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(54) A HANDRAIL SAFETY DEVICE FOR A MOVING WALKWAY

(57) The invention relates to a safety device (10) for a moving walking system (20) with a handrail belt (25), wherein the safety device comprises a support element (11) for arranging the safety device (10) to the moving walking system (20) and movable surface elements (12), wherein the movable surface elements (12) have a first state (A) and a second state (B). In the first state (A), the

movable surface elements (12) enclose at least a part of the handrail belt (25) to form a handrail inlet and in the second state (B), the movable surface elements provide an open space around at least a part of the handrail belt (25). The invention further relates to a moving walking system comprising said safety device (10).

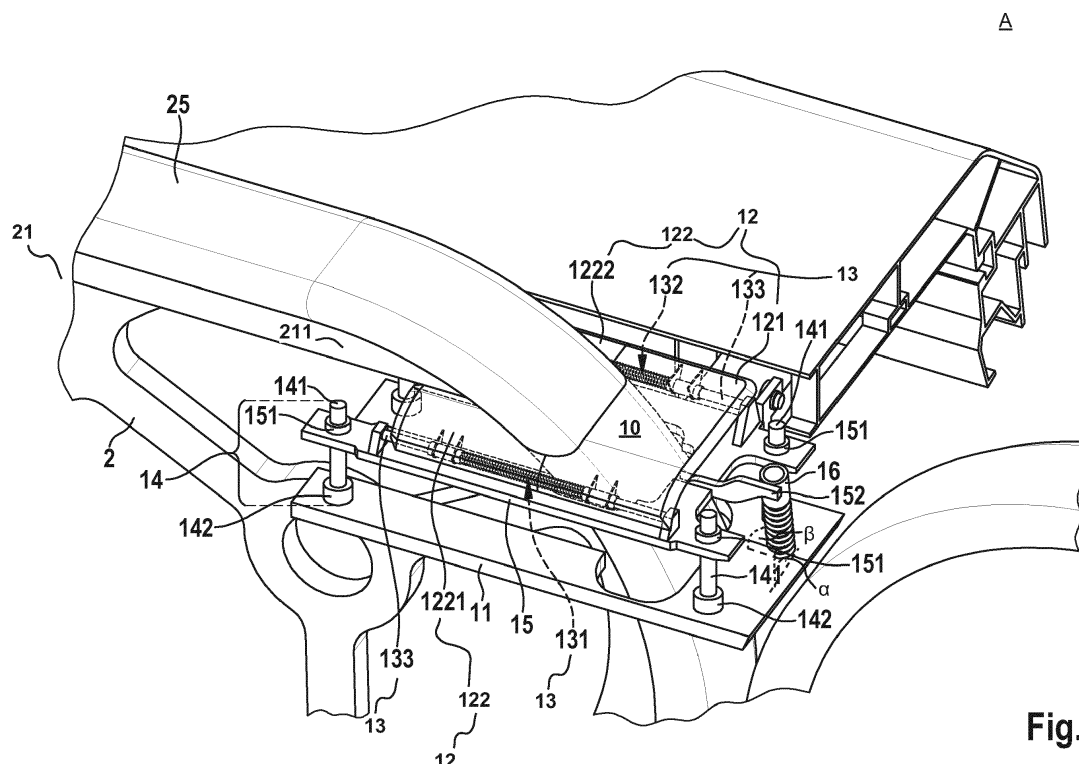


Fig. 1

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Description

[0001] The invention relates to a moving walking system, also known as moving walkways, such as those used in all manner of large-scale premises, for example, in airports and/or stations in which there is an aim to facilitate passenger transport/movement. In particular, the invention refers to a safety device for such a system.

[0002] Handrails and handrail systems for moving walkways are already known. EP 0 837 026 A1 discloses a handrail mechanism for a moving sidewalk, wherein the handrail includes a plurality of independent moving handrail portions. All portions are arranged without overlapping with one another, each being driven at a speed close to the driving speed of nearby treadboards. A plurality of bridging systems are disposed at jointing portions between adjoining moving handrail portions to guide passenger hands from one moving handrail portion to the next. An electric indicator is provided in the vicinity of the bridging system to alert passengers of its existence. This system attempts to alert passengers and users of the handrail system to any upcoming changes or variations in speed along the handrail path. In the event of an emergency however, for example, an item of passenger clothing gets caught between the bridging system and a handrail belt, there is no way to prevent it. Whilst the passenger may be made aware of the impending presence of a bridging system, there is still a need to improve moving walkways comprising several handrails.

[0003] It is thus an object of the invention, to improve passenger safety on moving walking systems, wherein the walking system comprises at least two consecutive handrails in single line configuration.

[0004] This object is solved by a safety device according to claim 1, and a moving walking system according to claim 13. Preferred embodiments are the subject of the sub-claims and the description and are further illustrated in the drawings. The terms walking system and walkway refer to one and the same thing and are used interchangeably throughout the description.

[0005] The safety device according to the invention comprises a support element for arranging the safety device to the moving walking system and movable surface elements. The movable surface elements have a first state (state A) and a second state (state B) such that in the first state, the movable surface elements are adapted to enclose at least a part of the handrail, preferably a handrail belt, to form a handrail inlet and in the second state the movable surface elements provide an open space around at least a part of the handrail, preferably around the handrail belt.

[0006] This advantageously improves passenger safety. The first state advantageously promotes continuity of the handrail for normal usage by a passenger. The second state is advantageously only realized in the event an obstacle interferes with the handrail. Should this occur, the second state advantageously realizes a gap, around the handrail, thus allowing for the obstacle to be removed.

Preferably this gap is around the handrail belt wherein said handrail belt is preferably a continuous endless handrail belt.

[0007] In a further advantageous embodiment, the movable surface elements comprise at least a first movable part and a second movable part. The first movable part and a second movable part are arranged on opposing sides and are adapted to move in a lateral direction. In the first state, the first movable part and the second movable part preferably enclose at least a part of the handrail. Most preferably, they enclose the handrail belt of the handrail. In the second state, the first movable part and the second movable part are preferably separated from each other in the lateral direction such that an open space around the handrail is provided. Most preferably, this open space is located around the handrail belt of the handrail. It is also preferred that the first and second movable parts are adapted to move in a forward lateral direction, a backward lateral direction, or both, wherein said parts can move in both directions simultaneously, i.e., the first movable part moves forward and the second movable part moves backwards. In moving from the first state to the second state, it is preferred that the first movable part moves in a forward lateral direction and the second movable part moves in a backward lateral direction. It is further preferred that these movements occur simultaneously. In moving from the second state to the first state, it is preferred that the first movable part moves in a backward lateral direction and the second movable part moves in a forward lateral direction. It is also further preferred that this movement is performed manually. This is advantageous for passenger safety as the first movable part and the second movable part are separable, thereby in the case of entrapment, or obstacle contact, said parts are both capable of moving in opposite lateral directions which releases a space around the handrail, in particular around the handrail belt. This allows for removal of the obstacle or relief from entrapment.

[0008] In another advantageous embodiment, the first movable part of the safety device is arranged such that it is directed to the touchable upper side of the handrail, i.e., the portion of the handrail which a passenger can easily hold on to. The second movable part of the safety device is arranged such that it is directed to the bottom side of the handrail, i.e., the portion of handrail which precedes the handrail belt. The first movable part is preferably directed to the touchable upper side of the handrail at the point where the handrail belt enters its turn around portion, i.e., the portion between the handheld area of the handrail and the return portion which is inaccessible to passengers. This advantageously ensures that the safety device is located at the part of the handrail where the continuity of travel is interrupted, and therefore, is most likely to be susceptible to obstacles and/or entrapments.

[0009] In another advantageous embodiment, the second movable part is formed by a first second movable part and a second second movable part, wherein be-

tween the first second movable part and the second second movable part there is a space for a support structure of the handrail. The support structure can be incorporated within the moving walkway, for example, within a balustrade or balustrade cover of the handrail or with a friction wheel. This advantageously provides a safety device which can be easily incorporated into a new or existing handrail system.

[0010] In a preferred embodiment, the safety device also comprises a first guiding system, wherein said first guiding system is adapted to guide the first movable part and the second movable part in the lateral direction. Preferably, the first guiding system is adapted to move the first movable part, the first second movable part and the second second movable part in the lateral direction. This advantageously creates movable surface elements which are capable of responding to external factors, e.g., obstacles in the environs of the handrail.

[0011] Preferably, the first movable part and the second movable part are coupled with at least a first compression mechanism, wherein in the first state, the first compression mechanism is compressed and in the second state, the first compression mechanism is relaxed. More preferably, the first movable part and the second movable part are coupled with a first compression mechanism and a second compression mechanism, wherein in the first state, the first compression mechanism and the second compression mechanism are compressed and in the second state, the first compression mechanism and the second compression mechanism are relaxed. The compression mechanism may be any mechanism, e.g., a spring, pneumatic pump, that is capable of causing upon activation, the movable surface parts to move in a lateral direction, preferably in opposite lateral directions, and preferably wherein said movement is simultaneous. Preferably, the first compression mechanism is positioned at one terminal end of the first movable part and the second movable part and the second compression mechanism is positioned at the opposite terminal end of the first movable part and the second movable part. Preferably said terminal ends are parallel to the handrail belt so that the first compression mechanism and the second compression mechanism are both positioned at the longitudinal sides of the handrail belt. It is preferred that when the second movable part comprises a first second movable part and a second second movable part, that the first second movable part be coupled with a first compression mechanism, and the second second movable part be coupled with a second compression mechanism. This advantageously provides the movable surface elements with a means of lateral movement, wherein said means accommodates lateral movement in opposite directions so that a space around at least a part of a handrail can be achieved, preferably a space around a handrail belt.

[0012] In another advantageous embodiment, the safety device further comprises a mobile support structure, wherein the mobile support structure is preferably

adapted to move towards the support element, and wherein the mobile support structure preferably supports at least one out of the following: the first guiding system; the at least one compression mechanism; the movable surface elements. More preferably, this mobile support structure supports at least the first guiding system, at least one compression mechanism, preferably a first compression mechanism, most preferably a first and a second compression mechanism, and the movable surface elements i.e., the first movable part and the second movable part or the first movable part and the first second movable part and the second second movable part. The mobile support structure is preferably adapted to move towards the support element. In a preferred embodiment of the invention, the mobile support structure, when in the first state, is spaced further apart from the support element than when in the second state. The mobile support structure also comprises at least a first protrusion, more preferably a first and second protrusion, more preferably a first, a second and a third protrusion, most preferably a first, a second, a third and a fourth protrusion. Said protrusions are preferably positioned at the outer most perimeter of the mobile support structure wherein each protrusion is adapted to host an elongated vertical rod, e.g., a bolt.

[0013] In another advantageous embodiment of the invention, the space between the mobile support structure and the support element remains unchanged when moved from the first state to the second state.

[0014] In another advantageous embodiment, the mobile support structure is connected to the support element. Said support element is preferably itself connected to the moving walking system, more preferably to a friction wheel within the moving walking system. This advantageously provides a safety device which can be installed in various ways to a moving walking system.

[0015] In another advantageous embodiment, the safety device further comprises a second guiding system, wherein said second guiding system is adapted to guide the mobile support structure preferably in the vertical direction. The second guiding system preferably comprises at least two elongated vertical rods, e.g., a bolt, wherein said rods are hosted by a protrusion of the mobile support structure. It is preferred that the second guiding system comprises three elongated vertical rods, and most preferred that it comprises four elongated vertical rods. Preferably, each protrusion of the mobile support structure hosts an elongated vertical rod of the second guiding system so that the mobile support system is capable of moving in a vertical direction. The second guiding system further comprises a buffer, e.g., a rubber stopper. Said buffer is positioned at the terminal end of at least one elongated vertical rod, preferably at the terminal end of all elongated vertical rods, wherein said terminal end is attached to the support element. This advantageously connects the mobile support structure with the support element and facilitates in the operation of the safety device.

[0016] This second guiding system is particularly designed to guide the mobile support structure in the direction towards the support element. It is preferred that the second guiding system cooperates with the first guiding system. This advantageously ensures that the movable support elements are capable of moving in both lateral and vertical directions, thereby enhancing user safety in case of entrapment and/or obstacles.

[0017] In another advantageous embodiment, the mobile support structure is coupled with at least one further compression mechanism, e.g., a spring. This further compression mechanism is adapted to release the mobile support structure so that when in the first state, the at least one further compression mechanism is compressed and in the second state, the at least one further compression mechanism is relaxed. The further compression mechanism is preferably arranged to be tilted at an angle of between 60°-90° to the longitudinal direction of the support element so that the further compression mechanism is tilted in the lateral extension direction. More preferably, it is arranged at an angle of between 70°-89.9°, most preferably at an angle of between 80°-89.5° to the longitudinal direction of the support element. This degree of tilt is advantageous because it allows the release of the mobile support structure. This release causes the mobile support structure to move along the second guiding system.

[0018] In another advantageous embodiment, the mobile support structure comprises a nose which is adapted to act on the at least one further compression mechanism. The nose preferably acts on the at least one further compression mechanism when the mobile support structure is moved towards the support element. This advantageously provides a means of communication between the further compression mechanism and the mobile support structure.

[0019] In another advantageous embodiment, the safety device can further comprise a transducer. The transducer is preferably activated when the movable surface elements are in the second state. The activated transducer can be adapted to generate a signal which may prompt a controller of the moving walking system to slow down or stop the moving handrail and/or the moving pallets of the moving walking system. This advantageously provides a safety device which can communicate directly with the moving handrail/pallets of the moving walkway, and thus significantly improves passenger safety in the case of entrapment and/or obstacles.

[0020] Preferably, the further compression mechanism is attached to the support element at a vertical projection area of the mobile support structure. Particularly, the further compression mechanism is arranged at an angle of between 60°-90°, particularly at an angle between 70°-89.9°, to the longitudinal direction of the support element. More preferably, the further compression mechanism is arranged at an angle of between 80-89.5° to the longitudinal direction of the support element, most preferably, it is arranged at an angle of 80° to the longitudinal

direction of the support element. This advantageously allows the further compression mechanism to interact with the nose of the mobile support structure, thereby creating a sensing mechanism. In a preferred embodiment, the further compression mechanism is attached to the walking system at for example, the balustrade.

[0021] Preferably the further compression mechanism is held in place by the nose of the mobile support structure, more preferably, it is held in place by being compressed under the nose of the mobile support structure. This sensing mechanism can be activated by a downward force acting on the movable surface elements. Due to the angle of the further compression mechanism to the longitudinal direction, this downward force causes the further compression mechanism to release from under the nose of the mobile support structure.

[0022] Advantageously, the outer upper edges of the movable surface parts of the safety device are beveled. It is most preferred that the corresponding surface of the handrail is also beveled. This advantageously provides the movable surface elements with a surface geometry that compliments the handrail and promotes a smooth functioning of the safety device.

[0023] Another aspect of the invention relates to a moving walking system with a balustrade, a balustrade cover and at least one handrail comprising a moving handrail belt, wherein the part of the at least one handrail which is intended to be used by passengers for safety purposes protrudes from the balustrade cover. Said moving walking system further comprises a safety device according to the invention. More preferably, said moving walking system comprises an opening which in the first state of the safety device is closed by the movable surface elements, wherein the movable surface elements enclose at least a part of the handrail to form a handrail inlet of the moving walking system. Preferably, the movable surface elements enclose at least a part of the handrail belt of the moving walking system. This advantageously provides a moving walking system with improved passenger safety wherein any entrapments or obstacles in contact with the handrail, preferably in contact with the handrail belt, can be removed.

[0024] In another advantageous embodiment, the moving walking system comprises at least a first handrail and a second handrail in a single line configuration, wherein the safety device is arranged at the end of the first handrail such that in the first state, it forms a handrail inlet for the first handrail. Preferably, the safety device is positioned at the touchable upper side at the end of the first handrail, before the start of the second handrail. More preferably, the safety device is positioned at the point where the handrail belt of the first handrail enters its turn around portion, i.e., the portion between the handheld area of the handrail and the return portion which is inaccessible to passengers hands. This advantageously provides a safety device at the intersection between two handrails, i.e., at the point where it is most likely that

entrapments and/or obstacles can occur.

[0025] According to another advantageous embodiment, the moving walking system according to the invention is a variable speed moving walking system. This advantageously provides a variable speed moving walkway with improved passenger safety.

[0026] In another advantageous embodiment, the movable surface elements of the safety device of the moving walking system release at least a part of the opening of the balustrade cover. This advantageously allows for the release of any entrapment or obstacle which has previously come into contact with the moving walkway, thereby improving passenger safety.

[0027] In another advantageous embodiment, the bottom side of the surrounding of the opening of the balustrade cover of the moving walking system is beveled corresponding to the outer upper edges of the movable surface parts. This advantageously provides the balustrade with a surface geometry that complements the safety device according to the invention.

[0028] In another advantageous embodiment, the safety device of the invention is installed in the moving walking system in such a manner that when applying a force on the movable surface elements, wherein said force exceeds a predetermined threshold, the safety device moves from the first state into the second state. Preferably the threshold can be defined as a value between 1°N and 20°N, preferably between 5°N and 12°N (N: Newton). This advantageously provides a safety device which can be activated by a passenger and user of the moving walking system.

[0029] The invention is described in more detail with the help of the figures, wherein it is shown schematically:

- Fig. 1 shows a schematic top view representation of the mechanism of the safety device according to an exemplary embodiment of the invention being installed in a moving walking system.
- Fig. 2 shows a schematic cross-section representation of the mechanism of the safety device according to an exemplary embodiment of the invention being installed in a moving walking system.
- Fig. 3 shows a schematic cross-section representation of the mechanism of the safety device according to an exemplary embodiment of the invention being installed in a moving walking system.
- Fig. 4 shows a cross-section representation of the mechanism of the safety device according to an exemplary embodiment of the invention being installed in a moving walking system.
- Fig. 5 shows a cross-section representation of the mechanism of the safety device according to an exemplary embodiment of the invention being installed in a moving walking system.
- Fig. 6 shows a schematic representation of the further compression mechanism of the safety de-

vice according to another exemplary embodiment of the invention.

- Fig. 7 shows a schematic representation of the safety device according to an exemplary embodiment of the invention incorporated with the handrail belt of a moving walking system.
- Fig. 8 shows a schematic representation of a moving walking system comprising two safety devices, each one according to an exemplary embodiment of the invention. The safety device is integrated with the handrail belt on each side of the moving walking system.
- Fig. 9a shows a schematic representation of the safety device according to an exemplary embodiment of the invention in the first state (A).
- Fig. 9b shows a schematic representation of the safety device according to an exemplary embodiment of the invention in the second state (B).

[0030] The figures are for reference purposes only and are not to scale.

[0031] Fig. 1 shows a section of a moving walking system which with a handrail 21 comprising a handrail belt 25, wherein the moving walking system comprises an embodiment of the safety device 10 according to the invention. The safety device 10 comprises a support element 11 for arranging the safety device 10 to the moving walking system and further comprises movable surface elements 12. The support element 11 is configured to be connected to the moving walking system.

[0032] The movable surface elements 12 have a first state A and a second state B such that in state A, as shown in Fig. 1, the movable surface elements 12 enclose at least a part of the handrail belt 25 to form a handrail inlet. In state B, the movable surface elements 12 provide an open space around at least a part of the handrail belt 25 (as shown for another embodiment of the safety device in Fig. 9b).

[0033] The movable surface elements 12 comprise a first movable part 121, and a second movable part 122 wherein the first movable part 121 and the second movable part 122 are arranged on opposing sides of the handrail belt 25 and are movable in a lateral direction. In the embodiment of the invention shown in figure 1, the second movable part 122 is formed by a first second movable part 1221 and a second second movable part 1222, wherein between the first second movable part 1221 and the second second movable part 1222 there is a space for a support structure 211 of the handrail 21. The first movable part 121 and the second second movable part 1221, 1222 are contacted with a first guiding system 13 which is positioned longitudinally parallel to the handrail 21. The guiding system 13 guides the movable parts 12, 121, 1221, 1222 in a lateral direction. The movable parts 12, 121, 1221, 1222, are coupled with at least a first compression mechanism 131 of the guiding system 13, wherein in state A the first compression mechanism 131 is compressed and in state B the first compression mech-

anism 131 is relaxed.

[0034] The guiding system 13 further comprises a second compression mechanism 132, wherein in state A the second compression mechanism 132 is compressed and in state B the second compression mechanism 132 is relaxed. The first and second compression mechanisms 131, 132, are in this embodiment the same, and are in the form of a spring. The first compression mechanism 131 and the second compression mechanism 132 are each positioned on a rod 133. The rods 133 contact a mobile support structure 15.

[0035] The mobile support structure 15 comprises four protrusions 151, each positioned at the corner of the outer most perimeter of the mobile support structure 15. The protrusions 151 host an elongated vertical rod 141, preferably a bolt, wherein said vertical rod 141 is from a second guiding system 14.

[0036] The second guiding system 14 comprises four vertical rods 141 (only 3 are shown). Said vertical rods 141 are vertically arranged with respect to the base area of the support element 11, the support element 11 being mounted to the handrail 21. This allows the mobile support system 15 to move in a vertical direction. The second guiding system 14 also comprises a buffer 142, e.g., a rubber stopper. Said buffer 142 is positioned at the terminal end of each elongated vertical rod 141, wherein said terminal end is attached to the support element 11.

[0037] The mobile support structure 15 is adapted to move towards the support element 11 so that in state A the mobile support structure 15 is spaced further apart from the support element 11 than when in state B. The mobile support structure 15 supports the first guiding system 13; the first and second compression mechanism 131, 132; and the movable surface elements 12.

[0038] The mobile support structure 15 is coupled with at least one further compression mechanism 16, e.g., a spring mechanism, for releasing the mobile support structure 15, wherein in state A the at least one further compression mechanism 16 is compressed and in state B the at least one further compression mechanism 16 is relaxed (as shown in the embodiment illustrated in Fig. 3). This releasing occurs when a downward force F, which exceeds a predetermined threshold, is applied to the movable surface elements 12.

[0039] The mobile support structure 15 also comprises a nose 152. The nose 152 facilitates holding the mobile support structure 15 in place so that the movable surface elements 12 remain at rest in state A and form the handrail inlet. The nose 152 compresses the further compression mechanism 16 and holds it in the compressed state when the movable surface elements 12 are in state A. The further compression mechanism 16 is arranged at an angle α of 80° to the lateral direction of the support element 11, so that the further compression mechanism is tilted in the lateral direction. This degree of tilt is not shown in the figure. The angle β is 90°.

[0040] Fig. 2 shows a side profile of the safety device 10 installed in a moving walkway system similar to the

one shown in Fig. 1. The safety device 10 is in state A. State A is the normal state when no problems occur during the usage of the handrail belt of the moving walking system. The arrow (a) shows more clearly the application of a force F, which leads to a change of the safety device 10 from state A to state B. The change from state A to state B provides an anti-trapping feature in the event a persons hand, body or clothing becomes trapped at the end of a handrail belt, e.g., the handrail belt 25, since it provides an open space around the handrail belt 25 and thus allows for the release of the trapped hand or piece of clothing. If the force F exceeds a predetermined value, e.g. a force of 5 Newton, the mobile support structure 15 is moved downwards as indicated by the arrow (c) and the movable surface elements 12 move laterally in opposite directions as indicated by the arrows (b). That means, when a force F above a predetermined threshold is applied to the movable surface elements 12, (121, 122 or 121 and 1221, 1222) they move from state A to state B, i.e., the first movable part 121 moves in a forward lateral direction and the second movable part 122 moves in the backward lateral direction, or, the first movable part 121 moves in the forward lateral direction and the first second movable part 1221 and the second second movable part 1222 both move in the backward lateral direction. This provides an open space around at least part of the handrail 21, preferably around the handrail belt 25, shown more clearly in the embodiment illustrated in Fig. 3.

[0041] The mobile support element 15 is released via interaction between the nose 152 and the tilted further compression mechanism 16. The further compression mechanism releases the nose 152 of the mobile support structure 15 allowing the mobile support structure 15 to move in a downward direction via the second guiding system 14. This permits the mobile support structure 15 to activate a transducer 17. The transducer 17 signals to a control unit (not shown in Fig. 2) of the moving walkway causing the walkway to slow down and stop. The opening provided around the handrail belt when the safety device 10 is changed from state A to state B relieves passenger entrapment, thus improving user safety.

[0042] Fig. 3 shows a side profile of the safety device 10 according to an embodiment of the invention similar to the one shown in Fig. 1. The safety device 10 is in the second state B. The first movable part 121 is in a forward lateral position of the handrail belt 25 on the first guiding system 13. The second movable part 122 or the first second movable part 1221 and the second second movable part 1222 is in a backwards lateral position of the handrail belt 25 on the first guiding system 13. The further compression mechanism 16 is in a non-compressed state. In order for the movable parts 12 to be returned to state A and the safety device 10 to be reactivated, the movable parts 12 and the further compression mechanism 16 are manually returned to their positions in state A.

[0043] Fig. 4 and Fig. 5 show a detailed cross-sectional view of the mechanism of safety device 10 according to

an exemplary embodiment of the invention. In this particular embodiment, a support element 11 moves about a pivot position, preferably rotates about a pivot position, wherein said position is located within the moving walking system. In Fig. 4 and Fig. 5 it is shown as being positioned about a friction wheel 2. The support element 11 is positioned in such a way that whilst the friction wheel 2 turns during operation of the moving walkway, the support element 11 does not. The support element 11 will only move about this pivot position, e.g. rotate about this pivot position when a force F has been applied to the movable surface elements 12 which causes the mobile support structure 15 to depress.

[0044] The movable surface elements 12 are positioned around a handrail belt 25 such that the first movable surface element 121 is located in front of the handrail belt 25 and the second movable part 122, or optionally, the first second movable part 1221 and the second second movable part 1222, are located behind the handrail belt 25. A handrail support 211 is preferably positioned between the first second movable part 1221 and the second second movable part 1222. The handrail belt 25 passes the safety device 10 at points x and y . The movable surface elements 12 contact a first guiding system 13 and are mounted on top of a first compression mechanism 131 and a second compression mechanism 132 (not shown in Fig. 4 and Fig. 5). The first guiding system 13 is itself positioned on a mobile support structure 15, wherein said mobile support structure 15 is connected to the support element 11. A nose 152 of the mobile support structure 15 is in contact with a further compression mechanism 16. The further compression mechanism 16 is in the compressed state and is arranged at an angle α of between 80° - 89.5° to the longitudinal direction of a base 161, wherein said base 161 is mounted to a balustrade 23 or a balustrade cover 24 of the moving walkway (tilt angle not shown). The angle β is 90° .

[0045] Fig. 5 shows more clearly the effect on the movable surface elements 12 upon application of a force F , e.g. a force of 5 N. Once the force F is applied, the further compression mechanism releases the nose 152 of the mobile support structure 15 allowing the mobile support structure 15 to move downwards to positions x' and y' and the movable surface elements to move in the forward and lateral directions, as shown by the arrows (b) to provide an open space around the handrail belt 25, i.e., to move from state A to state B. The mobile support element 15 is released via interaction between the nose 152 and the tilted further compression mechanism 16. The opening provided around the handrail belt when the safety device 10 is changed from state A to state B relieves any passenger entrapment, thus improving user safety. This movement also causes the mobile support structure 15 to activate a transducer 17 (shown in Fig. 4). The transducer 17 communicates to a control unit (not shown in Fig. 4 and Fig. 5) of the moving walkway thus causing it to slow down and stop.

[0046] Fig. 6 shows a detailed schematic representa-

tion of the further compression mechanism 16 of the safety device 10 similar to the one shown in Fig. 4 and Fig. 5, in particular it shows its interaction with the movable surface elements 12 and the mobile support structure 15. The support element 11 is not shown. The further compression mechanism 16 is tilted at an angle (α) of 80° to a base 161, wherein said base 161 is mounted to the balustrade 23 or balustrade cover 24 of the moving walkway. The further compression mechanism 16 is in contact with only the nose 152 of the mobile support structure 15 of the safety device 10. It is shown here in the released state, i.e., when the movable surface elements 12 are in state B. The first compression mechanism 131 and the second compression mechanism 132 of the first guiding system 13 are distinguishable under the movable surface elements 12, i.e., the first movable part 121.

[0047] Fig. 7 shows a top view of an embodiment of the safety device 10 according to the invention. The safety device 10 is positioned on a moving walkway 20, wherein said walkway 20 comprises a first handrail 21 and a second handrail 22 in a single line configuration. The first handrail comprises a support structure 211 with a handrail belt 25, and the second handrail 22 comprises a support structure 221 with a handrail belt 26, wherein said handrails 25, 26 are in single line configuration. The safety device 10 comprises a first movable part 121, a first second movable part 1221 and a second second movable part 1222. There is a space for the support structure 211 of handrail 21 between the first second movable part 1221 and the second second movable part 1222. The safety device 10 shown is in state A since no space is provided around the handrail 21, in particular around the handrail belt 25. This is the "normal" state for most of the time during normal usage of the moving walking system. It is only in cases of entrapment occurring at the end of a handrail belt of a moving walking system that a force F is applied to the movable part 121 and causes the safety device 10 to change from state A to state B, thus releasing a free space around the handrail belt 25 and consequently resolving any entrapment.

[0048] Fig. 8 shows an embodiment of the moving walking system 20 according to the invention. Said walking system 20 comprises a first handrail 21 with a support structure 211 and first handrail belt 25, as well as second handrail 22 with a support structure 221 and second handrail belt 26, wherein the first handrail 21 and second handrail 22 are in single line configuration, preferably in single line configuration on each side of the moving walkway 20. The moving walkway system 20 comprises walking pallets 27 and a safety device 10 according to an embodiment of the invention. Preferably the safety device 10 is positioned at the intersection of the first handrail 21 and the second handrail 22, in particular, it is positioned where the first handrail belt 25 ends and before the second handrail belt 26 begins. A safety device 10 is positioned at the end of the first handrail belt 25 on both sides of the moving walkway system 20.

[0049] Fig. 9a and Fig. 9b show another embodiment of a safety device 10 according to the invention. The safety device 10 shown in Fig. 9a and Fig. 9b is separate from a moving walking system. The safety device 10 comprises movable surface elements 12 wherein the movable surface elements 12 comprise a first moveable part 121, a first second movable part 1221 and a second second movable part 1222; a mobile support structure 15 and a first guiding system 13 (not shown in Fig. 9a and Fig. 9b), wherein said guiding system comprises a first compression mechanism 131 and a second compression mechanism 132 (not shown in Fig. 9a and Fig. 9b). In Fig. 9a, the safety device 10 is in state A with the movable surface elements 12 encompassing a void 123. This void 123 represents the area of the safety device 10 which is filled by the handrail of the moving walking system, preferably the handrail belt (not shown in Fig. 9a and Fig. 9b). The mobile support structure 15 comprises four protrusions 151 and a nose 152. The elongated vertical rods 141 of the second guiding system 14 as well as support element 11 and the further compression mechanism 16 as explained with reference to Fig. 1, for example, are not shown in Fig. 9a and Fig. 9b. The arrows (b) and (c) show the direction of force F and the consequent lateral movement (b) of the movable surface elements 121 and 1221, 1222. Fig. 9b shows the safety device 10 of Fig. 9a in state B, i.e. after force F has been applied. The movable surface elements 12 are laterally displaced such that the first movable part 121 is laterally displaced from the first second movable part 1221 and the second second movable part 1222. The first compression mechanism 131 and the second compression mechanism 132 of the first guiding system 13 become visible after the displacement of the movable surface elements 12.

[0050] These embodiments are preferred embodiments of the invention and are in no way intended to limit the scope of the invention. Any number of these embodiments may be combined in any way without parting from the scope of the invention.

Reference signs list

[0051]

- | | |
|------|----------------------------|
| 1 | connection |
| 2 | friction wheel |
| 10 | safety device |
| 11 | support element |
| 12 | movable surface elements |
| 121 | first movable part |
| 122 | second movable part |
| 1221 | first second movable part |
| 1222 | second second movable part |
| 123 | void |
| 13 | first guiding system |

- | | | |
|-----|------------------------------|---|
| 131 | first compression mechanism | |
| 132 | second compression mechanism | |
| 133 | rod | |
| 5 | 14 | second guiding system |
| | 141 | elongated vertical rod |
| | 142 | buffer |
| | 15 | mobile support structure |
| 10 | 151 | protrusion |
| | 152 | nose |
| | 16 | further compression mechanism |
| | 161 | base |
| 15 | 17 | transducer |
| | 20 | moving walking system/ moving walkway |
| | 21 | handrail/first handrail |
| 20 | 211 | support structure |
| | 22 | second handrail |
| | 221 | support structure |
| | 23 | balustrade |
| | 24 | balustrade cover |
| 25 | 241 | opening |
| | 25 | first handrail belt |
| | 26 | second handrail belt |
| | 27 | walking pallets |
| 30 | A | first state |
| | B | second state |
| | F | force applied to movable surface elements |

35 Claims

- | | |
|----|---|
| 1. | A safety device (10) for a moving walking system (20) with a handrail (21) comprising a handrail belt (25); wherein the safety device (10) comprises a support element (11) for arranging the safety device (10) to the moving walking system (20) and further comprises movable surface elements (12); wherein the movable surface elements (12) have a first state (A) and a second state (B) such that in the first state (A), the movable surface elements (12) are adapted to enclose at least a part of the handrail belt (25) to form a handrail inlet and in the second state (B), the movable surface elements (12) are adapted to provide an open space around at least a part of the handrail belt (25). |
| 2. | The safety device (10) according to claim 1, characterized in that the movable surface elements (12) comprise at least a first movable part (121) and a second movable part (122), wherein the first movable part (121) and the second movable part (122) are arranged on opposing sides and are adapted to move in a lateral direction, where- |

in in the first state (A) the first movable part (121) and the second movable part (122) are adapted to enclose said at least part of the handrail belt (25) and in the second state (B) the first movable part (121) and the second movable part (122) are separated from each other in the lateral direction such that the open space around the handrail belt (25) is provided.

3. The safety device (10) according to claim 2 or claim 3, **characterized in that** the second movable part (122) is formed by a first second movable part (1221) and a second second movable part (1222) wherein between the first second movable part (1221) and the second second movable part (1222) there is a space for a support structure (211) of the handrail (21); and wherein the first movable part (121) and the second movable part (122) are coupled with at least a first compression mechanism (131), wherein in the first state (A) the first compression mechanism (131) is compressed and in the second state (B) the first compression mechanism (131) is relaxed.
4. The safety device (10) according to one of claims 2 to 4, **characterized by** a first guiding system (13) for guiding the first movable part (121) and the second movable part (122) in the lateral direction.
5. The safety device (10) according to one of the preceding claims, **characterized by** a mobile support structure (15), wherein the mobile support structure (15) is adapted to move towards the support element (11), and wherein the mobile support structure (15) supports at least one out of the following: the first guiding system (13); the at least one compression mechanism (131); the movable surface elements (12).
6. The safety device (10) according to claim 5, **characterized in that** in the first state (A) the mobile support structure (15) is spaced further apart from the support element (11) than when in the second state (B).
7. The safety device (10) according claim 5 or claim 6, **characterized by** the mobile support structure (15) being connected to the support element (11) wherein said support element (11) is itself configured to be connected to the moving walking system (20).
8. The safety device (10) according to one of claims 5 to 7, **characterized by** a second guiding system (14) for guiding the mobile support structure (15) in the direction towards the support element (11).
9. The safety device (10) according to one of claims 5 to 8, **characterized in that** the mobile support structure (15) is coupled with at least one further com-

pression mechanism (16) for releasing the mobile support structure (15), wherein in the first state (A) the at least one further compression mechanism (16) is compressed and in the second state (B) the at least one further compression mechanism (16) is relaxed.

10. The safety device (10) according to claim 9, **characterized in that** the mobile support structure (15) comprises a nose (152) which is adapted to act on the at least one further compression mechanism (16), wherein the nose (152) acts on the at least one further compression mechanism (16) when the mobile support structure (15) is moved towards the support element (11).
11. The safety device (10) according to one of the preceding claims, **characterized by** a transducer (17) wherein the transducer (17) is activated in the second state (B), wherein the activated transducer (17) is adapted to generate a signal which may prompt a controller of the moving walking system (20) to slow down or stop the moving handrail belt (25) and/or the moving pallets of the moving walking system (20).
12. The safety device (10) according to one of the preceding claims, **characterized in that** the at least one further compression mechanism (16) is arranged at an angle of less than 90° to the lateral direction of the support element (11).
13. A moving walking system (20) with a balustrade (23), balustrade cover (24) and at least one handrail (21) comprising a moving handrail belt (25), wherein the part of the at least one handrail belt (25) which is intended to be used by passengers for safety purposes protrudes from the balustrade cover (24), **characterized in that** the moving walking system (20) further comprises a safety device (10) according to one of claims 1 to 12, wherein the balustrade cover (24) comprises an opening (241) which in the first state (A) of the safety device (10) is closed by the movable surface elements (12), wherein the movable surface elements (12) enclose at least a part of the handrail belt (25) to form a handrail inlet of the moving walking system (20).
14. A moving walking system (20) according to claim 13 **characterized by** at least a first handrail (21) and a second handrail (22) in a single line configuration, wherein the safety device (10) is arranged at the end of the first handrail (21) such that in the first state (A) it forms a handrail inlet for the first handrail (21); and, **characterized in that** it is either a single speed moving walkway system or a variable speed moving walkway system.

15. A moving walking system (20) according to claim 13 or claim 14, **characterized in that** the safety device (10) is installed in such a manner that when applying a force (F) on the movable surface elements (12), wherein said force exceeds a predetermined threshold, the safety device (10) moves from the first state (A) into the second state (B).

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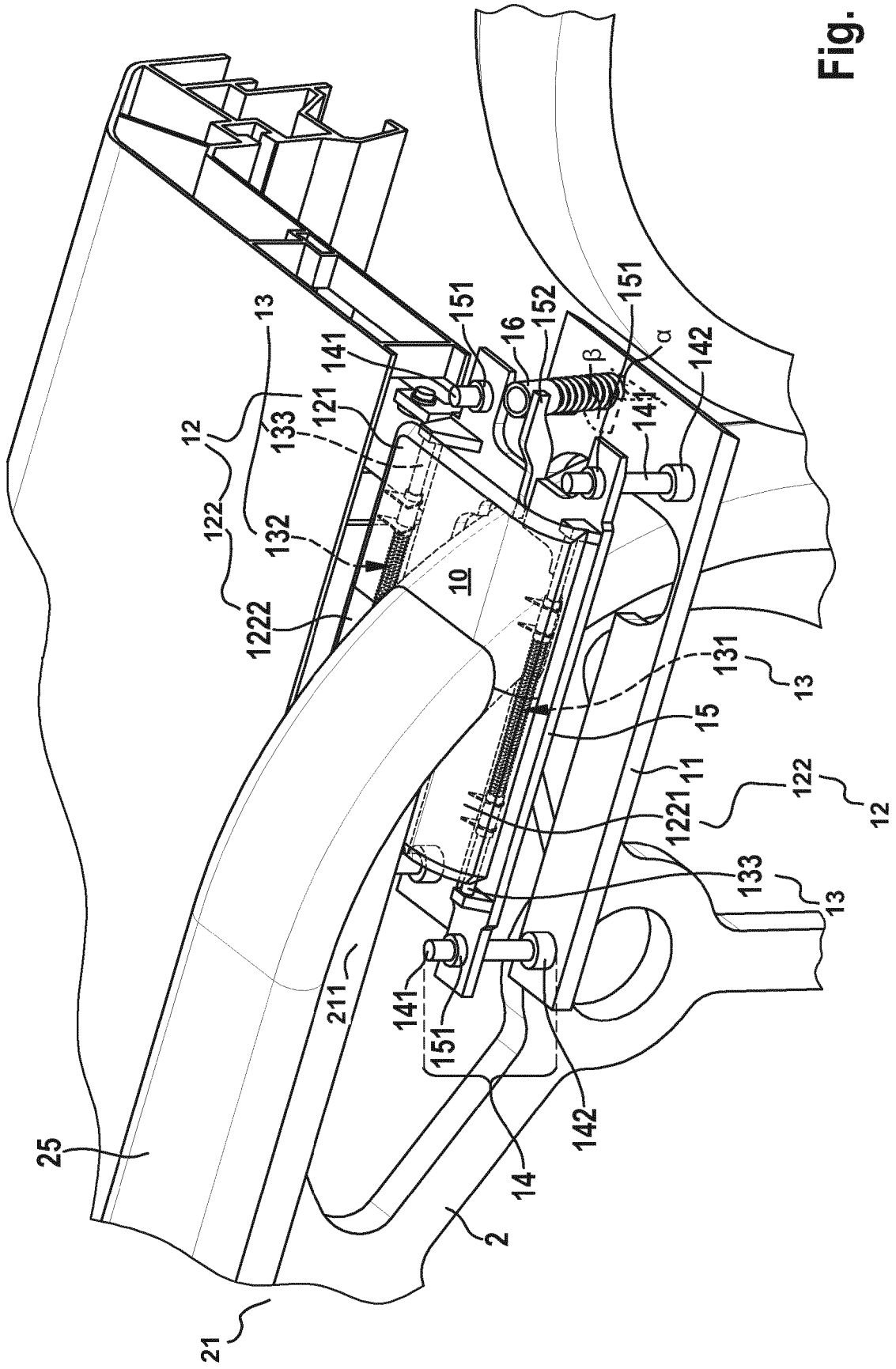


Fig. 1

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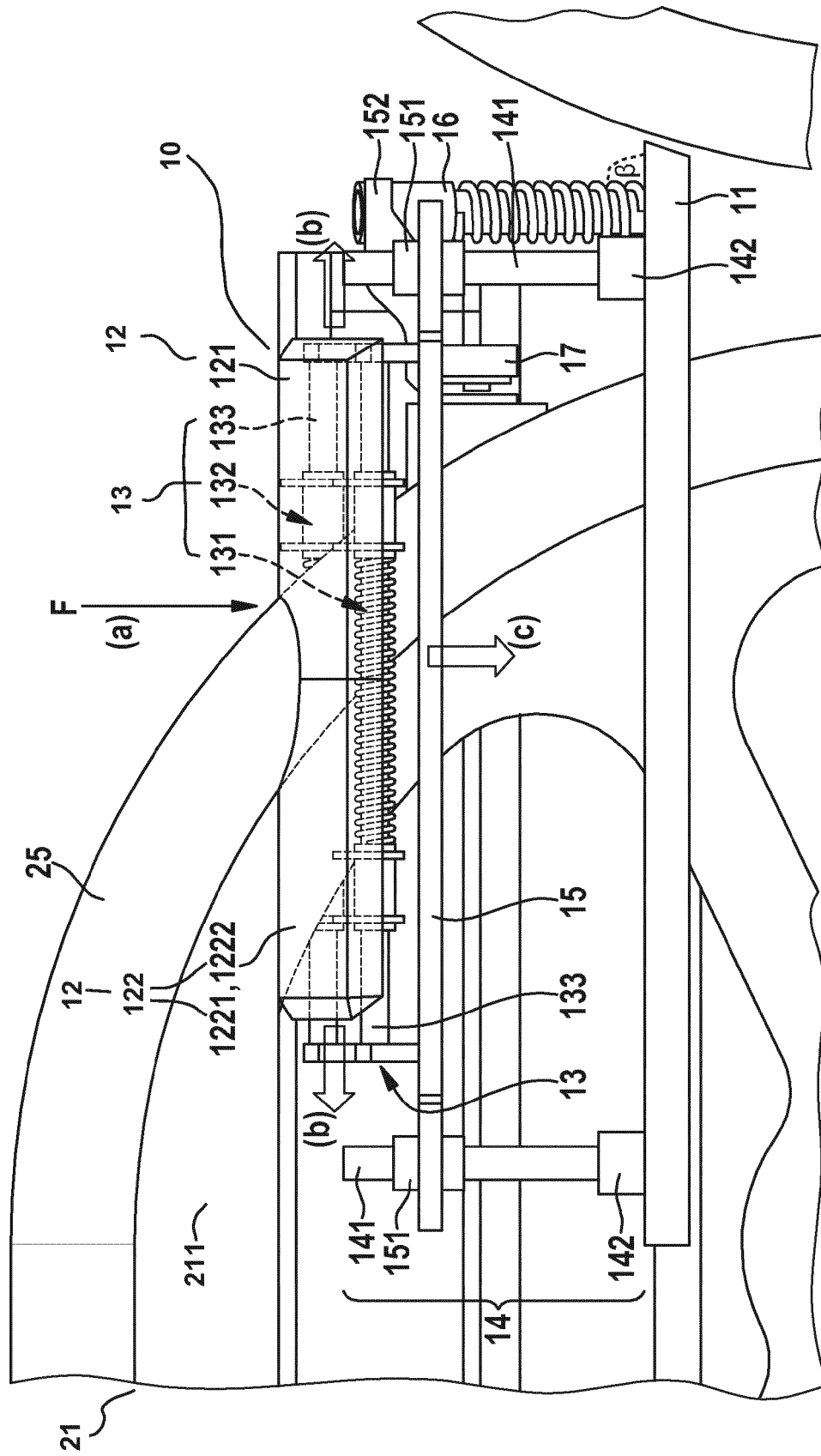
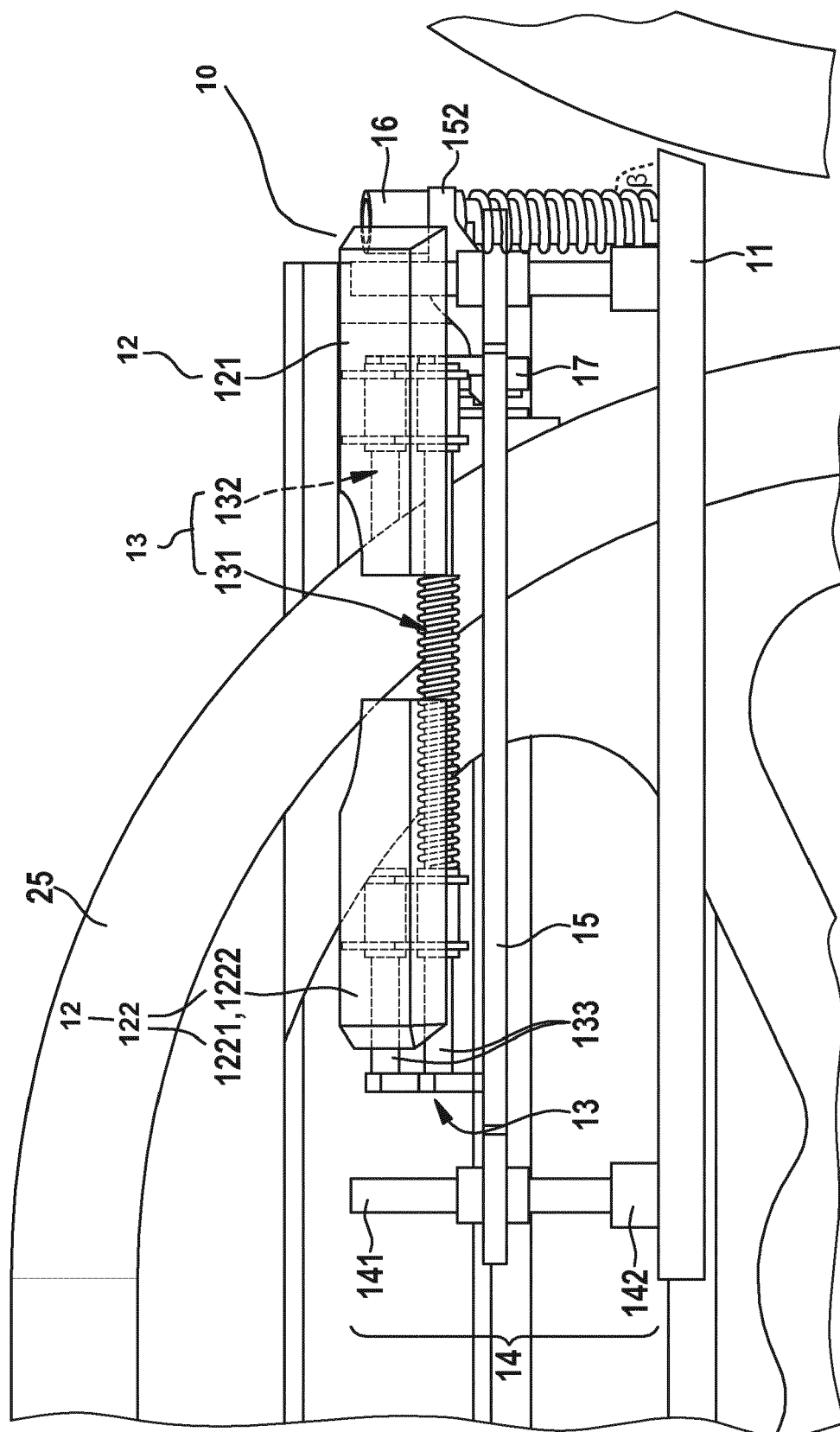


Fig. 2



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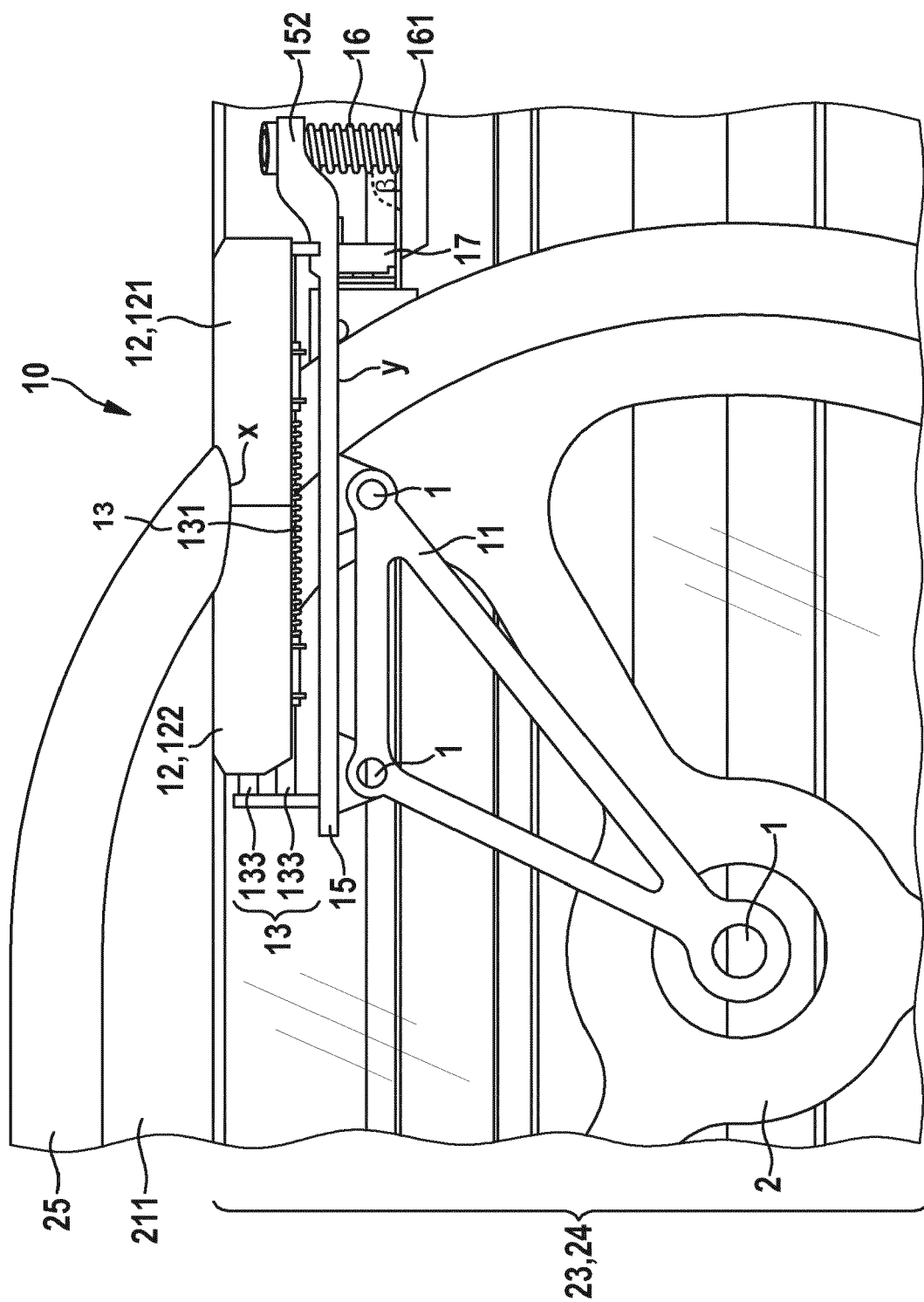
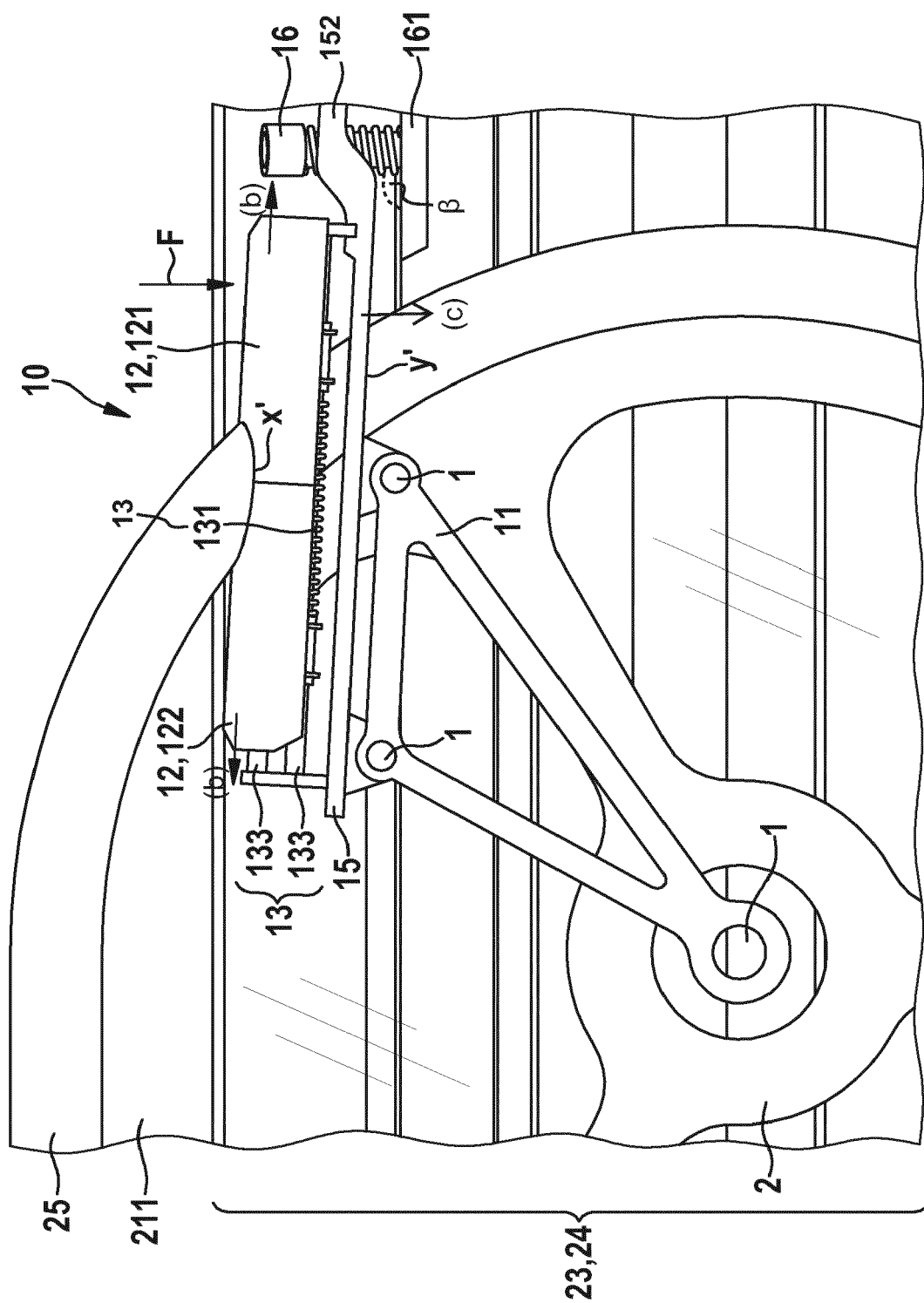
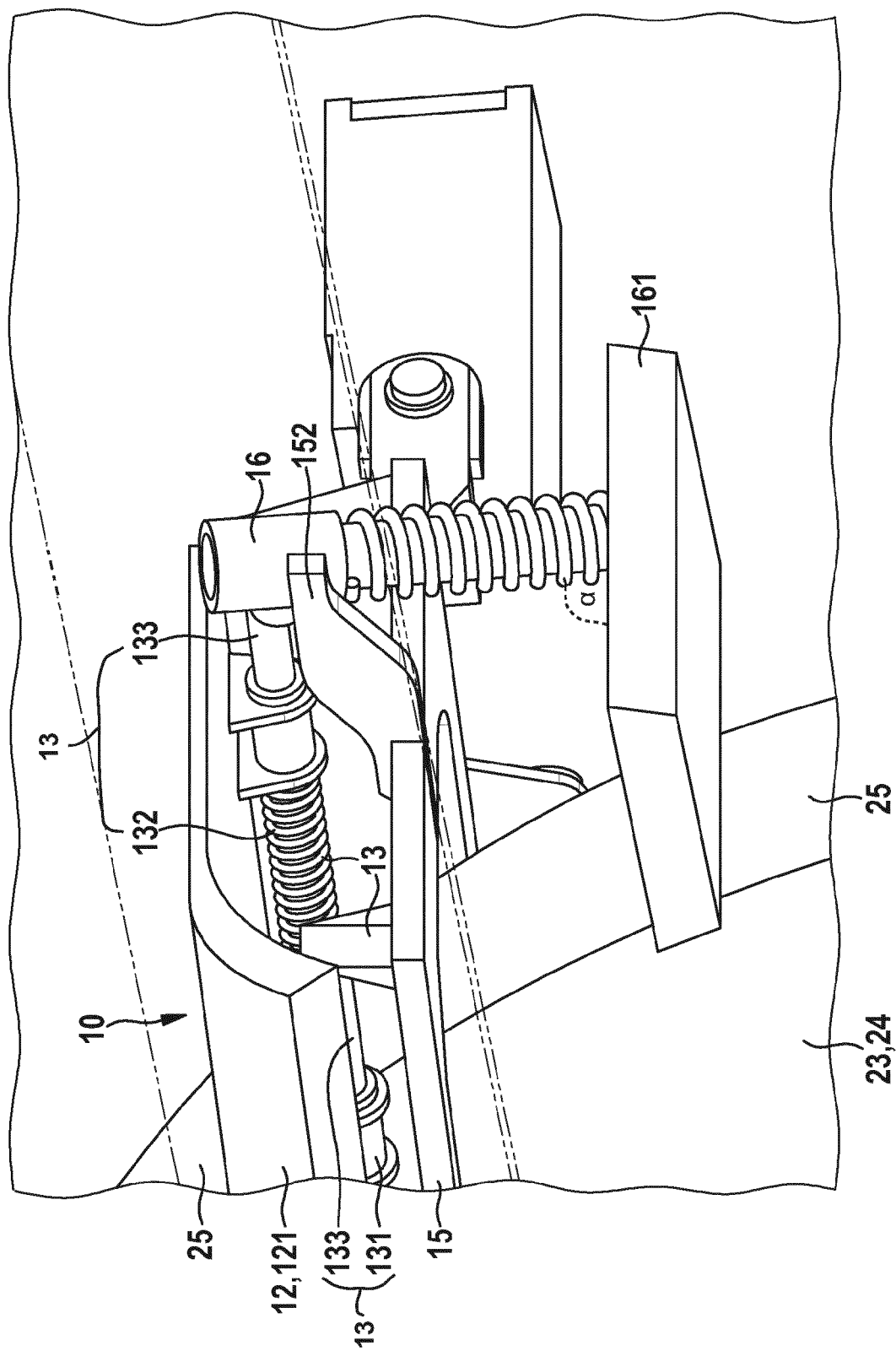


Fig. 4



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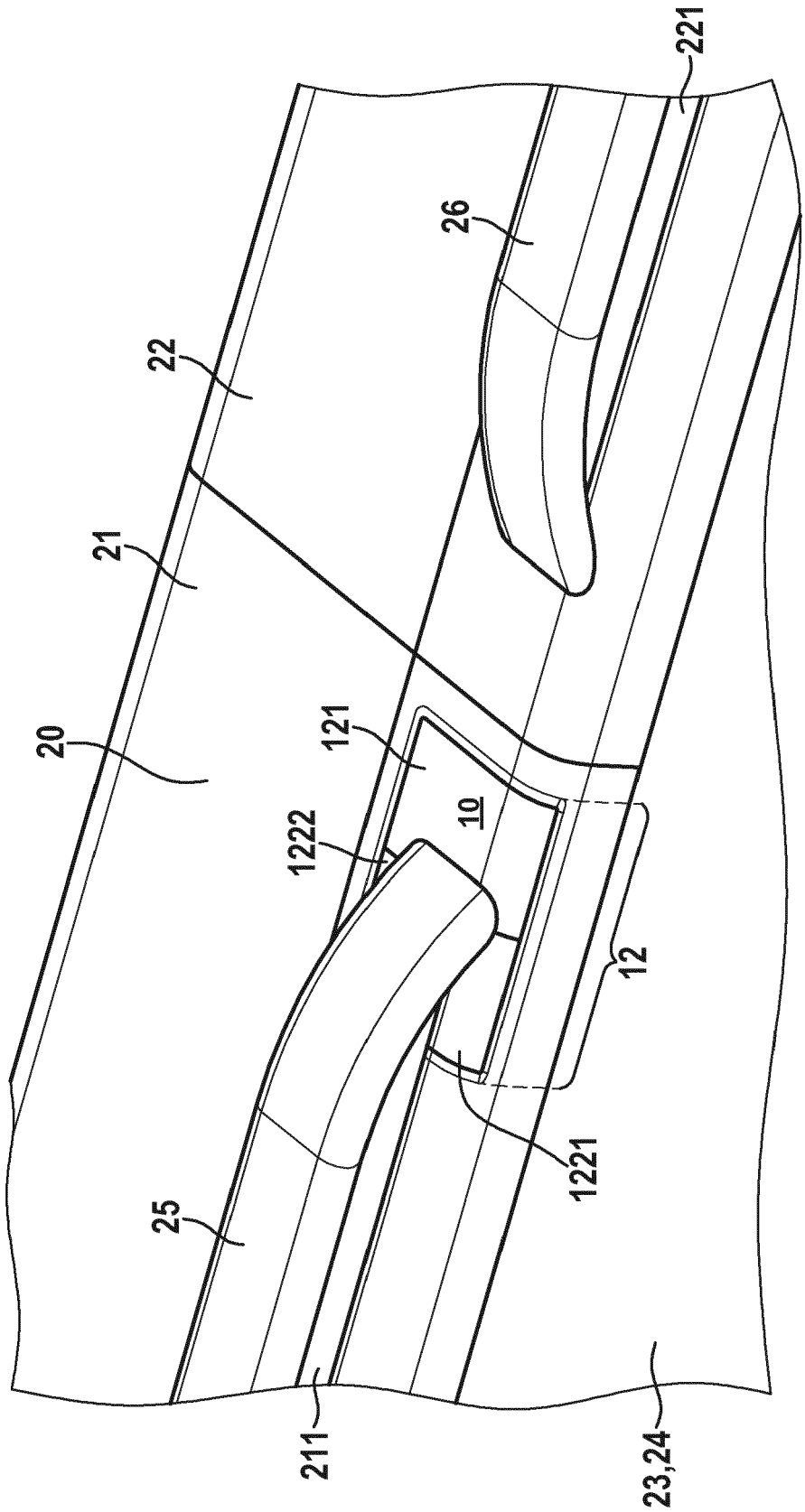


Fig. 7

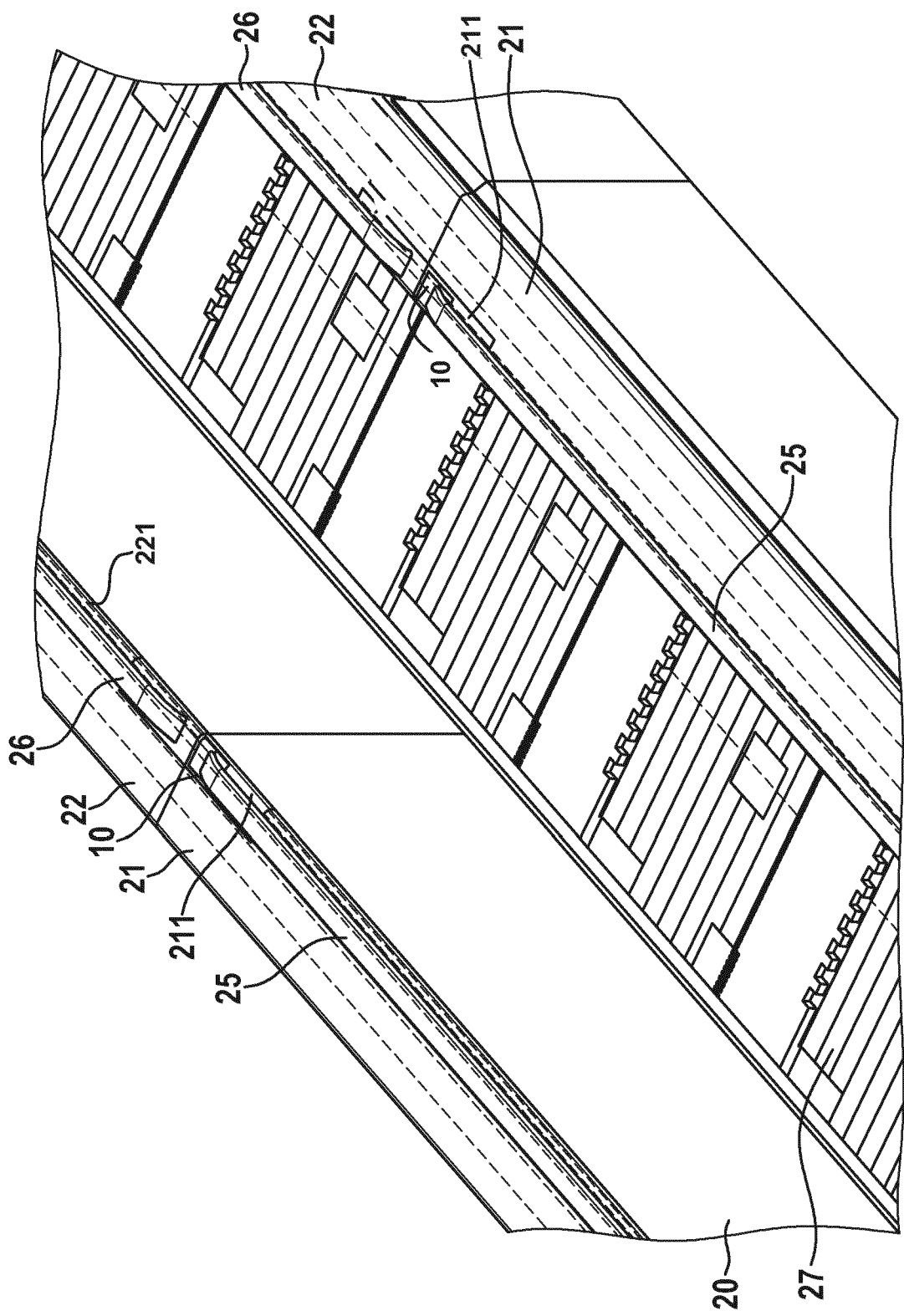


Fig. 8

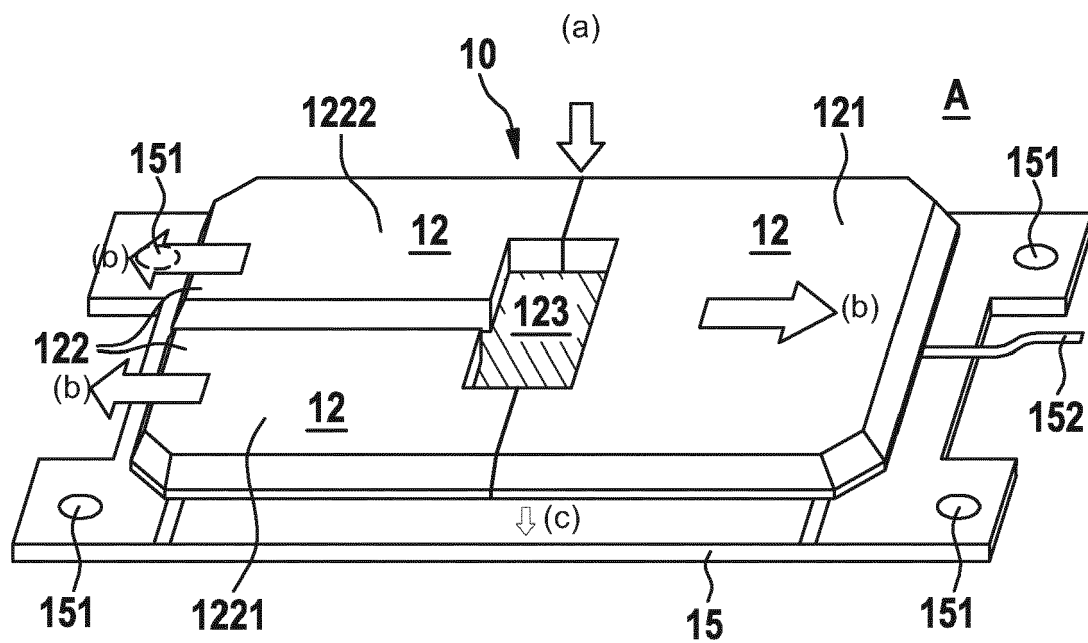


Fig. 9a

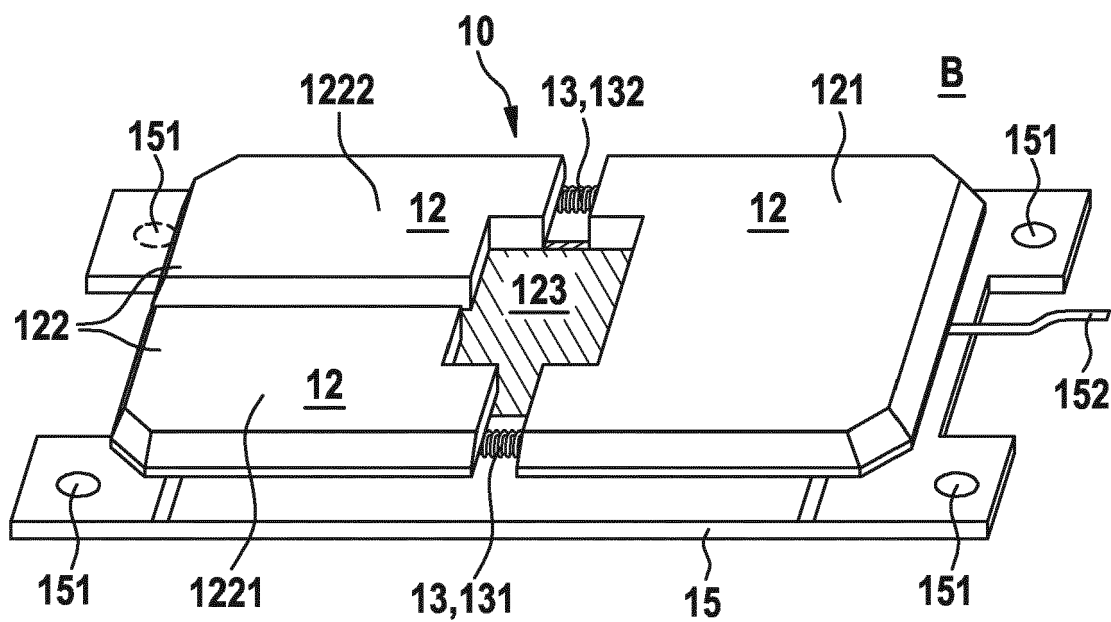


Fig. 9b



EUROPEAN SEARCH REPORT

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EP 18 38 2228

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Place of search The Hague		Date of completion of the search 6 November 2018	Examiner Dogantan, Umut H.
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