

DESCRIPTION

ELEVATOR DOOR ANTI-FALL DEVICE AND ELEVATOR DOOR DEVICE

5 FIELD

[0001]

The present invention relates to an elevator door anti-fall device for preventing an elevator door provided at each entrance in a shaft structure from falling, and also to an elevator door device provided with the elevator door
10 anti-fall device.

BACKGROUND

[0002]

As an elevator door device provided at each entrance in a shaft
15 structure, there is conventionally known an elevator door device including a plate portion provided along the inner wall of the shaft structure, a rail provided along an inner surface of the plate portion, a roller configured to roll on the rail, and an elevator door connected to the roller (e.g., Patent Literature 1). In such an elevator door device, the roller rolls on the rail, thereby
20 allowing the elevator door to open and close.

CITATION LIST

Patent Literature

[0003]

25 Patent Literature 1: JP 2(1990)-310286 A

SUMMARY

Technical Problem

[0004]

30 Meanwhile, when a force acts on the elevator door of Patent Literature 1, for example, from the outer side (platform side) toward the inner side (shaft

side), the elevator door may be tilted or deform. Furthermore, in the case where an elevator car to be lifted up and down through the shaft is not positioned facing the elevator door, there is a possibility that the elevator door falls.

5 [0005]

In view of such circumstances, it is therefore an object of the present invention to provide an elevator door anti-fall device and an elevator door device capable of preventing the elevator door from falling.

10 Solution to Problem

[0006]

The elevator door anti-fall device according to the present invention is provided in an elevator door device including: a plate portion provided along an inner wall of a shaft structure; a rail provided along an inner surface of the plate portion; a roller configured to roll on the rail; and an elevator door
15 configured to open and close by being connected to the roller, and prevents the elevator door from falling. The elevator door anti-fall device includes a laterally restricting portion arranged between the roller and the plate portion so as to restrict the roller from moving laterally at least when the elevator door
20 is closed.

[0007]

According to the elevator door anti-fall device of the present invention, the laterally restricting portion is arranged between the roller and the plate portion at least when the elevator door is closed. This allows the laterally
25 restricting portion to be in abutting contact with a lateral side of the roller when the roller moves laterally, thereby restricting the roller from moving laterally.

[0008]

Further, in the elevator door anti-fall device according to the present
30 invention, the laterally restricting portion may be arranged so as to overlap or cover at least an upper portion of the roller in a direction in which the roller

and the plate portion face each other.

[0009]

In the elevator door anti-fall device with such a configuration, the laterally restricting portion is arranged so as to overlap or cover at least an
5 upper portion of the roller in a direction in which the roller and the plate portion face each other. Accordingly, the laterally restricting portion comes into abutting contact with an upper portion of a lateral side of the roller when the roller laterally moves with its lower portion (portion in abutting contact with the rail) as a point of support, thereby surely restricting the roller from
10 moving laterally.

[0010]

Further, the elevator door anti-fall device according to the present invention may include an upward restricting portion arranged above the roller so as to restrict the roller from separating upward from the rail at least when
15 the elevator door is closed.

[0011]

In the elevator door anti-fall device with such a configuration, the upward restricting portion is arranged above the roller at least when the elevator door is closed. This allows the upward restricting portion to be in
20 abutting contact with an upper portion of the roller when the roller is about to separate upward from the rail. Therefore, it is possible to restrict the roller from separating upward from the rail.

[0012]

Further, in the elevator door anti-fall device according to the present
25 invention, a plurality of laterally restricting portions may be provided side by side corresponding to a plurality of rollers provided for one elevator door.

[0013]

Further, the elevator door device according to the present invention includes: a plate portion provided along an inner wall of a shaft structure; a rail
30 provided along an inner surface of the plate portion; a roller configured to roll on the rail; an elevator door configured to open and close by being connected to

the roller; and the above-described elevator door anti-fall device.

Advantageous Effects of Invention

[0014]

5 As has been described above, according to the elevator door anti-fall device and the elevator door device of the present invention, the laterally restricting portion comes into abutting contact with a lateral side of the roller when the roller laterally moves, thereby restricting the roller from moving laterally, as a result of which an excellent effect can be exerted, that is, the
10 elevator door can be prevented from falling.

BRIEF DESCRIPTION OF DRAWINGS

[0015]

FIG. 1 shows an overall front view of an elevator door device according
15 to one embodiment of the present invention.

FIG. 2 shows an overall rear view of the elevator door device according to the one embodiment.

FIG. 3 shows a perspective view, as seen from a rear side, of a main part of the elevator door device according to the one embodiment.

20 FIG. 4 shows an inside perspective view, as seen from the front side, of a main part of the elevator door device according to the one embodiment.

FIG. 5 shows a right side view of a main part of the elevator door device according to the one embodiment.

FIG. 6 schematically illustrates an action of a comparative example as a
25 comparison with the elevator door device according to the one embodiment, where FIG. 6(a) shows an overall right side view thereof, and FIG. 6(b) shows an enlarged right side view of a main part thereof.

FIG. 7 schematically illustrates an action of the comparative example, where FIG. 7(a) shows an overall right side view thereof, and FIG. 7(b) shows
30 an enlarged right side view of a main part thereof.

FIG. 8 schematically illustrates an action of the comparative example,

where FIG. 8(a) shows an overall right side view thereof, and FIG. 8(b) shows an enlarged right side view of a main part thereof.

FIG. 9 schematically illustrates an action of the comparative example, where FIG. 9(a) shows an overall right side view thereof, and FIG. 9(b) shows
5 an enlarged right side view of a main part thereof.

FIG. 10 schematically illustrates an action of the elevator door device according to the one embodiment, where FIG. 10(a) shows an overall right side view thereof, and FIG. 10(b) shows an enlarged right side view of a main part thereof.

10 FIG. 11 schematically illustrates an action of the elevator door device according to the one embodiment, where FIG. 11(a) shows an overall right side view thereof, and FIG. 11(b) shows an enlarged right side view of a main part thereof.

FIG. 12 schematically illustrates an action of the elevator door device
15 according to the one embodiment, where FIG. 12(a) shows an overall right side view thereof, and FIG. 12(b) shows an enlarged right side view of a main part thereof.

FIG. 13 schematically illustrates an action of the elevator door device according to the one embodiment, where FIG. 13(a) shows an overall right side
20 view thereof, and FIG. 13(b) shows an enlarged right side view of a main part thereof.

FIG. 14 shows an inside perspective view, as seen from the front side, of a main part of an elevator door device according to another embodiment of the present invention.

25 FIG. 15 shows an inside perspective view, as seen from the front side, of a main part of an elevator door device according to still another embodiment of the present invention.

DESCRIPTION OF EMBODIMENTS

30 [0016]

Hereinafter, one embodiment of the elevator door device according to

the present invention is described with reference to FIG. 1 to FIG. 13. Prior to describing each component of the elevator door device according to this embodiment, an elevator device in which the elevator door device is provided is described.

5 [0017]

As shown in FIG. 1 to FIG. 5, the elevator device is provided with an elevator car for carrying people (not shown or numbered), a cylindrical hollow shaft structure X having a shaft X1 through which the elevator car is lifted up and down thereinside, a plurality of elevator door devices 1 that respectively
10 open and close a plurality of entrances X3 provided in the shaft structure X corresponding to platforms X2, and a drive mechanism (not shown or numbered) for lifting up and down the elevator car. In the following description, the shaft X1 side is taken as an inner side (inward), and each platform X2 side is taken as an outer side (outward).

15 [0018]

Each elevator door device 1 according to this embodiment is provided with a pair of elevator doors (which hereinafter may be referred to also as "platform doors", or may be referred to simply as "doors") 2 that open and close each entrance X3, a frame 3 fixed to the shaft structure X, and support
20 mechanisms 4 that allow the frame 3 to movably support the respective doors 2. Further, the elevator door device 1 is provided with a synchronization mechanism 5 that synchronizes the pair of doors 2 with each other.

[0019]

The elevator door device 1 is provided with an elevator door anti-fall
25 device (which hereinafter may be referred to simply as an "anti-fall device") 6 that prevents each door 2 from falling. Furthermore, the elevator door device 1 is provided with a guiding mechanism 7 that guides the lower end portion of the door 2, and a retaining mechanism 8 that holds the door 2 so that the corresponding entrance X3 is closed by the door 2.

30 [0020]

The door 2 includes a door body 21 formed into a rectangular shape, and

a guided portion 22 provided protruding downward from the lower end portion of the door body 21 so as to be guided by the guiding mechanism 7. The pair of doors 2 includes a first door 2a and a second door 2b arranged outwardly of the first door 2a. The first door 2a is configured to move by being engaged with an
5 openable and closable car door (not shown or numbered) provided in the elevator car.

[0021]

The pair of doors 2 shift from a closing position (position shown by solid lines in FIG. 1 and FIG. 2) at which they close the entrance X3 to an opening
10 position (position shown by dashed-double-dotted lines in FIG. 1 and FIG. 2) at which they open the entrance X3 by moving toward one side, and shift from the opening position to the closing position by moving toward the other side. That is, the elevator door device 1 according to this embodiment is generally called a "side opening" type, since the pair of doors 2 move in the same direction to open
15 and close the entrance X3.

[0022]

The pair of doors 2 are arranged so that their end portions that are adjacent in the width direction overlap each other in the facing direction when they are located at the closing position. Specifically, the pair of doors 2 are
20 arranged so that one end portion of the first door 2a and the other end portion of the second door 2b overlap each other when they are located at the closing position. Further, the pair of doors 2 are arranged so as to entirely overlap each other in the facing direction when they are located at the opening position.

[0023]

25 The frame 3 includes a plate portion 31 provided along an inner wall X4 of the shaft structure X, and a fixed portion 32 fixed to the shaft structure X. The frame 3 is formed into an elongated shape along the moving direction of the doors 2. Further, the frame 3 is arranged above the entrance X3.

[0024]

30 The plate portion 31 includes a plate body 311 formed into a flat elongated shape, and a groove portion 312 arranged along the longitudinal

direction. The plate body 311 is in tight contact with the inner wall X4 of the shaft structure X. Further, a space is formed between the groove portion 312 and the inner wall X4.

[0025]

5 The fixed portion 32 is formed into a flat plate shape and provided protruding inwardly from the upper end portion of the plate body 311. The fixed portion 32 is fixed to the inner wall X4 using a coupling member (not shown or numbered, e.g., an angle member).

[0026]

10 Each support mechanism 4 includes a rail 41 provided along the inner surface of the plate portion 31, a pair of rollers 42 mounted on the rail 41 so as to roll on the rail 41, a connector 43 that connects the pair of rollers 42 with the corresponding door 2, and a pair of auxiliary rollers 44 in abutting contact with the lower portion of the rail 41. The support mechanisms 4 include a first
15 support mechanism 4a that supports the first door 2a, and a second support mechanism 4b that supports the second door 2b.

[0027]

Each rail 41 is formed into an elongated shape along the moving direction of the corresponding door 2. Further, the rail 41 is arranged along
20 the groove portion 312 of the plate portion 31. The rail 41 is fixed to the plate portion 31 using bolts 45. The head of each bolt 45 is accommodated within the groove portion 312 of the plate portion 31.

[0028]

The rail 41 of the first support mechanism 4a and the rail 41 of the
25 second support mechanism 4b are arranged facing each other in the facing direction of the pair of doors 2. Specifically, the rail 41 of the first support mechanism 4a and the rail 41 of the second support mechanism 4b are provided side by side with their longitudinal directions in parallel to each other.

[0029]

30 The rail 41 of the first support mechanism 4a is arranged inwardly of the rail 41 of the second support mechanism 4b by interposing brackets 46

between itself and the plate portion 31. Further, the rail 41 of the first support mechanism 4a is formed longer than the rail 41 of the second support mechanism 4b.

[0030]

5 Each roller 42 includes a concave portion 421 along its outer periphery. The roller 42 is formed so as to have a larger thickness than the thickness of the rail 41. Further, the roller 42 is attached onto an outer surface of the connector 43 at an upper portion of the connector 43 formed into a flat plate shape. Furthermore, the pair of rollers 42 are provided side by side in the
10 width direction of the connector 43 and attached respectively to the end portions in the width direction of the connector 43.

[0031]

Each auxiliary roller 44 is attached onto the outer surface of the connector 43 at a lower portion of the connector 43. Further, the pair of
15 auxiliary rollers 44 are provided side by side in the width direction of the connector 43 and attached respectively to the end portions in the width direction of the connector 43. The auxiliary roller 44 has an upper portion in abutting contact with the rail 41, thereby suppressing the corresponding roller 42 from separating upward from the rail 41.

20 [0032]

The synchronization mechanism 5 includes an elongated base portion 51 fixed to an upper portion of the connector 43 of the second support mechanism 4b, a pair of pulleys 52 that are rotatably fixed respectively to the end portions of the base portion 51, an endless belt 53 hung over the pair of
25 pulleys 52, and a coupling portion 54 that couples the connector 43 of the first support mechanism 4a to an inner portion of the belt 53. Further, the synchronization mechanism 5 includes a fixing portion 55 that fixes the plate portion 31 of the frame 3 to an outer portion of the belt 53.

[0033]

30 The anti-fall device 6 includes a pair of anti-fall units 61 provided side by side corresponding to the pair of rollers 42 provided on each door 2. The

anti-fall units 61 include a pair of first anti-fall units 61a that prevent the first door 2a from falling, and a pair of second anti-fall units 61b that prevent the second door 2b from falling.

[0034]

5 Each anti-fall unit 61 is arranged facing the corresponding roller 42 when the doors 2 are located at the closing position. The anti-fall unit 61 includes a laterally restricting portion 611 that restricts the roller 42 from moving laterally when the doors 2 are located at the closing position, and an upward restricting portion 612 that restricts the roller 42 from separating
10 upward from the rail 41 when the doors 2 are located at the closing position.

[0035]

Each laterally restricting portion 611 is arranged outwardly of the corresponding roller 42, when the doors 2 are located at the closing position. Specifically, the laterally restricting portion 611 is arranged between the roller
15 42 and the plate portion 31 when the doors 2 are located at the closing position. Further, the laterally restricting portion 611 is formed so as to have a width dimension that is substantially equal to the diameter of the corresponding roller 42.

[0036]

20 The laterally restricting portion 611 of each first anti-fall unit 61a is arranged so as to entirely overlap or cover the corresponding roller 42 in a direction in which the roller 42 and the plate portion 31 face each other when the doors 2 are located at the closing position. The first anti-fall unit 61a is fixed to the rail 41 by the lower end portion of the laterally restricting portion
25 611 being attached to the outer surface of the rail 41.

[0037]

The laterally restricting portion 611 of each second anti-fall unit 61b is arranged so as to overlap or cover an upper portion of the corresponding roller 42 in a direction in which the roller 42 and the plate portion 31 face each other
30 when the doors 2 are located at the closing position. The second anti-fall unit 61b is fixed to the plate portion 31 by the laterally restricting portion 611 being

attached to the plate portion 31.

[0038]

Each upward restricting portion 612 is arranged above the corresponding roller 42 when the doors 2 are located at the closing position.

- 5 Further, the upward restricting portion 612 is formed so as to have a width dimension that is substantially equal to the diameter of the corresponding roller 42. The upward restricting portion 612 is provided protruding inwardly from the upper end portion of the laterally restricting portion 611.

[0039]

- 10 The guiding mechanism 7 includes a first guiding portion 71 that guides the guided portion 22 of the first door 2a, and a second guiding portion 72 that guides the guided portion 22 of the second door 2b. Further, the guiding portions 71, 72 are each formed into a groove along the moving direction of the corresponding door 2. The guiding portions 71, 72 are each brought into
15 sliding contact with the surface on the outer side and the surface on the inner side of the guided portion 22 of the corresponding door 2 by the guided portion 22 being inserted thereinto.

[0040]

- The retaining mechanism 8 includes an anti-shift mechanism 81 that
20 prevents the shift of the first door 2a from the closing position to the opening position. Further, the retaining mechanism 8 includes a bias mechanism 82 that biases the second door 2a toward the closing position.

[0041]

- The anti-shift mechanism 81 includes a latching portion 812 that is
25 attached to the other end portion of the connector 43 of the first support mechanism 4a via an elastic body 811, and a latched portion 813 that is attached to the other end portion of the frame 3 via the rail 41 of the first support mechanism 4a so as to be latched by the latching portion 812. The anti-shift mechanism 81 is configured to release the latched state of the latched
30 portion 813 by the latching portion 812 when the elastic body 811 elastically deforms as the first door 2a is brought into engagement with the car door.

[0042]

The bias mechanism 82 is composed of an elastic body. The bias mechanism 82 is configured to bias the second door 2b toward the aforementioned other side by having its one end portion coupled to the other
5 end portion of the connector 43 of the second support mechanism 4b and having its other end portion coupled to the other end portion of the frame 3.

[0043]

The configuration of the elevator door device 1 according to this embodiment is as has been described above. Next, the opening and closing
10 operation of the doors 2 in the elevator door device 1 according to this embodiment is described.

[0044]

First, when the doors 2 are located at the closing position, one end portion of the first door 2a and the other end portion of the second door 2b
15 overlap each other. Further, when the doors 2 are located at the closing position, the laterally restricting portion 611 of each anti-fall unit 61 is arranged between the roller 42 and the plate portion 31, and the upward restricting portion 612 of each anti-fall unit 61 is arranged above the roller 42.

[0045]

Furthermore, when the doors 2 are located at the closing position, the
20 latched portion 813 is latched by the latching portion 812, and the bias mechanism 82 biases the second door 2b toward the aforementioned other side. Thus, the doors 2 are retained at the closing position. From such a state, the elevator car moving up and down through the shaft X1 is moved to face the
25 doors 2, and the first door 2a is engaged with a car door provided on the elevator car, thereby releasing the state where the latched portion 813 is latched by the latching portion 812.

[0046]

Thereafter, the car door moves toward the one side, thereby causing the
30 first door 2a to move toward the one side together with the car door.

Accompanying this, the pulleys 52 and the base portion 51 are moved via the

belt 53 fixed to the plate portion 31 by the fixing portion 55, and thus the second door 2b fixed to the base portion 51 is also moved toward the one side in synchronization with the first door 2a. When the doors 2 have been situated at the opening position, the doors 2 entirely overlap each other in their facing
5 direction.

[0047]

Since the pulleys 52 each function as a movable pulley, the first door 2a moves at a speed twice the moving speed of the second door 2b. That is, the first door 2a moves a distance twice the moving distance of the second door 2b.
10 Accordingly, the first door 2a is called a "fast door" whereas the second door 2b is called a "slow door" in general.

[0048]

Thereafter, when the car door is moved toward the other side, the first door 2a engaged with the car door is moved toward the other side together with
15 the car door, and the second door 2b is moved toward the other side in synchronization with the first door 2a via the synchronization mechanism 5. When the doors 2 have arrived at the closing position and the car door releases the engagement with the first door 2a, the latched portion 813 is latched by the latching portion 812.

20 [0049]

Next, the action to prevent the doors 2 from falling in the elevator door device 1 according to this embodiment is described. Specifically, the action to prevent the doors 2 from falling in the case where a rigid body Y collides with the first door 2a from the outer side (platform X2 side) toward the inner side
25 (shaft X1 side) is described.

[0050]

First, prior to describing the action of the elevator door device 1 according to this embodiment, the action of an elevator device according to a comparative example that does not include the anti-fall device 6 is described
30 with reference to FIG. 6 to FIG. 9. In FIG. 6 to FIG. 9, the parts denoted by the same reference numerals as in FIG. 1 to FIG. 5 represent the same

components or constituents as in the elevator door device 1 according to the above-mentioned embodiment.

[0051]

As shown in FIG. 6, the rigid body Y collides, from the outside toward
5 the inside, with an intermediate portion in the up-down direction of the first door 2a. Then, the first door 2a deforms in such a manner that the outer surface of the first door 2a is recessed, as shown in FIG. 7, since the roller 42 of the first support mechanism 4a is in abutting contact with the rail 41 and the guided portion 22 of the first door 2a is in abutting contact with the first
10 guiding portion 71.

[0052]

With that, the roller 42 moves with its lower portion that is in abutting contact with the rail 41 as a point of support. Specifically, the roller 42 moves with its upper portion being tilted outward. Then, when the first door 2a
15 further deforms in such a manner that the outer surface of the first door 2a is recessed more, as shown in FIG. 8, the guided portion 22 is forced out of the first guiding portion 71.

[0053]

Thereafter, the first door 2a is entirely forced inwardly. Thus, the
20 roller 42 is detached from the rail 41, as shown in FIG. 9. In this way, the first door 2a falls. It should be noted that, although the first door 2a partially recovers from elastic deformation by separating from the rigid body Y, the first door 2a is still plastically deformed.

[0054]

25 Next, the action of the elevator door device 1 according to this embodiment is described. First, the rigid body Y collides, from the outside toward the inside, with an intermediate portion in the up-down direction of the first door 2a, as shown in FIG. 10. Then, the first door 2a deforms in such a manner that the outer surface of the first door 2a is recessed, as shown in FIG.
30 11, since the roller 42 of the first support mechanism 4a is in abutting contact with the rail 41 and the guided portion 22 of the first door 2a is in abutting

contact with the first guiding portion 71.

[0055]

With that, the roller 42 moves with its lower portion that is in abutting contact with the rail 41 as a point of support. Specifically, the roller 42 moves
5 with its upper portion being tilted outward. Then, an upper portion on the outer side of the roller 42 comes into abutting contact with the laterally restricting portion 611 of the first anti-fall unit 61a (the abutting point is shown as point A in FIG. 11), which makes it possible to restrict the upper portion of the roller 42 from being tilted outwardly at or beyond a specific angle.

10 [0056]

Thereafter, the roller 42 jumps up so as to separate upward from the rail 41, and therefore an upper portion on the inner side of the roller 42 comes into abutting contact with the upward restricting portion 612 of the first anti-fall unit 61a, as shown in FIG. 12 (the abutting point is shown as point B
15 in FIG. 12), which makes it possible to restrict the roller 42 from jumping up to or beyond a specific height. At this time, the first door 2a recovers from elastic deformation.

[0057]

Then, when the roller 42 returns back onto the rail 41 by the self-weight
20 of the first door 2a, etc., the first door 2a is supported thereon in a plastically deformed state. Specifically, the roller 42 is mounted on the rail 41, and the guided portion 22 is inserted into the first guiding portion 71. In this way, the first anti-fall unit 61a prevents the first door 2a from falling.

[0058]

25 As can be seen from the above, according to the elevator door device 1 of this embodiment, since the laterally restricting portion 611 of each anti-fall unit 61 is arranged between the roller 42 and the plate portion 31 when the doors 2 are located at the closing position, the laterally restricting portion 611 comes into abutting contact with a lateral side of the roller 42 when the roller
30 42 laterally moves. Therefore, it is possible to restrict the roller 42 from moving laterally and thus to prevent the doors 2 from falling.

[0059]

Further, in the elevator door device 1 according to this embodiment, the laterally restricting portion 611 is arranged so as to overlap or cover an upper portion of the roller 42 in a direction in which the roller 42 and the plate portion 5 31 face each other. Accordingly, when the roller laterally moves with its lower portion (portion in abutting contact with the rail) as a point of support, the laterally restricting portion comes into abutting contact with an upper portion of a lateral side of the roller. Therefore, it can be ensured to restrict the roller from moving laterally.

10 [0060]

Further, in the elevator door device 1 according to this embodiment, the upward restricting portion 612 of the anti-fall unit 61 is arranged above the roller 42 when the doors 2 are located at the closing position. This allows the upward restricting portion 612 to be in abutting contact with an upper portion 15 of the roller 42 when the roller 42 is about to separate upward from the rail 41. Therefore, it is possible to restrict the roller 42 from separating upward from the rail 41.

[0061]

It should be noted that the elevator door device and the elevator door 20 anti-fall device according to the present invention are not limited to the above-mentioned embodiments. It is needless to say that various modifications can be made without departing from the gist of the present invention. Further, it is of course possible to arbitrarily select the configuration, method, etc., of the various modifications mentioned below and 25 apply them to the configuration, method, etc., of the above-mentioned embodiments.

[0062]

For example, the elevator door device 1 according to the above-mentioned embodiments described herein has a configuration in which 30 the pair of doors 2 open and close the entrance X3 by moving in the same direction, which is not restrictive. Specifically, as shown in FIG. 14, it is also

possible to employ an elevator door device 10 with a configuration in which the pair of doors 2 open and close the entrance by moving in the opposite directions. Such an elevator door device 10 is generally called a "center opening" type.

[0063]

5 In the elevator door device 10 shown in FIG. 14, the pair of doors 2 move in synchronization with each other by the synchronization mechanism (not shown in FIG. 14) coupling the connectors 43 that connect the doors 2 and the rollers 42 configured to roll on the rail 41 to each other. The pair of doors 2 open the entrance by separating from each other, whereas the pair of doors 2
10 close the entrance by coming close to each other.

[0064]

 Further, an elevator door anti-fall device 60 shown in FIG. 14 includes the pair of anti-fall units 61 provided side by side corresponding to the pair of rollers 42 provided on each door 2. As shown in FIG. 14, each anti-fall unit 61
15 includes the laterally restricting portion 611 arranged between the corresponding roller 42 and the plate portion 31 of the frame 3 so as to restrict the roller 42 from moving laterally, and an upward restricting portion arranged above the roller 42 so as to restrict the roller 42 from separating upward from the rail 41, when the doors 2 are located at the closing position.

20 [0065]

 Further, the elevator device 1 according to the above-mentioned embodiments described herein has a configuration in which the connectors 43 are arranged inwardly of the rail 41, which is not restrictive. For example, the connectors may be arranged outwardly of the rail 41 and connect the rollers 42
25 and the doors 2.

[0066]

 Further, the elevator device 1 according to the above-mentioned embodiments described herein has a configuration in which a pair of rollers 42 are provided for each door 2, which is not restrictive. For example, one roller,
30 or three or more rollers may be provided for each door.

[0067]

Further, the elevator device 1 according to the above-mentioned embodiments described herein has a configuration provided with a pair of doors 2, which is not restrictive. For example, one door, or three or more doors may be provided in the elevator device.

5 [0068]

Further, the elevator device 1 and the elevator door anti-fall device 6 according to the above-mentioned embodiments described herein have a configuration in which the number of the anti-fall units 61 and the number of the rollers 42 to be provided are the same, which is not restrictive. For
10 example, the anti-fall unit may be provided only for some rollers 42. Further, the anti-fall units 610 each may be formed into an elongated shape and provided extending over the pair of rollers 42, as shown in FIG. 15.

[0069]

An elevator door anti-fall device 600 shown in FIG. 15 includes one
15 anti-fall unit 610 for each pair of rollers 42 provided in the corresponding door 2. As shown in FIG. 15, each anti-fall unit 610 includes the laterally restricting portion 613 arranged between the corresponding roller 42 and the plate portion 31 of the frame 3 so as to restrict the roller 42 from moving laterally, and an upward restricting portion 614 arranged above the roller 42 so as to restrict the
20 roller 42 from separating upward from the rail 41, when the doors 2 are located at the closing position.

[0070]

Further, the elevator device 1 and the elevator door anti-fall device 6 according to the above-mentioned embodiments described herein have a
25 configuration in which the laterally restricting portion 611 is arranged between the corresponding roller 42 and the plate portion 31 when the rollers 42 are located at the closing position, which is not restrictive. For example, as shown in FIG. 15, the laterally restricting portion 613 may be formed into an elongated shape along the moving direction of the corresponding door 2 so as to
30 be arranged between the roller 42 and the plate portion 31 also when being located between the opening position and the closing position (that is, during

the shift between the opening position and the closing position).

[0071]

Further, the elevator device 1 and the elevator door anti-fall device 6 according to the above-mentioned embodiments described herein have a configuration in which the upward restricting portion 612 is arranged above the corresponding roller 42 when the rollers 42 are located at the closing position, which is not restrictive. For example, as shown in FIG. 15, the upward restricting portion 614 may be formed into an elongated shape along the moving direction of the corresponding door 2 so as to be arranged above the roller 42 also when being located between the opening position and the closing position (that is, during the shift between the opening position and the closing position).

[0072]

Further, the elevator device 1 and the elevator door anti-fall device 6 according to the above-mentioned embodiments described herein have a configuration in which the laterally restricting portion 611 and the upward restricting portion 612 are integrally formed, that is, formed as one member (anti-fall unit 61), which is not restrictive. For example, the laterally restricting portion and the upward restricting portion each may be a separate member.

[0073]

Further, the elevator device 1 and the elevator door anti-fall device 6 according to the above-mentioned embodiments described herein have a configuration in which the laterally restricting portion 611 is fixed to the plate portion 31 or the rail 41, and the corresponding roller 42 is displaced relative to the laterally restricting portion 611 with the shift of the door 2, which is not restrictive. For example, the laterally restricting portion may be fixed to the roller 42.

REFERENCE SIGNS LIST

[0074]

	1, 10: Elevator Door Device
	2: Elevator Door (Door, Platform Door)
5	3: Frame
	4: Support Mechanism
	5: Synchronization Mechanism
	6, 60, 600: Elevator Door Anti-Fall Device
	7: Guiding Mechanism
10	8: Retaining Mechanism
	31: Plate Portion
	41: Rail
	42: Roller
	43: Connector
15	61, 610: Anti-Fall Unit
	611, 613: Laterally Restricting Portion
	612, 614: Upward Restricting Portion
	X: Shaft Structure
	X1: Shaft
20	X2: Platform
	X3: Entrance
	X4: Inner Wall

CLAIMS

- 1 An elevator door anti-fall device, provided in an elevator door device
including a plate portion provided along an inner wall of a shaft structure, a
5 rail fixed to the plate portion and provided along an inner surface of the plate
portion, a roller configured to roll on the rail, an auxiliary roller being in
abutting contact with a lower portion of the rail, and an elevator door
configured to open and close by being connected to the roller and the auxiliary
roller, for preventing the elevator door from falling,
10 the elevator door anti-fall device comprising:
a laterally restricting portion arranged between the roller and the plate
portion so as to restrict the roller from moving in a direction orthogonal to the
direction in which the rail extends at least when the elevator door is closed, the
laterally restricting portion being fixed to any one of the plate portion and the
15 rail.
- 2 The elevator door anti-fall device according to claim 1, wherein
the laterally restricting portion is arranged so as to overlap or cover at
least an upper portion of the roller in a direction in which the roller and the
20 plate portion face each other.
- 3 The elevator door anti-fall device according to claim 1 or 2, comprising:
an upward restricting portion arranged above the roller so as to restrict
the roller from separating upward from the rail at least when the elevator door
25 is closed, the upward restricting portion being fixed to any one of the laterally
restricting portion and the plate portion.
- 4 The elevator door anti-fall device according to claim 1 or 2, wherein
a plurality of laterally restricting portions as set forth are provided side
30 by side corresponding to a plurality of rollers provided for one elevator door.

- 5 An elevator door device comprising:
 - a plate portion provided along an inner wall of a shaft structure;
 - a rail provided along an inner surface of the plate portion;
 - a roller configured to roll on the rail;
- 5 an elevator door configured to open and close by being connected to the roller; and
- the elevator door anti-fall device according to claim 1 or 2.