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(54) **NOISE ABSORBING STRUCTURE AND NOISE ABSORBING/INSULATING STRUCTURE**

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(57) **ABSTRACT**

A noise absorbing structure for effectively absorbing noise in a wide frequency range includes a first noise absorbing portion that is hollow and includes one or more first holes. The structure further includes a second noise absorbing portion that is hollow and includes one or more second holes. The total area of the one or more first holes differs from the total area of the one or more second holes.

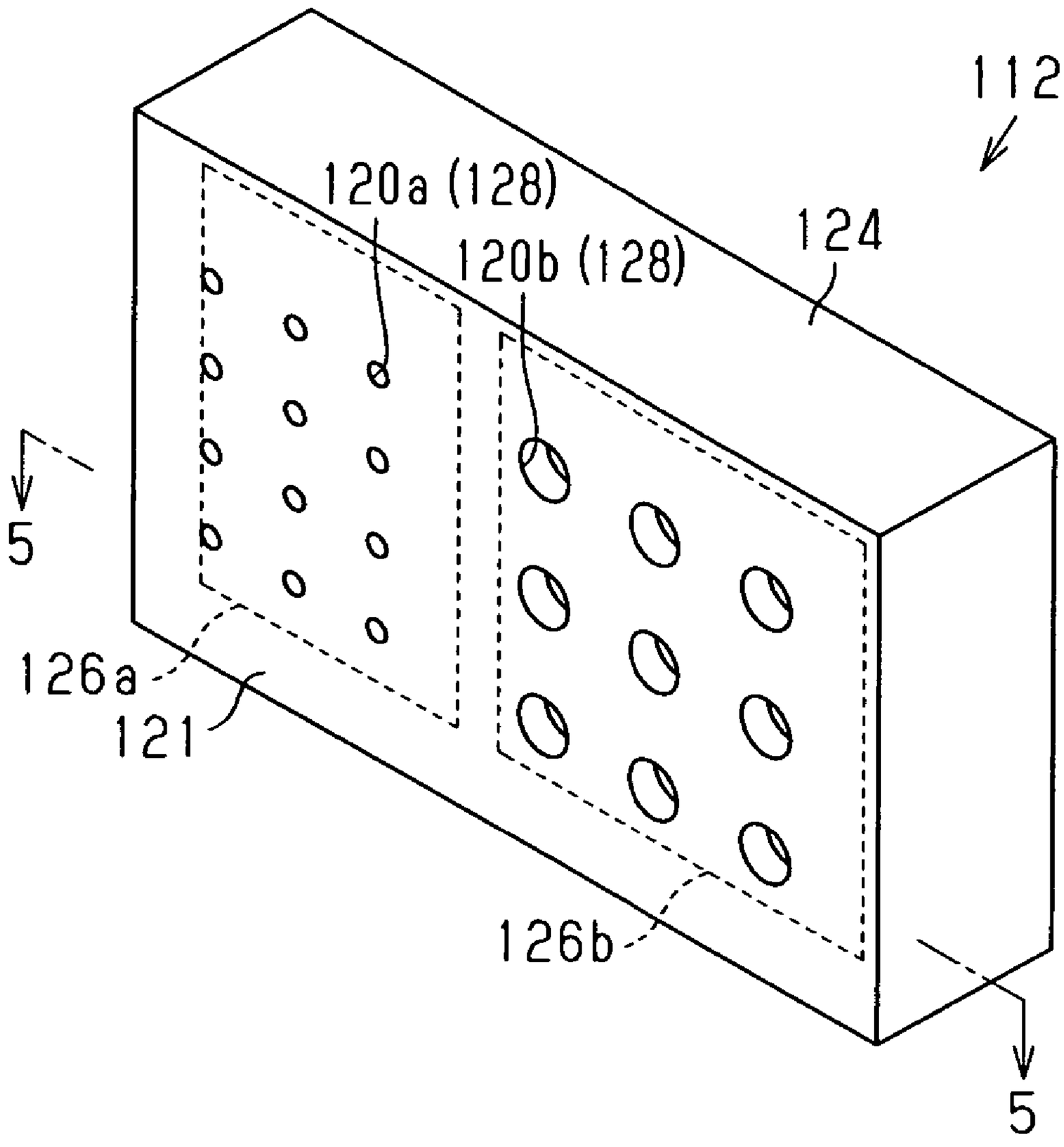


Fig.1

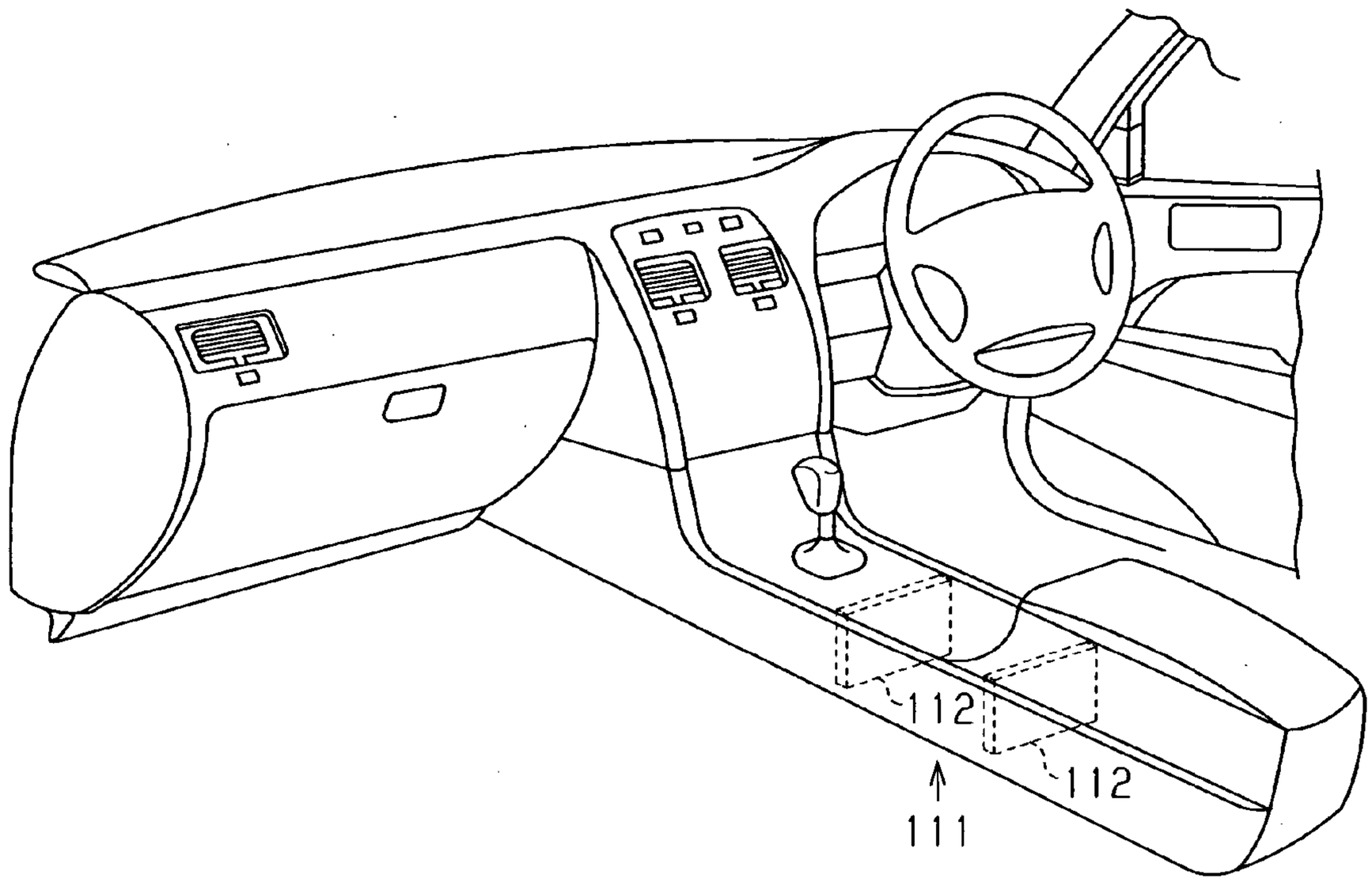
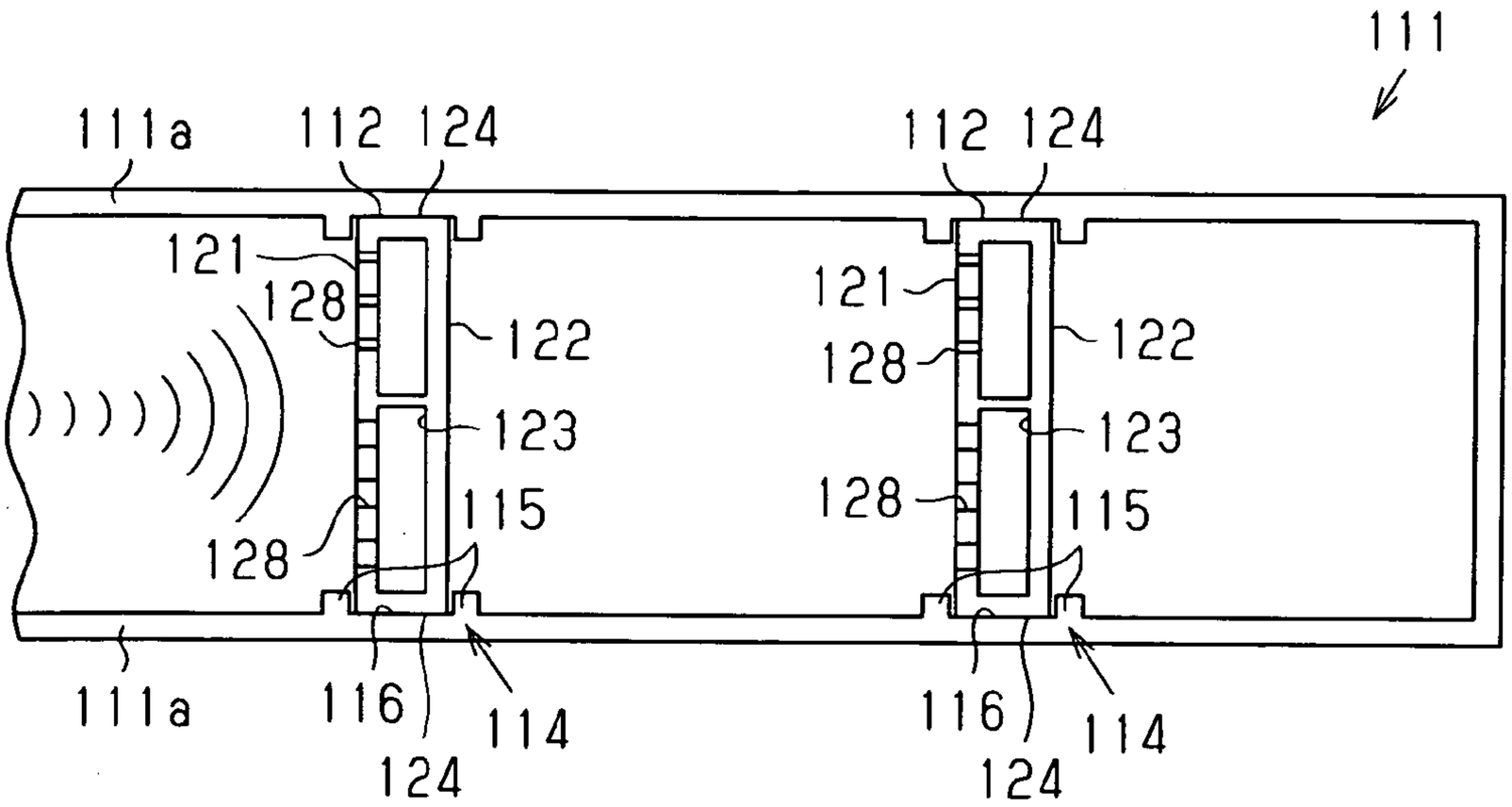


Fig.2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124
112
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121
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123
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111a
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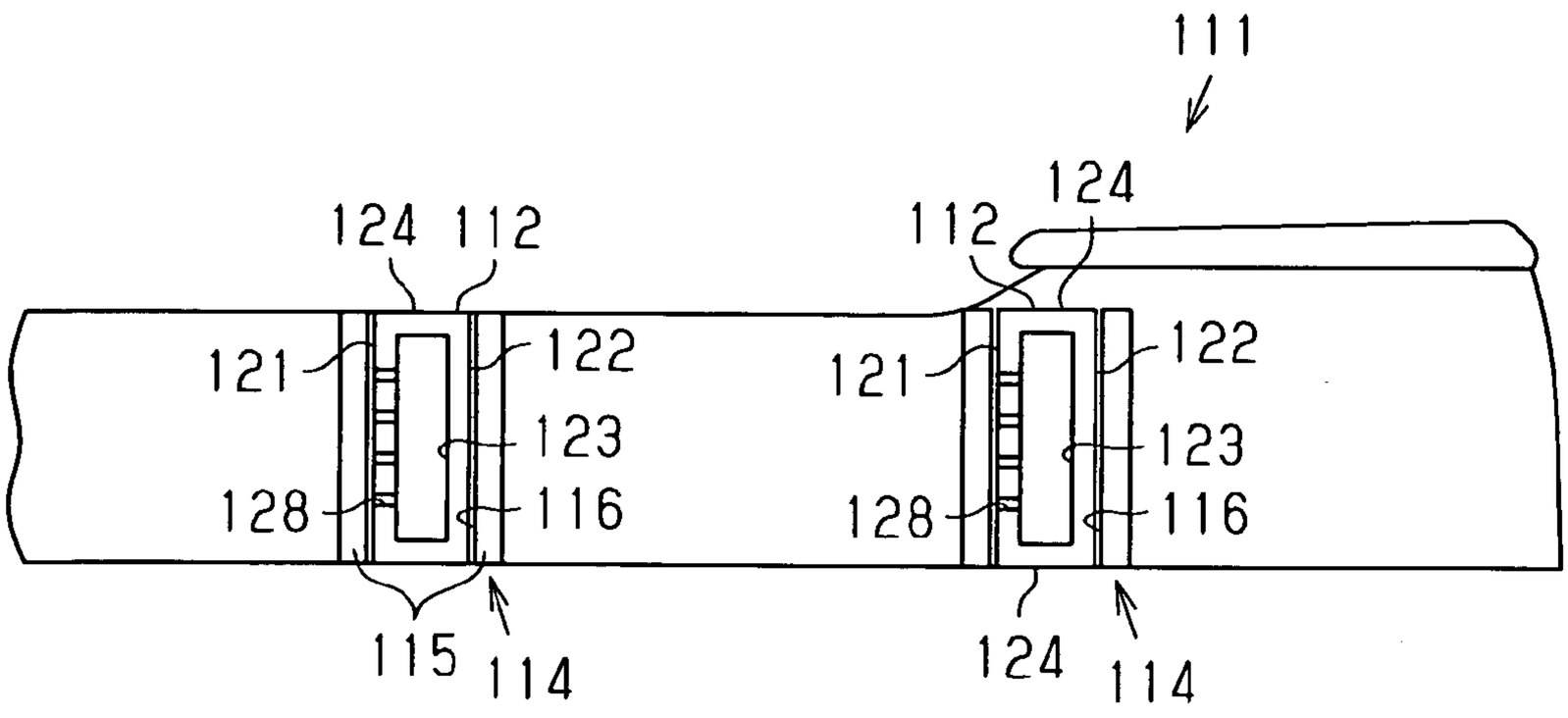
116
114
124

Fig.3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121
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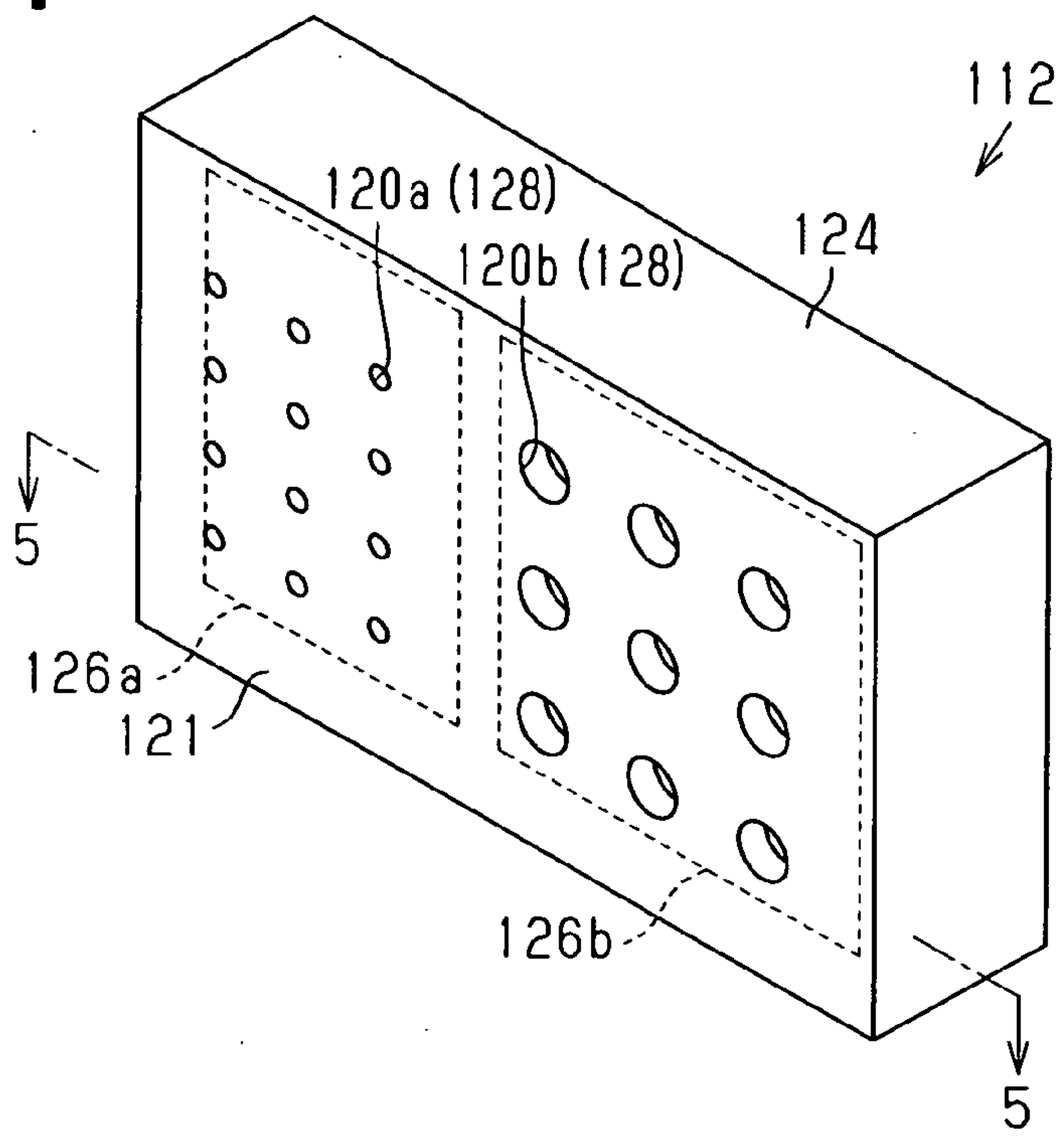
114
124
114

Fig.4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120a (128)
120b (128)
124
5
126a
121
126b
5

Fig.5

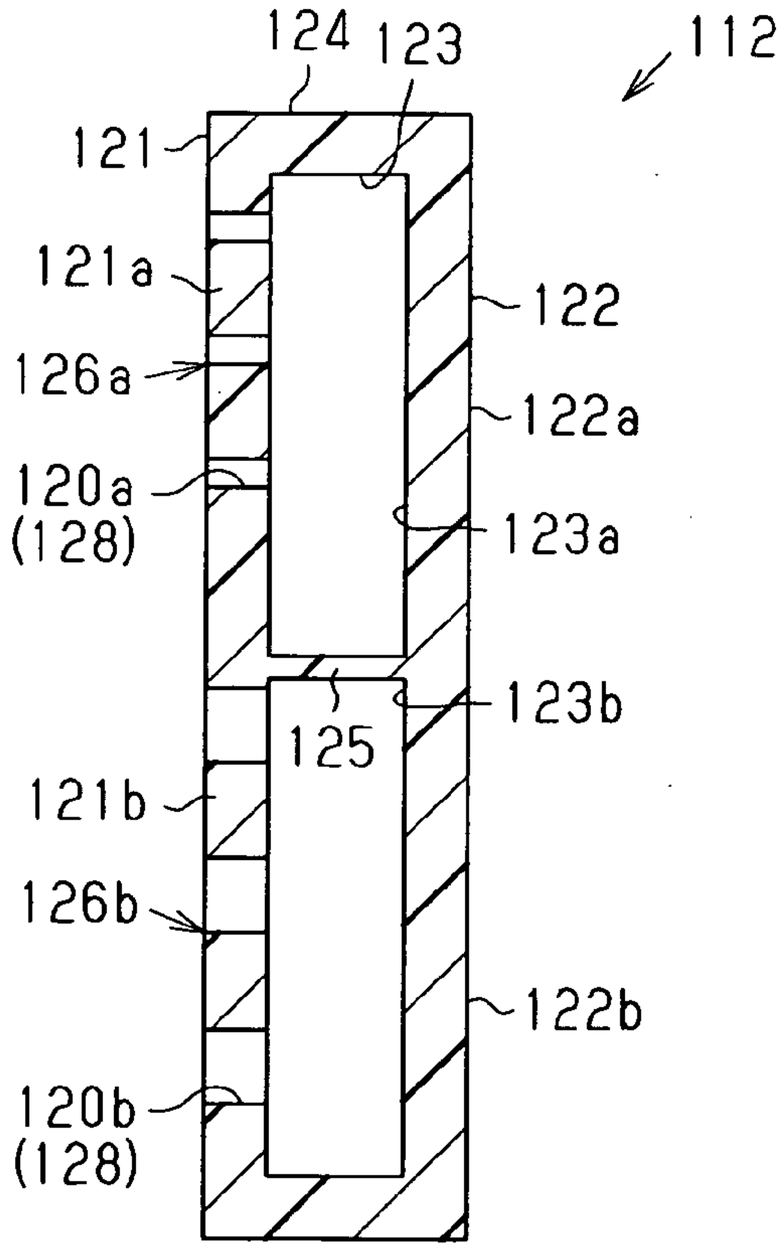
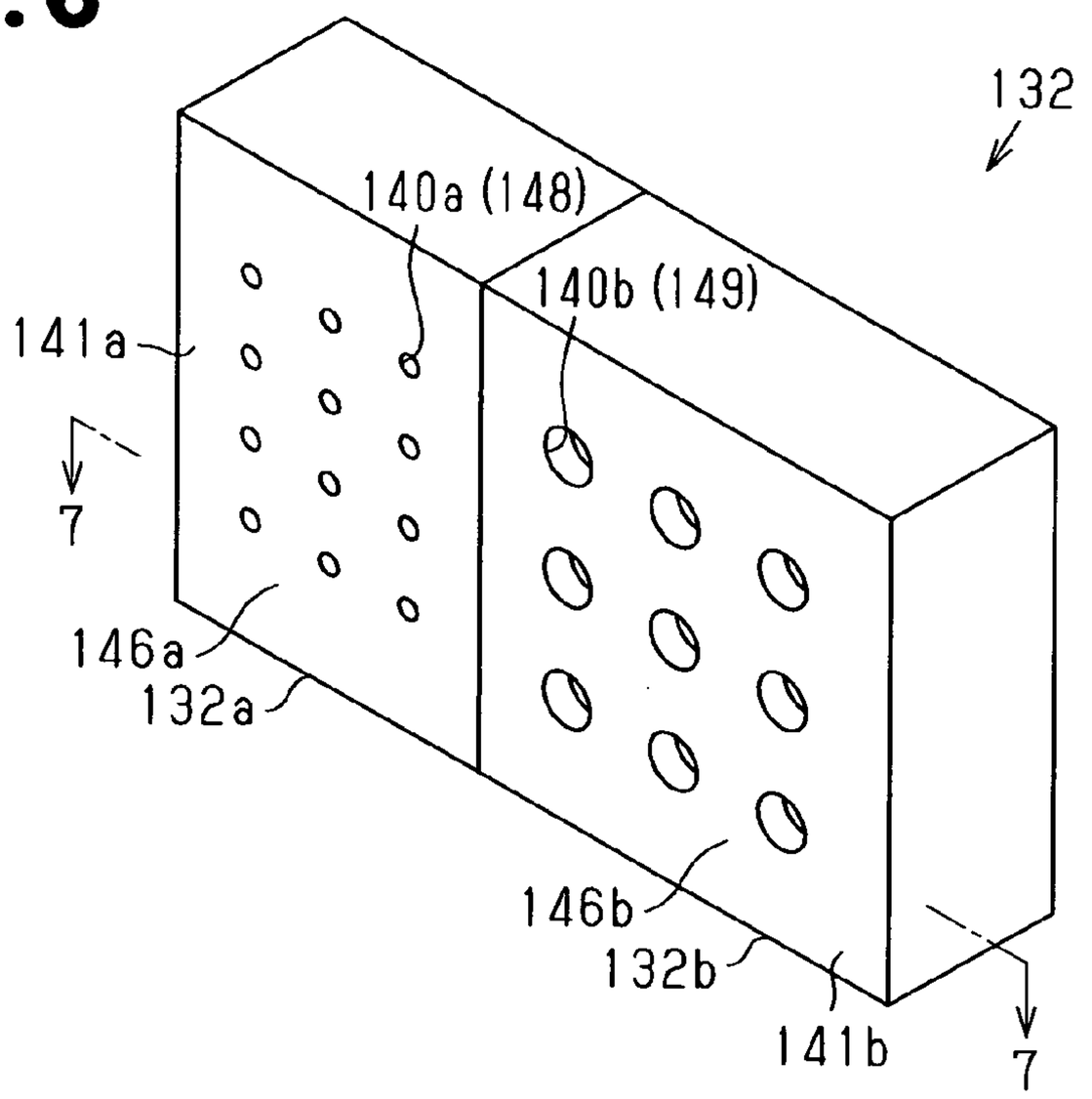

124
123
112
121
121a
122
126a
122a
120a
(128)
123a
123b
125
121b
126b
122b
120b
(128)

Fig.6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140b (149)
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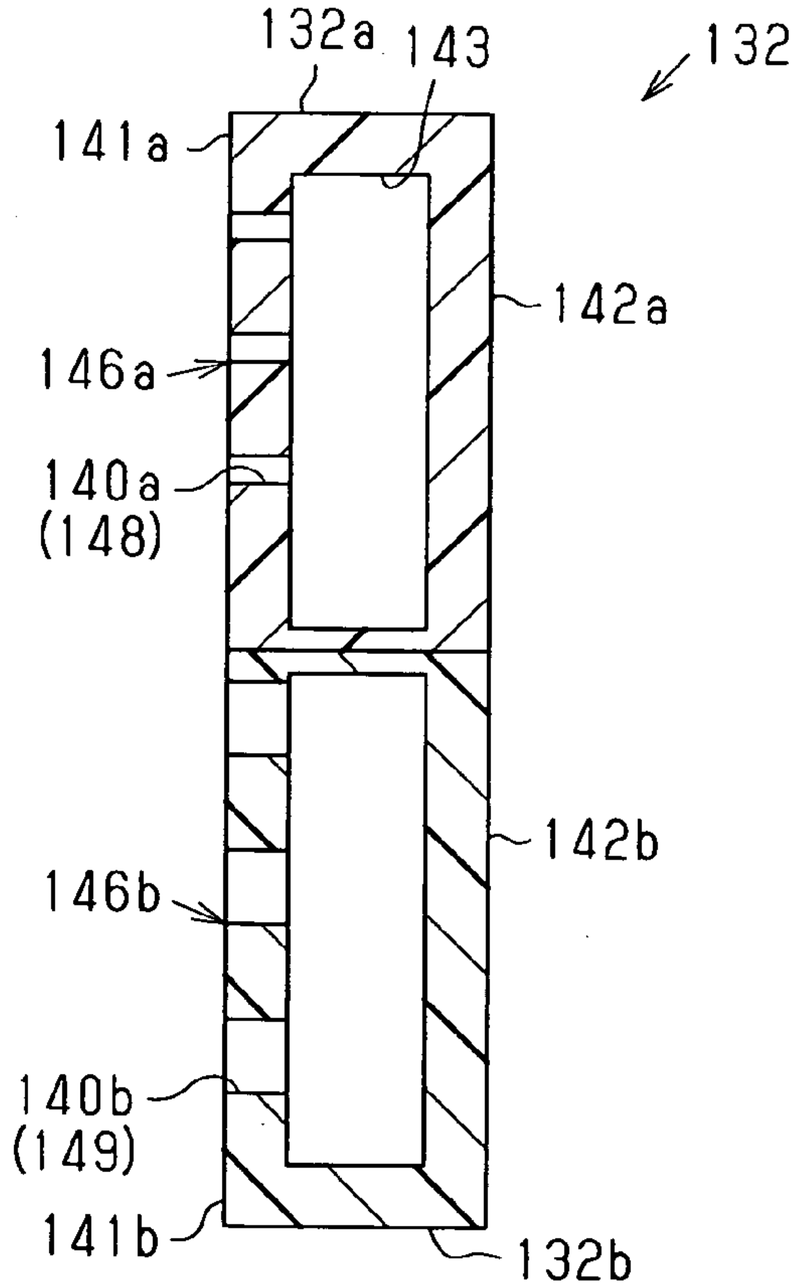
7
146a
132a
146b
132b
141b
7

Fig.7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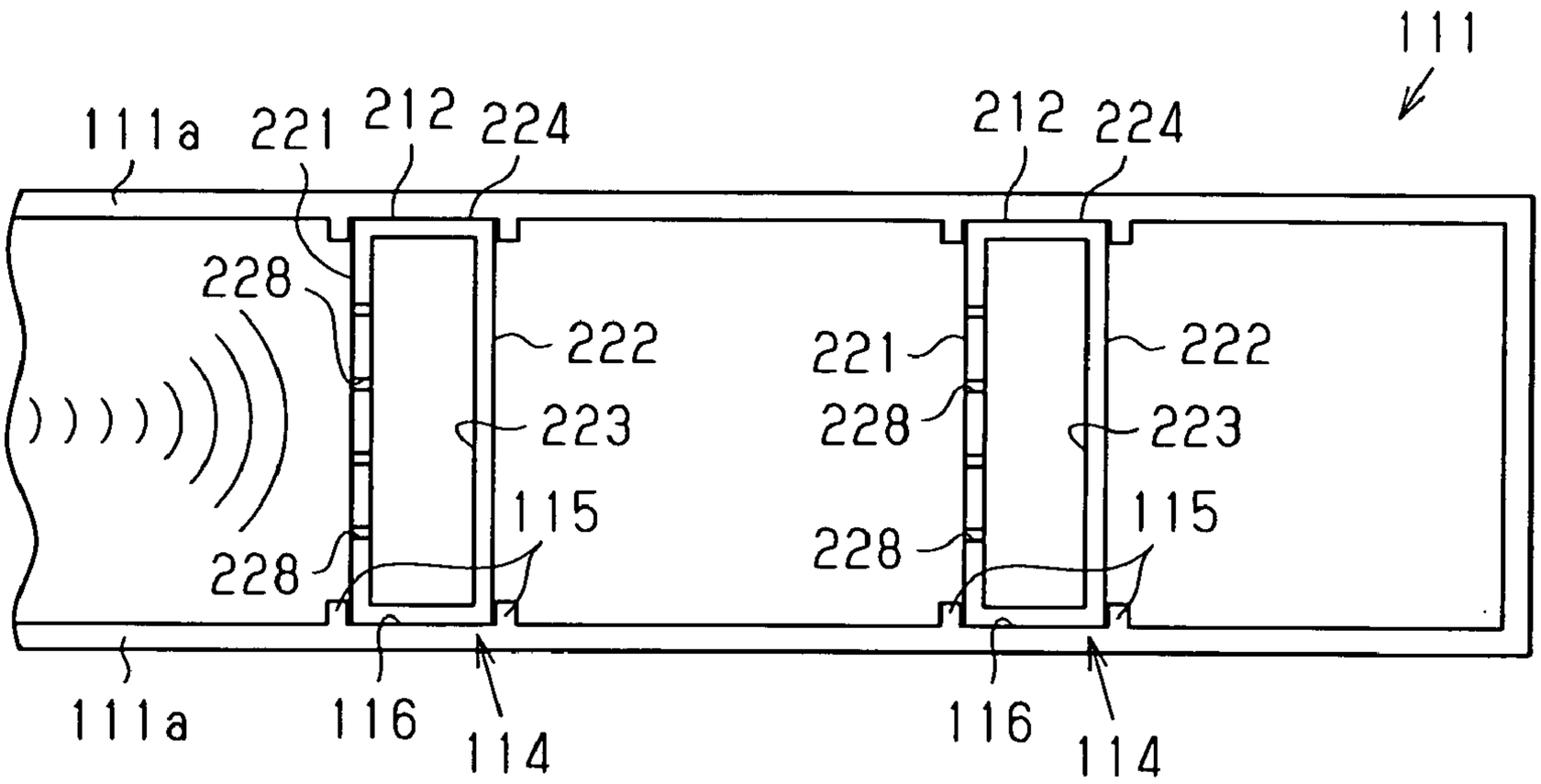
141a
142a
146a
140a
(148)
142b
146b
140b
(149)
141b
132b

Fig.8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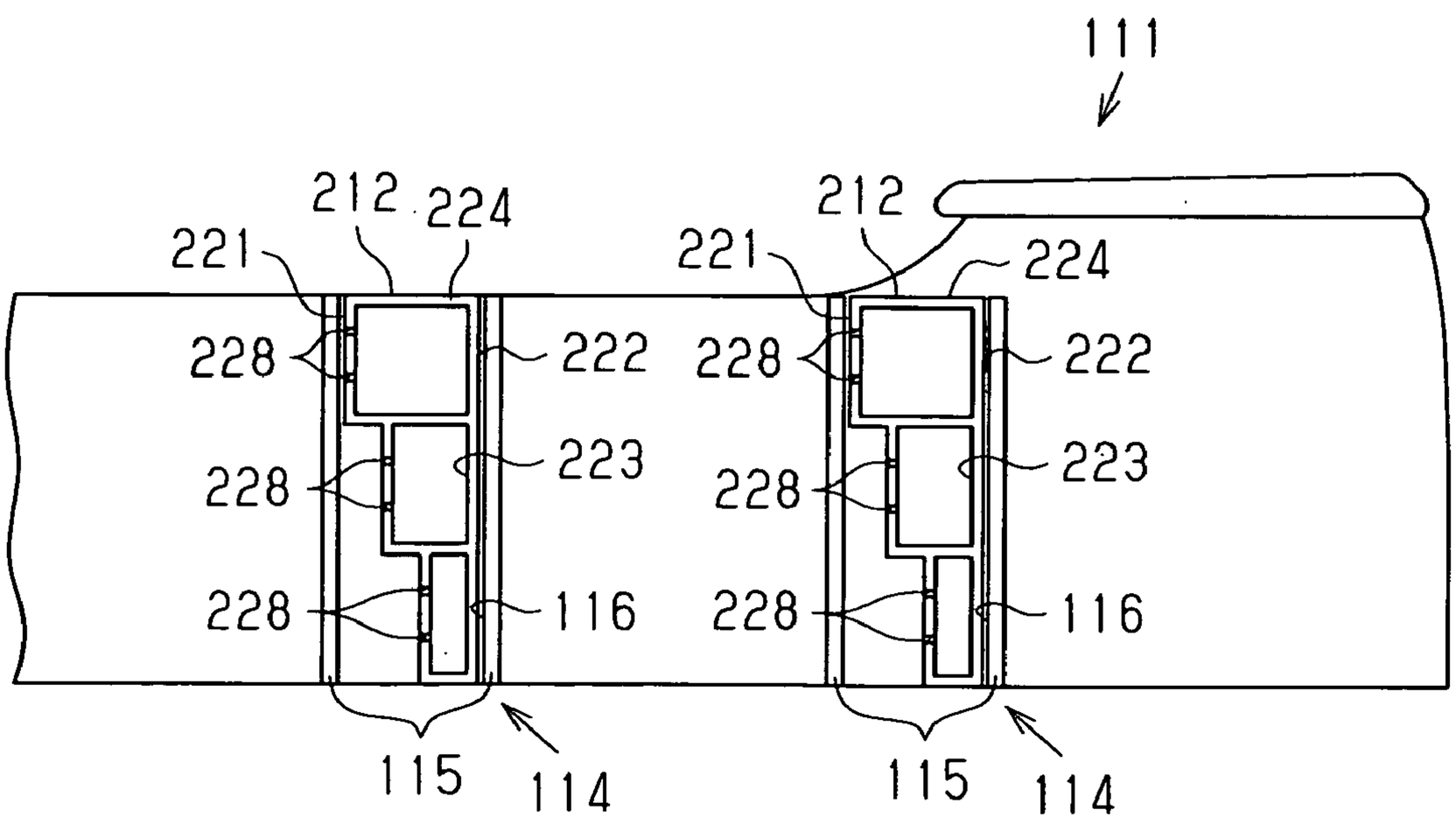
111a
116
114
116
114

Fig.9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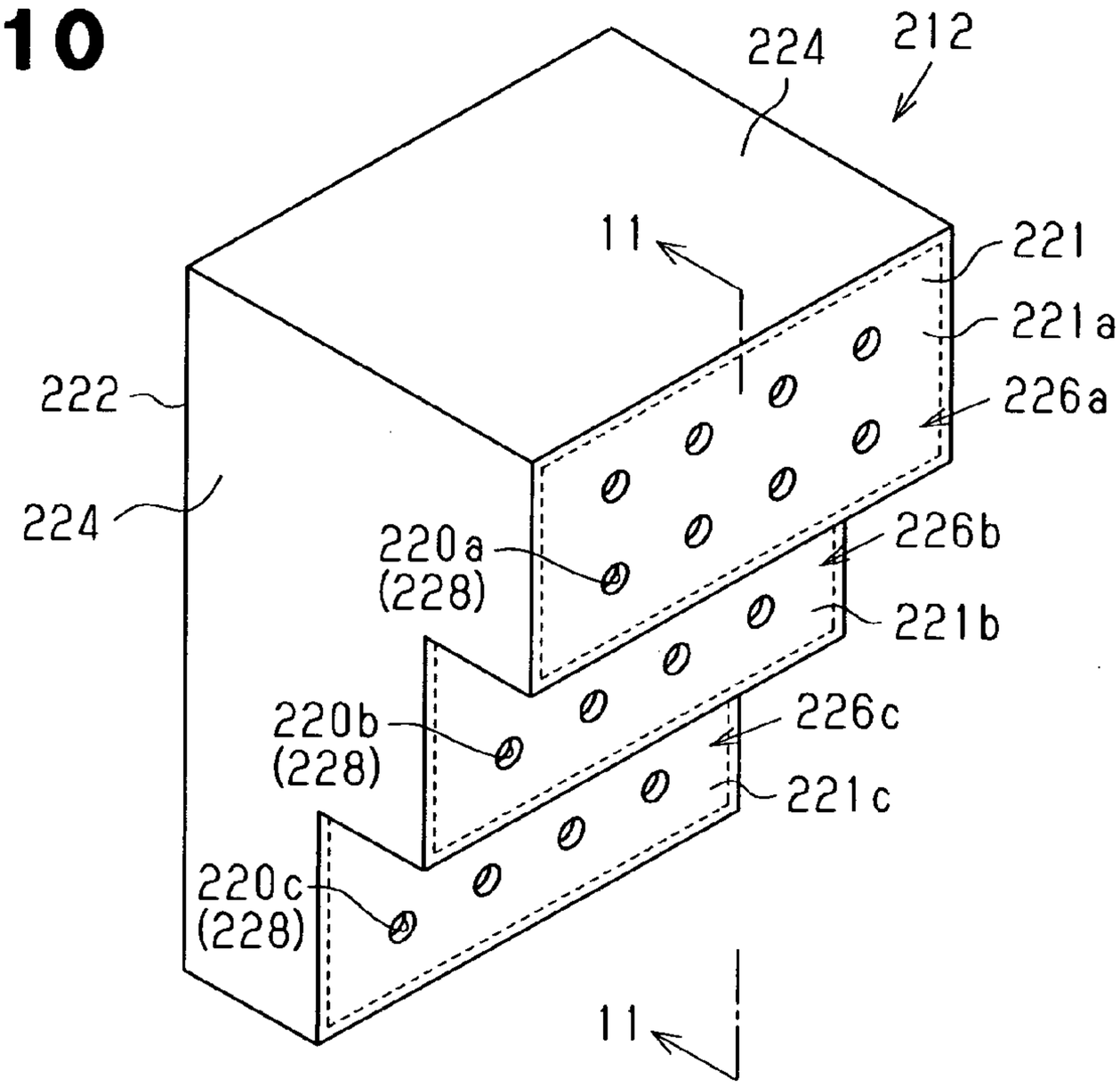
114
115
114

Fig.10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11
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221a
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226a
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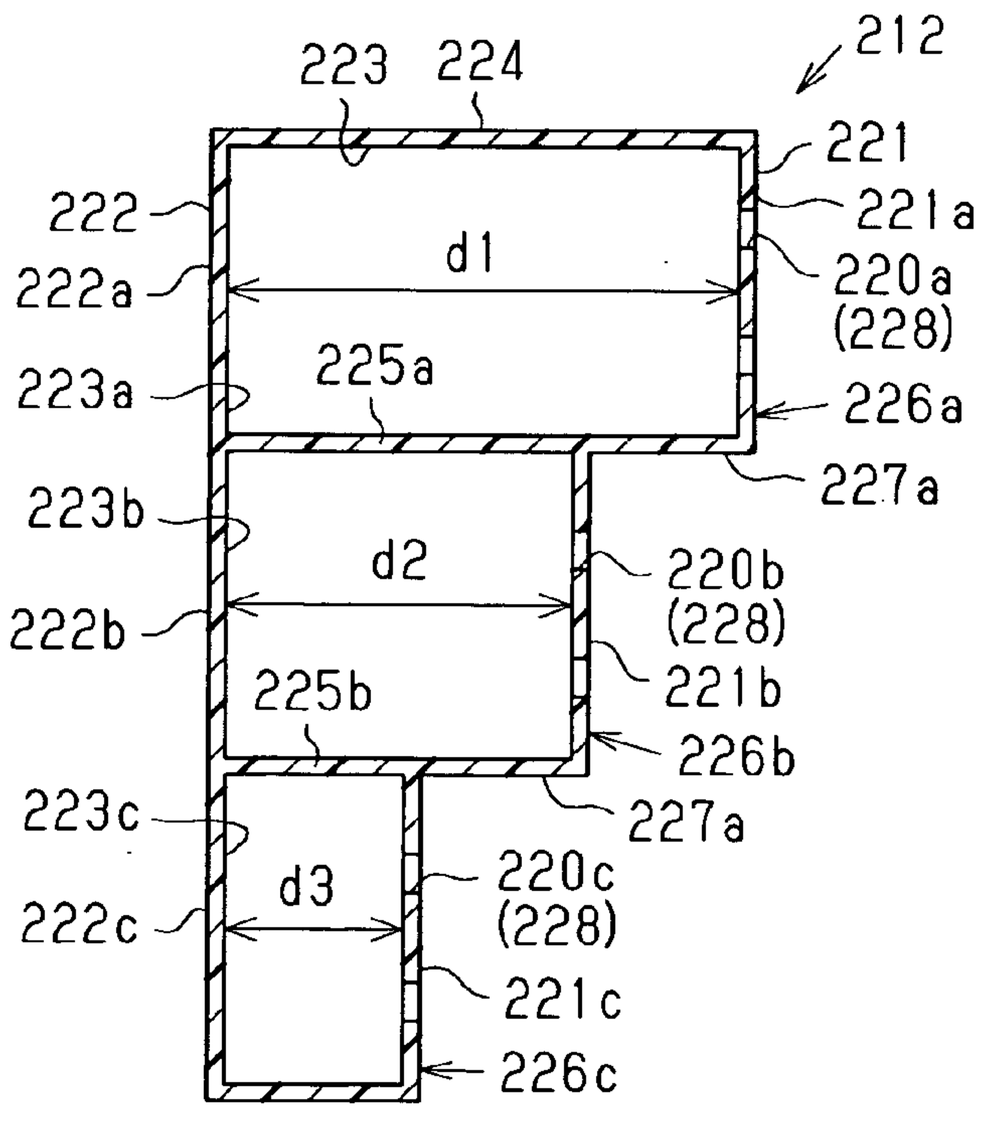
220a
(228)
226b
221b
220b
(228)
226c
221c
220c
(228)
11

Fig.11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222
221a
d1
222a
220a
(228)
225a
223a
226a
227a
223b
d2
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(228)
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225b
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227a
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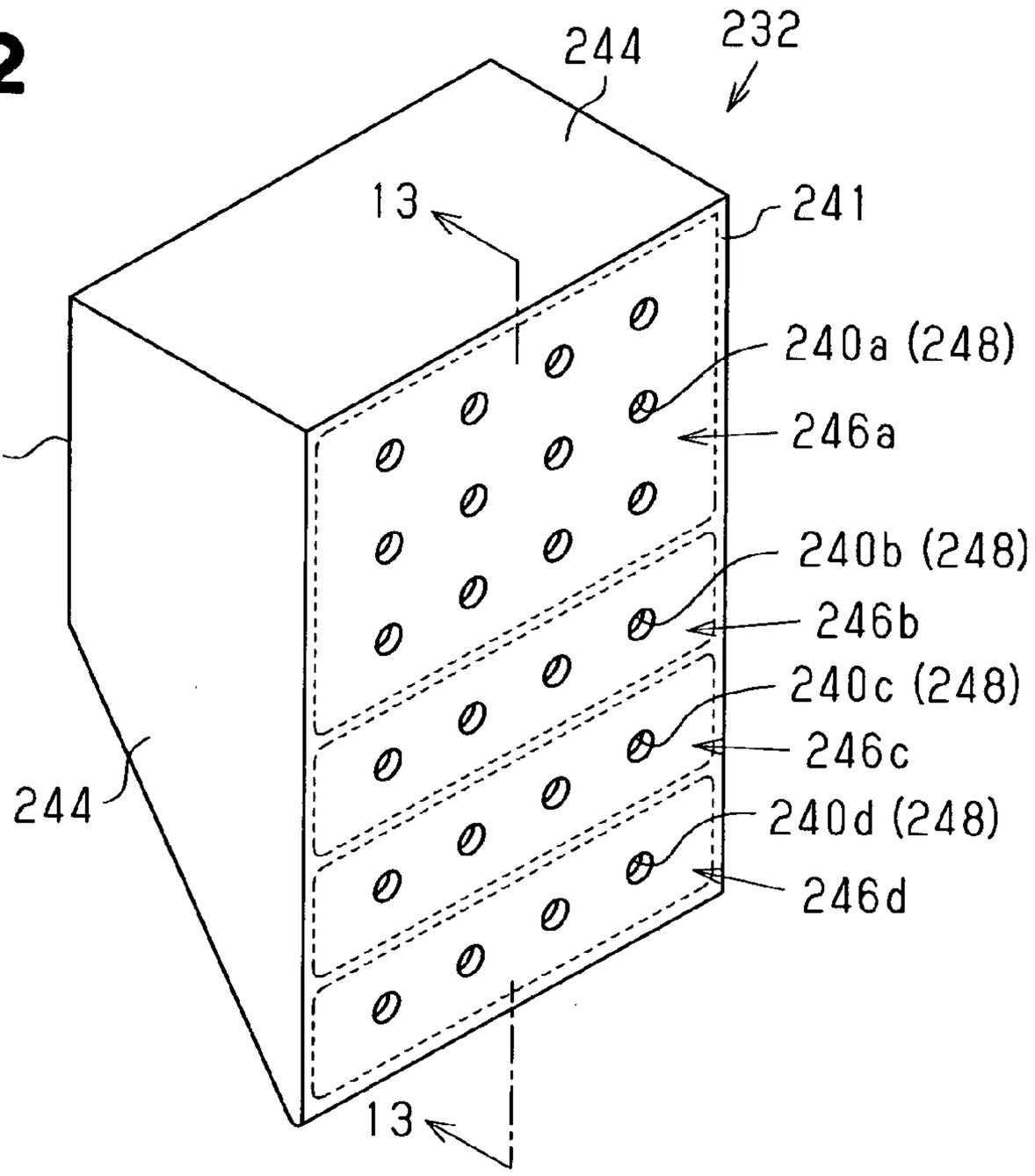
d3
220c
(228)
222c
221c
226c

Fig.12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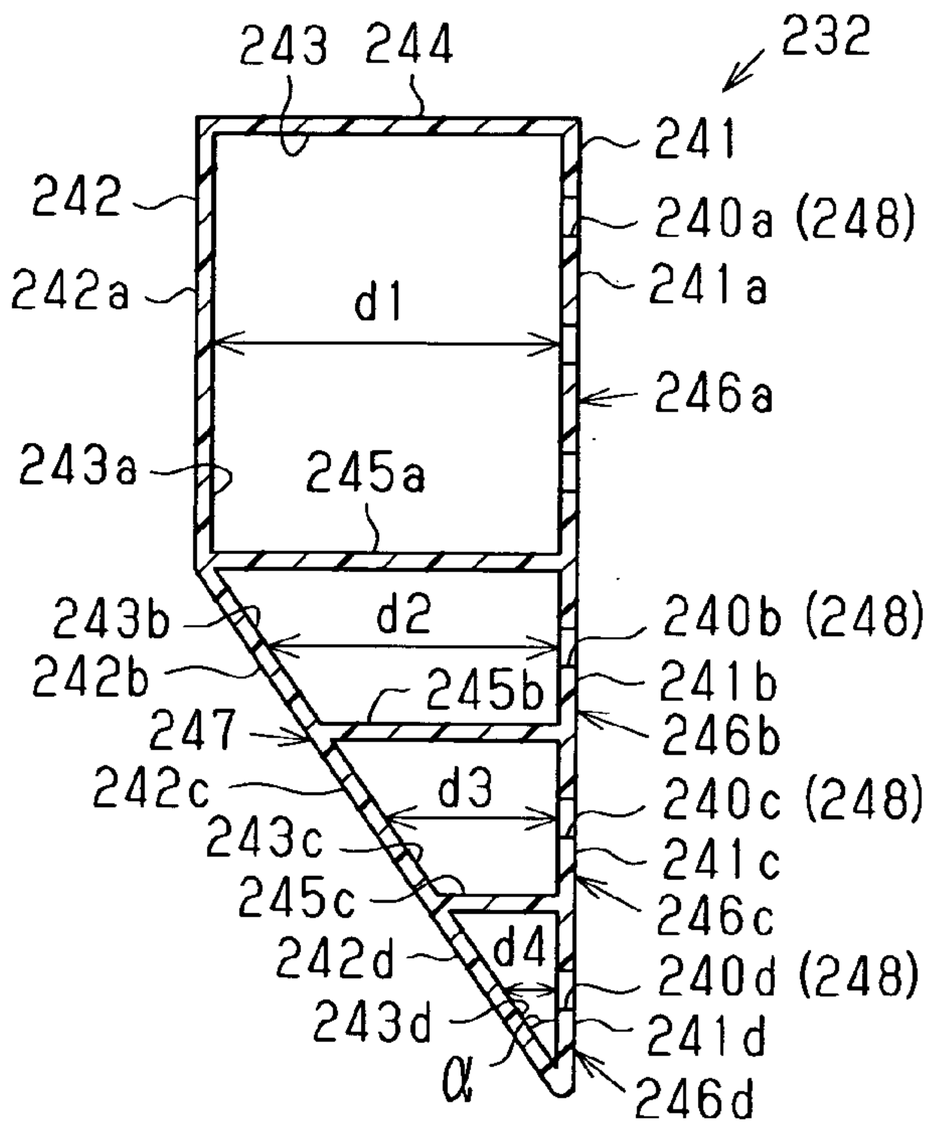
246a
240b (248)
246b
240c (248)
246c
240d (248)
246d
244
13

Fig.13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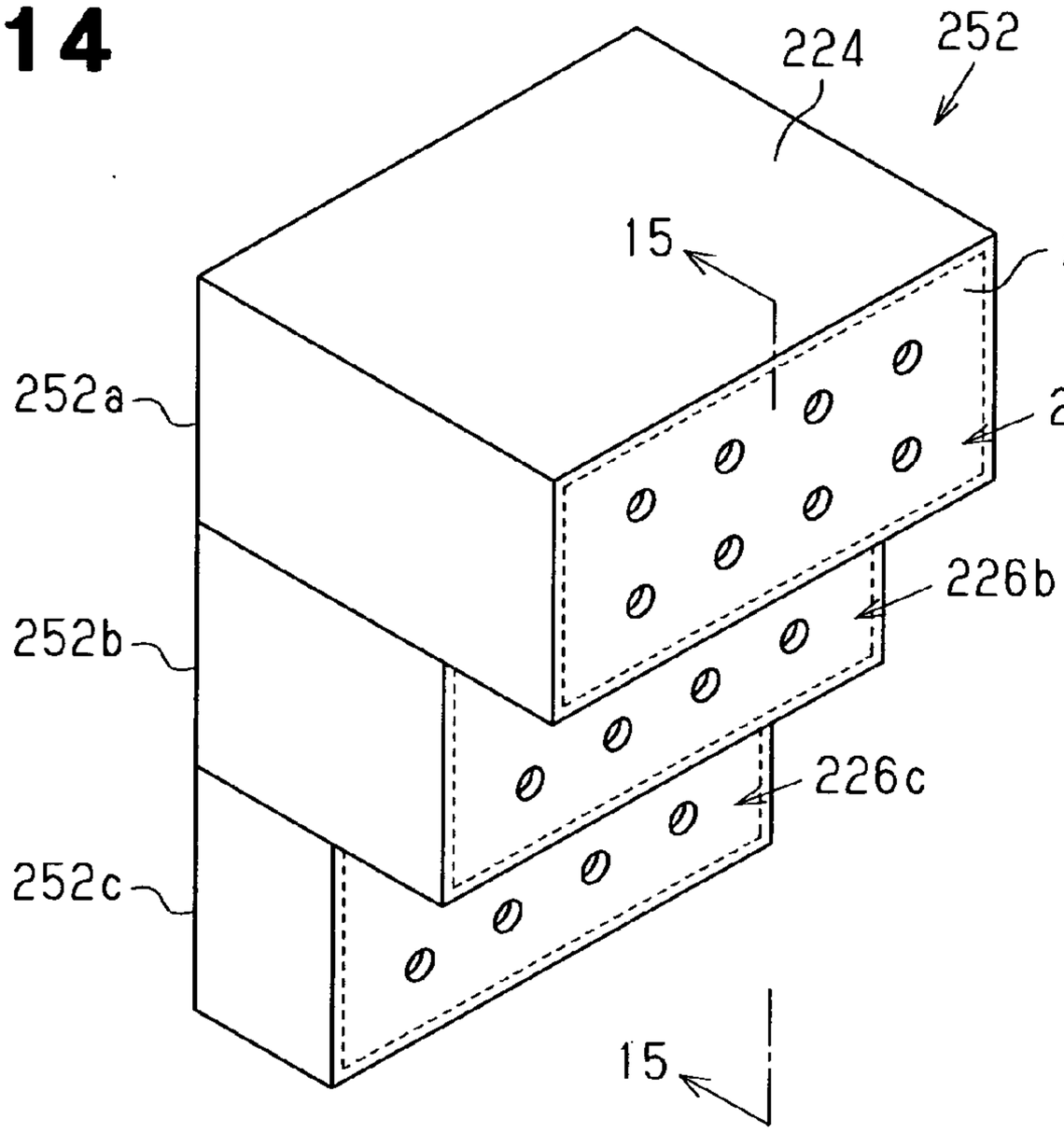
232
241
242
240a (248)
242a
d1
241a
246a
243a
245a
243b
d2
240b (248)
242b
245b
241b
247
246b
242c
d3
240c (248)
243c
241c
245c
246c
242d
d4
240d (248)
243d
241d
α
246d

Fig.14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226b
252b
226c
252c
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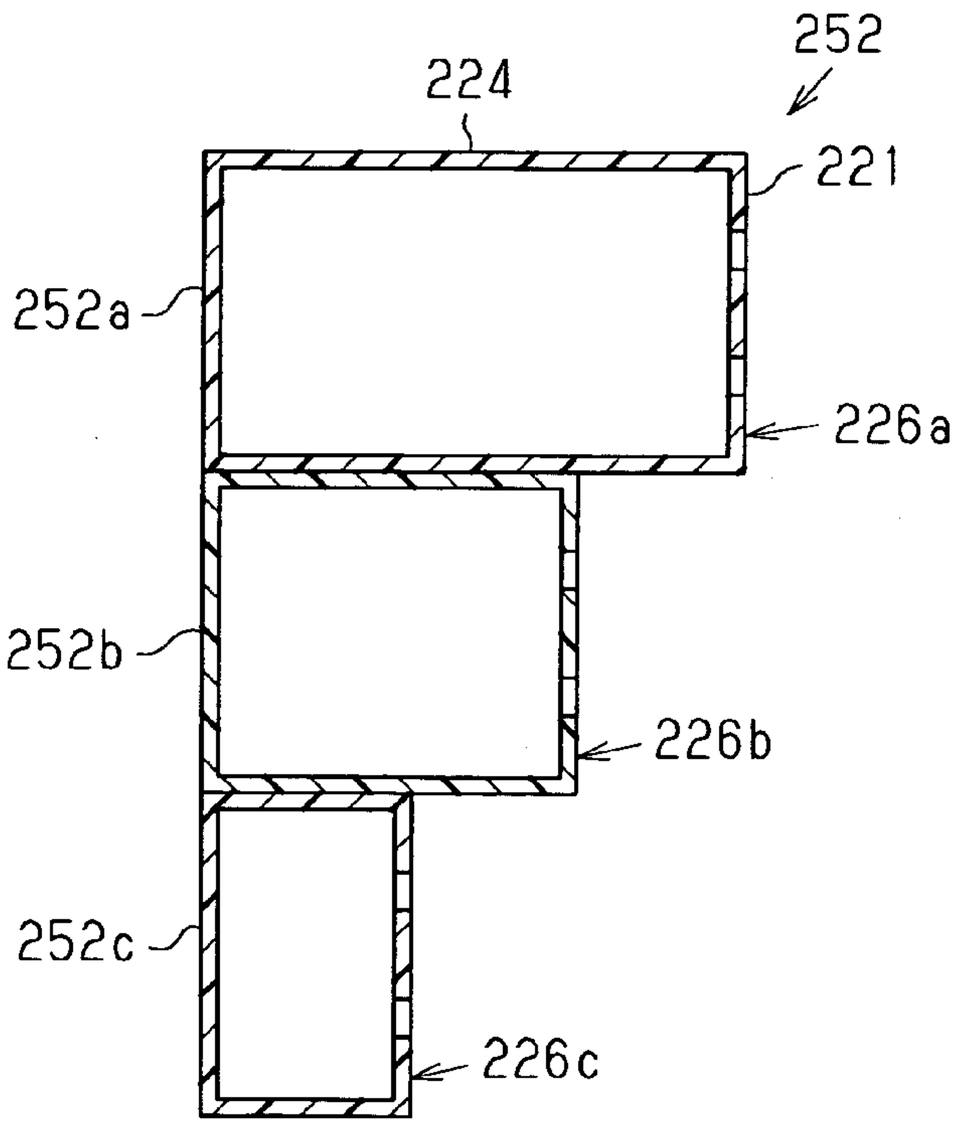
Fig.15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226a
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226b
252c
226c

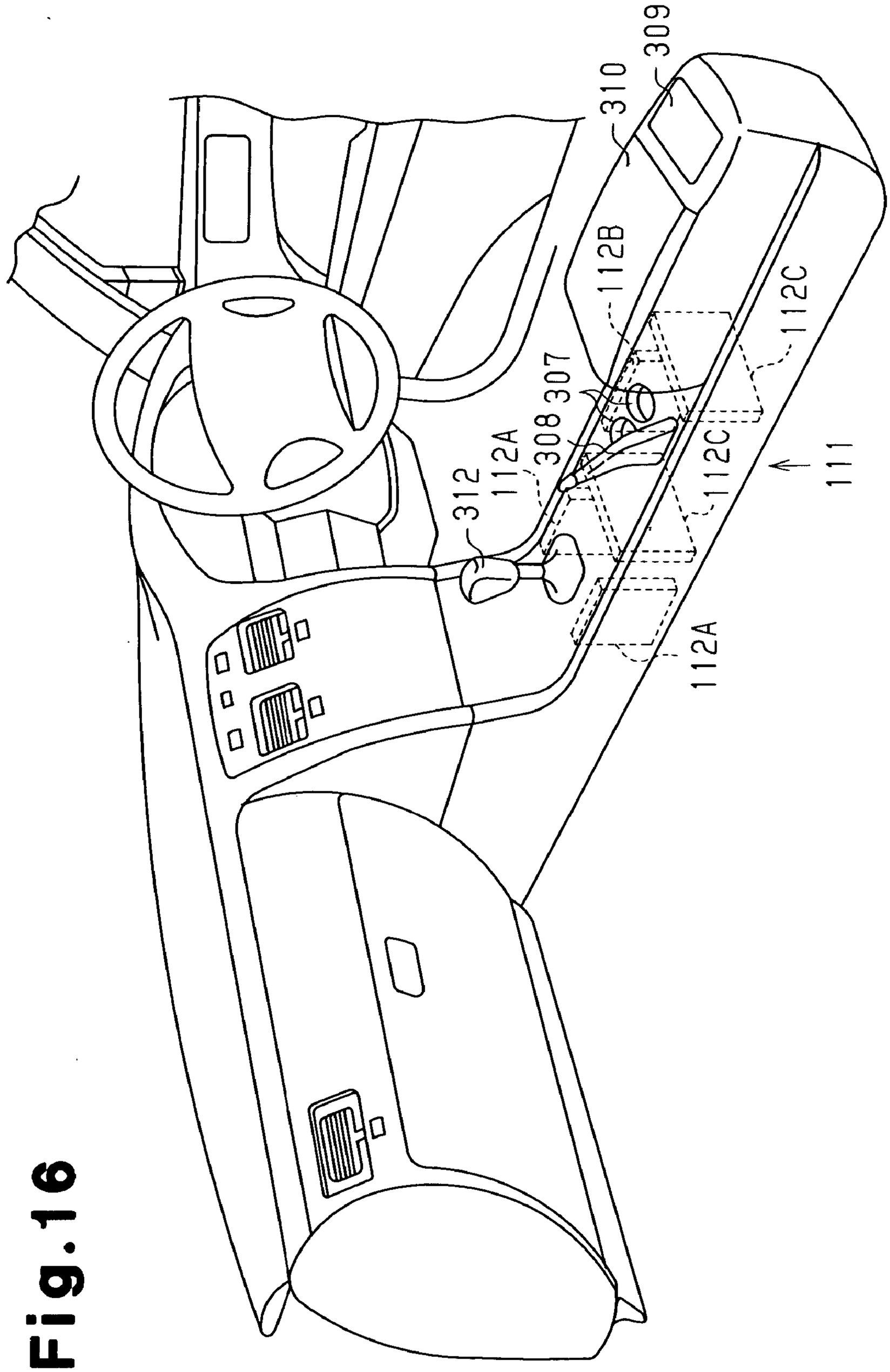
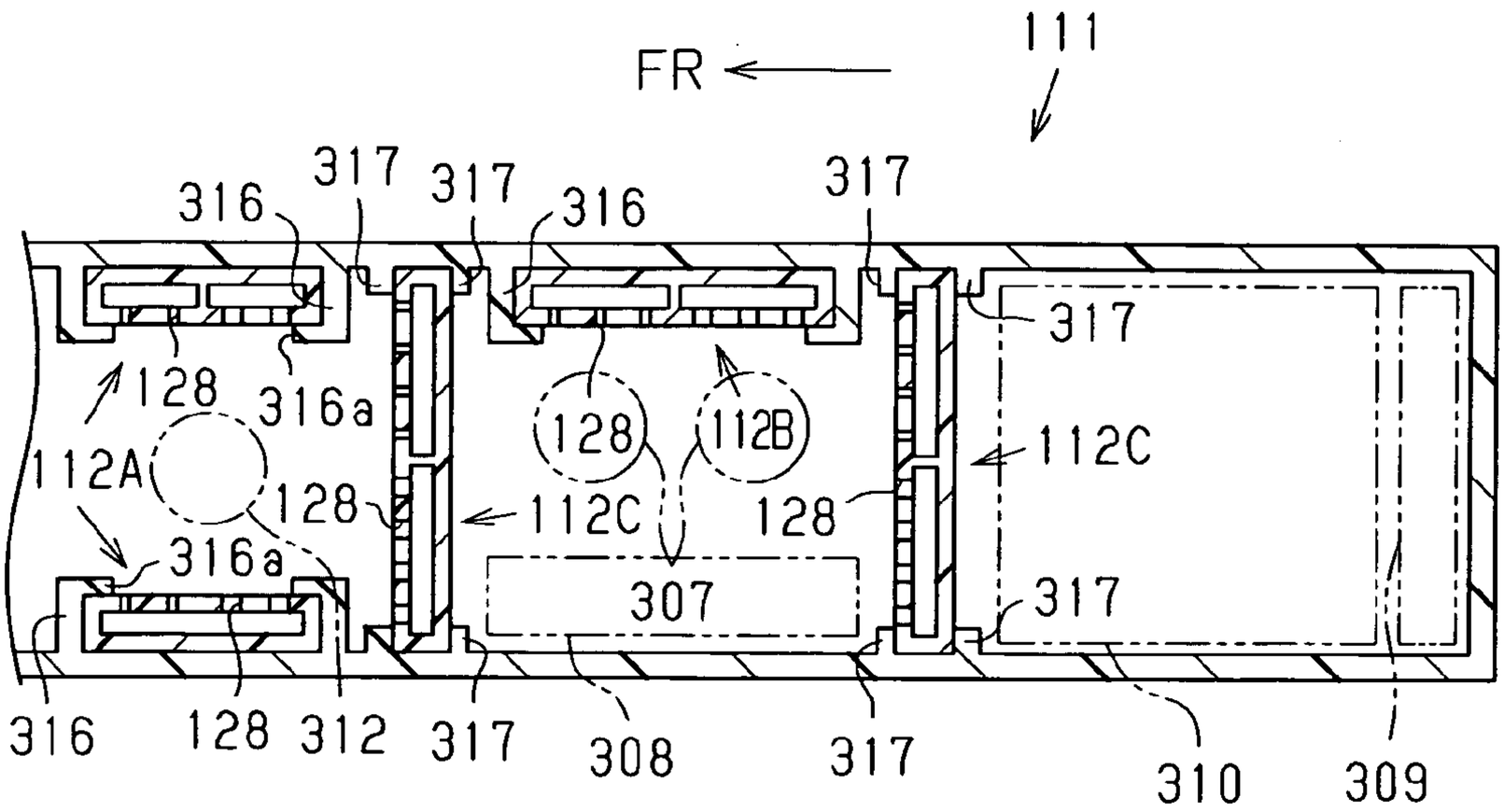


Fig.16

Fig.17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112C
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112C
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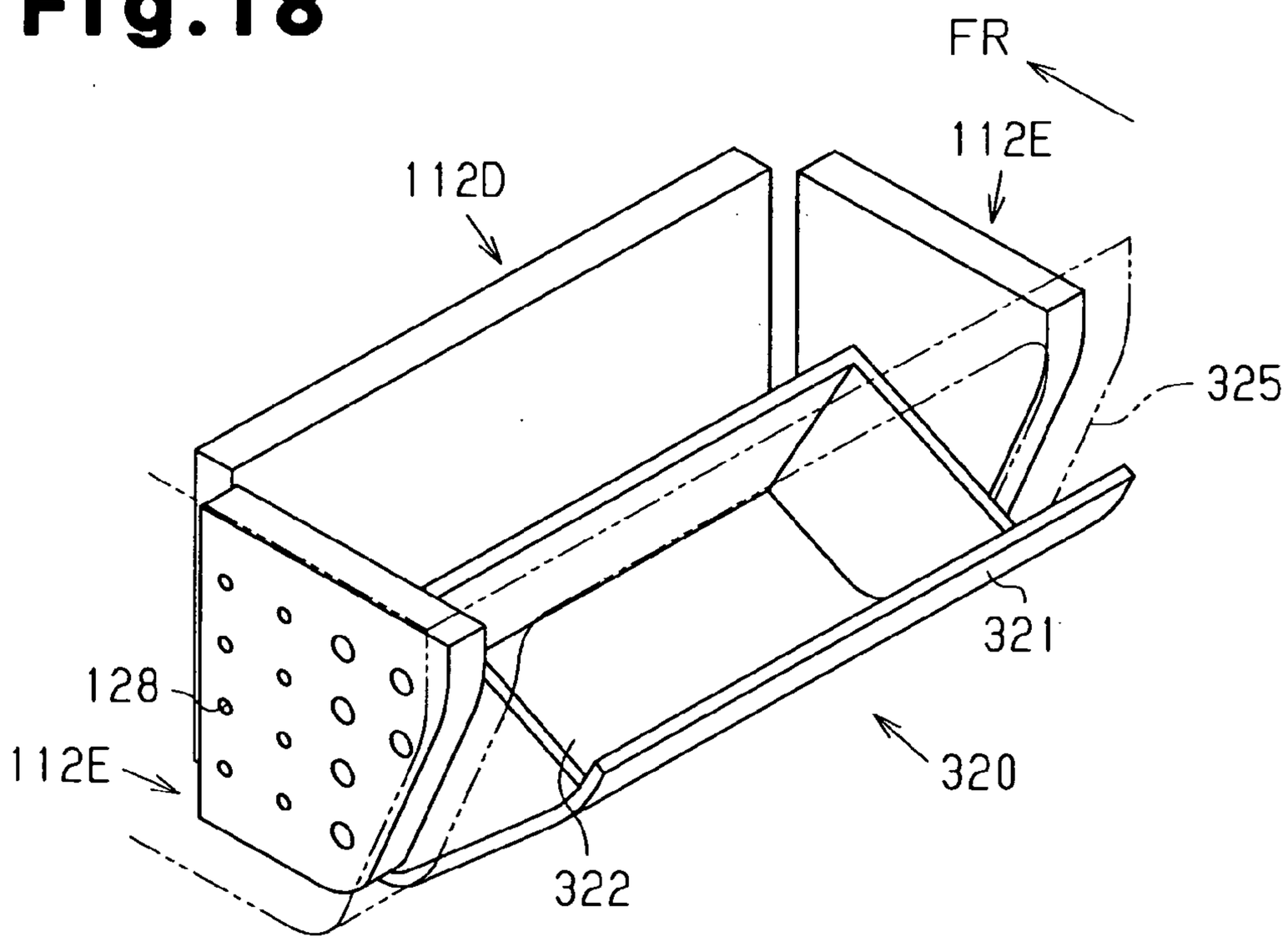
309

Fig.18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112E
320
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Fig.19

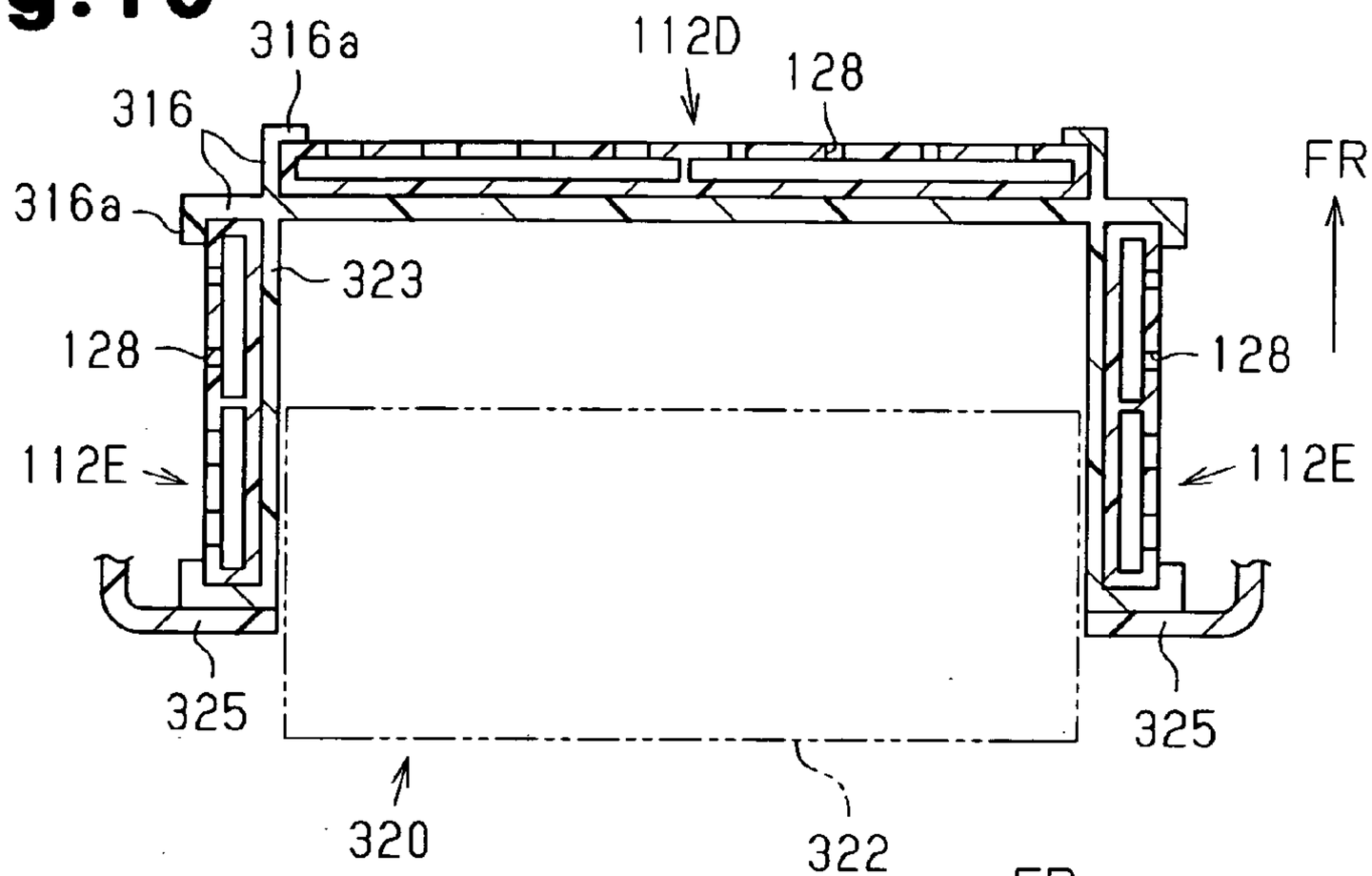


Fig.20

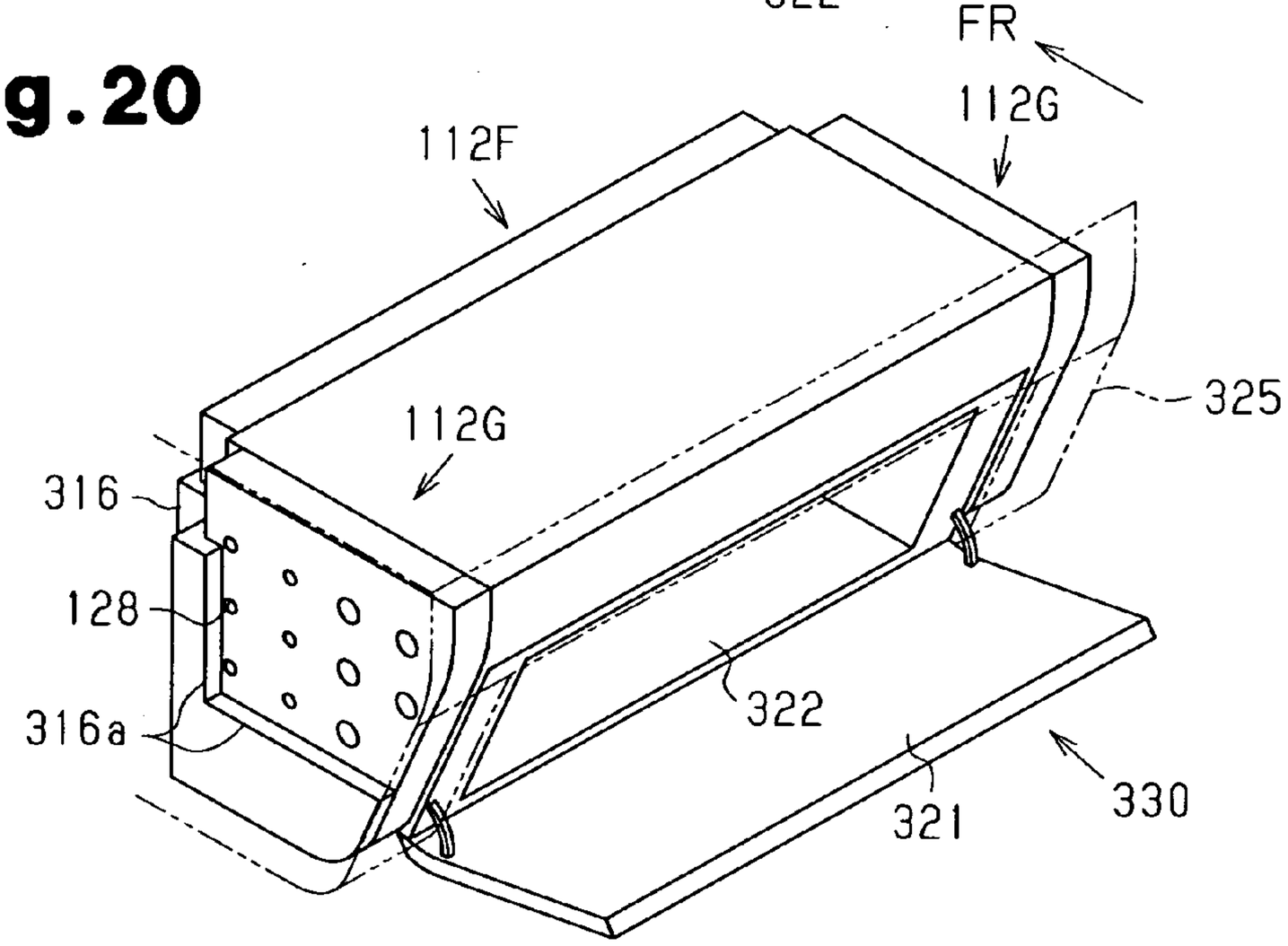


Fig.21A

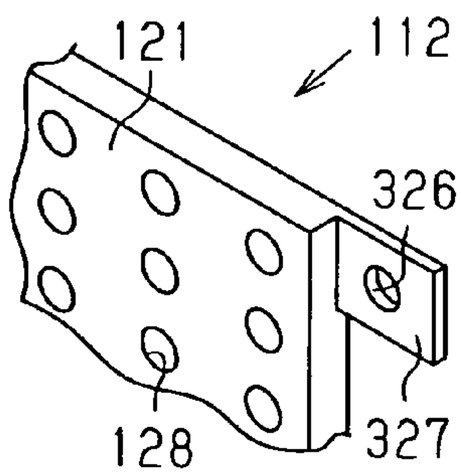
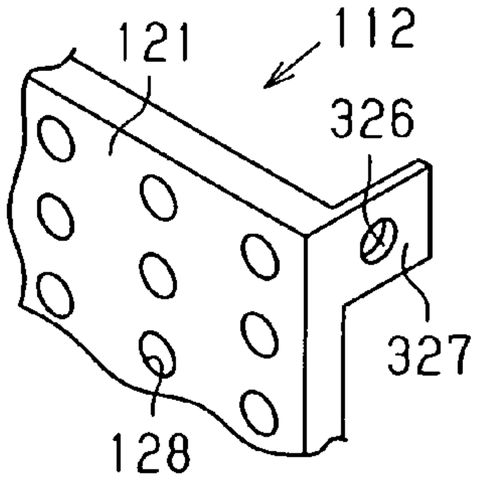


Fig.21B



NOISE ABSORBING STRUCTURE AND NOISE ABSORBING/INSULATING STRUCTURE

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a noise absorbing structure and a noise absorbing/insulating structure for absorbing noise, and more particularly, to a noise absorbing structure and a noise absorbing/insulating structure for absorbing noise in the passenger compartment of a vehicle.

[0002] In recent years, there has been an increasing demand for quietness in the passenger compartment of a vehicle. Accordingly, it is required that noise be further reduced in the passenger compartment. As a measure for reducing the noise, there has been proposed a noise absorbing structure, which includes a base with a plurality of holes (noise absorbing wall) and a space provided at the back of the base. This type of noise absorbing structure exhibits its noise absorbing effect based on the Helmholtz resonance principle when noise generated by a noise source passes through the holes formed in the noise absorbing wall. The sonic energy is absorbed rapidly by this noise absorbing effect.

[0003] Japanese Laid-Open Utility Model Publication No. 2-115049 describes an example of a vehicle ceiling that absorbs noise. The vehicle ceiling is provided with a hollow member. Further, a plurality of holes (noise absorbing holes) for air-column resonance reduction is formed on the passenger compartment side of a base. With this vehicle ceiling, the noise in the passenger compartment is guided through the holes into an air layer within the hollow member and reduced therein.

[0004] Japanese Laid-Open Patent Publication No. 2000-16189 describes a rear shelf trim for absorbing noise. The rear shelf trim is provided with a hollow member having an upper wall. Additionally, a plurality of holes is formed in the upper wall. The total area of the holes corresponds to about 20 to 50% of the area of the upper wall having these holes. With this rear shelf trim, the noise in the passenger compartment is also guided through the holes into the hollow space within the hollow member and absorbed therein.

[0005] Japanese Laid-Open Patent Publication No. 5-92441 describes a noise-insulating board having cylindrical hollow bodies arranged in a concentrated manner on a support board. The distal end of the cylindrical hollow body is open.

[0006] Further, as one of other noise reduction measures, felt or THINSULATE is applied to the rear face of a console box. The noise generated from the engine and gears is absorbed and reduced by the felt or THINSULATE.

[0007] In the above-described vehicle ceiling and rear shelf trim of the prior art, the holes all have an identical diameter. That is, the openings have an identical area. Accordingly, the frequency range of the noise absorbed by these holes is limited to a narrow range. Also, as for the noise-insulating board described above, since it is difficult to enlarge the volume of space in the cylindrical hollow bodies, the noise absorbing effect based on the Helmholtz resonance principle cannot be exhibited sufficiently. Consequently, the conventional noise absorbing mechanisms still need improvement, particularly in terms of absorbing the interior noise in a wide frequency range.

SUMMARY OF THE INVENTION

[0008] The present invention provides a noise absorbing structure and a noise absorbing/insulating structure capable of effectively absorbing noise in a wide frequency range.

[0009] One aspect of the present invention is a noise absorbing structure for absorbing noise. The structure is provided with a first noise absorbing portion that is hollow and includes one or more first holes, and a second noise absorbing portion that is hollow and includes one or more second holes. The one or more first holes has a total area different from that of the one or more second holes.

[0010] Another aspect of the present invention is a noise absorbing/insulating body for absorbing and insulating noise. The body is provided with a first noise absorbing portion that is hollow and includes a first noise absorbing wall having one or more first holes and a first noise insulating wall for insulating noise facing towards the first noise absorbing wall. The body is further provided with a second noise absorbing portion that is hollow and includes a second noise absorbing wall having one or more second holes and a second noise insulating wall for insulating noise facing towards the second noise absorbing wall. The one or more first holes has a total area different from that of the one or more second holes.

[0011] A further aspect of the present invention is a noise absorbing structure for absorbing noise. The structure is provided with a first sub-box that is hollow and includes one or more first holes, and a second sub-box that is hollow, includes one or more second holes, and has the same shape as the first sub-box. The one or more first holes has a total area different from that of the one or more second holes.

[0012] Another aspect of the present invention is a noise absorbing structure for absorbing noise. The structure is provided with a first noise absorbing portion that is hollow and includes a first noise absorbing wall having one or more first holes. The structure is further provided with a second noise absorbing portion that is hollow and includes a second noise absorbing wall having one or more second holes. The first noise absorbing portion and the second noise absorbing portion each have a volume that is different from one another.

[0013] A further aspect of the present invention is a noise absorbing/insulating structure for absorbing and insulating noise. The structure is provided with a first noise absorbing portion that is hollow and includes a first noise absorbing wall having one or more first holes and a first noise insulating wall for insulating noise facing towards the first noise absorbing wall. The structure is further provided with a second noise absorbing portion that is hollow and includes a second noise absorbing wall having one or more second holes and a second noise insulating wall for insulating noise facing towards the second noise absorbing wall. The first noise absorbing portion and the second noise absorbing portion each include a volume that is different from one another.

[0014] Another aspect of the present invention is a noise absorbing structure for absorbing noise. The structure is provided with a first sub-box that is hollow and includes one or more first holes, and a second sub-box that is hollow and includes one or more second holes having the same shape as the first holes. The one or more first holes has a total area and

the one or more second holes has a total area that is the same as the total area of the one or more first holes. The first sub-box and the second sub-box each have a volume that is different from one another.

[0015] Other aspects and advantages of the present invention will become apparent from the following description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The invention, together with objects and advantages thereof, may best be understood by reference to the following description of the presently preferred embodiments together with the accompanying drawings in which:

[0017] **FIG. 1** is a perspective view showing a passenger compartment in which a noise absorbing/insulating box according to a first embodiment of the present invention is installed;

[0018] **FIG. 2** is a horizontal cross-sectional view of the console showing the position where the noise absorbing/insulating box of **FIG. 1** is installed;

[0019] **FIG. 3** is a vertical cross-sectional view of the console showing the position where the noise absorbing/insulating box of **FIG. 1** is installed;

[0020] **FIG. 4** is a perspective view showing the noise absorbing/insulating box of **FIG. 1**;

[0021] **FIG. 5** is a cross-sectional view taken along line **5-5** of **FIG. 4**;

[0022] **FIG. 6** is a perspective view showing a noise absorbing/insulating box according to a second embodiment of the present invention;

[0023] **FIG. 7** is a cross-sectional view taken along line **7-7** of **FIG. 6**;

[0024] **FIG. 8** is a horizontal cross-sectional view of a console showing the position where a noise absorbing/insulating box according to a third embodiment of the present invention is installed;

[0025] **FIG. 9** is a vertical cross-sectional view of the console showing the position where the noise absorbing/insulating box of **FIG. 8** is installed;

[0026] **FIG. 10** is a perspective view showing the noise absorbing/insulating box of **FIG. 8**;

[0027] **FIG. 11** is a cross-sectional view taken along line **11-11** of **FIG. 10**;

[0028] **FIG. 12** is a perspective view showing a noise absorbing/insulating box according to a fourth embodiment of the present invention;

[0029] **FIG. 13** is a cross-sectional view taken along line **13-13** of **FIG. 12**;

[0030] **FIG. 14** is a perspective view showing a noise absorbing/insulating box according to a fifth embodiment of the present invention;

[0031] **FIG. 15** is a cross-sectional view taken along line **15-15** of **FIG. 14**;

[0032] **FIG. 16** is a perspective view showing a console box in which a noise absorbing/insulating box according to a sixth embodiment of the present invention is installed;

[0033] **FIG. 17** is a partial cross-sectional view showing the console box of **FIG. 16**;

[0034] **FIG. 18** is a schematic view showing a glove compartment in which a noise absorbing/insulating box according to a seventh embodiment of the present invention is installed;

[0035] **FIG. 19** is a cross-sectional view showing the glove compartment of **FIG. 18**;

[0036] **FIG. 20** is a schematic view showing a glove compartment in which a noise absorbing/insulating box according to an eighth embodiment of the present invention is installed; and

[0037] **FIGS. 21A and 21B** are perspective views showing further examples of the noise absorbing/insulating box.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0038] In the drawings, like numerals are used for like elements throughout.

First Embodiment

[0039] A first embodiment of a noise absorbing/insulating structure according to the present invention will now be described with reference to **FIG. 1** through **FIG. 5**. The noise absorbing/insulating structure of the first embodiment is installed in a console **111**, which is an interior equipment of a vehicle.

[0040] As shown in **FIG. 1**, the console **111** is arranged between the driver's seat and passenger seat in the passenger compartment. Drive train components (not shown) including the engine and gears are mounted in the front lower part of the vehicle. Various kinds of noise, generated by the drive train components, are propagated through the inner space of the console **111** and leak into the passenger compartment through gaps thereby creating the noise in the passenger compartment. Two noise absorbing/insulating boxes **112** are installed inside the console **111** as noise absorbing bodies for reducing the passenger compartment noise. The two noise absorbing/insulating boxes **112** form a noise absorbing/insulating structure.

[0041] In the console **111**, as shown in **FIG. 2**, attachment portions **114** are defined on the inner faces of opposing side walls **111***a*. A noise absorbing/insulating box **112** is attached to each attachment portion **114**. The attachment portions **114** each have a pair of guide walls **115** projecting towards the inside of the console **111**. A guide groove **116** is formed between the pair of guide walls **115**. These attachment portions **114** are located at front and rear parts of the console **111** at positions corresponding to where the noise absorbing/insulating boxes **112** are to be installed. The lateral sides of each noise absorbing/insulating box **112** are inserted in the guide grooves **116** of the corresponding attachment portion **114**. This fixes the noise absorbing/insulating boxes **112** at predetermined positions in the console **111**.

[0042] The noise absorbing/insulating boxes **112** each have a substantially rectangular box shape and are formed

by blow molding or injection molding synthetic resin, such as polypropylene (PP), polyethylene (PE), or acrylonitrile-butadiene copolymer (ABS). The noise absorbing/insulating box **112** has a first wall **121**, a second wall **122** opposing the first wall **121**, and four side walls **124**, which link the first wall **121** and the second wall **122**. In other words, the noise absorbing/insulating box **112** is a hollow structure and is provided with a space **123** therein. The first wall **121** is provided with a plurality of circular holes **128**, which communicate the space in the console **111** with the space **123** in the noise absorbing/insulating box **112**. No holes are formed in the second wall **122** or the side walls **124** so that the second wall **122** and side walls **124** block the space **123** in the noise absorbing/insulating box **112** from the space in the console **111**.

[**0043**] The noise absorbing/insulating boxes **112** held by the attachment portions **114** are arranged with their respective first walls **121** facing the front side of the vehicle. One of the noise absorbing/insulating boxes **112** is arranged in a front part of the console **1111** and the other one is in a rear part of the console **111** so as to block the path of noise propagated in the console **111**. As shown in **FIG. 3**, the heights of these two noise absorbing/insulating boxes **112** are determined according to the height of the console **111**. The lateral sides and upper and lower sides of the noise absorbing/insulating boxes **112**, which are held by the attachment portions **114**, abut against the inner walls of the console **111**. This means that the noise absorbing/insulating boxes **112** are arranged such that no gap is formed between the noise absorbing/insulating boxes **112** and the inner walls of the console **111**. Consequently, the noise absorbing/insulating boxes **112** prevent engine noise or gear noise generated by the drive train components from leaking into the passenger compartment and creating noise in the passenger compartment.

[**0044**] In each of the noise absorbing/insulating boxes **112**, air in the holes **128** of the first wall **121** acts as a mass when noise propagated from the front side of the vehicle passes through the holes **128** in the console **111**. Aside from the air in the holes **128** of the first wall **121**, air in the space **123** of the noise absorbing/insulating box **112** isolated by the second wall **122** and the side walls **124** from the space in the console **111** acts as a spring. The air in the holes **128** is vibrated acutely by the interaction of the mass (air in the holes **128**) with the spring (air in the space **123**) to convert sonic energy into thermal energy. This rapidly reduces noise. The noise absorbing/insulating box **112** exhibits its noise absorbing capability in this manner and rapidly absorbs the noise generated by a noise source.

[**0045**] Next, the principal parts of the present invention will be described. **FIG. 4** is a general perspective view of the noise absorbing/insulating box **112**, and **FIG. 5** is a cross-sectional view taken along line **5-5** of **FIG. 4**. The two noise absorbing/insulating boxes **112** located at the front and rear parts of the console **111**, respectively, have an identical configuration.

[**0046**] As shown in **FIGS. 4 and 5**, the noise absorbing/insulating box **112** has a first noise absorbing portion **126***a* and a second noise absorbing portion **126***b*, which are hollow and partitioned by a partition wall **125** that connects the first wall **121** and the second wall **122**. In other words, the noise absorbing/insulating box **112** of the first embodiment is formed by integrating the first noise absorbing portion **126***a*, which has a rectangular box shape, with the second noise absorbing portion **126***b*, which also has a rectangular box shape. The first noise absorbing portion **126***a* is defined by parts of the first wall **121** and the second wall **122**, the side walls **124** and the partition wall **125**. The second noise absorbing portion **126***b* is defined by other parts of the first wall **121** and the second wall **122**, the side walls **124** and the partition wall **125**. The partition wall **125** divides the space **123** in the noise absorbing/insulating box **112** into two sub-spaces **123***a* and **123***b*. The sub-space **123***a* in the first noise absorbing portion **126***a* has the same volume as the sub-space **123***b* in the second noise absorbing portion **126***b*.

[**0047**] The part of the first wall **121** forming the first noise absorbing portion **126***a* is defined as a first noise absorbing wall **121***a*. The part of the second wall **122** forming the first noise absorbing portion **126***a* and facing towards the first noise absorbing wall **121***a* is defined as a first noise insulating wall **122***a*. The other part of the first wall **121** forming the second noise absorbing portion **126***b* is defined as a second noise absorbing wall **121***b*. The other part of the second wall **122** forming the second noise absorbing portion **126***b* and facing towards the second noise absorbing wall **121***b* is defined as a second noise insulating wall **122***b*.

[**0048**] A plurality of holes **128** are formed in the first noise absorbing wall **121***a* at equal intervals in the longitudinal and lateral directions of the first noise absorbing wall **121***a*. A plurality of holes **128** are formed in the second noise absorbing wall **121***b* at equal intervals in the longitudinal and lateral directions of the second noise absorbing wall **121***b*. The group of the plurality of holes **128** formed in the first noise absorbing wall **121***a* constitutes a first noise absorbing hole group **120***a*. The group of the plurality of holes **128** formed in the second noise absorbing wall **121***b* constitutes a second noise absorbing hole group **120***b*.

[**0049**] The holes **128** constituting the first noise absorbing hole group **120***a* have an identical diameter and identical opening area. The holes **128** constituting the second noise absorbing hole group **120***b* also have an identical diameter and an identical opening area. The holes **128** constituting the second noise absorbing hole group **120***b* have a larger diameter, and hence a larger opening area, than the holes **128** constituting the first noise absorbing hole group **120***a*. Accordingly, the opening area **S1** of the first noise absorbing hole group **120***a*, which is the total sum of the opening areas of the holes **128** in the first noise absorbing wall **121***a*, differs from the opening area **S2** of the second noise absorbing hole group **120***b*, which is the total sum of the opening areas of the holes **128** in the second noise absorbing wall **121***b*. In the first embodiment, the opening area **S2** of the second noise absorbing hole group **120***b* is larger than the opening area **S1** of the first noise absorbing hole group **120***a*.

[**0050**] As described above, the noise absorbing/insulating box **112** exhibits its noise absorbing capability as the result of air in the holes **128** acting as a mass and air in the space **123** acting as a spring. In a similar manner, the first and second noise absorbing portions **126***a* and **126***b* exhibit their noise absorbing capability as the result of air in the first and second noise absorbing hole groups **120***a* and **120***b* acting as a mass and air in the sub-spaces **123***a* and **123***b* of the first and second noise absorbing portion **126***a* and **126***b* acting as a spring.

[0051] Since the sub-spaces **123***a* and **123***b* have the same volume, air in the sub-spaces **123***a* and **123***b* act as springs that act in the same manner. In contrast, since the opening area **S1** of the first absorbing hole group **120** differs from the opening area **S2** of the second noise absorbing hole group **120***b*, the mass of the air in the first noise absorbing hole group **120***a* differs from that of the air in the second noise absorbing hole group **120***b*. Since the masses acting in the first and second noise absorbing portions **126***a* and **126***b* differ from each other, the frequency ranges of the noise absorbed in the first and second noise absorbing portion **126***a* and **126***b* differ from each other. Accordingly, the noise absorbing/insulating box **112** is capable of absorbing a wide range of noise including the frequency range absorbed by the first noise absorbing portion **126***a* and the frequency range absorbed by the second noise absorbing portion **126***b*.

[0052] The opening areas **S1** and **S2** of the first and second noise absorbing hole groups **120***a* and **120***b* are determined as required according to the frequency range of noise to be absorbed by the noise absorbing/insulating box **112**, or the frequency range of noise generated by the noise source. Additionally, the first and second noise insulating walls **122***a* and **122***b* that do not have the first and second noise absorbing hole groups **120***a* and **120***b* are arranged to block the noise propagated in the console **111** from the front side of the vehicle. Consequently, the noise absorbing/insulating box **112** has a noise insulating capability for insulating noise in addition to the noise absorbing capability for absorbing noise generated by a noise source.

[0053] The noise absorbing/insulating box **112** of the first embodiment has the advantages described below.

[0054] The noise absorbing/insulating box **112** is designed such that the opening area **S1** of the first noise absorbing hole group **120***a* of the first noise absorbing portion **126***a* differs from the opening area **S2** of the second noise absorbing hole group **120***b* of the second noise absorbing portion **126***b*. As a result, when various types of noise in a wide frequency range pass through the first and second noise absorbing hole groups **120***a* and **120***b*, the noise absorbing effect based on the Helmholtz resonance principle is exhibited, and the noise is rapidly absorbed by the noise absorbing/insulating box **112**. Therefore, the noise absorbing/insulating box **112** absorbs noise in a wider frequency range than the conventional techniques. That is, the noise absorbing/insulating box **112** exhibits a favorable noise absorbing capability with respect to noise in a wide frequency range. Accordingly, with the noise absorbing/insulating box **112** of the first embodiment, noise such as that of the engine and the gears in the drive train is further reduced compared to the prior art. This achieves improved quietness in the passenger compartment.

[0055] In the first and second noise absorbing portions **126***a* and **126***b*, all of the plurality of holes **128** constituting the first noise absorbing hole group **120***a* have an identical diameter and identical opening area, and all of the plurality of holes **128** constituting the second noise absorbing hole group **120***b* also have an identical diameter and an identical opening area. In the noise absorbing/insulating box **112**, the frequency ranges of the noises absorbed by the first and second noise absorbing portions **126***a* and **126***b* may be determined separately and explicitly.

[0056] The noise absorbing/insulating box **112** includes the first and second noise insulating walls **122***a* and **122***b* opposing the first and second noise absorbing walls **121***a* and **121***b*, respectively. The first and second noise insulating walls **122***a* and **122***b* have no holes **128** and separate the space **123** in the noise absorbing/insulating box **112** from the outside. Therefore, the first and second noise insulating walls **122***a* and **122***b* block the noise that is propagated through air and inhibits noise generated by a noise source from leaking outside. Accordingly, the noise absorbing/insulating box **112** exhibits excellent noise absorbing/insulating capability with respect to noise in a wide frequency range.

[0057] In the noise absorbing/insulating box **112**, the first and second noise absorbing portions **126***a* and **126***b* have an identical volume, while the opening areas **S1** and **S2** of the first and second noise absorbing hole groups **120***a* and **120***b* of the first and second noise absorbing portions **126***a* and **126***b* differ from each other. When the noise absorbing/insulating box **112** is constructed in this manner, the range of the noise absorbed by the noise absorbing/insulating box **112** is varied easily by changing only the first wall **121** having the holes **128**. Therefore, the configuration of the noise absorbing/insulating box **112** may easily be modified in correspondence with the frequency range of the noise that is to be absorbed. The noise absorbing/insulating box **112** may thus be used for many purposes.

[0058] The noise absorbing/insulating box **112** is thin and has a rectangular box shape and, therefore, occupies a relatively small volume. Accordingly, it is easy to ensure space for installing the noise absorbing/insulating box **112** even in a limited space within vehicle interior equipment such as the console **111**.

[0059] Two noise absorbing/insulating boxes **112** are arranged in the interior of the console **111** so as to block the path of noise generated by the drive train components and propagated in the console **111**. The positions where the noise absorbing/insulating boxes **112** are arranged are optimal for absorbing noise generated by the noise source and for insulating noise generated by the noise source. Thus, the noise generated by the drive train components are absorbed and insulated effectively by installing the two noise absorbing/insulating boxes **112** in these positions.

Second Embodiment

[0060] Hereafter, a noise absorbing/insulating box **132** according to a second embodiment of the present invention will be described with reference to **FIGS. 6 and 7**. **FIG. 6** is a perspective view of the noise absorbing/insulating box **132**, and **FIG. 7** is a cross-sectional view taken along line **7-7** of **FIG. 6**.

[0061] As shown in **FIG. 6** and **FIG. 7**, the noise absorbing/insulating box **132** includes first and second noise absorbing/insulating sub-boxes **132***a* and **132***b*, which are assembled integrally with each other. The volumes in the first and second noise absorbing/insulating sub-boxes **132***a* and **132***b* are the same. The noise absorbing/insulating box **132** is thin and has a rectangular box shape formed by joining the side of the first noise absorbing/insulating sub-box **132***a* with the side of the second noise absorbing/insulating sub-box **132***b*.

[0062] In the noise absorbing/insulating box **132** of the second embodiment, the first noise absorbing/insulating

sub-box **132***a* is constructed as a first noise absorbing portion **146***a* and the second noise absorbing/insulating sub-box **132***b* is constructed as a second noise absorbing portion **146***b*. Specifically, the first noise absorbing/insulating sub-box **132***a* has a first noise absorbing wall **141***a* and a first noise insulating wall **142***a* facing towards the first noise absorbing wall **141***a*. The first noise absorbing wall **141***a* has a plurality of holes **148** formed at equal intervals in the longitudinal and lateral directions of the first noise absorbing wall **141***a*. A group of the holes **148** formed in the first noise absorbing wall **141***a* constitutes a first noise absorbing hole group **140***a*.

[**0063**] The second noise absorbing/insulating sub-box **132***b* has a second noise absorbing wall **141***b* and a second noise insulating wall **142***b* facing towards the second noise absorbing wall **141***b*. The second noise absorbing wall **141***b* has a plurality of holes **149** having a larger diameter than the holes **148** of the first noise absorbing hole group **140***a*. The holes **149** are formed at equal intervals in the longitudinal and lateral directions of the second noise absorbing wall **141***b*. A group of the holes **149** formed in the second noise absorbing wall **141***b* constitutes a second noise absorbing hole group **140***b*.

[**0064**] In the second embodiment, like in the first embodiment, the first and second noise absorbing portions **146***a* and **146***b* have the same volume, while the opening area **S1** of the first noise absorbing hole group **140***a* differs from the opening area **S2** of the second noise absorbing hole group **140***b*. Accordingly, the noise absorbing/insulating box **132** is capable of absorbing a wide range of noise.

[**0065**] Consequently, the noise absorbing/insulating box **132** of the second embodiment has the advantages described below.

[**0066**] The noise absorbing/insulating box **132** is formed by assembling the first noise absorbing/insulating sub-box **132***a* having the first noise absorbing hole group **140***a* integrally with the second noise absorbing/insulating sub-box **132***b* having the second noise absorbing hole group **140***b*. The noise absorbing/insulating box **132** exhibits further a preferable noise absorbing capability in a wide frequency range by optimizing the combination of various noise absorbing/insulating sub-boxes designed to absorb noise in various frequency areas.

Third Embodiment

[**0067**] A noise absorbing/insulating box **212** according to a third embodiment of the present invention will now be described with reference to FIGS. **8** to **11**. In the third embodiment, the noise absorbing/insulating box **212** has a step-like shape as shown in **FIG. 10** and is installed in a console **111** as shown in **FIGS. 8 and 9**.

[**0068**] As shown in **FIGS. 10 and 11**, the noise absorbing/insulating box **212** has a first noise absorbing portion **226***a*, a second noise absorbing portion **226***b*, and a third noise absorbing portion **226***c*, which are hollow and are partitioned from each other by first and second partition walls **225***a* and **225***b* that link a first wall **221** and a second wall **222**. In other words, the noise absorbing/insulating box **212** of the third embodiment is constituted by integrating the first, second, and third noise absorbing portions **226***a*, **226***b*, and **226***c*, each of which has a rectangular box shape. The first wall **221** is formed to have a step-like shape as a whole. The first and second partition walls **225***a* and **225***b* are located at positions corresponding to steps **227***a* and **227***b* of the first wall **221**. Accordingly, the first noise absorbing portion **226***a*, the second noise absorbing portion **226***b*, and the third noise absorbing portion **226***c* respectively include sub-spaces **223***a*, **223***b*, and **223***c*, the volumes of which differ from each other.

[**0069**] The part of first wall **221** forming the first noise absorbing portion **226***a* is defined as a first noise absorbing wall **221***a*. The part of the second wall **222** forming the first noise absorbing portion **226***a* and facing towards the first noise absorbing wall **221***a* is defined as a first noise insulating wall **222***a*. The part of the first wall **221** forming the second noise absorbing portion **226***b* is defined as a second noise absorbing wall **221***b*. The part of the second wall **222** forming the second noise absorbing portion **226***b* and facing towards the second noise absorbing wall **221***b* is defined as a second noise insulating wall **222***b*. Further, the part of the first wall **221** forming the third noise absorbing portion **226***c* is defined as a third noise absorbing wall **221***c*. The part of the second wall **222** forming the third noise absorbing portion **226***c* and facing towards the third noise absorbing wall **22**.**1***c* is defined as a third noise insulating wall **222***c*.

[**0070**] The first to third noise absorbing walls **221***a* to **221***c* each have an elongated rectangular shape and equal lateral and longitudinal dimensions. The first to third noise absorbing walls **221***a* to **221***c* are each provided with eight holes **228**. The holes **228** are circular and have the same diameter. The holes **228** are formed at substantially equal intervals in the lateral and longitudinal directions of the first to third noise absorbing walls **221***a* to **221***c*. The holes **228** formed in the first noise absorbing wall **221***a* constitute a first noise absorbing hole group **220***a*. The holes **228** formed in the second noise absorbing wall **221***b* constitute a second noise absorbing hole group **220***b*. The holes **228** formed in the third noise absorbing wall **221***c* constitute a third noise absorbing hole group **220***c*. All the holes **228** constituting the first to third noise absorbing hole groups **220***a* to **220***c* have the same diameter, and hence, the same opening area. Also, the first to third noise absorbing hole groups **220***a* to **220***c* include the same number of holes **228**. Accordingly, the respective opening areas of the first noise absorbing hole group **220***a*, the second noise absorbing hole group **220***b*, and the third noise absorbing hole group **220***c*, or the total sum of the opening areas of the holes **228** in the respective groups, are equal to one another.

[**0071**] The first to third noise absorbing walls **221***a* to **221***c* extend parallel to the opposing first to third noise insulating walls **222***a* to **222***c*. Since the first wall **221** has a step-like shape as a whole, the distance d**1** between the first noise absorbing wall **221***a* and the first noise insulating wall **222***a*, the distance d**2** between the second noise absorbing wall **221***b* and the second noise insulating wall **222***b*, and the distance d**3** between the third noise absorbing wall **221***c* and the third noise insulating wall **222***c* are different from one another. Since the distances d**1** to d**3** are different from one another, the volume **V1** of the first noise absorbing portion **226***a*, the volume **V2** of the second noise absorbing portion **226***b*, and the volume **V3** of the third noise absorbing portion **226***c* are different from one another. The volumes **V1** to **V3** of the first to third noise absorbing portions **226***a* to **226***c* are determined in accordance with the frequency range of the

noise that is to be absorbed, that is, in accordance with the frequency range of the noise generated by the noise source. In the third embodiment, the volume **V1** of the first noise absorbing portion **226***a* is larger than the volume **V2** of the second noise absorbing portion **226***b*, and the volume **V2** is larger than the volume **V3** of the third noise absorbing portion **226***c*. The distances d**1** to d**3** each represent a minimum distance between the noise absorbing wall and the noise insulating wall in each of the noise absorbing portions.

[**0072**] As described above, the noise absorbing/insulating box **212** exhibits its noise absorbing capability as the result of air in the holes **228** acting as a mass and air in the space **223** acting as a spring. In the similar manner, the noise absorbing portions **226***a* to **226***c* also exhibit their noise absorbing capability as the result of air in the holes of the noise absorbing hole groups **220***a* to **220***c* acting as a mass, and air in the sub-spaces **223***a* to **223***c* of the noise absorbing portions **226***a* to **226***c* acting as a spring. Since the opening areas of the first to third noise absorbing hole groups **220***a* to **220***c* are the same, the masses of air in the first to third noise absorbing hole groups **220***a* to **220***c* are also the same. In contrast, since the volumes **V1** to **V3** of the first to third noise absorbing portions **226***a* to **226***c* are different from one another, the spring actions of air in the sub-spaces **223***a* to **223***c* are also different from one another. Since the spring actions are different among the first to third noise absorbing hole groups **220***a* to **220***c*, the frequency ranges of the noise absorbed in the first to third noise absorbing hole groups **220***a* to **220***c* are also different from one another. For this reason, the noise absorbing/insulating box **212** is capable of absorbing a wide range of noise due to the respective frequency ranges of noise that can be absorbed by the first to third noise absorbing portions **226***a* to **226***c*.

[**0073**] The noise absorbing/insulating box **212** of the third embodiment has the advantages described below.

[**0074**] The noise absorbing/insulating box **212** is designed such that the first to third noise absorbing portions **226***a* to **226***c* have different volumes **V1** to **V3**. Thus, the noise absorbing effect is achieved based on the Helmholtz resonance principle when various types of noise in a wide frequency range pass through the holes of the noise absorbing hole groups **220***a* to **220***c*, and noise is absorbed by the noise absorbing/insulating box **212** more rapidly. Therefore, the frequency range of noise absorbed by the noise absorbing/insulating box **212** is wider compared to the conventional techniques. That is, the noise absorbing/insulating box **212** exhibits a preferable noise absorbing capability to noise in a wide frequency range. Accordingly, the noise absorbing/insulating box **212** of the third embodiment reduces noise in the passenger compartment that is generated by the drive train components, such as the noise of the engine or gears, more effectively than in the prior art. This achieves a greater level of quietness in the passenger compartment.

[**0075**] The first wall **221** including the first to third noise absorbing walls **221***a* to **221***c* has a step-like shape. The volumes **V1** to **V3** of the noise absorbing portions **226***a* to **226***c* can be varied easily by adjusting the number or positions of the steps **227***a* and **227***b* in the first wall **221**. This fact facilitates a designer to design the noise absorbing/insulating box **212** and convenience in fabricating the noise absorbing/insulating box **212** is improved.

[**0076**] The noise absorbing/insulating box **212** includes the first to third noise insulating walls **222***a* to **222***c* respectively facing towards the first to third noise absorbing walls **221***a* to **221***c*. The first to third noise insulating walls **222***a* to **222***c* have no noise absorbing hole and separate the space **223** in the noise absorbing/insulating box **212** from the outside. Therefore, the first to third noise insulating walls **222***a* to **222***c* block the noise propagated through air and inhibit the noise generated by a noise source from leaking outside. Accordingly, the noise absorbing/insulating box **212** exhibits excellent capability of absorbing/insulating noise in a wide frequency range. Thus, noise is reduced and quietness is improved in the passenger compartment.

[**0077**] Two noise absorbing/insulating boxes **212** are arranged in the console **111** so as to block the path of noise generated by the drive train components and propagated in the console **111**. The noise absorbing/insulating boxes **212** are located at optimal positions for absorbing noise generated by the noise source and for insulating the noise generated by the noise source. Therefore, the noise generated by the drive train components is effectively absorbed and insulated by installing the two noise absorbing/insulating boxes **212** in the console **111**.

Fourth Embodiment

[**0078**] A fourth embodiment of the present invention will now be described with reference to **FIGS. 12 and 13**. **FIG. 12** is a perspective view of a noise absorbing/insulating box **232**, and **FIG. 13** is a cross-sectional view taken along line **13-13** of **FIG. 12**.

[**0079**] As shown in **FIGS. 12 and 13**, the noise absorbing/insulating box **232** has a planar first wall **241** and a second wall **242** facing towards the first wall **241**. In the middle of the noise absorbing/insulating box **232**, the second wall **242** is bent towards the first wall **241** so that part of the second wall **242** inclines toward the first wall **241**. Side walls **244** of the noise absorbing/insulating box **232** are shaped in correspondence with the first wall **241** and second wall **242**.

[**0080**] Three partition walls **245***a*, **245***b*, and **245***c* extend between the first wall **241** and the part of the second wall **242**, inclining with respect to the first wall **241** such that the space **243** in the noise absorbing/insulating box **232** is divided into four sub-spaces **243***a*, **243***b*, **243***c*, and **243***d*. Thus, the noise absorbing/insulating box **232** has first to fourth noise absorbing portions **246***a* to **246***d*, which are hollow and separated from each other by the three partition walls **245***a*, **245***b*, and **245***c*. The first wall **241** is divided into first to fourth noise absorbing walls **241***a* to **241***d* respectively corresponding to the first to fourth noise absorbing portions **246***a* to **246***d*. The second wall **242** is also divided into first to fourth noise insulating walls **242***a* to **242***d* in the same manner.

[**0081**] Each of the first to fourth noise absorbing walls **241***a* to **241***d* is provided with circular holes **248** having the same diameter and arranged at substantially equal intervals in the lateral and longitudinal directions of the noise absorbing/insulating box **232**. The holes **248** formed in the first to fourth noise absorbing walls **241***a* to **241***d* respectively constitute first, second, third, and fourth noise absorbing hole groups **240***a*, **240***b*, **240***c* and **240***d*. The opening areas of the second to fourth noise absorbing hole groups **240***b* to **240***d*, which are the total sums of the opening areas of the holes **248** in the respective groups, are equal to one another. The opening area of the first noise absorbing hole group

240*a* is larger than the opening areas of the second to fourth noise absorbing hole groups **240***b* to **240***d*.

[**0082**] Since the second wall **242** is partially inclined, the respective distances d**1** to d**4** between the first to fourth noise absorbing walls **241***a* to **241***d* and the first to fourth noise insulating walls **242***a* to **242***d* become smaller in this order towards the distal side of the noise absorbing/insulating box **232** (downward side in **FIGS. 12 and 13**). The volumes **V1**, **V2**, **V3**, and **V4** of the first to fourth noise absorbing portions **246***a* to **246***d* are determined in accordance with the distances d**1** to d**4**. Since the volumes **V1** to **V4** differ from one another and the opening area of the first noise absorbing wall **241***a* differ from the opening areas of the second to fourth noise absorbing walls **241***b* to **241***d*, frequency ranges of noise absorbed by the first to fourth noise absorbing portions **246***a* to **246***d* differ from one another. The volumes **V2** to **V4** of the second to fourth noise absorbing portions **246***b* to **246***d* are determined in accordance with the frequency ranges of the noise that is to be absorbed. In the fourth embodiment, the volumes become smaller in the order of the second noise absorbing portion **246***b*, the third noise absorbing portion **246***c*, and then the fourth noise absorbing portion **246***d*. The volume **V1** of the first noise absorbing portion **246***a* is obviously larger than the volumes **V2** to **V4** of the second to fourth noise absorbing portions **246***b* to **246***d*, and the opening area of the first noise absorbing hole group **240** is also obviously larger than the other opening areas.

[**0083**] Accordingly, the noise absorbing/insulating box **232** of the fourth embodiment has the advantages described below.

[**0084**] The bent portion **247** of the second wall **242** is inclined relative to the first wall **241**. Therefore, the respective volumes **V2** to **V4** of the noise absorbing portions **246***b* to **246***d* may easily be varied by adjusting the angle α between the bent portion **247** of the second wall **242** and the first wall **241**. This facilitates the designing and manufacturing of the noise absorbing/insulating box **232**.

Fifth Embodiment

[**0085**] A noise absorbing/insulating box **252** according to a fifth embodiment of the present invention will now be described with reference to **FIGS. 14 and 15**.

[**0086**] As shown in **FIGS. 14 and 15**, the noise absorbing/insulating box **252** includes noise absorbing/insulating sub-boxes **252***a* to **252***c* of different sizes. The noise absorbing/insulating box **252** is formed by adhesively bonding the sides of the noise absorbing/insulating sub-boxes **252***a* to **252***c* to one another.

[**0087**] The noise absorbing/insulating box **252** of the fifth embodiment has the advantageous described below.

[**0088**] The noise absorbing/insulating box **252** is formed by adhesively bonding the noise absorbing/insulating sub-boxes **252***a* to **252***c*, which have simple shapes. Accordingly, the noise absorbing/insulating box **252** is easy to manufacture. The noise absorbing/insulating sub-boxes **252***a* to **252***c* respectively absorb noise in different frequency ranges. Therefore, the noise absorbing/insulating box **252** exhibits a preferable noise absorbing capability relative to noise in a wide frequency range by optimizing the combination of the noise absorbing/insulating sub-boxes **252***a* to **252***c*.

Sixth Embodiment

[**0089**] A sixth embodiment of the present invention will now be described with reference to **FIGS. 16 and 17**. In the sixth embodiment, five noise absorbing/insulating boxes **112** of the first embodiment (**112**A to **112**C) are installed inside a console **111**.

[**0090**] As shown in **FIG. 16**, a console **111** is arranged between the driver's seat and the passenger seat of a vehicle. A gearshift lever **312** is arranged in the front portion of the console **111**. Cup holders **307** are arranged just behind the gearshift lever **312** on the driver's seat side of the console **111**. A parking brake **308** is located next to the cup holder **307** on the passenger seat side of the console **111**. A storage box **310** is provided behind the cup holder **307** to accommodate small articles. An ash tray **309** is provided behind the storage box **310**. The noise absorbing/insulating boxes **112**A to **112**C are provided in the console **111** as shown by the broken lines in **FIG. 16**.

[**0091**] As shown in **FIGS. 16 and 17**, the five noise absorbing/insulating boxes **112**A to **112**C are arranged at positions corresponding to the gearshift lever **312**, the cup holders **307**, and the parking brake **308**. That is, the noise absorbing/insulating boxes **112**A to **112**C are located in the front part of the console **111** so as to surround the mechanical parts associated with the gearshift lever **312** and parking brake **308**. The arrow FR in **FIG. 17** indicates the front direction.

[**0092**] In the sixth embodiment, three different types of noise absorbing/insulating boxes **112**A to **112**C having different widths are employed. The first noise absorbing/insulating box **112**A has the smallest width, and the third noise absorbing/insulating box **112**C has the largest width. Accordingly, the second noise absorbing/insulating box **112**B has an intermediate width between those of the first noise absorbing/insulating box **112**A and third noise absorbing/insulating box **112**C.

[**0093**] Two first noise absorbing/insulating boxes **112**A are arranged on the left and right sides of the gearshift lever **312** such that the holes **128** of the two first noise absorbing/insulating boxes **112**A face each other. A third noise absorbing/insulating box **112**C is provided just behind the gearshift lever **312** with the holes **128** of the third noise absorbing/insulating box **112**C facing the front side of the vehicle. That is, the gearshift lever **312** is surrounded from three directions by the three noise absorbing/insulating boxes consisting of the first two first noise absorbing/insulating boxes **112**A and the third noise absorbing/insulating box **112**C.

[**0094**] A second noise absorbing/insulating box **112**B is provided on the driver's seat side of the cup holder **307**. The holes **128** of the second noise absorbing/insulating box **112**B face toward the cup holder **307**, that is, toward the inside of the console **111**. Another third noise absorbing/insulating box **112**C is provided behind the cup holder **307** and the parking brake **308** with the holes **128** of the third noise absorbing/insulating box **112**C facing the front side of the vehicle.

[**0095**] As described above, the holes **128** of all five noise absorbing/insulating boxes **112**A to **112**C face the front side of the vehicle or the inside of the console **111**. That is, the holes **128** of the noise absorbing/insulating boxes **112**A to

112C are directed to the noise source constituted by drive train components such as the engine and the transmission.

[0096] The noise absorbing/insulating boxes 112A to 112C are respectively held and fixed by a plurality of guide walls 316 and 317 formed on the inner surface of the side walls of the console 111. More specifically, a pair of guide walls 317 are formed spaced apart from each other by a distance equal to the thickness of the third noise absorbing/insulating box 112C to hold the third noise absorbing/insulating box 112C. Two pairs of the guide walls 317 facing towards each other hold the third noise absorbing/insulating box 112C therebetween.

[0097] A pair of guide walls 316 each having a hook 316*a* are spaced from each other by a distance equal to the width of the first noise absorbing/insulating box 112A or second noise absorbing/insulating box 112B to hold the first noise absorbing/insulating box 112A or second noise absorbing/insulating box 112B. The distal end of the hook 316*a* of the front guide wall 316 and the distal end of the hook 316*a* of the rear guide wall 316 face each other. The distance from the hook 316*a* of the guide wall 316 to the side wall of the console 111 where the guide wall 316 is formed is equal to the thickness of the first or second noise absorbing/insulating box 112A or 112B. The hooks 316*a* and the side walls of the console 111 hold the first noise absorbing/insulating box 112A and the second noise absorbing/insulating box 112B.

[0098] If the total area of the holes 128 is in the range of 0.5 to 15.0% of the area of the first wall 121 having the holes 128, the noise absorbing/insulating box 112 absorbs noise generated by the drive train effectively. In the sixth embodiment, the total area of the holes 128 is about 1.5% of the area of the first wall 121 having the holes 128. When the percentage is 1.5%, the noise absorbing/insulating box 112 effectively absorbs noise having a frequency of about 800 Hz. Noise having a frequency of about 800 Hz is generated by the transmission when the vehicle is traveling and perceived as an unpleasant noise by the driver.

[0099] If the diameter of the holes 128 is 10 mm or less, the noise absorbing/insulating box 112 absorbs noise effectively. Additionally, when the diameter of the holes 128 is 0.01 mm or greater, more preferably, 0.1 mm or greater, the noise absorbing/insulating box 112 is capable of effectively absorbing noise.

[0100] In the sixth embodiment, the holes 128 are directed toward the drive train of the vehicle. Therefore, noise generated by the drive train when the vehicle is traveling is guided into the noise absorbing/insulating boxes 112A to 112C through the holes 128 and effectively attenuated. This absorbs the noise in the passenger compartment. As a result, noise leaking into the passenger compartment through the gaps of the console 111 is reduced.

[0101] The sixth embodiment has the advantages described below.

[0102] The holes 128 are directed to the drive train. Therefore, noise from the drive train is reduced effectively. Furthermore, the possibility of sound from an audio system being absorbed is reduced.

[0103] The total area of the holes 128 is 1.5% of the area of the first wall 121. Therefore, the noise absorbing/insulating boxes 112A to 112C effectively reduce noise generated by the transmission.

[0104] The noise absorbing/insulating boxes 112A to 112C are attached to the console 111 by inserting the noise absorbing/insulating boxes 112A to 112C between the guide walls 316 and 317. Accordingly, it is easy to install the noise absorbing/insulating boxes 112A to 112C. Moreover, no special parts are required to attach the noise absorbing/insulating boxes 112A to 112C to the console 111, and an increase of the number of parts is avoided.

[0105] The holes 128 of the five noise absorbing/insulating boxes 112A to 112C installed in the console 111 are directed in a number of different directions. Accordingly, noise is effectively absorbed from various directions.

Seventh Embodiment

[0106] A seventh embodiment of the present invention will now be described with reference to **FIGS. 18 and 19**.

[0107] A typical vehicle includes a glove compartment for accommodating small articles. A glove compartment 320 according to the seventh embodiment includes a lid 321 and a container 322 formed integrally with the lid 321. The lid 321 and the container 322, which are integrally formed with each other, are pulled open. An inner cover 323 is attached to an instrument panel 325 so as to surround the container 322. One first noise absorbing/insulating box 112D and two second noise absorbing/insulating boxes 112E are attached to the inner cover 323 next to the gaps between the lid 321 and the instrument panel 325. The noise absorbing/insulating boxes 112D and 112E are arranged along the rear wall and the left and right side walls of the inner cover 323, respectively. The noise absorbing/insulating boxes 112D and 112E are held by hooks 316*a* of the guide walls 316 formed integrally with the inner cover 323 such that the holes 128 face the outer side of the glove compartment 320.

[0108] The holes 128 of the first and second noise absorbing/insulating boxes 112D and 112E respectively provided on the rear wall and right wall of the inner cover 323 face the engine room and therefore effectively absorbs engine noise and transmission noise. The holes 128 of the second noise absorbing/insulating box 112E provided on the left wall of the inner cover 323 face the outer side of the vehicle and therefore effectively absorb noise picked up from the road.

[0109] In addition to the advantages of the sixth embodiment, the noise absorbing/insulating boxes 112D and 112E of the seventh embodiment has the advantages described below.

[0110] The noise absorbing/insulating box 112D and 112E are arranged next to the gaps between the lid 321 and the instrument panel 325. Thus, noise entering the passenger compartment through the gaps is effectively reduced.

Eighth Embodiment

[0111] An eighth embodiment of the present invention will now be described with reference to **FIG. 20**.

[0112] A glove compartment 330 according to the eighth embodiment includes a lid 321 and a container 322, which is separate from the lid 321.

[0113] One first noise absorbing/insulating box 112F and two second noise absorbing/insulating boxes 112G are provided next to the gaps between the container 322 and the

instrument panel **325**. The noise absorbing/insulating boxes **112**F and **112**G are arranged along the rear wall and the left and right walls of the container **322**, respectively. The noise absorbing/insulating boxes **112**F and **112**G are held by hooks **316***a* of guide walls **316** formed integrally with the container **322** such that the holes **128** face the outer side of the glove compartment **330**.

[**0114**] The noise absorbing/insulating boxes **112**F and **112**G of the eighth embodiment has the same advantages as the noise absorbing/insulating boxes **112**D and **112**E of the seventh embodiment.

[**0115**] It should be apparent to those skilled in the art that the present invention may be embodied in many other specific forms without departing from the spirit or scope of the invention. Particularly, it should be understood that the present invention may be embodied in the following forms.

[**0116**] In the first and second embodiments, the noise absorbing/insulating boxes **112** and **132** may each include three or more noise absorbing portions. For example, in the first embodiment, the noise absorbing/insulating box **112** may have three or more different types of noise absorbing holes with different opening areas, that is, three or more different types of noise absorbing portions. In the second embodiment, the noise absorbing/insulating box **132** may have three or more noise absorbing/insulating sub-boxes.

[**0117**] In the first embodiment, the noise absorbing/insulating structure includes the two noise absorbing/insulating boxes **112**. However, the noise absorbing/insulating structure may include one noise absorbing/insulating box **112** or three or more noise absorbing/insulating boxes **112**.

[**0118**] In each of the above embodiments, the noise absorbing/insulating box **112**, **132**, **212**, **232** may be arranged at any position in accordance with the position of a noise source or the shape of a component on which the noise absorbing/insulating box is to be attached. For example, the noise absorbing/insulating box **112** may be adhesively bonded to the inner surface of each of the side walls **111***a* of the console **111**.

[**0119**] In the first embodiment, the holes **128** constituting the first and second noise absorbing hole groups **120***a* and **120***b* may be formed at any position (randomly) on the first and second noise absorbing walls **121***a* and **121***b*, respectively. Also, each of the first and second noise absorbing hole groups **120***a* and **120***b* may be constituted by holes having different opening areas.

[**0120**] In the first embodiment, the holes **128** constituting the first and second noise absorbing hole groups **120***a* and **120***b* does not have to be spaced at equal intervals in the longitudinal and lateral directions of the noise absorbing/insulating box **112**.

[**0121**] In the first and second embodiments described above, the volume of the first noise absorbing portion **126***a* is equal to the volume of the second noise absorbing portion **126***b*. However, the volume of the first noise absorbing portion **126***a* may differ from the volume of the second noise absorbing portion **126***b*.

[**0122**] In the second embodiment, the noise absorbing/insulating box **132** may be constituted by assembling a plurality of noise absorbing/insulating boxes **112** of the first embodiment into a single body. Alternatively, the noise absorbing/insulating sub-boxes may be attached to the console **111** without being formed integrally with each other as separate bodies.

[**0123**] In each of the above embodiments, the holes **128**, **148**, **149**, **228**, and **248** are all circular. However, the holes **128**, **148**, **149**, **228** and **248** may have any shape. For example, the hole **128** may have an elliptical or polygonal shape. The polygonal shape may be, for example, the shape of a triangle or a diamond.

[**0124**] In the first and second embodiments, the noise absorbing/insulating box **112**, **132** is thin and has a rectangular box shape. However, the shape of the noise absorbing/insulating box **112**, **132** may be modified according to the required noise absorbing capability or the position where the noise absorbing/insulating box **112**, **132** is installed. For example, the shape of the noise absorbing/insulating box **112**, **132** may be spherical, disk-like, or trapezoidal.

[**0125**] In each of the above embodiments, the noise absorbing/insulating box **112**, **132**, **212**, **232** may be attached to a vehicle interior equipment item other than the console **111**, for example, to an instrument panel, a door trim, a rear trim, a roof trim, or a pillar trim. In this case, the noise absorbing/insulating box **112**, **132**, **212**, and **232** may be used to absorb noise other than noise from the vehicle's drive train components, for example, sound from an audio system or a human voice.

[**0126**] In the first and second embodiments, as long as the noise absorbing hole groups of the respective noise absorbing portions have different opening areas, the noise absorbing hole group may be composed of a single hole.

[**0127**] In the third embodiment, the space **223** in the noise absorbing/insulating box **212** may be divided into two, or four or more sub-spaces. In this case, the number of the steps **227***a* and **227***b* of the first wall **221**, and the number of the partition walls **225***a* and **225***b* extending from the steps **227***a* and **227***b* to second wall **222** may be changed from one to three or more so that the space **223** in the noise absorbing/insulating box **212** is divided into two or into four or more sub-spaces.

[**0128**] In the third embodiment, the second wall **222** may have a step-like shape and the first wall **221** may have a planar shape. Further, the first wall **221** and the second wall **222** may both have a step-like shape.

[**0129**] In the third embodiment, the distances d**1** to d**3** between the respective noise absorbing walls and the respective noise insulating walls in the first to third noise absorbing portions **226***a* to **226***c* become smaller in this order. However, the relationship of the distances d**1**, d**2**, and d**3** may be changed as required. In this case, the cross-sectional shape of the noise absorbing/insulating box **212** may be concave or convex.

[**0130**] In the third and fourth embodiments, the noise absorbing hole groups **220***a* to **220***c* have an identical opening area, and the noise absorbing hole groups **240***b* to **240***d* also have an identical opening area. However, the noise absorbing hole groups **220***a* to **220***c*, and **240***b* to **240***d* may have different opening areas, respectively.

[**0131**] In the fourth embodiment, part of the second wall **242** is inclined with respect to the first wall **241**. Instead, the entire second wall **242** may be inclined with respect to the first wall **241**.

[0132] In the fourth embodiment, the space **243** in the noise absorbing/insulating box **232** may be divided into three or less sub-spaces or five or more sub-spaces. In this case, the number of the partition walls **245***a* to **245***c* extending from the second wall **242** to the first wall **241** is changed to two or less or four or more so that the space **243** in the noise absorbing/insulating box **232** is divided into three or less sub-spaces or five or more sub-spaces.

[0133] In the fourth embodiment, the middle of the second wall **242** may be bent more gradually (or with a larger curvature radius) than that shown in **FIG. 12**.

[0134] In the fourth embodiment, the bent portion of the second wall **242** may be formed in the first wall **241**.

[0135] In the third to fifth embodiments, the side walls **224**, **244** provided along the circumference of the first and second walls may be step-like or slope-shaped. For example, a pair of the opposing side walls **224**, **244** may be inclined so that the noise absorbing/insulating box **212**, **232** has a trapezoidal or triangular shape as seen from the front. Alternatively, the side wall **224**, **244** may have a step-like shape so that the noise absorbing/insulating box has a concave or convex shape as seen from the front.

[0136] The noise absorbing/insulating box **232** of the fourth embodiment may be composed of a plurality of noise absorbing/insulating sub-boxes like the noise absorbing/insulating box **252** of the fifth embodiment.

[0137] In the seventh and eighth embodiments, the noise absorbing/insulating box **112** may be attached to the upper side or lower side of the glove compartment **320**, **330**.

[0138] In the seventh embodiment, a plurality of noise absorbing/insulating boxes **112** is attached to the inner cover **323**. Instead, a plurality of noise absorbing/insulating boxes **112** may be attached directly to the container **322** so as to surround the container **322**. In the third embodiment, the noise absorbing/insulating box **112** is arranged outside the container **322**. Instead, the noise absorbing/insulating box **112** may be arranged inside the container **322**. In these cases, the noise absorbing/insulating box **112** provided for the container **322** may be covered with a sheet or a cover such that the noise absorbing/insulating box **112** cannot be seen by passengers.

[0139] In each of the above embodiments, the noise absorbing/insulating box **112**, **132**, **212**, **232** is attached to vehicle interior equipment such as the console **111** by the guide walls **115**, **316**, and **317**. However, as shown in **FIG. 21A** or **21**B, for example, the noise absorbing/insulating box **112**, **132**, **212**, **232** may be provided with a tongue **327** having a hole **326** so that the noise absorbing/insulating box **112**, **132**, **212**, **232** is fixed to part of the vehicle body by means of the tongue **327** and a screw (not shown). Further, the noise absorbing/insulating box **112**, **132**, **212**, and **232** may be bonded to part of the vehicle body by the use of an adhesive.

[0140] In the sixth embodiment, if there is sufficient space between the cup holder **307** and the parking brake **308**, the second noise absorbing/insulating box **112**B may be arranged between the cup holder **307** and the parking brake **308**. Further, if the vehicle is provided with a pedal parking brake, the second noise absorbing/insulating box **112**B may be arranged at the position of the parking brake **308** in the sixth embodiment. In this case, the holes **128** of the second noise absorbing/insulating box **112**B still face the inside of the console **11**.

[0141] In the sixth to eighth embodiments, the noise absorbing/insulating box **112** of the first embodiment is attached to the console **111** or to the glove compartment **320**, **330**. Instead, the noise absorbing/insulating box **132**, **212**, **232**, or **252** of any of the second to fifth embodiments may be attached to the console **111** or to the glove compartment **320**, **330** in a similar manner to the sixth to eighth embodiments.

[0142] The present examples and embodiments are to be considered as illustrative and not restrictive, and the invention is not to be limited to the details given herein, but may be modified within the scope and equivalence of the appended claims.

What is claimed is:

1. A noise absorbing structure for absorbing noise, the structure comprising:

a first noise absorbing portion that is hollow and includes one or more first holes; and

a second noise absorbing portion that is hollow and includes one or more second holes,

wherein the one or more first holes has a total area different from that of the one or more second holes.

2. The noise absorbing structure according to claim 1, wherein the one or more first holes include two or more first holes each with the same opening area, and the one or more second holes include two or more second holes each with the same opening area.

3. The noise absorbing structure according to claim 1, wherein each of the first and second noise absorbing portions includes a noise insulating wall for insulating noise.

4. The noise absorbing structure according to claim 1, wherein the first noise absorbing portion and the second noise absorbing portion each include a volume that is the same as one another.

5. The noise absorbing structure according to claim 1, wherein the noise absorbing structure is arranged in a vehicle including interior equipment and a drive train for driving the vehicle, the noise absorbing structure being installed in the interior equipment such that the one or more first and second holes are directed toward the drive train.

6. The noise absorbing structure according to claim 5, wherein the first noise absorbing portion has a first noise absorbing wall including the one or more first holes, the second noise absorbing portion has a second noise absorbing wall including one or more second holes, and the total area of the one or more first hole and the one or more second holes is 0.5 to 15.0% of the area of the first and second noise absorbing walls.

7. The noise absorbing structure according to claim 5, wherein the one or more first holes and the one or more second holes each have a diameter that is ten millimeters or less.

8. The noise absorbing structure according to claim 5, wherein the vehicle interior equipment includes a guide wall for holding the noise absorbing structure, and the noise absorbing structure is held by the guide wall.

9. The noise absorbing structure according to claim 5, wherein the interior equipment includes a plurality of parts assembled with a space defined therebetween, and the noise absorbing structure is arranged as a part next to the space.

10. The noise absorbing structure according to claim 5, wherein the first and second noise absorbing portions con-

stitute a noise absorbing body, and the noise absorbing body is one of a plurality of noise absorbing bodies arranged such that the first and second holes in the noise absorbing bodies are directed in different directions.

11. A noise absorbing/insulating body for absorbing and insulating noise, the body comprising:

a first noise absorbing portion that is hollow and includes a first noise absorbing wall having one or more first holes and a first noise insulating wall for insulating noise facing towards the first noise absorbing wall; and

a second noise absorbing portion that is hollow and includes a second noise absorbing wall having one or more second holes and a second noise insulating wall for insulating noise facing towards the second noise absorbing wall,

wherein the one or more first holes has a total area different from that of the one or more second holes.

12. A noise absorbing structure for absorbing noise, the structure comprising:

a first sub-box that is hollow and includes one or more first holes; and

a second sub-box that is hollow, includes one or more second holes, and has the same shape as the first sub-box,

wherein the one or more first holes has a total area different from that of the one or more second holes.

13. A noise absorbing structure for absorbing noise, the structure comprising:

a first noise absorbing portion that is hollow and includes a first noise absorbing wall having one or more first holes; and

a second noise absorbing portion that is hollow and includes a second noise absorbing wall having one or more second holes,

wherein the first noise absorbing portion and the second noise absorbing portion each have a volume that is different from one another.

14. The noise absorbing structure according to claim 13, wherein:

the first noise absorbing portion includes a first opposing wall facing towards the first noise absorbing wall;

the second noise absorbing portion includes a second opposing wall facing towards the second noise absorbing wall; and

at least either a set of the first and second noise absorbing walls or a set of the first and second opposing walls includes a step such that the noise absorbing structure corresponds as a whole to a step-like shape.

15. The noise absorbing structure according to claims **13**, wherein:

the first noise absorbing portion includes a first opposing wall facing towards the first noise absorbing wall; and

the second noise absorbing portion includes a second opposing wall facing towards the second noise absorbing wall,

either one of a set of the first and second noise absorbing walls or a set of the first and second opposing walls includes a part inclined with respect to the other one of the set of the first and second noise absorbing walls or the set of the first and second opposing walls.

16. The noise absorbing structure according to claim 13, wherein the noise absorbing structure is arranged in a vehicle including interior equipment and a drive train for driving the vehicle, the noise absorbing structure being installed in the interior equipment such that the one or more first and second holes are directed toward the drive train.

17. The noise absorbing structure according to claim 16, wherein the total area of the one or more first holes and the one or more second holes is 0.5 to 15.0% of the area of the first and second noise absorbing walls.

18. The noise absorbing structure according to claim 16, wherein the one or more first holes and the one or more second holes each have a diameter that is ten millimeters or less.

19. The noise absorbing structure according to claim 16, wherein the vehicle interior equipment includes a guide wall for holding the noise absorbing structure, and the noise absorbing structure is held by the guide wall.

20. The noise absorbing structure according to claim 16, wherein the interior equipment includes a plurality of parts assembled with a space defined therebetween, and the noise absorbing structure is arranged as a part next to the space.

21. The noise absorbing structure according to claim 16, wherein the first and second noise absorbing portions constitute a noise absorbing body, and the noise absorbing body is one of a plurality of noise absorbing bodies arranged such that the first and second holes in the noise absorbing bodies are directed in different directions.

22. A noise absorbing/insulating structure for absorbing and insulating noise, the structure comprising:

a first noise absorbing portion that is hollow and includes a first noise absorbing wall having one or more first holes and a first noise insulating wall for insulating noise facing towards the first noise absorbing wall; and

a second noise absorbing portion that is hollow and includes a second noise absorbing wall having one or more second holes and a second noise insulating wall for insulating noise facing towards the second noise absorbing wall,

wherein the first noise absorbing portion and the second noise absorbing portion each include a volume that is different from one another.

23. A noise absorbing structure for absorbing noise, the structure comprising:

a first sub-box that is hollow and includes one or more first holes; and

a second sub-box that is hollow and includes one or more second holes having the same shape as the first holes,

wherein the one or more first holes has a total area and the one or more second holes has a total area that is the same as the total area of the one or more first holes, and the first sub-box and the second sub-box each have a volume that is different from one another.

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