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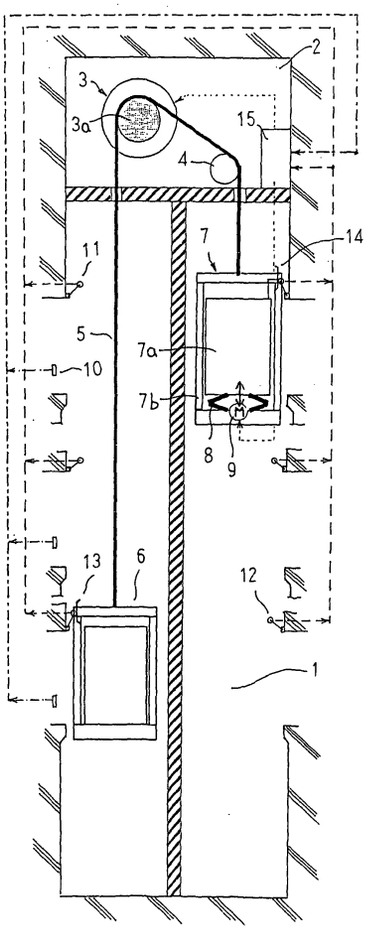
(54) **ELEVATOR DEVICE**

(57) The present invention is intended to obtain an elevator apparatus in which a first car and a second car connected with opposite ends of a main rope are able to land at the same time. The construction is such that the first and second cars are connected with the opposite ends of the main rope wrapped around a sheave and a deflector wheel, respectively, and a landing correction device for vertically moving a cab of the second car with respect to a car frame is arranged between the cab and the car frame. After the first car has landed on a set landing floor, the cab is moved up and down with respect to the car frame by the landing correction device, whereby a landing deviation of the second car can be corrected.

FIG. 1



EP 1 574 467 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to an elevator apparatus having two cars suspended with 1:1 roping, and more particularly, to an elevator apparatus provided with a landing correction device for normally landing the two cars at the same time.

BACKGROUND ART

[0002] A known elevator apparatus of a 1:1 roping system is constructed such that cars are connected with opposite ends of a main rope, respectively, which is wrapped around a drive sheave and a deflector wheel installed on an upper portion of a hoistway, as shown in Japanese patent application laid-open No. 2001-240343 for example. When one of the cars lands on the top floor while the main rope is caused to travel by driving the drive sheave, the other car lands on the bottom floor.

[0003] Here, in cases where there is developed an expansion of the main rope resulting from a time-varying change or an expansion or contraction of the main rope resulting from temperature or load changes, the landing position of the other car will shift or deviate by the expansion or contraction of the main rope upon landing of the one car, so it becomes impossible for both of the cars to land normally at the same time. Accordingly, it is necessary to land the other car and open its door after the one car has landed on a floor and its door has been opened and closed, thus giving rise to a problem that the service is reduced to a substantial extent.

[0004] Similarly, in cases where floor-to-floor distances are different from one another, particularly in the case of three or more stops (i.e., the number of landing places for the elevator apparatus is three or more), there arises a problem that both of the cars cannot land normally at the same time.

[0005] In order to solve such problems, an elevator called "Duo-Lifts" of a known 2:1 roping system, in which hydraulic jacks are arranged to be connected respectively with opposite fixed ends of a main rope in a machine room so as to be able to adjust the length of the main rope by the hydraulic jacks, has been proposed, for example, in ELEVETOR WORLD (26 February 92).

[0006] However, the Duo-Lifts, adopting the 2:1 roping system, has a complicated structure, and uses the two hydraulic jacks, thus making it impossible to provide cost reduction.

DISCLOSURE OF THE INVENTION

[0007] The present invention is intended to obtain an elevator apparatus of a 1:1 roping system which is capable of correcting the landing positions of cars according to an amount of expansion or contraction of a main rope or according to a difference in floor-to-floor distances by the use of a landing correction device, so as to enable both of the cars to land at the same time.

[0008] An elevator apparatus according to the present invention is constructed such that a sheave of a drive unit and a deflector wheel are arranged at an upper portion of a hoistway, and a first car and a second car are connected with opposite ends of a main rope suspended from the sheave and the deflector wheel, respectively, so that when one of the cars lands on a top floor, the other car lands on a bottom floor. The apparatus is provided with a landing correction device arranged between a cab and a car frame, which together constitute the second car, for moving up and down the cab with respect to the car frame thereby to correct a landing position of the second car.

[0009] In addition, an elevator apparatus according to the present invention is constructed such that a sheave of a drive unit and a deflector wheel are arranged at an upper portion of a hoistway, and a first car and a second car are connected with opposite ends of a main rope suspended from the sheave and the deflector wheel, respectively, so that when one of the cars lands on a top floor, the other car lands on a bottom floor. The apparatus is provided with a landing correction device arranged at a main rope connection portion of the second car for adjusting the length of the main rope thereby to correct a landing position of the second car.

[0010] Furthermore, an elevator apparatus according to the present invention is constructed such that a sheave of a drive unit and a deflector wheel are arranged at an upper portion of a hoistway, and a first car is connected with a sheave-side end of a main rope suspended from the sheave and the deflector wheel, whereas a second car is connected with a deflector wheel-side end of the main rope suspended from the sheave and the deflector wheel, so that when one of the cars lands on a top floor, the other car lands on a bottom floor. The apparatus is provided with a fixed deflector wheel and a movable deflector wheel arranged on a path of the main rope between the sheave and the deflector wheel, and a landing correction device for moving the movable deflector wheel toward and away from the fixed deflector wheel so as to adjust the length of the main rope between the deflector wheel and the second car thereby to correct a landing position of the second car.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

Fig. 1 is a vertical cross sectional view schematically showing the construction of an elevator apparatus according to a first embodiment of the present invention.

Fig. 2 is a system diagram of the elevator apparatus according to the first embodiment of the present invention.

Fig. 3 is a flow chart explaining the operation of the elevator apparatus according to the first embodiment of the present invention.

Fig. 4 is a vertical cross sectional view schematically showing the construction of an elevator apparatus according to a second embodiment of the present invention.

Fig. 5 is a vertical cross sectional view schematically showing the construction of an elevator apparatus according to a third embodiment of the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0012] Hereinafter, preferred embodiments of the present invention will be described in detail while referring to the accompanying drawings.

Embodiment 1

[0013] Fig. 1 is a vertical cross sectional view that schematically shows the construction of an elevator apparatus according to a first embodiment of the present invention. Fig. 2 is a system diagram of the elevator apparatus according to the first embodiment of the present invention. Fig. 3 is a flow chart that explains the operation of the elevator apparatus according to the first embodiment of the present invention.

[0014] In Fig. 1, a drive unit 3 and a deflector wheel 4 are installed in a machine room 2 which is constructed at an upper portion of a hoistway 1, with a main rope 5 being extended or wrapped around a sheave 3a of the drive unit 3 and the deflector wheel 4. In addition, a first car 6 is connected with a sheave-side end of the main rope 5, and a second car 7 is connected with a deflector wheel-side end of the main rope 5. Further, it is constructed such that when one of the first car 6 and the second car 7 lands on the top floor, the other car can land the bottom floor.

[0015] The second car 7 has its chamber or cab 7a mounted on a car frame 7b for vertical movement relative thereto. A pantograph structure 8 is arranged between the floor of the cab 7a or the car frame 7b. Further, a drive motor 9 for driving the pantograph structure 8 in the vertical movement is mounted on the car frame 7b. Thus, by driving the pantograph structure 8 to move in the vertical movement by means of the drive motor 9, the cab 7a is caused to move with respect to the car frame 7b. Here, note that the pantograph structure 8 and the drive motor 9 together constitute a landing correction device.

[0016] A call button 10 is installed in an elevator hall or landing place of each floor, and a first position detection switch 11 and a second position detection switch 12 are arranged on an inner wall surface of each floor in the hoistway 1. Also, a first position switch operation cam 13 and a second position switch operation cam 14 are arranged on the first car 6 and the second car 7, respectively. Upon landing of the first car 6 and the second car 7, the first position switch operation cam 13 and the second position switch operation cam 14 operate or actuate a first position detection switch 11 and a second position detection switch 12, respectively. Here, note that the second position switch operation cam 14 is moved up and down in association with the vertical movement of the cab 7a with respect to the car frame 7b.

[0017] The main control unit 15 is arranged in the machine room 2, and includes a control part 16 and a memory 17, as shown in Fig. 2. By driving the drive unit 3 based on car call signals from the call buttons 10, the main control unit 15 drives the first car 6 and the second car 7 to move in the vertical direction. Based on position signals for the first car 6 and the second car 7 from a first position detection switch 11 and a second position detection switch 12, the drive motor 9 is controlled to be driven to correct the landing position of the second car 7.

[0018] Next, the operation of the elevator apparatus as constructed above will be explained as the operation of the control part 16 while referring to the flow chart shown in Fig. 3. Here, note that data about the distances between respective floors is stored in the memory 17 beforehand.

[0019] The control part 16 writes the stop positions of the first and second cars 6, 7 into the memory 17 based on position signals for the first and second cars 6, 7 from the first and second position detection switches 11, 12. The stop positions of the first and second cars 6, 7 stored in the memory 17 are successively updated based on the position signals for the first and second cars 6, 7 from the first and second position detection switches 11, 12.

[0020] Then, the control part 16 monitors car call signals from the call buttons 10 (step 100), so that when a call button 10 is pushed, the floor where a corresponding car call is generated is specified by the control part 16. A car near the car call generation floor is identified from the data of the stop positions of the first and second cars 6, 7 stored in the memory 17, and the drive unit 3 is driven so as to make the nearby car thus identified land on the car call generation floor (step 101).

[0021] Then, the control part 16 determines, from the first position detection switch 13 on a set landing floor of the first car 6, whether the first car 6 has landed on the set landing floor (step 102). When it is determined that the first car 6 has normally landed on the set landing floor, the control part 16 stops the driving operation of the drive unit 3 (step 103).

[0022] Then, the control part 16 performs arithmetic processing so as to determine, based on the data of floor-to-floor distances stored in the memory 17, whether it is necessary to correct the landing position of the second car 7 (step 104). When it is determined in step 104 that the correction of the landing position of the second car 7 is unnecessary, the control flow moves to step 107, where it is determined, based on the second position detection switch 14 on a set landing floor of the sec-

ond car 7, whether the second car 7 has landed on the set landing floor. When it is determined in step 107 that the second car 7 has normally landed on the set landing floor, the control part 16 opens the doors of the first and second cars 6, 7.

[0023] On the other hand, when it is determined in step 107 that the second car 7 has not landed on the set landing floor, the control flow goes to step 108, where the drive motor 9 is driven to cause the pantograph structure 8 to move up or down, whereby the cab 7a of the second car 7 is moved in the vertical direction. Thereafter, the control part 16 determines, based on the second position detection switch 14 on the set landing floor of the second car 7, whether the second car 7 has landed on the set landing floor (step 109). When it is determined in step 109 that the second car 7 has normally landed on the set landing floor, the control part 16 stops the driving operation of the drive motor 9 (step 110). As a result, the doors of the first and second cars 6, 7 are opened. When it is determined in step 109 that the second car 7 has not landed on the set landing floor, a return to step 108 is performed. These steps 108-110 together constitute a correction step or process for a landing deviation of the second car 7 resulting from a time-varying extension (i.e., extension over time) of the main rope 5 or an expansion or contraction of the main rope 5 due to the load acting thereon.

[0024] On the other hand, when it is determined in step 104 that the correction of the landing position of the second car 7 is necessary, the control flow goes to step 105, where an amount of correction of the landing position of the second car 7 is calculated based on the data of floor-to-floor distances stored in the memory 17. Then, the drive motor 9 is driven to operate so that the amount of movement of the pantograph structure 8 is made equal to the amount of correction thus calculated (step 106), and thereafter the control flow goes to step 109. These steps 104 through 106 together constitute a correction step or process for a landing deviation of the second car 7 resulting from a difference between floor-to-floor distances or an inequality in floor-to-floor distances.

[0025] A similar operation is performed for a car call generated by any of car destination buttons (not shown) installed inside the first and second cars 6, 7, and hence an explanation thereof is omitted here.

[0026] Thus, according to this first embodiment, since the landing correction device constructed from the pantograph structure 8 and the drive motor 9 is arranged on the second car 7, even if a landing deviation is generated in the second car 7 upon normal landing of the first car 6, the landing deviation of the second car 7 is quickly corrected by means of the landing correction device. Accordingly, the doors of the first and second cars 6, 7 can be made to open at the same time. Therefore, even when a time-varying extension of the main rope 5 or an expansion or contraction thereof due to the load applied thereto is generated, or when the floor-to-floor distances are different from one another, or even when there are three or more stops in which floor-to-floor distances are not equal, it is possible to make the first and second cars 6, 7 normally land on floors, and their doors opened at the same time, whereby the service can be improved.

[0027] In addition, since the elevator apparatus according to this first embodiment adopts the 1:1 roping system, the structure thereof becomes simple, thus making it possible to reduce the cost of manufacture. Moreover, since the landing correction device is installed on the second car 7 alone, the number of landing correction devices used or required becomes one, and hence the reduction of cost can be accordingly made.

[0028] Further, the control part 16 of the main control unit 15 controls the drive unit 3 in such a manner that the drive unit is driven to make the first car 6 normally land on its set landing floor, and the control part 16 also controls the pantograph structure 8 and the drive motor 9 so that they are driven to make the second car 7 normally land on its set landing floor. Therefore, even if there takes place a time-varying extension of the main rope 5 or an expansion or contraction thereof due to a load applied thereto, the first and second cars 6, 7 can be made to land on the respective floors substantially at the same time without generating any landing deviation, so that they can be opened at the same time.

[0029] Furthermore, the floor-to-floor distances are stored in the memory 17, and the control part 16 calculates a landing deviation of the second car 7 generated upon normal landing of the first car 6, based on the data of the floor-to-floor distances stored in the memory 17, and controls to drive the pantograph structure 8 and the drive motor 9 so as to correct the calculated amount of landing deviation. With such an arrangement, even in cases where there are three or more stops in which floor-to-floor distances are different from one another, the first and second cars 6, 7 can be landed substantially at the same time without generating any landing deviation, so that they can be opened at the same time.

[0030] Here, note that in the above-mentioned first embodiment, the data of floor-to-floor distances stored in the memory 17 may be corrected based on the amount of correction of the landing deviation obtained in the process of correction of the landing deviation in steps 108 through 110. In this case, when a time-varying expansion of the main rope 5 or an expansion or contraction of the main rope 5 due to the load is generated, the data of floor-to-floor distances stored in the memory 17 is updated, so that the generation of a landing deviation of the second car 7 resulting from the expansion or contraction of the main rope 5 can be suppressed.

[0031] Besides, in the above-mentioned first embodiment, it has been described that the process of correcting a landing deviation resulting from a difference between the floor-to-floor distances in steps 104 through 106 is performed after the first car 6 has normally landed, but such a landing deviation correction process may instead be carried out before or during the vertical op-

eration of the first and second cars 6, 7.

Embodiment 2.

[0032] Fig. 4 is a vertical cross sectional view that schematically shows the construction of an elevator apparatus according to a second embodiment according to the present invention.

[0033] In Fig. 4, a second car 7A has a cab 7a fixed attached to a car frame 7b, and a landing correction device in the form of an electric winch 20 is arranged at a main rope connection portion of the second car 7A.

[0034] Here, note that the construction of this second embodiment other than the above is similar to that of the above-mentioned first embodiment.

[0035] In this second embodiment, too, the elevator apparatus operates based on the flow chart shown in Fig. 3. In a process of correcting a landing deviation resulting from an expansion or contraction of the main rope 7 in steps 108 through 110 and in a process of correcting a landing deviation resulting from a difference between floor-to-floor distances in steps 104 through 106, the control part 16 controls to drive the electric winch 20 so that the winch 20 winds up or draws out the main rope 5 thereby to correct the landing deviation of the second car 7A.

[0036] Thus, in the second embodiment, too, advantageous effects similar to those of the above-mentioned first embodiment can be achieved.

[0037] In addition, in this second embodiment, the electric winch 20 is used as the landing correction device, and the electric winch 20 is arranged at the main rope connection portion of the second car 7A. With such an arrangement, the amount of correction of the second car 7A can be increased to accommodate a wide range of landing corrections, and the cab 7a need not be constructed such that it is movable in the vertical direction with respect to the car frame 7b, as in the above-mentioned first embodiment. As a result, the second car 7A can be of a simple structure. That is, a car of the same structure as that of the first car 6 can be used for the second car 7A.

Embodiment 3.

[0038] Fig. 5 is a vertical cross sectional view that schematically shows the construction of an elevator apparatus according to a third embodiment according to the present invention.

[0039] In Fig. 5, a fixed deflector wheel 21 is arranged in the machine room 2 at a location close to the deflector wheel 4 with its axis of rotation being in alignment or coincidence with the axis of rotation of the deflector wheel 4. Also, a movable deflector wheel 22 is arranged in the machine room 2 with its axis of rotation being in parallel to the axis of rotation of the fixed deflector wheel 21 so as to be movable toward and away from the fixed deflector wheel 21. In addition, a movable deflector wheel driving part in the form of a hydraulic jack 23 is arranged in the machine room 2 so as to move the movable deflector wheel 22 toward or away from the fixed deflector wheel 21. Here, note that the fixed deflector wheel 21, the movable deflector wheel 22 and the hydraulic jack 23 together constitute a landing correction device. Moreover, the main rope 5 is connected with the first car 6, ascends therefrom so as to be wrapped around the sheave 3a, and further wrapped sequentially around the fixed deflector wheel 21, the movable deflector wheel 22 and the deflector wheel 4, and descends therefrom to be connected with the second car 7A. In other words, the fixed deflector wheel 21 and the movable deflector wheel 22 are arranged on the path of the main rope 5 between the sheave 3a and the deflector wheel 4.

[0040] Here, note that the construction of this third embodiment other than the above is similar to that of the above-mentioned second embodiment.

[0041] In this third embodiment, too, the elevator apparatus operates based on the flow chart shown in Fig. 3. In a process of correcting a landing deviation resulting from an expansion or contraction of the main rope 7 in steps 108 through 110 and in a process of correcting a landing deviation resulting from a difference between floor-to-floor distances in steps 104 through 106, the control part 16 controls the hydraulic jack 23 in such a manner that the hydraulic jack 23 is driven to move the movable deflector wheel 22 so as to approach or separate with respect to the deflector wheel 4 and the fixed deflector wheel 21, whereby the landing deviation of the second car 7A can be corrected.

[0042] Accordingly, in the third embodiment, too, advantageous effects similar to those of the above-mentioned second embodiment can be achieved.

[0043] In addition, since in this third embodiment, the landing correction device is installed in the machine room 2, the second car 7A need not have a special structure, and the self weight of the second car 7A becomes lighter, thus making it possible to suppress the generation of the expansion and contraction of the main rope 5 due to the load applied thereto.

[0044] Moreover, since the pair of the fixed deflector wheel 21 and the movable deflector wheel 22 are arranged on the path of the main rope between the sheave 3a and the deflector wheel 4, the roping ratio is increased, so a wide range of landing correction can be made with a small amount of movement of the movable deflector wheel 22.

[0045] In the above-mentioned third embodiment, it has been described that the number of pairs of the fixed deflector wheel 21 and the movable deflector wheel 22 is one, but a plurality of pairs of fixed deflector wheels 21 and movable deflector wheels 22 may instead be arranged on the main rope path between the sheave 3a and the deflector wheel 4. In this case, the roping ratio can be further increased, and hence it becomes possible to accommodate a much wider range of landing cor-

rections.

[0046] Further, although in the above-mentioned third embodiment, it has been described that the hydraulic jack 23 is used as the movable deflector wheel driving part, the movable deflector wheel drive part is not limited to such a hydraulic jack 23 but may instead comprise anything that is capable of moving the movable deflector wheel 22 to approach or separate with respect to the fixed deflector wheel 21. For example, an electric motor and a mechanism for converting the rotating torque of this electric motor into a linear motion force may be used.

[0047] Furthermore, in the above-mentioned first and second embodiments, the car connected with the sheave 3a side of the main rope 5 is made to normally land, and a landing deviation generated in the car connected with the deflector wheel 4 side of the main rope 5 is corrected, but the car connected with the deflector wheel side of the main rope 5 may instead be made to normally land, and a landing deviation generated in the car connected with the sheave side of the main rope 5 can be corrected.

INDUSTRIAL APPLICABILITY

[0048] As described above, an elevator apparatus according to the present invention, in which both cars connected with opposite ends of a main rope can be made to normally landed at the same time, is useful as an elevator apparatus capable of improving its service.

Claims

1. An elevator apparatus in which a sheave of a drive unit and a deflector wheel are arranged at an upper portion of a hoistway, and a first car and a second car are connected with opposite ends of a main rope suspended from said sheave and said deflector wheel, respectively, so that when one of said cars lands on a top floor, the other car lands on a bottom floor,

   said apparatus being **characterized by** comprising a landing correction device arranged between a cab and a car frame, which together constitute said second car, for moving up and down said cab with respect to said car frame thereby to correct a landing position of said second car.

2. An elevator apparatus in which a sheave of a drive unit and a deflector wheel are arranged at an upper portion of a hoistway, and a first car and a second car are connected with opposite ends of a main rope suspended from said sheave and said deflector wheel, respectively, so that when one of said cars lands on a top floor, the other car lands on a bottom floor,

   said apparatus being **characterized by** comprising a landing correction device arranged at a main rope connection portion of said second car for adjusting the length of said main rope thereby to correct a landing position of said second car.

3. An elevator apparatus in which a sheave of a drive unit and a deflector wheel are arranged at an upper portion of a hoistway, and a first car is connected with a sheave-side end of a main rope suspended from said sheave and said deflector wheel, whereas a second car is connected with a deflector wheel-side end of said main rope suspended from said sheave and said deflector wheel, so that when one of said cars lands on a top floor, the other car lands on a bottom floor,

   said apparatus being **characterized in that** a fixed deflector wheel and a movable deflector wheel are arranged on a path of said main rope between said sheave and said deflector wheel, and a landing correction device is provided for moving said movable deflector wheel toward and away from said fixed deflector wheel so as to adjust the length of said main rope between said deflector wheel and said second car thereby to correct a landing position of said second car.

4. The elevator apparatus as set forth in claim 3, **characterized in that** a plurality of pairs of fixed deflector wheel and movable deflector wheel are arranged on said path of said main rope between said sheave and said deflector wheel.

5. The elevator apparatus as set forth in any of claims 1 through 4, **characterized by** comprising a main control unit having a control part, said control part being operable to set landing floors for said first and second cars, respectively, based on generation of a car call registration and control to drive said drive unit so as to make said first car land on a set landing floor, said control part being further operable to control to drive said landing correction device in such a manner that said second car lands on a set landing floor after said first car has landed on a set landing floor.

6. The elevator apparatus as set forth in claim 5, **characterized in that** said main control unit is provided with a memory for storing data of floor-to-floor distances, and said control part calculates, based on said data of floor-to-floor distances stored in said memory, a landing deviation of said second car resulting from floor-to-floor distances generated when said first car has landed on a set landing floor, and controls to drive said landing correction device so as to correct the landing deviation thus calculated.

FIG. 1

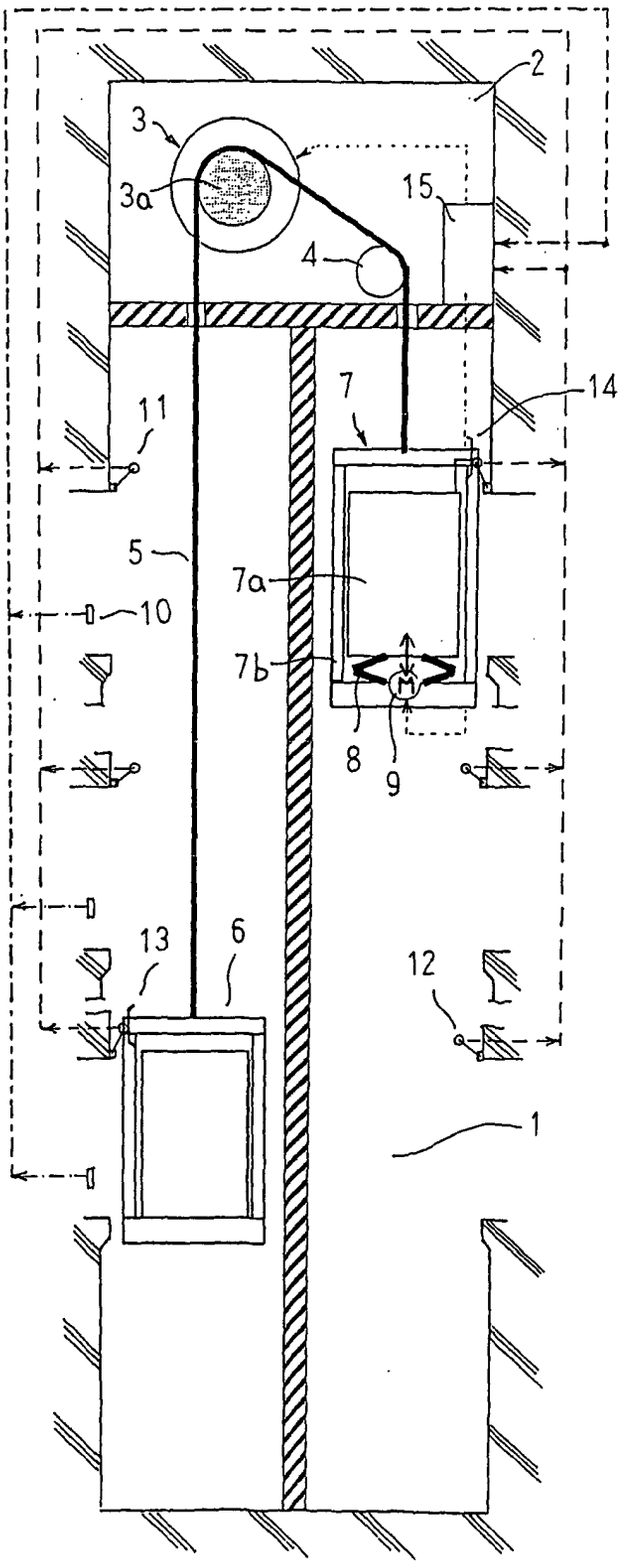


FIG. 2

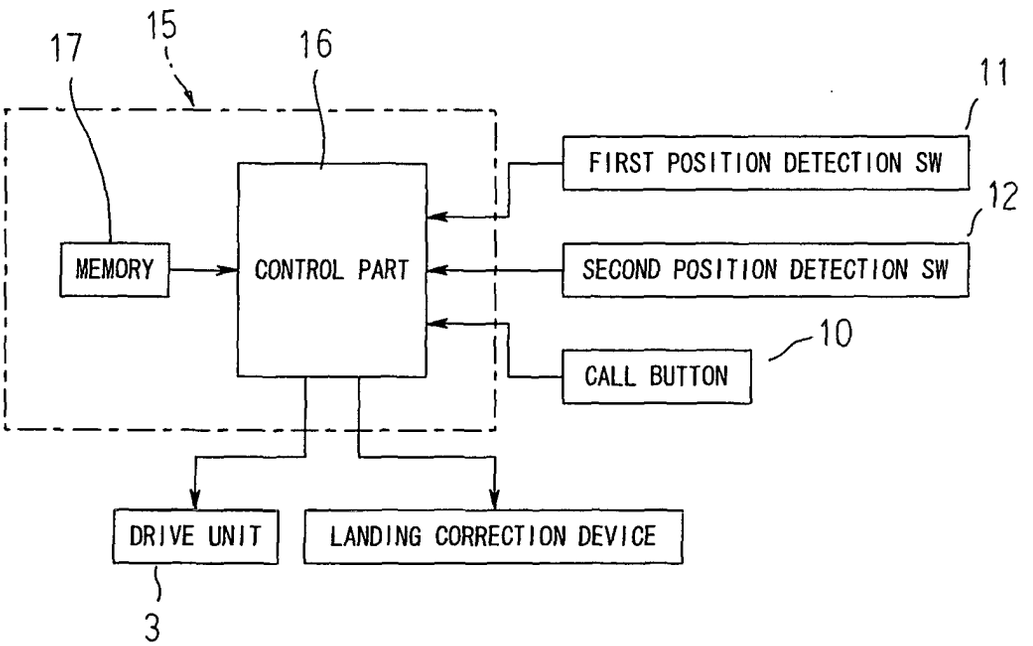

17
15
16
11
FIRST POSITION DETECTION SW
12
MEMORY
CONTROL PART
SECOND POSITION DETECTION SW
10
CALL BUTTON
DRIVE UNIT
LANDING CORRECTION DEVICE
3

FIG. 3

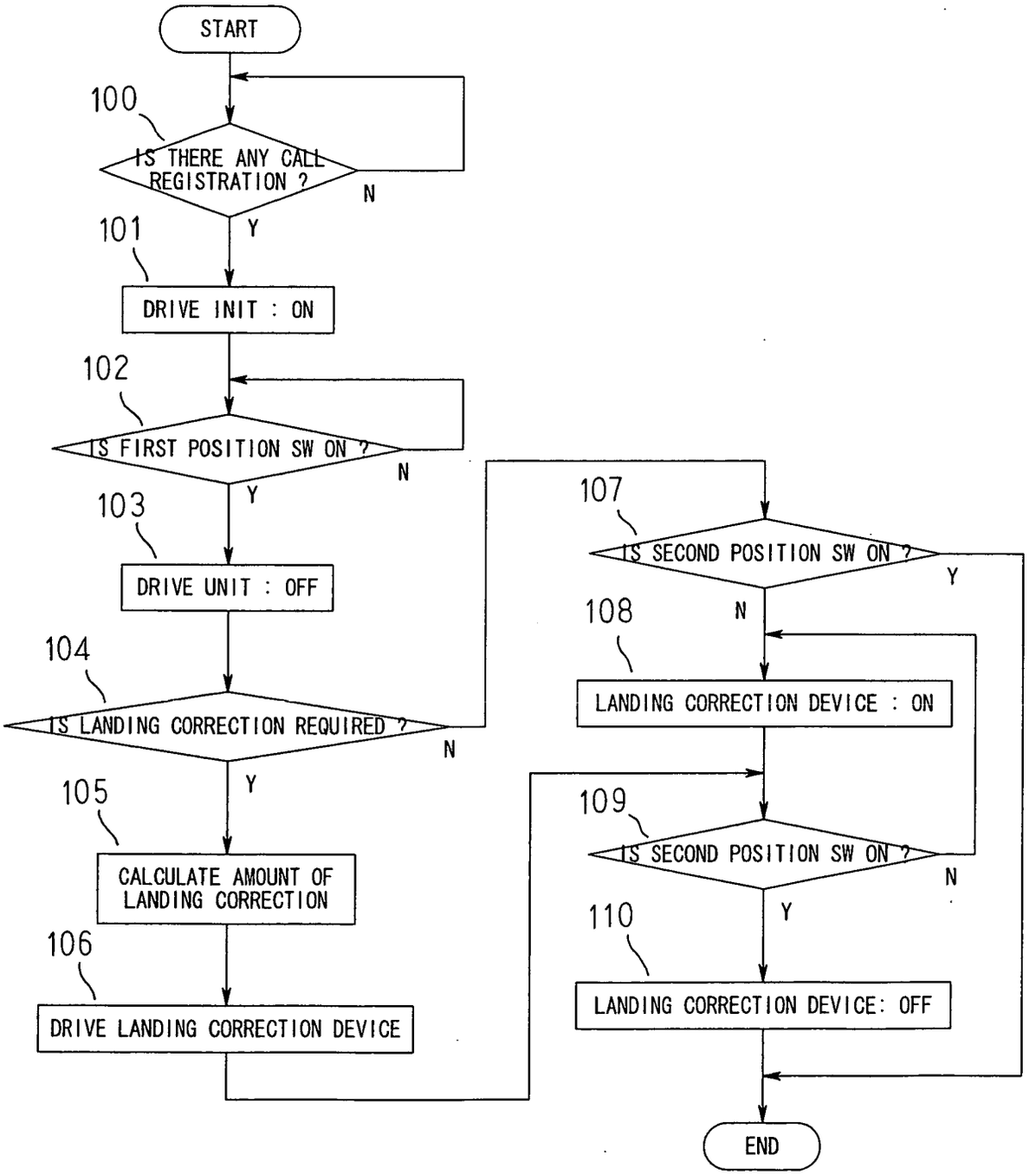

START
100
IS THERE ANY CALL REGISTRATION ?
N
Y
101
DRIVE INIT : ON
102
IS FIRST POSITION SW ON ?
N
Y
103
DRIVE UNIT : OFF
104
IS LANDING CORRECTION REQUIRED ?
N
Y
105
CALCULATE AMOUNT OF LANDING CORRECTION
106
DRIVE LANDING CORRECTION DEVICE
107
IS SECOND POSITION SW ON ?
Y
N
108
LANDING CORRECTION DEVICE : ON
109
IS SECOND POSITION SW ON ?
N
Y
110
LANDING CORRECTION DEVICE: OFF
END

FIG. 4

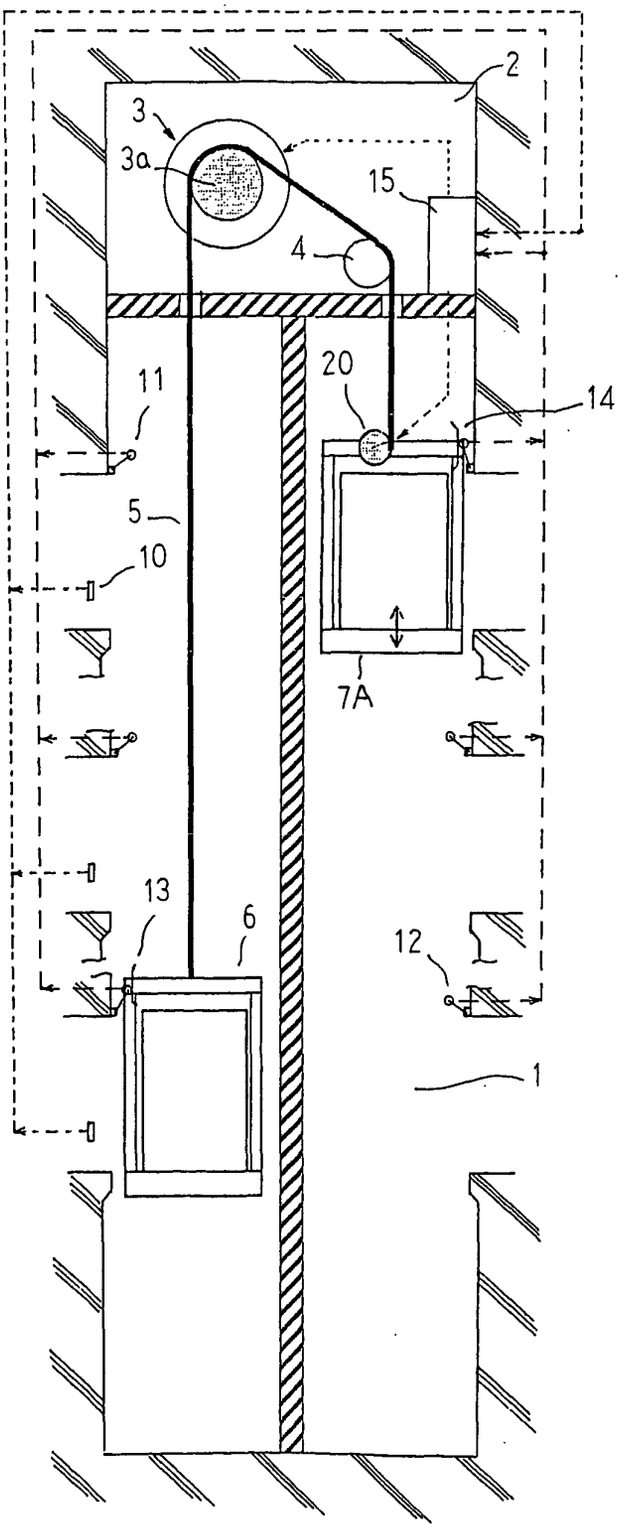
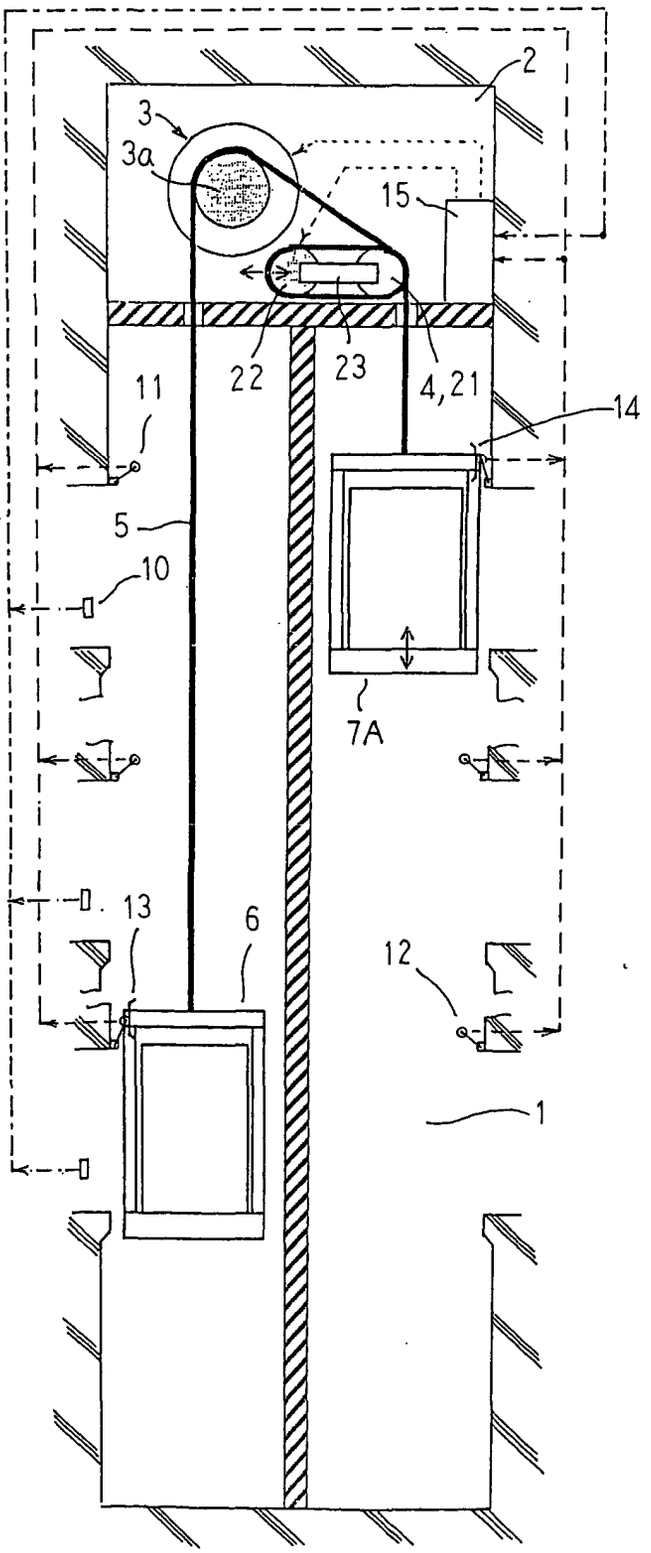


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP02/11999

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] B66B1/42

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] B66B1/00-11/08

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2003
Kokai Jitsuyo Shinan Koho	1971-2003	Toroku Jitsuyo Shinan Koho	1994-2003

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 23880/1974(Laid-open No. 114862/1975) (Tokyo Shibaura Electric Co., Ltd.), 19 September, 1975 (19.09.75), (Family: none)	3 1-2,4-6
Y	JP 2-66085 A (Toshiba Corp.), 06 March, 1990 (06.03.90), (Family: none)	1
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 43358/1976(Laid-open No. 134960/1977) (Tokyo Shibaura Electric Co., Ltd.), 13 October, 1977 (13.10.77), (Family: none)	1

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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31 July, 2003 (31.07.03)	26 August, 2003 (26.08.03)
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 1-60585 A (Toshiba Corp.), 07 March, 1989 (07.03.89), (Family: none)	2
Y	JP 55-80666 A (Hodo Deirukusukoetsuteru), 18 June, 1980 (18.06.80), (Family: none)	2
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