



(51) International Patent Classification:

B60R 21/215 (2011.01)

B29C 45/14 (2006.01)

B60Q 3/283 (2017.01)

B60R 21/2165 (2011.01)

(21) International Application Number:

PCT/EP2020/062405

(22) International Filing Date:

05 May 2020 (05.05.2020)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

10 2019 111 762.3

07 May 2019 (07.05.2019)

DE

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(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ,

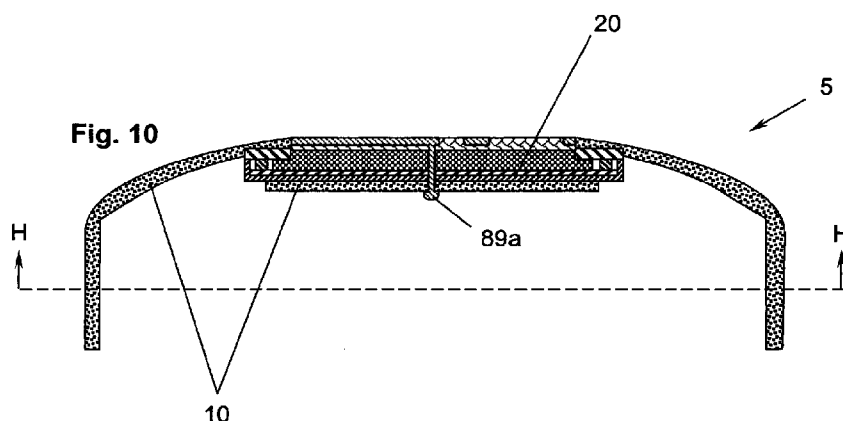
CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO,
DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN,
HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP,
KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME,
MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ,
OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA,
SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR,
TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,
TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,
MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: AIRBAG COVER WITH ELECTRONIC UNIT



(57) Abstract: An airbag cover (5) comprising an airbag cover main body (10) being made of a plastic material, and an electronic unit (20) having a front side and a rear side and comprising at least one electronic and/or at least one electro-optical element is described. The electronic unit (20) is held by the airbag cover main body (10). In order to achieve that the airbag cover is easy to manufacture and safe, meaning, that the electronic unit is safely held at the airbag cover main body during deployment of the airbag, the electronic (20) unit is held by the air- bag cover main body (10) in a form fitting manner. Preferably the cover main body (10) is injection molded around the electronic unit (20)



Airbag cover with electronic unit

Description

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The invention relates to an airbag cover comprising an airbag cover main body and an electronic unit according to the preamble of claim 1, to a method for manufacturing the same according to claim 15 and to an airbag module comprising such an airbag cover according to claim 17.

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Almost every steering wheel of a modern car has an airbag module. This airbag module comprises an airbag, an inflator and an airbag cover covering the airbag. This airbag cover usually forms the outer surface of the hub of the steering wheel. Most often the airbag cover comprises a decorative member which for example represents the car manufacturer's logo. The decorative member can be in form of at least one separate part such that the airbag cover comprises an airbag cover main body and this decorative member being attached to the airbag cover main body in this case. Most often this decorative member is located at a flap portion of the airbag cover main portion that opens when the airbag deploys.

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It is known in the art to illuminate the decorative member from the back such that the airbag cover additionally comprises an electronic unit with at least one light emitting element, most often a light emitting diode (LED). In this case the necessity arises to attach at least two additional elements to the airbag cover main body, namely the decorative member and the electronic unit. Of course it must be ensured that both elements remain attached to the flap portion of the airbag cover main portion when the airbag deploys.

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Starting from this prior art this application sets itself the task to provide an airbag cover comprising an airbag cover main body and an electronic unit attached to it which is easy to manufacture and safe, meaning, that the electronic unit is safely held at the airbag cover main body during deployment of the air-

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bag, especially in the case that the electronic unit is located at a flap portion of the airbag cover main portion.

This task is solved by an airbag cover with the features of claim 1.

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According to the invention the electronic unit is held by the airbag cover main body in a form fitting manner, which can especially be achieved by overmolding the electronic unit with the airbag cover main body (meaning that the airbag cover main body is injection-molded around the electronic unit). This means that
10 the electronic unit is held at the airbag cover main body without any additional mounting means. In some cases additional mounting means can be provided, but in any case there is a connection between the electronic unit and the airbag cover main body which does not rely on additional mounting means. The form fit between the airbag cover main body and the electronic unit has the effect that
15 usually the forces acting between those two elements when the airbag deploys are spread over a relatively large area which hinders the electronic unit or a part of the same from separating from the airbag cover main body because of a breakage of the electronic unit and/ or the airbag cover main body. This leads to a very safe behavior when the airbag deploys.

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Because there are no separate mounting means necessary this kind of connection is of course also very lightweight which additionally improves the opening behavior of the airbag cover (as mentioned, the electronic unit will most often be placed on a flap of the airbag cover main body which opens on deployment of
25 the airbag).

The electronic unit of course needs a power supply in form of an electric cable. Since it is preferred to overmold the electronic unit by the airbag cover main body, at least a section of this electric cable may also be overmolded with the
30 airbag cover main body. So, in this case the position of the electric cable is clearly defined and especially it cannot interfere with the deploying airbag. Another possibility is to connect the cable to the electronic unit after the overmolding process. This can be easier in view of the tooling. If the cable is not partially overmolded by the cover main body it will often be preferred to provide other

positioning and fixations means, to glue sections of the cable to the cover main body, or to melt and deform portions of the cover main body after the injection molding process in order to form positioning means for the cable. It is further preferred to arrange the electric cable such that it crosses a hinge line of the
5 airbag cover main body. This adds an additional security to the airbag cover, because the electric cable will hold the flap to the rest of the airbag cover main body even if the hinge should break during deployment of the airbag.

It is preferred to use a flat cable as an electric cable, especially because it is
10 space saving and has a better "hinging behavior".

One main application of the invention is to provide an electronic unit for illuminating a separate decorative member, but of course other applications of the invention are possible. For example the electronic unit could comprise a pressure or proximity sensor, which can for example be used for activating the horn.
15 In this case the electronic unit can completely be enclosed by the airbag cover main body.

As mentioned, one main application of the invention is to use the electronic unit
20 for illuminating a decorative member. In this case at least a part of a front side of the electronic unit (according to the definitions chosen here, the front side is the side pointing to the interior of the vehicle and away from the airbag) is not completely covered by the airbag cover main body such that light generated by the electronic unit can leave the electronic unit towards the decorative member
25 which is in this case placed in front of the electronic unit. This means that the airbag cover main body has a hole in front of the front side of the electronic unit. In order to ensure that the electronic unit can be held by the form fit between the electronic unit and the airbag cover main body, it is preferred that the airbag cover main body still covers a part of the front side of the electronic unit.

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In the case that the electronic unit comprises a light emitting element, usually a light emitting diode (LED), care must be taken to ensure that this light emitting element does not overheat leading to a reduction of its lifetime. For this reason it is preferred that a section of the rear side and/ or the lateral side of the elec-

tronic unit which is close to the light emitting element is not covered by the air-
bag cover main body such that heat generated by the light emitting element can
be transferred to the inside of the airbag module. Usually a plurality of light emit-
ting elements is present. In this case the electronic unit can especially have a
5 star-shape.

As has already been mentioned it is preferred to overmold the electronic unit. In
this case the electronics itself usually must be protected and so it is preferred to
provide an enclosure enclosing the electronic assembly. In the case that the
10 electronic unit serves for illuminating a decorative member this enclosure must
be at least partially transparent, translucent or it must comprise a light guiding
member.

The invention will now be described in detail by means of a preferred embodi-
15 ment in view of the figures. The figures show:

- Figure 1 a schematic plan view onto an electronic assembly,
- Figure 1a a sectional view taken along plane A-A in Figure 1,
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- Figure 2 a schematic plan view onto a light guide (in a view accord-
ing to Figure 1),
- Figure 2a a sectional view taken along plane B-B in Figure 2,
25
- Figure 2b a sectional view taken along plane C-C in Figure 2,
- Figure 3 a schematic plan view onto a housing of the enclosure of
the electronic unit (according to Figures 1 to 3),
30
- Figure 3b a sectional view taken along line D-D in Figure 4,

- Figure 4 a schematic plan view onto an end cover of the enclosure of the electronic unit (according to the representations of Figures 1 to 3),
- 5 Figure 4a a sectional view taken along plane E-E in Figure 4,
- Figure 5 a plan view onto a decorative element (according to Figures 1 to 4),
- 10 Figure 5a a sectional view taken along plane F-F in Figure 5,
- Figure 6 a plan view onto a diffusing element (according to Figures 1 to 5),
- 15 Figure 6a a sectional view taken along line G-G in Figure 6,
- Figure 7 the electronic unit being comprised of the parts shown in Figures 1 to 4 in a sectional view, for example according to Figure 1a,
- 20 Figure 8 the electronic unit shown in Figure 7 and an airbag cover main body being injection molded around the electronic unit in a sectional view according to Figure 7,
- 25 Figure 9 the items shown in Figure 8 and the decorative element and the diffusing element being attached to the electronic unit,
- Figure 10 what is shown in Figure 9 after the assembly of the airbag cover has been completed,
- 30 Figure 11 a sectional view taken along plane H-H in Figure 10, and

Figure 12 an airbag module comprising the airbag cover shown in Figure 10 in a sectional view according to Figure 10.

In the embodiment described now, an electronic unit serves for illuminating a decorative member, but it should be noted that an electronic unit which is held by an airbag cover main body in a form fitting manner could also have other purposes. For example it could comprise a screen and/ or sensors (for example for the horn activation). But the illumination of a decorative member is a main application of the invention.

Figures 1 to 4 show all components of an electronic unit. These components are an electronic assembly 70 as shown in Figures 1 and 1a, a light guide 50 as shown in Figures 2, 2a and 2b, a housing 40 of an enclosure as shown in Figures 3 and 3a, and an end cover 60 of this enclosure as shown in Figures 4 and 4a.

First reference is made to Figures 1 and 1a. This figure shows, as mentioned, an electronic assembly 17 which comprises a circuit board 71 (usually a printed circuit board), a plurality of LEDs 78 which serve as light emitting elements, and a connector 77. This connector 77 serves for attaching an electric cable so that the electronic assembly 17 can be provided with electric energy.

The circuit board 71 has a basically circular central area 72 and lateral areas 74 extending outwardly (in this case radially) from the central area 72, such that the circuit board 71 has a sort of a star-shape. A connector area 76 carrying the connector 77 does also extend radially from the central area 72. In each of the lateral areas 74 a light emitting element in form of a light emitting diode (LED) 78 is mounted. These LEDs 78 are mounted in such a way that they emit their light basically radially inwardly towards the center of the central area 72.

Further, connection holes 79 are provided in the circuit board 71.

Figures 2 to 2b show a light guide 50. This light guide can be made of a common light guiding plastic material, for example amorphous polyamide (PA). The

shape of this light guide 50 is similar to the shape of the circuit board 71: it has a circular central area and lateral areas 54 extending from this central area 52. In the embodiment shown the lateral areas 54 have a reduced thickness in relation to the central area 52, but this is not mandatory: In other embodiments the light guide could have a uniform thickness. One lateral area 54 is provided for each LED 78 of the electronic assembly 17. Connection holes 59 are also provided in the light guide 50. The outer surface of the light guide can be protected by a removable protective foil (not shown).

Figures 3 and 3a show a housing 40 which comprises bottom wall 40a and a side wall 40c. The bottom wall 40a is basically shaped as the circuit board 71 but is slightly larger, such that the electronic assembly 70 can be placed into the housing such that the circuit board 71 extends parallel to the bottom wall 40a, as will be shown later in view of Figure 7. Consequently the housing comprises a central area 42, lateral areas 44 and a connector area 46. As the circuit boards 71 and the light guide 50, the bottom wall 40a comprises connection holes 49. In order to use the light generated by LEDs efficiently, it is preferred to make the housing from white or light grey plastic material such that its surfaces reflect the light. In an alternative it would be possible to coat at least parts of the inner surface of the housing with a reflective coating.

Finally an end cover 60 is provided. This end cover has basically the shape of the bottom wall 40a of the housing, but has a central hole 62 in the middle. The inner diameter of this central hole 42 basically corresponds to the outer diameter of the central area 52 of the light guide 50.

Figures 5 and 5a show a decorative element and Figures 6 and 6a show a light diffusing element 90. These two elements together form a decorative member adapted for being attached to the electronic unit being comprised of the electronic assembly 70, the light guide 50, the housing 40 and the end cover 60.

The decorative element 80 has a visible part 82 (for example the logo of the car manufacturer) and connection studs 89 extending from this visible part 82.

The diffusing element 90 is basically disc-shaped and its diameter corresponds to the diameter of the central area 52 of the light guide, especially it can have exactly the same diameter. The diffusing element 90 has an area with reduced thickness 92 following the shape of the visible part 82 of the decorative element 80. Connection holes 99 are located in this area with reduced thickness. At this occasion it is to be noted that each of the connection holes 79, 59, 49 and 99 correspond to a connection stud 89 of the decorative element 80.

In the first assembly step, the electronic assembly 17, the light guide 50, the end cover 60 and the housing 40 are assembled to the electronic unit 20 as shown in Figure 7. When doing so, first the electronic assembly 70 is placed into the housing 40, when the light guide 50 is placed onto the circuit board 71 of the electronic assembly 70 and finally the end cover 60 is placed onto the side wall 40c of the housing 40. The end cover 60 can for example be snapped, glued or ultrasonic-welded to the housing, such that an enclosure is defined which encloses the electronic assembly. This enclosure consists of the housing 40, light guide 50 and the end cover 60. So, the electronic unit 20 showed in Figure 7 can be looked at as being comprised of this enclosure and the electronic assembly 70. Like its components the electronic unit 20 has a central area and lateral areas extending radially from the central area. Further, the electronic unit 20 has a front side 20a, a rear side 20b and a lateral side 20c.

As can also be seen from Figure 7 the connection holes of the light guide 50, the circuit board 71 and the bottom wall 40a of the housing 40 are aligned.

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In the next production step the electronic unit 20 is placed into an injection molding cast and the airbag cover main body 10 is injection molded partially around the electronic unit. The outcome of this process is shown in Figure 8. One can see that the airbag cover main body 10 covers only a part of the front side 20a of the electronic unit 20, namely the outer surface of the end cover 60, but leaves the outer surface of the light guide 50 uncovered, meaning that the airbag cover main body 10 has a central hole 11. The airbag cover main body 10 also covers most of the rear side 20B of the electronic unit 20 meaning the bottom wall 40a of the housing 40. As can also be seen in Figure 8 the lateral

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areas 24 of the electronic unit (the lateral areas 44 of the housing) remain uncovered by the airbag cover main body 10 such that these areas are not thermally insulated by the airbag cover main body.

- 5 If it is desired to paint the outer surface of the airbag cover main body it is preferred to do this in a next step, prior to mounting the decorative element (see below). This has the advantage that the decorative element does not need to be protected from the paint. If the outer surface of the light guide is protected by a removable protective foil, this foil should be left onto the outer side of the reflective element until the painting process is finished.

15 In the next production step the decorative element 80 and the diffusing element 90 which form the decorative member are mounted to the electronic unit 20 by pushing the connection studs 89 of the decorative element 80 through the connection holes. This leads to the situation as shown in Figure 9.

Finally the ends of connection studs 89 are heated and flattened such that thickened end portions 89a are formed, such that the decorative member is held at the airbag cover main body and the electronic unit 20.

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Figure 11 shows the sectional view along plane H-H in Figure 10. One can again see that the lateral areas 24 of an electronic unit 20 are not covered by the airbag cover main body 10. One can additionally see that an electric cable 30 being connected to the connector 77 by means of a mating connector 32 is also partially molded into the airbag cover main body 10. In order to achieve this, the electric cable 30 must be connected to the electronic unit 20 prior to the overmolding process. The molded-in-portion of the electric cable 30 is shown in dotted lines in Figure 11. As has already been mentioned, the overmolding of the cable 30 is only optional. It is also possible to connect the mating connector 32 to the connector 77 after the molding process. In this case it would for example be possible to glue sections of the cable 30 to the inner side of the airbag cover main body 10 in order to define the position of the cable 30.

One can also see in Figure 11 that the electronic unit 20 is located in a flap portion of the airbag cover main body 10 being surrounded by split lines 14 (shown in the pattern dot - slash - dot) and a hinge line 12 being shown in the pattern slash - dot - dot - slash. The flap portion forms the door through which the expanding airbag deploys. The electric cable 30 which is in form of a flat cable crosses the hinge line 12 such that it can still hold the electronic unit 20 and the flap portion of the airbag cover main body even if the hinge of the hinge line 12 breaks. This also applies to embodiments in which the cable is not molded into the airbag cover main body.

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Figure 12 shows the airbag cover 5 being mounted to a housing 106 of an airbag module 100 which further comprises an airbag 102 and an inflator 104. Figure 12 shows a typical driver airbag module, but it needs to be mentioned that the invention could also be applied to other kinds of airbag modules, especially to passenger airbag modules.

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In the embodiment shown the central area and the lateral areas of the electronic unit are located in one plane. Although not shown, it might often be preferred that the lateral areas are angled a little "downwards" from the central area such that the electronic unit can follow a curved shape of the airbag cover. This will enhance the integrity of the airbag cover without the need of increasing the thickness of the wall of the airbag cover main body.

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List of reference numbers

	5	airbag cover
	10	airbag cover main body
5	11	central hole
	12	hinge line
	14	split line
	19	connection hole
	20	electronic unit
10	20a	front side
	20b	rear side
	20c	lateral side
	22	central area
	24	lateral area
15	26	connector area
	30	electric cable
	40	housing of enclosure
	40a	bottom wall
	40c	side wall
20	42	central area
	44	lateral area
	46	connector area
	49	connection hole
	50	light guide
25	52	central area
	54	lateral area
	59	connection hole
	60	end cover
	62	central hole
30	64	lateral area
	69	connector area
	70	electronic assembly
	71	circuit board
	72	central area

	74	lateral area
	76	connector area
	77	connector
	78	LED
5	79	connection hole
	80	visible part (decorative element)
	89	connection studs
	90	diffusing element
	92	area with reduced thickness
10	99	connection hole
	100	airbag module
	102	airbag
	104	inflator
	106	housing
15		

Claims

1. Airbag cover (5) comprising:
an airbag cover main body (10) being made of a plastic material, and
5 an electronic unit (20) having a front side (20a) and a rear side (20b) and comprising at least one electronic and/or at least one electro-optical element, said electronic unit (20) being held by the airbag cover main body (10),
characterized in that the electronic (20) unit is held by the airbag cover
10 main body (10) in a form fitting manner.
2. Airbag cover according to claim 1, characterized in that the airbag cover main body (10) is injection molded around the electronic unit (20).
- 15 3. Airbag cover according to claim 1 or 2, characterized in that the electronic unit (20) is supplied by means of an electric cable (30), preferably a flat cable.
4. Airbag cover according to claim 3, characterized in that the electric cable
20 (30) crosses a hinge-line (12) of the airbag cover main body (10).
5. Airbag cover according to one of the preceding claims, characterized in that the airbag cover main body (10) covers the whole front side (20a) of the electronic unit (20) and at least a part of the rear side (20b) of the
25 electronic unit (20), wherein it is preferred that the airbag cover main body (10) encloses the whole electronic unit (20).
6. Airbag cover according to one of the claims 1 to 4, characterized in that the airbag cover main body (10) covers at least a part of the rear side
30 (20b) of the electronic unit (20) but not the whole of its front side (20a), wherein it is preferred that the airbag cover main body (10) covers a part of the front side (20a) of the electronic unit (20).

7. Airbag cover according to claim 6, characterized in that the electronic unit (20) comprises at least one light emitting element, especially at least one light emitting diode (78).
- 5 8. Airbag cover according to claim 7, characterized in that a section of the rear side (20b) and/or of a lateral side (20c) of the electronic unit (20) is not covered by the airbag cover main body (10) in the vicinity of the at least one light emitting element (78).
- 10 9. Airbag cover according to one of the claims 7 or 8, characterized in that the electronic unit (20) comprises a central area (22) and at least one lateral area (24) protruding from the central area (22), wherein the light emitting element (78) is located in said lateral area (24).
- 15 10. Airbag cover according to one of the claim 6 to 9, characterized in that it additionally comprises a decorative member covering at least the part of the front side (20a) of the electronic unit (20) not being covered by the airbag cover main body (10).
- 20 11. Airbag cover according to claims 6 and 10, characterized in that decorative member comprises a transparent, translucent or light diffusing element (90).
- 25 12. Airbag cover according to one of the preceding claims, characterized in that the electronic unit (20) comprises an electronic assembly (70) with a circuit board (71) and the at least one electronic and/or electro-optical element being mechanically and electrically connected to the circuit board (71), and an enclosure enclosing the electronic assembly (70).
- 30 13. Airbag cover according to claim 12, characterized in that at the enclosure comprises a housing (40) being preferably made at least partially of a white, grey or reflective material.

14. Airbag cover according to one of the claims 6 to 11 and to claim 12 or 13, characterized in that at least a part of the front side of the enclosure is transparent, translucent, light diffusing or light guiding.
- 5 15. Method for manufacturing an airbag cover according to claim 2 and one of the claims 10, 11 or 14, wherein the electronic unit (20) is molded into the airbag cover main body (10) and the decorative member is mounted to the sub-assembly being comprises of the electronic unit (20) and the airbag cover main body (10) in a subsequent assembly step.
- 10 16. Method according to claim 15, characterized in that the airbag cover main body (10) is at least partially coated or painted prior to the mounting of the decorative member.
- 15 17. Airbag module comprising an airbag (102) and an airbag cover (5) according to one of the claims 1 to 14.

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Fig. 1

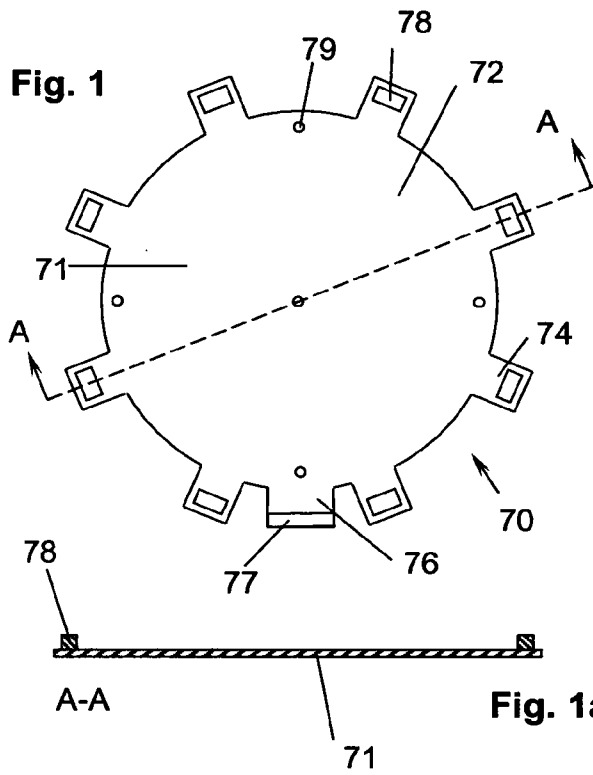


Fig. 2

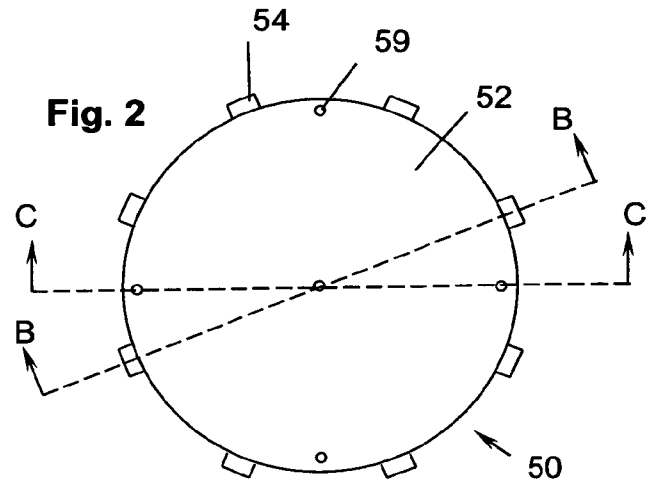


Fig. 2a

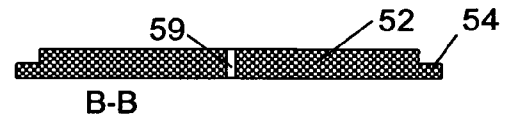


Fig. 2b

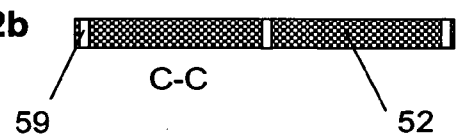


Fig. 3

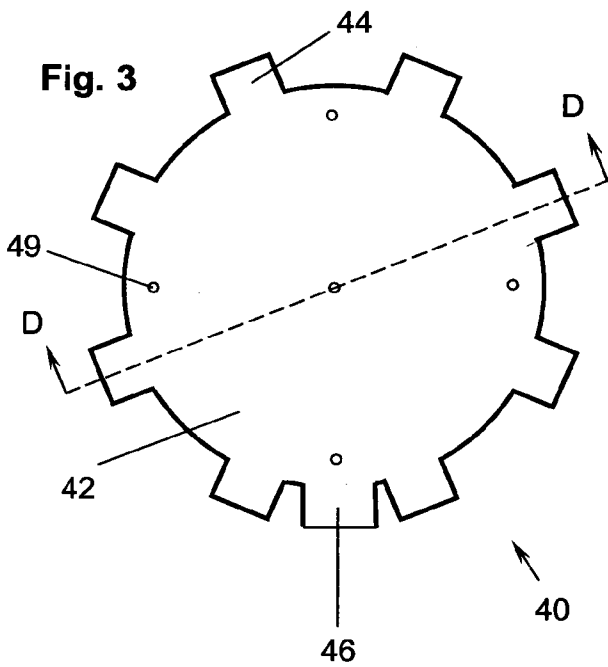


Fig. 4

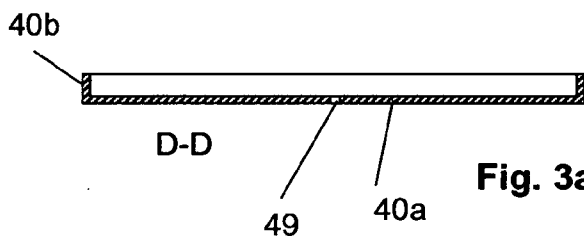
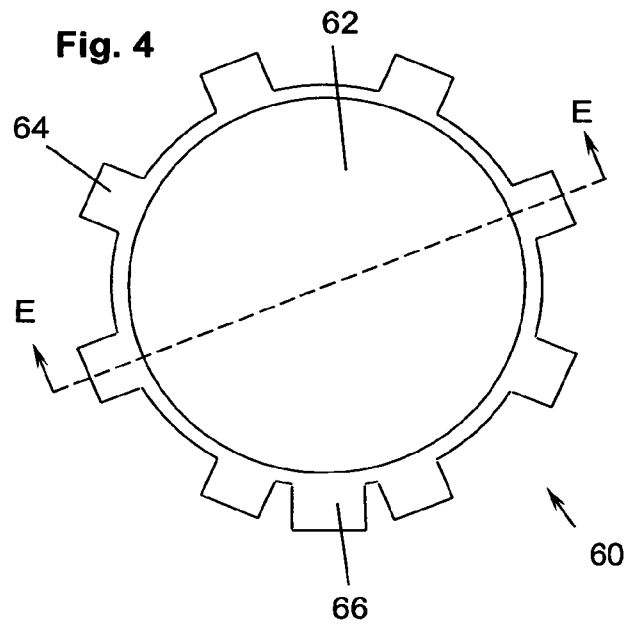


Fig. 3a

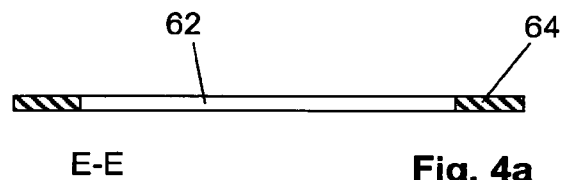
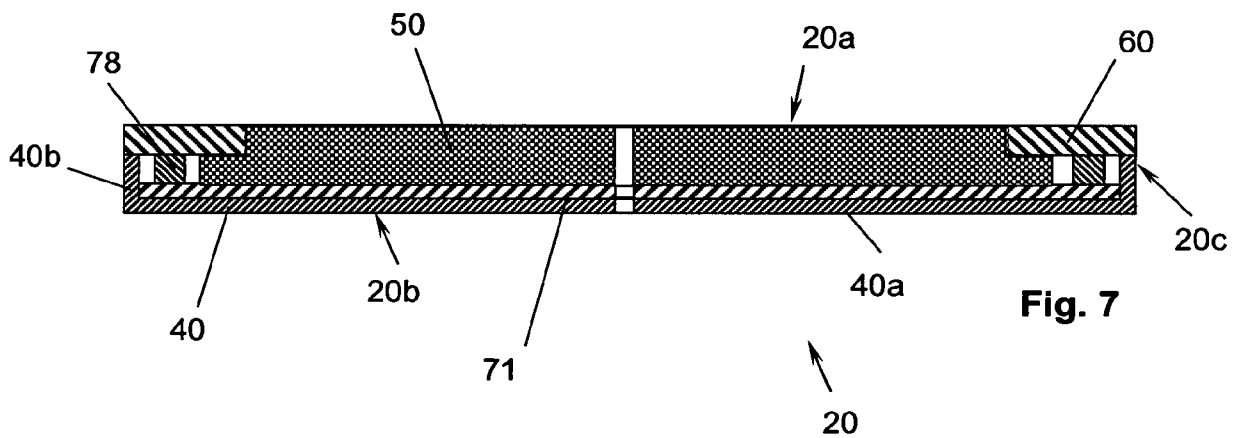
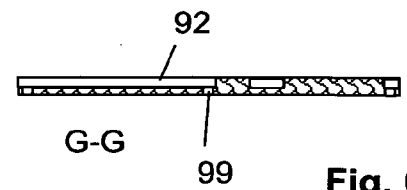
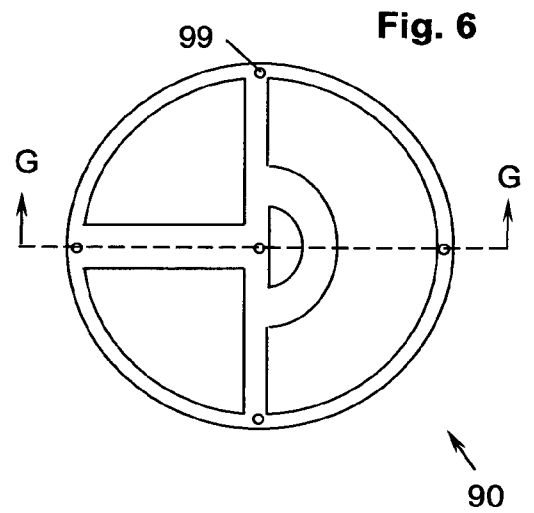
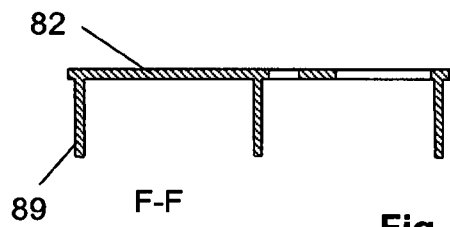
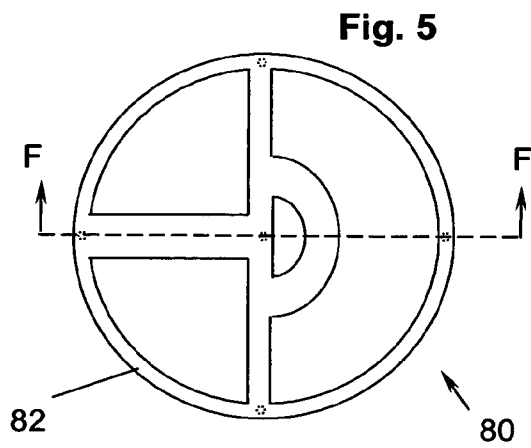
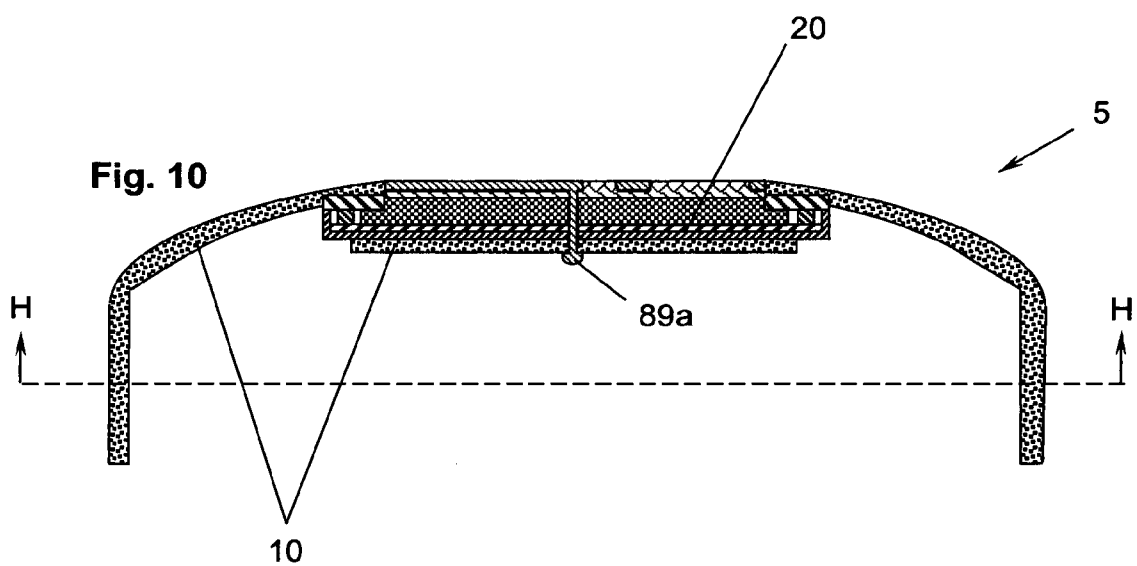
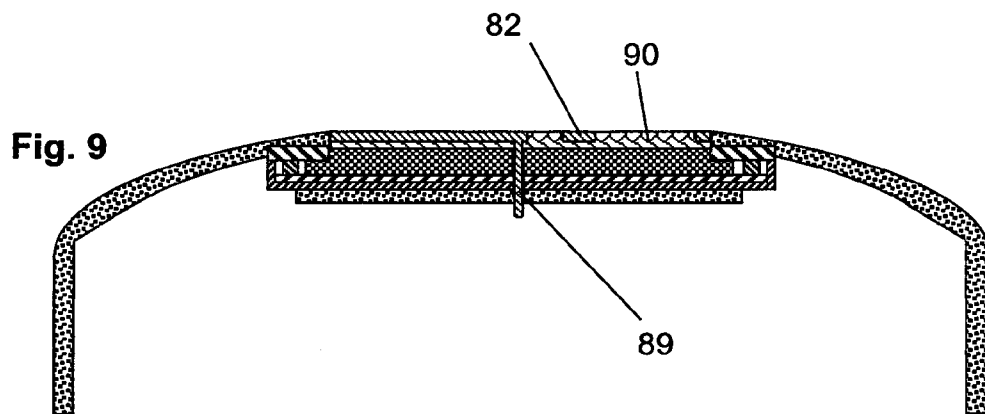
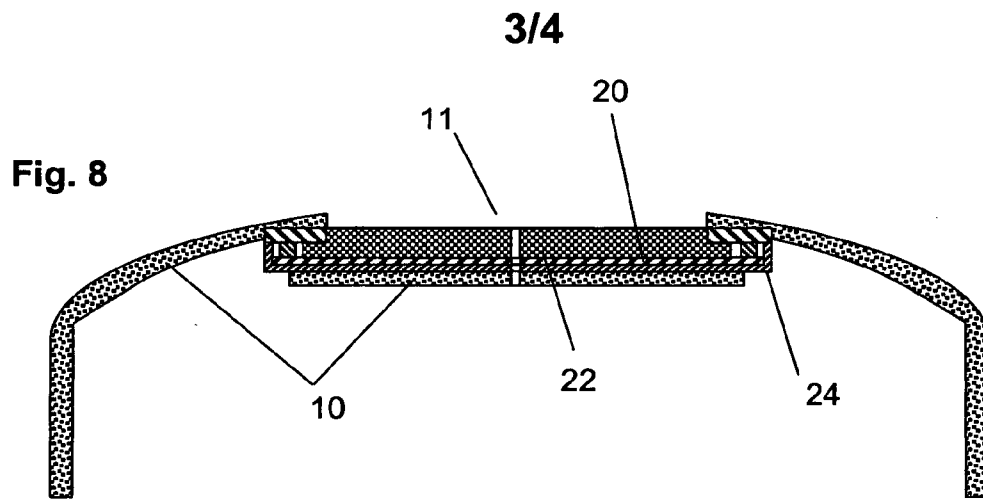
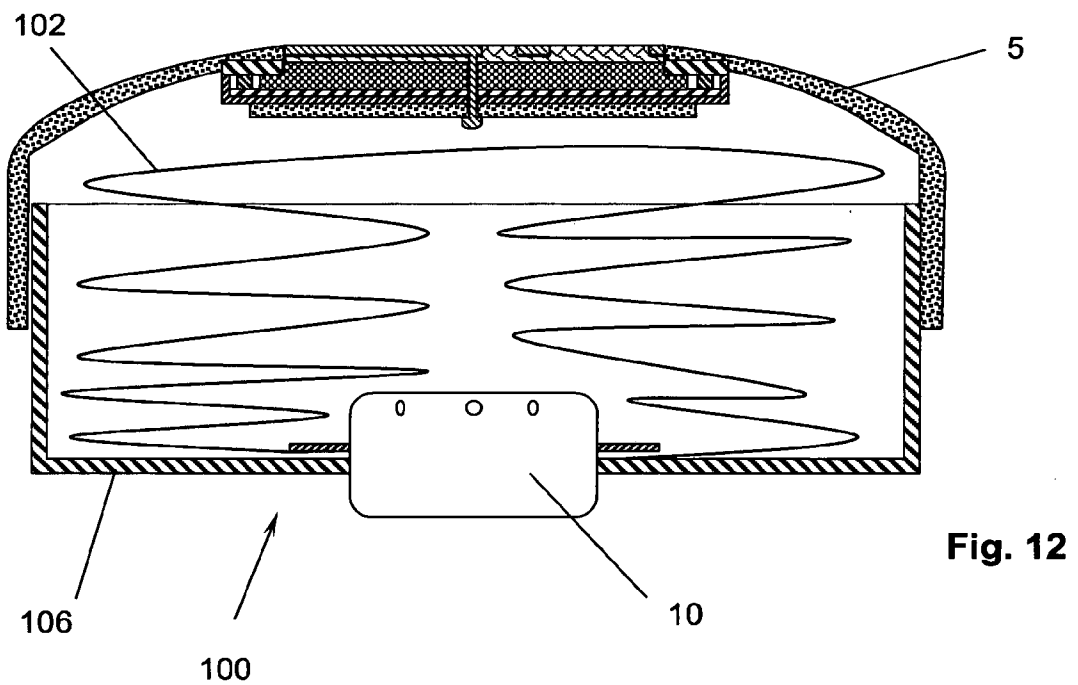
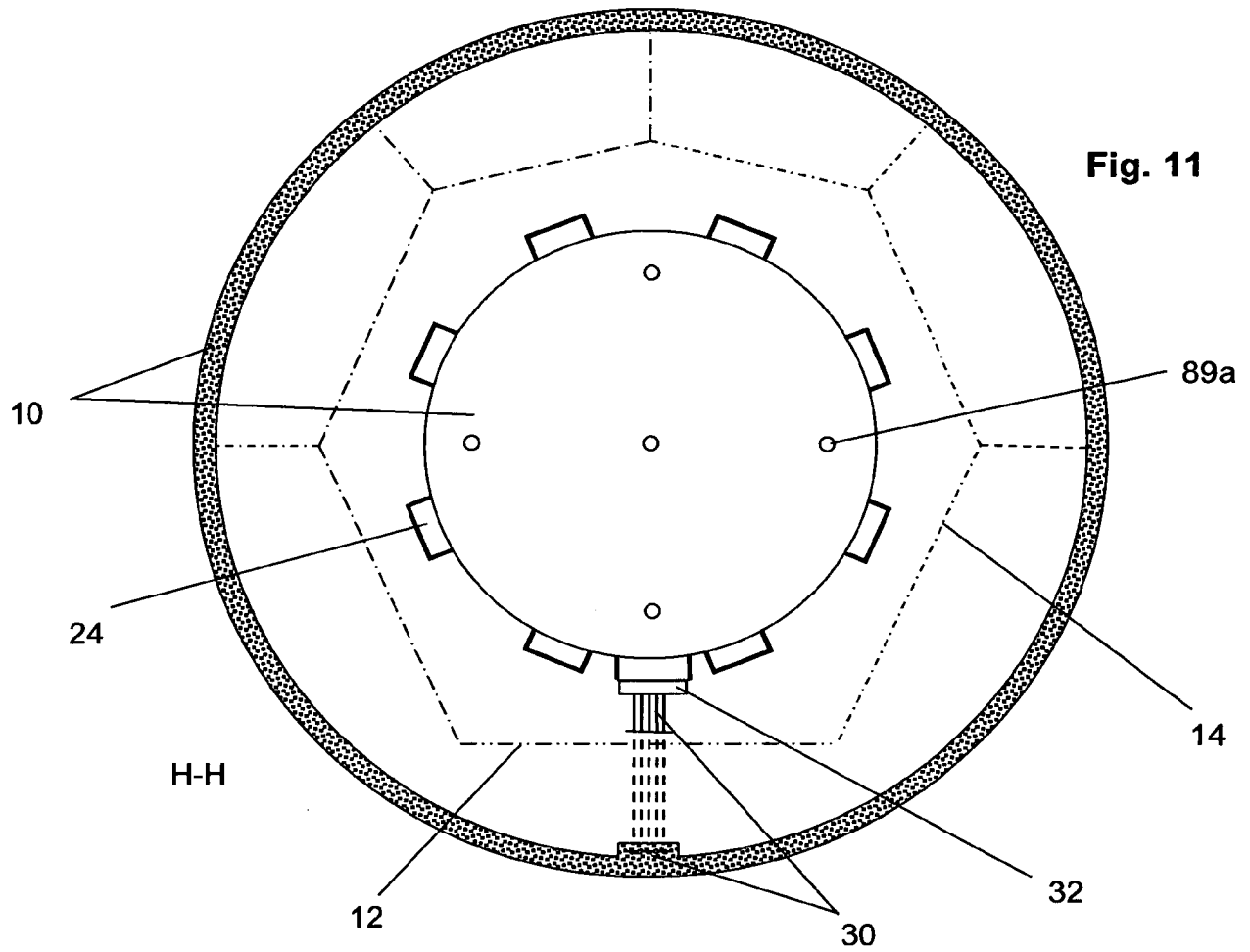


Fig. 4a





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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2020/062405

A. CLASSIFICATION OF SUBJECT MATTER

INV. B60R21/215 B60Q3/283 B29C45/14 B60R21/2165
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 B60Q B29C

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)

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	WO 2007/021263 A1 (AUTOLIV ASP INC [US]; SCHRAMM MICHAEL R [US] ET AL.) 22 February 2007 (2007-02-22) paragraph [0041]; figure 2 -----	1
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A	WO 2008/090576 A1 (BOMISA S P A [IT]; CORINALDI ALESSANDRO ALCIDE GI [IT] ET AL.) 31 July 2008 (2008-07-31) the whole document ----- -/-	1-17



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

8 June 2020

Date of mailing of the international search report

17/06/2020

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2020/062405

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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Information on patent family members

International application No

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