

ESCALATOR MONITORING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001]

The present invention relates to an escalator monitoring apparatus, and particularly relates to an escalator monitoring apparatus which is suitable for photographically recording how passengers ride on an escalator.

2. Description of the Background Art

[0002]

Some background-art escalator arrangement structures have protection units. Each protection unit is provided in a narrow-angle portion formed between a moving handrail of one escalator placed with an inclination between upper and lower floors in a building and a ceiling of the building or in a narrow-angle portion formed between a moving handrail of one of a plurality of escalators provided crosswise in side view and a bottom portion of another of the escalators, in order to prevent passengers from getting caught into the narrow-angle portion. Each protection unit has a structure in which a cylinder having a predetermined diameter is provided in a front end portion of the protection unit so that the cylinder can inform a passenger of danger and prevent the passenger from

being injured when the passenger collides with the cylinder of the protection unit.

[0003]

An accident that a passenger falls down or gets caught to tumble down the stairs for some reason may occur in an escalator included in such an escalator arrangement structure. In consideration of such a possibility, there has been proposed an escalator monitoring apparatus in which a monitoring camera is provided to take pictures of the state of an escalator which is being used by passengers, while a sensor is provided to detect vibration of the protection unit so that pictures can be recorded for a predetermined period around the time when the sensor detects the vibration of the protection unit (e.g. see JP-A-2002-114475).

[0004]

In addition, in an escalator included in such an escalator arrangement structure, a passenger leaning out of a moving handrail may be not aware of a narrow-angle portion approaching the passenger till the passenger touches a protection unit. In order to prevent a significant accident from occurring in such a case, a safety device for an escalator has been proposed, in which the protection unit can be recognized in advance due to a detector suspended in front of the protection unit and supported by an elastic body (e.g. see JP-UM-A-61-154278).

[0006]

In the aforementioned escalator monitoring apparatus according to the background art, wiring of a signal line to be connected to the sensor for detecting vibration of the protection unit is required to be extended to a control unit of the camera so that there is a problem that installation expense increases due to wiring work on the building side.

[0007]

In addition, the camera is required to be placed on a ceiling or a wall of the building. Since the place where the camera can be attached is limited, there is a problem that a good visual field of the camera cannot be secured. When the ceiling or the wall has a special structure such as a double height structure, a glass wall surface finishing structure, a ceiling special finishing structure, etc., there is a problem that the camera cannot be placed.

[0008]

Further, there is a phenomenon that light of a lighting system in the building enters the camera so that an essential part of an image becomes difficult to see due to reflected glare of the light in the image.

[0009]

Moreover, even if a passenger is informed of danger by the detector touching the passenger before the passenger

collides with the protection unit, only the passenger leaning out of an escalator can be aware of the danger. Thus, there is a problem as follows. That is, if the passenger remains leaning out, there may occur an accident that the head of the passenger gets caught into the narrow-angle portion between the moving handrail and the building ceiling or the passenger collides with the narrow-angle portion. Other passengers may be so late in becoming aware of the accident that they may be late in rescuing the passenger involved in the accident in the narrow-angle portion or in calling an ambulance.

[0010]

A first object of the present invention is to provide an escalator monitoring apparatus in which a camera for taking pictures of how passengers ride on an escalator can be placed regardless of the structure of a building or the structure of the escalator.

[0011]

A second object of the present invention is to provide an escalator monitoring apparatus in which a camera for taking pictures of how passengers ride on an escalator can be attached, detached and adjusted easily.

[0012]

A third object of the present invention is to provide an escalator monitoring apparatus in which a camera for taking

pictures of how passengers ride on an escalator is hardly affected by external light or light of a lighting system in a building.

[0013]

A fourth object of the present invention is to provide an escalator monitoring apparatus in which a camera can be protected from mischief, while a passenger leaning out of an escalator or passengers around the passenger can be warned.

[0014]

A fifth object of the present invention is to provide an escalator monitoring apparatus in which any kind of camera can be attached.

SUMMARY OF THE INVENTION

[0015]

In order to attain the foregoing objects, an escalator monitoring apparatus according to the present invention is provided in an escalator arrangement structure having a protection unit. The protection unit is disposed in a narrow-angle portion formed between a moving handrail of one escalator placed with an inclination and a ceiling of a building or in a narrow-angle portion formed between a moving handrail of one escalator and a bottom portion of another escalator disposed crosswise and adjacently to the first-mentioned escalator. The protection unit has a cylinder on a front side

thereof to prevent passengers from getting caught into the narrow-angle portion. The escalator monitoring apparatus includes a cylindrical body which has a predetermined length and which is suspended in front of the protection unit, and a camera which is received inside the cylindrical body.

[0016]

According to the invention configured thus, the monitoring camera can be mounted in the best position where ascending/descending conditions of passengers can be monitored, regardless of the ceiling or wall structure of the building around the escalator.

[0017]

The invention provides an escalator monitoring apparatus including a mounting jig which is received inside the cylindrical body together with the camera so as to support the camera. The mounting jig includes at least a camera mounting disc and a pair of suspension plates. The camera mounting disc is screwed to an upper mounting portion of the camera and has a hole of a predetermined diameter in a center thereof and a plurality of mounting holes provided at predetermined angular intervals in positions at a distance of a predetermined radius from the predetermined-diameter hole. The suspension plates have a pair of suspension holes provided near end portions thereof respectively and threaded holes provided at predetermined

distances below the suspension holes respectively. The camera is attached through the mounting holes and placed by suspenders inserted into the pair of suspension holes, and screws are then engaged with the threaded holes provided in the suspension plates through a pair of holes provided in a diameter direction of the cylindrical body respectively, so as to suspend the cylindrical body.

[0018]

According to the invention configured thus, the camera is mounted on the mounting jig, and the mounting jig with the camera is placed by the suspenders inserted into the suspension holes. Thus, the cylindrical body can be mounted on the mounting jig after the angle of a lens of the camera is adjusted.

[0019]

The invention provides an escalator monitoring apparatus further including a cover piece which covers an inner circumference of the cylindrical body so as to range from an upper end portion of the cylindrical body at least to a lower end portion of the mounting jig, and an antireflection piece which has at least a length extending from a lower end of the cover piece to a point where light emitted from a lower end portion of a visual field of the camera is projected on the visual field side of the camera in the cylindrical body, and which covers almost half a circumference of the cylindrical

body on an opposite side to the visual field of the camera. With this configuration, the antireflection piece suppresses light reflected by the inner wall of the cylindrical body and entering the viewing angle of the camera. It is therefore possible to reduce reflected glare in an image picked up by the camera.

[0020]

The invention provides an escalator monitoring apparatus, wherein the cover piece and the antireflection piece are formed and integrated as an opaque film having a T- or L-shape, while a plurality of pairs of holes matching with the pair of holes provided in the cylindrical body are provided in portions of the cover piece, so that the screws engaged with the threaded holes of the mounting jig can stop in an inner surface of the cylindrical body.

[0021]

According to the invention configured thus, the opaque film can hide the camera, the mounting jig, a cable, etc. Thus, the camera can be protected from mischief. In addition, due to the screws engaged with one pair of the plurality of pairs of holes of the cover piece in line with the holes of the cylindrical body, the cover piece and the antireflection piece can be fixed to the inner surface of the cylindrical body easily.

[0022]

According to the first configuration of the invention, it is possible to provide a monitoring apparatus in which the monitoring camera can be mounted in the best position where ascending/descending conditions of passengers can be monitored, regardless of the ceiling or wall structure of the building around the escalator, while the camera is received inside the cylindrical body to thereby obtain excellent design of the monitoring apparatus.

[0023]

According to the second configuration of the invention, the mounting jig mounted with the camera can be suspended with the suspenders inserted into the suspension holes. Thus, the camera can be adjusted and mounted easily and in a short time.

[0024]

According to the third configuration of the invention, the antireflection piece suppresses light reflected by the inner surface of the cylindrical body and entering the viewing angle of the camera, so as to reduce reflected glare of the light in an image picked up by the camera. It is therefore possible to provide an explicit picture.

[0025]

According to the fourth configuration of the invention, the opaque film covering the range from the upper end portion of the cylindrical body to the lower end portion of the mounting

jig can hide the camera, the mounting jig, a cable, etc. In addition, due to the plurality of pairs of holes provided in portions of the cover piece so as to match with the pair of holes provided in the cylindrical body, the cover piece and the antireflection piece can be fixed to the inner surface of the cylindrical body easily.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026]

Fig. 1 is a side view showing escalators to which a first embodiment of an escalator monitoring apparatus according to the present invention is applied;

Fig. 2 is a longitudinally sectional view showing a configuration of the first embodiment of the escalator monitoring apparatus according to the present invention;

Fig. 3 is a perspective view showing a configuration of a mounting jig provided in the first embodiment of the invention;

Fig. 4 is a cross-sectional view taken on line D-D in Fig. 2;

Fig. 5 is a development showing a configuration of an L-shaped antireflection piece provided in the first embodiment of the invention;

Fig. 6 is a view for explaining how to use the first embodiment of the invention;

Fig. 7 is a longitudinally sectional view showing an upper end main portion of a cylindrical body shown in Fig. 2;

Fig. 8 is a side view showing escalators to which a second embodiment of an escalator monitoring apparatus according to the present invention is applied;

Fig. 9 is a perspective view showing a configuration of a mounting jig provided in the second embodiment of the invention; and

Fig. 10 is a development showing a configuration of a T-shaped antireflection piece provided in the second embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0027]

Embodiments of escalator monitoring apparatuses according to the present invention will be described below with reference to the drawings.

[0028]

First Embodiment

Fig. 1 is a side view showing escalators to which a first embodiment of an escalator monitoring apparatus according to the present invention is applied. Fig. 2 is a longitudinally sectional view showing a configuration of the first embodiment of the escalator monitoring apparatus according to the present

invention. Fig. 3 is a perspective view showing a configuration of a mounting jig provided in the first embodiment of the invention. Fig. 4 is a cross-sectional view taken on line D-D in Fig. 2. Fig. 5 is a development showing a configuration of an L-shaped antireflection piece provided in the first embodiment of the invention. Fig. 6 is a view for explaining how to use the first embodiment of the invention. Fig. 7 is a longitudinally sectional view showing an upper end main portion of a cylindrical body shown in Fig. 2.

[0029]

As shown in Fig. 1, the first embodiment of the escalator monitoring apparatus according to the invention is applied to an escalator 1. The escalator 1 is placed lying between upper and lower floors. The escalator 1 has a moving handrail 2 to be held by passengers, a balustrade 3 supporting the moving handrail 2, an outer deck 4 retaining the balustrade 3 from its outside, a control unit 5 for controlling the escalator 1, and a bottom portion 6 having an oil pan etc. disposed under the escalator 1.

[0030]

In addition, assume that the first embodiment of the invention includes totally four escalators, that is, the aforementioned escalator 1 and other escalators 1a, 1b and 1c similar thereto. Here, the escalator 1 carries out ascending

operation from the first floor to the second floor. The escalator 1a carries out descending operation from the second floor to the first floor. The escalator 1b carries out ascending operation from the second floor to the third floor. The escalator 1c carries out descending operation from the third floor to the second floor.

[0031]

In addition, these escalators 1a, 1b and 1c are provided parallelly or crosswise with each other. Narrow-angle portions are formed between the moving handrail 2 of the escalator 1 and a bottom portion 6a of the escalator 1a and between the moving handrail 2 of the escalator 1 and a bottom portion 6b of the escalator 1b. In order to prevent passengers from getting caught into such narrow-angle portions, a protection unit 7 is disposed in each narrow-angle portion. As soon as a passenger touches the protection unit 7, the protection unit 7 can shake so as to make the passenger aware of danger. Further, a protection unit 8 is firmly fixed to the bottom portion 6a of the escalator 1a and a cylindrical body 9 is disposed in front of the protection unit 7.

[0032]

The cylindrical body 9 is made of a transparent acrylic material the same as that of a cylinder attached to the protection unit 7. The cylindrical body 9 suspended shakably has a

structure which can prevent any passenger from being injured when the passenger collides with the cylindrical body 9. The length of the cylindrical body 9 may be set so that the lower end thereof is at least 200 mm below the upper end of the moving handrail 2 when the cylindrical body 9 is suspended.

[0033]

As shown in Fig. 2, a camera for monitoring passengers on the escalator 1, that is, a camera 10 for taking pictures of how the passengers ride on the escalator 1 is disposed in the interior upper end of the cylindrical body 9. A dome 10A is mounted on the camera 10.

[0034]

In addition, as shown in Fig. 3, a mounting jig 11 has a camera mounting disc 11A and a pair of suspension plates 11B. The camera mounting disc 11A has a hole 11a of a predetermined diameter in a center thereof and a plurality of mounting holes 11b on a circumference of a predetermined radius from the center of the predetermined-diameter hole 11a and at predetermined angular intervals from the center. The hole 11a is used for connecting the camera 10 with a cable connector 19a of a wiring cable 19 wired from the bottom portion 6a of the escalator 1a through the outer deck 4. The mounting holes 11b are provided for screwing the camera mounting disc 11A to an upper mounting portion of the camera 10. The suspension plates 11B are provided

erectly to be opposed to each other around the predetermined-diameter hole 11a provided in the camera mounting disc 11A. Here, the suspension plates 11B are provided with threaded holes 11c provided at predetermined distances above the camera mounting disc 11A respectively, and a pair of suspension holes 11d provided near end portions of the suspension plates 11B respectively. Suspenders 13 for connecting the mounting jig 11 to a suspending fitting 12 are inserted into the suspension holes 11d.

[0035]

In addition, the threaded holes 11c and the suspension holes 11d are provided so that the camera mounting disc 11A can be kept horizontal when the cylindrical body 9 is suspended from the bottom portion 6a of the escalator 1a as shown in Fig. 1.

[0036]

That is, when the bottom portion 6a of the escalator 1a is inclined at an angle of about 30° with respect to the horizontal direction, one of the suspension plates 11B of the mounting jig 11 is extended by a predetermined distance so that an extension of the suspension holes 11d becomes parallel to the bottom portion 6a of the escalator 1a and the camera mounting disc 11A becomes horizontal. In addition, the suspension holes 11d are provided near the upper end portions of the suspension

plates 11B respectively.

[0037]

In this manner, the positions where the suspension holes 11d are placed are adjusted in accordance with the inclination angle of the bottom portion 6a of the escalator 1a so that the suspenders 13 having the same shape can be used while the camera mounting discs 11A can be kept horizontal. It is therefore possible to adjust the viewing angle of the camera 10 easily.

[0038]

Next, description will be made below on the optical influence of a lighting system provided in a building.

[0039]

As shown in Fig. 2, there may occur a phenomenon, so-called reflected glare, in which light C entering the inside of the cylindrical body 9 at an incident angle α smaller than a critical angle α_0 travels through the cylindrical body 9 while being reflected by the inner surface of the cylindrical body 9, and enters the visual field of the camera. To deal with the reflected glare of the light, reflection of external light by the inner surface of the cylindrical body 9 must be suppressed at least before the external light reaches the visual field of the camera.

[0040]

When an antireflection piece 15 is provided, e.g. by pasting a seal or by applying a paint, on half the circumference

of the cylindrical body 9 on the opposite side to the photographing direction of the camera, reflected glare can be prevented from occurring. Next, the range where such an antireflection piece 15 should be provided will be described.

[0041]

First, assume that light C at an incident angle α is reflected by the inner surface of the cylindrical body 9 having an inner diameter D_i , travels in a vertical plane passing the central axis of the cylindrical body 9 and reaches a lower end point A of the visual field of the camera. In this case, a distance L_2 between the lower end point A of the visual field of the camera and a projection point B from which the external light C is reflected twice in front of the lower end point A is obtained by $L_2 = 2 \times D_i \times \tan \alpha$. As described previously, reflected glare of external light in the visual field of the camera can be suppressed by the antireflection piece 15 provided, e.g. by pasting a seal or by applying a paint, on the opposite surface to the photographing direction of the camera over the vertical range between the lower end point A of the visual field of the camera and the projection point B and over the horizontal range of the horizontal viewing angle of the camera.

[0042]

As the incident angle goes beyond the critical angle α_0 and is closer to 90 degrees, the distance L_2 is closer to the

infinite. It is therefore ideally desired to completely cover half the length-direction surface of the cylindrical body 9 with an antireflection piece. Under actual lighting conditions, however, the incident angle α is rarely close to 90 degrees. In order to chiefly suppress light whose incident angle α satisfies $\alpha < \alpha_0$, the length may be obtained by $L_2 = 2 \times D_i \times \tan \alpha_0$. Also in this case, sufficient effect can be obtained.

[0043]

The range where reflected glare should be suppressed efficiently corresponds to the distance L_2 obtained by $L_2 = 2 \times D_i \times \tan \alpha_0$ from the lower end point A of the visual field of the camera. In this embodiment, the size of the aforementioned antireflection piece 15 such as the pasted seal or the applied paint is set as a length L_d obtained by adding a distance L_1 between the lower end point A of the visual field of the camera and the upper end of the cylindrical body 9 to the distance L_2 obtained by $L_2 = 2 \times D_i \times \tan \alpha_0$ from the lower end point A of the visual field of the camera. Thus, the position where the antireflection piece 15 should be pasted can be adjusted without measuring.

[0044]

In addition, projection points F1 and G1 on the outer circumferential surface of the cylindrical body 9 in the horizontal viewing angle θ_2 of the camera 10 and projection

points F2 and G2 on the inner circumferential surface of the cylindrical body 9 where the projection points F1 and G1 on the outer circumferential surface are extended on the opposite side to the visual field of the camera by the viewing angle θ_2 are obtained as shown in Fig. 4. The maximum range where the antireflection piece 15 should be provided to suppress reflected glare of light in the horizontal viewing angle θ_2 may correspond to an arc Lb1 between the projection points F1 and G1 on the outer circumferential surface. The minimum range where the antireflection piece 15 should be provided corresponds to an arc Lb2 formed by contact points where the projection points F2 and G2 on the inner circumferential surface are extended from the center of the cylindrical body 9 to the outer circumferential surface respectively. Even the antireflection piece 15 covering the minimum range can prevent light reflected by the cylindrical body 9 from entering the horizontal viewing angle θ_2 of the camera 10. Thus, sufficient effect can be obtained.

[0045]

That is, it will go well if the antireflection piece 15 is provided on the inner circumferential surface of the cylindrical body 9 over a range of from the arc Lb2 to the arc Lb1 correspondingly to the horizontal viewing angle θ_2 of the camera 10. In consideration of design, it is preferable that

the range is close to half the circumference of the cylindrical body 9.

[0046]

Next, as shown in Fig. 5, an opaque film 17 having an L-shape in which a cover piece 16 and an antireflection piece 15 are integrated has an oblong shape having a length L_d and a width W_d . The length L_d is obtained by adding a length L_c to a length L_a between the upper end of the cylindrical body 9 and a lower end of the cover piece 16. The width W_d is close to half the circumference of the cylindrical body 9 in a range of from the arc L_{b2} to the arc L_{b1} . A plurality of holes 17a into which screws 14 can be inserted are provided in an upper portion of the opaque film 17 so that the screws 14 can be screwed to the opaque film 17 in angular positions corresponding to the angle of the camera 10. The inner surface of the opaque film 17 on the camera 10 side has a color with low brightness, such as black, so as to reduce the influence of reflected glare. The other surface of the opaque film 17 may have any color. Words or patterns for warning may be drawn on the other surface, or a seal or the like may be pasted on the other surface.

[0047]

Because the cover piece 16 and the antireflection piece 15 are integrated, useless parts are generated when the L-shaped opaque film 17 is cut out. However, the opaque film 17 can

be mounted on the cylindrical body 9 easily and in a short time.

[0048]

In addition, a material which can be colored and is deformed easily is used for the L-shaped opaque film 17. Resin such as polyester or vinyl chloride, paper or cloth may be used as the material. Of them, a vinyl chloride film 0.3 mm thick can be handled easily.

[0049]

The cover piece 16 has a substantially belt-like shape. Near the upper side of the cover piece 16, two not-shown paired holes 16a are provided to extend from the upper side of the cover piece 16 correspondingly to the dimensions of a not-shown pair of holes in the upper end portion of the cylindrical body 9 and the distance between the pair of holes (half the circumferential size of the inner surface of the cylindrical body 9). On the left and right sides of the holes 16a, holes 16a are provided respectively. When the screws 14 are engaged with the holes 16a aligned with the screw holes 11c of the mounting jig 11, the cover piece 16 is formed into an annular shape having the same dimensions as the inner circumference of the cylindrical body 9. When the upper side of the cover piece 16 is aligned with the upper end of the cylindrical body 9, the two holes 16a are brought into line with the not-shown pair of holes in the cylindrical body 9.

[0050]

Here, the cover piece 16 may be made from resin such as polyester or vinyl chloride, paper or cloth in the same manner as the L-shaped opaque film 17. In view of design, it is preferable to make the cover piece 16 from the same material as the L-shaped opaque film 17 and in a similar color to that of the upper portion of the camera 10.

[0051]

Next, the procedure for mounting the camera 10 will be described.

[0052]

As shown in Figs. 6 and 7, the camera 10 is attached to the mounting holes 11b of the camera mounting disc 11A by not-shown screws. The cable connector 19a of the wiring cable 19 to be wired from the bottom portion 6a of the escalator 1a through the outer deck 4 is connected to the upper mounting portion 10a of the camera 10 through the predetermined-diameter hole 11a provided in the center of the bottom surface of the mounting jig 11. In addition, the suspending fitting 12 is fixed to the bottom portion 6a of the escalator 1a by fixing bolts 12a. The camera 10 is suspended swingably by the suspenders 13 inserted into the pair of suspension holes 11d provided respectively near the end portions of the suspension plates 11B provided erectly and opposed to each other on the

camera mounting disc 11A of the mounting jig 11. Thus, the viewing angle of the camera 10 is adjusted.

[0053]

In this manner, the camera 10 can be adjusted without attaching the cylindrical body 9 thereto. Thus, the work of the adjustment can be performed easily.

[0054]

In addition, as will be described later, the removable antireflection piece 15 for preventing reflection of predetermined-wavelength light is longer than the range of the vertical viewing angle θ_1 , and is pasted to cover substantially half the circumference of the cylindrical body 9 on the opposite side to the visual field of the camera 10.

[0055]

When words "CAMERA IN OPERATION" or "DO NOT LEAN OUT" (which may be an illustration or a mark) are printed on the antireflection piece 15, the antireflection piece 15 can also serve as an attention attracting plate for preventing passengers from doing mischief or for warning passengers to be aware of the narrow-angle portion.

[0056]

When such words are printed on the back side, the words can be also recognized visually by passengers riding on an adjacent escalator. Here, when the antireflection piece 15

is provided on the inner side of the cylindrical body 9, a reflection suppression effect can be enhanced.

[0057]

In addition, the antireflection piece 15 has a length from the upper end portion of the cylindrical body 9 at least to the lower end portion of the mounting jig 11, and the belt-like cover piece 16 formed out of an opaque film is provided to cover the inner surface of the cylindrical body 9 and mounted between the inner surface of the cylindrical body 9 and the mounting jig 11 and between the inner surface of the cylindrical body 9 and the camera 10, so as to make it difficult to see the camera 10 and the mounting jig 11 and thereby hide the existence of the camera 10 (it will go well as long as at least the range from the upper end portion of the cylindrical body 9 to the lower end portion of the mounting jig 11 can be hidden).

[0058]

Under the cylindrical body 9, a not-shown mounting jig provided in the outer deck 4 is connected to a hole provided in the lower end of the cylindrical body 9 by a wire 18 (which may be replaced by a chain) to prevent the cylindrical body 9 from swinging excessively.

[0059]

In addition, video data of the camera 10 are recorded onto a not-shown image memory through the wiring cable 19 wired

from the bottom portion 6a of the escalator 1a through the outer deck 4. The image memory is built in a monitoring portion 20 installed in the outer deck 4.

[0060]

Cylindrical bodies 901 to 905 in which not-shown cameras are built are also disposed in front of protection units 701 to 705 in narrow-angle portions shown in Fig. 1, respectively. The not-shown camera built in the cylindrical body 905 is connected to a monitoring portion 201. The two not-shown cameras built in the cylindrical bodies 901 and 902 are connected to a monitoring portion 202. The two not-shown cameras built in the cylindrical bodies 903 and 904 are connected to a monitoring portion 203.

[0061]

Next, a method for mounting the T- or L-shaped opaque film 17 formed to integrate the cover piece 16 and the antireflection piece 15 will be described.

[0062]

As preliminary work, the camera 10 is attached to the mounting jig 11 and the opaque film 17 is corrugated like curves in the lower portion thereof to bring the opaque film 17 into contact with the inner circumferential surface of the cylindrical body 9 (with the low-brightness black side being put on the inner side).

[0063]

First, the opaque film 17 made annular is put on the inner side of the cylindrical body 9, and a not-shown pair of holes of the cylindrical body 9 are aligned with a pair of the holes 17a of the opaque film 17.

[0064]

Secondly, the camera 10 is mounted from above the cylindrical body 9 and adjusted to align the not-shown holes of the cylindrical body 9, the holes 17a of the opaque film 17 and the threaded holes 11c of the mounting jig 11 with one another, so as not to displace the cylindrical body 9 and the opaque film 17.

[0065]

Thirdly, the screws 14 are engaged with the threaded holes 11c. Here, shoulder screws which are not threaded in predetermined distances below their necks are used as the screws 14, as shown in Fig. 2. Thus, by use of distant pieces having predetermined thickness not to abut against the inner wall of the cylindrical body 9, the mounting portion of the cylindrical portion 9 can be prevented from being broken or cracked when the screws 14 are engaged with the threaded holes 11c of the mounting jig 11.

[0066]

In addition, when general screws 14 which have threaded

below their necks are used, the mounting portion of the cylindrical portion 9 can be prevented from being broken or cracked if distant pieces having predetermined thickness not to abut against the inner wall of the cylindrical body 9 are used between the cylindrical body 9 and the threaded holes 11c of the mounting jig 11.

[0067]

In this manner, the opaque film 17 can be mounted easily inside the cylindrical body 9. Thus, reflected glare of light can be suppressed effectively, and mischief such as graffiti can be also prevented.

[0068]

Here, when misalignment appears between the photographing direction of the camera 10 and the running direction of the escalator, it becomes difficult to see the words written on the antireflection piece 15 of the opaque film 17. Of the holes 17a provided in the upper portion of the opaque film 17, the selected pair is replaced suitably by another pair so that the running direction of the escalator can be aligned with the direction of the opaque film 17. Thus, the words on the antireflection piece 15 of the opaque film 17 can be located to be easily seen by passengers on the escalator.

[0069]

With the configuration made thus, the cylindrical body

9 is suspended down in front of the protection unit 7 disposed in a narrow-angle portion, and the monitoring camera 10 is received inside the cylindrical body 9. Thus, the monitoring camera can be mounted in a good position where the ascending/descending conditions of the passengers can be monitored, regardless of the ceiling or wall structure of the building around the escalator. It is therefore possible to cancel the aforementioned restrictions of the building on the installation of the camera, while it is possible to reduce the installation expense of the escalator monitoring apparatus. The same rule can be applied to the other cylindrical bodies 901 to 905.

[0070]

In addition, the camera 10 is received inside the cylindrical body 9 without being exposed. It is therefore possible to ensure excellent design while it is possible to prevent any passenger from doing mischief on the camera 10. In addition, the mounting jig 11 for the camera 10 is formed to include the camera mounting disc 11A and the suspension plates 11B. Thus, there is no fear that any member of the mounting jig 11 or the suspenders 13 are put out of the outer circumference of the cylindrical body 9. It is therefore possible to suppress the occurrence of an injury even if a passenger touches the upper end portion of the cylindrical body 9 accidentally when

the escalator 1 is running.

[0071]

In addition, the camera provided in the cylindrical body 901 can monitor not only passengers ascending on the escalator 1 but also passengers descending on the escalator 1a placed crosswise and adjacently to the escalator 1. A wide range can be monitored by one camera.

[0072]

Further, about half the circumference of the cylindrical body 9 on the opposite side to the visual field of the camera 10 is covered with the antireflection piece 15 of the opaque film 17 so that external light of a lighting system or the like reflected by the cylindrical body 9 can be prevented from entering the viewing angle of the camera. It is therefore possible to obtain excellent pictures with being less affected by lighting in the building or the external light.

[0073]

Further, due to the cover piece 16 of the opaque film 17 provided in the inner circumferential surface of the upper portion of the cylindrical body 9, the mounting jig 11, the upper mounting portion 10a of the camera, the cable connector 19a, etc., can be hidden from passengers. It is therefore possible to provide an escalator monitoring apparatus with excellent design.

[0074]

Further, the cover piece 16 and the antireflection piece 15 are formed into an integrated shape. Thus, the cover piece 16 and the antireflection piece 15 can be placed on the inner surface of the cylindrical body 9 easily and in a short time. Due to a plurality of pairs of holes provided in portions of the cover piece 16 correspondingly to a pair of holes provided in the cylindrical body 9, the cover piece 16 can be screwed down to the threaded holes of the camera mounting jig 11 without affecting the angle of the camera.

[0075]

Second Embodiment

Fig. 8 is a side view showing escalators to which a second embodiment of an escalator monitoring apparatus according to the present invention is applied. Fig. 9 is a perspective view showing a configuration of a mounting jig provided in the second embodiment of the invention. Fig. 10 is a development showing a configuration of a T-shaped antireflection piece provided in the second embodiment of the invention.

[0076]

As shown in Figs. 8 to 10, the second embodiment of the invention differs from the aforementioned first embodiment in that the second embodiment is applied to an escalator 1 placed alone. To this end, a pair of suspension plates 11B of a mounting

jig 11 have the same dimensions so that a camera mounting disc 11A can be set to be horizontal when a cylindrical body 9 is suspended from a building ceiling 6d. In addition, suspension holes 11d are provided near the upper end portions of the suspension plates 11B respectively so that an extension of the suspension holes 11d can be made horizontal. Further, an opaque film 17 where a cover piece 16 and an antireflection piece 15 are integrated is formed into not an L-shape but a T-shape. The other configuration is the same as that of the first embodiment.

[0077]

According to the second embodiment of the invention configured thus, a similar effect to that of the first embodiment can be obtained. In addition thereto, the suspension plates 11B of the mounting jig 11 have the same dimensions so that the mounting jig 11 can be manufactured easily. In addition, it is not necessary to adjust the direction of the pair of suspension plates 11B relatively to the building ceiling 6d. It is therefore possible to attach and remove the mounting jig 11 easily.

What is claimed is:

1. An escalator monitoring apparatus provided in an escalator arrangement structure having a protection unit, the protection unit being disposed in a narrow-angle portion formed between a moving handrail of one escalator placed with an inclination and a ceiling of a building or in a narrow-angle portion formed between a moving handrail of one escalator and a bottom portion of another escalator disposed crosswise and adjacently to the first-mentioned escalator, the protection unit having a cylinder on a front side thereof to prevent passengers from getting caught into the narrow-angle portion, the escalator monitoring apparatus comprising:

a cylindrical body which has a predetermined length and which is suspended in front of the protection unit; and

a camera which is received inside the cylindrical body.

2. An escalator monitoring apparatus according to Claim 1, further comprising:

a mounting jig which is received inside the cylindrical body together with the camera so as to support the camera, the mounting jig including at least a camera mounting disc and a pair of suspension plates, the camera mounting disc being screwed to an upper mounting portion of the camera and having a hole of a predetermined diameter in a center thereof and a plurality of mounting holes provided at predetermined angular intervals

in positions at a distance of a predetermined radius from the predetermined-diameter hole, the suspension plates having a pair of suspension holes provided near end portions thereof respectively and threaded holes provided at predetermined distances below the suspension holes respectively; wherein:

the camera is attached through the mounting holes and placed by suspenders inserted into the pair of suspension holes, and screws are then engaged with the threaded holes provided in the suspension plates through a pair of holes provided in a diameter direction of the cylindrical body respectively, so as to suspend the cylindrical body.

3. An escalator monitoring apparatus according to Claim 2, further comprising:

a cover piece which covers an inner circumference of the cylindrical body so as to range from an upper end portion of the cylindrical body at least to a lower end portion of the mounting jig; and

an antireflection piece which has at least a length extending from a lower end of the cover piece to a point where light emitted from a lower end portion of a visual field of the camera is projected on the visual field side of the camera in the cylindrical body, and which covers almost half a circumference of the cylindrical body on an opposite side to the visual field of the camera.

4. An escalator monitoring apparatus according to Claim 3, wherein:

the cover piece and the antireflection piece are formed and integrated as an opaque film having a T- or L-shape, while a plurality of pairs of holes matching with the pair of holes provided in the cylindrical body are provided in portions of the cover piece, so that the screws engaged with the threaded holes of the mounting jig can stop in an inner surface of the cylindrical body.