

Barrier for an escalator or for a moving walkway

The invention relates to a barrier for a transport device, which barrier serves as fall protection for users, its assembly method, as well as a transport device with such a barrier and a method for modernizing a transport device by means of such a barrier.

In the sense of the present document, transport devices are escalators and moving walkways with a conveyor belt that has a large number of steps or pallets. The steps or pallets form a conveying surface which serves to convey users and/or other loads, such as hand luggage or shopping carts.

Balustrades are usually arranged to the sides of the steps or pallets of the transport devices. Below the balustrades is a supporting structure to which the balustrades are attached. The supporting structure is covered at the top by a cover assembly and laterally by side paneling. The cover assembly and side paneling are usually attached to the supporting structure with the aid of fastening means.

For transport devices, building regulations and standards apply, such as EN-115, regarding their balustrade height (starting from their conveying surface) or the height at which the handrail is arranged. These building regulations are intended to ensure the safe use of the escalator or moving walkway and must be strictly adhered to by the operators or building owners.

Since the balustrades of conventional transport devices only extend to the height of the handrail, there are certain risks associated with improper use. As a result, users sometimes "surf" on the handrails or deliberately jump over the balustrade, or users are involuntarily pushed over the balustrade. This happens, for example, in soccer stadiums when hooligans jump off a transport device or push other users off a transport device.

Such situations are dangerous for the users of the transport devices and also for the people located under the transport devices and must therefore be avoided at all costs.

For example, WO 2020/114846A1 discloses a balustrade for an escalator in which first panels are arranged below the handrail, and, as an additional barrier, second panels are arranged laterally offset from the handrail and projecting above the handrail. A

disadvantage of this solution is that installing the panels in the mounting profile can lead to problems. In particular, the glass paper thereof tends to shift upon the insertion of the panels, and may get crumpled in the process and need to be replaced. Furthermore, it offers little damping at the clamping point, which can lead to an increased risk of breakage in glass panels. A further problem arises from the mass of the barrier and from forces acting upon the barrier due to greater leverage effects, which place additional stress on the balustrade. In most cases, this needs to be significantly reinforced, which increases its intrinsic mass and, in total, places an additional load on the supporting structure. Furthermore, measures to reinforce the balustrade of existing transport devices significantly increase the installation effort and may require extensive modifications to the existing balustrade panels. EP 3 757 052 A1 also discloses a barrier that can be arranged laterally on a balustrade of an escalator or moving walkway.

Against this background, it is an object of the present invention to provide an improved means of erecting the aforementioned barrier. In particular, the aim is to create a barrier that is easy and quick to install, visually appealing, and serves as fall protection. Furthermore, it should be possible to easily retrofit transport devices with such a barrier.

This object is achieved by a barrier to protect users from falling from a transport device that is configured as an escalator or moving walkway. The barrier is configured to be installed on the transport device next to a circulating movable handrail of the balustrade of the transport device, wherein, in the installed state, the barrier extends parallel to the handrail and projects in height beyond the balustrade or the handrail. The barrier has a clamping profile with a V-shaped groove that extends into the clamping profile in the longitudinal direction thereof, wherein the V-shaped groove is bounded by a groove base and two groove surfaces, and the groove surfaces are arranged at an opening angle to each other from the groove base towards a groove opening. The clamping profile can, for example, be made from an aluminum extrusion profile, the ends of which are covered with an end cap.

Furthermore, the barrier includes a balustrade panel. This has two parallel side surfaces and a lower edge and is arranged in the region of its lower edge in the V-shaped groove. The balustrade panel can also be configured of multiple parts and comprise a plurality of panel sections. Another component of the barrier is an L-shaped wedge insert with a wedge leg and a base leg. The wedge leg has a wedge-shaped cross-section and is

arranged between the first side surface of the balustrade panel and the first groove surface. The base leg is arranged between the lower edge of the balustrade panel and the groove base. In addition, a channel is formed in the base leg and extends parallel to the V-shaped groove. The formation of a channel in the base leg has the advantage that at least one of the following components can be laid in the clamping profile or in the V-shaped groove: an electrical conductor such as a signal line or power supply line; a lighting means; a CAN bus.

In addition, the barrier has a clamping wedge that is wedge-shaped in cross-section and arranged between the second side surface of the balustrade panel and the second groove surface. It is not necessary in this case for the wedge insert and the clamping wedge to extend continuously in the V-shaped groove or for their length to be matched to the length of the balustrade panel.

For reasons of cost, manufacturing, and installation, the wedge insert and the clamping wedge are configured to be significantly shorter than a balustrade panel so that they can also be used in curved sections of the clamping profile without having to be bent in the longitudinal extension of the clamping profile. To avoid additional bending moments on the balustrade panel as a result of the clamping force generated by the driven-in clamping wedge, the wedge insert and the clamping wedge are preferably arranged opposite each other in the V-shaped groove and not offset from each other in the longitudinal direction. A plurality of wedge inserts and clamping wedges can be provided per balustrade panel, whereby a distance can be provided between two pairs of wedge inserts/clamping wedges that is greater than the length of a wedge insert or a clamping wedge.

The L-shaped wedge insert provides a component that is per se dimensionally stable enough to withstand the forces of the balustrade panel when inserted into the V-shaped groove. Furthermore, the balustrade panel is precisely positioned in the V-shaped groove by the wedge insert so that a plurality of panel sections arranged side-by-side in series of a balustrade panel divided into a plurality of parts can be precisely positioned relative to each other without effort. In addition, the wedge insert, which is preferably made of a polymer material such as acrylonitrile butadiene styrene copolymer (ABS), polyethylene terephthalate (PET), polyamide (PA), and the like, offers very good shock absorption, so that the risk of breakage of the balustrade panel is significantly reduced, and its thickness can therefore be kept comparatively low.

In one embodiment of the barrier, the channel is arranged on that side of the base leg which is directed towards the groove base when the wedge insert is placed in the V-shaped groove. This creates a wide support surface for the lower edge of the balustrade panel. In order to ensure that the balustrade panel resting on top can be sufficiently illuminated in the region of the wedge insert by a lighting means arranged in the channel, at least one opening through the base leg is provided. The opening can also be used to run power supply lines and/or signal lines.

In one embodiment of the barrier, the channel is arranged on that side of the base leg which, given a wedge insert inserted in the V-shaped groove and inserted balustrade panel, is directed towards the lower edge of the balustrade panel. This embodiment has the advantage that no opening is required, since a lighting means arranged in the channel can also be arranged in the region of the wedge insert between the base leg and the lower edge of the balustrade panel.

The balustrade panel is preferably made of transparent material such as single-pane safety glass, double-pane safety glass, transparent plastic such as polycarbonate (PC), acrylic glass (PMMA), edge-illuminated acrylic glass that emits light via the side surfaces, and the like. The balustrade panel can also be made of opaque material such as wood, composite material, metal, or opaque polymer materials, wherein, without additional precautions, it cannot be illuminated from the V-shaped groove.

In one embodiment of the barrier, a lighting means is arranged in the V-shaped groove. This is also guided through the channel of the wedge insert so that the lighting means can have a constant cross-section over the entire length of the clamping profile and does not need to be interrupted. When a lighting means is arranged in the V-shaped groove, transparent balustrade panels are preferably used to illuminate it. It is also possible to use opaque balustrade panels by taking suitable precautions such as openings arranged in the balustrade panel, recesses in the clamping profile or wedge inserts, and locking wedges made of transparent plastics. All known light-emitting devices such as light-emitting diodes, fluorescent tubes, OLED films, and the like, can be used as lighting means.

The lighting means can be a light strip equipped with LED's. Light strips of the aforementioned type usually have an integrated power supply line with which the

individual light-emitting diodes are supplied with electrical energy. Depending upon the design, these light strips are dimmable and/or the color or wavelength of the emitted light can be adjusted as desired. In this case, a signal line may also be integrated into the light strip to control the individual LED's.

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To facilitate the assembly of the barrier, the channel can have a positioning means. The positioning means is configured to match the lighting means in such a way that it positions the lighting means perpendicular to the longitudinal direction of the clamping profile in the channel during and after assembly of the barrier. The positioning means can, for example, be a rounding or chamfering of the edges at the opening, facing the balustrade panel or the groove base, of the channel.

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In one embodiment of the barrier, the V-shaped groove on the first groove surface provided for the wedge insert has a projection that narrows the groove opening. The projection, together with the groove base and the first groove surface, forms a kind of lateral pocket into which the wedge leg of the wedge insert can be placed. The projection fixes the wedge insert in the V-shaped groove during installation and removal of the balustrade panel so that it remains at the provided location in the groove. This significantly further simplifies the installation work and allows it to be carried out even by less qualified assembly personnel.

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In addition, an elastic element can be arranged on the wedge leg of the wedge insert. When a wedge insert is inserted in the V-shaped groove, the elastic element clamps the wedge leg of the wedge insert between the projection and the groove base. The elastic element accordingly fixes the wedge insert even better in the V-shaped groove, in particular against displacements in its longitudinal direction. This is particularly advantageous in the inclined part of escalators, so that the wedge insert does not slip "downhill."

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To further increase the adhesion of the elastic element, it can have ribbing on one surface. When the wedge insert is inserted, the ribbing rests against the projection so that there is even higher static friction between the elastic element and the projection, which fixes the wedge insert in the inserted position.

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In another version of the barrier, the clamping wedge has an ejection nose. The installation personnel can attach a disassembly tool thereto to remove the clamping wedge from the V-shaped groove. This significantly simplifies the replacement of damaged or unsightly balustrade panels. If necessary, the clamping wedge can have an ejection nose at both ends so that two tools can be applied simultaneously to both ends of the clamping wedge, and it can be pulled out of the V-shaped groove.

In another embodiment of the barrier, fastening structures for an elastic sealing profile are formed on both sides at the groove opening of the V-shaped groove. The sealing profiles arranged on both sides prevent dirt and water from penetrating the V-shaped groove and give the transition from the clamping profile to the balustrade panel an aesthetic appearance.

On one side, facing away from the V-shaped groove, of the clamping profile, a T-shaped groove can also be formed, which is provided to accommodate fastening means. This allows the clamping profile to be attached to suitable structural parts of the transport device or, via adapter parts, to the transport device. Furthermore, clamping profiles divided into a plurality of sections can be firmly connected to each other at the end face by means of connecting tongues inserted into the T-groove.

In another embodiment of the barrier, it has a support which is provided at one end with a foot attachment region and, at the other end, with a head attachment region. The head attachment region is connected to the clamping profile by fastening means. Provided that the previously described T-shaped groove is present in the longitudinal direction of the clamping profile, the position of the support on the clamping profile can be freely selected. The foot attachment region is provided to be attached to a bearing structure of a transport device - for example, to its supporting structure.

The support can have a telescopic device between the head attachment region and the foot attachment region. This allows the distance between the head attachment region and the foot attachment region to be fixably adjusted.

In another embodiment of the barrier, it has a connecting element. The connecting element is connected at one end to the clamping profile or to the support and, at the other end, is configured in such a way that it can be attached to a handrail guide profile of a

transport device. By means of this connection of the balustrade and barrier, they support each other orthogonally to the longitudinal direction of the clamping profile so that both the balustrade as well as the barrier can be configured and built with reduced material thicknesses.

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The thickness of the balustrade panel to be installed can vary depending upon the contract, due to different standards or customer-specific requirements. However, clamping wedges and wedge inserts are typically installed in larger quantities, which is why a wedge insert set with wedge inserts whose wedge legs have different thicknesses and/or a clamping wedge set with clamping wedges of different thicknesses are preferably available. From the wedge insert set and/or from the clamping wedge set, a wedge insert or a correspondingly matched clamping wedge can then be selected matched to the thickness of the balustrade panel.

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The barrier can also have an end panel. The end panel has a first panel region with a first bottom edge and a second panel region with a second bottom edge that is offset from the first bottom edge. In such an installed barrier, the end panel is arranged with its first lower edge in the clamping profile and the second lower edge in a holding element. The holding element is provided to be attached to a floor region of a transport device or of a building that accommodates the transport device. Like the barrier, the holding element can also have a clamping profile with a wedge insert and clamping wedge in which a lighting means can be arranged.

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Depending upon its location in a building, the transport device, configured as an escalator or moving walkway, can be equipped with a barrier on one or both sides. Such transport devices typically have a circulating conveyor belt and, on both sides of the conveyor belt, a balustrade with a circulating movable handrail. The barrier according to the invention is installed next to the circulating movable handrail on the transport device, wherein the barrier is arranged on the side, facing away from the conveyor belt, of the handrail. In an installed state, the barrier extends parallel to the balustrade and projects in height beyond the balustrade or its handrail.

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An existing transport device of the aforementioned type can also be updated by equipping it with at least one barrier according to the invention.

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The installation method for the barrier includes at least the steps listed below. At least one of the following components is arranged in the V-shaped groove: a lighting means, a power supply line, a signal line, or the like. Then, a wedge insert is placed in the V-shaped groove so that the base leg of the wedge insert lies on the base of the V-shaped groove. In so doing, the component arranged upstream is guided through the channel of the wedge insert. The balustrade panel or end panel is then inserted into the V-shaped groove so that its lower edge lies on the base leg of the wedge insert, and the wedge leg is positioned between the first groove surface of the V-shaped groove and the first side surface of the balustrade panel. Then, the clamping wedge is positioned and pressed in between the second side surface of the balustrade panel and the second groove surface.

Preferred exemplary embodiments of the barrier according to the invention are explained in greater detail in the following description with reference to the accompanying drawings; identical elements are provided with the same reference signs in all figures. Neither the drawings nor the description are to be interpreted as limiting the invention. In the figures:

Figure 1 shows a three-dimensional view of a transport device configured as an escalator with glass balustrades and two laterally arranged barriers to protect users from falling;

Figure 2 shows an enlarged view of a cross-section through a clamping profile of the barrier shown in Figure 1;

Figure 3 shows a cross-section through the entire barrier and the glass balustrade of the transport device shown in Figure 1;

Figure 4 shows an enlarged view of a partial cross-section through a box-shaped balustrade of a transport device and the barrier attached thereto;

Figure 5 shows a set of wedge inserts for the barrier shown in Figures 1 to 3;

Figure 6 shows a set of clamping wedges of the barrier shown in Figures 1 to 4;

Figure 7 shows an enlarged view of the cutout B indicated in Fig. 2; and

Figure 8 shows a possible installation method for a barrier according to the invention.

5 Figure 1 shows a three-dimensional view of a transport device 1 configured as an escalator, as it is installed in a building 3 (shown with dashed lines). The transport device 1 has a circulating movable conveyor belt 5 with steps 7. Along each side of the conveyor belt 5 extend two balustrades 9 with glass panels 11. Transport devices 1 with such glass balustrades are used, for example, in department stores and shopping malls. A handrail
10 guide profile 13 (see Figure 3) with a circulating movable handrail 15 is arranged at the edge of each balustrade 9. The handrails 15 are moved synchronously with the conveyor belt 5. The balustrade height H_B of the balustrade 9 is adapted in such a way that its handrail 15 can be comfortably grasped by an adult person of average height, but is also easily reachable for smaller children. For example, EN-115 specifies a balustrade height
15 H_B of 900 cm to 1,100 cm depending upon the location of use.

Since there is no wall on any side of the transport device 1, users could fall over the balustrade and tumble down the side of the transport device 1 during the improper use mentioned above. To avoid this, a barrier 31 is installed on both sides of the handrail 15
20 on the transport device 1. As can be seen from Figure 1, the barrier 31 extends parallel to the balustrade 9. Its balustrade panel 45 projects in height H_A beyond the balustrade height H_B or the handrail 15. To enable users to hold onto the handrail 15, the barrier 31 is arranged on the side, facing away from the conveyor belt 5, of the handrail 15.

25 In order to show various embodiments of the barrier 31, the balustrade panel 45 installed on the right barrier 31 is made in one piece. As shown by the left barrier 31, the balustrade panel 45 can also be made of a plurality of parts and comprise a plurality of panel sections 46. In this case, the barrier 31 can have panel connectors 145 to connect the individual panel sections 46 together.

30 Fig. 2 schematically shows an enlarged view of a cross-section through the supporting barrier 31 shown in Fig. 1. The barrier 31 has a clamping profile 33 with a V-shaped groove 35 which extends therein in the longitudinal direction L (see Figure 1) of the clamping profile 33. The V-shaped groove 35 is bounded by a groove base 37 and two
35 groove surfaces 39, 41. In this case, the groove surfaces 39, 41 are arranged opening at an

angle to each other, proceeding from the groove base 37 to a groove opening 43. In other words, the width of the V-shaped groove 35 increases towards the groove opening 43. The clamping profile 33 can, for example, be made from an aluminum extrusion profile or an extruded plastic profile, the ends of which can be covered, for example, with an end cap 147 (see Figure 1).

The barrier 31 also has a balustrade panel 45, which has two parallel side surfaces 47, 49 and in the region of its lower edge 51 is arranged in the V-shaped groove 35. The balustrade panel 45 can be made of transparent material such as single-pane safety glass, laminated safety glass, a PMMA sheet, a polycarbonate sheet, and the like. The balustrade panel 45 can also be made of opaque material such as wood, composite material, metal, or opaque polymer materials.

Another component of the barrier 31 is an L-shaped wedge insert 53 with a wedge leg 55 and a base leg 57. The wedge leg 55 has a wedge-shaped cross-section and is arranged between the first side surface 47 of the balustrade panel 45 and the first groove surface 39. The base leg 57 of the wedge insert 53 is arranged between the lower edge 51 of the balustrade panel 45 and the groove base 37. In addition, a channel 58 is also formed in the base leg 57 and extends parallel to the V-shaped groove 35. The formation of a channel 58 in the base leg 57 has the advantage that, for example, a lighting means 151 can be laid within the clamping profile 31 or in the V-shaped groove 35 with a constant cross-section without interrupting it. All known light-emitting devices such as light-emitting diodes, fluorescent tubes, OLED films, and the like, can be used as lighting means 151. The channel also allows for easily laying electrical conductors such as signal lines 157 and power supply lines 155 in the V-shaped groove 35 (see also Figures 4 and 7).

In order to fasten the wedge insert 53 and the balustrade panel 45 in the clamping profile 33, the barrier 31 has a clamping wedge 59 with a wedge-shaped cross-section and arranged between the second side surface 49 of the balustrade panel 45 and the second groove surface 41. To ensure a secure and permanent clamping of the balustrade panel 45 in the V-shaped groove 35, the wedge angle α of the wedge leg 55 and the wedge angle β of the clamping wedge 59 must be smaller than the angle of a friction cone which is present between the first groove surface 39 and the wedge leg 55 or the second groove surface 41 and the clamping wedge 59. The angle of the friction cone, which is another way of describing the coefficient of friction between these components, depends upon the

surface roughness and the materials used for the clamping profile 33, the wedge insert 53, and the clamping wedge 59. In multi-part balustrade panels 45, wedge inserts 53 and clamping wedges 59 are preferably arranged in the clamping profile 33 such that they overlap two adjacent panel sections 46.

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The V-shaped groove 35 also has on the first groove surface 39, provided for the wedge insert 53, a projection 61 narrowing the groove opening 43. This projection 61 gives the wedge insert 53 a better hold in the V-shaped groove 35 so that it does not slip when the balustrade panel 45 is inserted. To further improve this hold, on the wedge leg 55 of the wedge insert 53, an elastic element 63 can be arranged which, when the wedge insert 53 is inserted into the V-shaped groove 35, clamps its wedge leg 55 between the projection 61 and the groove base 37. The elastic element 63 is even more clearly visible in Figure 5.

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To prevent the V-shaped groove 35 from filling with water and dirt, sealing profiles 65, 67 of elastomer material such as rubber, nitrile rubber, and the like are arranged at the groove opening 43 on both sides of the balustrade panel 45. In order to enable the sealing profiles 65, 67 to be mounted, fastening structures 69 are formed on both sides at the groove opening 43 of the V-shaped groove 35. The fastening structures 69 (shown is a tongue-and-groove connection) correspond to corresponding formations on the sealing profile 65, 67. The tongue-and-groove fastening structure 69 shown in Figure 2 is only one of the countless possible designs for fastening the sealing profile 65, 67 in the groove opening 43 and is therefore not to be understood as reduced to this one representation.

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In order to be able to attach the barrier 31 to the transport device 1, a T-shaped groove 71 is formed on one side, facing away from the V-shaped groove 35, of the clamping profile 33. Fastening means 73, such as square or hexagonal screw heads, can be arranged therein, wherein their position in the longitudinal direction L of the clamping profile 33 is freely selectable. This simple and robust construction allows the clamping profile 33 to be attached, for example, to a support 75 as shown in Figures 1 and 3, or to a box-shaped balustrade 91 as shown in Figure 4. Of course, other structures such as bores with internal threads, clampable projections, and the like can also be formed on the clamping profile 33 in order to connect it to the transport device 1.

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Figure 3 shows a cross-section through the entire barrier 31 and the balustrade 9 of the transport device 1 shown in Figure 1. The barrier 31 has, in addition to the clamping profile 33, the balustrade panel 45, the wedge insert 53, and the locking wedge 59, a support 75 which is provided at one end with a foot attachment region 77 and at the other end with a head attachment region 79. The head attachment region 79 is connected to the clamping profile 33 by means of attaching elements 73 arranged in the T-shaped groove 71 of the clamping profile 33. The foot attachment region 77 of the support 75 is screwed to a balustrade clamp 103 of the transport device 1, and the balustrade clamp 103 is attached to a supporting structure 101 (only its upper chord is shown) of the transport device 1. The supporting structure 101 is the load-bearing structure that accommodates all components of the transport device 1 and supports the mass thereof and its own mass in the structure 3. A glass panel 11 of the balustrade 9 is clamped in the clamping device 103 of the balustrade clamp.

To enable the support 75 to be manufactured in large series rather than for a specific contract, a telescopic device 81 is arranged between the head attachment region 79 and the foot attachment region 77. The telescopic device 81 is realized by a two-part support tube, wherein the two parts of the support tube are connected to each other by a thread 83 and allow an adjustment in axial direction A. By means of the telescopic device 81, a distance X between the head attachment region 79 and the foot attachment region 77 can be fixedly adjusted so that, on the one hand, manufacturing tolerances of the supporting structure 101 can be compensated for, and on the other, the desired height H_A of the balustrade panels 45 can be adjusted.

The barrier 31 also has a connecting element 85, which is connected at one end to the support 75. The other end of the connecting element 85 is attached to the handrail guide profile 13 of the transport device 1 already mentioned above. This stabilizes the support 75 and the balustrade 9 of the transport device 1 against the forces acting transversely to the longitudinal direction L (see also Figure 1) of the barrier 31 upon the balustrade 9 and the barrier 31.

Figure 4 shows an enlarged partial cross-section through a box-shaped balustrade 91 of a transport device 1 and the barrier 31 attached thereto. Box-shaped balustrades 91 have an internal metal structure 93 of metal profiles which are covered with paneling sheets 95. Such box-shaped balustrades 91, also called metal balustrades, are usually installed in

heavily frequented transport devices 1 in public buildings - for example, in subway stations, train stations, and airports. Since the box-shaped balustrades 91 already have a high inherent stiffness and strength, a support 75 can be dispensed with. Instead, the clamping profile 33 of the barrier 31 is screwed onto simple brackets 97, which are attached to the inner metal structure 93. The exemplary console 97 can be part of the barrier 31 or part of the box-shaped balustrade 91 of the transport device 1.

In contrast to the wedge insert 53 described in Figure 2, the channel 58 of the wedge insert 53 shown in Figure 4 is arranged on the opposite side of the base leg 57. In other words, the channel 58 is arranged on that side of the base leg 57 which, given a wedge insert 53 inserted into the V-shaped groove 35 and an inserted balustrade panel 45, is directed towards the lower edge 51 of the balustrade panel 45. This design has the advantage that, for example, power supply lines 155 and signal lines 157 can be laid very easily in the V-shaped groove 35. Furthermore, no opening 54 (see Figures 5 and 7) is required, since a lighting means 151 (not shown) arranged in the channel 58 can also be arranged in the region of the wedge insert 53 between the base leg 57 and the lower edge 51 of the balustrade panel 45.

Figure 5 shows a set 111 of wedge inserts 53 of the barrier 31 shown in Figures 1 to 3 in plan view and section view, wherein the plan view is the same for all wedge inserts 53 of the set 111. The wedge insert set 111 includes wedge inserts 53', 53'', 53''', 53'''' whose wedge legs 55 have different thicknesses. The base leg 57 is identically configured in all wedge inserts 53 of the wedge insert set 111. In order to ensure that the balustrade panel 45 resting on top (not shown) can be sufficiently illuminated in the region of the wedge insert 53 by a lighting means 151 arranged in the channel 58, there are a plurality of openings 54 through the base leg 57. The opening 54 can also be used to run power supply lines 155 and/or signal lines 157.

From the wedge insert set 111, a wedge insert 53 can then be selected that is matched to a thickness S of the balustrade panel 45 (see Figure 4). Preferably, the thickness S of the balustrade panel 45 matching the respective wedge leg 55 is indicated on the wedge insert 53. The wedge insert 53 is preferably manufactured using an injection-molding method from a polymer material, but it could also be manufactured using 3-D printing. To save material, the wedge insert 53 can have recesses 113 and/or indentations 115.

At both lateral ends of the wedge insert 53, leaf spring-like elastic elements 63 are arranged, which project in height beyond an upper edge 87 of the wedge leg 55. When the wedge insert 53 is inserted into the V-shaped groove 35 (see Figure 2), the two elastic elements 63 are bent down and placed under the projection 61. The elastic elements 63 now clamp the wedge insert 53 between the projection 61 and the groove base 37 of the V-shaped groove 35. This is particularly advantageous in the inclined part of transport devices 1 so that the wedge insert 53 does not slip "downhill" before or during the insertion of the balustrade panel 45. Of course, the leaf spring-like design of the elastic element 63 is only one possible example of many other variants of elastic elements that can be used here. As shown, the elastic element can be integrally molded onto the wedge insert 53. It is also possible to design the elastic element 63 as a separate component and to install it on the wedge insert 53.

To further increase the adhesion of the elastic element 63, it has on the surface a ribbing 89 that is provided to bear against the projection 61. When the wedge insert 53 is inserted, the ribbing 89 accordingly rests against the projection 61 so that there is an even higher static friction between the elastic element 63 and the projection 61, and the wedge insert is fixed even more securely in the inserted position. It should also be mentioned at this point that the arrangement of the elastic element 63 and the ribbing 89 does not necessarily have to correspond to the illustrated design. A person skilled in the art will recognize that other parts of the wedge insert 53, such as the upper edge 87, may also be suitable for attaching the elastic element 63 and/or the ribbing 89 thereto.

Figure 6 shows a clamping wedge set 121 with clamping wedges 59 of the barrier shown in Figures 1 to 4. The clamping wedges 59' 59", 59'", 59"" of the clamping wedge set 121 have a different thickness, analogous to the wedge inserts 53', 53", 53'", 53"" of the wedge insert set 111. From the clamping wedge set 121, a clamping wedge 59, matched to a thickness S of the balustrade panel 45, can also be selected. Preferably, the corresponding thickness S of the balustrade panel 45 is also indicated here on the clamping wedge 59. Preferably, the clamping wedge 59 is also manufactured using an injection-molding method from a polymer material. To save material, the clamping wedge 59 can also have recesses 123 and/or indentations 127.

At both ends of the clamping wedge 59, ejection noses 125 are arranged, on which a disassembly tool (not shown) can be placed to release the clamping wedge 59 from the V-

shaped groove 35. Of course, it is also possible to have only one ejection nose 125. However, a symmetrical arrangement of two ejection noses 125 facilitates the ejection of the clamping wedge 59 from the V-shaped groove 35, since a disassembly tool (not shown) can be placed on both sides.

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Figure 7 shows a larger view of the cutout B shown in Figure 2. In this embodiment of the wedge insert 53, the channel 58 is arranged on that side of the base leg 57 which faces the groove base 37 when the wedge insert 53 is inserted into the V-shaped groove 35.

10 This creates a wide support for the lower edge 51 of the balustrade panel 45. As mentioned above, at least one opening 54 through the base leg 57 is provided so that the light 99 emitted by the lighting means 151 can also reach the lower edge 51 of the balustrade panel 45 in the region of the wedge insert 53. The light strip used as a lighting means 151 has an integrated power supply line 155 and an integrated signal line 157.

15 To facilitate the assembly of the barrier 31, the channel 58 has a positioning means 153. In the present exemplary embodiment, the positioning means 153 is two chamfers with a chamfer angle γ , which are formed on the two edges of the opening 158 of the channel 58. The positioning means 153 is adapted with its dimensions to a contour or cross-section 56 of the lighting means 151 such that it positions the lighting means 151 transversely to the longitudinal direction L (see Figure 1) of the clamping profile 33 in the channel 58 during and after assembly of the barrier 31. The shown positioning means 153 represents only one of many different possibilities for positioning the lighting means in channel 58. Noses, projections, grooves, roundings at the groove opening 158, and the like can also be used as positioning means 153, provided they are matched to the lighting means 151 provided for installation.

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Figure 8 shows a possible installation method for a barrier 31 according to the invention of the aforementioned type. The sequence of steps does not necessarily have to be followed, so that other, sensible sequences of these steps are also included in the scope of protection. In step S1 of the assembly method, the clamping profile 33 is firmly connected to the transport device 1 by supports 75, connecting elements 85, or brackets 97 (see Figures 3 and 4). In addition, a light strip serving as a lighting means 151 is laid in the V-shaped groove 35.

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In a further step S2, the wedge insert 53 or a plurality of wedge inserts 53 are inserted into the V-shaped groove 35 so that the base leg 57 of the respective wedge insert 53 lies on the groove base 37 of the V-shaped groove 35. In so doing, the lighting means 151 is "automatically" positioned and fixed in the channel 58 of the wedge insert 53 by the alignment means 153 described in Figure 7.

In a further step S3, a first sealing profile 65 is attached above the wedge leg 55 of the wedge insert 53 or of the plurality of wedge inserts 53 to the fastening structure 69 provided therefor.

In a further step S4, a balustrade panel 45 or plurality of panel sections 46 are inserted into the V-shaped groove 35 so that its lower edge 51 lies on the base leg 57 of the wedge insert 53, and the wedge leg 55 is arranged between the first groove surface 39 of the V-shaped groove 35 and the first side surface 47 of the balustrade panel 45.

In a further step S5, one or more clamping wedges 59 are arranged and pressed in between the second side surface 49 of the balustrade panel 45 and the second groove surface 41.

In a further step S6, a second sealing profile 67 is attached above the clamping wedge 59, or the plurality of clamping wedges 59 are attached to the fastening structure 69 provided for this purpose.

The aforementioned steps S1 to S6 can also be part of a method for modernizing an existing transport device 1, in which this transport device 1 is equipped with a barrier 31 according to the invention.

Although transport devices 1 configured as escalators are shown in Figure 1, it is obvious that the barrier 31 and the associated method can also be used for moving walkways. In addition, two opposing channels 58 can also be formed in the base leg 57 of the wedge insert 53.

Finally, it should be noted that terms such as "having," "comprising," etc., do not preclude other elements or steps, and terms such as "a" or "one" do not preclude a plurality. Reference signs in the claims should not be considered to be limiting.

Claims

1. A barrier (31) to protect users from falling from a transport device (1) that is configured as an escalator or moving walkway, which barrier (31) is configured to be installed on the transport device (1) next to a circulating movable handrail (15) on a balustrade (9) of the transport device (1), wherein, in the installed state, the barrier (31) extends parallel to the handrail (15), and projects at a height (H_A) beyond the balustrade (9) or the handrail (15), and wherein the barrier (31) has:
- a clamping profile (33) with a V-shaped groove (35) that extends therein in the longitudinal direction (L) of the clamping profile (33), wherein the V-shaped groove (35) is bounded by a groove base (37) and two groove surfaces (39, 41), and the groove surfaces (39, 41) are arranged at an opening angle to each other from the groove base (37) towards a groove opening (43);
 - a balustrade panel (45) which has two parallel side surfaces (47, 49) and a lower edge (51) and is arranged in the V-shaped groove (35) in the region of its lower edge (51); and
 - a clamping wedge (59) designed with a wedge-shaped cross-section and arranged between the second side surface (49) of the balustrade panel (45) and the second groove surface (41),
- characterized in that** the barrier (31) further has:
- an L-shaped wedge insert (53) with a wedge leg (55) and with a base leg (57), wherein the wedge leg (55) has a wedge-shaped cross-section and is arranged between the first side surface (47) of the balustrade panel (45) and the first groove surface (39), and the base leg (57) is arranged between the lower edge (51) of the balustrade panel (45) and the groove base (37), and a channel (58) is formed in the base leg (57) and extends parallel to the V-shaped groove (35).
2. The barrier (31) according to claim 1, wherein the channel (58) is arranged on the side of the base leg (57) which, when the wedge insert (53) is inserted into the V-shaped groove (35), is directed towards the groove base (37), and wherein at least one opening (54) through the base leg (57) is provided.
3. The barrier (31) according to claim 1 or 2, wherein the channel (58) is arranged on the side of the base leg (57) which, when the wedge insert (53) is inserted into the V-

shaped groove (35) and the balustrade panel (45) is inserted, is directed towards the lower edge (51) of the balustrade panel (45).

4. The barrier (31) according to any of claims 1 to 3, wherein at least one of the following components is arranged in the V-shaped groove (35): a lighting means (151), a power supply line (155), a signal line (157); wherein this component is guided through the channel (58) of the wedge insert (53).

5. The barrier (31) according to claim 4, wherein the lighting means (151) is a light strip equipped with light-emitting diodes.

6. The barrier (31) according to claim 5, wherein the channel (58) has a positioning means (153) which is matched to the lighting means (151) and positions the lighting means (151) transversely to the longitudinal direction (L) of the clamping profile (33) in the channel (58) during and after assembly of the barrier (31).

7. The barrier (31) according to any of claims 1 to 6, wherein the V-shaped groove (35) has on the first groove surface (39) provided for the wedge insert (53) a projection (61) which narrows the groove opening (43), and wherein on the wedge leg (55) of the wedge insert (53) an elastic element (63) is arranged, which, when the wedge insert (53) is inserted into the V-shaped groove (35), clamps the wedge leg (55) of the wedge insert (53) between the projection (61) and the groove base (37).

8. The barrier (31) according to any of claims 1 to 7, wherein the clamping wedge (59) has an ejection nose (125) that is configured to allow a disassembly tool to be attached thereto in order to release the clamping wedge (59) from the V-shaped groove (35).

9. The barrier (31) according to any of claims 1 to 8, wherein fastening structures (69) for an elastic sealing profile (65) are formed on both sides at the groove opening (43) of the V-shaped groove (35).

10. The barrier (31) according to claim 8, wherein it has a support (75) which is provided at one end with a foot attachment region (77) and at the other end with a head attachment region (79), wherein the head attachment region (79) is connected to the

clamping profile (33) by means of fastening means (73), and the foot attachment region (77) is provided to be attached to a supporting structure (101) of a transport device (1).

11. The barrier (31) according to any of claims 1 to 10, wherein it has a connecting element (85), which connecting element (85) is connected at one end to the clamping profile (33) or to the support (75) according to claim 10 and is configured at the other end to be attached to a handrail guide profile (13) of a transport device (1).

12. The barrier (31) according to any of claims 1 to 11, wherein a wedge insert set (111) with wedge inserts (53', 53'', 53''', 53''') whose wedge legs (55) have different thicknesses and/or a clamping wedge set (121) with clamping wedges (59', 59'', 59''', 59''') of different thicknesses are provided, wherein a wedge insert (53) matched to a thickness (S) of the balustrade panel (45) can be selected from the wedge insert set (111), and/or a clamping wedge (59) matched to the thickness (S) of the balustrade panel (45) can be selected from the clamping wedge set (121).

13. A transport device (1) that is configured as an escalator or moving walkway, with a circulating conveyor belt (5), **characterized by** at least one barrier (31) according to any of claims 1 to 12, which barrier (31) is installed on the transport device (1) next to a circulating movable handrail (15) on a balustrade (9) of the transport device (1), wherein, in the installed state, the barrier (31) extends parallel to the balustrade (9), and at a height (H_A), projects beyond the balustrade (9) or the handrail (15), and wherein the barrier (31) is arranged on the side, facing away from the conveyor belt (5), of the handrail (15).

14. A method for modernizing a transport device that is configured as an escalator or moving walkway, **characterized in that** an existing transport device is equipped with a barrier according to any of claims 1 to 12.

15. An installation method for a barrier (31) according to any of claims 1 to 12, **characterized in that** the installation method comprises at least the following steps:

- arranging at least one of the following components in the V-shaped groove: a lighting means (151), a power supply line (155), a signal line (157);
- inserting the wedge insert (53) into the V-shaped groove (35) so that the base leg (57) of the wedge insert (53) rests on the groove base (37) of the V-shaped groove (35),

wherein the component arranged upstream is guided through the channel (58) of the wedge insert (53);

- inserting the balustrade panel (45) into the V-shaped groove (35) so that its lower edge (51) lies on the base leg (57) of the wedge insert (53), and the wedge leg (55) is
5 arranged between the first groove surface (39) of the V-shaped groove (35) and the first side surface (47) of the balustrade panel (45); and
- arranging and pressing in the clamping wedge (59) between the second side surface (49) of the balustrade panel (45) and the second groove surface (41).