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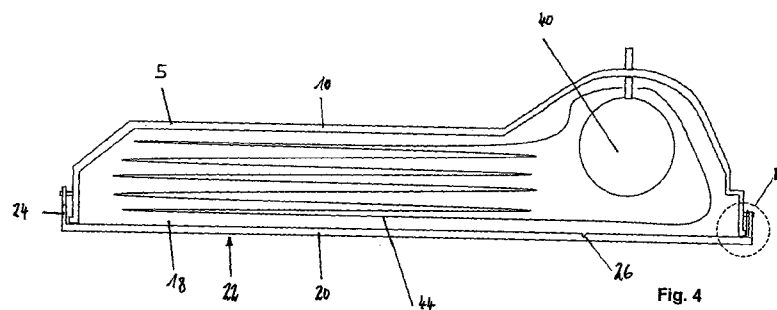
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(54) Title: AIRBAG MODULE AND METHOD FOR PRODUCING AN AIRBAG MODULE



(57) Abstract: An airbag module with a gas generator (40), a housing (5) and an airbag (44) accommodated in said housing (5) is described, wherein the housing (5) comprises at least two housing parts (10, 20), which are connected to one another via a connection hinge and at least one first connection unit, and wherein an opening hinge is present around which a first partial area of the housing swings open towards the remaining second partial area on deployment of the airbag (44), for which purpose set opening means are also provided. In order to rationalise the production process of the airbag module overall, in the area of the connection hinge at least one second connection unit is present by means of which the two housing parts (10, 20) stay connected even during the deployment, so that the connection hinge is free of forces in the mounted state and in the triggered state and that the opening hinge is allocated to precisely one of the two housing parts.

Airbag module and method for producing an airbag module

Description

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Technical field of the invention

The invention relates to an airbag module according to the preamble of Claim 1 and to a method for producing an airbag module according to Claim 15.

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A plurality of airbag modules are installed in virtually every modern motor vehicle. A distinction is generally drawn between front airbag modules, side airbag modules and curtain airbag modules. The front airbag modules are in turn divided into the following categories: driver airbag modules, which are generally installed in the steering wheel of the motor vehicle, passenger airbag modules, which are situated behind the instrument panel, and knee airbag modules, which are situated either behind the instrument panel or in a region adjacent to the instrument panel in the footwell, as is proposed in DE 10 2006 020 577.2. Side airbag modules are arranged either in the seat backrest or behind the side trim.

Both front and side airbag modules generally have a housing, an airbag folded into the housing and a gas generator.

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Prior art

Generic DE 19 607 342 A1 describes an airbag module which is provided for installation in the seat backrest of a motor vehicle; it is therefore a side airbag module. The housing of this airbag module has two housing parts, namely two half shells, which are connected in a rear region by means of a hinge and are snapped to each other in a front region. The two housing parts are produced as separate parts, generally as separate injection-moulded parts, and are connected to each other during assembly first by means of the hinge and then, after pivoting the housing about the axis of the hinge, by means of snap connections in the front part. The connection to the vehicle - that is in the concrete case with the frame of

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the seat backrest - takes place by means of a plate which is connected to the gas generator and extends through the hinge region. If the gas generator situated inside the housing is fired and the airbag expands, the housing opens in the front region in that the snapping lugs of one housing part break and the housing swings
5 open along the hinge.

Summary of the invention

Proceeding from this, the object of the present invention is to improve a generic
10 airbag module such that its overall production process is rationalised and thus made more cost-effective.

This object is achieved by an airbag module with the features of Claim 1. A method for producing such an airbag module is specified in Claim 15.

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According to the invention, two hinges are provided, namely a connection hinge and an opening hinge, which are configured as separate functional elements. Furthermore, connection units are provided which ensure that the connection hinge stays closed even when the airbag expands. Because of this it is necessary
20 to allocate the opening hinge to one of the two housing parts, as a result of which an "asymmetrification" arises compared to the prior art. As in the prior art, the closing of the housing takes place by pivoting by the housing parts together about the connection hinge. In contrast to the prior art, this connection hinge is however functionless after the assembly is finished.

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The fact that the function of the hinge is distributed to two functional units, namely to a connection hinge and an opening hinge which is different from the connection hinge, creates the possibility of treating the airbag module as one component during the entire production process; in particular the preferred possibility
30 according to Claim 2 of producing the housing as a one-pieced part made of plastic is provided.

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The fact that the housing of the airbag module appears as only one component during the entire production process has numerous advantages: Firstly, the possibility of two housing parts which do not fit together being assembled on each other by mistake is excluded. Another advantage lies in the sales/administrative
5 field. As the housing always appears as one component, only one number has to be assigned to it in a PPS system, which results in production control and parts management being made easier, which in turn contributes towards lowering costs.

A further advantage of the airbag module according to the invention is that the
10 underlying design principle can be applied both to side airbags and to front airbags, namely to passenger airbags and knee airbags.

Finally, it is also advantageous that the final assembly of the airbag module, in particular the assembly of one housing part on the other housing part, is very
15 simple.

The airbag module according to the invention is in particular suitable as a knee airbag module, in particular as a knee airbag module which can be used in a design as proposed in DE 10 2006 020 577.2.
20

Advantageous configurations of the invention can be found in the subclaims as well as in the exemplary embodiment which is now described in more detail with reference to the figures.

25 Brief description of the drawings

- Figure 1 shows a side view of an airbag module,
- Figure 2 shows a plan view of that shown in Figure 1 from direction A,
- Figure 3 shows a plan view of that shown in Figure 2 from direction C,
- 30 Figure 4 shows a section along plane B-B of Figure 2,
- Figure 5 shows the detail D from Figure 4,
- Figure 6 shows what is shown in Figure 4 with the airbag expanded,

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- Figure 7 shows the airbag module from Figure 1 in an illustration corresponding to Figure 1, wherein the airbag module is in the assembled state as a knee airbag module in a motor vehicle,
- Figure 8 shows the airbag module from Figure 1 in a not yet completely assembled state,
- Figure 9 shows a sectional illustration of a part-region of a tool which is suitable for producing an airbag housing, in a state before production of the first housing part, and
- Figure 10 shows what is shown in Figure 9 after movable tool parts have been opened so that the integral hinge can be moulded on the first housing part.

Detailed description of preferred embodiments

- First the structure of the airbag module according to the invention is described with reference to Figures 1 to 5. Figure 1 is a side plan view, Figure 2 is the view from direction A in Figure 1, Figure 3 is a plan view from direction C in Figure 2, Figure 4 is a section along plane B-B from Figure 2 and Figure 5 is the detail D from Figure 4. The airbag module consists essentially of the following components: a housing 5, a gas generator 40 arranged in the housing 5 and an airbag 44 folded into the housing 5, wherein the gas generator 40 is situated in conventional manner inside the airbag 44. The gas generator extends laterally slightly out of the housing and is furthermore connected to the latter by means of retaining bolts 42.

- The housing 5 consists of two parts, namely of the first housing part 10 and the second housing part 20. The first housing part 10 is formed with a much greater height than the second housing part 20 and is used to accommodate the gas generator 40 and the airbag 44. It has an extensive opening 18. Mounting flanges 16 with bores 16a are provided laterally on the first housing part 10. The second housing part 20 is used essentially as a covering element, wherefore it has a covering face 22 which is essentially flat in the exemplary embodiment shown. A peripheral edge 24, which has four sides and from which snapping tabs 27

- 5 -

extend, extends from this covering face 22. Snapping tabs 27 extend from each of the four sides of the peripheral edge 24. To each snapping tab 27 of the second housing part 20 a snapping lug 17 of the first housing part 10 is allocated, on which the corresponding snapping tab is snapped. Each snapping tab and
5 snapping lug form a connection unit. In addition to the snapping tabs 27, projections 32 extend from the rear side 24a of the peripheral edge 24 (see in particular Figures 2 and 3). Between each of these projections 32 and the edge region of the opening 18 of the first housing part 10, an integral hinge 30 extends, which in the assembled state shown in Figures 1 to 5 is situated between the two
10 housing parts 10, 20 so that it is virtually invisible and inaccessible from the outside. These integral hinges form the connection hinge. As one can see, the connection hinge formed by the integral hinges 30 and the snapping tabs 27 extending from the rear side 24a of the peripheral edge 24 and their respective snapping lugs 17 - these snapping tabs and snapping lugs are referred to as
15 second connection units - are very close and run parallel to each other. One could say that the connection hinge and the connection formed by the second connection units overlap each other. One can also see that the second connection units bypass the connection hinge in the mounted state.

20 Through slots 25 which form a predefined breaking line are provided in the peripheral edge 24 of the second housing part 20 except at the rear side 24a. A weakening line 26 extends approximately from the end points of this predefined breaking line over the covering face 22 of the second housing part 20. This weakening line forms the opening hinge. Alternatively, it is for example also
25 possible to create the opening hinge by injection-moulding of a separate plastic component. One can see that opening hinge formed by the weakening line 26 is quite near to the connection hinge and runs parallel to it.

Figure 6 shows what is shown in Figure 3 but after the gas generator 40 has fired
30 and the expanding airbag 44 has opened the housing 5. During this opening the predefined breaking line formed by the through slots 25 breaks, and the front section of the covering face 22 swings open about the opening hinge formed by the weakening line 26. All the snapping tabs 27 remain connected with the

associated snapping lugs 17, in particular also the snapping tabs 27 of the rear part 24a of the peripheral edge 24. The integral hinges 30 also remain intact. The opening of the housing 5 therefore only affects the second housing part 20 to which the opening hinge is also exclusively allocated.

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Figure 7 shows the just described airbag module in the installed state, namely adjacent to the instrument panel 50 of a motor vehicle so that the airbag module is a knee airbag module. Fastening to the motor vehicle takes place via the mounting flange 16, through the bores 16a of which screw-fastenings or other
10 suitable connecting elements extend, which form the connection to the motor vehicle. In the embodiment shown, the mounting flange is screwed to a support 52 of the motor vehicle. Additional fastening elements, in particular snapping elements, can be provided, which connect the housing 5 to the adjacent instrument panel and the adjacent footwell cover 54. It can be seen that the
15 covering face 22 extends essentially horizontally and forms a part of the cover of the footwell.

The function of the integral hinges 30, which form the connection hinge, is explained with reference to Figure 8. Figure 8 shows the state in which the
20 housing 5 is present on the workstation on which the gas generator 40 is assembled and the airbag 44 is folded into the first housing part 10. Although the first housing part 10 is completely accessible for the said working steps, the second housing part 20 is held permanently and undetachably on the first housing part 10 by the connection hinge so that it cannot be lost or mixed up. After the gas
25 generator 40 and the airbag 44 have been assembled, the second housing part 20 is swung about the connection hinge (integral hinge 30) along the arrow direction shown and then the snapping tabs 27 are snapped on the snapping lugs 17, with which the assembly of the airbag module is completed. This final working step – swinging the second housing part 20 about the connection hinge and
30 snapping in the snapping tabs – is very simple and can be carried out very efficiently. In contrast to previous generic airbag modules, the housing is not closed by merely pivoting the housing parts together about the hinge, but by a two-stage movement, which comprises first an essentially rotary pivoting

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movement and then a translatory movement (see arrow), which allows a linear and simultaneous snapping of all the connection units. The additional degree of freedom necessary for this two-stage movement is made available by the special properties and lengths of the integral hinges.

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The further advantages, which essentially lie in the field of materials management, have already been described. As the connection hinge becomes functionless after assembly is complete, it could in principle also be removed, that is, cut off, which is however unnecessary at least in the solution shown, in which the integral
10 hinges 30 are situated completely inside the housing 5, and would only create additional work. This would however change nothing with regard to the advantages of the described production method of the airbag module.

Figures 9 and 10 respectively show a part of an injection moulding tool in which a
15 housing as described above can be produced. In the embodiment shown in Figure 8, the first housing part is produced first and then the integral hinge, which merges into the second housing part, is injection-moulded onto the first housing part. For this purpose, a form closure region 11 is provided in the transition region between the first housing part 10 and the integral hinge 30.

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In order to produce the housing, a tool is used with two tool halves 60, 62 between which a first cavity 66 for the first housing part and a second cavity 64 for the second housing part are situated. Also included in the second cavity 64 are the sections 64' for the integral hinges 30. A pair of movable tool elements 68,
25 which close the first cavity 66 in a first process step, are provided in the transition region between the first cavity 66 and each section 64'.

In a first step, the first housing part 10 is cast. For this purpose the first cavity 66 located between the two tool halves is used. After the first housing part is cast and
30 sufficiently cooled, the movable tool elements 68 are moved into the open position shown in Figure 10, so that in each case an additional cavity 65 is created, which is connected to the second cavity 64, namely the section 64' for the integral hinge. The main section of the second cavity 64 for the second housing part connects to

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each section 64'. The additional cavity 65 encloses a part of the first housing part 10 cast in the first cavity 66 so that a form closure region 11 is created between the integral hinge and the first housing part. After the second housing part 20 and the integral hinges 30 have been cast, an undetachable (except by destruction)
5 mechanical connection is created between each integral hinge and the first housing part 10. Each integral hinge 30 is connected directly to the second housing part 20, as the cavities for the integral hinges merge into the cavity for the second housing part. Possible gate points are indicated at points A and B. It would furthermore be possible to inject the integral hinges 30 separately, where to
10 each section 64' would need its own gate point. The connection of each integral hinge to the second housing part would then take place as to the first housing part by means of a form closure region.

It can be achieved in the manner shown in particular that the two housing parts
15 consist of different materials, in particular different plastics, which is often to be preferred as the material requirements and surface requirements of the two housing parts are different. The first housing part must in particular be able to take relatively great forces when the airbag expands. This property is not important for the second housing part 20; with the second housing part 20 it should be noted
20 that the covering face 22 is visible in some applications so that a plastic with correspondingly appealing visual and functional properties is to be preferred.

If the housing is to be produced from two different plastics as just described, two production possibilities are in particular given. Firstly, the housing can be
25 produced as just described in a two-component method. It is furthermore possible to produce one of the two housing parts first, which is then placed into an injection mould in which the second housing part is then moulded on via the integral hinge.

It should also be mentioned that the production of the housing from two different
30 plastics is preferred but not compulsory. It is in principle also possible to produce the housing 5 from one plastic so that the housing can be produced in a single injection moulding process. It should furthermore be mentioned that the two

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housing parts can in each case consist of more than one plastic, for example because an emblem or the like is moulded on.

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List of reference symbols

	5	Housing
	10	First housing part
5	11	Form closure region
	12	Front section
	14	Rear section
	15	End face
	16	Mounting flange
10	16a	Bore
	17	Snapping lug
	18	Opening
	20	Second housing part
	22	Covering face
15	24	Peripheral edge
	25	Through slots
	26	Weakening line
	27	Snapping tab
	30	Integral hinge
20	32	Projection
	40	Gas generator
	42	Retaining bolt
	44	Airbag
	50	Instrument panel
25	52	Support
	54	Footwell cover
	60,62	Tool halves
	64,66	Cavity
	64'	Section
30	65	Additional cavity
	68	Movable tool element
	A,B	Gate point

Claims

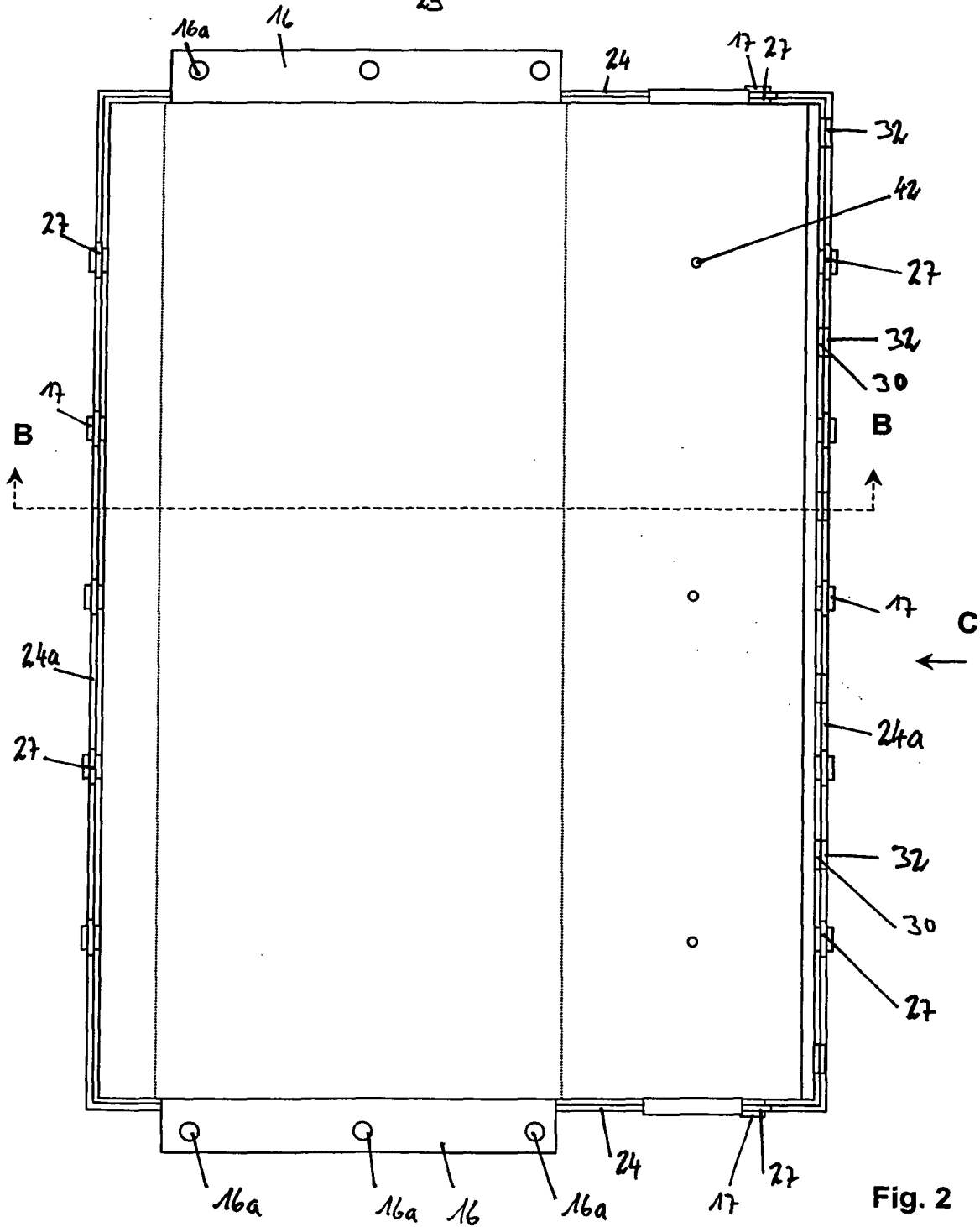
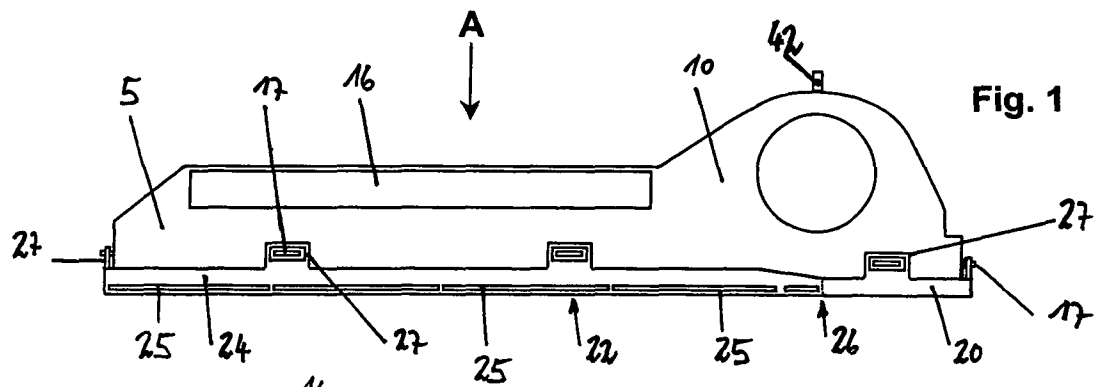
1. Airbag module with a gas generator (40), a housing (5) and an airbag (44) accommodated in said housing (5), wherein the housing (5) comprises at least two housing parts (10,20), which are connected to one another via a connection hinge and at least one first connection unit, and wherein an opening hinge is present around which a first partial area of the housing swings open against the remaining second partial area on deployment of the airbag (44), wherefore set opening means are arranged,
characterised in that in the area of the connection hinge at least one second connection unit is present by means of which the two housing parts (10,20) stay connected during the deployment, so that the connection hinge is free of forces in the mounted state and in the triggered state, and in that the opening hinge is allocated to precisely one housing part.
2. Airbag module according claim 1, characterised in that the housing (5) is a one-pieced part made of plastic.
3. Airbag module according claim 2, characterised in that the plastic part is made by means of injection moulding.
4. Airbag module according to one of the claims 2 or 3, characterised in that the two housing parts (10, 20) are made of the same plastic.
5. Airbag module according to one of the claims 2 or 3, characterised in that the two housing parts (10, 20) are made of different plastics.
6. Airbag module according to one of the preceding claims, characterised in that the connection hinge is comprised of at least one integral hinge (30).
7. Airbag module according to claim 6, characterised in that the integral hinge (30) is located between the two housing parts.

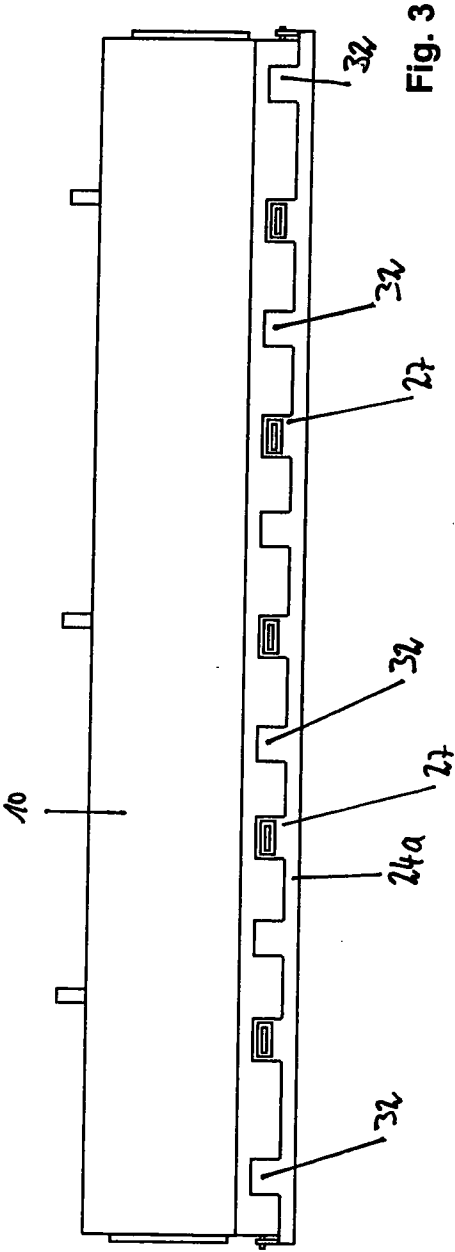
- 12 -

8. Airbag module according to one of the preceding claims, characterised in that the set opening means are through holes ((through slots 25).
9. Airbag module according to one of the preceding claims, characterised in that the opening hinge is a weakening line (26).
10. Airbag module according to one of the preceding claims, characterised in that at least one first connection unit is a snap connection.
- 10 11. Airbag module according to one of the preceding claims, characterised in that at least one second connection unit is a snap connection.
12. Airbag module according to one of the preceding claims, characterised in that the housing part which does not carry the opening hinge carries at least two mounting flanges (16).
- 15 13. Airbag module according to one of the preceding claims, characterised in that it is a knee airbag module.
- 20 14. Airbag module according to claim 13, characterised in that it extends basically horizontally in the mounted state.
15. Process for manufacturing an airbag module with a gas generator (40), a housing (5) and an airbag (44) accommodated in said housing (5), wherein the housing (5) comprises at least two housing parts (10,20), which are connected to one another via a connection hinge and at least two connection units, and wherein an opening hinge is present around which a first partial area of the housing swings open against the remaining second partial area on deployment of the airbag (44), wherefore set opening means are arranged, with the following steps:
 - manufacturing of the housing (5) as a one-pieced component, wherein the two housing parts (10,20) are connected to one another via the connection hinge,
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- folding the airbag into one of the two housing parts,
 - pivoting the second housing part around the connection hinge onto the first housing part,
 - closing of the two connection units, whereby the connection hinge becomes
- 5 functionless.





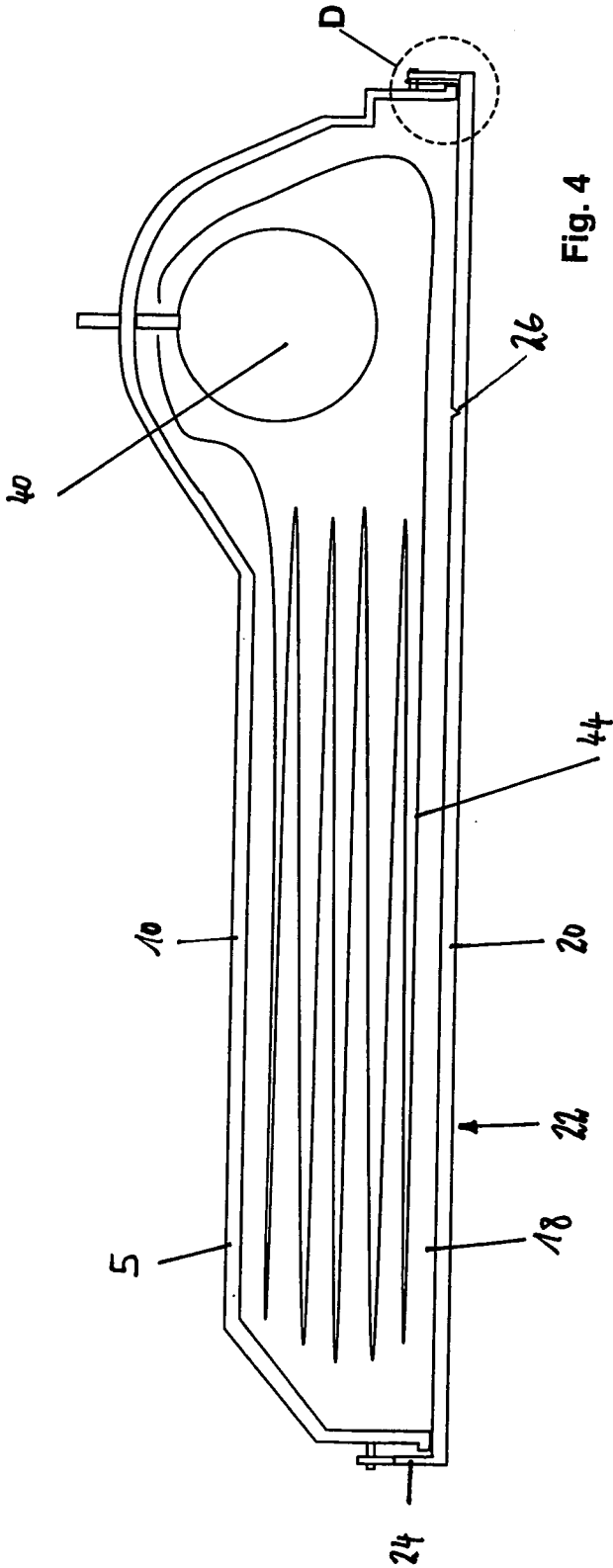


Fig. 4

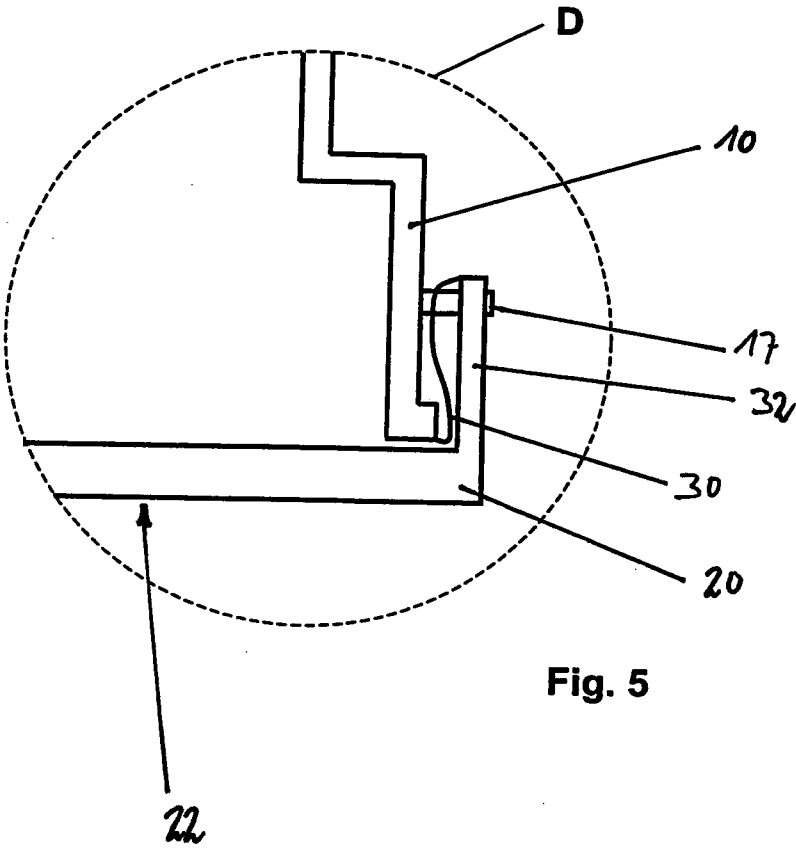


Fig. 5

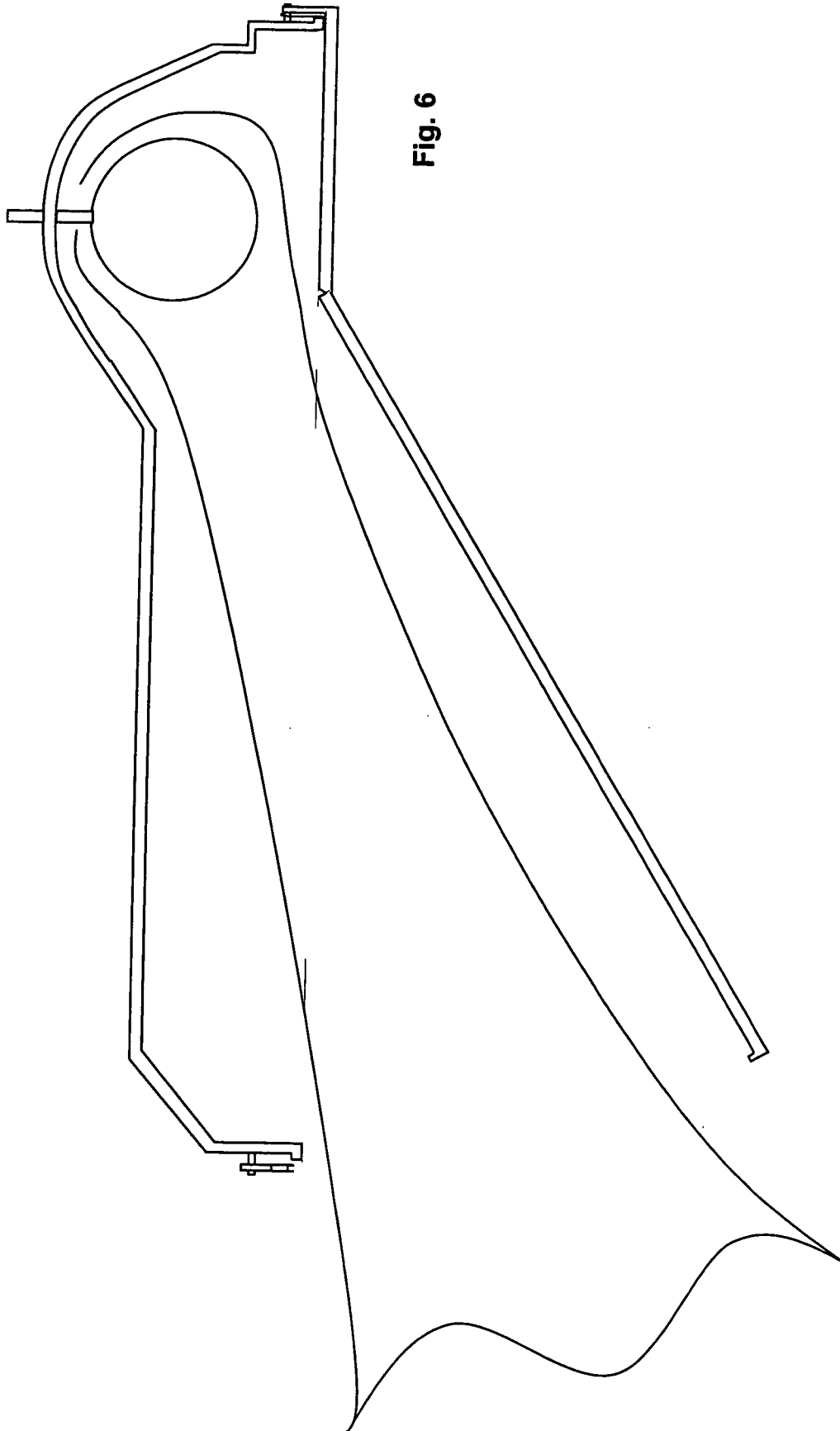
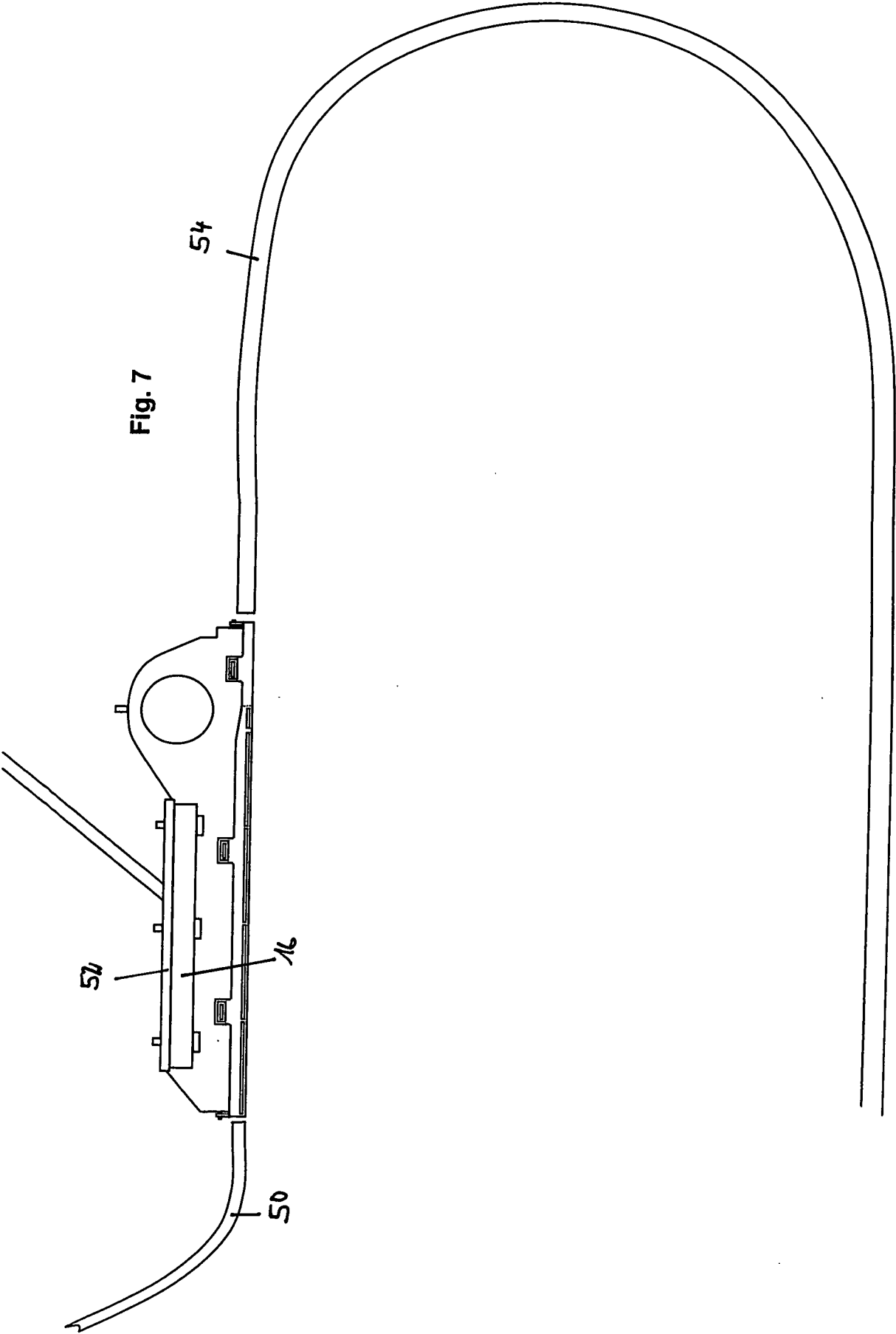


Fig. 7



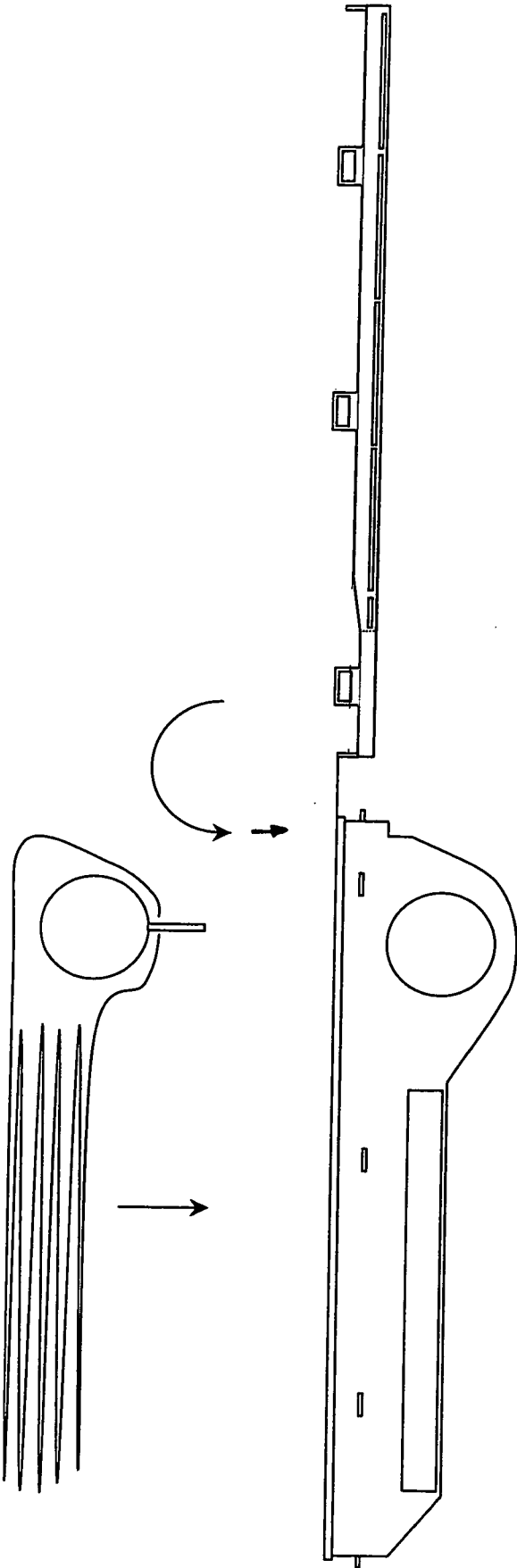


Fig. 8

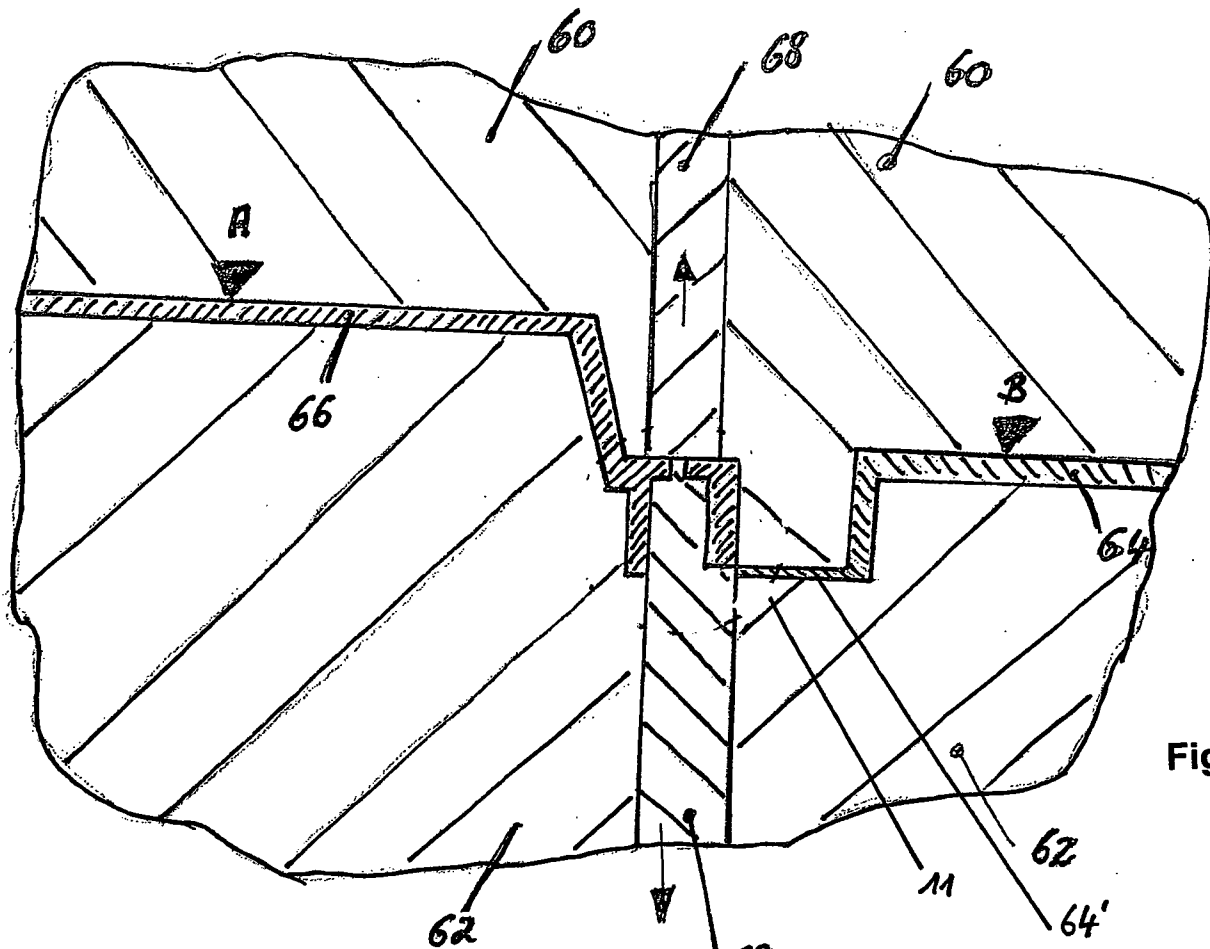


Fig. 9

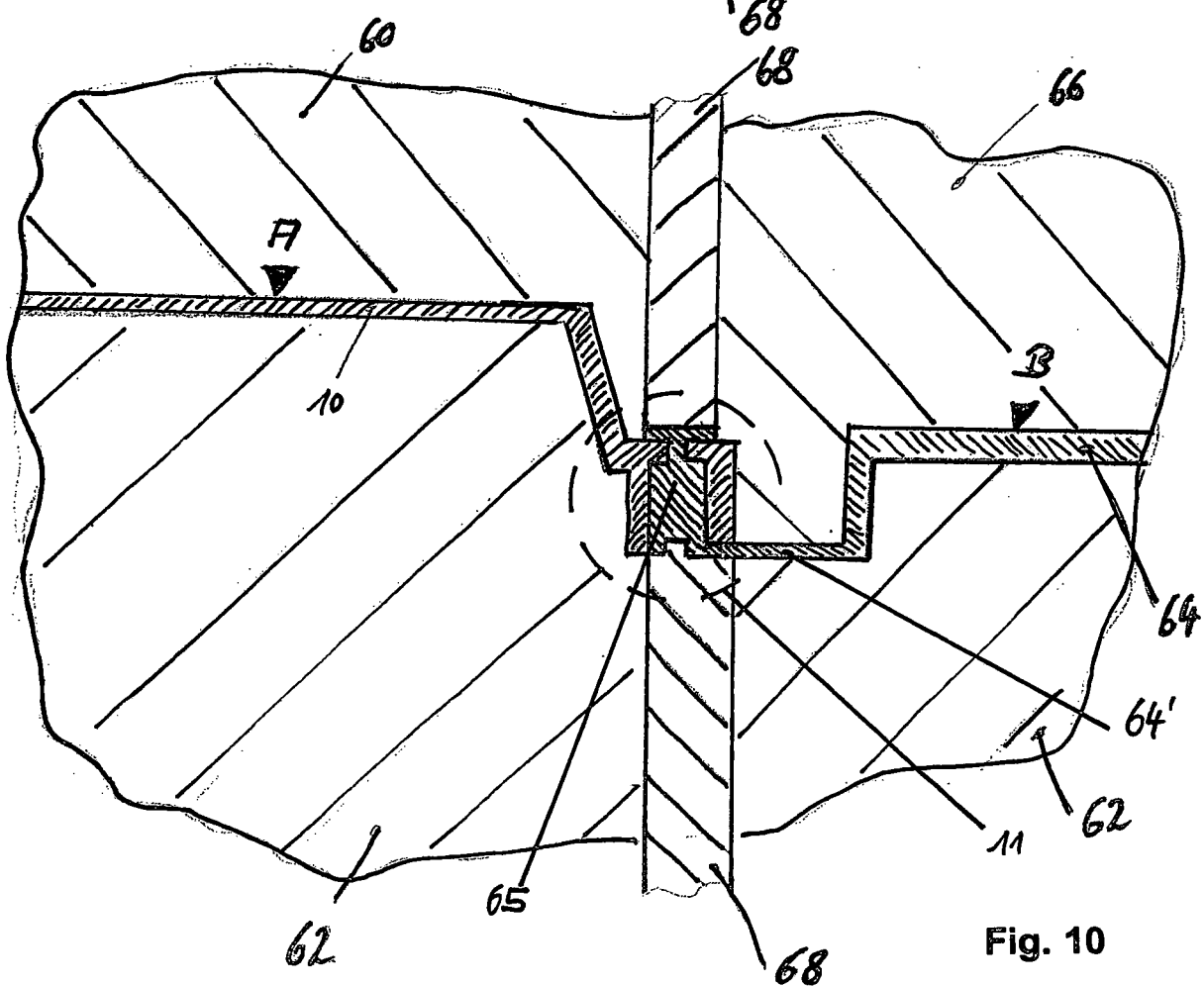


Fig. 10

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2010/000306

A. CLASSIFICATION OF SUBJECT MATTER

INV. B60R21/217

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)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 196 07 342 A1 (TAKATA EUROP GMBH [DE]) 28 August 1997 (1997-08-28) cited in the application	15
A	the whole document	1
A	DE 10 2006 020575 A1 (FORD GLOBAL TECH LLC [US]) 16 November 2006 (2006-11-16) the whole document	1-15



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See patent family annex.

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Date of the actual completion of the international search

28 April 2010

Date of mailing of the international search report

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Name and mailing address of the ISA/

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Tamme, H

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2010/000306

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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