

Vibration Damping Device for Elevator Car and Elevator

Technical Field

The invention relates to a vibration damping device for an elevator car and an elevator equipped with the vibration damping device, and especially to a vibration damping device for reducing the vibration transmitted from the bottom of the elevator car to the car.

Background

The elevator car moves up and down in the hoisting path via the ropes wound on the hoist. Elevators will vibrate during operation, and the types of vibration can be divided into vertical vibration and horizontal vibration. The vibration in the vertical direction is usually caused by elevator traction machines, traction ropes and guide shoes, and the vibration in the horizontal direction is usually caused by the guiding system. For example, abnormalities in the guide rails, loosening of the brackets, or defects in the used guide wheels in the guiding system will directly cause the elevator car to vibrate in the horizontal direction. Especially in the presence of eccentric load phenomenon, unbalanced force will appear in the car, which is more likely to cause deformation of the guide rail, resulting in the vibration in the horizontal direction.

Conventionally, the bottom of the elevator car is made of vibration damping rubber, arranged above the car frame, and vibration is reduced by the damping rubber. However, if a relatively large vibration occurs during operation of the elevator, the vibration cannot be fully absorbed only by setting the vibration damping rubber as in the past. In particular, as buildings become taller, the elevator also becomes faster, and if the elevator runs at high speed, the lateral vibration will become more pronounced and passengers will feel more uncomfortable. Therefore, there is an urgent need for a vibration damping device that can fully absorb the vibration of the elevator car.

The applicant has considered simply thickening the thickness of the vibration damping rubbers. However, the increase in the thickness of the rubber will cause the rubbers to become soft. If the rubber becomes soft, it will easily shake in the horizontal direction and the vibration in the horizontal direction will be more obvious. In addition, if

the rubber becomes soft, the vibration in the vertical direction may cause the rubbers to be crushed.

Contents of the Invention

One object of the invention is to provide a vibration damping device that can fully absorb the vibration of the elevator car.

One embodiment of the invention provides a vibration damping device for an elevator car, the elevator having a car and a car frame with a lower beam on which the car is placed, the vibration damping device being arranged between the bottom of the car and the lower beam of the car frame to absorb vibration transmitted to the car, wherein the vibration damping device includes two layers of rubber monomers overlapped one above the other.

According to the embodiment, in the vibration damping device for an elevator car, for each layer of the rubber monomer, an upper metal plate and a lower metal plate are provided in a manner of sandwiching the rubber monomer, the upper metal plate of the upper layer rubber monomer is joined to the bottom of the car in a manner of overlapping one above the other, the lower metal plate of the upper layer rubber monomer is joined to the upper metal plate of the lower layer rubber monomer in a manner of overlapping one above the other, and the lower metal plate of the lower layer rubber monomer is joined to the lower beam of the car frame in a manner of overlapping one above the other.

According to the vibration damping device for an elevator car of the embodiment, the upper metal plate of the upper layer rubber monomer has a first protruding part extending outward more than this rubber monomer, the lower metal plate of the upper layer rubber monomer has a second protruding part extending outward more than the first protruding part, the lower metal plate of the lower layer rubber monomer has a third protruding part extending outward more than this rubber monomer, and the upper metal plate of the lower layer rubber monomer has a fourth protruding part extending outward more than the third protruding part. The joining is to fasten the first protruding part and the bottom of the car, fasten the second protruding part and the fourth protruding part, and fasten the third protruding part and the lower beam of the car frame by means of bolts, respectively.

According to the vibration damping device for an elevator car of the embodiment, the

joining is to weld the upper metal plate of the upper layer rubber monomer to the bottom of the car, weld the lower metal plate of the upper layer rubber monomer to the upper metal plate of the lower layer rubber monomer, and weld the lower metal plate of the lower layer rubber monomer to the lower beam of the car frame.

According to the vibration damping device for an elevator car of the embodiment, there are two lower beams of the car frame arranged in parallel, and the vibration damping device is arranged separately for each of the lower beams.

According to the vibration damping device for an elevator car of the embodiment, the elastic coefficient of the rubber monomer ranges from 100 to 200 kg/mm, and the two-layer rubber monomers as an entirety have a coefficient of elasticity ranging from 50 to 100 kg/mm.

A further embodiment of the invention is to provide an elevator, which comprises the above vibration damping device for an elevator car.

Effects of the invention:

In the invention, the vibration damping device includes two layers of rubber monomers overlapped one above the other, and by configuring the vibration damping device to be of a double-layer structure of upper and lower independent layers, the elasticity coefficient is only half of that of the single layer structure. At the same time, the amount of deformation of the rubber is correspondingly reduced in the horizontal direction, which can avoid the excessive offset of the entire car in the horizontal direction caused by softening of the rubber, and can fully absorb the vibration of the elevator car, thereby achieving the purpose of damping vibration.

Description of the Drawings

Fig. 1 is a diagram showing the installation state of a vibration damping device of the elevator car of the invention.

Fig. 2 is a diagram showing an example of the two-layer structure of the vibration damping device of the elevator car of the invention.

List of reference signs:

car 1; car bottom 10
car frame 2; lower beam 20 of car frame;
rubber monomer 30a, 30b;
upper metal plate 31a and lower metal plate 32a for the upper layer rubber monomer 30a;
upper metal plate 33b and lower metal plate 34b for the lower layer rubber monomer 30b;
first protruding part 311a; second protruding part 321a; fourth protruding part 331b;
third protruding part 341b.

Embodiments

Hereinafter, embodiments of the present invention will be described with reference to the drawings.

Fig. 1 is a diagram showing the installation state of a vibration damping device of the elevator car of the invention. Fig. 2 is a diagram showing an example of the two-layer structure of the vibration damping device of the elevator car of the invention.

The elevator includes a car 1 for passengers to board; and a car frame 2 having a lower beam 20 on which the car 1 is placed, wherein the structures of the car and the car frame are the same as these in the prior art, so the detailed illustration and description are omitted here.

As shown in Fig. 1, there are two lower beams of the car frame arranged in parallel, and each lower beam is equipped with a vibration damping device 3 to absorb the vibration transmitted to the car. Specifically, the vibration damping device 3 is arranged between the bottom 10 of the car 1 and the lower beam 20 of the car frame 2, and includes two layers of rubber monomers 30a and 30b overlapped one above the other.

Next, the specific structures of the vibration damping devices of the elevator car of the present invention will be described in detail.

Hereinafter, when it is necessary to distinguish the upper and lower layers, the suffix *a* is added to the parts related to the upper layer rubber monomer 30a, and the suffix *b* is added to the parts related to the lower layer rubber monomer 30b.

As shown in Fig. 2, in the vibration damping device 3 of the elevator car of the

invention, for the upper layer rubber monomer 30a, an upper metal plate 31a and a lower metal plate 32a are provided in a manner of sandwiching this rubber monomer 30a, and likewise, for the lower layer rubber monomer 30b, an upper metal plate 33b and a lower metal plate 34b are provided in a manner of sandwiching this rubber monomer 30b.

Further, as shown in Fig. 2, in the vibration damping device 3, the upper metal plate 31a of the upper layer rubber monomer 30a has a first protruding part 311a extending outward more than the rubber monomer 30a, and the lower metal plate 32a of the upper layer rubber monomer 30a has a second protruding part 321a extending outward more than the first protruding part 311a. The lower metal plate 34b of the lower layer rubber monomer 30b has a third protruding part 341b extending outward more than this rubber monomer 30b, and the upper metal plate 33b of the lower layer rubber monomer 30b has a fourth protruding part 331b extending outward more than the third protruding part 341b. The first protruding part 311a and the bottom 10 of the car 1 are fastened by bolts, the second protruding part 321a and the fourth protruding part 331b are fastened by bolts, and the third protruding part 341b and the lower beam 20 of the car frame 2 are fastened by bolts.

Fig. 2 is only an example of the vibration damping device of the elevator car of the invention, where the fastening can be made without using the bolts, but the upper metal plate 31a of the upper layer rubber monomer 30a is welded to the bottom 10 of the car 1, the lower metal plate 32a of the upper layer rubber monomer 30a is welded to the upper metal plate 33b of the lower layer rubber monomer 30b, and the lower metal plate 34b of the lower layer rubber monomer 30b and the lower beam 20 of the car frame 2 are welded to each other.

That is, it is only required that the upper metal plate 31a of the upper layer rubber monomer 30a is joined to the bottom 10 of the car 1 in a manner of overlapping one above the other, the lower metal plate 32a of the upper layer rubber monomer 30a is joined to the upper metal plate 33b of the lower layer rubber monomer 30b in a manner of overlapping one above the other, and the lower metal plate 34b of the lower layer rubber monomer 30b is joined to the lower beam 20 of the car frame 2 in a manner of overlapping one above the other. The joining mode may be bolted connection or welding, wherein the welding may be full-surface welding or intermittent welding.

In the vibration damping device of the elevator car according to the invention, for example, the elastic coefficient of the rubber monomer ranges from 100 to 200 kg/mm, and the two-layer rubber monomers as an entirety have a coefficient of elasticity ranging from 50 to 100 kg/mm.

In the vibration damping device of the elevator car according to the invention, by configuring the vibration damping device to be of a double-layer structure of upper and lower independent layers, the elasticity coefficient is only half of that of the single layer structure. At the same time, the amount of deformation of the rubber is correspondingly reduced in the horizontal direction, which can avoid the excessive offset of the entire car in the horizontal direction caused by softening of the rubber, and can fully absorb the vibration of the elevator car. Thereby, the vibration damping device of the elevator car of the invention achieves the purpose of damping vibration.

The embodiment of the invention has been described above, but this embodiment is only given as an example and is not intended to limit the scope of the invention. New embodiments can be implemented in various other ways, and various omissions, replacements, and changes can be made without departing from the scope of the invention. These embodiments and their modifications are included in the scope and spirit of the invention, and are also included in the scope described in the claims and their equivalents.

CLAIMS

1. An elevator, comprising:

a car (1), and a car frame (2) with a lower beam (20) on which the car (1) is placed,
and

a vibration damping device (3), which absorbs vibration transmitted to the car (1)
and is arranged between a bottom (10) of the car (1) and the lower beam (20) of the car
frame (2),

wherein the vibration damping device (3) includes two layers of rubber monomers
(30a, 30b) overlapped one above the other,

in the vibration damping device, for each layer of the rubber monomer (30a, 30b),
an upper metal plate (31a, 33b) and a lower metal plate (32a, 4b) are provided in a
manner of sandwiching this rubber monomer,

the upper metal plate (31a) of the upper layer rubber monomer (30a) is joined to
the bottom (10) of the car (1) in a manner of overlapping one above the other,

the lower metal plate (32a) of the upper layer rubber monomer (30a) is joined to
the upper metal plate (33b) of the lower layer rubber monomer (30b) in a manner of
overlapping one above the other, and

the lower metal plate (34b) of the lower layer rubber monomer (30b) is joined to
the lower beam (20) of the car frame (2) in a manner of overlapping one above the other,

the upper metal plate (31a) of the upper layer rubber monomer (30a) has a first
protruding part (311a) extending outward more than this rubber monomer (30a),

the lower metal plate (32a) of the upper layer rubber monomer (30a) has a second
protruding part (321a) extending outward more than the first protruding part (311a),

the lower metal plate (34b) of the lower layer rubber monomer (30b) has a third
protruding part (341b) extending outward more than this rubber monomer (30b),

the upper metal plate (33b) of the lower layer rubber monomer (30b) has a fourth
protruding part (331b) extending outward more than the third protruding part (341b),
and

the joining is to fasten the first protruding part (311a) and the bottom (10) of the
car (1), fasten the second protruding part (321a) and the fourth protruding part (331b),

and fasten the third protruding part (341b) and the lower beam (20) of the car frame (2) by means of bolts, respectively.

2. The elevator according to claim 1, wherein,

there are two lower beams (20) of the car frame (2) arranged in parallel, and the vibration damping device (3) is arranged separately for each of the lower beams (20).

3. The elevator according to claim 1, wherein,

the elastic coefficient of the rubber monomer ranges from 100 to 200 kg/mm, and the two-layer rubber monomers as an entirety have a coefficient of elasticity ranging from 50 to 100 kg/mm.