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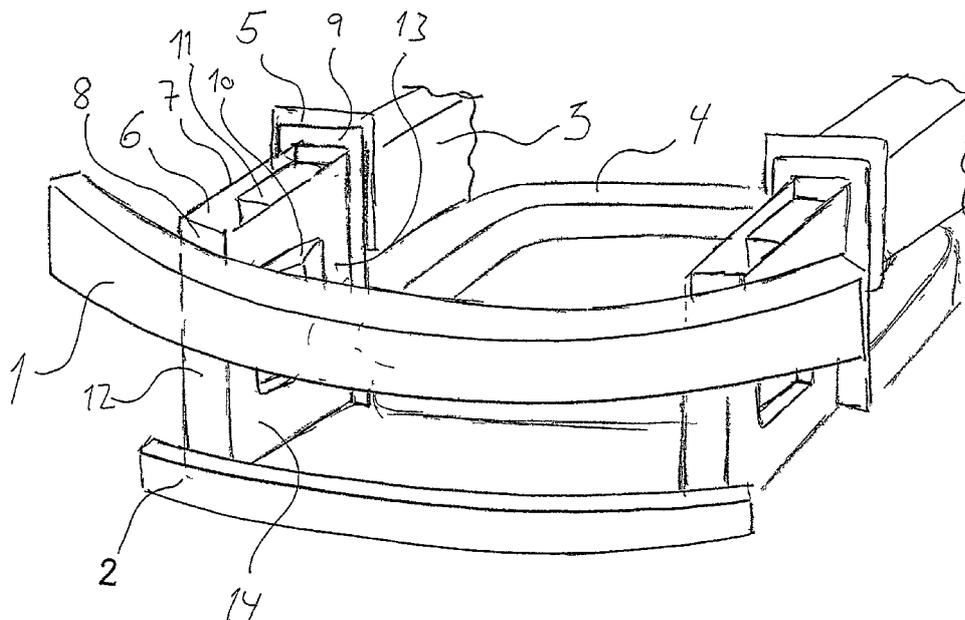
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: CRASH PROTECTION SYSTEM



(57) Abstract: The invention relates to a crash protection system for a vehicle comprising one upper (1) and one lower (2) crash absorbing component. The components extend in the transversal direction of the vehicle, and are integrated to each other by connecting means (6). The connecting means can be deformable crash boxes.

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### Crash protection system

5 The present invention relates to a new crash protection system for cars, particularly passenger cars, however also trucks and SUV's. The system is provided for the protection of the front of cars in frontal impacts, can however also be used to protect the rear end of the cars.

10 The invention is about improving the protection of the car and its occupants in crashes, at the same time as providing a non-aggressive crash interface towards others, in particular "soft" and "deformable" objects such as another car or a pedestrian.

The objective furthermore is to achieve this in a variety of crash situations and crash  
15 speeds, ranging from low speed impacts at walking pace to severe high speed ones. At the same time the invention has the object of further improving the crash towards hard objects such as walls, poles and so on.

In addition, the scope is to achieve this together with:

20 -not impairing "packaging room" in the vehicle, thus providing space for other objects and functions such as lights, sensors and ducting for cooling air and so on.

It is understood, that when said objects are achieved, not only will the damage and dangers due to crashes be diminished, but other desirable effects will be achieved,  
25 such as reducing the overhang of the car, lessen the need for strength of the main car body and so on.

This again reduces the need for weight and bulk of the car, which again is very desirable, and may also influence positively the cost of producing and operating (running) the car.

30

EP 1384629 A2 (Sato, Suganuma) displays a crash system with an upper shock absorber and a lower shock absorber where the crash stroke of the upper shock absorber is larger than that of the lower shock absorber. The objective here is to improve the pedestrian crash.

35

The present invention differs from prior art by the following means and properties:

5 -providing a crash module which has a high and a low part crash system which are functionally integrated with each other with means within the module during crash deformations,

10 -providing a crash module as above where the high and low part crash systems are supporting the crash deformation sequence of each other in order to ensure a predictable and optimized crash deformation,

-providing a crash module as above which may lead crash forces from one level to be dealt with as deformations on the part crash system of the other level through the connecting (integrating) means between the part crash systems,

15 -providing a crash module which is optimized for the complete range of crash situations, ranging from the pedestrian impact to the high speed crashes,

20 -providing a crash module as above where the connecting means between the top and bottom part crash systems may themselves be members which, like the transverse beams, may take direct impact blows and be deformed to absorb energy, as well as distributing the forces of these blows to parts of the module where they are absorbed by further deformation.

25 Said functional characteristics are achieved through providing connecting means between the part crash systems which:

-are part of the crash deformation and energy absorbing means of the complete crash module,

30 -are supporting and guiding each part of the crash system towards the other to ensure a stable and beneficial crash deformation,

-are contributing much more to the stiffness of the front of the car than that of the known prior art.

35

The purpose of the invention is to ensure an improved crash performance during the whole range of crash situations than before, in an economical manner.

Here improved crash performance also refers to being less aggressive towards the object that is hit, than has been possible with the prior art solutions.

5

This is achieved through the means of using new connecting means between upper and lower part crash systems in order to stabilize these during crash deformations, thus avoiding premature mal-functioning thereby exploiting the highest energy-absorbing potential of these part systems.

10

These and further advantages can be achieved with the invention as defined in the accompanying claims.

In the following, the invention shall be further described by figures and examples where:

15

Fig. 1 discloses a first embodiment of a crash protection system,

Fig. 2 discloses a second embodiment of a crash protection system,

20

Fig. 3 discloses a third embodiment of a crash protection system,

Fig. 4 discloses a fourth embodiment of a crash protection system.

25

The isometric Figures 1-4 display various preferred embodiments of the invention, seen from a point of view ahead of the car. Thus, these examples relate to a front crash module. In the figures, reference numerals 1 and 2 are the upper (high) and lower transverse (bumper) beams, whereas 3 is the right-hand side sidemember (engine rail, longitudinal), which is more or less a mirror image of the same left hand side item. Reference numeral 4 denotes the engine cradle (front engine and wheel suspension subframe) which is attached to the sidemembers either by elastic bushings or by non-elastic means.

30

Reference numeral 5 indicates assembly flanges at the front of each sidemember, onto which the top part of the front crash module is bolted. It is here understood that the attachment to the sidemember may be by other means than this flange, such as through "plug in" solutions, where a top portion of the crash module is inserted into the sidemember.

In Figure 1, the connecting means 6 constitutes of crashboxes which extend the height between the high and low transverse beams 1, 2, and attaches these to the module. This attachment can be through joining welding, bolting or riveting and/or similar means. In the case of these boxes being made from aluminium extrusions, the direction of the extrusion is in the vertical direction as compared to the car.

The boxes contain sidewalls 7, and front and rear walls 8, 9, which may be uninterrupted as shown, or opened up, in other words being two flanges only, both front and rear.

In order to increase the energy-absorbing folding resistance, particularly of the high load path immediately behind the main bumper beam, the box may be indented (10). Indentations from each side may extend both to meet, and be joined, for example by welding or riveting.

The top part of the box may furthermore be folded to close the top opening in a similar manner, to achieve the same effect.

Alternatively, or in addition to said folding, a stiffening and energy-absorbing member 11 may be inserted between the sidewalls 7 to achieve a higher local strength.

It is now realized that the portions 12 and 13 of the box now are more or less individual beams bridging the top and lower parts of the module. This is very beneficial when it comes to:

- absorbing direct blows (beam portion 12),
- providing bending resistance and load transfer means (beam portions 12 and 13),
- providing vertical "lines of defence" (12 and 13) against crash deformation intrusion of aggressive objects, such as another "narrow" bumper beam.

The functions of the lower load path 14 mirror the upper load path as said, albeit with a lower force level.

5 It is understood that the engine cradle 4 provides a support for the lower part of the crash module. This applies also in the case of the engine cradle being elastically mounted to the sidemembers. In this case, the forces are transmitted partly only through the rubber bushing, and more through mechanical contact between the cradle and parts of the sidemembers, after the normal elastic movement of the rubber bushings is exceeded.

10

In Figure 2, the main direction of the connecting means 6 is in the longitudinal direction of the vehicle. A top and a bottom closed chamber may be provided.

15 It is understood, that particularly the lower chamber, providing the low load-path which is dealing with less force, may be of an open configuration, such as provided through a hat- or U-shaped section.

20 In-between top and bottom chamber, the connecting means 17 may be provided through an integral web, as shown, or two webs apart, thus creating a third closed chamber (not shown).

It is understood that this third chamber may further be divided by dividing walls, creating a multitude of chambers.

25 The web (walls) 17 may furthermore be processed to incorporate holes 18, which may have reinforcement indentations around the holes (not shown), and may furthermore be cut, bent, reformed and bent/rolled to vertical beams at any place along its (their) lengths.

30 It is within the scope of the invention to provide connecting means 17 which are laid out in line with the means in the Figures 2 and 3, but have their main axes in the transverse direction of the vehicle.

Figure 3 shows an embodiment where the connecting means are fabricated from one length of material by bending. In other words, 19, 19a and 19 b are integral.

35 Reference numeral 19c shows a useful adaption where the member 19b is further split to increase the crash surface in-between the upper and lower transverse beam.

In both embodiments, the crash box 20 may be a separate tube, or semi-open tube, which is attached to, eventually closed by (not shown), the member 19. The latter embodiment is particularly useful for "plug in" type of upper attachments to the sidemembers.

5

Figure 4 shows a further embodiment, where the member 21 extends downwards at an angle to provide "triangulation" stiffness to the lower member. The area 23 is thus stabilized particularly in the vertical direction of the vehicle.

10

From this point the member 21 extends up to the front top part of the upper box 20.

It is clear that in this way both the lower member 16 as well as the upper beam/box are stabilized. This is beneficial during the severe plastic crash deformations of the crash module.

This stabilization will be upheld for the first part of the crash deformation, as this starts

15

from the front of the system.

Claims

- 5 1. Crash protection system for a vehicle comprising at least one upper (1) and one lower (2) crash absorbing component that extend in the transversal direction of the vehicle,  
c h a r a c t e r i s e d i n t h a t  
said components are integrated to each other by connecting means (6).
- 10 2. Crash protection system in accordance with claim 1,  
c h a r a c t e r i s e d i n t h a t  
the connecting means is constituted by one or more crashbox(-es).
- 15 3. Crash protection system in accordance with claim 1,  
c h a r a c t e r i s e d i n t h a t  
the upper crash component is integrated with at least one side member in the vehicle.
- 20 4. Crash protection system in accordance with claim 1,  
c h a r a c t e r i s e d i n t h a t  
the lower crash component is integrated with an engine cradle arranged in the vehicle.
- 25 5. Crash protection system in accordance with claim 1,  
c h a r a c t e r i s e d i n t h a t  
the upper crash absorbing component is a bumper beam.
- 30 6. Crash protection system in accordance with claim 2,  
c h a r a c t e r i s e d i n t h a t  
the crash box is attached to the upper and the lower component by means of joining welding, bolting, riveting or any other appropriate means.

- 5
7. Crash protection system in accordance with claim 2,  
c h a r a c t e r i s e d i n t h a t  
the crash box is formed as two hollow section modules, interconnected by a  
web member.
- 10
8. Crash protection system in accordance with claim 2,  
c h a r a c t e r i s e d i n t h a t  
the crash box is formed out of one blank of material, that may be an extruded  
profile, that is further processed to the final shape.
- 15
9. Crash protection system in accordance with claim 2,  
c h a r a c t e r i s e d i n t h a t  
the crash box comprises cantilevered structural members, arranged in a "V"  
shaped manner that serves to give a triangular stiffness between the upper and  
the lower crash absorbing component.
- 20
10. Crash protection system in accordance with claim 1,  
c h a r a c t e r i s e d i n t h a t  
its components are mainly made out of aluminium or an alloy thereof.

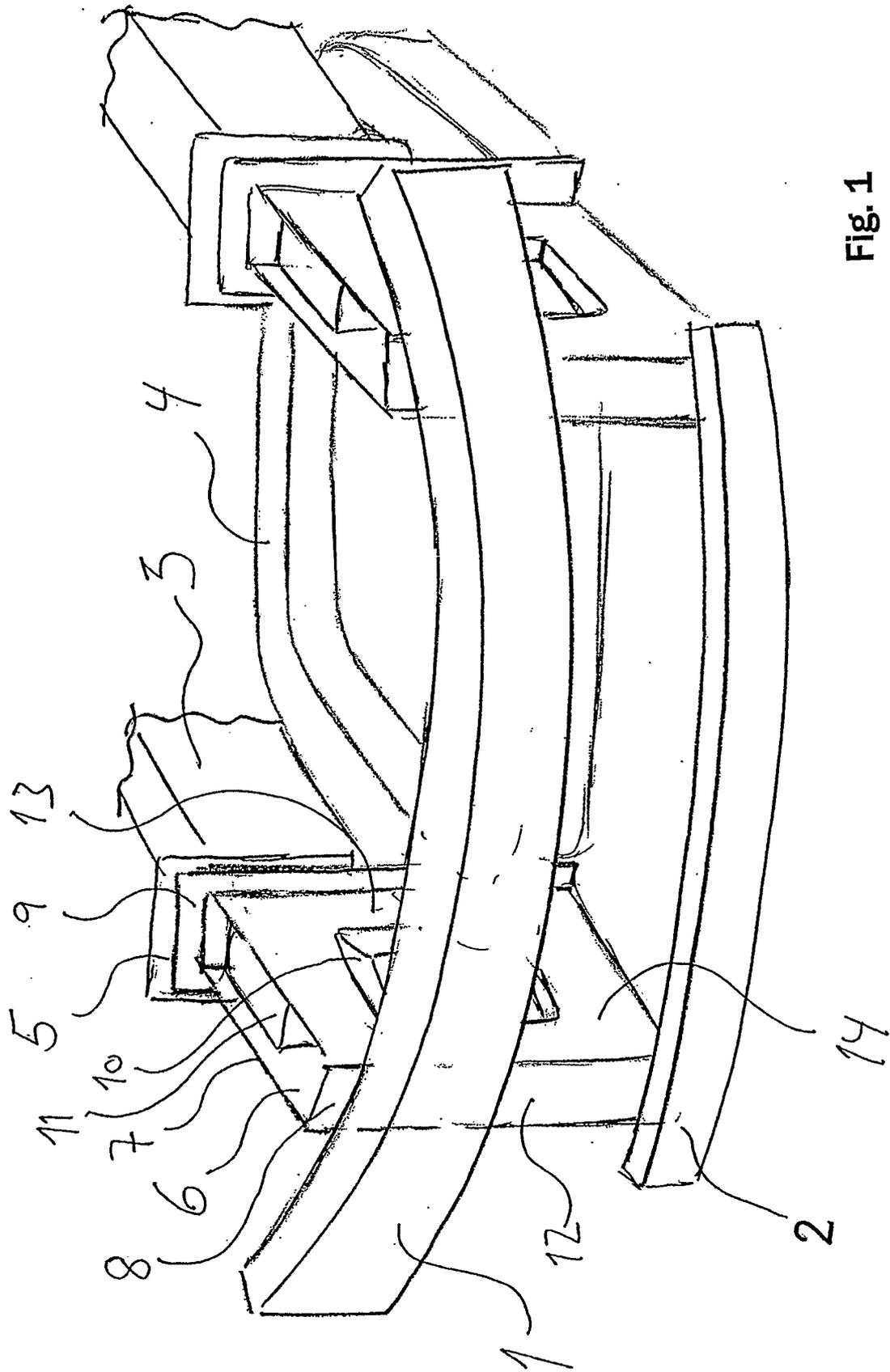


Fig. 1

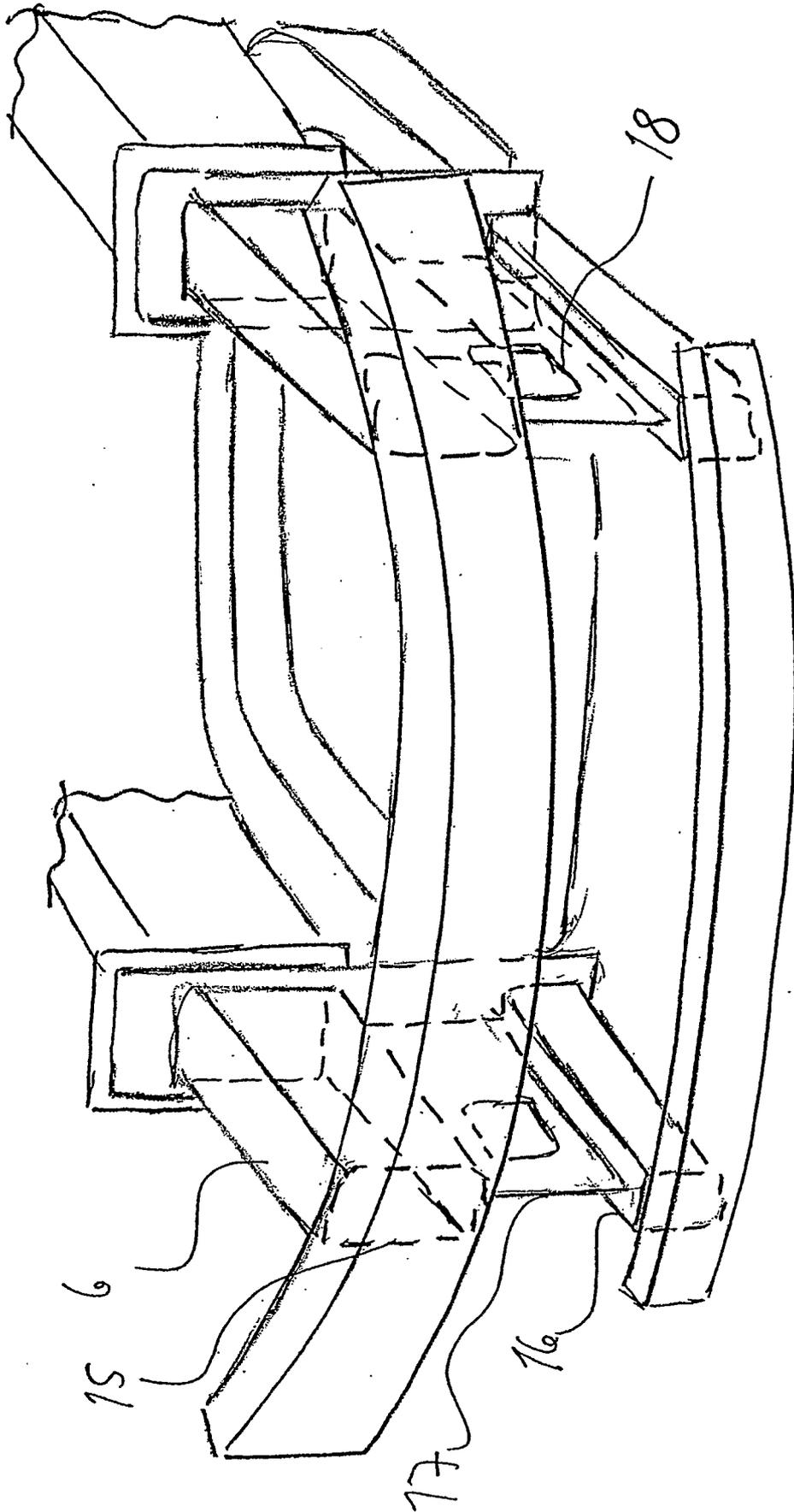


Fig. 2

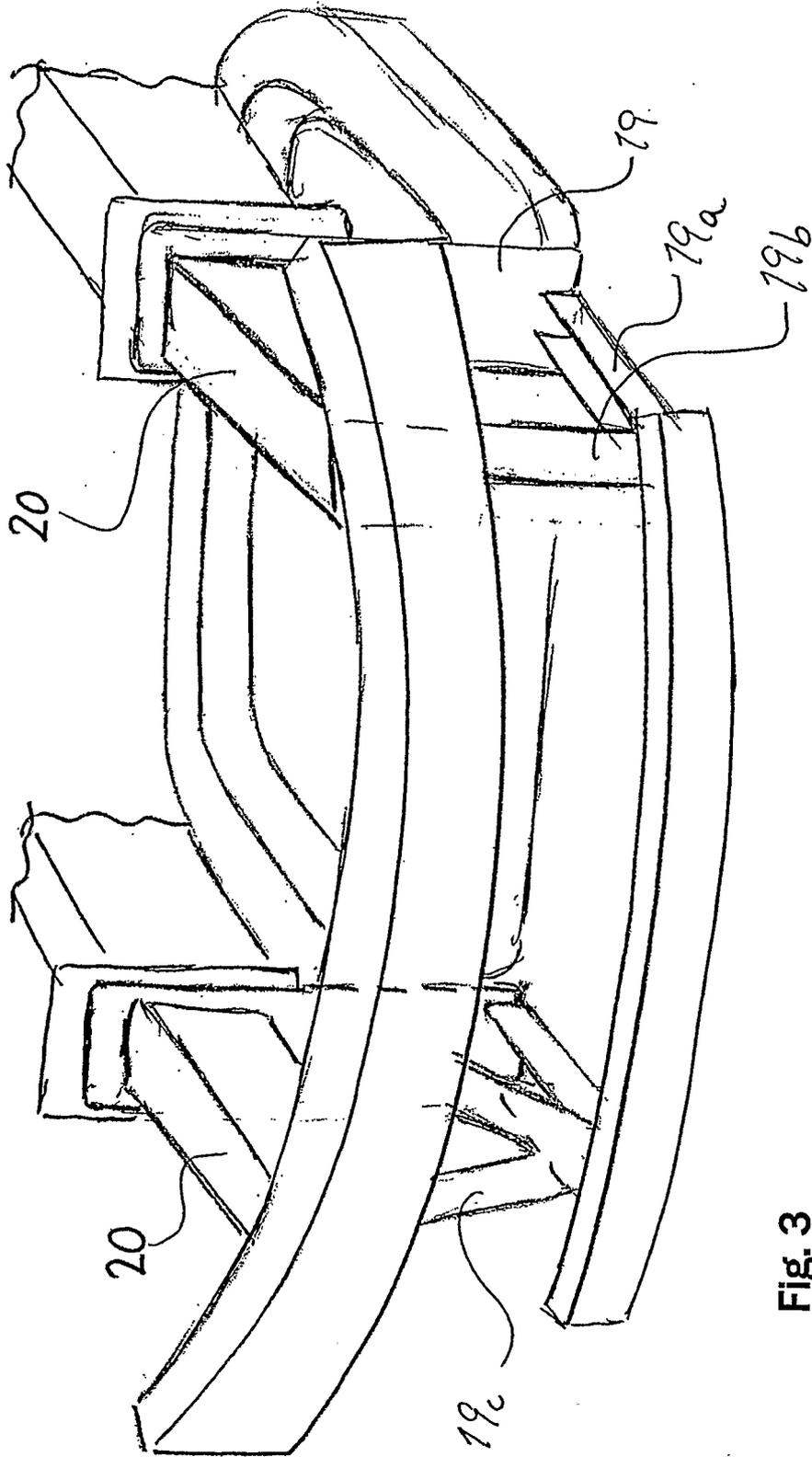


FIG. 3

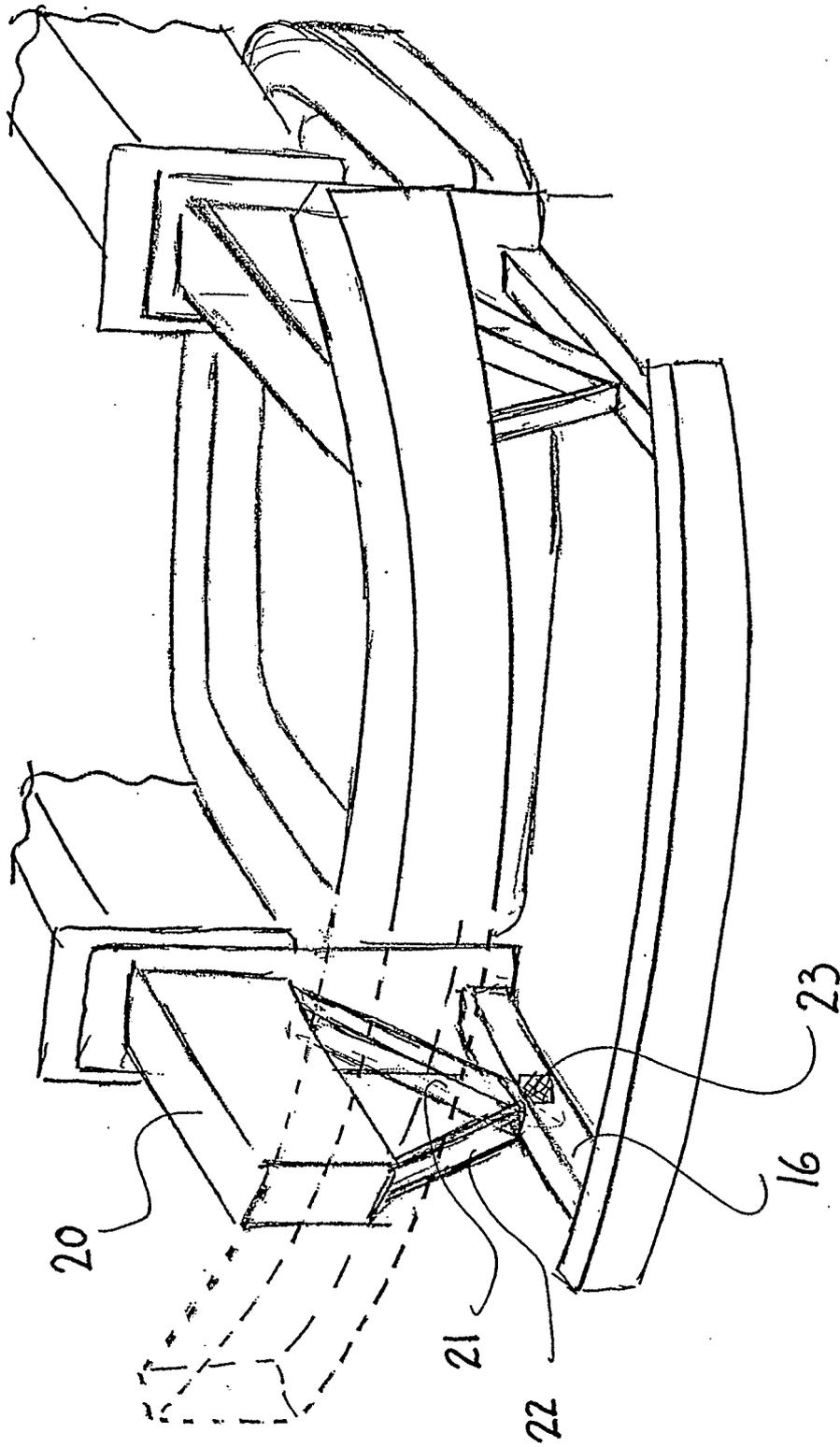


Fig. 4

**INTERNATIONAL SEARCH REPORT**

International application No.  
**PCT/NO2006/000280**

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC: see extra sheet  
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)

IPC: B60R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
SE, DK, FI, NO classes as above

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

EPO-INTERNAL, WPI DATA, PAJ

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1293389 A1 (COMPAGNIE PLASTIC OMNIUM), 19 March 2003 (19.03.2003), paragraph [0057]-[0061], fig 10-12 --	1-10
X	DE 10154113 A1 (ADAM OPEL AG), 15 May 2003 (15.05.2003), paragraph [0034]-[0039], abstract --	1-10
X	US 20050067860 A1 (MAKITA ET AL), 31 March 2005 (31.03.2005), paragraph [0062], fig 1,2, abstract --	1,3-5,10
X	EP 1000840 A2 (VOLKSWAGEN AKTIENGESELLSCHAFT), 17 May 2000 (17.05.2000), paragraph [0020]-[0025], fig 1, abstract --	1,3,5

Further documents are listed in the continuation of Box C.

See patent family annex.

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INTERNATIONAL SEARCH REPORT

International application No.  
PCT/NO2006/000280

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category <sup>m</sup>	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1266818 A2 (FUJI JUKOGYO KABUSHIKI KAISHA), 18 December 2002 (18.12.2002), figure 1, abstract  --	1,3,5,10
X	PATENT ABSTRACTS OF JAPAN vol 2003, no 12, 5 December 2003 (2003-12-05) 6 JP 2005001430 A (CALSONIC KANSEI CORP), 6 January 2005 (2005-01-06) fig 4, abstract  -- -----	1,3,5,10

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Cited literature, if any, will be enclosed in paper form.

## INTERNATIONAL SEARCH REPORT

International application No.

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