

Lighting device for double-ceiling elevator car

Technical field

Embodiments of the present invention relate to a lighting device for an elevator, and in particular to a lighting device for an elevator having a double-ceiling car.

Background Art

Generally, a light box of a double-ceiling elevator car is thick, and has a thickness of about 170 mm. In order to make a height of a car wall of the double-ceiling elevator car and a height of a car wall of a single-ceiling elevator car consistent with each other and meet net height requirements of the car, in the double-ceiling elevator car, a car ceiling frame is generally placed above the car wall so that the car wall is fixed to the car ceiling via the car ceiling frame. In this case, the double-ceiling elevator car and the single-ceiling elevator car cannot common the car wall. On the other hand, without the car ceiling frame, the thick light box will occupy a large space in the car, which will reduce the net height of the car and present a passenger a tight feeling.

In addition, generally, an annular or tubular lamp in the light box is installed on a car ceiling panel at the top of the light box, and emits light to irradiate an underlying acrylic panel directly. To achieve a certain illumination effect, the light box is thick, which results in a relatively high brightness right below the lamp and a relatively low brightness elsewhere. This causes a uniform overall lighting effect and affects the appearance. Moreover, wirings are crimped with terminals, which increases work hours required. The size of the lamp is fixed and cannot be changed with a change of the car.

Summary of the invention

The present invention directs to the above aspects, and provides a lighting device suitable for a double-ceiling elevator car which has a thin light box and provides a uniform illumination effect.

A lighting device for a double-ceiling elevator car of Technical Solution 1 comprises: high-power LED light strips, which are mounted on a light strip holder so that irradiation light is emitted toward a side of a light box at a prescribed angle; a light box top panel, wherein the light strip holder on which the high-power LED light strips are mounted is fixed to the light box top panel, and, at a side of the light box top panel proximate to the high-power LED strips, the light box top panel is coated at its surface with a coating for reflecting the irradiation light; and an acrylic lighting panel having

a light transmissive property, wherein the acrylic lighting panel is positioned under the high-power LED light strips, opposed to the light box top plate.

In the lighting device for the double-ceiling elevator car of Technical Solution 1, the high-power LED light strips are comprised of a plurality of high-power LED lights which are provided with lenses and arranged in a certain direction, and the lens is configured so that the irradiation light emitted from each of the high-power LED lights has an exit angle in a vertical direction of greater than 15 degrees and less than 25 degrees and an exit angle in a left-right direction of greater than 45 degrees and less than 55 degrees.

In the lighting device for the double-ceiling elevator car of Technical Solution 1, the light strip holder is an L-shaped light strip holder, and the high-power LED light strips are mounted at two sides of the light strip holder.

In the lighting device for the double-ceiling elevator car of any one of Technical Solutions 1-3, a light box frame is further comprised and is positioned directly under the high-power LED light strips and in the same plane as the acrylic lighting panel, wherein the acrylic lighting panel comprises a plurality of acrylic lighting panels, and the light box frame is held at its two sides by the acrylic lighting panels in a direction intersecting the certain direction.

In the lighting device for the double-ceiling elevator car of Technical Solution 4, the high-power LED light strips are mounted directly above the light box frame, at a distance of greater than 20 mm and less than 50 mm from the light box frame.

In the lighting device for the double-ceiling elevator car of Technical Solution 4, the high-power LED light strips are mounted to the light box top panel so that the light box top panel is equally divided.

In the lighting device for the double-ceiling elevator car of Technical Solution 1, the coating is a white coating.

In the lighting device for the double-ceiling elevator car of Technical Solution 4, the light box frame has a width of greater than 50 mm and less than 100 mm.

In the lighting device for the double-ceiling elevator car of Technical Solution 3, the L-shaped light strip holder is replaced with a C-shaped or U-shaped light strip holder.

In the lighting device for the double-ceiling elevator car of Technical Solution 1, the acrylic lighting panel is replaced with a PVC panel or a light-transmitting cloth.

In the lighting device for the double-ceiling elevator car of Technical Solution 1, the high-power LED light strips are connected by a connector, and a power source is provided to adjust brightness of light.

Technical effect

According to the present invention, the light box has a reduced thickness, the net height requirements of the car can be met even if the car top frame is not used above the car wall, and a single-ceiling car and a double-ceiling elevator car can share a car wall. In addition, the lighting device of the invention provides a uniform illumination effect, a reduced weight, a reduced cost and a better aesthetic appearance.

Brief Description of the Drawings

FIG. 1 is a schematic view of a car of an elevator, comprising a lighting device for a double-ceiling elevator car according to a first embodiment.

FIG. 2 is a schematic cross-sectional view of the lighting device for the double-ceiling elevator car according to the first embodiment.

FIG. 3 is a bottom view of the lighting device for the double-ceiling elevator car according to the first embodiment, in which an acrylic lighting panel and a light box frame are viewed from below.

FIG. 4 is a schematic cross-sectional view of the lighting device for the double-ceiling elevator car according to the first embodiment, showing an exit angle of irradiation light emitted from a high-power LED lamp in a vertical direction.

FIG. 5 is a schematic perspective view of the lighting device for the double-ceiling elevator car according to the first embodiment, showing an exit angle of irradiation light emitted from the high-power LED lamp in a left-right direction.

Fig. 6 is a schematic perspective view of a lighting device for a double-ceiling elevator car with a connector, according to a modification of the first embodiment.

FIG. 7 is a schematic plan view of a lighting device for a double-ceiling elevator car according to a modification of the first embodiment, in which a mounting position of a power source is shown.

Reference list

1: car; 2: car body; 2a: car ceiling panel; 2b: floor; 2c: side wall; 3: lighting device; 4: high-power LED light strip; 5: light box top; 6: light strip holder; 7: light box frame; 8: light box wall; 9: acrylic lighting panel; 10: power supply; 11: connector

Detailed Description of Preferred Embodiments

Exemplary embodiments of the present invention will be disclosed hereinafter. Configurations of the embodiments described below and functions and results (effects) achieved by the configurations are taken as examples.

Further, a first embodiment and modifications of the first embodiment described below include the same constituent elements. Therefore, in the following, the same constituent elements are identified by the same reference signs, and the same description will be omitted.

<First embodiment>

As shown in FIG. 1, a car 1 of an elevator comprises, for example, a car body 2 and a lighting device 3 for a double-ceiling elevator car. The car 1 is configured to be movable in a hoistway of the elevator that extends in a vertical direction, i.e. a Z direction.

For example, the car body 2 is configured to have a box shape of a rectangular parallelepiped that is elongated in the Z direction. The car body 2 has a plurality of walls and, for example, is comprised of a car ceiling panel 2a, a plurality of side walls 2c and a floor 2b. Both the car ceiling panel 2a and the floor 2b extend in a direction orthogonal to the Z direction, and are spaced apart in the Z direction and provided in parallel with each other. The car ceiling panel 2a forms a ceiling of the car 2 for mounting the lighting device 3 of the car.

The lighting device 3 is a lighting device for the double-ceiling elevator car, which has an ultra-thin light box wall as compared with that of a light box for a conventional double-ceiling elevator car. With a mounting structure peculiar to the present embodiment, the overall light box can have a thickness H less than 50 mm.

FIG. 2 shows a schematic cross-sectional view of the lighting device 3 for the double-ceiling elevator car. The lighting device 3 comprises, for example, high-power LED light strips 4, a light box top 5, light strip holders 6, a light box frame 7, a light box wall 8, and an acrylic lighting panel 9. FIG. 2 shows only an example. It is also conceivable to omit the light box frame 7 according to actual needs. However, without the light box frame 7, a uniform illumination effect may be caused.

FIG. 3 shows a bottom view of the lighting device 3 for the double-ceiling elevator car. Here, shaded portions refer to ultra-thin light box walls 8, the light box walls 8 being formed of a light opaque resin material or the like and shaped to have a shape of a quadrilateral frame. Similar to the light box walls 8, the light box frame 7 is also made of a light opaque resin material or the like. The light box frame 7 and the light box walls 8 can be formed of the same material or can be formed of different

materials. For example, the light box frame 7 can be formed to have a strip shape extending in a direction of broad sides of the light box walls 8. The acrylic lighting panel 9 is a lighting panel made of a transparent acrylic material for transmitting light.

The lighting device for the double-ceiling elevator car of the first embodiment will be described with reference to FIGS. 2 and 3. The lighting device 3 of the first embodiment is mounted at the top of the car body 2 of the car 1. As shown in Fig. 1, the lighting device 3 is mounted to the car ceiling panel 2a of the car body 2, and emits the irradiation light toward an interior of the car below.

The lighting device 3 comprises double ceilings, in which the light box top 5, as an upper ceiling, has an upper side which is connected with the car ceiling panel 2a so as to be mounted and secured to the car ceiling panel 2a of the car 2 as a ceiling for fixing, and the light box frame 7 and the acrylic lighting panel 9, as a lower ceiling, are connected with the light box top 5 as the upper ceiling by the ultra-thin light box walls 8 extending in a vertical direction. The light box frame 7 and the acrylic lighting panel 9 are opposed to the light box top 5, and the light box frame 7, the acrylic lighting panel 9, and the light box top 5 all extend in a horizontal direction parallel to the car ceiling panel 2a.

As shown in FIG. 3, the light box top 5, the light box walls 8, the light box frame 7 and the acrylic lighting panel 9 define a closed space. The high-power LED light strips 4 are mounted in the enclosed space.

In the first embodiment, the high-power LED light strips 4 are mounted to L-shaped light strip holders and then mounted to the light box top 5 together with the L-shaped light strip holders 6. The high-power LED light strips 4 are connected to the light box top 5 securely via the L-shaped light strip holders 6. Here, the L-shaped light strip holder is only an example, and a C-shaped light strip holder or a U-shaped light strip holder can also be used as long as it can be securely connected to the light box top 5.

The high-power LED light strip 4 is a light strip comprised of a plurality of high-power LED lights arranged in one and the same direction. In the first embodiment, the high-power LED light strip extends, for example, in a width direction of the light box. Lights in the high-power LED light strip are mounted on opposite sides of the L-shaped light strip holder in a back-to-back manner, emitting light in opposite directions, so that respective high-power LED lights in the high-power LED light strip emits irradiation light toward the light box wall 8, respectively. Each high-power LED light is equipped with a lens that causes the light to exit at a fixed exit angle. An exit direction of the light can be changed by adjusting an angle of the lens.

In FIG. 5, two high-power LED light strips 4 are shown to be mounted on the L-shaped light strip holder in the back-to-back manner. In the first embodiment, the high-power LED lights of the high-power LED lamp strips 4 are cylindrical in shape, wherein its arcuate outer circumference is light opaque, one of its two parallel surfaces is connected to the light strip holder 6 and is also light opaque, and the other one of the surfaces is provided with the lens, the exit angle of the irradiation light being adjusted by adjusting the lens.

In the first embodiment, in order to ensure a uniform illumination effect, the exit angle α of the irradiation light exiting the lens in the vertical direction is greater than 15 degrees and less than 25 degrees, and the exit angle β in the left-right direction is greater than 45 degrees and less than 55 degrees.

In addition, in order to ensure a uniform illumination effect, the light box top 5 is coated at a side proximate to the high-power LED lights with a reflective coating, and the acrylic lighting panel 9 as the lower car is configured as an acrylic panel having a light-transmitting effect. When the irradiation light is emitted out of the high-power LED lights and its exit angle is changed by the lenses, it is irradiated to the light box top 5 and the acrylic illumination panel 9, respectively. The irradiation light that is irradiated onto the acrylic lighting panel 9 is directly irradiated downward through the acrylic lighting panel 9 due to its good light transmittance, and on the other hand, the irradiation light that is irradiated onto the coating at the side (inside) of the light box top 5 proximate to the high-power LED lights is reflected by the coating to be irradiated toward the acrylic lighting panel 9 and then transmitted through the acrylic lighting panel 9 to be irradiated further downward. The above coating can be a white coating with good reflection effect or can be other reflective paint, etc., as long as it is capable of reflecting the light.

Further, as shown in FIG. 2, the L-shaped light strip holder 6 and the high-power LED light strips 4 mounted on the L-shaped light strip holder 6 are positioned so that the light box is equally divided. For example, the L-shaped light strip holders 6 and the high-power LED light strips 4 mounted on the L-shaped light strip holders 6 are positioned so that the light box is equally divided in its longitudinal direction. The light box frame 7 is positioned directly under the high-power LED light strips, and at each side of the high-power LED light strips is the light-transmitting acrylic lighting panel 9.

In the first embodiment, the length of the light box is trisected equally, and at each of the positions of 1/3 and 2/3 of the length in the longitudinal direction of the light box is mounted the high-power LED light strip 4. The light box frame 7 is positioned directly below the high-power LED light strip 4 with a center of the light box frame 7

being consistent with that of the L-shaped light strip holder 6. The light box frame 7 has a dimension in the width direction of greater than 50 mm and less than 100 mm, and preferably greater than 50 mm and less than 60mm. The light box frame 7 is held by the acrylic lighting panels 9 at both sides and located in the middle of the two acrylic lighting panels 9. Although it is described that the mounting positions of the high-power LED light strips 4 are selected so that the length of the light box is trisected, as mentioned above, it is not limited to this. Provide that a uniform illumination effect can be achieved, other mounting positions can be used.

In FIG. 2, L1 represents a width of the acrylic lighting panel 9, and L2 represents a width of the acrylic lighting panel 9 with the light box frames 7 at both sides. The width L1 of the acrylic lighting panel 9 can be expressed by the following formula: $L1 = (L - R \times a) / (a + 1)$, where L is the size of the light box, R is a width of the light box frame, and a is the number of the high-power LED light strips. The width L2 of the acrylic lighting panel can be expressed by the following formula: $L2 = L - L1$.

The high-power LED light strip 4 are mounted above the light box frame 7 at a distance H1 from the light box frame 7, and H1 is greater than 20 mm and less than 50 mm. By arranging the high-power LED light strip 4 at an appropriate distance from the light box frame 7, the uniform illumination effect can be achieved. With the above configuration, the thickness H of the light box can be reduced to 50 mm.

Further, the acrylic lighting panel 9 can also be configured as a PVC panel or a light-transmitting cloth, instead of the transparent acrylic panel.

By using the high-power LED light strips, the brightness can be enhanced and a distance of light transmission becomes longer. By adding the lens, the light can be well dispersed after passing through it and becomes uniform. The fact that the irradiation light is emitted toward the light box wall at a prescribed angle, instead of being emitted directly downwardly, results in that a portion of the irradiation light is directly transmitted through the acrylic lighting panel and another portion is reflected by the light box top coated with the special coating and then transmitted through the acrylic lighting panel. In this way, the uniform illumination effect of the light can be achieved at the acrylic Lighting panel and the lighting device is improved aesthetically.

In addition, due to the configuration that the high-power LED light strips with the lenses emit the light at a predetermined angle from the side, the light box top is coated with the light reflective material, and the acrylic lighting panel used is transparent, and due to the fact that the configuration is assembled in accordance with a predetermined mounting size, the thickness of the lighting device can be reduced to

50 mm, so that the net height requirements of the car can be met even if the car ceiling frame is not used above the car wall, and the single-ceiling car and the double-ceiling elevator car can share the car wall. Moreover, the reduced thickness causes a reduced weight and a reduced cost.

Further, the lighting device 3 of the present embodiment further comprises a power source 10 as shown in FIG. 2, and the power source is disposed at a side of the car box top 5 proximate to the ceiling of the car. The power source is, for example, a transformer that converts a 220V AC power to a 24V DC power for powering the lighting device 3. The brightness of light can be adjusted with the power source 10.

<Modification of the First embodiment>

Fig. 6 is a perspective view of a lighting device for a double-ceiling elevator car with a connector according to a modification of the first embodiment. The lighting device according to the modification of the first embodiment shown in FIG. 6 has the same configuration as the lighting device according to the first embodiment. Therefore, the same effects as those of the first embodiment can be obtained in this embodiment.

However, in the present embodiment, the lighting device further comprises a connector 11, which is different from the above embodiment.

The connector 11 is connected between a plurality of high-power LED light strips to electrically connect the plurality of high-power LED light strips. With the connector 11, the plurality of high-power LED light strips can be simultaneously lit, adjusted in brightness, and inspected.

FIG. 7 is a schematic plan view of the lighting device for the double-ceiling elevator car in the modification of the first embodiment in which exemplary mounting positions of a connector and a power source are shown. FIG. 7 shows that a plurality of high-power LED light strips are connected by the connector and powered by the power source. In this case, not only the same effects as those of the first embodiment can be achieved, but also the brightness of light can be adjusted by adjusting the power source. The plurality of high-power LED light strips can be controlled simultaneously, which facilitates the operation and decreases work hours.

The embodiments of the present invention have been described above, but the embodiments described above are merely illustrative and are not intended to limit the scope of the invention. These embodiments can be implemented in a variety of other ways. Further, various omissions, substitutions, and changes can be made without departing from the spirit of the invention. The invention and its modifications are intended to be included within the scope and spirit of the invention and included in

the invention defined by the claims and its equivalent scope.

CLAIMS

1. A lighting device for a double-ceiling elevator car, characterized by comprising:

high-power LED light strips, which are mounted on a light strip holder so that irradiation light is emitted toward a side of a light box at a prescribed angle;

a light box top panel, wherein the light strip holder on which the high-power LED light strips are mounted is fixed to the light box top panel, and, at a side of the light box top panel proximate to the high-power LED strips, the light box top panel is coated at its surface with a coating for reflecting the irradiation light;

an acrylic lighting panel having a light transmissive property, wherein the acrylic lighting panel is positioned under the high-power LED light strips, opposed to the light box top plate; and

a light box frame which is positioned directly under the high-power LED light strips and in the same plane as the acrylic lighting panel, wherein the acrylic lighting panel comprises a plurality of acrylic lighting panels, and the light box frame is held at its two sides by the acrylic lighting panels in a direction intersecting a certain direction.

2. The lighting device for the double-ceiling elevator car according to claim 1, characterized in that:

the high-power LED light strips are comprised of a plurality of high-power LED lights which are provided with lenses and arranged in the certain direction, and the lens is configured so that the irradiation light emitted from each of the high-power LED lights has an exit angle in a vertical direction of greater than 15 degrees and less than 25 degrees and an exit angle in a left-right direction of greater than 45 degrees and less than 55 degrees.

3. The lighting device for the double-ceiling elevator car according to claim 1, characterized in that:

the light strip holder is an L-shaped light strip holder, and the high-power LED light strips are mounted at two sides of the light strip holder.

4. The lighting device for the double-ceiling elevator car according to claim 1, characterized in that:

the high-power LED light strips are mounted directly above the light box frame, at a distance of greater than 20 mm and less than 50 mm from the light box frame.

5. The lighting device for the double-ceiling elevator car according to claim 1, characterized in that:

the high-power LED light strips are mounted to the light box top panel so that the light box top panel is equally divided.

6. The lighting device for the double-ceiling elevator car according to claim 1, characterized in that:

the coating is a white coating.

7. The lighting device for the double-ceiling elevator car according to claim 1, characterized in that:

the light box frame has a width of greater than 50 mm and less than 100 mm.

8. The lighting device for the double-ceiling elevator car according to claim 3, characterized in that:

the L-shaped light strip holder is replaced with a C- shaped or U-shaped light strip holder.

9. The lighting device for the double-ceiling elevator car according to claim 1, characterized in that:

the acrylic lighting panel is replaced with a PVC panel or a light-transmitting cloth.

10. The lighting device for the double-ceiling elevator car according to claim 1, characterized in that:

the high-power LED light strips are connected by a connector, and a power source is provided to adjust brightness of light.