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(54) Title: SIDE AIRBAG UNIT, VEHICLE SEAT AND MOTOR VEHICLE

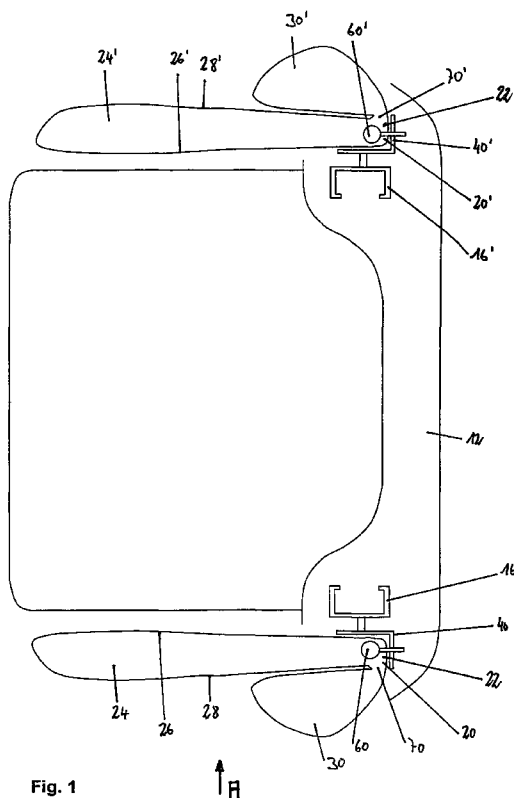


Fig. 1

(57) Abstract: A side airbag unit (20, 20') mounted on the frame (16, 16') of the backrest (12) of a vehicle seat is described. The side airbag unit (20, 20') comprises a mounting part (40), an inflator held on the mounting part and a side airbag (22, 22') with a main chamber (24, 24'), which is in flow connection with the inflator. In order so save weight, the side airbag further comprises a support chamber (30, 30') which from the point of view of the frame (16, 16') is located on the outer side of the main chamber (24, 24') and which is in flow connection with the main chamber (24, 24'). This support chamber (30, 30') gives lateral stiffness to the side airbag and thus the mounting part (40) can be designed in a light-weight manner.



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## Side airbag unit, vehicle seat and motor vehicle

### 5 Description

#### Technical field of the invention

The invention relates to a side airbag unit mounted on the frame of the backrest of  
10 a vehicle seat according to the preamble of Claim 1, a vehicle seat with at least  
one such side airbag unit according to Claim 12 and a motor vehicle with such a  
vehicle seat according to Claim 15.

So-called side airbags are known in the field of vehicle construction and are used  
15 for protection of the vehicle occupants in case of a side impact. In most  
applications, the side airbag inflates between the person to be protected and the  
side structure of the vehicle. Two basic designs are known in this connection:

#### Prior art

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In a first basic design it is possible to locate the side airbag unit which exhibits the  
side airbag and an inflator - mostly a gas generator - in the side structure of the  
motor vehicle. The side airbag has two side walls, whereby when the side airbag  
is inflated, one side wall points towards the occupant and one points towards the  
25 side structure of the motor vehicle, so that the one side wall forms the impact  
surface and the other side wall forms the support surface. The deployment  
direction of the airbag is basically horizontal in the direction of travel.

From DE 10 2005 046 267 A1 a variation of this basic design is known for a  
30 special application for cabriolets or convertibles. Here, the side airbag unit is  
located beneath the top edge of the door railing of the vehicle door and deploys  
mainly vertically upwards when the gas generator is activated. The side airbag

exhibits a main chamber and a support chamber, which is inflated between the main chamber and the side structure and supports itself on the side structure.

The second design is more common. Here, the side airbag unit is located in the backrest of the vehicle seat and is connected with the frame of the backrest by means of an inherently stable mounting part. The airbag which is used here also exhibits two side walls, whereby the one side wall forms the impact surface. If only a small amount of space exists between the side cheek of the backrest and the side structure, and if the side airbag is made sufficiently thick, the second side wall of the side airbag comes into contact with the side structure of the vehicle in an accident situation, and this side structure therefore forms a support surface. If this cannot be ensured, the mounting part often exhibits a section lying on the outside, which supports the side airbag. Such a design, however, means that the mounting part is of not inconsiderable weight, which is naturally disadvantageous.

### Summary of the invention

Starting from this, the invention sets itself the problem to improve the state of the art so that the side airbag unit can be formed with lower weight.

This problem is solved by means of an airbag unit with the characteristics of Claim 1, a vehicle seat with the characteristics of Claim 12 or by a motor vehicle with the characteristics of Claim 15.

According to the invention, the side airbag of the side airbag unit exhibits a main chamber and a support chamber being in flow connection with the main chamber. Within this, the main chamber points towards the vehicle occupants to be protected, while the support chamber serves to support the main chamber. The support chamber does not support itself on a support surface which is carried by the same component as the side airbag unit. The side airbag is thickened locally by the support chamber.

The support chamber gives lateral stiffness to the side airbag, because of a local increase of the airbag's thickness. The main chamber of the airbag, which comprises the impact surface, is supported on the support chamber so that a movement of the main chamber away from the passenger hitting the impact surface is hindered.

In many cases the "self supporting" of the airbag will be sufficient to provide the necessary support for the main chamber. If further support is needed or desired, this additional support can be achieved by the following measures:

In one embodiment the internal structure of the vehicle (in particular the inner side of the A pillar and the side window) can be used, in other words components, which are not directly connected with the side airbag unit. If this is not possible, for example because the internal structure is located too far away from the backrest, or because the side airbag unit is on the side of the seat which faces towards the centre of the vehicle, according to an embodiment of Claims 9 or 10 a strap can be provided which encompasses the front section of the main chamber and which is connected with both the support chamber and the frame and therefore contributes to the stabilisation of the arrangement.

None of the aforementioned measures makes a considerable contribution to the weight of the side airbag, so that the objective of weight reduction is achieved.

Preferred embodiments result from the further subclaims and from the embodiments which are now described in more detail with reference to the drawings. The drawings show:

#### Brief description of the drawings

- Figure 1 A horizontal section through the backrest of a vehicle seat with two side airbags according to the invention each in completely deployed state,
- Figure 2 A side view of the items shown in Figure 1 from Direction A,

Figure 3 The driver's seat from Figure 1 in installed state and a part of the passenger seat,

Figure 4 An alternative form of the invention in a sectional view corresponding to Figure 1,

5 Figure 5 A fabric layer of a side airbag and

Figure 6 A representation of the state of the art in a sectional view corresponding to Figure 1.

#### Detailed description of preferred embodiments

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First, the state of the art will be described again in relation to Figure 6. Figure 6 shows a horizontal section through the backrest of a vehicle seat 10, on whose frame 16 a side airbag unit 20 is mounted. Side airbag unit 20 exhibits a side airbag 22, a gas generator 60 serving as inflator and a housing-type mounting part 40, which is connected with the frame 16 located in the side cheek 14 of the backrest 12. The housing-type mounting part 40 has a U-shaped cross-section with three legs 42, 44, 46.

It can be seen from Figure 6, that when the vehicle occupant sitting on the seat strikes the impact surface of the first side wall 26 of the side airbag 22 in the direction of the arrow, the second side wall 28 lying opposite to the first side wall 26 transfers force to the third leg 46 of the retaining element and is thereby supported. The force transfer is carried out through the second leg 44, the first leg 42 and the retaining bolt 50 into the frame 16. In order to be able to achieve this force transfer, the housing-type mounting part 40 must be formed accordingly stable of metal, which leads to a high weight.

Figure 1 shows a first embodiment of the invention in a view corresponding to Figure 6. Figure 2 shows a bird's eye view of the items shown in Figure 1 from Direction A. In the backrest 12 of the vehicle seat 10 (which here is the driver's seat), two side airbag units 20, 20' are located, each with a mounting part 40, 40' and each fastened to the frame 16, 16' of backrest 12. The mounting parts are L-shaped and each do not offer a support section for its side airbag 22, 22' on the

outside. Both side airbags 22, 22' of the side airbag units 20, 20' are shown in fully expanded state. It can be seen that side airbags 22, 22' each exhibit a main chamber 24, 24' and a support chamber 30, 30'. The support chambers 30, 30' each extend from a rear section of their respective airbag 22, 22'. In the preferred  
5 embodiment shown, the support chambers 30, 30' extend from the rear end of their respective airbag 20, 20'. Both support chambers extend towards the front of the vehicle. Within this arrangement, the main chambers 24, 24', which are designed with greater length and greater volume than the support chambers 30, 30' point inwards, so that their first side walls 26, 26' exhibit the impact surfaces.  
10 The gas generator 60, 60' - or at least the parts of the gas generators in which the outflow openings are located - are each located in the main chamber 24, 24'. Main chamber 24, 24' and support chamber 30, 30' are each connected with one another by means of at least one overflow opening 70, 70' next to the gas generator 60, 60' near the rear end of the mounted airbag 22, 22'.

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Figure 3 shows an installed situation of the vehicle seat just described, which serves as the driver's seat. In the first embodiment which is shown, the distance between the frame 16 and the internal structure I of the vehicle (in the concrete example in particular the A pillar and the side window) are selected in such a way  
20 that at the latest when the vehicle occupant impacts against the impact surface of the first side wall 26 and upon the transfer of force from the main chamber 24 to the support chamber 30 which follows this, the support chamber 30 comes to lie against internal structure I of the vehicle, so that the transferred forces are led off and therefore a support function is provided.

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As can be seen from figures 1 and 3, the driver's seat in the embodiment shown is not only equipped with a side airbag unit 20 being located between the driver and the side structure (door) of the vehicle, but also with a further side airbag unit 20' being located between the driver and the interior of the vehicle. Here, the support  
30 chamber itself is not supported on its outer side. The stiffening of the airbag is solely achieved by the local thickening of the airbag in a rear area by means of the support chamber 30' of the further airbag unit 20'.

Figure 4 shows a second embodiment of the invention which can in particular be used if, because of the geometry of the interior of the vehicle, a support on the side structure or on a further side airbag is not possible and the increased lateral stiffness of the airbag provided by the support chamber alone is not regarded as being sufficient. The basic geometry is the same as in the first embodiment with the support chamber 30 extending from a rear area (from the rear end) of the airbag. A strap 36 is provided whose one end is connected at a first fixing point 36a with the skin of the support chamber 30 and whose second end is connected with the frame 16 at a second fixing point 36b. The preferred second fixing point 36b with the frame lies in the rear area of frame 16, so that the frame 16 is basically encompassed by the strap and the transverse distance Q between the connection point of side airbag and mounting part (in the embodiment shown, these are gas generator bolts 62) and the bearing point 36c of the strap 36 on the frame 16 is as large as possible, in order to achieve maximum stability. If, in the case of a side impact, force is exerted on the main chamber 24 by the vehicle occupant in the direction of the arrow, and transferred from the main chamber to the support chamber 30, the strap tensions and transfers force from the support chamber 30 directly to the frame 16, so that sufficient support can be provided even without a support surface.

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Figure 5 shows a spread-out first fabric layer 80 of the side airbag 22. The entire airbag 22 can be sewn together of two fabric layers which are congruent, or the airbag 22 is formed in one piece, whereby two fabric layers, which are also congruent, are woven together via non-inflatable areas 82. In the case of a sewn airbag, the two fabric layers in non-inflatable areas 82 are at least sewn together in some sections. The connected, non-inflatable areas 82 are shown shaded. It can be seen that the overflow openings 70 are formed as tubular areas in a - outside the overflow openings - non-inflatable area 82. Penetration openings 84 are provided in a fabric layer for gas generator bolts 62, so that the gas generator bolts also serve for fastening of the side airbag 22. Because of the design that has been selected, the manufacture of the airbag is very simple and does not require the expenditure of much more time or effort than a corresponding one-chamber airbag.

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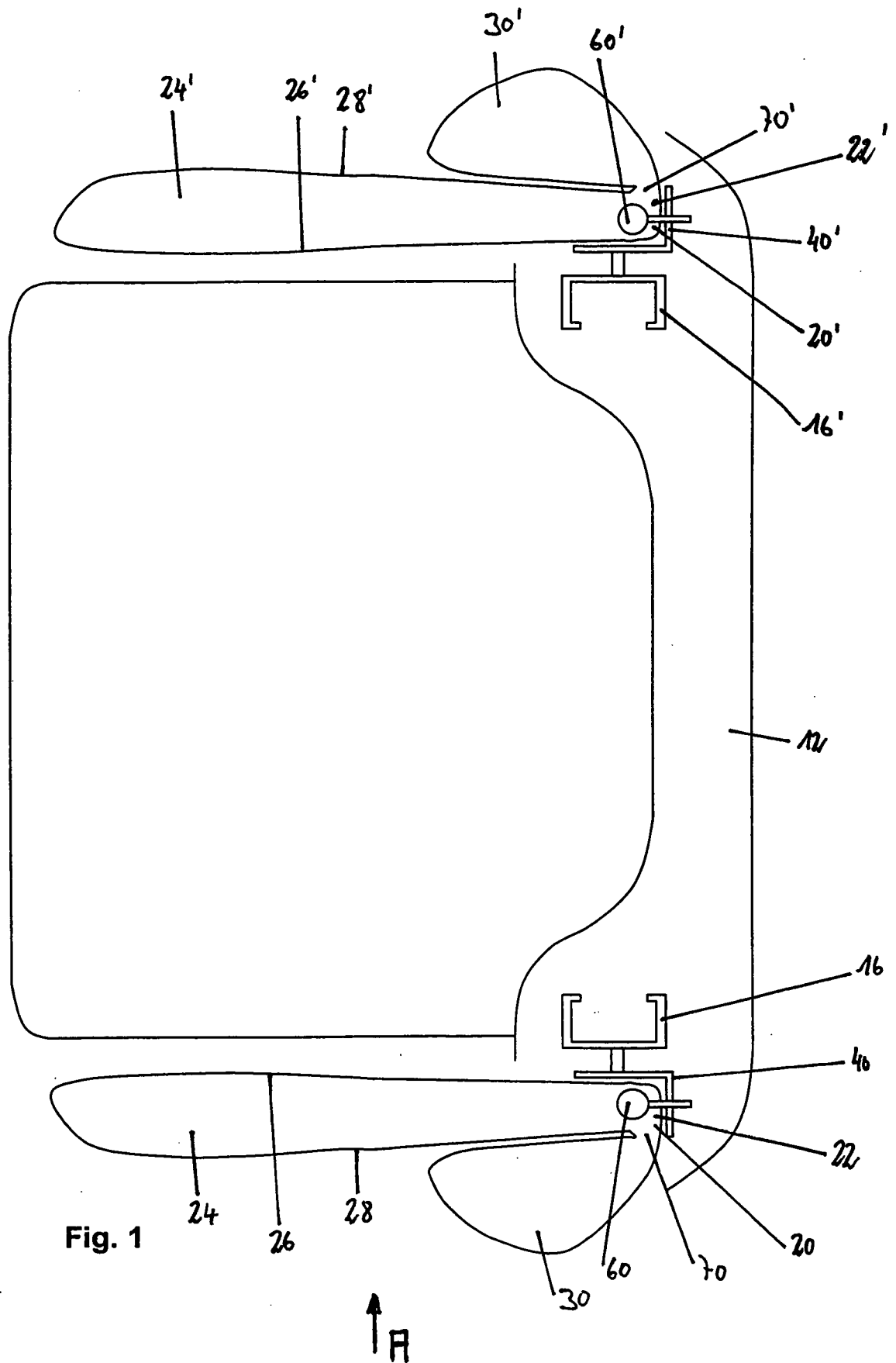
## List of reference numbers

|    |         |                                  |
|----|---------|----------------------------------|
|    | 10      | Vehicle seat                     |
|    | 12      | Backrest                         |
| 5  | 14, 14' | Side cheek                       |
|    | 16, 16' | Frame                            |
|    | 20, 20' | Side airbag unit                 |
|    | 22, 22' | Side airbag                      |
|    | 24, 24' | Main chamber                     |
| 10 | 26, 26' | First side wall (impact surface) |
|    | 28, 28' | Second side wall                 |
|    | 30, 30' | Support chamber                  |
|    | 36      | Strap                            |
|    | 36a     | First fixing point               |
| 15 | 36b     | Second fixing point              |
|    | 36c     | Bearing point                    |
|    | 40      | Mounting part                    |
|    | 42      | First leg                        |
|    | 44      | Second leg                       |
| 20 | 46      | Third leg                        |
|    | 60      | Gas generator                    |
|    | 62      | Gas generator bolt               |
|    | 70      | Overflow opening                 |
|    | 80      | Fabric layer                     |
| 25 | 82      | Non-inflatable area              |
|    | 84      | Penetration opening              |
|    | I       | Internal structure               |
|    | Q       | Transverse distance              |

Patent claims

1. A side airbag unit (20,20') mounted on the frame (16,16') of the backrest (12) of a vehicle seat with a mounting part (40), an inflator held on the mounting part and a side airbag (22,22') with a main chamber (24,24'),  
5 which is in flow connection with the inflator,  
characterised in that the side airbag further exhibits a support chamber (30,30') which from the point of view of the frame (16,16') is located on the outer side of main chamber (24,24') and which is in flow connection with  
10 the main chamber (24,24').
2. Side airbag unit according to Claim 1, characterised in that mounting part (40) is open on the outer side.
- 15 3. Side airbag unit according to claim 2, characterised in that the mounting part has a L-shaped cross section.
4. Side airbag unit according to one of the previous claims, characterised in that the support chamber (30,30') exhibits a smaller volume than the main  
20 chamber (24,24').
5. Side airbag unit according to Claim 4, characterised in that the support chamber (30,30') exhibits a maximum of 50% of the volume of main the chamber (24,24').  
25
6. Side airbag unit according to one of Claims 4 or 5, characterised in that the length of support chamber (30,30') amounts to a maximum of 40% of the length of the main chamber (24,24').
- 30 7. Side airbag unit according to one of the previous claims, characterised in that the inflator fills the main chamber (24,24') directly.

8. Side airbag unit according to Claim 7, characterised in that the inflator is located inside the main chamber (24,24').
- 5 9. Side airbag unit according to one of Claims 7 or 8, characterised in that at least one overflow opening (70,70') is provided between main chamber (24,24') and support chamber (30,30').
- 10 10. Side airbag unit according to one of the previous claims, characterised in that a strap (36) is provided with a first and a second end, whose first end is connected with a front or side section of support chamber (30,30'), which encompasses a front section of the main chamber (24,24'), and whose second end it at least indirectly connected with the frame (16,16').
- 15 11. Side airbag unit according to Claim 10, characterised in that the second end of the strap (36) is connected directly to the frame (16,16').
12. Vehicle seat with at least one side airbag unit according to one of the Claims 1 to 10.
- 20 13. Vehicle seat according to Claim 12, characterised in that a side airbag unit (20') is located on the side of the vehicle seat directed to the center of the vehicle.
- 25 14. Vehicle seat according to Claim 12 or Claim 13, characterised in that a side airbag unit (20) is located on the side of the vehicle seat directed to the outside of the vehicle.
15. Motor vehicle with a vehicle seat according to one of Claims 12 to 14.



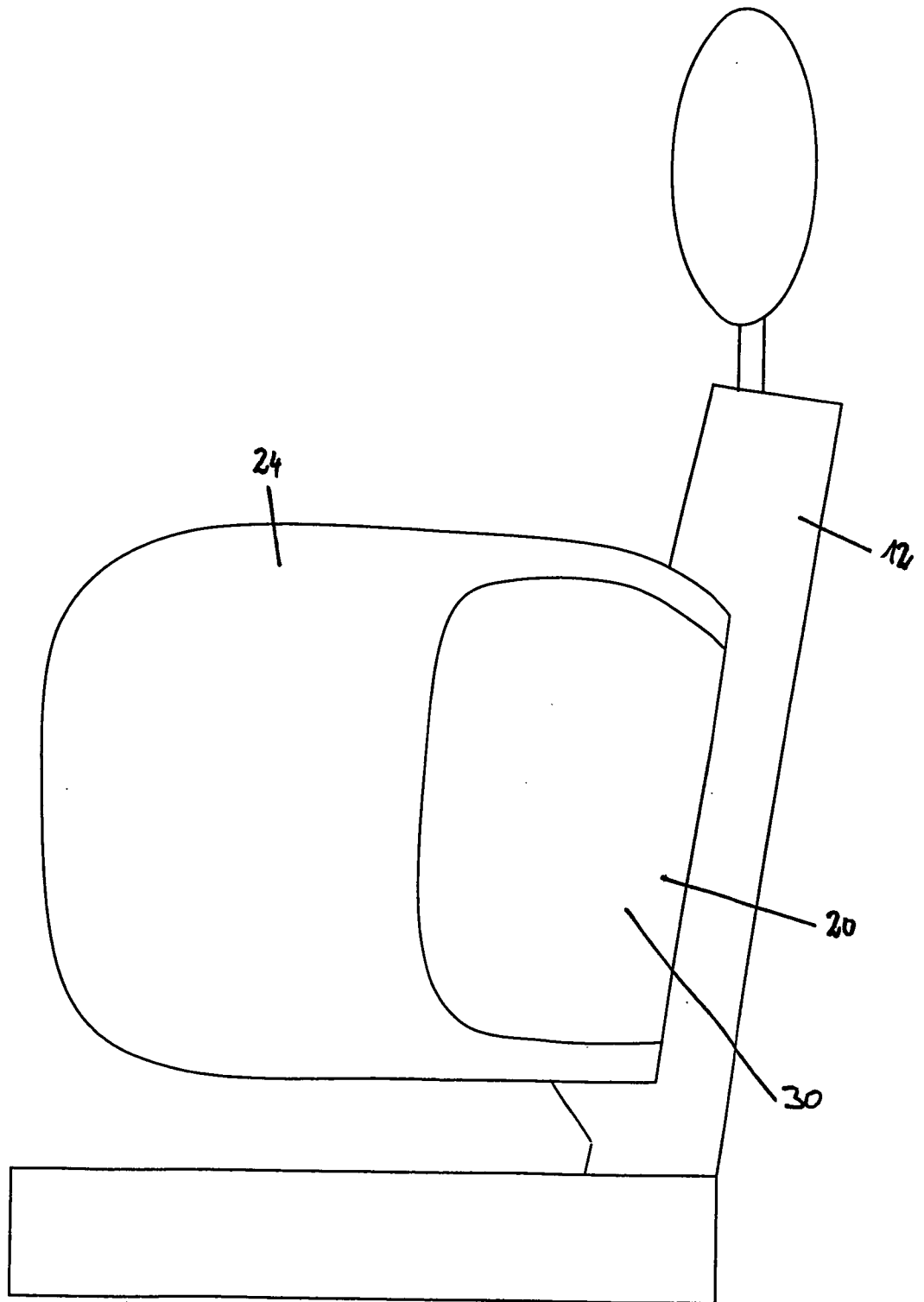


Fig. 2

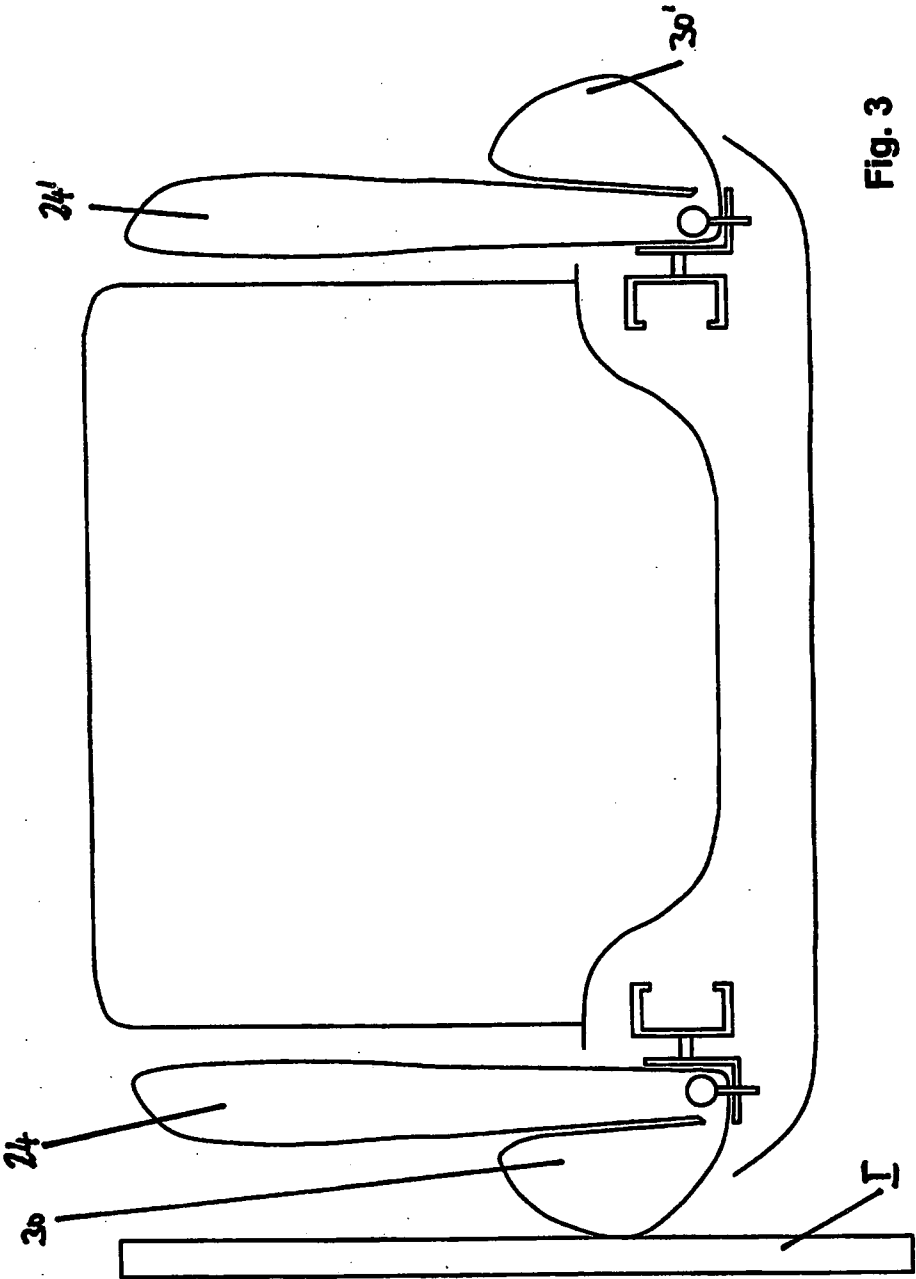
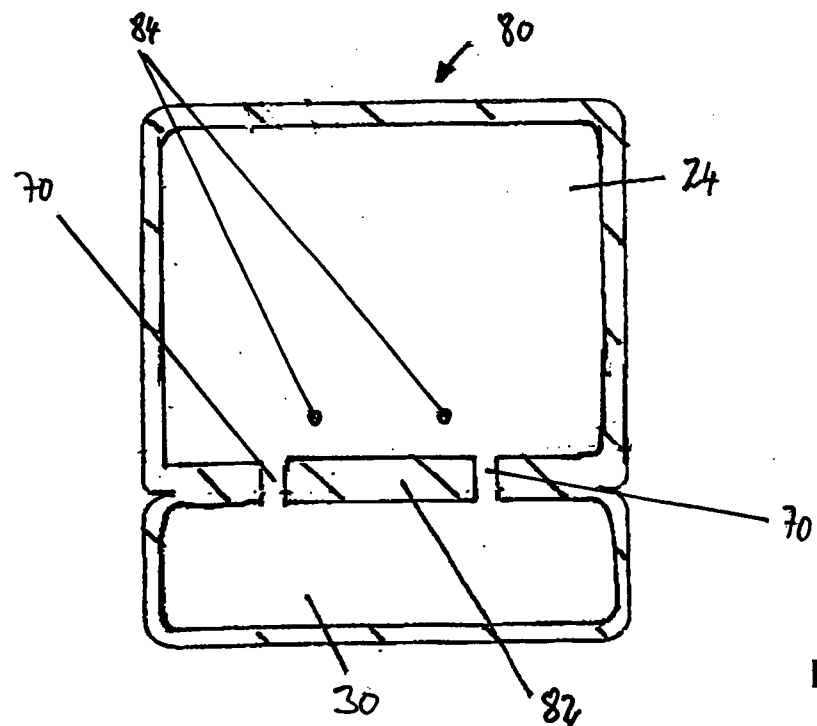
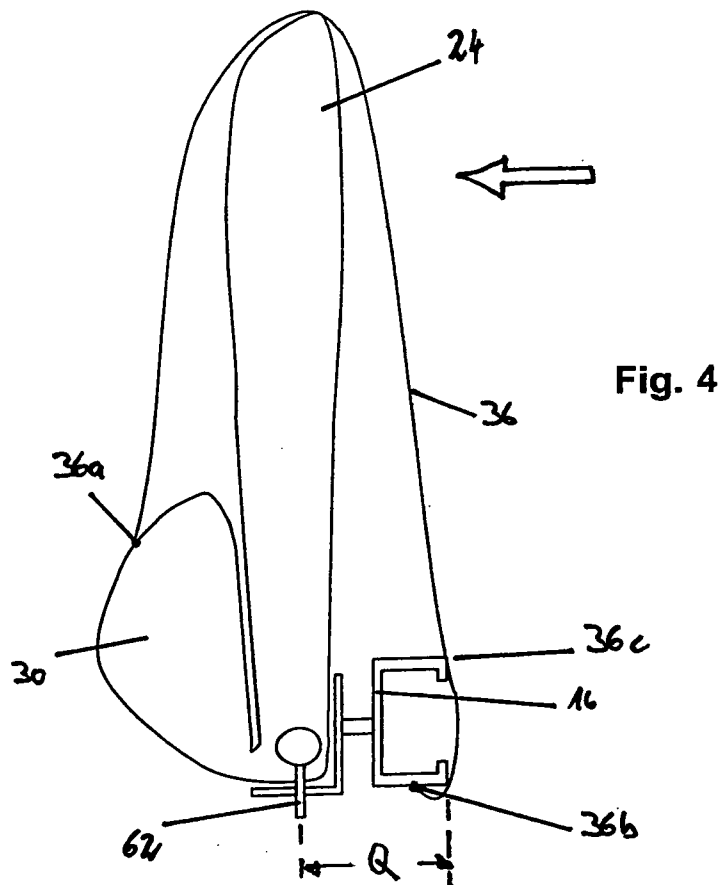


Fig. 3



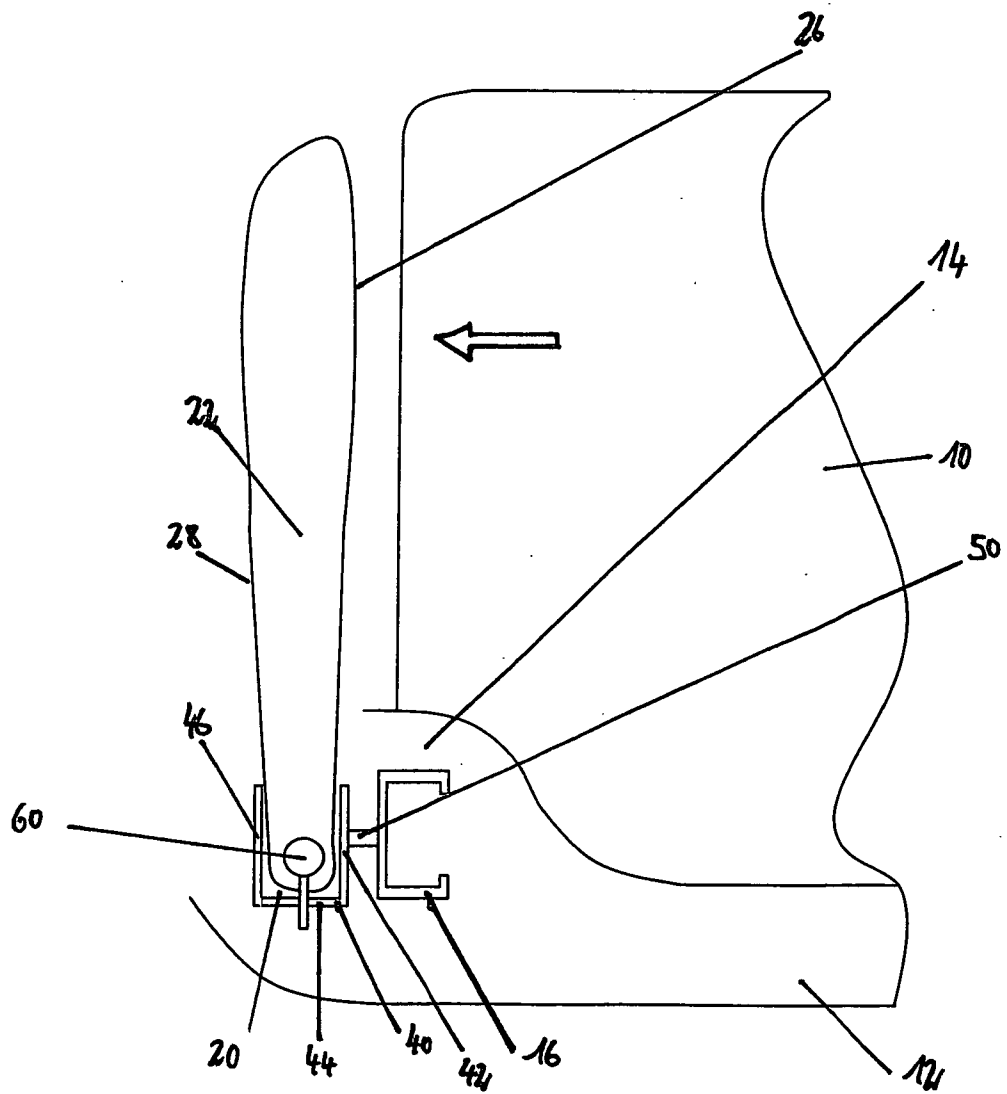


Fig. 6 (prior art)

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2010/002416

## A. CLASSIFICATION OF SUBJECT MATTER

INV. B60R21/233 B60R21/21 B60R21/207  
ADD.

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)

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| A         | * abstract; figure 2                                                                                                      | 1                     |
|           | -----<br>-/--                                                                                                             |                       |

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

\* Special categories of cited documents :

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02/09/2010

Name and mailing address of the ISA/

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## C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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