

ELEVATOR CAR AND ELEVATOR DEVICE

Field of the invention

The present invention relates to an elevator car of one-way-door type, which has a mechanism for detecting insertion of foreign object such as a string at an elevator door, and an elevator device including the elevator car.

5 Background of the invention

An elevator door device has been proposed, that includes a pressure-sensitive sensor for detecting a string-like foreign object at a door-closing-direction end of a door disposed at an entrance/exit opening of an elevator car (see, for example, JP-A-2009-269680).

10 A device has been also proposed, that includes a save plate for guiding a string-like foreign object lying on a car floor to a pressure-sensitive sensor to detect the foreign object (see, for example, JP-A-2007-326699).

Although the above conventional devices are capable of detecting even a comparatively thin string-like foreign object, they sometimes fail to detect, with the pressure-sensitive sensor, a string-like foreign object having such a thickness as to fittingly enter the gap
15 between the door and a car jamb when the foreign object enters the gap.

Summary of the invention

An object of the present invention is to provide an elevator car and an elevator device that are capable of detecting a string-like foreign object, whatever thickness the string-like foreign objects may have.

20 An elevator car and an elevator device are provided to achieve the above-described object according to the present invention, and they include a cab on a car frame with a rubber vibration isolator located therebetween. A pressure-sensitive sensor is mounted on a fore end of a one-way-opening car door that opens/closes an opening of the cab. A car jamb faces the pressure-sensitive sensor when the car door is closed, and save plates are provided on a
25 lower fore end portion of the car door and a lower portion of the car jamb. A slanting portion is provided at a position receding relative to a cab interior exposed surface of the car jamb as seen from the interior of the cab when the car door is closed, and an overlap along a door opening/closing direction between the car door and the car jamb is set smaller than the size of a gap between the car door and the car jamb.

According to the present invention, the accuracy with which a string-like foreign object is detected at the one-way-opening-type door can be improved advantageously with a comparatively simple arrangement.

Other objects, features and advantages of the invention will become apparent from the following description of the embodiments of the invention taken in conjunction with the accompanying drawings.

Brief description of the drawings

Fig. 1 is a schematic sectional view showing an entire elevator;

Fig. 2 is a front view of an entrance/exit portion of a car of an elevator device seen from the front side;

Fig. 3 is a plan view of a state of a car door of the elevator device seen from above;

Fig. 4 is an enlarged plan view showing details of a portion II surrounded by a curved line in Fig. 3;

Fig. 5 is an enlarged plan view showing a state in which a string-like foreign object is caught;

Fig. 6 is an enlarged plan view of abutting portions of a car door 5a and a car jamb 31 seen from above;

Fig. 7 is an enlarged front view of lower end abutting portions of the car door 5a and the car jamb 31 seen from the front side;

Fig. 8 is a view corresponding to Fig. 4, showing a case where no slanting portion is provided on the car jamb and an overlap is large;

Fig. 9 is a view corresponding to Fig. 6, showing the lower end abutting portions of the car door 5a and the car jamb 31 seen from the front side; and

Fig. 10 is a view corresponding to Fig. 7, showing a state where a car sill is sunk and a gap below the car door 5a is increased.

Detailed description of the invention

An embodiment of an elevator device according to the present invention will be described with reference to the accompanying drawings.

Fig. 1 is a schematic sectional view showing an entire elevator according to an embodiment of the present invention. As shown in Fig. 1, an elevator device 100 in the present embodiment has a car 102 and a counterweight 103 moving vertically in a hoistway 101

provided in a building; a rope 104 for hanging the car 102 and the counterweight 10; a sheave 106 mounted to a traction machine or a hoisting device for driving vertically the car 102 and the counterweight 103; and a pulley 107 around which the rope 104 is wrapped.

In the present embodiment, the sheave 106 of the traction machine and the pulley 107 are disposed in a machine room 105 positioned above the hoistway 101. The rope 104 connects the car 102 and the counterweight 103. The rope 104 has its one end fixed to the car 102 and is led upward and wrapped around the sheave 106 of the traction machine in the machine room 105. Thereafter, it is led downward and wrapped around the pulley 107. The rope 104 is then wrapped around the sheave 106 again and further wrapped around the pulley 107, and the other end of the rope 104 is fixed to the counterweight 103.

Thus, the sheave 106 and the pulley 107 adjust a distance between the car 102 and the counterweight 103 to have a gap therebetween such that they do not collide against each other. The car 102 can be vertically moved between the top floor HF and the bottom floor LF of the building by driving the traction machine. When the car 102 is moved, the counterweight 103 is vertically moved in the direction opposite to the moving direction of the car 102. While the illustration of floors between the top floor HF and the bottom floor LF is omitted in the figure, only two floors of the top floor HF and the bottom floor LF may exist or further floor or floors may exist.

Fig. 2 is a front view of an entrance/exit portion of the car seen from the front side. As shown in Fig. 2, the car 102 has a plank 115, a car sill 4 and a cab 50 on a car frame via rubber vibration isolators 114. The car frame is constituted of a crosshead 111, posts 112 and a car platform 113. Car doors 5a and 5b have upper portions hung by means of door hangers 2a and 2b and are rolled on a door rail 3 to be opened or closed, thereby the opening of the cab 50 is opened or closed. The door rail 3 is mounted on a door rail frame 1. The door rail frame 1 is mounted on the posts 112. A safety shoe 8 attached by means of safety shoe levers 6 and 7 is located on the car door 5a. In a case where a person, a freight or the like is caught during ordinary door closing, the safety shoe 8 moves in the door opening direction relative to the car door 5a to detect contact with or catching of the person, freight or the like and to start door opening by reversing the door operation of the car doors 5a and 5b from closing to opening.

During the door closing/opening operation, the car door 5a moves about twice distance than the car door 5b moves in generally the same time period. That is, the speed at which the car door 5a moves is about twice the speed at which the car door 5b moves. The car door 5a is constructed as a high-speed door, while the car door 5b is constructed as a low-speed

door.

Fig. 3 is a plan view of the car doors of the elevator device seen from above. As shown in Fig. 3, when the car 102 stops at a destination floor, it faces a landing entrance/exit constituted of jambs 61a and 61b covering peripherals of an opening at the landing on the destination floor, a landing sill 60 provided so as to face the car sill 4, and hoistway doors 62a and 62b which move on the landing sill 60 and cover the landing opening such as it can be opened and closed.

Fig. 4 is an enlarged plan view showing details of a portion II surrounded by a curved line in Fig. 3. As shown in Fig. 4, a joint strip 20 is located on the fore end of the car door 5a. A joint strip 21 is also located on a car jamb 51. The joint strips 20 and 21 face each other at the time of door closing, and shock-absorbing members, made of an elastic material such as rubber, are located inside the joint strips 20 and 21 and abut against each other. A pressure-sensitive sensor 20a is located in the shock-absorbing member in the joint strip 20. In a case where a string-like foreign object 200 is caught between the car door 5a and the car jamb 51 as shown in Fig. 5, the string-like foreign object 200 is caught between the joint strips 20 and 21 with the door closing operation of the car door 5a and the joint strip 21 acts to press the string-like foreign object 200 toward the joint strip 20. Thus, the car doors 5a and 5b are opened by detecting catching of the string-like foreign object 200 with the pressure-sensitive sensor 20a incorporated in the joint strip 20.

In a state where the one-way-opening-type door is completely closed as shown in Fig. 4, the fore end of the car door 5a recedes relative to the cab interior exposed surface of the car jamb 51, as seen from the interior of the cab 50 in the car 102. By providing a slanting portion 51a in the car jamb 51, an overlap S2 between the car jamb 51 and the fore end of the car door 5a is reduced in comparison with a gap S1 formed in this state. It is desirable that the overlap S2 satisfies the formula: $S1/2 \geq S2$.

Fig. 8 is a diagram corresponding to Fig. 4, showing a case where the slanting portion 51a is not provided in the car jamb 51, and where the overlap is large. As shown in Fig. 8, if the slanting portion 51a is not provided in the car jamb 51, and if the overlap between the car jamb 51 and the fore end of the car door 5a is large, such a case is conceivable where there is a possibility of failure to detect catching of the string-like foreign object 200 with the pressure-sensitive sensor 20a. It is because, when a string-like foreign object 200 having a size approximately equal to the gap between the car door 5a fore end and the car jamb 51 is caught between the car door 5a fore end and the car jamb 51, the string-like foreign object 200 is brought into contact with an outermost end portion of the joint strip 20 to slightly increase the

space between the joint strips 20 and 21, and the string-like foreign object 200 is caught between the outermost end of the joint strip 20 and the joint strip 21 without being pressed by the shock-absorbing member in which the pressure-sensitive sensor 20a is provided. However, the provision of the slanting portion 51a as shown in Fig. 4 avoids this problem and enables

obtaining markedly high detection accuracy. By setting the margin S2 as satisfies the formula $S1/2 \geq S2$ in relation to the gap S1 in particular, the desired reliability of detection of pinching of the pressure-sensitive sensor 20a can be ensured.

Fig. 9 is an enlarged front view of lower abutment portions of the car door 5a and the car jamb 51, as seen from the front side. In the present embodiment, as shown in Fig. 9, a door shoe 9a is located on the lower end of the car door 5a. The door shoe 9a slides in a groove in the car sill 4 to guide the opening/closing operation of the car door 5a. Due to this arrangement, however, a gap G1 in which the joint strip 20 having the pressure-sensitive sensor 20a is provided therein does not exist between the lower end of the car door 5a and the car sill 4. Therefore, a save plate 30 having a slanting surface which rises from a lower position in the groove in the car sill 4 toward the joint strip 20 having the pressure-sensitive sensor 20a therein is mounted to a lower fore end portion of the car door 5a, and a save plate 31 having a slanting surface which rises from a lower position in the groove of the car sill 4 toward the joint strip 20 is mounted to a lower fore end portion of the car jamb 51. These save plates 30 and 31 are provided to scoop up the string-like foreign object 200 on the plank, as described below. By the door closing operation of the car door 5a, the slanting surfaces of the save plates 30 and 31 intersect each other in V-shaped form to catch the string-like foreign object 200 existing on the plank between these portions in V-shaped form. With the further progress of the door closing operation of the car door 5a, the bottom in the V-shaped form becomes shallower. With this change, the string-like foreign object 200 is lifted upward by the slanting surfaces to be scooped up to the joint strip 20 on which the pressure-sensitive sensor 20a is located.

The plank 115, the car sill 4 and the cab 50 are constructed on the rubber vibration isolators 114 on the car frame as shown in Fig. 2. Thus, when the car sill 4 sinks with the deformation of the rubber vibration isolators 114 as a result of entering of a person, a freight or the like into the car, the car jambs 51 can also sink with the car sill 4. On the other hand, since the car doors 5a and 5b are hung by means of the door hangers 2a and 2b on the door rail 3 on the door rail frame 1 on the car frame as shown in Fig. 2, they are irrelevant to this sinking. Therefore, as shown in Fig. 10, the gap between the lower end of the car door 5a and the car sill 4 is increased as G2, where the joint strip 20 having the pressure-sensitive sensor 20a therein does not exist. A level difference G3 in a height direction G3 is then generated between the

save plates 30 and 31. A case is conceivable where the string-like foreign object 200 scooped up from the plank is caught with this level difference G3 and does not contact the joint strip 20 having the pressure-sensitive sensor 20a therein although it contacts the joint strip 21, and thus the pressure-sensitive sensor 20a cannot detect the string-like foreign object 200.

5 In the present embodiment, therefore, as shown in Figs. 6 and 7, a second save plate 40 has a slanting surface having its lower end tip in contact with the surface of the car sill 4 and rising toward the joint strip 21 as seen from a direction from the front, and the second save plate 40 is located on a side of the car jam 51 at a position corresponding to the surface of the car door 5a on the hoistway 101 side, i.e., on the landing facing side of the car jamb 51, generally in
10 parallel with the save plate 31 on a lower portion of the car jamb 51. Thus, the second save plate 40 is provided to scoop up the string-like foreign object 200 in the level difference in the height direction G3 to the joint strip 20 having the pressure-sensitive sensor 20a therein so that the string-like foreign object 200 is prevented from being caught in the level difference in the height direction G3 even when the car jamb 51 is sunk by the deformation of the rubber vibration
15 isolators 114 caused, for example, by entering of a person, a freight or the like into the car. Moreover, scooping up of the string-like foreign object 200 even to a position higher by G4 on the joint strip 20 having the pressure-sensitive sensor 20a therein is enabled.

The maximum height of the second save plate 40 may be set at higher position than that of the save plate 30 on the lower fore end portion of the car door 5a displaced by the
20 amount of displacement of the rubber vibration isolator 114 under the cab 50. With this arrangement, the a string-like foreign object on the plank can be guided to the pressure-sensitive sensor 20a at the fore end of the car door 5a even when the plank is sunk by a person or a freight, thereby improving the reliability with which a foreign object can be detected and improving the accuracy of detection with the pressure-sensitive sensor.

25 Thus, in the present embodiment, the second save plate 40 is mounted on the car jamb 51 in addition to the save plate 31 to enable increasing the probability of the string-like foreign object 200 on the plank guided to pressure-sensitive sensor 20a at the fore end of the car door 5a, thereby improving accuracy of detection with the pressure-sensitive sensor.

In the present embodiment, the second save plate 40 is mounted to the car jamb
30 51 at one point with a bolt so as to be placed on the car sill 4. In this way, the second save plate 40 can be constructed so that the lower end of the slanting surface of the second save plate 40 can be in contact with the surface of the car sill 4 even when deformation or strain is caused in the car sill 4 by deformation of the rubber vibration isolators 114 caused by entering of a person of a freight into the car, thereby improving the reliability of the accuracy of scooping up of the

string-like foreign object 200.

Also, the second save plate 40 is fixed to the car jamb 51 with a shock-absorbing member interposed therebetween to enable limiting the generation of sound such as vibration accompanying shaking of the car 102 caused during vertical movement of the car 102 while
5 maintaining the arrangement in which the lower end of the slanting surface of the second save plate 40 contacts the surface of the car sill 4.

Further, the second save plate 40 is provided on the landing facing side of the car jamb 51 to enable securing a sufficiently large installation space and improving the maintainability.

10 The length of the second save plate 40 may be set equal to or shorter than the cab 50 interior exposed surface of the car jamb 51 to enable mounting without hindering loading or unloading of a passenger or a freight into the elevator device.

While the present embodiment has been described with respect to the arrangement for one to one roping by way of example, the present invention can be applied to arrangements
15 for various types of roping such as two to one roping and three to one roping. Further, while the present embodiment has been described with respect to the arrangement including the machine room 105 by way of example, the present invention can be applied to a machine room-less elevator device or the like having a traction machine in the hoistway 101.

It should be further understood by those skilled in the art that although the
20 foregoing description has been made on embodiments of the invention, the invention is not limited thereto and various changes and modifications may be made without departing from the spirit of the invention and the scope of the appended claims.

Claims:

1. An elevator car comprising a car frame and a cab on the car frame with a rubber vibration isolator therebetween,

wherein a pressure-sensitive sensor is mounted on a fore end of a one-way-opening car door for opening or closing an opening of the cab so that a car jamb faces the pressure-sensitive sensor when the car door is closed,

wherein save plates are located on a lower fore end portion of the car door and a lower portion of the car jamb, and

wherein a slanting portion is provided at a position receding relative to a cab interior exposed surface of the car jamb as seen from the interior of the cab when the car door is closed, and an overlap along a door opening or closing direction between the car door and the car jamb is set smaller than the size of a gap between the car door and the car jamb.

2. The elevator car according to Claim 1, further comprising a second save plate on the car jam at a position corresponding to the surface of the car door on the hoistway side generally in parallel with the save plate on the lower portion of the car jamb.

3. The elevator car according to Claim 2, wherein the maximum height of the second save plate is set at higher position than that of the save plate on the lower fore end portion of the car door displaced by the amount of displacement of the rubber vibration isolator under the cab.

4. An elevator device comprising a car for moving vertically in a hoistway, a rope for hanging the car, and a drive for driving the rope,

wherein the car has a cab on a car frame with a rubber vibration isolator interposed therebetween, a pressure-sensitive sensor being mounted on a fore end of a one-way-opening car door for opening or closing an opening of the cab, a car jamb facing the pressure-sensitive sensor when the car door is closed, and save plates being located on a lower fore end portion of the car door and a lower portion of the car jamb, and

wherein a slanting portion is located at a position receding relative to a cab interior exposed surface of the car jamb as seen from the interior of the cab when the car door is closed, an overlap along a door opening or closing direction between the car door and the car jamb being set smaller than the size of a gap between the car door and the car jamb.