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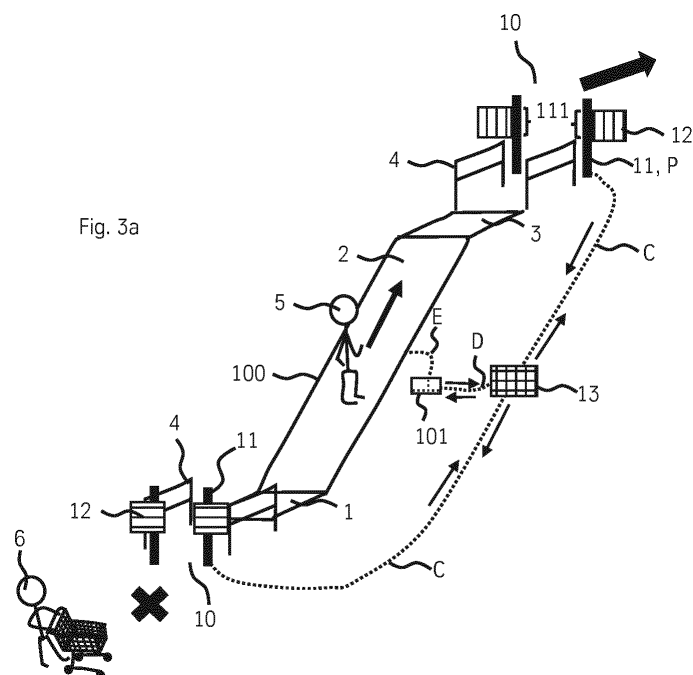
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(54) **GATE SYSTEM CONFIGURED FOR A PASSENGER MOVING SYSTEM HAVING A REVERSIBLE TRAVELLING DIRECTION**

(57) The present invention refers to a gate system (10) adapted to control passenger access to a passenger moving system (100) said moving system having a reversible travelling direction, wherein the gate system (10) comprises: at least one first post (11) positioned at a first landing area (1) of the passenger moving system (100) wherein said first post (11) comprises a rotating element (111) and a barrier (12); at least one second post (11) positioned at a second landing area (3) of the passenger

moving system (100) wherein said second post (11) comprises a rotating element (111) and a barrier (12); wherein the barrier (12) of the at least one first post (11) and the barrier (12) of the at least one second post (11) are each configured to be in a first position or a second position, wherein each barrier (12) is adapted to alternate between the first and second position according to the travelling direction of the passenger moving system (100).



Description

[0001] The invention relates to a gate system adapted to control passenger access to a passenger moving system said moving system having a reversible travelling direction; a passenger moving system comprising such a gate system; and a method for controlling passenger access to a passenger moving system.

[0002] Barriers positioned about the entrance of a passenger moving system are commonly used to control and regulate passenger flow when entering said moving system. More particularly, they are positioned at the entrance to prevent shopping and/or baggage trolleys from entering the moving system thereby mitigating a serious safety risk. Passenger moving systems preferably comprise moving walks and escalators. There are currently two main types of barriers that are used in the art; a fixed barrier and a removable barrier.

[0003] A fixed barrier positioned at the entrance of an escalator or moving walk allows passengers to pass through a first landing area to travel on the escalator or moving walk whilst obstructing trolleys from doing the same. Having reached a second landing area, the passenger exits the system. According to regulations, in particular, EN 115-1:2017, an unrestricted area is available to accommodate passengers exiting the escalator or moving walk. In this area, a barrier installation is not permitted. In escalators and moving walks with fixed barriers, the travelling direction cannot be changed, thus the entrance and exit area of the escalator or moving walk never changes nor does the position of the barrier.

[0004] An escalator or moving walk having an alternating direction of travel requires a barrier at the relevant entrance area. A fixed barrier is not suitable in this situation thus a removable barrier is used. The removable barrier must be located according to the entrance area matching the travelling direction of the escalator or moving walk. This is cumbersome and requires a significant amount of "manpower" in removing a barrier at one end of an escalator or moving walk and relocating it another end when the direction of travel is changed. Furthermore, there are specific requirements in the regulations EN 115-1:2017 pertaining to how a removable barrier is to be placed, thus if a removable barrier is positioned incorrectly during relocation, the escalator or moving walk will not pass a safety inspection. In some escalators or moving walks, it may not even be possible to reposition a barrier in a way that complies with regulations.

[0005] A further disadvantage associated with removable barriers is that a time lag exists between the opening and/or the closing of the relevant barrier or barriers at an exit or an entrance of an escalator or moving walk. This can pose a safety risk since in the time it takes to change the travelling direction of the escalator or moving walk and re-position the barrier or barriers accordingly, a passenger with a trolley could enter the escalator or moving walk during this transition period, thereby jeopardizing their safety as well as the safety of other passengers on the escalator or moving walk.

[0006] A recently developed removable barrier is disclosed in EP 2778337 A1. This barrier is designed to be operated manually or remotely to control access to an escalator or moving walk or a similar installation wherein when the barrier is in a "closed" position, an emergency passage is permitted via retraction of the "closed" position by applying an abnormal force to it. Another barrier system is disclosed in EP 510522 A2 wherein the system is adapted to permit entrance to a passenger moving system of a specific type of trolley and to prevent all other trolley types from entering the passenger moving system.

[0007] However the current art fails to address the problem of ensuring the coordination of the travelling direction of the escalator or moving walk with the positioning of the removable barrier or barriers when the travelling direction is changed, wherein the removable barriers when adjusted remain in compliance with safety regulations.

[0008] It is thus an object of the invention, to provide a solution to this particular problem in order to improve passenger safety and to improve the efficiency of passenger moving system installations. This object is solved by a gate system according to claim 1 and a passenger moving system according to claim 13 and a method according to claim 14.

[0009] The inventive gate system, a passenger moving system comprising the inventive gate system and a method for controlling passenger access to a passenger moving system, are the subject of the appended claims and are described in further detail in the following embodiments and figure description.

Embodiments

[0010] The invention relates to a gate system adapted to control passenger access to a passenger moving system said moving system having a reversible travelling direction. The passenger moving system preferably comprises escalators and moving walks. The inventive gate system comprises:

- at least one first post, preferably a pair of first posts, positioned at a first landing area of the passenger moving system wherein said first post, preferably each first post, comprises a rotating element and a barrier. The rotating element preferably comprises the barrier;
- at least one second post, preferably a pair of second posts, positioned at a second landing area of the passenger moving system wherein said second post, preferably each second post, comprises a rotating element and a barrier. The rotating element preferably comprises the barrier;
- a control center, preferably configured to provide information about the status of the gate system and to actuate the

barrier or barriers into an "open" or "closed" position. Preferably the control center is adapted to be connected to a control unit of the passenger moving system, e.g., an escalator or moving walk. The control unit is preferably configured to control the escalator or moving walk, e.g., to control its travelling direction; to control whether it should come to a stop or not;

- optionally, an interface device, wherein the interface device can be connected to:

A. the control unit of the passenger moving system; or

B. the control center of the gate system; or

C. the control unit and the control center.

[0011] The interface device can be adapted to replace the control center of the gate system (option A). In such a situation, should it be required, the control unit may be adapted to be more "intelligent". For example, the control unit can undertake the task to execute the characteristics of the control center thus providing for any necessary connections (e.g., via electrical, wireless or other means) and thereby allowing for control of the gate system, in particular, the barrier or barriers.

[0012] The interface device can also be employed as an auxiliary to the control center (option B), or to both the control unit and the control center (option C). This would preferably depend on the requirements of the passenger moving system and the gate system. wherein

- the barrier of the at least one first post and the barrier of the at least one second post are each configured to be in
- a first position or
- a second position,

wherein said first and second positions are preferably different. Preferably the first position relates to a barrier which is open and the second position relates to a barrier which is closed or *vice versa*. When the gate system comprises a first and second pair of posts, the barriers of the first pair of posts preferably have the same position and the barriers of the second pair of posts preferably have the same position.

[0013] In an embodiment of the invention, the barrier or barriers at the first landing area has a different position to the barrier or barriers at the second landing area.

[0014] In an embodiment of the invention, each barrier is adapted to alternate between the first and second position according to the travelling direction of the passenger moving system. Preferably alternation occurs, preferably automatically via cooperation between the control unit and the control center. Preferably alternation occurs, preferably automatically, via cooperation between the control unit and the interface device. Preferably alternation occurs, preferably automatically, via co-operation between the control unit, the control center and the interface device.

[0015] The control center and optionally the interface device, preferably comprise

- a programmable controller, e.g., software including a microprocessor, or
- a non-programmable controller comprised of a plurality of electronic component parts, e.g., hardware.

Preferably the programmable controller and/or the non-programmable controller each comprise at least one piece of software which is adapted to communicate with a control unit of the passenger moving system. The software preferably provides for the "syncing" or "communication" of information between the control unit and the control center, or between the control unit and the interface device, or between the control unit, the control center and/or the interface device, thus enabling the automatic response of the gate system upon a change in the travelling direction of the passenger moving system. The inventive gate system ensures that when the travelling direction of the passenger moving system is changed, the safety measures put in place, i.e., the barriers do not have to be removed and re-positioned at the correct landing area, rather, their position changes automatically upon the change in travelling direction and thereby saves time and ensures that no passenger can enter a passenger moving system at the wrong landing area. Furthermore the posts are preferably positioned about the passenger moving system at each landing area according to safety regulations such that the post(s) at the first landing area can operate as entrance safety barriers and the post(s) at the second landing area can also operate as entrance safety barriers. Therefore, the inventive gate system ensures that the safety features, e.g., the barriers positioned at each landing area, comply with safety regulations regardless of which direction the passenger moving system is moving in, thus simultaneously improving operational efficiency and passenger safety.

[0016] In an embodiment of the invention, the rotating element is preferably adjustable in height or in length, or both. This advantageously accommodates various safety requirements for various passenger moving systems.

[0017] In an embodiment of the invention, the first position preferably relates to the barrier being configured preferably via rotation, to provide an unrestricted exit for a passenger when disembarking from the passenger moving system. In such a configuration, the gate system is described as "open". This advantageously ensures that only passengers who are permitted to travel on a passenger moving system can embark and disembark such a moving system, thus improving passenger safety.

The second position preferably relates to the barrier being configured, preferably via rotation, to block access to the passenger moving system of a prohibited passenger, and permit access to a passenger, wherein a prohibited passenger preferably relates to a passenger pushing a trolley or a pram or a passenger in possession of other non-permitted items on a passenger moving system. In such a configuration, the gate system is described as "closed".

[0018] In an embodiment of the invention, each post comprises a first trigger and a second trigger, wherein the second trigger is preferably at a different location to the first trigger. Each rotating element preferably comprises an activator for activating the first trigger or the second trigger. Two triggers are preferred to ensure a stronger signal. This advantageously provides that each individual post, in particular the barrier is controllable. A preferred form of trigger includes sensor devices, e.g., magnetic sensors; IR sensors; light sensors; heat sensors; mechanical switches, e.g., safety switches.

[0019] In an embodiment of the invention, the barrier is preferably adapted to be

- in the first position when the first trigger is activated;
- in the second position when the second trigger is activated,

wherein activation is preferably based on a logic system. Said logic system requires only one trigger within the post to be activated at any given time. For example, the first trigger is activated and has the logic state of 1, whilst the second trigger is not activated and has the logic state of 0, giving a logic state configuration of (1, 0), or vice versa. This state is recognized by the logic system as an instruction to have the barrier in the "open" position. Said logic system ensures that the barrier is only in the open or closed position when the first and second triggers have the logic state configuration of:

- (1, 0) respectively or
- (0, 1) respectively.

[0020] When the first trigger has the logic state of 0 and the second trigger has the logic state of 0, this is interpreted as a "barrier error" and no movement of the barrier 12 occurs. When the first trigger has the logic state of 1 and the second trigger has the logic state of 1, this is interpreted as a "barrier error" and no movement of the barrier 12 occurs. When either the first or second trigger is faulty, this is also interpreted as a "barrier error". This logic applies to each post within the gate system. For example, when the inventive gate system comprises a first post positioned at the first landing area and a second post positioned at the second landing area, each post operates according to this logic system. When the inventive gate system comprises a first pair of posts at the first landing area and a second pair of posts at the second landing area, each post within each pair of posts operates according to this logic system. Thus, there is no "middle ground" where the inventive gate system could fail when changing between the open and closed configurations. This advantageously improves operational efficiency and passenger safety.

[0021] Preferably activation occurs upon alignment of the trigger with the activator. Preferably alignment occurs via a rotation of the rotation element upon an instruction signal transmitted via the control center and the control unit, or upon an instruction signal transmitted via the interface device and the control unit, or upon an instruction signal transmitted via the interface device, control center and the control unit. Preferably alignment occurs in the vertical plane. This advantageously ensures that each individual post can be independently operated.

[0022] In an embodiment of the invention, the barrier is one selected from the group comprising:

- a horizontal barrier
- a vertical barrier

wherein the horizontal barrier is positioned

- above ground level or
- at ground level.
- or a combination of both.

This advantageously provides a gate system having a barrier suitable for various types of passenger moving systems. It is also envisaged that the barrier at a first landing area could be a horizontal barrier and the barrier at the second landing area could be a vertical barrier or *vice versa*.

[0023] In an embodiment of the invention, the control unit comprised within the passenger moving system is adapted

to communicate with at least one of:

- the rotating element of each post, preferably via the control center of the gate system or via the interface device of the gate system or via both the control center and interface device of the gate system;
- the control center of the passenger moving system;
- optionally the interface device;

preferably via a plurality of information transmission means. Said transmission means preferably includes electronic wiring and/or the use of wireless signals. This advantageously ensures that the gate system is "synced" to the passenger moving system in order to improve operational efficiency.

[0024] In an embodiment of the invention, the interface device is adapted to communicate with at least one of:

- the rotating element of each post within the gate system;
- the control unit of the passenger moving system;
- optionally the control center of the gate system.

Communication preferably occurs via a plurality of information transmission means. Said transmission means preferably includes electronic wiring and/or the use of a wireless connection or other suitable means. This advantageously ensures that the gate system is "synced" to the passenger moving system in order to improve operational efficiency.

[0025] In an embodiment of the invention, the rotating element is adapted to rotate, preferably to rotate about a pivot, preferably to automatically rotate about a pivot, upon a change in travelling direction of the passenger moving system. This advantageously avoids the need for removing the safety features on one side of a passenger moving system and reconfiguring them to the other side of the passenger moving system when its travelling direction is changed. Thus improving operational efficiency and passenger safety.

[0026] In an embodiment of the invention, the barrier is an elevated horizontal barrier, i.e., it is preferably positioned above ground level, wherein said barrier is adapted to be rotated horizontally about a pivot via the rotating element wherein the pivot is the post. This advantageously provides a gate system having a barrier suitable for various types of passenger moving systems.

[0027] In an embodiment of the invention, the barrier is a vertical barrier positioned parallel to the post and preferably connected thereto via the rotating element, wherein said barrier is adapted to be rotated horizontally about a pivot via the rotating element, wherein the pivot is the post. Preferably the rotating element provides a distance between the post and the parallel vertical barrier such that the barrier is laterally displaced from the post. This advantageously provides a gate system having a barrier suitable for various types of passenger moving systems.

[0028] In an embodiment of the invention, the barrier is a horizontal barrier positioned at ground level wherein said barrier is adapted to be rotated vertically about a pivot via the rotating element, wherein the pivot is comprised within the post. This advantageously provides a gate system having a barrier suitable for various types of passenger moving systems.

[0029] In an embodiment of the invention, the barrier comprises an external surface and an elevated surface wherein the elevated surface is adapted to be:

- exposed upon a vertical upwards rotation of the barrier. This preferably represents the barrier when in the "closed" position. The exposed elevated surface provides a deterrent to any prohibited passenger that approaches the passenger moving system
or
- hidden upon a vertical downwards rotation of the barrier. This preferably represents the barrier when in the "open" position. The exposed surface is rotated such that it is comprised within the post and only the external surface is exposed to passengers. This advantageously provides a gate system with a space-saving design.

[0030] When the barrier is in the open position, it is preferably comprised within the post, wherein the post preferably takes the form of a ramp in the ground. Such a configuration advantageously avoids the need for vertical posts at either end of the handrail of an escalator or moving walk or at either end of an access barrier leading to or from said escalator or moving walk. When the barrier is then in the closed position, such a configuration functions the same as the elevated horizontal barrier or the vertical barrier.

[0031] In an embodiment of the invention, the elevated surface comprises at least one visual indicator. Preferably the visual indicator is activated upon a vertical upwards rotation of the barrier. This advantageously saves power when the barrier is in the "open" position.

[0032] In an embodiment of the invention, the at least one visual indicator is selected from the group comprising:

- LED's, including organic light-emitting diodes, polymer light-emitting diodes, active-matrix organic light-emitting diodes (AMOLED)
- electroluminescent wires
- photo-luminescent material;
- mechano-luminescent material.

[0033] This advantageously provides a gate system with a further safety feature that can be used to alert a prohibited passenger to the presence of a closed barrier.

[0034] In an embodiment of the invention, the elevated surface comprises other devices normally installed in an escalator or a moving walk which can be used as key switches or activators, for example; speakers (to transmit audio signals). Preferably such switches or activators are also activated upon a vertical upwards rotation of the barrier. This advantageously allows for an easier management of an escalator or a moving due to the location of such devices.

[0035] The invention also relates to a passenger moving system comprising a gate system as herein described, wherein the passenger moving system is preferably an escalator or a moving walk.

[0036] The invention also relates to a method of controlling passenger access to a passenger moving system wherein the passenger moving system has a reversible travelling direction. The method comprises the steps of:

- installing a gate system as herein described on the passenger moving system, wherein the gate system is installed between a first landing area and a second landing area of the passenger moving system. Preferably the travelling direction is reversible between e.g., an ascending and descending direction or a forwards and backwards direction;
- connecting the gate system with a control unit of the passenger moving system via either the control center; the interface device, or the control center and the interface device such that any change in travelling direction registered at the control unit is also registered, preferably simultaneously, at the control center and/or interface device;
- transmitting the information regarding a change in travelling direction to the posts at each landing area;
- automatically rotating the rotating element of each post about a pivot in order to activate and deactivate the respective trigger via the respective activator;
- adjusting the position of the barriers at each landing area according to the new travelling direction of the passenger moving system. Preferably the barriers at a first landing area move from a closed position to an open position, and the barriers at a second landing area move from an open position to a closed position or *vice versa*.

Figure Description

[0037] The invention is described in more detail with the help of the figures:

Figs. 1a to 2b show a schematic representation of a gate system provided in the prior art;
 Figs. 3a and 3b show a schematic representation of a gate system according to an embodiment of the invention;
 Figs. 2a and 4b show a schematic representation of a gate system according to an embodiment of the invention;
 Fig. 4c shows a schematic representation of the transition between an open gate and a closed gate according to an embodiment of the invention as shown in figs 4a and 4b;
 Figs. 3a and 5b show a schematic representation of a gate system according to an embodiment of the invention;
 Figs. 5c and 5d show a schematic representation of an open gate and a closed gate respectively according to an embodiment of the invention as shown in figs. 5a and 5b;
 Figs. 4a to 6d show a schematic representation of the gate system in the open and closed position according to any embodiment of the invention

[0038] A passenger moving system 100 as shown in each of the figures herein described comprises a first landing area 1; a second landing area 3; moving pallets 2 travelling between the first landing area 1 and the second landing area 3; or moving steps 2 travelling between the first landing area 1 and the second landing area 3; and optionally an access barrier 4 positioned on each side of each respective landing area 1, 3. The access barrier 4 is optional depending on the position of the posts 11 and the safety regulations as defined by EN-115. In the examples shown, the passenger moving system 100 is an escalator and comprises moving steps 2.

[0039] Fig. 1a shows a removable gate system according to the prior art 01, positioned about the passenger moving system 100. A passenger 5 is travelling on the moving steps 2 and a prohibited passenger 6 approaches the access barriers 4 with the intention of entering the landing area 1. A prohibited passenger 6 is a passenger in control of a luggage or shopping trolley.

[0040] The passenger 5 has passed through the gate system 01 and is moving from landing area 1 towards landing area 3 from where the passenger 5 can exit the passenger moving system 100 in the direction of the arrow. The prohibited passenger 6 however is unable to pass through the gate system 01 and is therefore prevented from accessing the

landing area 1, and most importantly, the moving steps 2. In fig. 1b, it is intended to change the direction of travel of the moving steps 2 so the removable gate system 01 has been relocated in front of the access barriers 4 to the landing area 3. However, the travelling direction of the moving steps 2 has not yet been changed, leaving the access barriers 4 at landing area 1 freely accessible to a prohibited passenger 6. The prohibited passenger 6 and the passenger 5 now both travel on the moving steps 2. The passenger 5 will be able to exit the landing area 3 through the removable gate system 01 without problem, however, the prohibited passenger 6 will not and instead become trapped. This causes significant safety risks for all users of the escalator 100.

[0041] Similarly in fig. 2a passenger 5 has passed through the gate system 01 and is moving from landing area 3 towards landing area 1 from where the passenger 5 can exit the passenger moving system 100 in the direction of the arrow. The prohibited passenger 6 however is unable to pass through the gate system 01 and is therefore prevented from accessing the landing area 3 and most importantly, the moving steps 2. In fig. 2b, it is intended to change the direction of travel of the moving steps 2 so the removable gate system 01 has been relocated in front of the access barriers 4 to the landing area 3. However, the travelling direction of the moving steps 2 has not yet been changed, leaving the access barriers 4 at landing area 3 freely accessible to a prohibited passenger 6. The prohibited passenger 6 and the passenger 5 now both travel on the moving steps 2. The passenger 5 will be able to exit the landing area 1 through the removable gate system 01 without problem, however, the prohibited passenger 6 will not and instead become trapped. This causes significant safety risks for all users of the escalator 100.

[0042] Figs. 3a and 3b show a solution to the above problem according to an embodiment of the invention. Fig. 3a shows an escalator 100 travelling in an upwards direction, whilst fig. 3b shows the same escalator 100 travelling in a downwards direction. A gate system 10 according to a first embodiment of the invention comprises a first pair of posts 11 positioned in front of the access barriers 4 at landing area 1 and a second pair of posts 11 positioned in front of the access barriers 4 at landing area 3. The positioning of each pair of posts 11 complies with safety regulations should they be adapted to be at the entrance of an escalator 100. Each post 11 comprises a rotating element 111 comprising a barrier 12 and an information transmission means C (to maintain clarity of the figures only one post 11 is shown as having a connection to the information transmission means C) The gate system 10 further comprises a control center 13 to which the first pair of posts 11 at landing area 1 and the second pair of posts 11 at landing area 3 are connected via the information transmission means C. The control center 13 is adapted to communicate with and rotate both pairs of posts 11 at each landing area 1, 3 simultaneously. The control center further comprises a motor 131 (not shown) wherein the motor is adapted to rotate the posts 11 about a pivot P, i.e., the post 11, according to the communicated information. The control center 13 is also adapted to be connected to and communicate with the control unit 101 of the escalator 100 via an information transmission means D. An information transmission means E extends between the escalator 100 and the control unit 101. Through the transmission means C, D and E, the escalator and the gate system 10 are able to communicate and in particular, coordinate to achieve optimum safety and efficiency.

[0043] The rotating element 111 in this particular example is located within the body of the post 11 and forms part thereof, at a height above ground level. The rotating element 111 is configured to respond to instructions received from a control center 13 such that when a change in the travelling direction of the escalator 100 occurs, the rotating element 111 rotates accordingly and thereby rotates the barrier 12. In this particular embodiment, the rotating element 111 is capable of a rotation of up to 200 degrees.

[0044] The barrier 12 in this particular embodiment is in the form of a horizontally extending arm. The barriers 12 on the first pair of posts 11 at landing area 1 are positioned such that the extended arms face inwards towards each other in a "closed" position whilst the barriers 12 on the second pair of posts 11 at landing area 3 are positioned such that the extended arms are facing outwards away from each other in an "open" position. The escalator 100 is travelling in the upward direction from landing area 1 towards landing area 3.

[0045] In fig. 3a, a passenger 5 is travelling upwards on the moving steps 2 of the escalator 100 towards landing area 3. A prohibited passenger 6 is prevented from accessing landing area 1 due to the barriers 12 being in the closed position. In fig. 3b, the travelling direction of the escalator 100 has changed and it now travels downwards from landing area 3 towards landing area 1. The change of direction is initiated via the control unit 101. This information is transmitted via transmission means D from the control unit 101 to the control center 13, which processes it and responds accordingly by sending instructions to each pair of posts 11 at landing area 1 and landing area 3 to change the position of their respective barriers accordingly. The barriers 12 at the landing area 1 change from the closed position to an open position via a rotation about P, whilst the barriers 12 at landing area 3 change from the open position to a closed position via a rotation about P. This positional change of the barriers 12 is simultaneous with the change of the direction of the moving steps 2 of the escalator 100, thereby avoiding any time lag associated with repositioning removable barriers as is currently known in the art as well as preventing the prohibited passenger 6 from entering the landing area 3 when the escalator may still be moving in the previous opposite direction. The passenger 5 is able to proceed through the closed barriers 12 at landing area 3 and safely travel towards landing area 1 and exit through the now open barriers 12.

[0046] Figs. 4a and 4b show the same two configurations of the same escalator 100 as shown in figs. 3a and 3b comprising a gate system 10 according to the invention. The gate system 10 is a gate system according to a second

embodiment of the invention. This gate system 10 is the same as the gate system described in the first embodiment with the exception that

- the barrier 12 is in the form of a vertically extending arm which is connected to the post 11 via the rotating element 111
- wherein the rotating element 111 laterally extends from the body of the post 11 and is located at the bottom thereof, i.e., at ground level.

[0047] The rotating element 111 is preferably positioned above ground level in order to avoid detrimental frictional forces between the rotating element 111 and the ground and other obstructions to rotation. The rotating element 111 is preferably positioned at a distance of 0.1 mm to 15 mm above ground level, preferably at a distance of 0.5 mm to 5 mm above ground level. The barriers 12 when in the "open" position at landing area 3 (fig. 4a) and landing area 1 (fig. 4b) remain in line with, and serve as a continuance of, the access barriers 4. They can even serve as access barriers 4 in situations when no access barriers are already present. The barriers 12 when in the "closed" position at landing area 1 (fig. 4a) and landing area 3 (fig. 4b) are rotated inwards towards each other about the pivot P, i.e., the respective post 11 such that the distance between them is sufficient to prevent a prohibited passenger 6 from entering (shown more clearly in fig. 4c).

[0048] The length of the rotating element 111 is adjustable such that the distance between a pair of barriers 12 can be adjusted in order to accommodate a variety of width restrictions relating passengers allowed to pass through to a landing area 1, 3 and travel on the escalator 100. The minimum length that the rotating element 111 can have however is always sufficient to prevent a prohibited passenger 6 from passing between the post 11 and the barrier 12.

[0049] Fig. 4c shows a more detailed view of the rotation process performed with the gate system 10 presented in figs. 4a and 4b. Fig. 4c is an overhead view (not to scale) of the section marked X in fig. 4b. The escalator 100 further comprises a handrail 102 comprised within a balustrade 103. When the escalator 100 is moving in the direction of arrow A, the landing area corresponds to landing area 3 as shown in fig. 4a. When the escalator 100 is moving in the direction of arrow B, the landing area corresponds to landing area 1 as shown in fig. 4b. The post 11 comprising the rotating element 111 and the vertical barrier 12 thereon is located at the opposite side of the access barrier 4. When in the open position O, the barrier 12 is aligned parallel with the direction of the handrail 102. To arrive in the closed position C, each barrier 12 is rotated inwards 90 degrees about the pivot P, i.e., their respective post 11, and is aligned perpendicular to the handrail 102. Rotation occurs upon a change in the direction of travel of the escalator 100, wherein said change is controlled by the control unit 101 (not shown). This information is transmitted to the control center 13 via the transmission means D (not shown) and the control center 13 instructs the rotating element 111 via transmission means C (not shown) to rotate the required number of degrees, i.e., 90 in order to position the barrier 12 accordingly. The barrier 12 in this particular embodiment can rotate up to 180 degrees. For example, if the starting direction of travel of the escalator 100 follows arrow A, the gate system 10 will be in the open position O. Once the direction of travel changes to follow arrow B, the control center 13 will cause each rotating element 111 to rotate 90 degrees inwards until the closed position C has been reached. The same process, albeit in the opposite direction, will be applied simultaneously to the pair of posts 11 at the landing area on the opposite side of the escalator 100. A rotation of 90 degrees clockwise from the closed position C of the barrier 12 on the left-hand side and a rotation of 90 degrees anti-clockwise from the closed position C of the barrier 12 on the righthand side, which is equivalent to a rotation of 180 degrees from the open position, provides the possibility of creating a lateral access barrier, similar to the access barrier 4, if this is so desired. Such a barrier can be used as a continuation of an already existing access barrier 4, or as an added/new safety feature in an existing escalator installation.

[0050] Figs. 5a and 5b show the same two configurations of the same escalator 100 as shown in figs. 3a, 3b, 4a and 4b comprising a gate system 10 according to the invention. The gate system 10 is a gate system according to a third embodiment of the invention. This gate system 10 operates in the same manner as the gate system described in the first and second embodiments with the exception that

- instead of a pair of posts 11 at each landing area 1, 3, a single post 11 is used, wherein the single post is in the form of a ramp which extends horizontally across a width enclosed by the access barriers 4;
- the barrier 12 is comprised in the ramp 11, wherein said barrier 12 comprises an external surface 12x and an elevated surface 12e;
- the rotating element 111 is comprised in the ramp 11 and rotates the barrier 12 vertically upwards and/or downwards;
- when the gate system 10 is in the open position: the barrier 12 is rotated such that only the external surface 12x is exposed, said external surface 12x being aligned with the external surface of the ramp 11 so that a passenger 5 can traverse the external surface 12x as they enter/exit the landing area 1, 3 via the access barriers 4;
- when the gate system 10 is in the closed position: the barrier 12 is rotated such that it protrudes vertically from the ramp 11 and both the external surface 12x and the elevated surface 12e are exposed. The elevated surface 12e is capable of being traversed by a passenger 5, but not a prohibited passenger 6.

[0051] Fig. 5a shows a gate system 10 wherein the ramp 11 at landing area 1 is in the open position and the ramp 11 at landing area 3 is in the closed position. The gate system 10 according to this particular embodiment is explained in further detail in figs. 5c and 5d.

[0052] Fig. 5c shows a close up view of fig. 5a, in particular it shows the prohibited passenger 6 as they approach the access barriers 4 leading to the landing area 1 and the escalator 100 (not shown). The trolley belonging to the prohibited passenger 6 is prevented from passing through the access barriers 4 due to the closed position of the gate system 10. The barrier 12 has been rotated via the rotating element 111 (not shown) about pivot P such that it protrudes from the surface of the ramp 11 and exposes the elevated surface 12e to prevent the prohibited passenger 6 from travelling any further. The elevated surface 12e extends across the whole length of the barrier 12 and comprises a visual indicator 121. In the example shown in fig. 5c, a plurality of visual indicators 121 are present on the elevated surface 12e. These visual indicators 121 e.g., a plurality of LEDs, communicate to the prohibited passenger 6 that they are not permitted to travel any further. The same situation applies to the prohibited passenger 6 at the landing area 3 of fig. 5b.

[0053] A cross-sectional representation about lines a-a shows the configuration of the barrier 12 and the visual indicators 121 with respect to the ramp 11 and the ground level when the gate system 10, in particular the barrier 12 is in the closed position. The external surface of the ramp 11 is parallel to ground level and lies at an angle of θ_3 above ground level. The external surface of the ramp 11 comprises the external surface 12x of the barrier 12. The barrier 12, in particular the external surface 12x lies at an angle of θ_2 above ground level and at an angle of θ_1 above the external surface of the ramp.

[0054] Fig. 5d shows a close up view of fig. 5b, in particular it shows the passenger 5 as they travel on the escalator 100 from landing area 3 and exit the escalator 100 via landing area 1. In fig 5b, the travelling direction of the escalator 100 has been changed from the travelling direction shown in fig. 5a. The control center 13 has instructed the gate system 10, in particular the ramp 11 at landing area 1 and the ramp 11 at landing area 3 to change the position of their respective barriers 12. The barrier 12 at landing area 1 has now changed from the closed position (fig. 5a) to an open position (fig. 5b), and the barrier 12 at landing area 3 has now changed from the open position (fig. 5a) to a closed position (fig. 5b).

[0055] In fig. 5d, the passenger 5 has traversed the landing area 1 and made their way through the access barriers 4 to arrive at the gate system 10. This gate system 10 is now in the open position after a downwards rotation of the barrier 12 about the pivot P. The elevated surface 12e has receded into the ramp 11 to expose only the external surface 12x. The passenger 5 is able to walk without problem over the ramp 11 and continue on their journey. The same situation applies to the passenger 5 at the landing area 3 of fig. 5a.

[0056] A cross-sectional representation about lines b-b shows the configuration of the barrier 12 and the visual indicators 121 with respect to the ramp 11 and the ground level when the gate system 10, in particular the barrier 12 is in the open position. The external surface of the ramp 11 is parallel to ground level and lies at an angle of θ_3 above ground level. The external surface of the ramp 11 comprises the external surface 12x of the barrier 12 such that the two surfaces form a continuous external surface.

[0057] Fig. 6a to 6d show a logic system. A gate system 10 according to any embodiment of the invention operates via this logic system. The logic system shown in figs. 6a and 6b is an electronic-based logic system. The logic system shown in figs. 6c and 6d is a mechanical-based logic system. Each type of logic system will be explained separately.

[0058] The gate system 10 shown in each example of fig. 6a to 6d comprises a control center 13 and a post 11, which itself comprises a rotating element 111. Only one post 11 having one rotating element 111 is shown, however, when the gate system 10 comprises a pair of posts 11 at each end of the passenger moving system (as shown in figs. 3a to 5b), the logic system described applies to each post 11 comprised within the gate system 10. The rotating element 111 comprises a barrier 12 and an activator 140. The activator 140 is positioned in line with the barrier 12 on the rotating element 111. A first trigger 141 and a second trigger 142 are comprised within the housing of the post 11 such that each trigger 141, 142 is able to communicate with the activator 140. Two triggers 141, 142 are used in order to have a better communication signal. The activator 140 activates either the first trigger 141 or the second trigger 142 when it aligns with said first or second trigger 141, 142 via a rotation of the rotating element 111. In the examples below, alignment of the activator 140 and trigger 141, 142 occurs in the vertical plane. The rotating element 111 is rotated by a motor 131 (not shown) comprised within the control center 13 wherein rotation occurs upon instructions received by the control center 13 from the control unit 101 of the passenger moving system 100.

[0059] When the barrier 12 and thus activator 140 is aligned with the first trigger 141, or second trigger 142, said trigger 141, 142 is activated, and has the logic state 1. When the barrier 12 and thus activator 140 is not aligned with the first trigger 141, or second trigger 142, said trigger 141, 142 is not activated and has the logic state 0.

[0060] Table 1 below shows the relationship between the logic states and the corresponding barrier position:

Table 1

First trigger 141	Second trigger 142	Logic state configuration	Barrier status
1	0	(1, 0)	Barrier open
0	0	(0, 0)	Barrier error
1	1	(1, 1)	Barrier error
0	1	(0, 1)	Barrier closed
1 = activated, 0 = non-activated			

[0061] Looking at the electronic based logic system shown in figs. 6a and 6b, the activator 140 is a metal piece in the form of a sheet. The first trigger 141 and second trigger 142 are both magnetic sensors. Any material other than a metal could also be used as the activator 140 provided the corresponding trigger 141, 142 is adapted to be activated by said material. In fig. 6a, the barrier 12 is rotated such that the piece 140 is aligned with and activates the first sensor 141 thus giving it the state 1. When in this configuration, the barrier 12 is not aligned with the second sensor 142. Thus sensor 142 is not activated and has the state 0. This logic state configuration (1, 0) represents the barrier 12 in the "open" position.

[0062] In fig. 6b, an instruction has been received at the control center 13 to change the position of the barrier 12 from open to closed due to a change in travelling direction. Such an instruction requires a change in logic state of the sensor 141 from activated to non-activated and a change in the logic state of the sensor 142 from non-activated to activated. The rotating element 111 rotates the barrier 12 such that the activator 140 is now facing the second sensor 142. The second sensor 142 is activated and has the state 1. The barrier 12 is no longer aligned with the first sensor 141, thus it is no longer activated and has the state 0. This logic state configuration (0, 1) represents the barrier 12 in the "closed" position.

[0063] Looking at figs. 6c and 6d, the logic system used is mechanical based instead of electronic based, e.g., using sensors. The activator 140 is in the form of an indent comprised within the outer surface of the rotating element 111. It may also be comprised within the post 11. The first trigger 141 and the second trigger 142 are each a mechanical switch. The first mechanical switch 141 comprises a first rolling element 1411, and the second mechanical switch 142 comprises a second rolling element 1421. Each rolling element 1411, 1421 is adapted to contact the outer surface of the rotating element 111. Each rolling element 1411, 1421 is under pressure when it contacts the outer surface of the rotating element 111. When the first rolling element 1411, or the second rolling element 1421 contacts the indent 140, the pressure is released and the logic state configuration of the corresponding mechanical switch 141, 142 is altered.

[0064] In fig. 6c, the barrier 12 is rotated such that the indent 140 aligns with the first rolling element 1411 of the first mechanical switch 141. The first rolling element 1411 is released via the indent 140 thus activating the first mechanical switch 141 giving it the state 1. When in this configuration, the barrier 12 and consequently indent 140 is not aligned with the second mechanical switch 142. The second rolling element 1421 rests under pressure upon the outer surface of the rotating element 111 and the second mechanical switch 142 is not activated, thus it has the state 0. This logic state (1, 0) configuration represents the barrier in the "open" position.

[0065] In fig. 6d, an instruction has been received at the control center 13 to change the position of the barrier 12 from open to closed due to a change in travelling direction. Such an instruction requires the logic state of the first mechanical switch 141 to change from 1 to 0, i.e., from activated to non-activated; and a change in the logic state of the second mechanical switch 142 from 0 to 1, i.e., from non-activated to activated. The rotating element 111 rotates the barrier 12 and the indent 140 aligns with the rolling element 1421 of the second mechanical switch 142. The rolling element 1421 is released thus activating the second mechanical switch and giving it the logic state of 1. The barrier 12 and consequently the indent 140 is no longer aligned with the first mechanical switch 141 and it deactivates. The first rolling element 1411 rests under pressure upon the outer surface of the rotating element 111 and the first mechanical switch has the logic state of 0. This logic state configuration (0, 1) represents the barrier in the "closed" position.

[0066] It will be appreciated that whilst the examples described in figs. 3a, 3b, 4a and 4b relate to a pair of posts positioned at each end of a passenger moving system, the inventive gate system can also comprise a single post at each end.

[0067] It should furthermore be understood that aspects of any embodiment described hereinabove may be combined with aspects of another embodiment whilst still falling within the scope of the present disclosure. Accordingly, the foregoing description is intended to be illustrative rather than restrictive.

Reference signs list**[0068]**

- 5 01 removable gate system of prior art
- 1 first landing area
2 moving pallets or moving steps
3 second landing area
10 4 access barrier
5 passenger
6 prohibited passenger
- 10 gate system
15 11 post
111 rotating element
- 12 barrier
20 12e elevated surface
12x external surface
121 visual indicator
- 13 control center/interface device
25 131 motor
- 140 activator
141 first trigger
142 second trigger
30 1411 first rolling element
1421 second rolling element
- 100 passenger moving system
101 control unit
35 102 handrail
103 balustrade
- A direction of exit
B direction of entrance
40 C, D, E information transmission means
P pivot
X overhead sectional representation
- 01 angle between ramp and barrier in the open position
45 02 angle between ground and barrier in the open position
02 angle between ground and outer surface of ramp/barrier in the closed position

Claims

- 50 1. A gate system (10) adapted to control passenger access to a passenger moving system (100) said moving system having a reversible travelling direction, wherein the gate system (10) comprises:
- 55 - at least one first post (11) positioned at a first landing area (1) of the passenger moving system (100) wherein said first post (11) comprises a rotating element (111) and a barrier (12);
- at least one second post (11) positioned at a second landing area (3) of the passenger moving system (100) wherein said second post (11) comprises a rotating element (111) and a barrier (12);

wherein

- the barrier (12) of the at least one first post (11) and the barrier (12) of the at least one second post (11) are each configured to be in
- a first position; or
- a second position,

wherein each barrier (12) is adapted to alternate between the first and second position according to the travelling direction of the passenger moving system.

2. The gate system (10) according to claim 1 **characterized in that** the barrier (12) at the first landing area (1) has a different position to the barrier (12) at the second landing area (3).

3. The gate system (10) according to any of the preceding claims, **characterized in that**

- each post (11) comprises a first trigger (141) and a second trigger (142);
- each rotating element (111) comprises an activator (140) for activating the first trigger (141) or the second trigger (142).

4. The gate system (10) according to any of the preceding claims, **characterized in that** the barrier (12) is adapted to be

- in the first position when the first trigger (141) is activated;;
- in the second position when the second trigger (142) is activated.

5. The gate system (10) according to any of the preceding claims, **characterized in, that** the barrier (12) is one selected from the group comprising:

- a horizontal barrier;
- a vertical barrier;

wherein the horizontal barrier is positioned

- above ground level; or
- at ground level.

6. The gate system (10) according to any of the preceding claims **characterized in that** a control unit (101) comprised within the passenger moving system (100) is adapted to communicate with the rotating element (111) of each post (11).

7. The gate system (10) according to any of the preceding claims **characterized in that** the rotating element (111) is adapted to rotate upon a change in travelling direction of the passenger moving system (100).

8. The gate system (10) according to any of the preceding claims **characterized in that** the barrier (12) is an elevated horizontal barrier wherein said barrier (12) is adapted to be rotated horizontally about a pivot (P) via the rotating element (111), wherein the pivot (P) is the post (11).

9. The gate system (10) according to any of claims 1 to 7 **characterized in that** the barrier (12) is a vertical barrier positioned parallel to the post (11), wherein said barrier (12) is adapted to be rotated horizontally about a pivot (P) via the rotating element (111), wherein the pivot (P) is the post (11).

10. The gate system (10) according to any of claims 1 to 7 **characterized in that** the barrier (12) is a horizontal barrier positioned at ground level wherein said barrier (12) is adapted to be rotated vertically about a pivot (P) via the rotating element (111), wherein the pivot (P) is comprised within the post (11).

11. The gate system according to claim 10 **characterized in that** the barrier (12) comprises an external surface (12x) and an elevated surface (12e) wherein the elevated surface is adapted to be:

- exposed upon a vertical upwards rotation of the barrier (12); or

- hidden upon a vertical downwards rotation of the barrier (12).

12. The gate system according to claim 11 **characterized in that** the elevated surface (12e) comprises at least one visual indicator (121).

13. A passenger moving system (100) comprising a gate system (10) according to any of the preceding claims.

14. A method of controlling passenger access to a passenger moving system (100) wherein the passenger moving system (100) has a reversible travelling direction, the method comprising the steps of:

- installing a gate system (10) according to any of the claims 1 to 12 on the passenger moving system (100), wherein the gate system (10) is installed between a first landing area (1) and a second landing area (1) of the passenger moving system (100);

- connecting the gate system (10) with the passenger moving system (100) such that any change in travelling direction of the passenger moving system (100) changes the position of the gate system (10).

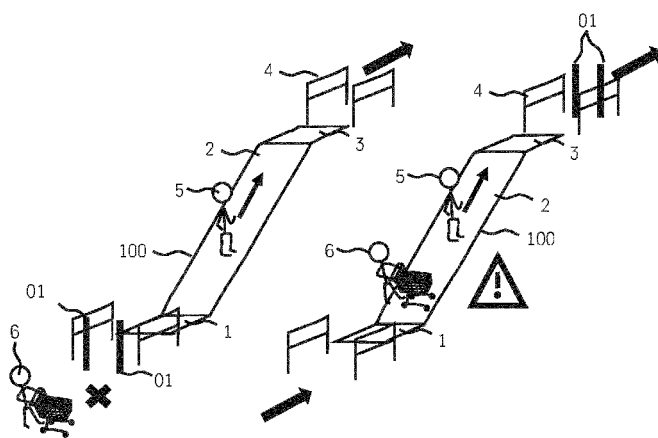


Fig. 1a

Fig. 1b

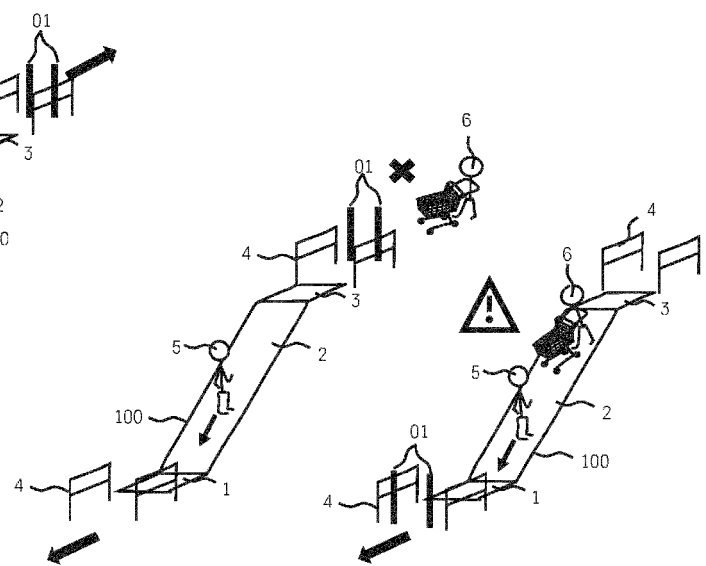
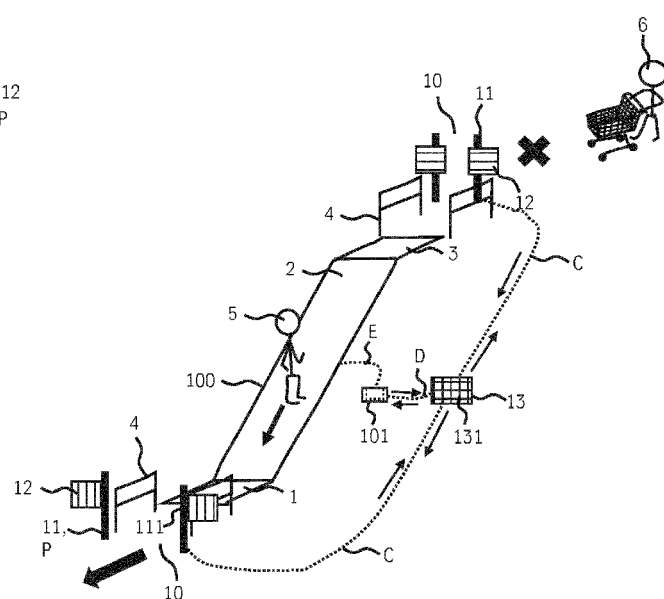
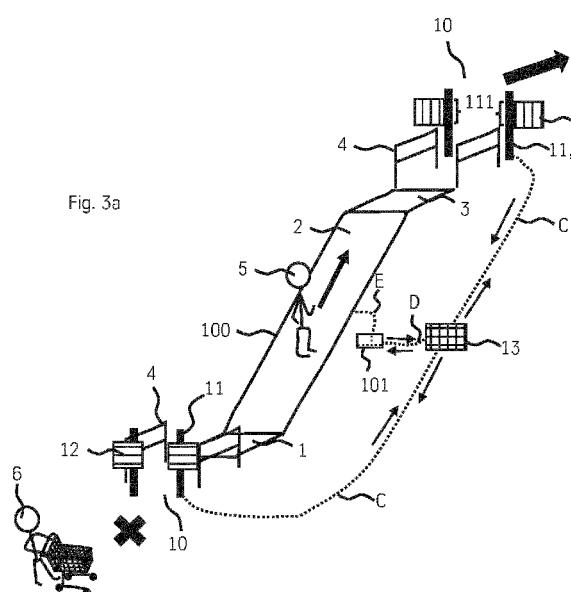
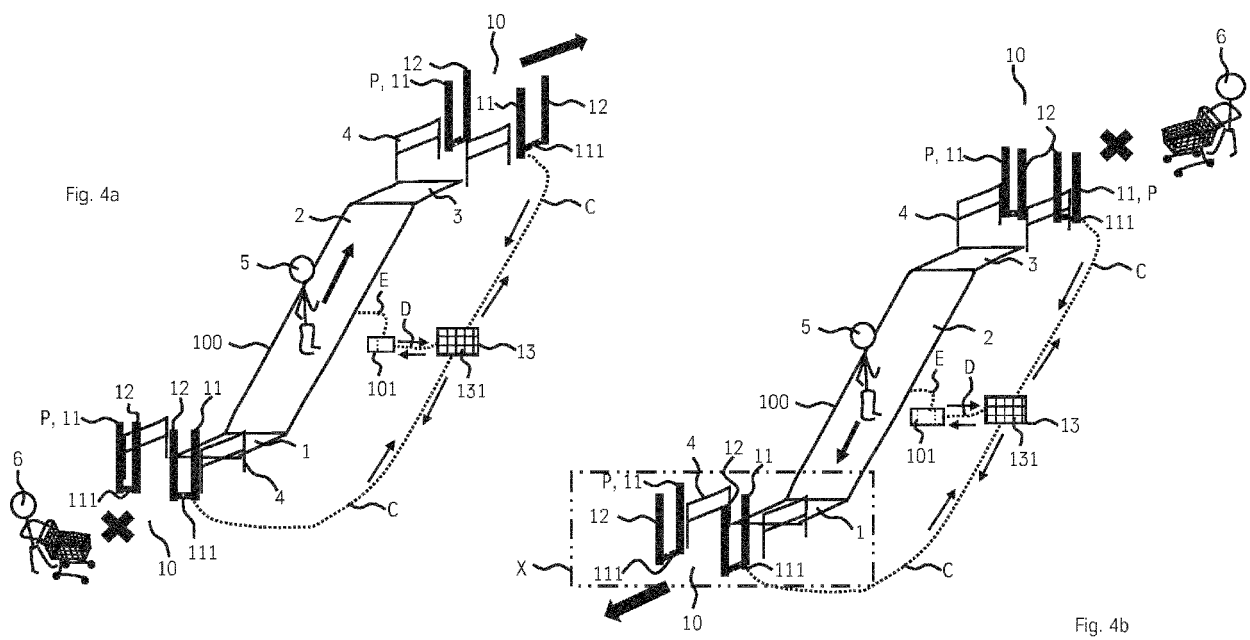


Fig. 2a

Fig. 2b





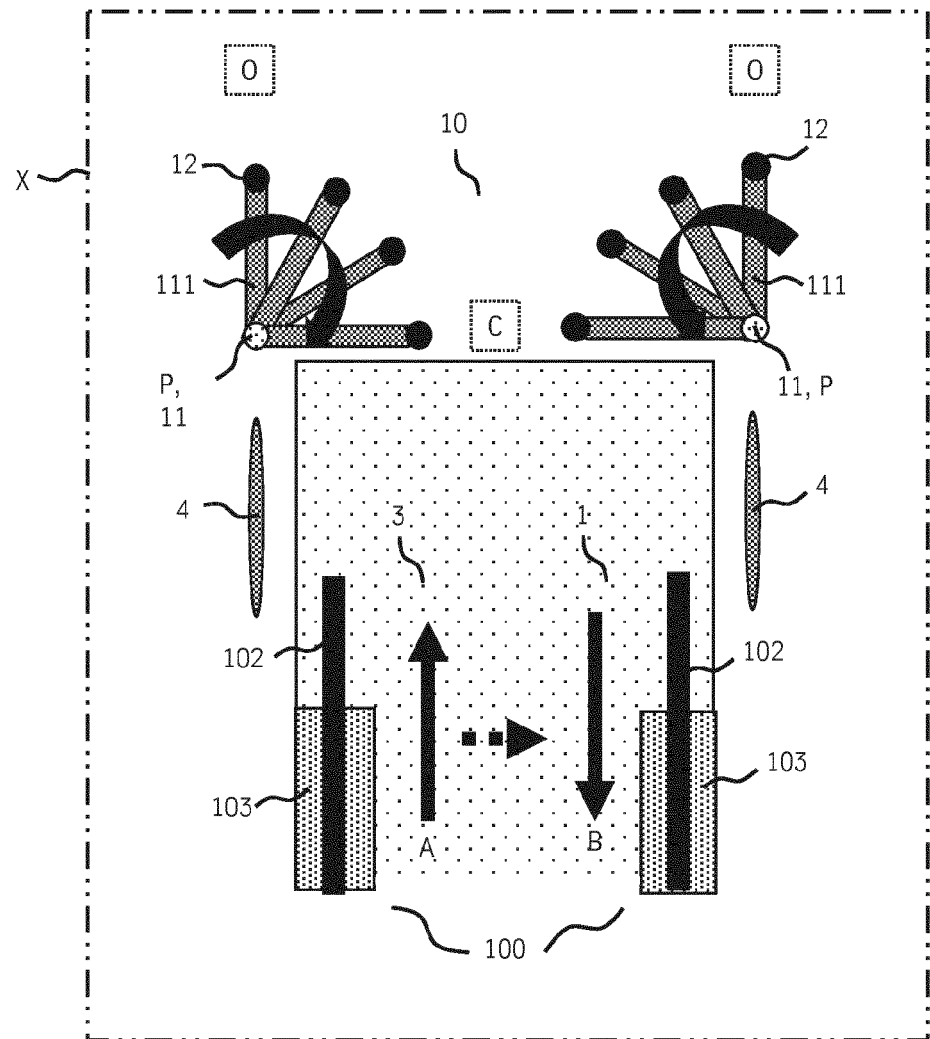
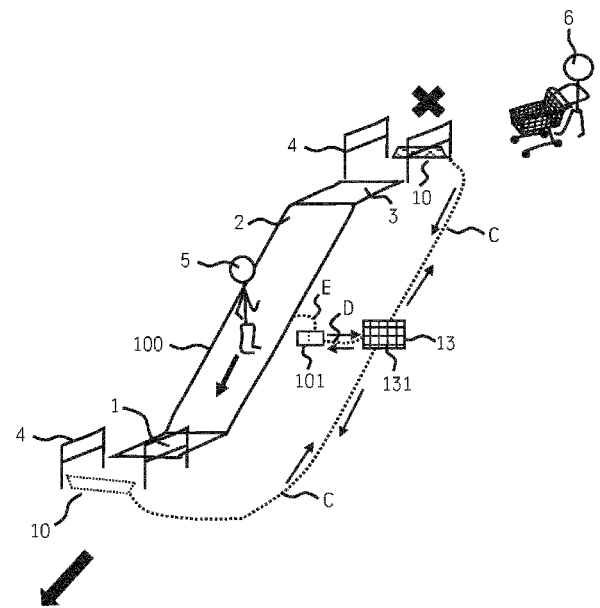
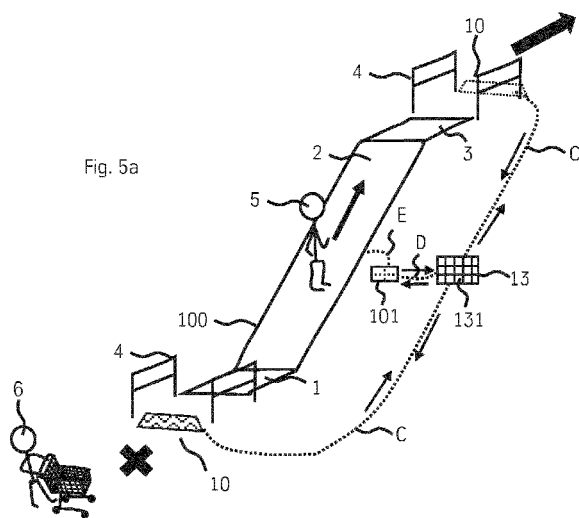


Fig. 4c



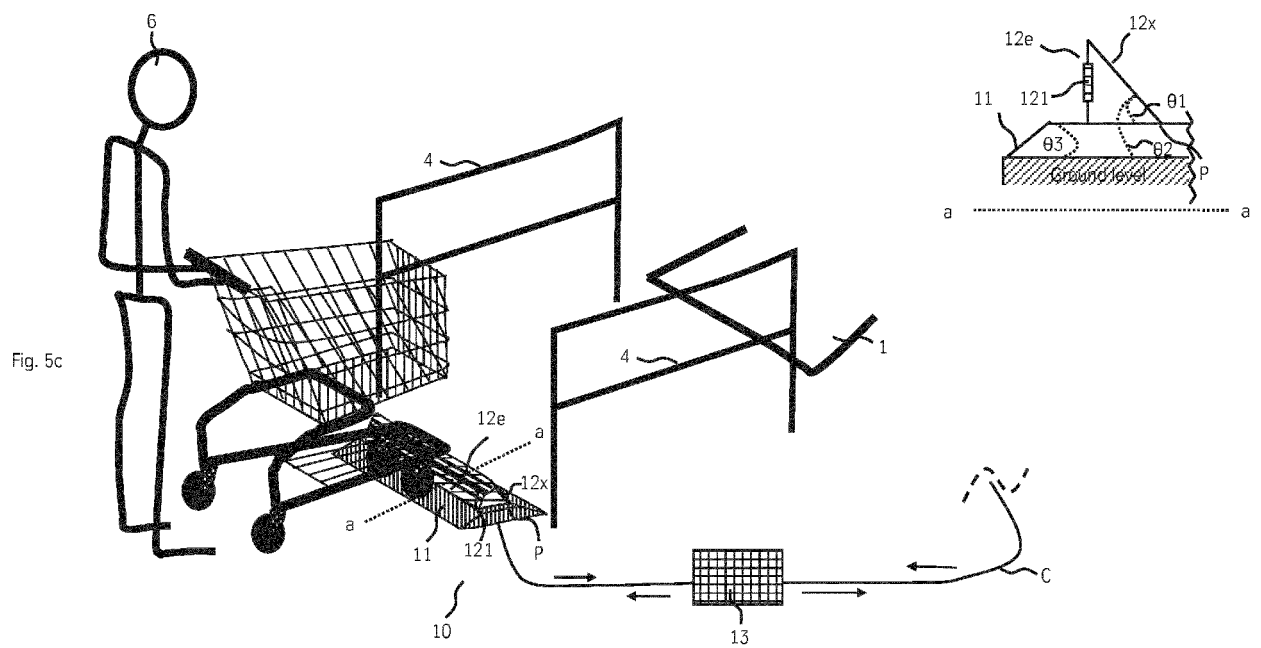
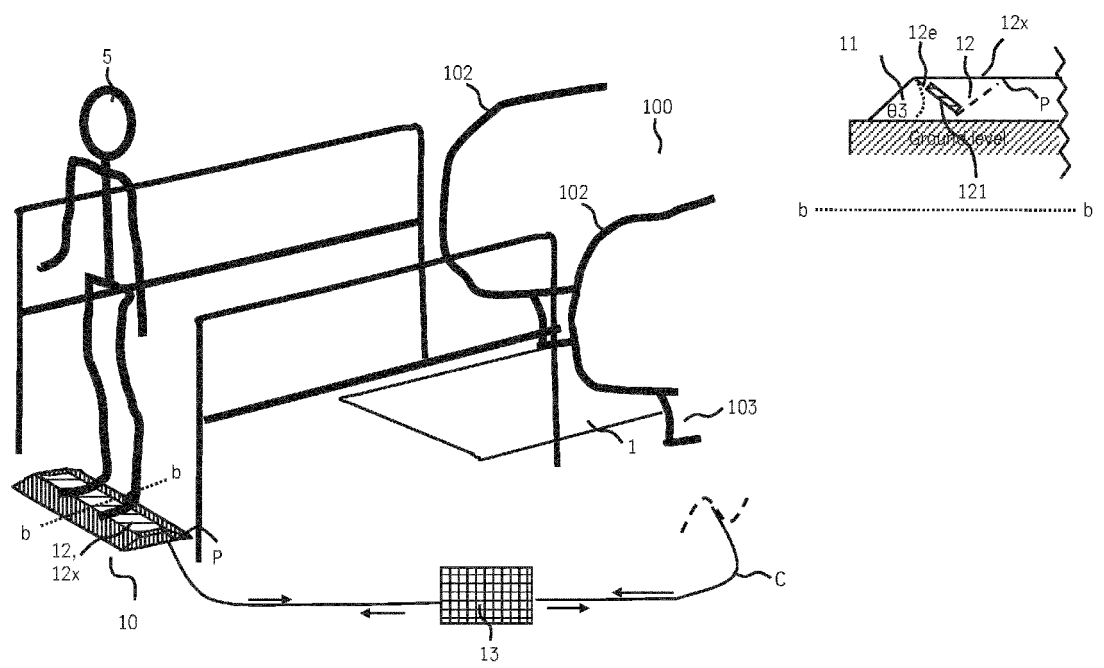


Fig. 5d



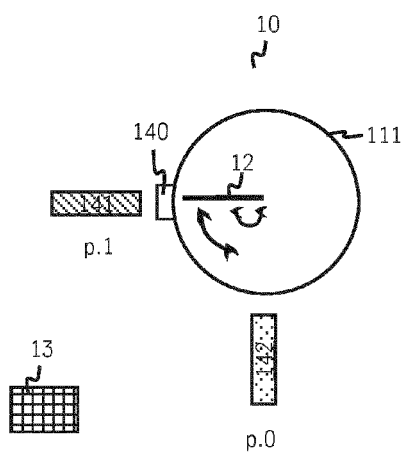


Fig. 6a

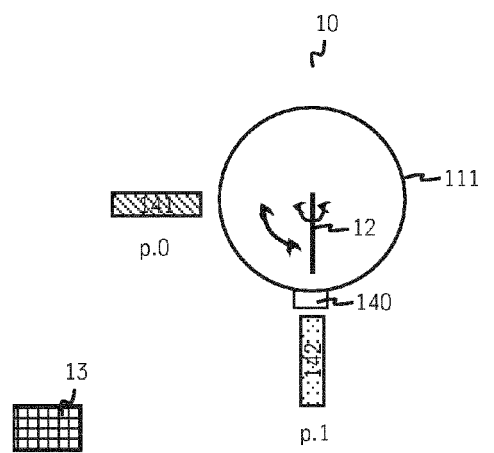


Fig. 6b

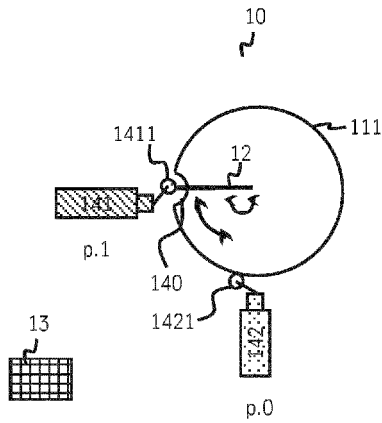


Fig. 6c

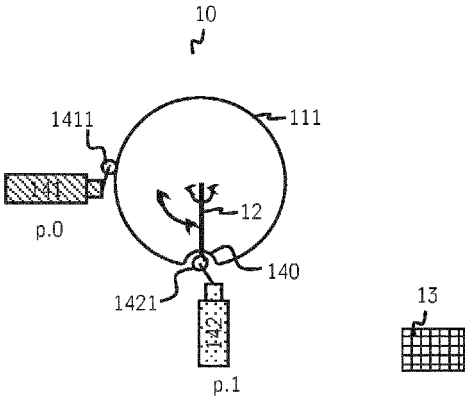


Fig. 6d



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			B66B E06B
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 18 February 2020	Examiner Dogantan, Umut H.
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