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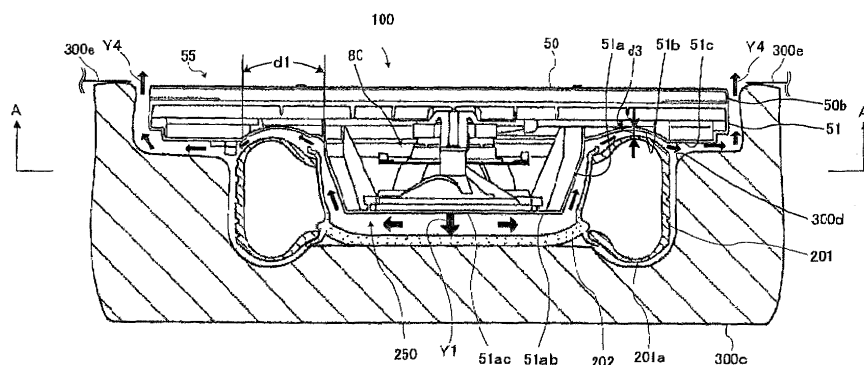
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(54) Speaker device

(57) A speaker device (100) includes a speaker unit (80) having plural terminal portions (14a, 14b) and a voice coil (8), and a speaker box (55) housing it. Each lead wire of the voice coil is connected to each wiring connected to an amplifier at a position of each terminal portion (14). The speaker box (55) includes a second housing (51) having plural ribs (51e), and a first housing (50) mounted on the second housing (51), having a pressing rib (50f) formed into a mesh shape. Each rib (51e) has a recessed portion (51f) fixing each wiring (15) and projects

to a predetermined position on an inner surface of the second housing (51). Each wiring, arranged in the recessed portion (51f) of each rib (51e), floats by a predetermined height with respect to the inner surface of the second housing (51) to be fixed to each rib. To a position covering each rib and each wiring, a cushion member (150) is fixed. Moreover, the first housing (50) is mounted on the second housing (51), and the cushion member (150) is pressed on the side of each rib (51e) by a pressing rib (50f) provided on the inner surface of the first housing (50).

FIG. 7



Description

[0001] The present invention relates to a wiring configuration for a speaker device.

[0002] Conventionally, there is known a speaker device which includes a vibration system such as a voice coil, a diaphragm and a frame, and a magnetic circuit, and which is housed into an enclosure (housing). In such a speaker device, each lead wire of the voice coil is electrically connected to a wiring drawn from an amplifier at a predetermined position of the enclosure or the speaker device. Thereby, a signal and power are inputted from the amplifier.

[0003] In such a speaker device, there are proposed various kinds of wiring configurations capable of preventing cutting of the wiring.

[0004] There is proposed such a wiring configuration that a speaker code is fit into a guiding groove for guiding the speaker code, provided at a predetermined position of an enclosure, and the speaker code is fixed by plural ribs provided in the guiding groove (see Japanese Patent Application Laid-open under No. 6-284487), for example. In addition, there is proposed such a wiring configuration that a stopper which has a holding part temporarily holding the speaker code and an engagement part with which the stopper is engaged are provided and the stopper holding the speaker code is engaged with the engagement part to be rotated in order to fix the speaker code to a speaker body (see Japanese Patent Application Laid-open under No. 6-284487). Thereby, efficiency of operation in fixing the speaker code can be improved.

[0005] In addition, there is proposed such a code wiring configuration that a code is supported by a code supporting portion provided in a speaker cabinet in order to prevent occurrence of an abnormal sound due to a contact between the code of a speaker system and other part (see Japanese Patent Application Laid-open under No. 11-55775, for example).

[0006] There is known a speaker device for a vehicle, mounted on an inner portion of a recessed portion of a spare tire (see Japanese Patent Application Laid-open under No. 7-137581, for example). In the speaker device for the vehicle, a speaker unit is housed into a speaker box, and the code is drawn from the speaker unit to the side of a trunk room floor surface via a space in the speaker box. Additionally, there is known a headphone having high reliability of a code connected between speaker housing parts (see Japanese Patent Application Laid-open under No. 2001-245377, for example). In the headphone, the code is engaged with and housed into a guide portion formed into a groove shape at a position corresponding to a middle portion of a connecting portion at an inner portion of a headband to be held by plural bosses at a position corresponding to the vicinity of a connecting member.

[0007] The present invention has been achieved in order to solve the above problem. It is an object of this invention to provide a speaker device including a wiring

configuration capable of shortening a fixing time of a wiring and preventing occurrence of an abnormal sound due to collision between the wiring and a housing.

[0008] According to one aspect of the present invention, there is provided a speaker device including: a speaker unit which includes a voice coil; a wiring which is electrically connected to the voice coil; and a housing which is provided at a position opposite to the wiring and includes plural ribs fixing the wiring, wherein each of the ribs is provided at a position corresponding to a predetermined position of the wiring in the housing, and the wiring is fixed to each of the ribs in a manner floating from the housing.

[0009] The above speaker device includes the speaker unit having the voice coil, the wiring electrically connected to the voice coil, and the housing provided at the position opposite to the wiring and having the plural ribs for fixing the wiring.

[0010] Particularly, in the speaker device, each of the ribs is provided at the predetermined position of the wiring in the housing, e. g. , a position corresponding to each constant space of the wiring, and the wiring floating from the housing is fixed to each of the ribs. Thereby, at the time of driving of the speaker device, it becomes possible that movement of the wiring on the side of the housing is limited and collision between the housing and the wiring is prevented. Thus, it can be prevented that the abnormal sound such as a flutter sound (trembling sound) occurs and sound quality is deteriorated.

[0011] In the speaker device, no adhesive for reinforcing the wiring fixing to each of the ribs is applied onto the wiring. Therefore, in an assembly process of the speaker device, a waiting time for drying the adhesive when the adhesive is applied onto the wiring is unnecessary. Hence, a fixing time of the wiring, furthermore, an assembly time of the speaker device, can be shortened.

[0012] In a manner of the above speaker device, each of the ribs may have a recessed portion to which the wiring is fixed, and a bottom surface of the recessed portion may be provided at a position corresponding to a predetermined height with respect to an inner surface of the housing positioned flush with a lower end portion of the rib in the rib, and a part of the wiring may be arranged on the bottom surface.

[0013] In this manner, each of the ribs has the recessed portion to which the wiring is fixed. The bottom surface of the recessed portion is provided at the position corresponding to the predetermined height with respect to the inner surface of the housing positioned flush with the lower end portion of the rib in the rib, and the part of the wiring is arranged on the bottom surface of the recessed portion. In a preferred example, the predetermined height may be a height at which the wiring and the housing do not collide at the time of the driving of the speaker device, in accordance with various kinds of manners of the speaker device. Thereby, at the time of the driving of the speaker device, it can be occrurcly prevented that the housing and the wiring collide with each other and the

abnormal sound occurs.

[0014] In another manner, the speaker device may further include a cushion member having an adhesive surface, wherein the cushion member is mounted on each of the ribs via the adhesive surface, and the wiring is covered with the cushion member.

[0015] In this manner, the speaker device includes the cushion member having the adhesive surface to which an adhesive agent is applied or a double face tape is attached. In a preferred example, the cushion member maybe made of a member having an elastic function such as a sponge and urethane. The cushion member is fixed onto each of the ribs via the adhesive surface. Thereby, at the time of the driving of the speaker device, it can be prevented that the wiring becomes off the rib. In addition, since the wiring is covered with the cushion member, at the time of the driving of the speaker device, the movement of the wiring on the upper side of the housing is limited.

[0016] In still another manner of the above speaker device, the part of the wiring arranged on the bottom surface of the recessed portion may be sandwiched by side walls and the bottom surface of the recessed portion and the cushion member. Thereby, the part of the wiring arranged on the bottom surface of the recessed portion of each of the ribs can be securely fixed by each of the ribs and the cushion member.

[0017] In still another manner, the speaker device may further include an additional housing mounted on the housing, wherein the additional housing includes a pressing rib pressing the cushion member on a side of the rib and a side of the wiring when the additional housing is mounted on the housing.

[0018] In this manner, the speaker device includes the additional housing mounted on the housing. The additional housing, which is mounted on the housing, has the pressing rib pressing the cushion member on the side of the rib and the side of the wiring. In a preferred example, the pressing rib may be formed into a mesh, grid or plane shape. Thereby, at the time of the driving of the speaker device, the movement of the wiring not only on the side of the housing but also on the side of the additional housing is limited, and it can be prevented that the housing and the additional housing collide with the wiring. Therefore, it can be prevented that the abnormal sound such as the flutter sound (trembling sound) occurs and the sound quality is deteriorated.

[0019] The nature, utility, and further features of this invention will be more clearly apparent from the following detailed description with respect to preferred embodiment of the invention when read in conjunction with the accompanying drawings briefly described below.

FIG. 1 is a plan view schematically showing such a state that a speaker device according to an embodiment of the present invention is mounted on a predetermined position in a trunk room of a vehicle;
FIG. 2 is a perspective view of the speaker device

of this embodiment when observed from a front side; FIG. 3 is a perspective view of the speaker device of this embodiment when observed from a rear side; FIG. 4 shows a partly cross-sectional perspective view of the speaker device corresponding to FIG. 2, in which a part of the speaker device is cut off; FIG. 5 is an one-side cross-sectional view of a speaker unit of this embodiment when cut along a plane having a central axis thereof; FIG. 6 shows a perspective view showing an inner configuration of the speaker device of this embodiment; FIG. 7 is a cross-sectional view of the speaker device when cut along a cutting line A-A' shown in FIG. 1; FIG. 8 is a perspective view showing a configuration of an inner portion of a second housing of this embodiment; FIG. 9 shows a perspective view of a pressing rib provided at an inner portion of a first housing of this embodiment; FIG. 10 shows a cross-sectional view along a cutting line B-B' shown in FIG. 9; FIG. 11 shows a partly cross-sectional view of a wiring configuration according to the present invention; FIG. 12 shows a partly cross-sectional view of a wiring configuration according to a comparative example; and FIG. 13 is a plan view schematically showing such a state that the speaker device according to this embodiment is mounted on a predetermined position in a trunk room of a sedan-type vehicle.

[0020] The preferred embodiments of the present invention will now be described below with reference to the attached drawings.

[Configuration of Speaker Device]

[0021] A speaker device 100 according to an embodiment of the present invention is the speaker device in the phase inverter system (bass reflex system) outputting an acoustic wave from both a front side and a rear side of the diaphragm. At the same time, the speaker device 100 is the speaker device of a sub woofer type. The speaker device 100 can be preferably used as a speaker device for a vehicle. As shown in FIG. 1, when the speaker device 100 is applied to a wagon-type vehicle 300, for example, the speaker device 100 is mounted on a predetermined position in a luggage compartment 300b arranged behind a rear seat. In the wagon-type vehicle 300, a space corresponding to the luggage compartment 300b and a space including a seat for a passenger communicate with each other. Therefore, these two spaces are called "vehicle interior 300a" together, hereinafter.

[0022] First, a description will be given of a configuration of the speaker device 100 according to the present invention with reference to FIG. 2 to FIG. 7.

[0023] FIG. 2 shows a perspective view of the speaker

device 100 when observed from the front side. FIG. 3 shows a perspective view of the speaker device 100 when observed from the rear side. FIG. 4 is a perspective view corresponding to FIG. 2 and a partly cross-sectional view of the speaker device 100 in which a part thereof is cut off. FIG. 5 is a one-side cross-sectional view of a speaker unit 80, being a component of the speaker device 100 and an output source of the sound, when cut by a plane including a central axis L1 thereof. FIG. 6 is a perspective view of the speaker device 100 when observed from the front side, and it is also a perspective view showing an inner configuration of the speaker device 100. FIG. 7 is a cross-sectional view along a cutting-line A-A' shown in FIG. 1, which shows such a state that the speaker device 100 is mounted on the predetermined position in the luggage compartment 300b.

[0024] The speaker device 100 includes the speaker unit 80 and a speaker box 55 serving as a housing, which houses the speaker unit 80.

[0025] First, a description will be given of a configuration of the speaker box 55.

[0026] The speaker box 55 includes a first housing 50 and a second housing 51.

[0027] The first housing 50 is mounted on the second housing 51 and has a function of an upper cover for covering the inner portion of the second housing 51. The first housing 50 has one upper wall 50a and plural side walls 50b integrated with the upper wall 50a, and it is formed into a substantial box shape. At positions on the inner side of the upper wall 50a and corresponding to plural mounting portions 51d (see FIG. 6) provided on the inner side of the second housing 51 which will be explained later, plural mounting portions 50d (see FIG. 9) are provided. On the one side wall 50b of the plural side walls 50b, a bass reflex port 50c serving as an opening is formed. The bass reflex port 50c has a function of outputting the acoustic wave outputted from the rear side of a diaphragm 10 being the component of the speaker unit 80 in the outward direction of an arrow Y3, as will be explained later. In addition, when the side wall 50b on which the bass reflex port 50c is formed is observed from the front side, hinges 61 are provided at both left and right positions of the bass reflex port 50c, respectively. Moreover, on the upper wall 50a and in the vicinity of positions of corners of the side wall 50b opposite to the side wall 50b on which the plural hinges 61 are provided, plural fixing screws 60 are provided. As shown in FIG. 7, the fixing screws 60 and the hinges 61 have functions of fixing the speaker device 100 to a tire house 300c in the luggage compartment 300b of the wagon-type vehicle 300 in such a state that the speaker device 100 is opposite to a spare tire 201 with a constant space 250.

[0028] The second housing 51 has a first part 51a formed into a substantial cup shape, a second part 51b outwardly extending from an outer peripheral end of the first part 51a, and a third part 51c outwardly extending from an outer peripheral end of the second part 51b. Hereinafter, a total part of the first part 51a, the second

part 51b and the third part 51c is generically called "sound output shape part".

[0029] The first part 51a has a function of housing and supporting the speaker unit 80. A bottom portion 51ab of the first part 51a has flatness, and a grille 51ac formed into a mesh or grating state is formed thereon. The grille 51ac has a function of making the acoustic wave, outputted from the front side of the diaphragm 10 (see FIG. 5) being the component of the speaker unit 80, pass through in the direction of an arrow Y1 on the outer side of the first part 51a. As shown in FIG. 7, the second part 51b which characterizes the present invention has a curved shape with respect to the output direction (traveling direction) of the acoustic wave outputted from the speaker unit 80. In addition, the second part 51b is formed into a substantial annular shape when planarly observed. Further, as shown in FIG. 7, the second part 51b is formed into the substantially same curved shape as a shape of a side portion 201a of the spare tire 201. Therefore, as shown in FIG. 7, a length (width) d1 along the curved surface of the second part 51b in the radial direction of the spare tire 201 is set to the substantially same value as a length along the curved surface of the side portion 201a of the spare tire 201 in the radial direction of the spare tire 201. The third part 51c has flatness, and an outer shape thereof is formed into a substantially rectangle shape. In addition, on the inner side of the second housing 51 and at appropriate positions on the first part 51a, the second part 51b and the third part 51c, the plural mounting portions 51d are provided, respectively. The respective mounting portions 51d have functions to engage with the plural mounting portions 50d (see FIG. 9) provided on the inner side of the above mentioned first housing 50 to fit the first housing 50 to the second housing 51.

[0030] Next, a description will be given of the configuration of the speaker unit 80.

[0031] The speaker unit 80 includes a magnetic circuit 20, a vibration system 21 and other components, as shown in FIG. 5.

[0032] The magnetic circuit 20 has a yoke 1, a magnet 2 and a plate 3, and is formed as an outer magnet type magnetic circuit. The yoke 1 has a cylindrical pole portion 1a and a flange portion 1b outwardly extending from a lower end portion of the outer peripheral wall of the pole portion 1a. The magnet 2 is formed into an annular shape and mounted onto the flange portion 1b. The plate 3 is formed into a substantially annular shape and mounted onto the magnet 2. A gap (magnetic gap) 17 is formed between the outer peripheral wall of the pole portion 1a being the component of the yoke 1 and the inner peripheral wall of the plate 3.

[0033] The vibration system 21 includes a frame 6, a voice coil bobbin 7, a voice coil 8, a damper 9, the diaphragm 10, an edge 11 and a cap 12.

[0034] The frame 6 is formed into a substantial cup shape and has a function of supporting various kinds of components forming the speaker unit 80.

[0035] The voice coil bobbin 7 is formed into a substantially cylindrical shape and provided at a position covering the vicinity of the upper end portion of the pole portion 1a being the component of the yoke 1.

[0036] The voice coil 8 is wound around the vicinity of the lower end portion of the outer peripheral wall of the voice coil bobbin 7 and has two wirings, which includes plus lead wires and minus lead wires (not shown). Each of the plus lead wires is an input wiring for an L(or R)-channel signal, and each of the minus lead wires is an input wiring for a ground (GND:ground) signal. The two plus lead wires and the two minus lead wires are connected to terminal portions 14a and 14b provided on the frame 1, respectively (see FIG. 8, too). The terminal portion 14a and the terminal portion 14b are provided at the substantially middle portion of the frame 6 and at positions opposite to each other. Each one end of wirings 15a and 15b is connected to the terminal portions 14a and 14b via a connector. Meanwhile, at a predetermined position of the third part 51c of the second housing 51, each other end of the wirings 15a and 15b is connected to each wiring on an output side of an amplifier (not shown) via a connector. Each of the wirings 15a and 15b includes a pair of a plus wiring and a minus wiring, respectively. Thereby, the signal and the power of two channels are inputted to the voice coil 8 from the amplifier side via the wirings 15a and 15b, the terminal portions 14a and 14b, the two plus lead wires and the two minus lead wires. Hereinafter, when the wirings 15a and 15b are not particularly distinguished, they are simply expressed as "wiring 15" together. Similarly, when the terminal portions 14a and 14b are not particularly distinguished, they are simply expressed as "terminal portion 14" together.

[0037] The damper 9 is formed into an annular shape and has plural waveforms (corrugations) concentrically formed. The inner peripheral edge portion of the damper 9 is mounted onto the vicinity of the upper end portion of the outer peripheral wall of the voice coil bobbin 7. Meanwhile, the outer peripheral edge portion of the damper 9 is mounted onto the position corresponding to the substantially middle portion of the frame 1.

[0038] The diaphragm 10 is formed into a cone shape. The inner peripheral edge portion of the diaphragm 10 is mounted onto the upper end portion of the outer peripheral wall of the voice coil bobbin 7.

[0039] The edge 11 is formed into an annular shape. The inner peripheral edge portion of the edge 11 is mounted on the outer peripheral edge portion of the diaphragm 10, and the outer peripheral edge portion of the edge 11 is mounted on the upper end portion of the frame 1.

[0040] The cap 12 is formed into a dome shape and provided at a position covering the upper end portion of the voice coil bobbin 7. The cap 12 has a function of preventing dust and water from entering the inner portion of the speaker unit 80.

[0041] Other component is a buffer member 13, other

than the above-mentioned terminals 14 and the wirings 15. The buffer member 13 is originally formed into a pole shape, and it is mounted onto the upper surface of the outer peripheral edge portion of the edge 11 in a state of being deformed into a circle shape. As the buffer member 13, a member having elasticity, such as sponge and urethane, is preferred, for example.

[0042] In the speaker unit 80 having such a configuration, the signal and power outputted from the amplifier is inputted to the voice coil 8 via each wiring 15, each terminal 14, the two plus lead wires and the two minus lead wires. Thereby, the driving force is generated to the voice coil 8 in the magnetic gap 17, which vibrates the diaphragm 10 in the direction of the central axis L1 of the speaker unit 80. In this manner, the speaker unit 80 outputs the acoustic wave in both of the direction of the arrow Y1 on the front side of the diaphragm 10 and the direction of the arrow Y2 of the rear side of the diaphragm 10, respectively.

[0043] The above-mentioned speaker unit 80 is housed into the speaker box 55 including the first housing 50 and the second housing 51. Thereby, the speaker device 100 is formed.

[0044] Concretely, as particularly shown in FIG. 4, the speaker unit 80 is housed into the first part 51a to be fixed thereto so that the buffer member 13 being the component of the speaker unit 80 and the bottom portion 51ab of the first part 51a of the second housing 51 contact with each other and the yoke 1 being the component of the speaker unit 80 and the upper wall 50a of the first housing 50 contact with each other. Therefore, the front side of the diaphragm 10 being the component of the speaker unit 80 is arranged on the side opposite to the grille 51ab of the second housing 51. In addition, as shown in FIG. 6 and FIG. 9, the first housing 50 is mounted onto the second housing 51 in such a state that the plural mounting portions 50d being the component of the first housing 50 and the plural mounting portions 51d being the components of the second housing 51 engage with each other. In this manner, the speaker device 100 is formed.

[0045] In such a speaker device 100, if the speaker unit 80 is driven, the acoustic wave outputted from the front side of the diaphragm 10 is outputted in the direction of the arrow Y1 via the grille 51ac, and the acoustic wave outputted from the rear side of the diaphragm 10 is outputted in the direction of the arrow Y3 via the space between the first housing 50 and the second housing 51 and the bass reflex port 50c.

(Method of Mounting Speaker Device on Vehicle)

[0046] Next, a description will be given of a method of mounting the speaker device 100 onto the predetermined position in the luggage compartment 300b of the wagon-type vehicle 300, with reference to FIG. 7.

[0047] As shown in FIG. 7, a tire house portion 300c as a structure of the wagon-type vehicle 300 is formed

on a lower side of a floor surface 300e having a function of mounting luggage in the luggage compartment 300b. The tire house portion 300c includes a space 300d for housing the spare tire 201 including a wheel 202. The spare tire 201 is mounted in the space 300d, and the speaker device 100 is arranged on the upper side of the spare tire 201 and in the space 300d, with the constant space 250. Thereby, the speaker device 100 can be mounted on the wagon-type vehicle 300 without losing the necessary space in the vehicle interior 300a. Additionally, the speaker device 100 is fixed to the tire house portion 300c via the fixing screws 60 and the hinges 61 provided in the first housing 50. When the spare tire 201 is taken out, the fixing screws 60 are unfastened and the speaker device 100 is rotated with the hinges 61 as a center by lifting the side of the fixing screws 60 of the speaker device 100. Then, the spare tire 201 is exposed. Thereby, the spare tire 201 can be taken out of the wagon-type vehicle 300.

[0048] In a state shown in FIG. 7, the sound output shape part is opposite to the spare tire 201 with the constant space 250. Concretely, the first part 51a of the second housing 51 is housed into the inner side of the wheel 202 to be opposite to the wheel 202 with the constant space 250. In addition, the second part 51b of the second housing 51 is opposite to the side portion 201a of the spare tire 201 formed into the curved shape with the constant space 250. The third part 51c of the second housing 51, the side wall of the second housing 51 and the side wall 50b of the first housing 50 are opposite to the tire house portion 300c with the constant space 250. Additionally, the space 250 between the first part 51a and the wheel 202, the space 250 between the second part 51b and the side portion 201a of the spare tire 201, the space 250 between the third part 51c and the tire house portion 300c and the space 250 between the side walls of the second housing 51 and the first housing 50 and the tire house portion 300c are mutually communicate with each other. The space 250 functions as an acoustic passage introducing the acoustic wave outputted from the speaker unit 80 into the vehicle interior 300a, as will be explained later.

[0049] Namely, as shown in FIG. 5 to FIG. 7, in the speaker device 100, at the time of driving of the speaker unit 80, the acoustic wave outputted from the front side of the diaphragm 10 is outputted in the direction of the arrow Y1 via the grille 51ac of the second housing 51, and the acoustic wave outputted from the rear side of the diaphragm 10 is outputted in the direction of the arrow Y3 via the bass reflex port 50c, respectively.

[0050] As shown in FIG. 1, FIG. 6 and FIG. 7, the acoustic wave outputted in the direction of the arrow Y1 travels into the space 250 between the first part 51ab of the second housing 51 and the wheel 202 in the arrow direction shown in the drawing. Then, the acoustic wave travels into the space 250 between the second part 51b of the second housing 51 and the side portion 201a of the spare tire 201 in the arrow direction shown in the

drawing, in the space 250 between the third part 51c of the second housing 51 and the tire house portion 300c in the arrow direction shown in the drawing, and in the space 250 between the side wall of the second housing 51 and the side wall 50b of the first housing 50 and the tire house portion 300c in the arrow direction shown in the drawing, in sequence. Further, the acoustic wave is outputted into the vehicle interior 300a in which the passenger exists, as shown in the direction of the arrow Y4. Though the illustration in the drawing is omitted, the acoustic wave outputted in the direction of the arrow Y3 via the bass reflex port 50c also travels into the above-mentioned space 250 to be subsequently outputted into the vehicle interior 300a.

[Mounting Configuration of Wiring]

[0051] Next, a description will be given of a mounting configuration of the wiring being a characteristic of the present invention, with reference to FIG. 8 to FIG. 11.

[0052] FIG. 8 is a perspective view showing an inner portion of the second housing 51 which houses the speaker unit 80. FIG. 9 is a perspective view of the speaker unit 100 when observed from the front side, and a perspective view showing the inner portion of the second housing 51. FIG. 10 is a cross-sectional view along a cutting line B-B' shown in FIG. 9. FIG. 11 shows a partly cross-sectional view of a broken-line area E5 shown in FIG. 10, when the area E5 is observed from the direction of an arrow Y15.

[0053] In addition to the above-mentioned components, the second housing 51 includes plural ribs 51e, formed into a projecting shape, on an inner surface (bottom surface) thereof. Each of the ribs 51e is formed on the inner surface of the second housing 51, i.e., at the outer peripheral edge portion of the first part 51a and on the inner surfaces of the second part 51b and the third part 51c, with a constant space, respectively. Each of the ribs 51e has a function of fixing each wiring 15 connected to each of the terminal portions 14 of the speaker unit 80. Namely, as shown in an enlarged area surrounded by a broken-line shown in FIG. 8, a recessed portion 51f is formed on the upper surface of each of the ribs 51e, and each wiring 15 is arranged in the recessed portion 51f. In addition, a bottom, surface 51g of each of the recessed portions 51f is set to a height d30 higher than the inner surface (bottom surface) of the second housing 51. It is preferable that the height d30 is set to a height at which each wiring 15 does not collide with the first housing 50 and the second housing 51 at the time of the driving of the speaker device 100, in accordance with various kinds of manners of the speaker device 100.

[0054] The wiring 15a of the plural wirings 15 is drawn from the terminal portion 14a to a fixing portion 51h provided in the vicinity of a position at a corner on the inner surface of the third part 51c via the first part 51a and the second part 51b and is fixed into the recessed portion 51f of each of the ribs 51e provided on the inner surfaces

of the second part 51b and the third part 51c, respectively. Meanwhile, the wiring 15b is drawn from the terminal portion 14b to the vicinity of the outer peripheral edge portion of the first part 51a in the vicinity of the terminal portion 14a along the outer peripheral edge portion of the first part 51a. Further, the wiring 15b is drawn from the position to the fixing portion 51h provided on the inner surface of the third part 51c via the second part 51b and is fixed into the recessed portion 51f of each of the ribs 51e provided on the inner surfaces of the first part 51a, the second part 51b and the third part 51c, respectively.

[0055] In addition, the speaker device 100 includes a cushion member 150 formed into a pole shape, made of a member having elasticity such as the sponge and the urethane, in addition to the above-mentioned components. Onto one surface of the cushion member 150, the adhesive agent is applied, or the double face tape is attached. Each wiring 15 is fixed into the recessed portion 51f of each of the ribs 51e, and then the cushion member 150 is fixed onto the upper surface of each of the ribs 51e via the adhesive surface to cover the upper surface of each wiring 15. Thereby, each wiring 15 is sandwiched by the side walls and the bottom surface 51g of each of the recessed portions 51f and the cushion member 150 to be fixed. However, the wiring 15a positioned between the outer peripheral edge portion of the first part 51a and the terminal portion 14a and the wiring 15b positioned between the outer peripheral edge portion of the first part 51a and the terminal portion 14b exist in a space above the first part 51a, respectively, and they are not covered with the cushion member 150.

[0056] The first housing 50 includes a pressing rib 50f formed into a mesh or grid shape, in addition to the above-mentioned components. The pressing rib 50f is formed to project from the inner surface of the first housing 50. In such a state that the first housing 50 is mounted on the second housing 51, the pressing rib 50f functions to press the cushion member 150 on the side of each rib 51e and the side of each wiring 15. Thereby, it is prevented that the cushion member 150 floats on the side of the first housing 50. In addition, so as to make the function the most effective, it is preferable that the pressing rib 50f is formed at a position corresponding to each of the ribs 51e via at least the cushion member in such a state that the first housing 50 is mounted on the second housing 51. FIG. 9 to FIG. 11 show such a state that the pressing rib 50f presses the cushion member 150 on the side of each of the ribs 51e.

[0057] Next, a description will be given of a mounting method of each wiring 15 with reference to FIG. 8 to FIG. 11.

[0058] First, the speaker unit 80 is housed into the first part 51a of the second housing 51 to be fixed thereto. Subsequently, each wiring 15 connected to each of the terminal portions 14 of the speaker unit 80 is fixed into the recessed portion 51f of each of the ribs 51e provided on the inner surface of the second housing 51 to be drawn from each of the terminal portions 14 up to the fixing

portion 51h provided on the inner surface of the above-mentioned second housing 51. The cushion member 150 is deformed into a shape shown in FIG. 8. Then, the adhesive surface of the cushion member 150 is placed opposite to each of the ribs 51e and each wiring 15, and the cushion member 150 is fixed onto the upper surface of each of the ribs 51c. Thereby, each wiring 15 is sandwiched by the side walls and the bottom surface 51g of the recessed portion 51f of each of the ribs 51e and the cushion member 150 to be fixed. At the same time, the upper surface of each wiring 15 is covered with the cushion member 150. Next, each of the mounting portions 50d of the first housing 50 is engaged with each of the mounting portions 51d of the second housing 51, and the first housing 50 is mounted on the second housing 51. Thereby, the cushion member 150 is pressed on the side of the second housing 51 by the pressing rib 50f formed into the mesh or grid shape, provided on the inner surface of the first housing 50.

[0059] Next, a description will be given of characteristic operation and effect of the present invention as compared with a comparative example.

[0060] FIG. 12 shows a mounting configuration of the wiring according to the comparative example. When the comparative example is explained, the same reference numerals are given to the same components as those of the present invention, and explanations thereof will be omitted or simplified.

[0061] The speaker device according to the comparative example includes a housing 170 corresponding to the second housing 51 of the present invention. Plural projecting ribs 170e are provided at appropriate positions on an inner surface (bottom surface) 170a of the housing 170. Each of the ribs 170e has a recessed portion 170f, and each wiring 15 is fixed into each of the recessed portions 170f. Particularly, in the comparative example, a bottom surface 170g of each of the recessed portions, which each wiring 15 is mounted on, and the inner surface 170a of the housing 170 become flush with each other. For the purpose of reinforcement, an adhesive 180 is applied onto each wiring 15 fixed into the recessed portion 170f of each of the ribs 170e, and each wiring 15 is fixed to each of the ribs 170f.

[0062] In the comparative example having such a wiring configuration, there are problems below.

[0063] In the comparative example, the adhesive 180 is used so that each wiring 15 is fixed to each of the ribs 170e. Therefore, in the assembly process of the speaker device, the waiting time for drying the adhesive 180 is necessary. Thus, the assembly time of the speaker device is problematically increased by the amount of time. Additionally, in the comparative example, the bottom surface 170g of each of the recessed portions 170f and the inner surface 170a of the housing 170 become flush with each other. Thus, when the adhesive state of the adhesive 180 to each wiring 15 fixed to each of the ribs 170e is insufficient, at the time of the driving of the speaker device, each wiring 15 floats from the bottom surface

170g of each of the ribs 170e, and each wiring 15 collides with the inner surface 170a of the housing 170. hence, the abnormal sound such as the flutter sound (trembling sound) occurs, and the sound quality is problematically deteriorated.

[0064] On the other hand, in the present invention, the projecting ribs 51e including the recessed portions 51f for fixing each wiring 15 are provided on the inner surface (bottom surface) of the second housing 51 with constant spaces. The bottom surface 51g of each of the recessed portions 51f, which each wiring 15 is mounted on, is set to the height d30 higher than the inner surface (bottom surface) of the second housing 51. In addition, each wiring 15 is fixed to each of the recessed portions 51f. The upper surface of each wiring 15 opposite to the first housing 50 is covered with the cushion member 150 having the adhesive component such as the adhesive agent, and the cushion member 150 is fixed onto the upper surface of each of the ribs 51f. Therefore, at the position of each of the ribs 51e, each wiring 15 is sandwiched by the side walls and the bottom surface 51g of the recessed portion 51f and the cushion member 150 to be fixed. Moreover, in such a state that the first housing 50 is mounted onto the second housing 51, the cushion member 150 is pressed by the pressing rib 50f formed into the mesh or grid shape, provided on the inner surface of the first housing 50, on the side of each of the ribs 51e.

[0065] In the present invention having such a wiring configuration, each wiring 15 is fixed to each of the ribs 51e in the state that each wiring floats from the inner surface (bottom surface) of the second housing 51 by the predetermined height d30. Thereby, at the time of the driving of the speaker device 100, the movement of each wiring 15 on the side of the second housing 51 is limited, and the collision between the second housing 51 and each wiring 15 can be prevented.

[0066] Additionally, the cushion member 150 is fixed onto each of the ribs 51f via the adhesive surface. Thereby, it can be prevented that each wiring 15 becomes off each of the ribs 51f at the time of the driving of the speaker device 100.

[0067] In addition, the upper surface of each wiring 15 is covered with the cushion member 150. Further, in such a state that the first housing 50 is mounted on the second housing 51, the cushion member 150 is pressed by the pressing rib 50f formed into the mesh or grid shape, provided on the inner surface of the first housing 50, on the side of each of the ribs 51e. Thereby, at the time of the driving of the speaker device 100, the movement of each wiring 15 on the side of the first housing 50 is limited, and it can be prevented that the first housing 51 and each wiring 15 collide with each other.

[0068] As described above, according to the wiring configuration of the present invention, at the time of the driving of the speaker device 100, the movement of each wiring 15 on the sides of the first housing 50 and the second housing 51 is limited. Hence, it can be securely prevented that the first housing 50 and the second hous-

ing 51 collide with each wiring 15. Thus, it can be prevented that the abnormal sound such as the flutter sound (trembling sound) occurs and the sound quality is deteriorated.

[0069] In the present invention, unlike the comparative example, there is no process of applying the adhesive onto each wiring 15 for the purpose of the reinforcement after fixing each wiring 15 to each of the ribs 51f. Therefore, in the assembly process of the speaker device 100, the waiting time for drying the adhesive is unnecessary. By the amount of time, a mounting time of the wiring 15, furthermore, the assembly time of the speaker device 100, can be shortened, as compared with the comparative example.

[Modification]

[0070] In the above embodiment, the pressing rib 50f provided on the inner surface of the first housing 50 is formed into the mesh or grid shape, and the first housing 50 is mounted on the second housing 51. In this state, each of the pressing ribs 50f presses each portion of the cushion member 150. However, in the present invention, in order to form the configuration of more stably pressing the cushion member 150, the pressing rib 50f may be formed into a plane shape, for example. Then, in such a state that the first housing 50 is mounted on the second housing 51, the pressing rib 150 may press the entire cushion member 150.

[0071] Additionally, in the above embodiment, the speaker device 100 is applied to the wagon-type vehicle 300. The speaker device 100 is provided into the luggage compartment 300b, and the acoustic wave is directly outputted into the vehicle interior 300a via the speaker device 100.

[0072] However, the present invention is not limited to this. Namely, in the present invention, as shown in FIG. 13, the speaker device 100 can be also applied to a sedan-type vehicle 301. In this case, the speaker device 100 is provided in a trunk room 301b, and a duct 300f is provided between the speaker device 100 and the vehicle interior 300a. Therefore, the acoustic wave outputted from the speaker device 100 is outputted into the vehicle interior 300a via the duct 300f.

Claims

1. A speaker device (100) comprising:

- a speaker unit (80) which includes a voice coil (8);
- a wiring (15) which is electrically connected to the voice coil; and
- a housing (51) which is provided at a position opposite to the wiring and includes plural ribs (51e) fixing the wiring,

wherein each of the ribs is provided at a position corresponding to a predetermined position of the wiring in the housing (51), and the wiring (15) is fixed to each of the ribs (51e) in a manner floating from the housing.

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2. The speaker device (100) according to claim 1, wherein each of the ribs (51e) has a recessed portion (51f) to which the wiring (15) is fixed, and wherein a bottom surface (51g) of the recessed portion is provided at a position corresponding to a predetermined height with respect to an inner surface of the housing (51) positioned flush with a lower end portion of the rib in the rib, and a part of the wiring is arranged on the bottom surface. 10 15
3. The speaker device (100) according to claim 1 or 2, further comprising a cushion member (150) having an adhesive surface, wherein the cushion member is mounted on each of the ribs (51e) via the adhesive surface, and the wiring (15) is covered with the cushion member. 20
4. The speaker device (100) according to claim 3, wherein the part of the wiring (15) arranged on the bottom surface (51g) of the recessed portion (51f) is sandwiched by side walls and the bottom surface (51g) of the recessed portion and the cushion member (150). 25 30
5. The speaker device (100) according to claim 3 or 4, further comprising an additional housing (50) mounted on the housing (51), wherein the additional housing (50) includes a pressing rib (50f) pressing the cushion member (150) on a side of the rib (51e) and a side of the wiring (15) when the additional housing (50) is mounted on the housing (51). 35
6. The speaker device (100) according to claim 5, wherein the pressing rib (50f) is formed into a mesh, grid or plane shape. 40

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FIG. 1

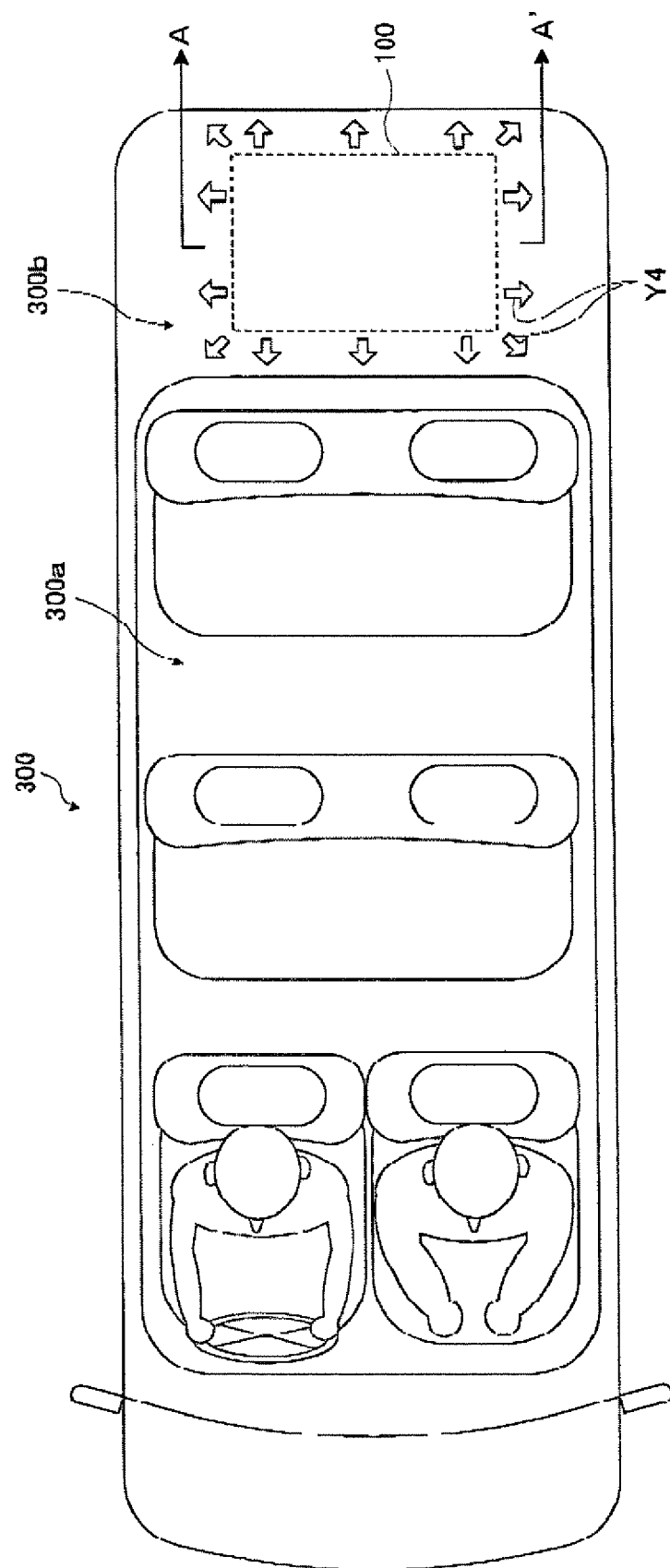


FIG. 2

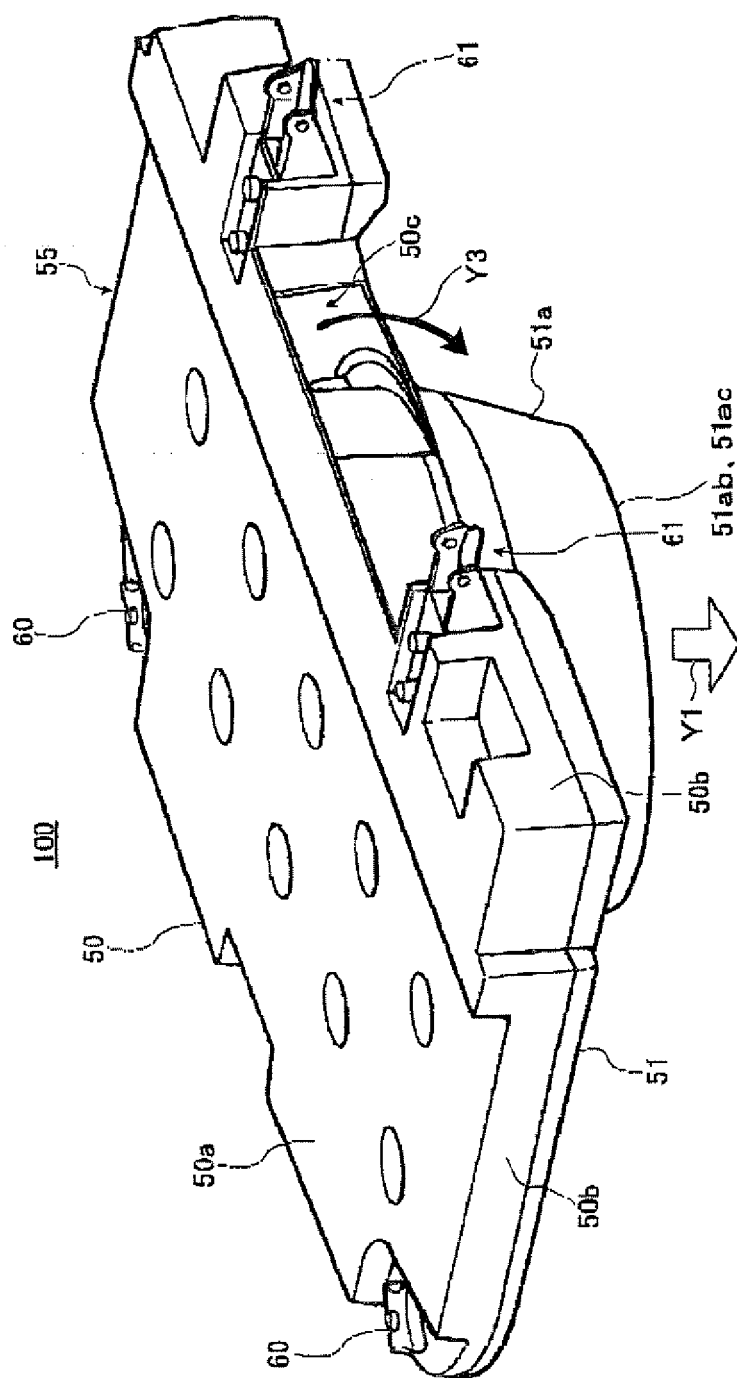


FIG. 3

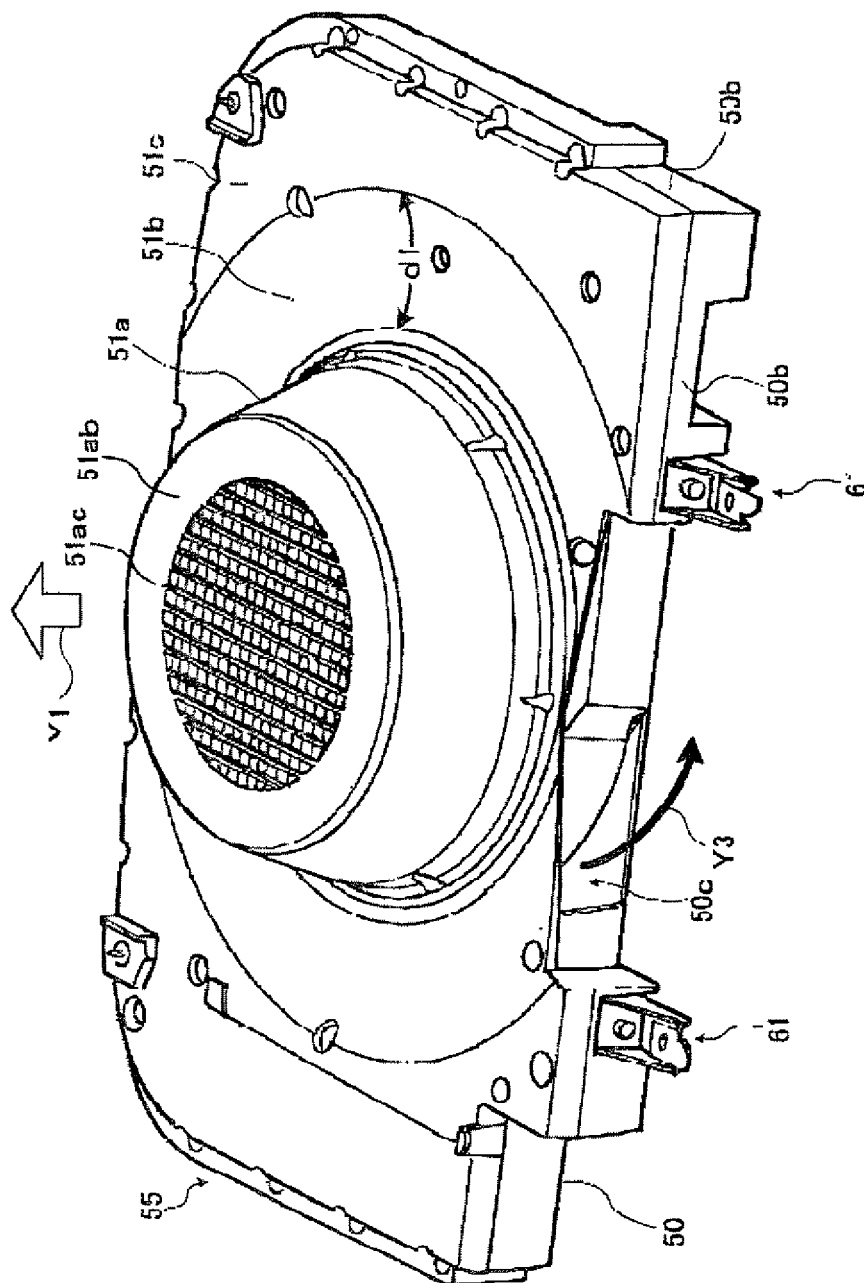


FIG. 4

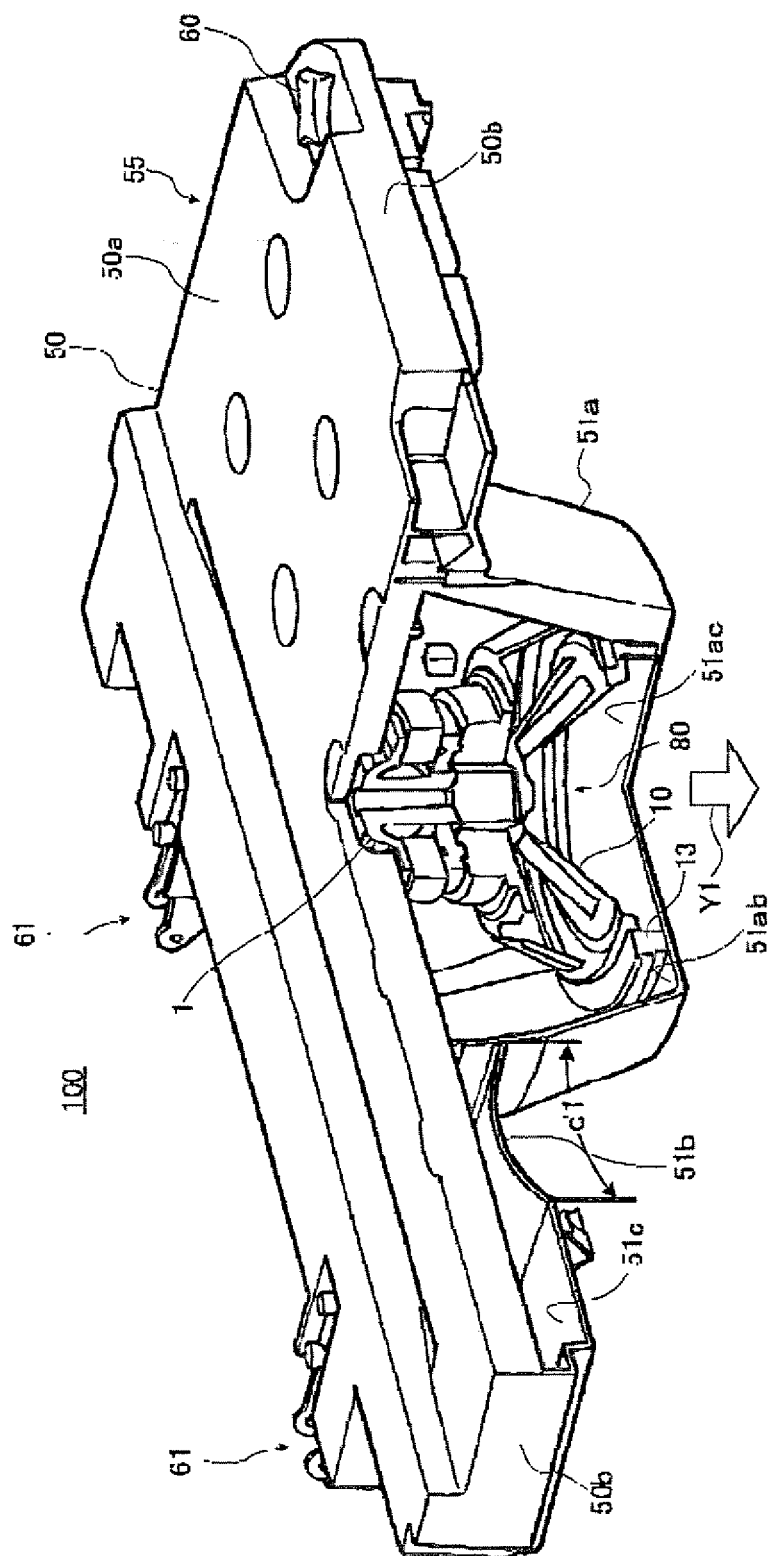


FIG. 5

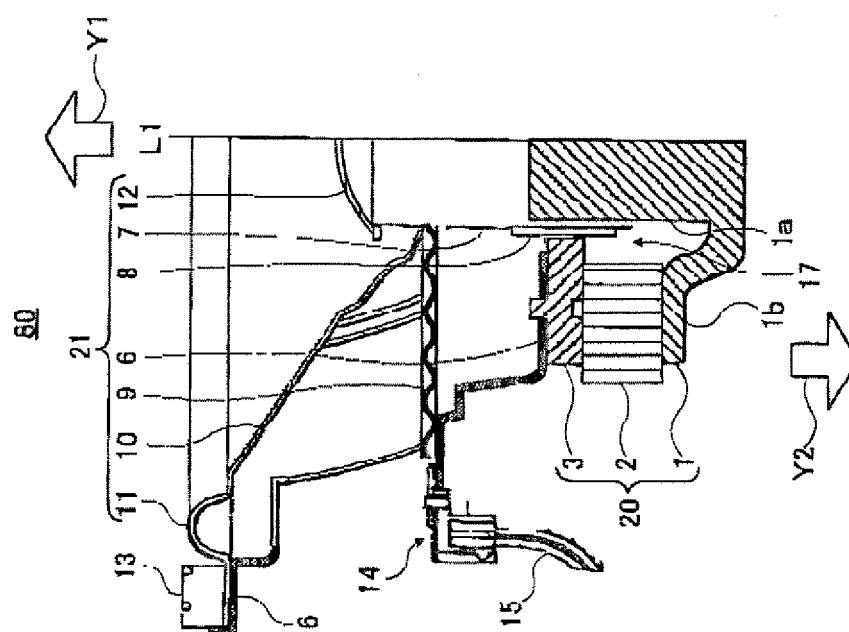


FIG. 6

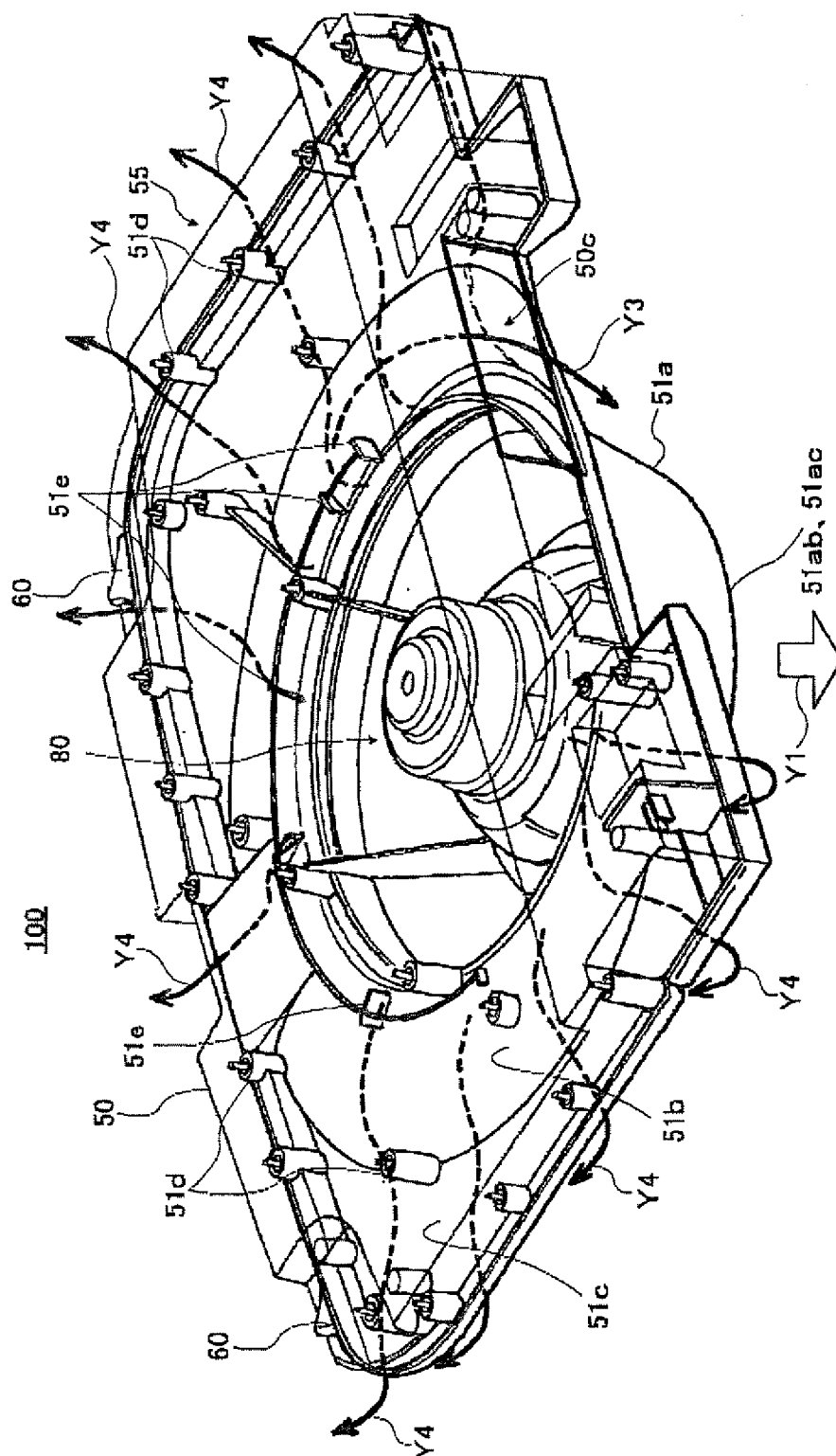


FIG. 7

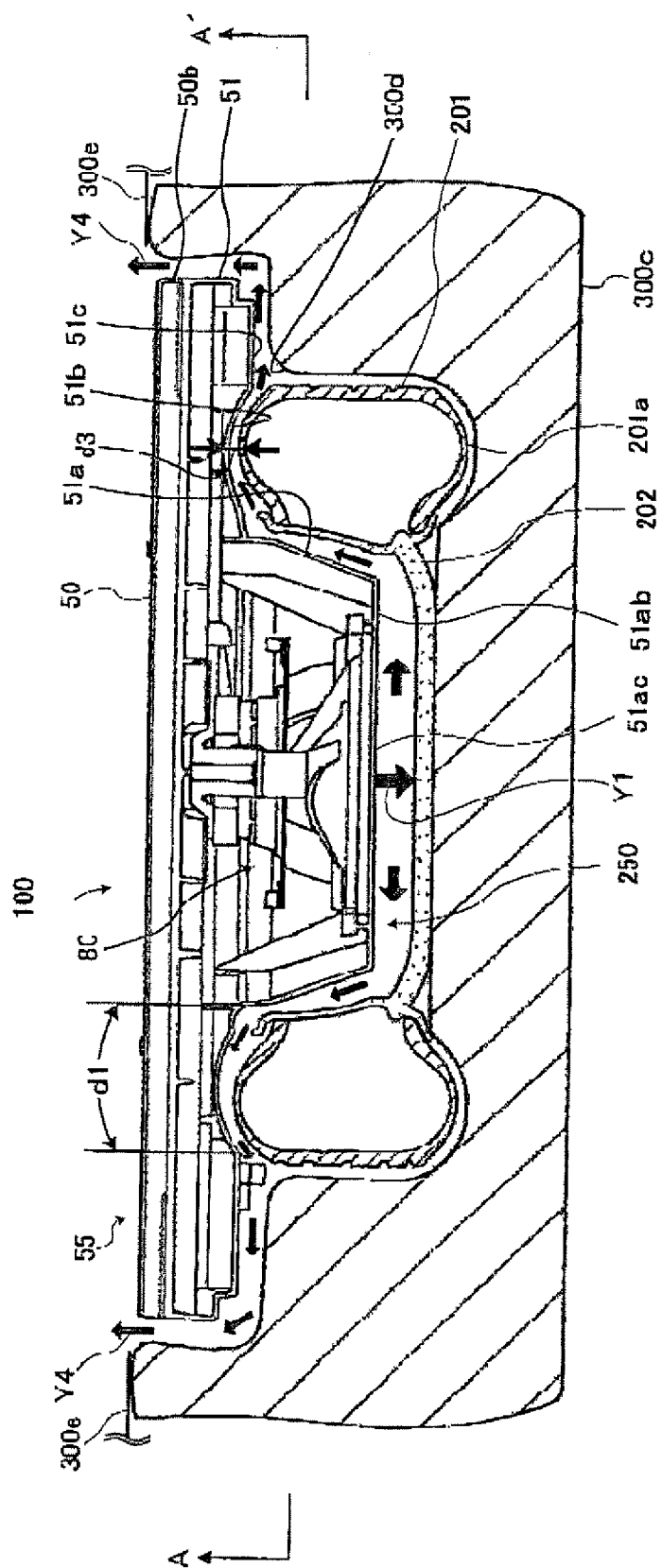


FIG. 8

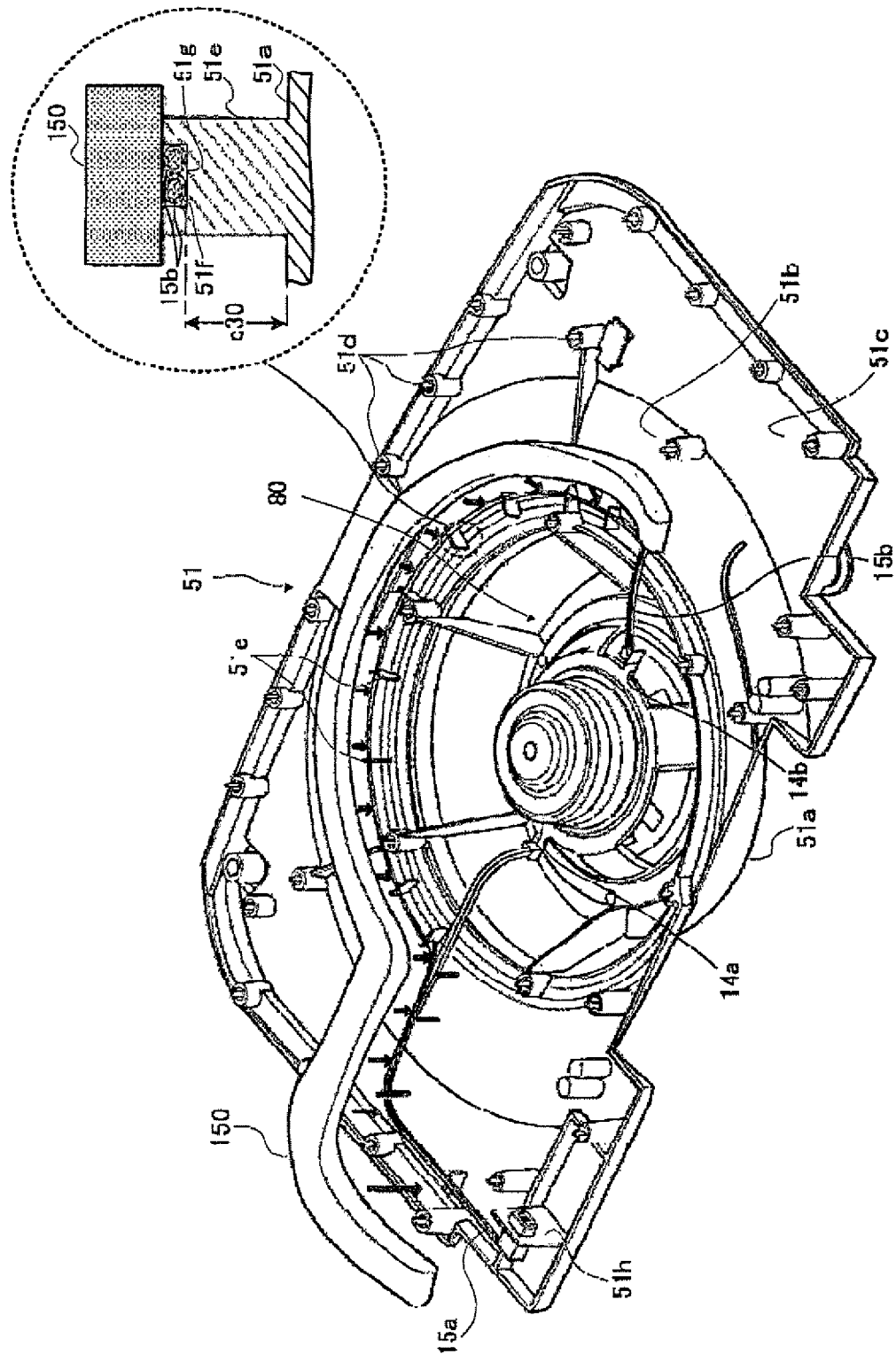


FIG. 9

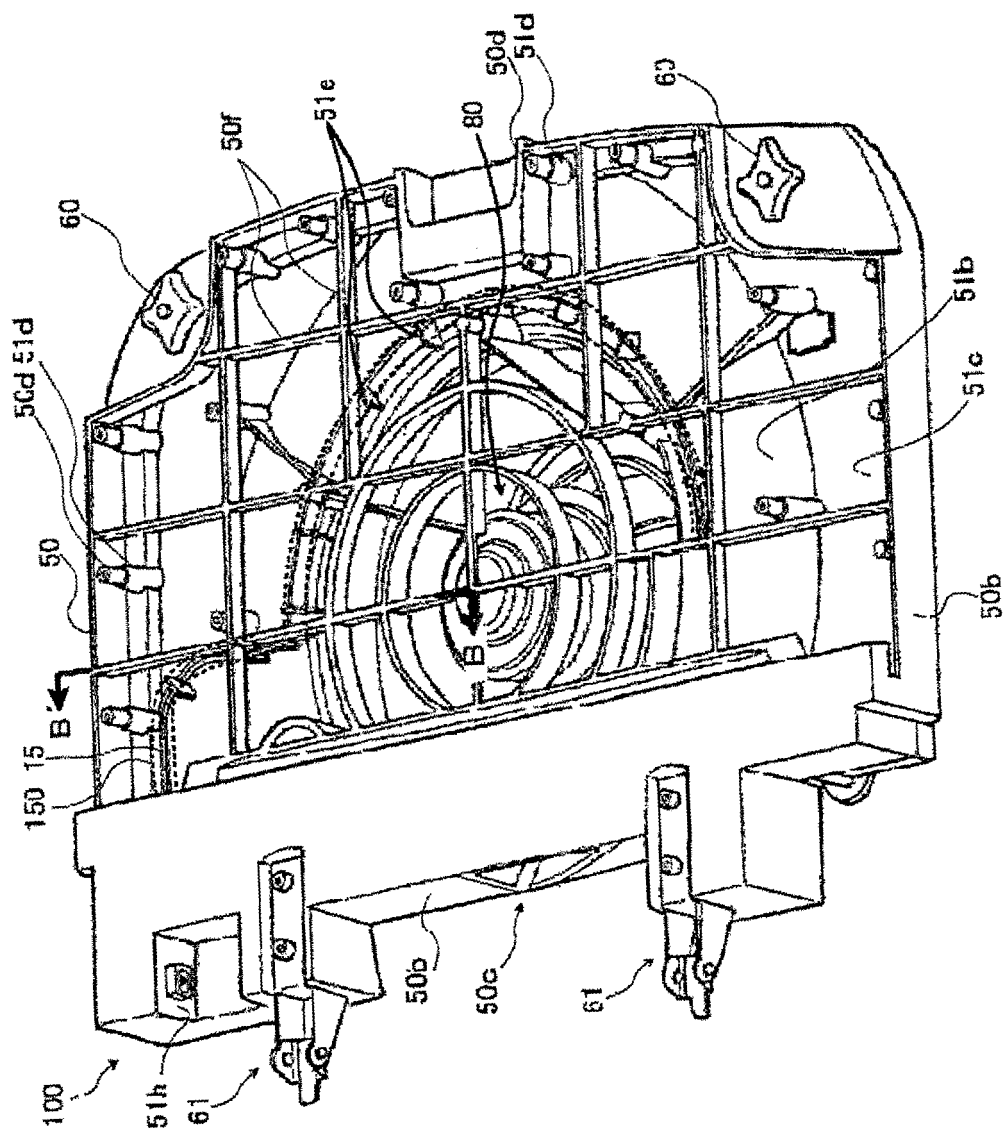


FIG. 10

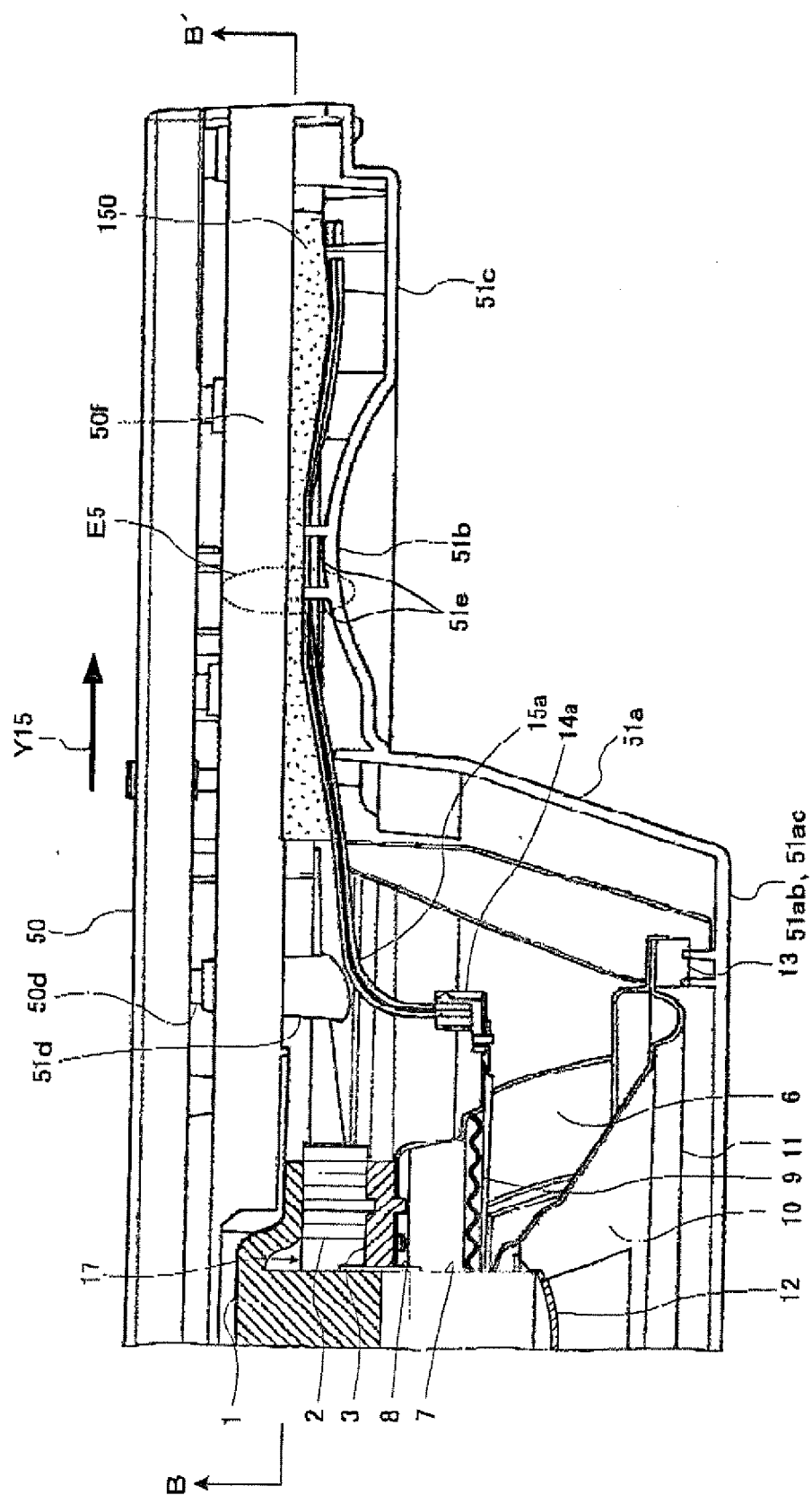


FIG. 11

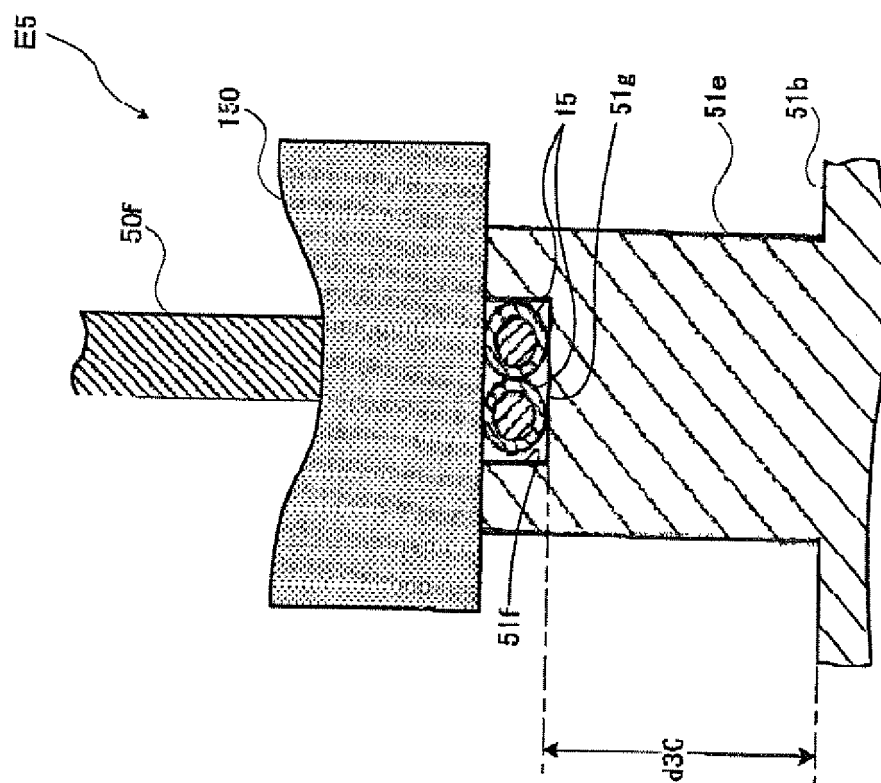


FIG. 12

<COMPARATIVE EXAMPLE>

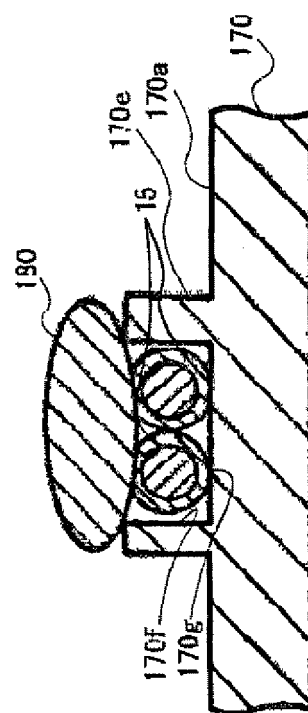
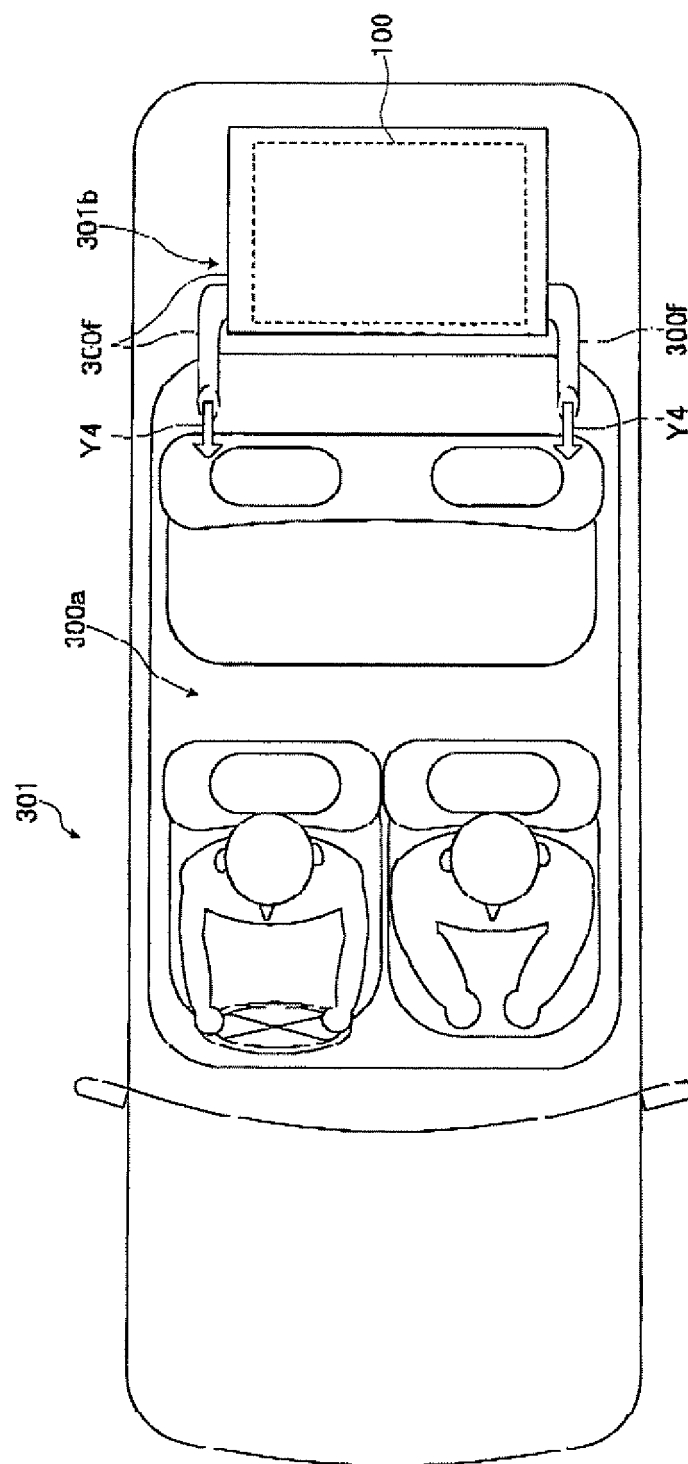


FIG. 13



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 6284487 A [0004] [0004]
- JP 11055775 A [0005]
- JP 7137581 A [0006]
- JP 2001245377 A [0006]