



(51) International Patent Classification:
B60J 5/04 (2006.01)

(21) International Application Number:

PCT/EP2019/078425

(22) International Filing Date:

18 October 2019 (18.10.2019)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

1819481 1

29 November 2018 (29.11.2018) GB

(71) Applicant: JAGUAR LAND ROVER LIMITED
[GB/GB]; Abbey Road, Whitley, Coventry Warwickshire
CV3 4LF (GB).

(72) **Inventors: MABEY, Jonathan;** c/o Jaguar Land Rover, Patents Department W/1/073, Abbey Road, Whitley, Coventry Warwickshire CV3 4LF (GB). **BURGESS, Matthew;** c/o Jaguar Land Rover, Patents Department W/1/073, Abbey Road, Whitley, Coventry Warwickshire CV3 4LF (GB).

(74) **Agent: HOLMES, Matthew;** c/o Jaguar Land Rover,
Patents Department W/1/073, Abbey Road, Whitley,
Coventry Warwickshire CV3 4LF (GB).

(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,

(54) Title: A DOOR, A DOOR ARRANGEMENT AND A VEHICLE

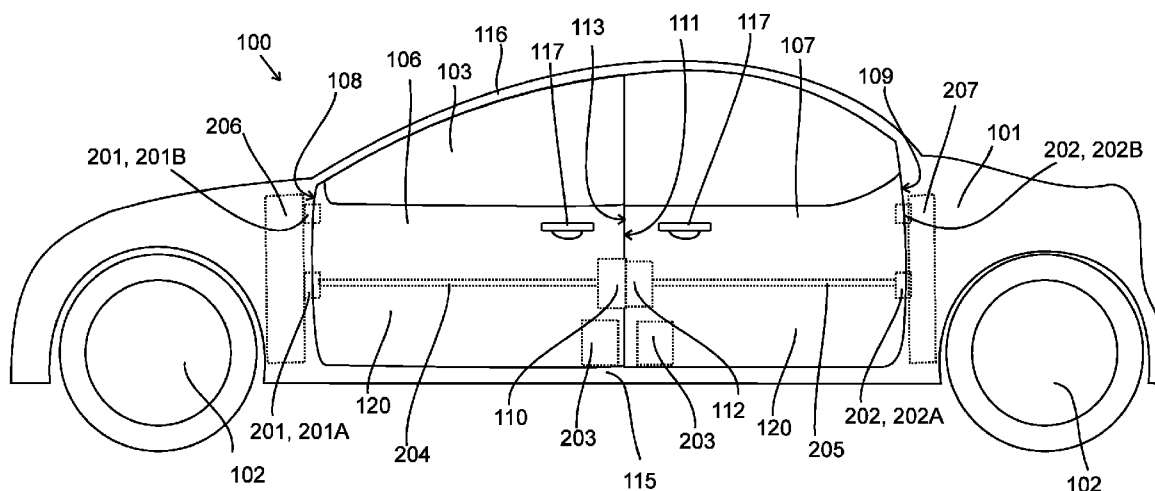


Fig. 2

(57) Abstract: Aspects of the present invention relate to a door for a vehicle, a door arrangement and a vehicle. The door (106, 107) comprises a first door panel (120) and a first support mechanism (201) configured to support the first door panel (120) on a body (101) of a vehicle (100). The first support mechanism (201) is configured to enable movement of the door (106, 107) between an open position and a closed position. The door includes a first connection part (110) attached to the first door panel (120), for providing a latching connection with a second connection part (112) of the vehicle (100) to maintain the door (106, 107) in the closed position. The door (106, 107) also includes a first tension member (204) connected to both the support mechanism and the first connection part (110). The first support mechanism (201) and the first connection part (110) are configured to enable the first tension member (204) to be put in tension between the first support mechanism (201) and the first connection part (110). The first tension member (204) is sufficiently flexible to enable a lateral force against the first tension member (204) to be mainly resisted by tension forces that the lateral force produces in the first tension member (204) when the first support mechanism (201) and the first connection part (110) are restrained.

OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

- (84) Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

- *with international search report (Art. 21(3))*
-

A DOOR, A DOOR ARRANGEMENT AND A VEHICLE

TECHNICAL FIELD

- 5 The present disclosure relates to a door, a door arrangement and a vehicle. In particular, but not exclusively it relates to a door for a vehicle, a door arrangement for a vehicle and a vehicle in which the vehicle is a road vehicle such as a car.

BACKGROUND

10

The safety of occupants of road vehicles, such as cars, depends partly upon the strength of the structure of the vehicle that surrounds the occupants. This includes the strength of the sides of the vehicle, which is of importance during a side impact on the vehicle. Consequently, road vehicles are known to have doors that include additional structural members formed of high tensile steel bars, to increase the ability of the doors to withstand impacts from other vehicles, thereby increasing occupant safety. However, the additional structure adds to the weight of the doors and the overall weight of the vehicle.

15

On conventional road vehicles, such as cars, passengers are able to obtain access to front seats of the cabin of the vehicle by a front door mounted on an A-pillar at the front end of the front door and may be able to obtain access to rear seats by a rear door, typically mounted on a B-pillar at the front end of the rear door, or possibly mounted on a C-pillar at the rear end of the rear door. In the event of a side impact on such a vehicle, the B-pillar positioned between the front and rear door plays a significant part in providing structural reinforcement for side impact events.

20

25

In recent times, vehicle designs have been proposed that eliminate the B-pillar between front and rear doors to provide easier access into the cabin of the vehicle. However, the disadvantage of this arrangement is that it results in the front and rear doors extending across a relatively wide single opening, without the support that a B-pillar would provide to the doors in the event of a side impact on the vehicle.

30

It is an aim of the present invention to address one or more of the disadvantages associated with the prior art.

35

SUMMARY OF THE INVENTION

Aspects and embodiments of the invention provide a door, a door arrangement and a vehicle as claimed in the appended claims.

5

According to an aspect of the invention there is provided a door for a vehicle, the door comprising: a first door panel; a first support mechanism configured to support the first door panel on a body of a vehicle, the first support mechanism being configured to enable movement of the door between an open position and a closed position; a first connection part
10 attached to the first door panel, for providing a latching connection with a second connection part of the vehicle to maintain the door in the closed position; and a first tension member connected to both the support mechanism and the first connection part; wherein the first support mechanism and the first connection part are configured to enable the first tension member to be put in tension between the first support mechanism and the first connection
15 part, and the tension member is sufficiently flexible to enable a lateral force against the tension member to be mainly resisted by tension forces that the lateral force produces in the tension member when the first support mechanism and the first connection part are restrained.

This provides the advantage that the tension member provides a barrier to an object impacting
20 against the door, such as another vehicle, to prevent it from encroaching into the cabin of the vehicle. Also, because the tension member is a flexible member connected to the first support mechanism and the first connection part, so that the forces of tension created in the tension member provide the main resistance to the encroachment, the tension member may be formed of a relatively light structure. For example, the tension member may be formed of a high tensile
25 steel cable.

According to another aspect of the invention there is provided a door for a vehicle, the door comprising: a first door panel; a first support mechanism configured to support the first door panel on a body of a vehicle, the first support mechanism being configured to enable
30 movement of the door between an open position and a closed position; a first connection part attached to the first door panel, for providing a latching connection with a second connection part of the vehicle to maintain the door in the closed position; and a first tension member connected to both the support mechanism and the first connection part; wherein the first support mechanism and the first connection part are configured to enable the first tension

member to be put in tension between the first support mechanism and the first connection part.

5 Optionally, the first connection part comprises a latch mechanism for connection with a second connection part comprising a striker. This provides the advantage that the first connection part may be simply releasably restrained to provide an anchor for the tension member.

10 Optionally, the first support mechanism comprises a hinge. This provides the advantage that the tension member is anchored to the body of the vehicle via the hinge and no additional connection arrangement is required to anchor the tension member to the body of the vehicle at the hinge side of the door.

15 Optionally, the first tension member extends along a first straight line that passes through the first support mechanism and the first connection part. This provides the advantage that the tension member extends between the first support mechanism and the first connection member without any slackness in the first tension member. Consequently, as soon as an impacting object pushes against the tension member the tension forces in the tension member are able to increase more steadily and they are jerked less.

20 Optionally, the first tension member comprises at least one wire.

Optionally, the first tension member comprises a cable comprising a plurality of wires.

25 Optionally, the first tension member is formed of a metal.

According to another aspect of the invention there is provided a door arrangement for a vehicle comprising the door of any one of the previous paragraphs, in which said door is a first door of the vehicle and the door arrangement includes a second door comprising: a second door panel; a second support mechanism configured to support the second door panel on a body of the vehicle and enable movement of the second door between an open position and a closed position; a second connection part attached to the second door panel; and a second tension member connected to both the second support mechanism and the second connection part; wherein the first connection part of the first door is configured to provide a latching connection with the second connection part of the second door. This provides the advantage that the two doors are able to extend across a relatively wide opening to provide easy access

30

35

into and out from the cabin of the vehicle, while the tension members provide a barrier for resisting encroachment into the cabin by object impacting against one or both of the doors.

Optionally, the second tension member is formed of the same type of material as the first tension member.

Optionally, the first connection part comprises a latch mechanism and the second connection part comprises a striker. This provides the advantage that the first connection part may be simply releasably connected to the second connection part in a manner in which play between the connection parts may be minimized.

Optionally, the second support mechanism comprises a hinge. This provides the advantage that the second tension member is anchored to the body of the vehicle via the hinge and no additional connection arrangement is required to anchor the tension member to the body of the vehicle at the hinge side of the door.

Optionally, the first tension member extends in a first direction and the second tension member extends in a second direction, and the angle between the first direction and the second direction is less than 10 degrees. This provides the advantage that the amount of lateral movement of the tension members caused by an impacting object before they become taut is kept within a limit, and therefore the initial jerk applied to the tension members as they become taut is limited.

Optionally, the angle between the first direction and the second direction is less than 2 degrees. This provides the advantage that the amount of lateral movement of the tension members caused by an impacting object before they become taut is kept relatively small, and therefore the initial jerk applied to the tension members as they become taut is kept relatively small.

Optionally, the first tension member extends along a first line that passes through the first support mechanism and the first connection part, and the second tension member extends along a second line through the second support mechanism and the second connection part. This provides the advantage that the amount of lateral movement of the tension members caused by an impacting object before they become taut is kept relatively small.

Optionally, the second tension member extends along the first line through the second support mechanism and the second connection part, so that the first tension member and the second tension member are aligned. This provides the advantage that tension may be built up relatively gradually in the tension members from the time at which an impacting object initially pushes against the tension members.

According to another aspect of the invention there is provided a vehicle comprising a body defining a cabin, and a door according to any one of the previous paragraphs.

According to a further aspect of the invention there is provided a vehicle comprising a body defining a cabin, and a door arrangement according to any one of the previous paragraphs.

Optionally, the body has an opening to enable entry into the cabin, the first support mechanism is attached to the body at a first side of the opening and the second support mechanism is attached to the body at a second side of the opening that is opposite to the first side.

Optionally, in the event of a force of an impacting object causing a tension force in the first tension member, the first support mechanism is configured to transfer the tension force to the body at the first side of the opening, and the first connection part, the second connection part, the second tension member and the second support mechanism are configured to transfer the tension force to the body at the second side of the opening.

According to yet a another aspect of the invention there is provided a door arrangement for a vehicle, the door arrangement comprising a first door and a second door, wherein the first door comprises: a first door panel; a first support mechanism configured to support the first door on a body of a vehicle and enable movement of the first door between an open position and a closed position; a first connection part attached to the first door panel; and a first tension member connected to both the first support mechanism and the first connection part; and the second door comprises: a second door panel; a second support mechanism configured to support the second door on a body of a vehicle and enable movement of the second door between an open position and a closed position; a second connection part attached to the second door panel; and a second tension member connected to both the second support mechanism and the second connection part; wherein the first connection part of the first door is configured to provide a latching connection with the second connection part of the second door.

This provides the advantage that the tension members provide a barrier to an object impacting against the door, such as another vehicle, to prevent it from encroaching into the cabin of the vehicle. Also, because the tension members are connected to the support mechanisms and the connection parts, tension forces generated in the tension members are able to resist a lateral force exerted by an impacting object and so the tension members are able to be provided with a relatively light structure.

Optionally, the first connection part comprises a latch mechanism and the second connection part comprises a striker. This provides the advantage that the first connection part may be simply releasably connected to the second connection part in a manner in which play between the connection parts may be minimized.

Optionally, the first support mechanism comprises a hinge. This provides the advantage that the tension members are anchored to the body of the vehicle via the hinge and no additional connection arrangement is required to anchor the tension member to the body of the vehicle at the hinge side of the first door.

Optionally, the first tension member extends in a first direction and the second tension member extends in a second direction, and the angle between the first direction and the second direction is less than 10 degrees. This provides the advantage that the amount of lateral movement of the tension members caused by an impacting object before they become taut is kept within a limit, and therefore the initial jerk applied to the tension members as they become taut is limited.

Optionally, the first tension member comprises at least one wire.

According to yet a further aspect of the invention there is provided vehicle comprising a body defining a cabin, and a door arrangement according to any one of the previous paragraphs, wherein the body has an opening to enable entry into the cabin, the first support mechanism is attached to the body at a first side of the opening and the second support mechanism is attached to the body at a second side of the opening that is opposite to the first side.

Within the scope of this application it is expressly intended that the various aspects, embodiments, examples and alternatives set out in the preceding paragraphs, in the claims

and/or in the following description and drawings, and in particular the individual features thereof, may be taken independently or in any combination. That is, all embodiments and/or features of any embodiment can be combined in any way and/or combination, unless such features are incompatible. The applicant reserves the right to change any originally filed claim or file any new claim accordingly, including the right to amend any originally filed claim to depend from and/or incorporate any feature of any other claim although not originally claimed in that manner.

BRIEF DESCRIPTION OF THE DRAWINGS

One or more embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Fig. 1 shows a vehicle embodying the present invention with its doors in an open position;

Fig. 2 shows the vehicle of Fig. 1 with its doors closed;

Fig. 3 shows an alternative vehicle embodying the present invention;

Fig. 4 shows a first connection part of a front door and a second connection part of a rear door of the vehicle of Fig. 1, with a latch member in a latched position;

Fig. 5 shows the connection parts of the doors of Fig. 4 with the latch member in an unlatched position;

Fig. 6 shows another vehicle embodying the present invention;

Fig. 7 shows an enlarged view of a first connection part, supporting mechanisms and a tension member of the vehicle of Fig. 6;

Fig. 8 shows a further vehicle embodying the present invention; and

Fig. 9 shows an enlarged view of a first connection part, supporting mechanisms and two tension members of the vehicle of Fig. 8.

DETAILED DESCRIPTION

A door 106, 107 for a vehicle 100 and a vehicle in accordance with an embodiment of the present invention is described herein with reference to the accompanying Figs. 1, 2, 4 and 5.

With reference to Figs. 1 and 2, the vehicle 100 is a road vehicle comprising a body 101 supported on road wheels 102. The body 101 defines a cabin 103 which, in the present

embodiment, contains seating 104 (shown in Fig. 1) to enable users of the vehicle to be seated and an opening 105 to enable users to enter and exit the cabin 103.

The vehicle 100 also comprises a front door 106 and a rear door 107 that each comprises an outer panel 120. In combination, the outer panels 120 of the two doors 106 and 107 extend across the width of the opening 105 when the doors 106 and 107 are in a closed position, as shown in Fig. 2. The doors 106 and 107 are shown in their open positions in Fig. 1, in which they allow access through the opening 105.

The outer panel 120 of the front door 106 is supported from the body 101 at its front edge 108 by first supporting mechanisms 201 (shown in Fig. 2) that enable the front door 106 to move between the open position of Fig. 1 and the closed position of Fig. 2. Similarly the outer panel 120 of the rear door 107 is supported from the body 101 at its rear edge 109 by second supporting mechanisms 202 that enable the rear door 107 to move between the open position of Fig. 1 and the closed position of Fig. 2. The first supporting mechanisms 201 of the front door 106 are attached to the body 101 at the front side of the opening 105, while the second supporting mechanisms 202 of the rear door 107 are attached to the body 101 at the rear side of the opening 105.

The first supporting mechanisms 201 comprise hinges 201A and 201B, and the second supporting mechanisms 202 comprise hinges 202A and 202B. Therefore the supporting mechanisms 201 and 202 enable the doors 106 and 107 to rotate between their open and closed positions.

The front door 106 comprises a first connection part 110 attached to its outer panel 120 adjacent to its rear edge 111. Similarly the rear door 107 comprises a second connection part 112 attached to its outer panel 120 adjacent to its front edge 113. In the present embodiment the second connection part 112 comprises a striker (401 shown in Figs. 4 and 5) and the first connection part 110 comprises a latching mechanism (400 shown in Figs. 4 and 5) configured to provide latching engagement with the striker when the doors 106 and 107 are closed. However, it will be appreciated that in other embodiments, the first connection part 110 may comprise a striker and the second connection part 112 may comprise a latching mechanism to latch with the striker.

In the present embodiment, the doors 106 and 107 each comprise a second latching mechanism 203 (shown in Fig. 2) configured to latch with a corresponding striker 114 (shown in Fig. 1) mounted on the body 101 of the vehicle 100. The body 101 comprises a sill 115 which extends along the vehicle 100 at the bottom of the doors 106 and 107, and in the present embodiment, the strikers 114 are located on the sill 115. The second latching mechanism 203 enables each of the doors 106 and 107 to be individually latched against the sill 115. The second latching mechanism 203 of the front door 106 is located adjacent to the rear edge 111 of its outer panel 120. Similarly, the second latching mechanism 203 of the rear door 107 is located adjacent to its front edge 113 of its outer panel 120.

The second latching mechanisms 203 may be similar to those found on conventional cars on front doors that latch against a B pillar, or rear doors that latch against a C pillar.

In some alternative embodiments the doors 106 and 107 are provided with latching mechanisms 115 for latching against strikers 114 positioned on a cant rail 116 that extends over the top of the doors. In some such embodiments the doors 106 and 107 are not provided with a means of latching against the sill 115. In other alternative embodiments, the doors may only be arranged to latch to each other, or just one of the two doors may be arranged to latch against the sill 115 or cant rail 116.

The doors 106 and 107 of Figs. 1 and 2 are each provided with a handle 117 to enable a user of the vehicle 100 to cause the release of the first connection part 110 and the latching mechanism 203.

The front door 106 also comprises a first tension member 204 that is connected at a first end to the support mechanism 201A and a second end connected to the first connection part 110. The first tension member 204 extends along a straight line between the first support mechanism 201A and the first connection part 110, and it is formed of a material having high tensile strength. The tension member 204 is formed of a flexible material but it is provided with sufficient tension so that it extends along substantially straight lines between the first support mechanism 201A and the first connection part 110. The required tension may be provided by a tensioning mechanism at the support mechanism 201A or at the first connection part 110, for example by means of a ratchet mechanism (not shown), or as a part of the tension member 204 for example by incorporating a turnbuckle into the tension member 204.

In the embodiment of Figs. 1 and 2 the tension member 204 is formed of a cable comprising a plurality of steel wires. However, in other embodiments the tension member 204 may comprise a single steel wire or several steel wires formed into a strap structure. In some alternative embodiments, the wire, cable or strap structure may be formed of an alternative metal or a fibre composite material.

The rear door 107 comprises a second tension member 205 which is connected at a first end to the second support mechanism 202A and a second end connected to the second connection part 112. The second tension member 205 is similarly arranged to extend along a straight line between the second support mechanism 202A and the second connection part 112, and it is formed of the same type of material as the first tension member 204. In the present embodiment the first tension member 204 and the second tension member 205 are collinear.

However, as illustrated in a similar but alternative vehicle 100 embodying the present invention shown in Fig. 3, the first tension member 204 extends from the first support mechanism 201A to the first connection part 110 along a first direction 302 and the second tension member 205 extends from the second connection part 112 to the second support mechanism 202A along a second direction 303 so that there is an angle 304 between the two directions 302 and 303. In some embodiments the angle 304 is arranged to be within 2 degrees of zero but in other embodiments it may be up to 10 degrees.

All other features of the vehicle 100 of Fig. 3 may be as described for the vehicle 100 of Figs. 1 and 2, and where shown they have been provided with the same reference signs.

Returning to the embodiment of Figs. 1 and 2, it may be observed in Fig. 1 that unlike conventional cars, there is no pillar extending between the sill 115 and the cant rail 116 at the position of the rear edge 111 of the front door 106 and the front edge 113 of the rear door 107 when they are closed. However, like conventional cars, the body 101 of the vehicle 100 comprises a strong rigid first pillar 206 forward of the opening 105 and a strong rigid second pillar 207 to the rear of the opening 105.

With the doors 106 and 107 in their closed positions, the first tension member 204 and the second tension member 205 connected by the first connection part 110 and the second connection part 112 form a barrier that extends between the first support mechanism 201 and

the second support mechanism 202, which are anchored to the pillars 206 and 207 of the body 101 of the vehicle 100. Although flexible, the tension members 204 and 205 are capable of withstanding high tension forces. Consequently, in the event of another vehicle impacting against one or both of the doors 106 and 107, the tension members 204 and 205 are placed
5 in tension, supported by the body 101, and the tensional force in the tension members 204 and 205 acts against the other vehicle to prevent its access through the opening 105. For example, rather than allowing the other vehicle entry into the cabin 103, the force of the other vehicle against the tension members 204 and 205 may cause the vehicle 100 of Figs. 1 and 2 to be pushed sideways. It will therefore be appreciated that the tension members 204 and
10 205 provide a barrier that increases the protection of occupants of the cabin 103.

It should also be understood that when subjected to the lateral force applied to them by the impacting vehicle, the tension members 204 and 205 do not resist the lateral force by their rigidity and resistance to bending. Instead, because they are flexible and have high tensile
15 strength, they resist the lateral force exerted by the impacting vehicle mainly by the tension forces that are created within them. However, in some alternative embodiments, the tension members may be rigid, and when subjected to the lateral force applied to them by the impacting vehicle, the tension members resist the lateral force by resistance to bending as well as by the tension forces created within them.

Also it may be noted that, because the tension members 204 and 205 extend in a straight line that extends through the support mechanisms 201 and 202 and the connection parts 110 and 112, when an impacting object pushes against the tension members 204 and 205 the tension
20 forces in the tension members are able to increase steadily and they are jerked less than they would be if they were originally allowed to be slack. For similar reasoning, the amount of play between the connection members 110 and 112 when connected together is kept to a minimum. I.e. the space through which one connection part 110 or 112 is able to move relative to the other connection part 110, 112 when they are connected together is kept to a minimum.

In the embodiment of Figs. 1 and 2, the supporting mechanisms 201 comprise hinges 201A and 201B, and the second supporting mechanisms 202 comprise hinges 202A and 202B. However, in alternative embodiments, the doors 106 and 107 are arranged to slide between open and closed positions. In some such embodiments, the supporting mechanisms 201 and 202 comprise guide mechanisms that are attached to the body 101, and the doors 106 and
30 107 comprise a rail that is configured to slide by movement over the guide mechanism.
35

In other embodiments the doors 106 and 107 are arranged to slide open and closed, and the supporting mechanisms 201 and 202 comprise guide mechanisms that are attached to the doors 106 and 107 and which are arranged to move along rails fixed to the body of the vehicle.

5 In some such embodiments, the rail is configured to limit further movement of the guide mechanism in its closing direction when it is closed, so that the guide mechanism is able to hold the tension member in tension when required. In other such embodiments, the guide mechanism may be arranged to be latched to the body when the doors are in their closed positions.

10 In other alternative embodiments, each of the two doors 106 and 107 may be provided with a different type of support mechanism on which it is mounted to move between open and closed positions. For example, in some embodiments, just one of the doors 106 and 107 may be arranged to slide on a guide mechanism while the other door is mounted on hinges.

15 Figs. 4 and 5 provides a schematic illustration of the first connection part 110, the second connection part 112 and the second latching mechanisms 203 on the inner sides of the outer panels 120 of the doors 106 and 107. The second connection part 112 comprises a striker 401 in the form of a steel loop (which extends out of the paper in Figs. 4 and 5). The striker
20 401 is fixed to a supporting plate 402, to which a hook 403 is attached. The hook provides an anchor point to which one end of the second tension member 205 is attached. The tension member 205 is in the form of a steel cable having an eyelet at each of its ends. Thus, as shown in Fig. 4, the tension member 205 is attached to the second connection part 401 by the eyelet hooked over the hook 403.

25 The first tension member 204 is similarly provided with eyelets 404 and attached to a hook 403 of the first connection part 110. The first connection part 110 comprises a latching mechanism 400 that includes a latching member 405. The latching member 405 is mounted to rotate on a pivot pin 406 between the latched position of Fig. 4 and the unlatched position
30 of Fig. 5. The latching member 405 may be moved into its latched position against the force of a first spring (not shown) and held in the latched position by a detent 410 that acts against a ratchet portion 407 of the latching element. The detent 410 is itself mounted on a pivot pin 408 and urged into the position shown in Fig. 4 by a second spring (not shown), where it retains the latching member 405 in its latched position.

The latching member 405 is configured such that it does not extend past the rear edge 111 of the outer panel 120 of the first door 106 in its unlatched position, as shown in Fig. 5, but extends past the rear edge 111 to latch over the striker 401 in its latched position shown in Fig. 4.

5

The actuation of the latching member 405 and the detent 410 is performed by an actuation mechanism shown generally at 409. The actuation mechanism 409 may be provided with a mechanical linkage to the handle 117 of the front door 106 to enable the detent 410 to be moved to a retracted position, shown in Fig. 5, where it releases the latching member 405, which may then be unlatched, for example by the first spring. In addition, or alternatively, a sensor (not shown) is located at each of the handles 117 and configured to provide a signal when the handle 117 is actuated, and the actuation mechanism 409 may comprise an electromechanical actuator that is configured to retract the detent 410 in dependence on the signal generated by the sensor at either one of the handles 117.

15

The doors 106 and 107 or the body 101 of the vehicle 100 may comprise sensors (not shown) configured to detect when the doors 106 and 107 are in their closed positions and to provide a signal indicative of when they are in their closed positions. For example, the sensors may be arranged to detect when the second latching mechanisms 203 are in their latched positions and to provide a signal indicative of this. Alternatively the sensors may comprise proximity sensors arranged to detect when each of the doors is closed. The proximity sensors may be located, for example, in the doors 106 and 107 adjacent to the sill 115, or in the sill adjacent to the doors 106 and 107. The actuation mechanism 409 also comprises an electromechanical actuator configured to cause the latching member 405 to move from the unlatched position to the latched position in dependence on receiving signals from the sensors indicating that both of the doors 106 and 107 have been moved to their closed position.

25

A second vehicle 100A embodying the present invention is shown in Fig. 6. In addition, an enlarged view of a first connection part 110A, supporting mechanisms 201 and a tension member 204 of the vehicle 100A is provided in Fig. 7, in which the outer panel 120 is shown in dotted outline.

30

The second vehicle 100A is a road vehicle in the form of a car 100A. The car 100A has a body 101A defining a cabin 103 and an opening 105 to enable users of the car 100A to enter and exit the cabin 103.

35

The car 100A has just one door, such as door 106A, on each of its two sides. The door 106A has an outer panel 120 that is supported by supporting mechanisms 201 comprising two hinges 201A and 201B attached to the body 101A of the car 100A at a front edge 108 of the outer panel 120. The supporting mechanisms 201 allow the door 106A to move between an open position allowing access through the opening 105 and the closed position shown in Fig. 6, in which it extends across the entire width of the opening 105.

A first connection part 110A comprising a latching mechanism 110A is attached to the outer panel 120 of the door 106A on its inner side and adjacent to its rear edge 109. A second connection part 112A comprising a striker is attached to the body 101 of the car 100A at the rear side of the opening 105. The latching mechanism 110A may be configured to latch with the striker in a conventional manner when the door 106A is moved to its closed position. The door 106A also comprises a handle 117 to enable a user to release the latching mechanism 110A.

In addition, the door 106A comprises a tension member 204 connected to both the supporting mechanism 201 and the first connection part 110A. The tension member 204 may have a form similar to the tension member 204 of Fig. 2.

In the embodiment of Figs. 6 and 7, the tension member 204 has a first end attached to the first hinge 201 and a second end attached to the second hinge 201B. The first end and the second end of the tension member 204 are retained at the respective hinges 201A and 201B so that linear movement with respect to the hinges is prevented. For example, the hinges 201A and 201B may be provided with hooks 701 and 702 and the tension member may be provided with an eyelet 703 at each end that is attached to the hooks 701 and 702.

A mid-point of the tension member 204 is looped through a hole in a retaining loop 601 which forms a part of the first connection part 110A, so that a first section 602 of the tension member 204 extends between the first hinge 201A and the first connection part 110A and a second section 603 of the tension member 204 extends between the first connection part 110A and the second hinge 201B.

The tension member 204 is formed of a flexible material but it is provided with sufficient tension so that it extends along substantially straight lines between the first hinge 201A and the first

connection part 110A and between the second hinge 201B and the first connection part 110A. The required tension may be provided by a tensioning mechanism at either of the hinges 201A and 201B or at the first connection part 110A, for example by means of a ratchet mechanism, or alternatively the tensioning mechanism may form a part of the tension member 204, for example by incorporating a turnbuckle.

The support mechanisms 201 and the first connection part 110A are restrained by their connections to the body 101A of the vehicle 100A on either side of the opening 105. Consequently the tension member 204 is held at each of its ends in a manner that enables it to be put in tension by a lateral force exerted by an object impacting against the door 106A. The tension force created in the tension member 204 resists movement of the impacting object into the cabin 103 of the car 101A, and therefore is able to provide protection for its occupants.

In alternative embodiments to that of Figs. 6 and 7, the tension member 204 only extends between one of the hinges 201A or 201B and the first connection part 110A, where it is anchored to enable a tensional force to be created within the tension member.

Another vehicle 100B embodying the present invention is shown in Fig. 8. In addition, an enlarged view of a first connection part 110A, supporting mechanisms 201 and a tension member 204 of the vehicle 100B is provided in Fig. 9, in which the outer panel 120 is shown in dotted outline.

The vehicle 100B is similar to that of Fig. 6 but differs in that it has a door 106B comprising two tension members 204 and 204A. A first end of the first tension member 204 is anchored to the first hinge 201A at the front edge 108 of the door 106B and a second end is anchored to a first connection part 110B at a rear edge 109 of the door 106B. A first end of the second tension member 204A is anchored to a second hinge 201B at the front edge 108 of the door 106B and a second end is also anchored to the first connection part 110B.

The first connection part 110B comprises a hook 801 and a hook 701, 702 is also attached to each of the hinges 201A and 201B. The ends of the tension members 204 and 204A are provided with eyelets 703 for attachment to the hook 801 of the first connection part 110B and for attachment to one of the hooks 701 and 702 that are fixed to the hinges 201A and 201B.

It will be appreciated that the tension members 204 and 204A provide protection for occupants of the vehicle 100B in a similar manner to the tension member 204 of the vehicle 100A of Fig. 6.

- 5 It will be appreciated that various changes and modifications can be made to the present invention without departing from the scope of the present application.

Although embodiments of the present invention have been described in the preceding paragraphs with reference to various examples, it should be appreciated that modifications to
10 the examples given can be made without departing from the scope of the invention as claimed. For example, in alternative embodiments, the vehicle is provided with user input devices to enable a user to request opening and/or closing of a door and a control system that is configured to cause a servo motor to actuate one or more of the door latching mechanisms.

- 15 Also the described embodiments comprise tension members that are provided with eyelets for connection to a hook, but it will be appreciated that alternative means of anchoring the ends of the tension members may be employed, provided they provide a robust mechanical fixing. For example, in some embodiments, the ends of the tension members may be crimped into a fixing tab configured to enable attachment to the support mechanisms or the connection parts.

20

Features described in the preceding description may be used in combinations other than the combinations explicitly described.

- 25 Although functions have been described with reference to certain features, those functions may be performable by other features whether described or not.

Although features have been described with reference to certain embodiments, those features may also be present in other embodiments whether described or not.

- 30 Whilst endeavoring in the foregoing specification to draw attention to those features of the invention believed to be of particular importance it should be understood that the Applicant claims protection in respect of any patentable feature or combination of features hereinbefore referred to and/or shown in the drawings whether or not particular emphasis has been placed thereon.

35

CLAIMS

1. A door for a vehicle, the door comprising:

a first door panel;

5 a first support mechanism configured to support the first door panel on a body of a vehicle, the first support mechanism being configured to enable movement of the door between an open position and a closed position;

a first connection part attached to the first door panel, for providing a latching connection with a second connection part of the vehicle to maintain the door in the closed position; and

10 a first tension member connected to both the support mechanism and the first connection part;

wherein the first support mechanism and the first connection part are configured to enable the first tension member to be put in tension between the first support mechanism and the first connection part, and

15 the first tension member is sufficiently flexible to enable a lateral force against the first tension member to be mainly resisted by tension forces that the lateral force produces in the first tension member when the first support mechanism and the first connection part are restrained.

20 2. A door according to claim 1, wherein the first connection part comprises a latch mechanism for connection with a second connection part comprising a striker.

25 3. A door according to claim 1 or claim 2, wherein the first support mechanism comprises a hinge.

30 4. A door according to any one of claims 1 to 3, wherein the first tension member extends along a first straight line that passes through the first support mechanism and the first connection part.

5. A door according to any one of claims 1 to 4, wherein the first tension member comprises at least one wire.

35 6. A door according to claim 5, wherein the first tension member comprises a cable comprising the plurality of wires.

7. A door according to any one of claims 1 to 6, wherein the first tension member is formed of a metal.

8. A door arrangement for a vehicle comprising the door of any one of claims 1 to 7, in which said door is a first door of the vehicle and the door arrangement includes a second door comprising:

a second door panel;

a second support mechanism configured to support the second door panel on a body of the vehicle and enable movement of the second door between an open position and a closed position;

a second connection part attached to the second door panel; and

a second tension member connected to both the second support mechanism and the second connection part;

wherein the first connection part of the first door is configured to provide a latching connection with the second connection part of the second door.

9. A door arrangement according to claim 8, wherein the second tension member is formed of the same type of material as the first tension member.

10. A door arrangement according to claim 8 or claim 9, wherein the first connection part comprises a latch mechanism and the second connection part comprises a striker.

11. A door arrangement according to any one of claims 8 to 10, wherein the second support mechanism comprises a hinge.

12. A door arrangement according to any one of claims 8 to 11, wherein the first tension member extends in a first direction and the second tension member extends in a second direction, and the angle between the first direction and the second direction is less than 10 degrees.

13. A door arrangement according to claim 12, wherein the angle between the first direction and the second direction is less than 2 degrees.

14. A door arrangement according to any one of claims 8 to 13, wherein the first tension member extends along a first line that passes through the first support mechanism and the first connection part, and the second tension member extends along a second line through the second support mechanism and the second connection part.

5

15. A door arrangement according to claim 14, wherein the second tension member extends along the first line through the second support mechanism and the second connection part, so that the first tension member and the second tension member are aligned.

10

16. A vehicle comprising a body defining a cabin, and a door according to any one of claims 1 to 7.

17. A vehicle comprising a body defining a cabin, and a door arrangement according to any one of claims 8 to 15.

15

18. A vehicle according to claim 17, wherein the body has an opening to enable entry into the cabin, the first support mechanism is attached to the body at a first side of the opening and the second support mechanism is attached to the body at a second side of the opening that is opposite to the first side.

20

19. A vehicle according to claim 18, wherein in the event of a force of an impacting object causing a tension force in the first tension member, the first support mechanism is configured to transfer the tension force to the body at the first side of the opening, and the first connection part, the second connection part, the second tension member and the second support mechanism are configured to transfer the tension force to the body at the second side of the opening.

25

20. A door arrangement for a vehicle, the door arrangement comprising a first door and a second door, wherein the first door comprises:

30

a first door panel ;

a first support mechanism configured to support the first door on a body of a vehicle and enable movement of the first door between an open position and a closed position;

a first connection part attached to the first door panel; and

a first tension member connected to both the first support mechanism and the first connection part; and

the second door comprises:

a second door panel;

5 a second support mechanism configured to support the second door on a body of a vehicle and enable movement of the second door between an open position and a closed position;

a second connection part attached to the second door panel; and

10 a second tension member connected to both the second support mechanism and the second connection part;

wherein the first connection part of the first door is configured to provide a latching connection with the second connection part of the second door.

21. A door arrangement according to claim 20, wherein the first connection part comprises
15 a latch mechanism and the second connection part comprises a striker.

22. A door arrangement according to claim 20 or claim 21, wherein the first support mechanism comprises a hinge.

20 23. A door arrangement according to any one of claims 20 to 22, wherein the first tension member extends in a first direction and the second tension member extends in a second direction, and the angle between the first direction and the second direction is less than 10 degrees.

25 24. A door arrangement according to any one of claims 20 to 23, wherein the first tension member comprises at least one wire.

25. A vehicle comprising a body defining a cabin, and a door arrangement according to any one of claims 20 to 24, wherein the body has an opening to enable entry into the cabin,
30 the first support mechanism is attached to the body at a first side of the opening and the second support mechanism is attached to the body at a second side of the opening that is opposite to the first side.

35

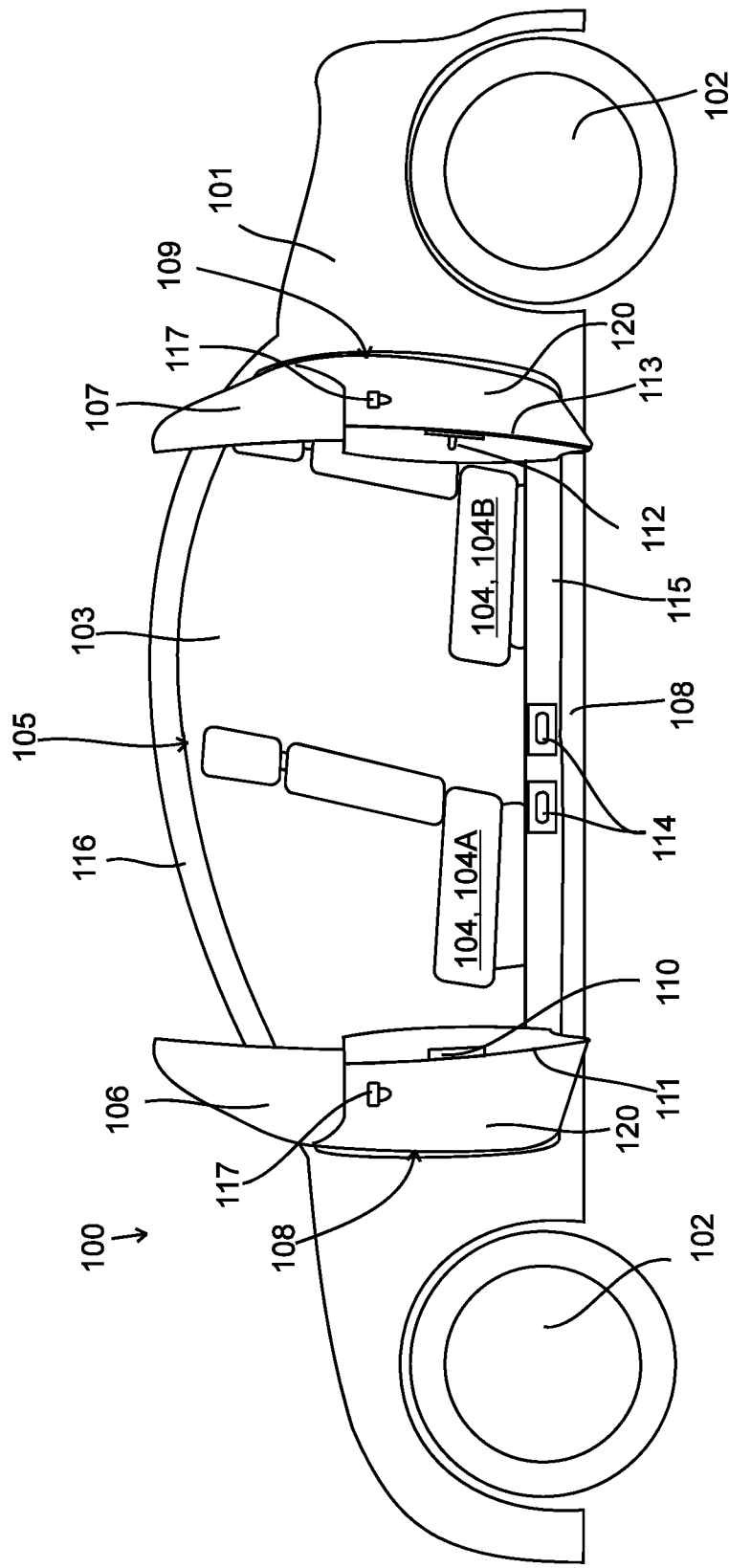


Fig. 1

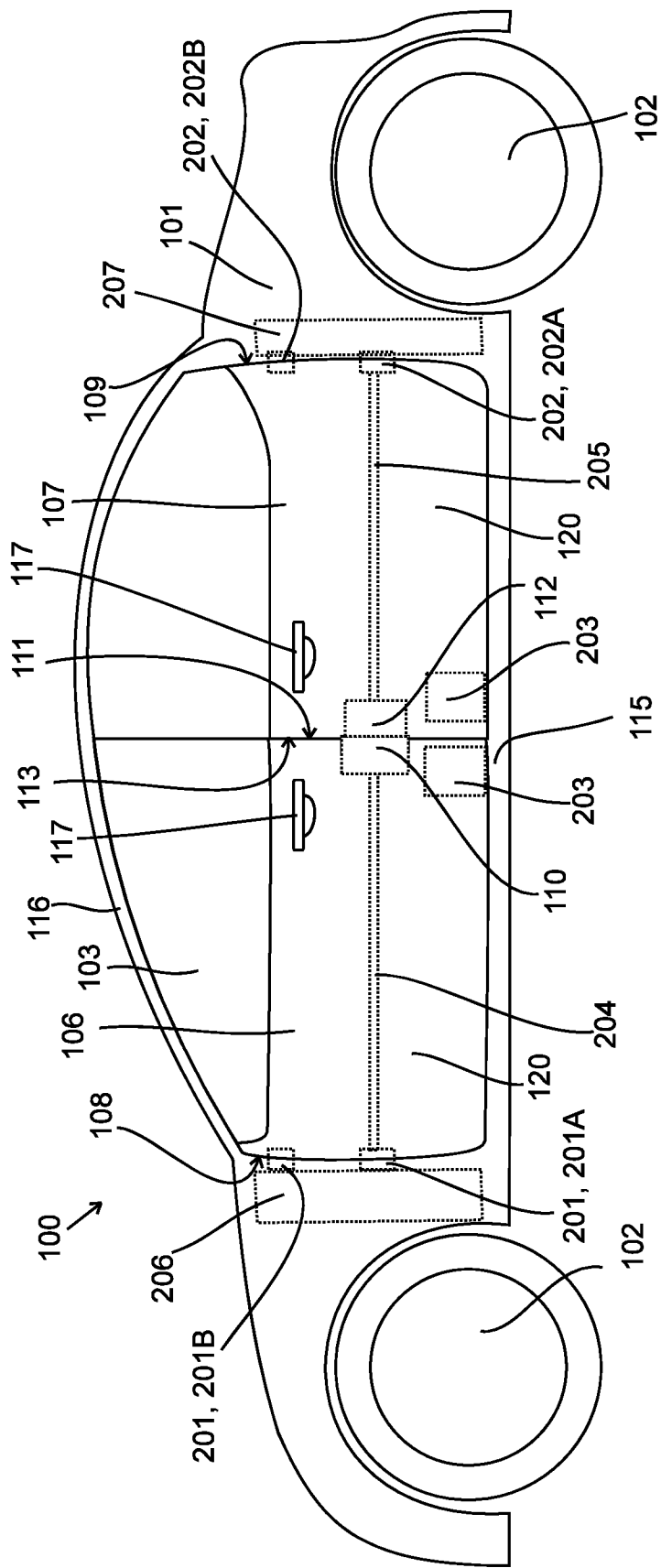


Fig. 2

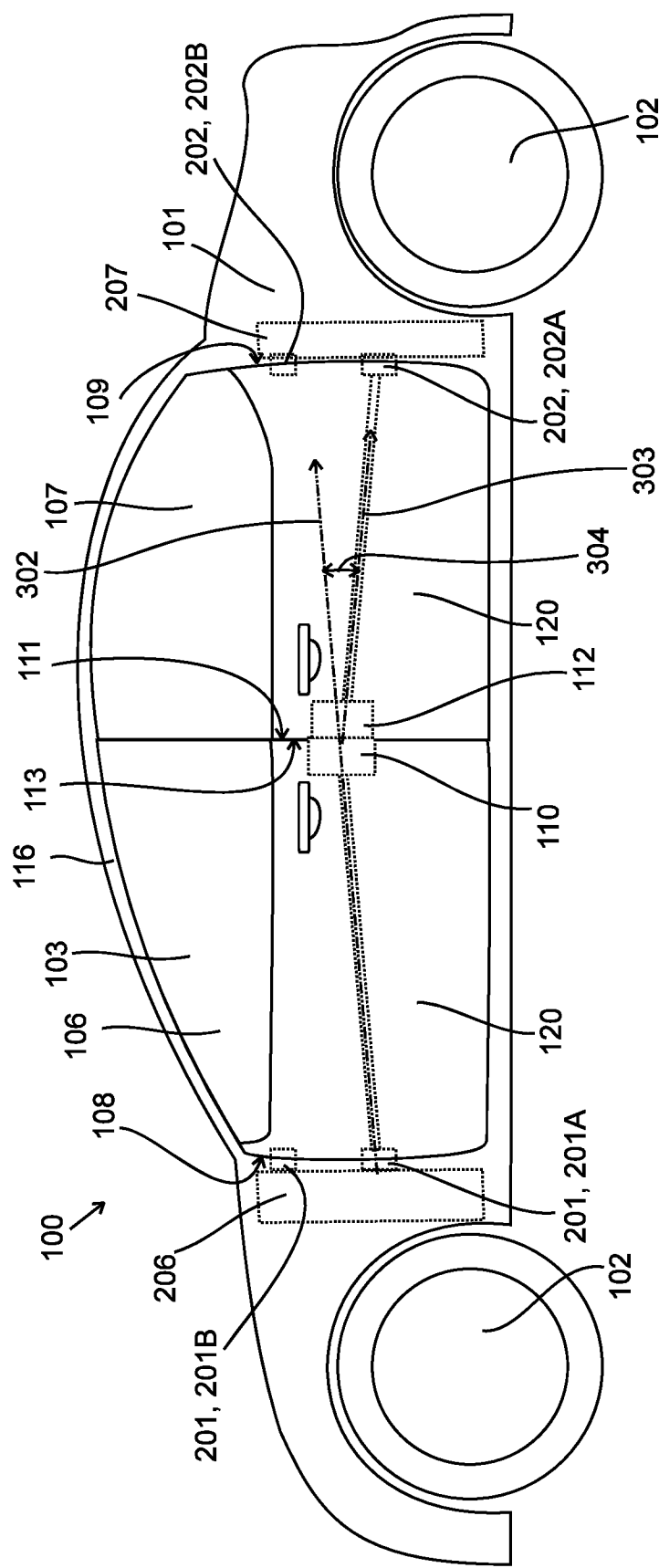


Fig. 3

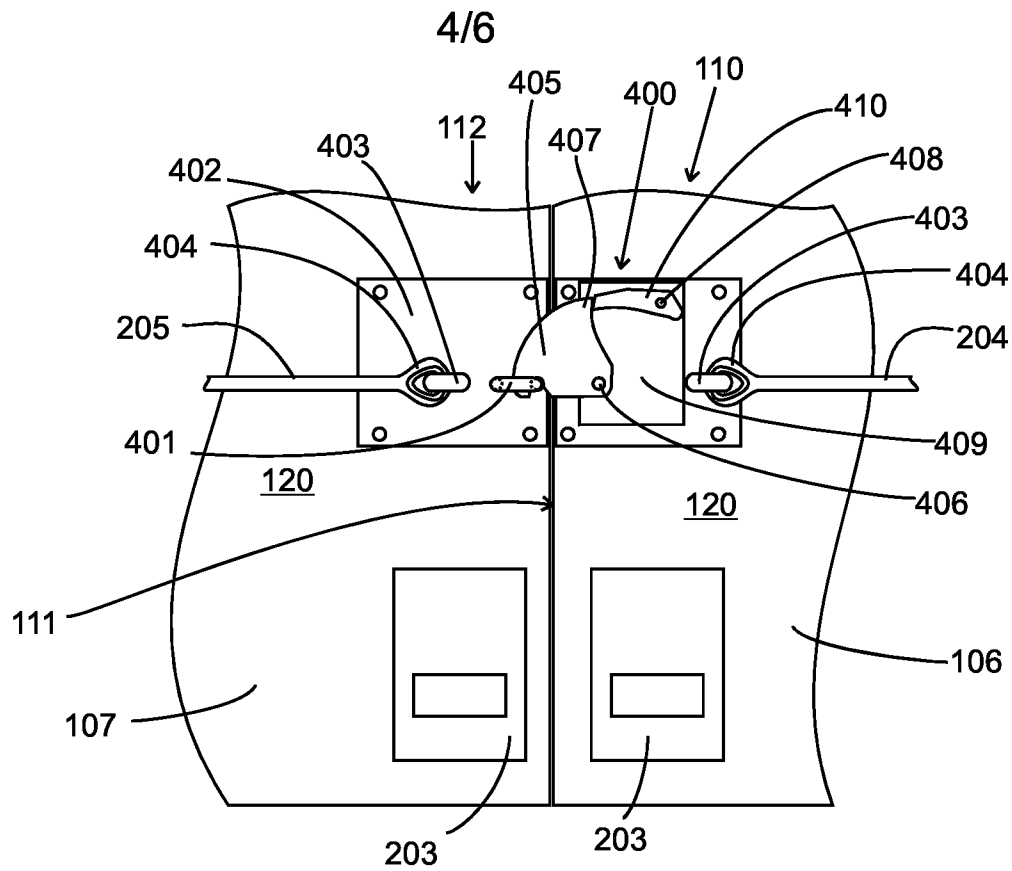


Fig. 4

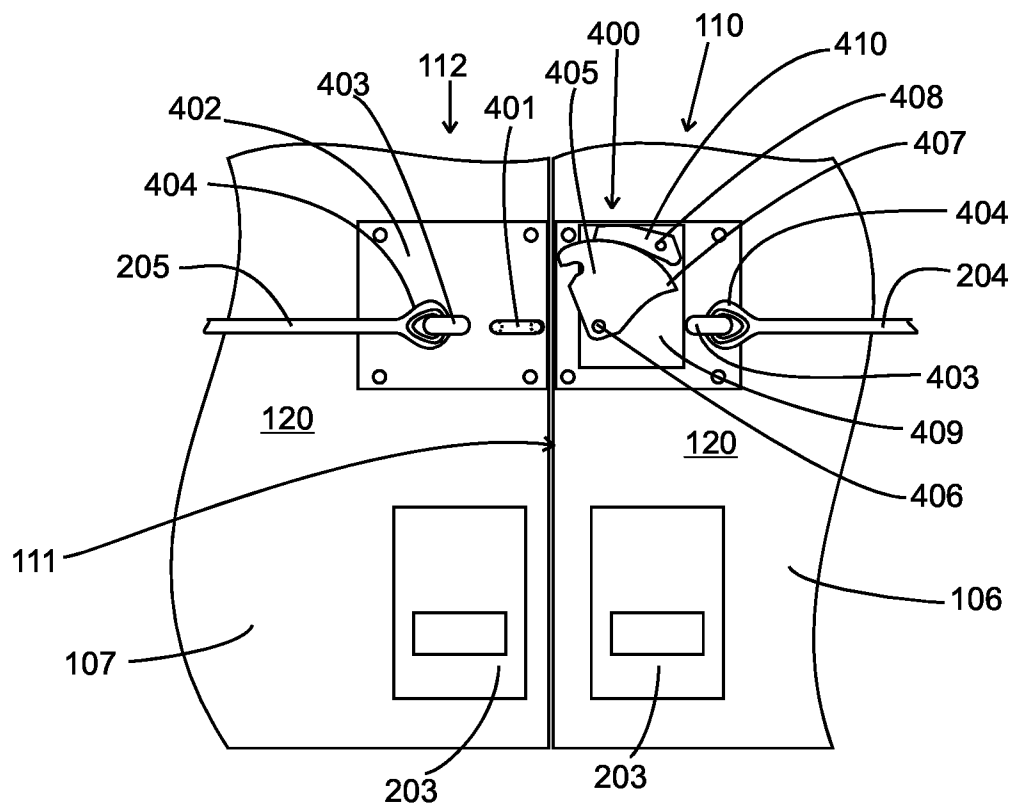


Fig. 5

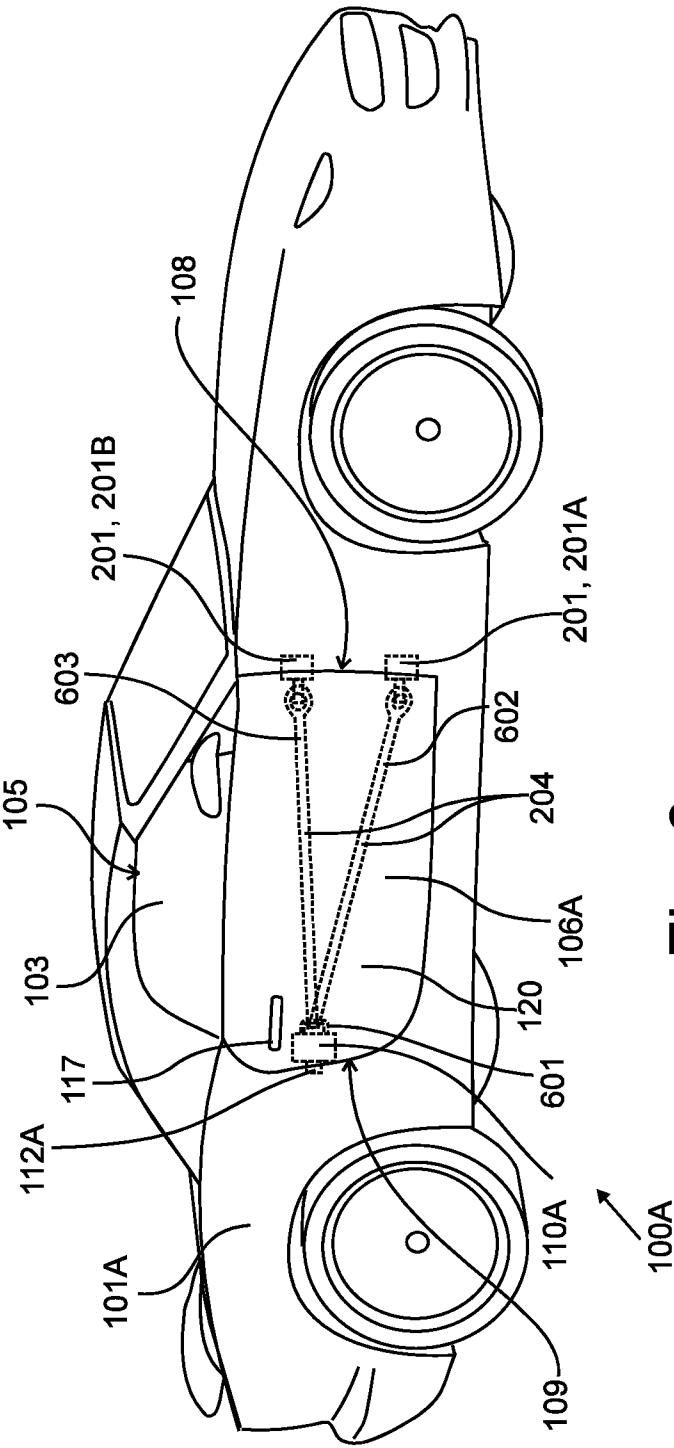


Fig. 6

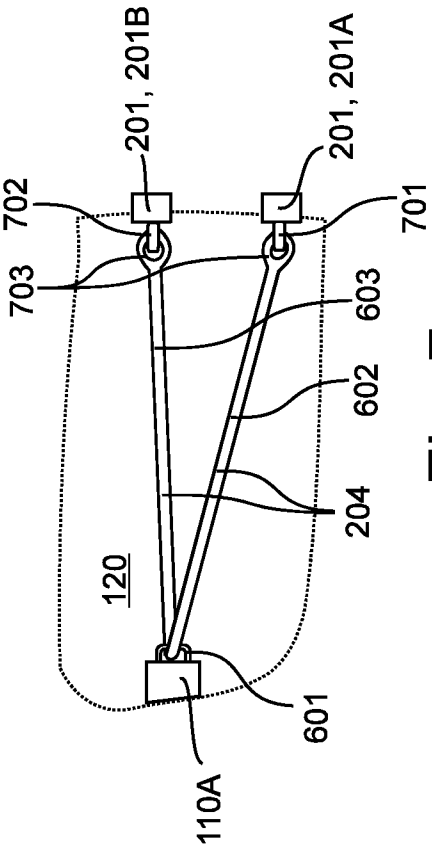


Fig. 7

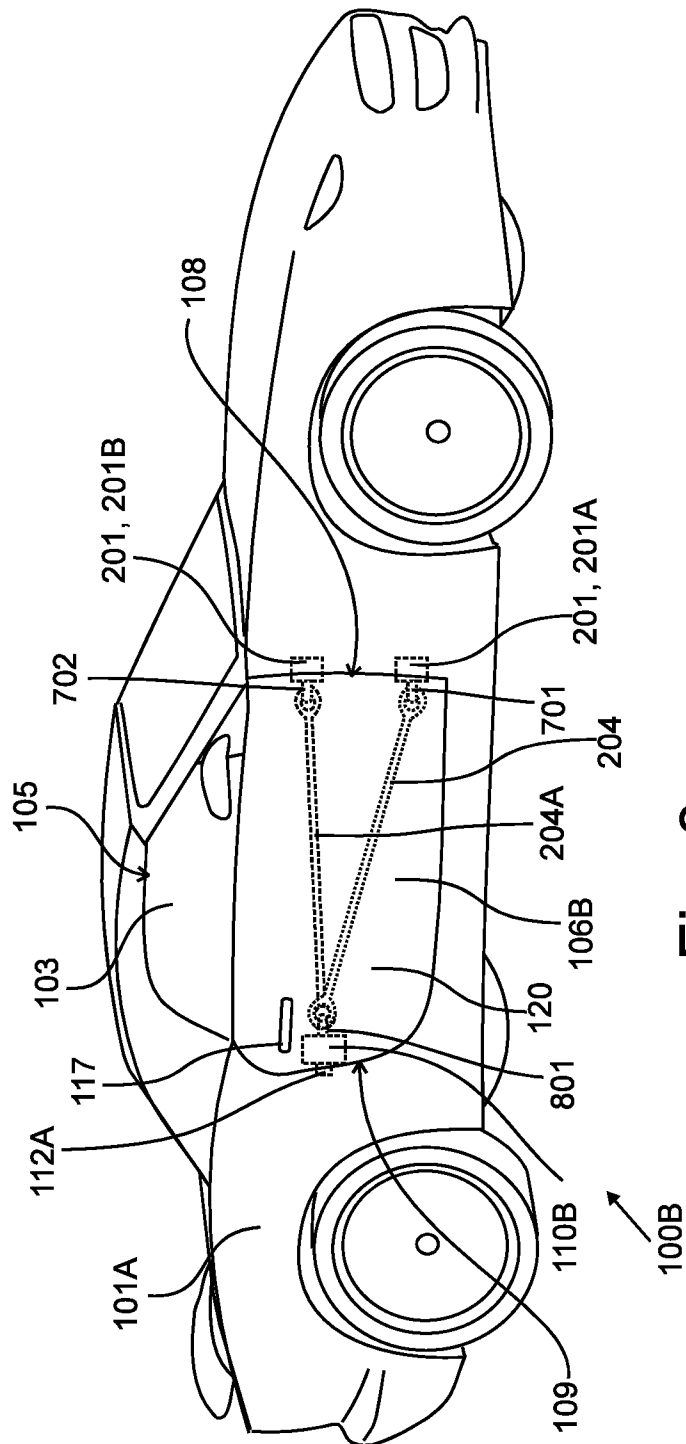


Fig. 8

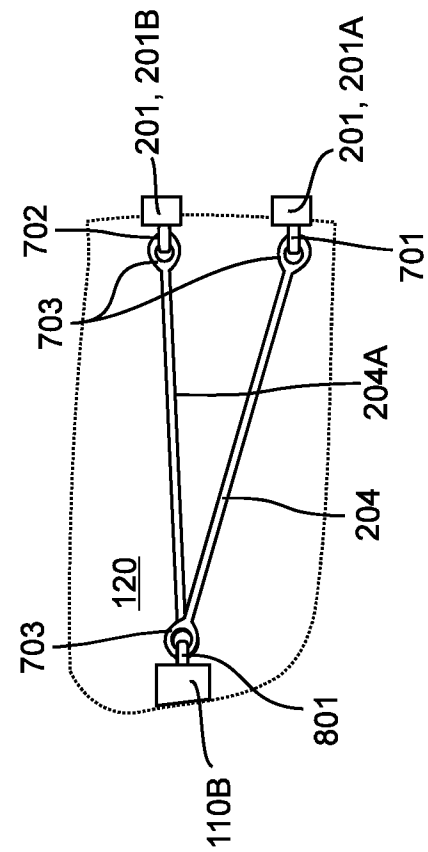


Fig. 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/078425

A. CLASSIFICATION OF SUBJECT MATTER
INV. B60J5/04
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)
B60J

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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 1 353 738 A (CHRYSLER UK) 22 May 1974 (1974-05-22)	1-7,16
Y	page 1, line 80 - page 2, line 60 figure 1	8-15, 17-19,24
X	JP 2002 104239 A (MAZDA MOTOR) 10 April 2002 (2002-04-10)	20-23,25
Y	paragraph [0030] - paragraph [0033] paragraph [0053] - paragraph [0060] paragraph [0096] - paragraph [0099] figures 1,2,3,7,16	8-15, 17-19,24
X	DE 10 2009 002777 A1 (FAURECIA INNENRAUM SYS GMBH [DE]) 11 November 2010 (2010-11-11) paragraph [0037] - paragraph [0042] figures 1,2	1-7,16
	----- -/--	



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

23 January 2020

Date of mailing of the international search report

31/01/2020

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Heijnen, Philip

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/078425

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 1 292 011 A (GEN MOTORS CORP [US]) 11 October 1972 (1972-10-11) page 1, line 55 - page 2, line 41 figures 1-3 -----	1-7,13, 15
A	JP 2003 226136 A (NISSAN MOTOR) 12 August 2003 (2003-08-12) figures 1,2,3 paragraph [0017] - paragraph [0023] paragraph [0037] - paragraph [0044] -----	13,15,20
X	US 2010/052360 A1 (HSU CHIH-CHENG [US] ET AL) 4 March 2010 (2010-03-04) paragraph [0015] - paragraph [0018] figures 1-3 -----	1-7,16
X	JP H05 294141 A (NISSAN MOTOR) 9 November 1993 (1993-11-09) paragraph [0021] - paragraph [0031] paragraph [0034] - paragraph [0036] figures 1-5 -----	1-7,16
A		9,12,14, 17,20

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2019/078425

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 1353738	A	22-05-1974	NONE
JP 2002104239	A	10-04-2002	NONE
DE 102009002777	A1	11-11-2010	NONE
GB 1292011	A	11-10-1972	DE 2006498 A1 02-09-1971 GB 1292011 A 11-10-1972
JP 2003226136	A	12-08-2003	JP 3765274 B2 12-04-2006 JP 2003226136 A 12-08-2003
US 2010052360	A1	04-03-2010	NONE
JP H05294141	A	09-11-1993	NONE