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(54) Title: VEHICLE WITH BODY STRUCTURE COMPRISING REINFORCING PANEL

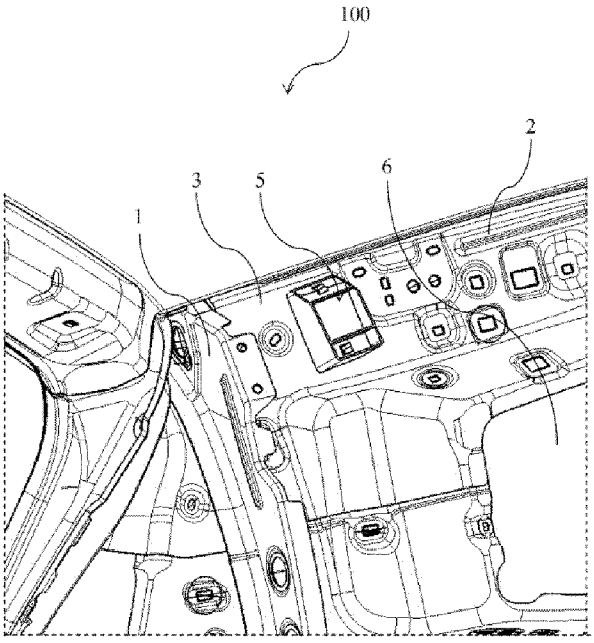

FIG. 3

(57) Abstract: The present disclosure relates to a vehicle with a body structure comprising a reinforcing panel. The body structure comprises: a D-pillar inner panel; a quarter-window inner panel connected to the D-pillar inner panel from a front side of the D-pillar inner panel relative to the longitudinal direction; a reinforcing panel having a shape following that of the quarter-window inner panel, and connected to the quarter-window inner panel and the D-pillar inner panel from an outer side of the quarter-window inner panel; an insert provided between the quarter-window inner panel and the reinforcing panel, and comprising a housing and an adhesive accommodated in at least a part of the housing before expansion, wherein the housing abuts against the quarter-window inner panel, and the adhesive abuts against the reinforcing panel after expansion.

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VEHICLE WITH BODY STRUCTURE COMPRISING REINFORCING PANEL

RELATED FIELD

[0001] The present invention claims the priority of the Chinese application 202310691947.0 filed on June, the 12th of 2023 (12.06.2023), the content of which (text, drawings and claims) is incorporated herein by reference.

[0002] The present disclosure generally relates to the field of vehicles, and more specifically, to a vehicle with a body structure comprising a reinforcing panel.

BACKGROUND

[0003] Torsional stiffness is an important parameter for evaluating performance of a vehicle. The greater the torsional stiffness, the less likely the vehicle body will deform, and the higher comfort, handling performance and safety the vehicle will have.

[0004] In the prior art, the torsional stiffness of the body structure at a corner position near the rear quarter window of the vehicle, especially near a connection position of the D-pillar inner panel, is poor, which results in poor NVH (Noise, Vibration, Harshness) performance of the vehicle and may generate large vibrations and/or noise during travel of the vehicle, thereby reducing riding experience for passengers.

SUMMARY

[0005] The present disclosure aims at overcoming at least one of the defects in the prior art by providing a vehicle with a body structure comprising a reinforcing panel. In other words, the vehicle according to the present disclosure can increase the torsional stiffness of a rear portion of the vehicle body, thereby improving the NVH performance of the vehicle and the riding experience for passengers.

[0006] To this end, the present disclosure provides a vehicle with a body structure. The vehicle has a longitudinal direction representing a direction of travel. The body structure comprises: a D-pillar inner panel; a quarter-window inner panel connected to the D-pillar inner panel from a

front side of the D-pillar inner panel relative to the longitudinal direction; a reinforcing panel having a shape following that of the quarter-window inner panel, and connected to the quarter-window inner panel and the D-pillar inner panel from an outer side of the quarter-window inner panel; and an insert provided between the quarter-window inner panel and the reinforcing panel, and comprising a housing and an adhesive accommodated in at least a part of the housing before expansion, where the housing abuts against the quarter-window inner panel, and the adhesive abuts against the reinforcing panel after expansion.

[0007] According to an alternative embodiment of the present disclosure, the housing comprises: a side wall extending between the quarter-window inner panel and the reinforcing panel, wherein the side wall abuts against the quarter-window inner panel and is spaced apart from the reinforcing panel through a gap; a base surrounded by the side wall and connected to the side wall.

[0008] According to an alternative embodiment of the present disclosure, an end surface of the side wall oriented towards the reinforcing panel has a bending shape adapted to that of the reinforcing panel.

[0009] According to an alternative embodiment of the present disclosure, the base and the side wall delimit a first cavity with a first opening oriented towards the reinforcing panel, and a second cavity with a second opening oriented towards the quarter-window inner panel; wherein the adhesive is accommodated in at least a part of the first cavity before expansion and abuts against the reinforcing panel through the first opening after expansion.

[0010] According to an alternative embodiment of the present disclosure, the insert further comprises: a clip provided on the base and protruding from the second cavity through the second opening, and the quarter-window inner panel is provided with a slot mated with the clip.

[0011] According to an alternative embodiment of the present disclosure, the insert further comprises: a supporting frame provided in the second cavity and supporting the base.

[0012] According to an alternative embodiment of the present disclosure, the insert further comprises at least one dividing panel configured to divide the first cavity.

[0013] According to an alternative embodiment of the present disclosure, the adhesive is a structural adhesive with a Young's modulus greater than 400MPA.

[0014] Compared with the prior art, the vehicle with a body structure comprising a reinforcing panel according to the present disclosure has multiple advantages, especially: at the corner position near the rear quarter window of the vehicle, the insert capable of abutting against the quarter-window inner panel and the reinforcing panel is provided in the cavity between the quarter-window inner panel and the reinforcing panel, thereby improving the torsional stiffness of the quarter-window inner panel and the reinforcing panel, reducing vibration noise at this position and effectively improving the NVH performance of the vehicle. Moreover, the insert has a simple structure, convenient installation, and can be popularized and used in various types of vehicle body structures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Other features and advantages of the present disclosure will be readily understood by the following preferred embodiments described in detail in conjunction with the accompanying drawings, in which a same reference numeral indicates a same or similar component.

[0016] FIG. 1 is a schematic view of a vehicle according to an embodiment of the present disclosure, illustrating a side rear portion of a body structure;

[0017] FIG. 2 is a perspective view of the body structure in FIG. 1;

[0018] FIG. 3 is a perspective view of the body structure in FIG. 2 with a side-body outer panel and a reinforcing panel being hidden;

[0019] FIG. 4 is a partial cross-sectional view taken along A-A in FIG. 2;

[0020] FIG. 5 is a perspective view of an insert of the body structure in FIG. 2;

[0021] FIG. 6 is another perspective view of the insert of the body structure in FIG. 2;

[0022] FIG. 7a is a schematic view of the insert of the body structure in FIG. 2 before expansion of an adhesive; and

[0023] FIG. 7b is a schematic view of the insert of the body structure in FIG. 2 after expansion of the adhesive.

DETAILED DESCRIPTION

[0024] The implementation and usage of specific embodiments are discussed in detail below. However, it is understood that the specific embodiments discussed herein are merely intended to illustrate specific ways of implementing and using the present disclosure, and are not intended to limit the protection scope of the present disclosure.

[0025] In the specification, when describing structures and positions of components, the directional expressions such as "up" and "down" are not absolute, but are relative. These directional expressions are appropriate when the components are arranged as shown in the accompanying drawings, but should be changed accordingly when the positions of the components in the drawings are changed. In addition, the terms "inner" and "outer" are defined with reference to the interior-exterior direction of the vehicle. For example, "an outer side" indicates a side facing towards the exterior of the vehicle.

[0026] In the specification, the terms "front" and "rear" are defined with reference to the front-rear direction along an X direction of the vehicle. Besides, in the specification, the X direction indicates a longitudinal direction of the vehicle V (i.e., a direction of travel of the vehicle), the Y direction indicates a transverse direction of the vehicle V (i.e., a direction at an angle of 90 degrees relative to the direction of travel), and a Z direction indicates a vertical direction of the vehicle V (i.e., an up-down direction).

[0027] A preferred embodiment of the present disclosure is described below with reference to FIGS. 1 to 7b.

[0028] As shown in FIGS. 1 to 3, a side rear portion of a body structure 100 of a vehicle V according to the present disclosure mainly comprises a D-pillar inner panel 1, a quarter-window inner panel 3, a reinforcing panel 4, a side-body outer panel 7, and an insert 5 provided between the quarter-window inner panel 3 and the reinforcing panel 4. As shown in FIG. 4, the side-body outer panel 7 is connected to the quarter-window inner panel 3 from the outer side of the quarter-window inner panel 3. In other words, the side-body outer panel 7, the reinforcing panel 4, and the quarter-window inner panel 3 are sequentially arranged from outside to inside along the Y direction. A roof side beam 2 extending along the X direction is provided in front of the D-pillar inner panel 1. The quarter-window inner panel 3 connects the D-pillar inner panel 1 to the roof side beam 2 from the front side of the D-pillar inner panel relative to the X direction,

and has a substantially L shape to form a body corner surrounding a rear quarter window 6 of the vehicle. The reinforcing panel 4 has a shape following that of the quarter-window inner panel 3, and is connected to the quarter-window inner panel 3 and the D-pillar inner panel 1 from the outer side of the quarter-window inner panel 3.

[0029] The insert 5 comprises a housing 51 and an adhesive 52 accommodated in at least a part of the housing 51 before expansion. The housing 51 abuts against the quarter-window inner panel 3. The adhesive 52 is made of a material with an expansion property so that it can abut against the reinforcing panel 4 after expansion, thereby allowing the insert 5 to fill a Y-directional gap between the quarter-window inner panel 3 and the reinforcing panel 4.

[0030] As shown in FIGS. 4 and 5, the housing 51 of the insert 5 comprises a base 511 and a side wall 512. The base 511 is substantially parallel to the quarter-window inner panel 3, and is surrounded by and connected to the side wall 512. The side wall extends between the quarter-window inner panel 3 and the reinforcing panel 4, and comprises a first end surface 5121 and a second end surface 5122 opposite to the first end surface 5121. The first end surface 5121 is oriented towards the reinforcing panel 4 and is spaced apart from the reinforcing panel 4 through a gap L. The second end surface 5122 is oriented towards the quarter-window inner panel 3 and abuts against the quarter-window inner panel 3.

[0031] The base 511 and the side wall 512 delimit a first cavity 513 with a first opening 5131 oriented towards the reinforcing panel 4, and a second cavity 514 with a second opening 5141 oriented towards the quarter-window inner panel 3. As shown in FIGS. 7a and 7b, the adhesive 52 is accommodated in at least a part of the first cavity 513 before expansion and abuts against the reinforcing panel 4 through the first opening 5131 after expansion.

[0032] Preferably, the adhesive 52 is a structural adhesive with a Young's modulus greater than 400MPA. Young's modulus is used to reflect the relationship between stress and strain along a loading direction of a material under stress. The magnitude of Young's modulus indicates the stiffness of the material, wherein the greater the Young's modulus, the less likely the material will deform. For example, when the temperature of the adhesive 52 is substantially the same as that of the paint shop for the entire vehicle, the adhesive 52 starts to expand, and the expanded surface abuts against the reinforcing panel 4. The increased height caused by expansion is about 3 mm. In some embodiments, the reinforcing panel 4 also protrudes

outwardly following the expansion of the adhesive 52.

[0033] In the illustrated embodiment, the first end surface 5121 of the side wall 512 has a bending shape adapted to that of the reinforcing panel 4. More specifically, the first end surface 5121 comprises a parallel section 5121a that is substantially parallel to the quarter-window inner panel 3, and an oblique section 5121b that extends obliquely from the upper end of the parallel section 5121a towards the quarter-window inner panel 3, such that the first end surface 5121 is always spaced apart from the reinforcing panel 4 through the gap L.

[0034] Preferably, the insert 5 further comprises at least one dividing panel 516 dividing the first cavity 513. For example, as shown in FIG. 6, the insert 5 is provided with an upper dividing panel 5161 and a lower dividing panel 5162. The two dividing panels divide the first cavity 513 into three cavities: upper, middle and lower cavities. The adhesive 52 is filled in the three cavities respectively. The number and position of the dividing panels 516 may be determined according to actual needs, which are not limitative in the present disclosure.

[0035] As shown in FIG. 6, a supporting frame 5142 for supporting the base 511 is preferably provided in the second cavity 514. According to one embodiment, the supporting frame is provided as multiple crossed reinforcing ribs, provided in the second cavity 514 and protruding from the base 511 towards the quarter-window inner panel 3, so as to increase the structural strength of the insert 5. These reinforcing ribs divide the second cavity 514 into multiple rectangular cavities.

[0036] The insert 5 further comprises a clip 61 provided on the base 511 and protruding from the second cavity 514 through the second opening 5141. The quarter-window inner panel 3 is provided with a slot 62 mated with the clip 61, so that the insert 5 is snap-fitted to the quarter-window inner panel 3, and the second end surface 5122 of the side wall 512 abuts against the quarter-window inner panel 3. Preferably, a first clip 611 and a second clip 612 protruding towards the quarter-window inner panel 3 are respectively provided on the upper and lower portions of the base 511, and a first slot and a second slot mated with the two clips are respectively provided at corresponding positions of the quarter-window inner panel 3. The number and position of the clips 61 and slots 62 may be determined according to actual needs, which are not limitative in the present disclosure. According to other variants, the insert 5 may also be fixedly connected to the quarter-window inner panel 3 by other fixing methods with the

second end surface 5122 of the side wall 512 abutting against the quarter-window inner panel 3, which is not limitative in the present disclosure.

[0037] The arrangement of the insert 5 allows the first-order torsional mode of the body structure 100 at the corner position near the rear quarter window 6 of the vehicle V to reach approximately 0.2 Hz, and to reduce the travel noise by 1.2 dB. In other words, the insert 5 not only strengthens the structural strength between the quarter-window inner panel 3 and the reinforcing panel 4, but also improves the torsional stiffness of the vehicle body at the corner position near the rear quarter window 6 of the vehicle, thus effectively improving the NVH performance of the vehicle, avoiding large vibrations and noise during travel of the vehicle, and ensuring the comfort for the passengers.

[0038] The technical contents and features of the present disclosure have been disclosed above. However, it is understood that those skilled in the art can make various changes and improvements to the above-disclosed conception under the creative concept of the present disclosure, and all these various changes and improvements fall within the protection scope of the present disclosure.

[0039] The description of the above embodiments is exemplary rather than limitative, and the protection scope of the present disclosure is defined by the appended claims.

CLAIMS

1. A vehicle (V) with a body structure (100), the vehicle (V) having a longitudinal direction (X) representing a direction of travel,

wherein the body structure (100) comprises:

a D-pillar inner panel (1);

a quarter-window inner panel (3) connected to the D-pillar inner panel (1) from a front side of the D-pillar inner panel (1) relative to the longitudinal direction (X);

a reinforcing panel (4) having a shape following that of the quarter-window inner panel (3), and connected to the quarter-window inner panel (3) and the D-pillar inner panel (1) from an outer side of the quarter-window inner panel (3); and

an insert (5) provided between the quarter-window inner panel (3) and the reinforcing panel (4), and comprising a housing (51) and an adhesive (52) accommodated in at least a part of the housing (51) before expansion, wherein the housing (51) abuts against the quarter-window inner panel (3), and the adhesive (52) abuts against the reinforcing panel (4) after expansion.

2. The vehicle (V) with a body structure (100) according to claim 1, wherein the housing (51) comprises:

a side wall (512) extending between the quarter-window inner panel (3) and the reinforcing panel (4), wherein the side wall (512) abuts against the quarter-window inner panel (3) and is spaced apart from the reinforcing panel (4) through a gap (L); and

a base (511) surrounded by the side wall (512) and connected to the side wall (512).

3. The vehicle (V) with a body structure (100) according to claim 2, wherein an end surface (5121) of the side wall (512) oriented towards the reinforcing panel (4) has a bending shape adapted to that of the reinforcing panel (4).

4. The vehicle (V) with a body structure (100) according to claim 2, wherein

the base (511) and the side wall (512) delimit a first cavity (513) with a first opening (5131) oriented towards the reinforcing panel (4), and a second cavity (514) with a second opening (5141) oriented towards the quarter-window inner panel (3); and

wherein the adhesive (52) is accommodated in at least a part of the first cavity (513) before expansion and abuts against the reinforcing panel (4) through the first opening (5131) after expansion.

5. The vehicle (V) with a body structure (100) according to claim 4, wherein the insert (5) further comprises:

a clip (61) provided on the base (511) and protruding from the second cavity (514) through the second opening (5141),

and wherein the quarter-window inner panel (3) is provided with a slot (62) mated with the clip (61).

6. The vehicle (V) with a body structure (100) according to claim 4, wherein the insert (5) further comprises:

a supporting frame (5142) provided in the second cavity (514) and supporting the base (511).

7. The vehicle (V) with a body structure (100) according to claim 4, wherein the insert (5) further comprises at least one dividing panel (516) configured to divide the first cavity (513).

8. The vehicle (V) with a body structure (100) according to any one of claims 1 to 7, wherein the adhesive (52) is a structural adhesive with a Young's modulus greater than 400MPA.

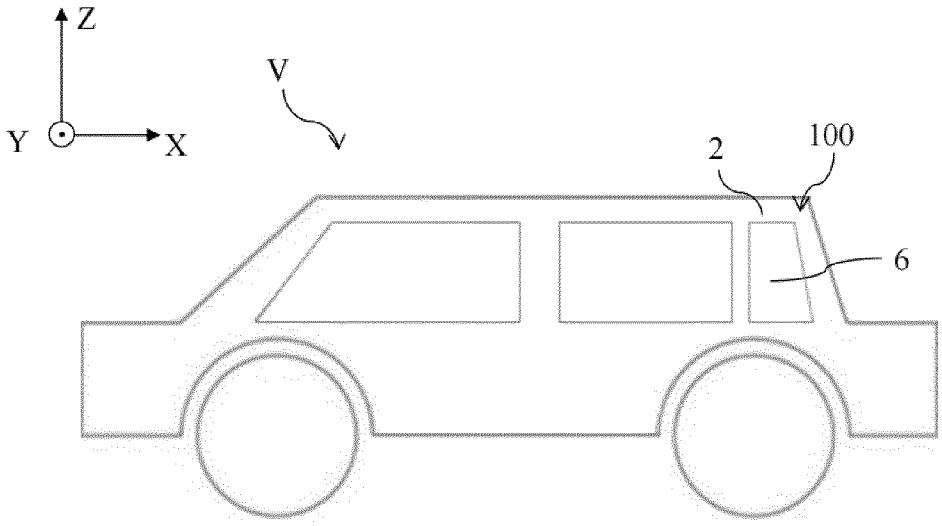

FIG. 1

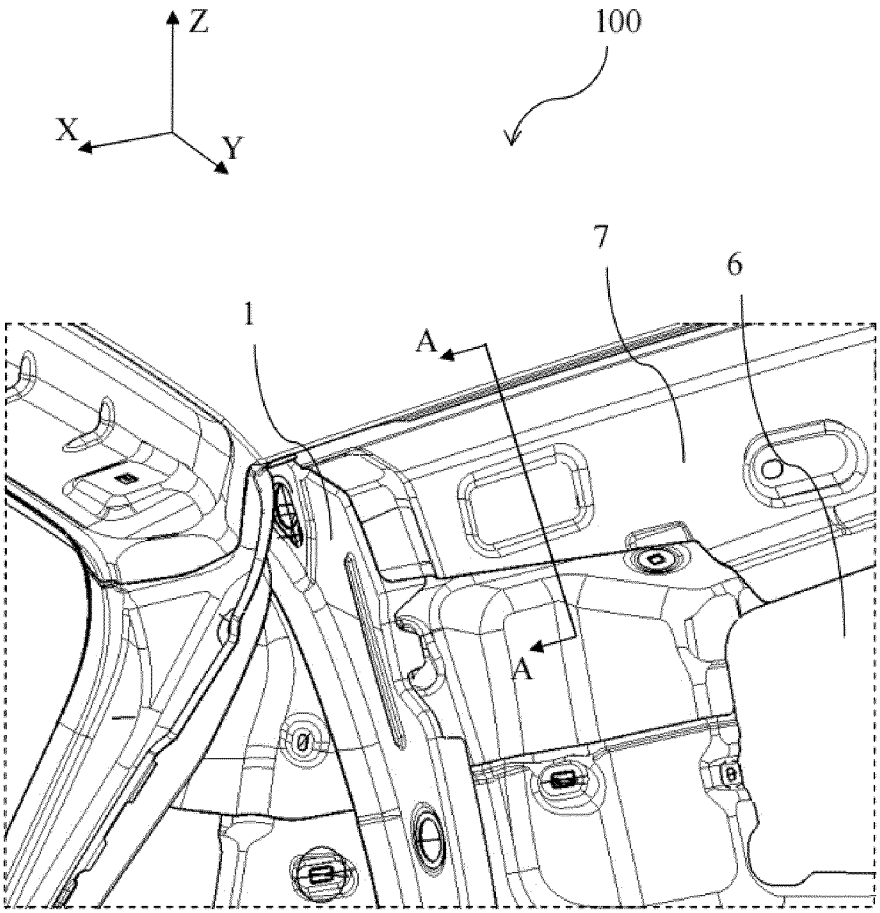

FIG. 2

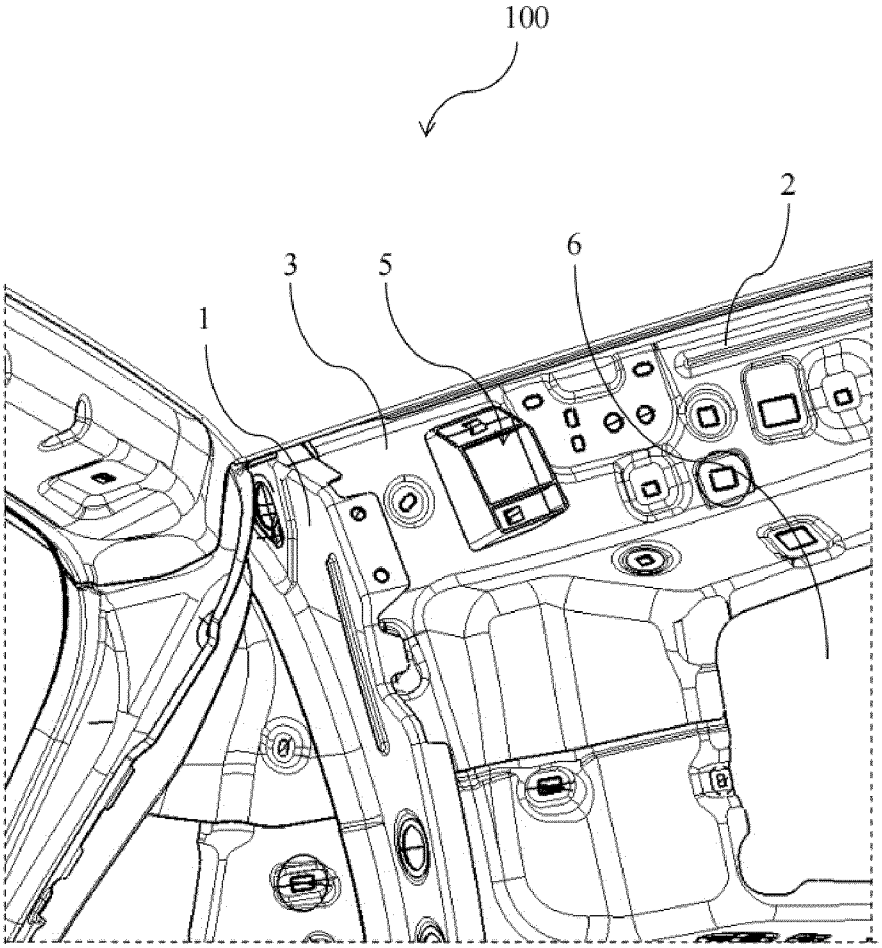

FIG. 3

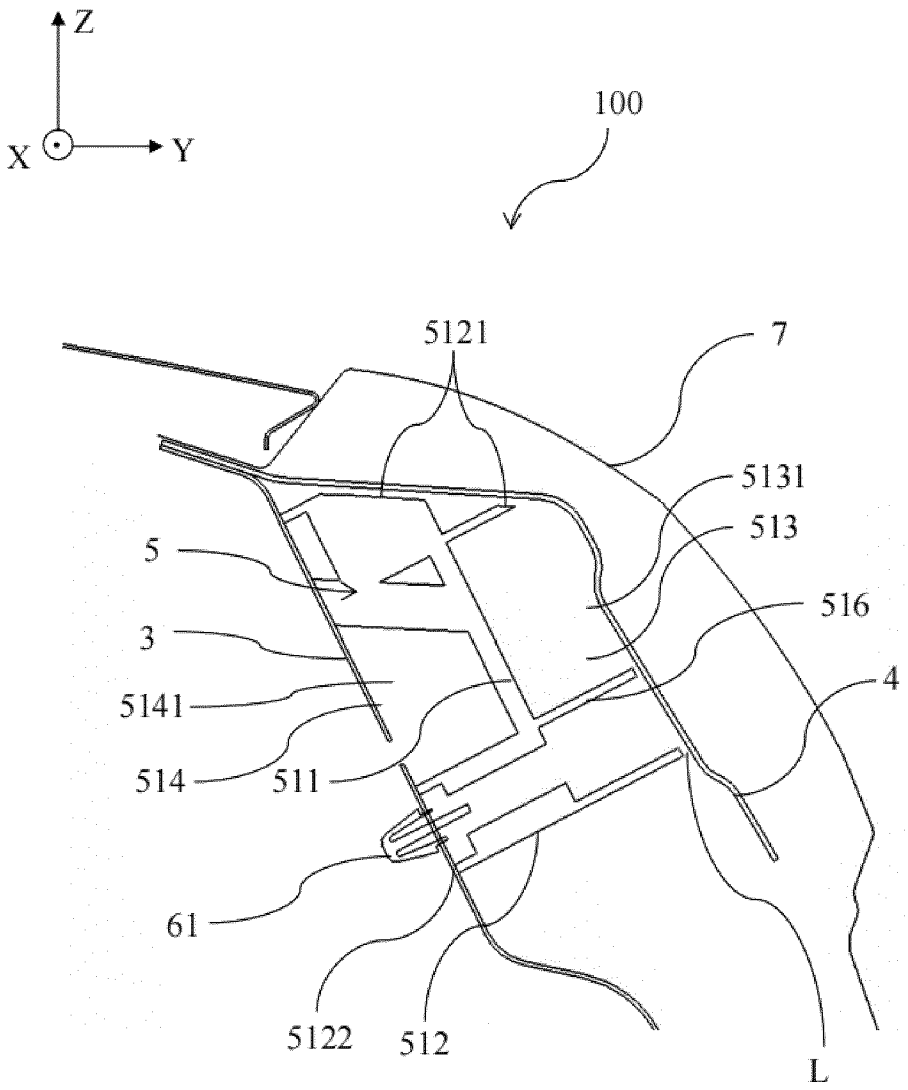

FIG. 4

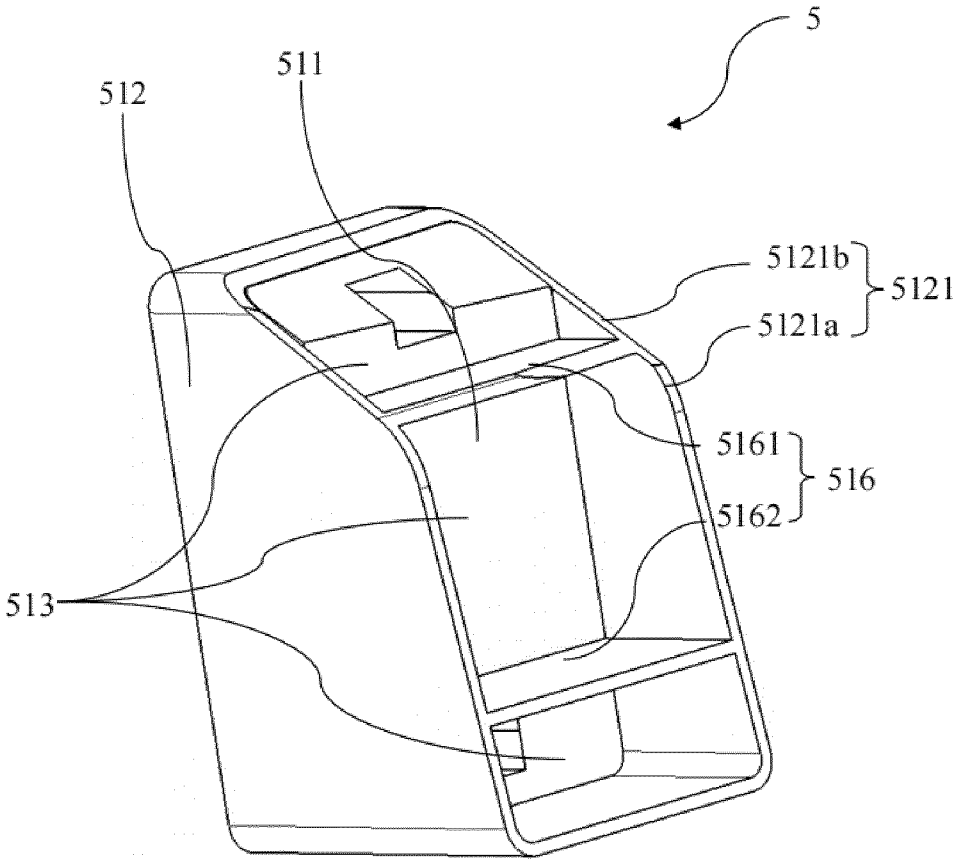

FIG. 5

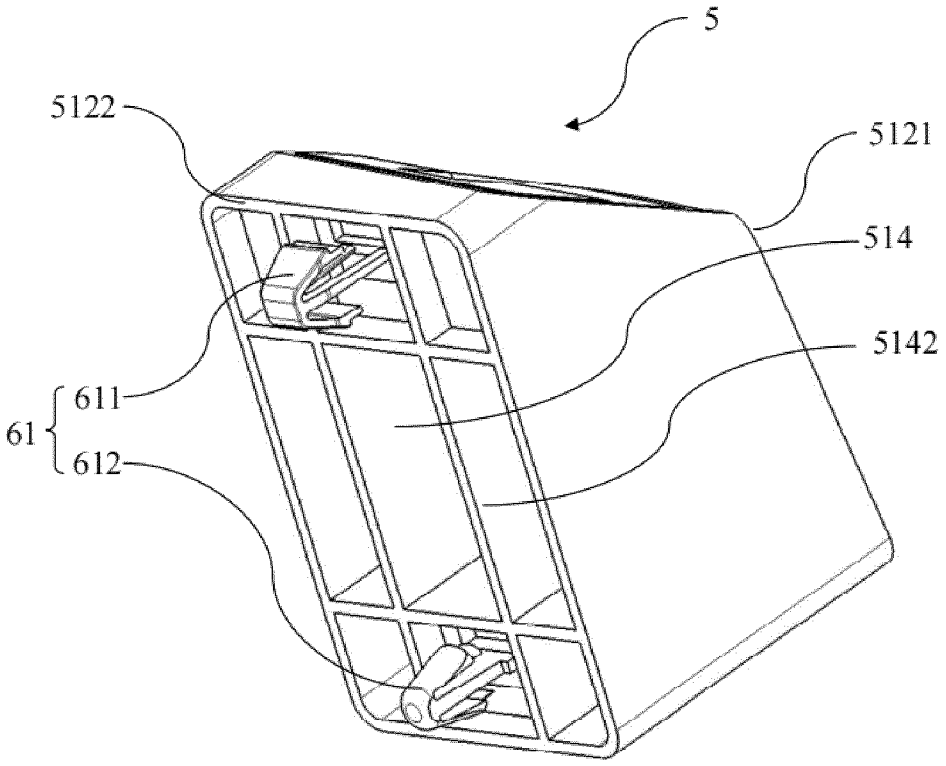

FIG. 6

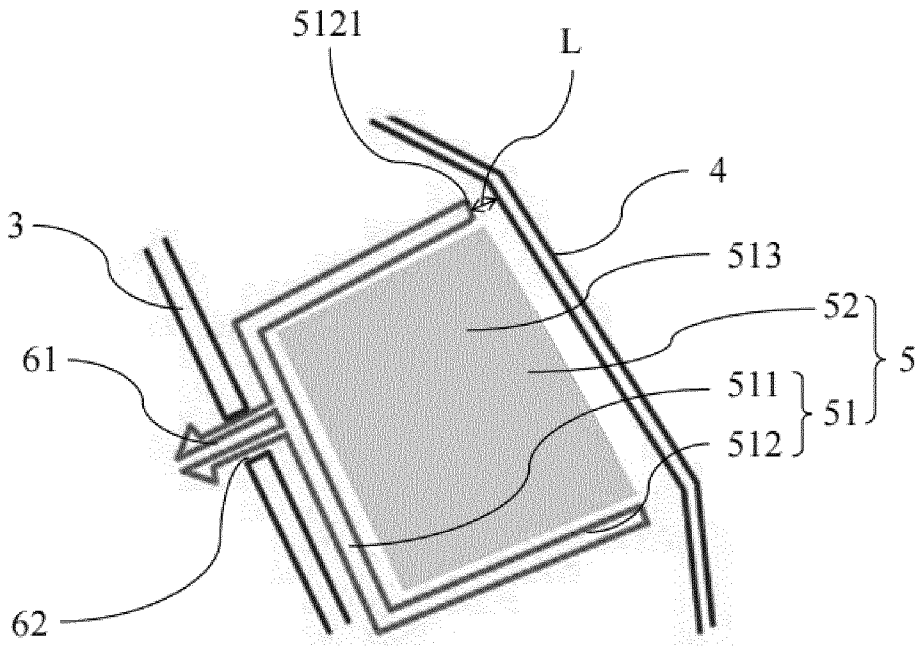

FIG. 7a

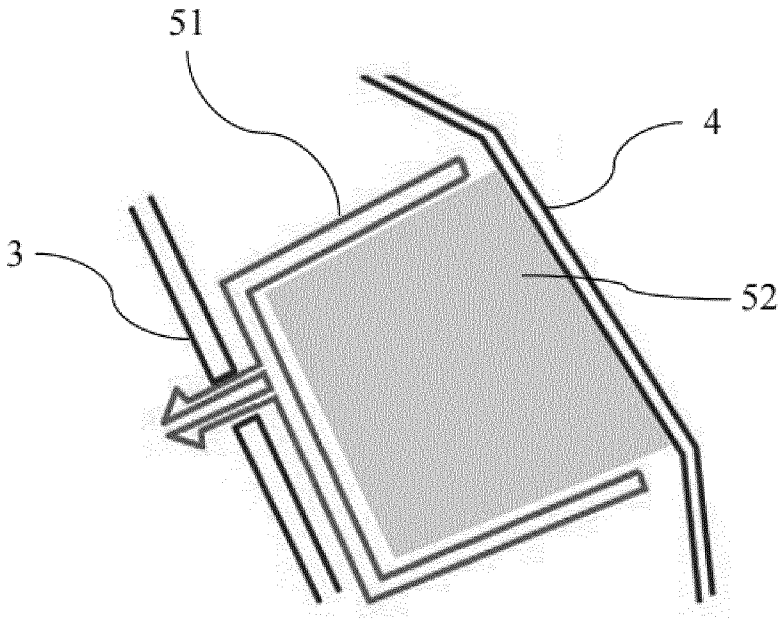

FIG. 7b

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2024/064408

A. CLASSIFICATION OF SUBJECT MATTER

INV. B62D25/04 B29C44/12 B62D25/02 B62D29/00
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B62D B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2013 233855 A (MAZDA MOTOR) 21 November 2013 (2013-11-21) abstract; claims; figures paragraphs [0013] - [0055]	1-8
A	US 2021/171117 A1 (KIM HYUNG TAE [KR]) 10 June 2021 (2021-06-10) paragraphs [0010] - [0072]; claims; figures	1-8
A	US 2022/177038 A1 (YOSHIDA SACHIKO [JP] ET AL) 9 June 2022 (2022-06-09) paragraphs [0004] - [0028]; claims; figures	1-8

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[x] Further documents are listed in the continuation of Box C.

[x] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
17 July 2024	12/08/2024

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Tiedemann, Dirk

1

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2024/064408

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2011/221234 A1 (VILCEK MARK J [US] ET AL) 15 September 2011 (2011-09-15) cited in the application paragraphs [0005] - [0056]; claims; figures -----	1-8

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2024/064408

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