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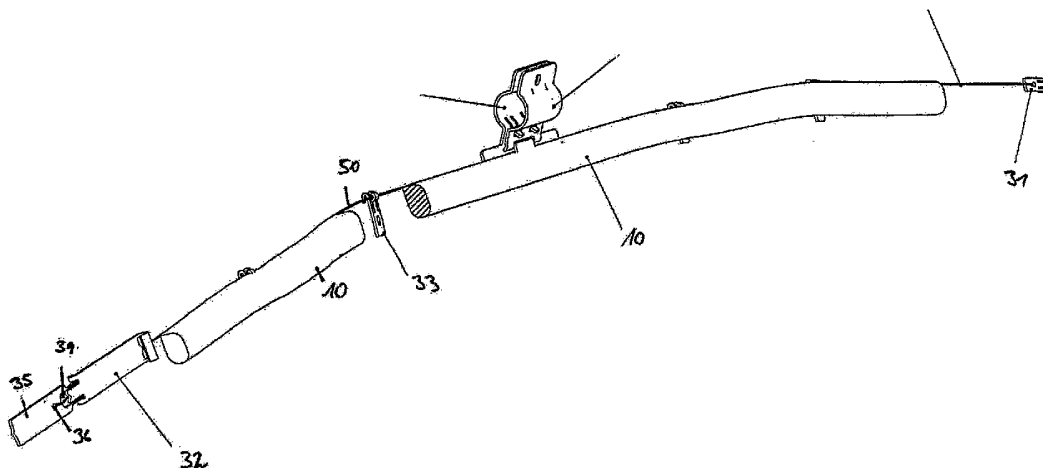
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(54) Title: CURTAIN AIR BAG UNIT



(57) Abstract: Curtain air bag unit for a motor vehicle is provided which comprises an air bag extending parallel to the longitudinal axis of the motor vehicle. Further it comprises fixing means for fixing the air bag in the area of the roof bar of the motor vehicle, whereby the fixing means comprise a tension member, that extends from a first fixing element to a second fixing element. It also comprises tensioning means for influencing the tensile stress of the tension member during mounting of the curtain air bag unit into the motor vehicle. A pre-cut tension member can be used whose length is chosen in a way that the mounting in the vehicle can be carried out simply and conveniently.

CURTAIN AIR BAG UNIT

Description

- 5 The invention concerns a curtain air bag unit according to claim 1.

In order to protect the passengers during a side crash or during a roll-over crash so-called curtain air bags are known. Such curtain air bags are attached at or next to the roof bar of the vehicle and expand in case of
10 operation in such a way that they cover at least a part of the side windows and mostly also the B-column of the vehicle. Fixing means which join the upper edge of the curtain air bag with the inner structure of the vehicle must be present.

- 15 For example from the US 5,899,486 a curtain air bag unit is known, whose fixing means comprise a tension member in the form of a wire. This wire extends from a first fixing element joined with the inner structure of the vehicle to a second fixing element joined with inner structure of the vehicle and that extends through a long, round tube section of the air bag which is
20 connected to the section of the air bag which expands in the case of work of the gas generator.

- A very uniform connection of the air bag to the motor vehicle is achieved by the construction chosen in the US 5,899,486. Because no section of the
25 airbag is being joined directly and rigidly to the inner structure of the vehicle a breaking of the fabric can surely be prevented during the expansion even under unfavorable circumstances.

- A disadvantage of the suggested construction is, that a high-quality
30 mounting of the needed wire is difficult. If a precut wire is used, following problem occurs: In the mounted state the wire should show a relatively high tensile stress in order not to sag and not to produce any rattle noises. To achieve that it must be as short as possible that makes the mounting of the

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wire very difficult. If a longer wire is chosen, the mounting is simpler but no optimal functioning can be achieved. If no precut wire is used, length and tension of the wire will usually vary considerably from vehicle to vehicle, what is problematic from the viewpoint of a constantly high quality.

5

In view of the above-described circumstances, it is an object of the present invention, to provide a curtain air bag unit that can simply be installed in the vehicle with a high quality being achieved.

10 In accordance with the present invention, a tensioning means for influencing the tensile stress of the tension member is provided. The following can be reached by that measure: A pre-cut tension member can be used whose length is chosen in a way that the mounting in the vehicle can be carried out simply and conveniently. In a next step the tensioning means is actuated
15 according to a simple installation instruction. This brings the tension member onto a desired, relatively high tensile stress level. One achieves therefore both: A simple way of mounting of the tension member and the high tensile stress wanted.

20 The tension member can be formed as a cable, a cord or a strip which could be metallic, could be made of plastic or fabric.

The invention is explained now in detail by ways of examples with respect to the accompanying figures. These figures show:

25

- Figure 1 A side air bag which is attached to a passenger car by means of a cable,
Figure 2 a first embodiment of the invention in which one fixing element is set up as a tensioning lever,
30 Figure 3a the tensioning lever of figure 2 in opened position in a longitudinal sectional representation,
Figure 3b the tensioning lever of figure 3a in half locked position,
Figure 4 a second embodiment of the invention in with which one fixing element is set up as an infinitely variable tensioning means,

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- Figure 5a the detail D of figure 4 in a top view,
Figure 5b a sectional view along the line B-B of figure 5a,
Figure 6a a tensioning means which is located between the two fixing
elements in open position,
5 Figure 6b the tensioning means of figure 6a in a locked position.
Figure 7a the tensioning means is formed as a clipped fixing element
Figure 7b the clipped fixing element during mounting to roof bar structure
Figure 7c the clipped fixing element of figure 7b in a subsequent step of
mounting
10 Figure 7d the clipped fixing element of figure 7c in mounted condition

The figure 1 shows a curtain air bag unit. The curtain air bag unit comprises an air bag 10 and fixing means for mounting the air bag 10 in the area of the roof bar RB of the motor vehicle. The air bag 10 extends along a longitudinal
15 axis L which coincides with the longitudinal axis of the motor vehicle. The air bag 10 comprises an expansion section 12 and a tube section 14. The expansion section 12 is connected to a gas generator (not shown) and is filled with gas in case of an accident. The tube section 14 is located at the upper rim of the air bag 10 and is used for receiving a cable 50 extending
20 along the longitudinal axis L. The cable 50 is the tension member. The cable 50 is the part of the fixing means and extend between the fixing elements 31, 32 that are located at or next to the A-column A and the C-column C respectively. The air bag covers the side windows and the B-column. Tethers 16, which are attached to the A- and C-column, position the
25 expanded air bag 10 correctly in the vehicle and control its tension in inflated condition.

As already mentioned the cable 50 is part of the fixing means that attach the air bag 10 to the motor vehicle. The cable 50 extends from the first fixing
30 element 31 to the second fixing element 32 and is in sections received in the tube section 14. Further the fixing plate 20 and intermediate hooks 33 provide guiding of the cable 50 between the two fixing elements 31,32. The fixing plate 20 can for example be used for mounting of the gas generator. The tube section 14 has gaps 14b in that the intermediate hooks 33 reach.

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Such hooks 33 are secured to the cable 50 and are associated to apertures in the side structure of the vehicle. Alternatively the hooks 33 can be formed in the side structure, for example as bent tabs, on which the cable is hooked up.

5

According to the invention a tensioning means is present, by means of which the tensile strength in the cable 50 can be influenced. There are many kinds of possibilities how the tensioning means can be designed and located. In particular one of the two fixing elements 31,32 can be formed as the tensioning means. Further the tensioning means can be located
10 between the two fixing elements 31,32, preferably at the fixing plate 20.

In the following three embodiments are described in detail. In the first two embodiments the second fixing element is also the tensioning means; In the case of the third embodiment the tensioning means is mounted between the
15 two fixing elements.

First embodiment

20 A first embodiment is shown in figure 2. In this embodiment the second fixing element 32 is designed as a tensioning lever representing the tensioning means. The construction of the tensioning lever is now described in detail with regard to the figures 2 and 3a. The tensioning lever 34 comprises a stationary arm 35 which is secured to the inner structure of the motor vehicle. At the stationary arm 35 the final eye 37 is fixed. The end of
25 the cable 50 is held in this final eye. Via the joint 38 the movable arm 42 is connected to the stationary arm 35. In the opened state as shown in the figures 2 and 3a the angle α between the two arms 35,42 is about 180 °.

30 The cable 50 extends from the already mentioned final eye 37, that is located at the bottom of the stationary arm 35, through the boring 36 onto the top face 35b of the stationary arm. From here the cable 50 extends through the aperture 39 to the bottom 42a of the movable arm 42 and runs

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through the routing-eye 44. From this point the cable 50 extends to the first fixing element 31.

When the movable arm 42 is slued, that means when the angle α is reduced, the tip 42b deflects the cable 50. The cable now extends from the boring 36 to the tip 42b and from here back to the routing-eye 44, where it is bent again. Consequently, the overall length of the path between the first fixing element 31 and the final eye 37 of the second fixing element 32 is increased, that is, the cable is tightened. In completely locked position the two arms 35, 42 enclose an angle of essentially 0° . A blocking means can be present, with which the second arm 42 can be blocked in this locked position. One advantage of this embodiment is that the tightening of the cable 50 can be achieved with a single movement of the hand.

15 Second embodiment

The figures 4, 5a and 5b show a second embodiment of the invention. As in the first embodiment, the second fixing element 32 is used as tensioning means. The tensioning means is made in a way that the tensile stress in the cable 50 can be chosen continuously.

Figure 5a which is the detail D from figure 4 shows the construction of the tensioning means schematically. Tensioning means of this kind are known, for example in guitars. The leveling screw 60 stands in working-combination with the teeth 66 of the package 62 (this can be seen particularly in figure 5b). So, in the case of a turn of the leveling screw 60 the package 62 is also turned. The package 62 shows a slot 64 through which the cable 50 is led. The twisting of the leveling screw 60 turns the package 62 and the cable 50 is wound onto the body surface 62a of the package 62 so that it is tightened like a guitar string.

By adjusting the tension in the cable 50 via a screw, the tension can easily be measured during assembly and therefore such mounting concept is repeatable in identical manner with good quality. Further it is easily

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servicable. By releasing the screw connection the air bag unit can be dismounted, if it needs to be replaced after an accident situation.

Third embodiment

5

The figures 6a and 6b show a third embodiment. In this embodiment the tensioning means is located between the two fixing elements. For example the tensioning means can be mounted at the fixing plate 20, to which the gas generator can also be attached. At the fixing plate 20 the cam 72 is
10 pivotably mounted. The lever 74 is rigidly attached to the cam 72. The cable 50 is guided by two rigid eyes 70 and passes the body surface of the cam 72. In the opened position represented in figure 6a, the cable 50 is not deflected by the cam 72. If, as shown in figure 6b, the lever 74 is turned 90°, the top 73 of the cam 72 deflects the cable 50 and the cable 50 is thus
15 tightened. As in the first embodiment, the tensioning of the cable 50 can be achieved with a single movement.

Also this embodiment is servicable, if the air bag unit needs to be replaced after an accident situation. The locked lever 74 needs to be unlocked and the cam 72 is then removed and the cable loses tension, so that the air bag
20 unit can be dismounted.

Such concept is further having the advantage that due to the lever 74, it can be prevented that the passenger car is assembled without correct mounting of the air bag unit. If the lever 74 is not locked and the cable is not tensioned, the trim of the columns and the roof can not be positioned
25 correctly. Only in the locking position of the lever 74 such trims can be positioned and mounted in the interior of the passenger car.

Fourth embodiment

30 Figure 7a shows a fixing element 32, which is formed as a u-shaped metallic clip bracket having two arms 81, 82. Both arms have a curved hook shape at their end portions 83, 84. Each arm is associated with an aperture 85, 86 in the roof bar structure 87 of the passenger car. The width of each end portion 83, 84 corresponds to the width of the apertures 85, 86. The main

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portion of each of the arms 81, 82 has a bigger width than the end portion 83, 84, which does not fit to in the apertures 85, 86. So the fixing element 32 is first inserted into the apertures with the end portions 83, 84 of its arms 81, 82, as can be seen in sequence of figure 7a to figure 7b. Subsequently it is moved in locking position with a movement along the roof bar structure 87,
5 as shown in figure 7b. Figure 7c shows the locked position of the fixing element 32.

The fixing element 32 is provided with an opening 92, 93 in each arm 81, 82.
10 A hollow screw 89 extends through both openings 92, 93. The cable 50 extends through the hollow body of the screw 89 and through the openings 92, 93 in the fixing element. The head of the screw 89 is provided with a recess in which a stop ball 90 is located (shown in figure 7c). Another stop ball 91 is provided in the cable 50 at the opposite side of the fixing element
15 32. Both stop balls 90, 91 have the function to secure the cable end portion at the fixing element 32, so that it can not be removed from it. After insertion of the fixing element 32 into the roof bar structure 87 the cable 50 is tensioned by putting a defined torque at the screw 89 and therewith pulling the cable 50 through the fixing element 32 with a defined length.

20

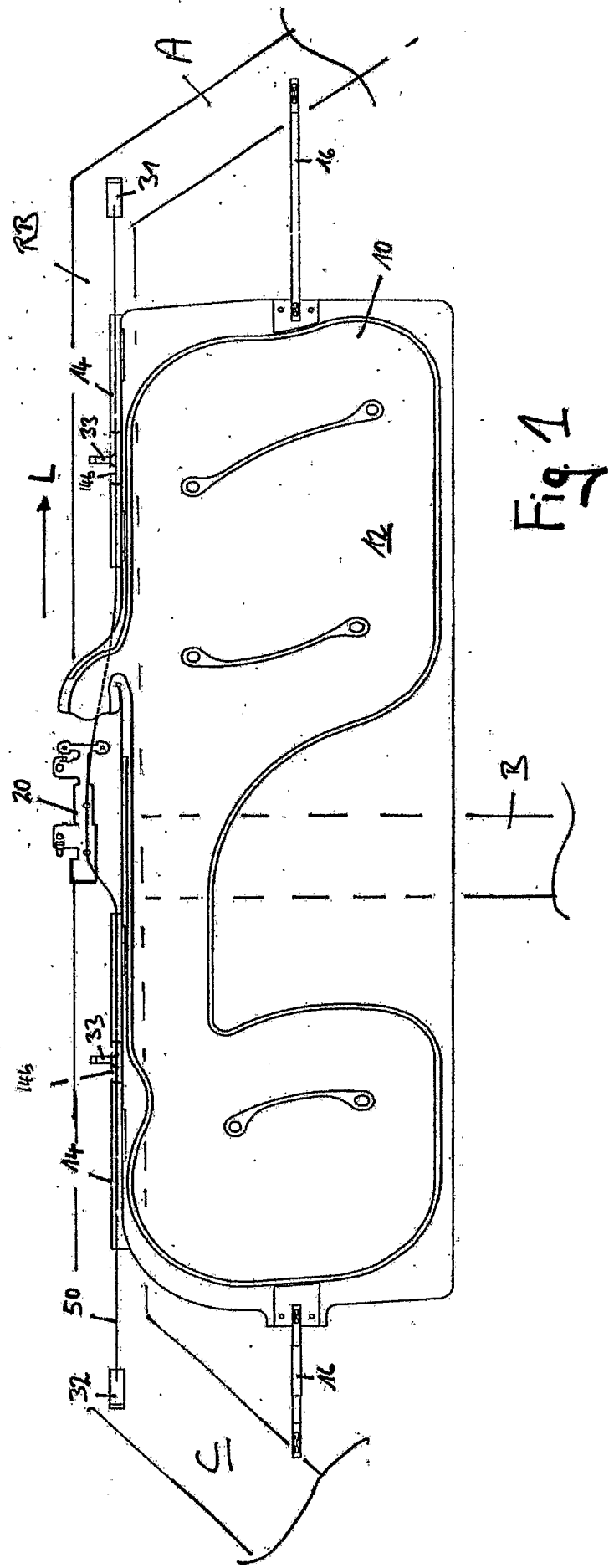
This tensioning means can easily be dismounted by releasing the tension of the cable with the screw and removing the clip element 32 from the roof bar structure 87.

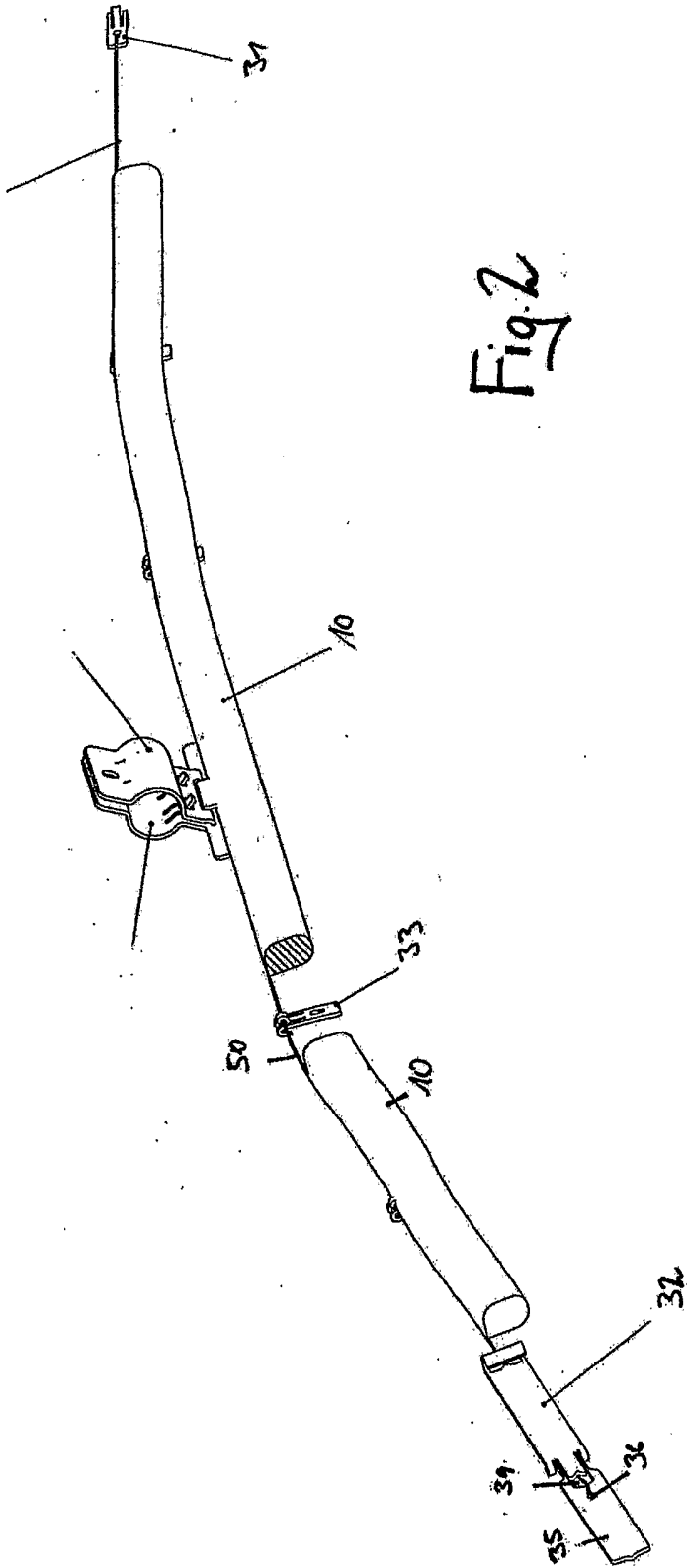
Patent claims

1. Curtain air bag unit for a motor vehicle comprising:
 - an air bag extending parallel to the longitudinal axis of the motor vehicle,
 - fixing means for fixing the air bag in the area of the roof bar of the motor vehicle, whereby
 - the fixing means comprise a tension member, that extends from a first fixing element to a second fixing element, and
 - tensioning means for influencing the tensile stress of the tension member during mounting of the curtain air bag unit into the motor vehicle.
2. Curtain air bag unit according to claim 1, whereby one of the two fixing elements is also the tensioning means.
3. Curtain air bag unit according to claim 1, whereby the tensioning means is located between the two fixing elements.
4. Curtain air bag unit according to one of the preceding claims with the first fixing element being mounted in the area of a front column of the motor vehicle and the second fixing element being mounted in the area of a rear column of the motor vehicle.
5. Curtain air bag unit according to claim 4 with the first fixing element being mounted to the A-column of the motor vehicle and the second fixing element being mounted to the C-column of the motor vehicle.
6. Curtain air bag unit according to one of the preceding claims with the airbag comprising an expansion section and a tube section, said tube section having gaps in which intermediate hooks reach in order to guide the tension member and/ or to attach the tension member to the roof bar.

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7. Curtain air bag unit according to claim 6, wherein the intermediate hooks are secured on the cable.
8. Curtain air bag unit according to claim 6, wherein the intermediate
5 hooks are formed in the roof bar structure.
9. Curtain air bag unit according to one of the preceding claim,
characterized in that the tensioning means can be actuated by the
movement of a lever.
- 10
10. Curtain air bag unit according to one of the preceding claim,
characterized in that the tensioning means can be actuated by the
movement of a leveling screw.
- 15 11. Curtain air bag according to one of the preceding claims,
characterized in that the tensile stress of the tension member is
increased in a last step of the mounting of the air bag.
- 20 12. Curtain air bag according to one of the preceding claims,
characterized in that the tension member is formed as cable, as cord
or as strip and is formed from metal, plastic or fabric.





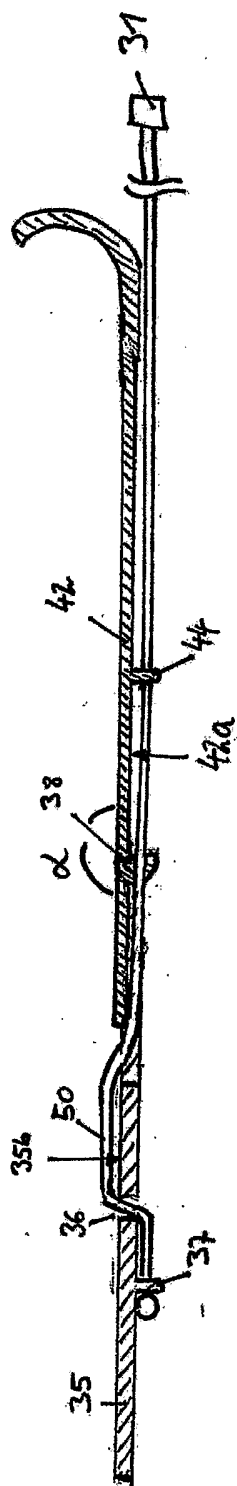


Fig 3a

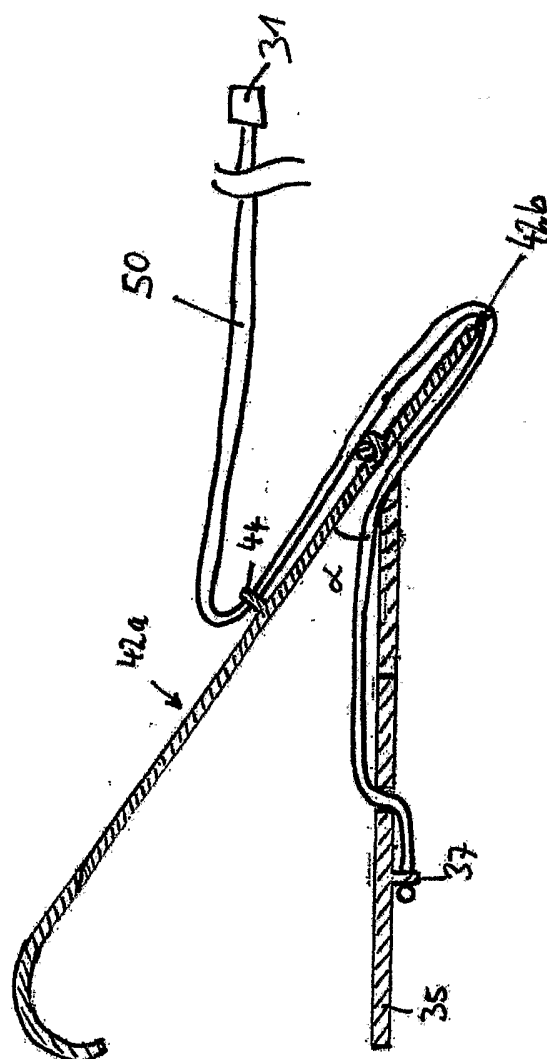
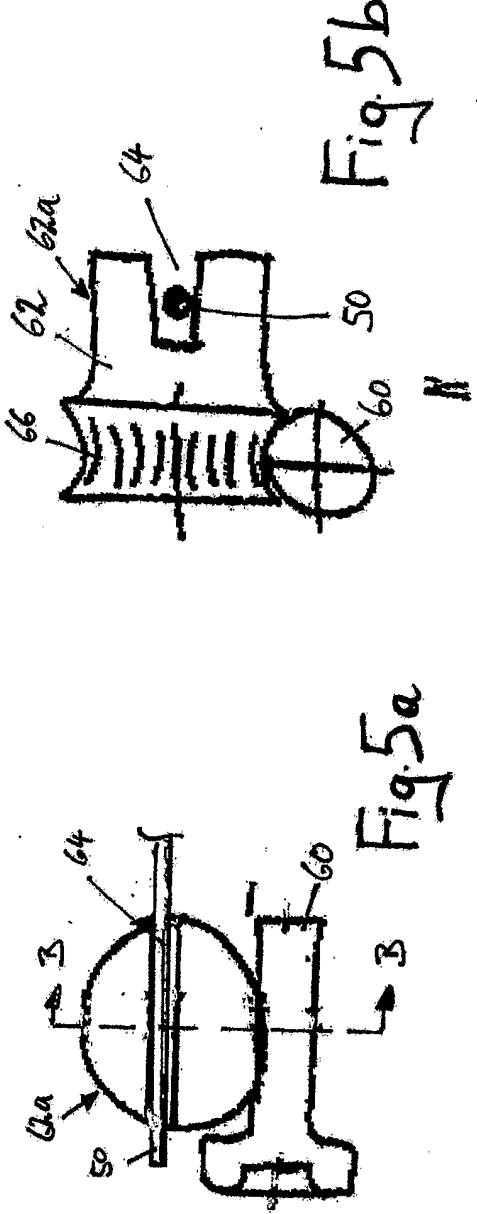
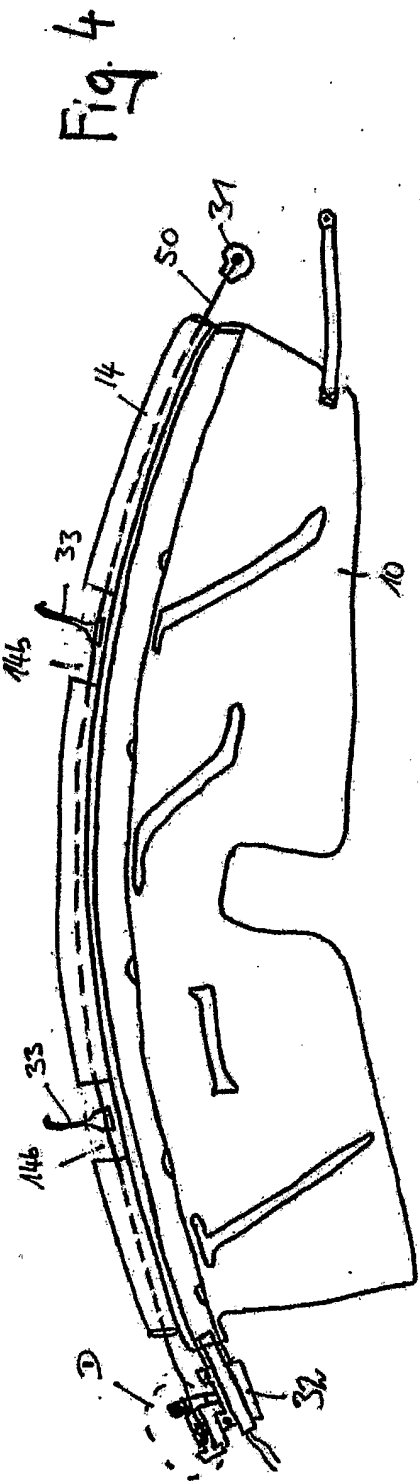


Fig 3b



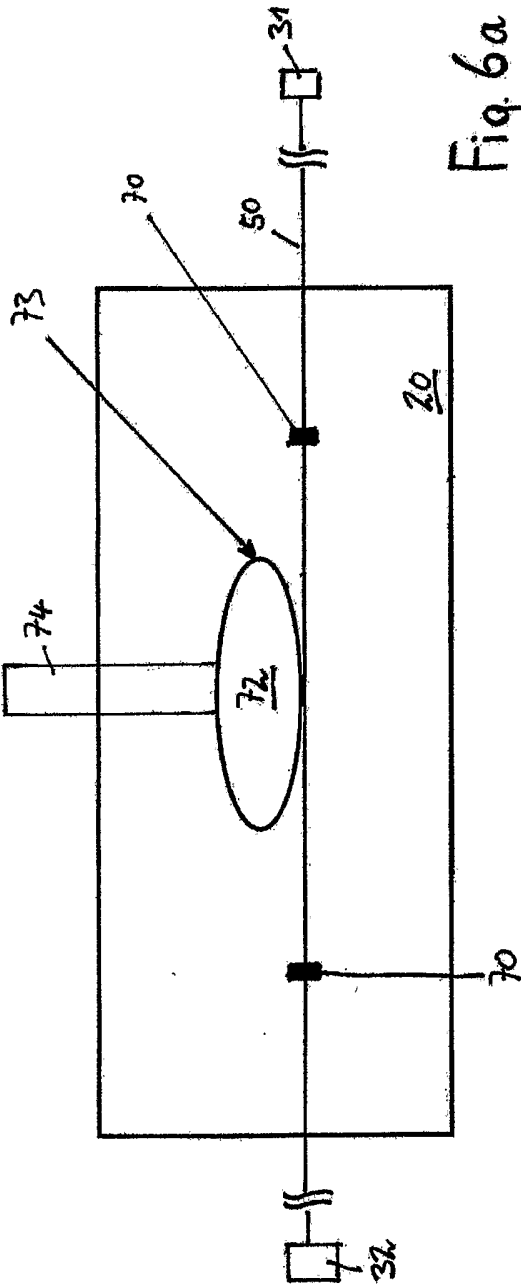


Fig. 6a

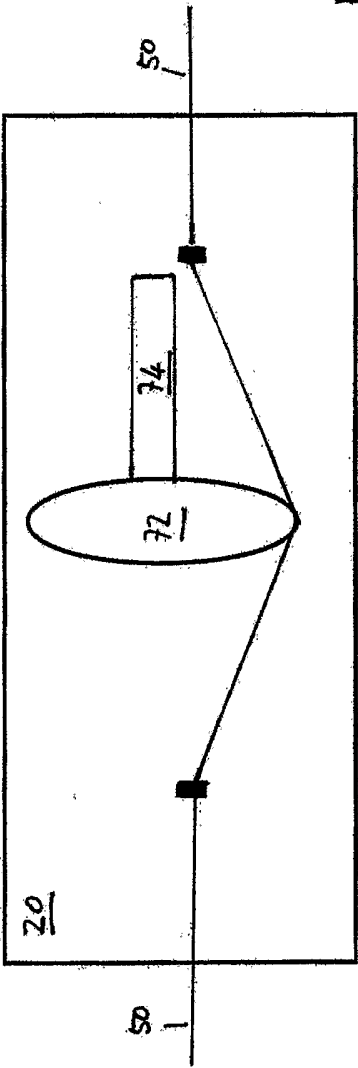
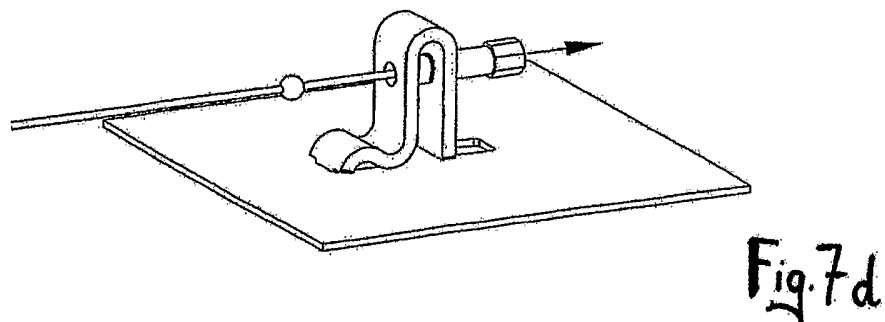
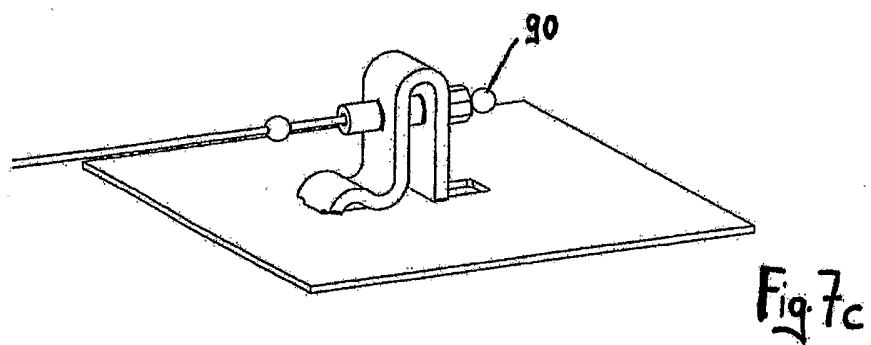
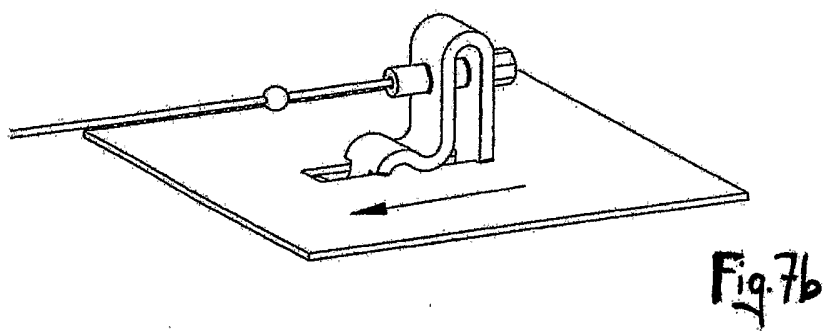
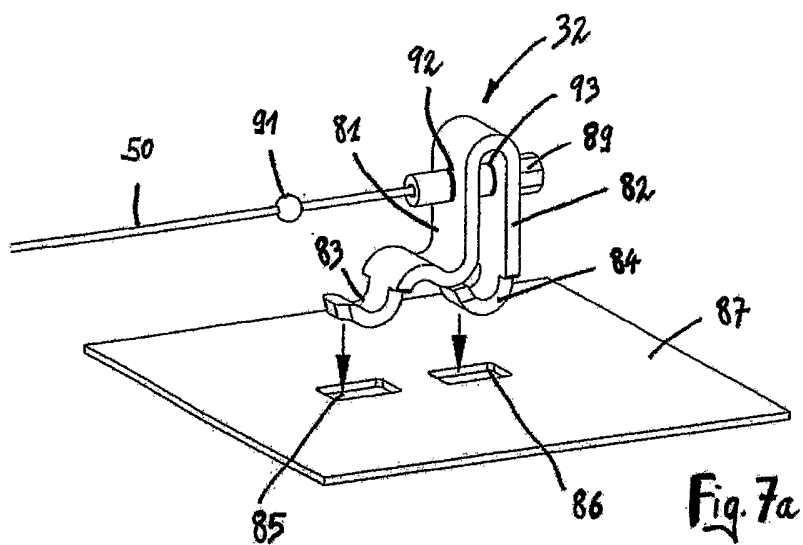


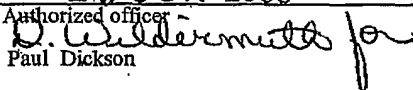
Fig. 6b



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US05/03269

A. CLASSIFICATION OF SUBJECT MATTER IPC(7) : B60R 21/20 US CL : 280/730.2 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) U.S. : 280/730.2, 728.2, 733, 743.2 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)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6,135,490 A (SPARY) 24 October 2000 (24.10.2000), figures 2-3.	1
A	US 2003/0178832 A1 (DOMINISSINI et al) 25 September 2003 (25.09.2003)	1
A	US 5,865,465 A (BAUER et al) 2 February 1999 (02.02.1999).	1
A	US 6,494,486 B2 (PAUSCH et al) 17 December 2002 (17.12.2002).	1
A	US 2004/0140653 A1 (BOSSECKER et al) 22 July 2004 (22.07.2004).	1
☐ 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	"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
"E"	earlier application or patent published on or after the international filing date	"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
"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)	"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
"O"	document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed	
Date of the actual completion of the international search 26 August 2005 (26.08.2005)		Date of mailing of the international search report 19 JUN 2006
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703) 305-3230		Authorized officer  Paul Dickson Telephone No. 571-272-3600

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US05/03269

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.: 6-12
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:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
 2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
 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.:
- Remark on Protest** ☐ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.