceleration of the elevator car prior to the unexpected stop. Furthermore, a determination of the position of the elevator car 110 may take into account other data stored in data storage, and accessible therefrom, such as information on a deceleration of the elevator car 110 when the elevator car 110 is instructed to stop due to the specific situation e.g. by applying an emergency stop mechanism. Hence, the travel distance over the deceleration may be determined and added to the latest known position to generate the estimation of the position. Further aspects, such as the load of the elevator car 110, may also be taken into account for determining the travel distance during the deceleration before the stop. Alternatively or in addition, the estimation of the position of the elevator car 110 may also comprise a step in which an accuracy of the estimation in an implementation in which there is only information available on a landing the elevator car 110 passed by at the last time before the stop is improved by evaluating a time after the detection of the bypass of the landing and based on that an estimation is made how long the elevator car 110 may have traveled during the determined time to the travel direction before the stop. Adding that distance to the position of the landing, an estimation of the position of the elevator car 110 may be generated. All in all, the estimation of the position with a predefined accuracy may provide needed information to determine a travel distance to a next landing in a first direction and another travel distance to a next landing to a second direction being opposite to the first direction. Hence, in addition to the estimation of the position of the elevator car 110 the apparatus 200 have access to data defining positions of the landings in a manner that travel distances may be determined in any of the manners as described.

[0039] As an outcome of the method as described so far is the direction towards which the elevator car 110 shall be moved in order to consume as little energy as possible, or at least less than to move the elevator car 110 to the opposite direction. The information on the direction is based on the generated estimate, or estimation, indicative of the total energy consumption of causing the elevator car to travel from its estimated position to a respective landing. In view of this, an embodiment of the invention may comprise a further step of determining an amount of energy available from an energy source 195 for the rescue drive, and then determining if the amount of energy available from the energy source 195 exceeds the estimate indicative of the total energy consumption corresponding to the selected travel direction. In response to a detection that the amount of energy available from the energy source 195 for the rescue drive exceeds the estimate indicative of the total energy consumption corresponding to the selected travel direction an indication of an allowance to initiate the rescue drive to the selected travel direction is generated. This kind of approach is arranged to confirm that the elevator car 110 really reaches the landing in the selected direction.

[0040] Moreover, a further aspect to determine, prior to an initiation of the rescue drive, may be that the energy storage is capable of providing a peak power occurring at start when the movement is initiated and/or at the end of the drive when braking the elevator car 110 to stop at the landing. This may e.g. be determined so that it is confirmed that the energy storage is capable of providing necessary current level to initiate the travel as well as to allow the braking to establish the required peak power. More specifically, this approach may be implemented so that the apparatus 200 configured to perform the method is configured to determine a first peak power required by elevator car 110 to travel from its estimated position to the next landing in the first direction and to determine a second peak power required by elevator car 110 to travel from its estimated position to the next landing in the opposite direction to the first direction. The determinations of the peak powers, respectively, may be performed so that required peak powers for initiating the travel to the respective directions are determined with the movements of the elevator car controlled for determining the first and the second estimates of the total energy consumption as already described. The remaining part of the required power may be estimated mathematically by taking into account the travel distance to the respective floors (e.g. evaluating that the required power is liner over the travel distance) and estimating the required power to perform the braking e.g. based on history data or similar. By summing up these items the required peak powers to both directions may be estimated and determined. In response to the determinations of the peak powers each of them may be compared to a reference value. The reference value may be dependent on one or more characteristics of the energy source, i.e. its capability to provide the power, and the information on the reference value may be stored in a memory accessible to the apparatus in order to obtain the reference value for the comparison. Upon the comparison and its outcome the travel direction selected based on the comparison of the first estimate and the second estimate of the total energy consumption for the rescue drive may be confirmed upon a detection that a determined peak power to a same travel direction as the selected travel direction is below the reference value. In other words, if the required peak power may be provided the selection of the travel direction based on the estimates of the total energy consumption of the elevator car may be confirmed. On the other hand, if it turns out in the comparison of the peak powers that a determined peak power to a same travel direction as the selected travel direction based on the comparison of the first estimate and the second estimate for the rescue drive exceeds the reference value, the travel direction in question may be prevented. In other words, the travel direction is prevented since the energy source cannot provide the necessary power throughout the travel even if it stores enough energy to the respective travel. Naturally, in the latter case it is to be confirmed that the other direction is possible in terms of power and energy consumption in order to allow the travel to that direction. For sake of clarity it is worthwhile to mention that the estimation of the peak powers and the conclusions based on the estimation as described herein may be performed at least partly concurrently to the evaluation of the total energy consumption. Hence, at least one of the travel directions may be prevented based on the peak power estimation prior to that the selection of the travel direction based on the total energy consumption is concluded.

[0041] Still further, the selection of the travel direction may, in some embodiments, also comprise a generation of a control signal to an elevator drive to cause a generation of a control signal to the electric motor to initiate the rescue drive.

[0042] For sake of clarity it is worthwhile to mention that the landings called as the next landings in the first and the second direction do not necessarily refer to the next physical landings, but the ones defined to be used for rescue operations. Hence, the determinations of the total energy consumption are performed with respect to those next landings.

[0043] An example of an apparatus 200 configurable to perform the method as described is schematically illustrated in Figure 4. For sake of clarity, it is worthwhile to mention that the block diagram of Figure 4 depicts some components of an entity that may be employed to implement a functionality of the apparatus 200. The apparatus 200 comprises a processor 410 and a memory 420. The memory 420 may store data, such pieces of data as described but also computer program code 425 causing the safety operation in the described manner. The apparatus 200 may further comprise a communication interface 430, such as a wireless communication interface or a communication interface for wired communication, or both. The communication interface 430 may thus comprise one or more modems, antennas, and any other hardware and software for enabling an execution of the communication e.g. under control of the processor 410. Furthermore, I/O (input/output) components may be arranged, together with the processor 410 and a portion of the computer program code 425, to provide a user interface for receiving input from a user, such as from a technician, and/or providing output to the user of the apparatus when necessary. In particular, the user I/O components may include user input means, such as one or more keys or buttons, a keyboard, a touchscreen, or a touchpad, etc. The user I/O components may include output means, such as a loudspeaker, a display, or a touchscreen. The components of the apparatus may be communicatively connected to each other via data bus that enables transfer of data and control information between the components.

[0044] The memory 420 and a portion of the computer program code 425 stored therein may further be arranged, with the processor 410, to cause the apparatus 200 to perform at least a portion of a method for selecting the travel direction as is described herein. The processor 410 may be configured to read from and write to the memory 420. Although the processor 410 is depicted as a respective single component, it may be implemented as respective one or more separate processing components. Similarly, although the memory 420 is depicted as a respective single component, it may be implemented as respective one or more separate components, some, or all of which may be integrated/removable and/or may provide permanent / semi-permanent / dynamic / cached storage.

[0045] The computer program code 425 may comprise computer-executable instructions that implement functions that correspond to steps of the method when the computer program code 425 is loaded into the processor 410 of the controller 210 and executed therein. As an example, the computer program code 425 may include a computer program consisting of one or more sequences of one or more instructions. The processor 410 is able to load and execute the computer program by reading the one or more sequences of one or more instructions included therein from the memory 420. The one or more sequences of one or more instructions may be configured to, when executed by the processor 410, cause the apparatus 200 to perform a method as explicitly described in the description herein. Hence, the apparatus may comprise at least one processor 410 and at least one memory 420 including the computer program code 425 for one or more programs, the at least one memory 420 and the computer program code 425 configured to, with the at least one processor 410, cause the apparatus to perform the method.

[0046] The computer program code 425 may be provided e.g. a computer program product comprising at least one computer-readable non-transitory medium having the computer program code 425 stored thereon, which computer program code 425, when executed by the processor 410 causes the apparatus to perform the method. The computer-readable non-transitory medium may comprise a memory device or a record medium such as a CD-ROM, a DVD, a Blu-ray disc, or another article of manufacture that tangibly embodies the computer program. As another example, the computer program may be provided as a signal configured to reliably transfer the computer program.

[0047] Still further, the computer program code 425 may comprise a proprietary application, such as computer program code for causing an execution of the method in the manner as described in the description herein.

[0048] Any of the programmed functions mentioned may also be performed in firmware or hardware adapted to or programmed to perform the necessary tasks.

[0049] The entity performing the method may also be implemented with a plurality of apparatuses, such as the one schematically illustrated in Figure 4, as a distributed computing environment. For example, one of the apparatuses may be communicatively connected with other apparatuses, and e.g. share the data of the method, to cause another apparatus to perform at least one portion of the method. As a result, the method performed in the distributed computing environment allows the rescue operation in the elevator system 1000 in the manner as described.

[0050] As mentioned, the apparatus 200 may be a predefined controller of the elevator system 1000, such as the main controller configured to control the overall operation of the elevator system 1000. The apparatus 200, or the plurality of apparatuses 200, are advantageously arranged to be supplied with power from the energy storage 195 automatically in response to a power failure from the mains, or it may be provided with their own energy storage in order to confirm that the apparatus 200 is operable at any event, and capable of performing the method as described.

Claims

1. A method for selecting a travel direction of an elevator car (110) for a rescue drive, **characterized in that** the method comprises:

    generating (210) a first estimate indicative of a total energy consumption of the elevator car (110) to travel from its estimated position to a next landing (10) in a first direction by:

        determining an amount of energy required to cause the elevator car (110) to move to the first direction by controlling the elevator car (110) to move a first reference distance to the first direction,
        estimating an amount of energy required to move the elevator car (110) from its estimated position to the next landing in the first direction,
        summing up the amount of energy required to cause the elevator car (110) to move to the first direction and the amount of energy required to move the elevator car (110) from its estimated position to the next landing (10) in the first direction for generating the first estimate,

generating (220) a second estimate indicative of a total energy consumption of the elevator car (110) to travel from its estimated position to a next landing (10) in an opposite direction to the first direction by:

determining an amount of energy required to cause the elevator car (110) to move to the opposite direction to the first direction by controlling the elevator car (110) to move a second reference distance to the opposite direction to the first direction,
estimating an amount of energy required to move the elevator car (110) from its estimated position to the next landing (10) in the opposite direction to the first direction,
summing up the amount of energy required to cause the elevator car (110) to move to the opposite direction to the first direction and the amount of energy required to move the elevator car (110) from its estimated position to the next landing (10) in the opposite direction to the first direction for generating the second estimate,

comparing (230) the first estimate and the second estimate, and
selecting (240) the travel direction for the rescue drive corresponding to an estimate being smaller among the first estimate and the second estimate.

2. The method of claim 1, wherein the amount of energy required to cause a movement of the first reference distance or a movement of the second reference distance is derived from data indicative of an input current of an electric motor (160) configured to cause the respective movement.

3. The method of any of the preceding claims, wherein the estimated position of the elevator car (110) is determined based on at least one of the following: data indicative of a position of the elevator car (110) obtained from at least one sensor; position data of the elevator car (110) stored in data storage.

4. The method of claim 3, wherein the estimated position of the elevator car (110) is determined from the position data stored in the data storage by selecting the piece of data as the data for the estimated position which is stored to the data storage most recently prior to an event that caused the rescue drive.

5. The method of any of the preceding claims, wherein the estimating of the amount of energy required to move the elevator car (110) from its estimated position to the next landing (10) in the first direction or to the next landing (10) in the opposite direction to the first direction is performed by estimating an amount of energy needed to generate a torque to the traction sheave to move the elevator car (110) to respective directions.

6. The method of any of the preceding claims, wherein the step of estimating the amount of energy required to move the elevator car (110) from its estimated position to the next landing (10) in the first direction or in the opposite direction to the first direction comprises a determination of information indicative a change in balance of the elevator system (1000) over a first path from the estimated position of the elevator car (110) to the next landing (10) in the first direction and over a second path from the estimated position of the elevator car (110) to the next landing (10) in the opposite direction to the first direction.

7. The method of any of the preceding claims, the method further comprising:

determining an amount of energy available from an energy source (195) for the rescue drive,
determining if the amount of energy available from the energy source (195) for the rescue drive exceeds an estimate indicative of the total energy consumption corresponding to the selected travel direction, and
generating, in response to a detection that the amount of energy available from the energy source (195) for the rescue drive exceeds an estimate indicative of the total energy consumption corresponding to the selected travel direction, an indication of an allowance to initiate the rescue drive to the selected travel direction.

8. The method of any of the preceding claims, the method further comprises:

determining a first peak power required by elevator car (110) to travel from its estimated position to the next landing in the first direction and determining a second peak power required by elevator car (110) to travel from its estimated position to the next landing in the opposite direction to the first direction,
comparing the determined first peak power and the determined second peak power to a reference value,
confirming the travel direction selected based on the comparison of the first estimate and the second estimate for the rescue drive upon a detection that a determined peak power to a same travel direction as the selected travel direction is below the reference value,
preventing the travel direction selected based on the comparison of the first estimate and the second estimate for the rescue drive upon a

detection that a determined peak power to a same travel direction as the selected travel direction exceeds the reference value.

9. The method of any of the preceding claims, wherein the selection of the travel direction comprises a generation of a control signal to an elevator drive to cause a generation of a control signal to the electric motor (160).

10. An apparatus (200) for selecting a travel direction of an elevator car (110) for a rescue drive, the apparatus (200) is configured to execute the method according to any of claims 1 to 9.

11. An elevator system (1000) comprising an apparatus according to claim 10.

12. A computer program comprising instructions to cause the apparatus of claim 10 to carry out the method according to any of claims 1 to 9.

Patentansprüche

1. Verfahren zum Auswählen einer Fahrtrichtung einer Aufzugskabine (110) für eine Rettungsfahrt, **dadurch gekennzeichnet, dass** das Verfahren Folgendes umfasst:
Erzeugen (210) einer ersten Schätzung, die einen Gesamtenergieverbrauch der Aufzugskabine (110) angibt, um von ihrer geschätzten Position zu einem nächsten Flur (10) in einer ersten Richtung zu fahren, durch:

    Bestimmen einer Energiemenge, die erforderlich ist, um zu bewirken, dass sich die Aufzugskabine (110) durch Steuern der Aufzugskabine (110) um eine erste Referenzdistanz zu der ersten Richtung in die erste Richtung bewegt,
    Schätzen einer Energiemenge, die erforderlich ist, um die Aufzugskabine (110) von ihrer geschätzten Position zum nächsten Flur in der ersten Richtung zu bewegen,
    Summieren der Energiemenge, die erforderlich ist, um zu bewirken, dass sich die Aufzugskabine (110) in die erste Richtung bewegt, und der Energiemenge, die erforderlich ist, um die Aufzugskabine (110) von ihrer geschätzten Position zum nächsten Flur (10) in die erste Richtung zu bewegen, zum Erzeugen der ersten Schätzung,
    Erzeugen (220) einer zweiten Schätzung, die einen Gesamtenergieverbrauch der Aufzugskabine (110) angibt, um von ihrer geschätzten Position zu einem nächsten Flur (10) in einer zu der ersten Richtung entgegengesetzten Richtung zu fahren, durch:

    Bestimmen einer Energiemenge, die erforderlich ist, um zu bewirken, dass sich die Aufzugskabine (110) in die zu der ersten Richtung entgegengesetzten Richtung bewegt, indem die Aufzugskabine (110) gesteuert wird, sich um eine zweite Referenzdistanz zu der zu der ersten Richtung entgegengesetzten Richtung zu bewegen,
    Schätzen einer Energiemenge, die erforderlich ist, um die Aufzugskabine (110) von ihrer geschätzten Position zum nächsten Flur (10) in die zu der ersten Richtung entgegengesetzte Richtung zu bewegen,
    Summieren der Energiemenge, die erforderlich ist, um zu bewirken, dass sich die Aufzugskabine (110) in die zu der ersten Richtung entgegengesetzten Richtung bewegt, und der Energiemenge, die erforderlich ist, um die Aufzugskabine (110) von ihrer geschätzten Position zu dem nächsten Flur (10) in die zu der ersten Richtung entgegengesetzte Richtung zu bewegen, zum Erzeugen der zweiten Schätzung,
    Vergleichen (230) der ersten Schätzung und der zweiten Schätzung, und
    Auswählen (240) der Fahrtrichtung für die Rettungsfahrt, die einer Schätzung entspricht, die unter der ersten Schätzung und der zweiten Schätzung kleiner ist.

2. Verfahren nach Anspruch 1, wobei die Energiemenge, die erforderlich ist, um eine Bewegung des ersten Referenzabstands oder eine Bewegung des zweiten Referenzabstands zu bewirken, aus Daten abgeleitet wird, die einen Eingangsstrom eines Elektromotors (160) angeben, der dazu ausgelegt ist, die jeweilige Bewegung zu bewirken.

3. Verfahren nach einem der vorhergehenden Ansprüche, wobei die geschätzte Position der Aufzugskabine (110) basierend auf mindestens einem der Folgenden bestimmt wird: Daten, die eine Position der Aufzugskabine (110) angeben, die von mindestens einem Sensor erhalten wird; Positionsdaten der Aufzugskabine (110), die in einer Datenspeicherung gespeichert sind.

4. Verfahren nach Anspruch 3, wobei die geschätzte Position der Aufzugskabine (110) aus den Positionsdaten bestimmt wird, die in der Datenspeicherung gespeichert sind, indem das Datenelement als die Daten für die geschätzte Position ausgewählt wird, die zuletzt vor einem Ereignis, das die Rettungsfahrt verursacht hat, in der Datenspeicherung gespeichert wird.

5. Verfahren nach einem der vorhergehenden Ansprüche, wobei das Schätzen der Energiemenge, die

erforderlich ist, um die Aufzugskabine (110) von ihrer geschätzten Position zum nächsten Flur (10) in der ersten Richtung oder zum nächsten Flur (10) in der zu der ersten Richtung entgegengesetzten Richtung zu bewegen, durch Schätzen einer Energiemenge durchgeführt wird, die benötigt wird, um ein Drehmoment zu der Traktionsscheibe zu erzeugen, um die Aufzugskabine (110) in jeweilige Richtungen zu bewegen.

6. Verfahren nach einem der vorhergehenden Ansprüche, wobei der Schritt des Schätzens der Energiemenge, die erforderlich ist, um die Aufzugskabine (110) von ihrer geschätzten Position zum nächsten Flur (10) in der ersten Richtung oder in der zu der ersten Richtung entgegengesetzten Richtung zu bewegen, eine Bestimmung von Informationen umfasst, die eine Änderung des Gleichgewichts des Aufzugsystems (1000) über einen ersten Pfad von der geschätzten Position der Aufzugskabine (110) zum nächsten Flur (10) in der ersten Richtung und über einen zweiten Pfad angeben von der geschätzten Position der Aufzugskabine (110) zum nächsten Flur (10) in der zur ersten Richtung entgegengesetzten Richtung.

7. Verfahren nach einem der vorhergehenden Ansprüche, wobei das Verfahren ferner Folgendes umfasst:

Bestimmen einer Energiemenge, die von einer Energiequelle (195) für die Rettungsfahrt verfügbar ist,
Bestimmen, ob die Energiemenge, die von der Energiequelle (195) für die Rettungsfahrt verfügbar ist, eine Schätzung überschreitet, die den Gesamtenergieverbrauch angibt, der der ausgewählten Fahrtrichtung entspricht, und
Erzeugen, als Reaktion auf eine Detektion, dass die Energiemenge, die von der Energiequelle (195) für die Rettungsfahrt verfügbar ist, eine Schätzung überschreitet, die den Gesamtenergieverbrauch angibt, der der ausgewählten Fahrtrichtung entspricht, einer Angabe einer Erlaubnis, die Rettungsfahrt in die ausgewählte Fahrtrichtung zu initiieren.

8. Verfahren nach einem der vorhergehenden Ansprüche, wobei das Verfahren ferner Folgendes umfasst:

Bestimmen einer ersten Spitzenleistung, die von der Aufzugskabine (110) erforderlich ist, um von ihrer geschätzten Position zum nächsten Flur in der ersten Richtung zu fahren, und
Bestimmen einer zweiten Spitzenleistung, die von der Aufzugskabine (110) erforderlich ist, um von ihrer geschätzten Position zum nächsten Flur in der zu der ersten Richtung entgegengesetzten Richtung zu fahren,
Vergleichen der bestimmten ersten Spitzenleistung und der bestimmten zweiten Spitzenleistung mit einem Referenzwert,
Bestätigen der ausgewählten Fahrtrichtung basierend auf dem Vergleich der ersten Schätzung und der zweiten Schätzung für die Rettungsfahrt bei einer Detektion, dass eine bestimmte Spitzenleistung zu einer gleichen Fahrtrichtung wie die ausgewählte Fahrtrichtung unter dem Referenzwert liegt,
Verhindern der Fahrtrichtung, die basierend auf dem Vergleich der ersten Schätzung und der zweiten Schätzung für die Rettungsfahrt ausgewählt wird, bei einer Detektion, dass eine bestimmte Spitzenleistung zu einer gleichen Fahrtrichtung wie die ausgewählte Fahrtrichtung den Referenzwert überschreitet.

9. Verfahren nach einem der vorhergehenden Ansprüche, wobei die Auswahl der Fahrtrichtung eine Erzeugung eines Steuersignals an einen Aufzugantrieb umfasst, um eine Erzeugung eines Steuersignals an den Elektromotor (160) zu bewirken.

10. Einrichtung (200) zum Auswählen einer Fahrtrichtung einer Aufzugskabine (110) für eine Rettungsfahrt, wobei die Einrichtung (200) dazu ausgelegt ist, das Verfahren nach einem der Ansprüche 1 bis 9 auszuführen.

11. Aufzugsystem (1000), das eine Einrichtung nach Anspruch 10 umfasst.

12. Computerprogramm, das Anweisungen umfasst, um zu bewirken, dass die Einrichtung nach Anspruch 10 das Verfahren nach einem der Ansprüche 1 bis 9 ausführt.

Revendications

1. Procédé de sélection d’une direction de déplacement d’une cabine (110) d’ascenseur en vue d’une progression de sauvetage, **caractérisé en ce que** le procédé comporte :
la génération (210) d’une première estimation indicative d’une consommation d’énergie totale de la cabine (110) d’ascenseur pour se déplacer de sa position estimée à un prochain palier (10) dans une première direction :

en déterminant une quantité d’énergie nécessaire pour amener la cabine (110) d’ascenseur à se déplacer vers la première direction en commandant la cabine (110) d’ascenseur pour qu’elle se déplace d’une première distance de référence vers la première direction,
en estimant une quantité d’énergie nécessaire

pour déplacer la cabine (110) d'ascenseur de sa position estimée au prochain palier dans la première direction,

en sommant la quantité d'énergie nécessaire pour amener la cabine (110) d'ascenseur à se déplacer vers la première direction et la quantité d'énergie nécessaire pour déplacer la cabine (110) d'ascenseur de sa position estimée au prochain palier (10) dans la première direction pour générer la première estimation,

la génération (220) d'une seconde estimation indicative d'une consommation d'énergie totale de la cabine (110) d'ascenseur pour se déplacer de sa position estimée à un prochain palier (10) dans une direction opposée à la première direction :

en déterminant une quantité d'énergie nécessaire pour amener la cabine (110) d'ascenseur à se déplacer vers la direction opposée à la première direction en commandant la cabine (110) d'ascenseur pour qu'elle se déplace d'une seconde distance de référence vers la direction opposée à la première direction,

en estimant une quantité d'énergie nécessaire pour déplacer la cabine (110) d'ascenseur de sa position estimée au prochain palier (10) dans la direction opposée à la première direction,

en sommant la quantité d'énergie nécessaire pour amener la cabine (110) d'ascenseur à se déplacer vers la direction opposée à la première direction et la quantité d'énergie nécessaire pour déplacer la cabine (110) d'ascenseur de sa position estimée au prochain palier (10) dans la direction opposée à la première direction pour générer la seconde estimation,

la comparaison (230) de la première estimation et de la seconde estimation, et

la sélection (240) de la direction de déplacement pour la progression de sauvetage correspondant à une estimation qui est plus petite parmi la première estimation et la seconde estimation.

2. Procédé selon la revendication 1, la quantité d'énergie nécessaire pour provoquer un mouvement de la première distance de référence ou un mouvement de la seconde distance de référence étant tirée de données indicatives d'un courant d'entrée d'un moteur électrique (160) configuré pour provoquer le mouvement en question.

3. Procédé selon l'une quelconque des revendications précédentes, la position estimée de la cabine (110) d'ascenseur étant déterminée d'après au moins un des éléments suivants: des données indicatives d'une position de la cabine (110) d'ascenseur obtenues à partir d'au moins un capteur; des données de position de la cabine (110) d'ascenseur conservées dans un stockage de données.

4. Procédé selon la revendication 3, la position estimée de la cabine (110) d'ascenseur étant déterminée à partir des données de position conservées dans le stockage de données en sélectionnant le fragment de données en tant que données pour la position estimée qui sont stockées dans le stockage de données le plus récemment avant un événement ayant causé la progression de sauvetage.

5. Procédé selon l'une quelconque des revendications précédentes, l'estimation de la quantité d'énergie nécessaire pour déplacer la cabine (110) d'ascenseur de sa position estimée au prochain palier (10) dans la première direction ou au prochain palier (10) dans la direction opposée à la première direction étant effectuée en estimant une quantité d'énergie nécessaire pour générer un couple sur la poulie de traction pour déplacer la cabine (110) d'ascenseur vers des directions respectives.

6. Procédé selon l'une quelconque des revendications précédentes, l'étape d'estimation de la quantité d'énergie nécessaire pour déplacer la cabine (110) d'ascenseur de sa position estimée au prochain palier (10) dans la première direction ou dans la direction opposée à la première direction comportant une détermination d'informations indicatives d'un changement dans l'équilibre du système (1000) d'ascenseur sur un premier trajet de la position estimée de la cabine (110) d'ascenseur au prochain palier (10) dans la première direction et sur un second trajet de la position estimée de la cabine (110) d'ascenseur au prochain palier (10) dans la direction opposée à la première direction.

7. Procédé selon l'une quelconque des revendications précédentes, le procédé comportant en outre :

la détermination d'une quantité d'énergie disponible à partir d'une source (195) d'énergie pour la progression de sauvetage,

le fait de déterminer si la quantité d'énergie disponible à partir de la source (195) d'énergie pour la progression de sauvetage dépasse une estimation indicative de la consommation d'énergie totale correspondant à la direction de déplacement sélectionnée, et

la génération, en réponse à une détection du fait que la quantité d'énergie disponible à partir de la source (195) d'énergie pour la progression de sauvetage dépasse une estimation indicative de la consommation d'énergie totale correspondant à la direction de déplacement sélectionnée, d'une indication d'une autorisation d'amorcer la progression de sauvetage vers la direction de déplacement sélectionnée.

8. Procédé selon l'une quelconque des revendications précédentes, le procédé comportant en outre :

la détermination d'une première puissance de crête nécessaire à la cabine (110) d'ascenseur pour se déplacer de sa position estimée au prochain palier dans la première direction et la détermination d'une seconde puissance de crête nécessaire à la cabine (110) d'ascenseur pour se déplacer de sa position estimée au prochain palier dans la direction opposée à la première direction,
la comparaison de la première puissance de crête déterminée et de la seconde puissance de crête déterminée à une valeur de référence,
la confirmation de la direction de déplacement sélectionnée sur la base de la comparaison de la première estimation et de la seconde estimation pour la progression de sauvetage suite à la détection du fait qu'une puissance de crête déterminée vers une même direction de déplacement que la direction de déplacement sélectionnée est inférieure à la valeur de référence,
le fait d'empêcher la direction de déplacement sélectionnée sur la base de la comparaison de la première estimation et la seconde estimation pour la progression de sauvetage suite à la détection du fait qu'une puissance de crête déterminée vers une même direction de déplacement que la direction de déplacement sélectionnée dépasse la valeur de référence.

9. Procédé selon l'une quelconque des revendications précédentes, la sélection de la direction de déplacement comportant la génération d'un signal de commande vers un moyen d'entraînement d'ascenseur pour provoquer la génération d'un signal de commande vers le moteur électrique (160).

10. Appareil (200) de sélection d'une direction de déplacement d'une cabine (110) d'ascenseur en vue d'une progression de sauvetage, l'appareil (200) étant configuré pour exécuter le procédé selon l'une quelconque des revendications 1 à 9.

11. Système (1000) d'ascenseur comportant un appareil selon la revendication 10.

12. Programme informatique comportant des instructions pour amener l'appareil selon la revendication 10 à réaliser le procédé selon l'une quelconque des revendications 1 à 9.

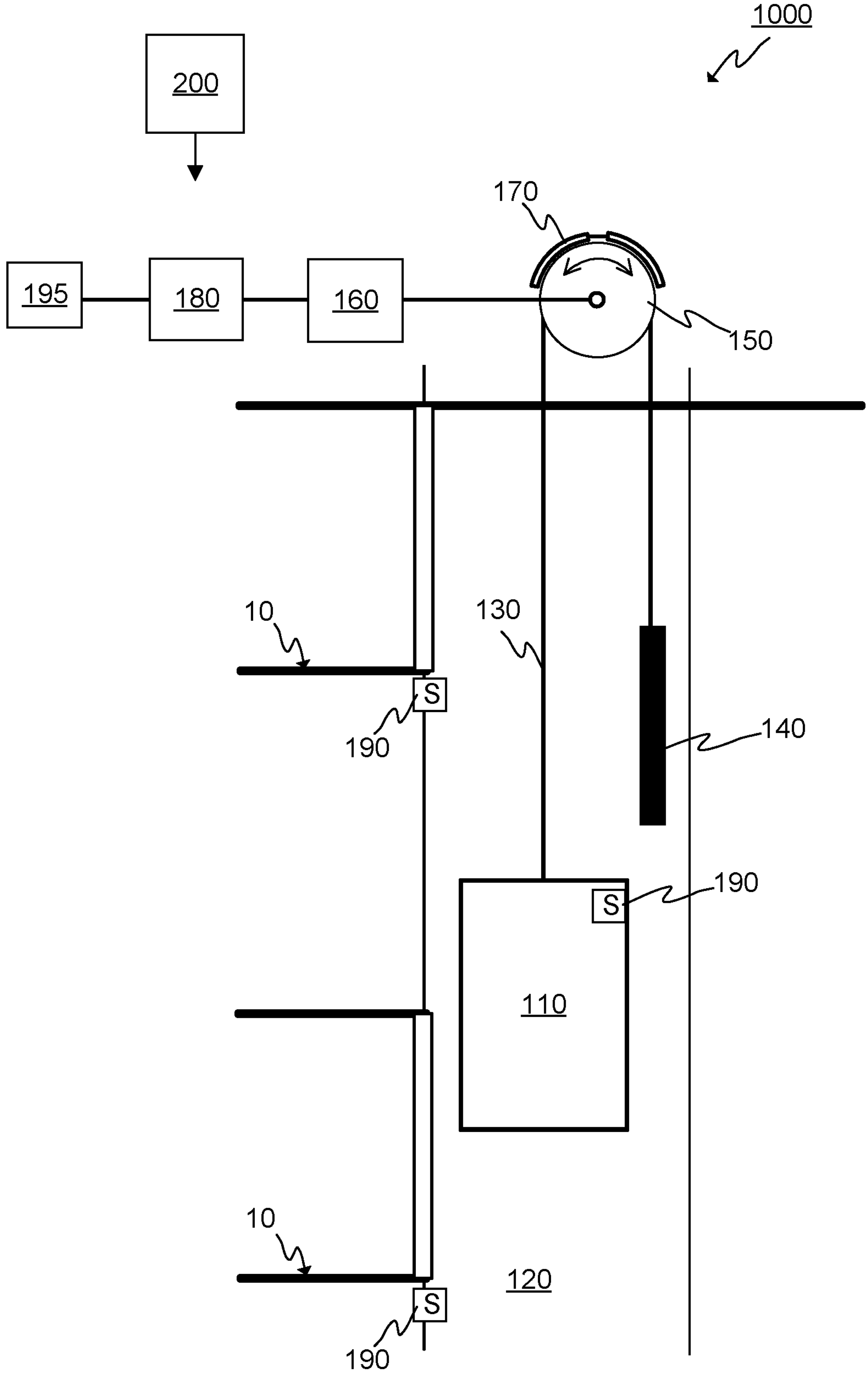
1000
200
170
195
180
160
150
10
130
S
190
140
S
190
110
10
120
S
190

FIGURE 1

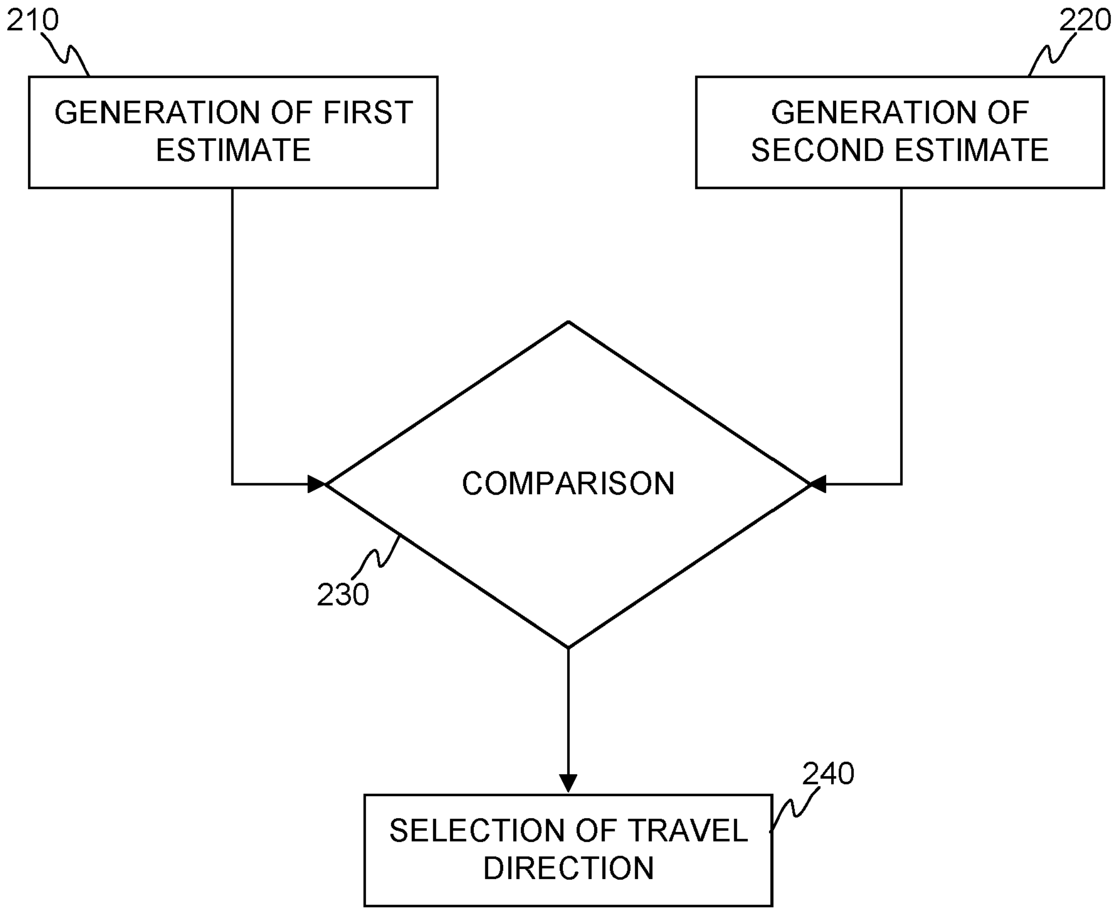

FIGURE 2

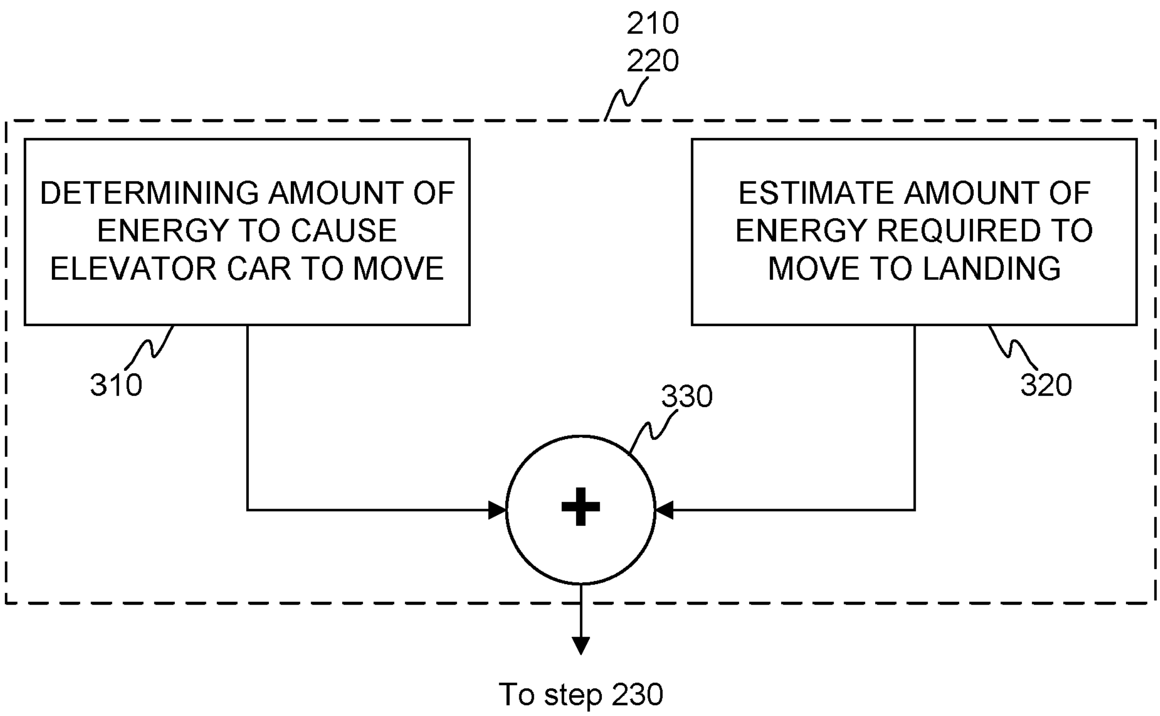

FIGURE 3

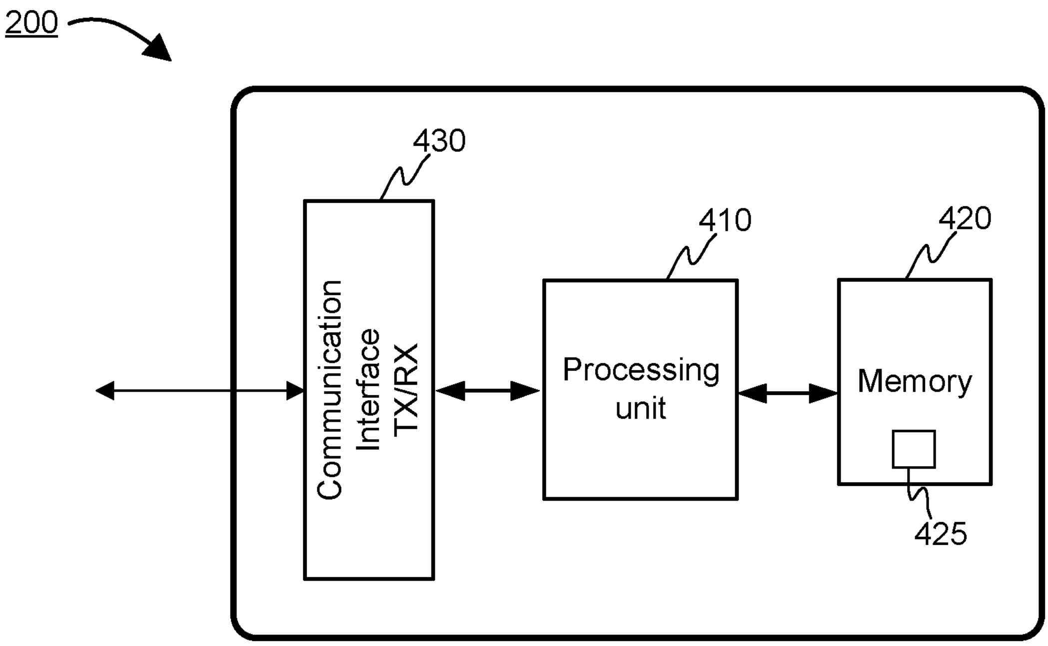
200
430
410
420
Communication Interface TX/RX
Processing unit
Memory
425

FIGURE 4

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2005126171 A **[0004]**