

DESCRIPTION

SUPPORT STRUCTURE FOR ESCALATOR AND LOWER SUPPORT MEMBER USED FOR THE SAME

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of and priority to Japanese Patent Application No. 2022-111173 filed on July 11, 2022, the entire contents of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

An embodiment of the present invention relates to a support structure for an escalator and a lower support member used for the same.

2. Description of Related Art

An earthquake-resistant structure for an escalator is defined by the Building Standards Act, and a structure for attaching a truss to a building also requires a predetermined structure. Due to recent revisions of the Act, a support structure for supporting a lower portion of the truss has become required to stop swinging of the truss in a right-left direction when the building shakes in the event of an earthquake.

SUMMARY OF THE INVENTION

However, there has been a problem that a lower accommodation space provided by digging into a lower floor of the building to accommodate the lower portion of the truss is a small space and it is thus extremely difficult for a worker to weld a support member and the truss in this small space while adjusting the support member that prevents swinging of the truss.

In view of the above, an embodiment of the invention has a purpose of providing a support structure for an escalator and a lower support member used therefor, the support structure allowing easy attachment thereof and preventing swinging of an escalator in a right-left direction when a building shakes in the event of an earthquake.

An embodiment of the invention is a support structure for an escalator, and has: the escalator; and a lower support member for placing a lower portion of the escalator on a floor surface of a building. The escalator has: a truss that extends in a front-rear direction; and a right and left pair of legs that is provided to a bottom of a lower horizontal portion in a lower portion of the truss and is placed on the floor surface. The lower support member has: a right and left pair of anti-swing members that

extends along the front-rear direction between the placed right and left pair of the legs and each include a vertical plate vertically provided in an up-down direction on the floor surface; a plate that is attached to an outer surface in a right-left direction of each of the vertical plates along the front-rear direction; one or plural plate-shaped shims that are held between the plate and the vertical plate; and plural bolts that integrally fix the vertical plate, the shim, and the plate. Inner portions in the right-left direction of the right and left pair of the legs respectively abut outer surfaces in the right-left direction of the right and left pair of the plates.

In addition, an embodiment of the invention is a lower support member that has: a right and left pair of anti-swing members that is fixed to a floor surface, on which a right and left pair of legs in a lower portion of a truss extending in a front-rear direction of an escalator is placed, that extends along the front-rear direction, and includes vertical plates provided in an up-down direction; a plate that abuts an inner side in a right-left direction of each of the right and left pair of the legs and that is attached to an outer surface in the right-left direction of each of the vertical plates along the front-rear direction; one or plural plate-shaped shims that are held between the plate and the vertical plate; and plural bolts that integrally

fix the vertical plate, the shim, and the plate.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side explanatory view in which an escalator in an embodiment of the invention is seen from a left side;

FIG. 2 is a perspective view of a state where a lower horizontal portion of a truss is placed in a lower accommodation space; and

FIG. 3 is a perspective view of a left leg and a left lower support member;

FIG. 4 is a perspective view of a state where an anti-swing member, a shim, and a plate are attached to a base;

FIG. 5 is an exploded perspective view of the anti-swing member, the shim, and the plate;

FIG. 6 is a vertical cross-sectional view in which the lower support member and a right and left pair of legs are seen from behind; and

FIG. 7 is a vertical cross-sectional view in which the left leg is seen from the left side.

DESCRIPTION OF EMBODIMENTS

A description will hereinafter be made on a support structure for attaching an escalator 10 in an embodiment of the invention to a building 1 and a lower support member 32 used therefor with reference to FIGS. 1 to 7.

(1) Escalator 10

A description will be made on an overall structure of the escalator 10 that is attached to the building 1 with reference to FIGS. 1 and 2. In order to facilitate understanding of the following description, in regard to the escalator 10, a direction from a lower floor to an upper floor is set as a front-rear direction in a state of looking up the upper floor from the lower floor. FIG. 1 is a simplified side view in which the escalator 10 is seen from a left side and members on a right side are not illustrated.

As illustrated in FIG. 1, a truss 12 as a framework of the escalator 10 is configured by combining plural metal frame materials (see FIG. 2), and includes a rectangular-parallelepiped upper horizontal portion 18, a rectangular-parallelepiped lower horizontal portion 20, and a sloping portion 22 provided between the upper horizontal portion 18 and the lower horizontal portion 20. A support angle 14 is provided to an upper portion of a front end of the upper horizontal portion 18 of the truss 12, and a support angle 16 is provided to an upper portion of a rear end of the lower horizontal portion 20. With the support angle 14 and the support angle 16, the truss 12 is provided across an upper floor 2 on the upper floor of the building 1 and a lower floor 3 on the lower floor thereof along the front-rear direction. Inside the sloping portion 22, plural

endlessly-coupled steps 24 move in the front-rear direction. A right and left pair of balustrades 26, 26 is vertically provided on top of both right and left ends of the upper horizontal portion 18, the sloping portion 22, and the lower horizontal portion 20, respectively. On top of the balustrade 26, a handrail belt 28 synchronously moves with the steps 24.

Also, as illustrated in FIG. 1, an upper accommodation space 4 for accommodating the upper horizontal portion 18 of the truss 12 is dug into the upper floor 2 on the upper floor side of the building 1. An upper recessed portion 6 for placing the support angle 14 is formed on the upper floor 2 on top of a front surface of this upper accommodation space 4. In order to stably accommodating the upper horizontal portion 18 of the truss 12 in the upper accommodation space 4, an upper support member 30 is installed on a horizontal upper bottom surface 8 of the upper accommodation space 4, and the upper horizontal portion 18 of the truss 12 is placed thereon.

As further illustrated in FIG. 1, a lower accommodation space 5 for accommodating the lower horizontal portion 20 and a lower portion of the sloping portion 22 of the truss 12 is dug into the lower floor 3 on the lower floor side of the building 1. A lower recessed portion 7 for placing the support angle 16 is formed on the lower

floor 3 on top of a rear surface of this lower accommodation space 5. As illustrated in FIGS. 1 and 2, in order to stably accommodate the lower portion of the sloping portion 22 and the lower horizontal portion 20 of the truss 12 in the lower accommodation space 5, the lower support member 32 is provided on a horizontal lower bottom surface 9 of the lower accommodation space 5, and the lower horizontal portion 20 is placed thereon.

(2) Support Structure for Escalator 10

The support structure for the escalator in this embodiment is provided to place the lower horizontal portion 20 of the truss 12 of the escalator 10 on the lower bottom surface 9 of the lower accommodation space 5, and has: the escalator 10 described above; a right and left pair of legs 56, 56 provided to the truss 12 of the escalator 10; and the lower support member 32 provided on the lower bottom surface 9.

First, as illustrated in FIG. 2, a right and left pair of bases 34, 34 is projected in a rear portion of the lower bottom surface 9 of the lower accommodation space 5. The right and left pair of the bases 34, 34 each have an upper horizontal surface, each have a rectangular shape in a plan view, and are formed on the right and left sides with a certain clearance being provided therebetween.

(2-1) Right and Left Pair of Legs 56, 56

A description will be made on the right and left pair of the legs 56, 56. As illustrated in FIGS. 2, 3, and 6, each of the right and left pair of the legs 56, 56 is attached to a bottom of the lower horizontal portion 20 of the truss 12.

The left leg 56 has: a horizontal leg plate 66 that is attached to a left portion of a bottom surface of the lower horizontal portion 20 of the truss 12 via an unillustrated bolt; an upper leg plate 64 that is provided to a bottom of the horizontal leg plate 66 in a right-left direction; and a right and left pair of vertical leg plates 68, 68 that is respectively projected downward from both right and left ends of the upper leg plate 64. A right and left pair of projections 70, 70 is projected in the front-rear direction from outer sides of the right and left pair of the vertical leg plates 68, 68, respectively.

As illustrated in FIG. 7, plural rollers 58 are aligned horizontally in a line between the right and left pair of the vertical leg plates 68, 68, and a rotational shaft 60 of each of the rollers 58 extends in the right-left direction. This rotational shaft 60 is fixed between the right and left pair of the vertical leg plates 68, 68 in a freely rotatable manner via a bearing, which is not illustrated.

The right leg 56 is attached to a right portion of the

bottom surface of the lower horizontal portion 20 of the truss 12, and has a bilaterally symmetrical structure to the left leg 56.

As illustrated in FIGS. 2 and 6, the right and left pair of the legs 56, 56 provided to the lower horizontal portion 20 of the truss 12 are respectively placed on the right and left pair of the bases 34, 34, and the plural rollers 58 contact respective one of the bases 34, 34. When the building 1 shakes in the front-rear direction due to an earthquake, the entire truss 12 moves on the bases 34, 34 in the front-rear direction due to rotation of these rollers 58. The structure of the right and left pair of the legs 56, 56 described above is merely illustrative, and any other structure can be adopted as long as the entire truss 12 can move on the bases 34, 34 in the front-rear direction.

(2-2) Lower Support Member 32

Next, a description will be made on the lower support member 32. The lower support member 32 has a right and left pair of anti-swing members 36, 36, plates 42, and shims 44.

As illustrated in FIGS. 3 and 6, the left anti-swing member 36 is fixed to a right end portion of the left base 34 along the front-rear direction. The left anti-swing member 36 is an L-angle and is long in the front-rear direction. This anti-swing member 36 includes: a rectangular horizontal plate 38 that is fixed to the base

34; and a rectangular vertical plate 40 that is provided upward in an up-down direction from a left end portion of the horizontal plate 38. In order to maintain an orthogonal state between the horizontal plate 38 and the vertical plate 40, substantially right triangular ribs 41 are provided at equally-spaced intervals between the horizontal plate 38 and the vertical plate 40.

As illustrated in FIGS. 4 to 6, the plate 42 with a predetermined thickness (for example, 5 mm) is arranged on the left side of the vertical plate 40 of the left anti-swing member 36. The plate 42 is rectangular in a side view, a dimension thereof in the front-rear direction is the same as a dimension of the vertical plate 40 in the front-rear direction, and a dimension thereof in a height direction (the up-down direction) is shorter than a dimension of the vertical plate 40 in the height direction.

As illustrated in FIGS. 4 to 6, the shim 44 is arranged between the vertical plate 40 of the left anti-swing member 36 and the plate 42. The shim 44 is rectangular in the side view and has a thickness of 2 mm to 3 mm, for example. A rectangular projection piece 46 is projected from an upper portion of a rear end of this shim 44. A dimension of a rectangular portion of the shim 44 in the front-rear direction excluding the projection piece 46 is the same as those of the vertical plate 40 and the plate 42, and only

the projection piece 46 is projected rearward from the vertical plate 40 and the plate 42. A dimension of the shim 44 in the height direction (the up-down direction) is smaller than the dimension of the vertical plate 40 in the height direction.

As illustrated in FIG. 5, the vertical plate 40 is provided with plural screw holes 48. The plate 42 is also provided with screw holes 50 at positions corresponding to the screw holes 48. Meanwhile, in the shim 44, vertically long holes 52 are opened at positions corresponding to the screw holes 48 and the screw holes 50, and a lower end of each of these long holes 52 is opened to a lower side of the shim 44.

As illustrated in FIGS. 2 and 6, the right anti-swing member 36 is arranged on the right base 34, and the shim 44 and the plate 42 are arranged on the right side of the vertical plate 40 of this anti-swing member 36. A structure of the anti-swing member 36, the shim 44, and the plate 42 on the right side is bilaterally symmetrical to the structure of the anti-swing member 36, the shim 44, and the plate 42 on the left side.

As illustrated in FIG. 6, even when the building 1 shakes in the right-left direction due to the earthquake, swinging of the right and left pair of the legs 56, 56, which are attached to the lower horizontal portion 20 of

the truss 12, in the right-left direction is blocked between the plates 42, 42, which are respectively attached to the right and left pair of the anti-swing members 36, 36. As a result, the truss 12 does not move in the right-left direction. In other words, the right projection 70 of the left leg 56 abuts a left surface of the left plate 42, and the left projection 70 of the right leg 56 abuts a right surface of the right plate 42. Thus, the right and left pair of the legs 56, 56 do not swing in the right-left direction.

(3) Attachment Method of Lower Support Member 32

Next, a description will be made on an attachment method of the lower support member 32 by a worker.

First, the worker fixes the horizontal plate 38 of the left anti-swing member 36 to the right end portion of the left base 34 in the front-rear direction by a bolt or welding. This work can be performed in the large lower accommodation space 5 in which the truss 12 is not accommodated. There is no need to finely position the left anti-swing member 36 for fixing. This is because fine adjustment to eliminate a gap and completely prevent swinging is done later with the plate 42 and the shim 44. Similarly, the worker also fixes the right anti-swing member 36 to a left end portion of the right base 34 by a bolt or welding. Even in the case of the existing escalator 10, there is no need to finely

position the right and left pair of the anti-swing members 36, 36 to be fixed to the bases 34, 34. Thus, the worker can easily perform the work even in the small lower accommodation space 5 in which the truss 12 is accommodated.

Next, the plates 42, 42 are respectively attached to the right and left pair of the anti-swing members 36, 36 by bolts 54.

Next, the lower horizontal portion 20 of the truss 12 is accommodated in the lower accommodation space 5, and the right and left pair of the legs 56, 56 are respectively placed on the right and left pair of the bases 34, 34. At this time, the legs 56, 56 of the truss 12 are placed such that the front-rear direction thereof matches the front-rear direction of the anti-swing members 36, 36.

Next, in order to prevent the right and left pair of the legs 56, 56 from swinging in the right-left direction between the right and left pair of the anti-swing members 36, 36, the shim 44 is placed between the plate 42 and the vertical plate 40 of the anti-swing member 36 such that the plate 42 abuts the projection 70 of the leg 56 for each of the right and left pair of the legs 56, 56. The number of this shim 44 is not limited to one, and the plural shims 44 may be placed to prevent swinging in the right-left direction. In other words, in the case where there is a large clearance between the leg 56 and the plate 42, the

number of the shim 44 is increased such that the leg 56 and the plate 42 completely abut each other. On the other hand, in the case where there is no clearance therebetween, the shim 44 may not be placed. To place this shim 44, it is only needed to arrange the long hole 52 of the shim 44 at a position of the bolt 54 between the plate 42 and the vertical plate 40 of the anti-swing member 36 and to insert the shim 44 while holding the projection piece 46 by hand.

Lastly, the worker tightens the bolt 54 to fix the plate 42, the shim 44, and the anti-swing member 36. Here, a tip of the bolt 54 and a nut are projected from the plate 42 toward the leg 56. However, since the plate 42 abuts the projection 70 that is projected from the leg 56, the tip of this bolt 54 and the nut do not directly abut the leg 56.

(4) Effects

According to this embodiment, the right and left pair of the legs 56, 56, which are attached to the lower horizontal portion 20 of the truss 12, are prevented from swinging in the right-left direction by the plates 42, 42, which are respectively attached to the right and left pair of the anti-swing members 36, 36. As a result, the truss 12 does not move in the right-left direction even when the building 1 shakes in the right-left direction due to the earthquake.

Meanwhile, in the case where the building 1 shakes in the front-rear direction due to the earthquake, the truss 12 can move by the rollers 58.

In addition, for the adjustment to prevent swinging of the right and left pair of the legs 56, 56 in the right-left direction by the right and left pair of the anti-swing members 36, 36, it is only needed to insert the shim 44 between the plate 42 and the vertical plate 40 according to a size of the clearance and to fix the shim 44, the plate 42, and the vertical plate 40 by the bolt 54, for each of the right and left pair of the legs 56, 56. Thus, the work can easily be performed. In particular, the shim 44, the plate 42, and the vertical plate 40 can easily be attached by placing the long hole 52 of the shim 44 in a manner to match the position of the bolt 54 and inserting the shim 44. At this time, the worker only needs to hold the projection piece 46 by hand for insertion. Thus, the worker can perform the work with one hand. In addition, since the shim 44, the plate 42, and the vertical plate 40 can be fixed by tightening the bolt 54, there is no need for welding.

(5) Modified Examples

In the above embodiment, the projection piece 46 is projected from the upper portion of the rear end portion of the shim 44. However, instead thereof, the projection piece 46 may be projected from an upper portion of a front end

portion of the shim 44. Alternatively, the projection piece 46 may be provided to both of the front end portion and the rear end portion.

The above description has been made on the embodiment of the invention. However, this embodiment is merely provided as the example and thus is not intended to limit the scope of the invention. These novel embodiments can be implemented in any of various other aspects, and various types of elimination, replacement, and changes can be made thereto within the scope that does not depart from the gist of the invention. These embodiments and the modifications thereof are included in the scope and the gist of the invention and are also included in the invention described in the claims and the equivalent scope thereof.

CLAIMS

1. A support structure for an escalator, the support structure comprising: the escalator; and a lower support member for placing a lower portion of the escalator on a floor surface of a building, wherein

the escalator has:

a truss that extends in a front-rear direction; and

a right and left pair of legs that is provided to bottom of a lower horizontal portion in a lower portion of the truss and is placed on the floor surface,

the lower support member has:

a right and left pair of anti-swing members that extends along the front-rear direction between the placed right and left pair of the legs and each include a vertical plate vertically provided in an up-down direction on the floor surface;

a plate that is attached to an outer surface in a right-left direction of each of the vertical plates along the front-rear direction; and

one or plural plate-shaped shims that are held between the plate and the vertical plate;

plural bolts that integrally fix the vertical plate, the shim, and the plate, and

inner portions in the right-left direction of the

right and left pair of the legs respectively abut outer surfaces in the right-left direction of the right and left pair of the plates.

2. The support structure for an escalator according to claim 1, wherein

the shim has a long hole through which the bolt passes, and

the long hole extends downward, and a lower end of the long hole is opened to a lower side of the shim.

3. The support structure for an escalator according to claim 1, wherein

a projection piece that is projected between the anti-swing member and the plate is provided to a front portion or a rear portion of the shim.

4. The support structure for an escalator according to claim 1, wherein

the leg is provided with plural rollers that are aligned horizontally, and

the leg can move on the floor surface in the front-rear direction by the plural rollers.

5. The support structure for an escalator according

to claim 1, wherein

the floor surface, on which the right and left pair of the legs are placed, is a base that is projected from a horizontal lower bottom surface of a lower accommodation space formed in a lower floor of the building.

6. A lower support member comprising:

a right and left pair of anti-swing members that is fixed to a floor surface, on which a right and left pair of legs in a lower portion of a truss extending in a front-rear direction of an escalator is placed, that extends along the front-rear direction, and includes vertical plates vertically provided in an up-down direction;

a plate that abuts an inner side in a right-left direction of each of the right and left pair of the legs and that is attached to an outer surface in the right-left direction of each of the vertical plates along the front-rear direction;

one or plural plate-shaped shims that are held between the plate and the vertical plate; and

plural bolts that integrally fix the vertical plate, the shim, and the plate.