



(11) **EP 2 770 107 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention  
of the grant of the patent:  
**08.11.2017 Bulletin 2017/45**

(21) Application number: **12841941.3**

(22) Date of filing: **28.09.2012**

(51) Int Cl.:  
**E01B 19/00** <sup>(2006.01)</sup>

(86) International application number:  
**PCT/JP2012/075154**

(87) International publication number:  
**WO 2013/058082 (25.04.2013 Gazette 2013/17)**

(54) **NOISE INSULATION DEVICE FOR RAIL AND METHOD OF ATTACHING SAME**

GERÄUSCHISOLATIONSVORRICHTUNG FÜR SCHIENEN UND VERFAHREN ZUR DEREN  
BEFESTIGUNG

DISPOSITIF D'ISOLATION ANTIBRUIT POUR RAIL ET SON PROCÉDÉ D'ATTACHE

(84) Designated Contracting States:  
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB  
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO  
PL PT RO RS SE SI SK SM TR**

(30) Priority: **17.10.2011 JP 2011227621**  
**17.10.2011 JP 2011227622**

(43) Date of publication of application:  
**27.08.2014 Bulletin 2014/35**

(73) Proprietors:  
• **Sekisui Chemical Co., Ltd.**  
**Osaka-shi, Osaka 530-8565 (JP)**  
• **Shoyo Sangyo Co., Ltd.**  
**Osaka-shi, Osaka 550-0015 (JP)**

(72) Inventors:  
• **ICHIHARA, Koji**  
**Kyoto-shi**  
**Kyoto 601-8105 (JP)**  
• **OGUCHI, Takashi**  
**Tokyo 105-8450 (JP)**

• **MATSUDA, Yoshifumi**  
**Ritto-shi**  
**Shiga 601-8105 (JP)**  
• **ISHII Masayuki**  
**Osaka-shi**  
**Osaka 550-0015 (JP)**  
• **YAMADA, Atsushi**  
**Osaka-shi**  
**Osaka 550-0015 (JP)**

(74) Representative: **Peter, Julian**  
**Staeger & Sperling**  
**Partnerschaftsgesellschaft mbB**  
**Sonnenstrasse 19**  
**80331 München (DE)**

(56) References cited:  
**WO-A1-2010/113807 JP-A- H10 152 801**  
**JP-A- H10 152 801 JP-A- 2006 002 442**  
**JP-A- 2006 002 442 JP-A- 2008 095 408**  
**JP-A- 2008 095 408**

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

## Description

### Technical Field

5 **[0001]** The present invention relates to a noise insulation device for a rail, and more particularly, to a noise insulation device for a rail including a fastener used to fasten noise insulation members to a rail.

### Background Art

10 **[0002]** As a noise insulation device for a rail in the related art including a fastener used to fasten noise insulation members to a rail, there is proposed a noise insulation device including a first noise insulation member having a sound absorption mat and a sound insulation cover and attached to a necessary part on a rail surface from one side, a second noise insulation member having a sound absorption mat and a sound insulation cover and attached to a necessary part on the rail surface from the other side, and a fastener used to fasten the both noise insulation members.

15 **[0003]** According to those described in Patent Documents 1 and 2, the fastener is formed of two fastening members and these fastening members are stacked on a side in a lower surface of a rail bottom and fixed with bolts. According to the one described in Patent Document 3, the fastener is fixed with screws.

### Cited List

20

### Patent Documents

#### **[0004]**

25 Patent Document 1: JP-A-2007-224700  
Patent Document 2: JP-A-2006-2442  
Patent Document 3: JP-A-2008-95408

30 **[0005]** Further prior art in this technical field is disclosed in JP H10 152801.

### Summary of the Invention

### Problems that the Invention is to Solve

35 **[0006]** The one described in Patent Document 3 requires a tool for screw fixation and therefore has a problem that workability is poor. Those described in Patent Documents 1 and 2 employ bolt fixation and workability is good in comparison with screw fixation. However, a tool is required for the work. In addition, because a stacked portion for bolt fixation overhangs from the rail, there is a problem that this overhanging portion interferes with rail maintenance.

40 **[0007]** An object of the invention is to provide a noise insulation device for a rail requiring no tool for bolt fixation or screw fixation and therefore capable of making works less tedious and less complex and also solving a problem that a portion overhanging from the rail interferes with rail maintenance by reducing the overhanging portion.

### Means for Solving the Problem

45 **[0008]** A noise insulation device for a rail of the invention includes a first noise insulation member having a sound absorption mat and a sound insulation cover and attached to a necessary part on a rail surface from one side, a second noise insulation member having a sound absorption mat and a sound insulation cover and attached to a necessary part on the rail surface from the other side, and a fastener used to fasten the both noise insulation members, and is characterized in that: the fastener is formed of a first fastening member and a second fastening member; the first fastening member has a horizontal portion inserted beneath a lower surface of a rail bottom and a rising portion provided so as to continue from an end of the horizontal portion and fit to the sound insulation cover of one of the noise insulation members; the second fastening member has a horizontal portion inserted beneath the horizontal portion of the first fastening member and a rising portion provided so as to continue from an end of the horizontal portion and fit to the sound insulation cover of the other one of the noise insulation members; and at least one convex portion is provided to one of the first and second fastening members and a concave portion to be fit together with the convex portion is provided to the other one of the fastening members, so that the first fastening member and the second fastening member are fit together in a re-attachable manner with the respective horizontal portions being stacked.

55 **[0009]** In order to fasten two noise insulation members using two fastening members, it is generally necessary to

provide fastened portions to the respective fastening members and to connect the fastened portions with bolts. However, not only by forming each fastener in a shape having the horizontal portion and the rising portion, but also by configuring in such a manner that the first fastening member and the second fastening member are fit together in a re-attachable manner, it becomes possible to eliminate the fastening by bolts and the fastened portions of the fasteners provided for the fastening. Accordingly, no tool is required for bolt fixation or screw fixation, which can in turn make works less tedious and less complex, and also a problem that a portion overhanging from the rail interferes with rail maintenance can be solved by reducing the overhanging portion.

**[0010]** It is preferable that the portion overhanging from the rail is within 10 mm from the rail bottom. This condition can be fulfilled easily by fastening the noise insulation members using the two fastening members as described above.

**[0011]** The configuration by which the fastening members are fit together in a re-attachable manner can be achieved, for example, by providing at least one convex portion to one of the first and second fastening members (the horizontal portion and/or the rising portion thereof) and providing a concave portion to be fit together with the convex portion to the other member. The numbers and shapes of the convex portion and the concave portion are not particularly limited. For example, it may be configured in such a manner that one convex portion is provided to one member and one concave portion to the other member or two convex portions are provided to one member and two concave portions to the other member. Further, it may be configured in such a manner that one convex portion and one concave portion are provided to one member and one convex portion and one concave portion to the other member. In addition, it may be configured in such a manner that one portion is formed in a corrugated or serrated shape and the other portion is formed in a corresponding corrugated or serrated shape. It should be appreciated that the concave portion does not necessarily have a bottom surface in abutment with the tip end surface of the convex portion and the concave portion may be a hole or a slit.

**[0012]** According to the invention at least one of the first and second fastening members is provided with a bent portion formed at an end of the horizontal portion on an opposite side to the rising portion so as to restrict a movement of the fastening member toward the rising portion.

**[0013]** The fastening member provided with the bent portion can sandwich the sound insulation member from the both sides of the rail bottom surface with the rising portion and the bent portion. It thus becomes possible to achieve a certain degree of fastening without the other fastening member, and further firmer fastening can be achieved when this fastening member is combined with the other fastening member.

**[0014]** It is preferable that the bent portion is provided to the second fastening member and brought into abutment with the rising portion of the first fastening member from an outer side. When configured in this manner, movements of the both first and second fastening members in a direction orthogonal to the rail are prevented, which makes the fastening firm.

**[0015]** It is preferable that the at least one convex portion includes a first convex portion provided on an outer surface of the rising portion of the first fastening member, and that a first concave portion to be fit together with the first convex portion is provided to the bent portion of the second fastening member. When configured in this manner, in addition to the function of preventing movements of the respective fastening members in a direction orthogonal to the rail by the bent portion, it becomes possible to achieve a function of preventing movements of the respective fastening members in a direction orthogonal to the rail by the first convex portion and the first concave portion that are fit together, which makes the fastening firmer.

**[0016]** It is preferable that the at least one convex portion includes a second convex portion provided so as to protrude in a horizontal direction from the end of the horizontal portion of the first fastening member on the opposite side to the rising portion, and that a second concave portion to be fit together with the second convex portion is provided at a lower end of the rising portion of the second fastening member. When configured in this manner, the respective two convex portions and the corresponding two concave portions are fit together so that a relative movement of the respective fastening members in a rail length direction is prevented in a reliable manner. Positioning is thus performed in a reliable manner.

**[0017]** A method of attaching the noise insulation device for a rail in which the second convex portion and the second concave portion are fit together (claim 5) to a rail includes: a step of installing the first fastening member by inserting the horizontal portion of the first fastening member beneath the lower surface of the rail bottom from one side of the rail; a step of installing the second fastening member by inserting the horizontal portion of the second fastening member beneath the horizontal portion of the first fastening member from the other side of the rail for the second concave portion of the second fastening member and the second convex portion of the first fastening member to be fit together in such a manner that there is no clearance between the end of the horizontal portion of the first fastening member on the opposite side to the rising portion and an end of the second fastening member on a side of the rising portion whereas there is a clearance between an end of the horizontal portion of the first fastening member on the side of the rising portion and an end of the horizontal portion of the second fastening member on a side of the bent portion; and a step of eliminating the clearance between the end of the horizontal portion of the first fastening member on the side of the rising portion and

the end of the second fastening member on the side of the bent portion using a bar-like tool given that one end of the tool is a pivot point and the other end of the tool is a point of effort by bringing an intermediate portion of the tool in abutment with the end of the horizontal portion of the second fastening member on the side of the bent portion from below and applying an upward force to the point of effort.

**[0018]** It may be configured in such a manner that the at least one convex portion includes a first convex portion provided to the horizontal portion of one of the first and second fastening members, and that a first concave portion to be fit together with the first convex portion is provided to the horizontal portion of the other one of the fastening members.

**[0019]** In this case, it is preferable that the horizontal portion of one of the first and second fastening members is provided with a guide portion that guides the horizontal portion of the other one of the fastening members when the horizontal portion of the other one of the fastening members is stacked thereon and also restricts a movement of the horizontal portion of the other one of the fastening members in a rail length direction after the horizontal portions are stacked.

**[0020]** When configured in this manner, the horizontal portion is guided by the guide portion when the first fastening member and the second fastening member are fit together. Hence, because displacement is prevented, the fastening members can be fit together easily. Also, because the guide portion and the horizontal portion are fit together, the first fastening member and the second fastening member become more resistant to separation.

**[0021]** More preferably, a convex portion is provided to the horizontal portion of one of the first and second fastening members and a concave portion to be fit together with the convex portion is provided to the horizontal portion of the other fastening member. In addition, the bent portion and the guide portion are provided to the first fastening member.

When configured in this manner, a relative movement of the both fastening members can be suppressed by fitting the convex portion and the concave portion together. Moreover, a movement of the first fastening member in a rail width direction is suppressed by the bent portion, and a movement of the second fastening member in the rail length direction is suppressed by the guide portion of the first fastening member. Hence, the first fastening member and the second fastening member are connected firmly and the noise insulation members are fastened extremely firmly.

**[0022]** It may be configured in such a manner that the sound insulation cover is formed in a shape of a flat plate bridged between an upper end of a side surface of a rail waist and a tip end of an upper surface of the rail bottom. Also, it may be configured in such a manner that the sound insulation cover has a slope portion extending from an upper end of a side surface of a rail waist to a tip end of an upper surface of the rail bottom, a vertical portion extending from a lower end of the slope portion along a side surface of the rail bottom, and a horizontal portion extending from a lower end of the vertical portion along a lower surface of the rail bottom, and that the sound absorption mat is provided to both of the slope portion and the horizontal portion. The former configuration has an advantage that the configuration of the noise insulation members can be simpler. The latter configuration has an advantage that the noise insulation effect can be further enhanced by the sound absorption mat and the sound insulation cover provided to the lower surface of the rail bottom.

**[0023]** It is preferable that the vertical portion of the sound insulation cover is provided with a convex portion that prevents displacement of the respective fastening members in a rail direction. When configured in this manner, it becomes possible to prevent the fastener from displacing in the rail length direction in a reliable manner.

**[0024]** It is preferable that the sound absorption mat is formed of at least one of a fibrous sound absorbing material, a resin foam of sound absorbing material, an open-celled foam of sound absorbing material, an inorganic porous sound absorbing material, and an inorganic particle sintered sound absorbing material. In terms of the noise insulation effect and ease of handling, a fibrous sound absorbing material, such as glass wool and rock wool, and a resin foam of sound absorbing material, such as urethane foam, EPDM foam, and polyethylene foam, is more preferable.

**[0025]** It is also preferable that the sound insulation cover is formed of at least one of a metal plate, a resin plate, and an inorganic plate. In terms of ease of processing, long-term durability, and mechanical strength, it is preferable to use an erosion resistant steel plate, such as a Galvalume steel plate, and a plated sheet steel of molten zinc-aluminum-magnesium alloy.

**[0026]** A surface density and a thickness of the sound insulation cover are not particularly limited. However, a surface density of 0.5 to 15 kg/m<sup>2</sup> and a thickness of 0.1 to 2.0 mm are preferable.

**[0027]** A length of the sound insulation cover is not particularly limited. Assume that one sound insulation cover is provided at every sleeper interval, then in a site adopting a typical sleeper interval of 550 to 600 mm, the length of the sound insulation cover is preferably 600 to 650 mm. The sleeper interval in an actual site of work has a variance of about 50 mm. Hence, by setting the length to 600 to 650 mm for the site adopting the sleeper interval of 550 to 600 mm, it becomes possible to install the covers without leaving any clearance by overlapping the adjacent covers. When consideration is given to this manner of installation to overlap the sound insulation covers, a thickness of the sound insulation cover is preferably 0.1 to 2.0 mm as specified above.

**[0028]** A position at which the upper peripheral portion of the sound insulation cover is in contact with the rail surface is not particularly limited to a position 38 mm below the upper surface of the rail head top as long as the position does not reach a construction gauge set in the horizontal direction. It is, however, preferable that the upper peripheral portion

is in contact with the rail surface at a position 42 to 62 mm below the upper surface of the rail top head.

**[0029]** A damping sheet may be interposed between the sound absorption mat and the sound insulation cover. The damping sheet in this case preferably has a coefficient of loss of 0.1 or higher, and for example, has a double-layer structure formed of a damping resin layer and a constrained layer.

#### Advantages of the Invention

**[0030]** According to the noise insulation device for a rail of the invention, the first fastening member has the horizontal portion inserted beneath the lower surface of the rail bottom and the rising portion provided so as to continue from the end of the horizontal portion and fit to the sound insulation cover of one of the noise insulation members, and the second fastening member has the horizontal portion inserted under the lower surface of the rail bottom and the rising portion provided so as to continue from the end of the horizontal portion and fit to the sound insulation cover of the other one of the noise insulation members, so that the first fastening member and the second fastening member are fit together in a re-attachable manner with the horizontal portion of the former and the horizontal portion of the latter being stacked. Hence, no tool is required for bolt fixation or screw fixation, which can in turn make works less tedious and less complex, and also a problem that a portion overhanging from the rail interferes with rail maintenance can be solved by reducing the overhanging portion.

#### Brief Description of the Drawings

##### **[0031]**

[Fig. 1] Fig. 1 is a cross section showing a first embodiment of a noise insulation device for a rail of the invention.

[Fig. 2] Fig. 2 is a perspective view of a first fastening member of a fastener in the noise insulation device for a rail of the first embodiment.

[Fig. 3] Fig. 3 is a perspective view of a second fastening member of the fastener in the noise insulation device for a rail of the first embodiment.

[Fig. 4] Fig. 4 is a view showing an attachment method of the noise insulation device for a rail of the first embodiment.

[Fig. 5] Fig. 5 is a side view showing a preferred embodiment of a sound insulation cover in the noise insulation device for a rail of the first embodiment.

[Fig. 6] Fig. 6 is perspective views showing preferred embodiments of the sound insulation cover in the noise insulation device for a rail of the first embodiment.

[Fig. 7] Fig. 7 is a cross section showing a second embodiment of the noise insulation device for a rail of the invention.

[Fig. 8] Fig. 8 is a perspective view of a first fastening member of a fastener in the noise insulation device for a rail of the second embodiment.

[Fig. 9] Fig. 9 is a perspective view of a second fastening member of the fastener in the noise insulation device for a rail of the second embodiment.

[Fig. 10] Fig. 10 is a cross section showing a reference example of the noise insulation device for a rail of the invention.

[Fig. 11] Fig. 11 is a perspective view of a fastener in the noise insulation device for a rail of the reference example.

#### Description of Reference Numerals and Signs

##### **[0032]**

- |                 |                                    |
|-----------------|------------------------------------|
| (1)             | noise insulation device for a rail |
| (2)             | first noise insulation member      |
| (3)             | second noise insulation member     |
| (4)             | fastener                           |
| (5)             | first fastening member             |
| (6)             | second fastening member            |
| (7)             | fastener                           |
| (8)             | first fastening member             |
| (9)             | second fastening member            |
| (11) and (14)   | sound absorption mat               |
| (13) and (16)   | sound insulation cover             |
| (13a) and (16a) | slope portion                      |
| (13b) and (16b) | vertical portion                   |
| (13c) and (16c) | horizontal portion                 |

|                      |                                        |
|----------------------|----------------------------------------|
| (21)                 | horizontal portion                     |
| (22)                 | rising portion                         |
| (23)                 | bent portion                           |
| (24)                 | convex portion (first convex portion)  |
| 5 (25)               | guide portion                          |
| (31)                 | horizontal portion                     |
| (32)                 | rising portion                         |
| (34)                 | through-hole (first concave portion)   |
| (41)                 | horizontal portion                     |
| 10 (42)              | rising portion                         |
| (44)                 | convex portion (second convex portion) |
| (45)                 | convex portion (first convex portion)  |
| (51)                 | horizontal portion                     |
| (52)                 | rising portion                         |
| 15 (53)              | bent portion                           |
| (54)                 | through-hole (second concave portion)  |
| (55)                 | through-hole (first concave portion)   |
| (61), (62), and (63) | convex portion                         |

## Mode for Carrying Out the Invention

**[0033]** Hereinafter, embodiments of the invention will be described with reference to the drawings. In the following description, the terms, "top", "bottom", "right", and "left", mean the top, the bottom, the right, and the left of Fig. 1, respectively.

**[0034]** Fig. 1 shows a first embodiment of a noise insulation device for a rail of the invention. The noise insulation device (1) for a rail includes a first noise insulation member (2) attached to a necessary part on a surface of the rail (R) from the left (one side), a second noise insulation member (3) attached to a necessary part on the surface of the rail (R) from the right (the other side), and a fastener (7) formed of a first fastening member (8) and a second fastening member (9) used to fasten the both insulation members (2) and (3).

**[0035]** The noise insulation members (2) and (3) are formed, respectively, of sound absorption mats (11) and (14), damping sheets (12) and (15), and sound insulation covers (13) and (16), which are sequentially stacked in layers from the inner side.

**[0036]** The noise insulation members (2) and (3) are formed, respectively, of sound absorption mats (11) and (14), damping sheets (12) and (15), and sound insulation covers (13) and (16), which are sequentially stacked in layers from the inner side.

**[0037]** The sound absorption mats (11) and (14) are provided in parts divided, respectively, to waist sound absorption mats (11a) and (14a), each of which is bridged from a midpoint in height of a side surface of a rail waist (Rw) to a center of an upper surface of a rail bottom (Rb) in a width direction, and bottom sound absorption mats (11b) and (14b) fit to a lower surface of the rail bottom (Rb) from beneath. In the drawing, the waist sound absorption mats (11a) and (14a) are not shown in a rectangular shape in traverse section. Instead, each is shown in a shape as if portions in contact with the rail (R) were cut out from a rectangle. It should be appreciated, however, that this shape is formed because the contact portions are pressed against the rail (R) and squeezed by compression. When attached to the rail (R), a thickness of the bottom sound absorption mats (11b) and (14b) is reduced to about half the thickness in a free state.

**[0038]** The damping sheets (12) and (15) are formed to have the same size (area) as the sound absorption mats (11) and (14), respectively, and divided, respectively, to waist damping sheets (12a) and (15a) and bottom damping sheets (12b) and (15b).

**[0039]** The sound insulation covers (13) and (16) are formed, respectively, of slope portions (13a) and (16a), each of which is bridged from near an upper end in height of the side surface of the rail waist (Rw) to near a tip end of the upper surface of the rail bottom (Rb), vertical portions (13b) and (16b) extending downward, respectively, from lower ends of the slope portions (13a) and (16a) along the side surfaces of the rail bottom (Rb), and horizontal portions (13c) and (16c) extending, respectively, from lower ends of the vertical portions (13b) and (16b) along the lower surface of the rail bottom (Rb) toward a center of the rail.

**[0040]** A slight clearance is provided between the horizontal portions (13c) and (16c) of the sound insulation covers (13) and (16), respectively. End faces of the horizontal portions (13c) and (16c) of the sound insulation covers (13) and (16), respectively, end faces of the bottom sound absorption mats (11b) and (14b), and end faces of the bottom damping sheets (12b) and (15b) are substantially flush with one another.

**[0041]** In this embodiment, the first fastening member (8) is installed first from the right and subsequently the second fastening member (9) is installed from the left.

**[0042]** As is also shown in Fig. 2, the first fastening member (8) has a horizontal portion (41) inserted beneath the lower surface of the rail bottom (Rb) and a rising portion (42) provided so as to continue from a right end of the horizontal portion (41) and fit to the sound insulation cover (16) of the second noise insulation member (3).

**[0043]** The horizontal portion (41) is fit to both of the horizontal portion (13c) of the sound insulation cover (13) of the first noise insulation member (2) and the horizontal portion (16c) of the sound insulation cover (16) of the second noise insulation member (3) from beneath.

**[0044]** The rising portion (42) is formed of a vertical portion (42a) stacked on the vertical portion (16b) of the sound insulation cover (16) and a slope portion (42b) stacked on the slope portion (16a) of the sound insulation cover (16). An upper end position of the slope portion (42b) is set to be substantially equal to an upper end position of the waist sound absorption mat (14a) of the second noise insulation member (3). As is also shown in Fig. 3, the second fastening member (9) is formed of a horizontal portion (51) inserted under the lower surface of the rail bottom (Rb) and a rising portion (52) provided so as to continue from a right end of the horizontal portion (51) and fit to the sound insulation cover (13) of the first noise insulation member (2).

**[0045]** The horizontal portion (51) is stacked on the horizontal portion (41) of the first fastening member (8) from beneath. The rising portion (52) is formed of a vertical portion (52a) stacked on the vertical portion (13b) of the sound insulation cover (13) and a slope portion (52b) stacked on the slope portion (13a) of the sound insulation cover (13). An upper end position of the slope portion (52b) is set to be substantially equal to an upper end position of the waist sound absorption mat (11a) of the first noise insulation member (2).

**[0046]** The second fastening member (9) is provided with a bent portion (53) formed at a right end (end on the opposite side to the rising portion) of the horizontal portion (51) in abutment with the vertical portion (42a) of the rising portion (42) of the first fastening member (8) from the outer side. An upper end of the bent portion (53) is formed so as to bend outward. An upper end position of the bent portion (53) is set to be as high as or lower than the rail bottom (Rb). Because the upper end position of the bent portion (53) is set to be as high as or lower than the rail bottom (Rb), it is easy to move the second fastening member (9) to the right (inner side) of the rail (R) when installed from the left of Fig. 1. An installation work can be thus performed easily.

**[0047]** A narrow rectangular convex portion (second convex portion) (44) protruding in a horizontal direction is provided at a left end of the horizontal portion (41) of the first fastening member (8). A rectangular through-hole (second concave portion) (54) to be fit together with the convex portion (44) of the first fastening member (8) is provided at a lower end of the vertical portion (52a) of the second fastening member (9).

**[0048]** A substantially semi-circular convex portion (first convex portion) (45) is provided to the vertical portion (42a) of the rising portion (42) of the first fastening member (8). A circular through-hole (first concave portion) (55) to be fit together with the substantially semi-circular convex portion (45) is provided to the bent portion (53) of the second fastening member (9). In this manner, the first fastening member (8) and the second fastening member (9) are fit together in a re-attachable manner by fitting the two concave portions (44) and (45) together with the two through-holes (54) and (55), respectively.

**[0049]** A rubber cushion (46) extending across and in abutment with the horizontal portions (13c) and (16c) of the sound insulation covers (13) and (16) of the noise insulation members (2) and (3), respectively, is provided to the horizontal portion (41) of the first fastening member (8). Also, a rubber cushion (47) in abutment with an upper part of the slope portion (16a) of the sound insulation cover (16) of the second noise insulation member (3) is provided to the slope portion (42b) of the rising portion (42) of the first fastening member (8). A rubber cushion (57) in abutment with an upper part of the slope portion (13a) of the sound insulation cover (13) of the first noise insulation member (2) is provided to the slope portion (52b) of the rising portion (52) of the second fastening member (9).

**[0050]** The damping sheets (12) and (15) are formed, respectively, of damping resin layers (17) and (19) laminated to the back surfaces of the sound insulation covers (13) and (16), respectively, and 0.27-mm-thick steel plates (18) and (20) as constrained layers stacked on the surfaces of the sound absorption mats (11) and (14), respectively, and laminated to the damping resin layers (17) and (19), respectively.

**[0051]** According to the noise insulation device (1) for a rail of the first embodiment, the first fastening member (8) and the second fastening member (9) to fasten the noise insulation members (2) and (3) are fit together and thereby connected to each other. Accordingly, no tool is required for bolt fixation or screw fixation, which can in turn make works less tedious and less complex. In addition, the bent portion (53) of the second fastening member (9) prevents not only leftward movements of the second fastening member (9) but also rightward movements of the first fastening member (8). Hence, these members are not readily come off.

**[0052]** In the first embodiment, the convex portion (44) in the horizontal portion (41) of the first fastening member (8) and the corresponding through-hole (54) in the vertical portion (52a) of the second fastening member (9) can be omitted. In this case, the left end face of the horizontal portion (41) of the first fastening member (8) is in abutment with the vertical portion (52a) of the second fastening member (9), and in this state, the convex portion (45) in the rising portion (42) of the first fastening member (8) is fit together with the through-hole (55) in the bent portion (53) of the second fastening member (9).

**[0053]** A method of attaching the noise insulation device (1) for a rail of the first embodiment to the rail (R) is shown in Fig. 4.

**[0054]** In order to attach the noise insulation device (1) for a rail of the first embodiment to the rail (R), as is shown in Fig. 4(a), whether the sound absorption mats (11b) and (14b) of the noise insulation members (2) and (3), respectively, are in abutment with the lower surface of the rail bottom (Rb) is confirmed first, and then the first fastening member (8) is installed by inserting the horizontal portion (41) of the first fastening member (8) beneath the lower surface of the rail bottom (Rb) from the right of the rail (R). By fitting the horizontal portion (41) of the first fastening member (8) onto the lower surface of the rail bottom (Rb), as is shown in Fig. 4(b), the first fastening member (8) is installed in substantially the same conditions when attachment is completed. Subsequently, the second fastening member (9) is installed. In this instance, the second fastening member (9) is inserted under the lower surface of the rail bottom (Rb) while leaving a clearance comparable to the height of the bent portion (53) between the both horizontal portions (41) and (51) to prevent the bent portion (53) from interfering with the horizontal portion (41) of the first fastening member (8). Subsequently, the through-hole (second concave portion) (54) of the second fastening member (9) is fit together with the convex portion (first convex portion) (44) of the first fastening member (8). As is shown in Fig. 4(c), an intermediate portion of the bent portion (53) of the second fastening member (9) normally interferes with the right end of the horizontal portion (41) of the first fastening member (8) in this state and the both members cannot be fit together tightly. Accordingly, this is a state in which there is no clearance between the left end (end on the opposite side to the rising portion) of the horizontal portion (41) of the first fastening member (8) and the left end (end on the side of the rising portion) of the second fastening member (9) whereas there is a clearance between the right end (end on the side of the rising portion) of the horizontal portion (41) of the first fastening member (8) and the right end (end on the opposite side to the rising portion) of the second fastening member (9). Herein, a bar-like tool (60) is used and a left end (60a) of the tool (60) is given as the pivot point and a right end (60b) of the tool (60) is given as the point of effort. Then, the clearance between the right end of the horizontal portion (41) of the first fastening member (8) and the right end of the second fastening member (9) is eliminated by bringing an intermediate portion (60c) of the tool (60) in abutment with the right end (end on the side of the bent portion) of the horizontal portion (51) of the second fastening member (9) from below and applying an upward force to the right end (60b) (the point of effort). Accordingly, as is shown in Fig. 4(d), the convex portion (first convex portion) (45) of the first fastening member (8) and the through-hole (first concave portion) (55) of the second fastening member (9) are fit together and the first fastening member (8) and the second fastening member (9) are connected to each other firmly. The noise insulation device (1) for a rail can be thus attached to the rail (R) so as not to come off the rail (R).

**[0055]** For the purpose of preventing the fastener (7) from moving in a length direction of the rail (R), it is preferable for the noise insulation device (1) for a rail of the first embodiment to provide convex portions (61) to the sound insulation cover (13) so as to sandwich the fastener (7) from both sides of the rail (R) in the length direction as is shown in Fig. 5. The convex portions can be convex portions (61) of a half-cut semispherical shape as is shown in Fig. 6(a), convex portions (62) of a circular truncated conical shape as is shown in Fig. 6(b), or convex portions (63) of a semispherical shape as is shown in Fig. 6(c). In the case of the convex portions (61) of a half-cut semispherical shape, the cut planes are formed so as to oppose the fastener (7) as is shown in Fig. 5.

**[0056]** Fig. 7 is a view showing a second embodiment of the noise insulation device for a rail of the invention. The noise insulation device (1) for a rail includes a first noise insulation member (2) attached to a necessary part on the surface of the rail (R) from the left (one side), a second noise insulation member (3) attached to a necessary part on the surface of the rail (R) from the right (the other side), and a fastener (4) formed of a first fastening member (5) and a second fastening member (6) used to fasten the both noise insulation members (2) and (3).

**[0057]** The noise insulation members (2) and (3) are the same as their respective counterparts in the first embodiment above and a description is omitted herein by labeling the same reference numerals as those of the first embodiment above.

**[0058]** As is also shown in Fig. 8, the first fastening member (5) has a horizontal portion (21) inserted beneath the lower surface of the rail bottom (Rb) and a rising portion (22) provided so as to continue from a left end of the horizontal portion (21) and fit to the slope portion (13a) of the sound insulation cover (13) of the first noise insulation member (2). The horizontal portion (21) is fit to both of the horizontal portion (13c) of the sound insulation cover (13) of the first noise insulation member (2) and the horizontal portion (16c) of the sound insulation cover (16) of the second noise insulation member (3) from beneath. An upper end position of the rising portion (22) is set to be substantially equal to an upper end position of the waist sound absorption mat (11a) of the first noise insulation member (2).

**[0059]** As is also shown in Fig. 9, the second fastening member (6) has a horizontal portion (31) inserted under the lower surface of the rail bottom (Rb) and a rising portion (32) provided so as to continue from a right end of the horizontal portion (31) and fit to the slope portion (16a) of the sound insulation cover (16) of the second noise insulation member (2). The horizontal portion (31) is stacked on the horizontal portion (21) of the first fastening member (5) from beneath. An upper end position of the rising portion (32) is set to be substantially equal to an upper end position of the waist sound absorption mat (14a) of the second noise insulation member (3).

**[0060]** The first fastening member (5) is provided with a bent portion (23) formed at the right end (end on the opposite

side to the rising portion) of the horizontal portion (21) so as to restrict leftward movements (toward the rising portion) of the first fastening member (5). An upper end position of the bent portion (23) is set to be as high as or lower than the rail bottom (Rb). The first fastening member (5) is installed from the left of Fig. 7. In this instance, because the upper end position of the bent portion (23) is set to be as high as or lower than the rail bottom (Rb), it is easy to move the first fastening member (5) to the right (inner side) of the rail (R). An installation work can be thus performed easily.

**[0061]** A convex portion (first convex portion) (24) of a square shape and becoming lower toward the right is provided near the left end on the lower surface of the horizontal portion (21) of the first fastening member (5). A through-hole (first concave portion) (34) of a square shape to be fit together with the convex portion (24) of the first fastening member (5) is provided to the horizontal portion (31) of the second fastening member (6). The first fastening member (5) and the second fastening member (6) are fit together in a re-attachable manner by fitting the convex portion (24) and the through-hole (34) together.

**[0062]** A guide portion (25) is provided at the right end of the horizontal portion (21) of the first fastening member (5) along both edges of the horizontal portion (21). The guide portion (25) is formed of opposing walls (25a) formed so as to protrude downward from the both edges of the horizontal portion (21). An interval between the opposing walls (25a) is set to be substantially equal to the horizontal portion (31) of the second fastening member (6). Owing to this configuration, when the horizontal portion (21) of the first fastening member (5) and the horizontal portion (31) of the second fastening member (6) are stacked, the horizontal portion (31) of the second fastening member (6) is guided by the guide portion (25) of the first fastening member (5), so that displacement is prevented. After the horizontal portions (21) and (31) are stacked, movements of the horizontal portion (31) of the second fastening member (6) in the rail length direction are restricted.

**[0063]** A rubber cushion (26) extending across and in abutment with the horizontal portions (13c) and (16c) of the sound insulation covers (13) and (16) of the noise insulation members (2) and (3), respectively, is provided to the horizontal portion (21) of the first fastening member (5). Also, a rubber cushion (27) in abutment with an upper part of the slope portion (13a) of the sound insulation cover (13) of the first noise insulation member (2) is provided to the rising portion (22) of the first fastening member (5). A rubber cushion (37) in abutment with an upper part of the slope portion (16a) of the sound insulation cover (16) of the second noise insulation member (3) is provided to the rising portion (32) of the second fastening member (6).

**[0064]** According to the noise insulation device (1) for a rail of the second embodiment, the first fastening member (5) and the second fastening member (6) to fasten the noise insulation members (2) and (3) are fit together and thereby connected to each other. Accordingly, no tool is required for bolt fixation or screw fixation, which can in turn make works less tedious and less complex. It should be noted that the first fastening member (5) and the second fastening member (6) are fit together in a re-attachable manner not necessarily by fitting the convex portion (24) of the horizontal portion (21) of the first fastening member (5) and the through-hole (concave portion) (34) of the horizontal portion (31) of the second fastening member (6) together. It may be configured in such a manner that a concave portion is provided to the horizontal portion (21) of the first fastening member (5) and a convex portion is provided to the upper surface of the horizontal portion (31) of the second fastening member (6). Alternatively, the numbers and shapes of the convex portion and the through-hole (concave portion) may be changed.

**[0065]** The bent portion (23) and the guide portion (25) are provided to the first fastening member (5). However, a guide portion may be provided to the second fastening member (6) by omitting the guide portion (25) of the first fastening member (5) or a bent portion may be provided also to the second fastening member (6) by omitting the guide portion (25) of the first fastening member (5). Alternatively, it may be configured in such a manner that the first fastening member (5) and the second fastening member (6) are connected by merely fitting the guide portion (25) of the first fastening member (5) and the horizontal portion (31) of the second fastening member (6) together without fitting the convex portion (24) of the horizontal portion (21) of the first fastening member (5) and the through-hole (concave portion) (34) of the horizontal portion (31) of the second fastening member (6) together.

**[0066]** In the description above, the sound absorption mats (11) and (14) may be formed of the waist sound absorption mats (11a) and (14a) alone, respectively. In this case, the sound insulation cover may be formed in the shape of a flat plate bridged between the upper end of the side surface of the rail waist and the tip end of the upper surface of the rail bottom.

**[0067]** In the above description, the damping sheets (12) and (15) enhance the noise insulation effect by suppressing vibrations of the sound insulation covers (13) and (16), respectively. It should be appreciated, however, that excellent noise insulation performance can be achieved by omitting the damping sheets (12) and (15) and instead by using sound absorption mats (11) and (14), which are provided in parts divided to waist sound absorption mats (11a) and (14a) and bottom sound absorption mats (11b) and (14b), respectively, and sound insulation covers (13) and (16) covering the sound absorption mats (11) and (14), respectively.

**[0068]** Fig. 10 shows a reference example when the noise insulation devices for a rail of the embodiments above is simplified. A noise insulation device (10) for a rail includes a first noise insulation member (2) attached to a necessary part on the surface of a rail (R) from the left (one side), a second noise insulation member (3) attached to a necessary

part on the surface of the rail (R) from the right (the other side), and a fastener (70) used to fasten the both noise insulation members (2) and (3).

[0069] The noise insulation members (2) and (3) are the same as their respective counterparts of the embodiments above and a description is omitted herein by labeling the same reference numerals as those of the embodiments above.

[0070] As is also shown in Fig. 11, the fastener (70) has a horizontal portion (71) inserted beneath the lower surface of the rail bottom (Rb), a first rising portion (72) provided so as to continue from a left end of the horizontal portion (71) and fit to the slope portion (13a) of the sound insulation cover (13) of the first noise insulation member (2), and a second rising portion (73) provided so as to continue from a right end of the horizontal portion (71) and fit to the vertical portion (16b) of the sound insulation cover (16) of the second noise insulation member (3).

[0071] The horizontal portion (71) is fit to both of the horizontal portion (13c) of the sound insulation cover (13) of the first noise insulation member (2) and the horizontal portion (16c) of the sound insulation cover (16) of the second noise insulation member (3) from beneath.

[0072] An upper end position of the first rising portion (72) is set to be substantially equal to an upper end position of the waist sound absorption mat (11a) of the first noise insulation member (2) and an upper end position of the second rising portion (73) is set to be as high as or lower than the rail bottom (Rb). The fastener (70) is installed from the left of Fig. 10. In this instance, because the upper end position of the second rising portion (73) is set to be as high as or lower than the rail bottom (Rb), it is easy to move the fastener (70) to the right (inner side) of the rail (R). An installation work can be thus performed easily.

[0073] The horizontal portion (71) is provided with a rubber cushion (74) extending across and in abutment with the horizontal portion (13c) and (16c) of the sound insulation covers (13) and (16) of the noise insulation members (2) and (3), respectively. The first rising portion (72) is provided with a rubber cushion (75) in abutment with an upper part of the slope portion (13a) of the sound insulation cover (13) of the first noise insulation member (2).

[0074] According to the noise insulation device (10) for a rail of this reference example, in contrast to the first and second embodiments above where two fastening members (8) and (9) and two fastening members (5) and (6) are required, respectively, both of the noise insulation members (2) and (3) can be fastened by the single fastener (70). In this instance, no tool is required for bolt fixation or screw fixation, which can in turn make works less tedious and less complex. Also, it is not structured so as to fasten the fastener (70) by bolts on a side in the lower surface of the rail bottom. Hence, a portion overhanging from the rail (R) becomes extremely small and does not interfere with rail maintenance.

#### Industrial Applicability

[0075] According to the noise insulation device for a rail of the invention, sounds generated at the rail are reduced and, moreover, works can be less tedious and less complex. Hence, contributions can be made to railroad noise-reduction.

#### Claims

1. A noise insulation device for a rail, including a first noise insulation member (2) having a sound absorption mat (11) and a sound insulation cover (13) and attached to a necessary part on a rail surface from one side, a second noise insulation member (3) having a sound absorption mat (14) and a sound insulation cover (16) and attached to a necessary part on the rail surface from the other side, and a fastener (7,4) used to fasten the both noise insulation members, wherein the fastener is formed of a first fastening member (8, 5) and a second fastening member (9,6); the first fastening member has a horizontal portion (41,21) inserted beneath a lower surface of a rail bottom and a rising portion (42,22) provided so as to continue from an end of the horizontal portion and fit to the sound insulation cover of one of the noise insulation members (3,2); the second fastening member has a horizontal portion (51,31) inserted beneath the horizontal portion (41,21) of the first fastening member and a rising portion (52,32) provided so as to continue from an end of the horizontal portion and fit to the sound insulation cover of the other one of the noise insulation members (3,2); and at least one convex portion (44,24) is provided to one of the first and second fastening members (8, 5, 9, 6) and a concave portion (54,34) to be fit together with the convex portion is provided to the other one of the fastening members, so that the first fastening member (8, 5) and the second fastening member (9, 6) are fit together in a re-attachable manner with the respective horizontal portions being stacked, the noise insulation device for a rail being **characterised in that** at least one of the first and second fastening members is provided with a bent portion (53,23) formed at an end of the horizontal portion on an opposite side to the rising portion (52,22) so as to restrict a movement of the fastening member toward the rising portion (52,22).

2. The noise insulation device for a rail according to claim 1, **characterized in that:**

the bent portion (53) is provided to the second fastening member and brought into abutment with the rising portion (42) of the first fastening member from an outer side.

3. The noise insulation device for a rail according to claim 2, **characterized in that:**

the at least one convex portion includes a first convex portion (45) provided on an outer surface of the rising portion (42) of the first fastening member; and a first concave portion (55) to be fit together with the first convex portion (45) is provided to the bent portion (53) of the second fastening member.

4. The noise insulation device for a rail according to claim 3, **characterized in that:**

the at least one convex portion includes a second convex portion (44) provided so as to protrude in a horizontal direction from the end of the horizontal portion of the first fastening member on the opposite side to the rising portion; and

a second concave portion (54) to be fit together with the second convex portion (44) is provided at a lower end of the rising portion of the second fastening member.

5. The noise insulation device for a rail according to claim 1, **characterized in that:**

the at least one convex portion includes a first convex portion (24) provided to the horizontal portion of one of the first and second fastening members; and

a first concave portion (34) to be fit together with the first convex portion is provided to the horizontal portion of the other one of the fastening members.

6. The noise insulation device for a rail according to claim 5, **characterized in that:**

the horizontal portion (21,31) of one of the first and second fastening members is provided with a guide portion (25) that guides the horizontal portion of the other one of the fastening members when the horizontal portion of the other one of the fastening members is stacked thereon and also restricts a movement of the horizontal portion of the other one of the fastening members in a rail length direction after the horizontal portions are stacked.

7. The noise insulation device for a rail according to any of claims 1 through 6, **characterized in that:**

the sound insulation cover (13, 16) is formed in a shape of a flat plate bridged between an upper end of a side surface of a rail waist and a tip end of an upper surface of the rail bottom.

8. The noise insulation device for a rail according to any of claims 1 through 6, **characterized in that:**

the sound insulation cover (13, 16) has a slope portion extending from an upper end of a side surface of a rail waist to a tip end of an upper surface of the rail bottom, a vertical portion extending from a lower end of the slope portion along a side surface of the rail bottom, and a horizontal portion extending from a lower end of the vertical portion along a lower surface of the rail bottom; and

the sound absorption mat (11, 14) is provided to both of the slope portion and the horizontal portion.

9. The noise insulation device for a rail according to claim 8, **characterized in that:**

the vertical portion of the sound insulation cover (13, 16) is provided with a convex portion that prevents displacement of the respective fastening members in a rail direction.

10. A method of attaching the noise insulation device for a rail set forth in claim 4 to a rail, **characterized by** comprising:

a step of installing the first fastening member (8,5) by inserting the horizontal portion (41,21) of the first fastening member beneath the lower surface of the rail bottom from one side of the rail;

a step of installing the second fastening member (9,6) by inserting the horizontal portion (51,31) of the second fastening member beneath the horizontal portion (41,21) of the first fastening member from the other side of the rail for the second concave portion (54,34) of the second fastening member and the second convex portion (44,24) of the first fastening member to be fit together in such a manner that there is no clearance between an end of the horizontal portion of the first fastening member on the opposite side to the rising portion and an end

of the second fastening member on a side of the rising portion whereas there is a clearance between an end of the horizontal portion of the first fastening member on the side of the rising portion and an end of the horizontal portion of the second fastening member on a side of the bent portion;  
and

a step of eliminating the clearance between the end of the horizontal portion of the first fastening member on the side of the rising portion and the end of the second fastening member on the side of the bent portion (53,23) using a bar-like tool (60) given that one end of the tool is a pivot point and the other end of the tool is a point of effort by bringing an intermediate portion of the tool in abutment with the end of the horizontal portion of the second fastening member on the side of the bent portion from below and applying an upward force to the point of effort.

## Patentansprüche

1. Geräuschisolationsvorrichtung für eine Schiene, umfassend ein erstes Geräuschisolationselement (2) mit einer Schallabsorptionsmatte (11) und einer Schallisoliationsabdeckung (13) und von einer Seite an einen notwendigen Teil auf einer Schienenoberfläche befestigt, ein zweites Geräuschisolationselement (3) mit einer Schallabsorptionsmatte (14) und einer Schallisoliationsabdeckung (16) und von der anderen Seite an einen notwendigen Teil auf der Schienenoberfläche befestigt und ein Befestiger (7, 4), die benutzt werden, um die beiden Geräuschisolationselemente zu befestigen, wobei  
der Befestiger aus einem ersten Befestigungselement (8, 5) und einem zweiten Befestigungselement (9, 6) gebildet ist;  
das erste Befestigungselement einen horizontalen Abschnitt (41, 21), der unter einer unteren Oberfläche eines Schienenbodens eingeführt ist, und einen steigenden Abschnitt (42, 22) hat, der so vorgesehen ist, dass er sich von einem Ende des horizontalen Abschnitts fortsetzt und zu der Schallisoliationsabdeckung eines der Geräuschisolationselemente (3, 2) passt;  
das zweite Befestigungselement einen horizontalen Abschnitt (51, 31), der unter dem horizontalen Abschnitt (41, 21) des ersten Befestigungselements eingeführt ist, und einen steigenden Abschnitt (52, 32) hat, der so vorgesehen ist, dass er sich von einem Ende des horizontalen Abschnitts fortsetzt und zu der Schallisoliationsabdeckung des anderen Geräuschisolationselements (3, 2) passt; und  
zumindest ein konvexer Abschnitt (44, 24) an einem der ersten und zweiten Befestigungselemente (8, 5, 9, 6) vorgesehen ist und ein konkaver Abschnitt (54, 34) an dem anderen der Befestigungselemente vorgesehen ist, um mit dem konvexen Abschnitt zusammen gefügt zu werden, sodass das erste Befestigungselement (8, 5) und das zweite Befestigungselement (9, 6) in einer wiederbefestigbaren Weise mit dem jeweiligen horizontalen Abschnitt aufeinander gestapelt zusammen gefügt wird, die Geräuschisolationsvorrichtung für eine Schiene **dadurch gekennzeichnet ist, dass** zumindest eine der ersten und zweiten Befestigungselemente mit einem gebogenen Abschnitt (53, 23) vorgesehen ist, der an einem Ende des horizontalen Abschnitts auf einer dem steigenden Abschnitt (52, 22) gegenüberliegenden Seite ausgebildet ist, sodass eine Bewegung des Befestigungselements in Richtung des steigenden Abschnitts (52, 22) begrenzt ist.
2. Geräuschisolationsvorrichtung für eine Schiene nach Anspruch 1, dadurch gekennzeichnet, dass:  
der gebogene Abschnitt (53) an dem zweiten Befestigungselement vorgesehen ist und von einer Außenseite in Anlage mit dem steigenden Abschnitt (42) des ersten Befestigungselements gebracht wird.
3. Geräuschisolationsvorrichtung für eine Schiene nach Anspruch 2, **dadurch gekennzeichnet, dass**:  
der zumindest eine konvexe Abschnitt einen auf einer äußeren Oberfläche des steigenden Abschnitts (42) des ersten Befestigungselements vorgesehenen ersten konvexen Abschnitt (45) umfasst; und  
ein erster konkaver Abschnitt (55) an dem gebogenen Abschnitt (53) des zweiten Befestigungselements vorgesehen ist, um mit dem ersten konvexen Abschnitt (45) zusammen gefügt zu werden.
4. Geräuschisolationsvorrichtung für eine Schiene nach Anspruch 3, **dadurch gekennzeichnet, dass**:  
der zumindest eine konvexe Abschnitt einen zweiten konvexen Abschnitt (44) umfasst, der vorgesehen ist um in eine horizontale Richtung von dem Ende des horizontalen Abschnitts des ersten Befestigungselements auf der zu dem steigenden Abschnitt gegenüberliegenden Seite hervorzustehen; und  
ein zweiter konkaver Abschnitt (54) an einem unteren Ende des steigenden Abschnitts des zweiten Befesti-

gungselements vorgesehen ist, um mit dem zweiten konvexen Abschnitt (44) zusammen gefügt zu werden.

5. Geräuschisolationsvorrichtung für eine Schiene nach Anspruch 1, **dadurch gekennzeichnet, dass:**

der zumindest eine konvexe Abschnitt einen ersten konvexen Abschnitt (24) umfasst, der an dem horizontalen Abschnitt von einem, dem ersten und dem zweiten Befestigungselement, vorgesehen ist; und ein erster konkaver Abschnitt (34) an dem horizontalen Abschnitt des anderen Befestigungselements vorgesehen ist, um mit dem ersten konvexen Abschnitt zusammen gefügt zu werden.

6. Geräuschisolationsvorrichtung für eine Schiene nach Anspruch 5, dadurch gekennzeichnet, dass:

der horizontale Abschnitt (21, 31) von einem der ersten und zweiten Befestigungselemente mit einem Führungsabschnitt (25) vorgesehen ist, der den horizontalen Abschnitt des anderen Befestigungselements führt, wenn der horizontale Abschnitt des anderen Befestigungselements darauf gestapelt wird und auch eine Bewegung des horizontalen Abschnitts des anderen Befestigungselements in eine Schienenlängsrichtung begrenzt, nachdem die horizontalen Abschnitte gestapelt sind.

7. Geräuschisolationsvorrichtung für eine Schiene nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass:**

die Geräuschisolationsabdeckung (13, 16) in einer Form einer flachen Platte ausgebildet ist, die zwischen einem oberen Ende einer Seitenfläche eines Schienenmittelteils und einem Spitzenende einer oberen Oberfläche des Schienenbodens überbrückt.

8. Geräuschisolationsvorrichtung für eine Schiene nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass:**

die Geräuschisolationsabdeckung (13, 16) einen sich von einem oberen Ende einer Seitenfläche eines Schienenmittelteils zu einem Spitzenende einer oberen Oberfläche des Schienenbodens erstreckenden Schrägabschnitt, einen sich von einem unteren Ende des Schrägabschnitts entlang einer Seitenfläche des Schienenbodens erstreckenden vertikalen Abschnitt und ein sich von einem unteren Ende des vertikalen Abschnitts entlang einer unteren Oberfläche des Schienenbodens erstreckenden horizontalen Abschnitt hat; und die Geräuschabsorptionsmatte (11, 14) an beidem, dem Schrägabschnitt und dem horizontalen Abschnitt, vorgesehen ist.

9. Geräuschisolationsvorrichtung für eine Schiene nach Anspruch 8, dadurch gekennzeichnet, dass:

der vertikale Abschnitt der Geräuschisolationsabdeckung (13, 16) mit einem konvexen Abschnitt vorgesehen ist, der Verschieben des jeweiligen Befestigungselements in eine Schienenrichtung verhindert.

10. Verfahren zum Befestigen der Geräuschisolationsvorrichtung für eine Schiene dargelegt in Anspruch 4 an eine Schiene, **gekennzeichnet durch** das Umfassen von:

einen Schritt des Installierens des ersten Befestigungselements (8, 5) durch Einführen des horizontalen Abschnitts (41, 21) des ersten Befestigungselements unter die untere Oberfläche des Schienenbodens von einer Seite der Schiene;

einen Schritt des Installierens des zweiten Befestigungselements (9, 6) durch Einführen des horizontalen Abschnitts (51, 31) des zweiten Befestigungselements unter den horizontalen Abschnitt (41, 21) des ersten Befestigungselements von der anderen Seite der Schiene, um den zweiten konkaven Abschnitt (54, 34) des zweiten Befestigungselements und den zweiten konvexen Abschnitt (44, 24) des ersten Befestigungselements in einer solchen Weise zusammen zu fügen, dass es keine Lücke zwischen einem Ende des horizontalen Abschnitts des ersten Befestigungselements auf der zu dem steigenden Abschnitt der gegenüberliegenden Seite und einem Ende des zweiten Befestigungselements auf einer Seite des steigenden Abschnitts gibt, wobei es eine Lücke zwischen einem Ende des horizontalen Abschnitts des ersten Befestigungselements auf der Seite des steigenden Abschnitts und einem Ende des horizontalen Abschnitts des zweiten Befestigungselements auf einer Seite des gebogenen Abschnitts; und

ein Schritt des Eliminierens der Lücke zwischen dem Ende des horizontalen Abschnitts des ersten Befestigungselements auf der Seite des steigenden Abschnitts und dem Ende des zweiten Befestigungselements auf der Seite des gebogenen Abschnitts (53, 23) durch Benutzung eines stangenhaften Werkzeugs (60), wobei ein Ende des Werkzeugs ein Drehpunkt und das andere Ende des Werkzeugs ein Angriffspunkt ist, durch in Anlage

bringen eines dazwischenliegenden Abschnitts des Werkzeugs an das Ende des horizontalen Bereichs des zweiten Befestigungselements auf der Seite des gebogenen Abschnitts von unten und durch Aufbringung einer aufwärts gerichteten Kraft auf den Angriffspunkt.

5

## Revendications

1. Dispositif d'isolation antibruit pour un rail, comprenant un premier élément d'isolation antibruit (2) possédant un tapis d'absorption acoustique (11) et un couvercle d'isolation acoustique (13) et fixé à une pièce nécessaire sur une surface de rail à partir d'un côté, un second élément d'isolation antibruit (3) possédant un tapis d'absorption acoustique (14) et un couvercle d'isolation acoustique (16) et fixé à une pièce nécessaire sur la surface de rail à partir de l'autre côté, et une pièce de fixation (7, 4) utilisée pour fixer les deux éléments d'isolation antibruit, dans lequel la pièce de fixation est constituée d'un premier élément de fixation (8, 5) et d'un second élément de fixation (9, 6) ; le premier élément de fixation possède une partie horizontale (41, 21) insérée en dessous d'une surface inférieure d'une base de rail et une partie dressée (42, 22) fournie de sorte à se prolonger à partir d'une extrémité de la partie horizontale et à s'ajuster sur le couvercle d'isolation acoustique de l'un des éléments d'isolation antibruit (3, 2) ; le second élément de fixation possède une partie horizontale (51, 31) insérée en dessous de la partie horizontale (41, 21) du premier élément de fixation et une partie dressée (52, 32) fournie de sorte à se prolonger à partir d'une extrémité de la partie horizontale et à s'ajuster sur le couvercle d'isolation acoustique de l'autre des éléments d'isolation antibruit (3, 2) ; et au moins une partie convexe (44, 24) est fournie sur l'un des premier et second éléments de fixation (8, 5, 9, 6) et une partie concave (54, 34) destinée à être ajustée avec la partie convexe est fournie sur l'autre des éléments de fixation, de sorte que le premier élément de fixation (8, 5) et le second élément de fixation (9, 6) sont ajustés l'un avec l'autre de manière rattachable par rapport aux parties horizontales respectives empilées, le dispositif d'isolation antibruit pour un rail étant **caractérisé en ce que** au moins l'un des premier et second éléments de fixation est doté d'une partie coudée (53, 23) formée à une extrémité de la partie horizontale sur un côté opposé à la partie dressée (52, 22) de sorte à limiter un mouvement de l'élément de fixation vers la partie dressée (52, 22).
2. Dispositif d'isolation antibruit pour un rail selon la revendication 1, **caractérisé en ce que** : la partie coudée (53) est fournie sur le second élément de fixation et mise en butée avec la partie dressée (42) du premier élément de fixation à partir d'un côté externe.
3. Dispositif d'isolation antibruit pour un rail selon la revendication 2, **caractérisé en ce que** : l'au moins une partie convexe comprend une première partie convexe (45) fournie sur une surface externe de la partie dressée (42) du premier élément de fixation ; et une première partie concave (55) destinée à être ajustée avec la première partie convexe (45) est fournie sur la partie coudée (53) du second élément de fixation.
4. Dispositif d'isolation antibruit pour un rail selon la revendication 3, **caractérisé en ce que** : l'au moins une partie convexe comprend une seconde partie convexe (44) fournie de sorte à faire saillie dans une direction horizontale à partir de l'extrémité de la partie horizontale du premier élément de fixation sur le côté opposé à la partie dressée ; et une seconde partie concave (54) destinée à être ajustée avec la seconde partie convexe (44) est fournie à une extrémité inférieure de la partie dressée du second élément de fixation.
5. Dispositif d'isolation antibruit pour un rail selon la revendication 1, **caractérisé en ce que** : l'au moins une partie convexe comprend une première partie convexe (24) fournie sur la partie horizontale de l'un des premier et second éléments de fixation ; et une première partie concave (34) destinée à être ajustée avec la première partie convexe est fournie sur la partie horizontale de l'autre des éléments de fixation.
6. Dispositif d'isolation antibruit pour un rail selon la revendication 5, **caractérisé en ce que** :

la partie horizontale (21, 31) de l'un des premier et second éléments de fixation est dotée d'une partie de guidage (25) qui guide la partie horizontale de l'autre des éléments de fixation lorsque la partie horizontale de l'autre des éléments de fixation est empilée sur celle-ci et elle limite en outre un mouvement de la partie horizontale de l'autre des éléments de fixation dans une direction de la longueur du rail après l'empilement des parties horizontales.

7. Dispositif d'isolation antibruit pour un rail selon l'une quelconque des revendications 1 à 6, **caractérisé en ce que** :

le couvercle d'isolation acoustique (13, 16) est façonné en une forme de plaque plane montée en pont entre une extrémité supérieure d'une surface latérale d'une âme de rail et une extrémité de pointe d'une surface supérieure de la base de rail.

8. Dispositif d'isolation antibruit pour un rail selon l'une quelconque des revendications 1 à 6, **caractérisé en ce que** :

le couvercle d'isolation acoustique (13, 16) présente une partie inclinée s'étendant d'une extrémité supérieure d'une surface latérale d'une âme de rail à une extrémité de pointe d'une surface supérieure de la base de rail, une partie verticale s'étendant à partir d'une extrémité inférieure de la partie inclinée le long d'une surface latérale de la base de rail et une partie horizontale s'étendant d'une extrémité inférieure de la partie verticale le long d'une surface inférieure de la base de rail ; et

le tapis d'absorption acoustique (11, 14) est fourni à la fois sur la partie inclinée et la partie horizontale.

9. Dispositif d'isolation antibruit pour un rail selon la revendication 8, **caractérisé en ce que** :

la partie verticale du couvercle d'isolation acoustique (13, 16) est dotée d'une partie convexe qui empêche le déplacement des éléments de fixation respectifs dans une direction du rail.

10. Procédé de fixation du dispositif d'isolation antibruit pour un rail selon la revendication 4, à un rail, **caractérisé en ce qu'il comprend** :

une étape d'installation du premier élément de fixation (8, 5) par l'insertion de la partie horizontale (41, 21) du premier élément de fixation en dessous de la surface inférieure de la base de rail à partir d'un côté du rail ;

une étape d'installation du second élément de fixation (9, 6) par l'insertion de la partie horizontale (51, 31) du second élément de fixation en dessous de la partie horizontale (41, 21) du premier élément de fixation à partir de l'autre côté du rail pour que la seconde partie concave (54, 34) du second élément de fixation et la seconde partie convexe (44, 24) du premier élément de fixation soient ajustées l'une avec l'autre de manière à ce qu'il n'y ait pas de dégagement entre une extrémité de la partie horizontale du premier élément de fixation sur le côté opposé à la partie dressée et une extrémité du second élément de fixation sur un côté de la partie dressée tandis qu'il existe un dégagement entre une extrémité de la partie horizontale du premier élément de fixation sur le côté de la partie dressée et une extrémité de la partie horizontale du second élément de fixation sur un côté de la partie coudée ; et

une étape d'élimination du dégagement entre l'extrémité de la partie horizontale du premier élément de fixation sur le côté de la partie dressée et l'extrémité du second élément de fixation sur le côté de la partie coudée (53, 23) au moyen d'un outil en forme de barre (60), sachant qu'une extrémité de l'outil est un point de pivotement et l'autre extrémité de l'outil est un point d'effort, en amenant une partie intermédiaire de l'outil en butée contre l'extrémité de la partie horizontale du second élément de fixation sur le côté de la partie coudée à partir du dessous et en appliquant une force ascendante sur le point d'effort,

Fig. 1

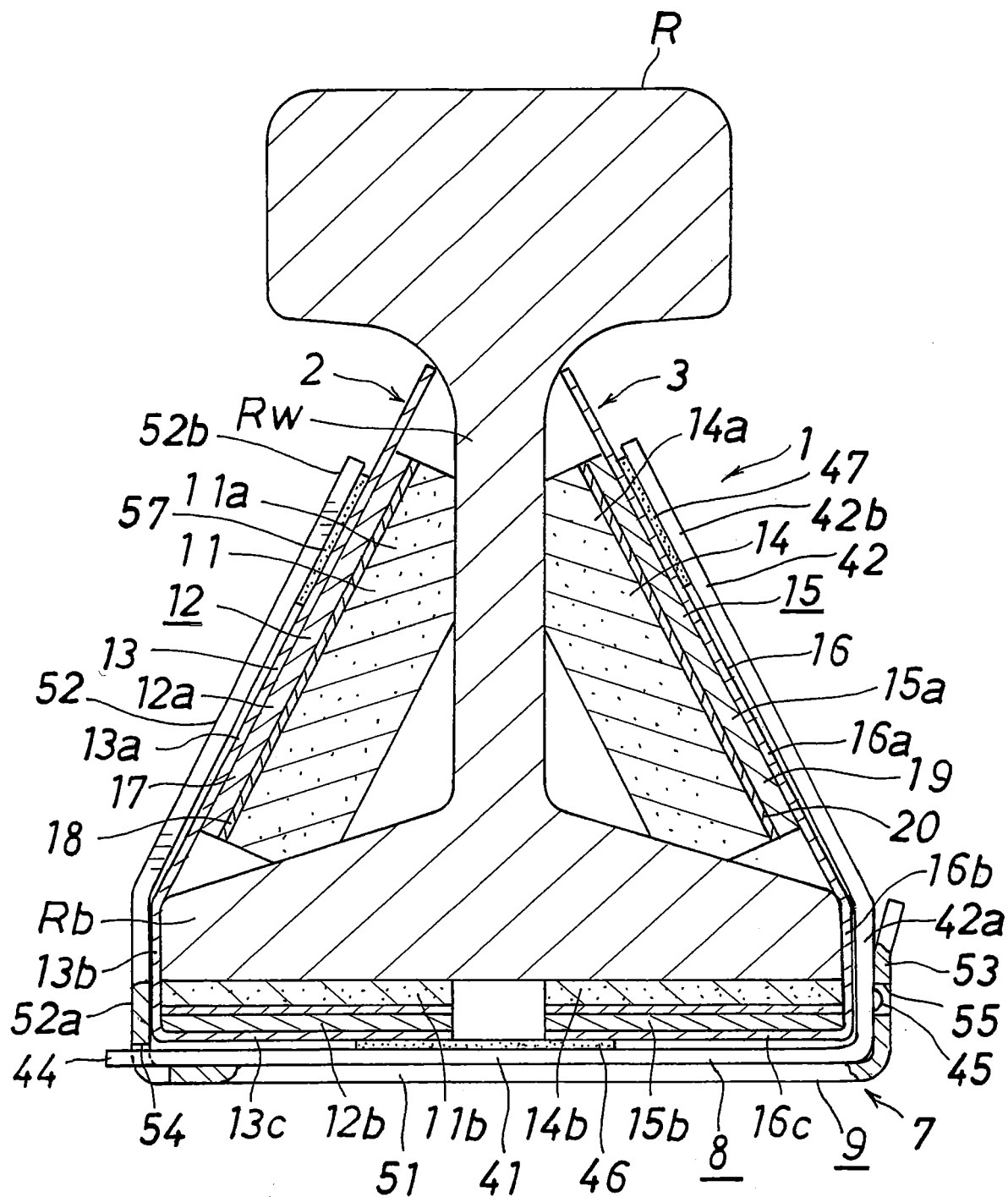


Fig. 2

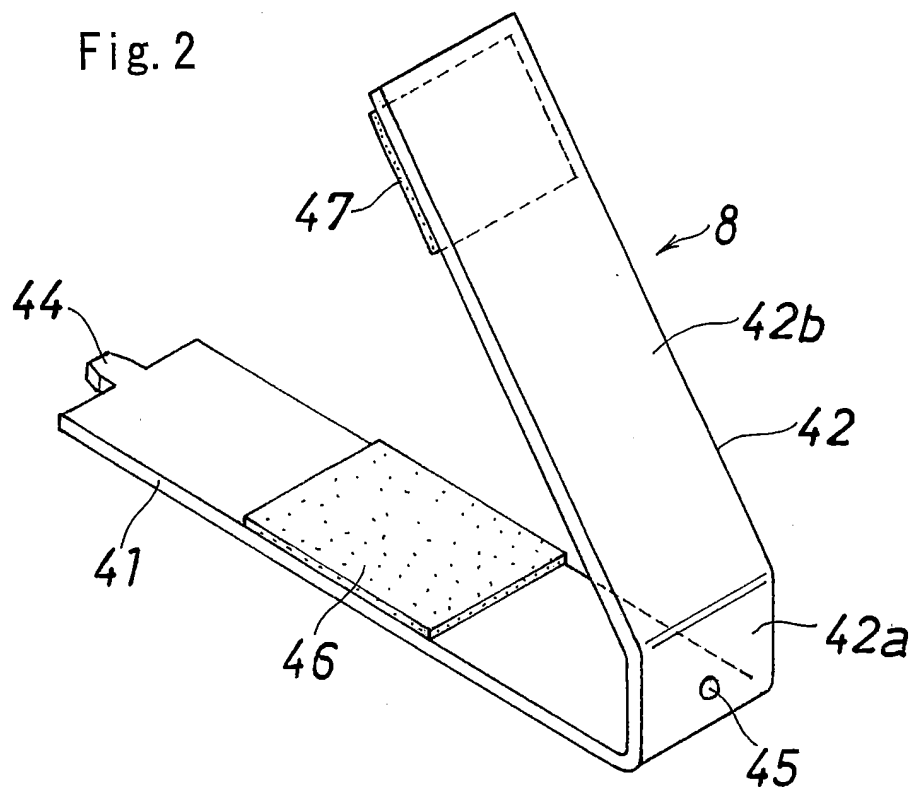


Fig. 3

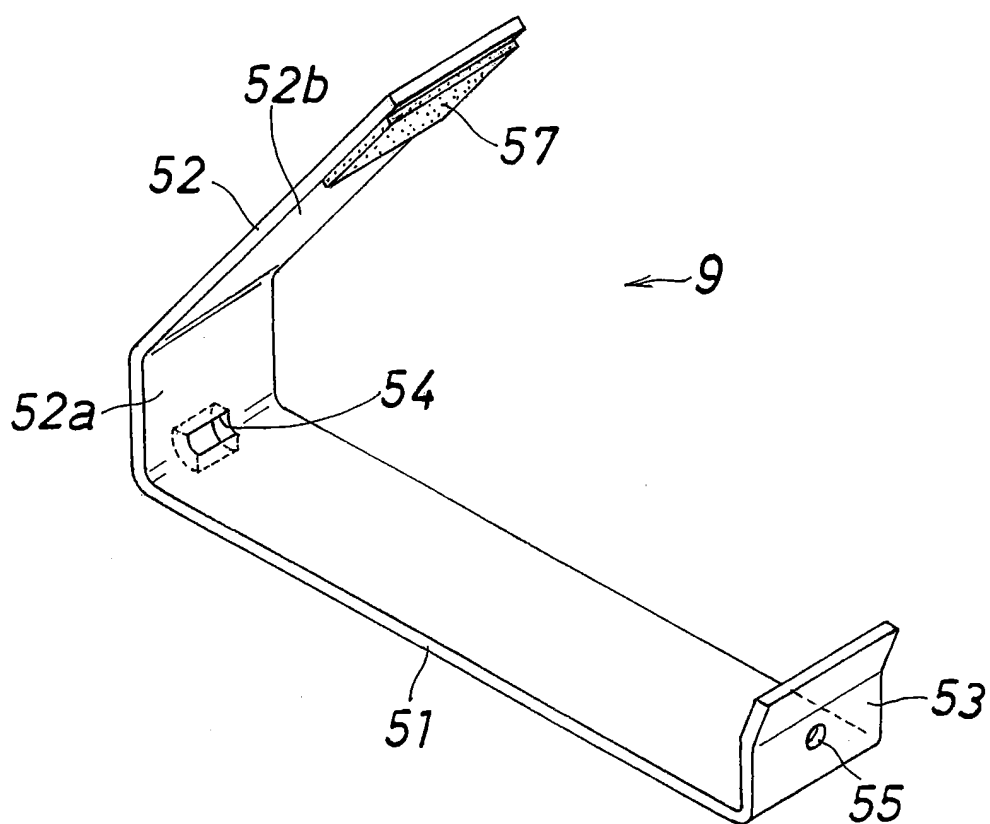


Fig. 4

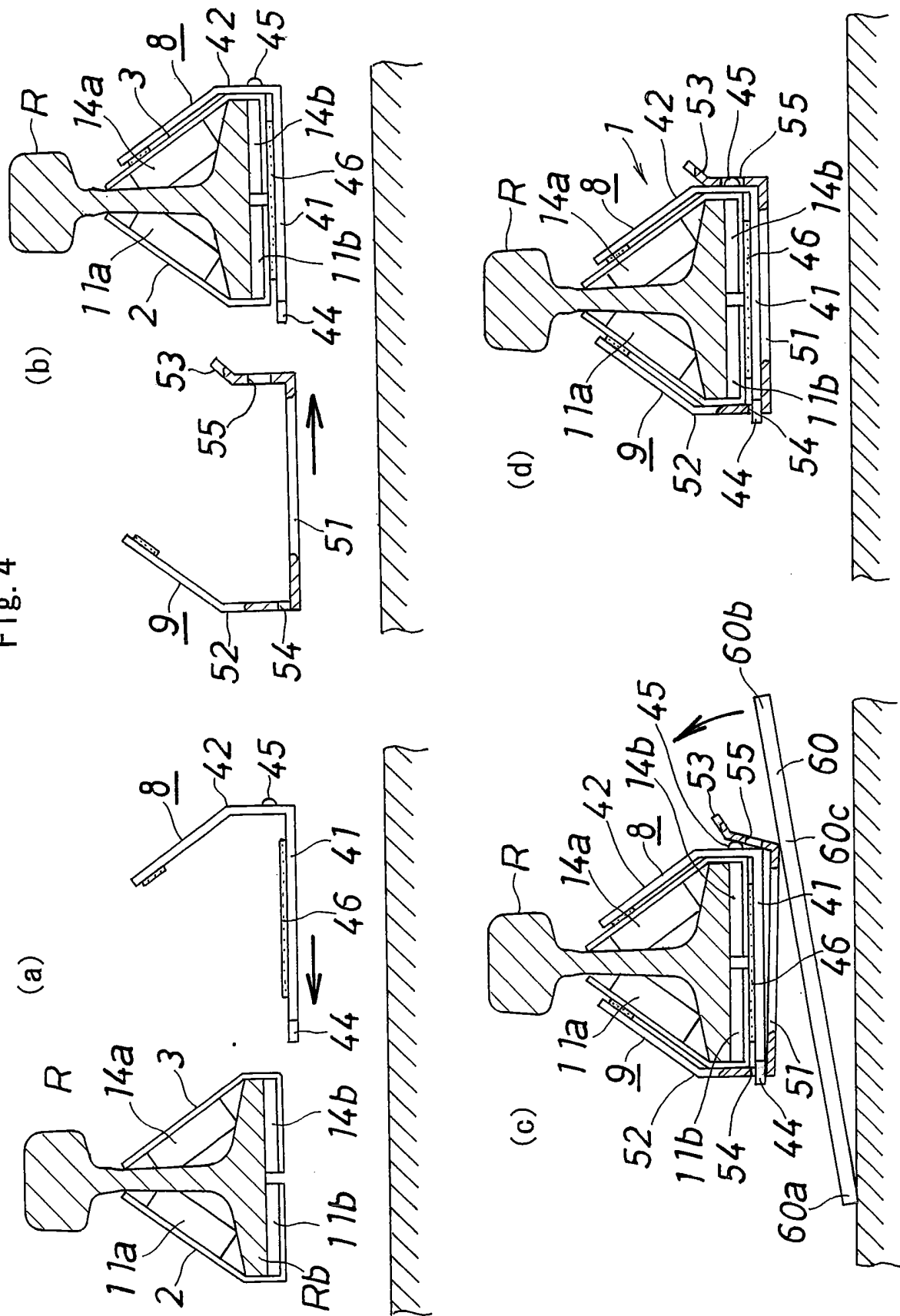


Fig. 5

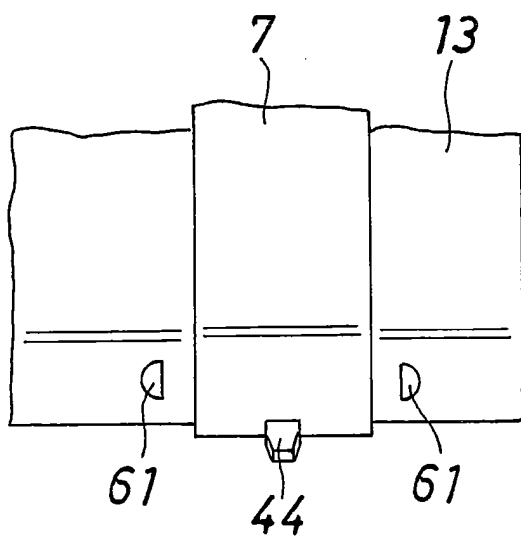


Fig. 6

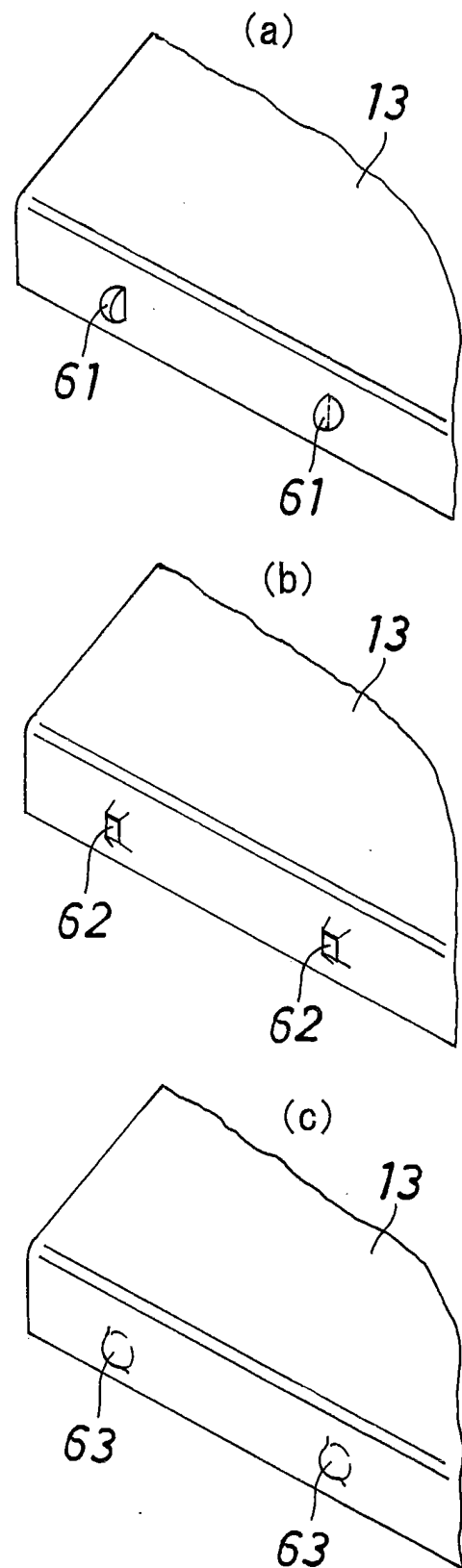


Fig. 7

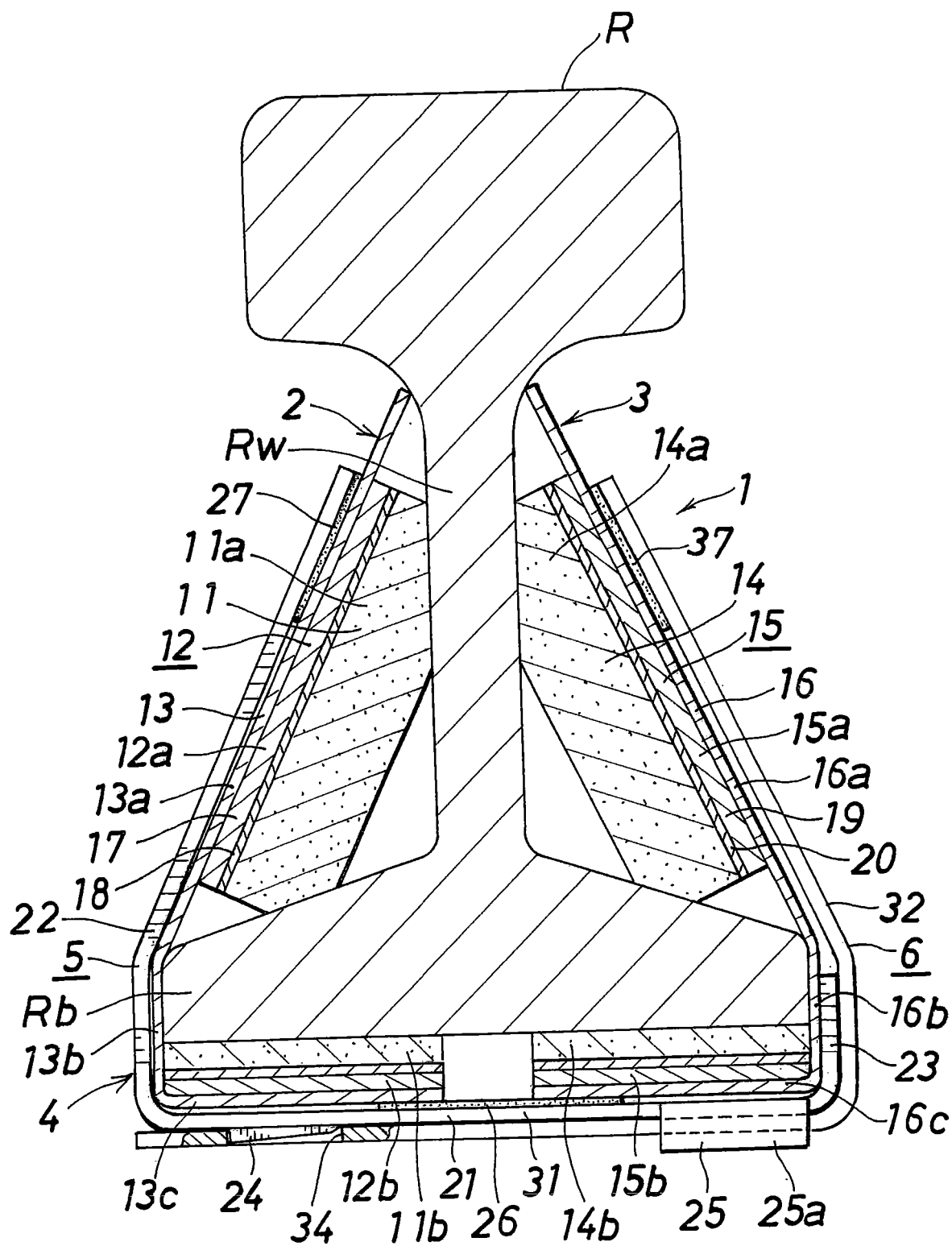


Fig. 8

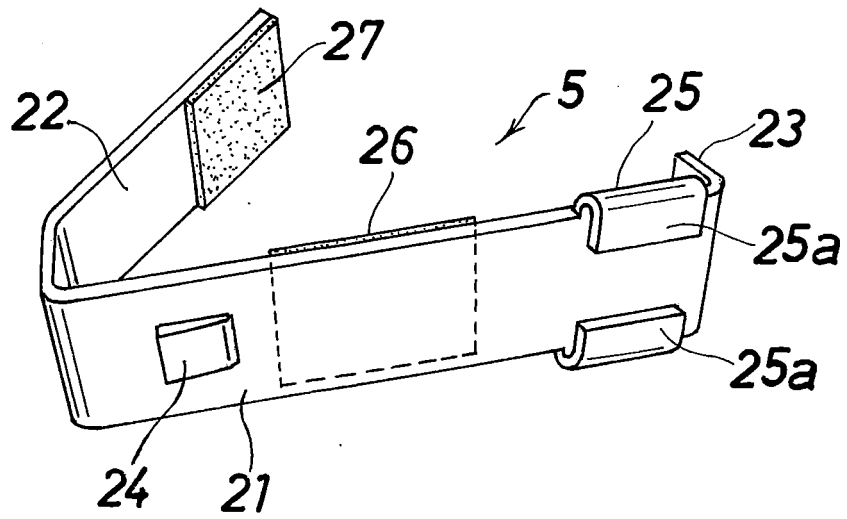


Fig. 9

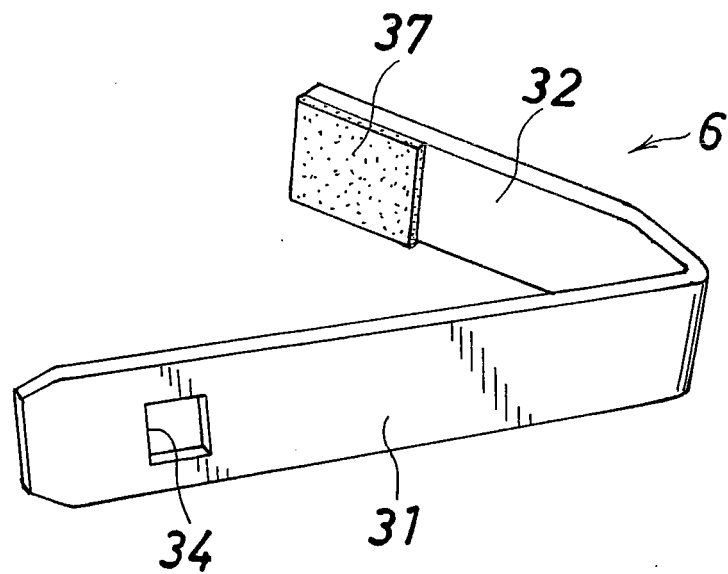


Fig. 10

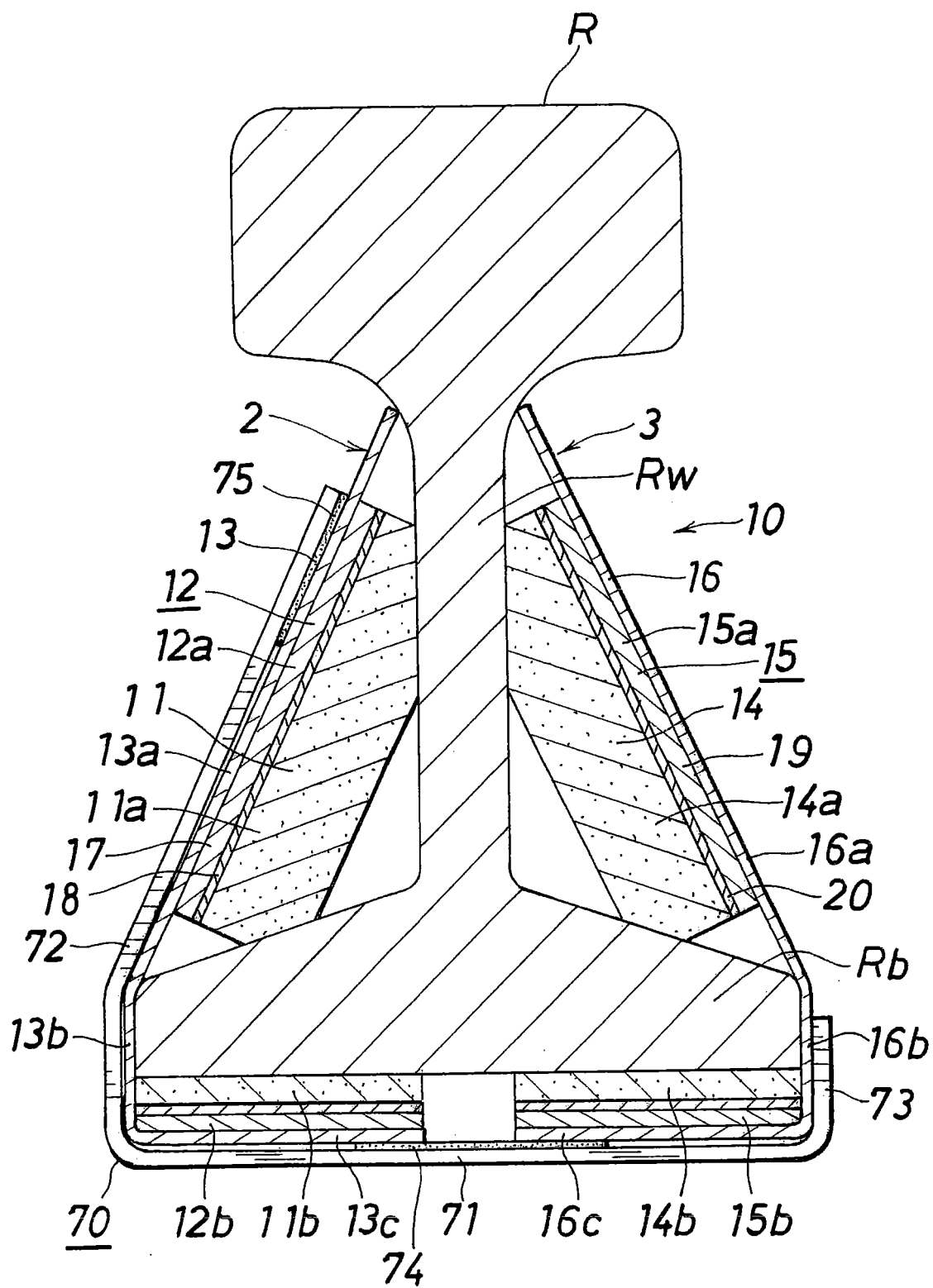
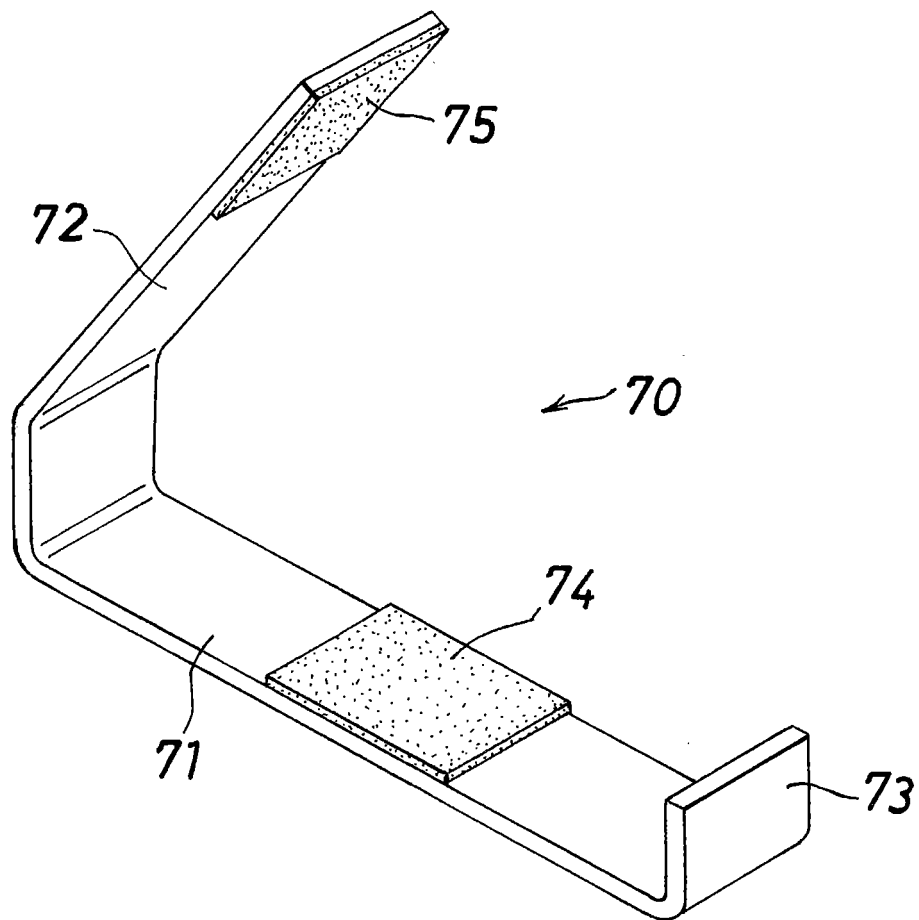


Fig. 11



**REFERENCES CITED IN THE DESCRIPTION**

*This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.*

**Patent documents cited in the description**

- JP 2007224700 A [0004]
- JP 2006002442 A [0004]
- JP 2008095408 A [0004]
- JP H10152801 B [0005]