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(54) **FOOTPLATE OF GANGWAY AND RAILWAY CAR**

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(52) **U.S. Cl.** **105/460**

(57) **ABSTRACT**

The invention provides a thin footplate of superior quality while suppressing noise caused by the footplate. A footplate **10** is formed by connecting extruded shape members **110** arranged in parallel along the width direction of a railway car by a pipe **80**, with the upper surface of the extruded shape members **110** used as the walking surface. Adjacent extruded shape members **110** contact each other via bushings **90**. Both ends of the pipe **80** are pulled via draft springs **50** and **50** disposed in V-shape onto the underframe. A slip stopper **120** is adhered to the upper surface of the extruded shape members **110**. Bottom surfaces of the extruded shape members contact the upper surface of the underframe via sliding members **70**. When the railway car passes a curve or the like that causes relative displacement of the cars, the footplate **10** is slid easily. When one of the railway cars is subjected to rolling, each extruded shape member gradually rotates (rolls) along the width direction of the railway car so that crews and the like can easily walk on the footplate.

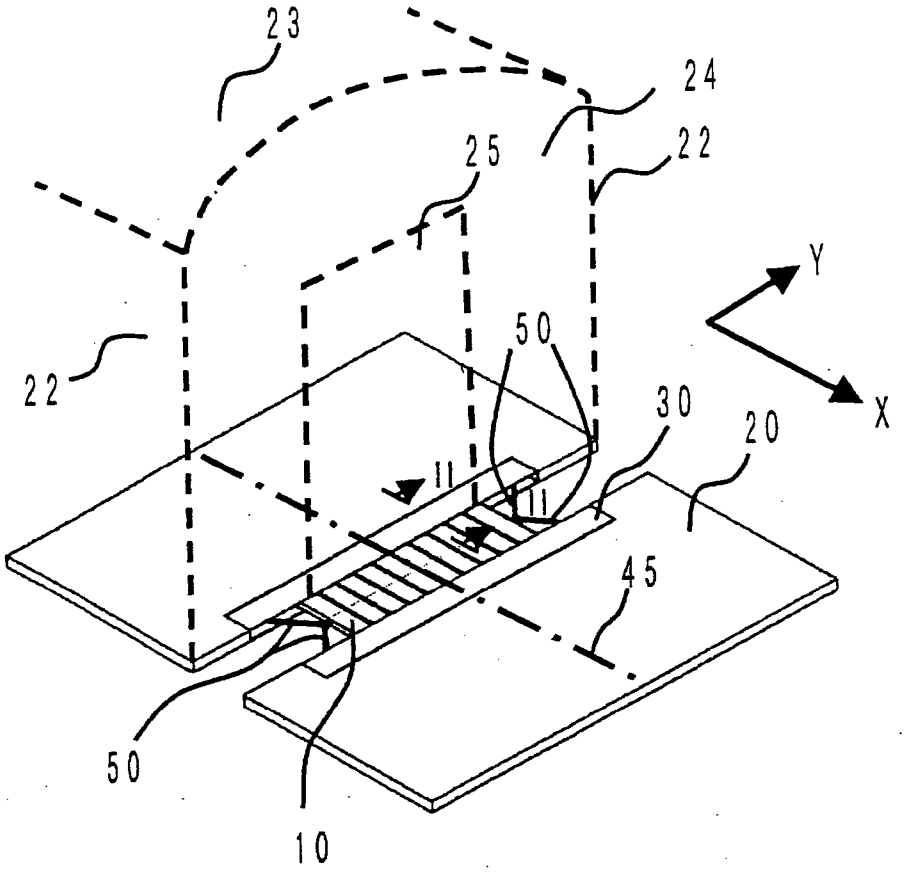


FIG. 1

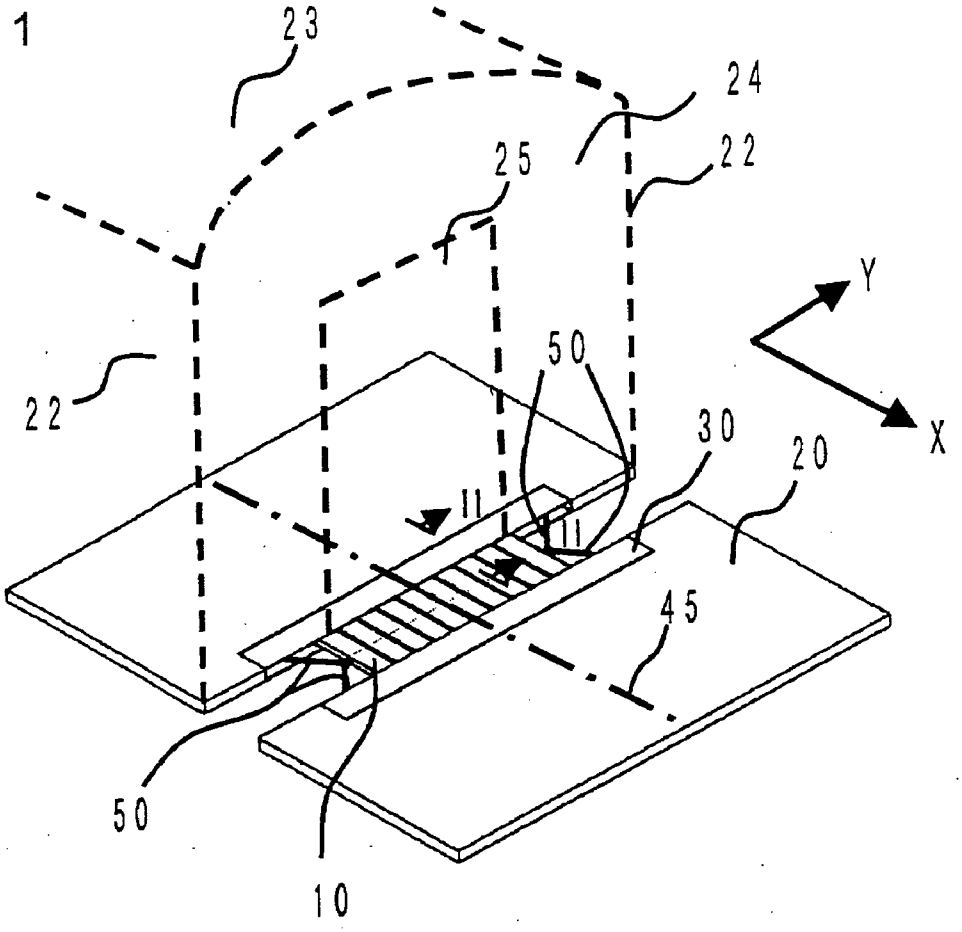


FIG. 2

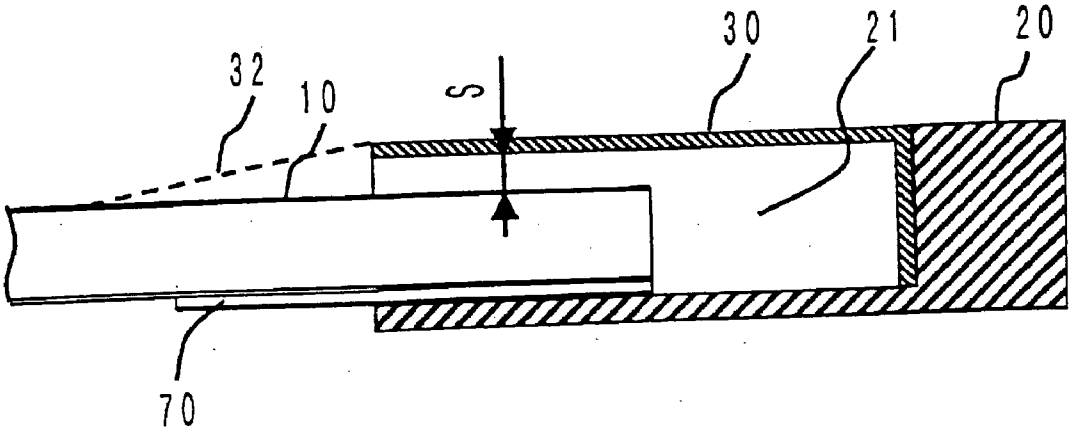


FIG. 3

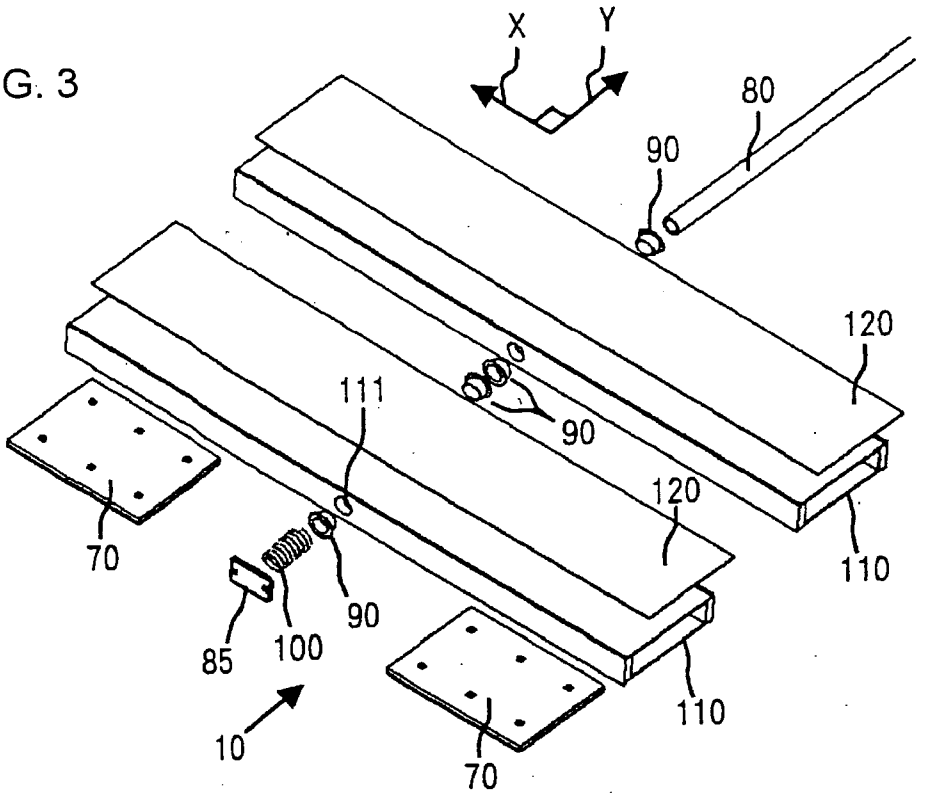


FIG. 4

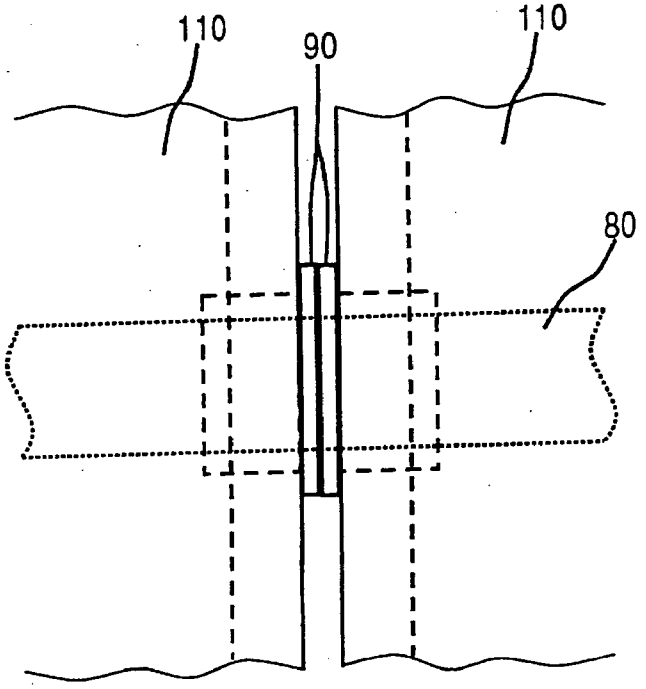


FIG. 5

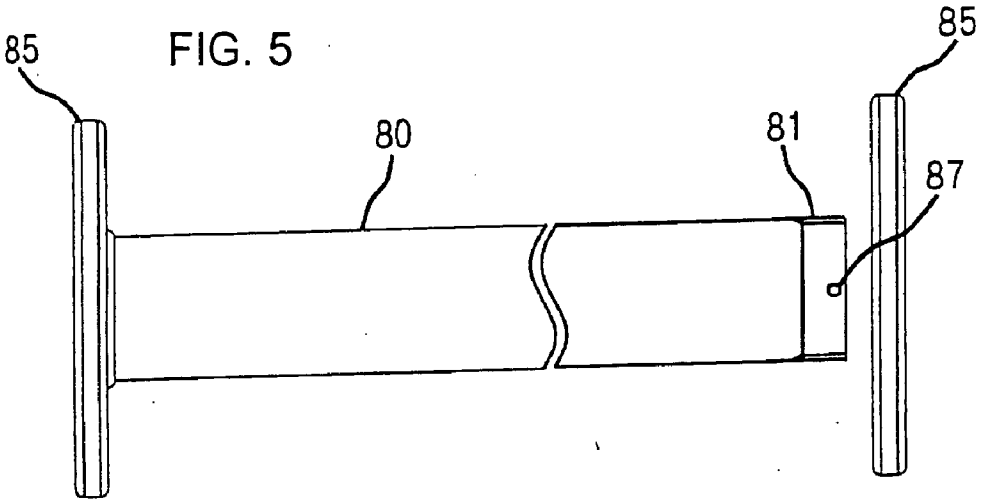


FIG. 6

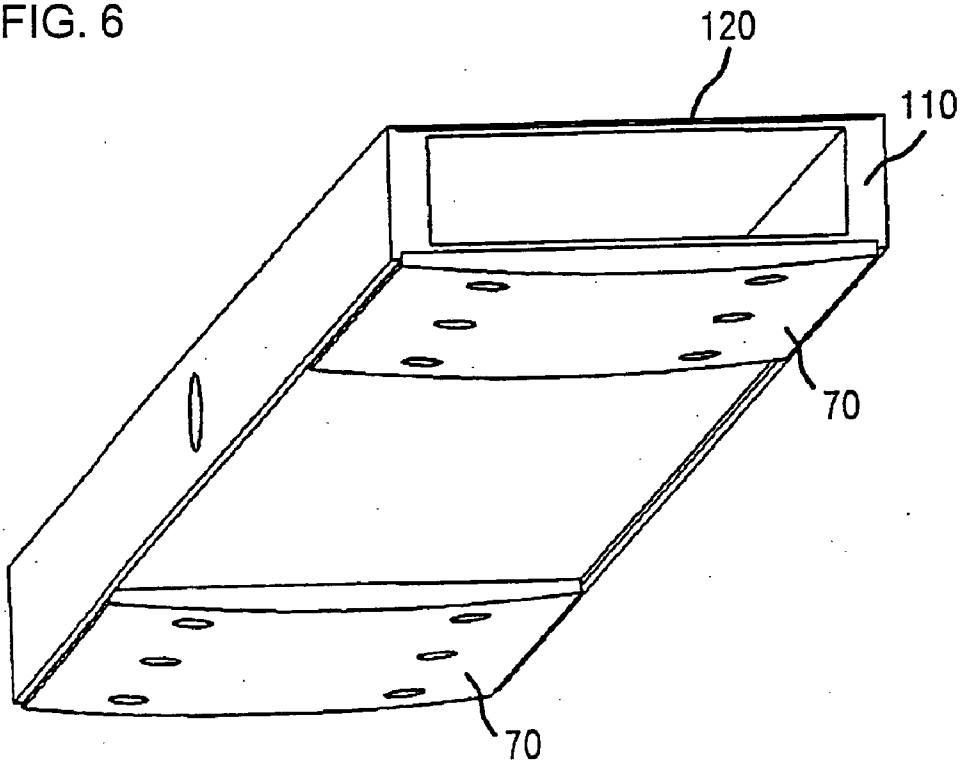


FIG. 7

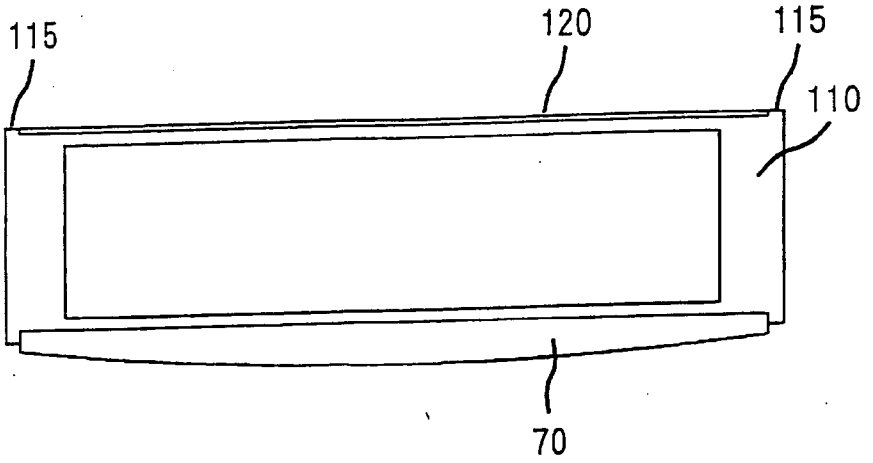


FIG. 8

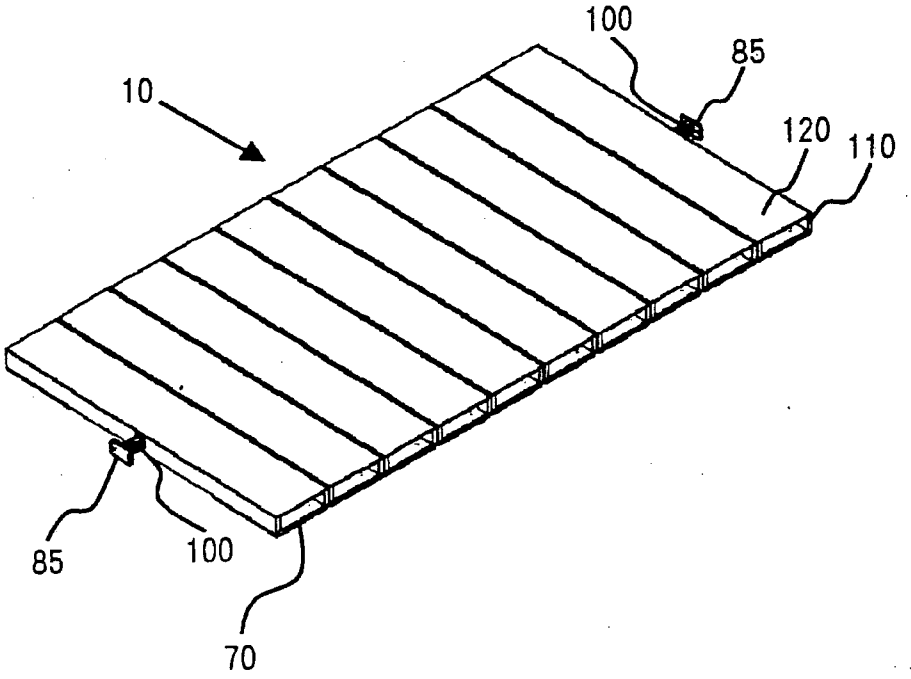
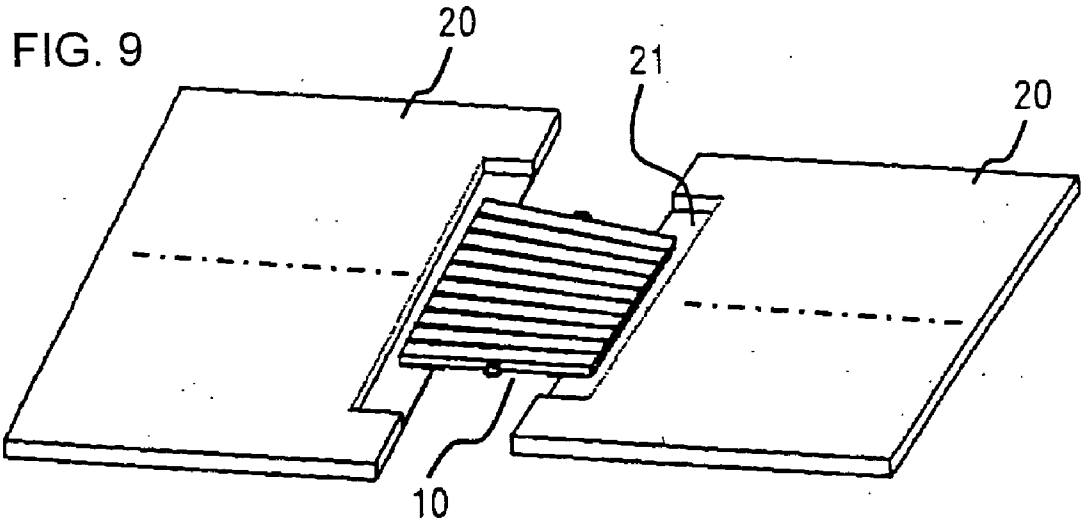


FIG. 9



FOOTPLATE OF GANGWAY AND RAILWAY CAR

[0001] The present application is based on and claims priority of Japanese patent application No. 2004-337333 filed on Nov. 22, 2004, the entire contents of which are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

[0002] 1. Field of the Invention

[0003] The present invention relates to a footplate of a gangway provided at a connecting portion of railway cars connected to form a train formation.

[0004] 2. Description of the Related Art

[0005] A gangway is provided at ends of respective cars of a train formation in which railway cars are connected to form a train, so as to enable easy and safe movement of passengers from one car to another.

[0006] Generally, as disclosed in Japanese Utility Model Publication No. 50-43848 (patent document 1), the gangway is composed of a footplate connected at a longitudinal end of a railway car and overlapped with another footplate, and a bellows connected to the longitudinal end of the railway car to cover the gangway at the longitudinal end of the railway car.

[0007] Such conventional gangway is not especially appropriate for application to the latest railway cars that are required to have superior outer appearance.

[0008] Japanese Patent No. 3060367 (patent document 2) discloses an art that is aimed at solving the problem and to provide improvement of the appearance. The footplate is placed on an end of the adjacent railway car. Rollers are provided at the bottom surface of the footplate that enable the footplate to move in the width direction when one railway car is displaced in the width direction with respect to another railway car.

[0009] The document, however, does not refer to the bellows.

[0010] According to the footplate disclosed in patent document 2, a wide gangway in the width direction can be formed.

[0011] Generally, in most commuter trains in Japan, there is no particular consideration provided to the design and structure of the gangway. Therefore, in comparison to the passenger cabin with improved interior and exterior design, the design of the gangway has not been improved for a long time.

[0012] Especially, according to the gangway disclosed in patent document 1 in which the plates provided at ends of railway cars are overlapped with one another, the vibration and the displacement of railway cars during movement of the train causes noise to be generated from the footplates.

[0013] The disclosure of patent document 2 solves the above-mentioned problem of the footplates. However, the footplates disclosed here is arranged so that the footplates deform into a parallelogram when the adjacent car bodies are displaced in the width direction, and requires rollers for supporting the footplate structure, so the thickness of the whole footplate structure is relatively large. Therefore, it is applicable to railway cars in European countries having a relatively large distance between the upper surface of the floor of the railway car and the upper surface of the coupler, but since the railway cars in Japan have couplers that have a height higher by approximately 200 mm than the railway cars in Europe, so the distance between the upper surface of the floor of the railway car and the upper surface of the coupler is not large enough to adopt the disclosed footplate structure.

SUMMARY OF THE INVENTION

[0014] The object of the present invention is to provide a footplate that has a relatively small thickness and generates only a small noise, to improve the overall quality of the gangway including the footplate.

[0015] The above object is realized by a footplate provided on a floor of a gangway at a connecting portion between railway cars to enable passengers and the like to move from one car to another, the footplate comprising: a plurality of flat panels disposed in parallel along a longitudinal direction of the railway car that are connected by a connecting member disposed along a width direction of the railway car; wherein the plurality of flat panels are capable of rotating around the connecting member.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] **FIG. 1** is a perspective view of the joint portion between cars;

[0017] **FIG. 2** is a II-II cross-section of **FIG. 1**;

[0018] **FIG. 3** is an exploded perspective view of the footplate **10**;

[0019] **FIG. 4** is a plan view of a connection between extruded shape members **110** and **110** of the footplate **10**;

[0020] **FIG. 5** is an exploded plan view of a pipe **80** connecting the extruded shape members **110**;

[0021] **FIG. 6** is a perspective view of the extruded shape members **110** of the footplate **10** seen from the bottom side;

[0022] **FIG. 7** is a right side view of **FIG. 6**;

[0023] **FIG. 8** is a completed perspective view of the footplate **10**; and

[0024] **FIG. 9** is a perspective view showing the behavior of footplate **10** when adjacent cars are subjected to rolling pitch.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0025] We will now describe a preferred embodiment for carrying out the present invention with reference to **FIGS. 1 through 9**.

[0026] **FIG. 1** illustrates a state in which a gangway footplate **10** is disposed on a railway car. The footplate **10** is positioned to cross over respective underframes **20** of adjacent railway cars. An end portion (end frame side) of the underframe **20** has a gain **21** (**FIGS. 2 and 9**) with a depth and size capable of housing the footplate **10** formed to extend from the underframe (upper surface of the floor) to the footplate **10** so as to minimize height difference. The width of the gain **21** (the width in the width direction of the car body) is greater than the width of the footplate **10**. The

depth of the gain **21** is somewhat greater than the height of the footplate **10**. After placing the footplate **10** on the underframe **20**, a cover **30** for covering the gain **21** is placed on and fixed to the underframe **20**. Thus, a continuous plane (upper surface of the floor) is formed from one underframe **20** to the other underframe. A space S is formed between the bottom surface of the cover **30** and the upper surface of the footplate **10**. The footplate **10** has a flat upper surface with respect to the longitudinal direction of the car body (direction X) and the width direction of the car body (direction Y).

[**0027**] In **FIG. 1**, the underframe **20** is covered by side frames **22**, a roof frame **23** and end frames **24**. The end frame **24** has a port **25** for a gangway. The adjacent cars are covered with bellows, but they are omitted from the drawing. X denotes the longitudinal direction of the car, and Y denotes the width direction of the car.

[**0028**] **FIG. 2** illustrates the relationship between the underframe **20**, the footplate **10**, the gain **21** and the cover **30**. When the width direction of the underframe is horizontal, a space S is formed between the upper surface of the footplate **10** and the lower surface of the cover **30**. The space S is approximately 25 mm. Then, a slope **32** for smoothly connecting the leading end of the cover **30** and the plane of the footplate **10** is disposed on the leading end of the cover **30**.

[**0029**] In **FIGS. 1 through 9**, the footplate **10** is formed of a plurality of extruded shape members (also referred to as flat panels) **110** that are disposed with their longitudinal directions corresponding to the longitudinal direction of the car body, a pipe (connecting member) **80** for connecting them in the width direction, a draft spring **50**, and so on. The extruded shape members **110** are formed of aluminum alloy. The extruded shape members **110** are extruded along direction X, with flat upper and lower surfaces. The shape members **110** are hollow. The pipe **80** is hollow so as to have light weight, but a solid cylinder can be used instead. The pipe **80** passes through the longitudinal center area of the extruded shape members **110**. The plurality of extruded shape members **110** form a floor surface on which crews and the like can walk easily. The length of the extruded shape member **110** is greater than the space between the adjacent cars. The length of the shape member **110** is approximately 700 mm.

[**0030**] In **FIG. 3** and other figures, holes **111** are formed to both side surfaces of the extruded shape member, and the cylindrical portions of bushings **90**, **90** are passed through each of the holes **111**, **111**. A pipe is passed through the bushings **90**. The bushings **90** are formed of resin. A coil spring **100** is placed between a flange portion of the bushing **90** passed through the extruded shape member **110** at the width-direction end thereof and an end plate **85** positioned at an axial end portion of the pipe **80**. The coil springs **100** are disposed at both ends of the pipe.

[**0031**] The end plate **85** on one axial end of the pipe **80** is welded onto the pipe **80**. The end plate **85** on the other end and the pipe **80** are formed separately. The coil spring **100** is passed through the pipe **80** onto which the end plate **85** is welded, and the bushing **90** is passed through from the other side of the pipe **80** at one end side of the plural extruded shape members **110**. After the extruded shape member **110** (bushing **90**) on the other end side is passed through, another coil spring **110** is placed and another end plate **85** is attached to the end of the pipe **80**. Then, a screw portion of the end plate **85** is screw-engaged with the screw **81** at the end of the pipe **80** so as to fix the members together.

[**0032**] As shown in **FIG. 4**, adjacent extruded shape members **110** contact each other via the flange portion of bushings **90**, **90**.

[**0033**] As shown in **FIGS. 3 and 4**, the extruded shape members **110** are pressed by coil springs **100**. In other words, the extruded shape members are pressurized by coil springs **100**.

[**0034**] As shown in **FIG. 2**, a slip stopper member **120** is adhered to the upper surface of the extruded shape member **110**. The upper surface of the extruded shape member **110** is recessed to correspond to the thickness of the slip stopper member **120**. A projection **115** (**FIG. 7**) is provided at each width-direction end of the recessed portion. The slip stopper member **120** is adhered along the projection **115**, by which the adhering operation is facilitated.

[**0035**] **FIG. 5** shows one example of the method for assembling the pipe **80** and the end plates **85**. One end plate **85** is welded to one end of the pipe **80**. An external thread is formed to the other end of the pipe **80**, which is engaged with an internal thread provided to the other end plate **85**. Thereafter, in order to prevent the end plate **85** from falling, a rotation stopper such as a split cotter pin is provided (in **FIG. 5**, reference number **87** denotes a bore for the split cotter pin).

[**0036**] **FIG. 7** shows a perspective view of the above assembly.

[**0037**] As shown in **FIG. 1**, at last, a hole formed to the end plate **85** and hooks (not shown) formed to the gain **21** of the underframes **20** are connected by the draft spring **50**. The positions of the hooks are greater in the width direction than the axial end of the pipe **80**. The vertical heights of the hooks are substantially equal to the position of the pipe **80** when the underframes **20** are positioned horizontally in the width direction. Thus, the pipe **80** is pulled horizontally in the width direction by two draft springs **50** disposed in a V-shape. Therefore, even if one of the railway cars is displaced in the width direction with respect to the other railway car, the width-direction center of the footplate **10** can be maintained near the width-direction center **45** of the railway car.

[**0038**] Further, as shown in **FIGS. 6 and 7**, slide members **70** are adhered to the bottom surface (at portions that slide against the gains **21** at both ends of the car) of each shape member **110**. The slide members **70** are formed of resin having lubricating property. The slide members **70** are fixed to the bottom surface of the shape member **110** via plural bolts (not shown). The slide members **70** facilitate the sliding of the footplate **10** when relative displacement of the cars occurs, such as when the cars pass through a curve.

[**0039**] As shown in **FIGS. 6 and 7**, the slide members **70** attached to the bottom surface of the extruded shape member **110** are arced, which protrude downward in the width direction. The slide members **70** are arced downward in the width direction in the present embodiment, but they can also be arced downward in the longitudinal direction of the extruded shape members.

[0040] **FIG. 9** shows the state in which the footplate **10** follows the movement of the underframe **20** while deforming into a curved surface when the adjacent railway cars are subjected to rolling pitch. A rolling pitch is a movement in which the car body rotates (rolls) around the longitudinal center axis **45** of the car body. In **FIG. 9**, the right car (underframe **20**) is not rolled and is horizontally positioned in the width direction, but the left car (underframe **20**) is rolled. The left car (underframe **20**) has its upper end side raised with respect to the right car (underframe **20**). When a rolling angle occurs to one of the underframes **20** (left) with respect to the plane of the underframe **20** of the other (right) adjacent car, each shape members **110** constituting the footplate **10** are rotated (rolled) vertically around the pipe **80** connecting the members **110** together. As a result, minute angles are formed between adjacent shape members **110**, which enable the footplate **10** to connect the left and right underframes **20**, **20** via a curved surface, so that the passengers can walk on the footplate to move to adjacent cars easily.

[0041] As shown in **FIG. 9**, when yawing angles are formed between adjacent underframes **20**, the line in which each slide member **70** contacts the underframe **20** is moved along with the tilting of the underframe **20**. At this time, if the shape of the portion of the slide member **70** coming into contact with the underframe **20** is formed in an arc, the movement can be realized smoothly.

[0042] The technical scope of the present invention is not restricted to the language used in the claims, the embodiment and the summary of the invention, but is extended to the range in which a person skilled in the art could easily substitute based on the present disclosure.

What is claimed is:

1. A footplate provided on a floor of a gangway at a connecting portion between railway cars to enable passengers and the like to move from one car to another, the footplate comprising:

a plurality of flat panels disposed in parallel along a longitudinal direction of the railway car that are connected by a connecting member disposed along a width direction of the railway car; wherein

the plurality of flat panels are capable of rotating around the connecting member.

2. The footplate according to claim 1, wherein

the plurality of flat panels has a member with lubricating property at a portion coming into contact with an end portion of the railway car.

3. The footplate according to claim 1, wherein

the plurality of flat panels has a member with lubricating property at a portion coming into contact with an end portion of the railway car; and

the member with lubricating property has an arced surface that comes into contact with the end portion of the railway car.

4. The footplate according to claim 1, wherein

the footplate is connected between a width-direction end of the connecting member and the width-direction end of the railway car via a stretchable coil spring.

5. A railway car comprising:

a footplate provided on a floor of a gangway at a connecting portion between railway cars to enable passengers and the like to move from one car to another, the footplate comprising:

a plurality of flat panels disposed in parallel along a longitudinal direction of the railway car that are connected by a connecting member disposed along a width direction of the railway car; wherein

the plurality of flat panels are capable of rotating around the connecting member.

6. The railway car according to claim 5, wherein

the plurality of flat panels has a member with lubricating property at a portion coming into contact with an end portion of the railway car; and

the member with lubricating property has an arced surface that comes into contact with the end portion of the railway car.

7. The railway car according to claim 5, wherein

a width-direction end of the connecting member and the width-direction end of the railway car are connected via a coil spring.

* * * * *