

CONTROL DEVICE OF ELEVATOR CAGE

Background of the invention

(1) Field of the invention

The present invention relates to a control device of an elevator cage using a blocking member provided in the vicinity of an entrance of each floor and a photoelectric position detector detecting the blocking member to detect the position of an elevator cage.

(2) Description of related art

Depending on the presence or absence of releveling control, as a blocking member provided at the entrance of each floor was used one sheet form blocking member having notches which includes a door-zone part cut to correspond to door-zone dimensions so as to detect a door zone, and a releveling part having a notch on a vertical one side to have a dimension for releveling control to eliminate a difference in level between the elevator-cage side and the hall side and having a door-zone dimension on the other side, or a blocking member which includes the door-zone part only.

Therefore, in order to enable leveling control of elevator cages both using a blocking member including a notch and using a blocking member including a door-zone part only and without a notch, the leveling control has been performed by detecting an edge of the door-zone part of the blocking member during moving up or down of the elevator cage using a photoelectric position detector. See JP-A-2004-67252.

The aforementioned conventional technique, in which the leveling control is performed by detecting an end of the door-zone part of the blocking member with a notch or of the blocking member without a notch during moving up or down of the elevator cage using a photoelectric position detector, however, has a variation in accuracy of the leveling control due to a distance advanced between the detection of the door-zone end and the actual stop processing, and so fails in high-accuracy leveling control.

Further, since elevators are required by law to install UCMP (Unintended Car Movement Protection), elevators have to be provided with a hardware configuration to automatically stop the travelling of the elevator cage when the elevator cage moves up or down due to a trouble of a driving device of the elevator, for example, before all entrance doors on the elevator cage side and on the landing side are closed.

Brief summary of the invention

In order to cope with these drawbacks of conventional techniques, it is an object of the present invention to provide a control device of an elevator cage capable of implementing UCMP (Unintended Car Movement Protection) as well as providing high-accuracy leveling control.

5 In order to fulfill the aforementioned object, the present invention is intended for a control device of an elevator cage including: an elevator cage; a motor that moves the elevator cage up and down; a blocking member provided at an entrance of each floor in a hoistway of the elevator cage; and a photoelectric position detector attached to the elevator cage that detects the blocking member optically to detect a position of the elevator cage.

10 Then, as first means of the present invention, the blocking member is composed of one sheet form member, and

a door-zone detection area, a door-zone upper end-releveling zone lower end detection area and a door-zone lower end-releveling zone upper end detection area are arranged in a line in a direction orthogonal to the hoisting direction of the elevator cage,

15 the door-zone detection area extending in a hoisting direction of the elevator cage, having a door-zone lower end and a door-zone upper end and being set to a door-zone dimension for detecting a door zone of the elevator;

the door-zone upper end - releveling zone lower end detection area extending along the hoisting direction of the elevator cage from a lower end of a releveling zone to a same position as that of the door-zone upper end of the door-zone detection area, the releveling zone being set to eliminate a difference in level between the elevator cage and the stop floor; and

20 the door-zone lower end-releveling zone upper end detection area extending along the hoisting direction of the elevator cage from a same position as that of the door-zone lower end of the door-zone detection area to an upper end of the releveling zone.

25 Further, the photoelectric position detector includes:

a first detection section to detect the door-zone lower end and the door-zone upper end of the door-zone detection area;

a second detection section to detect the releveling zone lower end and the door-zone upper end of the door-zone upper end-releveling zone lower end detection area; and

30 a third detection section to detect the door-zone lower end and the releveling zone upper end of the door-zone lower end-releveling zone upper end detection area.

The lower end of the door zone is detected by the first detection section and the third detection section,

the upper end of the door zone is detected by the first detection section and the

second detection section,

the lower end of the releveled zone is detected by the second detection section,

and

the upper end of the releveled zone is detected by the third detection section.

5 As second means of the present invention in the first means, the control device of the elevator cage further includes:

a cage-side door switch provided in the elevator cage to detect opening and closing of a cage-side door;

10 a landing-side door switch provided in each leveling floor to detect opening and closing of a landing-side door; and

an unintended car movement protection controller to stop the elevator cage when the elevator cage moves up or down before the cage-side door and the landing-side door are closed on a basis of a detection signal from the first through the third detection sections of the photoelectric position detector, an opening/closing signal from the cage-side door switch and an
15 opening/closing signal from the landing-side door switch.

With the aforementioned configuration of the first means, the one-sheet form blocking member includes a door zone part and a releveled zone part at an intermediate position of the door zone part. An end of the releveled part is detected by the photoelectric position detector, whereby a distance advanced between the detection of the end and an output of a stop
20 processing command to the elevator cage can be shortened, and therefore high-accuracy leveling control and releveled control are enabled.

With the aforementioned configuration of the second means, the elevator cage can be stopped when the elevator cage moves up or down before the cage-side door and the landing-side door are closed on a basis of a detection signal from the first through the third detection
25 sections of the photoelectric position detector, an opening/closing signal from the cage-side door switch and an opening/closing signal from the landing-side door switch.

Brief description of the several views of the drawing

Fig. 1 schematically illustrates an overall configuration of an elevator according to one embodiment of the present invention.

30 Fig. 2 is an enlarged plan view of a photoelectric position detector used in the embodiment of the present invention.

Fig. 3 is an enlarged front view of a blocking member used in the embodiment of the present invention.

Fig. 4 illustrates a correspondence relationship between the photoelectric position detector and the blocking member when the elevator cage stops at a leveling position in the embodiment of the present invention.

Fig. 5 is a circuit diagram of UCMP (Unintended Car Movement Protection)
5 according to the embodiment of the present invention.

Detailed description of the invention

The following describes embodiments of the present invention, with reference to the drawings. Fig. 1 schematically illustrates an overall configuration of an elevator according to one embodiment of the present invention. Fig. 2 is an enlarged plan view of a photoelectric
10 position detector used in the embodiment. Fig. 3 is an enlarged front view of a blocking member used in the embodiment. Fig. 4 illustrates a correspondence relationship between the photoelectric position detector and the blocking member when an elevator cage stops at a leveling position. Fig. 5 is a circuit diagram of UCMP (Unintended Car Movement Protection).

As illustrated in Fig. 1, a three-phase AC power source is supplied from a utility
15 power supply 1, which is then converted into a DC power source from the three-phase AC by a converter 2. The DC power source is then subjected to switching by an inverter 3 via a contact point 7A of an electromagnetic contactor S for control of the voltage and the frequency to drive a motor 4 rotationally. As the motor 4 rotates, an elevator cage 15 and a balance weight 5 connected with each other through a rope moves up or down.

20 Receiving a brake power source from an AVR 9 receiving a single-phase AC power source from the utility power supply 1, a brake 6 of the motor 4 is configured to control suction and excitation of a coil via a contact point 8A of an electromagnetic contactor BD and the contact point 7A of the electromagnetic contactor S.

On the upper part of the elevator cage 15 is provided a photoelectric position
25 detector 10. Fig. 2 is an enlarged plan view of the photoelectric position detector 10 used in the present embodiment. As illustrated in this drawing, the photoelectric position detector 10 has a U-shaped planar figure and a light emission section 22 and a light reception section 23 thereof are disposed to face each other with a predetermined gap therebetween.

The light emission section 22 is provided with a first light-emitting device 24, a
30 second light-emitting device 25 and a third light-emitting device 26 arranged in a line at predetermined intervals along the direction orthogonal to the hoisting direction X (see Figs. 1 and 3) of the elevator cage 15. The light reception section 23 is provided with a first light-reception device 27, a second light-reception device 28 and a third light-reception device 29

arranged in a line so as to face the first light-emitting device 24, the second light-emitting device 25 and the third light-emitting device 26, respectively.

Detection light 30 emitted from the first light-emitting device 24, the second light-emitting device 25 and the third light-emitting device 26 is received by the first light-reception device 27, the second light-reception device 28 and the third light-reception device 29, respectively. That is, this photoelectric position detector 10 is configured as a photoelectric position detector with three-optical axes.

As illustrated in Fig. 3 at a lower part, the first light-emitting device 24 and the first light-reception device 27 make up a first DZ1 detection section 101A, the second light-emitting device 25 and the second light-reception device 28 make up a second DZ2A detection section 102A, and the third light-emitting device 26 and the third light-reception device 29 make up a third DZ2B detection section 103A.

As illustrated in Fig. 2, the photoelectric position detector 10 has a hollow part 31 penetrating along the hoisting direction X of the elevator cage 15 between the light emission section 22 and the light reception section 23, into which a sheet-form blocking member 11 is inserted.

As illustrated in Fig. 1, this blocking member 11 is provided at each stop floor, i.e., at the entrance of each floor so as to protrude inwardly in hoistway 32 along which the elevator cage 15 moves up or down.

Fig. 3 is an enlarged front view of the blocking member 11 used in the present embodiment, illustrating a positional relationship of the blocking member to the aforementioned detection sections 101A to 103A of the photoelectric position detector 10 as well.

The blocking member 11 is composed of one sheet-form member having a light-blocking property, for example, made of metal, and is divided into a door-zone detection area 34, a door-zone upper end-releveling zone lower end detection area 35 and a door-zone lower end-releveling zone upper end detection area 36 from the left side of the drawing along the direction orthogonal to the hoisting direction X of the elevator cage 15.

Although different hatched lines are drawn in these detection areas 34, 35 and 36 of Fig. 3 to identify the ranges of these detection areas 34, 35 and 36, the blocking member 11 actually is a continuous one sheet-form member.

These detection areas 34 to 36 extend in the hoisting direction X of the elevator cage 15. The length (width) from a lower end 34a to an upper end 34b of the door-zone detection area 34 corresponds to the length (width) of a door zone 112 set beforehand.

A lower end 35a of the door-zone upper end-releveling zone lower end detection

area 35 corresponds to a lower end of a releveling zone 111 set beforehand, and an upper end 35b thereof is set to the same position as the upper end 34b of the door zone 112.

A lower end 36a of the door-zone lower end-releveling zone upper end detection area 36 is set to the same position as the lower end 34a of the door zone 112 and an upper end 5 36b thereof corresponds to an upper end of the releveling zone 111.

Accordingly, the length (width) from the lower end 35a of the door-zone upper end-releveling zone lower end detection area 35 to the upper end 36b of the door-zone lower end-releveling zone upper end detection area 36 corresponds to the length (width) of the releveling zone 111. As illustrated in Fig. 3, this releveling zone 111 is provided at an 10 intermediate position of the door zone 112.

Then, the photoelectric position detector 10 and the blocking member 11 have a correspondence relationship such that the first DZ1 detection section 101A of the photoelectric position detector 10 detects the door-zone detection area 34, the second DZ2A detection section 102A detects the door-zone upper end-releveling zone lower end detection area 35 and the third 15 DZ2B detection section 103A detects the door-zone lower end-releveling zone upper end detection area 36.

As illustrated in Fig. 1, when the elevator cage 15 moves up or down, the photoelectric position detector 10 provided on the elevator cage 15 optically detects the blocking member 11 provided at each stop floor 16, whereby leveling control and releveling control of the 20 elevator cage 15 are performed.

Further, a CD (cage-side door) 14 on the elevator cage side and a HD (landing-side door) 13 provided at each stop floor 16 are detected, whereby UCMP (Unintended Car Movement Protection) control is performed.

When the elevator cage 15 moves up and stops at the next floor, the photoelectric 25 position detector 10 optically detects the blocking member 11 provided at the stop floor.

The photoelectric position detector 10 is configured to detect the blocking member 11, which is inserted relatively inside the hollow part 31 in the photoelectric position detector 10 as the elevator cage 15 moves up or down.

As illustrated in Fig. 1, the photoelectric position detector 10 and the blocking 30 member 11 make up a specific-distance sensor 12.

The following describes a detection operation of the blocking member 11 by the photoelectric position detector 10 more specifically.

While the elevator cage 15 moves up and when the photoelectric position detector 10 does not reach the blocking member 11 yet, for example, as illustrated in Fig. 1 and Fig. 3,

detection light 30 emitted from the first light-emitting device 24, the second light-emitting device 25 and the third light-emitting device 26 is not blocked. Therefore the light-reception devices 27 to 29 (the first DZ1 detection section 101A, the second DZ2A detection section 102A and the third DZ2B detection section 103A) are in an ON, ON, ON state.

5 When the elevator cage 15 further moves up and the photoelectric position detector 10 passes by the lower end 34a and the lower end 36a of the blocking member 11, detection light 30 emitted from the first light-emitting device 24 and the third light-emitting device 26 is blocked by the blocking member 11 and detection light 30 emitted from the second light-emitting device 25 is not blocked.

10 As a result, the light-reception devices 27 to 29 (the first DZ1 detection section 101A, the second DZ2A detection section 102A and the third DZ2B detection section 103A) change the state to an OFF, ON, OFF state. That is, by two of the first light-reception device 27 and the third light-reception device 29 (the first DZ1 detection section 101A and the third DZ2B detection section 103A), the elevator cage 15 entering the door zone 112 can be detected.

15 In this way, the two first DZ1 detection section 101A and third DZ2B detection section 103A doubly detect the elevator cage 15 entering the door zone 112, and therefore even in the case of malfunction occurring in one of the detection sections, for example, detection can be made with the other detection section.

20 When the elevator cage 15 still further moves up and the photoelectric position detector 10 passes by the lower end 35a of the blocking member 11, detection light 30 emitted from the first light-emitting device 24, the second light-emitting device 25 and the third light-emitting device 26 are all blocked, and therefore the light-reception devices 27 to 29 (the first DZ1 detection section 101A, the second DZ2A detection section 102A and the third DZ2B detection section 103A) are in an OFF, OFF, OFF state. In this way, the second light-reception device 28 (the second DZ2A detection section 102A) turns OFF from ON, whereby detection is made that the elevator cage 15 enters the releveleving zone 111.

After the elevator cage 15 travels by a certain distance from the aforementioned lower end 35a (releveling lower end) of the blocking member 11, elevator stopping procedure starts to perform leveling control to stop the elevator cage 15 at a leveling position 17 as a target.

30 Fig. 4 illustrates a relationship between the photoelectric position detector 10 and the blocking member 11 when the elevator cage 15 stops at the leveling position 17. As illustrated in this drawing, the first DZ1 detection section 101A, the second DZ2A detection section 102A and the third DZ2B detection section 103A are in the releveleving zone 111.

After the elevator cage 15 is thus stopped at the leveling position 17, when more

passengers get in the elevator cage 15, the elevator cage 15 may move down and a difference in level between the elevator cage 15 and the leveling position 17 on the landing side may occur, i.e., the elevator cage 15 descends below the releveled zone 111. In this case, the second light-reception device 28 (the second DZ2A detection section 102A) detects such descent of the elevator cage 15 and releveled control is performed for another leveling of the elevator cage to the leveling position 17.

Conversely, after the elevator cage 15 is stopped, when many passengers get out of the elevator cage 15, the elevator cage 15 may move up and a difference in level between the elevator cage 15 and the leveling position 17 on the landing side may occur, i.e., the elevator cage 15 ascends above the releveled zone 111. In this case, the third light-reception device 29 (the third DZ2B detection section 103A) detects such ascent of the elevator cage 15 and releveled control is performed for another leveling of the elevator cage to the leveling position 17.

In the case where the elevator cage 15 does not stop at a certain floor but moves up, the third light-reception device 29 (the third DZ2B detection section 103A) turns ON from OFF as the photoelectric position detector 10 passes by the releveled zone 111 of the blocking member 11. Thereafter when the elevator cage 15 further moves up and the photoelectric position detector 10 passes by the upper end 34b and the upper end 35b of the blocking member 11, the light-reception device 27 and the light-reception device 28 (the first DZ1 detection section 101A and the second DZ2A detection section 102A) also turn ON from OFF, whereby the passage of the photoelectric position detector 10 through the blocking member 11 can be confirmed.

Fig. 5 is a circuit diagram of UCMP (Unintended Car Movement Protection) according to the present embodiment.

As illustrated in the drawing, the entrance at each stop floor is provided with an HD (landing-side door) switch 13A to detect opening and closing of the door. When this HD (landing-side door) switch 13A is pressed, an HD (landing-side door) input signal 13B is input to an UCMP controller 21 described later.

Inside the elevator cage 15 is provided a CD (cage-side door) switch 14A to detect opening and closing of the door. When this CD (cage-side door) switch 14A is pressed, a CD (cage-side door) signal 14B is input to the UCMP controller 21.

Meanwhile, a detection signal from the first DZ1 detection section 101A of the photoelectric position detector 10 is input as a DZ1 signal 101B to the UCMP controller 21 via an UCMP signal input section 20.

Further, a detection signal from the second DZ2A detection section 102A of the photoelectric position detector 10 and a detection signal from the third DZ2B detection section 103A of the photoelectric position detector 10 are input to the UCMP controller 21 via the UCMP signal input section 20 as a DZ2A signal 102B and a DZ2B signal 103B, respectively.

5 Moreover, a detection signal from the second DZ2A detection section 102A of the photoelectric position detector 10 and a detection signal from the third DZ2B detection section 103A of the photoelectric position detector 10 are input as a DZ1A signal 104B and a DZ1B signal 105B, respectively.

10 The HD (landing-side door) input signal 13B, the CD (cage-side door) signal 14B, the DZ2A signal 102B and the DZ2B signal 103B are used for logic circuit signals of the UCMP (Unintended Car Movement Protection) controller 21 configured with an intra-microcomputer logic circuit. On the other hand, the DZ1A signal 104B and the DZ1B signal 105B are used for releveleving control.

15 The first DZ1 detection section 101A of the photoelectric position detector 10 makes up a leveling controller 18. The second DZ2A detection section 102A and the third DZ2B detection section 103A of the photoelectric position detector 10 make up a releveleving controller 19.

20 A coil 7B of the contact point 7A (see Fig. 1) of the electromagnetic contactor S connecting to a circuit power source of the motor 4 and a coil 8B of the contact point 8A (see Fig. 1) of the electromagnetic contactor BD connecting to a circuit power source of the brake 6 are ON/OFF controlled in accordance with an output command of the UCMP (Unintended Car Movement Protection) controller 21, whereby UCMP (Unintended Car Movement Protection) is implemented.

25 The following describes a specific operation of the UCMP (Unintended Car Movement Protection).

Firstly, an OR circuit 40 detects whether the DZ2A signal 102B or the DZ2B signal 103B is input or not.

30 The DZ2A signal 102B input means that the second DZ2A detection section 102A of the photoelectric position detector 10 illustrated in Fig. 3 enters the door-zone upper end-releveleving zone lower end detection area 35 of the blocking member 11. The DZ2B signal 103B input means that the third DZ2B detection section 103A of the photoelectric position detector 10 enters the door-zone lower end-releveleving zone upper end detection area 36 of the blocking member 11.

Next, an AND circuit 41 detects whether the OR circuit 40 outputs a signal and

the DZ1 signal 101B is input or not. The DZ1 signal 101B input means that the first DZ1 detection section 101A of the photoelectric position detector 10 enters the door-zone detection area 34 of the blocking member 11.

Therefore, the DZ2A signal 102B or the DZ2B signal 103B input and the DZ1
5 signal 101B input mean that the photoelectric position detector 10 surely enters the door-zone detection area 34 of the blocking member 11, and therefore in the case of presence of an output from the AND circuit 41, it is determined that the blocking member is in the door zone, and in the case of absence of an output from the AND circuit 41, it is determined that the blocking member is outside of the door zone.

10 Next, an AND circuit 42 detects whether both of the HD (landing-side door) signal 13B from the switch 13A to detect opening and closing of the landing-side door 13 and the CD (cage-side door) signal 14B from the switch 14A to detect opening and closing of the elevator cage-side door 14 are input or not. Further, an AND circuit 43 detects whether both of the output signal from this AND circuit 42 and an output command signal 7C of the coil 7B of
15 the electromagnetic contactor S are input or not.

On the other hand, an AND circuit 44 detects whether both of the output signal from the AND circuit 41 and the output command signal 7C of the coil 7B of the electromagnetic contactor S are input.

Then, an OR circuit 45 detects whether a door-zone inside/outside judgment
20 output signal and an opening/closing judgment output signal of the HD (landing-side door) 13 and the CD (cage-side door) 14 are input, and on a basis of an output value from the OR circuit 45, power is supplied or shut down to the power source coil 7B of the motor 4 and the power source coil 8B of the brake 6, whereby the operation of UCMP (Unintended Car Movement Protection) is implemented.

25 That is, when the photoelectric position detector 10 resides outside the door zone, i.e. the door zone 112 of the blocking member 11 and when the HD (landing-side door) 13 and the CD (cage-side door) 14 are open, the UCMP (Unintended Car Movement Protection) controller 21 controls not to feed power to the power source coil 7B of the motor 4 and the power source coil 8B of the brake 6. As a result, the contact points 7A and 8A are not opened
30 and so the brake 6 is not released and the motor 4 is not driven.

CLAIMS:

1. A control device of an elevator cage comprising: an elevator cage; a motor that moves the elevator cage up and down; a blocking member provided at an entrance of each leveling floor in a hoistway of the elevator cage; and a photoelectric position detector attached to the elevator cage that detects the blocking member optically to detect a position of the elevator cage, wherein
 - the blocking member includes one sheet member:
 - a door-zone detection area extending in a hoisting direction of the elevator cage, having a door-zone lower end and a door-zone upper end and having a door-zone dimension to detect a door zone of an elevator;
 - a door-zone upper end-releveling zone lower end detection area extending along the hoisting direction of the elevator cage from a lower end of a releveling zone to a same position as that of the door-zone upper end of the door-zone detection area, the releveling zone being set to eliminate a difference in level between the elevator cage and the leveling floor; and
 - a door-zone lower end-releveling zone upper end detection area extending along the hoisting direction of the elevator cage from a same position as that of the door-zone lower end of the door-zone detection area to an upper end of the releveling zone,
 - wherein the door-zone detection area, the door-zone upper end-releveling zone lower end detection area and the door-zone lower end-releveling zone upper end detection area are arranged in a line in a direction orthogonal to the hoisting direction of the elevator cage,
 - wherein the photoelectric position detector includes:
 - a first detection section to detect the door-zone lower end and the door-zone upper end of the door-zone detection area;
 - a second detection section to detect the releveling zone lower end and the door-zone upper end of the door-zone upper end-releveling zone lower end detection area; and
 - a third detection section to detect the door-zone lower end and the releveling zone upper end of the door-zone lower end-releveling zone upper end detection area,
 - wherein the lower end of the door zone is detected by the first detection section and the third detection section,
 - the upper end of the door zone is detected by the first detection section and the second detection section,
 - the lower end of the releveling zone is detected by the second detection section,
 - and
 - the upper end of the releveling zone is detected by the third detection section.

2. The control device of elevator cage according to claim 1, further comprising:
a cage-side door switch provided in the elevator cage to detect opening and closing of a cage-side door;

a landing-side door switch provided in each leveling floor to detect opening and closing of a landing-side door; and

an unintended car movement protection controller to stop the elevator cage when the elevator cage moves up or down before the cage-side door and the landing-side door are closed on a basis of a detection signal from the first through the third detection sections of the photoelectric position detector, an opening/closing signal from the cage-side door switch and an opening/closing signal from the landing-side door switch.