AUTOMATIC PLATFORM GATE

A moveable platform barrier with a simple arrangement which enables stable standing/running of a moveable door receiving member is provided. The barrier comprises a guide rail 2 provided in a platform floor and extended in a lengthwise direction of the platform 1, a door receiving member 3, and a runner 35, drive means, the door receiving member 3 is configured to be moveable in the lengthwise direction of the platform 1 by the driving means causing the runner 35 to travel along the guide rail 2. The door receiving member 3 has a triangular profile with a platform-side front face 30, a track-side front face 31, a bottom 33, and a top 32.
Technical Field

[0001] The present invention relates to an automated platform gate provided adjacent to an edge of a platform to screen the platform from a track.

Background of the Invention

[0002] In recent years, as safety measures and such at railway stations, installing of a door apparatus or gate apparatus, referred to as a platform door, an automated platform gate and such, is becoming pervasive, and will become more widespread in the future.

[0003] According to the conventional platform door or automated platform gate, a space is formed between an edge of the platform and the platform door in a closed position. It is possible that a passenger who rushes into a car at the last moment gets inadvertently trapped in the space formed between the car with closed doors and the platform door or automated platform gate in the closed position. Risk can normally be eliminated by a detecting sensor or conductor’s a visual check but detecting sensor failure or a bad conductor’s view must be considered.

[0004] In practice, existing installed platform doors and automated platform gates have arrangements depending on door arrangements of rolling stock and therefore cannot deal with a platform at which different types of trains having different distances between adjacent doors stop. However, in practice, there are lines on which various types of trains run on the same line and the number of doors, door width, and door position are different depending on the type, purpose, and model of car. There is a need for the platform door or automated platform gate that can deal with the different types of cars having different door arrangements.

[0005] A number of platform doors or automated platform gates have been proposed to deal with the different types of cars having different door arrangements. The proposed devices can roughly be divided into a type employing a plurality of full height screens as disclosed in patent document 1 and a type employing a lower height door receiving member and a door leaf in which a moveable door receiving member is employed have been proposed (patent documents 3 and 4). To flexibly deal with the different types of cars with different door arrangements, a structure employing the moveable door receiving member would be advantageous.

[0006] According to the full height screen type door as described in patent document 1, the screen having a height from the floor of the platform higher than those of passengers moves in the lengthwise direction of the platform, which leads to a large-scale structure as a whole including a door frame as well as a cost increase. Further, a conductor’s view when passengers getting on off the train may be deteriorated.

[0007] According to the automated platform door having a lower height door receiving member and a door leaf, a structure is more simple in comparison with the full height screen type, and a conductor’s view when passengers getting on off the train can be maintained. Further, automated platform doors having a lower height door receiving member and a door leaf in which a moveable door receiving member is employed have been proposed (patent documents 3 and 4). To flexibly deal with the different types of cars having different door arrangements, a structure employing the moveable door receiving member would be advantageous.

[0008] To implement the platform barrier employing the moveable door receiving member, the problem is how to screen the platform from a track.

Summary of the Invention

[0009] The present invention seeks to provide a moveable platform barrier with a simple arrangement which enables stable standing/running of a moveable door receiving member.

[0010] Another aim of the present invention is to prevent a situation where a passenger gets trapped in a space between the car and the closed moveable platform barrier.

[0011] According to the present invention, there is provided a moveable platform barrier comprising a door receiving member having a platform-side front face, a track-side front face, a bottom, and a top; a door moveably provided in the door receiving member between a position where the door is projected from a side of the door receiving member and a position where the door is retracted into the door receiving member; a guide element provided in a platform floor and extended in a lengthwise direction of a platform; characterized in that the door receiving member has a depth dimension that gradually decreases from the bottom to the top, the door receiving member is provided with a runner and drive means and is configured to be moveable in the lengthwise direction of the platform by the driving means causing said runner to travel along the guide element.

Stable standing/running of the moveable door receiving member can be obtained by forming the door receiving member with a depth dimension that gradually decreases
from the bottom to the top. In one aspect, the guide rail is provided inside and beneath the platform floor and a narrow groove is formed along the guide rail. A mounting portion of the drive means (typically, a motor) is not limited. The drive means may be located in a lower space under the platform floor, or may be located in the door receiving member, for example.

In one aspect, the door receiving member is provided on the platform with a lower end of the track-side front face being in close proximity to or coincident with an edge of the platform and when the door is in a closed position where the door is projected from a side of the door receiving member, the door is configured to prevent forming a space that would allow a passenger to get trapped between said door in the closed position and the edge of the platform.

In one aspect, the door receiving member has a triangular or trapezoidal profile with the platform-side front face, an inclined track-side face, the bottom, and the top. According to this aspect, it is possible to keep passengers away from the track side due to the shape of the door receiving member even if having a lower height. In one aspect, the door comprises a platformside front face, a track-side front face, a bottom, and a top, and has a depth dimension that gradually decreases from the bottom to the top. In one aspect, the shapes of the door and the door receiving member are similar figures in a side view. More specifically, the door comprises the platform-side front face, the track-side face, the bottom, and the top and has a triangular or trapezoidal profile similar to that of the door receiving member. The bottom may not necessarily be closed by a plate-like member and such, and could be open.

In one aspect, the door receiving member is provided with a plurality of the doors wherein the plurality of doors and the door receiving member are configured to slide one another.

In one aspect, the barrier comprises two or more doors that project from the same side of the door receiving member wherein a rearward end of the first door is slidably receivable in the door receiving member and a side of the forward end of the first door has an opening such that a rearward end of the second door is slidably receivable in the first door.

In one aspect, the barrier comprises a first door and a second door which are projectable from either side of the door receiving member wherein a rearward end of the first door is slidably receivable in the door housing member from one side thereof, a rearward end of the second door is slidably receivable in the door housing member from the other end thereof, and the rearward side of the first door comprises an opening such that the rearward end portion of the second door is slidably moved into the first door.

In one aspect, the moveable platform barrier comprises a series of units arranged along the lengthwise direction of the platform, each unit comprising the door receiving member and doors projectable from either side of the door receiving member wherein besides forming an opening for passengers, said barrier is in a closed state where forward ends of opposed doors of neighboring units are in contact with or in close proximity to each other and said barrier comprises a locking device that maintains the closed state of the barrier in stationery/moving state besides forming the opening.

In one aspect, the locking device comprises an engaging element provided on one door and a portion to be engaged provided on the other door with respect to the doors whose forward ends are in contact with or in close proximity to each other. The locking device is in a locked state when the engaging element engages the portion to be engaged and the locked state is maintained when the barrier is in stationery/moving state besides forming the opening. When forming the opening, the locked state is unlocked such that the two doors whose forward ends are in contact with or in close proximity to each other move away from each other to form the opening.

In one aspect, the locking device is located under the platform floor. Namely, the locking device is provided at a lower portion of the forward end of each door. In one aspect, the door comprises a runner at a bottom of a forward end of the door and the runner is located under the platform floor. The runner and the locking device are mounted on the common member that is provided at the bottom of the forward end of the door.

With respect to the mechanism for locking the forward ends of door pairs, it can readily be understood by the ordinary skilled person in the art that a number of structures can be employed and the specific structure of the locking device is not limited in the present invention. According to an embodiment that will be described in later, the locked state is unlocked mechanically but the locked state may be unlocked electrically. For example, in the latter, an electric locking device whose locked state is unlocked when energized is employed such that the locking device is energized in response to an input of the signal for opening the door to unlock the locked state. The door may be provided with a runner (roller and such) at a bottom surface thereof.

In one aspect, the door comprises the runner at a bottom of a forward end of the door and a forward end portion of the door is supported by the runner. This arrangement enables stable standing/running of the moveable door receiving member as a whole.

In one aspect, the runners of the door receiving member and the door are located under the platform floor and move under the platform floor along guide elements extended in the lengthwise direction of the platform.

In one aspect, the guide element for the runner of the door receiving member doubles as the guide element for the runner of the door. This arrangement enables to reduce the number of elements for the platform barrier as well as reduce the required space under the platform floor.
In one aspect, the door receiving member has a triangular or trapezoidal profile with an inclined platform-side front face, the track-side front face, the bottom, and the top. According to this arrangement, the shape of the door receiving member give a sense of openness to the passengers on the platform in comparison with the door receiving member having a triangular or trapezoidal profile with the platform-side front face, the inclined track-side face, the bottom, and the top.

In one aspect, on an upper portion of the inclined platform side front surface of the moveable platform barrier, there is provided a handrail extending in the width direction of the door receiving member (lengthwise direction of the platform).

In one aspect, the door has a triangular or trapezoidal profile with an inclined platform-side front face, the track-side front face, the bottom, and the top as well as on an upper portion of the inclined platform side front surface of the door, there is provided a handrail extending in the width direction of the door receiving member (lengthwise direction of the platform). In one aspect, the handrail on the door is slidable to the handrail on the door receiving member such that at least a portion of the handrail on the door is received in the handrail on the door receiving member when the door is housed in the door receiving member.

[0017] In one aspect, the door is comprised of a plurality of elongated members extending horizontally from a side of the door receiving member. In one aspect, the plurality of elongated members are located over the entire side shape (triangular or trapezoidal profile, for example) of the door receiving member. Namely, the plurality of elongated members are located to form a triangular or trapezoidal cross section as a whole.

[0018] In one aspect, rearward ends and/or forward ends of the plurality of elongated members are integrated with a panel and the plurality of elongated members are configured to be moveable by moving at least one of the elongated members with the drive means. In one aspect, the plurality of elongated members are provided with a cushion member at respective forward ends.

In one aspect, the elongated member may expand and contract (telescoping, for example).

[0019] In one aspect, the door receiving member comprises a truss structure and wherein a plurality of receiving spaces having a triangular cross section and extending horizontally between sides of the door receiving member are formed inside the door receiving member with the truss structure, and each of the elongated members is receivable in the corresponding receiving space, respectively.

In one aspect, each elongated member has a triangular cross sectional shape adapted to the corresponding receiving space.

In one aspect, the plurality of elongated members project from either side of the door receiving member, and the plurality of receiving spaces are divided into receiving spaces for a set of elongated members projected from one side of the door receiving member and receiving spaces for a set of elongated members projected from the other side of the door receiving member.

[0020] According to the present invention employing a door receiving member having a platform-side front face, a track-side front face, a bottom, and a top and having a depth dimension that gradually decreases from the bottom to the top (typically, a triangular or trapezoidal profile), center of gravity of the moveable door receiving member can be lowered with an upper side being light weight. It is possible to make the bottom of the door receiving member wider relative to the upper side so that rotation moment about a fulcrum at a lower side is less likely to be exerted thereby improving stabilization of standing/running of the moveable door receiving member.

[0021] According to a door receiving member comprising a platform-side front face, a track-side front face, a bottom, and a top and having a depth dimension that gradually decreases from the bottom to the top (typically, a triangular or trapezoidal profile), center of gravity of each of the door receiving member and doors as well as the overall unit can be lowered such that stabilization of standing/running of the moveable door receiving member can be improved.

The moveable platform barrier is stabilized when the moveable platform barrier is expanded, or in a closed position where the doors are projected from the door receiving member. A door having a triangular or trapezoidal profile like the door receiving member (preferably, similar figures) allows the door receiving member to function as a door without visually distinguishing the moveable door receiving member when the door is closed.

[0022] According to the present invention, a door receiving member having a platform-side front face, a track-side front face, a bottom, and a top and having a depth dimension that gradually decreases from the bottom to the top and at least one of sides of the door receiving member having an opening is employed. This arrangement enables to keep passengers away from the track side due to the shape of the door.
space between the car and the closed platform barrier. As specific structures for the door, the door having a profile similar to that of the door receiving member, and the door comprising a plurality of elongated members extending horizontally from the side of the door receiving member are provided.

[0023] Lightweighting of the door is possible with the door comprising a plurality of elongated members. For example, a further lightweighting is possible with a hollow elongated member. With the door receiving member having a truss structure, lightweighting is possible while maintaining strength of the door receiving member. With the Lightweighting of the door and the door receiving member, it is possible to efficiently operate the door and the door receiving member with a lesser force.

Brief Description of the Drawings

[0024] Fig. 1A is a schematic perspective view of an embodiment of a moveable platform barrier according to the present invention when viewed from the track side;
Fig. 1B is a schematic perspective view of an embodiment of a moveable platform barrier according to the present invention when viewed from the platform side;
Fig. 2A is a schematic perspective view of another embodiment of a moveable platform barrier according to the present invention when viewed from the track side;
Fig. 2B is a schematic perspective view of another embodiment of a moveable platform barrier according to the present invention when viewed from the platform side;
Fig. 3A is a schematic perspective view of a further embodiment of a moveable platform barrier according to the present invention when viewed from the track side;
Fig. 3B is a schematic perspective view of a further embodiment of a moveable platform barrier according to the present invention when viewed from the platform side;
Fig. 4A is a side view showing a moveable door receiving member, a first door and a second door where they are stowed overlapping one another;
Fig. 4B is a view showing guide means between the door receiving member and the first door;
Fig. 4C is a view showing guide means between the door receiving member and the first door;
Fig. 5A is a perspective view of a platform barrier showing another embodiment of the door;
Fig. 5B is a vertical sectional view of the platform barrier illustrating a drive mechanism for the door;
Fig. 5C is a vertical sectional view of the platform barrier (a lower portion) illustrating a drive mechanism for the door;
Fig. 5D is a view similar to Fig. 5A but structures of forward ends of the rods are different;
Fig. 6A(a) shows a moveable door receiving member having a truss structure, (b) shows a first door and (c) shows a second door;
Fig. 6B shows a drive system for the door according to the embodiment of Fig. 6A;
Fig. 6C shows a supporting structure for a forward end of a ball screw shown in Fig. 6B;
Fig. 7A is a schematic perspective view of a further embodiment of a moveable platform barrier according to the present invention when viewed from the track side;
Fig. 7B is a schematic perspective view of a further embodiment of a moveable platform barrier according to the present invention when viewed from the platform side;
Fig. 8 shows a running and drive mechanism of the moveable door receiving member in which (A) relates to a ball screw drive mechanism and (B) relates to a belt drive mechanism;
Fig. 9 shows details of the running and drive mechanism of Fig. 8(A);
Fig. 10 shows details of the running and drive mechanism of Fig. 8(B);
Fig. 11 shows details of the running and drive mechanism of Fig. 8(A);
Fig. 12 shows details of the running and drive mechanism of Fig. 8(B);
Fig. 13 is a schematic perspective view of a further embodiment of a moveable platform barrier according to the present invention when viewed from the platform side;
Fig. 14 is a front view of a further embodiment of the moveable platform barrier;
Fig. 15 is a sectional view of a further embodiment of the moveable platform barrier;
Fig. 16 is a partial enlarged view of Fig. 14;
Fig. 17 is a view explaining a locking device where a locked state is shown; and
Fig. 18 is a view explaining a locking device where an unlocked state is shown.

Detail Description

[0025] Several embodiments will be explained but the same reference numerals are assigned to the similar elements throughout the specification and descriptions regarding the element assigned with the same reference numeral can be referred to each other. In the following embodiments, the present invention will be explained according to a moveable platform barrier comprising a guide rail provided in a platform floor and extended in a lengthwise direction of the platform, a moveable door receiving member comprising a door pocket, a runner, and drive means for causing the runner to travel along the guide rail and being moveable in the lengthwise direction of the platform, and a door slidably received in the door
An overall arrangement of a moveable platform barrier of the present invention will be described. A guide rail 2 is provided in a floor of a platform 1 and extends in a lengthwise direction of the platform 1. In one aspect, the guide rail 2 may extend along substantially the entire length of the platform 1. Alternatively a plurality of shorter guide rails may be arranged in the lengthwise direction of the platform 1. The guide rail 2 is embedded in the floor of the platform 1 and an upper surface of a portion where the guide rail 2 is embedded is flush with the floor of the platform 1.

On the floor of the platform 1, there are provided a plurality of moveable door receiving members 3 adjacent to an edge facing a track side. Each door receiving member is moveable along the guide rail 2 in the lengthwise direction of the platform 1. The moveable door receiving member 3 has a first surface (a platform side front face) 30 facing a platform-side A (see Fig. 4A), a second surface (a track side front face) 31 facing a track side B (see Fig.4A), a top 32, and a bottom 33. The moveable door receiving member 3 has a substantially triangular shape in a side view. At least one of side faces 34 of the door receiving member 3 has an opening. The moveable door receiving member 3 has a height lower than those of passengers and a height between about 120 cm and 130 cm according to one embodiment. The shape and size of the moveable door receiving member 3 is not limited to the foregoing description.

According to an embodiment shown in Figs. 1A and 1B, the moveable door receiving member 3 comprises a vertical first surface 30 and an inclined second surface 31. The second surface 31 has a lower end being positioned at an edge of the platform and extends upwardly gradually away from the track side B (towards the platform side A). An upper end of the first surface 30 and an upper end of the second surface 31 are integral with the curved top 32. A lower end of the first surface 30 and a lower end of the second surface 31 are coupled via a horizontal bottom 33.

According to the embodiment shown in Figs. 1A and 1B, each door receiving member 3 comprises two doors, namely a first door 4 and a second door 5 that project from the same side face of the moveable door receiving member 3. Cross sections of the first and second doors 4, 5 and the door receiving member 3 are similar figures such that the moveable door receiving members 3, the first door 4 and the second door 5 slide one another. The followings are detailed descriptions.

The first door 4 comprises a first surface (a platform side front face) 40 facing a platform-side A, a second surface (a track side front face) 41 facing a track side B, a top 42, and a bottom (not shown in Figs. 1A and 1B) and has a triangular profile.

At least one of the side faces of the moveable door receiving member 3 has an opening such that a door housing portion is formed in an inner space of the door receiving member 3 to receive the first door 4 from its rearward portion. A forward side of the first door 4 has an opening such that a door housing portion is formed in an inner space of the first door 4 to receive the second door 5 from its rearward portion. It is a matter of design variations to which extent the first door 4 can be retracted into the door receiving member 3 and to which extent the second door 5 can be retracted into the first door 4. Even when the doors are in the deepest retracted positions (a stowed position), the forward end of the first door 4 may be projected from the side of the door receiving member 3 and/or the forward end of the second door 5 may be projected from the side of first door 4.

The moveable platform barrier is in a closed state when the first door 4 is projected from the side of the door receiving member 3 and the second door 5 is projected from the side of the first door 4 as well as the sides of the adjacent second doors 5 are in contact with each other. The moveable platform barrier is in an open state when the first door 4 is retracted into the door receiving member 3 and/or the second door 5 is retracted into the first door 4 so that the sides of adjacent second doors 5 move apart from each other to form a space therebetween. Alternatively, the moveable platform barrier is in an open state when one or both of adjacent door receiving members 3 move apart from each other to form a space between adjacent door receiving members 3.

The moveable door receiving member 3 has a generally triangular profile and the shape is not limited to that shown in Figs. 1A and 1B. Figs. 2A, 2B, 3A, and 3B show the moveable door receiving member 3 whose shapes are similar to that of Figs. 1A and 1B. Figs. 1A and 1B show a planar inclined second surface 31 while Figs. 2A and 2B show a curved inclined second surface 31' whose curved surface gently concaves toward a first surface 30' (toward the platform side A). Figs. 3A and 3B show a curved inclined second surface 31' whose curved surface gently bulges away from a first surface 30' (toward the track side B).

According to the embodiment of Figs. 1A and 1B, the first door 4 and the second door 5 both project from the same side of the door receiving member 3 but doors may project from either side of the door receiving member 3 respectively. According to the embodiments of Figs. 2A, 2B, 3A, and 3B, the door receiving member 3 is provided with two doors, namely, a first door 4 and a second door 5', which project either side of the door receiving member 3 respectively. Cross sections of the first and second doors 4, 5 and the door receiving member 3 are similar figures such that the moveable door receiving members 3, the first door 4' and the second door 5' slide one another. More specifically, in the following description, a rearward end of the first door 4' stowed in the door receiving member 3 is adapted to slidably re-
receive a rearward end of the second door 5' stowed in the door receiving member 3.

[0036] The first door 4' comprises a first surface (a platform side front face) 40' facing a platform-side A, a second surface (a track side front face) 41' facing a track side B, a top 42', and a bottom (not shown in Figs. 2A, 2B, 3A and 3B) and has a triangular profile.

[0037] The second door 5' comprises a first surface (a platform side front face) 50' facing a platform-side A, a second surface (a track side front face) 51' facing a track side B, a top 52', and a bottom 53' and has a triangular profile.

[0038] Both side faces of the moveable door receiving member 3 have an opening such that a door housing portion is formed in an inner space of the door receiving member 3 to receive the first door 4' from its rearward portion and the second door 5' from its rearward portion respectively.

[0039] A rearward side of the first door 4' has an opening such that a door housing portion is formed in an inner space of the first door 4' to receive the rearward portion of the second door 5'. When the first door 4' and the second door 5' are in stowed positions, the rearward portion of the first door 4' retracted into the door receiving member 3 from one side thereof is adapted to slidably receive the rearward portion of the second door 5' retracted into the door receiving member 3 from the other side thereof. It is a matter of design variations to which extent the first door 4' and the second door 5' can be retracted into the door receiving member 3. Even when the doors are in the deepest retracted positions (stowed position), the forward end of the first door 4 may be projected from one side of the door receiving member 3 and/or the forward end of the second door 5 may be projected from the other side of the door receiving member 3. When both the first door 4' and the second door 5' are projected from the sides of the door receiving member 3 in the deepest retracted positions (stowed positions), the rearward ends of the first door 4' and the second door 5' may not slide one another.

[0040] An arrangement for causing the door to slidally move relative to the door receiving member comprise guide means being provided in the door pocket of the door receiving member and guiding the door to slide during opening and closing movements of the door and a drive mechanism for causing the door to slide along the guide mean. A motor is typically used as a drive source for the drive mechanism. For specific arrangements, reference is made to descriptions related to Figs. 4B and 4C (guide means), and descriptions related to Figs. 5B and 5C (guide means and drive mechanism). According to the present embodiment where the door receiving member having a triangular cross section slidably receives the doors having the similar shape, in one aspect, it is desirable to locate the drive mechanism and motor at a lower portion so as to facilitate an effective use of the lower space inside the door receiving portion and lower center of gravity of the moveable platform barrier as a whole. It can be understood by the skilled person in the art that the description of this paragraph can be applied to where a door having a triangular cross section is adapted to slidally receive a door having the similar shape.

[0041] For a general door apparatus, a door slidally to the door pocket is well-known as a sliding door by a person having ordinary skilled in the art. An automatic sliding door causing the door to automatically slide is also well-known by a person having ordinary skilled in the art. These techniques may be applied to the present invention regarding the mechanism for moving the doors. Door apparatus in which doors are projected from either side of the pocket is disclosed in JPA11-334579 and reference can be made. Patent document 2, JPA2000-16281, and JPA2008-280034 disclose a door receiving member employing two doors that project from the same side face of the door receiving member in which one door functions as an intermediate door receiving member for housing the other door, the other door is housed in the one door and the one door is housed in the pocket of the door receiving member and reference can be made.

[0042] Referring to Figs. 8 to 10, the moveable door receiving member 3 comprises wheels 35 at its bottom surface 33. The wheels 35 rotate along the guide rail 2 such that the moveable door receiving member 3 moves in the lengthwise direction of the platform 1. As foregoing, in one aspect, the guide rail 2 extends substantially along the entire length of the platform 1. A plurality of guide rails may be provided at an interval corresponding to travel distance of respective moveable door receiving members 3. The moveable door receiving member 3 comprises a drive mechanism enabling self-running of the door receiving member 3 by rotating the wheels 35. The moveable door receiving member 3 travels in the lengthwise direction of the platform 1 while the wheels 35 travel along the guide rail 2 by the drive mechanism. The drive mechanism will be explained later.

[0043] Fig. 4A is a schematic sectional view showing an embodiment of a moveable door receiving member and doors. Overall arrangements of the door receiving member and the doors correspond to the embodiment shown in Figs. 1A and 1B. Profiles of the door receiving member and the doors are similar to those of Fig. 3A and 3B. Fig. 4 will be explained according to a case where a first door 4 and a second door 5 both project from the same side of the door receiving member but the following explanation can be applied to explanation of a first door 4' and a second door 5' (rearward ends thereof slide one another) each projects from the either side of the door receiving member.

[0044] According to the embodiment shown in Fig. 4A, the moveable door receiving member 3, the first door 4, and the second door 5 are made of double-skinned structural members by welding and such. For example, providing the double-skinned structural members for first surfaces 30, 40, 50, the double-skinned structural members for second surfaces 31, 41, 51, the double-skinned
structural members for the tops 32, 42, 52, and the double-skinned structural members for the bottoms 43, 53 and assembling the members by aluminum welding to form the door receiving member 3, the first door 4 and the second door 5 respectively. According to the illustrated embodiment, the bottom 33 of the door receiving member 3 is made of a steal plate but the bottom 33 may be made of the double-skinned structural member. The wheels 35 are provided at a lower surface of the bottom 33 of the door receiving member 3. The first surfaces 30, 40, 50 and the second surfaces 31, 41, 51 may be divided into upper parts and lower parts, double-skinned structural members for the upper parts and the lower parts are provided and they are to be connected by welding. The double-skinned structural member may be an extruded shape from a lightweight metal alloy such as an aluminum metal alloy. Alternatively, the structural members for the door receiving member 3, the first door 4 and the second door 5 may be assembled by using a screw or bolt. In Fig. 4A, motors M for driving the first door 4 and the second door 5 are shown. According to the illustrated embodiment, the bottom 53 of the second door 5 is raised and a first portion 430 in a depth direction of the bottom 43 of the first door 4 is upwardly protruded such that a space for receiving one motor M is formed between the first portion 430 and the bottom 33 of the door receiving member 3 to receive the motor M for the first door. Also, a space for receiving the other motor M is formed between a second portion 431 in a depth direction of the bottom 43 and the bottom 53 of the second door 5 to receive the motor M for the second door. Stable running of a moveable door receiving member and doors can be obtained with lowered center of gravity thereof as a whole by locating the motors M at a lower portion.

According to one aspect, guide means is provided between respective opposed surfaces of the door receiving member 3, the first door 4 and the second door 5, which allows a sliding movement while preventing direct contact of the respective surfaces. The guide means will be explained according to Figs. 4B and 4C. With respect to opposed surfaces of the first surface 30 of the door receiving member 3 and the first surface 40 of the first door 4, the first surface 30 is provided with a contact plate 300 extending in a moveable direction of the door receiving member 3 and the first door 4, and the first surface 40 is provided with a roller assembly. The roller assembly comprises a roller 400 that is rotatable about a vertical rotating axis, a bracket 401 for rotatably retaining the roller 400 whose rotating axis is fixed to the bracket 401, a case 402 provided to form a cavity in the first surface 40 to receive the roller 400 and the bracket 401 therein, and a tension spring 403 provided between the bracket 401 and the case 402. The bracket 401 and the case 402 both have a U-shaped profile having an upper part, a lower part and a vertically extending bottom part. The tension spring 403 is provided between an outer surface of the bottom part of the bracket 401 and an inner surface of the bottom part of the case 402 so as to resiliently support the roller 40 in a direction in which the roller moves in and out of the first surface 40. A contact element 404 is provided on the first surface 40 so as to prevent the roller 400 and the bracket 401 getting out of the cavity 401 when the contact element is in contact with edges of the upper and lower parts of the bracket 401.

Fig. 4C shows a state where the first door 4 is installed inside the door receiving member 3. As shown in Fig. 4C, the opposed surfaces of the first surface 30 of the door receiving member 3 and the first surface 40 of the first door 4 are close together, and the contact plate 300 of the first surface 30 is in close proximity to contact with the surface of the roller 400 at the first surface 40. In one aspect, the guide means is provided between the opposed surfaces of the second surface 31 of the door receiving member 3 and the second surface 41 of the first door 4 as well as the bottom 33 of the door receiving member 3 and the bottom 43 of the first door 4. Guide means (liner guide) of Figs. 5B and 5C may be employed in combination with the foregoing guide means. It can be understood by the skilled person in the art that the descriptions related to the present paragraph and an immediate previous paragraph can be applied to where a door having a triangular cross section is adapted to slidable receive a door having the similar shape.

According to the embodiments shown in Figs. 1A, 1B, 2A, 2B, 3A, 3B, and 4A, the door receiving member 3, the first doors 4, 4', and the second doors 5, 5' having a triangular profile, center of gravity of each of the doors can be obtained regardless of positions (projected position or stowed position) of the first doors 4, 4' and the second doors 5, 5'.

When the moveable platform barrier is in a closed position, it appears from Figs. 1A, 2A and 3A that any space between the moveable platform barrier (the first door 4, 4', the second door 5, 5', and the door receiving member 3) and the edge of the platform 1 where passengers would get trapped is not formed. Thus the situation where a passenger gets inadvertently trapped in the space between the car and the moveable platform barrier can be prevented.

According to the foregoing embodiments, the doors having figures similar to the door receiving member 3 are employed but the door may be comprised of a plurality of elongated members such as rods, bars, and slats, which are projectable in opening and closing directions of the door. In this case, a panel may be provided at forward ends of rods or slats. The panel may constitute the side face of the door receiving member 3 when the rods or slats are retracted inside the door receiving member. Fig. 5A shows a door 8 comprising a plurality of rods 6 horizontally projectable from the side of the door re-
Movement mechanism of the door 8 shown in Fig. 5A will be explained according to Figs. 5B and 5C. A rearward end of each rod 6 is fixed to a panel-shaped door supporting frame 60 and each rod 6 extends horizontally from the door supporting frame 60 in a cantilever manner. In one aspect, the door supporting frame 60 has a triangular shape and size corresponding to the cross section of the door receiving member 3 and can slidably move inside the door receiving member 3. A door housing portion of the door receiving member 3 is provided with a rail of linear guide 61 extending in the lengthwise direction (opening and closing directions of door 8) of the rods 6 such that the door supporting frame 60 slidably moves while being guided by the linear guide 61 (a slider being guided along the rail). In one aspect, three linear guides 61 are provided in the door receiving member 3 for guiding corner portions of triangular shaped door supporting frame 60 but the number of linear guides is not limited to three and two linear guides may be employed.

The door housing portion is provided with ball screws 62 extending in the lengthwise direction (opening and closing directions of door 8) of the rods 6. In the illustrated embodiment, two ball screws 62 are provided but the number of ball screws is not limited. A slider (a ball nut) 63 is mounted on the ball screw 62 so as to be moveable in the lengthwise direction of ball screw 62 and the slider 63 is fixed at the door supporting frame 60. According to the illustrated embodiment, the slider 63 is fixed at an end of hollow portion 600 of the rod 6 having a larger diameter than those of the remaining rods 6 so that the slider 30 is coupled to the door supporting frame 60 via the rod 6 with the larger diameter whose rearward end is fixed to the door supporting frame 60. A forward end of the ball screw 62 extends in the follow portion 600 of the rod 6 with the larger diameter. A motor 64 is connected to an end of the lower ball screw 62. A terminal bearing 65 is connected to an end of the upper ball screw 62. The motor 64 and the terminal bearing 65 are fixed inside the door receiving member via fixing means (not shown). The upper ball screw 62 rotates together with the lower ball screw 62 via a looped transmission mechanism (pulley 66 and belt 67, for example). The slider 63 moves in left or right direction on the ball screw 52 by rotating the motor 64 forwardly or reversely according to an instruction from the controller so that the door 8 moves in the lengthwise direction of the platform 1 for opening or closing of the door. When the door 8 moves to a predetermined position, rotation of the motor 64 stops so that the door 8 stops. It can be understood by the skilled person in the art that the drive mechanism described in this paragraph may be applied to sliding movement of the door having a figure similar to the door receiving member having a triangular cross section.

Referring to Fig. 5D, the door may be comprised of a plurality of rods 6 without the panel 7. A forward end or entire of each rod 6 may be made of a flexible member. According to Fig. 5D, a cushion member 70 made of a resilient member such as rubber and resin is provided at the forward end of the rod 6. In one aspect, the cushion member 70 is shaped to mate with a cushion member 70’ of the other rod 6’ when the door 8’ is in a closed position. Regarding the movement mechanism of the door 8’, the mechanism shown in Figs. 5B and 5C can be employed. Each rod 6 may be driven independently, especially if the number of rods 6 is small.

Regarding the door 8 shown in Figs. 5A and 5D, on the side face of the door receiving member 3, the rods 6 are projected from a portion (especially, a lower portion) adjacent to the second front surface 31 so that any space between the door 8 and the edge of the platform 1 where passengers would get trapped is not formed when the moveable platform barrier is in the closed state.

The cross sectional shape and number of rods 6 are not limited to those of Figs. 5A and 5D. The door may be comprised of a plurality of blade-like slats in place of pipe-like rods 6. The door may be comprised of a smaller number of rods 6. For example, on the triangular side face of the door receiving member 3, the door consists of five pieces of rods including three pieces of rods corresponding to three corners (or, a corner formed by a platform-side vertical edge and a track-side sloped edge, a corner formed by a platform-side vertical edge and a track-side bottom edge, and a corner formed by a track-side sloped edge and a track-side bottom edge), one at an intermediate portion of the vertical edge on the platform side, and one at an intermediate portion of the sloped edge on the track side.

Figs. 6A, 7A and 7B show still another embodiment. According to aspect of Figs. 7A and 7B, each door receiving member 3 comprises two doors which are projectable from either side of the door receiving member 3, namely, a first door 9 and a second door 10. The first door 9 comprises a plurality of slats 11 having a triangular cross section and a panel 12 connected to the forward ends of the slats 11. Similarly, the second door 10 comprises a plurality of slats 13 having a triangular cross section and a panel 14 connected to the forward ends of the slats 13.

Referring to Fig. 6(A)(a), the door receiving member 3 has a truss structure and comprises outer walls including a first surface 30, a second surface 31, a top 32 and a bottom 33 and a plurality of elements T for forming the truss structure extending in an inner space of the outer walls between sides of the door receiving member 3. In the inner space of the door receiving member 3, a plurality of spaces having a triangular cross section are formed as a result of the truss structure. The spaces having a triangular cross section constitute spaces 11, 12 extending horizontally between the sides of the door receiving member 3 for housing a plurality of slats 11, 13. The plurality of spaces having a triangular cross section
are divided into the spaces S1 for housing slats 11 and the spaces S2 for housing slats 13.

[0057] Figs. 6A(b,c) are view illustrating the divisions of spaces having a triangular cross section and slats 11 of the first door 9 corresponding to the space S1 as well as slats 13 of the second door 10 corresponding to the space S2. Fig. 6A(d) is a partial enlarged view of Fig. 6A(c). It is noted that shapes of the first door and second door of Fig. 6Ab,c do not completely correspond to those shown in Figs. 7A and 7B. The number of slats 11, 13 and the number of spaces S1, S2 are not limited to the illustrated embodiment, and for example, the door may be comprised of a smaller number of slats.

[0058] Linear guides 61 are provided as a slide element between partitioned walls of the spaces S1, S2 having a triangular cross section in the door receiving member 3 and each of slats 11, 13. The above-mentioned roller assembly may be employed in place of or in addition to the small-sized supporting linear guide 61. As shown in an enlarged view of Fig. 6A(d), the linear guide 61 comprises a rail 610 provided at the wall of the space and a slider 611 provided at the slat 13 such that the slider 611 is slidably supported by the rail 610 in the length of the rail 610.

[0059] A drive source (typically, a motor) can be located by using the space (a relatively larger lower space) having a triangular cross section. The plurality of slats 11 are connected together at their forward ends by the panel 12 so that the first door 9 can be moved by selecting either of slats 11 I and driving the selected slat(s). The plurality of slats 13 are connected together at their forward ends by the panel 14 so that the second door 10 can be moved by selecting either of slats 13 and driving the selected slat(s). The foregoing explanation relates to the embodiment where the first door 9 and the second door 10 are projected from either side of the door receiving member 3. In this case, the first door 9 and the second door 10 may project and retract in a multi-stage (two or more) telescopic manner.

[0060] Referring to Figs. 6B and 6C, movement mechanism of slats 11, 13 will be explained. The foregoing ball screw mechanism can be used as a drive system. The forward ends of slats 13 are integrated via the panel 14 so that all slats 13 can simultaneously be moved by moving any one of slats 13. According to the illustrated example, one of slats among the lowermost slats is selected as a driving slat and the remaining slats 13 are driven slats. The motor 64 is fixed to a wall of the remaining space in the space S2 for housing the driving slat 13.

[0061] Inside the space S2, the ball screw 62 extends along the lengthwise direction of the slat 13. The motor 64 is connected to an end of the ball screw 62. A slider (ball nut) 63 is mounted on the balls screw 62 and movable in the lengthwise direction of the ball screw 62. The slider 63 is fixed to a rearward end of the driving slat 13. The ball screw 62 extends in a hollow portion of the driving slat 13 and is rotatably supported by a retaining bearing 68 at its forward end. The retaining bearing 680 comprises a bearing 680 and a case 681 housing the bearing 680.

[0062] The retaining bearing 68 is supported by the linear guide 61. More specifically, the slider 611 is fixed to the case 681 of the retaining bearing 68 and slidably supported by the rail 610 of the linear guide 61 in the lengthwise direction of the rail. The rail 610 is fixed to the inner wall of the hollow portion of the driving slat 13 at its entire length. The retaining bearing 68 enables the movement of the driving slat 13 while continually retaining the forward end of the ball screw 62.

[0063] The slider 63 moves in left or right direction on the ball screw 52 by rotating the motor 64 forwardly or backwardly according to an instruction from the controller so that the slats 13 move in the lengthwise direction of the platform 1 for opening and closing of the door. When the slats 13 move to a predetermined position, rotation of the motor 64 is stopped so that the slats 13 stop. Here, slats 13 only are shown but a movement mechanism for the slats 11 can be considered similar. Fig. 6B shows one motor but a plurality of motors may be provided to drive synchronously.

[0064] Fig. 13 shows still further embodiment of moveable platform barrier according to the present invention. The moveable door receiving member 3 has a first surface (a platform side front face) 30 facing a track side B (Fig. 4A), a second surface (a track side front face) 31 facing a track side B (Fig. 4A), a top 32, and a bottom. The moveable door receiving member 3 has a substantially triangular shape in a side view. The moveable door receiving member 3 comprises an inclined first surface 30 and a vertical second surface whose lower end is positioned at an edge of the platform. An upper end of the first surface 30 and an upper end of the second surface are integral with the curved top 32. The moveable door receiving member 3 has a height lower than those of passengers and a height between about 120 cm and 130 cm according to one embodiment. The shape and size of the moveable door receiving member 3 is not limited to the foregoing description.

[0065] According to the embodiment shown in Fig. 13, each door receiving member 3 comprises two pieces of doors, namely a first door 4 and a second door 5 that project from the same side face of the moveable door receiving member 3. Cross sections of the first and second doors 4, 5 are similar figures such that the moveable door receiving members 3, the first door 4 and the second door 5 slide one another.

[0066] The first door 4 comprises a first surface (a platform side front face) 40 facing a platform-side A, a second surface (a track side front face) 41 facing a track side B, a top 42, and a bottom and has a triangular profile. The second door 5 comprises a first surface (a platform side front face) 50 facing a platform-side A, a second surface (a track side front face) 51 facing a track side B, a top 52, and a bottom and has a triangular profile.

[0067] On an upper portion of the inclined platform side
receiving member 3, the handrail 401 is provided at the upper portion of the platform side front surface of the door of the platform 1. The handrail 301 is provided at the front surface of the moveable platform barrier, there are the moveable door receiving member 3. Each wheel 35 altogether are mounted on the bottom surface 34 of the moveable door receiving member 3. Each wheel 35 is rotatably supported by a vertically extending plate-like bracket 36. A narrow groove 15 is provided on the floor of the platform 1 and the plate-like bracket 36 extends through the groove. The width of the groove 15 is preferably designed such that insertion of passenger’s shoes and any other footwear, a tip of stick, rollers of the bottom of a bag and such into the groove is prevented.

The handrail 301 comprises a lateral member 301a having a length substantially the same as a width of door receiving member 3 and supports 301b upwardly extending from the upper portion of the platform side front face 30 of the door receiving member 3. The supports 301b support the lateral member 301a so as to distance the lateral member 301a away from the upper portion of the platform side front face 30.

The handrail 401 comprises a lateral member 401a having a length substantially the same as a width of the first door 4 where a rearward end of the lateral member is slidably received inside the forward end portion of the lateral member 301a and a forward end of the lateral member is supported by a support 401b upwardly extending from the upper portion of the platform side front face 40 of the first door 4. The lateral member 401a is supported at a distance away from the upper portion of the platform side front surface 40.

The handrail 501 comprises a lateral member 501a having a length substantially the same as a width of the second door 5 where a rearward end of the lateral member 501a is slidably received inside the forward end portion of the lateral member 401a and a forward end of the lateral member 501a is supported by a support 501b upwardly extending from the upper portion of the platform side front face 50 of the second door 5. The lateral member 501a is supported at a distance away from the upper portion of the platform side front face 50.

The handrails 301, 401, 501 together form a telescopic handrail. When the moveable platform barrier is in the closed position, the first door 4 is received in the door housing portion of the door receiving member 3 from its rearward portion and the second door 5 is received in the door housing portion of the first door 4 from its rearward portion. At this time, the lateral member 401a is received in the inner forward end portion of the lateral member 301a from its rearward end portion and the lateral member 501a is received in the inner forward end portion of the lateral member 401a from its rearward end portion.

Referring to Figs. 8 to 10, a running and drive mechanism of the moveable door receiving member 3 will be explained. Fig. 9 shows the running and drive mechanism of the moveable door receiving member 3 in which (A) relates to a drive mechanism using ball screws and (B) relates to a drive mechanism using a belt. Referring to Fig. 9 to 11, two sets of wheels spaced apart in both widthwise direction and depth direction (thickness direction) of the door receiving member 3, four wheels 35 altogether are mounted on the bottom surface 34 of the moveable door receiving member 3. Each wheel 35 is rotatably supported by a vertically extending plate-like bracket 36. A narrow groove 15 is provided on the floor of the platform 1 and the plate-like bracket 36 extends through the groove. The width of the groove 15 is preferably designed such that insertion of passenger’s shoes and any other footwear, a tip of stick, rollers of the bottom of a bag and such into the groove is prevented.

The handrail 301 comprises a lateral member 301a having a length substantially the same as a width of door receiving member 3 and supports 301b upwardly extending from the upper portion of the platform side front face 30 of the door receiving member 3. The supports 301b support the lateral member 301a so as to distance the lateral member 301a away from the upper portion of the platform side front face 30.

The handrail 401 comprises a lateral member 401a having a length substantially the same as a width of the first door 4 where a rearward end of the lateral member is slidably received inside the forward end portion of the lateral member 301a and a forward end of the lateral member is supported by a support 401b upwardly extending from the upper portion of the platform side front face 40 of the first door 4. The lateral member 401a is supported at a distance away from the upper portion of the platform side front surface 40.

The handrail 501 comprises a lateral member 501a having a length substantially the same as a width of the second door 5 where a rearward end of the lateral member 501a is slidably received inside the forward end portion of the lateral member 401a and a forward end of the lateral member 501a is supported by a support 501b upwardly extending from the upper portion of the platform side front face 50 of the second door 5. The lateral member 501a is supported at a distance away from the upper portion of the platform side front face 50.

The handrails 301, 401, 501 together form a telescopic handrail. When the moveable platform barrier is in the closed position, the first door 4 is received in the door housing portion of the door receiving member 3 from its rearward portion and the second door 5 is received in the door housing portion of the first door 4 from its rearward portion. At this time, the lateral member 401a is received in the inner forward end portion of the lateral member 301a from its rearward end portion and the lateral member 501a is received in the inner forward end portion of the lateral member 401a from its rearward end portion.

Referring to Figs. 8 to 10, a running and drive mechanism of the moveable door receiving member 3 will be explained. Fig. 9 shows the running and drive mechanism of the moveable door receiving member 3 in which (A) relates to a drive mechanism using ball screws and (B) relates to a drive mechanism using a belt. Referring to Fig. 9 to 11, two sets of wheels spaced apart in both widthwise direction and depth direction (thickness direction) of the door receiving member 3, four wheels 35 altogether are mounted on the bottom surface 34 of the moveable door receiving member 3. Each wheel 35 is rotatably supported by a vertically extending plate-like bracket 36. A narrow groove 15 is provided on the floor of the platform 1 and the plate-like bracket 36 extends through the groove. The width of the groove 15 is preferably designed such that insertion of passenger’s shoes and any other footwear, a tip of stick, rollers of the bottom of a bag and such into the groove is prevented.

The handrail 301 comprises a lateral member 301a having a length substantially the same as a width of door receiving member 3 and supports 301b upwardly extending from the upper portion of the platform side front face 30 of the door receiving member 3. The supports 301b support the lateral member 301a so as to distance the lateral member 301a away from the upper portion of the platform side front face 30.

The handrail 401 comprises a lateral member 401a having a length substantially the same as a width of the first door 4 where a rearward end of the lateral member is slidably received inside the forward end portion of the lateral member 301a and a forward end of the lateral member is supported by a support 401b upwardly extending from the upper portion of the platform side front face 40 of the first door 4. The lateral member 401a is supported at a distance away from the upper portion of the platform side front surface 40.

The handrail 501 comprises a lateral member 501a having a length substantially the same as a width of the second door 5 where a rearward end of the lateral member 501a is slidably received inside the forward end portion of the lateral member 401a and a forward end of the lateral member 501a is supported by a support 501b upwardly extending from the upper portion of the platform side front face 50 of the second door 5. The lateral member 501a is supported at a distance away from the upper portion of the platform side front face 50.
member 3 stops. member 3 reaches a predetermined position, the rotation of the platform 1. When the door receiving member 3 travels in the lengthwise direction of the platform 1. When the door receiving member 3 reaches a predetermined position, the rotation of the motor M stops so that the running door receiving member 3 stops.

[0076] Referring to Figs 8(B) and 10, in a space below the floor of the platform 1 where the guide rail 2 is embedded, a looped belt 21 extends in the lengthwise direction of the guide rail 2 corresponding to each movable door receiving member 3. The belt 21 is looped over a driven pulley 22 at one side of the guide rail 2 and is looped over a driving pulley 23 at the other side of the guide rail 2. The belt 21 has an upper portion 21A and a lower portion 21B. The bracket 36 supporting the wheel 35 travels along the guide rail 2 and the drive mechanism of Fig. 8(B). Among Figs. 9, 10, 11, and 12, the same reference numerals are assigned to the same elements. Substantial differences between the embodiments of Fig. 9 and Fig. 11, and between the embodiments of Fig. 10 and Fig. 11 are that positions of the running portion (guide rail 2, wheel 35, stopper wheel 37) and drive portion (motor M, ball screw 16, slider 17, belt 21, driving pulley 22, driven pulley 23) are altered. According to the embodiments of Figs 11 and 12, maintenance of the drive portion can easily be done by removing a cover 20.

[0077] A moveable platform barrier with a moveable door receiving member 3 has been proposed (patent documents 3 and 4), and the running and drive mechanism of the moveable door receiving member 3 is not limited to the disclosure of the present specification and can be readily designed by a person having ordinary skill in the art. However, according to the present invention, it is noted that stable standing/running of a moveable door receiving member can be obtained by employing the moveable door receiving member 3 having a triangular profile which enables simple arrangement of a driving mechanism.

[0079] Referring to Figs. 14 to 18, other embodiments will be explained. A moveable platform barrier comprises a door receiving member 3, a first door 4', and a second door 5'. The first and second doors 4' and 5' are moveably provided in the door receiving member 3 between a position where the door is projected from respective side of the door receiving member 3 and a position where the door is retracted inside the door receiving member 3. As shown in Fig. 15, the door receiving member 3, the first door 4' and the second door 5' comprise a first vertical surface 30, 40' and 50' and a second inclined surface 31, 41', and 51' and have a triangular profile and are similar figures. The first and second doors 4' and 5' are slidable provided in the door receiving member 3 via sliding means 38.

[0080] Referring to Fig. 14, the door receiving member 3, the first door 4' and the second door 5' comprise frames 3000, 4000, and 5000 respectively, each having vertically extending frame members and horizontally extending frame members, and thin front plates 3001, 4001, and 5001 installed on the frame 3000, 4000, and 5000 respectively. These arrangements enable lightening of the structures while maintaining strength of structures. Cross sectional shapes of the frames correspond with cross sectional shapes of the door receiving member 3, the first door 4' and the second door 5', respectively.

[0081] According to the illustrated aspect, the sliding means comprises a door supporting rail which extends horizontally in a width direction of the door receiving member 3 and is provided at a lower portion of the door receiving member 3 and driven rollers which is provided at lower portions of the first door 4' and the second door 5' and rotate along the door supporting rail. By locating the sliding means 38 at the lower portion of the moveable platform barrier, center of gravity can be lowered and a relatively large lower space can effectively be utilized. More specifically, lower portions of the second surfaces 31, 41' and 51' of the door receiving member 3, the first door 4', and the second door 5' are vertical and the driven rollers are provided at lower portions of the first surfaces 30, 40' and 50 and the second surfaces 31, 41' and 51'. The door supporting rail is supported by the bottom 33 of the door receiving member 3 or a member upwardly extending from the bottom 33 of the door receiving member 3. According to the illustrated aspect, in a retracted state (a stowed state), forward ends of the first and second doors 4' and 5' are coincident with the side face of the door receiving member 3 or hidden inside the side face (namely, there is no remaining portion of the door). A rearward end of the second door 5' can be received in a rearward end of the first door 4'. Guide means (see. Figs 4B and 4C) may be adequately provided between opposing surfaces of the door receiving member 3, the first door 4' and the second door 5'.

[0082] A drive mechanism of the door receiving member 3 is similar to the foregoing embodiment and will be explained briefly. A lower portion of the door receiving member 3 is provided with a support plate extending into
the platform floor through a narrow groove provided in
the platform floor and a roller assembly provided at the
support plate. The roller assembly comprises two types
of rollers, a roller 35 rotating along a lower rail 2' and a
roller 37 rotating along an upper rail 20'. A drive mecha-
nism of the door receiving member 3 comprises a motor
M provided inside the platform floor for driving the door
receiving member, a driving pulley 22, two driven pulleys
(only one driven pulley 23 is shown in Fig. 14), and a
drive belt 21 looped over the two driven pulleys 23. The
drive mechanism may adequately comprise a reducer and
tension pulley.

[0083] A door driving mechanism will be explained.
The driving mechanisms of the first door 4' and second
doors 5' are the same. The mechanism comprises a ball
screw 80 extending along the moveable direction (width
direction) of the first door 4' and second door 5' for open-
ning and closing of the doors. The ball screws 80 are pro-
vided at the first door 4' and second door 5' respectively,
and the first and second doors 4' and 5' move together
with the movement of the ball screws 80. A rotation of
the ball screw 80 is prevented by rotation prevention
means comprising a stopper ring 81 provided at an end
of the ball screw 80 and a rail 82 provided at the door
receiving member 3. A ball nut 83 is provided at the door
receiving member 3 via a seat for reception 84 of the ball
nut. The ball nut 83 is provided on an outer surface of the
ball screw 80 such that the ball screw 80 moves in the
lengthwise direction thereof by rotating the ball nut 83
with ball nut rotating means. The ball nut rotating means
comprises motors M1 and M2 provided at the
door receiving member 3 for driving the doors, a driving
pulley 85, a driven pulley 86, and a drive belt 87. The ball
screw 80 moves back and forth associated with the for-
ward/reverse rotation of the ball nut 83 so that opening/
closing movement of the first door 4' and the second door
5' is obtained.

[0084] Portions 90 for supporting a forward end of the
doors are provided side by side in the depth direction of
the door at a lower portion of the forward end portion of
the first door 4' and the second door 5', respectively. The
portion 90 for supporting a forward end of the door com-
prises a support plate extending inside the platform
through a narrow groove provided in the platform floor
and a roller assembly provided at the support plate. The
roller assembly comprises a supporting frame 91 and
three rollers 92, 93, 94 in which one roller 92 rotates along
a lower rail 2' and two roller 93, 94 rotate along an upper
rail 20'. According to the illustrated embodiment, the roll-
ers of the door receiving member 3, the first door 4'
and the second door 5' are guided along the common upper
and lower guide rails 2', 20'.

[0085] The moveable platform barrier comprises a plu-
arity of units arranged in series in the lengthwise direction
of the platform where the each unit comprises the door
receiving member 3 and the first and the second doors
4' and 5' which are projectable from either side of the
door receiving member 3 respectively. In either of the
running state and stationary state besides forming a pas-
sage for passengers, the moveable platform barrier is in
a closed state where forward ends of the opposed doors
(a first door 4' of a unit and a second door 5' of a unit
adjacent to the former) of neighboring units are in contact
with or in close proximity to each other. The moveable
platform barrier comprises a locking device for maintain-
ing the closed state of the platform barrier. The locking
device is unlocked when forming the passage corre-
spanding to an entrance of the train.

[0086] The locking device comprises a rotatable en-
gaging element 95 provided at one door and a portion
96 to be engaged provided at the other door with respect
to the two doors whose forward ends are in contact with
or in close proximity to each other. The locking device is
in a locked state when the element 95 engages the por-
tion 96 to be engaged. When the forward ends of the
doors are in contact with or in close proximity to each
other, the element 95 engages the portion 96 to be en-
gaged such that the locked state is obtained. When the
forward ends of the doors move away from each other,
the element 95 rotates about a rotating support pin 950
to disengage the portion 96 for unlocking. Locking/un-
locking of the locking device can be implemented me-
chanically or electrically. The state where the forward
ends of the doors are in contact with or in close proximity
to each other can be maintained by acting force toward
to each other by motors M1, M2 during the running/sta-
tionary state of the platform barrier besides forming an
opening for passengers. For example, a certain current
is supplied to the motors M1, M2 to apply torque in the
closing direction of the doors when the motors M1, M2
not rotating. By doing so, the doors move while maintain-
ing the closed state during waiting for the train.

[0087] The rotatable engaging element 95 and the por-
tion to be engaged 96 are mounted on the supporting
frame 91 of the portion 90 for supporting a forward end
of the door. The rotatable engaging element 95 is asso-
ciated with the ball screw 80 for opening and closing of
the door via a rotatable acting element 97. From the
closed position of the doors (the locked state), when the
ball screw 80 moves in a direction for opening the door
to form an opening, the rotatable engaging element 95
rotates upward to disengage the locked state. The rotat-
able acting element 97 is located at the forward end of
the door with an upper end being a rotation fulcrum 970
and a lower side being swingable. A sloped acting surface
971 is provided at a lower portion of the rotatable acting
member 97 and a follower roller 951 provided at an end
of the rotatable engaging element 95 contacts the acting
surface 971. When the rotatable acting element 97 is in
a vertical position, the rotatable engaging element 95 is
in a horizontal position. When the rotatable acting ele-
ment 97 tilts to become an inclined position, the rotatable
engraining element 95 rotates upward from the horizontal
position with the follower roller 951 being guided by the
acting surface 971 of the rotatable acting element 97.

[0088] The rotatable acting element 97 is coupled to
the ball screw 80 by an oval hole 972 of the rotatable acting element 97 receiving a swingable shaft 800 provided on the ball screw 80 such that the rotatable acting element 97 rotates associated with the movement of the ball screw 80. A forward end of the ball screw 80 has support provided by a fixed frame 801 provided at the forward end of the door with a play as to be moveable in the moving direction of the door (the ball screw 80). A forward end member 802 is provided at a forward end of the ball screw 80 so as to prevent the ball screw 80 from getting out of the fixed frame 801. The forward end member 802 is moveable inside the fixed frame 801 in the lengthwise direction of the ball screw 80.

[0089] When the forward end member 802 in the fixed frame 801 is in a position away from the door receiving member 3 (a left hand side in Figs. 17 and 18), the rotatable acting element 97 is in the vertical position and the rotatable engaging element 95 in the horizontal position. According to the illustrated aspect, a rotation fulcrum 970 of the rotatable acting element 97 and the swingable shaft 800 are on the same vertical axis but the swingable shaft 800 in Fig. 17 may be positioned somewhat to the right as long as inadvertent unlocking due to the gravity is prevented when non-powered. When the forward end member 802 in the fixed frame 801 is in a position near the door receiving member 3 (a right hand side in Figs. 17 and 18), the rotatable acting element 97 tilts about the rotation fulcrum 970 to become an inclined position and the rotatable engaging element 95 moves upward with the follower roller 951 provided at the rotatable engaging element 95 being guided by the sloped acting surface 971 formed at the lower portion of the rotatable acting element 97.

[0090] A return spring 98 is provided between the rotatable engaging element 95 and the supporting frame 91 to apply bias for maintaining the horizontal position of the rotatable engaging element 95. When the rotatable acting element 97 moves to the vertical position from the inclined position, the rotatable engaging element 95 returns to the horizontal position by biasing force of the return spring 98. When the ball screw 80 moves in the closing direction of the door, the forward end member 802 on the ball screw 80 is in the position away from the door receiving member 3 in the fixed frame 801 and the rotatable engaging element 95 is in the horizontal position. When the forward ends of the doors are in contact with or in close proximity to each other, the sloped surface 952 at the forward end of the rotatable engaging element 95 contacts the portion 96 to be engaged such that the rotatable engaging element 95 moves upward to run over the portion 96 to be engaged with the sloped surface 952 being guided by the portion 96 to be engaged and returns to the horizontal position by the return spring 98, thereby the rotatable engaging element 95 engaging the portion 96 to be engaged to become the locked position. Referring to Fig. 17, the center of gravity of the rotatable engaging element 95 is positioned to the left of the rotatable support 950 and the rotatable engaging element 95 falls in the direction of engagement even when the return spring 98 is broken.

[0091] The present invention can be utilized as a moveable platform barrier installed on a platform.

Claims

1. A moveable platform barrier comprising:

   a door receiving member (3) having a platform-side front face (30), a track-side front face (31), a bottom (33), and a top (32);
   a door (4, 5) moveably provided in said door receiving member (3) between a position where the door is projected from a side of said door receiving member and a position where the door is retracted into the door receiving member;
   a guide element (2) provided in a platform floor and extended in a lengthwise direction of a platform (1);
   characterized in that said door receiving member (3) has a depth dimension that gradually decreases from the bottom (33) to the top (32), said door receiving member (3) is provided with a runner (35) and drive means and is configured to be moveable in the lengthwise direction of the platform (1) by said driving means causing said runner to travel along said guide element (2).

2. The moveable platform barrier of claim 1 wherein said door receiving member (3) has a triangular or trapezoidal profile with the platform-side front face (30), an inclined track-side face (31), the bottom (33), and the top (32).

3. The moveable platform barrier of claim 1 wherein said door receiving member (3) has a triangular or trapezoidal profile with an inclined platform-side front face (30), the track-side front face (31), the bottom (33), and the top (32).

4. The moveable platform barrier of any one of claims 1 to 3 wherein said door comprises a runner (92, 93, 94) at a bottom of a forward end of the door and a forward end portion of the door is supported by the runner (92, 93, 94).

5. The moveable platform barrier of claim 4 wherein the runners (35, 92, 93, 94) of the door receiving member and the door are provided under the platform floor and moveable under the platform floor along guide elements (2, 2', 20') extended in the lengthwise direction of the platform (1).

6. The moveable platform barrier of claim 5 wherein the guide element (2) for the runner (35) of the door receiving member doubles as the guide element (2')
for the runner (92) of the door.

7. The moveable platform barrier of any one of claims 1 to 6 wherein said door receiving member (3) is provided on the platform (1) with a lower end of the track-side front face (31) being in close proximity to or coincident with an edge of the platform and the door is configured to prevent forming a space that would allow a passenger to get trapped between said door in a closed position and the edge of the platform when said door is in the closed position where the door is projected from a side of the door receiving member (3).

8. The moveable platform barrier of any one of claims 1 to 7 wherein the door (4, 5) comprises a platform-side front face (40, 50), a track-side front face (41, 51), a bottom (43, 53), and a top (42, 52), and has a depth dimension that gradually decreases from the bottom (43, 53) to the top (42, 52).

9. The moveable platform barrier of claim 8 wherein the door (4, 5) has a triangular or trapezoidal profile with the platform-side front face (40, 50), the track-side face (41, 51), the bottom (43, 53), and the top (42, 52).

10. The moveable platform barrier of claim 8 or 9 wherein the door receiving member (3) is provided with a plurality of the doors (4, 5, 4', 5') and wherein said plurality of doors (4, 5, 4', 5') and the door receiving member (3) are configured to slide one another.

11. The moveable platform barrier of any one of claims 8 to 10 wherein the door receiving member (3) comprises a first door (4') and a second door (5') which are projectable from either side of said door receiving member (3) wherein a rearward end of said first door (4') is slidably receivable in the door housing member (3) from one side thereof, and a rearward end of said second door (4') is slidably receivable in the door housing member (3) from the other side thereof.

12. The moveable platform barrier of claim 11 wherein a rearward side of said first door (4') comprises an opening and a rearward end portion of said second door (5') is slidably moved into said first door.

13. The moveable platform barrier of any one of claims 1 to 12, said moveable platform barrier comprising a series of units arranged along the lengthwise direction of the platform, each unit comprising the door receiving member (3) and doors (4', 5') that is projectable from either side of the door receiving member (3) wherein besides forming an opening for passengers, said barrier is in a closed state where forward ends of opposed doors of neighboring units are in contact with or in close proximity to each other and said barrier comprises a locking device (95, 96) that maintains the closed state of the barrier in stationery/moving state besides forming the opening.

14. The moveable platform barrier of claim 13 wherein said locking device (95, 96) is located under the platform floor.

15. The moveable platform barrier of any one of claims 1 to 7 wherein said door (8) is comprised of a plurality of elongated members (6) extending horizontally from a side (34) of the door receiving member (3).

16. The moveable platform barrier of claim 15 wherein rearward ends and/or forward ends of said plurality of elongated members (6) are integrated with a panel (7) and said plurality of elongated members (6) are configured to be moveable by moving at least one of said elongated members with the drive means.

17. The moveable platform barrier of claim 15 or 16 wherein said door receiving member (3) comprises a truss structure and wherein a plurality of receiving spaces (S1, S2) having a triangular cross section and extending horizontally between sides of the door receiving member (3) are formed inside the door receiving member (3) with said truss structure, and each of said elongated members (11, 13) is receivable in the corresponding receiving space (S1, S2).

18. The moveable platform barrier of claim 17 wherein said elongated member (11, 13) and said receiving space (S1, S2) are substantially the similar figures in cross section.
Fig. 3B
Fig. 18
### INTERNATIONAL SEARCH REPORT

**International application No.:** PCT/JP2010/069802

**A. CLASSIFICATION OF SUBJECT MATTER**
B61B1/02 (2006.01)i, E01F1/00 (2006.01)i, E05F15/14 (2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)
B61B1/02, E01F1/00, E05F15/14

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

- Jitsuyo Shinan Koho 1922-1996
- Jitsuyo Shinan Toroku Koho 1996-2010
- Kokai Jitsuyo Shinan Koho 1971-2010
- Toroku Jitsuyo Shinan Koho 1994-2010

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

<table>
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<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<td>JP 2006-008067 A (East Japan Railway Co., Nabtesco Corp.), 12 January 2006 (12.01.2006), entire text; all drawings (Family: none)</td>
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- **X** Further documents are listed in the continuation of Box C.
- **\[\]** See patent family annex.

- **A** document defining the general state of the art which is not considered to be of particular relevance
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- **Date of the actual completion of the international search:** 10 December, 2010 (10.12.10)
- **Date of mailing of the international search report:** 21 December, 2010 (21.12.10)

- **Authorized officer:**
- **Telephone No.:**

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REFERENCES CITED IN THE DESCRIPTION

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