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

(11) **EP 3 726 848 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
14.08.2024 Bulletin 2024/33

(21) Application number: **19169139.3**

(22) Date of filing: **15.04.2019**

(51) International Patent Classification (IPC):
H04R 1/02 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
H04R 1/02; H04R 1/025; H04R 2499/13

(54) MOUNTING ARRANGEMENT FOR A LOUDSPEAKER GRILLE

MONTAGEANORDNUNG FÜR EIN LAUTSPRECHERGITTER

AGENCEMENT DE MONTAGE POUR GRILLE DE HAUT-PARLEUR

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

(43) Date of publication of application:
21.10.2020 Bulletin 2020/43

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Description

TECHNICAL FIELD

[0001] The disclosure relates to a mounting arrangement for a loudspeaker grille, in particular for a loudspeaker grille of a loudspeaker arrangement inside a vehicle.

BACKGROUND

[0002] Loudspeaker arrangements usually comprise a plurality of different components. A loudspeaker enclosure usually accommodates one or more loudspeakers. The loudspeaker enclosure may be mounted on a wall, e.g., on a panel in a passenger compartment of a vehicle. The loudspeaker enclosure often is screwed on a wall, for example. A loudspeaker grille is mounted in front of the at least one loudspeaker. Especially in the automotive industry, it is often crucial that the different parts of a loudspeaker assembly may be assembled in a fast and cost effective way. Further, consumers expect the loudspeaker arrangement to have an appealing look.

[0003] Document GB 2 379 577 A discloses a speaker installation structure, wherein locking hooks and a locking clip installed on a speaker frame are engaged with installation holes formed in the inner panel of a car door so as to fix the speaker frame to the inner panel, and the locking hooks and locking clip are disposed on the inner side of the outer periphery of annular seal members stuck to the installation surface of the speaker frame and fitted closely to the inner panel, whereby, even if water invades from an opening or installation holes of the inner panel to a speaker side, the water can be stopped by the seal members so as to prevent the water from flowing out to a cabin side, and thus the entry of water can be surely avoided.

[0004] Document US 5 904 002 A discloses a door assembly for a motor vehicle. The door assembly comprises a molded door panel having a first side and a second side. The first side of the door panel is adapted to face into a passenger compartment of the motor vehicle. The second side of the door panel supports a belt line reinforcement, a lock and catch assembly, and a window lift assembly. The door assembly is adapted for joining with a door exterior.

[0005] Document JP S60 200698 A discloses a speaker system comprising a fitting mechanism part made of an elastic material having a groove for fitting a punching net, by fixing fitings bent in L-shape on a speaker grill and by inserting with pressure the bending part of the fittings into the groove of the fitting mechanism part. Fittings are fixed on four corners of the reverse side of a net frame. Said fittings have bending parts for fitting in groove. In this example of embodiment, since a net frame is made of plastic molded part, a boss of the molded part is inserted into a hole and collapsed by heating, whereby the fittings are fixed. Instead of a boss, this may be fixed by a machine screw, and when a net frame is made of wood, a wood screw may be used.

[0006] Document EP 2 835 285 A1 discloses a member-fastening structure which permits three members to be easily fastened and fixed together, with a third member held between a first member and a second member. The fastening of three members is accomplished as follows. A meter visor has a first through-hole formed therein. A speaker ring has a projecting part formed thereon which is inserted into the first through-hole. The projecting part has a second through-hole formed therein which penetrates in a direction perpendicular to a projecting direction of the projecting part. A speaker grille is positioned on the meter visor, and the projecting part of the speaker ring is then caused to project downward through the first through-hole of the meter visor. A clip is inserted into the second through-hole of the projecting part (which projects from an underside of the meter visor) and engaged with the second through-hole of the projecting part and the underside of the meter visor.

SUMMARY

[0007] A mounting arrangement includes a frame configured to accommodate a speaker grille, at least one guiding element connected to the frame, wherein each of the at least one guiding elements comprises a pin configured to be inserted into a corresponding first counterpart that is connected to a loudspeaker enclosure, wherein, when the at least one guiding element is inserted into the corresponding first counterpart, the frame is fixated at least in a first direction or plane with respect to the loudspeaker enclosure, wherein the first direction or plane is a horizontal direction or plane, and at least one fastening element connected to the frame, wherein each of the at least one fastening elements is configured to be inserted and snap into a corresponding second counterpart that is connected to the loudspeaker enclosure, wherein, when the at least one fastening element is inserted into the corresponding second counterpart, the frame is fixated at least in a second direction or plane with respect to the loudspeaker enclosure, wherein the second direction or plane is a vertical direction or plane that is different from and perpendicular to the first direction or plane. The frame includes a front section and a rear section, wherein the front section is configured to be arranged on a front side of the loudspeaker enclosure, and the rear section is configured to be arranged on a rear side of the loudspeaker enclosure, wherein the front section and the rear section are arranged at a defined angle with respect to each other, wherein the defined angle is between 20° and 70° .

[0008] A loudspeaker enclosure configured to accommodate at least one loudspeaker includes at least one first counterpart, wherein each of the at least one first counterparts is configured to receive a corresponding guiding element that is connected to a frame and comprises a pin, wherein the frame is configured to accom-

modate a speaker grille, and wherein, when the at least one guiding element is inserted into the corresponding first counterpart, the frame is fixated at least in a first direction or plane with respect to the loudspeaker enclosure, wherein the first direction or plane is a horizontal direction or plane. The loudspeaker enclosure further includes at least one second counterpart, wherein each of the at least one second counterparts is configured to receive a corresponding fastening element that is connected to the frame, wherein, when the at least one fastening element is inserted into the corresponding second counterpart, the frame is fixated at least in a second direction or plane with respect to the loudspeaker enclosure, wherein the second direction or plane is a vertical direction or plane that is different from and perpendicular to the first direction or plane.

[0009] A loudspeaker arrangement includes a loudspeaker enclosure configured to accommodate at least one loudspeaker, a frame configured to accommodate a speaker grille, at least one guiding element connected to the frame and comprising a pin, wherein each of the at least one guiding elements is configured to be inserted into a corresponding first counterpart that is connected to the loudspeaker enclosure, wherein, when the at least one guiding element is inserted into the corresponding first counterpart, the frame is fixated at least in a first direction or plane with respect to the loudspeaker enclosure, wherein the first direction or plane is a horizontal direction or plane, and at least one fastening element connected to the frame, wherein each of the at least one fastening elements is configured to be inserted and snap into a corresponding second counterpart that is connected to the loudspeaker enclosure, wherein, when the at least one fastening element is inserted into the corresponding second counterpart, the frame is fixated at least in a second direction or plane with respect to the loudspeaker enclosure, wherein the second direction or plane is a vertical direction or plane that is different from and perpendicular to the first direction or plane. The frame includes a front section and a rear section, wherein the front section is configured to be arranged on a front side of the loudspeaker enclosure, and the rear section is configured to be arranged on a rear side of the loudspeaker enclosure, wherein the front section and the rear section are arranged at a defined angle with respect to each other, wherein the defined angle is between 20° and 70°.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The method may be better understood with reference to the following description and drawings. The components in the figures are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention. Moreover, in the figures, like referenced numerals designate corresponding parts throughout the different views.

Figure 1 schematically illustrates an example of a loudspeaker arrangement.

Figure 2 schematically illustrates a further example of a loudspeaker arrangement.

Figure 3, including Figures 3A and 3B schematically illustrates an example of a loudspeaker arrangement in an unassembled state and in an assembled state.

Figure 4 schematically illustrates a front view of an exemplary loudspeaker enclosure.

Figure 5, including Figures 5A to 5C, schematically illustrates an exemplary loudspeaker enclosure, a detailed view of an exemplary fastening element, and a detailed view of an exemplary guiding element.

Figure 6, including Figures 6A to 6C, schematically illustrates a front view, a side view and a rear view of an exemplary frame for a loudspeaker arrangement.

Figure 7 schematically illustrates a detailed view of a fastening element.

Figure 8 schematically illustrates a loudspeaker arrangement comprising a frame and a loudspeaker enclosure according to an example.

Figure 9 schematically illustrates a detailed view of a fastening element and a corresponding counterpart according to an example.

Figure 10, including Figures 10A and 10B, schematically illustrates a side view and a rear view of a loudspeaker enclosure of a loudspeaker arrangement according to another example.

Figure 11, including Figures 11A to 11C, schematically illustrates a front view, a side view and a rear view of an exemplary frame for a loudspeaker arrangement.

Figure 12 schematically illustrates an exploded view of an exemplary frame for a loudspeaker arrangement.

Figure 13 schematically illustrates an exploded view of a frame including a loudspeaker grille according to one example.

Figure 14, including Figures 14A to 14C, schematically illustrates a front view, a side view and a rear view of an exemplary frame including a loudspeaker grille.

Figure 15 schematically illustrates an exploded view of a loudspeaker enclosure including a plurality of

loudspeakers.

Figure 16 schematically illustrates a loudspeaker enclosure and corresponding frame mounted in a vehicle according to one example.

Figure 17, including Figures 17A to 17C, schematically illustrates an exemplary loudspeaker arrangement including a frame and a loudspeaker enclosure in an unassembled state.

DETAILED DESCRIPTION

[0011] Referring to Figure 1, a loudspeaker arrangement is schematically illustrated. In particular, Figure 1 schematically illustrates a side view of a loudspeaker arrangement. The loudspeaker arrangement comprises a loudspeaker enclosure 30 and a frame 10. The loudspeaker enclosure 30 is configured to accommodate at least one loudspeaker (loudspeaker not specifically illustrated in Figure 1). The frame 10 is configured to accommodate a speaker grille (speaker grille not specifically illustrated in Figure 1). When the frame 10 is connected to the loudspeaker enclosure 30 and a speaker grille is attached to the frame 10, the speaker grille 10 is arranged in front of the at least one loudspeaker arranged within the loudspeaker enclosure 30.

[0012] The frame 10 comprises a connection element 20 that is configured to connect the frame 10 to the loudspeaker enclosure 30. The loudspeaker enclosure 30 may be mounted to a wall 40, for example. According to one example, the wall 40 is a panel in a passenger compartment of a vehicle. For example, the loudspeaker enclosure 30 may be screwed to the wall 40. However, the loudspeaker enclosure 30 may also be connected to the wall 40 in any other suitable way.

[0013] The loudspeaker enclosure 30 may comprise a counterpart 22 for the connection element 20. That is, when connecting the frame 10 to the loudspeaker enclosure 30, the connection element 20 may be inserted into the counterpart 22, or may be connected to the counterpart 22 in any other suitable way. This is schematically illustrated in Figure 2. In Figures 1 and 2, the different elements are illustrated in an unassembled state.

[0014] Now referring to Figure 3, one example of a loudspeaker arrangement is schematically illustrated. A guiding element 202 is connected to the frame 10. The guiding element 202 is configured to be inserted into a corresponding first counterpart 222, which is connected to the loudspeaker enclosure 30. As is exemplarily illustrated with an arrow in Figure 3A, the guiding element 202 may be inserted into the corresponding first counterpart 222 in a vertical direction y. This, however, is only an example. The guiding element 202 does not necessarily have to be inserted into the corresponding counterpart 222 vertically. It is also possible that the guiding element 202 be inserted into the corresponding first counterpart 222 in a direction that is beveled with respect to the vertical direction y. Figure 3B illustrates the guiding element 202 that is inserted into the corresponding counterpart 222.

[0015] The guiding element 202 may not be permanently coupled to the first counterpart 222. It may be possible to disconnect the guiding element 202 from the first counterpart 222 by moving the guiding element 202 upwards in the vertical direction y. However, when the guiding element 202 is inserted into the first counterpart 222, the frame 10 is fixated with respect to the loudspeaker enclosure 30 in at least one first (e.g., horizontal) direction x. Generally, the frame 10 may be fixated with respect to the loudspeaker enclosure 30 in a horizontal plane, for example.

[0016] Further, a fastening element 204 is connected to the frame 10 which is arranged distant to the guiding element 202. The fastening element 204 is configured to be inserted into a corresponding second counterpart 224, which is connected to the loudspeaker enclosure 30. As is exemplarily illustrated with an arrow in Figure 3A, the fastening element 202 may be inserted into the corresponding second counterpart 224 in a horizontal direction x. This, however, is only an example. The fastening element 204 does not necessarily have to be inserted into the corresponding second counterpart 224 horizontally. It is also possible that the fastening element 204 be inserted into the corresponding second counterpart 224 in a direction that is beveled with respect to the horizontal direction x. Figure 3B illustrates the fastening element 204 that is inserted into the corresponding second counterpart 224. According to one example, the fastening element 204 may snap into the corresponding second counterpart 224 (e.g., snap-in or snap mechanism).

[0017] The fastening element 204 may not be permanently coupled to the second counterpart 224. It may be possible to disconnect the fastening element 204 from the second counterpart 224, e.g., by moving the fastening element 204 in the horizontal direction x away from the loudspeaker enclosure 30. However, when the fastening element 204 is inserted into the second counterpart 224, the frame 10 is fixated with respect to the loudspeaker enclosure 30 in at least one second (e.g., vertical) direction y. Generally, the frame 10 may be fixated with respect to the loudspeaker enclosure 30 in a vertical plane, for example. The fastening element 204 fixates the frame 10 with respect to the loudspeaker enclosure 30 in at least one second direction that is different from the first direction.

[0018] Therefore, after inserting the guiding element 202 into the corresponding first counterpart 222 and inserting the fastening element 204 into the corresponding second counterpart 224, the frame 10 is securely fastened to the loudspeaker enclosure 30. The guiding element 202, the fastening element 204 as well as the first counterpart 222 and the second counterpart 224 may be arranged on the frame 10 and the loudspeaker enclosure, respectively, such that they are no longer visible after mounting the frame 10 to the loudspeaker enclosure 30.

Further, the frame 10 may completely cover the loudspeaker enclosure 30 such that the loudspeaker enclosure 30 and any connection mechanism that is used to mount the loudspeaker enclosure 30 on a wall 40 are no longer visible. The loudspeaker arrangement, therefore, has a very appealing look after mounting the frame 10 on the loudspeaker enclosure 30.

[0019] Figure 3 schematically illustrates a frame 10 with only one guiding element 202 and only one fastening element 204. This, however, is only an example. The arrangement may also comprise more than one guiding element 202 and more than one fastening element 204. The number of first counterparts 222 may correspond to the number of guiding elements 202, and the number of second counterparts 224 may correspond to the number of fastening elements 224.

[0020] Now referring to Figure 4, a front view of an exemplary loudspeaker enclosure is illustrated. The loudspeaker enclosure 30 comprises a casing 301. In the example of Figure 4, a first loudspeaker 50 and a second loudspeaker 52 are arranged inside the casing 301. The first loudspeaker 50 may be a mid-range speaker, and the second loudspeaker 52 may be a tweeter, for example. This, however, is only an example. Generally, at least one loudspeaker may be arranged inside the casing 301. The at least one loudspeaker may be any kind of loudspeaker such as a mid-range speaker, full-range speaker, woofer, subwoofer, or tweeter, for example. Any other types of loudspeakers are also possible. The casing 301 may comprise at least one opening. Each of the at least one loudspeakers may be arranged in one of the openings such that a first side of the loudspeaker fasces an inside of the casing 301, and a second side of the loudspeaker faces an outside of the casing 301. According to one example, the first loudspeaker 50 may be mounted on the casing 301 by means of screws 600. This, however, is only an example. The first loudspeaker 50 and any other additional loudspeakers may be mounted on the casing 301 in any suitable way.

[0021] The loudspeaker enclosure 30 illustrated in Figure 4 comprises two first counterparts 222. The first counterparts 222 are arranged in an upper section of the casing 301. The loudspeaker enclosure 30 further comprises one second counterpart 224 arranged in a lower section on the front of the loudspeaker enclosure 30, distant to the first counterparts 222. "Upper section" and "lower section" in this context, however, only refer to the positions with regard to the loudspeaker enclosure 30 as illustrated, not with regard to the ground surface. When mounted in a vehicle, for example, the loudspeaker enclosure 30 illustrated in Figure 4 may be turned or rotated in any suitable way to fit in the interior of the vehicle.

[0022] Figure 5A schematically illustrates a front view of a loudspeaker enclosure 30 without the loudspeakers 50, 52 arranged inside the casing 301. However, Figure 5A does not illustrate a complete loudspeaker enclosure 30 or casing 301, but merely a front baffle of the loudspeaker enclosure 30 (see, e.g., Figure 15). Any other parts of the loudspeaker enclosure 30 (e.g., a rear panel 34 or a rear enclosure 36, see Figure 15) are not specifically illustrated in Figure 5A. The loudspeaker enclosure 30 may generally be shaped to fit in the interior of a vehicle. Generally, however, the loudspeaker enclosure 30 may have any other suitable shape. The loudspeaker enclosure 30 illustrated in Figure 4 may be mounted on the righthand side of a passenger compartment, and the loudspeaker enclosure 30 (front baffle) illustrated in Figure 5A may be mounted on the left-hand side of a passenger compartment, for example.

[0023] As is schematically illustrated in the section view D- D in Figure 5B, the fastening element 204 may snap into the second counterpart 224 when arranged in its final mounting position. Figure 5B illustrates the fastening element 204 before snapping into the second counterpart 224. The direction of movement of the fastening element 204 is illustrated with an arrow in Figure 5B. The second counterpart 224 may comprise a recess that the fastening element 204 may snap into.

[0024] Now referring to Figure 5C, an exemplary guiding element 202 and corresponding first counterpart 222 are illustrated. The first counterpart 222 in the example of Figure 5C comprises a sleeve. That is, the first counterpart 222 may comprise a hollow tubular part or bushing which allows the guiding element 202 to be inserted into the first counterpart 222. The guiding element 202 may comprise a pin, for example, which fits into the first counterpart 222. That is, a diameter d1 of the pin may correspond to or may be slightly smaller than a diameter d2 of the inside of the first counterpart 222. The guiding element 202 may have a rounded cross-section, as is exemplarily illustrated in Figure 5C. Any other suitable cross-sections such as oval, rectangular, square, or diamond shaped, for example, are also possible.

[0025] Now referring to Figure 6, a frame 10 is exemplarily illustrated, wherein Figure 6A illustrates a front view, Figure 6B illustrates a side view, and Figure 6C illustrates a rear view of the frame 10. The at least one guiding element 202 may be arranged on a rear side of the frame 10. In Figure 6 two guiding elements 202 are exemplarily illustrated. As can be seen in Figure 6B, the guiding elements 202 may form an angle α with respect to the front face of the frame 10. This angle α may be between 5° and 60°, for example.

[0026] The frame 10 may comprise a first opening 54 and a second opening 56. When the frame 10 is connected to a loudspeaker enclosure 30, the first opening 54 may be arranged in front of a first loudspeaker (e.g., first loudspeaker 50 as illustrated in Figure 4), and the second opening 56 may be arranged in front of a second loudspeaker 52 (e.g., second loudspeaker 52 as illustrated in Figure 4). This allows sound produced by the loudspeakers to freely pass the frame 10. As will be described in more detail further below, a speaker grille may be arranged in front of the openings 54, 56, for example. The speaker grille may be configured to protect the loudspeakers and any other audio components while at the

same time allowing the sound produced by the loudspeakers to clearly pass. The number of openings in the frame 10 generally may correspond to the number of loudspeakers in the loudspeaker enclosure 30.

[0027] Now referring to the section view C- C of Figure 7 (concerning section view C - C, see also Figure 6C), a fastening element 204 is illustrated in further detail. The fastening element 204 may comprise a rigid flap, for example, that is mounted to the frame 10. For example, the fastening element 204 may be glued or welded to the frame 10. It is, however, also possible that the frame 10 and the fastening element 204 are integrally formed as a single piece.

[0028] Now referring to Figure 8, a side view of a frame 10 and one part of a loudspeaker enclosure 30 is schematically illustrated. In Figure 8, a part of a loudspeaker enclosure 30 is illustrated, which may form a front panel or front face of the loudspeaker enclosure 30. A rear enclosure and/or rear gasket are not specifically illustrated in Figure 8.The frame 10 illustrated in Figure 8 corresponds to the frame 10 as illustrated in Figure 6. Arrows in Figure 8 indicate the directions in which the guiding elements 202 are inserted into the first counterparts (not visible in Figure 8), and in which a fastening element 204 is inserted into a second counterpart 224.

[0029] Each of the second counterparts 224 may comprise a guiding section 2242 and a recess 2244, for example. This is schematically illustrated in the enlarged detail view A of Figure 9 (see also Figure 5A for detail view A). A fastening element 204 may be inserted into the guiding section 2242 first. The guiding section 2242 may be funnel-shaped and may taper towards the recess 2244. When moving the fastening element 204 through the guiding element 2242, it is guided towards the recess 2244. This allows for certain tolerances when inserting the fasting element 204 into the second counterpart 224. This is indicated in short arrows in Figure 9. When mounting the frame 10 to the loudspeaker enclosure 30, it is therefore not necessary to exactly position the fasting element 204 with respect to the recess 2244 of the corresponding second counterpart 224. A certain misalignment is permissible, as the mouth formed by the guiding section 2242 has larger dimensions than the recess 2244 and also has lager dimensions than the fastening element 204.

[0030] Now referring to Figure 10, an example of a loudspeaker enclosure 30 is exemplarily illustrated, with Figure 10A illustrating a side view and Figure 10B illustrating a rear view of the loudspeaker enclosure 30. Loudspeakers that are arranged inside the loudspeaker enclosure 30 are not freely visible in Figure 10 as they are concealed behind the parts of the loudspeaker enclosure 30. The loudspeaker enclosure 30 may comprise further openings 70. According to one example, electrical connections 80 that are needed to connect the loudspeakers to a vehicle battery, for example, may pass through such further openings 70. One or more first counterparts 222 may be arranged at an upper end of the loudspeaker enclosure. Each of the first counterparts 222 may be beveled with respect to a front panel of the loudspeaker enclosure 30 at a respective angle β. The front panel of the loudspeaker enclosure 30 may be arranged parallel to a vertical axis, for example. This, however, is only an example. The loudspeaker enclosure 30 illustrated in Figure 10 may generally be rotated in any suitable way to suitably arrange it in a passenger compartment of a vehicle.

[0031] Now referring to Figure 11, an exemplary frame 10 is illustrated, with Figure 11A illustrating a front view, Figure 11B illustrating a side view, and Figure 11C illustrating a rear view of the frame 10. The frame 10 may comprise a front section 12 and a rear section 14. The front section 12 and the rear section 14 are arranged at a defined angle γ with respect to each other. The defined angle γ may be between 20° and 70°, for example. The front section 12 and the rear section 14 may be connected to each other by means of a bent connecting element 16. In an assembled state, the front section 12 may cover a front side of a loudspeaker enclosure 30, and the rear section 14 may at least partly cover a rear side of a loudspeaker enclosure 30. This is exemplarily illustrated in Figure 17, wherein Figure 17A illustrates a front view, Figure 17B illustrates a side view, and Figure 17C illustrates a rear view of a frame 10 and a loudspeaker enclosure 30 in an unassembled state. A direction in which the frame 10 is mounted to the loudspeaker enclosure 30 is illustrated by bold arrows in Figure 17.

[0032] A first fastening element 204 may be connected to the front section 12, and a second fastening element 204 may be connected to the rear section 14. The first fastening element 204 is not specifically illustrated in Figure 11. At least one guiding element 202 may be connected to the bent connecting element 16. The guiding elements 202 may be arranged on a side of the bent connecting element 16 (e.g., inside of bent connecting element) which faces the loudspeaker enclosure 30, when the frame 10 is mounted to the loudspeaker enclosure 30. Therefore, no guiding elements 202 are visible in the views illustrated in Figure 11 as they are shielded by the other components of the frame 10.

[0033] In the example illustrated in Figure 11, the front section 12 of the frame 10 comprises a single opening. Therefore, in the view of Figure 11A it is possible to see the rear section 16 through the opening. As has been described above, however, it is also possible that the front section 12 of the frame comprises more than one opening.

[0034] According to another example, as is schematically illustrated in Figure 12, a cover 18 may be mounted to the frame 10. The cover 18 may partly cover the opening of the frame 10 and may comprise any number of openings 54, 56, wherein the number of openings 54, 56 in the cover 18 may correspond to the number of loudspeakers that are arranged in the corresponding loudspeaker enclosure 30 (loudspeaker enclosure 30 not illustrated in Figure 12). As is exemplarily illustrated in

Figure 12, it is also possible that one or more guiding elements 202 be mounted on or integrally formed by the cover 18. In this case, the frame 10 itself may not comprise any further guiding element 202. The cover 18 may be regarded as being part of the frame 10, even if the cover is formed as a separate part and is subsequently mounted on the frame 10. The frame 10 may be mounted on a loudspeaker enclosure 30 after mounting the cover 18 on the frame 10, for example.

[0035] Figure 13 schematically illustrates an exploded view of an exemplary frame 10 and further components that may be mounted on the frame 10. As has been described with respect to Figure 12 above, a cover 18 may be mounted on the frame 10, the cover 18 comprising one or more guiding elements 202. A loudspeaker grille 184 may be mounted on the cover 18 and to the frame 10. When the frame 10 is mounted on a loudspeaker enclosure 30, the grille 184 that is mounted on the frame 10 may cover the at least one loudspeaker arranged in the loudspeaker enclosure 30. Optionally, a layer of scrim material, fabric, or cloth 182 may be arranged between the loudspeaker grille 184 and the cover 18.

[0036] In the examples illustrated in Figures 11, 12 and 13, the frame 10 together with one or more of the additional components, e.g., cover 18 and loudspeaker grille 184, may also be referred to as grille assembly, front enclosure or upper enclosure, for example.

[0037] According to one example, the loudspeaker grille 184 may comprise stainless steel. The cover 18 may comprise the material PC-GF 10 (material number 2311), for example. PC-GF 10 is a polycarbonate injection molding type comprised of 10% glass fiber. The frame 10 may be comprised of carbon fiber, for example. Any other suitable materials, however, are also possible. For example, the different elements may be comprised of any suitable carbon, metallic or plastic material.

[0038] According to one example, the loudspeaker grille 184 may comprise a plurality of projections 902. In an unassembled state, the projections 902 may extend perpendicular to a back side of the loudspeaker grille 184. When mounting the loudspeaker grille 184 on the cover 18 or the frame 10, the projections 902 may be inserted into corresponding holes 904 in the cover 18 or in the frame 10. Subsequently, the projections 902 may be bent in order to fixate the loudspeaker grille 184 to the cover 18 or to the frame 10. The projections 902 may be bent by 90°, for example, in order to prevent them from sliding back out of the respective holes 904. After bending the projections 902 by 90°, they may be essentially parallel to the back side of the loudspeaker grille 184.

[0039] Now referring to Figure 14, the frame 10 and further elements 18, 182, 184 are illustrated in an assembled state, with Figure 14A illustrating a front view, Figure 14B illustrating a side view and Figure 14C illustrating a rear view. The frame 10 illustrated in Figure 14 is similar to the frame of Figure 11, however, with the loudspeaker grille 184 mounted on the frame 10. A cover 18 and an optional layer of scrim material, fabric, or cloth 182 are not visible in Figure 14, as they are covered by other elements.

[0040] Now referring to Figure 15, an exploded view of an exemplary loudspeaker enclosure 30 and two loudspeakers 50, 52 as well as electrical connections 80 is schematically illustrated. The loudspeaker enclosure 30 may comprise a plurality of separate components. For example, the loudspeaker enclosure 30 may comprise a rear gasket 32, a rear panel 34, and a rear enclosure 36, forming a main enclosure in an assembled state. A first and a second loudspeaker 50, 52 may be arranged in this main enclosure. For example, the loudspeakers 50, 52 may be mounted on a front baffle 38. The front baffle 38 may be mounted on the main enclosure and may form a front panel of the main enclosure. The front baffle 38 may comprise openings for receiving the loudspeakers. One or more loudspeakers 50, 52 may be fixated to the front baffle 38 by means of screws 88, for example. It is also possible to fixate the rear panel to the rear enclosure 36 by means of screws 86, for example. Electrical connections 80 may extend through openings in the rear enclosure 36, as has been described with respect to Figure 10 above.

[0041] Figure 16 exemplarily illustrates a loudspeaker arrangement in a passenger compartment of a vehicle. Only a small detail of the interior of a vehicle is schematically illustrated in Figure 16. The general form of the loudspeaker enclosure 30 and the frame 10 may be adapted to the shape of the interior equipment. The loudspeaker enclosure 30 may be assembled and all necessary components (e.g., loudspeakers 50, 52) may be arranged in the loudspeaker enclosure 30. The pre-assembled loudspeaker enclosure 30 may then the mounted inside the vehicle. As has been described above, the loudspeaker enclosure 30 may be mounted on a panel of the passenger compartment by means of screws, for example (screws not specifically illustrated in Figure 16).

[0042] The frame 10 may also be pre-assembled if the separate elements are not formed integrally. According to one example, the loudspeaker grille 184 may be formed integrally with the frame 10 or with a cover 18. The frame 10 may then be mounted on the loudspeaker enclosure 30 in a very easy and fast way. The frame 10 may be held in one hand by a technician assembling the frame 10 to the loudspeaker enclosure 30. The frame 10 may be placed on the loudspeaker enclosure 30 such that each of the at least one guiding element 202 is aligned with the corresponding first counterpart 222 of the loudspeaker enclosure 30. The guiding elements 202 may then be inserted into the corresponding first counterparts 222 in a direction schematically illustrated by a bold arrow in Figure 16. When the guiding elements 202 are aligned with the corresponding first counterparts 222, each of the at least one fastening element 204 is automatically aligned with the corresponding second counterpart 224. As has been described with respect to Figure 9 above, certain tolerances are allowed, as the fastening

elements 204 may be first aligned with guiding sections 2242 of the second counterparts 224. When the guiding elements 202 are inserted into the first counterparts 222, the fastening elements 204 are, at the same time, inserted into the second counterparts 224 until they snap into their final position in the recesses 2244.

[0043] Once the frame 10 is mounted on the loudspeaker enclosure 30, a user is not able to perceive any fastening means. That is, the loudspeaker arrangement has a very pleasant appearance. Generally, the user is not able to remove the frame 10 from the loudspeaker enclosure 30 easily. Special tools may be necessary to remove the fastening elements 204 from their final resting positions in the recesses 2244 of the second counterparts 224. A user, therefore, cannot unintentionally damage the loudspeaker arrangement without deliberately applying force.

Claims

1. A mounting arrangement comprising:

a frame (10) configured to accommodate a speaker grille (184),
at least one guiding element (202) connected to the frame (10), wherein each of the at least one guiding element (202) comprises a pin configured to be inserted into a corresponding first counterpart (222) that is connected to a loudspeaker enclosure (30), wherein, when the at least one guiding element (202) is inserted into the corresponding first counterpart (222), the frame (10) is fixated at least in a first direction or plane with respect to the loudspeaker enclosure (30), wherein the first direction or plane is a horizontal direction or plane, and
at least one fastening element (204) connected to the frame (10), wherein each of the at least one fastening element (204) is configured to be inserted and snap into a corresponding second counterpart (224) that is connected to the loudspeaker enclosure (30), wherein, when the at least one fastening element (204) is inserted into the corresponding second counterpart (224), the frame (10) is fixated at least in a second direction or plane with respect to the loudspeaker enclosure (30), wherein the second direction or plane is a vertical direction or plane that is different from and perpendicular to the first direction or plane, wherein
the frame (10) comprises a front section (12) and a rear section (14), wherein the front section (12) is configured to be arranged on a front side of the loudspeaker enclosure (30), and the rear section (14) is configured to be arranged on a rear side of the loudspeaker enclosure (30), and
characterised in that
the front section (12) and the rear section (14) are arranged at a defined angle (γ) with respect to each other, wherein the defined angle (γ) is between 20° and 70°.

2. The mounting arrangement of claim 1, wherein

each of the at least one guiding element (202) comprises a pin, and
each of the at least one first counterpart (222) comprises a sleeve.

3. The mounting arrangement of claim 1 or 2, wherein

each of the at least one fastening element (204) comprises a rigid flap, and
each of the at least one second counterpart (224) comprises a slot or groove.

4. The mounting arrangement of any of claims 1 to 3, comprising exactly two guiding elements (202).

5. The mounting arrangement of any of claims 1 to 4, wherein a first fastening element (204) is attached to the front section (12) of the frame (10), and a second fastening element (204) is attached to the rear section (14) of the frame (10).

6. The mounting arrangement of any claims 1 to 5, wherein front section (12) of the frame (10) and the rear section (14) of the frame (10) are connected to each other by means of a bent connecting element (16), and wherein the at least one guiding element (202) is connected to the bent connecting element (16) and arranged between the front section (12) and the rear section (14).

7. The mounting arrangement of any of the preceding claims, further comprising a speaker grille (184), wherein

the frame (10) comprises at least one opening; and
the speaker grille (184) is configured to cover the at least one opening and to let sound clearly pass through the speaker grille (184).

8. The mounting arrangement of any of the preceding claims, wherein each of the at least one guiding element (202) is beveled at a defined angle (α) with respect to a front face of the frame (10), and wherein the defined angle (α) is between 5° and 60°.

9. A loudspeaker arrangement comprising:

a loudspeaker enclosure (30) configured to accommodate at least one loudspeaker (50, 52),
a frame (10) configured to accommodate a

speaker grille (184),
at least one guiding element (202) connected to the frame (10) and comprising a pin, wherein each of the at least one guiding element (202) is configured to be inserted into a corresponding first counterpart (222) that is connected to the loudspeaker enclosure (30), wherein, when the at least one guiding element (202) is inserted into the corresponding first counterpart (222), the frame (10) is fixated at least in a first direction or plane with respect to the loudspeaker enclosure (30), wherein the first direction or plane is a horizontal direction or plane, and
at least one fastening element (204) connected to the frame (10), wherein each of the at least one fastening element (204) is configured to be inserted and snap into a corresponding second counterpart (224) that is connected to the loudspeaker enclosure (30), wherein, when the at least one fastening element (204) is inserted into the corresponding second counterpart (224), the frame (10) is fixated at least in a second direction or plane with respect to the loudspeaker enclosure (30), wherein the second direction or plane is a vertical direction or plane that is different from and perpendicular to the first direction or plane, wherein
the frame (10) comprises a front section (12) and a rear section (14), wherein the front section (12) is configured to be arranged on a front side of the loudspeaker enclosure (30), and the rear section (14) is configured to be arranged on a rear side of the loudspeaker enclosure (30), and **characterised in that**
the front section (12) and the rear section (14) are arranged at a defined angle (γ) with respect to each other, wherein the defined angle (γ) is between 20° and 70°.

10. The loudspeaker arrangement of claim 9, wherein

each of the at least one guiding element (202) comprises a pin, and
each of the at least one first counterpart (222) comprises a sleeve.

11. The loudspeaker arrangement of claim 9 or 10, wherein

each of the at least one fastening element (204) comprises a rigid flap, and
each of the at least one second counterpart (224) comprises a slot or groove

12. The loudspeaker enclosure of claim 11, wherein each of the at least one second counterpart (224) further comprises a guiding section (2242), wherein each guiding section (2242) is funnel-shaped and tapers towards a recess (2244) such that a fastening element (204) that is inserted into the guiding section (2242) is guided through the guiding section (2242) towards the recess (2244).

Patentansprüche

1. Montageanordnung, umfassend:

einen Rahmen (10), der zur Aufnahme eines Lautsprechergitters (184) konfiguriert ist,
mindestens ein Führungselement (202), das mit dem Rahmen (10) verbunden ist, wobei jedes des mindestens einen Führungselements (202) einen Stift umfasst, der so konfiguriert ist, dass er in ein entsprechendes erstes Gegenstück (222) eingeführt werden kann, das mit einem Lautsprechergehäuse (30) verbunden ist, wobei, wenn das mindestens eine Führungselement (202) in das entsprechende erste Gegenstück (222) eingeführt wird, der Rahmen (10) mindestens in einer ersten Richtung oder Ebene bezogen auf das Lautsprechergehäuse (30) fixiert wird, wobei die erste Richtung oder Ebene eine horizontale Richtung oder Ebene ist, und
mindestens ein Befestigungselement (204), das mit dem Rahmen (10) verbunden ist, wobei jedes des mindestens einen Befestigungselements (204) so konfiguriert ist, dass es in ein entsprechendes zweites Gegenstück (224), das mit dem Lautsprechergehäuse (30) verbunden ist, eingesetzt wird und einrastet, wobei, wenn das mindestens eine Befestigungselement (204) in das entsprechende zweite Gegenstück (224) eingeführt wird, der Rahmen (10) mindestens in einer zweiten Richtung oder Ebene bezogen auf das Lautsprechergehäuse (30) fixiert wird, wobei die zweite Richtung oder Ebene eine vertikale Richtung oder Ebene ist, die sich von der ersten Richtung oder Ebene unterscheidet und senkrecht zu dieser ist, wobei
der Rahmen (10) einen vorderen Abschnitt (12) und einen hinteren Abschnitt (14) umfasst, wobei der vordere Abschnitt (12) so konfiguriert ist, dass er an einer Vorderseite des Lautsprechergehäuses (30) angeordnet wird, und der hintere Abschnitt (14) so konfiguriert ist, dass er an einer Rückseite des Lautsprechergehäuses (30) angeordnet wird, und **dadurch gekennzeichnet, dass**
der vordere Abschnitt (12) und der hintere Abschnitt (14) in einem bestimmten Winkel (γ) zueinander angeordnet sind, wobei der bestimmte Winkel (γ) zwischen 20° und 70° liegt.

2. Montageanordnung nach Anspruch 1, wobei

jedes der mindestens einen Führungselemente (202) einen Stift umfasst, und
jedes der mindestens einen ersten Gegenstücke (222) eine Hülse umfasst.

3. Montageanordnung nach Anspruch 1 oder 2, wobei

jedes der mindestens einen Befestigungselemente (204) eine starre Klappe umfasst, und
jedes der mindestens einen zweiten Gegenstücke (224) einen Schlitz oder eine Nut umfasst.

4. Montageanordnung nach einem der Ansprüche 1 bis 3, umfassend genau zwei Führungselemente (202).

5. Montageanordnung nach einem der Ansprüche 1 bis 4, wobei ein erstes Befestigungselement (204) am vorderen Abschnitt (12) des Rahmens (10) befestigt ist und ein zweites Befestigungselement (204) am hinteren Abschnitt (14) des Rahmens (10) befestigt ist.

6. Montageanordnung nach einem der Ansprüche 1 bis 5, wobei der vordere Abschnitt (12) des Rahmens (10) und der hintere Abschnitt (14) des Rahmens (10) mittels eines gebogenen Verbindungselements (16) miteinander verbunden sind, und wobei das mindestens eine Führungselement (202) mit dem gebogenen Verbindungselement (16) verbunden und zwischen dem vorderen Abschnitt (12) und dem hinteren Abschnitt (14) angeordnet ist.

7. Montageanordnung nach einem der vorhergehenden Ansprüche, ferner umfassend ein Lautsprechergitter (184), wobei

der Rahmen (10) mindestens eine Öffnung umfasst; und
das Lautsprechergitter (184) so konfiguriert ist, dass es die mindestens eine Öffnung abdeckt und Schall deutlich durch das Lautsprechergitter (184) durchlässt.

8. Montageanordnung nach einem der vorhergehenden Ansprüche, wobei jedes der mindestens einen Führungselemente (202) in einem definierten Winkel (α) bezogen auf eine Vorderseite des Rahmens (10) abgeschrägt ist und wobei der definierte Winkel (α) zwischen 5° und 60° liegt.

9. Lautsprecheranordnung, umfassend:

ein Lautsprechergehäuse (30), das zur Aufnahme mindestens eines Lautsprechers (50, 52) konfiguriert ist,
einen Rahmen (10), der zur Aufnahme eines Lautsprechergitters (184) konfiguriert ist,
mindestens ein Führungselement (202), das mit dem Rahmen (10) verbunden ist und einen Stift umfasst, wobei jedes des mindestens einen Führungselements (202) so konfiguriert ist, dass es in ein entsprechendes erstes Gegenstück (222) eingeführt werden kann, das mit dem Lautsprechergehäuse (30) verbunden ist, wobei, wenn das mindestens eine Führungselement (202) in das entsprechende erste Gegenstück (222) eingeführt wird, der Rahmen (10) mindestens in einer ersten Richtung oder Ebene bezogen auf das Lautsprechergehäuse (30) fixiert wird, wobei die erste Richtung oder Ebene eine horizontale Richtung oder Ebene ist, und
mindestens ein Befestigungselement (204), das mit dem Rahmen (10) verbunden ist, wobei jedes des mindestens einen Befestigungselements (204) so konfiguriert ist, dass es in ein entsprechendes zweites Gegenstück (224), das mit dem Lautsprechergehäuse (30) verbunden ist, eingesetzt wird und einrastet, wobei, wenn das mindestens eine Befestigungselement (204) in das entsprechende zweite Gegenstück (224) eingeführt wird, der Rahmen (10) mindestens in einer zweiten Richtung oder Ebene bezogen auf das Lautsprechergehäuse (30) fixiert wird, wobei die zweite Richtung oder Ebene eine vertikale Richtung oder Ebene ist, die sich von der ersten Richtung oder Ebene unterscheidet und senkrecht zu dieser ist, wobei
der Rahmen (10) einen vorderen Abschnitt (12) und einen hinteren Abschnitt (14) umfasst, wobei der vordere Abschnitt (12) so konfiguriert ist, dass er an einer Vorderseite des Lautsprechergehäuses (30) angeordnet wird, und der hintere Abschnitt (14) so konfiguriert ist, dass er an einer Rückseite des Lautsprechergehäuses (30) angeordnet wird, und **dadurch gekennzeichnet, dass**
der vordere Abschnitt (12) und der hintere Abschnitt (14) in einem bestimmten Winkel (γ) zueinander angeordnet sind, wobei der bestimmte Winkel (γ) zwischen 20° und 70° liegt.

10. Lautsprecheranordnung nach Anspruch 9, wobei

jedes der mindestens einen Führungselemente (202) einen Stift umfasst, und
jedes der mindestens einen ersten Gegenstücke (222) eine Hülse umfasst.

11. Lautsprecheranordnung nach Anspruch 9 oder 10, wobei

jedes der mindestens einen Befestigungselemente (204) eine starre Klappe umfasst, und
jedes der mindestens einen zweiten Gegenstücke (224) einen Schlitz oder eine Nut umfasst.

12. Lautsprechergehäuse nach Anspruch 11, wobei jedes der mindestens einen zweiten Gegenstücke (224) ferner einen Führungsabschnitt (2242) umfasst, wobei jeder Führungsabschnitt (2242) trichterförmig ist und sich zu einer Aussparung (2244) hin verjüngt, so dass ein Befestigungselement (204), das in den Führungsabschnitt (2242) eingeführt wird, durch den Führungsabschnitt (2242) zur Aussparung (2244) geführt wird.

Revendications

1. Agencement de montage comprenant :

un cadre (10) configuré pour recevoir une grille de haut-parleur (184),
au moins un élément de guidage (202) relié au cadre (10), dans lequel chacun de l'au moins un élément de guidage (202) comprend une broche configurée pour être insérée dans une première contrepartie correspondante (222) qui est reliée à une enceinte de haut-parleur (30), dans lequel, lorsque l'au moins un élément de guidage (202) est inséré dans la première contrepartie correspondante (222), le cadre (10) est fixé au moins dans une première direction ou un premier plan par rapport à l'enceinte de haut-parleur (30), dans lequel la première direction ou le premier plan est une direction horizontale ou un plan horizontal, et
au moins un élément de fixation (204) relié au cadre (10), dans lequel chacun de l'au moins un élément de fixation (204) est configuré pour être inséré et s'encliqueter dans une seconde contrepartie correspondante (224) qui est reliée à l'enceinte de haut-parleur (30), dans lequel, lorsque l'au moins un élément de fixation (204) est inséré dans la seconde contrepartie correspondante (224), le cadre (10) est fixé au moins dans une seconde direction ou dans un second plan par rapport à l'enceinte de haut-parleur (30), dans lequel la seconde direction ou le second plan est une direction verticale ou un plan vertical qui est différent de et perpendiculaire à la première direction ou
au premier plan, dans lequel
le cadre (10) comprend une section avant (12) et une section arrière (14), dans lequel la section avant (12) est configurée pour être disposée sur un côté avant de l'enceinte de haut-parleur (30), et la section arrière (14) est configurée pour être disposée sur un côté arrière de l'enceinte de haut-parleur (30), et **caractérisé en ce que**
la section avant (12) et la section arrière (14) sont disposées à un angle défini (γ) l'une par rapport à l'autre, dans lequel l'angle défini (γ) est compris entre 20° et 70°.

2. Agencement de montage selon la revendication 1, dans lequel chacun de l'au moins un élément de guidage (202) comprend une broche, et
chacune de l'au moins une première contrepartie (222) comprend un manchon.

3. Agencement de montage selon la revendication 1 ou 2, dans lequel

chacun de l'au moins un élément de fixation (204) comprend un volet rigide, et
chacune de l'au moins une seconde contrepartie (224) comprend une fente ou une rainure.

4. Agencement de montage selon l'une quelconque des revendications 1 à 3, comprenant exactement deux éléments de guidage (202).

5. Agencement de montage selon l'une quelconque des revendications 1 à 4, dans lequel un premier élément de fixation (204) est fixé à la section avant (12) du cadre (10), et un second élément de fixation (204) est fixé à la section arrière (14) du cadre (10).

6. Agencement de montage selon l'une quelconque des revendications 1 à 5, dans lequel la section avant (12) du cadre (10) et la section arrière (14) du cadre (10) sont reliées l'une à l'autre par un élément de liaison coudé (16), et dans lequel l'au moins un élément de guidage (202) est relié à l'élément de liaison coudé (16) et disposé entre la section avant (12) et la section arrière (14).

7. Agencement de montage selon l'une quelconque des revendications précédentes, comprenant également une grille de haut-parleur (184), dans lequel

le cadre (10) comprend au moins une ouverture ; et
la grille de haut-parleur (184) est configurée pour recouvrir l'au moins une ouverture et pour laisser le son passer clairement à travers la grille de haut-parleur (184).

8. Agencement de montage selon l'une quelconque des revendications précédentes, dans lequel chacun de l'au moins un élément de guidage (202) est biseauté selon un angle défini (α) par rapport à une face avant du cadre (10), et dans lequel l'angle défini (α) est compris entre 5° et 60°.

9. Agencement de haut-parleur comprenant :

une enceinte de haut-parleur (30) configurée pour recevoir au moins un haut-parleur (50, 52),
un cadre (10) configuré pour recevoir une grille de haut-parleur (184),
au moins un élément de guidage (202) relié au

cadre (10) et comprenant une broche, dans lequel chacun de l'au moins un élément de guidage (202) est configuré pour être inséré dans une première contrepartie correspondante (222) qui est reliée à l'enceinte de haut-parleur (30), dans lequel, lorsque l'au moins un élément de guidage (202) est inséré dans la première contrepartie correspondante (222), le cadre (10) est fixé au moins dans une première direction ou un premier plan par rapport à l'enceinte de haut-parleur (30), dans lequel la première direction ou le premier plan est une direction horizontale ou un plan horizontal, et

au moins un élément de fixation (204) relié au cadre (10), dans lequel chacun de l'au moins un élément de fixation (204) est configuré pour être inséré et s'encliqueter dans une seconde contrepartie correspondante (224) qui est reliée à l'enceinte de haut-parleur (30), dans lequel, lorsque l'au moins un élément de fixation (204) est inséré dans la seconde contrepartie correspondante (224), le cadre (10) est fixé au moins dans une seconde direction ou dans un second plan par rapport à l'enceinte de haut-parleur (30), dans lequel la seconde direction ou le second plan est une direction verticale ou un plan vertical qui est différent de et perpendiculaire à la première direction ou au premier plan, dans lequel

le cadre (10) comprend une section avant (12) et une section arrière (14), dans lequel la section avant (12) est configurée pour être disposée sur un côté avant de l'enceinte de haut-parleur (30), et la section arrière (14) est configurée pour être disposée sur un côté arrière de l'enceinte de haut-parleur (30), et **caractérisé en ce que**

la section avant (12) et la section arrière (14) sont disposées à un angle défini (γ) l'une par rapport à l'autre, dans lequel l'angle défini (γ) est compris entre 20° et 70°.

10. Agencement de haut-parleur selon la revendication 9, dans lequel

chacun de l'au moins un élément de guidage (202) comprend une broche, et

chacune de l'au moins une première contrepartie (222) comprend un manchon.

11. Agencement de haut-parleur selon la revendication 9 ou 10, dans lequel

chacun de l'au moins un élément de fixation (204) comprend un volet rigide, et

chacune de l'au moins une seconde contrepartie (224) comprend une fente ou une rainure.

12. Enceinte de haut-parleur selon la revendication 11, dans laquelle chacune de l'au moins une seconde contrepartie (224) comprend également une section de guidage (2242), dans laquelle chaque section de guidage (2242) est en forme d'entonnoir et s'amincit vers un évidement (2244) de sorte qu'un élément de fixation (204) qui est inséré dans la section de guidage (2242) est guidé à travers la section de guidage (2242) vers l'évidement (2244).

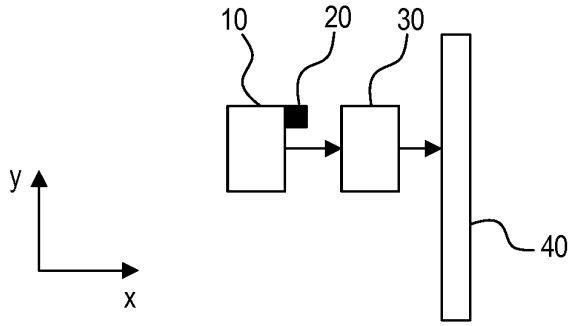

FIG 1

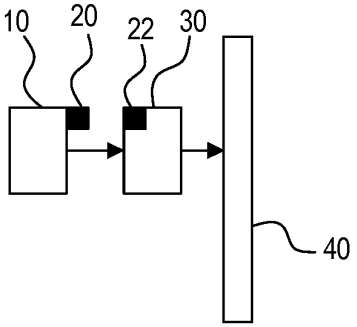

FIG 2

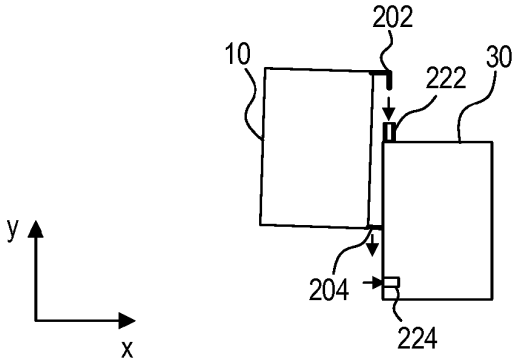

FIG 3A

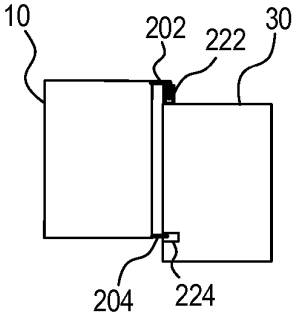

FIG 3B

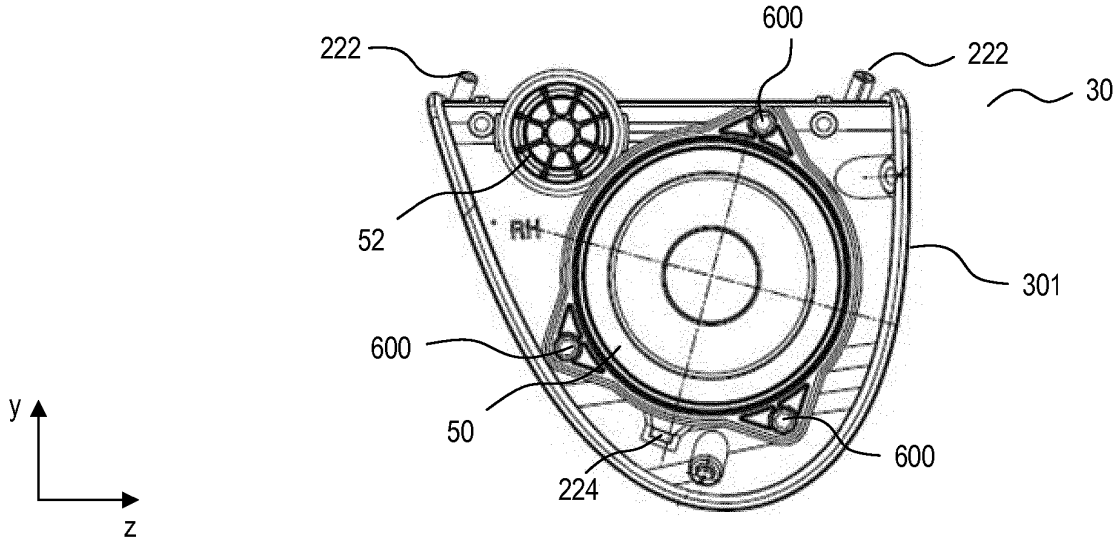

FIG 4

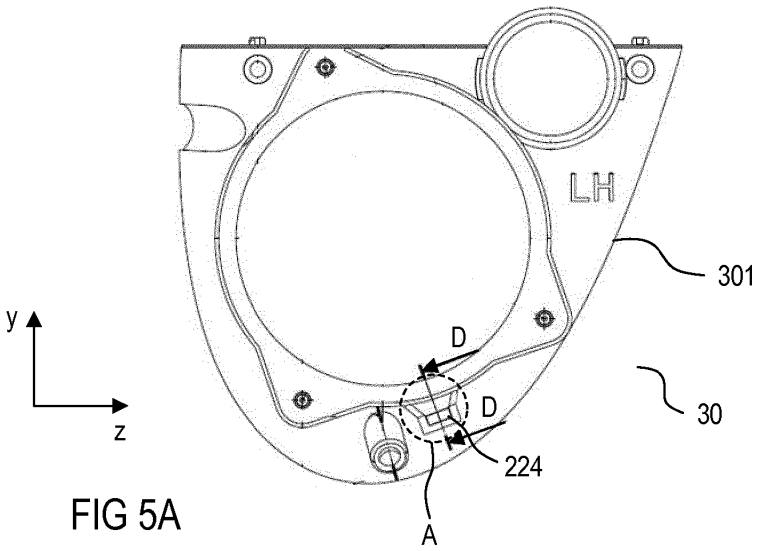

FIG 5A

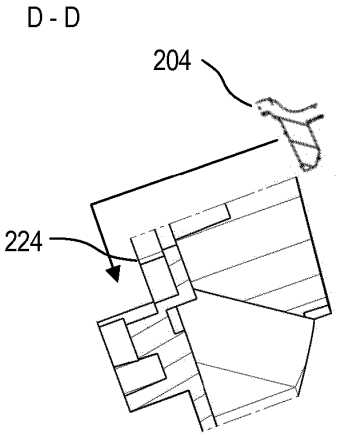

FIG 5B

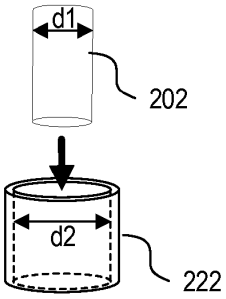

FIG 5C

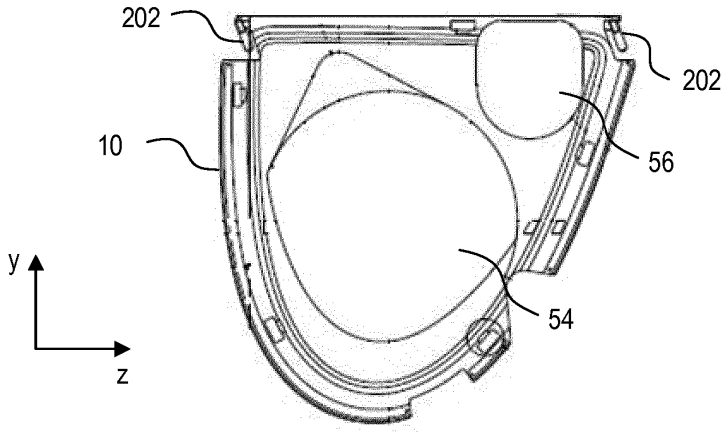

FIG 6A

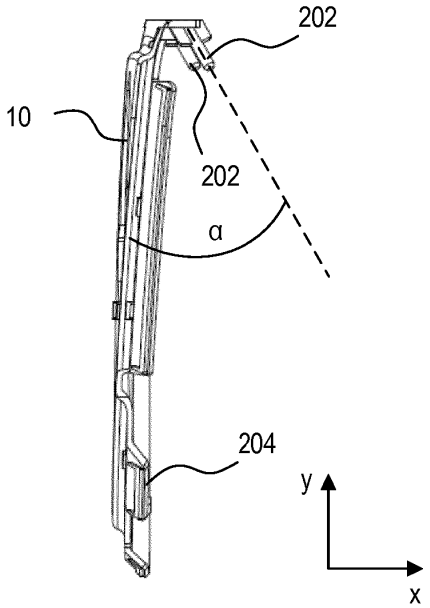

FIG 6B

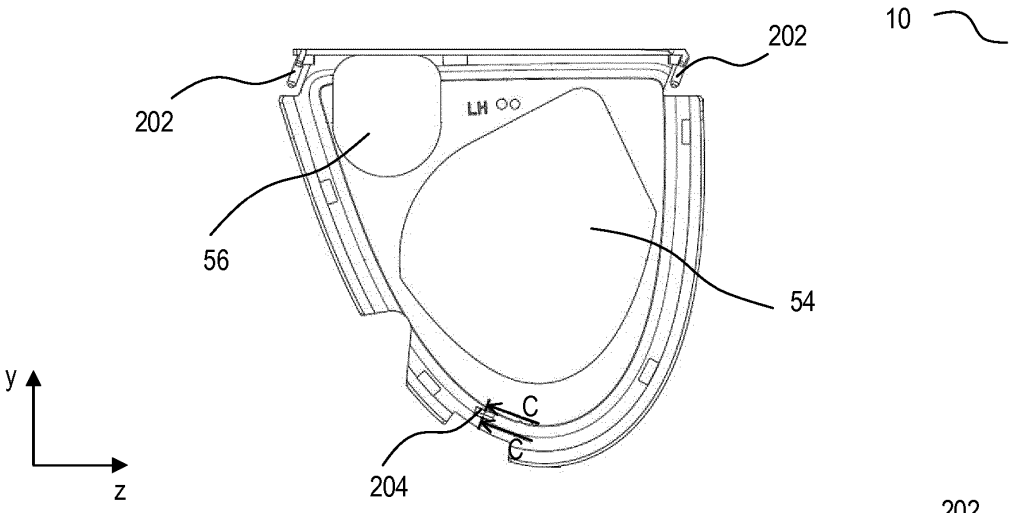

FIG 6C

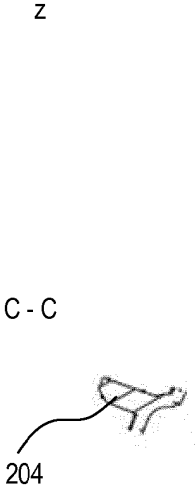

FIG 7

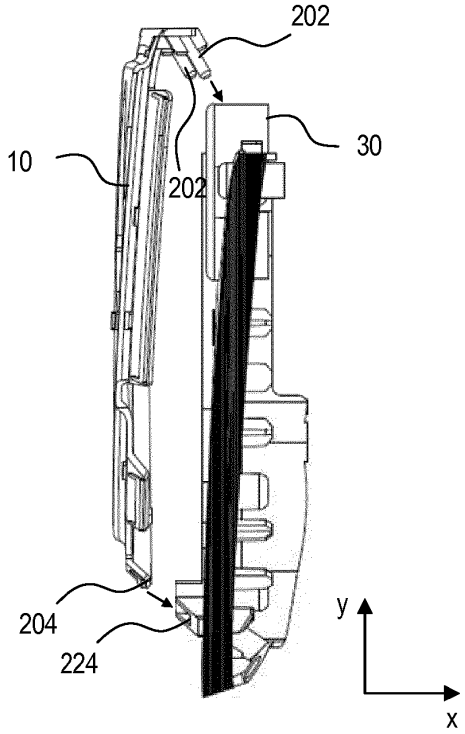

FIG 8

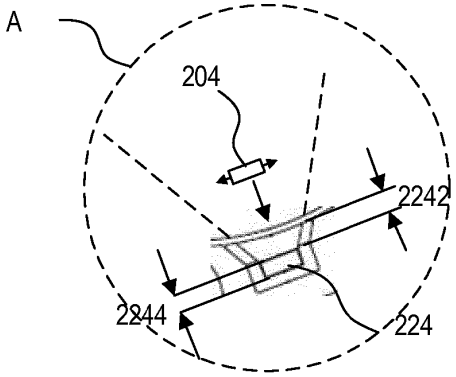

FIG 9

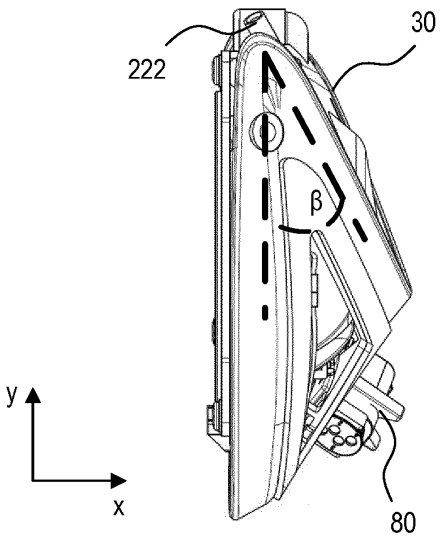

FIG 10A

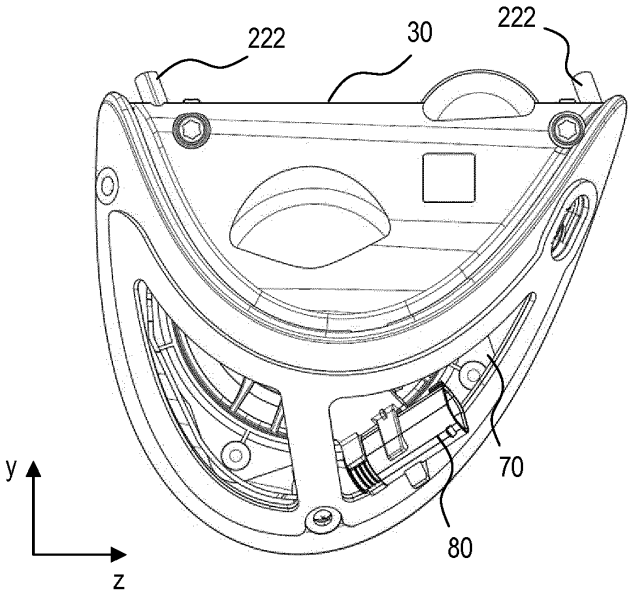

FIG 10B

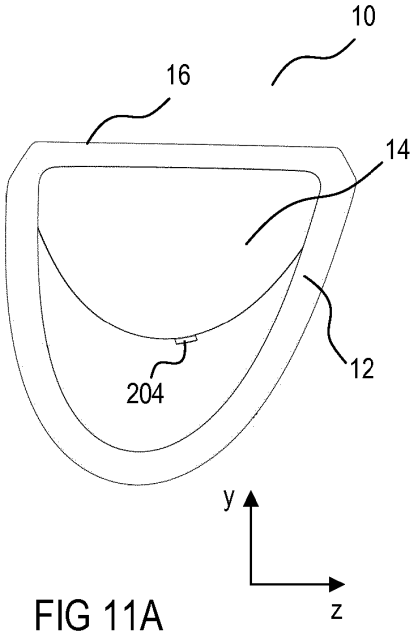

FIG 11A

FIG 11B

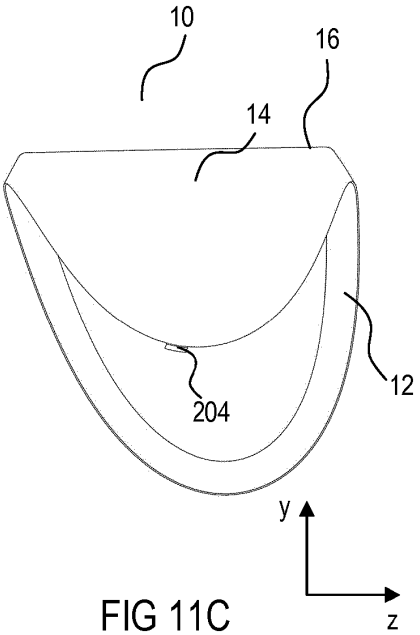

FIG 11C

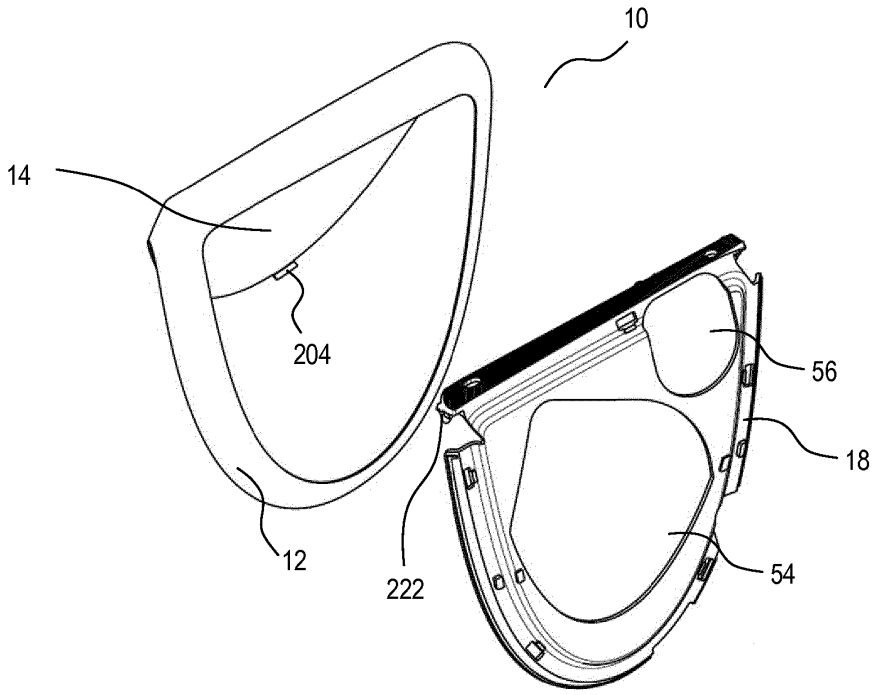
10
14
204
56
18
12
222
54

FIG 12

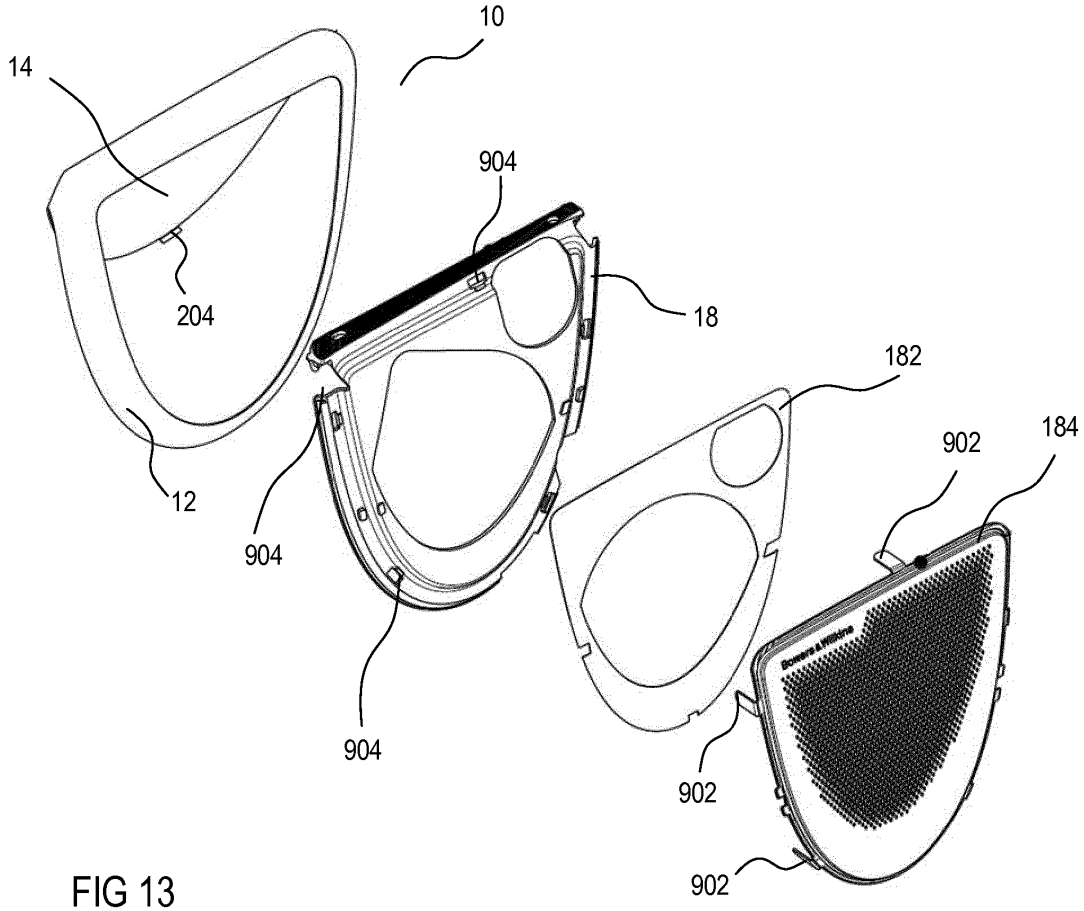
10
14
904
204
18
182
902
184
12
904
904
902
902

FIG 13

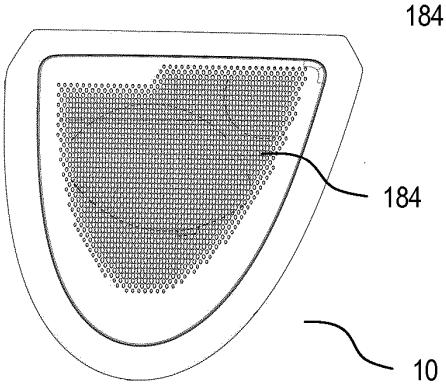

FIG 14A

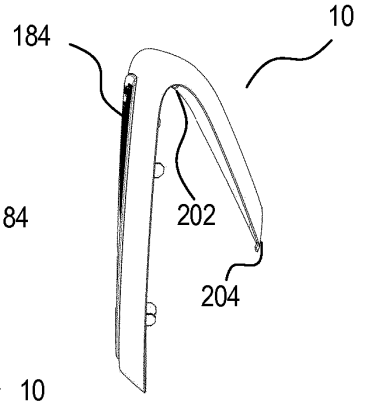

FIG 14B

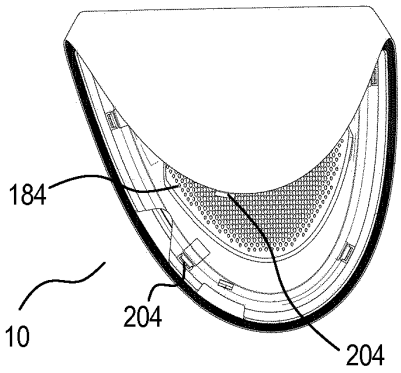

FIG 14C

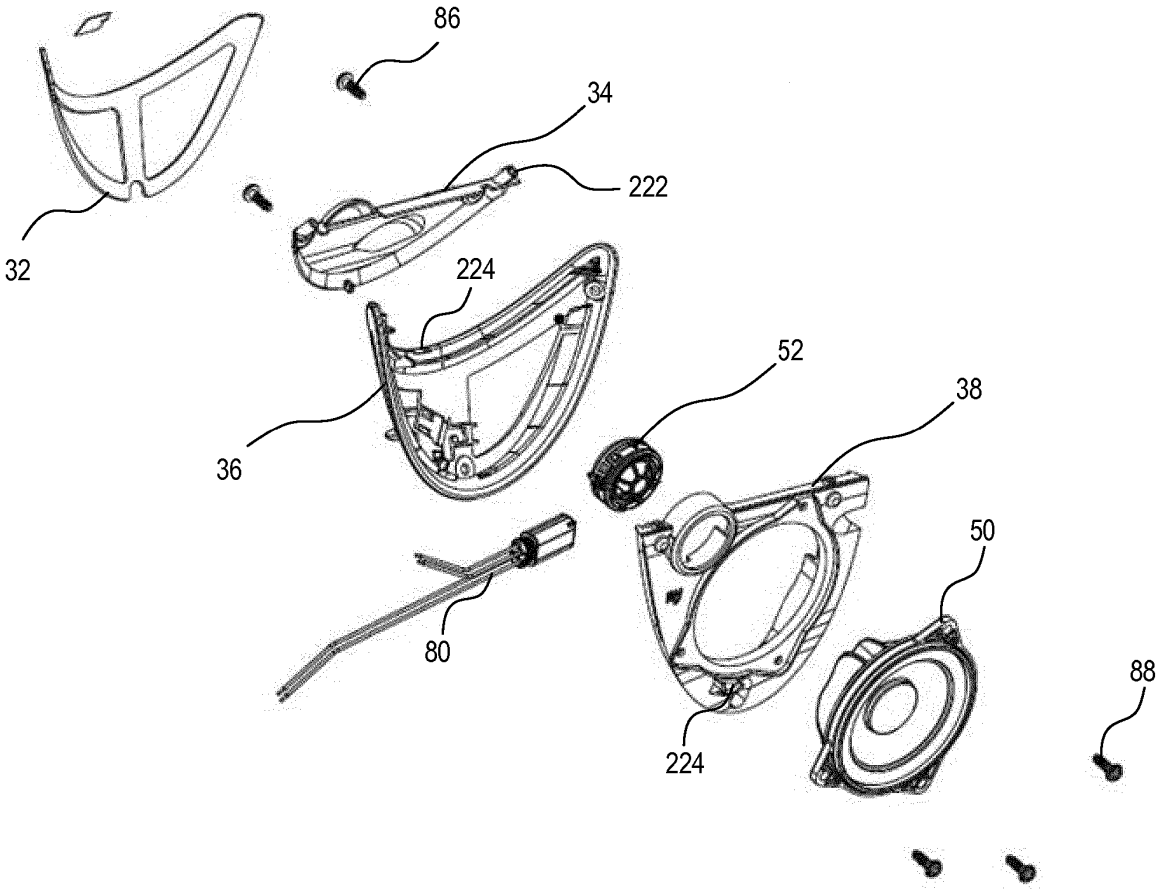

FIG 15

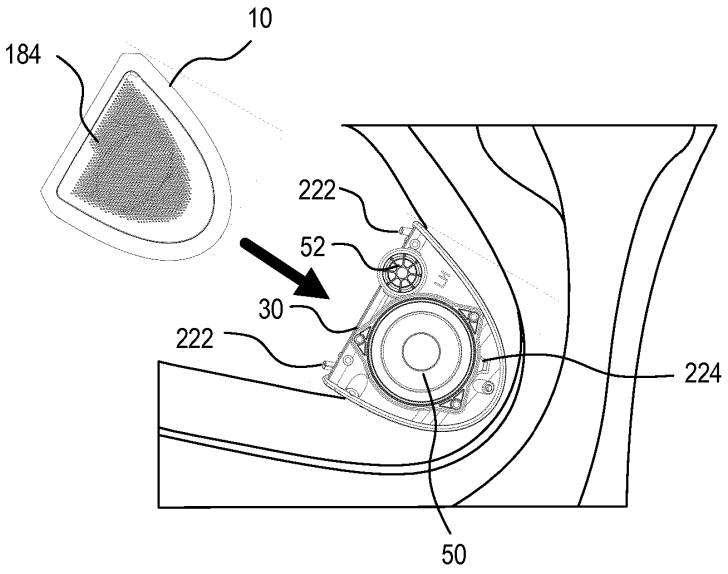

FIG 16

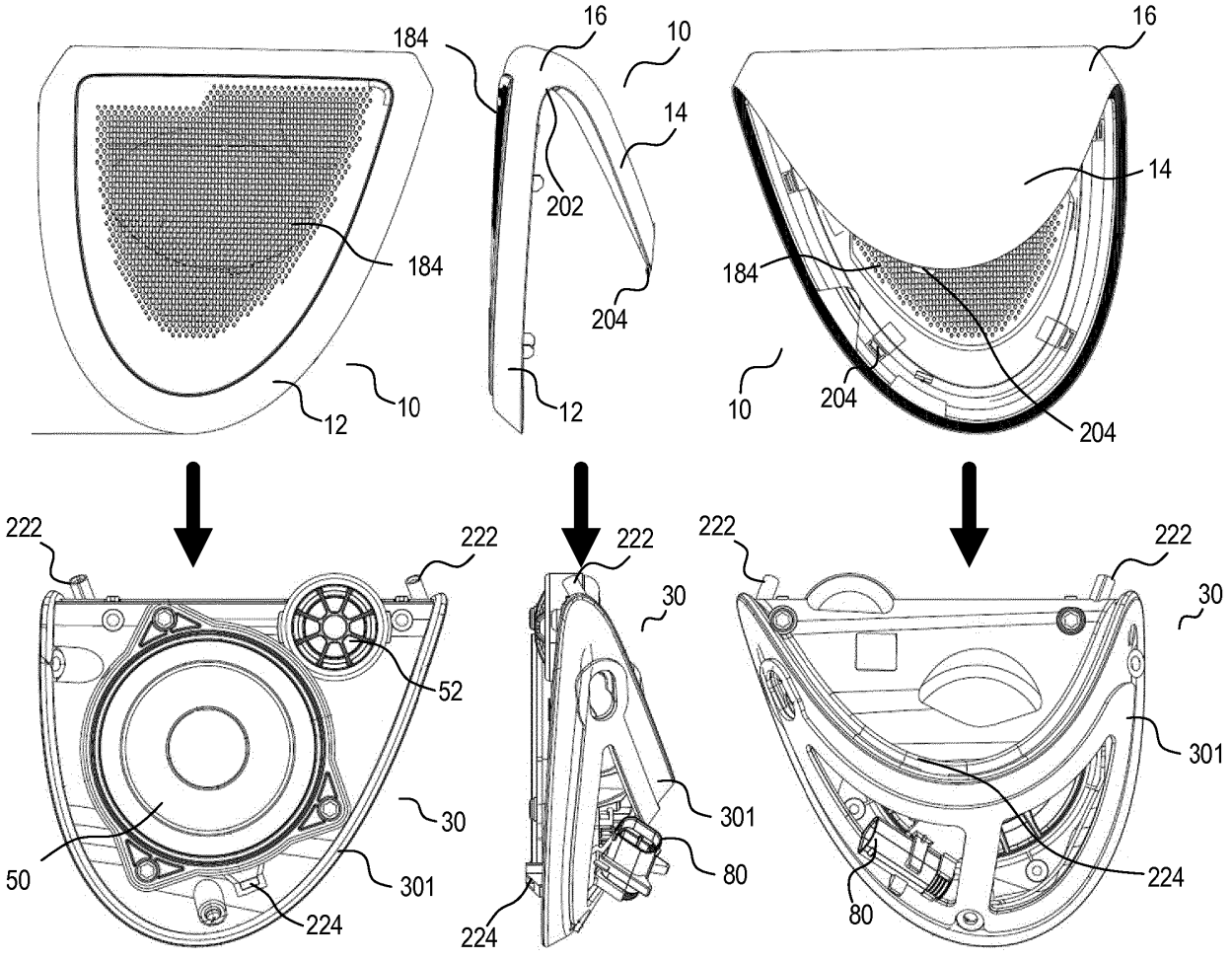

FIG 17A FIG 17B FIG 17C

REFERENCES CITED IN THE DESCRIPTION

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- US 5904002 A **[0004]**
- JP S60200698 A **[0005]**
- EP 2835285 A1 **[0006]**