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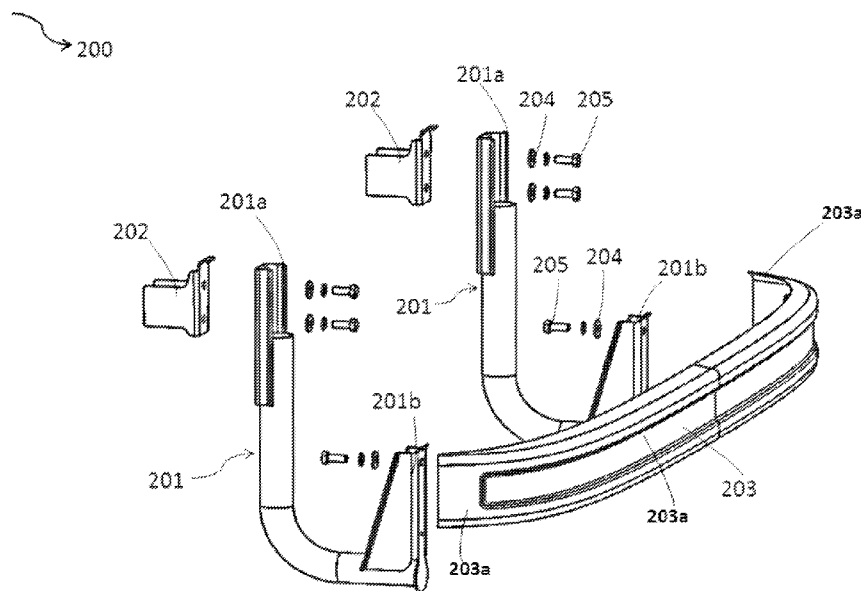


Fig. 6

(57) Abstract: The present invention relates to a bumper assembly (200) for a vehicle. The bumper assembly (200) comprises of a bumper (203) and at least one mounting member (201). The bumper (203) extends along a transverse axis of said vehicle (10) and is detachably mounted to said pair of side rails (101) of the chassis (100) through said atleast one mounting member (201). In the present invention, the bumper assembly (200) mounted to the vehicle chassis (100) and assembled independent of the cabin (21) of the vehicle (10) ensures that forces due to a rear impact are transferred to the bumper assembly (200), thus protecting the cabin (21) from damage.



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A BUMPER ASSEMBLY FOR A VEHICLE

FIELD OF INVENTION

[0001] The present invention relates to a vehicle. More particularly, the present invention relates to a bumper assembly for the vehicle.

5

BACKGROUND

[0002] In many of the developing & under developed countries, a motor vehicle particularly a three-wheeled automotive vehicle is a significant mode of public transportation. It is vastly used as a point to point mode of transport of both goods and persons from one place to other in rural as well as in urban areas. The three-wheeled vehicle is generally characterized by a tin, iron or sheet metal body resting on a front wheel and a pair of rear wheels and includes a cabin constituting a passenger compartment. While negotiating traffic condition, a rear end collision can result in damage to the cabin thus resulting in the replacement of whole cabin which can be complex as well as costly.

15 [0003] With the proliferation of governmental standards on safety standards and regulations in terms of safety performance requirements for motor vehicles, a wide variety of energy absorbing bumper assemblies have been installed on vehicles. Bumpers are metal shields designed to absorb shock caused due to impact and collision and hence prevents or reduces damage to the vehicle. Generally, a bumper attached or integrated to the front and rear of the vehicle absorbs impact in a minor collision and prevents the vehicle body from damage and hence minimizing the repair costs. Thus, with a front or rear impact at a relatively low speed against other vehicles or else against fixed obstacles, the bumper has the purpose of absorbing energy by undergoing deformation to prevent damage to other components.

25 [0004] In a known arrangement of the bumper assembly in a vehicle, the bumper is provided for a front end or rear end of a motor vehicle. For a front end

of the motor vehicle, the bumper system typically includes a bumper beam extending transversely and secured to a forward end of a pair of front rails, which extend longitudinally and are spaced transversely.

5 [0005] In a conventional three-wheeled vehicle, the bumper relates to a rear body structure and is mounted to the cabin. However, the cabin being made up of sheet metal and the bumper that of a strip of steel is not strong enough to withstand impact. Thus, if the rear structure of the vehicle is damaged by any collision or impact, then the damage is caused to both cabin and the bumper and hence the repairing involves the replacement of both bumper and the cabin.

10 [0006] In another known arrangement of the bumper assembly to the three-wheeled vehicle, the rearward mounting of the bumper to the cabin leads to the immediate breakage of the cabin and the bumper even at light collision, thereby necessitating replacement with a new cabin, which is expensive and leads to an increase in repair cost.

15 [0007] The conventional arrangement and mounting of the bumper on the rear body structure that is the cabin of the three-wheeled structure has been a weak installation and hence the cabin gets scraped, scratched and dented from a minor collision. Hence, resulting in the replacement of both bumper and cabin which is generally complex and prohibitively costly. Thus, there is a continuing
20 need for an improved mounting provision for the bumper assembly to the vehicle which is simple, light weight, damage resistant and which can be assembled independent of cabin at a reasonably low cost.

BRIEF DESCRIPTION OF THE DRAWINGS

25 [0008] The detailed description is described with reference to the accompanying figures. The same numbers are used throughout the drawings to reference like features and components.

[0009] **Figure. 1** illustrates a side view of a three-wheeled vehicle as per one embodiment of the present invention.

[00010] **Figure. 2** is a perspective side view of the three-wheeled vehicle illustrating a bumper mounted to a vehicle chassis as per one embodiment of the present invention.

5 [00011] **Figure. 3** shows a perspective view of the vehicle chassis illustrating the mounting of a bumper assembly to the vehicle chassis according to one embodiment of the present invention.

[00012] **Figure. 4** illustrates an exploded view of the bumper assembly mounted on the vehicle chassis as per one embodiment of the present invention.

10 [00013] **Figure. 5** illustrates a plane enlarged exploded view of the bumper assembly on the vehicle chassis as per one embodiment of the present invention.

[00014] **Figure. 6** illustrates an exploded view of the bumper assembly of the three-wheeled vehicle as per one embodiment of the present invention.

DETAILED DESCRIPTION

15 [00015] Automotive industries have recognized the need for lightweight, fuel efficient automobiles with safety standards and regulations imposed by the government. One such automotive component subject to heavy regulation is bumper assemblies with regard to crash safety standards. Bumper assembly installed on the vehicles serves to protect the vehicle in low-speed impacts.

20 [00016] Conventionally, the bumper assembly is comprised of a bumper beam made of a metallic material with the requisite strength to conform to governmental standards for low and high speed crashes. However, in a three-wheeled vehicle, the bumper assembly is mounted only to a rear structure of the vehicle. Since both cabin and bumper are made up of sheet metal, hence are not strong to withstand the damage due to minor collision. In the three-wheeled vehicle, the bumper is
25 welded to the cabin such that any collision or impact to the rear of the vehicle can result in damage to both cabin and the bumper. Thus, replacement of said cabin and said bumper is costly. Though bumper is available at lower cost, but the replacement of the cabin is expensive thus increasing overall repairing cost.

[00017] The disadvantages of the conventional mounting of the bumper to the cabin of the three-wheeled vehicle can be overcome by mounting the bumper to the vehicle chassis. Thus, providing easy serviceability and minimizing the overall repairing cost.

5 [00018] With the above objectives in view, the present invention discloses the bumper assembly for the three-wheeled vehicle mounted on the vehicle chassis in the manner that the bumper is assembled independent of the cabin and hence any damage to the bumper due to any collision results in replacement of only bumper and not the cabin.

10 [00019] With one embodiment of the present invention, the bumper assembly is mounted to the chassis of the vehicle and any impact to the bumper results in replacement of bumper and hence minimizing the repairing cost and providing requisite strength to the vehicle body. Thus, the improved mounting of bumper assembly to the vehicle chassis is strong enough to provide excellent performance
15 in high speed and low speed crashes.

[00020] The present invention relates to a rear body structure for the vehicle. More particularly, the present invention relates to the bumper assembly mounted to the chassis in the rear of the vehicle along the traverse axis of the vehicle. Thus, any minor collision to the rear structure of the vehicle results in the damage to the
20 bumper. The bumper replacement is done at low cost. The bumper assembly is mounted in the manner that the opposing ends of the bumper of the bumper assembly is curved thus preventing the side impact to the vehicle.

[00021] As per one embodiment of the present invention, the vehicle chassis comprises a front portion, a rear portion and a pair of side rails extending
25 longitudinally from said front portion to said rear portion. In one embodiment, the bumper assembly is detachably mounted to the rear portion of the chassis of the three-wheeled vehicle. The front portion of the chassis comprises of a floor panel rigidly secured to at least some portion of said pair of side rails. The rear portion of the chassis defines said pair of side rails extending upwardly from the
30 opposite sides of said front portion of said pair of side rails and further

terminating rearwardly along the longitudinal axis of said vehicle. As per one embodiment, the bumper assembly includes the bumper extending along the transverse axis of the vehicle. The bumper assembly is detachably mounted to said pair of side rails through at least one mounting member. Thus, the bumper
5 assembly is assembled independent of the cabin of the three-wheeled vehicle. Hence, any damage to the vehicle due to collision or impact protects the cabin from damage.

[00022] The present invention discloses the bumper assembly being detachably mounted to said pair of side rails of the rear portion of the vehicle
10 chassis through said at least one mounting member. As per one embodiment of the present invention, said at least one mounting sub-assembly comprises of at least one mounting bracket and at least one mounting contact portion for assembling said bumper assembly to the chassis. As per one embodiment, said at least one
15 mounting bracket is an inverted J-shaped bracket. As per one embodiment of the present invention, said inverted J-shaped mounting bracket comprises an angle of bent ranging from 30° to 90°.

[00023] Preferably, the rear portion of the vehicle chassis comprises said pair of side rails extending upwardly from opposite sides of the front portion of the chassis and further extending rearwardly along the longitudinal axis of the
20 vehicle. Thus, the bumper assembly mounted to the rear portion of the vehicle chassis undergoes deformation to prevent damage to one or more components including the cabin of the vehicle by absorbing the rear impact to the vehicle body.

[00024] As per one embodiment of the present invention, the rear portion of
25 the vehicle chassis provided with the bumper assembly comprises of said bumper extending along the transverse axis of said vehicle and said at least one mounting member. The bumper is detachably mounted to said pair of side rails of said rear portion of said chassis through said at least one mounting member. The bumper assembly mounted to the rear portion of the chassis and assembled independent of
30 the cabin protects the cabin from damage and break from any impact by collision.

[00025] It is advantageous to have the bumper assembly assembled separately on the vehicle chassis. Such mounting of the bumper assembly to the vehicle chassis protects the cabin of the three-wheeled vehicle from being damaged thus minimizes the repairing cost. Also, as per one embodiment of the present invention, the bumper has a arcuate surface with different radii such that the opposing ends of the bumper is curved and thus protecting the vehicle from side impact, scratches and dent. As per the present invention, the mounting of the bumper assembly to the vehicle chassis contribute rigidity to the vehicle body and hence prevents from damage or dent by absorbing the rear impact.

10 [00026] Although the present invention has been exemplified for the three-wheeled vehicle, it is not restricted only for the three-wheeled vehicle. Application of the present invention may be extended to other vehicles, including four wheeled vehicles.

[00027] Exemplary embodiment detailing features of the three-wheeled vehicle, in accordance with the present invention will be described hereunder. The embodiments described herein apply to the three-wheeled vehicle powered by an internal combustion engine. However, the present invention is not restricted in its application and is also applicable to vehicles employing the drive motor or either by the internal combustion engine or the drive motor selectively or by the internal combustion engine alone.

15 [00028] The three wheeled automotive vehicle is mainly, but not solely, used as a passenger carrier. It is to be noted that "front" and "rear", and "left" and "right" wherever referred to in the ensuing description, refer to front and rear, and left and right directions as seen in a state of being seated on a seat of the vehicle and looking forward. Furthermore, a longitudinal axis refers to a front to rear axis relative to the vehicle, while a lateral axis refers generally to a side to side, or left to right axis relative to the vehicle. Various other features of the three-wheeled vehicle according to the present subject matter here will be discernible from the following further description thereof, set out hereunder.

[00029] Further features and advantages of the invention, are described in detail below with reference to the accompanying drawings. In the drawings, like reference numbers generally indicate identical, functionally similar, and/or structurally similar elements. The drawing in which an element first appears is indicated by the leftmost digit(s) in the corresponding reference number.

[00030] **Fig. 1.** illustrates a side perspective view of an exemplary three-wheeled vehicle (10) as per one embodiment of the present subject matter. The vehicle (10) has a frame (not shown), which includes a head tube, a main tube assembly extending rearward from the head tube. The vehicle (10) has a front cowl (13) positioned in the anterior portion of the head tube. A wind shield (12) is mounted to the front cowl (13). A floorboard (22) is extending from the bottom portion of the front cowl (13) to the rearward direction of the vehicle (10), supported by the frame (not shown). A handle bar assembly (14) is rotatably supported by the head tube, positioned behind the front cowl (13). A front fender (15) is above the front wheel (16), covering at least a portion of the front wheel (16). A bottom portion of the cabin (21) constituting a passenger compartment is connected to the posterior portion of the floorboard (22). A pair of rear wheels (19) are connected to a swing arm through one or more suspension(s), the swing arm is in turn connected to the frame. The rear suspension includes a shock absorber and a suspension spring mounted to the frame. A hydraulic braking system is attached to the front wheel (16) and said pair of rear wheel (19). A hood (11) connects a top portion of the front cowl (13) and a top portion of the body panel (20). The vehicle (10) is longitudinally divided into two portions along the line X-X; a front portion has a driver's seat (17) while a rear portion of the vehicle has at least one passenger seat (18) with a seating capacity of one or more passengers. The driver seat (17) is positioned in a posterior portion to a handle bar assembly (14). A seat base and a backrest form the driver seat. The driver operates the vehicle (10) in a sitting position by sitting on the seat base. A partition wall is positioned along the line X-X extending in the lateral direction of the vehicle (10). The driver's seat (17) comprises a seat base (17a) and a fixed backrest (17b).

[00031] Fig. 2. shows a perspective side view of the three-wheeled vehicle (10) illustrating said bumper (203) of the bumper assembly (200) (shown in Fig.3 to 6) mounted to the vehicle chassis (100). The bumper assembly (200) is assembled independent of the cabin (21) of three-wheeled vehicle (10) and is mounted to the rear portion (R) of said vehicle chassis (100). Thus, preventing the vehicle body from any damage caused by impact or collision can damage the bumper (203) hence. Thus, minimizing overall repair cost. As per one embodiment of the present invention, the bumper (203) extends along the transverse axis of the vehicle (10) and is having arcuate surface with different radii. According to one embodiment of the present invention, said pair of side rails extends longitudinally between the front portion (F) and the rear portion (R) of the chassis (100). The rear portion (R) of said vehicle chassis (100) (shown in Fig.3 to 5) comprises of said pair of side rails (101) extending upwardly from opposite sides of the front portion (F) of the chassis (100) and further terminating rearwardly along the longitudinal axis of said vehicle (10). The bumper assembly (200) (shown in Fig.3 to 6) is mounted to said pair of side rails (101) of the rear portion (R) of the chassis (100) through said at least one mounting sub-assembly (201). The bumper (203) of the bumper assembly (200) extends along the transverse axis of the vehicle (10) and is mounted to the vehicle chassis (100) through at least one mounting contact portion (201a), (201b) (shown in Fig.6) provided on said at least one mounting sub-assembly (201). The bumper assembly (200) is assembled independent of the cabin (21) of the vehicle (10) through weld nuts, screws or bolts. As per one embodiment of the present invention, said bumper (203) of the bumper assembly (200) with arcuate surface comprises of said curved opposing ends (203a) and an intermediate portion (203b). The curved opposing ends (203a) of said bumper (203) comprises of mount surface for mounting to said rear portion (R) of the vehicle chassis (100) and thus acts as edge guards to protect the cabin (21) from any side impact.

[00032] Fig. 3 shows a perspective view of the vehicle chassis (100) illustrating said bumper assembly (200) mounted to the vehicle chassis (100). As per one embodiment of the present invention, the vehicle chassis (100) is a

semi-monocoque chassis (100) having a ladder like tubular frame (not shown). The ladder like tubular frame of the vehicle chassis (100) comprises of said pair of side rails (101) extending longitudinally from the front portion (F) to the rear portion (R) of the chassis (100). The front portion (F) comprises of the floor panel (22) being rigidly secured to said at least a portion of said pair of side rails (101) and extends along a longitudinal axis of said vehicle (10). The rear portion (R) of the vehicle (10) comprises of said pair of side rails (101) extending upwardly from opposite sides of said front portion (F) of the chassis (100) and terminating rearwardly along the longitudinal axis of the vehicle (10). The bumper assembly (200) is mounted to the said pair of side rails (101) of said rear portion (R) of said chassis (100). According to one embodiment of the present invention, said bumper assembly (200) comprises of said bumper (203) and said at least one mounting sub-assembly (201). The bumper (203) is detachably mounted to said pair of side rails (101) of said rear portion (R) of the chassis (100) through said at least one mounting sub-assembly (201). According to the present invention, the bumper assembly (200) mounted to the vehicle chassis (100) and assembled independent of the cabin (21) of the vehicle (10) ensures that forces due to a rear impact are transferred to the bumper assembly (200), thus protecting the cabin (21) from damage.

[00033] Fig. 4 illustrates an exploded view of the bumper assembly (200) mounted to the vehicle chassis (100). The vehicle chassis (100) comprises of said front (F), said rear portion (R) and said pair of side rails (101) extending along the longitudinal axis of said vehicle. The bumper assembly (200) is mounted to the rear portion (R) of the vehicle chassis (100) and being assembled independent of the cabin (21) of the vehicle (10). Thus, such securement of the bumper assembly (200) on the vehicle chassis (100) acts as stiffening member, hence adding strength and rigidity to the vehicle body. As per the present invention, said rear portion (R) of the vehicle chassis (100) comprises of said pair of side rails (101) extending upwardly from the opposite sides of the front portion (F) of the chassis (100) and further terminates rearwardly along the longitudinal axis of the vehicle (10). The bumper assembly (200) is mounted to said pair of side rails of the rear

portion of the vehicle chassis (100). As per one embodiment of the present invention, said vehicle chassis (100) comprises one or more cross members (105) extending transversely between said pair of side rails (101). In one embodiment, said one or more cross members (105) along with said pair of the side rails (101) forms mounting space for the internal combustion engine. According to one embodiment of the present invention, the bumper assembly (200) is assembled independent of the cabin (21) in such a manner that when rear impact is caused to the vehicle (10), the bumper (203) is damaged or dented first and then the impact load is transferred to said at least one mounting sub-assembly (201) and at least one mounting bracket (202) without causing any damage to the vehicle chassis (100) and the cabin (21). That is, any impact or collision to the rear portion (R) of said vehicle chassis (100) causes damage to the bumper (203) and other parts of bumper assembly (200) including said at least one mounting sub-assembly (201) and at least one mounting bracket (203) and hence the load due to the impact does not pass to the vehicle chassis (100). Thus, protecting the cabin (21) and the chassis (100) from being damaged with minor collision and hence reducing the repairing cost for the damage due to impact. As per one embodiment of the present invention, said bumper assembly (200) is detachably mounted to the rear portion (R) of the vehicle chassis (100) by mounting it to said pair of side rails (101). The bumper assembly (200) comprises of said bumper (203) extending along the transverse axis of the vehicle (10). The bumper comprises of said opposing end portions (203a) and the intermediate portion (203b) extending longitudinally between said opposing end portions (203a) and having said arcuate surface such that the opposing end portions (203a) of the bumper (203) protects the cabin (21) of the vehicle (10) from side impact without affecting the engine performance and the cabin assembly of the vehicle (10).

[00034] Fig. 5 illustrates a plane enlarged exploded view of the bumper assembly (200) on the vehicle chassis (100) as per one embodiment of the present invention. In one embodiment, the bumper assembly (200) is assembled in the rear portion (R) of the vehicle chassis (100) through said at least one mounting sub-assembly (201) comprising of said at least one mounting bracket (202). In one

embodiment, said a least one mounting bracket (202) is an inverted J-shaped bracket (202). As per one embodiment of the present invention, said inverted J-shaped mounting bracket comprises an angle of bent ranging from 30° to 90°. The bumper assembly (200) is detachably mounted to said pair of side rails (101) of the rear portion (R) of the chassis (200) through weld nuts, screws or bolts to provide mounting provision. As per one embodiment of the present invention, said bumper assembly (200) comprises of said bumper (203) and said at least one mounting sub-assembly (201).

[00035] Further in Fig.5, as per one embodiment of the present invention, said at least one mounting sub-assembly(201) is detachably attached to said pair of side rails (101) of the rear portion (R) of the chassis (100) though said at least one mounting bracket (202). As per one embodiment of the present invention, said opposing end portions (203a) of the bumper (203) comprises of at least one spaced-apart mount surface adapted for mounting of said bumper (203) to the vehicle chassis (100) through said at least one mounting sub-assembly (201). As per one embodiment of the present invention, said pair of side rails (101), and said one or more cross-members (105) extending transversely between said pair of side rails (101) makes it possible to provide one or more mounts (104) for an internal combustion engine.

[00036] Fig. 6 illustrates an exploded view of the bumper assembly (200) of the three-wheeled vehicle (10) as per one embodiment of the present invention. As per one embodiment of the present invention, said at least one mounting sub-assembly(201) comprises of at least one mounting bracket (202) and said at least one mounting contact portion (201a), (201b). As per one embodiment of the present invention, said at least one mounting contact portion (201a), (201b) comprises of a first attachment member (201a) and a second attachment member (201b). The first attachment member (201a) is adapted for detachably securing said at least one mounting bracket (202) to said pair of side rails (101) and the second attachment member (201a) is adapted for detachably attaching said bumper (203) to said at least one mounting sub-assembly (201). As per one

embodiment of the present invention, said at least one mounting bracket (202) contributes to the rigidity of the mounting of said bumper assembly (200) to the rear portion (R) of the vehicle chassis (100). Referring to one embodiment of the present invention, in the vehicle (10) said at least one mounting contact portion

5 (201a), (201b) are configured to attach said at least one mounting sub-assembly (201) to said pair of side rails (101) through said at least one mounting bracket (202). In one embodiment of the present invention, said at least one mounting sub-assembly (201) comprises of said at least one mounting bracket (202) and said at least one mounting contact portion (201a), (201b). According to

10 one embodiment of the present invention, said at least one mounting sub-assembly (201) is secured to said at least one contact portion (201a), (201b) in a manner such that there is a substantial reduction in a section modulus for a cross-sectional area measured by considering at least some attaching portion of said at least one mounting sub-assembly (201) to said at least one contact portion (201a), (201b).

15 In one embodiment for the present invention, the section modulus for the bumper (203) of said bumper assembly (200) ranges from $1.6 \times 10^3 \text{ mm}^3$ to $5.3 \times 10^3 \text{ mm}^3$. Thus, said securement of said at least one mounting sub-assembly (201) to said at least one contact portion (201a), (201b) provides stiffness to the mounting of the bumper assembly (200) to the vehicle chassis (100) and hence prevents the

20 transferring of load or causing of any damage to the vehicle chassis (100).

[00037] Furthermore, the reduction of the effective section modulus at the cross-section of said at least one mounting sub-assembly (201) to said at least one contact portion (201) when taken together brings out significant importance in strengthening the mounting of said at least one mounting sub-assembly (201) to

25 said pair of side rails (101). As per one embodiment of the present invention, the bumper assembly (200) is detachably attached to said pair of side rails (101) of the rear portion (R) of the chassis (100) through one or more fasteners including screws, bolts and weld nuts (204), (205). In one embodiment, the bumper (203) of said bumper assembly (200) is made up of sheet metal. As per one embodiment of

30 the present invention, one or more weld nuts (204), (205) provided in said at least

one mounting bracket (202) is configured for receiving said at least one mounting sub-assembly(201).

[00038] Further in Fig.6, as per one embodiment of the present invention, said bumper (203) is having said arcuate surfaces defining different radii. In one embodiment, the bumper (203) comprises of said opposing end portions (203a) and a centrally disposed said intermediate portion (203b) extending longitudinally between said end portions (203a). According to one embodiment of the present invention, said opposing end portions (203a) of the bumper (203) comprises of at least one spaced-apart mount surface adapted for mounting of said bumper (203) to the vehicle chassis (100) through said at least one mounting sub-assembly(201). According to one embodiment of the present invention, said bumper (203) and said at least one mounting sub-assembly (201) are assembled with the aid of said one or more fasteners as weld nuts (204), (205), bolts and screws.

[00039] Advantageously, as per one embodiment of the present invention, the mounting of the bumper assembly to said pair of side rails of the rear portion of the vehicle chassis makes it possible to contribute to the rigidity of the vehicle body and in addition reduces the overall repairing cost of the vehicle. As per one embodiment of the present invention, the improved mounting, assembling of bumper assembly independent of the cabin is simple, light weight and can be manufactured at a reasonably low cost. According to one embodiment of the present invention, one or more mounting provisions of the bumper assembly provides the assembling of the bumper assembly on the vehicle chassis without compromising the performance and profile of the existing part of the vehicle. Thus, mounting of the bumper assembly independent of cabin of the vehicle provides good alignment of the bumper and protects the vehicle body from being damage from the impact and provides ease of serviceability to the bumper assembly and its part thereof.

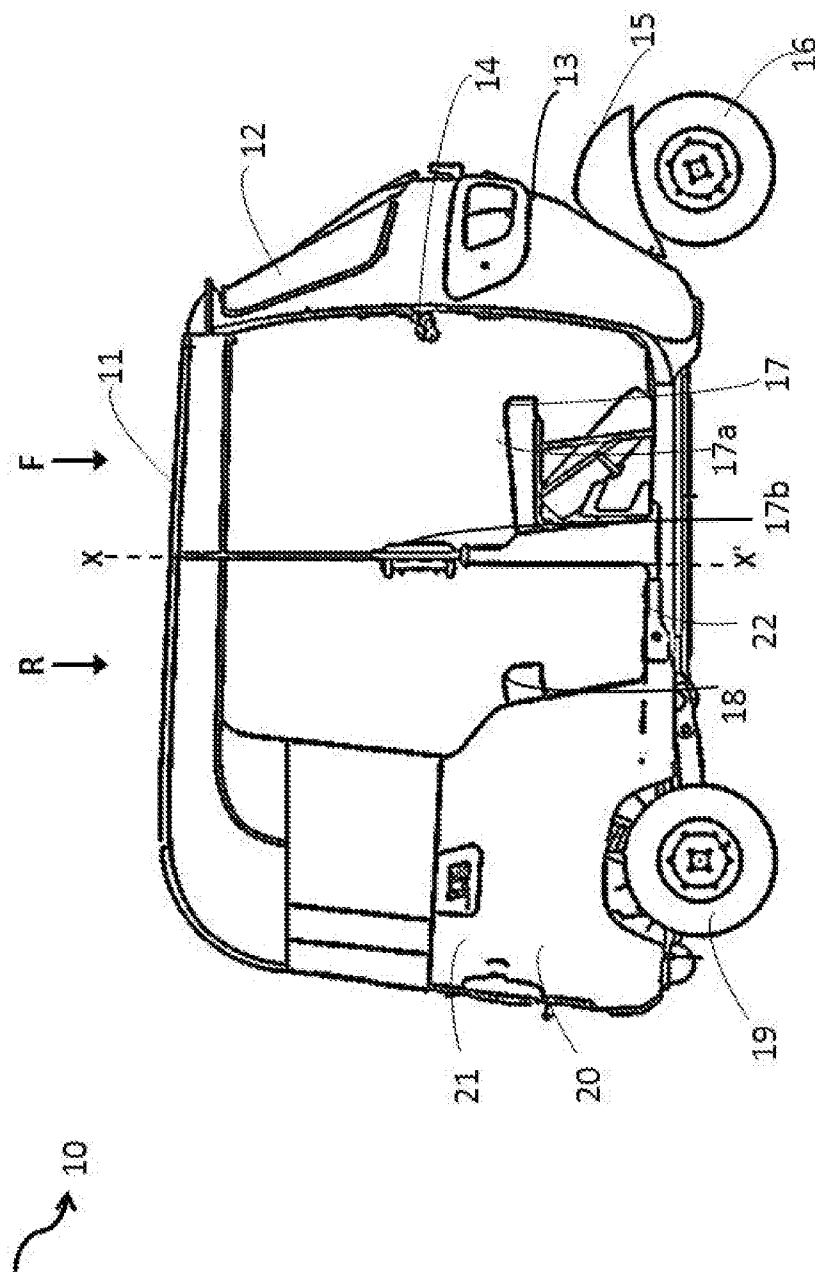
[00040] Improvements and modifications may be incorporated herein without deviating from the scope of the invention.

30

I/We Claim:

1. A vehicle (10) comprising:
a chassis (100) including a front portion (F) and a rear portion (R);
a pair of side rails (101) extending longitudinally from said front portion (F) to said rear portion (R); and
a bumper assembly (200) comprising a bumper (203) extending along a transverse axis of said vehicle (10), said bumper assembly (200) includes at least one mounting sub-assembly (201); said bumper (203) of said bumper assembly (200) is detachably mounted to said pair of side rails (101) through said at least one mounting sub-assembly (201).
2. The vehicle (10) as claimed in claim 1, wherein said at least one mounting sub-assembly (201) includes at least one mounting bracket (202) and at least one mounting contact portion (201a), (201b).
3. The vehicle (10) as claimed in claim 2, wherein said at least one mounting contact portion (201a), (201b) comprises of a first attachment member (201a) and a second attachment member (201a).
4. The vehicle (10) as claimed in claim 3, wherein said first attachment member (201a) of said at least one mounting contact portion (201a), (201b) is adapted for detachably securing said at least one mounting bracket (202) to said pair of side rails (101).
5. The vehicle (10) as claimed in claim 4, wherein said second attachment member (201a) of said at least one mounting contact portion (201a), (201b) is adapted for attaching said bumper (203) to said at least one mounting sub-assembly (201).
6. The vehicle (10) as claimed in claim 5, wherein said at least one mounting contact portion (201a), (201b) is configured to attach said at least one mounting sub-assembly (201) to said pair of side rails (101) through said at least one mounting bracket (202).
7. The vehicle (10) as claimed in claim 1, wherein the bumper assembly (200) is detachably attached to said pair of side rails (101) of the rear portion (R) of the chassis (100) through at least one fasteners including screws, bolts and weld nuts (204), (205).
8. The vehicle (10) as claimed in claim 1, wherein said bumper (203) of said bumper assembly (200) is made up of sheet metal.

9. The vehicle (10) as claimed in claim 1, wherein said bumper (203) comprises an arcuate cross-section defining different radii.
10. The vehicle (10) as claimed in claim 9, wherein said bumper (203) comprises of opposing end portions (203a) and centrally disposed intermediate portion (203b) extending longitudinally between said end portions (203a).
11. The vehicle (10) as claimed in claim 10, wherein said opposing ends portions (203a) of the bumper (203) comprises of at least one spaced-apart mount surface adapted for mounting of said bumper (203) to the vehicle chassis (100) through at least one mounting sub-assembly (201).
12. The vehicle (10) as claimed in claim 1, wherein, said a least one mounting bracket (202) is an inverted J-shaped bracket.
13. The vehicle (10) as claimed in claim 12, wherein said inverted J-shaped bracket (202) includes an angle of bent ranging from 30° to 90°.
14. The vehicle (10) as claimed in claim 1, wherein the section modulus for the bumper (203) of said bumper assembly (200) ranges from $1.6 \times 10^3 \text{ mm}^3$ to $5.3 \times 10^3 \text{ mm}^3$.



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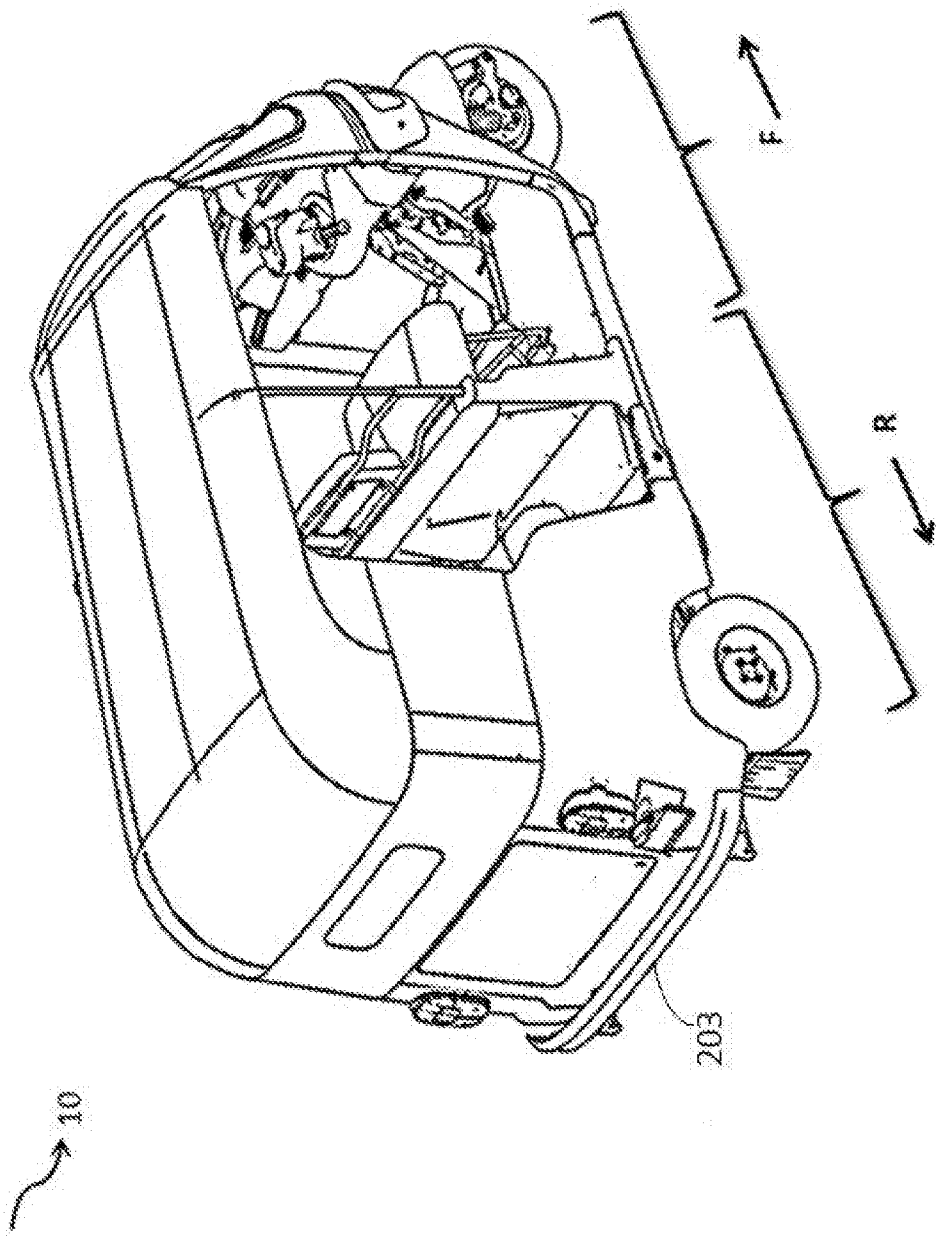


Fig. 2

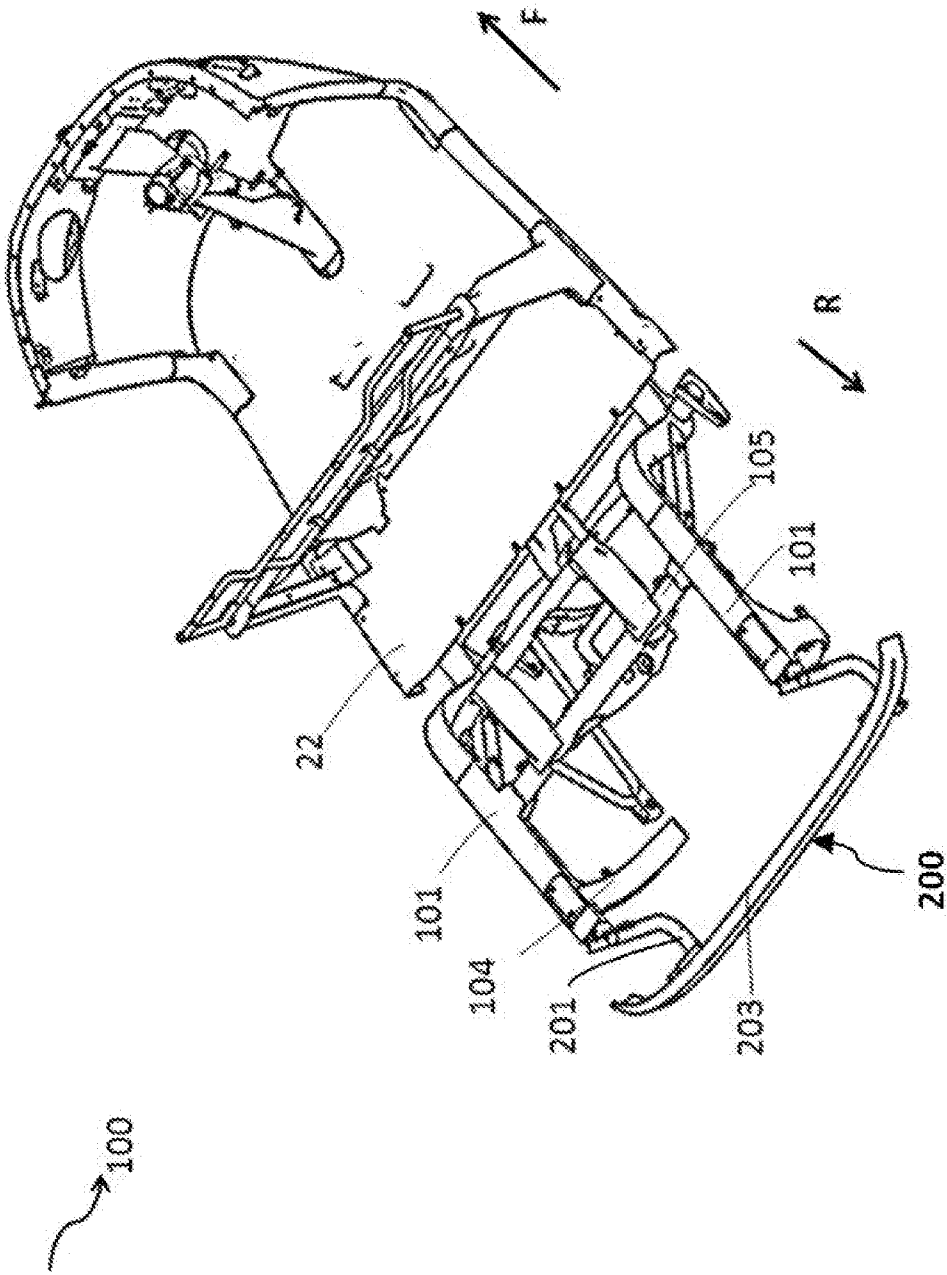


Fig. 3

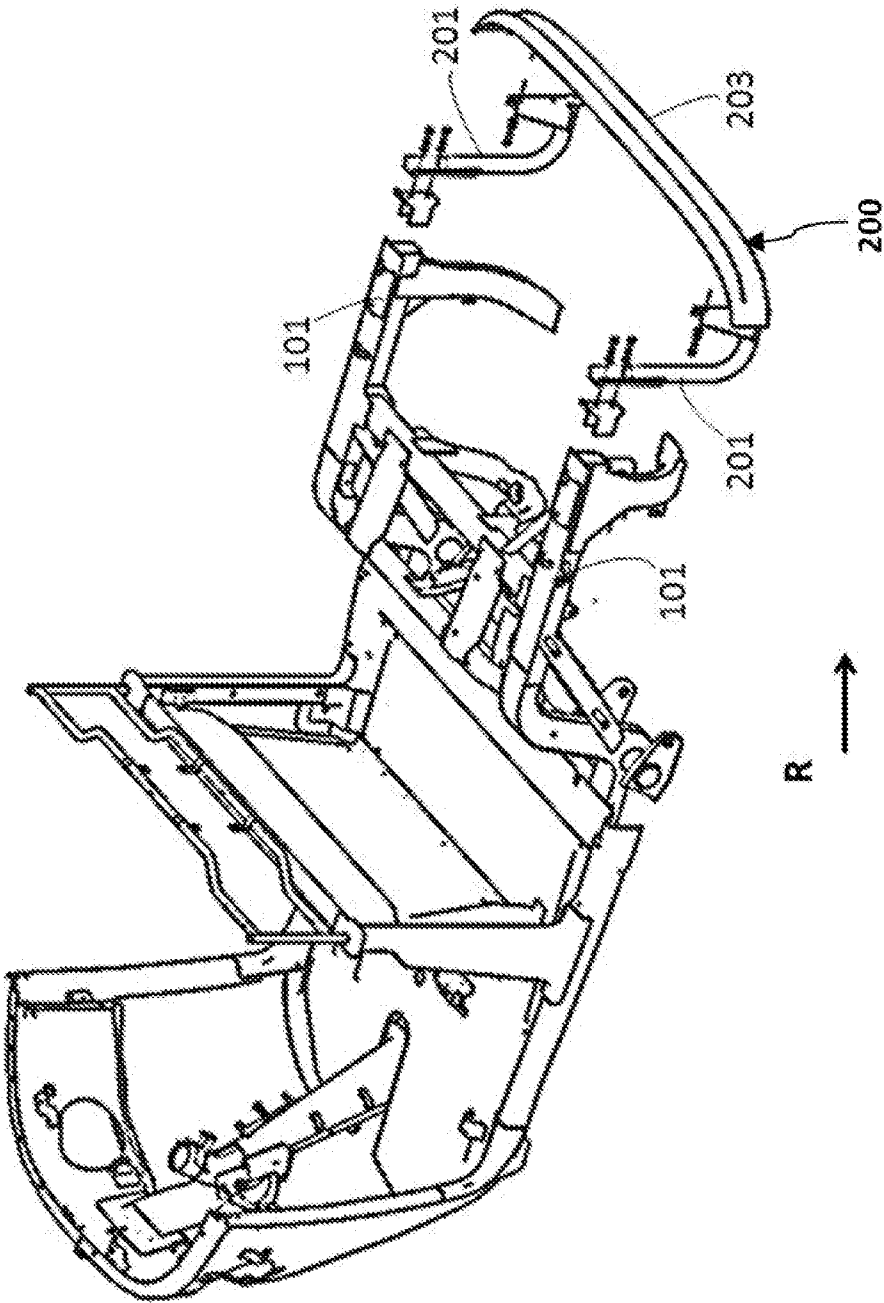
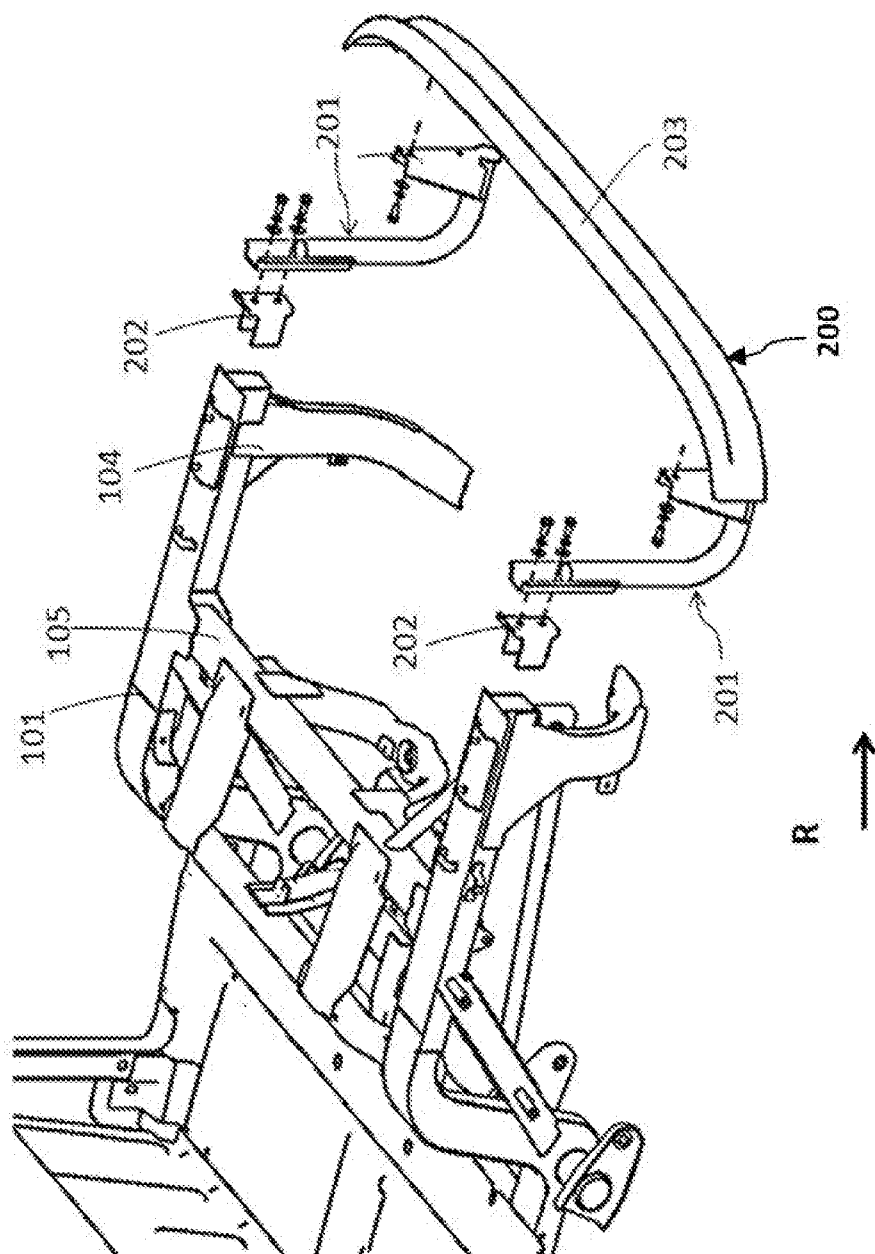


Fig. 4



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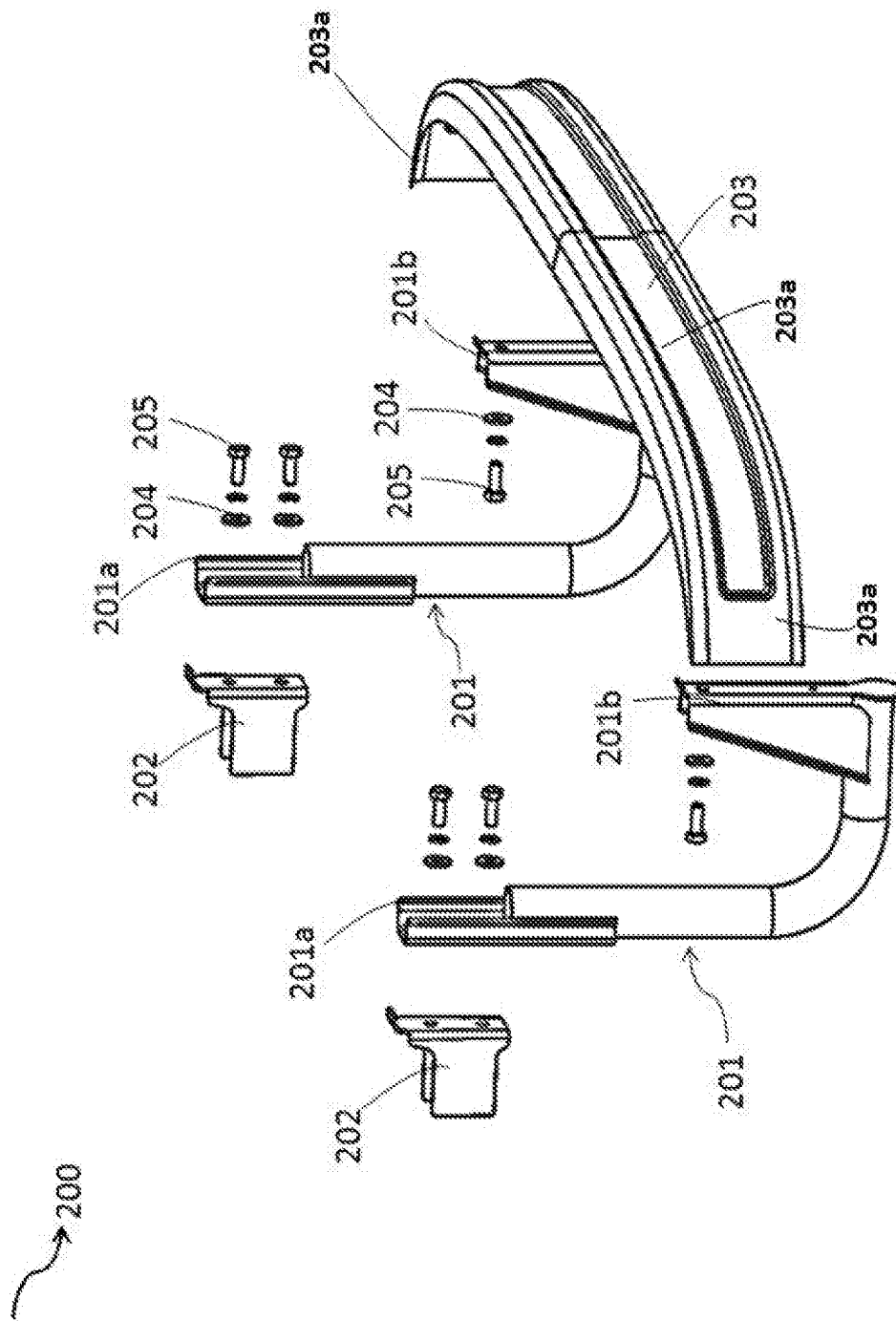


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2017/054532

A. CLASSIFICATION OF SUBJECT MATTER
B60R19/02 Version=2017.01

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)

B60R

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)

Patseer, IPO Internal Database

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US4204702 A, OLTROGGE VICTOR C, 27 May 1980 (27/05/1980) paragraphs-(1-10), claims-(1-11), Figs. (2, 27, 29)	1-5, 7-9 6, 10-14
Y	US6764116 B2, TRANSFREIGHT TECHNOLOGY, LLC, 20 July 2004 (20/07/2004) Figs. (5-10)	6, 12-14
Y	US20070200373 A1, RYAN MILLER et. al, 30 August 2007 (30/08/2007) Fig. 8	10-11

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"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

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Date of the actual completion of the international search

07-11-2017

Date of mailing of the international search report

07-11-2017

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/IB2017/054532

Citation	Pub.Date	Family	Pub.Date
US 6764116 B2	20-07-2004	US 6962378 B2	08-11-2005
		US 20030137156 A1	24-07-2003
		US 20040217604 A1	04-11-2004
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		WO 2007101105 A3	24-01-2008