

SPECIFICATION

TITLE OF THE INVENTION

ELEVATOR DEVICE

5

FIELD OF THE INVENTION

The present invention relates to an elevator device, and, in particular, relates to an elevator device provided on an elevator car with a car speed
10 detecting means for activating an emergency stop device mounted on the elevator car.

DESCRIPTION OF PRIOR ART

Conventionally, a provision of a car speed
15 detecting means on an elevator car is already proposed that immediately activates an emergency stop device mounted on the elevator car and prevents the elevator car from falling, for example, in a case when a main rope suspending the elevator car is cut off and the
20 elevator car falls with a speed exceeding the rated speed, as, for example, disclosed in JP-A-61-277573.

Namely, in the car speed detecting means as disclosed in JP-A-61-277573, a rocker arm is provided one end of which is rotatably supported at the side
25 of the elevator car and the other end is extended toward

the laying down direction of a guide rail, a roller is provided that contacts the guide rail and rotates at the end of the extension of the rocker arm and the upward and downward running speed of the elevator car is
5 detected through the rotation of the roller.

SUMMARY OF THE INVENTION

According to the car speed detecting means as disclosed in JP-A-61-277573, since the roller of the
10 rocker arm rotates while contacting with the guide rail in synchronism with the upward and downward running of the elevator car, an accurate car speed is possibly detected.

However, an elevator car possibly rocks during
15 running depending on such as a loading condition of passengers and a laying down condition of the guide rail. For this reason, the rocker arm extending in the laying down direction of the guide rail in the car speed detecting means as disclosed in JP-A-61-277573 rocks
20 due to a rocking of the elevator car during the running thereof, as a result, the rotating speed of the roller rotatably supported at the top end portion of the rocker arm with respect to the guide rail varies in response to the rocking of the elevator car, and the
25 varied rotating speed is detected as the upward and

downward running speed of the elevator car. Namely, although the roller contacting the guide rail is rotated at a rotating speed ω that coincides with the upward and downward running speed of the elevator car, herein, when assuming that the rocking speed of the rocker arm due to rocking of the elevator car is $\Delta\omega$, the roller also rotates at $\Delta\omega$. Further, since the car speed detecting means generates detection signals in response to relative rotation speed between the rocker arm and the roller, the car speed detecting means detects as the rotating speed in addition to the rotating speed ω coinciding with the upward and downward running speed of the elevator car by taking into account of the rocking speed $\Delta\omega$ of the rocker arm. Therefore, with respect to the true rotating speed ω corresponding to the upward and downward running speed of the elevator car, the component of the rocking speed $\Delta\omega$ of the rocker arm is detected as an error, and there arises a problem that a correct upward and downward running speed of the elevator car cannot be detected. In other words, because of the rocking of the rocker arm due to rocking of the elevator car, the position of the roller with respect to the laying down direction of the guide rail (the upward and downward running direction of the elevator car) changes momentarily, and due to the momentary

position change of the roller, an error is caused between the upward and downward running speed of the elevator car and the rotating speed of the roller. Such an error of the upward and downward running speed becomes remarkable in an elevator device that is driven in a super high speed, thus, it is feared to delay the activation timing of the emergency stop device therefor.

In order to reduce such an detection error of the upward and downward running speed, it can be addressed by prolonging the length of the rocker arm and by reducing the rocking angle of the rocker arm when the elevator car rocks, and to thereby reduce the change of the rotating speed of the roller due to rocking of the rocker arm. However, if the length of the rocker arm is prolonged, it becomes necessary to ensure an extra installation space in upward or downward direction of the elevator car, and such arises a problem of increasing an occupying volume of the elevator car.

An object of the present invention is to provide an elevator device that can detect accurately the upward and downward running speed of the elevator car without increasing an occupying volume of the elevator car.

In order to achieve the above object, the present invention provides a car speed detecting means in which

an elevator car rotatablly supports a rocker arm that extends in a direction perpendicular to the laying down direction of a guide rail and is rockable in the direction perpendicular to the laying down direction of the guide rail, and the rocker arm rotatablly supports a roller that contacts the guide rail and rotates in the direction of the laying down direction of the guide rail as well as the upward and downward running speed of the elevator car is detected by making use of the rotation of a roller shaft of the roller.

By constituting in the above manner, the change of the roller position with respect to the laying down direction of the guide rail (the upward and downward running direction of the elevator car) is eliminated even when the elevator car rocks, and the roller moves by rotation on the guide rail at the same speed as the upward and downward running speed of the elevator car. For this reason, no errors due to rocking of the elevator car are caused between the upward and downward running speed of the elevator car and the rotating speed of the roller, and the upward and downward running speed of the elevator car can be detected with a good accuracy. Further, since the rocker arm is extended from the elevator car in a direction crossing perpendicularly to the laying down direction of the guide rail, it

becomes unnecessary to ensure an extra installation space in upward or downward direction of the elevator car, and a possible increase of an occupying volume of the elevator car can be suppressed.

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EFFECTS OF THE INVENTION

An elevator device can be obtained that can detect accurately the upward and downward running speed of the elevator car without increasing an occupying volume of
10 the elevator car.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

Fig.1 is a perspective view of a car speed detecting means showing a first embodiment of an
15 elevator device according to the present invention.

Fig.2 is a perspective view showing a pulse generating portion in the car speed detecting means as of Fig.1.

Fig.3 is a laterally cross sectioned plane view
20 as of Fig.1.

Fig.4 is a corresponding view to that of Fig.1 of a car speed detecting means showing a second embodiment of an elevator device according to the present invention.

25 Fig.5 is a plane view as of Fig.4.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Herein below, the first embodiment of an elevator device according to the present invention will be explained based on a car speed detecting means as shown in Figs.1 through 3.

An elevator car 1 runs upward and downward within a hoistway by a traction machine not shown while being guided by a guide rail 2 laid down in the height direction of the hoistway.

To the elevator car 1, a bracket 3 is fixed, and to the bracket 3 a first supporting shaft 4 is fixed that is in parallel with the longitudinal direction of the guide rail 2. To this supporting shaft 4 one of the end sides of a rocker arm 5 is supported in free of rotation, and the other end side of the rocker arm 5 is extended so as to cross perpendicularly to the longitudinal direction of the guide rail 2 (the laying down direction). And at the extending end side of the rocker arm 5, a bearing 6 is supported in free of rotation by a second supporting shaft 7 that is in parallel with the first supporting shaft 4.

To the bearing 6 supported in such a manner, a roller shaft 9 for a roller 8 that rotates on the guide rail 2 while contacting the same is supported in free

of rotation.

Further, on the roller shaft 9, a magnetic code 10 is formed in which different magnetic polarities are alternatively arranged in its circumferential direction, and a first magnetic sensor 11A and a second magnetic sensor 11B are disposed in close proximity to the magnetic code 10, thereby, a car speed detecting means 12 is formed by these of the magnetic code 10, the first magnetic sensor 11A and the second magnetic sensor 11B. Accordingly, this car speed detecting means 12 generates pulse signals to be proportional to the rotating speed of the roller 8, and the pulse signals outputted from the car speed detecting means 12 are converted by a processing device not shown into an upward and downward running speed of the elevator car 1. And the car speed detecting means 12 is supported by the bearing 6.

On the other hand, the rocker arm 5 is pressed to the side of the guide rail 2 by means of a pressure spring 13, and with the pressure spring 13 the roller 8 is pressed on the rolling movement face 2F of the guide rail 2.

Further, the roller 8 is constituted by a roller main body 14 formed in a cup shape and coupled to the roller shaft 9 and a tire 15 of rubber material mounted

over the outer most circumference of the roller main body 14, and the second supporting shaft 7 is provided at a position where the center line L1 in width direction of the tire 15 and the line L2 connecting the centers of the first supporting shaft 4, the second supporting shaft 7 and the roller shaft 9 cross perpendicularly each other. Further, the rocker arm 5 and the bearing 6 are coupled via the second supporting shaft 7 inside the cup shaped roller main body 14.

Other than the above, between the bearing 6 and the roller main body 14, a stepped portion 8S serving as a stopper is provided to which an angle P of a top end portion 5E of the rocker arm 5 abuts so that the roller 8 is restricted to rotate largely around the second supporting shaft 7.

Since the present embodiment is constituted as in the above manner, when the elevator car 1 is running upward or downward along the guide rail 2 without rocking, the relative position Pa between the elevator car 1 and the guide rail 2 is constant as indicated by a solid line in Fig.3, the tire 15 of the roller 8 contacts over the entire width thereof with the rolling movement face 2F of the guide rail 2 and moves by rolling, thereby, the upward and downward running speed of the elevator car 1 can be correctly detected.

On the other hand, when the elevator car 1 rocks during the upward or downward running in an arrowed X direction as in Fig.3, the relative position Pb between the elevator car 1 and the guide rail 2 displaces as indicated by a dotted line. Through this displacement of the elevator car 1, the bracket 3 fixed to the elevator car 1 also displaces integrally together with the elevator car 1, and the rocker arm 5 rotates around the first supporting shaft 4 and inclines by an angle θ . However, since the top end side of the rocker arm 5 is pressed to the guide rail 2 by the pressure spring 13, the roller 8 continues rotation without removing from the rolling movement face 2F of the guide rail 2, and the upward and downward running speed of the elevator car 1 can be correctly detected.

Further, due to the inclination of the rocker arm 5 only an end portion Q in the width direction of the tire 15 contacts the rolling movement face 2F of the guide rail 2, however, since the reaction force F from the guide rail 2 concentrates at the end portion Q, a rotating force M that suppresses the inclination of the roller 8 is generated by the reaction force F so that the bearing 6 is rotated around the second supporting shaft 7, thereby, the entire width of the tire 15 of the roller 8 is caused contacted to the rolling movement

face 2F of the guide rail 2. This is achieved by disposing the second supporting shaft 7 at the position as explained above.

Further, even when the elevator car 1 rocks in the
5 opposite direction from the arrowed X direction, the inclination of the roller 8 with respect to the rolling movement face 2F of the guide rail 2 can be likely suppressed.

As has been explained hitherto, according to the
10 present embodiment, even when the elevator car 1 rocks during the upward or downward running, since the upward and downward running speed of the elevator car 1 can be correctly detected, even if a main rope suspending the elevator car 1 is cut off and the elevator car 1
15 begins to fall, since the roller 8 always contacts the guide rail 2 and is rotated, a speed exceeding, for example, 1.3 times of the rated speed can be detected correctly, and an emergency stop device not shown can be correctly activated.

20 Such a correct detection of the car speed is realized because the roller 8 is rotatably supported by the rocker arm 5 protruding from the elevator car 1 in the direction crossing perpendicularly to the laying down direction of the guide rail 2 so that the
25 position of the roller 8 contacts with the guide rail

2 at the same position as the position of the elevator car 1 even when the elevator car 1 is caused to rock, thereby, a car speed detection can be performed with a good accuracy in comparison with the conventional car speed detecting means in which the position of the roller 8 varies with respect to the position of the elevator car 1 when the elevator car 1 rocks.

Other than the above, since the roller 8 is rotatably supported by the rocker arm 5 protruding from the elevator car 1 in the direction crossing perpendicularly to the laying down direction of the guide rail 2, the length size of the rocker arm 5 never affects the height size of the elevator car 1, thereby, it is unnecessary to ensure an extra installation space in upward or downward direction of the elevator car 1, and a possible increase of an occupying volume of the elevator car is prevented.

Now, in the above explanation of the present embodiment, although the entire width of the tire 15 of the roller 8 is caused contacted to the rolling movement face 2F, in order to ensure a contact surface pressure with the rolling movement face 2F, it is possible either to increase the spring pressure of the pressure spring 13 or to increase the contact surface pressure by providing a recessed groove 16 on the

opposing surface to the rolling movement face 2F of the tire 15 over the entire circumference thereof in the circumferential direction.

Further, in the present embodiment, the cross sectional shape of the tire 15 of the roller 8 is rectangle. For this reason, it is necessary to ensure a contact surface pressure by contacting the entire width of the tire 15 with the rolling movement face 2F. Through constituting in such manner, in a case where a guide device for guiding the elevator car 1 along the guide rail 2 is guide shoes, even when such as oil contained in the guide shoes is partially deposits on a part of the rolling movement face 2F of the guide rail 2 opposing to the width direction of the tire 15, the tire 15 can contact the remaining portion of the rolling movement face 2F, the roller 8 can rotate without fail.

However, in a case where a guide device for guiding the elevator car 1 along the guide rail 2 is guide rollers, since there occurs no deposition of such as oil on the rolling movement face 2F, it is needless to say to be able to address the requirement by omitting the second supporting shaft 7, by fixing the bearing 6 to the rocker arm 5 and by protruding the surface of the tire 15 in a circular arc shape while following the basic constitution in which the roller 8 is rotatably

supported by the rocker arm 5 protruding from the elevator car 1 in the direction crossing perpendicularly to the laying down direction of the guide rail 2.

5 Nextly, the second embodiment of an elevator device according to the present invention will be explained based on a car speed detecting means as shown in Figs.4 and 5. Further, since the same reference numerals in the present embodiment as those in Figs.
10 1 through 3 show the same constitutional members, the repetitive detailed explanation thereof is omitted.

Different constitutions of the present embodiment from the first embodiment are that at the top end portion of the rocker arm 5, the center in the longitudinal
15 direction of a crossbeam member 17 is coupled in free of rotation via the second supporting shaft 7 in a manner to cross perpendicularly to the rocker arm 5 in horizontal direction, from the both ends of the crossbeam member 17 a first arm member 18A and a second
20 arm member 18B are respectively extended in a direction crossing perpendicularly to the laying down direction of the guide rail 2, a first roller 8A and a second roller 8B are rotatably supported respectively by these first arm member 18A and second arm member 18B, further, the
25 first arm member 18A is coupled in free of rotation to

the crossbeam member 17 via a third supporting shaft 19 that is parallel to the first and second supporting shafts 4 and 7, and the pressure spring 13 is provided between the first arm member 18A and the second arm member 18B that exerts a pressure in a direction to narrow the gap therebetween.

Further, at the roller shaft 9A of the first roller 8A a rotary encoder 20A serving as the car speed detecting means is coupled. Still further, in place of the rotary encoder 20A, a tachogenerator that outputs a power being proportional to rotating speed can be attached.

And, by catching the guide rail 2 with the first roller 8A and the second roller 8B, a contact pressure of the first roller 8A with respect to the guide rail 2 is ensured.

According to the present embodiment, when the elevator car rocks like the first embodiment, the rocker arm 5 inclines. However, since the crossbeam member 17 rotates around the second supporting shaft 7, the attitudes of the first roller 8A and the second roller 8B with respect to the guide rail 2 do not change, and a correct car speed can be detected.

Namely, as shown in Fig.5, when the rocker arm 5 inclines due to rocking of the elevator car, reaction

forces F_a and F_b from the guide rail 2 are caused to the first roller 8A and the second roller 8B, and with these reaction forces F_a and F_b , rotation forces M_a and M_b around the second supporting shaft 7 are caused to the crossbeam member 17. Herein, since the reaction force F_a is generated at a remote position with respect to the second supporting shaft 7 than the reaction force F_b , the rotation force M_a becomes larger than the rotation force M_b , thereby, a rotation force M is caused that restores the crossbeam member 17 to its original position by the difference $(M_a - M_b)$ of these rotation forces M_a and M_b . Through the restoring of the crossbeam member 17 to its original position, the upward and downward running speed of the elevator car can be correctly detected by the like action as the first embodiment.

In this way, even with the present embodiment, equivalent effects as of the first embodiment can be achieved.

Other than the above, since the pressure spring 13 is mounted between the first arm member 18A and the second arm member 18B, it is sufficient that the pressure spring only responds to the change of the gap, the change of the pressing force thereof can be limited in comparison with the pressure spring in the first

embodiment that requires to follow the rocking of the rocker arm 5.

Now, as shown in Fig.4, by coupling a rotary encoder 20B even to the roller shaft 9B for the second roller 8B, and by detecting the car speed at the same time with the rotary encode 20A, the device can be constituted to be able to inform either of the rotary encoders fails when an detection error appears or to permit failure detection when one of them fails.

10 Further, in a case when the rotary encoder 20B is not provided for the second roller 8B, the width of the second roller 8B can be widened without regarding the surface pressure with the guide rail 2. Thereby, the difference between the rotation forces M_a and M_b due to the reaction forces F_a and F_b from the guide rail 2 is enlarged to obtain a larger rotation force M as well as an attitude stability of the first roller 8A and the second roller 8B can be increased.

Although the present invention relates to an elevator device provided on an elevator car with a car speed detecting means for activating an emergency stop device mounted on the elevator car, the car speed detecting means provided on the elevator car can be utilized for an operation management of the elevator device other than activating the emergency stop device.

EXPLANATION OF REFERENCE NUMERALS

1...Elevator car, 2...Guide rail, 3...Bracket,
 4...First supporting shaft, 5...Rocker arm,
 5 6...Bearing, 7...Second supporting shaft, 8...Roller,
 8A...First roller, 8B...Second roller, 9, 9A,
 9B...Roller shaft, 10...Magnetic code, 11A...First
 magnetic sensor, 11B...Second magnetic sensor,
 12...Car speed detecting means, 13...Pressure spring,
 10 14...Roller main body, 15...Tire, 16...Recessed groove,
 17...Crossbeam member, 18A...First arm member,
 18B...Second arm member, 19...Third supporting shaft
 and 20A, 20B...Rotary encoder.

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WHAT WE CLAIM IS:

1. An elevator device provided with a car speed detecting
5 means on an elevator car running upward and downward while
being guided by a guide rail characterized in that the
elevator car is provided with a supporting shaft being in
parallel with the laying down direction of the guide rail,
the supporting shaft rotatably supports a rocker arm that
10 extends in a direction perpendicular to the laying down
direction of the guide rail as well as is rockable in the
direction perpendicular to the laying down direction of the
guide rail, the rocker arm rotatably supports a roller
that contacts the guide rail and rotates in the direction
15 of the laying down direction of the guide rail, a pressure
spring is provided that presses the roller toward the side
of the guide rail, and the car speed detecting means
detects the upward and downward running speed of the
elevator car by making use of the rotation of a roller
20 shaft of the roller.

2. An elevator device provided with a car speed detecting
means on an elevator car running upward and downward while
being guided by a guide rail characterized in that the
25 elevator car is provided with a first supporting shaft
being in parallel with the laying down direction of the

guide rail, the first supporting shaft rotatably supports
a rocker arm that extends in a direction perpendicular to
the laying down direction of the guide rail as well as is
rockable in the direction perpendicular to the laying down
5 direction of the guide rail, a bearing that is supported in
free of rotation by a second supporting shaft being in
parallel with the first supporting shaft and rocks in a
direction perpendicular to the laying down direction of the
guide rail is provided at the top end side of the rocker
10 arm, a roller is provided that is rotatably supported by
the bearing, contacts the guide rail and rotates in the
direction of the laying down direction of the guide rail, a
pressure spring is provided that presses the roller toward
the side of the guide rail, and the car speed detecting
15 means detects the upward and downward running speed of the
elevator car by making use of the rotation of a roller
shaft of the roller.

3. An elevator device provided with a car speed detecting
20 means on an elevator car running upward and downward while
being guided by a guide rail characterized in that the
elevator car is provided with a supporting shaft being in
parallel with the laying down direction of the guide rail,
the supporting shaft rotatably supports a rocker arm that
25 extends in a direction perpendicular to the laying down
direction of the guide rail as well as is rockable in the

direction perpendicular to the laying down direction of the guide rail, at the top end portion of the rocker arm, the center in the longitudinal direction of a crossbeam member is coupled in free of rotation in a manner to cross
5 perpendicularly to the rocker arm in horizontal direction, from the both ends of the crossbeam member a first arm member and a second arm member are respectively extended in a direction crossing perpendicularly to the laying down direction of the guide rail, rollers rolling along the
10 direction of the laying down direction of the guide rail are rotatably supported respectively by these first arm member and second arm member, further, the first arm member is coupled in free of rotation to the crossbeam member so as to permit rocking in a direction perpendicular to the
15 laying down direction of the guide rail, the pressure spring is provided between the first arm member and the second arm member that exerts a pressure in a direction to narrow the gap therebetween, the guide rail is caught with the roller rotatably supported by the first arm and the
20 roller rotatably supported by the second arm, and the car speed detecting means detects the upward and downward running speed of the elevator car by making use of the rotation of a roller shaft of at least one of the rollers for the first arm member and the second arm member.

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4. An elevator device according to claim 2 characterized in

that the roller includes a roller main body formed in a cup shape and coupled to the roller shaft and a tire mounted at the outer most circumference of the roller main body, and the second supporting shaft is provided at a position where the center line in width direction of the tire and the line connecting the centers of the first supporting shaft, the second supporting shaft and the roller shaft cross perpendicularly each other.

5. An elevator device according to claim 4 characterized in that inside the cup shaped roller main body a bearing for the roller shaft is provided, and the car speed detecting means is supported by the bearing.

6. An elevator device according to any one of claims 1 through 5 characterized in that the car speed detecting means is constituted by a ring in which a magnetic code is buried and attached to the roller shaft and a magnetic sensor facing the surface of the ring via a gap.