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(54) RAILWAY VEHICLE DOOR DEVICE AND RAILWAY VEHICLE DOOR SYSTEM

SCHIENENFAHRZEUGTÜRVORRICHTUNG UND SCHIENENFAHRZEUGTÜRSYSTEM

DISPOSITIF DE PORTE DE VÉHICULE FERROVIAIRE ET SON SYSTÈME

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(56) References cited:
EP-A1- 1 013 864 DE-C- 564 572
GB-A- 604 101 JP-A- 10 088 895
JP-A- 58 026 177 JP-A- 62 253 888
JP-A- 2001 049 943 JP-A- 2001 049 944
JP-A- 2001 055 860 JP-U- 59 054 679
JP-U- 63 129 076

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Description

TECHNICAL FIELD

[0001] The present invention relates to a door device and a door system provided to an entrance port of a railroad vehicle.

BACKGROUND ART

[0002] A door device has been conventionally been used to let rail road passengers get on and off. Regarding the door devices for railroad vehicles, there are cases where a number of passengers lean on the doors during the peak of commuting hours, thus applying various forces to the doors. For this reason, various studies have been conducted on railroad vehicle door devices, taking into account the safety of passengers.

[0003] For example, Patent Document 1 discloses a side sliding door device for trains, having side sliding doors suspended and supported moveably with an aide of door rollers, which device is intended to ensure smooth operation of opening or closing and improve the safety.

[0004] The train side sliding door device of the Patent Document 1 having two door rollers for supporting the side sliding door against the downward load of the sliding door, is additionally provided with a guide roller for restricting an upward movement of the side sliding door. Further, a gap between the guide roller and the ceiling plane of the door rail is made smaller than that between the door roller and the ceiling plane.

[0005] With the train side sliding door device of Patent Document 1, the guide roller abuts the door rail ceiling plane before the two door rollers, even when the side sliding door receives a traverse load from the passengers and the door rollers move upward along the curve of the floor plane of the door rail. Therefore, the door rollers will not contact the door rail ceiling plane to cause a stuck state. Further, even if a foreign material is caught between the side sliding door while the gap between the door rollers and the door rail ceiling plane is big, the side sliding doors will not be largely tilted.

[0006] EP 1 013 864 describes a trolley for a sliding door, having a running roller rolling on a running rail for supporting the sliding door. A counter rail on which a counter roller rolls is also described, whereby the running and counter rollers have an associated rocker-shaped running mechanism bearer.

[0007] GB 604 101 describes a sliding door suspended from a runner including a lever on which two rollers are mounted. The rollers are adapted to travel in channel guide.

[0008] DE 564 572 describes an adjustable sliding door hanger having an eccentric ring for adjusting the door.

[0009] [Patent Document 1] Japanese Unexamined Patent Publication No. 007985/2005 (Tokukai2005-007985)

DISCLOSURE OF THE INVENTION

[TECHNICAL PROBLEM]

[0010] In the railroad vehicle door device or of Patent Document 1 or any other known railroad vehicle door devices, the gap between the door rollers and a rail unit provided at an upper portion needs to be adjusted after placing the door rollers on the rail unit, for the purpose of preventing derailing of the door rollers from the rail unit.

[0011] However, a structure for adjusting the gap between the door rollers and the rail unit has been a technical problem to be solved in the railroad field in which safe transportation of passengers is required, for the reason that the possibility of having the door rollers derailed from the rail unit is high, when such an adjustment mechanism is damaged or broken down.

[0012] It is therefore an object of the present invention to provide a railroad vehicle door device capable of preventing derailing of the door rollers from the rail unit thus ensuring safe opening or closing of the door.

[0013] It is another object of the present invention to provide a railroad vehicle door device capable of preventing derailing of the door rollers from the rail unit thus ensuring safe opening or closing of the door, which device allows reduction of manufacturing and set-up costs.

[TECHNICAL SOLUTION AND EFFECTS]

[0014]

(1) A railroad vehicle door device of the present invention includes the features according to claim 1. In the railroad vehicle door device of the present invention, the support unit is formed so as to be able to move in the C-shape cross section by the first door roller and the second door roller. Moving this suspender suspending the door opens or closes the railroad vehicle door. To the support unit is provided the first door roller. To one end of the support unit is the second door roller, and the suspender on the other end of the support unit. Thus, when a vertically downward force stemming from the self-load of the door works on the other end of the support unit, the first door roller is supported by one side of the rail unit. The first door roller serves as a fulcrum, and the second door roller is subject to a vertically upward force and supported by the other side of the rail unit.

In this case, the self-load of the door works on the suspender. The first door roller then serves as a fulcrum, and causes the second door roller to abut the side of the rail unit opposite to the side where the first door roller abuts, thereby supporting the door. Thus, there is no need for a gap that requires adjustment for preventing derailing, and an adjustment mechanism is no longer necessary. This prevents derailing attributed to damage or breakdown of the adjustment mechanism, and allows safe and reliable

opening or closing of the doors. Further, no adjustment work is necessary because there is no adjustment mechanism, which enables reduction of manufacturing and installing costs. Since the first door roller and the second door roller are provided to the support unit, the first door roller and the second door roller are easily inserted from an end of the rail unit having the C-shape cross section, at the time of assembling.

(2)

The railroad vehicle door device of the present invention may further include a plate member formed along a length direction of the rail unit, wherein the support unit is provided symmetrically on each side of the plate member, the support unit being provided with the first door roller, the second door roller, and the suspender.

In this case, the support unit is provided on each side of the plate member. Therefore, the plate member and the support unit can be handled as a single unit. Further, the distance between the suspenders of each support unit is made constant. Therefore, unlike a case of forming separate members, no positioning process is necessary, and the door is easily suspended. Further, the support unit symmetrically provided on the left and right restrains load applied to the first door roller and the second door roller, when reciprocating the plate member and the pair of support units relative to the rail unit, thus enabling smooth reciprocation along the rail unit.

(3) The railroad vehicle door device of the present invention is preferably adapted so that: an imaginary line connecting a shaft of the first door roller and a shaft of the second door roller is slightly tilted from the length direction of the rail unit.

In this case, the first door roller and the second door roller are not largely tilted, and sufficient distance between the shafts of the first door roller and the second door roller is ensured. This disperses the self-load (acting force) from the door via the suspender of the support unit to the first door roller and the second door roller, in a balanced manner, and also absorbs an offset-load from the door. As a result, an increase in the load from reciprocation of the support units and an offset load are absorbed, and smooth reciprocation along the rail unit is possible.

(4) The railroad vehicle door device of the present invention is preferably adapted so that: an opening of the C-shape cross section of the rail unit has a pair of convex rails and the outer circumferential surface of the first door roller has a concave rail-facing portion, or the opening of the C-shape cross section of the rail unit has a pair of concave rails, and the outer circumferential surface of the first door roller has a convex rail-facing portion; and the shortest spacing distance between the convex or the concave rails of said pair of rails is shorter than the maximum circumference diameter of the first door roller.

In this case, the rail unit has the pair of concave or convex rails, and the first door roller has a rail-facing portion having a shape that corresponds to the rails. The gap between the rail-facing portion and the rail is preferably between 0.5 mm, inclusive, and 10 mm, inclusive, and is more preferably between 1 mm, inclusive, and 2 mm, inclusive. Further, the shortest spacing distance of the rail unit is smaller than the diameter of the first door roller. Therefore, it is possible to completely prevent derailing of the first door roller from the rail unit. As a result, even when the door is subject to a vertically upward or downward force or a swing force, the first door roller does not derail from the rail unit. Note that the first door roller is inserted from an end of the rail unit at the time of assembling.

(5) The railroad vehicle door device of the present invention is preferably adapted so that: an opening of the C-shape cross section of the rail unit has a pair of convex rails, and the outer circumferential surface of the first door roller has a concave rail-facing portion, or the opening of the C-shape cross section of the rail unit has a pair of concave rails, and the outer circumferential surface of the first door roller has a convex rail-facing portion; and the shortest spacing distance between the convex or the concave rails of said pair of rails is shorter than the maximum circumference diameter of the second door roller.

In this case, the rail unit has the pair of concave or convex rails, and the second door roller has a rail-facing portion having a shape that corresponds to the rails. The gap between the rail-facing portion and the rail is preferably between 0.5 mm, inclusive, and 10 mm, inclusive, and is more preferably between 1 mm, inclusive, and 2 mm, inclusive. Further, the shortest spacing distance of the rail unit is smaller than the diameter of the second door roller. Therefore, it is possible to completely prevent derailing of the second door roller from the rail unit. As a result, even when the door is subject to a vertically upward or downward force or a swing force, the second door roller does not derail from the rail unit. Note that the second door roller is inserted from an end of the rail unit at the time of assembling.

(6) The railroad vehicle door device of the present invention may be adapted so that: a hole that enables suspension from the suspender is formed on a core material forming the door.

In this case, the hole that enables the suspension are formed on the core material of the door. As such, there is no need for a separate process of attaching to the door a member having the hole for enabling the suspension. It is therefore possible to simplify the manufacturing and installing process.

(7) The railroad vehicle door device of the present invention may be adapted so that: a plurality of slotted holes are formed on a core material forming the door, the plurality of slotted holes being capable of

holding shafts on the opposite side of the first door roller and the second door roller (on the side of the rollers opposite to the rail unit), the shafts being held at one end by the support unit.

In this case, the slotted holes formed on the core material of the door holds the shafts of the first door roller and the second door roller. Further, these holes having ellipsoidal shape prevent the first door roller and the second door roller from being directly subject to the self-load of the door. Further, since the core material holds the shafts on the opposite side of the support unit, the circumferences of the first door roller and the second door roller are protected by the support unit and the core material of the door.

(8) The railroad vehicle door device of the present invention may be adapted so that: the suspender is provided to the support unit and is rotatable by a disc-like member and a decentralized shaft of the disc-like member, and the suspender of the door is suspended from the disc-like member so as to enable adjustment of the levellness of the door. The suspender may be structured so that the plate member and the support unit are fixed by the same shaft.

In this case, rotating the decentralized disc-like member enables adjustment of the suspender in relation to the vertically upward or downward direction. This allows easy adjustment of the height of the door.

(9) The railroad vehicle door device of the present invention is adapted so that: a core material of the door is provided so as to extend over a portion which is suspended from the suspender.

In this case, the core material provided so as to extend over the portion suspended from the suspender. Therefore, the suspender is able to reliably hold the vertically downward load from the door. As a result, there is no unnecessary return force or moment force between the suspender and the core material, and the suspender therefore is able to stably hold the core material.

(10) The railroad vehicle door device of the present invention may be adapted so that: the support unit further includes a screw fastener part for fixation on the plate member.

In this case, the support unit is reliably fixed on the plate member. Unlike the case of fixing only the suspender, the support unit and the plate member are fixed by a plurality of shafts. Therefore, it is possible to reliably fix the plate member and the support unit.

As a result, the support unit and the plate member are smoothly moved along the rail unit.

(11) A railroad vehicle door system of the present invention includes the features according to claim 11.

[0015] In the railroad vehicle door system of the present invention, the support unit is formed so as to be able to move in the C-shape cross section by the first door roller and the second door roller. The system is structured to enable opening or closing of the door by

moving this suspender suspending the door. To the support unit is provided the first door roller. To one end of the support unit is the second door roller, and the suspender on the other end of the support unit. Thus, when a vertically downward force stemming from the self-load of the door works on the other end of the support unit, the first door roller is supported by one side of the rail unit. The first door roller serves as a fulcrum, and the second door roller is subject to a vertically upward force and supported by the other side of the rail unit.

[0016] In this case, the self-load of the door works on the suspender. The first door roller then serves as a fulcrum, and causes the second door roller to abut the side of the rail unit opposite to the side where the first door roller abuts, thereby supporting the door. Thus, there is no need for a gap that requires adjustment for preventing derailing, and an adjustment mechanism is no longer necessary. This prevents derailing attributed to damage or breakdown of the adjustment mechanism, and allows safe and reliable opening or closing of the doors. Further, no adjustment work is necessary because there is no adjustment mechanism, which enables reduction of manufacturing and installing costs. Since the first door roller and the second door roller are provided to the support unit, the first door roller and the second door roller are easily inserted from an end of the rail unit having the C-shape cross section, at the time of assembling.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

Fig. 1 is a schematic diagram illustrating a structure of an exemplary railroad vehicle door system adopting an embodiment of a railroad vehicle door device, according to the present invention.

Fig. 2A is a plane view illustrating an exemplary door roller device of the railroad vehicle door device.

Fig. 2B is a top view illustrating an exemplary door roller device of the railroad vehicle door device.

Fig. 3 is an enlarged view schematically illustrating the door roller device of the railroad vehicle door device in the rail unit.

Fig. 4 is a cross sectional view taken along the line A-A of Fig. 3.

Fig. 5 is a cross sectional view taken along the line B-B of Fig. 3.

Fig. 6 is a cross sectional view taken along the line C-C of Fig. 3.

Fig. 7 is a cross sectional view taken along the line D-D of Fig. 3.

Fig. 8 is a diagram showing the railroad vehicle door device (right door leaf hanging on the door roller device).

Fig. 9 is a schematic cross sectional view illustrating a cross section taken along the line E-E of Fig. 8.

REFERENCE NUMERALS

[0018]

100	Door Roller Device
110	First Door Roller
110a, 120a	Concave rail-facing portion
112, 113	Shaft
120	Second Door Roller
140	Screw Fastener Part
150	Suspender
152	Disc-Like Member
160	Right Plate
170	Left Plate
180	Shared plate
200	Rail unit
200a	Convex pair of rails
300	Drive Mechanism
500	Railroad Vehicle Door system
710	Left Door Leaf
720	Right Door Leaf
750	Suspension member
751,752,761,762	Hole
753,754,763,764	Slotted Hole
781,782	Suspender
800	Railroad Vehicle door Device
θ	Angle

BEST MODE FOR CARRYING OUT THE INVENTION

The following describes an embodiment of the present invention. (First Embodiment)

[0019] Fig. 1 is a schematic diagram illustrating a structure of an exemplary railroad vehicle door system adopting an embodiment of a railroad vehicle door device, according to the present invention.

[0020] As illustrated in Fig. 1, a railroad vehicle door system 500 includes a drive mechanism 300 and a railroad vehicle door device 800. Further, the railroad vehicle door device 800 includes: door roller devices 100, a rail unit 200, a left door rack 310, a right door rack 320, a control box 400, communicating members 600 and 610, a left door leaf 710, and a right door leaf 720.

[0021] The drive mechanism 300 of Fig. 1 is provided with the right door rack 320 and a left door rack 310. The right door rack 320 and the left door rack 310 extends in the horizontal direction and are parallel to each other. The leading ends of the right door rack 320 and the left door rack 310 are provided with communicating members 600 and 610, and the communicating member 610 is fixed on the door roller devices 100. Each door roller device 100 is formed along the rail unit 200 and is moveable. Further, the door roller device 100 is provided so as to enable suspension of the left door leaf 710 and the right door leaf 720.

[0022] In such a railroad vehicle door system 500 of Fig. 1, the drive mechanism 300 is driven according to

an instruction from the control box 400. The driving of the drive mechanism 300 moves the right door rack 320 and the left door rack 310 in such a manner that these door racks extend or constrict in the horizontal direction, thus moving the communicating members 600 and 610 at the leading ends of the right door rack 320 and the left door rack 310. The movement of the communicating members 600 and 610 moves the door roller devices 100 along the rail unit 200, thereby opening or closing the left door leaf 710 and the right door leaf 720.

[0023] The following details the door roller devices 100. Fig. 2A is a plane view illustrating an exemplary door roller device 100. Fig. 2B is a top view illustrating an exemplary door roller device 100.

[0024] As illustrated in Fig. 2A, each door roller device 100 essentially includes: first door rollers 110, second door rollers 120, screw fastener parts 140, suspenders 150, a right plate 160, a left plate 170, and a shared plate 180.

[0025] As illustrated in Figs. 2A, 2B, the shared plate 180 is provided so as to extend in the horizontal direction. The right plate 160 and the left plate 170 are fixed on the left and right of the shared plate 180 respectively and are symmetrical to each other.

[0026] The right plate 160 fixed to an end portion of the shared plate 180 is provided with a first door roller 110, a second door roller 120, a screw fastener part 140, and a suspender 150. To the screw fastener part 140 and the suspender 150 of the right plate 160 are provided later-mentioned bolts each penetrating through the shared plate 180 and fixes the right plate 160. Similarly, the left plate 170 fixed to an end portion of the shared plate 180 is provided with a first door roller 110, a second door roller 120, a screw fastener part 140, and a suspender 150. To the screw fastener part 140 and the suspender 150 of the left plate 170 are provided bolts each penetrating through the shared plate 180 and fixes the left plate 170.

[0027] Next, the following describes the right plate 160 in the rail unit 200 of Fig. 3. Fig. 3 is an enlarged view schematically illustrating the door roller device 100 in the rail unit 200. Fig. 4 is a cross sectional view taken along the line A-A of Fig. 3. Fig. 5 is a cross sectional view taken along the line B-B of Fig. 3. Fig. 6 is a cross sectional view taken along the line C-C of Fig. 3. Fig. 7 is a cross sectional view taken along the line D-D of Fig. 3.

[0028] As illustrated in Figs. 3 through 7, the rail unit 200 is a long member having a C-shape cross section. Each end portion of the C-shape cross section of the rail unit 200 has a convex curved surface. Further, the right plate 160 is disposed so as to be in the rail unit 200. As illustrated in Figs. 4 through 7, the right plate 160 is formed so that the portion fixed to the shared plate 180 has a thickness and a shape different from those of the portions of the right plate 160 holding the first door roller 110 and the second door roller 120 (see Fig. 2B).

[0029] When the later-mentioned right door leaf 720 is suspended on the suspenders 150, each suspender 150

is subject to a downward force. This causes the first door roller 110 to contact the lower part of the rail unit 200 and function as the fulcrum. The second door roller 120 on the other hand contacts the upper part of the rail unit 200 and serves as a point of counteraction. During this state, an imaginary line connecting the shafts of the first door roller 110 and the second door roller 120 forms a slight angle θ such as three degree or smaller with respect to the direction in which the rail unit 200 extends. Note that it is preferable that the imaginary line connecting the shafts of the first door roller 110 and the second door roller 120 forms an angle θ of not more than one degree with respect the direction in which the rail unit 200 extends.

[0030] The right plate 160 has a slope 160a on the side of the right plate 160 to be fixed to the shared plate 180. To the leading end of the right plate 160 having the slope 160a is fixed the suspender 150 by a bolt B. Further, the bolt B fixes not only the suspender 150 but also the right plate 160 to the shared plate 180. To the suspender 150 is attached a disc-like member 152 which is decentralized with respect to the bolt B of the suspender 150. That is, the disc-like member 152 is attached so as to be able to rotate as is indicated by the disc-like member 152 and the disc-like member 152a (broken line) in Fig. 4. Nearby this suspender 150 is provided a screw fastener part 140.

[0031] The screw fastener part 140 is fixed by a bolt B, nearby the suspender 150 fixed to the right plate 160. Further, the bolt B fixes not only the screw fastener part 140, but also the shared plate 180 to the right plate 160. Thus, the right plate 160 is fixed to the shared plate 180 by the bolts B at two parts: at the suspender 150 and the screw fastener part 140.

[0032] As illustrated in Figs. 4 to 7, the rail unit 200 has a substantially C-shape cross section. In the present embodiment, the rails of the rail unit 200 are convex. In the following, the minimum spacing distance between the convex rails of the rail unit 200 is indicated by L11.

[0033] On the other hand, as illustrated in Figs. 2A, 2B, and 6, a first door roller 110 is provided on a line extending through the shafts of the suspender 150 and the screw fastener part 140. The first door roller 110 is provided substantially in the middle of the right plate 160. As illustrated in Figs. 2A, 2B, and 6, the shaft 112 on one side of the first door roller 110 is held by the right plate 160.

[0034] The outer circumferential surface of the first door roller 110 has a concave rail-facing portion 110a that corresponds to the convex 200a rail of the rail unit 200. The minimum circumferential diameter of the concave rail-facing portion 110a of the first door roller 110 is indicated by D11, and the maximum circumferential diameter of the concave rail-facing portion 110a is indicated by D10.

[0035] As illustrated in Fig. 6, the minimum circumferential diameter D11 of the concave rail-facing portion 110a of the first door roller 110 is smaller than the minimum spacing distance L11 between the convex rails 200a of the rail unit 200 by a distance (gap) L10, and the

value of the maximum circumferential diameter D10 of the concave rail-facing portion 110a of the first door roller 110 is greater than that of the minimum spacing distance L11 between the convex rails 200a of the rail unit 200.

[0036] Note that, since the right door leaf 720 is suspended on the suspender 150, the first door roller 110 contacts the convex rails 200a at the vertically lower part of the rail unit 200, and a gap L10 is formed between the first door roller 110 and the convex rails 200a at the vertically upper part of the rail unit 200, in Fig. 6. The gap L10 is preferably between 0.5 mm, inclusive, and 10 mm, inclusive, and is preferably approximately 1 mm in the present embodiment.

[0037] Further, as illustrated in Fig. 6, a ball bearings 113 are mounted in the first door roller 110 so as to enable smooth rotation about the shaft 112 of the first door roller 110.

[0038] Next, the following describes the second door roller 120. As illustrated in Figs. 2A, 2B, and 7, the second door roller 120 is provided to an end portion of the right plate 160. The shaft 122 on one side of the second door roller 120 is held by the right plate 160, as illustrated in Fig. 7.

[0039] The outer circumferential surface of the second door roller 120 has a concave rail-facing portion 120a which corresponds to the convex rails 200a of the rail unit 200. The minimum circumferential diameter of the concave rail-facing portion 120a of the second door roller 120 is indicated by D12, and the maximum circumferential diameter of the concave rail-facing portion 120a is indicated by D13.

[0040] As illustrated in Fig. 7, the minimum circumferential diameter D12 of the concave rail-facing portion 120a of the second door roller 120 is smaller than the minimum spacing distance L11 between the convex rails 200a of the rail unit 200 by a distance (gap) L13, and the maximum circumferential diameter D13 of the concave rail-facing portion 120a of the second door roller 120 is greater than the minimum spacing distance L11 between the convex rails 200a of the rail unit 200.

[0041] Since the right door leaf 720 is suspended on the suspender 150, the second door roller 120 contacts the convex rails 200a at the vertically upper part of the rail unit 200, and a gap L13 is formed between the second door roller 120 and the convex rails 200a at the vertically upper part of the rail unit 200, in Fig. 7. The gap L13 is preferably between 0.5 mm, inclusive, and 10 mm, inclusive, and the gap L10 preferably approximates 1 mm in the present embodiment. Further, the gap L13 may equal to the gap L10 between the first door roller 110 and the rail unit 200.

[0042] Further, as illustrated in Fig. 7, ball bearings 123 are mounted in the second door roller 120 so as to enable smooth rotation about the shaft 122 of the second door roller 120.

[0043] Subsequently, Fig. 8 illustrates the right door leaf 720 suspended from the door roller device 100. Fig. 9 is a schematic cross sectional view taken along the line

E-E of Fig. 8.

[0044] As illustrated in Fig. 8, the door roller device 100 is inserted into the rail unit 200 from an end of the rail unit 200. Then, the right door leaf 720 is suspended relative to the shared plate 180, left plate 170, and the right plate 160.

[0045] Here, as illustrated in Fig. 9, the right door leaf 720 is provided with a suspension member 750 which is a principal member constituting the right door leaf 720. Further, as illustrated in Fig. 8, the suspension member 750 is provided with: a hole 751 corresponding to the suspender 150 of the left plate 170; a hole 752 corresponding to the screw fastener part 140 of the left plate 170; an slotted hole 753 corresponding to the shaft 112 of the first door roller 110 of the left plate 170; an slotted hole 754 corresponding to the shaft 122 of the second door roller 120 of the left plate 170; a hole 761 corresponding to the suspender 150 of the right plate 160; a hole 762 corresponding to the screw fastener part 140 of the right plate 160; an slotted hole 763 corresponding to the shaft 112 of the first door roller 110 of the right plate 160; and an slotted hole 764 corresponding to the shaft 122 of the second door roller 120 of the right plate 160.

[0046] Further, the suspension member 750 is provided with a notch portion 770 at its middle portion, and suspenders 781 and 782 are formed left and right of the notch portion 770. These suspenders 781 and 782 are formed immediately below the hole 751 corresponding to the suspender 150 of the left plate 170, the hole 752 corresponding to the screw fastener part 140 of the left plate 170, the hole 761 corresponding to the suspender 150 of the right plate 160, and the hole 762 corresponding to the screw fastener part 140 of the right plate 160.

[0047] The hole 751 is suspended relative to the disc-like member 152 of the suspender 150 of the left plate 170, and the hole 752 is suspended relative to the screw fastener part 140 of the left plate 170, the hole 761 is suspended relative to the disc-like member 152 of the suspender 150 of the right plate 160, and the hole 762 is suspended relative to the screw fastener part 140 of the right plate 160. Thus, the weight of the right door leaf 720 is supported by the door roller device 100.

[0048] Further, the slotted holes 753, 754, 763, and 764 of the suspension member 750 illustrated in Figs. 8 and 9 are engaged with the outer circumferential surfaces of the shafts 122 of the second door rollers 120 and the shafts 112 of the first door rollers 110 illustrated in Figs. 6 and Fig. 7 in such a manner that a load is not applied to the shafts 112 of the first door rollers 110 and the shafts 122 of the second door rollers 120, as illustrated in Fig. 9. Note that the Figs. 8 and 9 only describes the right door leaf 720; however, the left door leaf 710 illustrated in Fig. 1 also has the same mechanism.

[0049] In the door roller device 100 of the present invention, the shared plate 180, the right plate 160, and the left plate 170 are formed so as to be able to move in the C-shape cross section of the rail unit 200. Moving the

suspenders 150 and the screw fastener parts 140 of the right door leaf 720 and the left door leaf 710 opens or closes the right door leaf 720 and the left door leaf 710. In this case, a vertically downward forces from the self-loads of the right door leaf 720 and the left door leaf 710 work on the suspenders 150 and the screw fastener parts 140 of the right plate 160 and the left plate 170. The first door roller 110 is supported by one of the sides of the rail unit 200, and serves as a fulcrum, and the second door roller 120 is subject to an upward force and is supported by another side of the rail unit 200. Thus, there is no need for a gap that requires adjustment for preventing derailing, and there is no need for an adjustment mechanism. This prevents derailing attributed to damage or breakdown of the adjustment mechanism, and allows safe and reliable opening or closing of the doors. Further, since no adjustment work is necessary because there is no adjustment mechanism, reduction of manufacturing and installing costs are possible.

[0050] Further, since the right plate 160 and the left plate 170 are provided symmetrically on both ends of the shared plate 180 respectively, the first door roller 110 and the second door roller 120 are not largely tilted and sufficient distance between the shafts of the first door roller 110 and the second door roller 120 is ensured, when reciprocating the shared plate 180, the right plate 160, and the left plate 170 along the rail unit 200. This disperses the self-loads

[0051] (acting forces) from the right door leaf 720 via the suspenders 150 and the screw fastener parts 140 of the right plate 160 and the left plate 170 and the left door leaf 710, in a balanced manner, to the first door rollers 110 and the second door rollers 120, and also absorbs an offset loads from the door. As a result, an increase in the load from reciprocation of the right plate 160 and the left plate 170 and an offset loads are absorbed, and smooth reciprocation along the rail unit 200 is possible.

[0052] Further, the pair of convex rails 200a are formed on the rail unit 200, and the concave rail-facing portion 110a and the concave rail-facing portion 120a are formed on the first door roller 110 and the second door roller 120 respectively. The maximum circumferential diameters D10 and D13 are greater than the minimum spacing distance D11 between the convex rails 200a. Therefore, derailing of the first door roller 110 and the second door roller 120 from the rail unit 200 is reliably prevented. As a result, even when the right door leaf 720 and the left door leaf 710 are subject to a vertically upward or downward force or a swing force, the first door roller 110 and the second door roller do not derail from the rail unit 200, and smooth and stable movement of the door roller device 100 along the rail unit 200 is enabled.

[0053] Further, at the time of manufacturing or installing the door roller device 100, the right plate 160 and the left plate 170 are provided on both sides of the shared plate 180, respectively. The door roller device 100 therefore is handled as a single unit, and the distance between the suspenders 150 and the screw fastener parts 140 of

the right plate 160 and the left plate 170 are made constant. This is more advantageous than a case of separately providing these members because the door leaf 710 and the right door leaf 720 are easily suspended without a need for a positioning process.

[0054] Further, the holes 751, 752, 761, 762 and the slotted holes 753, 754, 763, 764 which enables suspension of the right door leaf 720 and the left door leaf 710 are formed on the suspension members 750 of the right door leaf 720 and the left door leaf 710. Therefore, it is possible to omit a conventionally-required step of attaching, to the right door leaf 720 and the left door leaf 710, a separate member having the holes that enables suspension. This allows easier manufacturing of the railroad vehicle door device 800 including the door roller device 100.

[0055] Further, rotating the decentralized disc-like member 152 of the door roller device 100 to move the disc-like member 152 to the position of the disc-like member 152a enables adjustment of the suspenders 150 in relation to vertically upward or downward direction. As a result, the levelness and the height of the right door leaf 720 and the left door leaf 710 are easily adjustable. Further, the slotted holes 753, 754, 763, 764 formed on the suspension members 750 of the right door leaf 720 and the left door leaf 710 hold the shafts 112 and 122 of the first door roller 110 and the second door roller 120. Further, the bolt B fixes not only the suspenders 150 but also the right plate 160 to the shared plate 180. Therefore, fixing the position in relation to the vertical position also allows, at the same time, fixing the door roller device 100 with the first door roller 110 and the second door roller 120 being rotatably abutted to the rail unit 200. This reduces the amount of work in manufacturing or installing as compared with the case of separately fixing the suspenders 150 and the right plate 160.

[0056] Further, the suspension members 750 of the right door leaf 710 and the left door leaf 720 are provided so as to extend over the portion to be suspended from the suspenders 150. Therefore, the suspension members 750 reliably hold the vertically downward load from the right door leaf 720 and the left door leaf 710. As a result, there is no unnecessary return force or a moment force between the suspender 150 and the suspension member 750, and the suspender 150 therefore is able to stably hold the suspension member 750.

[0057] The present embodiment deals with a case where the first door roller 110a and the second door roller 120 have the concave 110a and the rail-facing portion concave 120a. However, the present invention is not limited to this. The first door roller 110 and the second door roller 120 may have a different shape corresponding to the shape of the convex rails 200a of the rail unit 200. Further, in the present embodiment, the suspension member 750 has the notch portion 770 at its middle portion. However, the present invention is not limited to this, and the notch portion 770 does not have to be formed.

[0058] In the embodiment, the left door leaf 710 and

the right door leaf 720 corresponds to the doors at the entrance port. The railroad vehicle door system 500 corresponds to the railroad vehicle door system. The railroad vehicle door device 800 corresponds to the railroad vehicle door device. The drive mechanism 300 corresponds to the drive mechanism. The rail unit 200 corresponds to the rail unit. The right plate 160 and the left plate 170 each corresponds to the support unit. The first door roller 110 corresponds to the first door roller. The second door roller 120 corresponds to the second door roller. The suspender 150 corresponds to the suspenders. The shared plate 180 corresponds to the plate member. The angle θ corresponds to the slope angle. The concave rail-facing portion 110a and the concave rail-facing portion 120a correspond to the concave rail-facing portion. The convex rails 200a correspond to a pair of convex rails. The suspension member 750 corresponds to the core material forming the door of the car. The hole 751, 752, 761, 762 correspond to the hole shapes that enables suspension. The shafts 112 and 113 correspond to the shafts of the first door roller and the second door roller. The slotted holes 753, 754, 763, 764 correspond to the plurality of slotted holes. The disc-like member 152 corresponds to the disc-like member. The suspenders 781 and 782 correspond to portions which is suspended. The screw fastener part 140 corresponds to the screw fastener part. Further, the convex rail 200a corresponds to the rails and the concave rail-facing portion 110a and the concave rail-facing portion 120a corresponds to the rail-facing portion. Structuring in this way enables use of the suspension member 750 also as the core material forming the door of a car, and reduces manufacturing and installing costs as compared with a case of forming separate members.

Claims

1. A railroad vehicle door device (800), comprising:

a door (710, 720) provided at an entrance port of a railroad vehicle;
a rail unit (200) having a C-shape cross section;
a support unit (160, 170) formed along a length direction of the rail unit;
a first door roller (110) provided to the support unit, which is capable of traveling in the C-shape cross section of the rail unit;
a second door roller (120) provided to one end of the support unit, which is capable of traveling in the C-shape cross section of the rail unit; and
a suspender (150) provided to another end portion of the support unit, which is capable of suspending the door, **characterized in that:**

a core material (750) of the door (710, 720) is provided so as to extend over a portion which is suspended from the suspender

- (150).
2. The railroad vehicle door device according to claim 1, further comprising:
 - a plate member (180) formed along a length direction of the rail unit,
 - wherein the support unit is provided symmetrically on each side of the plate member, the support unit being provided with the first door roller, the second door roller, and the suspender.
 3. The railroad vehicle door device according to any one of claims 1 and 2, wherein an imaginary line connecting a shaft of the first door roller and a shaft of the second door roller is slightly tilted from the length direction of the rail unit.
 4. The railroad vehicle door device according to any one of claims 1 to 3, wherein:
 - an opening of the C-shape cross section of the rail unit has a pair of convex rails (200a), and the outer circumferential surface of the first door roller has a concave rail-facing portion (110a), or the opening of the C-shape cross section of the rail unit has a pair of concave rails, and the outer circumferential surface of the first door roller has a convex rail-facing portion; and
 - the shortest spacing distance (L11) between the convex or the concave rails of said pair of rails is shorter than the maximum circumference diameter (D10) of the first door roller.
 5. The railroad vehicle door device according to any one of claims 1 to 4, wherein:
 - an opening of the C-shape cross section of the rail unit has a pair of convex rails (200a), and the outer circumferential surface of the second door roller has a concave rail-facing portion (120a), or the opening of the C-shape cross section of the rail unit has a pair of concave rails, and the outer circumferential surface of the second door roller has a convex rail-facing portion; and
 - the shortest spacing distance (L11) between the convex or the concave rails of said pair of rails is shorter than the maximum circumference diameter (D13) of the second door roller.
 6. The railroad vehicle door device according to any one of claims 1 to 5, wherein a hole (751, 761) that enables suspension from the suspender (150) is formed on a core material (750) forming the door.
 7. The railroad vehicle door device according to any one of claims 1 to 6, wherein a plurality of slotted

holes (753, 754, 763, 764) are formed on a core material forming the door, the plurality of slotted holes (753, 754, 763, 764) being capable of holding shafts (112, 122) on the opposite side of the first door roller and the second door roller, the shafts being held at one end by the support unit.

8. The railroad vehicle door device according to claim 2, wherein: the suspender (150) is provided to the support unit and is rotatable by a disc-like member (152) and a decentralized shaft (B) of the disc-like member, and the suspender (781, 782) of the door is suspended from the disc-like member so as to enable adjustment of the levelness of the door.
9. The railroad vehicle door device according to claim 2, wherein: the support unit further includes a screw fastener part (140) for fixation on the plate member.
10. The railroad vehicle door device according to any of claims 1 to 9, wherein by causing the slotted holes formed on the core material to be engaged with the shafts on the opposite side so that a load is not applied to shafts on the opposite side, the first door roller and the second door roller are provided between the support unit and the core material.
11. A railroad vehicle door system, comprising: the railroad vehicle door device according to any of claims 1 to 10, and a drive mechanism (300) which opens or closes the door of the railroad vehicle door device.

Patentansprüche

1. Schienenfahrzeug-Türvorrichtung (800), umfassend:
 - eine Tür (710, 720), die an einer Eingangsöffnung eines Schienenfahrzeugs vorgesehen ist,
 - eine Schieneneinheit (200) mit einem C-förmigen Querschnitt,
 - eine Trägereinheit (160, 170), die entlang einer Längsrichtung der Schieneneinheit ausgebildet ist,
 - eine erste Türrolle (110), die in der Trägereinheit vorgesehen ist und die in dem C-förmigen Querschnitt der Schieneneinheit laufen kann,
 - eine zweite Türrolle (120), die an einem Ende der Trägereinheit vorgesehen ist und die in dem C-förmigen Querschnitt der Schieneneinheit laufen kann, und
 - eine Aufhängung (150), die an einem anderen Endabschnitt der Trägereinheit vorgesehen ist und an der die Tür aufgehängt werden kann,

dadurch gekennzeichnet, dass:

ein Kernmaterial (750) der Tür (710, 720) derart bereitgestellt ist, dass es sich über einen Abschnitt erstreckt, der an der Aufhängung (150) aufgehängt ist.

2. Schienenfahrzeug-Türvorrichtung nach Anspruch 1, ferner umfassend:

ein Plattenelement (180), das entlang einer Längsrichtung der Schieneneinheit ausgebildet ist, wobei die Trägereinheit symmetrisch an jeder Seite des Plattenelements bereitgestellt ist, wobei die Trägereinheit mit der ersten Türrolle, der zweiten Türrolle und der Aufhängung versehen ist.

3. Schienenfahrzeug-Türvorrichtung nach einem der Ansprüche 1 und 2, wobei eine imaginäre Linie, die eine Welle der ersten Türrolle und eine Welle der zweiten Türrolle verbindet, leicht aus der Längsrichtung der Schieneneinheit geneigt ist.

4. Schienenfahrzeug-Türvorrichtung nach einem der Ansprüche 1 bis 3, wobei eine Öffnung des C-förmigen Querschnitts der Schieneneinheit ein Paar konvexe Schienen (200a) aufweist und die Außenumfangsfläche der ersten Türrolle einen konkaven der Schiene gegenüberliegenden Abschnitt (110a) aufweist oder die Öffnung des C-förmigen Querschnitts der Schieneneinheit ein Paar konkave Schienen aufweist und die Außenumfangsfläche der ersten Türrolle einen konvexen der Schiene gegenüberliegenden Abschnitt aufweist, und der kürzeste Abstand (L11) zwischen den konvexen oder den konkaven Schienen des Schienenpaares kürzer ist als der maximale Umfangsdurchmesser (D10) der ersten Türrolle.

5. Schienenfahrzeug-Türvorrichtung nach einem der Ansprüche 1 bis 4, wobei eine Öffnung des C-förmigen Querschnitts der Schieneneinheit ein Paar konvexe Schienen (200a) aufweist und die Außenumfangsfläche der zweiten Türrolle einen konkaven der Schiene gegenüberliegenden Abschnitt (120a) aufweist oder die Öffnung des C-förmigen Querschnitts der Schieneneinheit ein Paar konkave Schienen aufweist und die Außenumfangsfläche der zweiten Türrolle einen konvexen der Schiene gegenüberliegenden Abschnitt aufweist, und der kürzeste Abstand (L11) zwischen den konvexen oder den konkaven Schienen des Schienenpaares kürzer ist als der maximale Umfangsdurchmesser (D13) der zweiten Türrolle.

6. Schienenfahrzeug-Türvorrichtung nach einem der Ansprüche 1 bis 5, wobei an einem die Tür ausbildenden Kernmaterial (750) ein Loch (751, 761) ausgebildet ist, das das Aufhängen von der Aufhängung (150) ermöglicht.

7. Schienenfahrzeug-Türvorrichtung nach einem der Ansprüche 1 bis 6, wobei auf einem die Tür ausbildenden Kernmaterial eine Mehrzahl von Schlitzlöchern (753, 754, 763, 764) ausgebildet ist, wobei die Mehrzahl an Schlitzlöchern (753, 754, 763, 764) Wellen (112, 122) an der gegenüberliegenden Seite der ersten Türrolle und der zweiten Türrolle halten kann, wobei die Wellen an einem Ende von der Trägereinheit gehalten werden.

8. Schienenfahrzeug-Türvorrichtung nach Anspruch 2, wobei die Aufhängung (150) an der Trägereinheit vorgesehen ist und mittels eines scheibenähnlichen Elements (152) und einer nicht mittig angeordneten Welle (B) des scheibenähnlichen Elements drehbar ist und wobei die Aufhängung (781, 782) der Tür an dem scheibenähnlichen Element derart aufgehängt ist, dass eine Höheneinstellung der Tür ermöglicht wird.

9. Schienenfahrzeug-Türvorrichtung nach Anspruch 2, wobei die Trägereinheit ferner ein Schraubenbefestigungsteil (140) zum Fixieren des Plattenelements einschließt.

10. Schienenfahrzeug-Türvorrichtung nach einem der Ansprüche 1 bis 9, wobei die erste Türrolle und die zweite Türrolle durch Auslösen des Eingreifens der in dem Kernmaterial ausgebildeten Schlitzlöcher mit den Wellen an der gegenüberliegenden Seite, so dass keine Last an den Wellen an der gegenüberliegenden Seite anliegt, zwischen der Trägereinheit und dem Kernmaterial bereitgestellt sind.

11. Schienenfahrzeug-Türsystem, umfassend:

die Schienenfahrzeug-Türvorrichtung nach einem der Ansprüche 1 bis 10 und einen Antriebsmechanismus (300), der die Tür der Schienenfahrzeug-Türvorrichtung öffnet oder schließt.

Revendications

1. Dispositif de porte de véhicule ferroviaire (800), comprenant :

une porte (710, 720) prévue au niveau d'une entrée d'un véhicule ferroviaire, une unité de rail (200) ayant une section transversale en forme de C ;

- une unité de support (160, 170) formée le long d'une direction de la longueur de l'unité de rail ;
un premier galet de porte (110) prévu sur l'unité de support, qui est capable de se déplacer dans la section transversale en forme de C de l'unité de rail ;
un deuxième galet de porte (120) prévu à une extrémité de l'unité de support, qui est capable de se déplacer dans la section transversale en forme de C de l'unité de rail ; et
une suspente (150) prévue sur une autre partie d'extrémité de l'unité de support, qui est capable de suspendre la porte, **caractérisé en ce que** :
- un matériau intérieur (750) de la porte (710, 720) est prévu de façon à s'étendre sur une partie qui est suspendue depuis la suspente (150).
2. Dispositif de porte de véhicule ferroviaire selon la revendication 1, comprenant en outre :
- un élément de plaque (180) formé le long d'une direction de la longueur de l'unité de rail, dans lequel l'unité de support est prévue symétriquement de chaque côté de l'élément de plaque, l'unité de support étant dotée du premier galet de porte, du deuxième galet de porte et de la suspente.
3. Dispositif de porte de véhicule ferroviaire, selon l'une quelconque des revendications 1 et 2, dans lequel une ligne imaginaire reliant un arbre du premier galet de porte et un arbre du deuxième galet de porte est légèrement inclinée par rapport à la direction de la longueur de l'unité de rail.
4. Dispositif de porte de véhicule ferroviaire selon l'une quelconque des revendications 1 à 3, dans lequel :
- une ouverture de la section transversale en forme de C de l'unité de rail a une paire de rails convexes (200a), et la surface circonférentielle extérieure du premier galet de porte a une partie faisant face au rail concave (110a), ou l'ouverture de la section transversale en forme de C de l'unité de rail a une paire de rails concaves, et la surface circonférentielle extérieure du premier galet de porte a une partie faisant face au rail convexe ; et
la distance d'espacement la plus courte (L11) entre les rails convexes et concaves de ladite paire de rails est plus courte que le diamètre de circonférence maximum (D10) du premier galet de porte.
5. Dispositif de porte de véhicule ferroviaire selon l'une quelconque des revendications 1 à 4, dans lequel :
- une ouverture de la section transversale en forme de C de l'unité de rail a une paire de rails convexes (200a), et la surface circonférentielle extérieure du deuxième galet de porte a une partie faisant face au rail concave (120a), ou l'ouverture de la section transversale en forme de C de l'unité de rail a une paire de rails concaves, et la surface circonférentielle extérieure du deuxième galet de porte a une partie faisant face au rail convexe ; et
la distance d'espacement la plus courte (L11) entre les rails convexes et concaves de ladite paire de rails est plus courte que le diamètre de circonférence maximum (D13) du deuxième galet de porte.
6. Dispositif de porte de véhicule ferroviaire selon l'une quelconque des revendications 1 à 5, dans lequel un trou (751, 761) qui permet la suspension à partir de la suspente (150) est formé sur un matériau intérieur (750) formant la porte.
7. Dispositif de porte de véhicule ferroviaire selon l'une quelconque des revendications 1 à 6, dans lequel une pluralité de trous fendus (753, 754, 763, 764) sont formés sur un matériau intérieur formant la porte, la pluralité de trous fendus (753, 754, 763, 764) étant capable de maintenir des arbres (112, 122) sur le côté opposé du premier galet de porte et du deuxième galet de porte, les arbres étant maintenus à une extrémité par l'unité de support.
8. Dispositif de porte de véhicule ferroviaire selon la revendication 2, dans lequel : la suspente (150) est prévue sur l'unité de support et peut être mise en rotation par un élément de type disque (152) et un arbre décentralisé (B) de l'élément de type disque, et la suspente (781, 782) de la porte est suspendue à partir de l'élément de type disque de façon à permettre l'ajustement de la planéité de la porte.
9. Dispositif de porte de véhicule ferroviaire selon la revendication 2, dans lequel : l'unité de support comprend en outre une partie de fixation à vis (140) pour la fixation sur l'élément de plaque.
10. Dispositif de porte de véhicule ferroviaire selon l'une quelconque des revendications 1 à 9, dans lequel, en provoquant la mise en prise des trous fendus formés sur le matériau intérieur avec les arbres sur le côté opposé, de sorte qu'aucune charge ne soit appliquée sur les arbres sur le côté opposé, le premier galet de porte et le deuxième galet de porte sont prévus entre l'unité de support et le matériau intérieur.
11. Système de porte de véhicule ferroviaire, comprenant :

le dispositif de porte de véhicule ferroviaire selon l'une quelconque des revendications 1 à 10, et un mécanisme d'entraînement (300) qui ouvre ou ferme la porte du dispositif de porte de véhicule ferroviaire.

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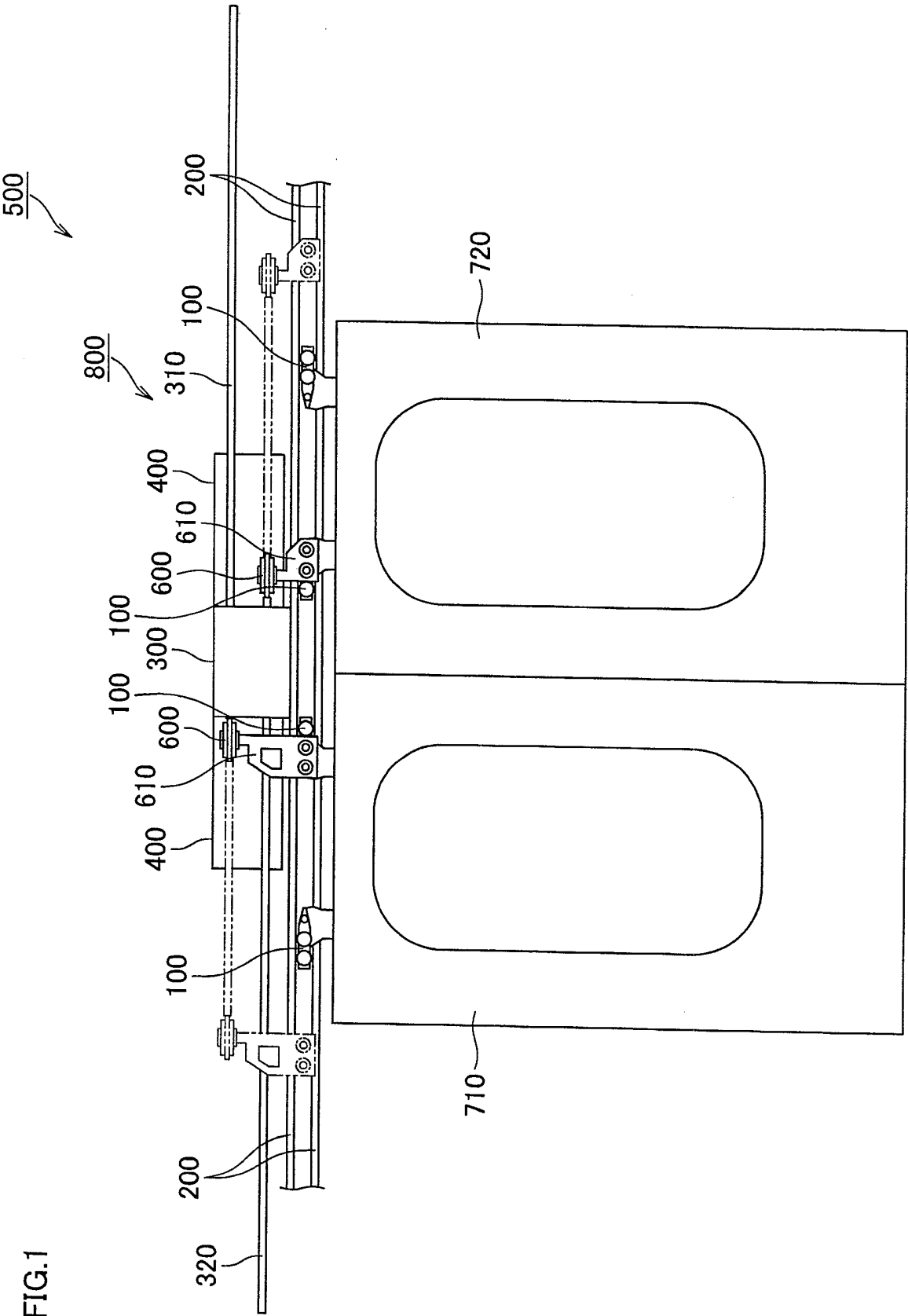


FIG.2A

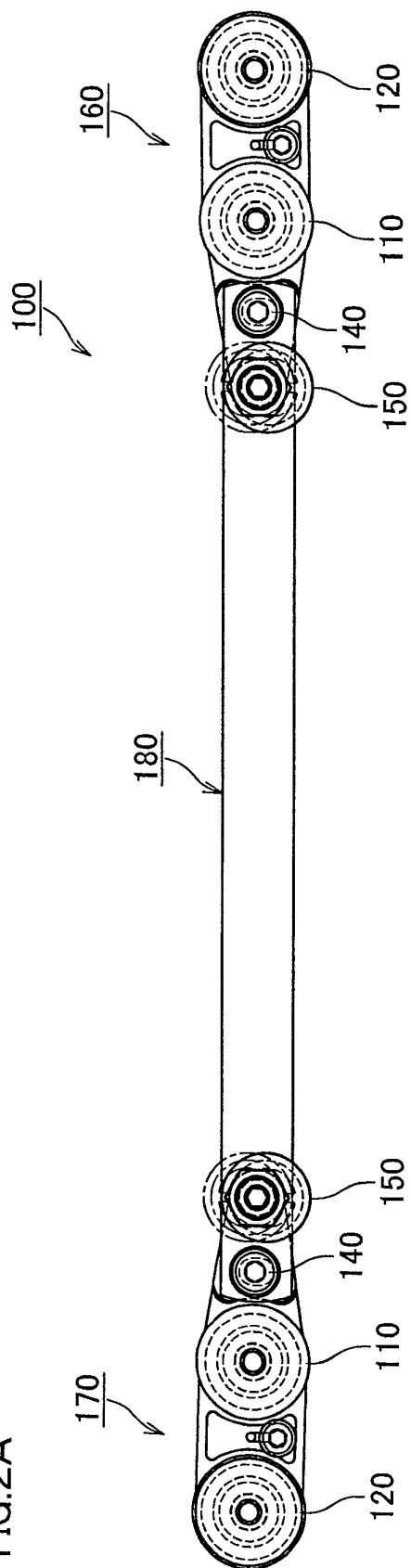


FIG.2B

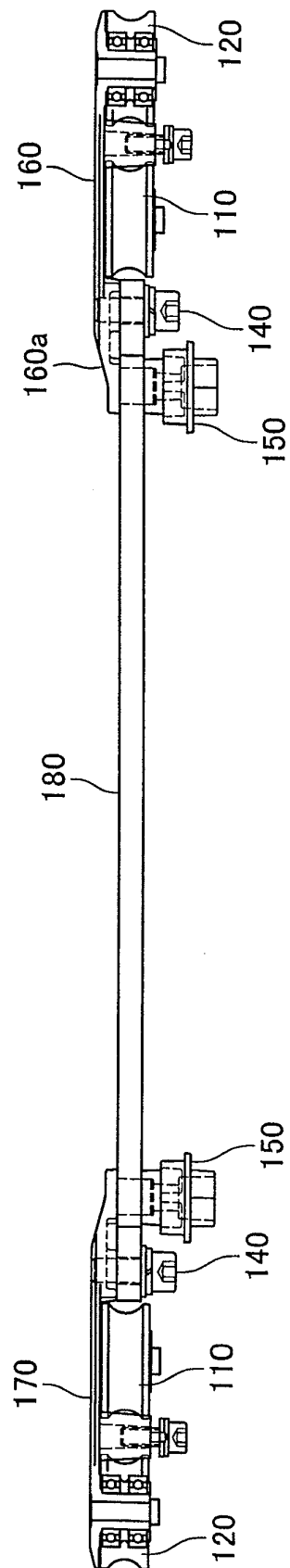


FIG.3

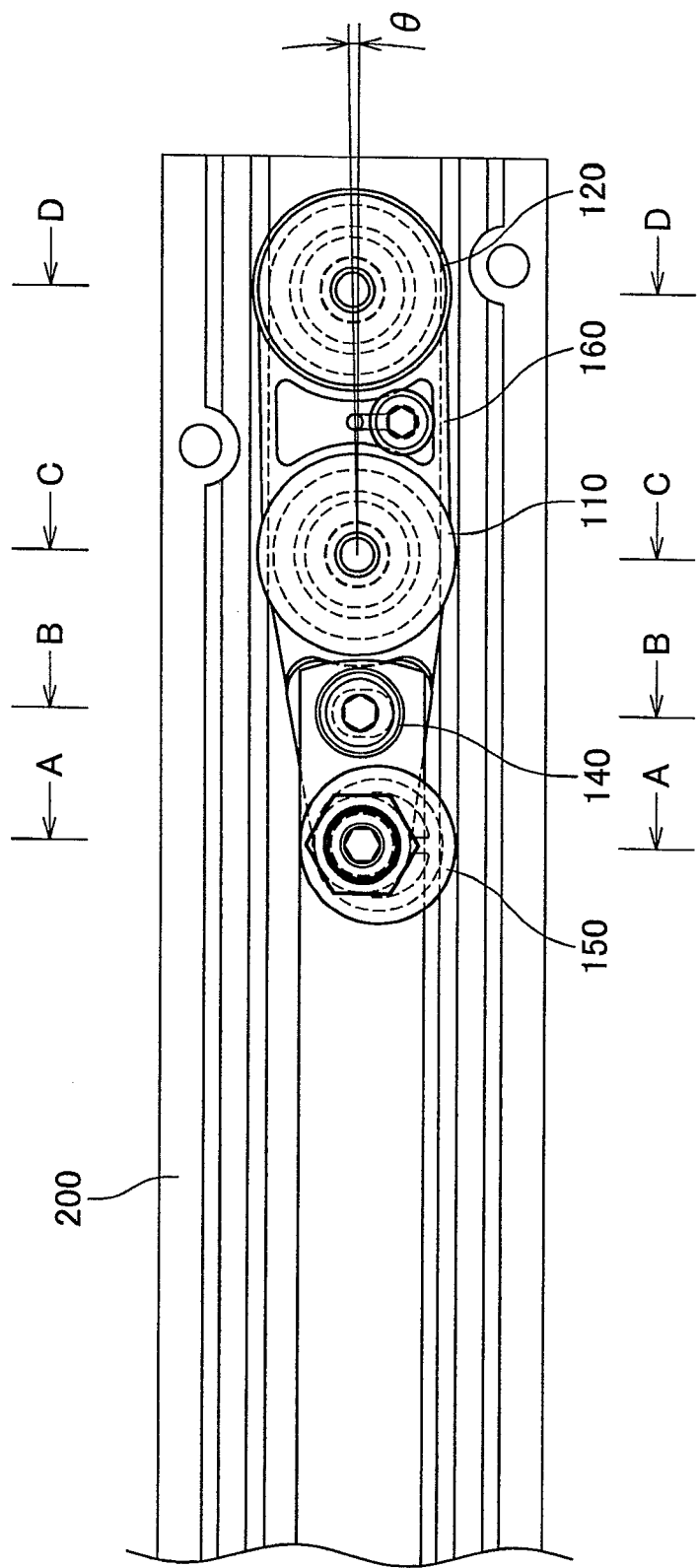
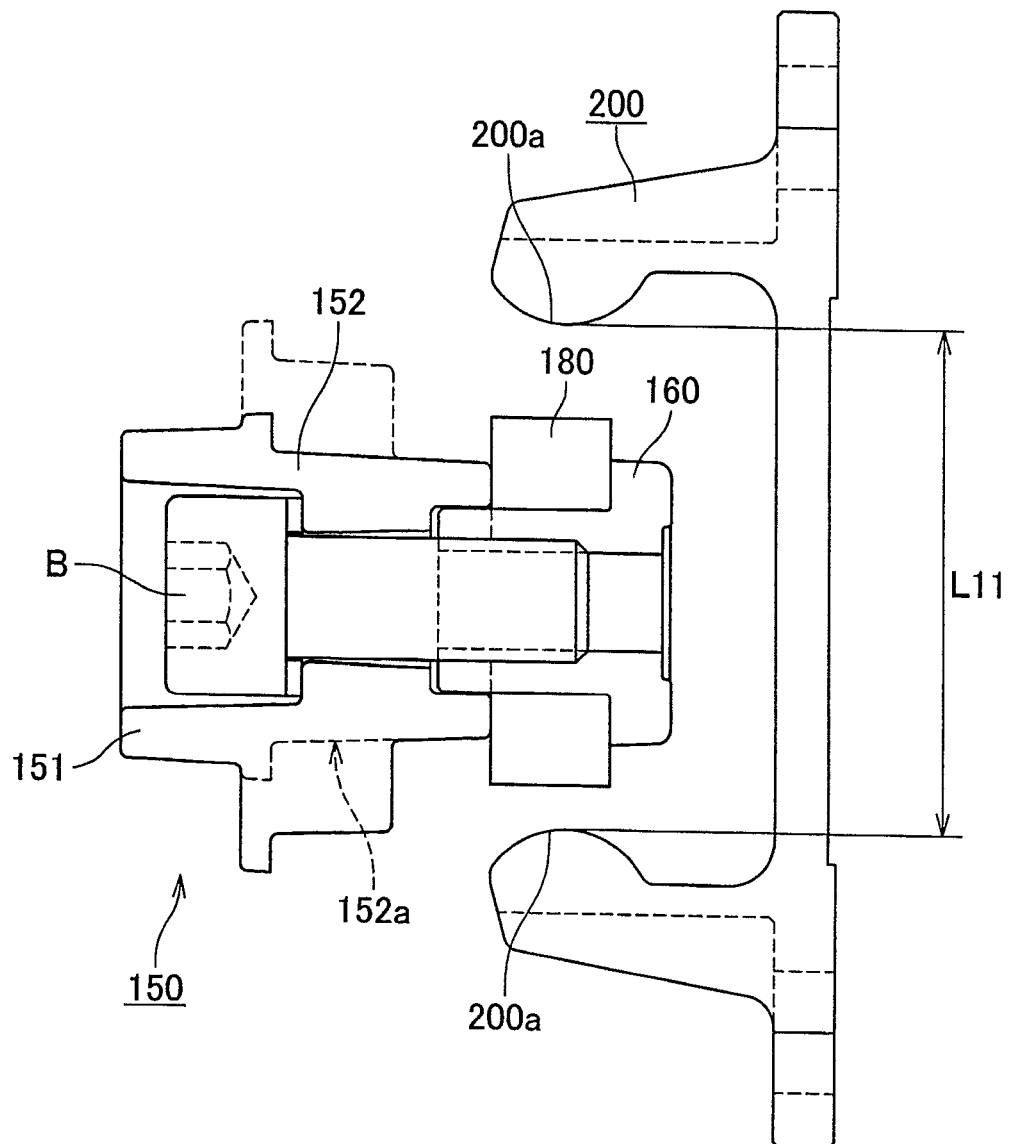
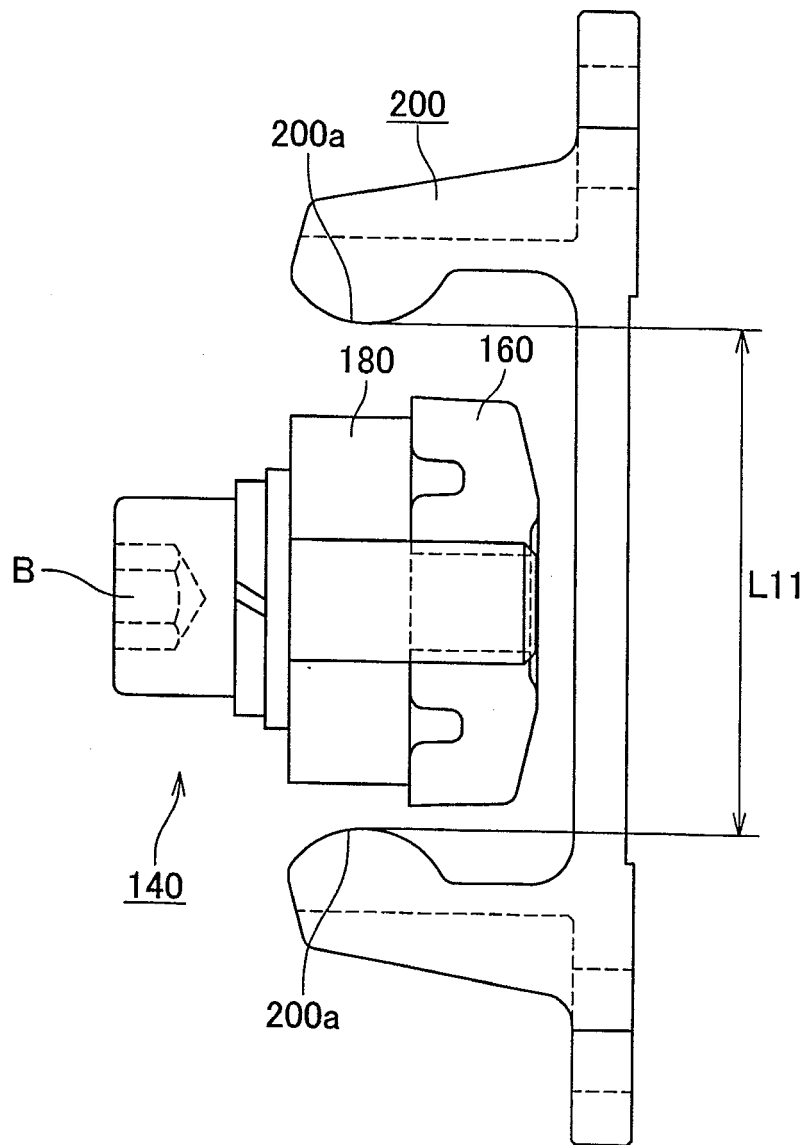


FIG.4



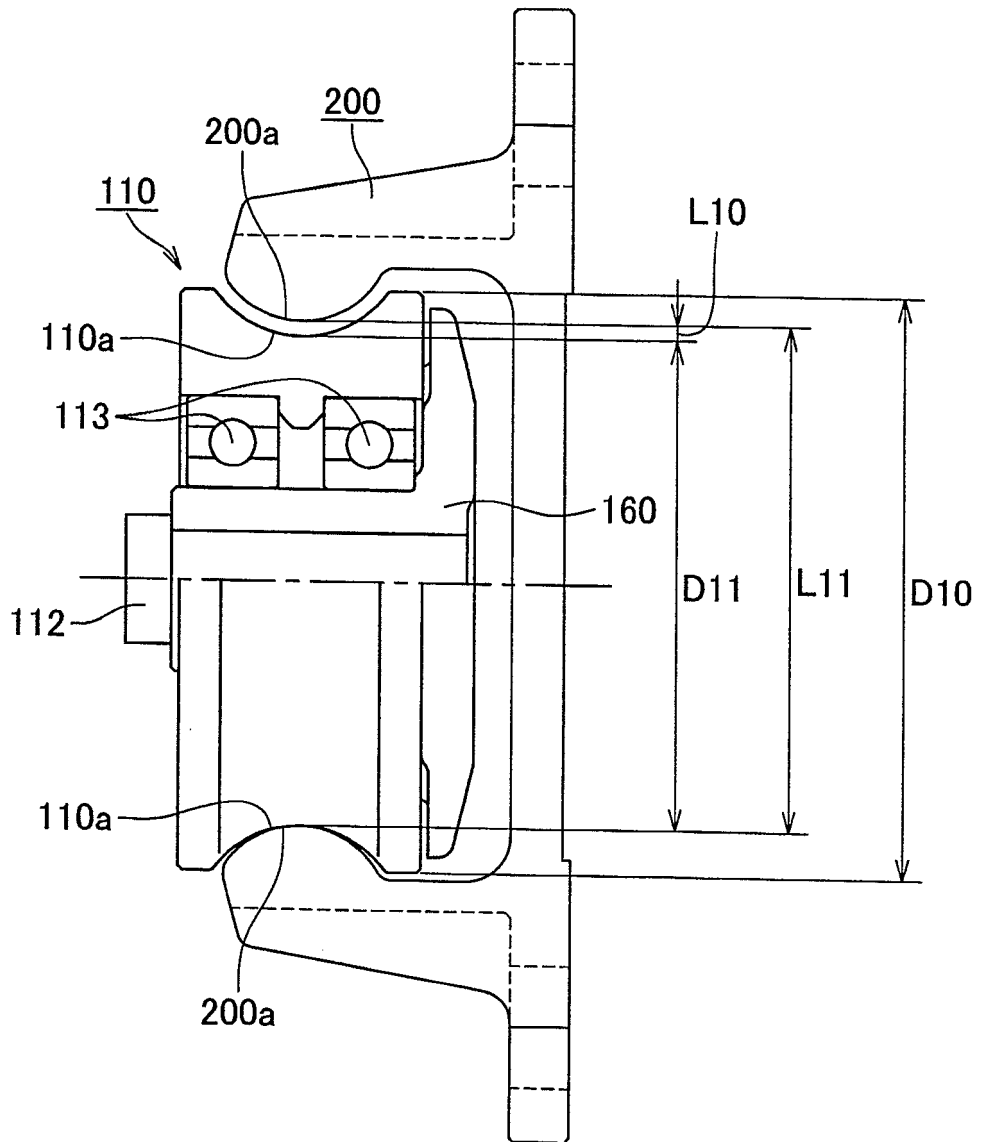
CROSS SECTIONAL VIEW TAKEN ALONG LINE A-A

FIG.5



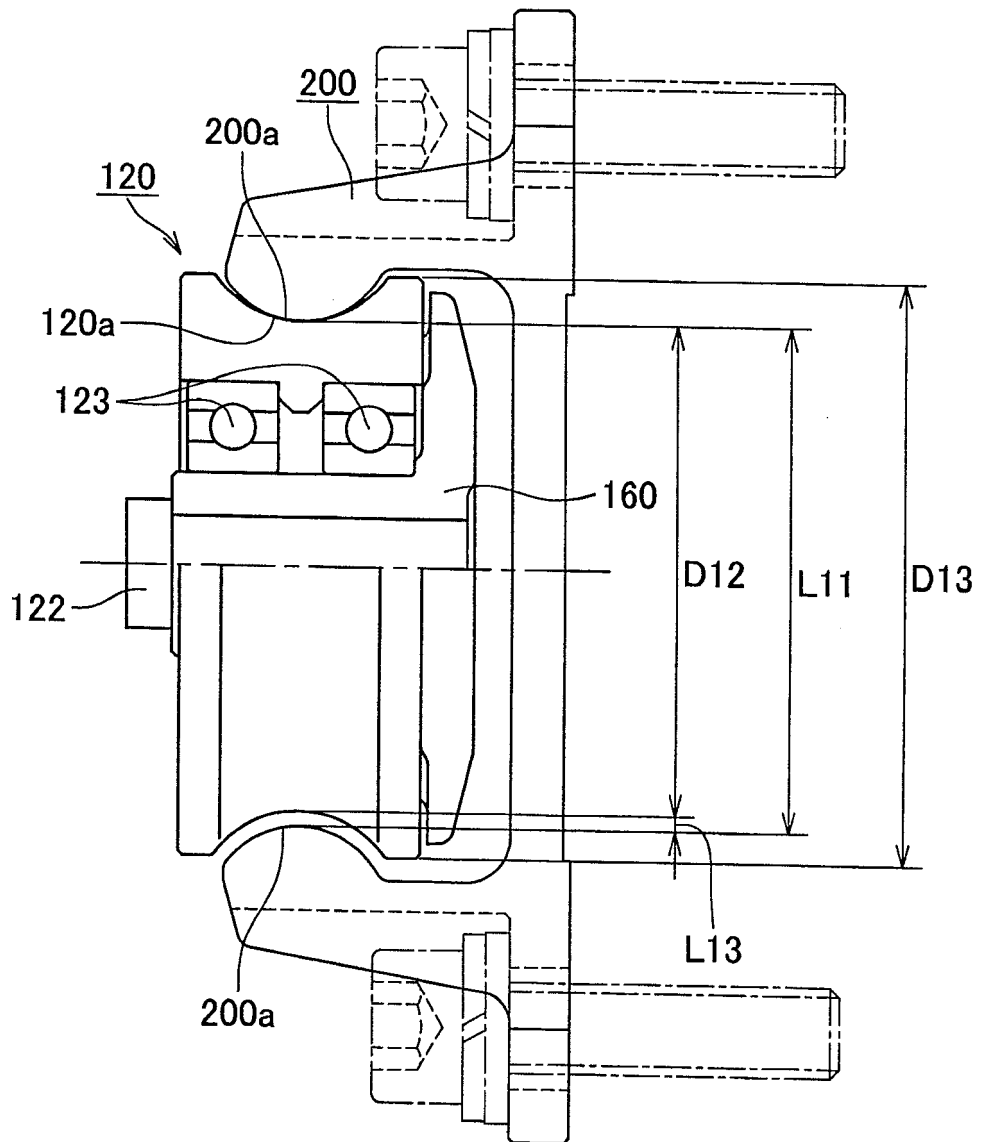
CROSS SECTIONAL VIEW TAKEN ALONG LINE B-B

FIG.6



CROSS SECTIONAL VIEW TAKEN ALONG LINE C-C

FIG. 7



CROSS SECTIONAL VIEW TAKEN ALONG LINE D-D

FIG. 8

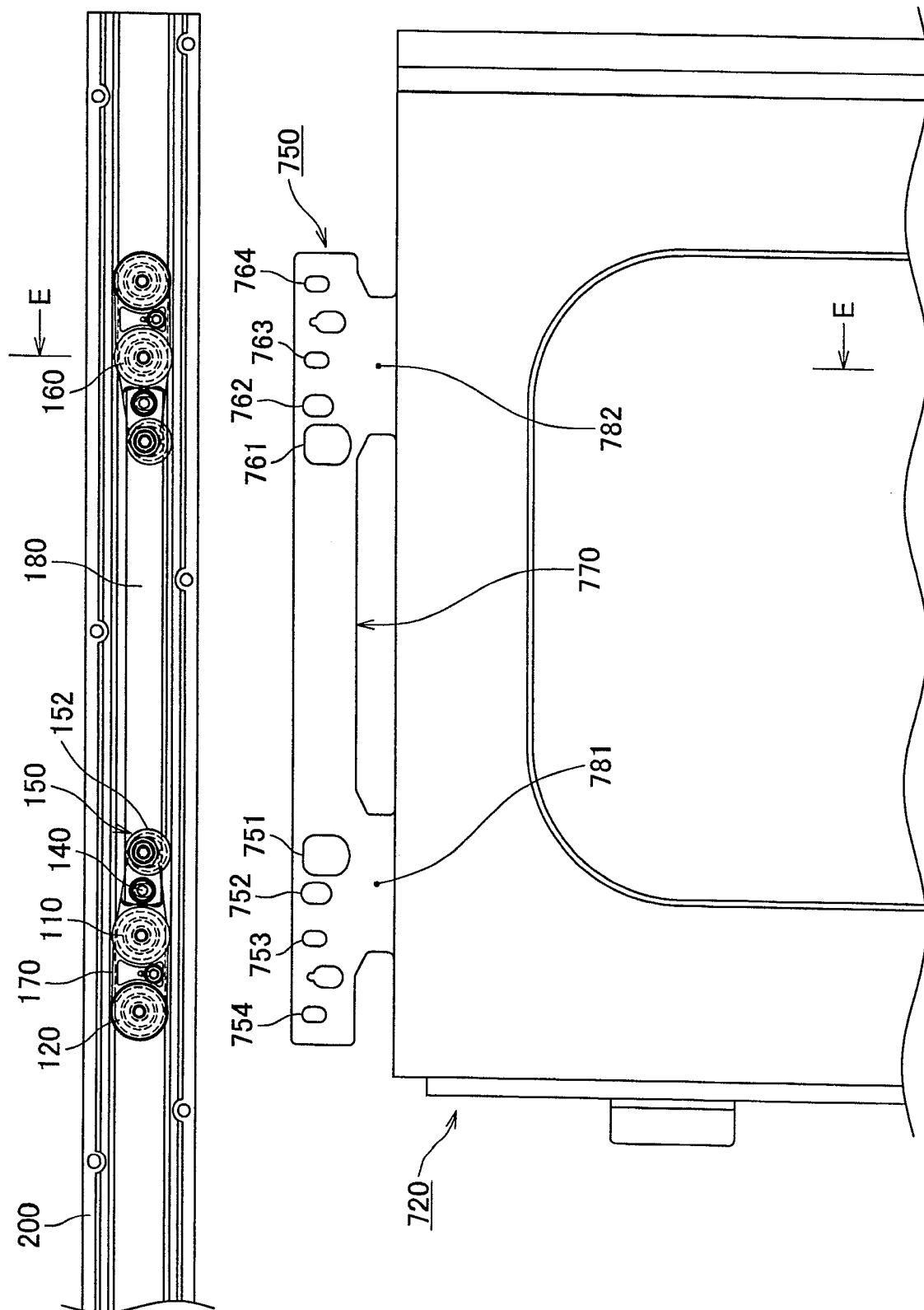
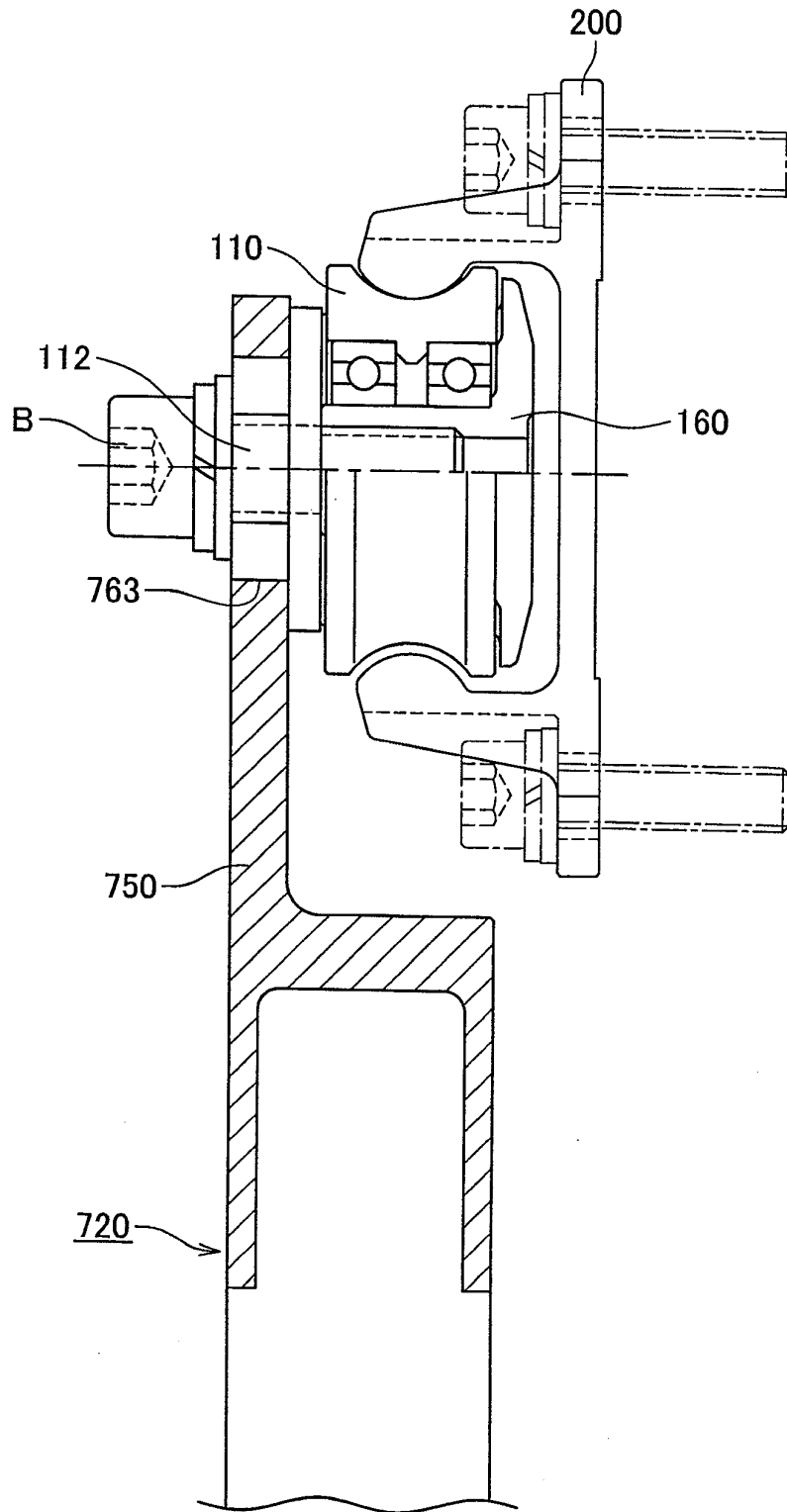


FIG.9



CROSS SECTIONAL VIEW TAKEN ALONG LINE E-E

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1013864 A [0006]
- GB 604101 A [0007]
- DE 564572 [0008]
- JP 2005007985 A [0009]