which is normally in the locking state, and which may be set to the unlocking state by firing the pyrotechnic material.

Title: AUTOMOTIVE VEHICLE BODY STRUCTURE AND VEHICLE HAVING SUCH BODY STRUCTURE.

Abstract: Automotive vehicle body structure comprising first (30) and second vehicle body parts movable relative to each other in a longitudinal direction (X), a deformable member (41) linked to the first vehicle body part (30) and adapted to absorb energy when the first vehicle body part (30) is moving relative to the second vehicle body part, a locking device (71, 72) having a locking state in which the locking device (71, 72) locks the first and second vehicle body parts together, and an unlocking state in which the locking device (71, 72) unlocks the first and second vehicle body parts relative to each other in the longitudinal direction (X). The locking device (71, 72) is a pyrotechnic device having a pyrotechnic material, which is normally in the locking state, and which may be set to the unlocking state by firing the pyrotechnic material.
Automotive vehicle body structure and vehicle having such body structure.

FIELD OF THE INVENTION

The present invention concerns an automotive vehicle body structure and a vehicle having such body structure.

BACKGROUND OF THE INVENTION

The present invention concerns more precisely an automotive vehicle body structure comprising:

- first and second vehicle body parts movable relative to each other in a longitudinal direction,
- a deformable member linked to the first vehicle body part and adapted to absorb energy when said first vehicle body part is moving relative to said second vehicle body part,
- a locking device having a locking state wherein said locking device locks said first and second vehicle body parts together, and an unlocking state wherein said locking device unlocks said first and second vehicle body parts relative to each other in said longitudinal direction.

It is known from the applicant's own patent application WO 2004/113131 to use an automotive vehicle body structure, wherein locking devices are driven to penetrate inside a deformable member or to go out from said deformable member, according to the speed of the vehicle.

Unfortunately, this kind of automotive vehicle body structures requires a bulky and expensive reversible actuator. Further, the use of such reversible actuator implies implies to have play between said first and second vehicle body parts to enable the movements of the actuator, thereby enabling movements between said first and second vehicle body parts, thus risking to generate vibrations and reducing the vehicle body structure stiffness. Moreover,
this actuator is used very rarely, which makes it appear even more costly.

OBJECTS AND SUMMARY OF THE INVENTION

One object of the present invention is to provide a vehicle body structure of the kind in question, having a small and economical actuator.

To this effect, the locking device is a pyrotechnic device having a pyrotechnic material, which is normally in said locking state, and which may be set to said unlocking state by firing said pyrotechnic material.

Thanks to these features, the locking device is mechanically simpler and does not require a bulky and expensive actuator. Moreover, the pyrotechnic locking device does not require necessarily to have large clearance between the first and second vehicle body parts, which may enable to avoid or limit noise and to have a body structure with higher stiffness.

In various embodiments of the automotive vehicle body structure, one and/or other of the following features may optionally be incorporated:

- the locking device comprises a plurality of pyrotechnic devices, each of them having a pyrotechnic material and being fired independently from the other, so as to modify a level of energy the deformable member can absorb;

- the deformable member is formed as a hollow profile, elongated in the longitudinal direction, with at least one wall,

- the locking device has an elongated main body which connects said first vehicle body part and said second vehicle body part together, when said locking device is in the locking state,

- the elongated main body connects said first vehicle body parts and said second vehicle body part without any play;
- the main body of the locking device is a hollow tube having an internal cavity and a zone of weakness, the internal cavity being at least partially filled with said pyrotechnic material which, when fired, is adapted to break said zone of weakness;
- the zone of weakness of the locking device is a lateral recess belonging to said main body;
- the main body of the locking device has essentially a form of a cylinder,
- the lateral recess is an annular recess on the periphery of the main body,-
- the locking device is chosen in the group comprising a pyrotechnic pin and a pyrotechnic bolt;
- the locking device has at least a connecting wire and is unlocked when an electric signal is applied to the connecting wire;
- the locking device is mainly situated inside the deformable member;
- the automotive vehicle body structure comprises a connecting plate fixed on the second vehicle body part, wherein said first portion of the locking device is engaged in a hole belonging to the deformable member, and said second portion of the locking device is engaged in a hole belonging to the connecting plate;
- the deformable member is adapted to absorb energy of a displacement of the first vehicle body part, by a deformation of the deformable member chosen in the group comprising:
  -- a buckling of the deformable member,
  -- a striction of at least one wall belonging to the deformable member with a protrusion fixed with the second vehicle body part, and said protrusion facing said at least one wall belonging to the deformable member,
  -- a shearing of at least one wall belonging to the deformable member;
- the deformation is produced by the locking device
Another object of the invention is to provide an automotive vehicle comprising a vehicle body structure as described above, at least one sensor, an electronic control unit which is connected to said at least one sensor, and which provides an electric signal to unlock the locking device when specific unlocking conditions are sensed by the at least one sensor.

In preferred embodiments of the automotive vehicle proposed by the invention, one and/or the other of the following features may optionally be incorporated:

- the sensor is adapted to measure an acceleration of the vehicle and said unlocking conditions at least includes a deceleration condition, which must be above a predetermined deceleration value;

- the sensor is adapted to measure the proximity of an obstacle and said unlocking conditions at least includes a detection condition, which must validate the detection of an obstacle in the proximity of the vehicle;

- the locking device comprises a plurality of pyrotechnic devices, and the electronic control unit provides at least one electric signal to unlock a group of pyrotechnic devices belonging to the locking device when said unlocking conditions are sensed by the at least one sensor, in order to adjust according to a crash severity strategy a level of energy the deformable element can absorb.

BRIEF DESCRIPTION OF THE DRAWINGS

Other features and advantages of the invention will be apparent from the following detailed description of two of its embodiments given by way of non-limiting example, with reference to the accompanying drawings. In the drawings:

- Figure 1 is partial perspective view of an automotive vehicle with a body structure according to the
invention,
- Figure 2 is an enlarged perspective view of a
detail of a first embodiment of the automotive vehicle body
structure of figure 1,
- Figure 3 is another enlarged perspective view of
the automotive vehicle body structure of figure 2,
- Figure 4 is a cross section of a pin of the body
structure of figure 3,
- Figure 5 is a longitudinal cross section of the
body structure of the figure 3 according to line V-V of
figure 3, a locking device being in a locking state,
- Figure 6 is a similar longitudinal cross section
as in figure 5, the locking device being in an unlocking
state,
- Figure 7 is a cross section of a bolt of a second
embodiment of the automotive vehicle body structure of
figure 1,
- Figure 8 is a longitudinal cross section of the
second embodiment of the automotive vehicle body structure,
the locking device being in a locking state.

MORE DETAILED DESCRIPTION

The figure 1 is a perspective view of an automotive
vehicle V having a body structure 1 for supporting
mechanical organs of the vehicle, such as an internal
combustion engine with a gear box.

The body structure 1 can comprise for example, as
usual, two upper metallic longitudinal members 10 with a
hollow section, linked to an automotive passenger
compartment (not shown) and supporting this passenger
compartment. Each of these upper longitudinal members 10 is
extending essentially according to a longitudinal axis X of
the vehicle and is supporting a metallic suspending leg 13
at the front end 11 of each upper longitudinal member. The
suspending leg 13 is extending toward the bottom
essentially according to a vertical axis Z.
The front ends 11 of the upper longitudinal members are fixed to a metallic beam 30 of the bumper face-bar which extends essentially according to a transversal axis Y perpendicular to the X and Z axis, and which is a bumper skin 31 partially shown on figure 1. The link between the fronts ends 11 of the upper longitudinal members and the beam 30 is done with energy absorbing devices 40, more precisely described here-bellow.

In addition, the body structure 1 can for example comprise:
- two lower longitudinal members 20, extending essentially parallel to the upper longitudinal members 10, each lower extending member 20 being rigidly fixed to one of the suspending leg 13,
- a lower cross member 50, rigidly linking the fronts ends of the two lower longitudinal members 20 (this cross member 50 can usually support the vehicle radiator).

The rear ends of the lower longitudinal member 20 can be rigidly linked to an engine cradle 60. The engine cradle 60 is also usually fixed under the passenger vehicle compartment (not shown).

One of these energy absorbing devices 40 is shown on the expanded view of figure 2, with only a portion of the beam 30.

In this example, the energy absorbing device 40 includes:
- a metallic deformable member 41 in the form of a longitudinal profile, extending essentially according to the longitudinal axis X, this deformable member 41 having a hollow cross section in a plane Y, Z, essentially rectangular,
- a metallic fixing plate 42 extending essentially in the plane Y, Z, and having a opening adapted to the deformable member cross section and in which the deformable member is engaged.

The deformable member 41 can be fixed to the beam
30 of the bumper face-bar by soldering or threaded joints at its front end. The deformable member 41 has four walls around its rectangular cross section: an upper wall 41a, a lower wall 41b and two lateral walls 41c.

The deformable member 41 is adapted to absorb energy when the beam 30 (first vehicle body part) is moving relative to the upper longitudinal member 10 (second vehicle body part) from the front to the rear in the longitudinal direction X.

The deformable member 41 can be of any known type of deformable member, and can absorb the energy of the longitudinal displacement of the beam 30 by a buckling of the deformable member 41, under the compression force produced by the beam 30 displacement.

The deformable member 41 can also absorb energy by a striction of at least one wall 41a, 41b, 41c, of the deformable member 41 with respect to a protrusion (not shown) fixed to the second vehicle body part and for example provided by the fixing plate 42. Said protrusion is facing said wall of the deformable member, and the displacement of the deformable member 41 against this fixed protrusion deforms the deformable member 41 and absorbs the beam 30 displacement energy.

The deformable member 41 can also absorb energy by a shearing of at least one wall 41a, 41b, 41c of the deformable member 41. This technology is described in previous patent application of the applicant, WO 99/59842. In that case, the fixing bolts of the energy absorbing device are forced to shear walls of the deformable member, when the beam moves in the longitudinal direction X.

The fixing plate 42 is shown on figures 2 and 3. It extends to the rear with two flanges, upper flange 42a and lower flange 42b, which extends in the X, Y plane. These flanges 42a, 42b are engaged into front openings of the front ends 11 of the upper longitudinal members 10. The fixing plate 42 can be positioned relative to the front
ends 11 of the upper longitudinal members 10 with a centering pin 42c, and can be fixed to the front ends 11 of the upper longitudinal members 10 with four bolts (not shown) going through the holes 42d at each of the four corners of the fixing plate 42, without any play. Consequently, the vehicle body structure stiffness is higher than in prior art, and the risk to generate vibrations is lower than in prior art.

The energy absorbing device 40 also includes two fixing organs, 71, 72, like pins. These pins 71, 72 are essentially extending along a vertical axis R1 and R2, respectively. It is understandable for the skilled person that the axis R1 and R2 could be in any direction except the longitudinal direction X. These pins 71, 72 cross through holes of upper wall 41a and lower wall 41b of the deformable member 41 and cross though corresponding holes 43e of flanges 42a, 42b. In that way, the pins 71, 72 are rigidly linking together the deformable member 41 and the fixing plate 42.

The figure 4 shows one of these pins 71, 72. The pin 71 comprises:
- an elongated main body 73, essentially in the form of a cylinder of axis R, with a lateral recess 77 that is annular and situated on the outside periphery of the main body 73, said lateral recess 77 separating the main body 73 in a first portion 74 and a second portion 75 on each side of the said lateral recess 77,
- at least one plug 76 for sealing the main body 73.

The main body 73 is a hollow tube having an internal cavity 79 partially filled with a pyrotechnic material 78.

The lateral recess 77 is a zone of weakness adapted to break when the pyrotechnic material 78 is activated or fired, by an electric signal provided to the pyrotechnic material 78 by a connecting wire 80 connecting an
electronic control unit (ECU) to the pin 71. Consequently, these pins 71, 72 (locking devices) are not reversible actuators, and are not bulky and not expensive compared to the prior art actuators.

Figures 5 and 6 are longitudinal cross sections of the first embodiment of the body structure 1 of the invention. On figure 5, the pin 71 (locking device) is in a locking state, crossing completely and transversally the deformable member 41 and the flanges of the fixing plate 42, maintaining the deforming member 41 rigidly with the fixing plate 42 in an initial position.

In that initial position, if the vehicle hits an obstacle in front of its bumper face-bar, the deformable member 41 deforms itself (not shown) and absorbs the energy of the bump.

On figure 6, the pin 71 is fired and is in an unlocking state. The pin 71 is cut into two portions that move inside the deformable member 41 and are disengaged from the deformable member 41, which is than movable relative to the upper longitudinal member 10.

Consequently, if the vehicle hits an obstacle in front of its bumper face-bar, for example a pedestrian, the bump moves the bumper face-bar, the beam 30 and the deformable members 41 to the rear of the vehicle, that is to say in the direction of the upper longitudinal member 10, up to a contact position between the beam 30 and the fixing plate 42, as represented on figure 6.

The bumper face-bar does not resist, which is advantageous for a pedestrian bump. The pedestrian is therefore preserved from severe injuries.

The vehicle incorporating the body structure described above works as follow.

At least one sensor SENS measure a physical value of the vehicle and/or a physical value of the vehicle environment. An electronic control unit ECU is connected to this at least one sensor SENS and to the pyrotechnic
locking device 71, 72 of the vehicle body structure via at least one connecting wire 80. If specific unlocking conditions are sensed by the sensor SENS, the electronic control unit ECU is generating an electric signal transmitted to the locking device 71, 72, which explodes and changes from locking state to unlocking state.

The specific unlocking conditions should include a speed condition on the vehicle speed. For example, the vehicle speed should be above a first limit, for example 20 km/h, and below a second limit, for example 40 km/h; that is to say in a speed range that highly concerns pedestrian bumps.

In a first variant, a sensor SENS (an accelerometer) measures the vehicle acceleration. If the acceleration of the vehicle is below a negative acceleration limit, the deceleration of the vehicle is high. If at least the speed condition and the deceleration condition are validated, the electronic control unit ECU generates the electric signal to fire the pyrotechnic material 78 of the locking devices 71, 72.

In a second variant, a proximity sensor SENS measures the proximity of an obstacle in front of the vehicle bumper face-bar. If an obstacle, like a pedestrian, is detected in the proximity of the vehicle, for example at a distance lower than a distance limit, for example a distance limit of one meter, the detection condition is validated. If at least the speed condition and the detection condition are validated, the electronic control unit ECU generates the electric signal to fire the pyrotechnic material 78 of the locking devices 71, 72.

In a third variant, the pyrotechnic locking device 71, 72 comprises a plurality of pyrotechnic devices, each of them having a pyrotechnic material 78 and being fired independently from the other. This variant could be useful for other applications than a pedestrian bump, applications wherein the deformation of the deformable member 41 is
desirable for absorbing the energy of a vehicle crash. More precisely, it could be desirable to adapt the level of energy the deformable member 41 can absorb to the predicted shock of the vehicle.

If first unlocking conditions are sensed by the at least one sensor SENS, the electronic control unit ECU is generating an electric signal transmitted to a group of pyrotechnic devices belonging to the pyrotechnic locking device. Consequently, under these first unlocking conditions, the number of pyrotechnic devices in the locking state is lower or equal to the total number of pyrotechnic devices, and the deformable member 41 can absorb a first level of energy, when the beam 30 (first vehicle body part) is moving relative to the upper longitudinal member 10 (second vehicle body part).

If second unlocking conditions are sensed by the at least one sensor SENS, the electronic control unit ECU is not generating any electric signal. All the locking devices 71, 72 are in the locking state. The deformable member 41 can absorb a second level of energy greater than the first level of energy.

Of course, the number of unlocking conditions could be more than two, depending on the number of pyrotechnic devices in the locking device 71, 72.

Moreover, the position of the pyrotechnic devices that are switched to the unlocking state can depend on the information sensed by the sensor SENS.

More the predicted shock of the vehicle is severe, more the number of pyrotechnic devices in the locking state should be large. Thanks to that possibility, the level of energy the deformable member (41) can absorb, may be adjusted to a crash severity strategy.

This last variant of vehicle shock can be combined with the other variants for pedestrian bump.

In a second embodiment of the invention, the pins 71, 72 (locking devices) of the first embodiment are
replaced by bolts 81, 82. The figure 7 shows one bolt 81 comprising:
- an elongated main body 73 threaded and adapted to be screwed inside any other part, this main body 73 being essentially in the form of a cylinder of axis R,
- a head 83 for the screwing the bolt 81, mounted on the main body 73,
- a lateral recess 77 of the main body, just bellow the head 83.

Similarly to the pin 71, the main body 73 of the bolt 81 is a hollow tube having an internal cavity 79 partially filled with a pyrotechnic material 78.

The lateral recess 77 is a zone of weakness adapted to break when the pyrotechnic material is fired, by an electric signal provided to the pyrotechnic material 78 by a connecting wire 80 connecting an electronic control unit (ECU) to the bolt 81.

The figure 8 is a longitudinal cross section of the vehicle body structure 1 on this second embodiment, in an initial position, that is to say the bolt 81 (locking device) being in the locking state.

It will be understood that this second embodiment works similarly to the first embodiment, the main difference being that the bolts 81, 82 are screwed through the fixing plate 42 in the deformation member 41, from the outside of the deformation member 41. Consequently, the body structure 1 of the second embodiment is more easily assembled and repaired after a first firing of the bolts.
CLAIMS

1. Automotive vehicle body structure comprising:
   - first and second vehicle body parts (30, 10) movable relative to each other in a longitudinal direction (X),
   - a deformable member (41) linked to the first vehicle body part (30) and adapted to absorb energy when said first vehicle body part (30) is moving relative to said second vehicle body part (10),
   - a locking device (71, 72; 81, 82) having a locking state wherein said locking device locks said first and second vehicle body parts (30, 10) together, and an unlocking state wherein said locking device unlocks said first and second vehicle body parts (30, 10) relative to each other in said longitudinal direction (X), characterized in that the locking device (71, 72; 81, 82) is a pyrotechnic device having a pyrotechnic material (78), which is normally in said locking state, and which may be set to said unlocking state by firing said pyrotechnic material (78).

2. Automotive vehicle body structure according to claim 1, wherein the locking device (71, 72; 81, 82) comprises a plurality of pyrotechnic devices, each of them having a pyrotechnic material (78) and being fired independently from the other, so as to modify a level of energy the deformable member (41) can absorb.

3. Automotive vehicle body structure according to claim 1, wherein:
   - the deformable member (41) is formed as a hollow profile, elongated in the longitudinal direction (X), with at least one wall (41a, 41b, 41c),
   - the locking device (71, 72; 81, 82) has an elongated main body (73) which connects said first vehicle body part (30) and said second vehicle body part (10) together, when said locking device (71, 72; 81, 82) is in
the locking state.

4. Automotive vehicle body structure according to claim 3, wherein the elongated main body (73) connects said first vehicle body parts (30) and said second vehicle body part (10) without any play.

5. Automotive vehicle body structure according to claim 3, wherein the main body (73) of the locking device (71, 72; 81, 82) is a hollow tube having an internal cavity (79) and a zone of weakness (77), the internal cavity (79) being at least partially filled with said pyrotechnic material (78) which, when fired, is adapted to break said zone of weakness (77).

6. Automotive vehicle body structure according to claim 5, wherein the zone of weakness (77) of the locking device (71, 72; 81, 82) is a lateral recess belonging to said main body (73).

7. Automotive vehicle body structure according to claim 5 or claim 6, wherein:
   - the main body (73) of the locking device (71, 72; 81, 82) has essentially a form of a cylinder,
   - the lateral recess (77) is an annular recess on the periphery of the main body (73).

8. Automotive vehicle body structure according to any one of the preceding claims, wherein the locking device (71, 72; 81, 82) is chosen in the group comprising a pyrotechnic pin and a pyrotechnic bolt.

9. Automotive vehicle body structure according to any one of the preceding claims, wherein the locking device (71, 72; 81, 82) has at least a connecting wire (80) and is unlocked when an electric signal is applied to the connecting wire (80).

10. Automotive vehicle body structure according to any one of the preceding claims, wherein the locking device (71, 72) is mainly situated inside the deformable member (41).

11. Automotive vehicle body structure according to
any one of the preceding claims, comprising a connecting plate (42) fixed on the second vehicle body part (10), wherein the locking device (71, 72; 81, 82) is engaged in a hole belonging to the deformable member (41) and in a hole (42e) belonging to the connecting plate (42).

12. Automotive vehicle body structure according to any one of the preceding claims, wherein the deformable member (41) is adapted to absorb energy of a displacement of the first vehicle body part (30), by a deformation of the deformable member (41) chosen in the group comprising:
- a buckling of the deformable member (41),
- a striction of at least one wall (41a, 41b, 41c) belonging to the deformable member (41) with a protrusion fixed with the second vehicle body part (10), and said protrusion facing said at least one wall (41a, 41b, 41c) belonging to the deformable member (41),
- a shearing of at least one wall (41a, 41b, 41c) belonging to the deformable member (41).

13. Automotive vehicle body structure according to claim 12, wherein the deformation is produced by the locking device (71, 72) on the deformable member (41).

14. Automotive vehicle comprising:
- a vehicle body structure 1 according to any of the preceding claims,
- at least one sensor (SENS),
- an electronic control unit (ECU) which is connected to said at least one sensor (SENS), and which provides an electric signal to unlock the locking device (71, 72) when specific unlocking conditions are sensed by the at least one sensor (SENS).

15. Automotive vehicle according to claim 14, wherein the sensor (SENS) is adapted to measure an acceleration of the vehicle and said unlocking conditions at least includes a deceleration condition, which must be above a predetermined deceleration value.

16. Automotive vehicle according to claim 14,
wherein the sensor (SENS) is adapted to measure the proximity of an obstacle and said unlocking conditions at least includes a detection condition, which must validate the detection of an obstacle in the proximity of the vehicle.

17. Automotive vehicle according to any one of the claims 14 to 16, wherein the locking device (71, 72; 81, 82) comprises a plurality of pyrotechnic devices, and the electronic control unit (ECU) provides at least one electric signal to unlock a group of pyrotechnic devices belonging to the locking device (71, 72) when said unlocking conditions are sensed by the at least one sensor (SENS), in order to adjust according to a crash severity strategy a level of energy the deformable element (41) can absorb.
### A. CLASSIFICATION OF SUBJECT MATTER

INV. B60R19/34
ADD. B60R19/26

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 practical, search terms used)
EPO-Internal

### C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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<th>Category</th>
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<th>Relevant to claim No.</th>
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<td>X</td>
<td>DE 200 13 385 'U1 (SUSPA COMPART AG [DE]) 9 November 2000 (2000-11-09) page 6, lines 22,23; figures</td>
<td>1, 2, 9-13</td>
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<td>WO 98/22327 A (VOLVO AB [SE]; LARSSON JOHNNY K [SE]; JERNSTROM CLAS [SE]) 28 May 1998 (1998-05-28) the whole document</td>
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<td>X</td>
<td>EP 1 486 381 A (INNOTEC FORSCHUNGS UND ENTWICK [DE]; REHAU AG &amp; CO [DE]) 15 December 2004 (2004-12-15) paragraph [0026]; figures</td>
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<td>X</td>
<td>DE 102 57 262 Al (VOLKSWAGEN AG [DE]) 24 June 2004 (2004-06-24) figures</td>
<td>1, 3, 9, 12, 13</td>
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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 document 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

**IT** 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.

**S** document member of the same patent family

**Date of the actual completion of the international search**

29 July 2008

**Date of mailing of the international search report**

03/11/2008

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

Douhet, Herve
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<td>A</td>
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<td>A</td>
<td>US 5 460 421 A (CULBERTSON TIMOTHY O [US]) 24 October 1995 (1995-10-24) column 3, lines 43-45; figures</td>
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INTERNATIONAL SEARCH REPORT

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.: because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☑ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-13

Remark on Protest

☒ The additional search fees were accompanied by the applicant’s protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant’s protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☐ No protest accompanied the payment of additional search fees.
This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-13

   Body structure comprising a specific pyrotechnic locking device

2. claims: 14-17

   Vehicle body comprising a specific control means for a locking device
<table>
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