

PASSENGER CONVEYOR

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This invention relates to a passenger conveyor such as an escalator and an electrically-operated sidewalk (people-mover).

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Generally, on a platform portion of a passenger conveyor, a distal end portion of a platform floor is slanting downward toward treadboards, and a comb for meshing engagement with cleats of the treadboard is mounted on a distal end of this slanting portion (Japanese Patent Unexamined Publication No. 57-18565, for example).

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In the above prior art, no consideration is given to the case where the passenger conveyor carries a push cart, and also to the case where old people or physically-handicapped people use the passenger conveyor. Particularly when the passenger gets off the passenger conveyor, the passenger may hit his toe against the comb to fall, or when the push cart is moved onto the platform floor, the wheels of the push cart may strike against the comb.

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It is an object of this invention to provide a passenger conveyor which enables a push cart to be smoothly moved from a treadboard to a platform floor.

1 Another object of the invention is to provide
a passenger conveyor in which the toe of a passenger is
less liable to strike a comb.

According to the present invention, there is
provided a passenger conveyor comprising a plurality of
5 treadboards interconnected in an endless manner so as
to move along a predetermined path of travel having an
advance side and a return side, and a platform floor
provided at one end of said advance side, said platform
floor having a slanting portion slanting downwardly in
such a manner that the upper and lower surfaces of said
10 slanting portion become closer to the treadboards of
said advance side progressively toward a distal end of
said slanting portion, wherein the length of said
slanting portion in the direction of travel of said
treadboards in said advance side is not less than the
length of one said treadboard in said direction of
15 travel; and is such that as said treadboards travel on
part of one treadboard beginning to be turned from said
advance side to said return side and the whole of the
next treadboard which is disposed horizontally and is
connected to the trailing end of said treadboard which
is beginning to be turned, are disposed beneath said
20 slanting portion.

With this arrangement, the length of the
slanting portion can be increased, and therefore the
angle of inclination of the slanting portion relative to
the treadboard can be made smaller. Because of this
25 decreased inclination angle, the angle of teeth (for
meshing with cleats of the treadboard) of a comb
relative to the treadboard is also decreased, and
therefore wheels of a push cart can be smoothly moved

1 onto the comb, and the toe of a passenger is less liable
to strike against the comb. Further, since the
inclination of the slanting portion is made gentler as
described above, the slanting portion is disposed closer
5 to the treadboard disposed beneath it. Therefore, when
the treadboard is to be turned to change the direction
of travel thereof, the trailing end of this treadboard
is raised and would be brought into engagement with the
inner or lower surface of the slanting portion, so that
10 the turning of the treadboard would be prevented.
However, since one treadboard is always disposed
horizontally beneath the slanting portion, the turning
treadboard is disposed at an upstream side of the
slanting portion, and therefore the turning treadboard
15 will not interfere with the platform floor.

Preferably, the projection length of teeth
from a comb body is greater than a length of overlap of
said teeth with the comb body, and preferably also each
of the teeth is thinned at its inner portion over a
20 region extending from a proximal end of the tooth
toward the distal end of the tooth.

With this arrangement, even when foreign
matter is caught between the tooth of the comb and the
cleat of the treadboard, damage to the cleat is kept to
25 minimum, and even if the thinned portion of the tooth
is broken off, the thickened portion of the tooth
remains, and therefore a large space or gap will not be
present between the comb and the cleats at a position

1 where the thinned portion of the tooth has been broken
off. Therefore, the operation of the passenger conveyor
can be continued safely.

5 Fig. 1 is a vertical cross-sectional view of a
portion of a platform floor of a passenger conveyor
according to the present invention;

Fig. 2 is a perspective view of a portion of
the platform floor;

10 Fig. 3 is a fragmentary cross-sectional view
taken along the line III-III of Fig. 1;

Fig. 4 is a vertical cross-sectional view,
showing a platform portion of the passenger conveyor of
the invention;

15 Fig. 5 is a perspective view of a portion of a
modified platform floor;

Fig. 6 is a vertical cross-sectional view of a
comb for the platform floor of Fig. 5;

20 Fig. 7 is a view similar to Fig. 3, but
showing the comb of Fig. 6;

Fig. 8 is a vertical cross-sectional view
showing the condition of breakage of a tooth of the comb
of Fig. 6:

25 Fig. 9 is a view similar to Fig. 3, but
showing the relation between the broken comb and a
treadboard; and

1 Fig. 10 is a view similar to Fig. 3, but
showing the relation between a treadboard and a comb
having teeth of a modified cross-section.

5 An ascending escalator embodying the invention
will now be described with reference to Figs. 1 to 4.
Fig. 4 shows an upper platform portion of the escalator
where passengers get off the escalator. A frame 1 is
extended between floors (not shown) of adjacent upper
10 and lower stairs of a building, and treadboards 2,
balustrades 5, moving handrails 6 and a platform floor 7
are supported on the frame 1. A plurality of tread-
boards 2 are interconnected in an endless manner, for
example, by chains (not shown). An advance side 2A of
15 the treadboards 2 interconnected in an endless manner
carries passengers, a push cart and so on, and moves
toward the upper stair, and a return side 2B of the
interconnected treadboards 2 moves beneath the advance
side 2A in a reverse direction. The treadboards 2 of
20 the advance side 2A are guided by guide rails 3 fixedly
mounted on the frame 1. Sprockets 4 are provided at
upper and lower turning portions where the direction of
movement of the treadboards 2 is changed from the
advance side 2A to the return side 2B, and vice versa.
25 The above-mentioned chains interconnecting the
treadboards 2 are extended around the sprockets 4.
Therefore, the treadboards (designated by 2R) reaching

1 the upper sprockets 4 are turned or inverted one after
another. A pair of balustrades 5 are upstanding, and
are provided respectively on the opposite sides of the
interconnected treadboards 2 of the advance side 2A. A
5 pair of handrails 6 are supported respectively on the
peripheral edges of the balustrades 5 so as to move in
synchronism with the movement of the treadboards 2. The
platform floor 7 is provided at the end of the advance
side 2A of the treadboards 2, and is fixedly mounted on
10 the frame 1 in overlying relation to the turning
treadboard 2R to cover the same.

The platform floor 7 comprises a floor plate 8
composed of a base plate 9 of a high strength and a
decorative plate 10 mounted on an upper surface of the
15 base plate 9, and a comb 11 mounted on a distal end of
the floor plate 8. The comb 11 comprises a body 12 and
teeth 13. The teeth 13 project forwardly from the
distal end of the body 12 and also project downwardly
from the body 12. The teeth 13 are meshed with a
20 plurality of cleats 2K in a non-contact manner which
cleats are formed on the treadboard 2. An upwardly-
directed stepped portion is formed on the distal end
portion of the base plate 9, and this stepped portion
provides a support portion 8E supporting the comb 11. A
25 downwardly-directed stepped portion is formed on the
rear end portion of the body 12 of the comb 11 remote
from the teeth 13, and this stepped portion provides a
mounting portion 12E through which the comb 11 is

1 supported on the base plate 9. The mounting portion 12E
is superposed on the support portion 8E, and then they
are fixedly connected together by flush-head screws 14.
The thicknesses of the support portion 8E and the
5 mounting portion 12E need to be determined in such a
manner that when the comb 11 is fixedly secured to the
floor plate 8, an upper surface 11S of the comb 11 is
not stepped with respect to an upper surface 8S of the
floor plate 8, but is smoothly continuous with the upper
10 surface 8S.

The platform floor 7 having the comb 11
mounted on its distal end is formed in the above-
mentioned manner. In order to reduce a step between the
platform floor 7 and the moving treadboard 2, the
15 platform floor 7 has a slanting portion L extending
continuously from a horizontal portion H thereof. The
length of the slanting portion L is not less than a
length L_0 of the treadboard 2 in the direction of travel
thereof. By thus increasing the length of the slanting
20 portion L while keeping the height of the horizontal
portion H of the platform floor 7 relative to the
treadboard 2 equal to the conventional height, the angle
of inclination (slanting) of the slanting portion L is
rendered gentler. Therefore, when the passenger or a
25 push cart is moved from the treadboard 2 to the platform
floor 7, the impact of striking of the passenger's toe
against the comb 11, as well as the impact of movement
of the push cart onto the platform floor 7, is reduced,

1 so that the safety, when getting off the escalator, can
be enhanced. As a result of the gentle inclination of
the slanting portion L, the slanting portion L is closer
to the treadboard 2 moving below the platform floor 7,
5 as compared with the conventional construction. The
treadboard 2 (2R) moving below the platform floor 7 is
turned, and a trailing end 2E of this turning treadboard
2R is once raised during the turning movement thereof.
As a result, the raised trailing end 2E of the tread-
10 board 2R would impinge on the gently-slanting portion L
disposed closer to the treadboard than before, so that
the platform floor 7 or the treadboard 2R would be
damaged or broken. To avoid this difficulty, in the
present invention, the platform floor 7 is so arranged
15 that at least one treadboard 2 of the advance side 2A
can be disposed horizontally beneath the slanting
portion L of the platform floor 7. That at least one
treadboard 2 is present in a horizontal condition
beneath the slanting portion L means that any treadboard
20 2 will not be turned at this region, and therefore the
turning treadboard 2R will not impinge on the slanting
portion L.

For the reasons mentioned above, in the
present invention, it is necessary to increase the
25 length of the slanting portion L to make its inclination
gentler, and it is also necessary that at least one
treadboard 2 should be disposed horizontally beneath the
slanting portion L. In other words, the point P of

1 start of the slanting portion L is disposed near the position where the trailing end 2E of the turning treadboard 2R is most raised.

The slanting portion L is composed of a
5 slanting portion L1 of the floor plate 8 and a slanting portion L2 of the comb 11. The slanting portion L1 is formed by a flat surface H1, and the slanting portion L2 is formed by a flat surface H2 and a curved surface R. The flat surface H1 is inclined at an angle θ_1 of not
10 more than 50° with respect to the horizontal portion H (and hence the horizontally-disposed treadboard 2), and the length of the slanting portion L is not less than 300 mm, in which case the invention can be practiced without hardly changing the conventional construction.
15 Particularly, the inclination angle θ_1 was 30° , and the flat surface H2 was inclined with respect to the flat surface H1 at an angle θ_2 less than the inclination angle θ_1 , and the length of the slanting portion L was 530 mm, in which case the getting-on and -off were easy
20 and safe. The radius of curvature of the curved surface R is about 300 mm.

The length L4 of that portion of the comb 11 between its distal end and the mounting portion 12E is at least 1.5 times larger than the length L3 of the
25 mounting portion 12E to increase the radius of curvature of the curved surface R. Incidentally, with respect to a model used for an experiment, the length of the slanting portion L2 of the comb 11 was about 115 mm, and the

1 length L3 of the mounting portion 12E was about 40 mm,
and the length L4 was about 75 mm. In this case, a push
cart could be smoothly moved onto the platform floor 7.
Thus, by increasing the distal end portion of the comb
5 11 and also by increasing the radius of curvature
thereof, the inclination of the comb 11 relative to the
treadboard 2 can be made gentle, and therefore the toe
of the passenger as well as wheels W of a push cart can
easily move onto the comb 11. As described above, the
10 overall length of the comb 11 is long, and the length L4
of the comb 11 projecting from the base plate 9 is long,
and therefore preferably the comb 11 should not be made
of a synthetic resin, but should be made of metal, such
as an aluminum alloy, so as to withstand a large load of
15 a push cart and so on.

In the above embodiment, each of the teeth 13,
which projects from the distal end of the body 12 of the
comb 11 and also projects into the gap between the
cleats 2K of the treadboard 2, has a uniform thickness
20 over the entire area thereof so that the gap between the
tooth 13 and the cleat 2K can be as small as possible.
Where the comb 11 is made of an aluminum alloy so as to
withstand a large load, the mechanical strength of the
teeth 13 are much superior to that achieved by a
25 synthetic resin. If a foreign matter, such as a small
stone and a coin, intrudes in the gap between the tooth
13 of the comb 11 and the cleat 2K of the treadboard 2,
one or both of the tooth 13 and the cleat 2K would be

1 broken. As a result, a large gap is provided between
the stationary comb 11 and the moving treadboard 2, and
there is a risk that the toe of the passenger may be
caught in this large gap.

5 To avoid this difficulty, according to a
modified form of the present invention, an improved
configuration of teeth 14 of a comb 11 is provided as
shown in Figs. 5 to 7. Although this modified comb 11
is similar in basic construction to the comb 11 of the
10 preceding embodiment in that the teeth 14 project from a
distal end of a body 12 away from its rear end and also
project into the gaps between the cleats 2K of the
treadboard 2, the thickness and length of the teeth 14
are improved. More specifically, the length L5 of the
15 tooth 14 in the direction of travel of the treadboard 2
is shorter than that of the tooth 13 of the preceding
embodiment. The length L8 of that portion of the tooth
14 overlapping the body 12 is shorter than the length L7
of that portion of the tooth 14 projecting from the
20 distal end of the body 12 along the direction of travel
of the treadboard 2. The tooth 14 is thickened at its
distal end and its upper portion over a region extending
from this distal end to its rear end to provide a
thickened portion 14A, and the remainder (that is, the
25 inner portion of the tooth 14) is thinned as at 14B.
That section of the thickened portion 14A overlapping
the body 12 is extended toward the rear or proximal end
of the body 12 to form a reinforcement rib 15 on the

1 lower or inner surface of the body 12. The thickened
portion 14A is formed mainly on the upper surface
portion of the tooth 14, and an abrupt step is formed at
the boundary between the thickened portion 14A and the
5 thinned portion 14B. The reinforcement rib 15 and the
thickened portion 14A linearly continuous therewith are
disposed above an upper surface 2T of the cleat 2K of
the treadboard 2.

With the above configuration (i.e., the length
10 and thickness) of the teeth 14, even if a foreign matter
intrudes into the gap between the tooth 14 and the cleat
2K, a force tending to deform the tooth 14 or the cleat
2K concentrates on the stepped portion between the
thickened portion 14A and the thinned portion 14B of the
15 tooth 14, so that generally the whole of the tooth 14 is
broken off the body 12 at this stepped portion, as shown
in Fig. 8. Thus, the damage by the intruding foreign
matter is undertaken by the comb 11 which can be easily
attached to and detached from the floor plate 8, and
20 therefore such a damage can be kept to minimum, and the
damaged comb 11 can be replaced by a new one in a short
time.

Fig. 9 shows the relation between the
treadboard 2 and the comb 14 one tooth 14 of which has
25 been broken. As can be seen from the cross-sectional
view of Fig. 9, a considerable space or gap is provided
between the broken tooth 14 and the two adjacent cleats
2K generally opposed thereto. However, the thickened

1 portion 14A of the broken tooth 14, which is continuous
with the reinforcement rib 15, is projected from the
lower surface of the comb body 12 opposed to the upper
surfaces 2T of the cleats 2K, and is disposed immediate-
5 ly above the above-mentioned space. Thus, the upper
portion of this space is not open, and the toe of the
passenger will not be caught by that portion where the
tooth 14 has been broken. Therefore, even if the tooth
14 is broken, the escalator does not need to be
10 immediately stopped, and the comb 11 is exchanged with a
new one when the escalator is not crowded, or after a
daily operation of the escalator is finished.

In the above embodiment, in order to
facilitate the breakage of the tooth 14, the thickened
15 portion 14A and the thinned portion 14B are provided to
form the stepped portion on the tooth 14. However, as
shown in Fig. 10, instead of changing the thickness of
the tooth 14, a groove 14G may be formed in each side
surface of the tooth 14. Each groove 14 is disposed
20 between the lower surface of the comb body 12 and the
upper surface 2T of the cleat 2K. Also, instead of the
grooves 14G, a number of through holes may be formed
through the tooth 14 along a line corresponding to a
line along which the groove 14 extends.

25 The comb 11 is integrally molded by pouring a
synthetic resin material or an aluminum alloy material
in a mold. In view of the direction of release of the
molded comb from the mold, the grooves 14G or the

1 through holes can not be formed by this molding operation, and they must be formed after the molding is finished. However, to form the grooves or the through
5 a very cumbersome operation. Therefore, in view of the moldability of the comb 11, it is most preferred that the thickness of the tooth 14 be changed to provide the stepped portion.

Although the above description has been
10 directed to the escalator, the present invention can be applied to an electrically-operated sidewalk in which each treadboard is not stepped with respect to its adjoining treadboard. Further, although the above description is directed to the upper platform portion
15 (i.e., the exit portion) of the upwardly-moving escalator, the present invention should naturally be applied also to a lower platform portion if the escalator is designed to be operated in a reversible manner (that is, in both upward and downward directions). Further, with respect to the escalator or the
20 electrically-operated sidewalk moving in one direction, the present invention only need to be applied to the exit portion; however, for the purpose of standardizing the platform parts, the present invention may be applied
25 also to an entrance platform.

As described above, according to the present invention, there is provided the passenger conveyor in which the passenger and a push cart can get off the

- 1 conveyor smoothly and safely, and even if a foreign matter is caught between the treadboard and the comb, damage resulting from it can be kept to minimum, so that safe operation of the passenger conveyor can be
- 5 continued.



CLAIMS

1. A passenger conveyor comprising a plurality of treadboards interconnected in an endless manner so as to move along a predetermined path of travel having an advance side and a return side, and a platform floor provided at one end of said advance side, said platform floor having a slanting portion slanting downwardly in such a manner that the upper and lower surfaces of said slanting portion become closer to the treadboards of said advance side progressively toward a distal end of said slanting portion, wherein the length of said slanting portion in the direction of travel of said treadboards in said advance side is not less than the length of one said treadboard in said direction of travel; and is such that as said treadboards travel on part of one treadboard beginning to be turned from said advance side to said return side and the whole of the next treadboard which is disposed horizontally and is connected to the trailing end of said treadboard which is beginning to be turned, are disposed beneath said slanting portion.

2. A passenger conveyor according to claim 1, in which the starting point of said slanting portion remote from said distal end thereof is disposed in the vicinity of a highest position of the locus of movement of each treadboard during the turning of the said treadboard below the platform floor.



3. A passenger conveyor according to claim 1 or claim 2 in which the angle of inclination of said slanting portion is not more than 5 degrees; and the length of said slanting portion is not less than 300 mm.

4. A passenger conveyor according to claim 1, claim 2 or claim 3 in which said upper surface of said slanting portion has a plurality of flat surfaces of different inclination angles relative to the horizontal.

5. A passenger conveyor according to claim 4, in which said slanting portion has at its distal end a comb having teeth for meshing with cleats on said treadboards, in a non-contact manner, part of said plurality of said flat surfaces being provided by an upper surface of said comb.

6. A passenger conveyor according to any one of claims 1 to 5, in which said upper surface of said slanting portion has two flat surfaces and a curved surface continuous with one of said flat surfaces in the direction of travel of said treadboards.

7. A passenger conveyor according to any one of claims 1 to 6, in which said slanting portion includes a comb fixedly mounted on a distal end portion of said slanting portion, said comb having a mounting portion and a projecting portion projected from said mounting portions, the length of said projecting portion being at least 1.5 times that of said mounting portion.



8. A passenger conveyor according to any one of claims 1 to 5, in which said slanting portion includes a comb provided at the distal end portion thereof, said comb having a body, and teeth formed on said body so as to be meshed with cleats on said treadboards, the projection length of said teeth from said comb body along the direction of travel of said treadboards is greater than the length of overlap of said teeth with said comb body along said direction of travel.

9. A passenger conveyor according to any one of claims 1 to 3, in which platform floor of which said slanting portion is part includes a floor member supported on a frame of said passenger conveyor and a comb mounted on the distal end of said floor member and having a plurality of teeth meshing with cleats formed on each of said treadboards, in a non-contact manner.

10. A passenger conveyor according to claim 9, in which said comb has a body fixedly mounted at its proximal portion on a distal end of said floor member, the projection length of said comb from the distal end of said floor member being at least 1.5 times greater than the length of overlapping of said proximal portion of said comb body with said floor member.

11. A passenger conveyor according to claim 10, in which an upper surface of said comb body has a flat surface formed on said proximal portion, and a curved surface continuous with said flat surface and extending substantially over said projection length of said comb.



12. A passenger conveyor according to claim 11 or claim 12, in which reinforcement ribs are formed on a lower surface of said comb body and extend along the direction of travel of said treadboards to distal ends of said teeth.

13. A passenger conveyor substantially as any herein described with reference to and as shown in the accompanying drawings.
