

BALUSTRADE OF PASSENGER CONVEYOR

The present invention relates to a balustrade of a
5 passenger conveyor, such as an escalator, or an electric-
ally operated passageway.

Passenger conveyors have been widely used in
buildings and have been accepted as one of the facilities
indispensable to the buildings for catering to the needs of
10 the visitors. There is a need to improve the existing con-
veyors, particularly to improve their appearance. To
achieve this it is necessary to improve the design of the
balustrade of the conveyor because, as is well known, the
balustrades provide the most important item in determining
15 the appearance of the conveyor. Thus the importance of the
design of the balustrades has been recognized because it is
a factor in determining the attractiveness of the interior
decoration of the building in which the conveyor is
installed.

20 Generally, a passenger conveyor or an escalator com-
prises a handrail moving in synchronism with a plurality of
steps linked in an endless loop, and balustrade members
located below the handrail include a handrail deck, an
inner deck and an outer deck. The conveyor also usually
25 has support means for supporting the balustrade members.
The balustrade members or the handrail deck, inner deck and
outer deck are usually referred to as design members. To



improve the effects achieved by the balustrade of good design, it is essential that these members be kept in a condition of excellent finishes. In one known type of balustrade, the outer deck is secured directly to

5 supporters of the support means by screws. This arrangement has disadvantages. One of them is that the screws impair the smoothness of the lustrous surface of the outer deck. Another disadvantage is that when the screws are tightened, the smooth surface of the outer deck is dis-
10 torted, giving an undesirable appearance. In other known types of balustrades, the outer deck is directly bonded to the supporters or joined thereto by welding. However, it has been impossible to eliminate the development of distortion or other defects on the surface of the outer deck.

15 The present invention has been developed in order to eliminate, or at least reduce these disadvantages. The present invention seeks to provide a balustrade of a passenger conveyor which is constructed such that there is little or no possibility of the development of defects,
20 such as distortion, on the surface of each balustrade member.

According to the invention, there is provided a balustrade of a passenger conveyor comprising a handrail moving in synchronism with a plurality of steps linked in
25 an endless belt, balustrade members located below the handrail including a handrail deck, an inner deck and an outer deck, and support means for supporting the balustrade

members, characterized in that said outer deck has a transverse cross-sectional shape substantially in the form of a letter C which opens toward the support means, that shape being formed by bending a stainless steel sheet to form the
5 outer deck and that a fixing member is fitted to the underside of the outer deck so as to secure the outer deck to the support means through the fixing member.

Embodiments of the invention will now be described in detail, by way of example, with reference to the
10 accompanying drawings, in which:

Fig. 1 is a side view of an upper part of a known passenger conveyor;

Fig. 2 is a sectional view taken along the line

1 II-II in Fig. 1;

Fig. 3 is a perspective view of the outer deck and the supporter of the passenger conveyor shown in Fig. 1, showing the manner in which the outer deck is
5 secured to the supporter;

Figs. 4-6 are perspective views of the outer deck and the supporter of passenger conveyors of the prior art, showing the different manners in which the outer deck is secured to the supporter;

10 Fig. 7 is a perspective view of the outer deck and the supporter showing the joint of the discrete portions of the outer deck of the prior art shown in Figs. 3-6;

Fig. 8 is a sectional view similar to Fig. 2
15 but showing the balustrade comprising one embodiment of the invention;

Fig. 9 is a sectional view, on an enlarged scale, of the essential portions of the balustrade shown in Fig. 8;

20 Fig. 10 is a perspective view of the supporter of the balustrade shown in Fig. 8, showing its construction;

Fig. 11 is a perspective view of the outer deck and the fixing member of the balustrade shown in
25 Fig. 8, showing the manner in which the fixing member is assembled with the outer deck;

Fig. 12 is a perspective view of the outer deck of the balustrade shown in Fig. 8, showing the joint

1 of the adjacent deck sections of the outer deck;

Fig. 13 is a schematic sectional view of an example in which the balustrade according to the invention is used; and

5 Fig. 14 is a view similar to Fig. 9 but showing modifications of the outer deck and the fixing member of the balustrade shown in Fig. 8.

Before describing the invention in detail,
10 balustrades of passenger conveyors of the prior art will be outlined. A balustrade of a passenger conveyor generally comprises, as shown in Figs. 1 and 2, a hand-rail 2 moving in synchronism with a plurality of steps 1 linked in an endless belt for carrying passengers, a
15 rail 3 for supporting the steps 1 while they move, a handrail deck 4 for guiding the handrail 2, a balustrade panel 5, a dressed packing 6 substantially in the form of a letter U for the balustrade panel 5, an inner deck 7, an outer deck 8 and an outer plate 9. The members
20 3, 4, 5, 6, 7, 8 and 9 are stationary members. The balustrade panel 5 and inner deck 7 are secured through a plurality of supporters 10 to a main frame 13 of a sturdy construction and the outer deck 8 is secured
through a plurality of supporters 11 to the main frame
25 13, by welding or by means of bolts 12. The passenger conveyor is provided with two balustrades of the afore-said construction located on both sides of the steps 1.

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- 1 The balustrades are identical in construction, so that only one of them will be shown and described.

The handrail deck 4, inner deck 7 and outer deck 8 are usually called design members. Whether the design of the passenger conveyor as a whole is good or poor depends largely on the condition in which these design members are finished. As is well known, a beautiful dressing material obtained by subjecting an extrusion formed product of an aluminum alloy to electrolytic oxidation to render it corrosion resistant has been widely in use for producing the design members. In recent years, a stainless steel sheet of small thickness has come to be used as shown in Fig. 2. Balustrades formed of stainless steel sheet offer the advantages that, besides having on its surface a beautiful luster characteristic of its own which appeals to everybody, they are hard and rarely injured at the surface so that no abrasion or denting develops easily and highly resistant to corrosion. Thus, it is desired that this material become more popular for use in producing the balustrade members. Particularly, in a balustrade of a see-through type shown in Fig. 2 in which transparent glass is used for forming the balustrade panel 5, the beautiful luster of a stainless steel sheet characteristic of the metal matches the transparency of a glass panel so that this type of balustrade is considered to be at the top of the rank from the point of view of the design.

1 However, the use of a stainless steel sheet
for producing balustrade members is not without dis-
advantages. For example, the construction of the outer
deck 8 suffers the following disadvantages, and it is
5 desired that they be obviated.

 Generally, stainless steel sheets are expensive
and they are three to four times as costly as ordinary
steel sheets. Thus, when a passenger conveyor is to be
produced at low cost, it becomes essential that the
10 thickness of the stainless steel sheets used be reduced.
When the stainless steel sheet is small in thick-
ness, difficulties would be experienced in performing
plastic working on it and keeping its surface in a
flawless condition for a prolonged period of time.
15 Particularly in the case of an escalator in which the
balustrades extend in a curving form between a lower
passenger embarkation and debarkation portion and an
upper passenger embarkation and debarkation portion
shown in Fig. 1, there are several curves including
20 concave sections, convex sections (U_1 and U_2) and a
terminal bent portion T. Difficulties are experienced
in bending the member to obtain a desired curve, and
particularly when the stainless steel sheet is small
in thickness, a distortion or other local deformation
25 tends to occur due to heat or an externally exerted force,
no matter how small the magnitude may be.

 A possible defect in design which the balustrade
members might suffer will be described by referring to

1 the outer deck 8 which is supposed to be typical of the
balustrade members. In one type of balustrade, the
outer deck 8 is secured to a supporter 11 as by screws
14 as shown in Fig. 2. As can be seen in Fig. 3, the
5 existence of the heads of the screws 14 impairs the
beauty of the lustrous surface of the stainless steel
sheet to the detriment of a design which emphasizes
the beauty of the lustrous surface. Moreover, if the
screws 14 were tightened too strongly, a distortion A
10 would develop around the heads of the screws 14. In
view of the fact that the outer deck 8 is substantially
planar at its surface, the distortion A would reflect
light rays from a light source at the ceiling of the
building in the direction of arrows Z in Fig. 2, thereby
15 making the distortions A conspicuous.

Meanwhile, when the outer deck 8 is bonded at
its bottom surface to the support member 11 as by an
adhesive agent S, a distortion B would develop on a
top surface of the outer deck 8. This is a defect
20 considered to be characteristic of a thin sheet which
is caused to occur, when the outer deck 8 is secured
to the main frame 13 at a curving section (such as the
convex section U_2 shown in Fig. 1), by the difference in
curvature between them which might arise from a mistake
25 occurring when the outer deck 8 was produced or by
forcibly pulling the outer deck 8 toward the main frame
13 by neglecting the torsion in the material. If the
upper deck 8 were forcibly pulled toward the main frame

1 13, the outer deck 8 would be stripped off the supporter
11 and protrude upwardly as indicated by an arrow Y in
Fig. 4, thereby rendering the balustrade unsatisfactory.

5 In another type of balustrade shown in Fig. 5,
bolts 15 are joined to a bottom surface of the outer
deck by melt adhesion and the supporter 11 is secured
by fixing nuts 16 to the bolts 15. This type suffers
the same disadvantage as suffered by the type shown
10 in Fig. 4. More specifically, the bolts 15 are joined
to the bottom surface of the upper deck 8 by a melt
adhesion process generally referred to as a stud welding
technique. When the stud welding technique is utilized,
the heat of welding might cause deformation of the outer
15 deck 8 to occur or a distortion C might occur due to a
tension oriented downwardly (in the direction of an
arrow Q).

In still another type of balustrade, the
outer deck 8 is directly joined by welding at its bottom
20 surface to the supporter 11 as shown in Fig. 6. In
this type, the same disadvantage as experienced by the
type shown in Fig. 5 would be experienced. That is, the
heat of welding of a welding bead 17 would cause a
thermal distortion D of a high magnitude to occur, and
25 this welding technique has the defect of being
unable to provide the outer deck 8 acceptable for
practical use.

As described hereinabove, various processes

1 have hitherto been used for joining the outer deck 8
to the supporter 11. In one process, the heads of
the screws 14 appear on the surface of the balustrade
member which should be kept in a condition of excellent
5 finishes, and in another, fixing members are joined to
the undersurface of the balustrade member by melt adhesion
or welding. None of them is considered to be the best
process and it is apparent that they would cause the
appearance of the passenger conveyor to markedly
10 decline.

One of the defects of the balustrade member
caused by the processes of the prior art is that the
fixing members are located in conspicuous positions or
on the top surface or bottom surface of a balustrade
15 member, such as the outer deck 8. In this case, the
thickness of the stainless steel sheet should be increased
to about 5 mm to avoid the occurrence of distortions A,
B, C and D, thereby causing a rise in cost.

An additional disadvantage of the balustrade
20 constructions shown in Figs. 3-6 is that a defect occurs
in the joint of adjacent sections of the outer deck 8
as shown in Fig. 7. More specifically, the material
for forming the outer deck 8 is small in thickness and
difficult to machine, rendering to produce a gap g between
25 discrete portions of the outer deck 8 due to an error
committed when they are assembled. When this defect is
produced, the interior of the passenger conveyor could
be seen through this gap. This is not an isolated

1 phenomenon and all the balustrade members which are divided longitudinally of the passenger conveyor have the same problem. It is desirable that suitable means be provided for converging the gap g.

5 An embodiment of the balustrade in conformity with the invention which is developed for the purpose of obviating the aforesaid defects of the prior art will now be described.

The embodiment shown in Figs. 8 and 9 comprises
10 an outer deck 18 (corresponding to the outer deck 8 of the prior art shown in Figs. 1-7) which is substantially in the form of a letter C open toward a supporter 21 or downwardly in Fig. 8 in transverse cross section, and a fixing member 19 fitted to the underside of the
15 outer deck 18 so that the latter is secured through the former to the supporter 21 and main frame 13. In Fig. 8, parts similar to those shown in Figs. 1 and 2 are designated by like reference characters and their detailed descriptions are omitted. Although not shown,
20 the handrail 2 and handrail deck 4 shown in Figs. 1 and 2 for movement in synchronism with the steps 1 are provided to the balustrade shown in Fig. 8.

Referring to Figs. 8 and 9, the lower deck
18 includes a main plate section 18D extending horizon-
25 tally between the balustrade panel 5 and outer plate 9, a channel-shaped section 18A including a depending portion 18a extending downwardly from a side of the main plate section 18D adjacent the balustrade panel 5 or a

1 left side thereof in Fig. 9 and a portion 18b
extending inwardly (rightwardly in Figs. 8 and 9) from
a lower end of the depending portion 18a so that the
open side of the channel shaped portion 18A faces
5 inwardly transversely of the outer deck 18, and a U-
shaped section 18B including a depending portion 18c
extending downwardly from a side of the main plate
section 18D adjacent the outer plate 9 or a right side
as seen in Fig. 9 and a curved portion 18d extending
10 from a lower end of the depending portion 18c in curved
form so that the open side of the U-shaped section 18B
faces the underside of the outer deck 18. The fixing
member 19 fitted to the underside of the outer plate
18 includes a depending portion 19a extending downwardly
15 from a left end of a main body and a depending portion
19b extending downwardly from a right end of the main
body which are located inwardly of the channel shaped
section 18A and the U-shaped section 18B of the outer
deck 18 respectively and maintained in engagement
20 therewith, and a fixing groove 19c formed on the under-
side of the main body substantially in a central portion
and having an open side facing downwardly for receiving
a head 20a of a fixing bolt 20. The outer deck 18 is
formed of a stainless steel sheet of a small thickness
25 which is bent into the aforesaid shape.

The dimensional relation between the outer
deck 18 and the fixing member of the aforesaid construc-
tion will be described. Referring to Fig. 9, when the

1 width of the outer deck 18 is indicated by Y, the width
of the fixing member 19 can be indicated by $[Y - (\text{thick-}$
ness of outer deck 18 x 2) - small clearance y]. That
is, the width of the fixing member 19 is essentially
5 smaller than the inside measurement of the width of the
outer deck 18. Meanwhile, the depending portion 19b of
the fixing member 19 is inserted in the U-shaped section
18B of the outer deck 18 on the side thereof adjacent
the outer plate 9 so as to restrict the loose fitting
10 of the fixing member 19 to the outer deck 18 by the
engagement of the depending portion 19b in the U-shaped
section 18B. The clearance y serves as a space
facilitating the engagement described hereinabove by
accommodating any error that might occur in production
15 or assembly.

Assembly of the outer deck 18 and the fixing
member and their arrangement in the longitudinal direction
will be described. In securing the outer deck 18 to
the main frame 13, the outer deck 18 is placed on the
20 supporter 21 secured to the main frame 13 and then the
fixing member 19 is inserted between the supporter 21
and the outer deck 18 from an end of the outer deck 18
and moved inwardly in the direction of an arrow P in
Fig. 11. After they are assembled as shown in Fig. 11,
25 the head 20a of the fixing bolt 20 is inserted in the
fixing groove 19c of the fixing member 19 as indicated
by an arrow Q to secure the fixing bolt 20 to the
supporter 21 by a nut 22. Likewise, a head of a fixing

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1 bolt is inserted in the fixing groove 19c from the opposite direction as indicated by an arrow Q' and the bolt is secured to the supporter 21 by another nut. The two bolts are intended to secure the fixing member 5 19 to a first support portion 21A and a second support portion 21B of the supporter 21 respectively as subsequently to be described.

The outer deck 18 consists, like the outer deck of a balustrade of the prior art, of a plurality 10 of deck sections (such as the ones designated by 18_1 and 18_2 in Fig. 11) which are arranged successively in adjacent relation longitudinally of the outer deck 18. The supporter 21 is secured in a position corresponding to the boundary between the two adjacent deck sections 15 which constitutes a joint of the outer deck 18. As can be clearly seen in Fig. 11, the fixing member 19 is also secured to the outer deck 18 in a position corresponding to each joint of the outer plate 18. In this case, the supporter 21 and fixing member 19 are 20 located at each joint of the outer deck 18 with a spacing interval in the range between 300 and 1,000 mm.

Referring to Fig. 10, the supporter 21 located at each joint of the outer deck 18 includes a first support portion 21A formed with a slot 21a open at its 25 left side edge, and a second support portion 21B formed with a slot 21b open at its right side edge. The first support member 21A is located beneath the deck section 18_2 on the left side in Fig. 11 and the slot 21a

1 receives a threaded stem 20b of the fixing bolt 20 when
the head 20a of the fixing bolt 20 is inserted in the
fixing groove 19c of the fixing member 19 as indicated
by the arrow Q in Fig. 11. The second support portion
5 21B is located beneath the deck section 18₁ on the
right side in Fig. 11 and the slot 21b receives, as is
the case with the slot 21a, the threaded stem of the
fixing bolt when the head thereof is inserted in the
fixing groove 19c of the fixing member 19 as indicated
10 by the arrow Q'. The first and second support members
21A and 21B may, of course, be provided as a unitary
structure.

By arranging the fixing member 19 in a posi-
tion corresponding to each joint of the outer member 18,
15 a gap g corresponding to the gap g formed in the outer
deck 8 of the prior art as shown in Fig. 7 which might
be formed between the adjacent outer deck sections or
in the joint of the outer deck 18 as shown in Fig. 12
can be closed by the fixing member 19, so that the
20 interior of the passenger is invisible through either
a surface portion M or a lateral surface portion N.

The balustrade according to the invention in
which the outer deck 18 is secured to the supporter 21
through the fixing member 19 as described hereinabove
25 offers the following advantages:

1. No flaws are produced on the surface of the
outer deck 18 which would render the balustrade un-
acceptable in external view;

1 2. No distortion or discoloration occurs on
the surface of the outer deck which would be produced
if welding were relied on as in the prior art, thereby
enabling building cost to be reduced;

5 3. The fixing member 19 can be positively
fitted to the underside of the outer deck 18 by the
engagement of the depending portion 19b of the former in
the U-shaped section 18B of the latter; and

10 4. Even if a gap g were formed at the joint
between the deck sections of the outer deck 18, it is
possible to close it by the fixing member 19.

From the foregoing, it will be apparent that
the balustrade according to the invention has a flawless
surface on the outer deck which is a tribute to the
15 good design of the balustrade. In the embodiment shown
and described in Fig. 8, the gap G formed between the outer
deck 18 and the dressed packing 6 enables an increase
or decrease in the width Y (see Fig. 8) of the outer
deck 18 to be accommodated by enlarging or reducing the
20 gap G. This function of the gap G to adjust the width
of the outer deck 18 is quite important when it is
necessary, when the passenger conveyor is located near
the wall of a building, to reduce a clearance between the
wall and the outer deck 18 of the passenger conveyor.

25 In the balustrade according to the invention,
it is possible to additionally provide an outer molding
23 to the supporter 21 for the outer deck 18. Referring
to Fig. 13, the outer molding 23 is formed at its inner

1 end portion (left end in Fig. 13) with a slit 23a receiving a bolt 24 threadably engaged in a threaded opening formed in the supporter 21 and clamped by a nut 25 to secure the outer molding 23 to the supporter 21. The
5 provision of the outer molding 23 of the aforesaid construction enables a distance S between the wall of a building in which the passenger conveyor is installed and an outer end of the outer deck 18 to be readily adjusted within the dimension of the slot 23a.

10 In the embodiment shown and described hereinabove, the U-shaped section 18B is provided to the outer end of the outer deck 18. However, the provision of this section is not essential and what is important is that the inner periphery of the depending portion 18a
15 of the outer deck 18 and the outer periphery of the depending portion 19a of the fixing member 19 are complementary in shape and the gap y between them can be minimized, to enable the two depending portions 18a and 19a to be optimally brought into engagement with
20 each other. Thus, if the outer deck 18 were substantially in the form of a letter C as shown, it could be positively combined with the fixing member 19 to enable the outer deck 18 to be supported by the supporter 21 through the fixing member 19.

25 Fig. 14 shows a modification of the constructional form of the outer deck 18 of the embodiment in conformity with the invention shown and described hereinabove. More specifically, the outer deck 18 shown in

- 1 Fig. 14 is provided with a channel-shaped section 18A' in place of the U-shaped section 18B of the constructional form shown in Figs. 8 and 9, at the outer end of the outer deck 18 or the right end thereof in Fig. 14.
- 5 As shown, the channel-shaped section 18A' includes a depending portion 18a' extending downwardly from the right side of the main plate section 18D, and a bottom portion 18b' extending inwardly or leftwardly in Fig. 14, so that the channel-shaped section 18A' has an open end
- 10 facing inwardly or leftwardly in Fig. 14. The fixing member 19 includes a depending portion 19a' extending downwardly from the right side of the main portion thereof which engages at its outer periphery the inner periphery of the channel-shaped section 18A' of the outer
- 15 deck 18. The depending portion 18a of the channel-shaped section 18A of the outer deck 18 is secured to the depending portion 19a of the fixing member 19 by means of a screw 26. If the inner or left side of the outer deck 18 is secured by the screw 26 to the corre-
- 20 sponding side of the fixing member 19, the risk of the fixing member 19 dislodging from the outer deck 18 due to loosening of the fixing bolt 20 caused as by vibration can be avoided.

CLAIMS:

1. A balustrade of a passenger conveyor comprising a handrail moving in synchronism with a plurality of steps linked in an endless belt, balustrade members located below
5 the handrail including a handrail deck, an inner deck and an outer deck, and support means for supporting the balustrade members, characterized in that said outer deck has a transverse cross-sectional shape substantially in the form of a letter C which opens toward the support means,
10 that shape being formed by bending a stainless steel sheet to form the outer deck and that a fixing member is fitted to the underside of the outer deck so as to secure the outer deck to the support means through the fixing member.
2. A balustrade according to claim 1, wherein the outer
15 deck includes a main plate section extending horizontally from side to side, and a channel-shaped section located at least at one side of the main plate section and open transversely inwardly of the outer deck, and wherein the fixing member includes an engaging portion engaging the
20 channel-shaped section of the outer deck.
3. A balustrade according to claim 1, wherein the outer
deck includes a main plate section extending from side to side, and a U-shaped section located at least at one side of the main plate section and curved substantially in the
25 form of a letter U toward the interior of the outer deck, and wherein the fixing member includes an engaging portion engaging the U-shaped section of the outer deck.





4. A balustrade according to any one of claims 1 to 3,
wherein the fixing member has a groove for inserting a head
of a fixing bolt for securing the fixing member to the
support means.
- 5 5. A balustrade according to claim 1 or claim 2,
wherein the outer deck and the fixing member are secured to
each other by means of a screw at one side.
6. A balustrade of a passenger conveyor substantially
as herein described with reference to and as illustrated in
10 Figs. 8 to 14 of the accompanying drawings.
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