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MOVABLE WALKWAY BALUSTRADES

This invention relates to balustrades of a movable walkway, such as moving stairway or moving footway.

Generally, a movable walkway comprises, as described in U.S.

- 5 Patent Specification 3,321,059 and 3,353,650 movable members, such as treads or steps linked in an endless belt for conveying passengers, and a pair of handrails, and stationary members, such as a pair of handrail frames for supporting the handrails, a pair of balustrade frames, a pair of outer decks, and a pair of inner decks. These rotary members
10 and stationary members are all supported by a strongly built main frame. The steps and handrails change the direction of their movement at each end of the movable walkway.

- A moving stairway or escalator will be described as an example for further discussion. The effective width of an escalator is typically
15 the width of the escalator as measured between the pair of balustrade panels. In one escalator described as an example, the steps have a width of about 1000 mm and the escalator has an overall width of about 1700 mm

1 when its effective width is 1200 mm.

In recent years there has been an increased demand for an escalator design which would enable spaces required for installing an escalator to be
5 decreased by minimizing its overall width while keeping its effective width intact so as not to reduce the capacity of the escalator to convey passengers. This demand for decreased spaces for installing an escalator is motivated by the need to make full use of floor
10 space as sales rooms. Thus a reduction in the overall width of an escalator would have a great merit from the economical point of view.

However, as subsequently to be described, difficulties are encountered in attaining this end.
15 If the width of the escalator as measured between the handrail frames is made smaller than the width thereof as measured between the handrails, a child could have his finger tips stuck in the gap and be injured.

Conversely, if the width of the escalator as measured
20 between the handrail frames is made larger than the width thereof as measured between the handrails, there would be the danger that objects carried by passengers would strike the handrail frames.

It is an object of the present invention to provide movable
25 walkway balustrades suitable for use in a movable walkway of the space saving type

which ensure the safety of passengers by obviating the problems involving gaps between the handrails and handrail frames which would otherwise be encountered when an attempt is made to reduce the overall width of the movable walkway.

5 According to the present invention there is provided a balustrade for a movable walkway having a pair of handrails movable in synchronism with a plurality of steps arranged for movement in an endless belt, the balustrade comprising a balustrade panel located below one of said handrails, and
10 a handrail frame interposed between said balustrade panel and said one handrail wherein said handrail frame has a first portion located within the handrail and a second portion located remotely from the handrail, the second portion having on a side thereof corresponding to an inner surface of the
15 movable walkway an inclined surface such that the width of the second portion of handrail frame is progressively reduced from a point adjacent the handrail towards a point remote from the handrail and adjacent the balustrade panel so that upon collision of an article with the inclined surface the article
20 is deflected inwardly of the movable walkway away from the handrail.

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

25 Fig. 1 is a side view of an upper portion of an escalator;

Fig. 2 is a sectional view taken along the line II-II in Fig. 1;

Fig. 3 and 4 show constructions of balustrades of movable
30 walkways of the prior art, Fig. 3 being a sectional view of the essential portions of the passenger conveyor shown in Fig. 2 and Fig. 4 being a sectional view taken along the line IV-IV in Fig. 1;

Fig. 5 is a sectional view corresponding to Fig. 4 and
35 showing the balustrade comprising one embodiment of the invention; and

Fig: 6 and 7 are sectional views of modifications of the balustrade shown in Fig. 5.

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The invention will now be described by referring to the embodiments shown in the drawings.

Figs. 1 and 2 show a ^{movable stairway} ~~passenger conveyor~~ or
5 escalator of the usual construction comprising a plurality of steps 1 connected in an endless belt for movement and a pair of handrails 2 which constitute essential portions. The escalator further comprises a pair of balustrade sections 3 (only one is shown)
10 located on opposite sides of the steps 1, each balustrade section 3 including a handrail frame 4, balustrade panel 5, inner deck 6 and an outer deck 7. The components of the escalator described hereinabove are all supported by a strongly built main frame 8. The steps
15 1 and handrails 2 change the direction of their movement at each end of the escalator (near a and b in Fig. 1).

Fig. 2 shows a typical transverse sectional shape of the balustrade section 3, and the widths of
20 the escalator are as follows.

The effective width W_1 of an escalator which is a width determined by measuring the spacing between the balustrade sections 3 (to be exact, the spacing as measured at a point 600 mm vertically
25 above the step 1 shown in Fig. 2) may vary from one escalator to another. Generally, an escalator with $W_1 = 1200$ mm is referred to as a 1200 model and an escalator with $W_1 = 800$ mm is referred to as a 800

1 model. In these two types of escalators, there are
two types of steps 1 for passengers to stand on, one
having a width W_2 of about = 1000 mm (for 1200 model)
and the other having a width W_2 of about 600 mm (for
5 800 model).

Meanwhile the width of the escalator as
measured between the handrails 2 designated by W_3 is
larger than the effective width W_1 so that the hand-
rail 2 is disposed outwardly of the balustrade panel
10 5 because the former is disposed over and below the
latter in its travel. The main frame 8 and outer
deck 7 are disposed outwardly of the handrail 2

and the widths of the escalator as measured
in the main frame 8 and between the outer decks 7
15 designated by W_4 and W_5 respectively have following
relations: ($W_3 < W_4$, $W_3 < W_5$ and $W_4 < W_5$). The over-
all width W_5 of the escalator is about 1700 mm.

An escalator is constructed such that cross-
sectional surfaces thereof are arranged in positions
20 in which they do not overlap one another with respect
to the nominal effective width W_1 .

In recent years there has been an increased
demand for an escalator design which would enable
spaces required for installing an escalator to be
25 decreased by minimizing its overall width while
keeping its effective width intact so as not to reduce
its passenger conveying capacity. This demand for
decreasing the required spaces for the escalator is

1 motivated by the need to make full use of floor space
as sales rooms. Thus a reduction in the overall width
of an escalator would have a great merit from the
economical point of view.

5 To meet this need, proposals have more recently
been made to move the main frame 8 to a position below
the handrail 2 as indicated by imaginary lines at 8a in
Fig. 2, so as to decrease the overall width W5.

This constructional
10 form is favorably received by the users because a
decrease in overall width W5 can be achieved without
varying the width of the steps 1 and the effective
width of the escalator as measured between the balust-
rade sections 3 (W2 and W1) which directly affect the
15 number of passengers conveyed. In this case, however,
the path of travel of each handrail 2 is considerably
influenced and the width W3 of the escalator as
measured between the handrails 2 is reduced. Thus the
handrail 2 is inevitably moved inwardly to a position
20 in which it is directly over and below the balustrade
panel 5 as shown in Figs. 3 and 4 (in Figs. 3 and 4,
the balustrade panel is designated by ^{5a}~~5~~ but the
width of the escalator as measured between the
balustrade panels 5a is W1). In this constructional
25 form, it is unavoidable that the handrail 2 and
balustrade panel 5 have the aforesaid structural
relationship if it is desired to reduce W5 while
keeping W1 and W2 intact.

1 The escalator of the constructional form
shown in Figs. 3 and 4 which is designed primarily
with a view to meeting the requirement for reducing
escalator installing spaces encounters problems with
5 regard to the safety with which passengers are
conveyed.

More specifically, the handrail frame 9 is
interposed between the handrail 2 and balustrade
panel 5a, and amounts M1 and M2 of the portion of the
10 handrail frame 9 which projects further then the
balustrade panel 5a should be selected. There is a
potential source of trouble in this selection.

If M1 is set at about 10-20 mm, there would be the
problem that a child's fingers would be stuck in the
15 gap ³ ~~4~~ between the handrail 2 and handrail frame 9
and injured. If M2 is increased so that the hand-
rail frame 9 extends greatly beyond the edge of the
handrail 2, an object (designated by K in Fig. 1)
carried by a passenger (designated by H in Fig. 1)
20 would strike the handrail frame 9 as indicated by
arrows A2 and B2 in Figs. 3 and 4 respectively. This
would result in damage to some parts of the escalator
and injury to the passenger if the latter falls on
the step due to the shock of collision. The situa-
25 tion is serious particularly when the projection of
the handrail frame 9 relative to the balustrade
panel 5 has the value M1 which is smaller than M2.
In this case, there could occur the accident that

- 1 the finger tips would be caught in the gap as indicated
by an arrow f1 in Fig. 3 or passenger would collide
against the handrail 2 as indicated by an arrow C
when the handrail 2 changes the direction of its travel.
5 The arrow B in Fig. 1 and the arrows B1 and B2 in
Fig. 3 indicate the cases of collision which would occur
if a passenger lifted an object he carries. It might
be said that in these cases the trouble is not so
serious as in the case of collision indicated by the
10 arrow C in Fig. 4.

When the projection of the handrail frame 2
has the larger amount M2 to avoid the problem of finger
tips being stuck in the gap as indicated by the arrow
f1 in Fig. 3, finger tips would have the difficulty
15 of being led into the gap as indicated by an arrow f2.
However, the problem of an object carried by a
passenger striking the handrail frame 9 as indicated
by arrows A1 and B1 in Figs. 3 and 4 would be raised.
The collision occurring in the directions of arrows A1
20 and B1 might be said to be smaller in shock produced
thereby than the collision occurring in the direction
of arrows A2 and B2 because the projection of the
handrail frame 9 has the smaller value M1.

From the foregoing, it will be appreciated
25 that the escalator having balustrades designed to
reduce escalator installing spaces as shown in Figs. 3
and 4 encounters a problem with regard to the safety
with which passengers are conveyed.

1 Figs. 5 and 6 show embodiments of the present invention in which the handrail frame 10 has inclined sides 10a tapering in going from the top of the hand-
rail ^{frame} 10 toward the balustrade panel 5a, although the
5 relative positions of the handrail 2 and balustrade panel 5 as viewed vertically of the balustrade panel 5a are similar to those shown in Fig. 4. The handrail frame 10 has angled portions 10b which, as shown in Fig. 5, extend slightly outwardly with respect to the
10 handrail 2 by an amount δ , so that the inclined sides 10a extend from the angled portions 10b toward the balustrade panel 5a at an angle θ with respect to a perpendicular to the length of the balustrade panel 5a. The inclined side surfaces 10a of the aforesaid con-
15 striction have the functions of preventing finger tips, for example, of a child from being stuck in the gap g as indicated by an arrow $f3$, and guiding an object carried by a passenger in the direction of an arrow D .
~~toward the steps 1.~~ In this case, no serious colli-
20 sion as indicated by the arrow C in Fig. 4 occurs, and even if a bag carried by a passenger, for example, strikes the handrail frame 10, the bag would be guided by the inclined side surface 10a, thereby enabling collision of the bag against the handrail 2 which is
25 travelling to be avoided.

The amount δ of projection of the angled portions 10b would be advantageously set at a level sufficiently high to prevent slipping of finger tips

1 into the gap. Fig. 6 shows a modification of the
embodiment shown in Fig. 5 in which the angled portion
of the inclined side 11a does not extend beyond the
edges of the handrail 2 and remains inwardly thereof
5 by an amount δa , and the handrail frame 11 may have a
large projection ^{11b}~~11a~~ on its outer side. Also, the
handrail frame may have a concavely inclined side
designated by Z in Fig. 7.

In Fig. 6, the handrail frame 11 has a space
10 Q for containing ^{cables for} illuminating means.

From the foregoing, it will be appreciated
that the balustrades of a passenger conveyor according
to the invention are capable of increasing the safety
of operation of a passenger conveyor designed primarily
15 to reduce spaces required for installing the escalator.



CLAIMS:

1. A balustrade for movable walkway having a pair of hand-rails movable in synchronism with a plurality of steps arranged for movement in an endless belt, the balustrade comprising a
5 balustrade panel located below one of the said handrails, and a handrail frame interposed between said balustrade panel and said one handrail wherein said handrail frame has a first portion located within the handrail and a second portion located remotely from the handrail, the second portion having
10 on a side thereof corresponding to an inner surface of the movable walkway an inclined surface such that the width of the second portion of handrail frame is progressively reduced from a point adjacent the handrail towards a point remote from the handrail and adjacent the balustrade panel so that upon
15 collision of an article with the inclined surface the article is deflected inwardly of the movable walkway away from the handrail.
2. A balustrade as claimed in Claim 1, wherein the outermost extremity of the second portion of the handrail frame having said inclined surface extends outwardly from the
20 balustrade panel beyond the handrail.
3. A balustrade as claimed in Claim 1, wherein the handrail extends outwardly relative to the balustrade panel beyond the outermost extremity of the second portion of the handrail frame having said inclined surface.
- 25 4. A balustrade as claimed in Claim 1 or 3, wherein said handrail frame is formed on its side opposite to that having said inclined surface with a space for containing cables for illuminating means.
5. A balustrade as claimed in any one of the preceding
30 claims, wherein said inclined surface of said handrail frame is concave.
6. A balustrade substantially as hereinbefore described with reference to, and as illustrated in, Fig. 5; or Fig. 5 when modified according to Fig. 6 or Fig. 7 of the accompanying
35 drawings.