



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
23.12.2009 Bulletin 2009/52

(51) Int Cl.:
H04R 1/28 (2006.01)

(21) Application number: **09007888.2**

(22) Date of filing: **16.06.2009**

(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 TR**

(72) Inventor: **Ito, Shin**
Hamamatsu-shi
Shizuoka-ken 430-8650 (JP)

(30) Priority: **19.06.2008 JP 2008159986**

(74) Representative: **Emde, Eric**
Wagner & Geyer
Gewürzmühlstrasse 5
80538 München (DE)

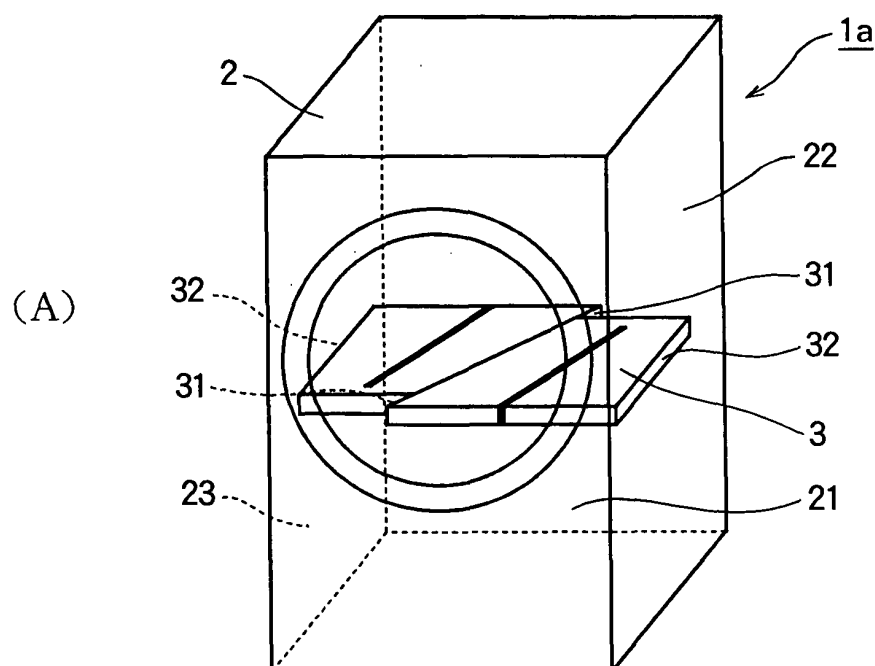
(71) Applicant: **YAMAHA CORPORATION**
Naka-ku
Hamamatsu-shi
Shizuoka-ken 430-8650 (JP)

(54) **Speaker**

(57) In a speaker set having an enclosure containing a drive unit, a flying bridge is arranged to interconnect inner walls of the enclosure. The flying bridge is formed with a recess at location excluding a portion abutting the inner walls, and a damping material is fitted in the recess for absorbing vibration of the enclosure. Typically, the flying bridge interconnects opposite ones of the inner

walls of the enclosure. The flying bridge is composed of a plurality of wedge-shaped parts contacting each other at planes oblique to the inner walls interconnected by the flying bridge, and the wedge-shaped parts are arranged such that a front end of one wedge-shaped part is directed opposite to a front end of another wedge-shaped part which is adjacent to the one wedge-shaped part.

FIG.4



Description

BACKGROUND OF THE INVENTION

[Technical Field of the Invention]

[0001] The present invention relates to a speaker having a structure to control vibration generated from an enclosure as a result of vibration generated from a speaker drive unit.

[Description of the Related Art]

[0002] In a conventional speaker, a speaker drive unit vibrates during emission of sound, and the vibration is transmitted from the speaker drive unit to an enclosure. As a result, the enclosure vibrates. Consequently, enclosure reverberation occurs, and therefore, noise is generated, with the result that sound quality is deteriorated. For this reason, a speaker capable of reducing vibration generated from an enclosure has been proposed (for example, see Japanese Patent Application Publication No. 2000-125380).

[0003] For example, Japanese Patent Application Publication No. 2000-125380 discloses a speaker box using a composite material, such as medium density fiberboard (MDF), wherein damping sheets are applied to walls of an enclosure.

[0004] However, the device of Japanese Patent Application Publication No. 2000-125380 has a problem in that it is not possible to completely control vibration generated from the main body of the speaker box although the vibration is reduced. Also, the composite material used to constitute each wall of the enclosure is expensive. Furthermore, it is necessary to select the quality of the composite material through trial and error to obtain optimal effects, which is time-consuming.

SUMMARY OF THE INVENTION

[0005] Therefore, it is an object of the present invention to provide a speaker wherein vibration generated from an enclosure is effectively controlled.

[0006] The speaker according to the present invention interconnects inner walls of the enclosure using a flying bridge. Also, the flying bridge has a recess formed at location excluding portions abutting the inner walls. Furthermore, a damping material is fitted in the recess. Consequently, the flying bridge having the recess formed therein interconnects the inner walls of the enclosure and, in addition, serves as an elastic body. The damping material fitted in the recess absorbs vibration transmitted to the flying bridge. Although vibration generated from a speaker drive unit is transmitted to the enclosure, the flying bridge absorbs the vibration of the enclosure, thereby controlling the vibration of the enclosure. As a result, it is possible to control noise caused by the vibration generated from the enclosure. Also, since the flying bridge

is constructed such that the recess is formed in the flying bridge, and the damping material is fitted in the recess, it is possible to prepare the flying bridge inexpensively and easily.

[0007] Also, the speaker according to the present invention may be constructed such that the flying bridge interconnects opposite ones of the inner walls of the enclosure. Consequently, it is possible for the opposite inner walls not to vibrate.

[0008] Furthermore, the speaker according to the present invention may be constructed such that the flying bridge interconnects portions of the inner walls which would develop a maximum amplitude of the vibration under a free state. Typically, the flying bridge interconnects appropriate centers of two inner walls which are maximally movable area. Consequently, the flying bridge is connected to the positions having the maximum amplitude, and therefore, it is possible to most effectively control vibration generated from the enclosure.

[0009] In addition, the speaker according to the present invention may be constructed such that the flying bridge comprises a plurality of wedge-shaped parts contacting each other at planes not parallel to the inner walls interconnected by the flying bridge, and the wedge-shaped parts are arranged such that a front end of one wedge-shaped part is directed opposite to a front end of another wedge-shaped part which is adjacent to the one wedge-shaped part.

In one form (as shown in fig. 6), the plurality of the wedge-shaped parts comprise a pair of the wedge-shaped parts, wherein one of the wedge-shaped parts is formed with the recess and the damping material is fitted in the recess, while the other wedge-shaped part is not formed with a recess nor does have a damping material.

For example, in a structure in which the flying bridge includes two wedge-shaped parts A and B, the respective parts may be disposed and fixed to the inner walls of the enclosure as follows. First, the front end of the part A is directed to the front of the enclosure, and one face of the part A is directly fixed to the middle of the inner wall of the left-side face of the enclosure. Subsequently, the front end of the part B is directed to the rear of the enclosure, and one face of the part B is brought into contact with the middle of the inner wall of the right-side face of the enclosure. Subsequently, the parts A and B are disposed such that planes of the parts A and B oblique to the inner wall faces of the enclosure come into contact with each other. Subsequently, the respective parts are slid until the inner walls of the enclosure are interconnected by the respective parts. Consequently, it is possible to install the respective parts of the flying bridge in the enclosure without adjusting the size (width) of the flying bridge based on the distance between the opposite inner walls of the enclosure, thereby achieving easy preparation of the flying bridge without the necessity to precisely adjust the size of the flying bridge to suit various enclosures.

[0010] Also, the speaker according to the present in-

vention may be constructed such that the flying bridge interconnects neighboring ones of the inner walls of the enclosure. In this structure, it is possible for the flying bridge to interconnect the neighboring inner walls of the enclosure, for example, even when the opposite inner walls of the enclosure cannot be interconnected due to the presence of the speaker drive unit or the like, and therefore, it is possible for the enclosure not to vibrate.

[0011] Furthermore, the speaker according to the present invention may be constructed such that the damping material is fitted in the recess in a contracted state. Consequently, the damping material is kept contracted by the recess, and therefore, it is possible to retain the damping material in the recess without adhesion.

According to the present invention, it is possible for the speaker to reliably control vibration generated from the enclosure, thereby improving sound quality without deterioration of sound quality due to noise caused by the vibration generated from the enclosure. Also, it is possible to control noise caused by the vibration generated from the enclosure inexpensively and easily.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

FIG. 1 is a view illustrating a flying bridge according to a first embodiment of the present invention.

FIG. 2 is a view illustrating a process of installing the flying bridge.

FIG. 3 is a conceptual view illustrating vibration generated from an enclosure of a speaker.

FIG. 4 is a see-through perspective view illustrating the enclosure in which the installation of the flying bridge is completed.

FIG. 5 is a front view illustrating another example of the flying bridge according to the first embodiment of the present invention.

FIG. 6 is a front view illustrating a further example of the flying bridge according to the first embodiment of the present invention.

FIG. 7 is a schematic view illustrating a flying bridge according to a second embodiment of the present invention.

FIG. 8 is a see-through perspective view illustrating an enclosure in which the installation of the flying bridge is completed.

DETAILED DESCRIPTION OF THE INVENTION

[First embodiment]

[0013] A speaker according to a first embodiment of the present invention will be described hereinafter with reference to FIGS. 1 to 4. FIG. 1 is a view illustrating a flying bridge according to the first embodiment of the present invention. FIG. 1(A) is a front view showing wood which is a material for a flying bridge, and FIG. 1(B) is a

front view schematically showing the flying bridge. FIG. 2 is a view illustrating a process of installing the flying bridge. FIG. 2(A) is a see-through plan view showing the interior of an enclosure of the speaker before the installation of the flying bridge, and FIG. 2(B) is a see-through plan view showing the interior of the enclosure after the installation of the flying bridge. FIG. 3 is a conceptual view illustrating vibration generated from an enclosure of a speaker. FIG. 4 is a see-through perspective view illustrating the enclosure in which the installation of the flying bridge is completed. FIG. 4(A) shows the installation of a single flying bridge, and FIG. 4(B) shows the installation of multiple flying bridges.

[0014] First, the shape of a flying bridge 3 installed in an enclosure 2 (See FIG. 2) of the speaker 1a and an example of a method of preparing the flying bridge 3 will be described. As shown in FIG. 1(A), the flying bridge 3 is formed of rectangular parallelepiped wood 5 having a predetermined thickness. The wood 5 may be medium density fiberboard (MDF) or other inexpensive materials. The flying bridge 3 is composed of a pair of parts 3a and 3b obtained by cutting the rectangular parallelepiped wood 5 along a straight line L passing through an appropriate center O of the rectangular parallelepiped wood 5. At this time, the oblique line L is not parallel to the respective sides of the wood 5. The parts 3a and 3b of the flying bridge 3 are formed in the shape of a right angle trapezoid, the section of which is an oblique side. However, the shape of the parts 3a and 3b are not limited to the right angle trapezoid. For example, the parts 3a and 3b may be formed in the shape of a wedge. The parts 3a and 3b may also be formed in the shape of a triangle. When the parts 3a and 3b are formed in the triangular shape, however, acute-angle portions of the parts 3a and 3b may have low strength. Consequently, it is necessary to pay attention to this point when installing the flying bridge 3.

[0015] As shown in FIG. 1(B), each of the parts 3a and 3b is provided with a recess 30, which is a cutout formed by cutting each of the parts 3a and 3b from an appropriate middle of one of the edges extending from the section 31, e.g., a long edge 33, toward an appropriate middle of the other of the edges extending from the section 31, e.g., a short edge 34. It is preferable for each recess 30 to have a uniform width. In each recess 30 is fitted a damping material 4, which is located at the edge face 33 side. Each damping material 4 may have a free thickness greater than the width of each recess 30 and a length equivalent to about half that of each recess 30. Preferably, each damping material 4 is a material having small temporal change and small compression distortion. Specifically, each damping material 4 may be high-density urethane foam.

[0016] Since the inexpensive wood 5 is cut, and the recesses 30, in which the respective damping materials 4 are fitted, are formed in the respective divided parts of the wood 5, as described above, it is possible to prepare the flying bridge 3 easily and inexpensively. Also, since

the damping materials 4, the thickness of which is greater than the width of the recesses 30, are fitted in the respective recesses 30, it is possible to easily fix the damping materials 4 in the respective recesses 20 by pressing the damping materials 4.

[0017] Next, a process of installing the flying bridge 3 in the enclosure 2 of the speaker 1a will be described. First, as shown in FIG. 2(A), the part 3a is disposed such that a side face 32 of the part 3a comes into contact with the inner wall of a left-side face 23 of the enclosure 2. Subsequently, the part 3b is disposed such that a side face 32 of the part 3b is parallel to the inner wall of a right-side face 22 of the enclosure 2 and such that the section 31 of the part 3b comes into contact with the section 31 of the part 3a. Afterwards, the part 3b is moved along the slant section 31 of the part 3a in the direction indicated by an arrow 7. When the side face 32 of the part 3b comes into contact with the inner wall of the enclosure 2, the parts 3a and 3b push against the opposite side faces 22 and 23 of the enclosure to a certain extent, as shown in FIG. 2(B), the movement of the part 3b is stopped. When the installation of the flying bridge 3 is completed as described above, it is possible to securely interconnect the opposite inner walls of the enclosure by the flying bridge 3.

[0018] When the flying bridge 3 is installed as described above, vibration generated from the opposite side faces 22 and 23 of the enclosure 2 is transmitted to the flying bridge 3 (the parts 3a and 3b), and the recesses 30, running appropriately parallel to the faces 32, expand and contract in response to the vibration. That is, the recesses 30 serve as an elastic body. Also, the damping materials 4 fitted in the respective recesses 30 absorb and convert the expansion and contraction (vibration) energy into thermal energy, which is dissipated to the outside.

[0019] Consequently, it is possible for the flying bridge 3 to absorb vibration generated from the opposite inner walls of the enclosure 2. Also, since the flying bridge 3 is constituted by the wedge-shaped parts, it is possible to easily install the flying bridge 3 to the inner walls of the enclosure 2.

[0020] Also, as described above, it is possible to adjust the size of the flying bridge 3 (the distance between the side face 32 of the part 3a and the side face 32 of the part 3b) only by moving the part 3b along the slant section 31 of the part 3a. Consequently, even when the distance between the opposite inner walls of the enclosure 2 varies to some extent due to an error or allowance during the manufacture of the enclosure 2, it is possible for the flying bridge 3 to reliably interconnect the opposite inner walls of the enclosure 2. For this reason, it is not necessary to precisely measure the distance between the inner walls of the speaker 1a, during the preparation of the flying bridge 3, whereby it is possible to easily produce the flying bridge 3.

[0021] Hereinafter, vibration generated from the enclosure 2 of the speaker 1a will be described. On the as-

sumption that an installation face 21 of the speaker 1a, where a speaker drive unit 20 is mounted, having a large height to width ratio, is set as the front of the speaker 1a as shown in FIG. 3, side faces 22 and 23 of the speaker 1a have the maximum area. For this reason, the central parts of the side faces 22 and 23 of the speaker 1a maximally vibrate under a free state, and therefore the central portions of the side faces 22 and 23 of the speaker 1a develops the maximum amplitude of the vibration.

[0022] The flying bridge 3 is installed, as shown in FIG. 4(A), such that portions having the maximum amplitude corresponding to approximate centers of the inner walls of the side faces 22 and 23 (the wall faces having the maximum area) of the speaker 1a are connected to each other. As a result, it is possible for the flying bridge 3 to more effectively absorb vibration generated from the enclosure 2. One or more flying bridges 3 may be installed. As shown in FIG. 4(B), it is preferable to install a plurality of flying bridges 3 since such a plurality of flying bridges absorb vibration generated from the enclosure 2 more effectively than only one flying bridge.

[0023] In the above construction, the flying bridge 3 according to the first embodiment of the present invention is prepared such that the opposite sides (the side face 32 of the part 3a and the side face 32 of the part 3b, the faces 33 and 34 of the parts 3a and 3b) are parallel to each other. However, the side faces 33 and 34 of the parts 3a and 3b, which do not contact the enclosure 2, may not be parallel to each other.

[0024] Also, the parts 3a and 3b of the flying bridge 3 according to the first embodiment of the present invention is explained as being installed to push against the opposite side faces 22 and 23 of the enclosure 2, to which, however, the present invention is not limited. For example, it may be possible to fix the respective parts of the flying bridge 3 to the opposite side faces of the enclosure 2 using an adhesive to interconnect the opposite side faces of the enclosure 2. When using screws, the flying bridge 3 may be installed such that the opposite side faces 22 and 23 of the enclosure 2 are pulled toward each other.

[0025] FIG. 5 is a front view illustrating another example of the flying bridge according to the first embodiment of the present invention. In the previous example of the first embodiment, the flying bridge 3 is explained as being constituted by the two parts, to which, however, the present invention is not limited. For example, the flying bridge may include three or more of wedge-shaped parts. A flying bridge 3' shown in FIG. 5(A) includes a plurality of parts 3a' to 3c' formed by cutting the wood 5 along oblique straight lines not parallel to the respective sides constituting the outer circumference of the wood 5. In each part is formed a recess 30', in which a damping material 4 is fitted. In this structure, the respective parts may come into contact with one another at planes not parallel to the inner wall faces of the enclosure, and wedge-shaped front ends of the respective parts may be disposed in directions opposite to the directions in which

the wedge-shaped front ends of the neighboring parts are disposed. Consequently, it is possible to reliably connect the flying bridge to the opposite inner walls of the enclosure 2 and to control the vibration generated from the enclosure 2.

Alternatively, as shown in FIG. 5(B), a flying bridge 3" may comprise a single part. In this case, the flying bridge 3" is fixed to the opposite side faces of the enclosure 2 by screws such that the opposite side faces of the enclosure 2 are interconnected to each other by the flying bridge 3".

[0026] Also, FIG. 6 is a front view illustrating a further example of the flying bridge according to the first embodiment of the present invention. In the previous examples of the first embodiment, the recess 30 is explained as being formed in each part of the flying bridge, to which, however, the present invention is not limited. For example, a recess 30''' may be formed in some of the parts of the flying bridge. A flying bridge 3''' shown in FIG. 6 includes a plurality of parts 3a''' and 3b''' formed by cutting the wood 5 along a straight line not parallel to the respective sides constituting the outer circumference of the wood 5. In the part 3b''' is formed a recess 30''', in which a damping material 4 is fitted.

[0027] As described above, it is possible to prepare the flying bridge 3 inexpensively and easily. Also, the flying bridge 3 absorbs vibration generated from the enclosure 2. As a result, it is possible to control vibration generated from the enclosure 2. Consequently, it is possible for the flying bridge 3 to control noise caused by vibration generated at the enclosure 2 inexpensively and easily.

[Second embodiment]

[0028] A speaker according to a second embodiment of the present invention will be described hereinafter with reference to FIGS. 7 and 8. FIG. 7 is a schematic view illustrating a flying bridge according to a second embodiment of the present invention. FIG. 7(A) is a front view showing wood which is a material for a flying bridge, and FIG. 7(B) is a front view schematically showing the flying bridge. FIG. 8 is a see-through perspective view illustrating an enclosure in which the installation of the flying bridge is completed. The second embodiment is different from the first embodiment in the shape of a flying bridge 6 and in the connection between neighboring inner walls of an enclosure 2 using the flying bridge 6. Therefore, only the differences of the second embodiment from the first embodiment will be described hereinafter.

[0029] First, the shape of flying bridges 6 installed in an enclosure 2 of a speaker 1b and a method of preparing the flying bridges 6 will be described. As shown in FIG. 7(A), the flying bridges 6 are prepared by cutting a rectangular parallelepiped wood 5 along a straight line L passing through an appropriate center O of the rectangular parallelepiped wood 5. Consequently, the flying bridges 6 are formed in the shape of a right angle trap-

ezoid, to which, however, the present invention is not limited.

[0030] As shown in FIG. 7(B), the flying bridge 6 is provided with a recess 60, which is formed by cutting the flying bridge 6 from an appropriate middle of a section 61 of the wood 5 toward a corner A (a corner between a side face 62 and a side face 63). In the recess 60 is fitted a damping material 4, which is located at the section 61 side, in the same manner as in parts 3a and 3b of the flying bridge 3. The damping material 4 has a thickness greater than the width of the recess 60. Consequently, the damping material 4 is fitted in the recess 60 in a contracted state. Since the inexpensive wood 5 is cut, and the recess 60, in which the damping material 4 is fitted, is formed in each divided part of the wood 5, as described above, it is possible to prepare the flying bridges 6 easily and inexpensively.

[0031] Next, a process of installing the flying bridges 6 in the enclosure 2 of the speaker 1b will be described. First, as shown in FIG. 8(A), the flying bridges 6 are installed such that the flying bridges 6 interconnect the neighboring inner walls of the enclosure 2. At this time, the flying bridges 6 are fixed to the neighboring inner walls of the enclosure 2 by an adhesive such that the side faces 62 and 63 of the respective flying bridges 6 come into contact with the neighboring inner walls of the enclosure 2.

[0032] When the flying bridges 6 are installed as described above, vibration generated from the neighboring inner walls of the enclosure 2 is transmitted to the flying bridges 6, and the recesses 60 expand and contract in response to the vibration. That is, the recesses 60 serve as an elastic body. Also, the damping materials 4 fitted in the respective recesses 60 absorb and convert the expansion and contraction (vibration) energy into thermal energy, which is dissipated to the outside.

[0033] In particular, a portion having the maximum amplitude corresponding to an approximate center of the inner wall of the right-side face 22 (the wall face having the maximum area) of the enclosure 2 may be connected to the inner wall of one of an installation face 21, a bottom face 24, a top face 25, or a rear face 26 neighboring to the right-side face 22. In the same manner, a portion having the maximum amplitude corresponding to an approximate center of the inner wall of the left-side face 23 of the enclosure 2 may be connected to the inner wall of one of the installation face 21, the bottom face 24, the top face 25, or the rear face 26 neighboring to the left-side face 22. Consequently, it is possible for the flying bridges 6 to absorb vibration generated from the portions having the maximum amplitude, thereby effectively absorbing vibration generated from the enclosure 2.

[0034] Also, the amplitude increases to such an extent that the distance between opposite pairs of sides 221 to 224 forming the right-side face 22 of the enclosure 2 (the distance between the long side 221 and the long side 223, the distance between the short side 222 and the short side 224) increases. For this reason, it is preferable

to install the flying bridge 6 such that the corner A of the flying bridge 6 comes into contact with the middle of the short side 222 (or the short side 224) of the right-side face 22, not the long sides 221 and 223 of the right-side face 22. That is, it is preferable to interconnect the right-side face 22 and the bottom face 24 (or the top face 25) by interconnecting the right-side face 22 and the rear face 25 (or the installation face 21). In the same manner, it is preferable to install the flying bridge 6 such that the corner A of the flying bridge 6 comes into contact with the middle of a short side 232 (or a short side 234) forming the left-side face 23 of the enclosure 2, not long sides 231 and 233 forming the left-side face 23. Consequently, it is possible for the flying bridge 6 to effectively absorb vibration generated from the portion having the maximum amplitude, thereby effectively absorbing vibration generated from the enclosure 2.

[0035] Consequently, it is possible for the flying bridge 6 to absorb vibration generated from the neighboring inner walls (the inner wall of the side face 22 and the inner wall of the bottom face 24) of the enclosure 2. Also, it is possible to easily fix the flying bridge 6 to the inner walls of the enclosure 2.

[0036] Also, each flying bridge 6 is installed in the enclosure 2 such that the face 62 having an obtuse-angle front end comes into contact with the portion having the maximum amplitude, and the face 63 having an acute-angle front end comes into contact with the neighboring inner wall. That is, since the high-strength side of each flying bridge 6 is fixed to the side having large amplitude, it is possible to more securely connect the neighboring inner wall to the side having large amplitude.

Furthermore, the number of the flying bridges 6 is not particularly restricted. As shown in FIG. 8(B), it is preferable to install a plurality of flying bridges 6 since the plurality of flying bridges absorb vibration generated from the enclosure 2 more effectively than only one flying bridge. In particular, the installation face 21 is prepared more rigidly than other wall faces, since the speaker drive unit 20 is fixed to the installation face 21, with the result that the installation face 21 is highly resistant to vibration. For this reason, it is possible to more effectively control vibration generated from the enclosure 2 by interconnecting any one (the bottom face 24, the top face 25, or the rear face 26) of the remaining faces excluding the installation face 21 and the side face 22 or the side face 23 via the flying bridge 6.

[0037] In the second embodiment of the present invention, the corner A is formed to have a right angle. However, when the flying bridge is installed in the enclosure 2, it is enough for the corner A to come into contact with the inner walls of the enclosure 2. Consequently, the corner A may not have an exactly right angle.

[0038] As described above, it is possible to prepare the flying bridge 6 inexpensively and easily. Also, the flying bridge 6 absorbs vibration generated from the enclosure 2. As a result, it is possible for the flying bridge 6 to control vibration generated from the enclosure 2.

Consequently, it is possible to control noise caused by vibration generated from the enclosure 2 inexpensively and easily.

[0039] Furthermore, the shape of the flying bridge is not limited to the above-described embodiments of the present invention as long as the recess, in which the damping material 4 is fitted, is formed in the flying bridge, and it is possible to interconnect the inner walls of the enclosure 2 by the flying bridge. Also, the number of recesses formed in each flying bridge is not particularly restricted although only one recess is formed in each part of the flying bridge in the above-described embodiments of the present invention. For example, a plurality of recesses may be formed in each part of the flying bridge.

Claims

1. A speaker comprising:

a speaker drive unit;
an enclosure that encloses the speaker drive unit; and
a flying bridge that interconnects inner walls of the enclosure, wherein
the flying bridge is formed with a recess at location excluding a portion abutting the inner walls,
and a damping material is fitted in the recess for absorbing vibration of the enclosure.

2. The speaker according to claim 1, wherein the flying bridge interconnects opposite ones of the inner walls of the enclosure.

3. The speaker according to claim 2, wherein the flying bridge interconnects portions of the inner walls which would develop a maximum amplitude of the vibration under a free state.

4. The speaker according to claim 2 or 3, wherein the flying bridge comprises a plurality of wedge-shaped parts contacting each other at planes not parallel to the inner walls interconnected by the flying bridge, and the wedge-shaped parts are arranged such that a front end of one wedge-shaped part is directed opposite to a front end of another wedge-shaped part which is adjacent to the one wedge-shaped part.

5. The speaker according to claim 4, wherein the plurality of the wedge-shaped parts comprise a pair of the wedge-shaped parts, wherein one of the wedge-shaped parts is formed with the recess and the damping material is fitted in the recess, while the other wedge-shaped part is not formed with a recess nor does have a damping material.

6. The speaker according to claim 1, wherein the flying bridge interconnects neighboring ones of the inner

walls of the enclosure.

7. The speaker according to any one of claims 1 to 6,
wherein the damping material is fitted in the recess
in a contracted state.

5

10

15

20

25

30

35

40

45

50

55

FIG. 1

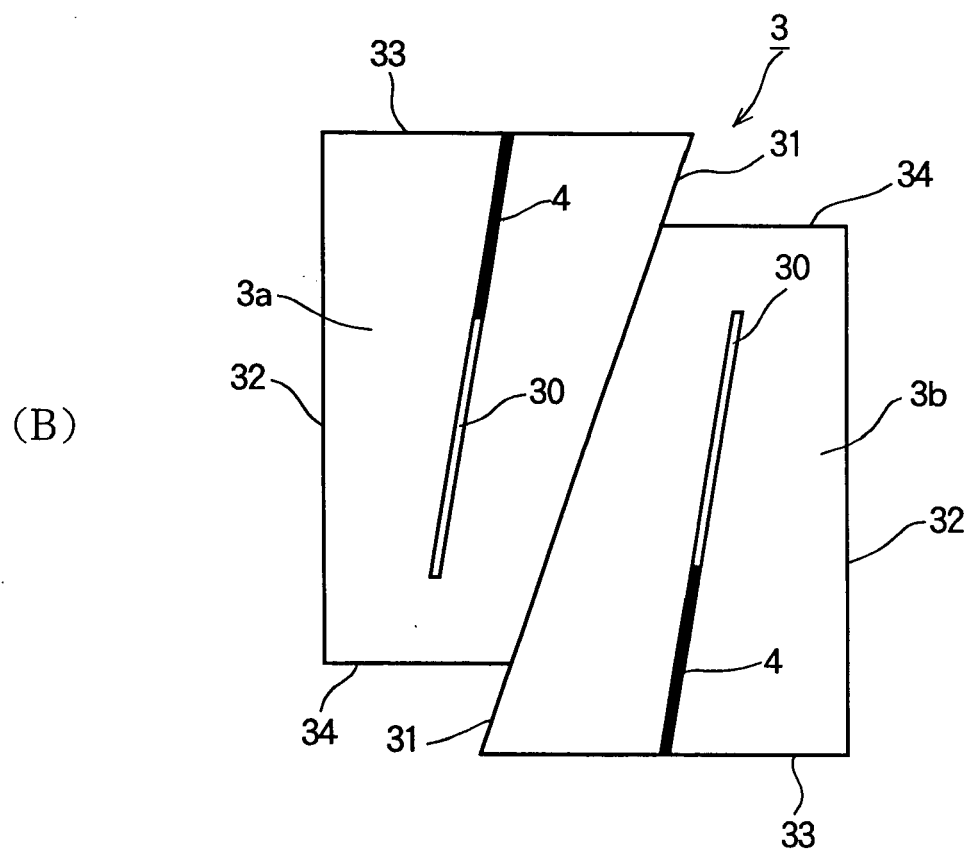
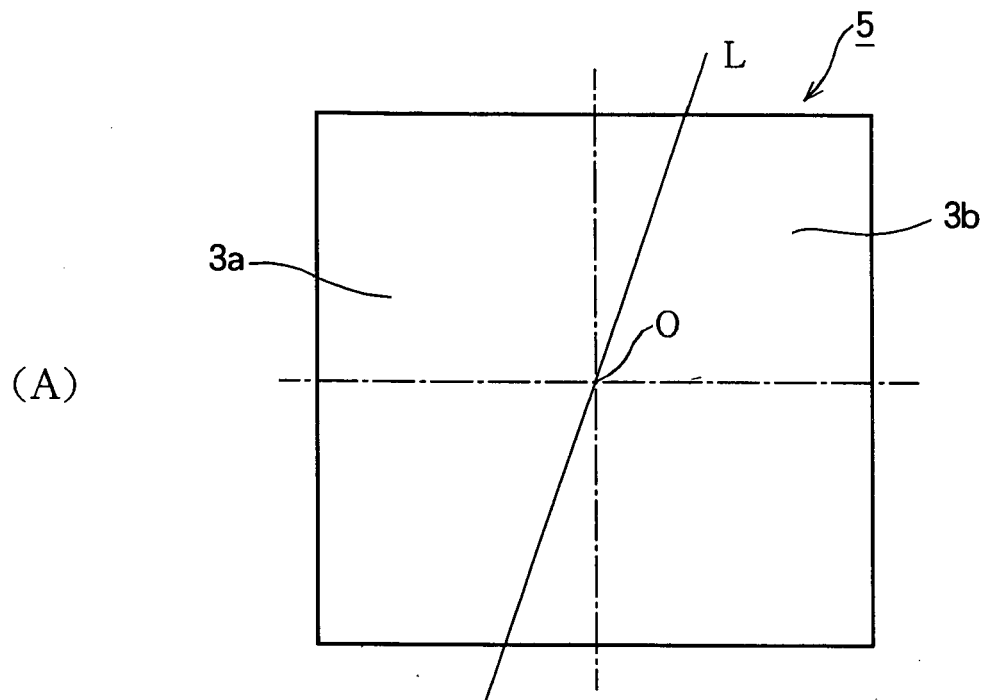


FIG. 2

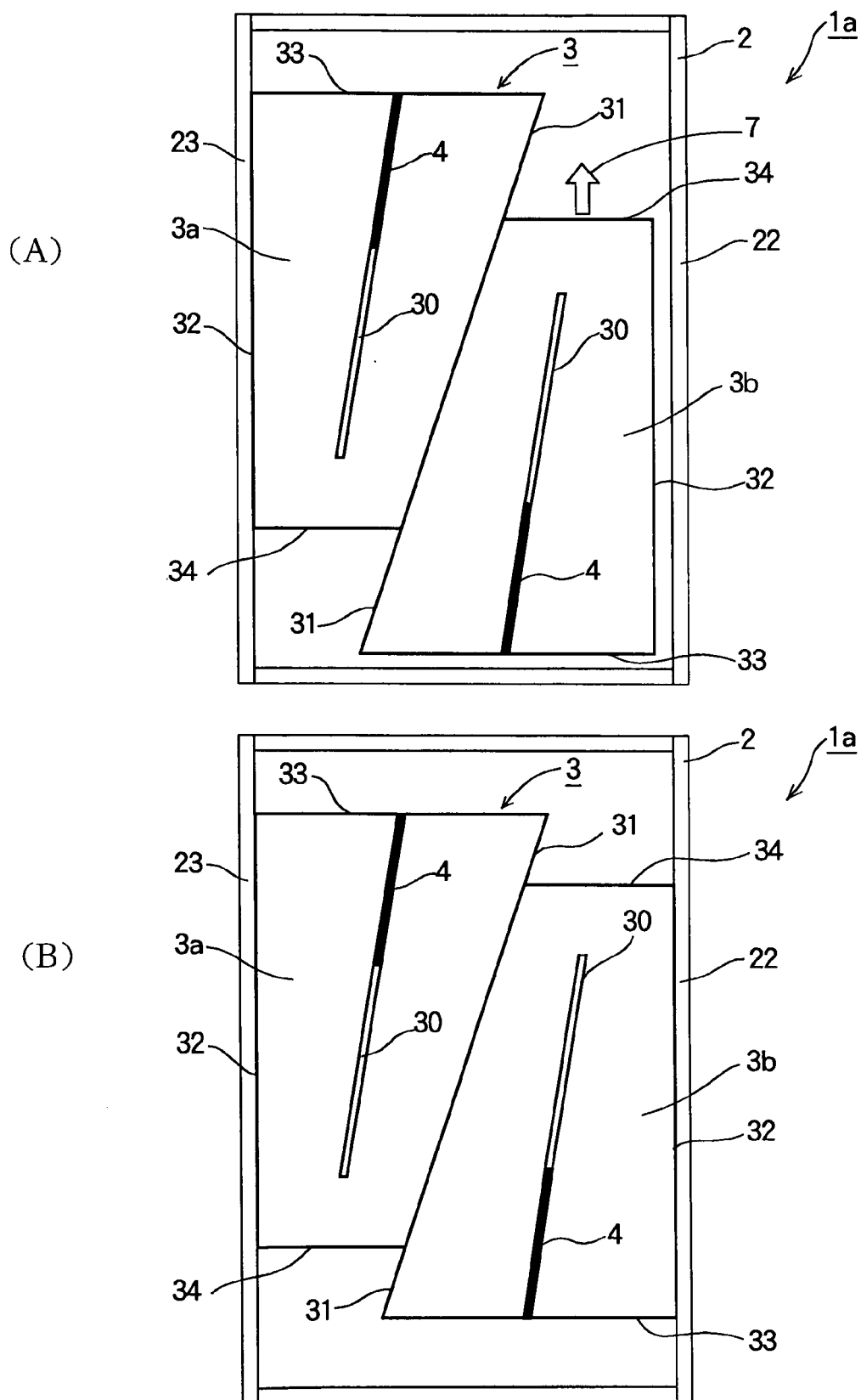


FIG. 3

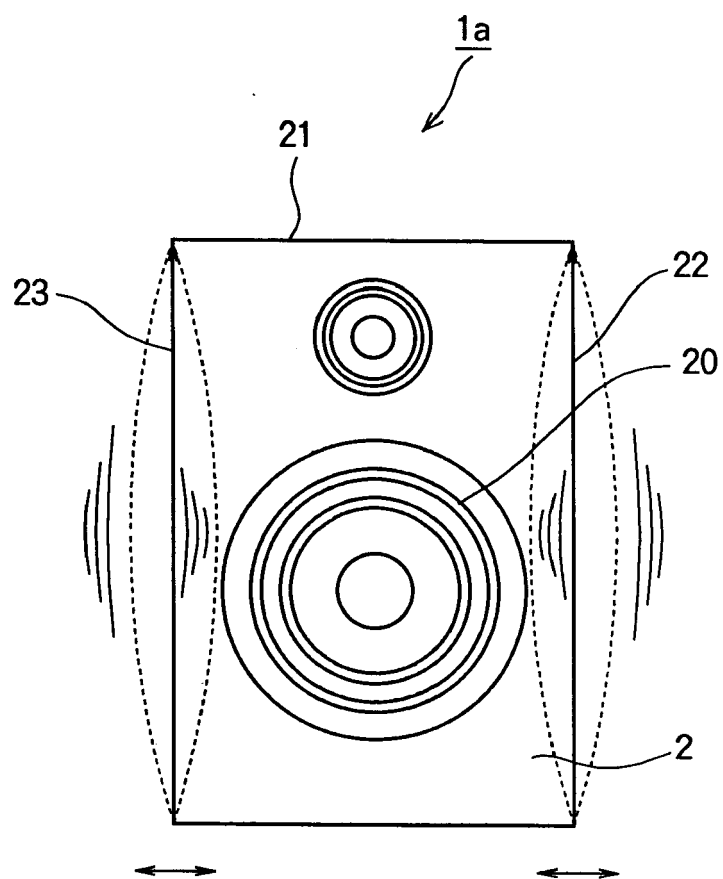


FIG.4

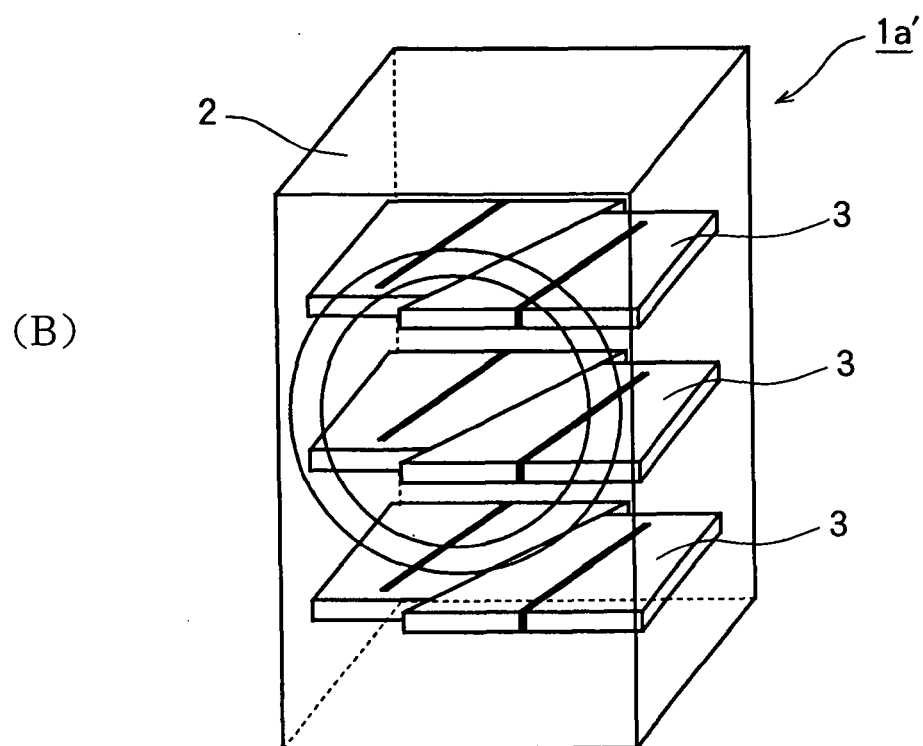
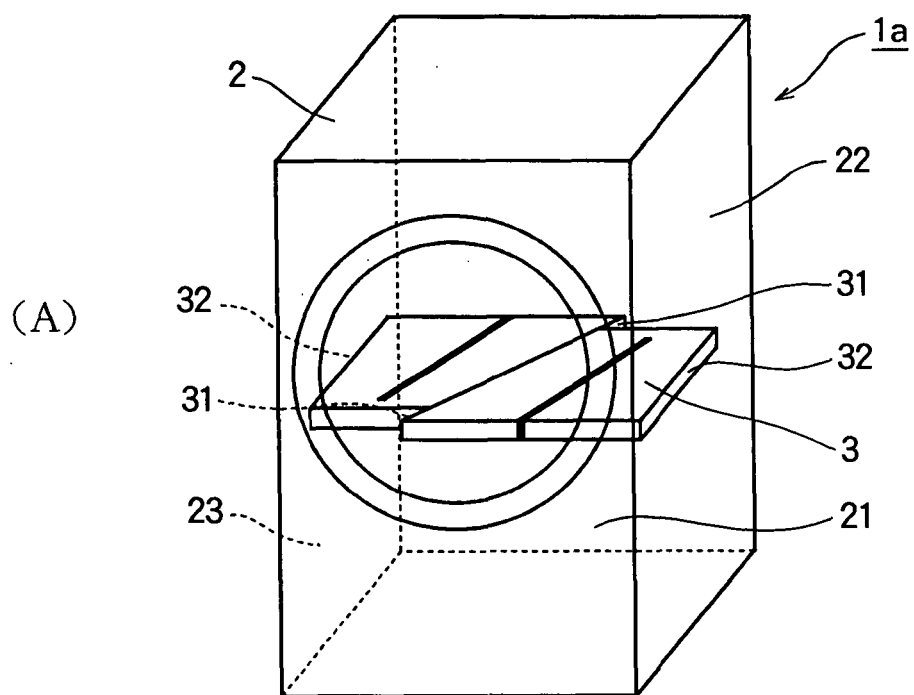


FIG.5

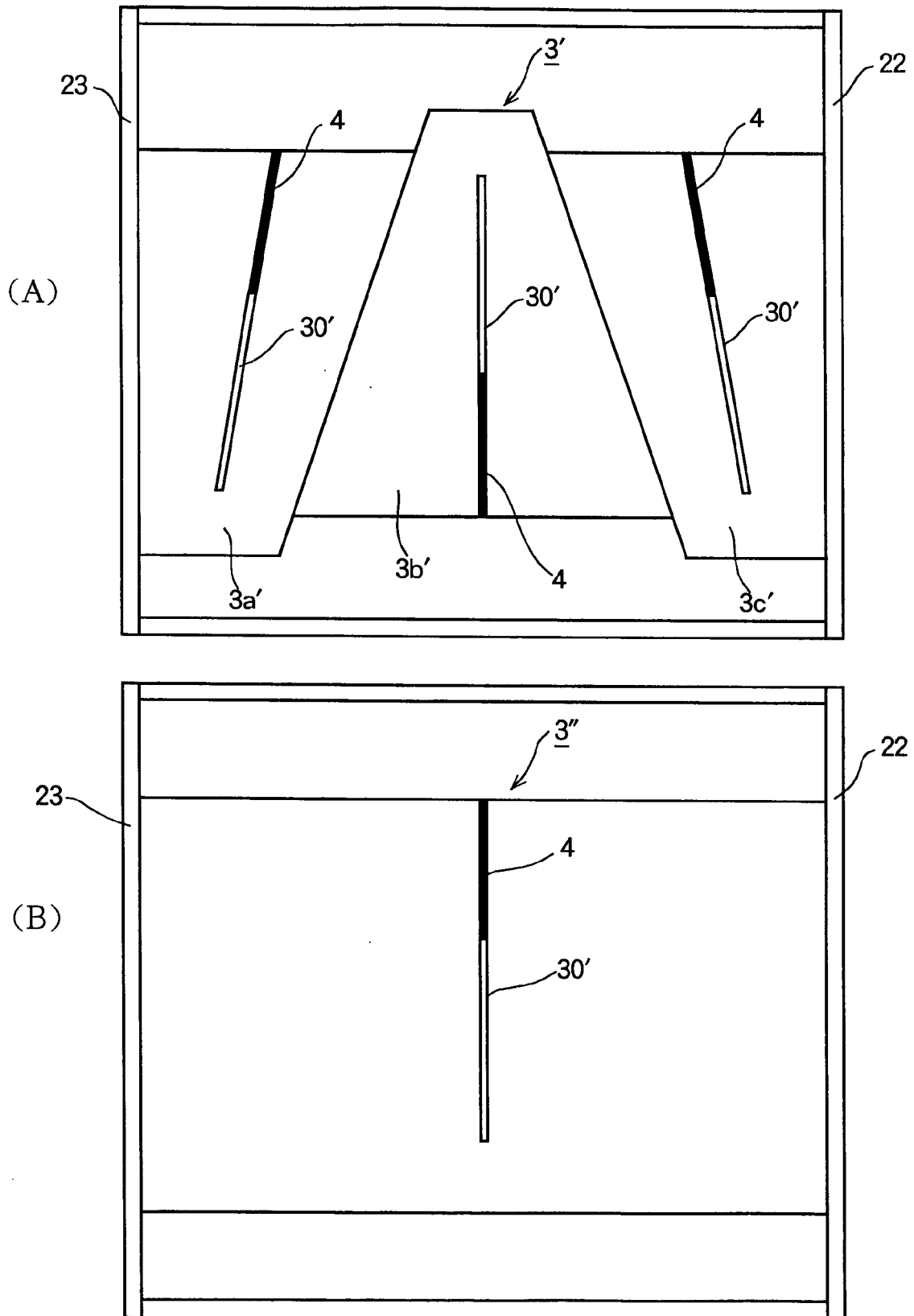


FIG.6

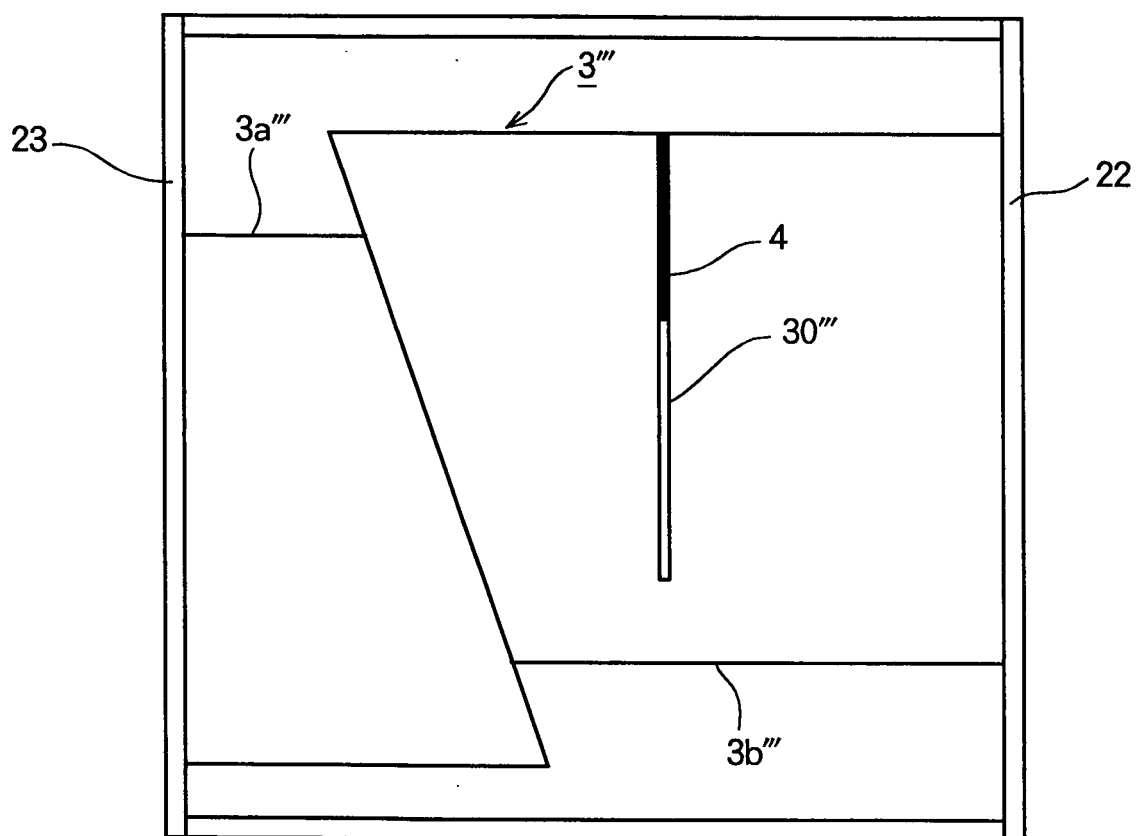


FIG.7

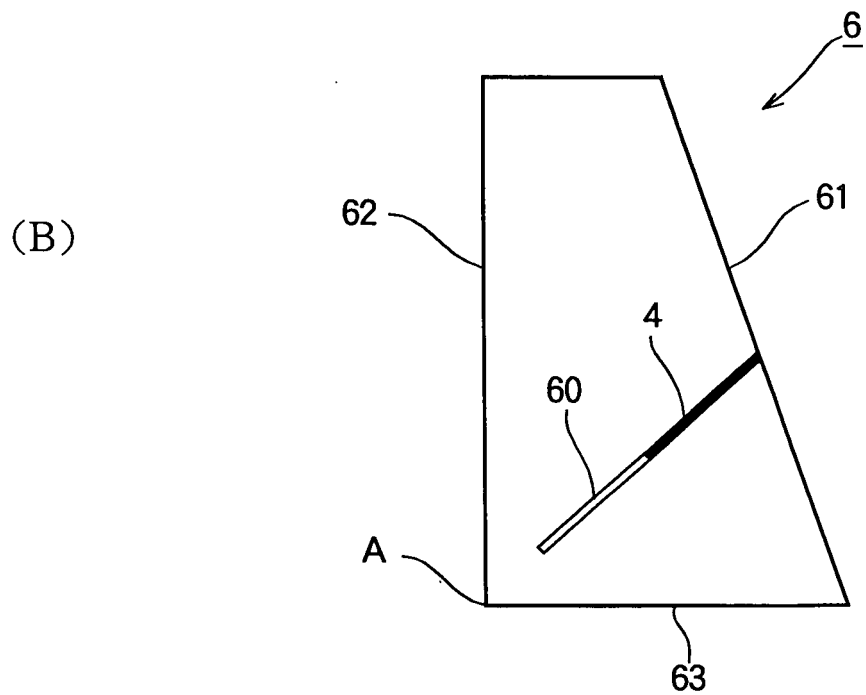
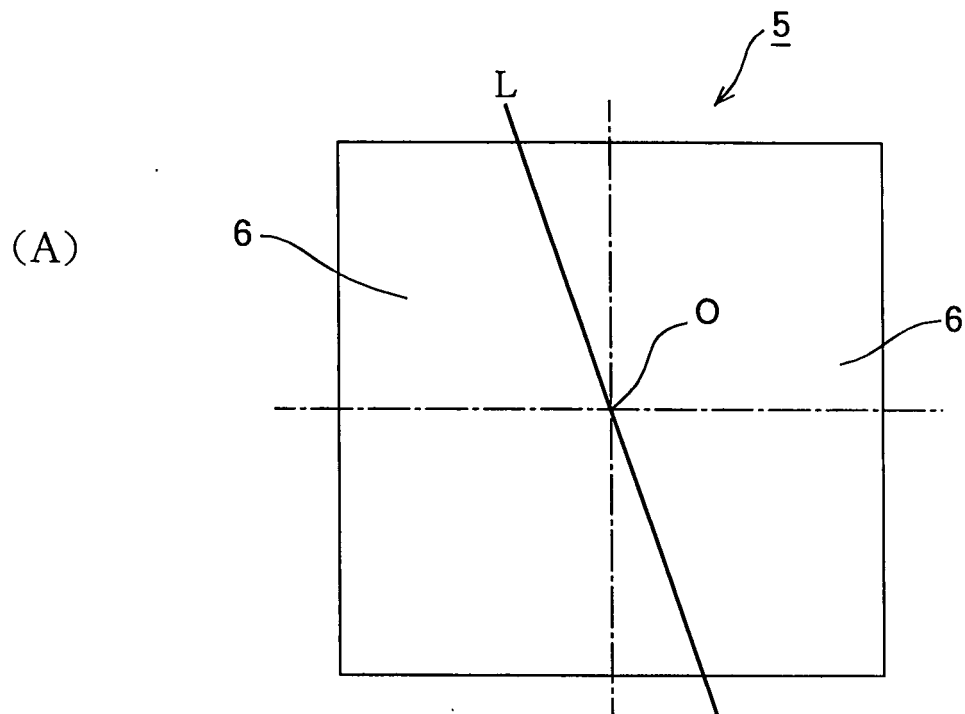
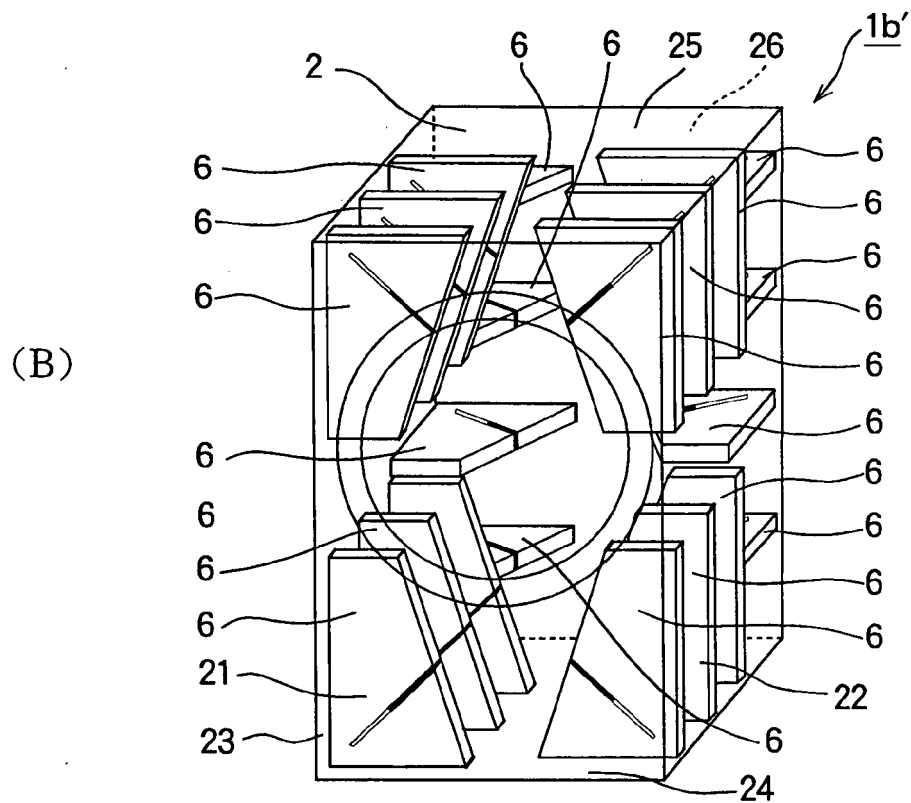
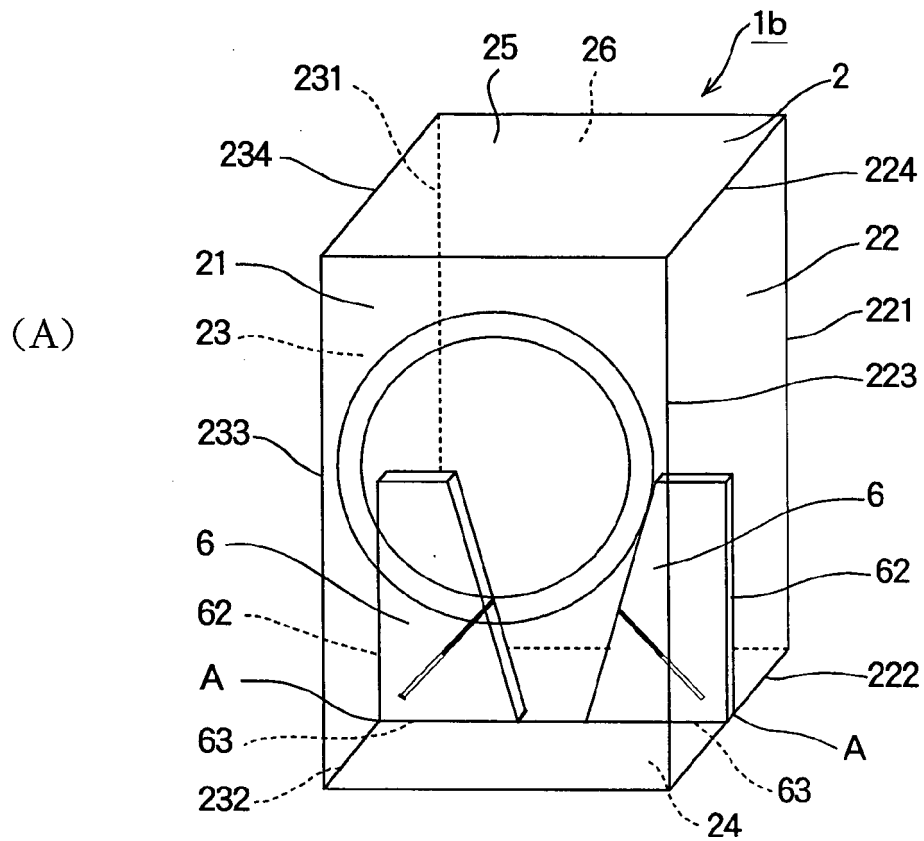


FIG. 8





EUROPEAN SEARCH REPORT

Application Number
EP 09 00 7888

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 4 690 244 A (DICKIE LAURENCE G [GB]) 1 September 1987 (1987-09-01) * figures 2-7 * * column 4, line 58 - column 5, line 21 * -----	1-4,6,7	INV. H04R1/28
A	JP 55 088496 A (MATSUSHITA ELECTRIC IND CO LTD) 4 July 1980 (1980-07-04) * abstract * * figure 2 * -----	1-7	
A	US 5 170 436 A (POWELL DARYL G [US]) 8 December 1992 (1992-12-08) * figures 1,3 * * column 3, line 56 - column 4, line 10 * -----	1-7	
			TECHNICAL FIELDS SEARCHED (IPC)
			H04R
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 27 October 2009	Examiner Moscu, Viorel
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

 2
EPO FORM 1503 03.82 (F04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 09 00 7888

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

27-10-2009

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
US 4690244	A	01-09-1987	CA	1253440 A1		02-05-1989
			DE	3686065 D1		27-08-1992
			DE	3686065 T2		18-03-1993
			DK	61986 A		10-08-1986
			EP	0191595 A2		20-08-1986
			JP	2015063 C		02-02-1996
			JP	7050960 B		31-05-1995
			JP	61232185 A		16-10-1986

JP 55088496	A	04-07-1980	JP	1323303 C		27-06-1986
			JP	60047798 B		23-10-1985

US 5170436	A	08-12-1992	NONE			

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 2000125380 A [0002] [0003] [0004]