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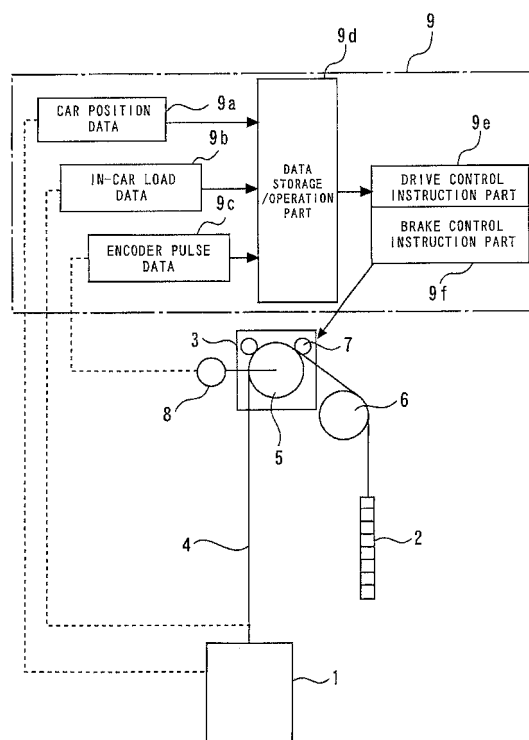
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(54) **ELEVATOR DEVICE**

(57) There is provided an elevator device in which the braking capability of a braking device can be measured while the car is being stopped. For this purpose, the elevator device comprising a driving device for driving the up-and-down movement of a car and a counterweight; a main rope that is wound on a sheave of the driving device and hangs the car and counterweight; the braking device for braking the sheave; and a control device for controlling these devices is characterized in that the elevator device includes an encoder for detecting the number of rotation of the sheave; and a brake that is provided in the braking device and has a brake coil that attracts a shoe when being supplied with electric current, and the control device carries out control to change over the operation mode; stops the car by means of the braking device in the state in which the weight is unbalanced between the car side and the counterweight side when the operation mode of elevator is a braking capability checking operation mode; controls the attraction current supplied to the brake coil to gradually release the brake of the braking device; measures the braking capability of the braking device based on the value of attraction current at the time of the start of car movement that is detected via the encoder; and judges that the braking capability of the braking device is abnormal if the braking capability deviates from a predetermined standard.

fig. 1



Description

Technical Field

[0001] The present invention relates to an elevator device.

Background Art

[0002] As a general traction type elevator device, an elevator device, for example, shown in Figure 6 has conventionally been known.

In Figure 6, reference sign 1 denotes a car disposed in a shaft, not shown, of an elevator so as to be movable up and down, 2 denotes a counterweight that is disposed in the shaft so as to be movable up and down, and moves in the direction reverse to the direction of the car 1, 3 denotes a driving device that is disposed in a top portion or the like of the shaft, and consists of a traction machine for driving the up-and-down movement of the car 1 and the counterweight 2, 4 denotes a main rope one end of which is connected to the upper portion of the car 1, the intermediate portions of which are wound on a sheave 5 of the driving device 3 and a deflector sheave 6, and the other end of which is connected to the upper portion of the counterweight 2, thereby hanging the car 1 and the counterweight 2 in the shaft in a well bucket form.

[0003] The main rope 4 is moved in association with the turning of the sheave 5 by a frictional force generated between the main rope 4 and the sheave 5, and the car 1 and the counterweight 2 are moved up and down in the shaft in a well bucket form by this movement of the main rope 4. The sheave 5 provided in the driving device 3 is driven by a drive motor, not shown, provided similarly in the driving device 3, and the turning thereof is braked by a braking device 7.

Also, the driving device 3 is provided with an encoder 8 that detects the rotating speed of the sheave 5, and outputs this speed as pulse data.

[0004] The above-described conventional and general traction type elevator device is configured as described below. During the time when the car is stopped, the sheave is held by the braking device provided in the driving device, whereby the car is stationarily held at the stop position. When any abnormality is detected during the running of the car, and the car is to be emergency stopped, the braking device of the driving device is operated to brake and stop the sheave, whereby the car is emergency stopped.

If the braking capability of the braking device is low, the braking distance at the emergency stop time becomes long, so that there is a fear that the car cannot be stopped instantly when the abnormality is detected by a safety device. In this case, for example, when a so-called door open running abnormality, in which the car runs in the state in which the elevator door is opened, is detected, the requirement for braking distance to the emergency stop position of car, which is stipulated by the regulations,

cannot be satisfied.

Further, there is a possibility that the car cannot be stationarily held normally during the stopping of the car.

[0005] Inversely, if the braking capability of the braking device is high, the deceleration of car at the emergency stop time becomes quick, so that an influence of inertial force etc. may be exerted on the user in the car. In this case, usually, as the standard of deceleration in emergency braking, it is said that 1G or lower (G: gravitational acceleration) is desirable, and there is a possibility that this standard cannot be met.

By the above-described situation, it is necessary that the braking capability of the braking device be set at a proper value, the braking capability be checked at the time of periodic maintenance and inspection, and it be checked whether or not the braking capability is made abnormal by time change and the like.

[0006] Accordingly, as the conventional elevator device in which the braking device is checked by the arithmetic operation of the braking capability of the braking device performed by using the deceleration at the time when the car is stopped, there has been known an elevator device including the traction machine on which the main rope for hanging the car and the counterweight is wound, a brake for giving a braking force to this traction machine, a speed detector for detecting the speed of the car, a storage part for storing the speed data of car outputted from this speed detector, an operation part for computing the deceleration at the time when the car is stopped and for computing the braking force of the brake by using the deceleration of car or the like, and a judgment circuit for judging, by comparing the operation result determined by the operation of the operation part with a predefined standard, whether or not the braking force of the brake is proper (for example, refer to Patent Literature 1).

Citation List

[0007] Patent Literature

[0007]

Patent Literature 1: Japanese Patent Laid-Open No. 06-263353

Summary of Invention

Technical Problem

[0008] Unfortunately, the conventional elevator device disclosed in Patent Literature 1 has a problem that since the braking force of the brake is computed by using the deceleration at the time when the running car is stopped, the braking force of the brake cannot be measured while the car is being stopped, and the car must be run for the measurement of braking capability only.

Also, this elevator device has a problem that since it is

judged, by comparing the braking capability determined by operation with the predefined standard, whether or not the braking capability is proper, an abnormality of braking capability cannot be detected until the braking capability of the braking device actually deviates from the standard value, so that a sign that the braking capability has become abnormal cannot be detected, and therefore, has a problem that during the time period from when the braking capability has actually become abnormal to when the check is made, there is a fear that a dangerous action is performed on account of the abnormality of the braking capability.

[0009] The present invention has been made to solve the above problems, and accordingly a first object thereof is to provide an elevator device in which the braking capability of a braking device can be measured while the car is being stopped.

Also, a second object of the present invention is to provide an elevator device in which a sign that the braking capability has become abnormal can be detected, and thereby a dangerous action caused by an abnormality of the braking capability can be prevented.

Means for Solving the Problems

[0010] An elevator device according to the present invention, which comprises a car and a counterweight both disposed in a shaft of an elevator so as to be movable up and down; a driving device for driving the up-and-down movement of the car and counterweight; a main rope that is wound on a sheave of the driving device and hangs the car and counterweight in the shaft; a braking device for braking the sheave of the driving device; and a control device for controlling the driving device and the braking device, is characterized in that the elevator device comprises an encoder for detecting the number of rotation of the sheave; and a brake that is provided in the braking device and has a brake coil that attracts a brake shoe to release braking when being energized by electric current, and the control device carries out control to change over the operation mode of the elevator to a braking capability checking operation mode; stops the car by means of the braking device in the state in which the weight is unbalanced between the car side and the counterweight side when the operation mode of elevator is the braking capability checking operation mode; controls the attraction current supplied to the brake coil to gradually release the brake of the braking device; detects the start of movement of the car via the encoder; measures the braking capability of the braking device based on the value of attraction current at the time of the start of car movement; and judges that the braking capability of the braking device is abnormal if the braking capability deviates from a predetermined standard.

[0011] Also, An elevator device according to the present invention, which comprising a car and a counterweight both disposed in a shaft of an elevator so as to be movable up and down; a driving device for driving

the up-and-down movement of the car and counterweight; a main rope that is wound on a sheave of the driving device and hangs the car and counterweight in the shaft; a braking device for braking the sheave of the driving device; and a control device for controlling the driving device and the braking device, is characterized in that the control device carries out control to change over the operation mode of elevator to a braking capability checking operation mode; measures the braking capability of the braking device when the operation mode of elevator is the braking capability checking operation mode; and judges that the braking capability of the braking device is abnormal if the change amount of the measured braking capability from the braking capability at the last measurement time deviates from a predetermined change amount standard.

Advantageous Effect of Invention

[0012] The present invention provides an elevator device having a car and a counterweight both disposed in a shaft of an elevator so as to be movable up and down; a driving device for driving the up-and-down movement of the car and counterweight; a main rope that is wound on a sheave of the driving device and hangs the car and counterweight in the shaft; a braking device for braking the sheave of the driving device; and a control device for controlling the driving device and the braking device, characterized in that the elevator device includes an encoder for detecting the rotating speed of the sheave; and a brake that is provided in the braking device and has a brake coil that attracts a brake shoe to release braking when being energized by electric current, and the control device carries out control to change over the operation mode of the elevator to a braking capability checking operation mode; stops the car by means of the braking device in the state in which the weight is unbalanced between the car side and the counterweight side when the operation mode of elevator is the braking capability checking operation mode; controls the attraction current supplied to the brake coil to gradually release the brake of the braking device; detects the start of movement of the car via the encoder; measures the braking capability of the braking device based on the value of attraction current at the time of the start of car movement; and judges that the braking capability of the braking device is abnormal if the braking capability deviates from a preset standard. Therefore, an effect is achieved that the braking capability of the braking device can be measured while the car is being stopped.

[0013] Also, the present invention provides an elevator device having a car and a counterweight both disposed in a shaft of an elevator so as to be movable up and down; a driving device for driving the up-and-down movement of the car and counterweight; a main rope that is wound on a sheave of the driving device and hangs the car and counterweight in the shaft; a braking device for braking the sheave of the driving device; and a control device for

controlling the driving device and the braking device, characterized in that the control device carries out control to change over the operation mode of elevator to a braking capability checking operation mode; measures the braking capability of the braking device when the operation mode of elevator is the braking capability checking operation mode; and judges that the braking capability of the braking device is abnormal if the change amount of the measured braking capability from the braking capability at the last measurement time deviates from a preset change amount standard. Therefore, an effect is achieved that a sign that the braking capability has become abnormal can be detected, and thereby a dangerous action caused by an abnormality of the braking capability can be prevented.

Brief Description of the Drawings

[0014]

Figure 1 is a schematic view showing the general configuration of an elevator device related to first embodiment of the present invention.

Figure 2 is a flowchart showing the flow of operations of elevator device related to first embodiment of the present invention.

Figure 3 is a diagram for explaining how to judge the abnormality of braking capability by using a converted brake torque of the elevator device related to first embodiment of the present invention.

Figure 4 is a flowchart showing the flow of operations of elevator device related to second embodiment of the present invention.

Figure 5 is a flowchart showing the flow of operations of elevator device related to third embodiment of the present invention.

Figure 6 is a schematic view showing the general configuration of a conventional elevator device.

Description of Embodiments

First embodiment

[0015] Figures 1 to 3 relate to a first embodiment of the present invention. Figure 1 is a schematic view showing the general configuration of an elevator device, Figure 2 is a flowchart showing the flow of operations of elevator device, and Figure 3 is a diagram for explaining how to judge the abnormality of braking capability by using a converted brake torque of the elevator device.

In Figure 1, reference sign 1 denotes a car disposed in a shaft, not shown, of an elevator so as to be movable up and down. In the shaft, a counterweight 2 is also disposed so as to be movable up and down, and moves in the direction reverse to the direction of the car 1.

[0016] In a top portion or the like of the shaft, a driving device 3 is disposed, and the driving device 3 consists of a traction machine for driving the up-and-down move-

ment of the car 1 and the counterweight 2. To the upper portion of the car 1, one end of a main rope 4 is connected. The intermediate portions of this main rope 4 are wound on a sheave 5 of the driving device 3 and a deflector sheave 6, and the other end of the main rope 4 is connected to the upper portion of the counterweight 2. Thereby, the car 1 and the counterweight 2 are hung in the shaft in a well bucket form.

The weight of the counterweight 2 is set so as to balance with the weight on the car 1 side, for example, at the time when a load of 50% of the rated load is carried in the car 1.

[0017] The main rope 4 is moved in association with the turning of the sheave 5 by a frictional force generated between the main rope 4 and the sheave 5, and the car 1 and the counterweight 2 are moved up and down in the shaft in a well bucket form by this movement of the main rope 4. The sheave 5 provided in the driving device 3 is driven by a drive motor, not shown, provided similarly in the driving device 3, and the turning of thereof is braked by a braking device 7.

[0018] The braking device 7 that brakes the turning of the sheave 5 includes a brake drum, not shown, that turns in association with the sheave 5, and a brake disposed so as to face to the brake drum. This brake includes a brake shoe that is pressed against the brake drum by the action of elastic force due to a spring to generate a braking force by means of a frictional force at the time when the brake shoe comes into contact with the brake drum, and a brake coil that attracts the brake shoe to release the braking when being energized by electric current.

Also, the driving device 3 is provided with an encoder 8 that detects the rotating speed of the sheave 5, and outputs this speed as pulse data.

[0019] The driving device 3 and the braking device 7 are controlled by a control device 9 installed in a machine room in the top portion of the shaft, on the wall of the shaft, or in the like location.

The control device 9 receives car position data 9a, in-car load data 9b, and encoder pulse data 9c, and controls the driving device 3 and the braking device 7 based on these data.

[0020] The car position data 9a, which indicates the present position of the car 1 in the shaft, is outputted by a car position detecting device, not shown, provided on the car 1. The car position detecting device detects the present position of the car 1, for example, by detecting a door zone plate, not shown, attached in the shaft.

The in-car load data 9b, which indicates the load in the car 1, is outputted by an in-car load detecting device, not shown, consisting of, for example, a weighing device provided on the car 1. The in-car load detecting device can also be configured by a camera for photographing the situation in the car.

The encoder pulse data 9c is outputted from the above-described encoder 8, and indicates the rotating speed of the sheave 5.

[0021] The above-described elevator has two operation modes of a normal operation mode and a braking

capability checking operation mode. The normal operation mode is a mode in which the elevator is normally operated at the normal time at which no special affair arises, and the braking capability checking operation mode is a mode in which the braking capability of the braking device 7 is measured to check whether or not the braking capability is abnormal.

These operation modes are changed over under the control of the control device 9 by the fulfillment of a predetermined operation mode transfer condition. This predetermined operation mode transfer condition is set so that, for example, the transfer to the braking capability checking operation mode is accomplished in a time zone in which the number of users of the preset elevator is small.

[0022] The above-described car position data 9a, in-car load data 9b, and encoder pulse data 9c are inputted to a data storage/operation part 9d provided in the control device 9.

The data storage/operation part 9d executes predetermined data storage processing and predetermined data operation processing in accordance with the operation mode of that elevator by using the car position data 9a, in-car load data 9b, and encoder pulse data 9c.

[0023] The operation result obtained by the data storage/operation part 9d is outputted to a drive control instruction part 9e and a brake control instruction part 9f provided in the control device 9.

The drive control instruction part 9e gives a control instruction to the driving device 3 based on the operation result obtained by the data storage/operation part 9d, and the driving device 3 operates in accordance with the control instruction sent from the drive control instruction part 9e. The brake control instruction part 9f gives a control instruction to the braking device 7 based on the operation result obtained by the data storage/operation part 9d, and the braking device 7 operates in accordance with the control instruction sent from the brake control instruction part 9f.

[0024] In the shaft in the vicinity of the top floor, which is the upside terminal floor at which the car 1 stops, a limit switch, not shown, is provided to restrain the car 1 from moving upward beyond a predetermined stop position at the top floor.

The configuration is made such that if the car 1 is about to move upward beyond a predetermined stop position at the top floor, the limit switch operates, and the operation of the limit switch leads to the operation of a safety device, whereby the car 1 is emergency stopped.

[0025] In this embodiment, the elevator device, especially the control device 9, operates following the flow shown in Figure 2.

When the elevator is in the normal operation mode (Step S0), if the above-described predetermined operation mode transfer condition, in which, for example, the time zone is a zone in which the number of users of the preset elevator is small, is fulfilled, the control device 9 is about to transfer the operation mode of the elevator to the braking capability checking operation mode (Step S1).

[0026] When the control device 9 is about to transfer the operation mode of the elevator to the braking capability checking operation mode, first, in Step S2, the data storage/operation part 9d of the control device 9 checks the load in the car 1 based on the in-car load data 9b, and in the successive Step S3, based on the load in the car 1 checked in Step S2, the data storage/operation part 9d judges whether or not a passenger (user) is absent in the car 1.

In this judgment, if it is judged that a passenger is not absent in the car 1, that is, that a passenger is present in the car 1, the control returns to Step S0, where the control device 9 continues the normal operation mode of the elevator.

[0027] On the other hand, in the judgment in Step S3, if it is judged that a passenger is absent in the car 1 and the car 1 is in a no-load condition, the control proceeds to Step S4. In Step S4, the control device 9 transfers the operation mode of the elevator to the braking capability checking operation mode, and performs the operations described below.

First, the drive control instruction part 9e of the control device 9 gives a control instruction to the driving device 3 to drive the driving device 3 so as to run the car 1 to the top floor. When the car 1 arrives at the top floor, the brake control instruction part 9f of the control device 9 gives a control instruction to the braking device 7 to operate the braking device 7 so as to stop the car 1 at the top floor.

[0028] As described above, the weight of the counterweight 2 is set so as to balance with the weight on the car 1 side at the time when a load of 50% of the rated load is carried in the car 1. Therefore, since the car 1 is in a no-load condition at this time, the counterweight 2 side is heavier than the car 1 side, so that by the difference in weight between the car 1 side and the counterweight 2, an unbalance torque TA is generated in the direction in which the car 1 is raised and the counterweight 2 is lowered.

The state in which the car 1 is stopped by the braking device 7 is a state in which the braking holding torque created by the braking device 7 is higher than the unbalance torque TA.

[0029] Next, the brake control instruction part 9f controls the value of attraction current supplied to the brake coil of the braking device 7 so as to increase that value gradually from zero, gradually releases the brake of the braking device 7, and gradually decreases the braking holding torque created by the braking device 7.

When the braking holding torque created by the braking device 7 becomes equal to the unbalance torque TA and becomes balanced with it, and the attraction current flowing to the brake coil further increases from this state so that the braking holding torque becomes lower than the unbalance torque TA, the sheave 5 of the driving device 3 begins to turn. The data storage/operation part 9d of the control device 9 monitors the encoder pulse data 9c sent from the encoder 8, and thereby detects the time

when the sheave 5 begins to turn. When the sheave 5 begins to turn, the data storage/operation part 9d measures the value of attraction current supplied to the brake coil of the braking device 7, and records it.

[0030] After a series of processing of measurement and record of the value of attraction current supplied to the brake coil has been finished in Step S4, the control proceeds to Step S5. In Step S5, the data storage/operation part 9d converts the value of attraction current supplied to the brake coil, which has been measured and recorded in Step S4, into the brake braking capability of the braking device 7.

The conversion of the value of attraction current supplied to the brake coil into the brake braking capability of the braking device 7 is accomplished as described below.

[0031] First, in advance, when a certain attraction current value is given to the brake coil, the relation of attraction force acting from the brake coil to the brake shoe is measured, and it is stored in the data storage/operation part 9d. The friction coefficient between the brake drum and the brake shoe and the rotating radius of the brake drum are also stored in advance in the data storage/operation part 9d.

The attraction force of the brake coil at the attraction current value obtained in Step S4 is determined from the corresponding relationship between the attraction current value and the attraction force, which have been stored in advance. By multiplying the attraction force thus obtained by the friction coefficient and rotating radius having been stored in advance, a converted brake torque T is calculated.

[0032] As seen from the calculation process, this converted brake torque T is the torque of attraction force of the brake coil. On the other hand, the braking holding torque is the torque of pressing force of the brake shoe against the brake drum.

Since the attraction force of the brake coil acts in the direction in which the pressing force of the brake shoe is weakened, the torque obtained by subtracting the converted brake torque T from the maximum braking holding torque at the time when the attraction current value is zero is the braking holding torque at the time when the sheave 5 begins to turn. In other words, the braking holding torque at the time when the sheave 5 begins to turn is approximately equal to the unbalance torque TA, so that the torque obtained by adding the converted brake torque T to the unbalance torque TA is the maximum braking holding torque at the time when the attraction current value is zero.

[0033] After Step S5, the control proceeds to Step S6, where, based on the converted brake torque T determined from the attraction current value in Step S5, the data storage/operation part 9d of the control device 9 judges whether or not the braking capability of the braking device 7 is within the preset range of maintenance standard.

The method for judging whether or not the braking capability of the braking device 7 is within the preset range of

maintenance standard is explained specifically with reference to Figure 3.

[0034] First, in the data storage/operation part 9d of the control device 9, the values of the unbalance torque TA at the time when the car 1 is in a no-load condition, a predetermined maintenance standard lower limit torque TL higher than the unbalance torque TA, and a predetermined maintenance standard upper limit torque TU higher than the maintenance standard lower limit torque TL have been stored in advance.

Since, as described above, the braking holding torque at the time when the value of attraction current supplied to the brake coil is increased gradually from zero and the sheave 5 begins to turn is approximately equal to the unbalance torque TA, the data storage/operation part 9d evaluates the maximum braking holding torque, which is the braking capability of the braking device 7, by means of a value obtained by adding the converted brake torque T to the unbalance torque TA.

[0035] That is, if the value obtained by adding the converted brake torque T to the unbalance torque TA is not smaller than the maintenance standard lower limit torque TL and not larger than the maintenance standard upper limit torque TU, the data storage/operation part 9d judges that the braking capability of the braking device 7 is within the preset range of maintenance standard and is normal. Also, if the value obtained by adding the converted brake torque T to the unbalance torque TA is smaller than the maintenance standard lower limit torque TL, or if the value obtained by adding the converted brake torque T to the unbalance torque TA is larger than the maintenance standard upper limit torque TU, the data storage/operation part 9d judges that the braking capability of the braking device 7 is out of the preset range of maintenance standard and is abnormal.

[0036] Thus, in Step S6, based on the converted brake torque T determined in Step S5, the data storage/operation part 9d of the control device 9 judges whether or not the braking capability of the braking device 7 is within the preset range of maintenance standard. In this judgment, if the value obtained by adding the converted brake torque T to the unbalance torque TA is not smaller than the maintenance standard lower limit torque TL and not larger than the maintenance standard upper limit torque TU, the data storage/operation part 9d judges that the braking capability of the braking device 7 is normal, and the control proceeds to Step S7.

In Step S7, the control device 9 finishes the braking capability checking operation mode, and in the successive Step S8, the control device 9 transfers the operation mode of the elevator to the normal operation mode. Thereafter, the operation flow ends.

[0037] On the other hand, in the judgment in Step S6, if the value obtained by adding the converted brake torque T to the unbalance torque TA is smaller than the maintenance standard lower limit torque TL or larger than the maintenance standard upper limit torque TU, the control proceeds to Step S9.

In Step S9, the control device 9 judges that the braking capability of the braking device 7 is abnormal and halts the operation of the elevator. In the successive Step S10, the control device 9 gives, by using a notifying device, not shown, a predetermined place such as the maintenance company of the elevator a notice that the braking capability of the braking device 7 is abnormal, and thereafter, the operation flow ends.

[0038] The elevator device configured as described above has the car and counterweight disposed in the shaft of the elevator so as to be movable up and down; the driving device for driving the up-and-down movement of the car and counterweight; the main rope that is wound on the sheave of the driving device and hangs the car and counterweight in the shaft; the braking device for braking the sheave of the driving device; and the control device for controlling the driving device and the braking device, and is characterized in that the elevator device includes the encoder for detecting the rotating speed of the sheave, and the brake that is provided in the braking device and has the brake coil that attracts the brake shoe to release braking when being energized by electric current, and the control device carries out control to change over the operation mode of elevator to the braking capability checking operation mode; stops the car by means of the braking device in the state in which the weight is unbalanced between the car side and the counterweight side when the operation mode of elevator is the braking capability checking operation mode; controls the attraction current supplied to the brake coil to gradually release the brake of the braking device; detects the start of movement of the car via the encoder; measures the braking capability of the braking device based on the value of attraction current at the time of the start of car movement; and judges that the braking capability of the braking device is abnormal if the braking capability deviates from the preset standard.

[0039] Also, the control device evaluates the braking capability of the braking device by means of the sum of the unbalance torque created by the unbalance in weight between the car side and the counterweight side and the torque of attraction force of the brake coil in the attraction current at the time when the attraction current supplied to the brake coil is controlled to gradually release the brake of the braking device and to start the car movement.

Therefore, the braking capability of the braking device can be measured while the car is being stopped.

[0040] The car load detecting device for detecting the load in the car is further provided, and based on the detection result of the car load detecting device, the control device measures the braking capability of the braking device when the car is in a no-load condition. Also, the limit switch for restraining the car from moving upward beyond the predetermined stop position at the top floor at which the car stops is further provided, the weight of the counterweight is set so as to be larger than the weight on the car side at the time when the car is in a no-load

condition, and the control device measures the braking capability of the braking device in the state in which the car is stopped at the stop position of the top floor.

Therefore, even if the car moves during the measurement of braking capability, the car moves upward and the limit switch operates, so that the movement of the car can be halted instantly.

[0041] Further, if it is judged that the braking capability of the braking device is abnormal, the operation of elevator is halted, and this result is notified to the predetermined place. Therefore, if an abnormality occurs in the braking capability of the braking device, the maintenance work can be promoted quickly.

15 Second embodiment

[0042] Figure 4, which relates to a second embodiment of the present invention, is a flowchart showing the flow of operations of elevator device.

In the above-described first embodiment, based on the converted brake torque determined from the attraction current value, it is judged whether or not the braking capability of the braking device is within the preset range of maintenance standard, whereby it is judged whether or not the braking capability is normal. In contrast, in the second embodiment explained hereunder, the braking capability (converted brake torque) of the braking device that was measured and computed in the braking capability checking operation mode at the last time is stored and accumulated in advance, a difference (change amount) in braking capability between this time and the last time is computed, and it is judged whether or not this difference (change amount) in braking capability is within the preset range of maintenance change amount standard, whereby it is judged whether or not the braking capability is normal.

[0043] That is, in this embodiment, the elevator device, especially the control device 9, operates following the flow shown in Figure 4.

When the elevator is in the normal operation mode (Step S20), if the above-described predetermined operation mode transfer condition, in which, for example, the time zone is a zone in which the number of users of the preset elevator is small, is fulfilled, the control device 9 is about to transfer the operation mode of the elevator to the braking capability checking operation mode (Step S21).

[0044] When the control device 9 is about to transfer the operation mode of the elevator to the braking capability checking operation mode, first, in Step S22, the data storage/operation part 9d of the control device 9 checks the load in the car 1 based on the in-car load data 9b, and in the successive Step S23, based on the load in the car 1 checked in Step S22, the data storage/operation part 9d judges whether or not a passenger (user) is absent in the car 1.

In this judgment, if it is judged that a passenger is not absent in the car 1, that is, that a passenger is present in the car 1, the control returns to Step S20, where the

control device 9 continues the normal operation mode of the elevator.

[0045] On the other hand, in the judgment in Step S23, if it is judged that a passenger is absent in the car 1 and the car 1 is in a no-load condition, the control proceeds to Step S24. In Step S24, the control device 9 transfers the operation mode of the elevator to the braking capability checking operation mode, and performs the operations described below.

First, the drive control instruction part 9e of the control device 9 gives a control instruction to the driving device 3 to drive the driving device 3 so as to run the car 1 to the top floor. When the car 1 arrives at the top floor, the brake control instruction part 9f of the control device 9 gives a control instruction to the braking device 7 to operate the braking device 7 so as to stop the car 1 at the top floor.

[0046] Next, the brake control instruction part 9f controls the value of attraction current supplied to the brake coil of the braking device 7 so as to increase that value gradually from zero, gradually releases the brake of the braking device 7, and gradually decreases the braking holding torque created by the braking device 7.

When the braking holding torque created by the braking device 7 becomes lower than the unbalance torque TA, the sheave 5 of the driving device 3 begins to turn. The data storage/operation part 9d of the control device 9 monitors the encoder pulse data 9c sent from the encoder 8, and thereby detects the time when the sheave 5 begins to turn. When the sheave 5 begins to turn, the data storage/operation part 9d measures the value of attraction current supplied to the brake coil of the braking device 7, and records it.

[0047] After a series of processing of measurement and record of the value of attraction current supplied to the brake coil has been finished in Step S24, the control proceeds to Step S25. In Step S25, the data storage/operation part 9d converts the value of attraction current supplied to the brake coil, which has been measured and recorded in Step S24, into the brake braking capability of the braking device 7.

Specifically, the attraction force of the brake coil at the attraction current value obtained in Step S24 is determined from the corresponding relationship between the attraction current value and the attraction force, which have been stored in advance. By multiplying the attraction force thus obtained by the friction coefficient and rotating radius having been stored in advance, the converted brake torque T is calculated.

[0048] After Step S25, the control proceeds to Step S26, where the data storage/operation part 9d computes the difference between the converted brake torque T determined this time in Step S25 and the converted brake torque T having been measured and computed in the last braking capability checking operation mode stored in the data storage/operation part 9d.

Also, the data storage/operation part 9d records the value of the converted brake torque T computed this time in

Step S25.

[0049] Then, the control proceeds to Step S27, where, based on the difference between the converted brake torques T determined in Step S26, the data storage/operation part 9d judges whether or not the change amount of braking capability of the braking device 7 is within the preset range of maintenance change amount standard. That is, the data storage/operation part 9d of the control device 9 stores, in advance, the value of a predetermined maintenance change amount standard torque TD, which is zero or larger. If the absolute value of difference between the converted brake torques T is not larger than the maintenance change amount standard torque TD, the data storage/operation part 9d judges that the braking capability of the braking device 7 is within the preset range of maintenance change amount standard and is normal.

Also, if the absolute value of difference between the converted brake torques T is larger than the maintenance change amount standard torque TD, the data storage/operation part 9d judges that the braking capability of the braking device 7 is out of the preset range of maintenance change amount standard and changed abnormally.

[0050] Thus, in Step S27, based on the difference between the converted brake torques T determined in Step S26, the data storage/operation part 9d judges whether or not the change amount of braking capability of the braking device 7 is within the preset range of maintenance change amount standard. In this judgment, if the absolute value of difference between the converted brake torques T is not larger than the maintenance change amount standard torque TD, the data storage/operation part 9d judges that the braking capability of the braking device 7 is normal, and the control proceeds to Step S28. In Step S28, the control device 9 finishes the braking capability checking operation mode, and in the successive Step S29, the control device 9 transfers the operation mode of the elevator to the normal operation mode. Thereafter, a series of the operation flow ends.

[0051] On the other hand, in the judgment in Step S27, if the absolute value of difference between the converted brake torques T is larger than the maintenance change amount standard torque TD, the control proceeds to Step S30.

In Step S30, the control device 9 judges that the braking capability of the braking device 7 is abnormal, and halts the operation of the elevator. In the successive Step S31, the control device 9 gives, by using the notifying device, not shown, a predetermined place such as the maintenance company of the elevator a notice that the braking capability of the braking device 7 is abnormal, and thereafter, a series of the operation flow ends.

Other configurations and operations are the same as those in the first embodiment.

[0052] The elevator device configured as described above has the car and counterweight disposed in the shaft of the elevator so as to be movable up and down; the driving device for driving the up-and-down movement

of the car and counterweight; the main rope that is wound on the sheave of the driving device and hangs the car and counterweight in the shaft; the braking device for braking the sheave of the driving device; and the control device for controlling the driving device and the braking device, and is characterized in that the control device carries out control to change over the operation mode of elevator to the braking capability checking operation mode; measures the braking capability of the braking device when the operation mode of elevator is the braking capability checking operation mode; and judges that the braking capability of the braking device is abnormal if the change amount of the measured braking capability from the braking capability at the last measurement time deviates from the preset change amount standard.

Therefore, a sign that the braking capability has become abnormal can be detected, and thereby a dangerous action caused by an abnormality of the braking capability can be prevented.

[0053] Also, the elevator device further includes the encoder for detecting the rotating speed of the sheave, and the brake that is provided in the braking device and has the brake coil that attracts the brake shoe to release braking when being energized by electric current, and the control device stops the car by means of the braking device in the state in which the weight is unbalanced between the car side and the counterweight side; controls the attraction current supplied to the brake coil to gradually release the brake of the braking device; detects the start of movement of the car via the encoder; and evaluates the braking capability of the braking device based on the value of attraction current at the time of the start of car movement.

Therefore, the sign that the braking capability of the braking device has become abnormal can be detected while the car is being stopped.

Third embodiment

[0054] Figure 5, which relates to a third embodiment of the present invention, is a flowchart showing the flow of operations of elevator device.

The above-described first embodiment (or the second embodiment) describes a so-called single brake type in which one brake is provided in the braking device. In contrast, the third embodiment describes a so-called double brake type in which two brakes capable of operating independently of each other are provided in the braking device.

[0055] In the third embodiment, the braking device 7 for braking the turn of the sheave 5 is provided with two brakes that are disposed so as to face to the brake drum and can operate independently of each other, that is, the so-called double brake is configured.

Each of these brakes is provided with the brake coil, and the attraction current supplied to each brake coil can be controlled independently via the control instruction given by the brake control instruction part 9f of the control de-

vice 9.

[0056] In this embodiment, the elevator device, especially the control device 9, operates following a series of the flow shown in Figure 4. Herein, the case where the double brake is used in the first embodiment is explained. When the elevator is in the normal operation mode (Step S40), if the above-described predetermined operation mode transfer condition, in which, for example, the time zone is a zone in which the number of users of the preset elevator is small, is fulfilled, the control device 9 is about to transfer the operation mode of the elevator to the braking capability checking operation mode (Step S41).

[0057] When the control device 9 is about to transfer the operation mode of the elevator to the braking capability checking operation mode, first, in Step S42, the data storage/operation part 9d of the control device 9 checks the load in the car 1 based on the in-car load data 9b, and in the successive Step S43, based on the load in the car 1 checked in Step S42, the data storage/operation part 9d judges whether or not a passenger (user) is absent in the car 1.

In this judgment, if it is judged that a passenger is not absent in the car 1, that is, that a passenger is present in the car 1, the control returns to Step S40, where the control device 9 continues the normal operation mode of the elevator.

[0058] On the other hand, in the judgment in Step S43, if it is judged that a passenger is absent in the car 1 and the car 1 is in a no-load condition, the control proceeds to Step S44. In Step S44, the control device 9 transfers the operation mode of the elevator to the braking capability checking operation mode, and performs the operations described below.

First, the drive control instruction part 9e of the control device 9 gives a control instruction to the driving device 3 to drive the driving device 3 so as to run the car 1 to the top floor. When the car 1 arrives at the top floor, the brake control instruction part 9f of the control device 9 gives a control instruction to the braking device 7 to operate the braking device 7 so as to stop the car 1 at the top floor.

Next, the brake control instruction part 9f completely releases one brake of the two brakes provided in the braking device 7 by energizing the one brake.

[0059] Then, the brake control instruction part 9f controls the value of attraction current supplied to the brake coil of the other brake so as to increase that value gradually from zero, gradually releases the other brake of the braking device 7, and gradually decreases the braking holding torque created by the other brake of the braking device 7.

When the braking holding torque created by the other brake of the braking device 7 becomes lower than the unbalance torque TA, the sheave 5 of the driving device 3 begins to turn. The data storage/operation part 9d of the control device 9 monitors the encoder pulse data 9c sent from the encoder 8, and thereby detects the time when the sheave 5 begins to turn. When the sheave 5

begins to turn, the data storage/operation part 9d measures the value of attraction current supplied to the brake coil of the braking device 7, and records it.

[0060] After a series of processing of measurement and record of the value of attraction current supplied to the brake coil has been finished in Step S44, the control proceeds to Step S45. In Step S45, the data storage/operation part 9d converts the value of attraction current supplied to the brake coil, which has been measured and recorded in Step S44, into the brake braking capability of the braking device 7.

Specifically, the attraction force of the brake coil at the attraction current value obtained in Step S44 is determined from the corresponding relationship between the attraction current value and the attraction force, which have been stored in advance. By multiplying the attraction force thus obtained by the friction coefficient and rotating radius having been stored in advance, the converted brake torque T is calculated.

[0061] After Step S45, the control proceeds to Step S46, where, based on the converted brake torque T determined from the attraction current value in Step S45, the data storage/operation part 9d judges whether or not the braking capability of the braking device 7 is within the preset range of maintenance standard.

The method for judging whether or not the braking capability of the braking device 7 is within the preset range of maintenance standard is the same as that in Step S6 in Figure 2 relating to the first embodiment. That is, if the value obtained by adding the converted brake torque T to the unbalance torque TA is not smaller than the maintenance standard lower limit torque TL and not larger than the maintenance standard upper limit torque TU, the data storage/operation part 9d judges that the braking capability of the braking device 7 is within the preset range of maintenance standard and is normal. Also, if the value obtained by adding the converted brake torque T to the unbalance torque TA is smaller than the maintenance standard lower limit torque TL, or if the value obtained by adding the converted brake torque T to the unbalance torque TA is larger than the maintenance standard upper limit torque TU, the data storage/operation part 9d judges that the braking capability of the braking device 7 is out of the preset range of maintenance standard and is abnormal.

[0062] In this judgment in Step S46, if the value obtained by adding the converted brake torque T to the unbalance torque TA is not smaller than the maintenance standard lower limit torque TL and not larger than the maintenance standard upper limit torque TU, the data storage/operation part 9d judges that the braking capability (of the other brake) of the braking device 7 is normal, and the control proceeds to Step S47.

In Step S47, the control device 9 finishes the braking capability checking operation mode, and in the successive Step S48, the control device 9 transfers the operation mode of the elevator to the normal operation mode. Thereafter, the operation flow ends.

[0063] On the other hand, in the judgment in Step S46, if the value obtained by adding the converted brake torque T to the unbalance torque TA is smaller than the maintenance standard lower limit torque TL or larger than the maintenance standard upper limit torque TU, the control proceeds to Step S49.

In Step S49, the control device 9 judges that the braking capability (of the other brake) of the braking device 7 is abnormal, and halts the operation of the elevator. In the successive Step S50, the control device 9 gives, by using a notifying device, not shown, a predetermined place such as the maintenance company of the elevator a notice that the braking capability (of the other brake) of the braking device 7 is abnormal, and thereafter, the operation flow ends.

[0064] In this embodiment, one of the two brakes provided in the braking device 7 is released, and the braking capability of the other brake is checked. However, the configuration may be made such that after Step S48 or S50, the roles of these brakes are exchanged with each other, and the braking capability of one brake, whose braking capability has not been checked, is checked this time.

In this case, in Step S44, the processing may be carried out so that the brake coil of the brake whose braking capability has been checked before ("the other coil" in the above explanation) of the two brakes provided in the braking device 7 is energized by electric current, whereby a completely released state is formed, and control is carried out so that the value of attraction current supplied to the brake coil of the brake whose braking capability has not yet been checked ("one brake" in the above explanation) is increased gradually, whereby the brake is released gradually and thereby the braking holding torque is decreased gradually.

[0065] Other configurations and operations are the same as those in the first embodiment.

Also, in this embodiment, the case where a double brake is used in the first embodiment has been explained. However, in the case where a double brake is used in the second embodiment as well, the configuration can be made in the same way.

[0066] The elevator device configured as described above is characterized in that in the configurations of first and second embodiments, the braking device has two brakes capable of operating independently of each other; and the control device releases one brake and controls the attraction current supplied to the brake coil of the other brake to gradually release the brake of the braking device, detects the start of movement of the car via the encoder, and evaluates the braking capability of the braking device based on the value of attraction current at the time of the start of car movement.

Therefore, in the braking device having a configuration of so-called double brake, the braking capability of each brake can be checked.

Industrial Applicability

[0067] The present invention can be applied to the elevator device having a car and a counterweight both disposed in a shaft of an elevator so as to be movable up and down, a driving device for driving the up-and-down movement of the car and counterweight, a main rope that is wound on a sheave of the driving device and hangs the car and counterweight in the shaft, a braking device for braking the sheave of the driving device, and a control device for controlling the driving device and the braking device.

Description of Symbols

[0068]

- 1 car
- 2 counterweight
- 3 driving device
- 4 main rope
- 5 sheave
- 6 deflector sheave
- 7 braking device
- 8 encoder
- 9 control device
- 9a car position data
- 9b in-car load data
- 9c encoder pulse data
- 9d data storage/operation part
- 9e drive control instruction part
- 9f brake control instruction part

Claims

1. An elevator device comprising a car and a counterweight both disposed in a shaft of an elevator so as to be movable up and down; a driving device for driving the up-and-down movement of the car and counterweight; a main rope that is wound on a sheave of the driving device and hangs the car and counterweight in the shaft; a braking device for braking the sheave of the driving device; and a control device for controlling the driving device and the braking device, **characterized in that** the elevator device comprises an encoder for detecting the number of rotation of the sheave; and a brake that is provided in the braking device and has a brake coil that attracts a brake shoe to release braking when being energized by electric current, and the control device carries out control to change over the operation mode of the elevator to a braking capability checking operation mode; stops the car by means of the braking device in the state in which the weight is unbalanced between the car side and the

counterweight side when the operation mode of elevator is the braking capability checking operation mode; controls the attraction current supplied to the brake coil to gradually release the brake of the braking device; detects the start of movement of the car via the encoder; measures the braking capability of the braking device based on the value of attraction current at the time of the start of car movement; and judges that the braking capability of the braking device is abnormal if the braking capability deviates from a predetermined standard.

2. The elevator device according to claim 1, **characterized in that** the control device evaluates the braking capability of the braking device by means of the sum of the unbalance torque created by the unbalance in weight between the car side and the counterweight side and the torque of attraction force of the brake coil in the attraction current at the time when the attraction current supplied to the brake coil is controlled to gradually release the brake of the braking device and to start the car movement.
3. An elevator device comprising a car and a counterweight both disposed in a shaft of an elevator so as to be movable up and down; a driving device for driving the up-and-down movement of the car and counterweight; a main rope that is wound on a sheave of the driving device and hangs the car and counterweight in the shaft; a braking device for braking the sheave of the driving device; and a control device for controlling the driving device and the braking device, **characterized in that** the control device carries out control to change over the operation mode of elevator to a braking capability checking operation mode; measures the braking capability of the braking device when the operation mode of elevator is the braking capability checking operation mode; and judges that the braking capability of the braking device is abnormal if the change amount of the measured braking capability from the braking capability at the last measurement time deviates from a predetermined change amount standard.
4. The elevator device according to claim 3, **characterized in that** the elevator device further comprises an encoder for detecting the number of rotation of the sheave; and a brake that is provided in the braking device and has a brake coil that attracts a brake shoe to release braking when being energized by electric current, and the control device stops the car by means of the braking device in the state in which the weight is unbalanced between the car side and the counterweight side; controls the attraction current supplied to the

brake coil to gradually release the brake of the braking device; detects the start of movement of the car via the encoder; and evaluates the braking capability of the braking device based on the value of attraction current at the time of the start of car movement.

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5. The elevator device according to claim 1, 2 or 4, **characterized in that** the braking device has two brakes capable of operating independently of each other; and

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the control device releases one brake and controls the attraction current supplied to the brake coil of the other brake to gradually release the brake of the braking device, detects the start of movement of the car via the encoder, and evaluates the braking capability of the braking device based on the value of attraction current at the time of the start of car movement.

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6. The elevator device according to any one of claims 1 to 5, **characterized in that** the elevator device further comprises a car load detecting device for detecting the load in the car, and based on the detection result of the car load detecting device, the control device measures the braking capability of the braking device when the car is in a no-load condition.

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7. The elevator device according to claim 6, **characterized in that** the elevator device further comprises a limit switch for restraining the car from moving upward beyond a predetermined stop position of the top floor at which the car stops; the weight of the counterweight is set so as to be larger than the weight on the car side at the time when the car is in a no-load condition; and the control device measures the braking capability of the braking device in the state in which the car is stopped at the stop position of the top floor.

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8. The elevator device according to any one of claims 1 to 7, **characterized in that** if it is judged that the braking capability of the braking device is abnormal, the operation of the elevator is halted, and this result is notified to a predetermined place.

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fig. 1

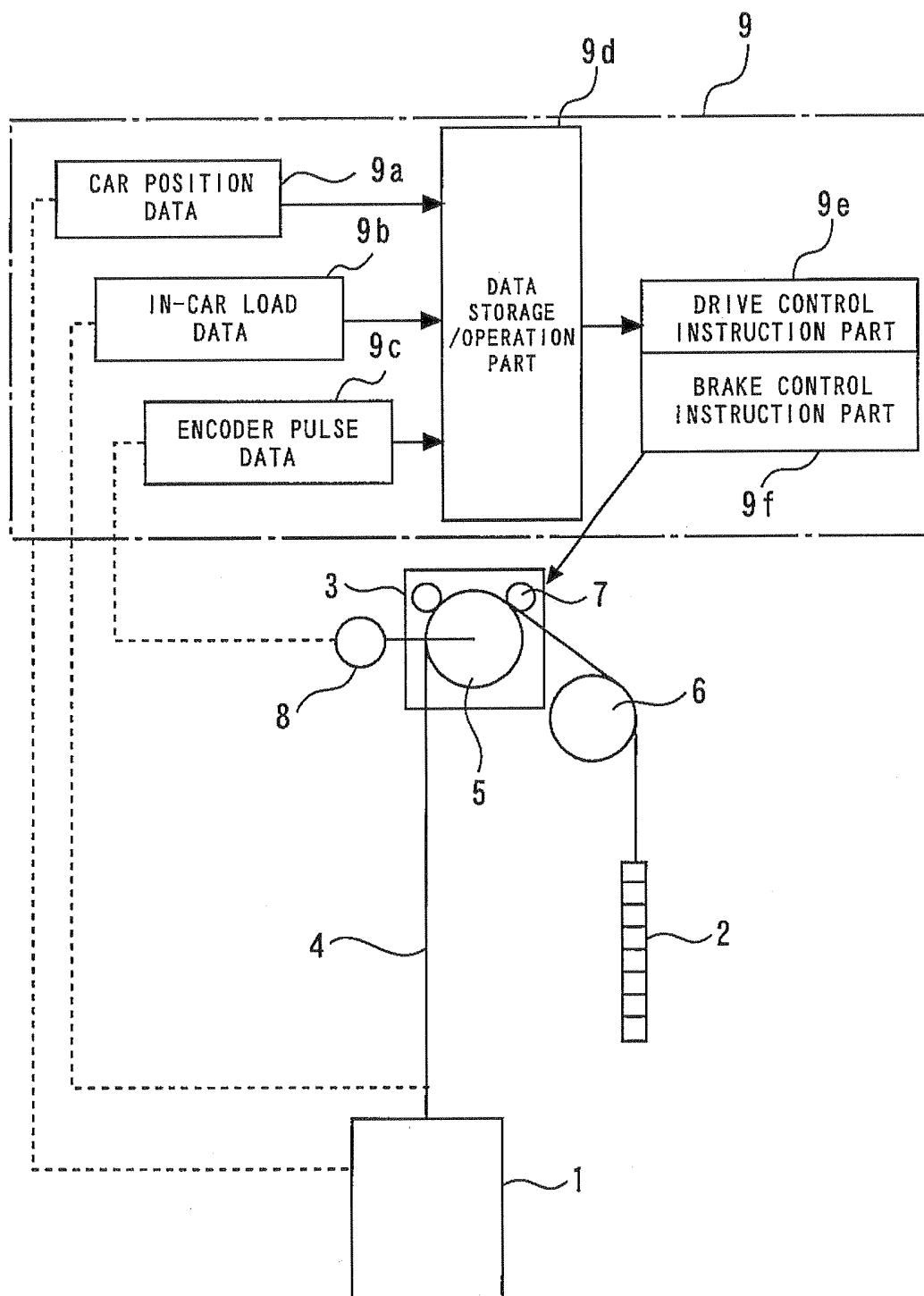


fig. 2

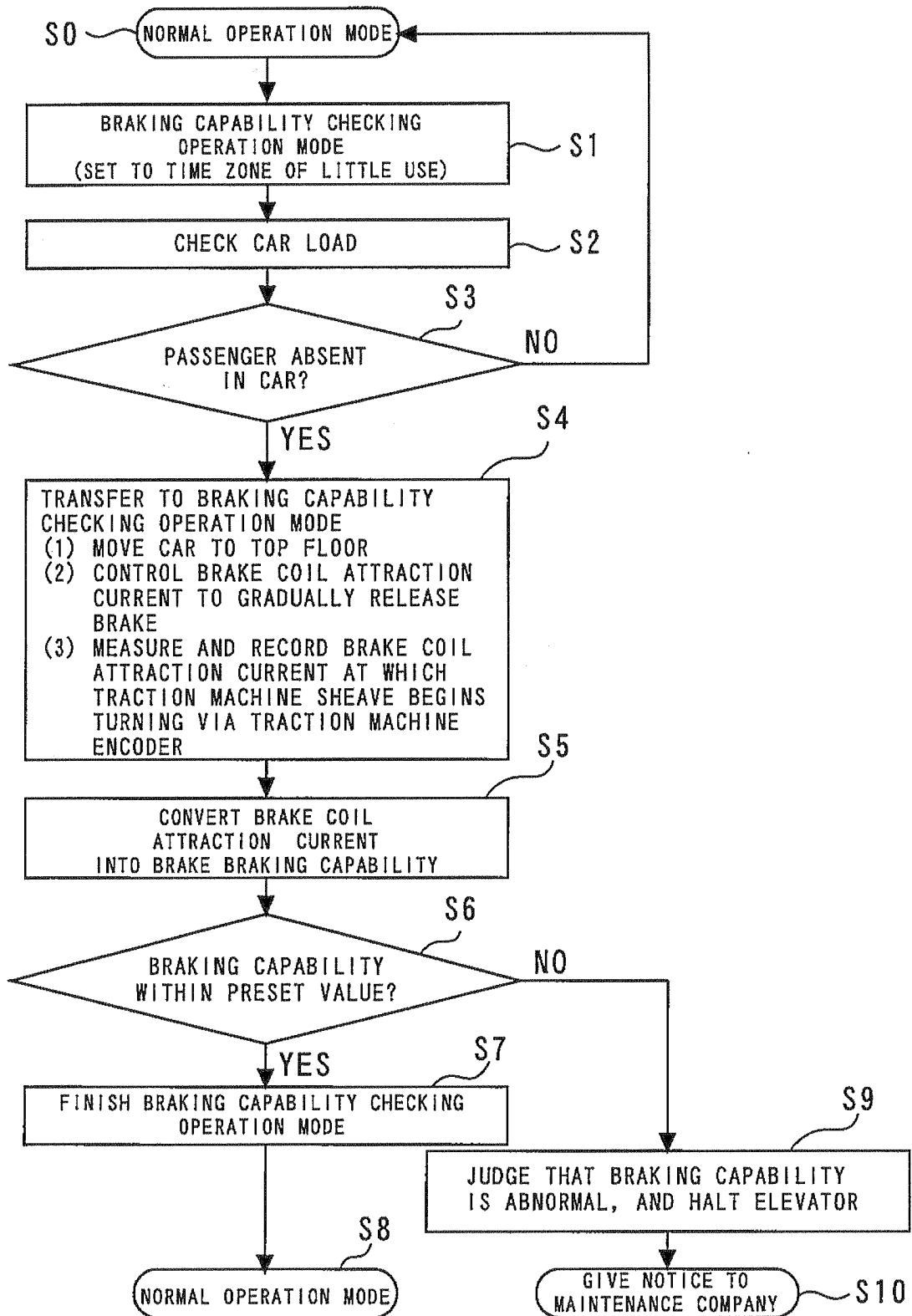


fig. 3

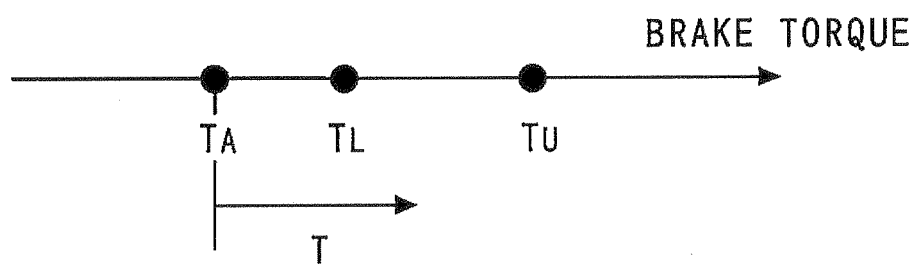


fig. 4

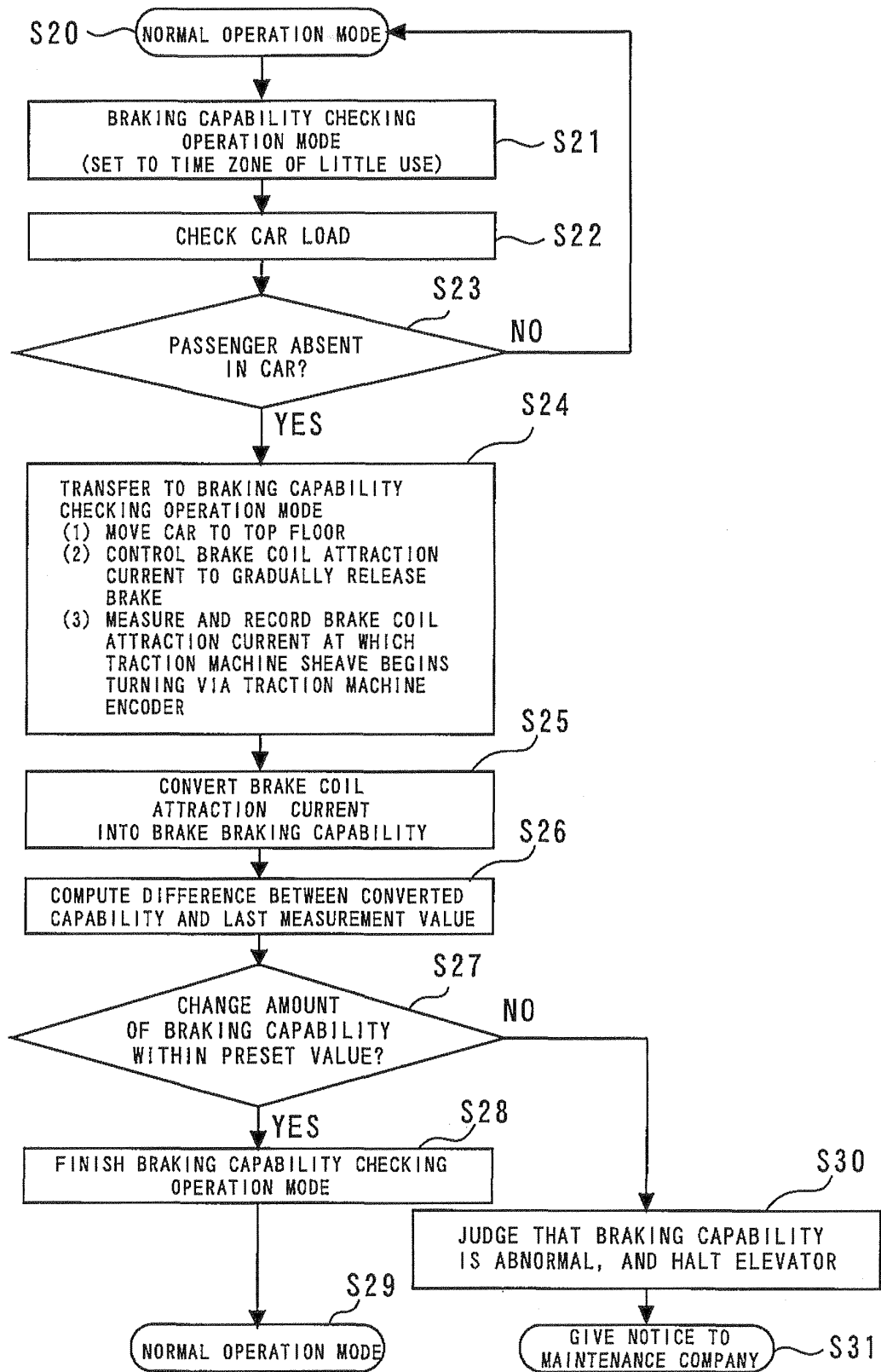


fig. 5

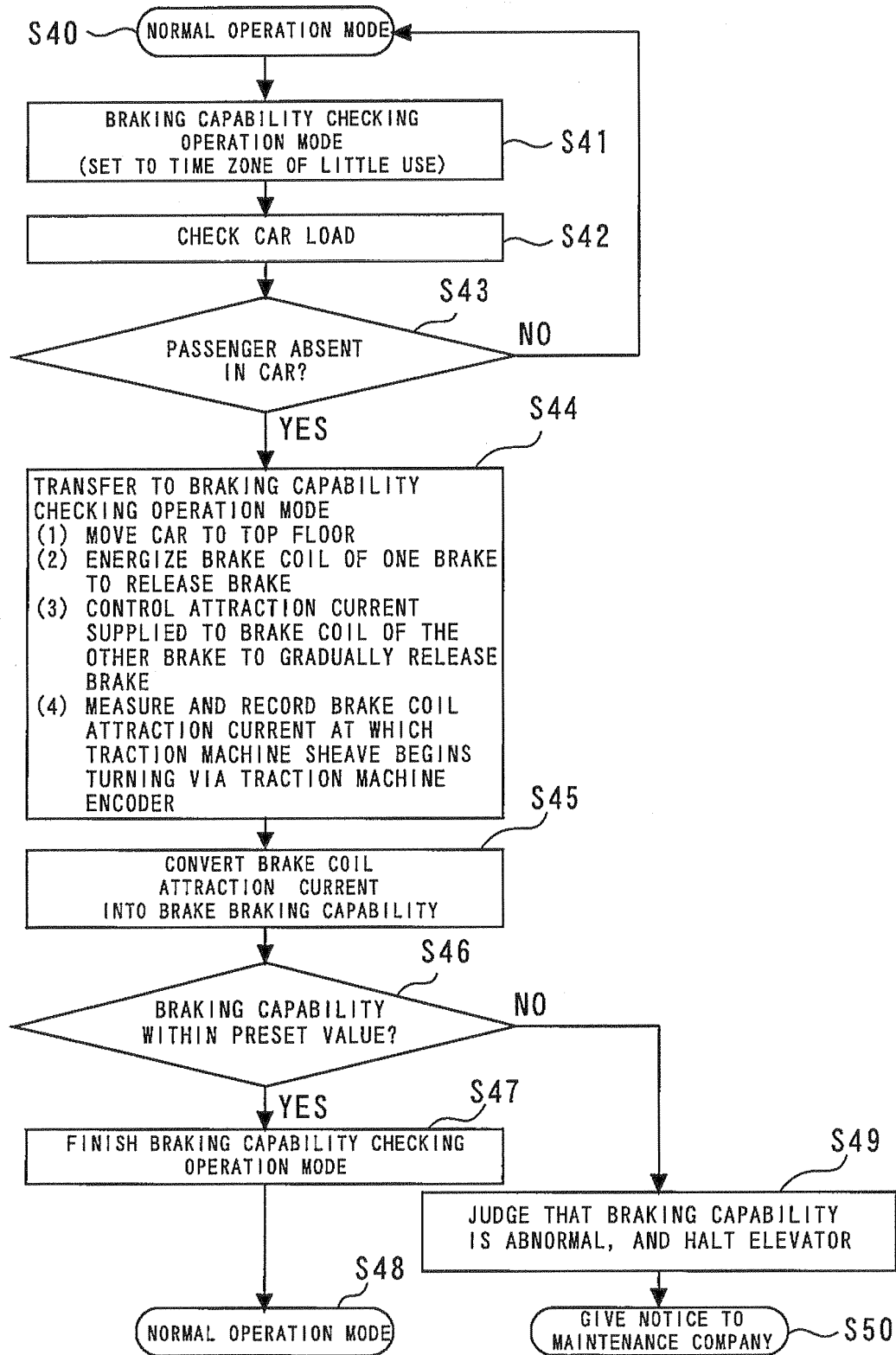
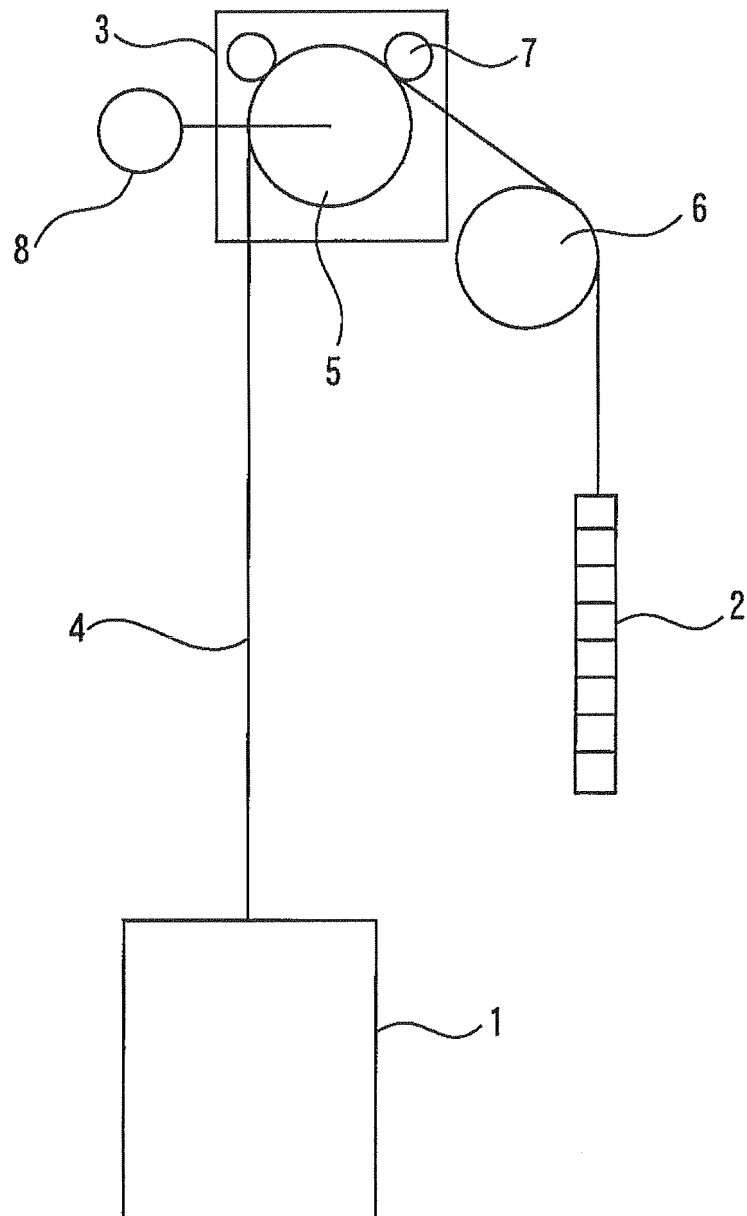


fig. 6



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/052519

A. CLASSIFICATION OF SUBJECT MATTER

B66B5/00(2006.01) i, B66B1/32(2006.01) i, B66B5/02(2006.01) i

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)

B66B5/00, B66B1/32, B66B5/02

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 1996-2010

Kokai Jitsuyo Shinan Koho 1971-2010 Toroku Jitsuyo Shinan Koho 1994-2010

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.
Y A	JP 2008-207898 A (Mitsubishi Electric Corp.), 11 September 2008 (11.09.2008), paragraphs [0011] to [0019] (Family: none)	1, 4-8 2
Y	JP 2009-137707 A (Mitsubishi Electric Corp.), 25 June 2009 (25.06.2009), paragraphs [0012] to [0034] (Family: none)	1, 4-8
X Y	JP 2003-182945 A (Hitachi Building Systems Co., Ltd.), 03 July 2003 (03.07.2003), paragraph [0023] (Family: none)	3 4

☒ 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

"E" earlier application or patent but published on or after the international filing date

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

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

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

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

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
27 April, 2010 (27.04.10)Date of mailing of the international search report
11 May, 2010 (11.05.10)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/052519

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 2009-526723 A (Otis Elevator Co.), 23 July 2009 (23.07.2009), paragraph [0014] & EP 1986945 A & WO 2007/094777 A2 & CN 101589300 A	7

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/052519

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

The inventions in claims 1-2, and 5-8 relate to the matter that an elevator car is kept in a stopped state by a brake device in a state in which there is a weight imbalance between the car side and the counterbalance weight side, the braking by the brake device is released gradually by controlling an attraction current to a brake coil, the start of the movement of the car is detected through an encoder, and the braking ability of the brake device is measured on the basis of the value of an attraction current at the time point when the car starts to move.

(continued to extra sheet)

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2010/052519

Continuation of Box No.III of continuation of first sheet (2)

The inventions in claims 3-4 relate to the matter that it is determined that the braking ability of a brake device is abnormal when the amount of variation of the measured braking ability from the braking ability in the preceding measurement does not meet a predetermined standard amount of variation.

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 6263353 A [0007]