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(54) **APPARATUS FOR REDUCING GAPS BETWEEN A PLATFORM AND A GUIDED VEHICLE**

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(57) **ABSTRACT**

An apparatus for reducing the gap between a platform and a guided vehicle has a horizontal row of parallel blades whose roots are rigidly fixed to the platform, having a resilient bending stiffness in a vertical direction which is greater than a bending stiffness in an horizontal direction parallel to the row. Each blade is of elastomer material containing one or more inserts for presenting lower resistance to bending in the horizontal direction than in the vertical direction. In a modified embodiment the apparatus has a mechanical actuator having a rest state and an active state. The actuator is coupled to the blades in such a manner that the blades are curved in one of the active state and rest state and project from the platform through a distance that is smaller than when the actuator is in the other of the active state and rest state.

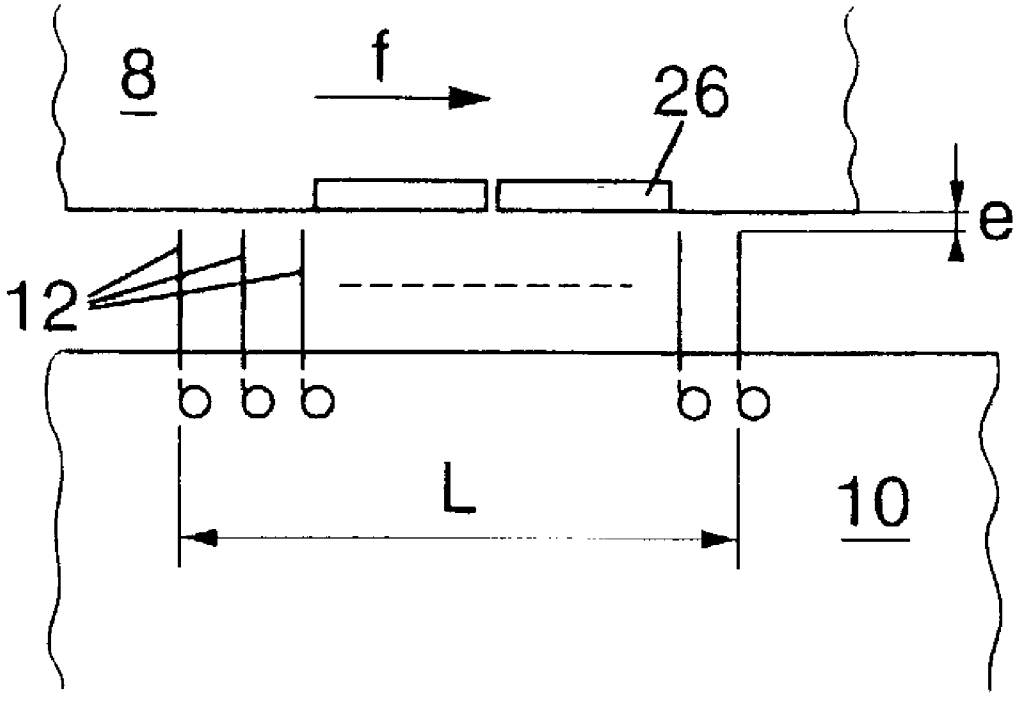


FIG. 1B

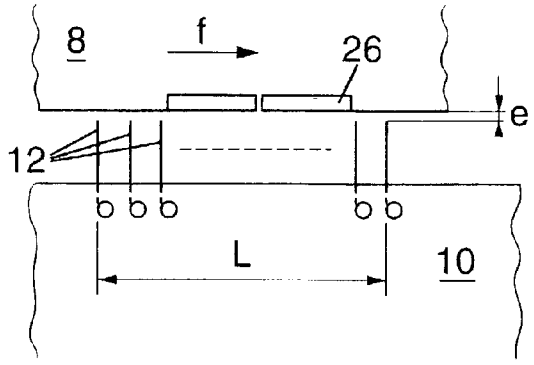


FIG. 1A

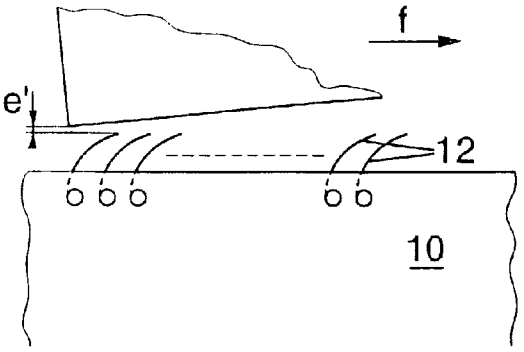


FIG. 2B

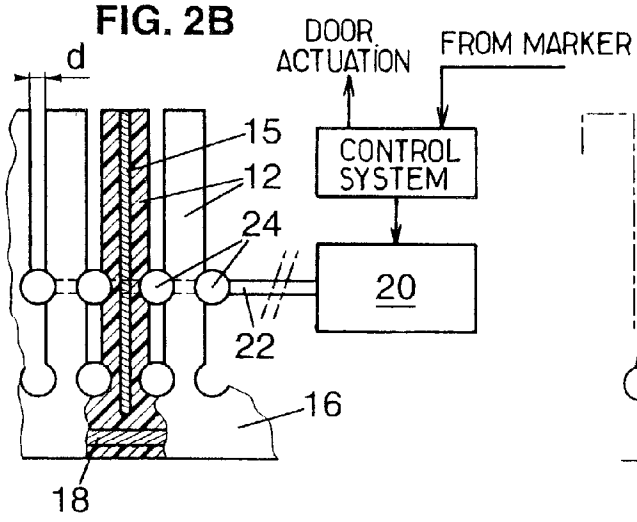
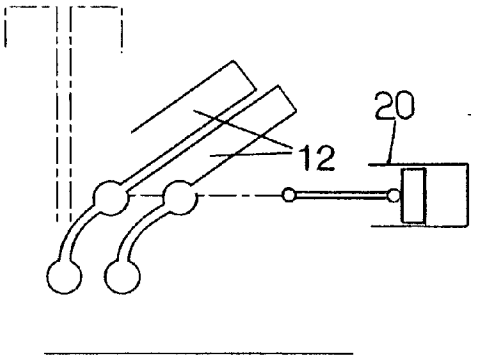


FIG. 2A



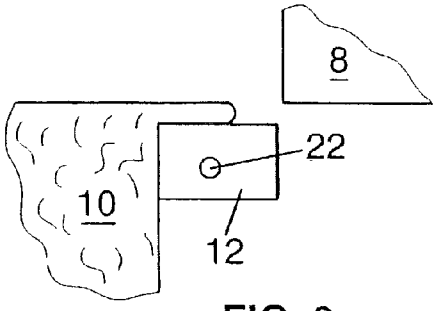


FIG. 3

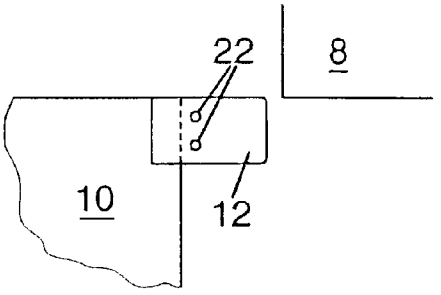


FIG. 4

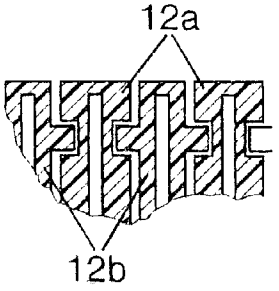


FIG. 5

APPARATUS FOR REDUCING GAPS BETWEEN A PLATFORM AND A GUIDED VEHICLE

BACKGROUND OF THE INVENTION

[0001] The invention relates to the field of passenger transportation by vehicles on wheels with or without tires, guided along a track.

[0002] Such vehicles and the track are typically so arranged that passengers board and leave the vehicle at stations having platforms level with the vehicle floor. A gap then exists between the vehicle and the platform. It is quite narrow when the track is rectilinear and receives vehicles all of which have a same size.

[0003] On the other hand, the horizontal gap may be significant and detrimental to safety of passengers if the station is curved, since an offset of the platform edge is necessary for enabling movement of the vehicle along the track or if a vehicle of reduced size stop or still when the track has a transversal slope.

[0004] Attempts have already been made for closing or decreasing the size of such gaps. U.S. Pat. No. 1,216,560 describes a guard platform comprising several bars slidable on the station platform and a frame bearing against the vehicle when the guard platform is extended. Such an arrangement is extremely bulky and expensive. It has also been proposed (U.S. Pat. No. 5,845,580) to provide a gap filling apparatus having a plurality of flexible sheet-like members whose roots are secured to the platform edge and whose free ends are arranged for contact with the vehicle. A very large number of narrow sheet like members is necessary. While that arrangement is acceptable when used for filling a variable gap between a road vehicle which unfrequently stops at a distance from the platform edge, it results in fast wear and tear when the members are forcibly bent by a train vehicle each time a train passes the station.

SUMMARY OF THE INVENTION

[0005] An object of the invention is to provide an apparatus for filling or bridging a gap between a platform and a guided vehicle for preventing injury to passengers which is adaptable to specific conditions and particularly to the different types of vehicles and transportation systems.

[0006] A more specific object of the invention is to provide a device for use in transportation systems with automated control of the movement of the vehicle along the path and for opening of the doors of the vehicle (and frequently of station platforms also). Such a system may easily be implemented for causing forced movement of the device from a stand-by condition in which no component of the device is in contact with a travelling vehicle to a position where the elements contact the vehicle after it has stopped and typically just before the access doors for passengers open.

[0007] According to a first aspect of the invention, there is provided a device for filling a gap between an edge and a station platform and a vehicle movable along a track when said vehicle is positioned adjacent to the platform edge, said device comprising and horizontal row of a plurality of mutually parallel members each having a root which is rigidly secured to said station platform, each having a resistance to flexure in the vertical direction which is higher than a resilient resistance against flexure in the horizontal direction, said members being apt to be resiliently bent by said vehicle as said vehicle moves in a direction of travel along said station and to resiliently return to a position having a greater amount of projection from the platform for reducing or filling the gap by contacting the vehicle, each of said members being constituted of elastomer material containing at least one insert having a resistance to flexure which is lower in a horizontal direction than in a vertical direction.

[0008] The bending stiffness in the vertical direction is typically greater than the bending stiffness in the transverse direction, i.e. the horizontal direction, by at least one order of magnitude. The stiffness in the vertical direction is selected in such a manner as to ensure that there is no perceptible bending under the weight of passengers while they are embarking or disembarking.

[0009] When the mutually parallel members are in the form of blades which are flexed by all vehicles each time they go past, wear takes place quite quickly. That arrangement will generally be adopted only when vehicles come very close to the platform infrequently (as can happen with vehicles on pneumatic tires that are guided somewhat approximately). In another embodiment that is advantageous for transportation systems on railway lines, an actuator is provided having a rest state and an active state, the actuator being coupled to the blades so as to curve the blades when it is in one of said states. The blades then project a shorter distance from the platform than when the actuator is in the other state. In general, the actuator and blades are designed so that the blades are in folded or curved condition when the actuator is not active. On being activated, the actuator moves the blades to a projecting position in which they are substantially straight, while on being deactivated, the actuator allows the elasticity of the blades to return them to the folded or curved condition.

[0010] At least in the absence of an actuator, the blades are made of elastomer material and each contains one or more inserts, e.g. metal inserts, presenting lower resistance to bending in the horizontal direction than in the vertical direction. The inserts may be constituted in particular by plates that are thin in the horizontal direction, and made out of a material presenting good flexibility, such as spring steel. They may be installed as a row of vertical rods. They may also be constituted by a sheet of metal wires in a disposition comparable to that used for conveyor belts. The blades may all be identical or not.

[0011] An ancillary object of the invention is to provide a gap filling device having a reduced number of flexible members and apt to be constructed in such a way that a spacing between mutually adjacent members, when in contact with the vehicle, is sufficiently narrow for limiting jamming of shoe heels. For that, in a specific embodiment, two different types of blade alternate. Every other blade has horizontal teeth penetrating into grooves in the other blades. This reduces the risk of stiletto heels, for example, penetrating deeply in the vertical direction between the blades. Alternatively, the blades may all be identical, each having a tooth on one side and a slot on the other.

[0012] The actuator may be implemented in a very wide variety of ways. In a preferred embodiment, it comprises one or more traction rods or cables disposed in the row direction,

mechanically coupled to the blades at respective intermediate points between their roots and their tips, and connected to a drive member that can be actuated to bend the blades or to straighten them out. The or each rod or cable may be coupled to the blades via vertical swellings located between the blades. In general, a pull rod or cable is coupled to the blades at a distance from the blade root such that when the blades are in the flexed or curved state, they project beyond the platform by no more than the length that leaves the minimum gap required to allow a vehicle to pass. In practice, the pull rod or cable is generally coupled to the blades at a distance from their roots lying in the range one-fourth to one-third of the length of the blade in the deployed state. The blades are so spaced and shaped that the gaps between them when they are in the deployed state are just wide enough to allow flexing of the blades which brings the blades towards one another.

[0013] Typically, a plurality of blades are connected to a common base member so as to constitute a one-piece unit suitable for fixing to a platform. The base member is then made out of the same elastomer material as the blades and is reinforced by a core made of metal or the like.

[0014] When the apparatus is for use with one-way track, the blades and optionally the actuator are typically designed so that the blades curve in the vehicle travel direction.

[0015] The above features and others will appear more clearly on reading the following description of particular embodiments of the invention, given as non-limiting examples. The description refers to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] **FIGS. 1A and 1B** are diagrams for showing the shape taken by the blades of apparatus, respectively when in the flexed state and when deployed;

[0017] **FIGS. 2A and 2B** show a fraction of a possible embodiment of a one-piece unit comprising blades together with a base member, shown respectively in the flexed state and in the deployed state;

[0018] **FIGS. 3 and 4** are elevation diagrams showing possible ways in which the apparatus can be mounted to a station platform; and

[0019] **FIG. 5** is a detail view in vertical cross-section showing blades of two different shapes, one presenting teeth and the other presenting tooth-receiving grooves.

DETAILED DESCRIPTION

[0020] Referring to **FIGS. 1A and 1B**, arrow f represents the travel direction of vehicles **8** relative to a platform **10**. The gap-reducing apparatus comprises parallel flexible blades **12** having roots fixed to the platform by means having the characteristics of a fixed-end connection, causing the portions of the blades that are close to the platform to project perpendicularly therefrom. The blades are distributed over a length L that is not less than the width of an access to the vehicle (which can be defined by means of doors on the platform) and of the threshold of the door. In practice, the length L is sufficient to occupy the entire area in which the access to the vehicle is likely to be found when the vehicle has stopped.

[0021] An actuator, shown diagrammatically in **FIG. 2**B, enables the blades to pass from the deployed state in which they are shown in **FIG. 1B** to the flexed state shown in **FIG. 1A**. The dimensions of the blades are such that in the flexed state they leave a determined minimum gap during the closest encounters with the vehicle as it travels past the platform, for example relative to the end portions of the cars in a train as the train goes past, and to maintain a nominal gap e of the same order when they are deployed, i.e. straight, and in register with a door in the middle of a car. The residual gap should be small enough to allow a wheelchair or a push chair to pass over it.

[0022] The blades **12** may have the structure shown in **FIGS. 2A and 2B**. They are made of elastomer material and each of them contains an insert, e.g. made of metal. In the example shown in **FIG. 2**B, the insert is in the form of a thin metal plate **15**. The blades are integral with a base member **16** also made of elastomer material reinforced by a metal core **18**. In the deployed state, the blades are separated by slots of sufficient width d to allow the blades to flex into the state shown in **FIG. 2A**.

[0023] The blades of apparatus that does not include an actuator are generally designed so that they present the straight shape shown in **FIG. 1B** or **2**B while they are at rest. In contrast, in apparatus including an actuator, it is preferable for the opposite configuration to be adopted in order to be able to accommodate a breakdown.

[0024] The actuator comprises a hydraulic or electrical actuator **20** having a moving member that moves linearly. The moving member is coupled to the blades via respective ball joints and one or more cables or rods **22** carrying cross-members **24**, each interposed between two successive blades. Two semi-cylindrical recesses in the flanks of the blades serve to receive the cylindrical cross-members that are capable of turning relative to the blades when they flex. In practice, the blades are generally 2 centimeters (cm) to 6 cm thick.

[0025] The apparatus can be mounted on a platform in various ways. In the example shown in **FIG. 3**, the actuator and the base member are mounted beneath the platform edge coping. In the example shown in **FIG. 4**, the actuator and the base member are mounted in a recess formed in the platform.

[0026] In the variant of **FIG. 5**, alternating blades **12***a* and **12***b* of two complementary shapes serve to reduce the risk of penetration and to reduce the depth of penetration, if any.

[0027] The apparatus of the invention is particularly easy to implement in a transport network where trains and door opening are controlled automatically (train doors and possibly also platform doors). In general, the track of such a transport system is provided with fixed beacons enabling the locations of trains to be identified and also making it possible to determine whether or not they have stopped. Under such circumstances, if the blades are deployed while at rest, the actuator **20** is controlled by the door control system so as to cause the blades to fold back while the train is coming into the station. Once the train has stopped in a passenger-access position, information is delivered by the track beacons, e.g. beacons of the kind described in U.S. Pat. No._____ and the system activates the actuators so as to cause the blades to be deployed. The gap is then reduced to

the distance e shown in **FIG. 1B**. This gap can even be of the same order as the minimum gap e' while trains are passing or as the gap that is provided along platforms that are straight. The doors **26** are caused to open at an instant which is offset relative to the actuators **20** being activated so that the doors do not open until the gap has been substantially filled.

[**0028**] The inverse sequence is implemented prior to train departure, once the doors **26** have been closed.

[**0029**] A variety of embodiments are possible, and in particular the blades may be designed to take up the shape shown in **FIGS. 1B and 2B** while they are at rest. Under such circumstances, the actuator brings them to the position shown in **FIGS. 1A and 2A** when the actuator is powered. Nevertheless, this solution presents the drawback that in the event of the actuator breaking down, then there is a high level of rubbing each time a train goes past which can lead to the blades quickly becoming damaged.

[**0030**] The apparatus can also be used on a tram line or a bus line. Under such circumstances, the actuator **20** can be controlled by a device similar or identical to the devices which operate to give such vehicles priority at traffic lights.

1. Apparatus for reducing a gap between a platform and a guided vehicle, comprising a horizontal row of parallel resilient blades having roots rigidly fixed to the platform, each of said blades being made of elastomer material containing one or more inserts having a resistance to bending in a vertical direction which is greater than a resistance to bending in an horizontal direction parallel to said row.

2. Apparatus according to claim 1, in which the blades have a bending stiffness in the vertical direction greater than a bending stiffness of the blades in a transverse direction by at least one order of magnitude.

3. Apparatus according to claim 1, in which the blades are arranged and located to be forcibly bent by the vehicle while the vehicle is going past the row in proximity to the platform.

4. Apparatus for reducing a gap between a platform and a guided vehicle, comprising:

a horizontal row of parallel resilient blades having roots rigidly fixed to the platform, the blades having a bending stiffness in a vertical direction which is greater than a bending stiffness in a horizontal direction, and

a mechanical actuator having a rest state and an active state, said actuator being coupled to the blades in such a manner that the blades are curved in one of the active state and rest state and project from the platform through a first distance that is smaller than a second distance through which blades project from the platform when the actuator is in the other of the active state and rest state.

5. Apparatus according to claim 4, wherein the actuator is designed to bring the blades into a state in which they are substantially straight and the blades have a resiliency tending to return said blades to a condition in which they are curved.

6. Apparatus according to claim 4, in which the actuator has a drive member for moving from a rest position to an active position in which it straightens out the blades.

7. Apparatus according to claim 4, in which the actuator comprises a drive member coupled to the blades via at least one pulling cable or rod extending in a direction of the row and coupled to the blades at a point intermediate between roots and tips of said blades.

8. Apparatus according to claim 7, in which the inserts are made of plates that are thin in the horizontal direction.

9. Apparatus according to claim 4, in which the blades are integral with a base member of elastomer material reinforced by a core.

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