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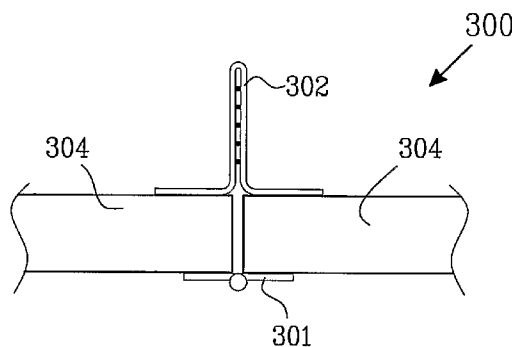
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(54) Title: AN UNDERRUN PROTECTION BEAM FOR A VEHICLE



(57) Abstract: The present invention relates to an underrun protection system beam comprising two beam portions a (304) joined together by means of a joint (301) and constituting a stiff beam (200, 300) and further comprising a lock element (302), having an energy absorbing structure.

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AN UNDERRUN PROTECTION BEAM FOR A VEHICLE

TECHNICAL FIELD

The present invention relates to a crash protection device and in particular to an underrun protection system.

5

BACKGROUND OF THE INVENTION

Safety standardizations and demands from the public drive development of different safety solutions in vehicles and in particular for commercial vehicles such as heavy good vehicles. These are equipped with underrun protection solutions for reducing the
10 damages to people traveling a smaller vehicle crashing into the heavy goods vehicle. The underrun protection is arranged to absorb energy in the collision and prevent or at least reduce the risk for the smaller vehicle to come in under the heavy vehicle. With an underrun protection solution the energy is primarily focused in the small vehicles front and/or the underrun protection solution itself.

15

Conventionally, underrun protection solutions absorb energy by inelastic deformation of parts of the underrun protection solution often together with deformation of parts of the crashing vehicle. These types of solutions can considerable reduce collision forces exerted on people traveling in respective vehicle and thus reduce risk of injuries.

20

Conventionally, underrun protection solutions are designed to operate at certain impact forces and since the most common crash situation is that when a vehicle strikes somewhat off center any deformation element or elements need to be dimensioned accordingly. Often, a stiff impact beam is provided which in turn is connected to two
25 deformation elements, one for each side of the vehicle as seen from a central axis along the longitudinal direction of the vehicle, which will deform due to the impact forces and distribute energy in the collision. However, for head on collisions for some underrun protections solutions, the resulting impact force on each deformation element will not be sufficient enough to engage the deformation operation of the deformation element since
30 the impact force is more or less equally divided between the two deformation elements.

SUMMARY OF THE INVENTION

It is therefore an object to provide an underrun protection solution which remedies or at least partly reduce some of the problems described above.

- 5 At the same time it is important to provide a rigid construction that will not break into smaller parts that can cause damage to the surrounding area.

This is provided through a number of aspects, in which a first aspect is provided in an underrun protection beam for a vehicle, comprising two beam portions joined together by
10 means of a joint and constituting a stiff beam and further comprising a lock element, having an energy absorbing structure.

The energy absorbing structure may comprise at least one lock element that upon release absorbs energy. The lock element may comprise a folded structure comprising two joined
15 shanks of a substantially V-shaped element and fixated at each end to the respective parts of the beam. The fixation holding the folded structure path may be arranged to absorb energy during release. The lock element (302) may be arranged to restrict the bending of the beam in a direction away from a crashing vehicle.

- 20 The fixation may comprise at least one of weld, screw, rivet, or bolt and nut.

A second aspect of the present invention, a vehicle comprising an underrun protection beam as described above is provided.

25 BRIEF DESCRIPTION OF THE DRAWINGS

In the following the invention will be described in a non-limiting way and in more detail with reference to exemplary embodiments illustrated in the enclosed drawings, in which:

Fig. 1 illustrates schematically a heavy vehicle with underrun protection according to the
30 present invention;

Fig. 2 illustrates schematically a close up of the underrun protection from Fig. 1; and

Fig. 3a to d illustrates schematically in different views a split underrun protection beam according to the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

5 In Fig. 1 reference numeral 1 generally denotes a heavy commercial vehicle (e.g. a truck, gas truck, refuse collection vehicle, and 2 a front underrun protection system (FUPS), according to the present invention, attached to the vehicle 1. The vehicle 1 comprises a frame 5, wheels 4, and a cabin 3 for the driver. The vehicle further comprises engine, gear box, power distribution components, and other components normally part of the vehicle;
10 however, these are easily appreciated by the person skilled in the art and may vary depending on vehicle function and type and are therefore not illustrated in the figures.

In Fig. 2 the front underrun protection according to the present invention is shown in more detail. A front underrun protection (FUP) beam 200 is shown together with parts of the
15 frame of the vehicle for understandings of the respective parts interrelated functionality. The underrun protection beam 200 is attached to a frame connector 202 in turn attached directly or indirectly to a frame 204 of the vehicle 1. In an embodiment of the present invention a console 205 is mounted on the frame 204 and the frame connector 202 of the FUP beam 200 is in turn attached to the console 204. A rail 201 may be mounted in
20 between the frame connector 202 and the console 205 in order to provide a movement capability of the FUP beam 200, frame connector 202 and rail 201 in relation to the console 205. In the embodiment shown in Fig. 2, the movement is translational. The FUP beam 200 may be made of a stiff material, for instance some suitable metal (e.g. aluminum or steel) or enforced ceramics. The rail may also have a curved form arcing
25 towards the center of the vehicle as it extends away from the underrun protection beam 200.

The underrun system incorporates both energy-absorbent and rigid components, which interact so that the vehicle's own crumple zone responds in the intended manner.

30

The underrun protection beam 200 can be of several different suitable shapes but should be of a design that is resilient enough to withstand the forces applied to it in order to transfer the forces to a deformation zone element 203 and not fail apart from a split operation that will be described in detail below. The beam 200 may be in some suitable
35 way connected to a bumper structure (not shown) or the bumper structure may be firmly

connected to some other part of the vehicle, for instance directly on the frame 5, 204. The bumper structure is manufactured to handle small forces, for instance such present when bumping into goods in a loading area or another vehicle during slow relative movement of the vehicles. The underrun protection system 210 comes into action when forces are
5 larger than a certain pre defined force limit which can be set by regulatory standards or other aspects of importance.

Figs 3a to 3d illustrate the underrun protection beam 300 in more detail from various aspects of the present invention. Fig. 3a is a perspective back view of the beam 300 and
10 Fig. 3b is a perspective front view of the beam 300. The beam according to the present invention is split into two shanks, preferably at center position of the beam 300. Each beam shank comprises a stiff structure 304 and the two shanks are held together by a joint 301 and a lock element 302. Each shank 304 may be of a durable and stiff material and formed as a hollow structure for reducing the weight of the beam 300. The beam 300
15 may have mating structures 303 for receiving crash tubes 203 and stop elements 303 for holding the crash tubes 203 to the beam 300.

The underrun protection beam has a joint 301 located preferably at the middle of the beam 300 in order to provide an underrun protection function for frontal hits where a
20 vehicle collides with the underrun protection head on and not at one side which is often the case. The two pieces of the split protection beam separated by the joint are held together with a welded seam on the lock element 302. The seam breaks when a vehicle hits the underrun protection and since the seam is welded it will absorb energy during the collision when the welds break. However, the lock element 302 is formed by a continuous
25 structure that is folded together forming a V-shape and welded; during a collision the welds break but the overall lock element structure 302 does not break thus holding the two protection beam parts 304 together. Having the beam 300 divided into two pieces gives a benefit of a better conformance to a crashing vehicle and that the underrun protection will operate functionally along the entire crash process. The split beam 300 will
30 conform to the crashing vehicle and thus better distribute the crash forces allowing the crashing vehicles crumple zones operate in a more optimized manner reducing risk of injuries to passengers in the crashing vehicle. For instance in some crash situations a non split beam 300 there is a risk that only one side of the crashing vehicles deformations zones is activated and material may penetrate further into the compartment of the
35 crashing vehicle, whereas with a split beam 300 the beam will adjust its position more

parallel to the front of the vehicle and distribute the crash forces more evenly. Another benefit is that the risk of getting material scattered from the heavy vehicle 1 is reduced because the split beam is held together by the lock element 302 and thus also the risk of injuring people or damaging objects in the surrounding area is also reduced. This is
5 illustrated in Figs 3c and 3d showing top views of the joint/lock area. Fig. 3c shows the situation for the system before a crash and Fig. 3d after or during a crash. In Fig. 3d is illustrated a crash with lower impact forces. At larger impact forces the lock element 302 will be straightened and will also operate as a restricting element restricting the movement of the underrun protection beam 300 how far the beam 300 may be bent in a crash. The
10 lock element 302 will also provide strengthening to the joint so that the beam 300 keeps together at a crash.

It should be appreciated by a skilled person that welding is given as an example and other attachments such as rivets, screws, bolt and nuts, etc. may be used.

15

Also at collisions occurring at one of the sides of the protection beams, the split in the protection beam will also be of advantage since then the movement of the protection beam and any deformation element behind will be better controlled. For instance in using a deformation element that moves in a linear manner or at least in along a horizontal
20 plane in a direction substantially along the longitudinal axis of the vehicle this may facilitate the operation of the deformation system in controlling the movement to be substantially linear throughout the crash course or follow a direction in a horizontal plane.

The FUP system 210 can be pre assembled as a module that may easily be attached to
25 the frame 5, thus potentially reducing assembly cost and/or assembly time for the vehicle. The FUP system 210 may be designed with different geometrical sizes and shapes and with different fastening means in order to fit different vehicles types and versions. The pre assembled module may comprise other elements for instance headlights, direction flasher, or other vehicle elements that can be found in the bumper or its vicinity.

30

Even though the above embodiments have been exemplified using a front underrun protection system (FUPS) it will operate in a similar manner for a rear underrun protection system (RUPS).

It should be noted that the word "comprising" does not exclude the presence of other elements or steps than those listed and the words "a" or "an" preceding an element do not exclude the presence of a plurality of such elements. It should further be noted that any reference signs do not limit the scope of the claims, and that several "means", "devices",
5 and "units" may be represented by the same item of hardware.

The above mentioned and described embodiments are only given as examples and should not be limiting to the present invention. Other solutions, uses, objectives, and functions within the scope of the invention as claimed in the below described patent
10 claims should be apparent for the person skilled in the art.

CLAIMS

1. An underrun protection beam (200, 300) for a vehicle (1), comprising two beam portions (304) joined together by means of a joint (301) and constituting a stiff beam (200, 300) and further comprising a lock element (302), having an energy absorbing structure.
5
2. The beam according to claim 1, wherein the energy absorbing structure comprises at least one lock element that upon release absorbs energy.
- 10 3. The beam according to claim 1, wherein the lock element (302) comprises a folded structure comprising two joined shanks of a substantially V-shaped element and fixated at each end to the respective parts (304) of the beam (200, 300).
4. The beam according to claim 3, wherein the fixation holding the folded structure path is arranged to absorb energy during release.
15
5. The beam according to claim 4, wherein the fixation comprise at least one of weld, screw, rivet, or bolt and nut.
- 20 6. The beam according to claim 2, wherein the lock element (302) is arranged to restrict the bending of the beam (200, 300) in a direction away from a crashing vehicle.
7. A vehicle comprising an underrun protection beam according to any of claims 1 to
25 6.

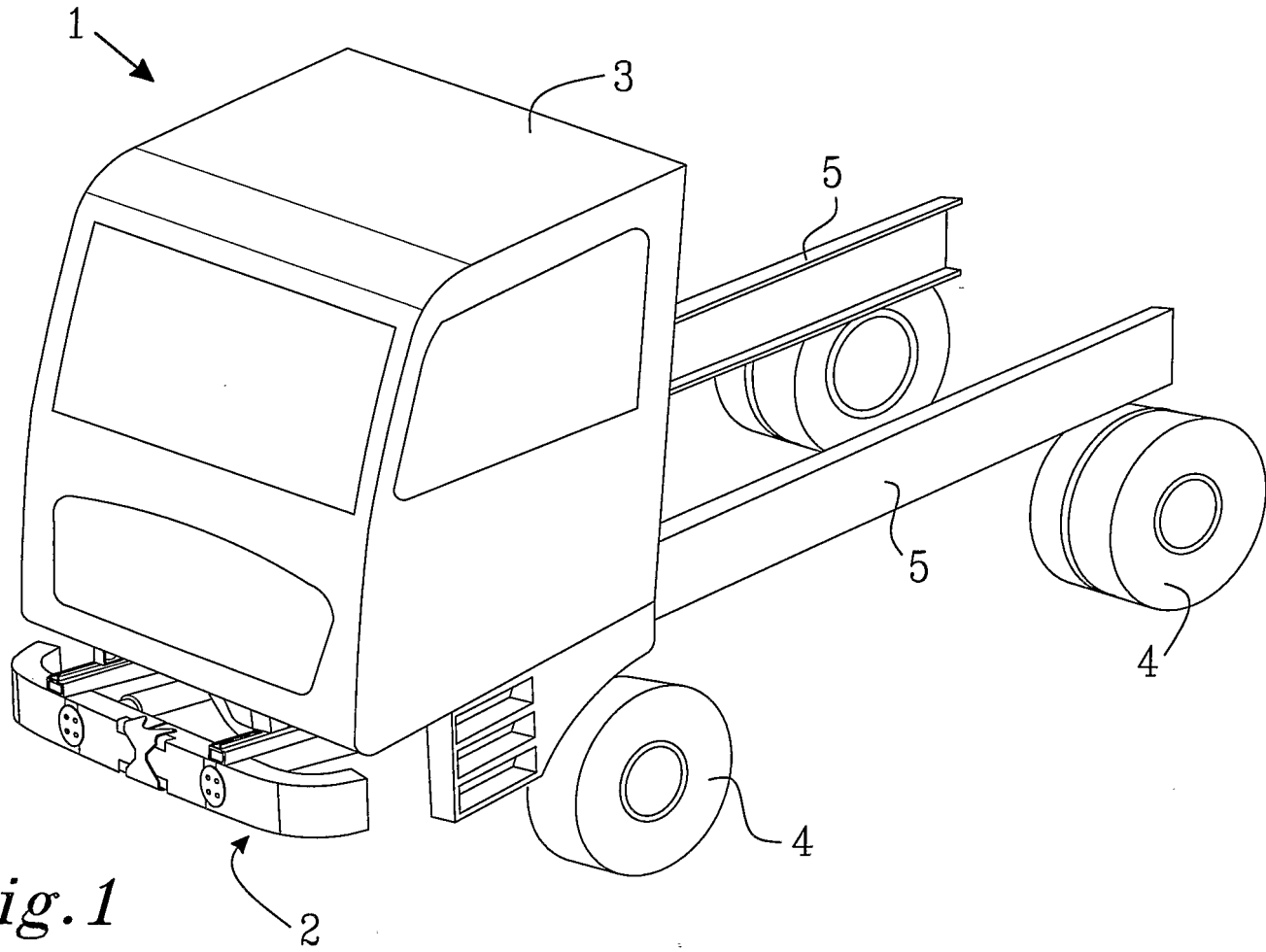


Fig. 1

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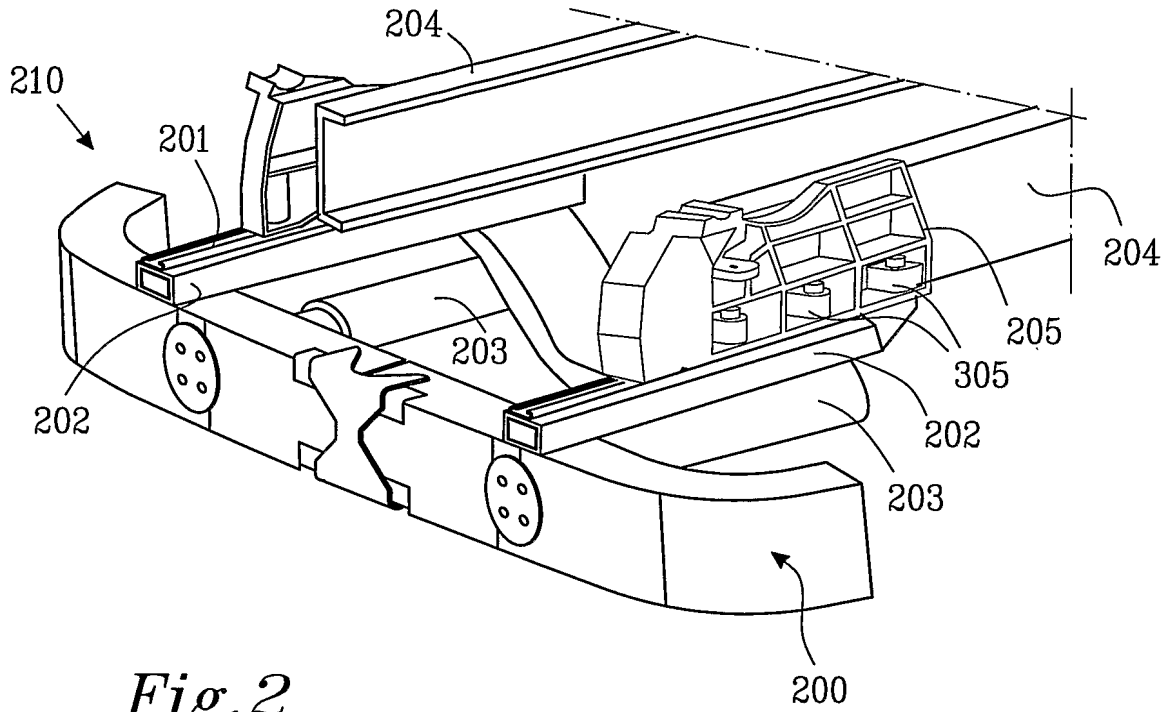


Fig. 2

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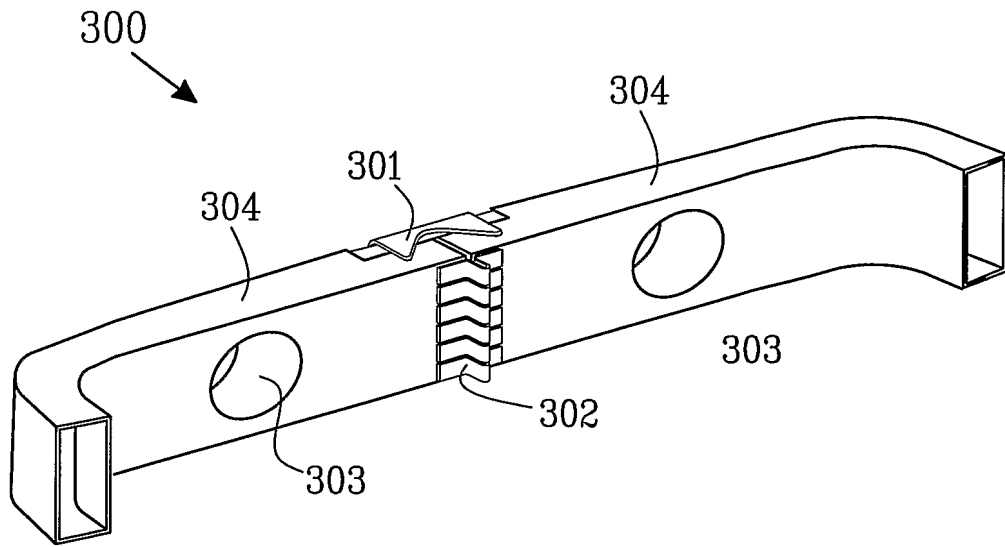


Fig. 3a

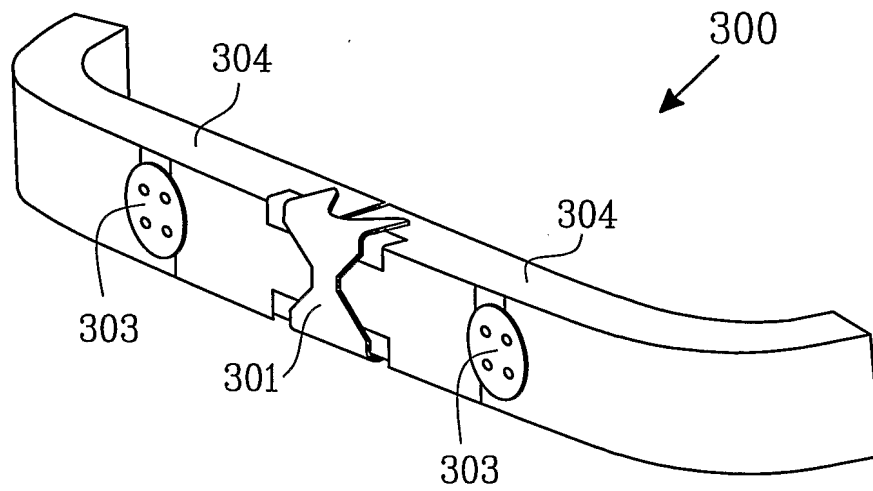


Fig. 3b

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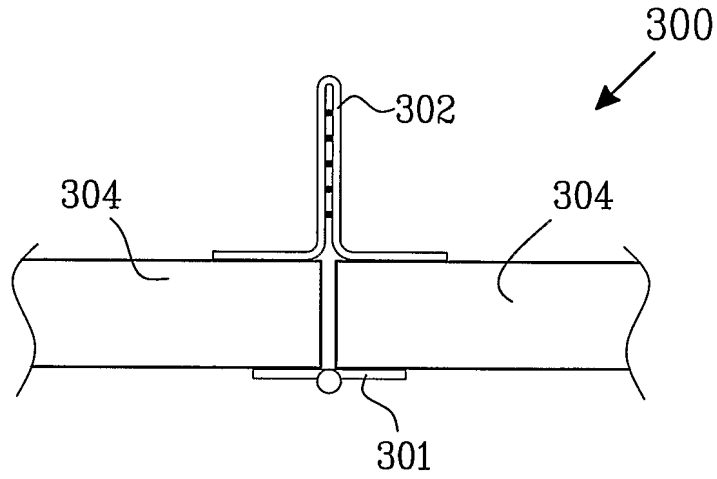


Fig. 3c

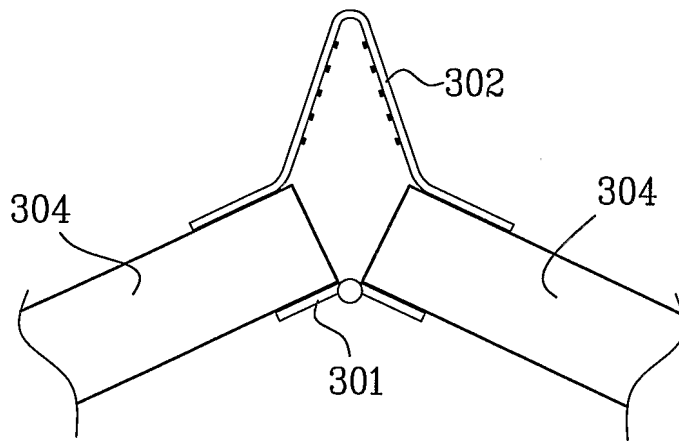


Fig. 3d

INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE2006/000807

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 0589227 A1 (MAN NUTZFAHRZEUGE AG), 30 March 1994 (30.03.1994), column 4, line 18 - line 30; column 5, line 29 - line 45, figures 11,17 --	1,2,6,7
A	DE 19907783 A1 (SUSPA COMPART AG), 31 August 2000 (31.08.2000) --	1-7
A	DATABASE EPODOC/EPO abstract & JP2004243831 A (PRESS KOGYO KK) 2 September 2004 (2004-09-02) --	1-7

 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/SE2006/000807

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 19643049 A1 (DAIMLER-BENZ AKTIENGESELLSCHAFT), 23 April 1998 (23.04.1998) -- -----	1-7

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B60R 19/56 (2006.01)

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/SE2006/000807

EP	0589227	A1	30/03/1994	DE	9218325 U	02/12/1993

DE	19907783	A1	31/08/2000	NONE		

DE	19643049	A1	23/04/1998	EP	0839690 A,B	06/05/1998
				SE	0839690 T3	
