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(54) A METHOD FOR CONTROLLING AN ELEVATOR

(57) The elevator comprises a car (10) moving upwards and downwards in an elevator shaft (20) and a main control unit (400). The car comprises at least one car door (12) operated by a door operator (15) and the shaft comprises landing doors (22). The method comprises registering the arrival of the car to a predetermined door zone (Z1) and to a predetermined levelling zone (Z3) at a landing (L1, L2) and controlling the door operator to start opening of the car doors (12) and the landing doors when the car arrives to the door zone. The method is characterized by controlling the door operator to perform the opening of the car doors and the landing doors in two separate consecutive stages comprising a first stage starting when the car arrives to the door zone and a second stage starting when the car has stopped within the levelling zone, whereby passage to and from the car is allowed only in the second stage.

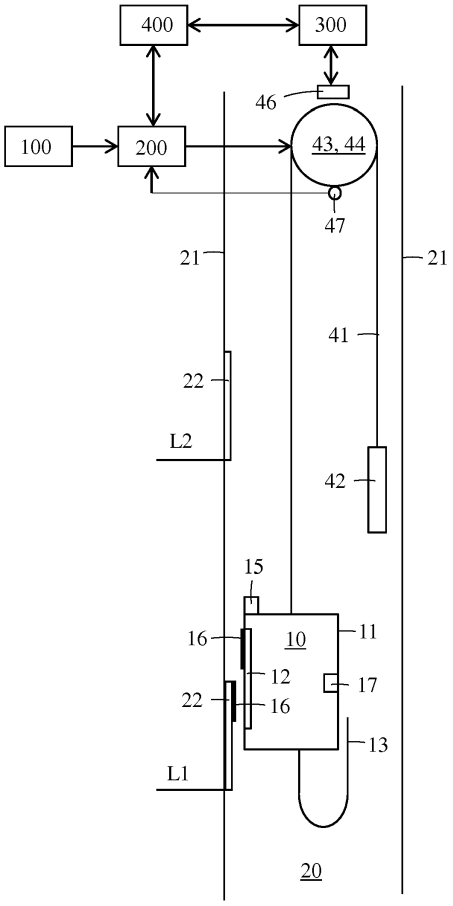

FIG. 2

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Description

FIELD

[0001] The invention relates to a method for controlling an elevator.

BACKGROUND

[0002] An elevator comprises typically a car, an elevator shaft, a machine room, lifting machinery, ropes, and a counter weight. A sling may surround the car or the sling may be integrated into the car. The lifting machinery may comprise a sheave, a machinery brake and an electric motor for rotating the sheave. The lifting machinery may move the car in a vertical direction upwards and downwards in the vertically extending elevator shaft. The ropes connect the sling and thereby also the car via the sheave to the counter weight. The sling may further be supported with gliding means on guide rails extending in the vertical direction in the shaft. The gliding means may comprise rolls rolling on the guide rails or gliding shoes gliding on the guide rails when the elevator car is moving upwards and downwards in the elevator shaft. The guide rails may be supported with fastening brackets on the side wall structures of the elevator shaft. The gliding means engaging with the guide rails keep the car in position in the horizontal plane when the car moves upwards and downwards in the elevator shaft. The counter weight is supported in a corresponding way on guide rails supported on the wall structure of the shaft. The elevator car transports people and/or goods between the landings in the building. The wall structure in the elevator shaft may be formed of solid walls or of an open steel structure.

[0003] The car may comprise horizontal or vertical sliding car doors and the shaft may comprise horizontal or vertical sliding landing doors. Each door may comprise at least one door panel, associated door panel guiding means and a moving mechanism, at least one door lock and a safety switch system used to prove a safe state (closed state) of the at least one door panel and the at least one lock. The car doors may be operated by a door operator positioned on the car. The door operator may comprise a motor connected to a suitable mechanical transmission that moves the car doors. A door coupler forms a mechanical coupling between the car doors and the landing doors. The door coupler may comprise a first part in connection with the car doors and a second part in connection the landing doors. The landing doors may move in synchronism with the car doors when the two parts of the door coupler are connected.

[0004] A door zone may be defined as a predefined vertical distance from a first point above to a second point below the sill of the landing. The elevator car enters into the door zone from above when the sill of the car passes the first point and from below when the sill of the elevator car passes the second point. The vertical distance between the first point and the sill of the landing and the vertical distance between the second point and the sill of the landing are normally equally long. The door zone may be e.g. ± 125 mm.

[0005] A relevelling zone may be defined as a predefined vertical distance from a first point above to a second point below the sill of the landing. The relevelling zone may according to the standard EN 81-20 be ± 20 mm. The car may in practise move after it has stopped at a landing due to loading and/or unloading of the car 10, elongation of the ropes etc. The car 10 should be relevelled when the car 10 has moved beyond the relevelling zone.

[0006] A levelling zone may be defined as a predefined vertical distance from a first point above to a second point below the sill of the landing. The levelling zone may according to the standard EN 81-20 be ± 10 mm. The elevator car should be parked within the levelling zone when the car is stopped at a landing.

[0007] Advance opening of the car doors and the landing doors may be started when the elevator car enters into the door zone. The two parts of the door coupler become connected to each other when the elevator car enters into the door zone. A first step in the advance opening is unlocking of the car doors and the landing doors. A second step is opening of the car doors and the landing doors. The two steps follow immediately after each other in prior art solutions. The assumption is that there is enough time for the car to settle into the stop zone before the car doors and the landing doors have opened to the extent that it is possible for a person (child) to pass through the opening in the car doors and the landing doors.

[0008] The opening of the car doors and the landing doors will not be stopped in prior art solutions even if the car does not for some reason stop within the stop zone as long as the car remains within the door zone. This means that a relatively high threshold could remain between the sill of the car and the sill of the landing when the car doors and the landing doors are open. This threshold may result in a tripping hazard for people leaving or entering the car. The door zone may be e.g. ± 125 mm, which means that the threshold could be 125 mm in case the car stops at the lower end or at the upper end of the door zone.

SUMMARY

[0009] An object of the present invention is to achieve an improved method for controlling an elevator.

[0010] The method for controlling an elevator is characterized by what is stated in the characterizing portion of claim 1.

[0011] The elevator comprises an elevator car moving upwards and downwards in an elevator shaft and a main control unit, the elevator car comprising at least one car door operated by a door operator, the shaft comprising landing doors.

[0012] The method comprises

registering an arrival of the elevator car to a predetermined door zone and to a predetermined levelling zone at a landing and transferring the information to the main control unit,
controlling the door operator with the main control unit to start opening of the car doors and the landing doors when the car arrives to the door zone at the landing.

[0013] The method is characterized by
controlling the door operator to perform the opening of the car doors and the landing doors in two separate consecutive stages comprising a first stage starting when the car arrives to the door zone and a second stage starting when the car has stopped within the levelling zone, whereby passage to and from the car is allowed only in the second stage.

[0014] The invention will reduce the risk of a passenger entering into the car or a passenger leaving the car to fall due to a high threshold between the sill of the car and the sill of the landing when the car stops at a landing.

[0015] The invention ensures that the threshold between the sill of the car and the sill of the landing is always small when the doors are automatically opened at a landing to such a degree that a person may pass through the opening to the car or from the car.

[0016] The door-to-door time of the elevator will be only slightly or not at all prolonged when the unlocking of the car doors and the landing doors is done at the same time when the car is parked into the levelling zone.

[0017] The method combines a precise parking of the car at the landing and a fast opening of the car doors and the landing doors at the landing.

[0018] Further options may be added to the method in order to take account of a situation in which the car does not for some reason park within the levelling zone. These further options aim at eliminating the risk of people being trapped in the car in such a situation.

[0019] A first option in such a situation is to try to correct the situation by relevelling the car so that the car is within the levelling zone. If the relevelling is successful and the car stops within the levelling zone, then the opening of the car door is continued.

[0020] A second option in such a situation is to make the door open button within the elevator car operative immediately when the elevator car has stopped under the prerequisite that the elevator car has stopped within the door zone of the landing. The passengers within the elevator car can escape from the elevator car to the landing by pressing the door open button resulting in that the door operator opens the elevator car doors and the landing doors allowing passage from the elevator car to the landing.

[0021] A third option in such a situation is to make the door open button within the elevator car operative after a predetermined time has passed after the elevator car stopped under the prerequisite that the elevator car has stopped within the door zone of the landing. The passengers within the elevator car can escape from the elevator car to the landing by pressing the door open button resulting in that the door operator opens the elevator car doors and the landing doors allowing passage from the elevator car to the landing.

[0022] A further possibility which may be used in connection with all of these three above mentioned options is to use an audio and/or a visual signal to indicate that there is an unusually high threshold between the sill of the car and the sill of the landing. The audio signal may be a spoken warning. The visual signal may be a flashing light in the threshold between the sills.

DRAWINGS

[0023] The invention will in the following be described in greater detail by means of preferred embodiments with reference to the attached drawings, in which

Figure 1 shows a first vertical cross section of an elevator,
Figure 2 shows a block diagram of the main parts in a control system of an elevator,
Figure 3 shows a door coupler system of an elevator,
Figure 4 shows positioning of an elevator car.

DETAILED DESCRIPTION

[0024] Fig. 1 shows a vertical cross section of an elevator. The elevator may comprise a car 10, an elevator shaft 20, a machine room 30, lifting machinery 40, ropes 41, and a counter weight 42. A frame called sling 11 may surround the car 10 or the sling 11 may be integrated into the car 10. The lifting machinery 40 may comprise a sheave 43, a machinery brake 46 and an electric motor 44 for rotating the sheave 43 via a shaft 45. The lifting machinery 40 may move the car 10 in a vertical direction S1 upwards and downwards in the vertically extending elevator shaft 20. The sling 11 may be connected by the ropes 41 via the sheave 43 to the counter weight 42. The sling 11 may further be supported with gliding means 27 at guide rails 25 extending in the vertical direction in the shaft 20. The figure shows two guide rails 25 at opposite sides of the car 10. The gliding means 27 can comprise rolls rolling on the guide rails 50 or gliding shoes gliding on the guide rails 25 when the car 10 is mowing upwards and downwards in the elevator shaft 20. The guide rails 25 may be attached with fastening brackets 26 to the side wall structures 21 in the elevator shaft 20. The figure shows only two fastening brackets 26, but there are several fastening brackets 26 along the height of each guide rail 25. The gliding means 27 engaging with the guide rails 25 may keep the car 10 in position in the horizontal plane when the car 10 moves upwards and downwards in the elevator shaft 20. The counter weight 42 may be supported in a corresponding way on guide rails that are attached to the wall structure 21 of the shaft 20. The machinery brake 46 may stop the rotation of the sheave 43 and thereby the movement of the elevator car 10. The car 10 may transport people and/or goods between the

landings in the building. The elevator shaft 20 may be formed so that the wall structure 21 is formed of solid walls or so that the wall structure 21 is formed of an open steel structure.

[0025] Figure 2 shows a block diagram of the main parts in a control system of an elevator. The elevator car 10 may be carried by the ropes 41, which connect the car 10 to the counter weight 42. The ropes 41 may pass over the sheave 43. The sheave 43 may be driven by the electric motor 44. The system may comprise a machinery brake 46, a machinery brake control unit 300, a frequency converter 200, and a main control unit 400.

[0026] The frequency converter 200 may be connected to the electrical grid 100. The electric motor 44 may advantageously be a permanent magnet synchronous motor 44. The frequency converter 200 may control the rotation of the electric motor 44. The rotation speed of the electric motor 44 may be measured with a sensor 47, which may be connected to the frequency converter 200. The frequency converter 200 may also receive a rotational speed reference i.e. a target value of the rotational speed of the electric motor 44 from the main control unit 400.

[0027] The machinery brake control unit 300 may be used to control the machinery brake 46 of the elevator. The machinery brake control unit 300 can e.g. be situated in connection with the control panel of the elevator or in connection with the main control unit 400 or in the vicinity of the machinery brake 46 or in connection with the electric motor 44.

[0028] The elevator car 10 may be driven by the electric motor 44 and the sheave 43 in order to move upwards and downwards in the shaft 20 between landings L1, L2. The elevator car 10 may comprise at least one car door 12 and the shaft 20 may comprise landing doors 22. The at least one car door 12 and the shaft doors 22 may be formed of a horizontal or a vertical sliding door. Each car door 12 and each landing door 22 may comprise at least one door panel, associated door panel guiding means and a moving mechanism, at least one door lock and a safety switch system used to prove a safe state (closed state) of the at least one door panel and the at least one lock. The car door 12 may be operated by a door operator 15 positioned on the car 10. The door operator 15 may comprise a motor connected via a mechanical transmission to the car door 12 in order to move the car door 12. A first part of a two-part door coupler 16 may be positioned in connection with the car doors 12 and a second part of the two part door coupler 16 may be positioned in connection with the landing doors 22. The door coupler 16 may form a mechanical coupling between the car doors 12 and the landing doors 22. The landing doors 22 may move in synchronism with the car doors 12 when the two parts of the door coupler 16 are connected. The movement of the car doors 22 may be transferred via the door coupler 16 to the landing doors 22. The cable 13 connecting the electric equipment in the elevator car 10 to the main control unit 400 are also shown in the figure. The car 10 may further be provided with a door open button 17, which may be used from the inside of the car 10. Pressing the door open button 17 results in that the door operator 15 opens the car doors 12 and the landing doors 22 under the prerequisite that the car 10 is in such a position that this can be allowed.

[0029] Figure 3 shows a door coupler system of an elevator.

[0030] A first part of a door coupler 16 may be supported on the car 10. The first part of the door coupler 16 may comprise two vertical guide parts 51, 52 positioned at a horizontal distance from each other. The guide parts 51, 52 may comprise a straight centre portion and outwardly bended end portions. The straight centre portions of the two guide parts 51, 52 may be positioned at a horizontal distance X3 from each other in a normal position.

[0031] A second part of the door coupler 16 may be supported on the landing door 22. The second part of the door coupler 16 may comprise a plate 61 having two rollers 62, 63 attached thereto. The first roller 62 may be attached only to the plate 61, which means that movement of the first roller 62 moves the plate 61. The second roller 63 may be attached directly or indirectly to the landing door 22 so that the second roller 63 forms a pivot point P1 for the plate 61. The plate 61 can thus be turned around the shaft of the second roller 63. The shaft of the second roller 63 forms thus the pivot point P1 for the plate 61. The plate 61 is shown with uniform lines in the locked position. The plate 61 may naturally be pivotally attached directly or indirectly to the landing door 22 from any point in the plate 61.

[0032] The first part and the second part of the door operator 16 are in different planes in the figure. The first part of the door coupler 16 may thus bypass the second part of the door operator 16.

[0033] A mechanical unlocking zone Z10 may be formed between a respective roller 62, 63 and a respective end of the straight portion of the guide parts 51, 52. The sum of the vertical lengths of the mechanical unlocking zones Z10 may be e.g. 300 mm.

[0034] Each guide part 51, 52 glides along a respective roller 62, 63 when the car 10 approaches a landing L1, L2. This means that the rollers 62, 63 become positioned between the guide parts 51, 52. The second guide part 52 may then be moved to the left in the figure i.e. in a first horizontal direction X1, which means that the horizontal distance X3 between the guide parts 51, 52 decreases as the first guide part 51 remains stationary in this situation. The second guide part 52 pushes thus the first roller 62 to the left resulting in that the plate 61 is turned around the pivot point P1. The plate 61 will thus turn around the pivot point P1 into the position showed by dashed lines in the figure.

[0035] Turning of the plate 61 around the pivot point P1 into the position showed by dashed lines results in that the lock claw 64 of the plate 61 will be released from the position behind the stationary stopper 71. The plate

61 will thus be in an unlocked position. The first guide part 51 may now be moved to the right in the figure i.e. in a second horizontal direction X2. This means that the second roller 63 and thereby also the plate 61 will move in the second direction X2. The plate 61 may be spring loaded so that the plate 61 returns to the locking position when the distance between the first guide 51 and the second guide 52 is returned to the original. The second roller 63 may be connected to the opening mechanism of the landing doors 22, whereby movement of the second roller 63 in the second horizontal direction X2 opens the landing doors 22.

[0036] The opening mechanism of the car doors 12 is connected to the first guide part 51. Movement of the first guide part 51 in the second horizontal direction X2 will thus open the car doors 12 and the landing doors 22.

[0037] There are also solutions in which the guide parts 51, 52 comprise a straight centre portion and inwardly bended end portions. The horizontal distance between the vertical guide parts 51, 52 may then be smaller and the rolls 62, 63 may be positioned vertically further away from each other. The vertical guide parts 51, 52 may pass between the rolls 62, 63 when the car approaches the landing. Moving the vertical guide parts 51, 52 horizontally outwards away from each other moves also the rolls 62, 63 horizontally away from each other, whereby the landing door lock is opened.

[0038] Figure 4 shows positioning of an elevator car.

[0039] A door zone Z1 (electrical door zone) may be defined as a zone where the sill of the car 10 and the sill of the landing L1, L2 doors are at a certain vertical distance from each other. The car 10 enters into the door zone Z1 from above when the sill of the car 10 is at a predetermined vertical first distance above the sill of the landing L1, L2 and from below when the sill of the car 10 is at a predetermined vertical second distance below the sill of the landing L1, L2. The predetermined vertical first distance and the predetermined vertical second distance are normally equally long.

[0040] The vertical length of the door zone Z1 (the electrical door zone) should be shorter than the vertical length of the mechanical unlocking zone Z10. The mechanical unlocking zone Z10 is explained in figure 3. The vertical length of the door zone may be e.g. ± 125 mm, i.e. 125 mm above the landing door sill and 125 mm under the landing door sill.

[0041] The door zone Z1 (electrical door zone) may be detected by arranging sensor means on the sling 11 or on the car 10 or on the door sill of the car 10 and detector means on the guide rails 50 or on the door sill of the landing or vice a versa. The detector means detects the event when the sensor means bypasses the detector means. The sensor means and detector means make it possible to detect when the car 10 arrives to the door zone Z1 (electrical door zone) from the upper side or from the underside of the landing L1, L2.

[0042] The sling 11 may be a separate part surrounding the car 10 or the sling 11 may be integrated into the car 10. A separate car 10 may be supported with a suspension within the sling 11. The car 10 may thus move slightly e.g. 1 to 10 mm within the sling 11. The sensor means and/or the detector means may thus in this case be attached to the car 10 instead of the sling 11 in order to eliminate the inaccuracy caused by the vertical movement of the car 10. The sensor means and/or the detector means are often attached to the sling 11 as it moves along a more exact vertical path. The car 10 may be slightly inclines when travelling due to an uneven positioning of the load within the car 10. It is most advantageous to attach the sensor means and/or the detector means to the sill of the car 10 and the sill of the landing door 22 as these are the elements that are to be aligned when the car 10 stops at a landing. The sill of the landing door 22 may sink along with the sinking of the building, which means that adjustment of the sensor means and/or the detector means is not needed in this case.

[0043] A relevelling zone Z2 may further be defined as the zone within which the car 10 may move after stopping at a landing L1, L2 without need for relevelling. If the car 10 for some reason moves out of the relevelling zone Z2, then relevelling of the car 10 has to be done. The car 10 could move out of the relevelling zone Z2 e.g. when the car 10 is loaded with people and/or goods. The sill of the car 10 is at a certain distance above or below the sill of the landing L1, L2 in the relevelling zone Z2.

[0044] The vertical length of the relevelling zone Z2 is in the standard EA 81-20 defined to be ± 20 mm. The car 10 may for various reasons e.g. loading of the car 10, elongation of the ropes 41 of the elevator move out of the relevelling zone Z2. Corrective measures should according to the standard EN 81-20 be taken when the car 10 moves out of the relevelling zone Z2.

[0045] A levelling zone Z3 may further be defined as the zone within which the car 10 should stop at a landing L1, L2. The sill of the car 10 is at a certain distance above or below the sill of the landing L1, L2 in the stop zone Z2.

[0046] The vertical length of the levelling zone Z3 is in the standard EA 81-20 defined to be ± 10 mm. This means that the sill of the car doors 12 should be within a vertical distance of ± 10 mm from the sill of the landing doors 22 when the car 10 has stopped at the landing L1, L2. The elevator car 10 should thus be parked within the levelling zone Z3 when stopping at a landing L1, L2.

[0047] The relevelling zone Z3 and the levelling zone Z2 can in a similar way be detected by respective sensor means on the guide rails or the sill of the landing and detector means on the sling 11 or the car 10 or the sill of the car. The detector means may register the upper limit and the lower limit of the relevelling zone Z3 and the levelling zone Z2 based on the bypassing of the sensor means.

[0048] The position of the elevator car 10 may be registered within the door zone Z1, the relevelling zone Z3 and the levelling zone Z2 at each landing L1, L2. This may be done so that only the bypassing of the upper and lower limits are registered or so that the position of the

car 10 is registered continuously within the door zone Z1, the relevelling zone Z3 and the levelling zone Z2. The position of the elevator car 10 may also be measured along the whole height of the elevator shaft 20. This can be done by conventional methods based e.g. on electrical, magnetic and/or light sensors and detectors.

[0049] After receiving the information that the elevator car 10 has arrived from above or from below into the door zone Z1, the main control unit 400 will in prior art solutions, if the speed of the elevator car 10 is under a predetermined value, start advance door opening i.e. instruct the door operator 15 to unlock the car doors 12 and the landing doors 22 and to start the opening of the car doors 12 and the landing doors 22. These steps are done consecutively without any delay between the steps. The assumption is thus that the sill of the elevator car 10 will be near the sill of the landing L1, L2 at the time the car doors 12 and the landing doors 22 have opened so much that a person can pass through the door opening. The advanced door opening will not be stopped even if the elevator car 10 does not stop within the stop window Z2 at the landing L1, L2 as long as the car 10 stops within the door zone Z1. The threshold between the sill of the elevator car 10 and the sill of the landing L1, L2 could thus be bigger than intended when the car doors 12 and the landing doors 22 are open. This bigger than intended threshold may result in a tripping hazard for people leaving or entering the car 10. The door zone Z1 may be e. g. ± 125 mm, which means that the threshold could be 125 mm in case the car 10 stops at the lower end or at the upper end of the door zone Z1.

[0050] The method according to the invention tries to avoid this tripping hazard. After receiving the information that the elevator car 10 has arrived from above or from below to the door zone Z1, the main control unit 400 operates the door operator 15 in two separate consecutive stages comprising a first stage starting when the car 10 arrives to the door zone Z1 and a second stage starting when the car 10 has stopped within the stop zone Z2, whereby passage to and from the car 10 is allowed only in the second stage. The first stage may start immediately when the car 10 arrives to the door zone Z1.

[0051] The main control unit 400 may as a first option in the first stage send a control signal to the door operator 15 only to unlock the car doors 12 and the landing doors 22.

[0052] The main control unit 400 may as a second option in the first stage send a control signal to the door operator 15 to unlock the car doors 12 and the landing doors 22 and to open the car doors 12 and the landing doors 22 only partially so that a person cannot pass through the door opening.

[0053] The person may be a child which means that the width of the opening in the car doors 12 and the landing doors 22 could maybe be less than 200 mm in order to prevent the person from passing through the opening.

[0054] The main control unit 400 may then in the second stage, when the main control unit 400 receives the information that the car 10 has stopped within the stop zone Z2, send a control signal to the door operator 15 to open the car doors 12 and the landing doors 22 completely.

[0055] Further options may be added to the method in order to take account of a situation in which the car 10 does not for some reason park within the levelling zone Z3. These further options aim at eliminating the risk of people being trapped in the car 10 in such a situation.

[0056] A first option in such a situation is to try to correct the situation by relevelling the car 10 so that the car 10 is within the levelling zone Z3. If the relevelling is successful and the car 10 stops within the levelling zone Z3, then the opening of the car door 12 is continued.

[0057] A second option in such a situation is to make the door open button 17 within the elevator car 10 operative immediately when the elevator car 10 has stopped under the prerequisite that the elevator car 10 has stopped within the door zone Z1 of the landing L1, L2. The passengers within the elevator car 10 can escape from the elevator car 10 to the landing L1, L2 by pressing the door open button 17 resulting in that the door operator 15 opens the elevator car doors 12 and the landing doors 22 allowing passage from the elevator car 10 to the landing L1, L2.

[0058] A third option in such a situation is to make the door open button 17 within the elevator car 10 operative after a predetermined time has passed after the elevator car 10 stopped under the prerequisite that the elevator car 10 has stopped within the door zone Z1 of the landing L1, L2. The passengers within the elevator car 10 can escape from the elevator car 10 to the landing L1, L2 by pressing the door open button 17 resulting in that the door operator 15 opens the elevator car doors 12 and the landing doors 22 allowing passage from the elevator car 10 to the landing L1, L2.

[0059] A further possibility which may be used in connection with all of these three above mentioned options is to use an audio and/or a visual signal to indicate that there is an unusually high threshold between the sill of the car 10 and the sill of the landing 22. The audio signal may be a spoken warning. The visual signal may be a flashing light in the threshold between the sills.

[0060] A still further possibility which may be used in connection with the invention deals with the different possibilities of controlling a door operator 15 operable via a serial interface.

[0061] Examples of commands from the main control unit 400 to the door operator 15 are e.g.

open the door (XX mm), where XX defines the opening of the doors in millimetres,

open the door (XX mm, opening speed), where XX defines the opening of the doors in millimetres and the opening speed defines the urgency of the opening (a smaller value opens the doors more softly and a greater value opens the doors faster),

stop the door opening.

[0062] Examples of answers from the door operator 15

to the main control unit 400 are e.g.
the size of the door opening in millimetres,
the position of the lock of the door,
the speed of the door.

[0063] The use of the invention is naturally not limited to the type of elevator disclosed in the figures or to the type of door coupler disclosed in the figures. The invention can be used in any type of elevator and with any type of door coupler. The elevator may lack a machine room and/or a counterweight. The counterweight may be positioned on either side wall or on both side walls or on the back wall of the elevator shaft. The sheave, the machine brake and the motor may be positioned in the machine room or somewhere in the elevator shaft. The car may be provided with at least one car door. The car may thus be provided with e.g. only one door at one wall or with two car doors at opposite walls or with three doors at three different walls.

[0064] The invention is in the embodiments shown in the figures explained by referring to horizontal sliding door panels, but the same principal may be applied also for vertical sliding door panels.

[0065] It will be obvious to a person skilled in the art that, as the technology advances, the inventive concept can be implemented in various ways. The invention and its embodiments are not limited to the examples described above but may vary within the scope of the claims.

Claims

1. A method for controlling an elevator comprising an elevator car (10) moving upwards and downwards in an elevator shaft (20) and a main control unit (400), the elevator car (10) comprising at least one car door (12) operated by a door operator (15), the shaft (20) comprising landing doors (22), the method comprising
   registering an arrival of the elevator car (10) to a predetermined door zone (Z1) and to a predetermined levelling zone (Z3) at a landing (L1, L2) and transferring the information to the main control unit (400),
   controlling the door operator (15) with the main control unit (400) to start opening of the car doors (12) and the landing doors (22) when the car (10) arrives to the door zone (Z1) at the landing (L1, L2),
   characterized by
   controlling the door operator (15) to perform the opening of the car doors (12) and the landing doors (22) in two separate consecutive stages comprising a first stage starting when the car (10) arrives to the door zone (Z1) and a second stage starting when the car (10) has stopped within the levelling zone (Z3), whereby passage to and from the car (10) is allowed only in the second stage.

2. The method according to claim 1, **characterized in that** the first stage comprises only unlocking of the car doors (12) and the landing doors (22).

3. The method according to claim 1, **characterized in that** the first stage comprises unlocking of the car doors (12) and the landing doors (22) and opening of the car doors (12) and the landing doors (22) only partially so that passage of a person through the opening in the car doors (12) and the landing doors (22) is still prevented.

4. The method according to claim 3, **characterized in that** the partial opening of the car doors (12) and the landing doors (22) is made so that the width of the opening through the car doors (12) and the landing doors (22) is less than 200 mm.

5. The method according to any of claim 2 to 4, **characterized in that** the second stage comprises opening of the car doors (12) and the landing doors (22) completely when the elevator car (10) has stopped within the levelling zone (Z3).

6. The method according to any one of claims 1 to 5, **characterized in that** in case the elevator car (10) does not for some reason stop within the levelling zone (Z3) at a landing (L1, L2), then a door open button (17) within the elevator car (10) is made operational immediately when the elevator car (10) has stopped under the prerequisite that the elevator car (10) has stopped within the door zone (Z1) of the landing (L1, L2), whereby passengers within the elevator car (10) can escape from the elevator car (10) to the landing (L1, L2) by pressing the door open button (17) resulting **in that** the door operator (15) opens the elevator car doors (12) and the landing doors (22) allowing passage from the elevator car (10) to the landing (L1, L2).

7. The method according to any one of claims 1 to 5, **characterized in that** in case the elevator car (10) does not for some reason stop within the levelling zone (Z3) at a landing (L1, L2), then a door open button (17) within the elevator car (10) is made operational after a predetermined time has passed after the elevator car (10) stopped under the prerequisite that the elevator car (10) has stopped within the door zone (Z1) of the landing (L1, L2), whereby passengers within the elevator car (10) can escape from the elevator car (10) to the landing (L1, L2) by pressing the door open button (17) resulting **in that** the door operator (15) opens the elevator car doors (12) and the landing doors (22) allowing passage from the elevator car (10) to the landing (L1, L2).

8. The method according to any one of claims 1 to 7, **characterized in that** in case the elevator car (10)

does not for some reason stop within the levelling zone (Z3) at a landing (L1, L2), then a warning concerning the threshold between the sill of the car (10) and the sill of the landing (L1, L2) is given with a voice machine in the car (10) when the car doors (12) and the landing doors (22) are opened completely.

9. The method according to any one of claims 1 to 8, **characterized in that** in case the elevator car (10) does not for some reason stop within the levelling zone (Z3) at a landing (L1, L2), then a visual warning lighting the threshold between the sill of the car (10) and the sill of the landing (L1, L2) is activated when the car doors (12) and the landing doors (22) are opened completely.

10. An elevator comprising
an elevator car (10) moving upwards and downwards in an elevator shaft (20), the elevator car (10) comprising car doors (12) operated by a door operator (15), the shaft (20) comprising landing doors (22), and a main control unit (400) receiving information of an arrival of the elevator car (10) to a predetermined door zone (Z1) and to a predetermined levelling zone (Z3) at a landing (L1, L2), the door operator (15) being controlled by the main control unit (400) to start opening of the car doors (12) and the landing doors (22) when the car (10) arrives to the door zone (Z1) at the landing (L1, L2),
characterized in that
the main control unit (400) is configured to control the door operator (15) to perform the opening of the car doors (12) and the landing doors (22) in two separate consecutive stages comprising a first stage starting when the car (10) arrives to the door zone (Z1) and a second stage starting when the car (10) has stopped within the levelling zone (Z3), whereby passage to and from the car (10) is allowed only in the second stage.

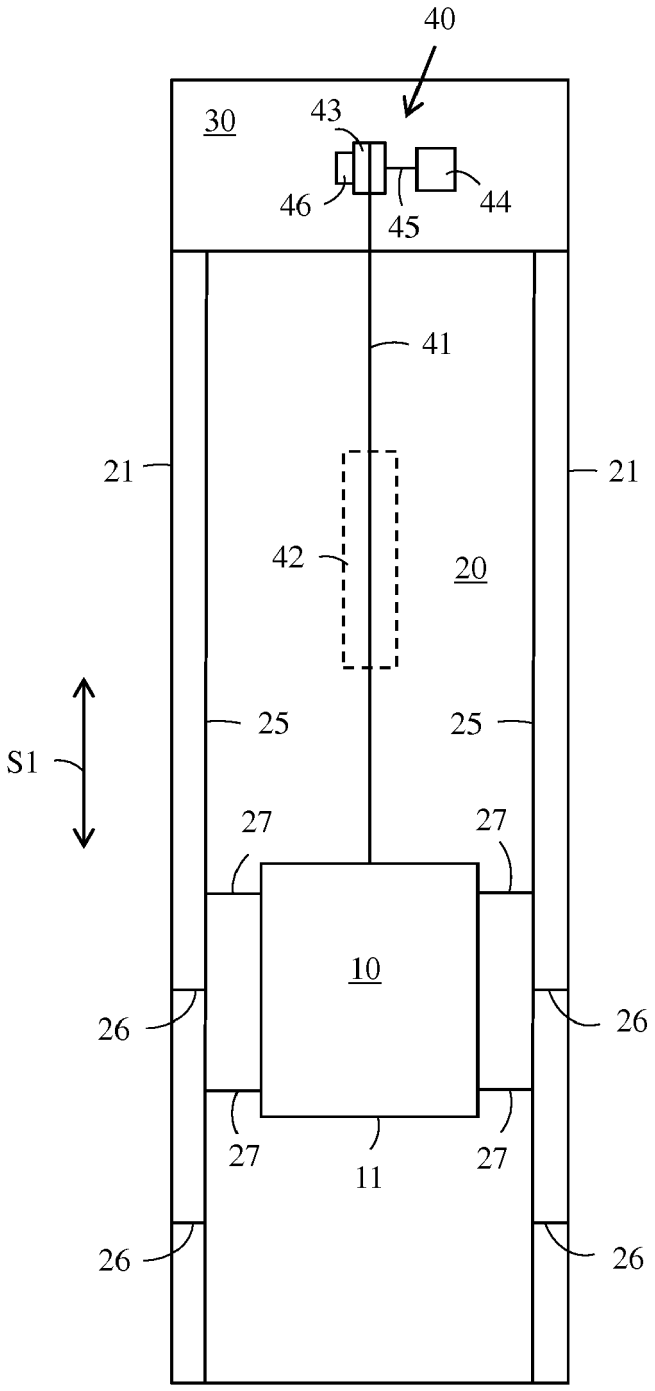

FIG. 1

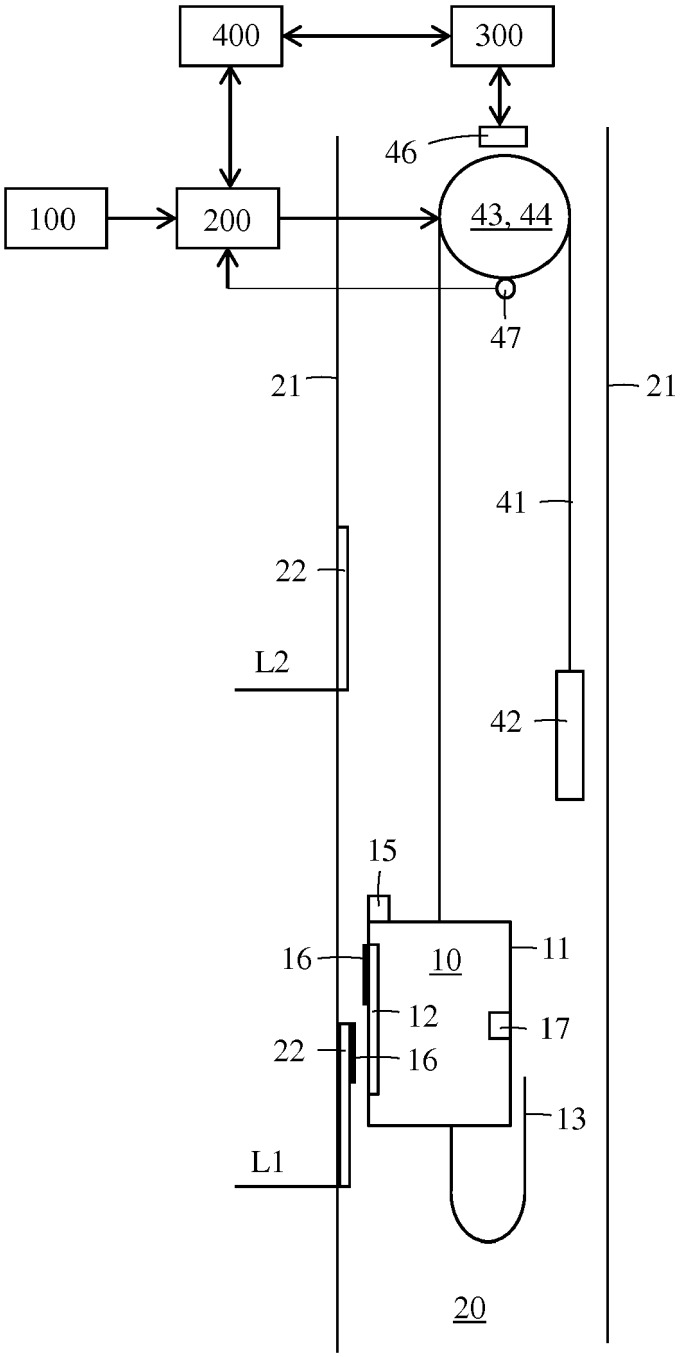
400
300
46
100
200
43, 44
47
21
21
41
22
L2
42
15
16
10
11
12
17
22
16
13
L1
20

FIG. 2

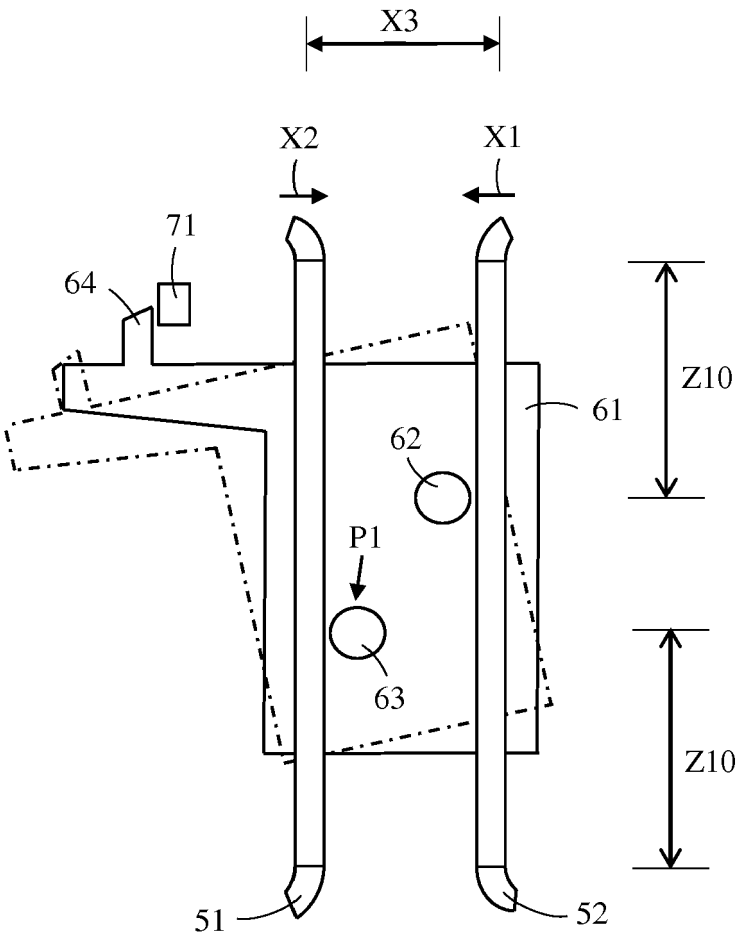

FIG. 3

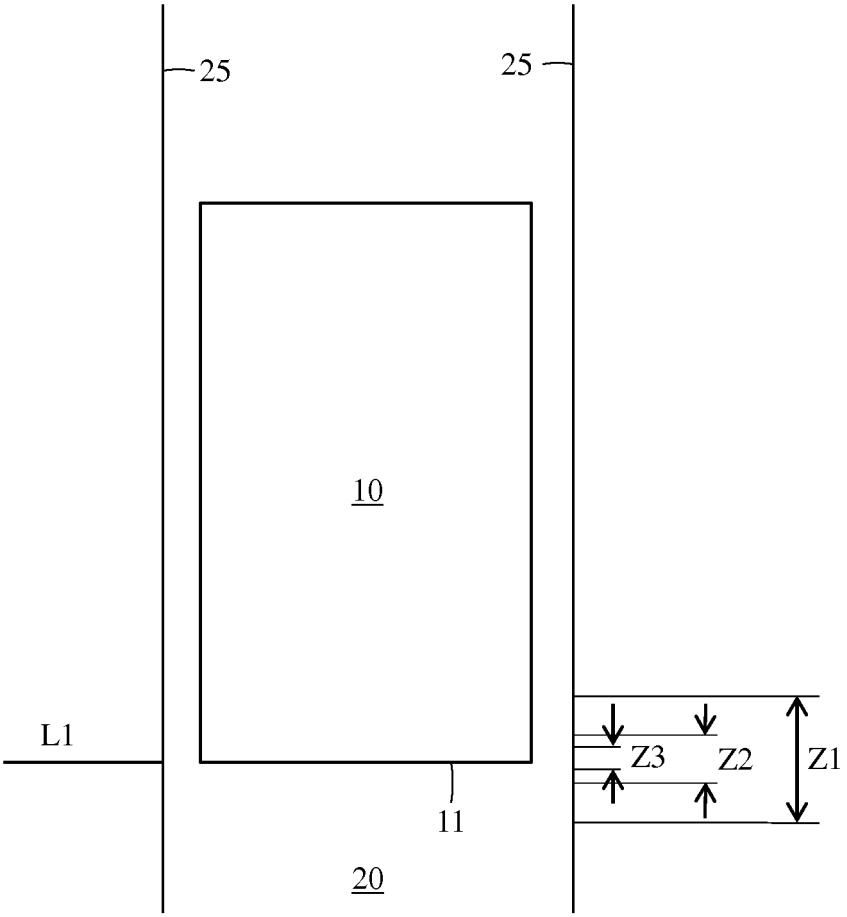

FIG. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 17 20 8329

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	WO 2017/016896 A1 (INVENTIO AG [CH]) 2 February 2017 (2017-02-02) * abstract * * page 6, line 1 - page 9, line 15 * * figures 1-3 * -----	1,2,5-10 3,4	INV. B66B13/14
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			TECHNICAL FIELDS SEARCHED (IPC)
			B66B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	20 June 2018	Oosterom, Marcel

CATEGORY OF CITED DOCUMENTS

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20-06-2018

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82