(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 415 933 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
25.10.2017 Bulletin 2017/43

(21) Application number: **10758579.6**

(22) Date of filing: **26.03.2010**

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

(86) International application number:
PCT/JP2010/055405

(87) International publication number:
WO 2010/113807 (07.10.2010 Gazette 2010/40)

(54) **NOISE INSULATION DEVICE FOR RAIL**

GERÄUSCHISOLATIONSVORRICHTUNG FÜR SCHIENEN

DISPOSITIF D'ISOLATION SONORE POUR RAIL

(84) Designated Contracting States:
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 SE SI SK SM TR

(30) Priority: **03.04.2009 JP 2009090649**

(43) Date of publication of application:
08.02.2012 Bulletin 2012/06

(73) Proprietor: **Sekisui Chemical Co., Ltd.**
Osaka 530-8565 (JP)

(72) Inventors:
- **MATSUDA, Yoshifumi**
  Kyoto-shi
  Kyoto 601-8105 (JP)
- **OGUCHI, Takashi**
  Kyoto-shi
  Kyoto 601-8105 (JP)
- **ABE, Hiroyuki**
  Kyoto-shi
  Kyoto 601-8105 (JP)

(74) Representative: **Ter Meer Steinmeister & Partner Patentanwälte mbB**
Nymphenburger Straße 4
80335 München (DE)

(56) References cited:
EP-A2- 1 186 710
DE-A1- 4 036 124
JP-A- 2006 002 442
JP-A- 2007 120 018
JP-A- 2008 063 813
WO-A1-93/01354
DE-A1- 4 036 124
JP-A- 2006 002 442
JP-A- 2007 224 700
JP-A- 2008 063 813

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).

EP 2 415 933 B1

Printed by Jouve, 75001 PARIS (FR)

Description

Technical Field

[0001] The present invention relates to a soundproof device for rails configured to prevent noise generated from railroad rails.

Background Art

[0002] As one of soundproof devices of this type, the one described in JP-A-2007-224700 is known, for example. This soundproof device has a configuration as shown in Fig. 11 including three first to third rail ties S (only the second rail tie is illustrated) configured to fix a rail R arranged in sequence from one end to the other end of the rail in the longitudinal direction, a first soundproof cover 81 bridged between the first and second rail ties S, and a second soundproof cover 82 bridged between the second and third rail ties S, in which the length of the first soundproof cover 81 matches a pitch between the first and second rail ties, the length of the second soundproof cover 82 matches a pitch between the second and third rail ties, and required portions of a rail surface are covered with the first soundproof cover 81 and the second soundproof cover 82 in a state of forming a abutting portion 83 between opposed end surfaces of the first soundproof cover 81 and the second soundproof cover 82 on the second rail tie 2.

[0003] In this soundproof device, since the pitches of the rail ties vary, preparation of a number of soundproof covers 81, 82 having different lengths are required corresponding to the variations.

[0004] In order to avoid this complication, preparation of a single type of the soundproof covers 81, 82 formed into a fixed length so as to match a small tie pitch is also put into practice. In this case, as shown in Fig. 12, the opposed end surfaces of the first soundproof cover 81 and the second soundproof cover 82 may not come into abutment with each other on the second rail tie S and hence a clearance 84 may be formed between the end surfaces (as illustrated in JP-A-2007-120018). In this event, noise leaks from the clearance 84, and the soundproof effect is impaired.

Cited Reference

Patent Document

[0005]

Patent Document 1: JP-A-2007-224700
Patent Document 2: JP-A-2007-120018

Summary of Invention

Problems to be Solved by the Invention

[0006] It is an object of the present invention to provide a soundproof device for rails, which does not require preparation of a number of soundproof covers having different lengths, and achieves effective prevention of the noise using a single type of soundproof covers having the same length.

Means for Solving the Problems

[0007] A soundproof device for rails according to the present invention includes: three first to third rail ties configured to fix a rail arranged in sequence from one end to the other end of the rail in the longitudinal direction, a first soundproof cover bridged between the first and second rail ties, and a second soundproof cover bridged between the second and third rail ties, and the respective soundproof covers have a fixed length which is longer than any of a pitch of the first and second rail ties and a pitch of the second and third rail ties, and required portions of a rail surface are covered with the first soundproof cover and the second soundproof cover in a state in which opposed end portions of the first soundproof cover and the second soundproof cover are overlapped with each other over a required width on the second rail tie.

[0008] According to the soundproof device for rails in the present invention, since a single type of soundproof covers having a larger length than a rail tie pitch are used and the opposed end portions of the adjacent two soundproof covers are overlapped with each other by an extent corresponding to the difference in length, the required portions of the rail surface can be covered entirely without forming a clearance between the opposed end surfaces of the adjacent two soundproof covers.

[0009] In addition, when the rail includes a top portion, a waist portion, and a bottom portion continuing from top to bottom in sequence, the soundproof covers each include a cover body bridged from an upper end of a side surface of the waist portion to an extremity of an upper surface of the bottom portion, and a sound absorbing material bonded on an inner surface of the cover body, and a portion of the sound absorbing materials of the respective soundproof covers are removed so that only the cover bodies of the respective soundproof covers are overlapped with each other at a portion where the first soundproof cover and the second sound proof cover are overlapped with each other, the cover bodies only having relatively small thickness can be overlapped with each other with high degree of workability without being interfered by the sound absorbing material having a relatively large thickness at the overlapped portion of the soundproof cover.

[0010] It is preferable that the sound absorbing material is obtained by causing the resin to foam. As the resin, polyethylene resin, EPDM, polypropylene resin, and pol-

yvinyl chloride resin are exemplified.

[0011] Specifically, if a resin having a cell diameter of 1 mm or smaller and formed of foamed polyethylene member is used from among the resins listed above, a noise reduction effect in a range from 500 to 3.15 kHz which affects the noise level much when the train passes therethrough is achieved significantly.

[0012] As specifications of the foamed member, a foaming magnification of 10 to 40, specifically a foaming magnification of 15 to 30 are preferable in view of soundproof property and workability. In addition, a continuous cell ratio of 90% or higher, and a compression stress (25%) of 3 to 5 kPa are preferable.

[0013] Also, if the rail includes the head portion, the waist portion, and the bottom portion continued from top to bottom in sequence, the soundproof covers each include a side cover covering the side surface of the waist portion and the upper surface of the bottom portion, and a bottom cover covering the bottom surface of the rail so as to continue from a lower end of the side cover, a large surface area from the side surface of the waist portion of the rail to a lower surface of the bottom portion is covered with the soundproof cover, further soundproof effect can be expected.

Advantages of the Invention

[0014] According to the present invention, there is provided a soundproof device for rails, which does not require preparation of a number of soundproof covers having different lengths, and achieves effective prevention of the noise using a single type of soundproof covers having the same length.

Brief Description of the Drawings

[0015]

Fig. 1 is a vertical longitudinal cross-sectional view of a soundproof device according to the present invention.

Fig. 2 is a side view of the same device.

Fig. 3 is a vertical longitudinal cross-sectional view of the soundproof device according to another embodiment of the present invention.

Fig. 4 is a side view of the same device.

Fig. 5 is a graph of a total frequency showing a soundproof effect brought about by the same device.

Fig. 6 is a graph of respective frequencies of the same device.

Fig. 7 is a table showing test conditions for confirming the soundproof effect depending on the difference of sound absorbing materials used in the same soundproof device.

Fig. 8 is a graph showing a noise reduction effect obtained in a laboratory conducted under the same test conditions.

Fig. 9 is a graph showing results of noise measurement when a train is actually passed therethrough conducted under the same test conditions.

Fig. 10 is a graph showing a result of simulation of the noise reduction effect on the basis of data shown in Fig. 8 and Fig. 9.

Fig. 11 is a side view corresponding to Fig. 2 showing an example in the related art.

Fig. 12 is a side view corresponding to Fig. 2 showing another example in the related art.

Modes for Carrying Out the Invention

[0016] Referring now to Fig. 1, a rail R includes a top portion Rt, a waist portion Rw, and a bottom portion Rb continuing from top to bottom in sequence.

[0017] Portions from both left and right surfaces of the waist portion Rw to a top surface of the bottom portion Rb are covered with a pair of left and right soundproof covers 11. The both soundproof covers 11 have the same structure although being mirror reversed.

[0018] The respective soundproof covers 11 each include a cover body 11A formed of a steel plate bridged from the upper end of a side surface of the waist portion Rw to an extremity of an upper surface of the bottom portion Rb, a thin damping resin damping material 21 and a thick formed resin sound absorbing material 22 bonded on an inner surface of the cover body 11A.

[0019] Fig. 2 shows a state of installation of the soundproof cover 11. Three first to third rail ties S1 to S3 are laid down in sequence from the left side to the right side, and the rail R extending in the lateral direction is supported thereby. The rail R is fixed onto the respective first to third rail ties S1 to S3 with tightening members T.

[0020] A first soundproof cover 31 is bridged between the first and second rail ties S1, S2, and a second soundproof cover 32 is bridged between the second and third rail ties S2, S3.

[0021] A first pitch P1 between the first and second rail ties S1, S2 and a second pitch P2 between the second and third rail ties S2, S3 are the same or the latter is larger than the former. The length L of the first soundproof cover 31 and the second soundproof cover 32 is the same. These sizes have a relationship; $P1 \leq P2 < L$.

[0022] An overlapped portion 33 is formed at a right end portion of the first soundproof cover 31 and a left end portion of the second soundproof cover 32 on the second rail tie S2, where both are overlapped with each other over a required width B. The width B of the overlapped portion 33 is on the order of 20 to 80 mm, according to the invention and, preferably, 50 mm considering variations in tie pitch and soundproof performance. If it is smaller than 20 mm, when the tie pitch varies significantly, the width of variations become larger than the overlapped portion 33, so that a clearance may be formed and a sound absorbing effect is lowered. If it exceeds 80 mm, the overlapped portion 33 is large, and hence a large amount of the sound absorbing material 22 must be removed, whereby the sound absorbing effect is lowered.

[0023] Furthermore, although detail illustration is not given, the damping materials 21 and the sound absorbing materials 22 of the respective soundproof covers 31, 32 are removed so that only the cover bodies (not shown) of the respective soundproof covers 31, 32 are overlapped at the overlapped portion 33 of the right end portion of the first soundproof cover 31 and the second soundproof cover 32.

[0024] At the right end portion of the first soundproof cover 31 and the left end portion of the second soundproof cover 32 are formed notches 31a, 32a, respectively, for avoiding interference with the tightening member T.

[0025] Fig. 3 shows a modification of a soundproof cover 41. The soundproof cover 41 in this modification includes side covers 42 and a bottom cover 43 formed integrally as a whole.

[0026] The side covers 42 have basically the same structure as the soundproof covers 41 shown in Fig. 1, and each include a side cover body 42A formed of a steel plate bridged from the upper end of the side surface of the waist portion Rw to the extremity of the upper surface of the bottom portion Rb, and a damping resin damping material 51 and a foamed resin sound absorbing material 52 bonded on the inner surface of the side cover body 42A. The bottom cover 43 includes a bottom cover body 43A formed of a steel plate aligned at an upper end thereof with a lower end of the side cover body 42A and having a L-shape in lateral cross section, and a damping resin damping material 53 and a foamed resin sound absorbing material 54 bonded on an upper surface of a horizontal portion thereof.

[0027] The soundproof covers 41 in this modification includes an overlapped portion 61 formed on a single rail tie S by opposed end portions of the two adjacent soundproof covers 41 as shown in Fig 4. The side cover 42 is formed with notches 71, 72 in the same manner as the notches 31a, 32a shown in Fig. 2. The bottom cover 43 is formed with notches 73, 74 for avoiding interference with the rail tie S.

[0028] The result of measurement of the soundproof effect of the soundproof cover according to the application of the present invention will be described in comparison with the soundproof effect brought about by the soundproof cover described in the section of Background Art.

[0029] The method of measurement will be as follows. The 50N rail R with a tie span of 600 mm is oscillated by pink noise fed from an oscillation speaker. In order to prevent the effect of a direct sound from the oscillation speaker, a microphone is placed at a position of 100 mm from the waist portion Rw of the rail R at a position of 2 m apart from a shaking point, and then the noise level is measured.

[0030] The soundproof effect is calculated by subtracting a sound pressure level of the rail R provided with the cover from a sound pressure level of the naked rail R, which is the rail R not provided with the cover.

[0031] Fig. 5 and Fig. 6 show the results of the measurement. Fig. 5 shows total average values of the sound pressure in a range from 400 to 4kHz, and Fig. 6 shows sound pressures at frequencies in a range from 400 to 4kHz, respectively.

[0032] In Fig. 5 and Fig. 6, a sign a represents a case where there is no clearance between the covers as shown in Fig. 7, a sign b represents a case where there is a clearance between the covers as shown in Fig. 8, a sign c represents a case where end portions of the covers are overlapped with each other as shown in Fig. 1, and a sign d represents a case where a bottom surface of the rail R is covered with the cover as shown in Fig. 3 in addition to the covered surface shown by the sign c, respectively.

[0033] As shown by the sign b, when there is the clearance between the covers, the sound pressure reduction effect is the lowest. In the case where there is no clearance between the covers as shown by the sign a and the case where the end portions of the covers are overlapped with each other as shown by the sign c, the sound pressure reduction effect is achieved by the same extent. In addition, the fact that the sound pressure reduction effect is higher when the bottom surface of the rail R is covered with the cover is as shown by the sign d.

[0034] The cover body described above is not limited to be formed of the steel plate, but may be formed of resin. However, when the covers are abutted without clearance therebetween as shown by the sign a as described above, there is a probability of formation of the clearance due to the thermal contraction of the rail. In this case, the sound pressure reduction effect may be lowered.

[0035] The fact that the soundproof effect is improved by forming the sound absorbing material of foamed resin member is proved by a test described below.

[0036] Fig. 7 shows test conditions. Measured data of the sound reduction effect in a laboratory using the resins under the conditions shown in Fig. 7 is shown in Fig. 8. Fig. 9 shows sound measurement data measured when a train is actually passed therethrough using the resins under the same conditions. Fig. 10 shows a result of simulation of the sound pressure reduction effects of the above-described various resins from the sound pressure levels when the train is passed therethrough using the data shown in Fig. 8 and Fig. 9. In any of Fig. 8 to Fig. 10, it is understood that the soundproof performance of the sound absorbing material, polyethylene resin having a cell diameter of 0.5 to 1 mm and a foaming magnification of 30 is superior.

[0037] When executing the soundproof covers on the spot, notches as a runout for the tightening member may be formed by on-the-spot adjustment on the spot of execution or may be formed in advance. With the on-the-spot adjustment, execution of the soundproof covers may be performed for the rails without being affected by a change of the tie pitch. In addition, the soundproof covers can be prepared without being bound by the notches. Therefore, the soundproof covers having a length longer

than the tie pitch can easily be used, and hence the workability is improved.

[0038] In addition, when the sound proof covers carried into the spot of execution are rolled, the handling of the rolled soundproof cover is facilitated.

[0039] Although the illustration is omitted, urethane foamed material or the like may be injected into clearances between the overlapped portion 33 of the soundproof covers and the rail R (positions where the sound absorbing materials 22 are omitted), whereby the sound absorbing effect can be enhanced by filling the clearances.

Industrial Applicability

[0040] The soundproof device for rails according to the present invention does not require preparation of a number of soundproof covers having different lengths, and achieve the effective prevention of the noise using a single type of soundproof covers having the same length.

Reference Numerals

[0041]

S1 to S3:	rail tie
31:	first soundproof cover
32:	second soundproof cover
L:	cover length
P1, P2:	tie pitch
R:	rail

Claims

1. A soundproof device for rails comprising: three first to third rail ties (S1, S2, S3) configured to fix a rail (R) arranged in sequence from one end to the other end of the rail in the longitudinal direction, a first soundproof cover (31) bridged between the first and second rail ties (S1, S2), and a second soundproof cover (32) bridged between the second and third rail ties (S2, S3), wherein the respective soundproof covers have a fixed length which is longer than any of a pitch (P) of the first and second rail ties and a pitch of the second and third rail ties, and portions of a rail surface are covered with the first soundproof cover (31) and the second soundproof cover (32) in a state in which opposed end portions of the first soundproof cover and the second soundproof cover are overlapped with each other forming an overlapped portion (33) over a width of 20 to 80 mm on the second rail tie,
further comprising a sound absorbing material (22) bonded on an inner surface of each cover body,
and wherein a first pitch (P1) between the first and second rail ties (S1, S2) and a second pitch (P2) between the second and third rail ties (S2, S3) are the same or the latter is larger than the former, and the length L of the first soundproof cover and the second soundproof cover is the same, and the sizes have a relationship; $P1 \leq P2 < L$.

2. The soundproof device for rails according to Claim 1, wherein the rail includes a top portion, a waist portion, and a bottom portion continuing from top to bottom in sequence, soundproof covers (11) each include a cover body (11A) bridged from an upper end of a side surface of the waist portion to an extremity of an upper surface of the bottom portion, and the cover bodies (11A) of the respective soundproof covers (11) are overlapped with each other at a portion where the first soundproof cover and the second sound proof cover are overlapped with each other.

3. The soundproof device for rails according to Claim 1, wherein the sound absorbing material (22) is a resin formed of polyethylene and the cell diameter thereof is 3 mm or smaller.

4. The soundproof device for rails according to Claim 1, wherein the rail includes a head portion (Rt), a waist portion (Rw), and a bottom portion (Rb) continuing from top to bottom in sequence, the soundproof covers each include a side cover (42) covering the side surface of the waist portion and the upper surface of the bottom portion, and a bottom cover (43) covering the bottom surface of the rail so as to continue from a lower end of the side cover, wherein the side covers (42) each include a side cover body (42A) formed of a steel plate bridged from the upper end of the side surface of the waist portion (Rw) to the extremity of the upper surface of the bottom portion (Rb), and a damping resin damping material (51) and a foamed resin sound absorbing material (52) bonded on the inner surface of the side cover body (42A), and wherein the bottom cover (43) includes a bottom cover body (43A) formed of a steel plate aligned at an upper end thereof with a lower end of the side cover body (42A) and having a L-shape in lateral cross section, and a damping resin damping material (53) and a foamed resin sound absorbing material (54) bonded on an upper surface of a horizontal portion thereof..

5. The soundproof device for rails according to Claim 4, wherein the sound absorbing material (54) is a resin formed of polyethylene and the cell diameter thereof is 3 mm or smaller.

6. The soundproof device for rails according to any one of Claims 4 and 5, wherein the soundproof covers include an overlapped portion (61) formed on a single rail tie (S) by opposed end portions of the two

adjacent soundproof covers (41), and the side cover (42) is formed with notches (71, 72), and the bottom cover (43) is formed with notches (73, 74).

Patentansprüche

1. Schallschutzvorrichtung für Schienen, umfassend: drei erste bis dritte Bahnschwellen (S1, S2, S3), die konfiguriert sind, eine Schiene (R) zu fixieren, indem sie hintereinander von einem Ende zum anderen Ende der Schiene in die Längsrichtung angeordnet sind, eine erste schalldichte Abdeckung (31), die zwischen der ersten und zweiten Bahnschwelle (S1, S2) brückenartig angeordnet ist, und eine zweite schalldichte Abdeckung (32), die zwischen der zweiten und dritten Bahnschwelle (S2, S3) brückenartig angeordnet ist, wobei die jeweiligen schalldichten Abdeckungen eine festgelegte Länge aufweisen, die länger als eine eines Abstandes (P) der ersten und zweiten Bahnschwelle und eines Abstandes der zweiten und dritten Bahnschwelle ist, und wobei Abschnitte einer Schienenfläche mit der ersten schalldichten Abdeckung (31) und der zweiten schalldichten Abdeckung (32) in einem Zustand bedeckt sind, in dem gegenüberliegende Endabschnitte der ersten schalldichten Abdeckung und der zweiten schalldichten Abdeckung einander überlappen, wobei sie einen Überlappungsabschnitt (33) über eine Breite von 20 bis 80 mm auf der zweiten Schiene bilden,
ferner umfassend ein schallabsorbierendes Material (22), das mit einer Innenfläche von jedem Abdeckkörper verbunden ist,
und wobei ein erster Abstand (P1) zwischen der ersten und zweiten Bahnschwelle (S1, S2) und ein zweiter Abstand (P2) zwischen der zweiten und dritten Bahnschwelle (S2, S3) gleich groß oder letzterer größer als der vorhergehende ist, und die Länge L der ersten schalldichten Abdeckung und der zweiten schalldichten Abdeckung gleich ist, und die Größen eine Beziehung aufweisen; $P1 \leq P2 < L$.

2. Schallschutzvorrichtung für Schienen nach Anspruch 1, wobei die Schiene einen oberen Abschnitt, einen Mittelteilabschnitt, und einen unteren Abschnitt umfasst, die sich von oben nach unten der Reihe nach erstrecken, schalldichte Abdeckungen (11), die jeweils einen Abdeckkörper (11A) umfassen, der sich brückenartig von einem oberen Ende einer Seitenfläche des Mittelteilabschnitts zu einem Endpunkt einer oberen Fläche des unteren Abschnitts erstreckt, und wobei die Abdeckkörper (11A) der jeweiligen schalldichten Abdeckungen (11) sich gegenseitig an einem Abschnitt überlappen, an dem die erste schalldichte Abdeckung und die zweite schalldichte Abdeckung sich gegenseitig überlappen.

3. Schallschutzvorrichtung für Schienen nach Anspruch 1, wobei das schallabsorbierende Material (22) ein aus Polyethylen gebildeter Kunststoff ist und der Zelldurchmesser davon 3 mm oder kleiner beträgt.

4. Schallschutzvorrichtung für Schienen nach Anspruch 1, wobei die Schiene einen Kopfabschnitt (Rt), einen Mittelteilabschnitt (Rw), und einen unteren Abschnitt (Rb) umfasst, die sich der Reihe nach von oben nach unten fortsetzen, wobei die schalldichten Abdeckungen jeweils eine Seitenabdeckung (42) umfassen, die die Seitenfläche des Mittelteilabschnitts und die obere Fläche des unteren Abschnitts bedeckt, und eine untere Abdeckung (43), die die untere Fläche der Schiene derartig abdeckt, dass sie sich von einem unteren Ende der Seitenabdeckung fortsetzt, wobei die Seitenabdeckungen (42) jeweils einen Seitenabdeckungskörper (42A) umfassen, der aus einer Stahlplatte gebildet ist, die brückenartig vom oberen Ende der Seitenfläche des Mittelteilabschnitts (Rw) zum Endpunkt der oberen Fläche des unteren Abschnitts (Rb) angeordnet ist, und ein dämpfendes Kunststoff-Dämpfungsmaterial (51) und ein schallabsorbierendes Material aus geschäumtem Kunststoff (52), die mit der Innenfläche des Seitenabdeckungskörpers (42A) verbunden sind, und wobei die untere Abdeckung (43) einen unteren Abdeckungskörper (43A) umfasst, der aus einer Stahlplatte gebildet ist, die an einem oberen Ende davon mit einem unteren Ende des Seitenabdeckungskörpers (42A) ausgerichtet ist und im seitlichen Querschnitt eine L-Form aufweist, und ein dämpfendes Kunststoffdämpfungsmaterial (53) und ein schallabsorbierendes Material aus geschäumtem Kunststoff (54), das mit einer oberen Fläche des horizontalen Abschnitts davon verbunden ist.

5. Schallschutzvorrichtung für Schienen nach Anspruch 4, wobei das schallabsorbierende Material (54) ein aus Polyethylen gebildeter Kunststoff ist und der Zelldurchmesser davon 3 mm oder kleiner beträgt.

6. Schallschutzvorrichtung für Schienen nach einem der Ansprüche 4 und 5, wobei die schalldichten Abdeckungen einen überlappten Abschnitt (61) umfassen, der auf einer einzelnen Bahnschwelle (S) durch gegenüberliegende Endabschnitte von zwei benachbarten schalldichten Abdeckungen (41) gebildet ist, und die Seitenabdeckung (42) mit Einkerbungen (71, 72) gebildet ist, und die untere Abdeckung (43) mit Einkerbungen (73, 74) gebildet ist.

Revendications

1. Un dispositif insonorisé pour des rails comprenant:

trois première à troisième attaches de rail (S1, S2, S3) configurées pour fixer un rail (R) disposés successivement d'une extrémité à l'autre extrémité du rail dans la direction longitudinale, une première couverture insonorisée (31) pontée entre les première et deuxième attaches de rail (S1, S2) et une deuxième couverture insonorisée (32) pontée entre les deuxième et troisième attaches de rail (S2, S3), dans lequel les couvertures insonorisées respectives ont une longueur fixe qui est plus longue que l'une quelconque d'une distance (P) des première et deuxième attaches de rail et d'une distance des deuxième et troisième attaches de rail et des parties d'une surface de rail sont recouvertes avec la première couverture insonorisée (31) et la deuxième couverture insonorisée (32)
dans un état dans lequel des parties d'extrémité opposées de la première couverture insonorisée et de la seconde couverture insonorisée sont superposées l'une avec l'autre, formant une partie superposée (33) sur une largeur de 20 à 80 mm sur la seconde attache de rail,
en outre comprenant un matériau absorbant le son (22) lié sur une surface intérieure de chaque corps de couverture,
et dans lequel une première distance (P1) entre les première et deuxième attaches de rail (S1, S2) et une seconde distance (P2) entres les deuxième et troisième attaches de rail (S2, S3) sont égales ou la dernière est plus grande que l'antérieure, et la longueur L de la première couverture insonorisée et de la deuxième couverture insonorisée est la même, et les tailles ont un rapport ; $P1 \leq P2 \leq L$.

2. Le dispositif insonorisé pour des rails selon la revendication 1, dans lequel le rail comprend une partie supérieure, une partie de taille et une partie inférieure continuant de haut en bas en séquence, les couvertures insonorisées (11) comprennent chacune un corps de recouvrement (11A) ponté d'une extrémité supérieure d'une surface latérale de la partie de taille à une extrémité d'une surface supérieure de la partie inférieure, et les corps de recouvrement (11A) des couvertures insonorisées (11) respectives sont superposés l'un avec l'autre à une partie dans laquelle la première couverture insonorisée et la deuxième couverture insonorisée sont superposés l'une avec l'autre.

3. Le dispositif insonorisé pour des rails selon la revendication 1, dans lequel le matériau insonorisant (22) est une résine formée en polyéthylène et son diamètre de cellule est de 3 mm ou moins.

4. Le dispositif insonorisé pour des rails selon la revendication 1, dans lequel le rail comprend une partie de tête (Rt), une partie de taille (Rw) et une partie inférieure (Rb) continuant de haut en bas en séquence, les couvertures insonorisées (11) comprennent chacune une couverture latérale (42) recouvrant la surface latérale de la partie de taille et la surface supérieure de la partie inférieure, et un une couverture inférieure (43) recouvrant la surface inférieure du rail de manière à continuer à partir d'une extrémité inférieure de la couverture latérale, dans lequel les couvertures latérales (42) comprennent chacune un corps de couverture latérale (42A) formé d'une plaque de fer pontée à partir de l'extrémité supérieure de la surface latérale de la partie de taille (Rw) à l'extrémité de la surface supérieure de la partie inférieure (Rb), et un matériau amortissant de résine amortissante (51) et un matériau absorbant le son en résine moussée (52) lié sur la surface intérieure du corps de couverture latérale (42A), et dans lequel la couverture inférieure (43) comprend un corps de couverture inférieure (43A) formé d'une plaque de fer alignée à une extrémité supérieure de celle-ci avec une extrémité inférieure du corps de couverture latérale (42A) et ayant une forme en L dans une section transversale latérale, et un matériau amortissant de résine amortissante (53) et un matériau absorbant le son en résine moussée (54) lié à une surface supérieure d'une partie horizontale de celui-ci.

5. Le dispositif insonorisé pour des rails selon la revendication 4, dans lequel le matériau absorbant le son (54) est une résine formée en polyéthylène et son diamètre de cellule est de 3 mm ou moins.

6. Le dispositif insonorisé pour des rails selon l'une quelconque des revendications 4 et 5,
dans lequel les couvertures insonorisées comprennent une partie superposée (61) formée sur une seule attache de rail (S) par des parties d'extremités opposées des deux couvertures insonorisées adjacentes (41), et la couverture latérale (42) est formée avec des encoches (71, 72), et la couverture inférieure (43) est formée avec des encoches (73, 74).

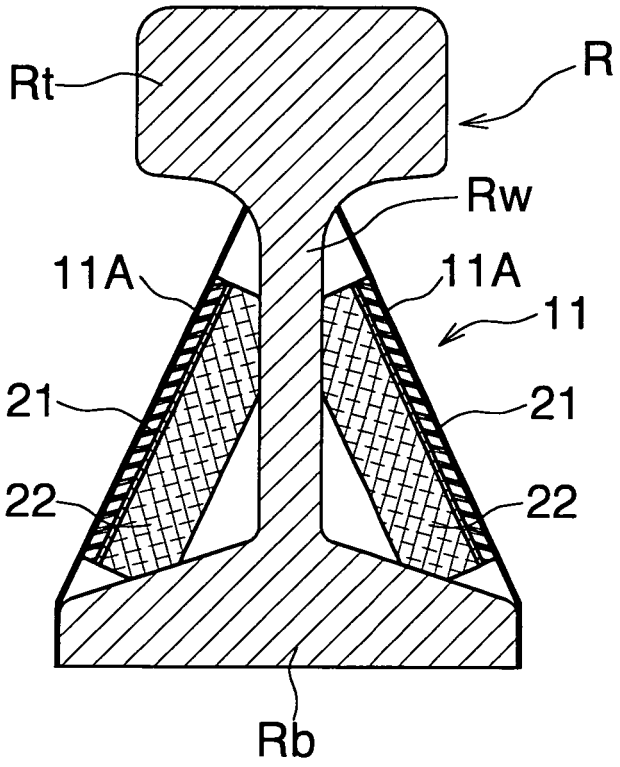


Fig.1

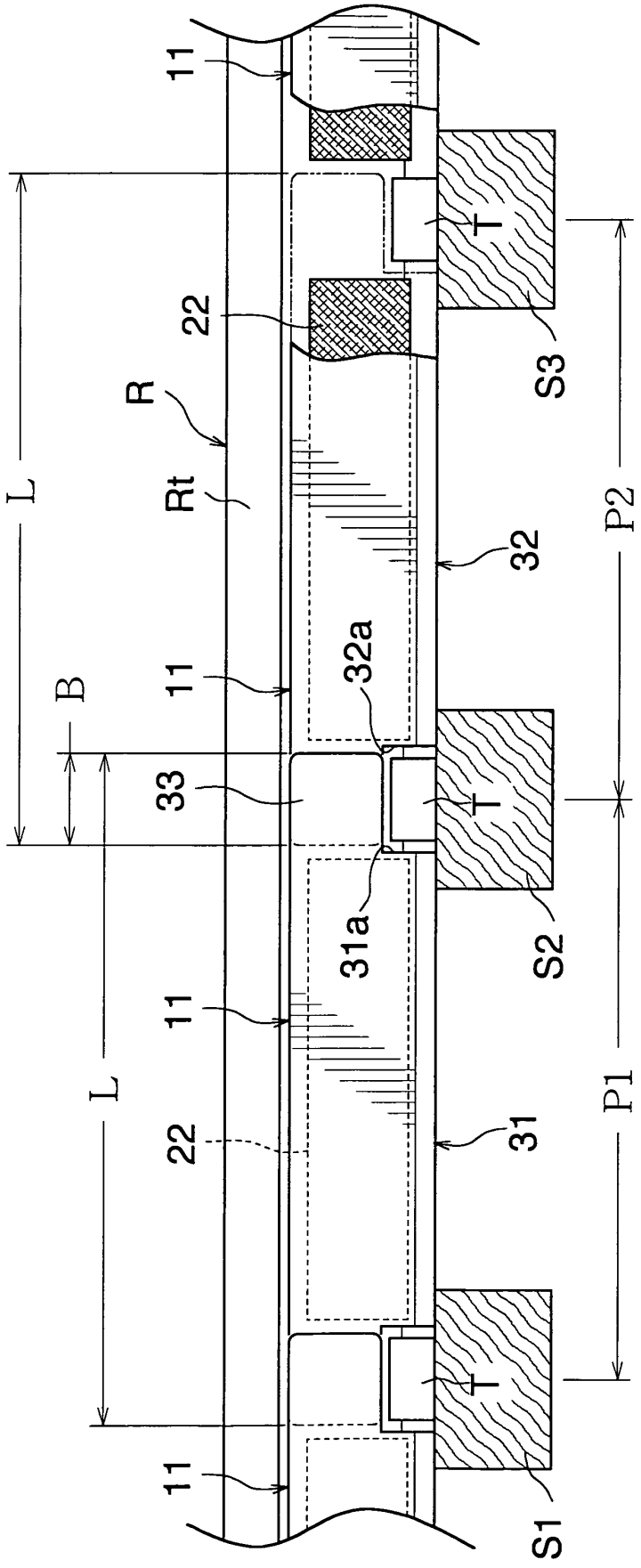


Fig.2

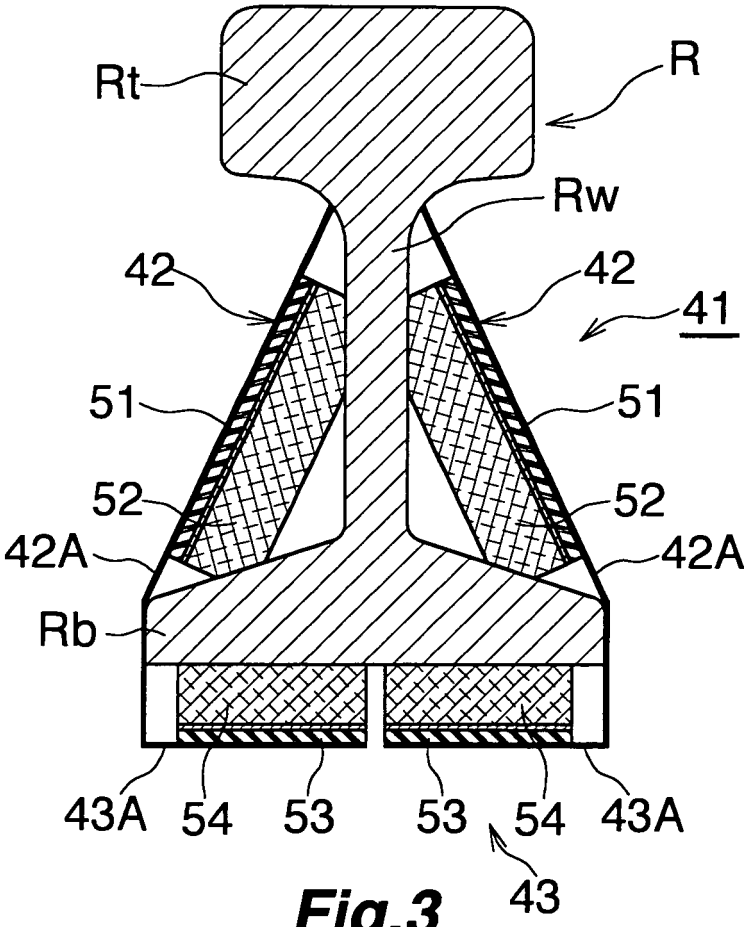

Rt
R
Rw
42
42
41
51
51
52
52
42A
42A
Rb
43A
54
53
53
54
43A
43

Fig.3

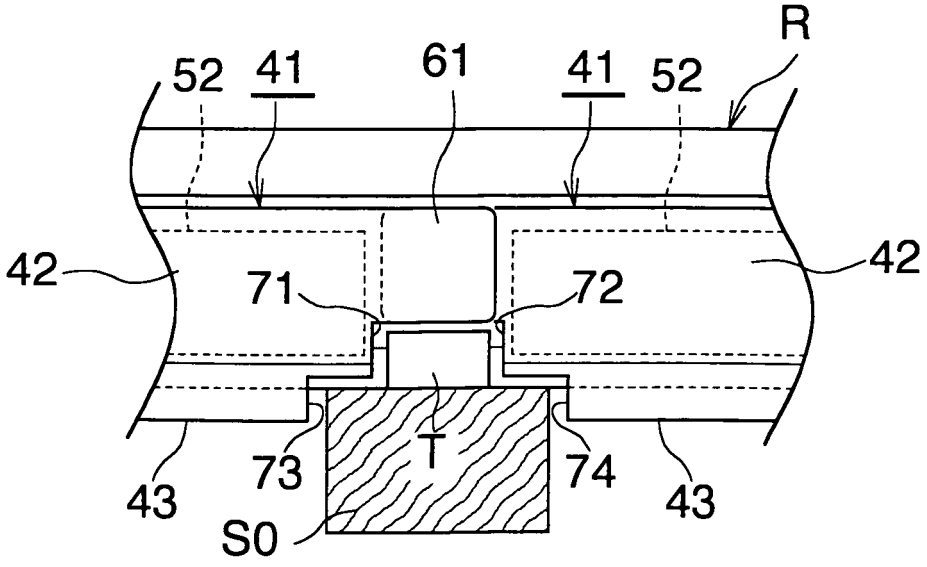

R
52
41
61
41
52
42
42
71
72
T
73
74
43
43
S0

Fig.4

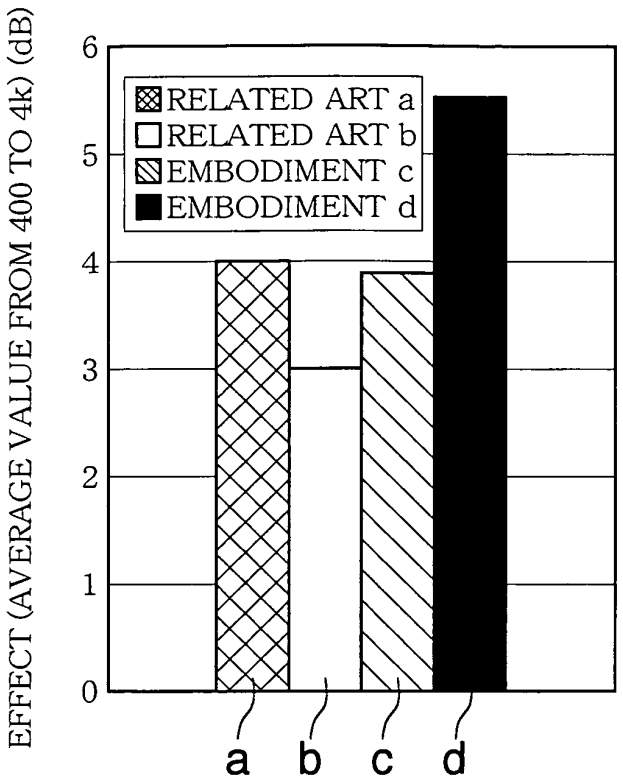

EFFECT (AVERAGE VALUE FROM 400 TO 4k) (dB)
6
5
4
3
2
1
0
RELATED ART a
RELATED ART b
EMBODIMENT c
EMBODIMENT d
a
b
c
d

Fig.5

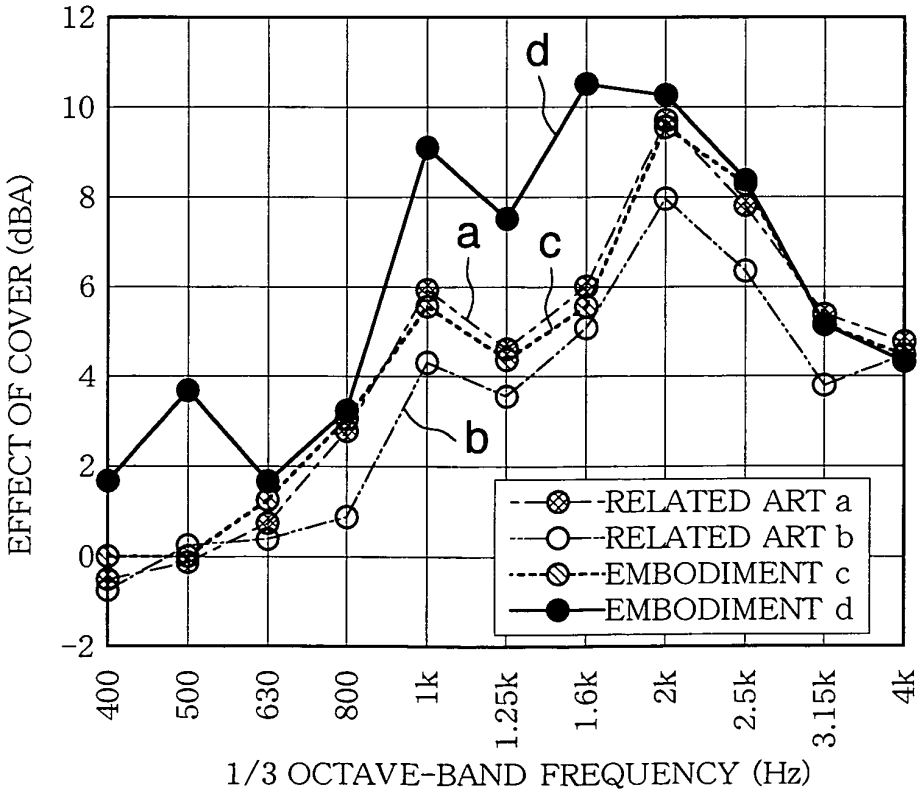

EFFECT OF COVER (dBA)
12
10
8
6
4
2
0
-2
d
a
c
b
RELATED ART a
RELATED ART b
EMBODIMENT c
EMBODIMENT d
400
500
630
800
1k
1.25k
1.6k
2k
2.5k
3.15k
4k
1/3 OCTAVE-BAND FREQUENCY (Hz)

Fig.6

TEST CONDITIONS

MATERIAL	CELL DIAMETER	FOAMING MAGNIFICATION
POLYETHYLENE	0.5～1mm	30
POLYETHYLENE	1.5～2.5mm	15
POLYETHYLENE	1.5～3mm	12
EPDM	0.5～1mm	30

Fig.7

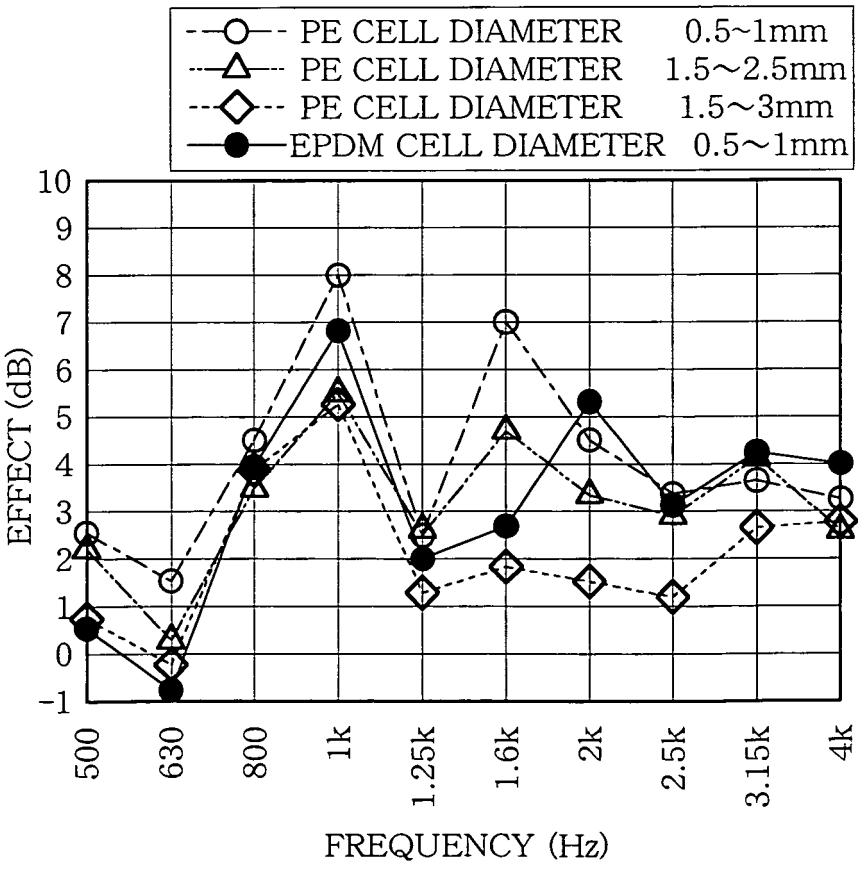


Fig.8

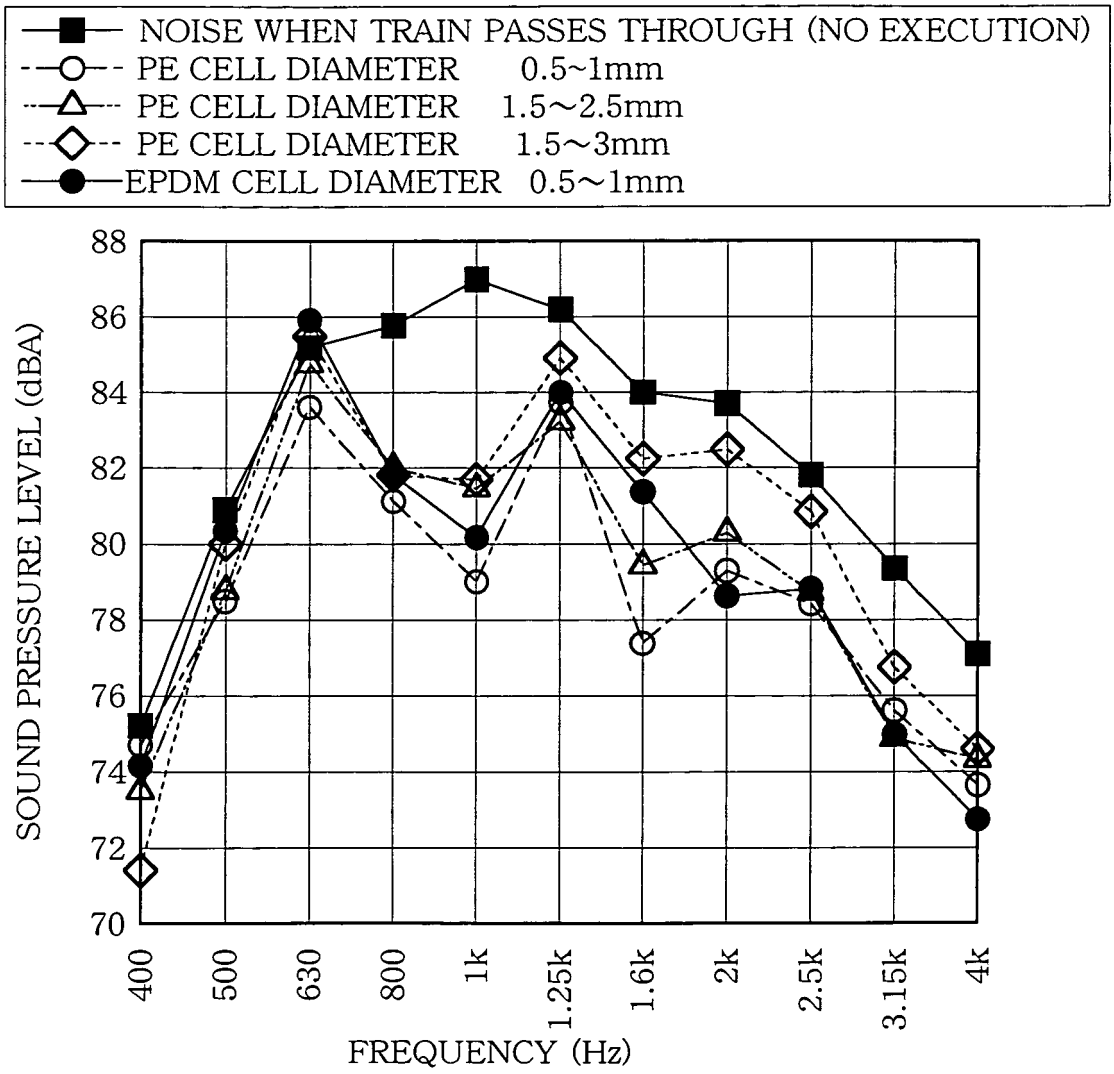

NOISE WHEN TRAIN PASSES THROUGH (NO EXECUTION)
PE CELL DIAMETER 0.5~1mm
PE CELL DIAMETER 1.5~2.5mm
PE CELL DIAMETER 1.5~3mm
EPDM CELL DIAMETER 0.5~1mm
SOUND PRESSURE LEVEL (dBA)
88
86
84
82
80
78
76
74
72
70
400
500
630
800
1k
1.25k
1.6k
2k
2.5k
3.15k
4k
FREQUENCY (Hz)

Fig.9

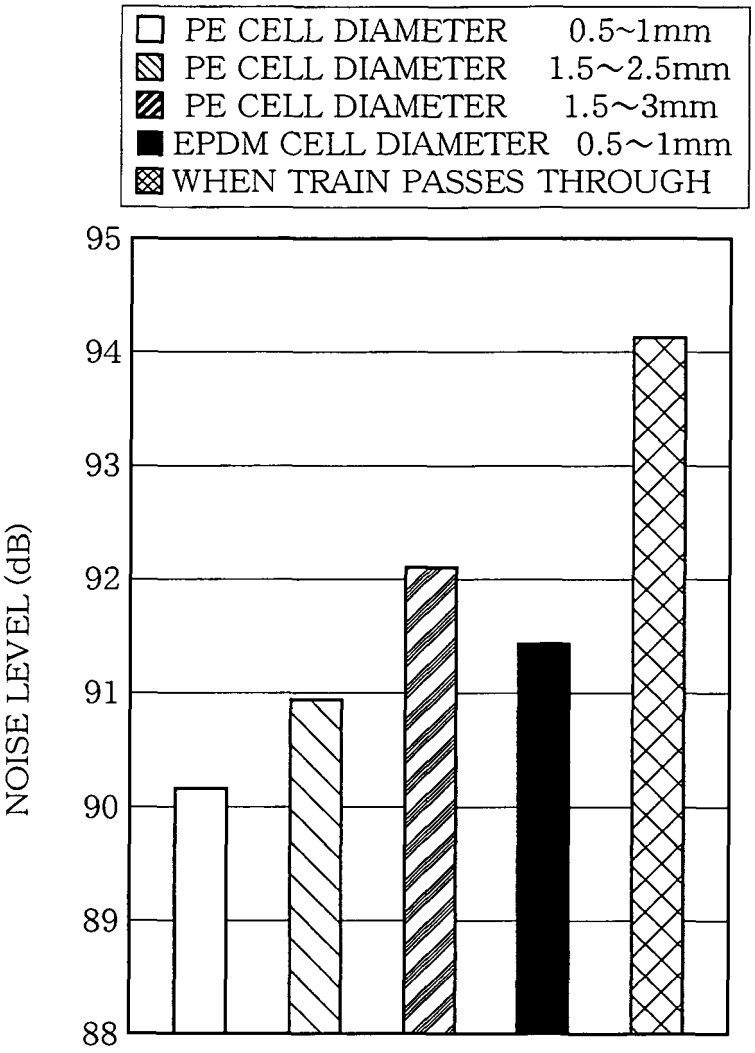

PE CELL DIAMETER 0.5~1mm
PE CELL DIAMETER 1.5~2.5mm
PE CELL DIAMETER 1.5~3mm
EPDM CELL DIAMETER 0.5~1mm
WHEN TRAIN PASSES THROUGH
NOISE LEVEL (dB)
95
94
93
92
91
90
89
88

Fig.10

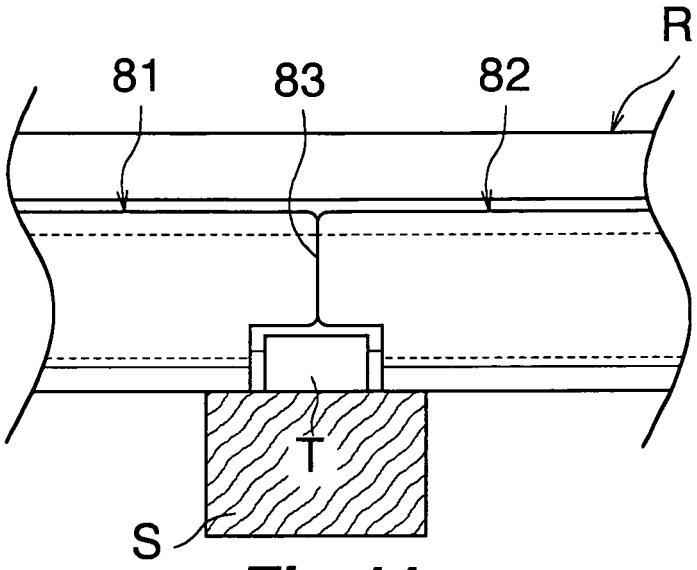


Fig.11

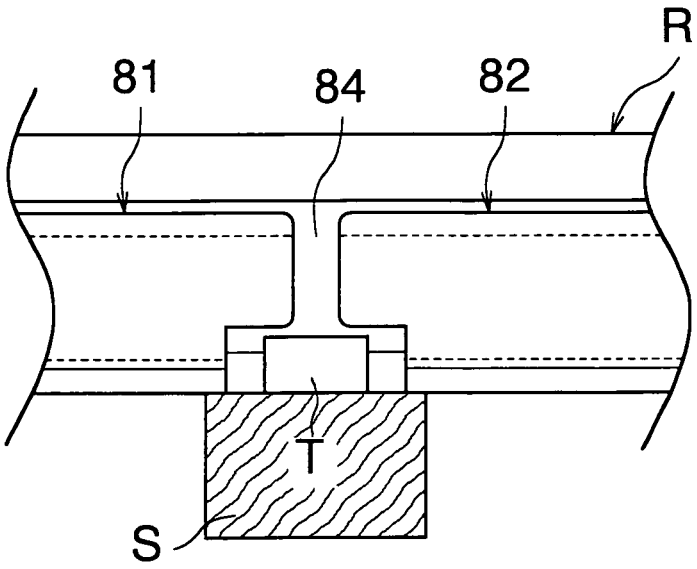


Fig.12

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 **[0002] [0005]**
- JP 2007120018 A **[0004] [0005]**