(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
15 August 2019 (15.08.2019)

WIPO | PCT

(10) International Publication Number
WO 2019/154894 A1

(51) International Patent Classification:
*B60R 21/217* (2011.01) *B60R 21/2165* (2011.01)
*B60R 21/203* (2006.01)

(21) International Application Number:
PCT/EP2019/052970

(22) International Filing Date:
07 February 2019 (07.02.2019)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
10 2018 102 755.9
07 February 2018 (07.02.2018) 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, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, 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,

WO 2019/154894 A1

(54) Title: AIRBAG MODULE, METHOD FOR MANUFACTURING AN AIRBAG MODULE AND STEERING WHEEL

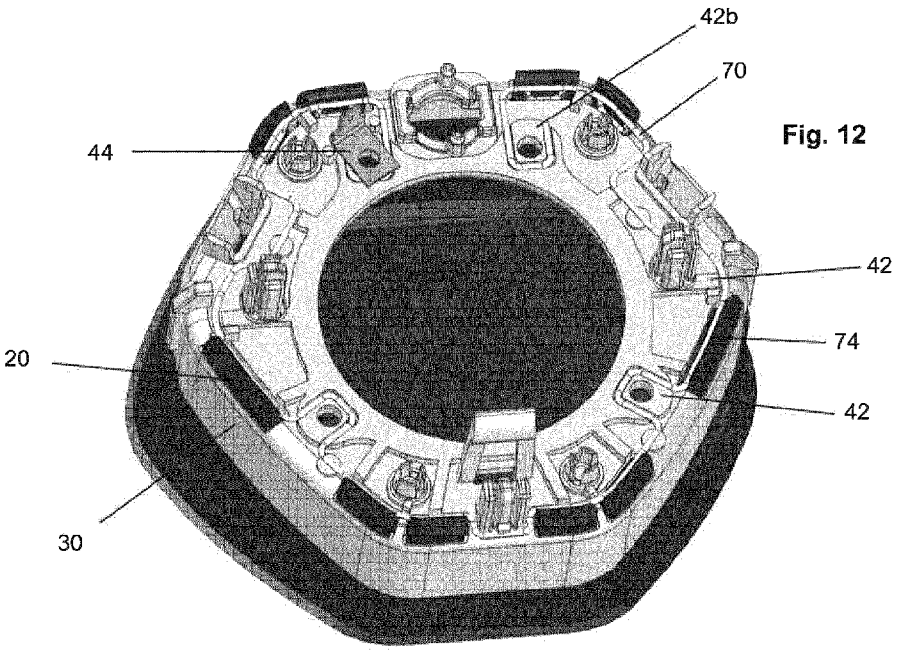



Fig. 12

(57) Abstract: An airbag module is described. This airbag module comprises a cover, a base, an inflator being attached to said base, and an airbag being accommodated in a space defined by the cover and the base. The cover shows at least one mounting portion (18). The mounting portion extends through a mounting opening (40) of the base. A securing element is attached to the outer side of the base. This securing element has a securing section (74) adjacent to the mounting portion (18). In order to make the production of the airbag module easier and more cost-effective, the securing element is in form of a blade or a wire (70).

*[Continued on next page]*

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))*

# Airbag module, method for manufacturing an airbag module and steering wheel

## Description

The invention relates to an airbag module according to the preamble of claim 1, to a method for manufacturing the same according to claim 16 and to a steering wheel comprising such an airbag module according to claim 17.

A very common setup of a driver airbag module is as follows: The airbag module is comprised of a base (which is often in form of a housing) and a cover attached to this base. The cover and the housing define an accommodation space in which an airbag package is stored. An inflator is attached to the base and is in fluid communication to the airbag of this airbag package. Most often this inflator extends through a central hole in the bottom wall of this base. In one embodiment of such a driver airbag module the base has a plurality of a mounting openings and the cover shows a mounting portion for each mounting opening. Usually these mounting portions have a hook-shaped end portion. So, the cover, which is usually a one-pieced moulded plastic element, can easily be snapped onto the housing.

For example from generic De 11 2007 002 512 B4 it is known to attach a securing element to the outer side of the bottom wall of the base which prevents the cover from unsnapping when the airbag deploys. The securing element has securing sections adjacent to the mounting portions.

If a driver airbag module is a part of a so-called floating module steering wheel, the complete airbag module can be pressed down against the basic body of the steering wheel in order to activate the horn. For this purpose the airbag module (especially the outer side of the bottom wall of the base) can show a module-side conductive contact element and the steering wheel body can comprise a body-side conductive contact element for cooperating with the module-side

conductive contact element. If the airbag module is pressed down against the basic body of the steering wheel the two conductive contact elements come into electrical contact to one another so that an electrical circuit is closed which leads to an activation of the horn.

Starting from this it is the task of the invention to improve a generic

This task is solved by an airbag module having the features of claim 1.

According to the invention the securing element is in form of a blade or a wire, especially in form of a blade or wire made from a resilient material, especially from a metal or an alloy, especially from steel.

Forming the securing element as a blade or a wire has the advantage that the securing element is to some extent elastically deformable, so that tolerances in the base and/or in the cover can be compensated. Additionally higher clamping forces (if desired) between the securing element and each mounting portion can easily be established.

Further advantages are that the securing element is easy to manufacture and can be very light weight.

Often it is preferred that at least one securing section of the securing element is in direct mechanical contact to its allocated mounting portion, but in some embodiments it might also be possible to design the airbag module such that there is a little gap between the securing section of the securing element and the mounting portion.

Especially if the securing element is in form of a wire it can be preferred that at least one mounting portion comprises a groove into which the respective securing section of the securing element extends at least partially. By doing so, an even better attachment between the base and the cover can be achieved.

Usually the covers has more than one mounting portion and it is preferred that the securing element serves for securing more than one mounting portion, especially all mounting portions.

In a very preferred embodiment the airbag module is a driver airbag module adapted for being mounted to a body of a steering wheel in such a way that it can be pressed down against the body of the steering wheel in order to actuate a horn. In this case the securing element can have a double function, namely as securing element and as a module-side conductive contact element which is adapted for cooperating with a body-side conductive contact element of the steering wheel body. This additionally reduces costs and weight.

In a preferred mounting process of the inventive airbag module the cover is first mounted to the base and then the securing element is mounted to the base, because if this assembly method is chosen the geometry can be such that an unintended disassembly of the cover from the base is practically impossible.

Further preferred embodiments follow from the further sub-claims.

The invention will now be described in detail by means of preferred embodiments in view of the attached figures.

The figures show:

Figure 1 all components of an embodiment of the inventive airbag module in a strongly schematic sectional view,

Figure 2 the housing, the inflator, and the airbag package of Figure 1 assembled to a subassembly,

Figure 3 what is shown in Figure 2 in a plan view from direction R1 in Figure 2,

Figure 4 the securing element from Figure 1 in a view according to Figure 3,

Figure 5 what is shown in Figure 2 after the cover has been attached to the housing,

Figure 6 what is shown in Figure 5 in a plan view from direction R2 in Figure 5,

Figure 7 what is shown in Figure 6 after the securing element has been attached to the bottom wall of the housing,

Figure 8 what is shown in Figure 7 in a representation according to Figure 5,

Figure 9 the airbag module of Figure 8 mounted to a steering wheel body,

Figure 10 what is shown in Figure 9 when the airbag module is pressed down,

Figure 11 a variation of a mounting portion,

Figure 12 a detailed perspective view to an airbag module, wherein the inflator is not shown,

Figure 13 a detail of Figure 12,

Figure 14 another variation of the first embodiment of an airbag module in a representation according to Figure 12,

Figure 15 a detail of Figure 14,

Figure 16 a second embodiment of an inventive airbag module in a representation according to Figures 12 and 14, and

Figure 17 a detail of Figure 16.

Figure 1 shows all elements of an embodiment of the inventive airbag module in a strongly schematic sectional view. This airbag module has a base in form of a housing 30 which is comprised of a bottom wall 34 and a side wall 32. A plurality of holes and openings is provided in the bottom wall 34, namely a central hole 36, holes 38 for inflator studs and mounting openings 40. The mounting openings 40 are located at the radial outer end of the bottom wall 34 in a transitional area between the bottom wall 34 and the side wall 32. Relevant for the invention is that holding parts 42 for a securing element form a part of the outer side of the bottom wall. The housing can be made in one piece and it can especially be a moulded plastic part.

Like every airbag module, the inventive airbag module has an inflator 50. In the embodiment shown this inflator 50 is comprised of an inflator main body 52, which usually encloses pyrotechnic material, a flange 54 and studs 56 extending from this flange 54.

Of course an airbag 62 is provided. Here, the airbag 62 is a part of an airbag package 60 which also shows a wrapper 64 enclosing the airbag 62. Providing a wrapper 64 is only optional.

Further a cover 12 is provided. This cover can also be a one-pieced plastic element. The cover 12 shows a roof section 14 and a side wall section 16 extending from said roof section 14. From the roof remote end of the side wall section 16 mounting portions 18 extend. These mounting portions 18 have hook-shaped end portions 20 with the hook sections extending radially outward.

Finally a wire-shaped securing element 70 is provided. This wire-shaped securing element 70 is mostly referred to as wire 70. The preferred material for this wire 70 is steel.

Figure 2 shows the housing 30, the inflator 50 and the airbag package 60 assembled to a subassembly in a conventional manner. Figure 3 shows what is shown in Figure 2 in a plan view from direction R1 in Figure 2, such that Figure 2 is a sectional view along plane A-A in Figure 3. One can see the not yet used mounting openings 40 and the plurality of the not yet used holding parts 42. In the embodiment shown, each of these holding parts 42 shows a groove. In Figure 3 one can additionally see two holding parts 42a and 42b for ends of the wire- shaped securing element 70.

The wire 70 fitting into the holding parts 42, 42a and 42b is shown in Figure 4. In this first embodiment the wire 70 extends in a single plane so that it has a two-dimensional shape.

In the next assembly step the cover 12 is assembled to the housing 30 by pushing the mounting portions 18 through the mounting openings 40 such that the hook-shaped end portions 20 of the mounting portions 18 are located outside the housing on the outer side 34a of the bottom wall 34. During the assembly process the mounting portions 18 are slightly bent inwardly, but since they are made of a resilient plastic material they snap back radially outward. The situation after snapping the cover 12 to the housing 30 is shown in Figures 5 and 6.

In the next assembly step the wire 70 is mounted to the bottom wall 34 by placing sections of the wire 70 in the grooves of the holding parts 42, 42a and 42b. By doing so a securing section 74 of the wire 70 is located next to each mounting portion 18 such that the mounting portion 18 cannot unsnap from the housing. It might often be preferred that each securing section 74 is in mechanical contact to its allocated mounting portion 18, but this is not absolutely mandatory. Since the securing element 70 is made of a resilient material, tolerances between the cover 12 and the housing 30 can be compensated.

In a final assembly step of the airbag module 10 a contact element 44 is screwed or riveted to the bottom wall 34, for example to one of the holding parts 42a for an end of the wire 70. In the embodiment shown, a cable 45 is directly attached to this contact element 44.

Figure 8 shows the completely assembled airbag module 10 in a representation according to Figure 5.

As has already been mentioned, the airbag module 10 is a driver airbag module intended for being mounted into a steering wheel body 90. For this purpose the steering wheel body 90 as a large recess in its hub area so that the airbag module 10 (or at least most of this airbag module 10) can be accommodated in this recess. Springs 94 extend between the steering wheel body 90 and the airbag module 10 such that the airbag module 10 can be pressed down against the steering wheel body 90 (see Figure 10).

The securing element 70 does not only serve for securing the cover but also serves as a module-side conductive contact element. The steering wheel body 90 also shows at least one contact element (usually more than one) namely the body-side conductive contact elements 92. The securing element 70 and the body side-conductive contact elements 92 are each a part of the horn circuit which is closed when the securing element 70 and at least one body-side conductive contact element 92 are in mechanical and thus electrical contact to one another.

As can be seen from Figure 11 at least one mounting portion 18 can show a groove 23 into which the securing section 74 of the wire 70 extends. By providing such a groove 23 an even better attachment of the cover 12 to the housing 30 can be provided.

Figures 12 and 13 show a variation to the embodiment just described, but in a more detailed representation. One can see that the shape of the wire-shaped securing element 70 is more complex and that at least some of the holding parts 42 do not show a real groove, but merely a step. As in the embodiment described in view of Figures 1 to 10 the securing element is also a wire 70 extending in a single plane, so that it has a two-dimensional shape.

Figures 14 and 15 show a further variation of the first embodiment. The main difference to the example embodiment of Figures 12 and 13 is that the wire-shaped securing element 70 does not extend in a single plane so it is a three dimensional part. This can lead to an even better securing of the cover 12 to the housing 30.

Figure 16 and 17 show a second embodiment. Here the securing element is not a wire, but in form of a blade 80. This blade 80 is a part of a stamped and bent sheet metal part comprising this blade and a plurality of attachment sections 82. These basically extend in a 90 degree angle from the blade-shaped securing element 80. The blade-shaped securing element 80 (also referred to as blade 80) is basically orientated such that its surface normals extend perpendicular to the axial direction $D_A$ of the airbag module 10.

As can for example be seen from Figure 17, the stamped and bent sheet metal part of this embodiment has V-shaped sections. In these V-shaped sections a section of the blade 80 forms the first leg of the V and an additional section of the sheet metal part forms the second leg 86 of the V. These V-shaped sections are at positions of securing sections 74 of the securing element, such that the clamping force can be enhanced, because one leg can be supported by the bottom wall 34. It is preferred that the second leg is the inner leg (as shown), but it would also be possible that the blade 80 (the first leg) form the inner leg and the second leg 86 abuts the mounting portion 18.

As in the first embodiment, the securing element (the blade 80) can additionally act as a module-side conductive contact element adapted for co-operating with a body-side conductive contact element of a steering wheel body.

Although the preferred application of the invention is the securing of a cover to a base (or housing) of a driver airbag module, it is to be emphasized that the concept can in principle also be applied to other types of airbag modules.

List of reference numbers

| | |
|---|---|
| 10 | airbag module |
| 12 | cover |
| 14 | roof section |
| 16 | sidewall section |
| 18 | mounting portion |
| 20 | hook-shaped end section |
| 23 | groove |
| 30 | housing |
| 32 | side wall |
| 34 | bottom wall |
| 34a | outer side of the bottom wall |
| 36 | central hole |
| 38 | hole for inflator studs |
| 40 | mounting opening |
| 42 | holding parts for the securing element |
| 42a, 42b | holding parts for the ends of the securing element |
| 43a | thread |
| 44 | contact element |
| 45 | cable attached to the contact element |
| 46 | screw or rivet |
| 50 | inflator |
| 52 | inflator main body |
| 54 | flange |
| 56 | stud |
| 60 | airbag package |
| 62 | airbag |
| 64 | wrapper |
| 70 | wire |
| 72a, 72b | end section |
| 74 | securing section |
| 75 | section bent out of plane |
| 80 | blade |

| | |
|---|---|
| 82 | attachment section of blade |
| 84 | securing section |
| 86 | second leg of V-shaped section |
| 90 | steering wheel body |
| 92 | body-side conductive contact element |
| 94 | spring |
| $D_A$ | axial direction |

Claims

1. Airbag module (10) comprising:
   - a cover (12) having a roof section (14), a sidewall section (16) extending from said roof section (14) and at least one mounting portion (18) extending from the end of the sidewall section (16) remote from the roof section (14),
   - a base having an outer side (34a), said base comprising at least one mounting opening (40) through which the mounting portion (18) extends,
   - an inflator (50) being attached to said base,
   - an airbag (62) being accommodated in a space defined by the cover (12) and the base,
   - a securing element being attached to the outer side (34a) of the base, said securing element having at least one securing section (74, 84) adjacent to the part of the mounting portion (18) extending through the mounting opening (40),

   characterized in that
   the securing element is in form of a blade (80) or a wire (70).

2. Airbag module according to claim 1, characterized in that the blade (80) or the wire (70) is made of a resilient material, especially of a metal or an alloy.

3. Airbag module according to claim 1 or claim 2, characterized in that the securing section (74, 84) of the securing element is in mechanical contact to the mounting portion (18).

4. Airbag module according to one of the preceding claims, characterized in that the mounting portion (18) comprises a groove (23) in which the securing section (74, 84) is located at least partially.

5. Airbag module according to one of the preceding claims, characterized in that the base is in form of a housing (30) with a bottom wall (34) and a

side wall (32), wherein the at least one mounting opening (40) is located in a transition area between the bottom wall (34) and the side wall (32).

6. Airbag module according to one of the preceding claims, characterized in that the at least one mounting portion (18) has a hook-shaped end portion (20) with the hook section extending into the radial outward direction.

7. Airbag module according to claim 6, characterized in that the securing section (74, 84) of the securing element is on the radial inward side of the mounting portion (18).

8. Airbag module according to one of the preceding claims, characterized in that the cover has a plurality of mounting portions (18) that are secured to the base by means of a single securing element having a plurality of securing sections (74, 84).

9. Airbag module according to one of the preceding claims, characterized in that the securing element is a wire (70) that defines a single plane.

10. Airbag module according to one of the claims 1 to 8, characterized in that the securing element is a wire (70) that defines at least to planes.

11. Airbag module according to one of the claims 1 to 8, characterized in that the securing element is a blade (80) whose surface normals basically extend perpendicular to the axial direction ($D_A$) of the airbag module (10).

12. Airbag module according to claim 11, characterized in that the blade (80) is a section of a stamped and bent sheet metal part that further comprises at least one attachment section (82) that is orientated basically perpendicular to the blade (80).

13. Airbag module according to one of the claims 11 or 12, characterized in that the stamped and bent sheet metal part has at least one V-shaped

section with a section of the blade (80) forming a first leg of the V and an additional section forming a second leg (86) of the V, wherein it is preferred that this V-shaped section is at the position of a securing section (74) of the securing element.

14. Airbag module according to one of the preceding claims, characterized in that it is a driver airbag module adapted for being mounted to a steering wheel body (90) and in that the securing element is a module-side conductive contact element adapted for co-operating with a body-side conductive contact element (92) of the steering wheel body (90).

15. Airbag module according to claim 14, characterized in that the module-side conductive contact element is electrically connected to an electrical contact element (44) that is attached to the base or that is a part of the base.

16. Method for manufacturing an airbag module (10) according to one of the preceding claims with the following steps:
- providing the base,
- attaching the inflator (50) and the airbag (62) to said base,
- mounting the cover (12) to the base such that the at least one mounting portion (18) extends through the at least one mounting opening (40),
- attaching the securing element to the base.

17. Steering wheel comprising a steering wheel body (90) with a body-side conductive contact element (92) and an airbag module according to one of the claims 14 or 15, wherein the airbag module (10) can be pressed down against the steering wheel body (90) and wherein at least a section of the securing element comes into mechanical and electrical contact to the at least one body-side conductive contact element (92) when the airbag module (10) is pressed down.

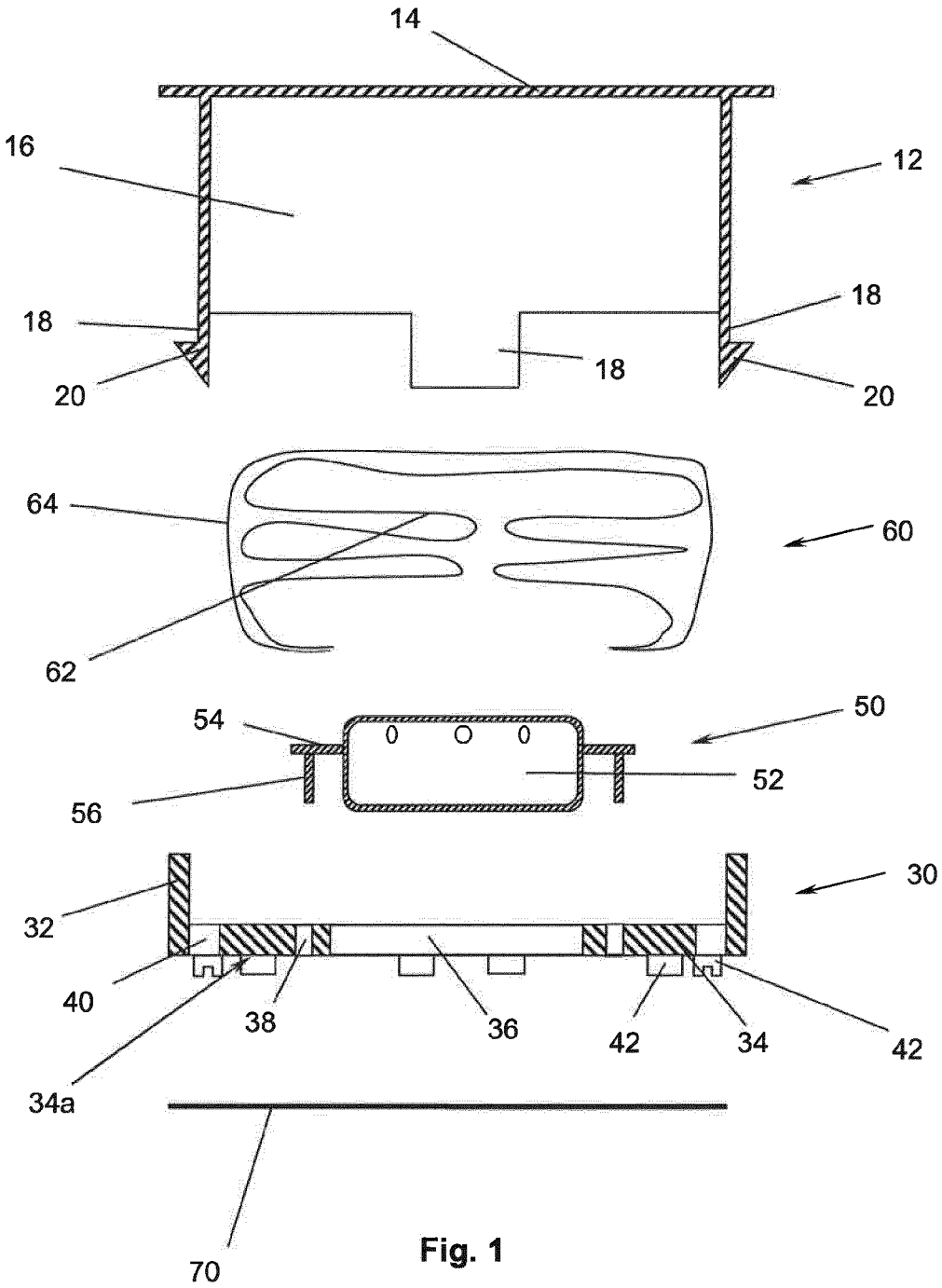

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Fig. 1

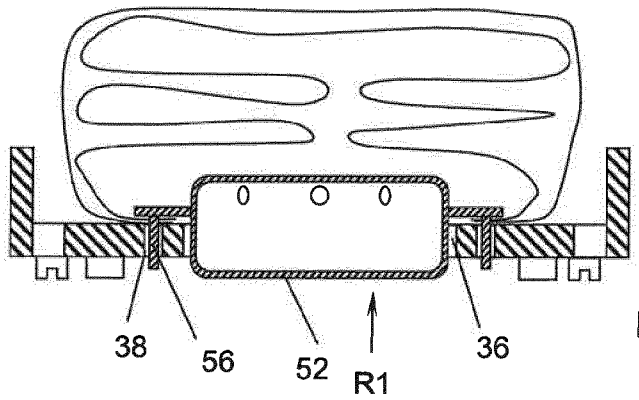



Fig. 2

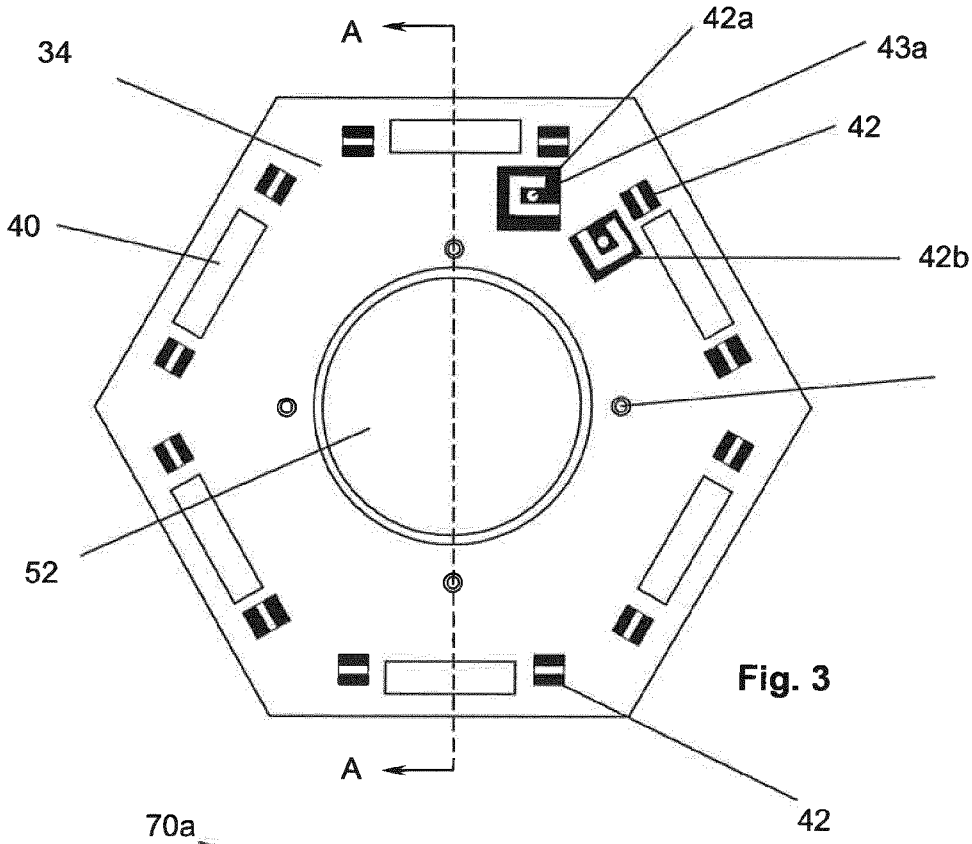



Fig. 3

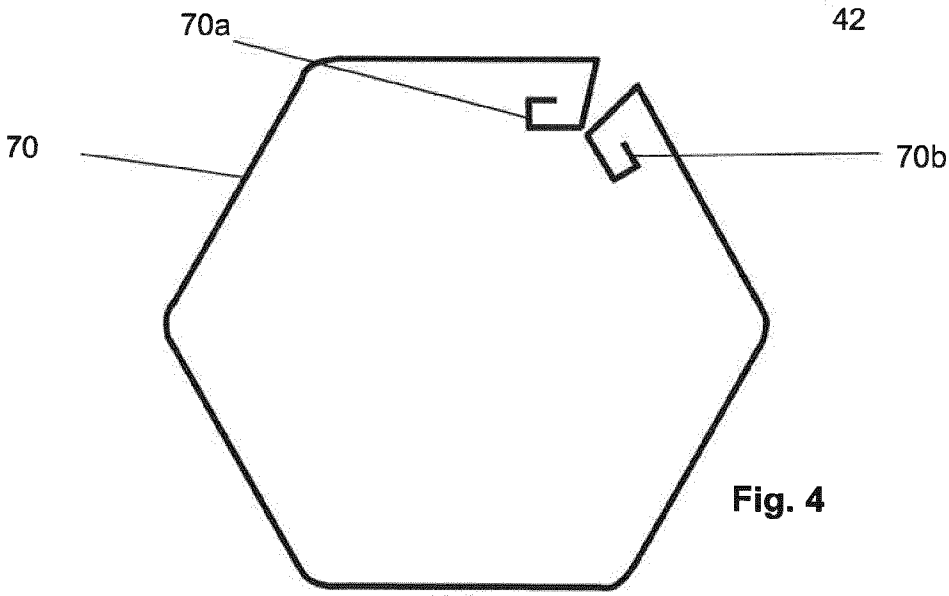



Fig. 4

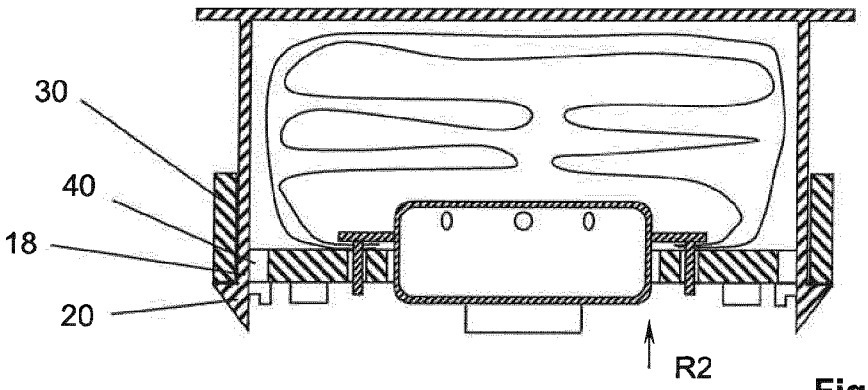



Fig. 5

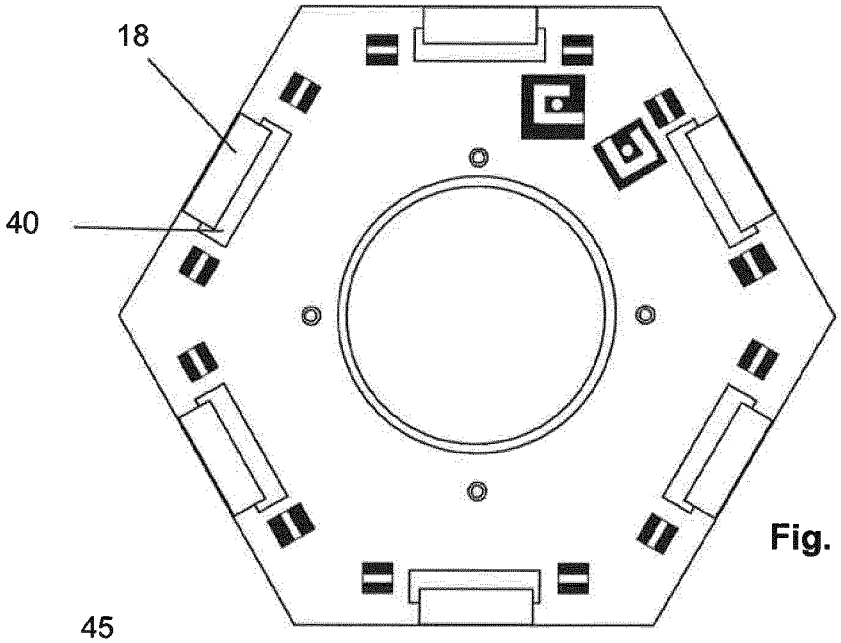



Fig. 6

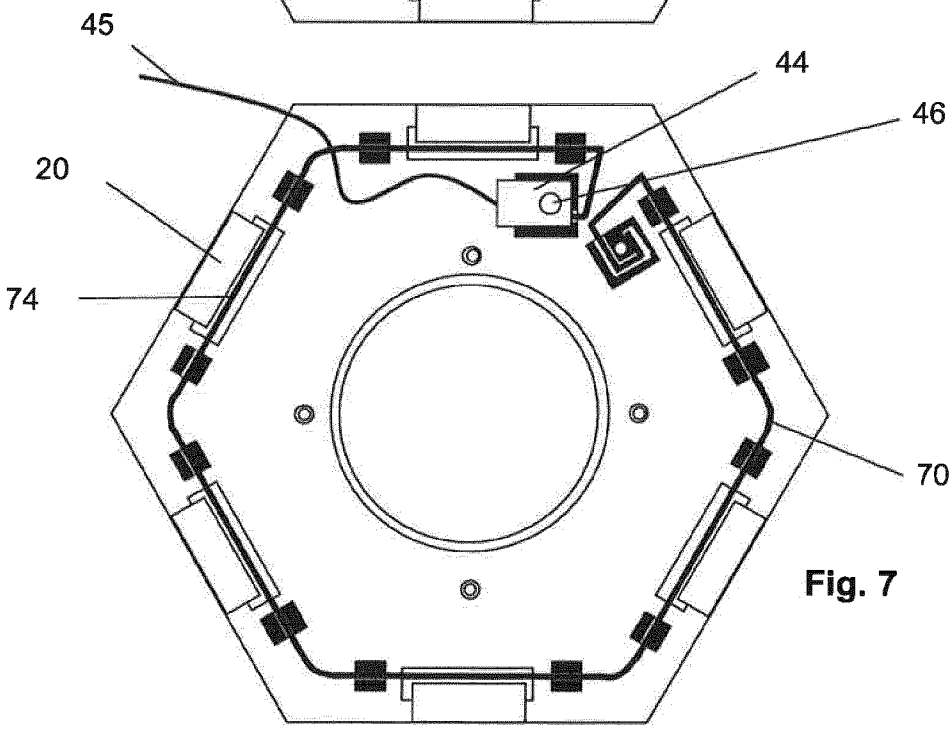



Fig. 7

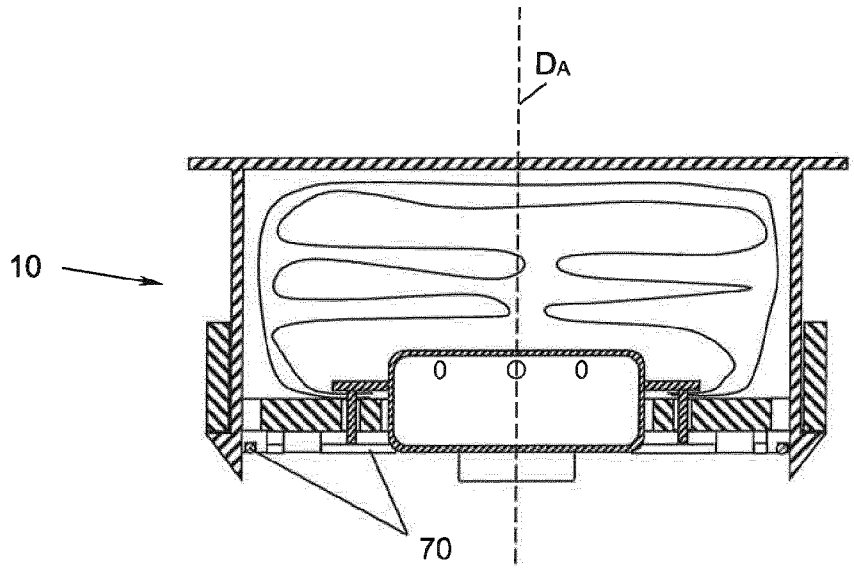



Fig. 8

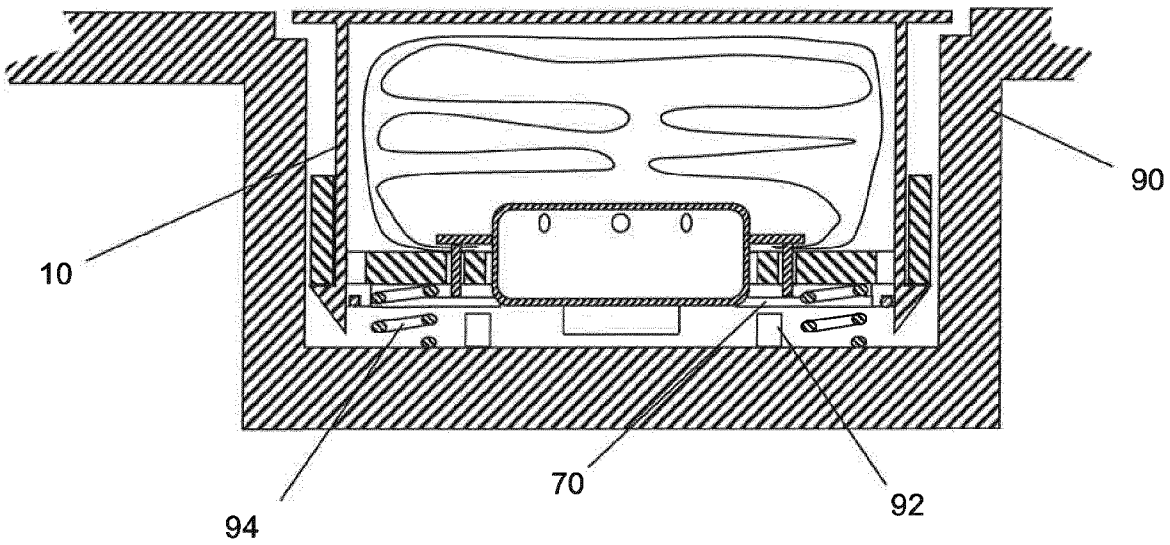



Fig. 9

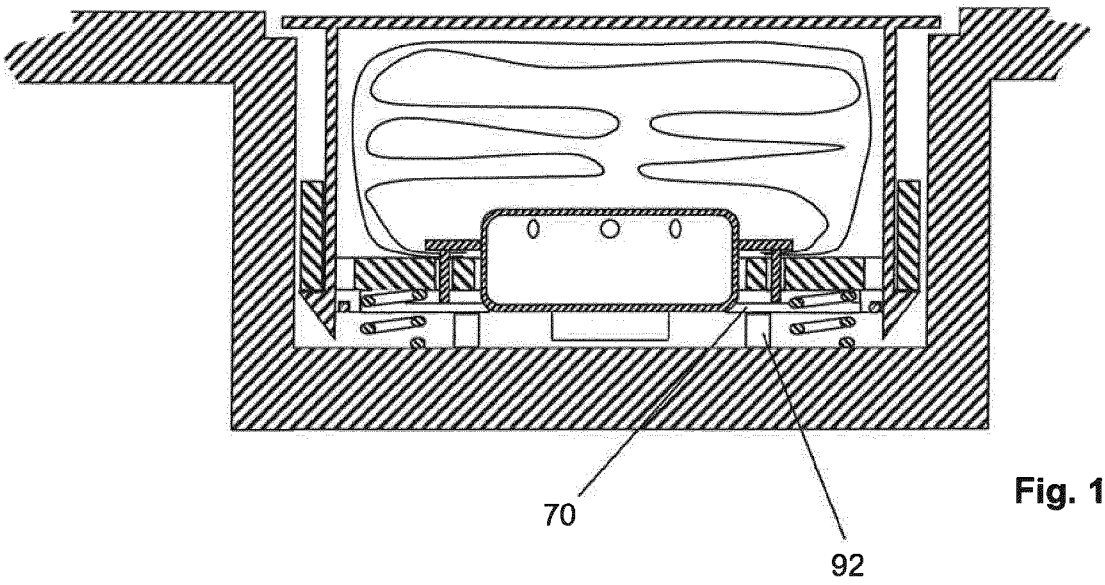



Fig. 10

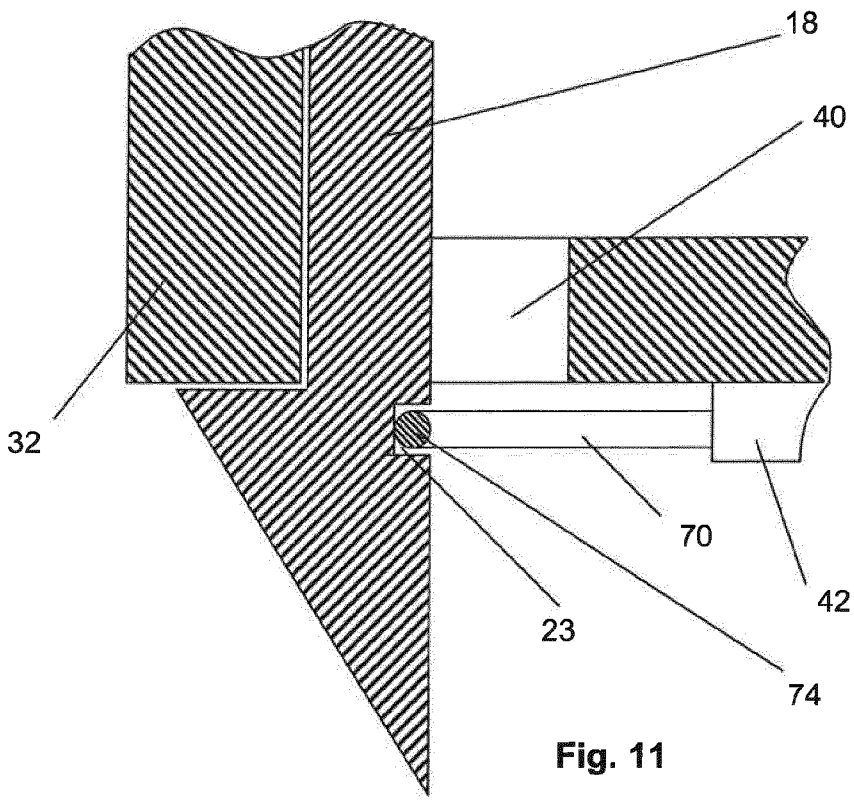



Fig. 11

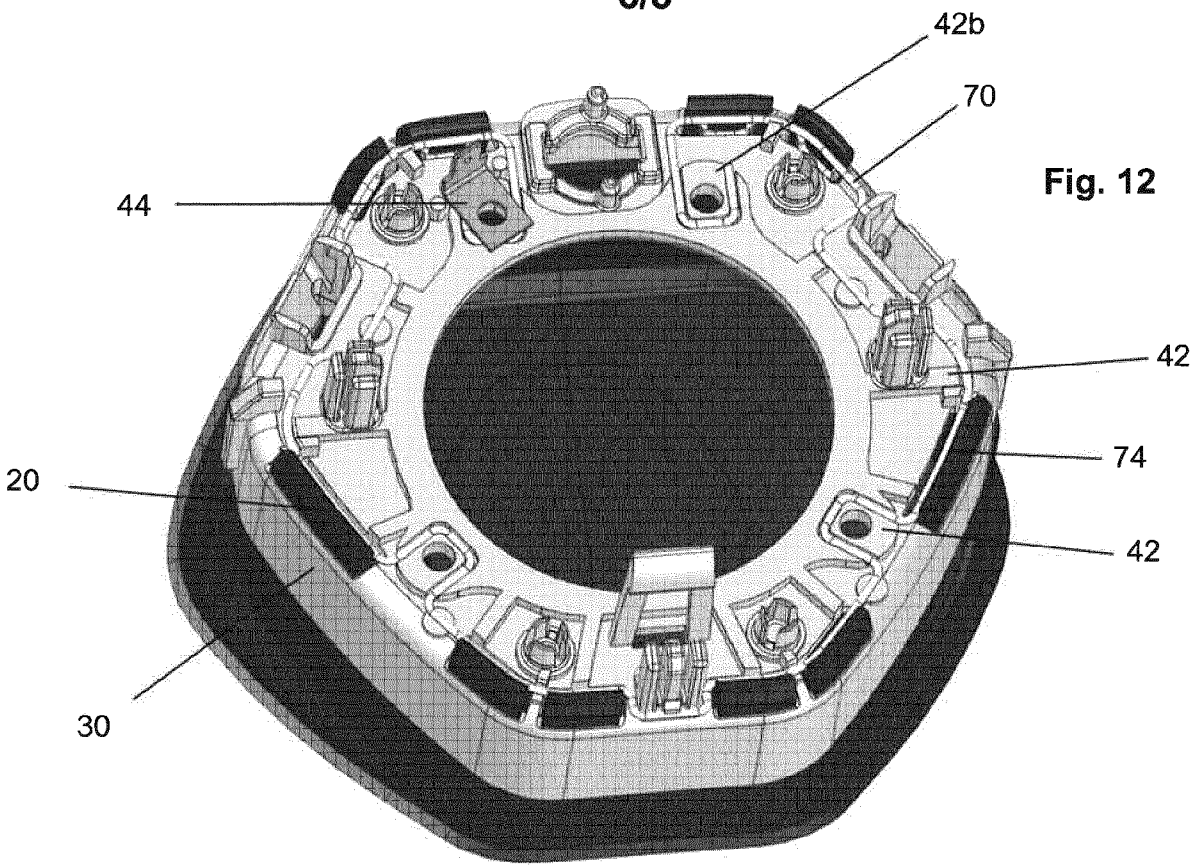



Fig. 12

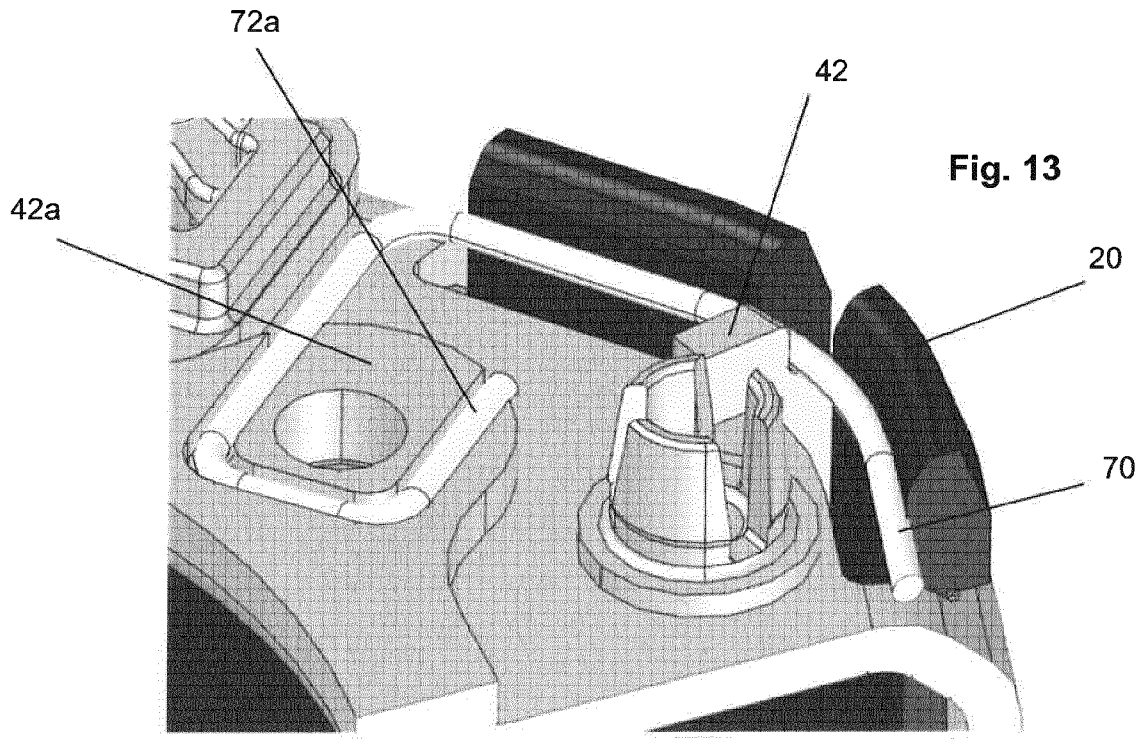



Fig. 13

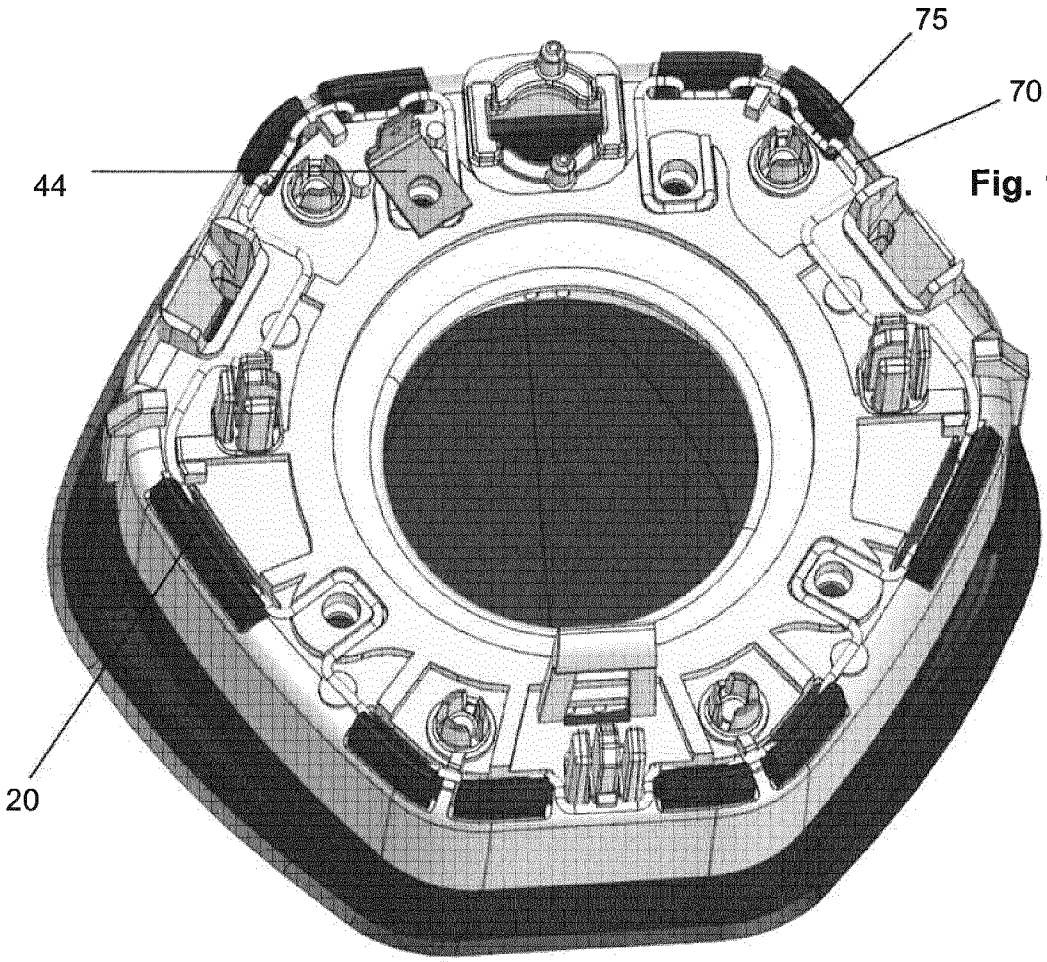



Fig. 14

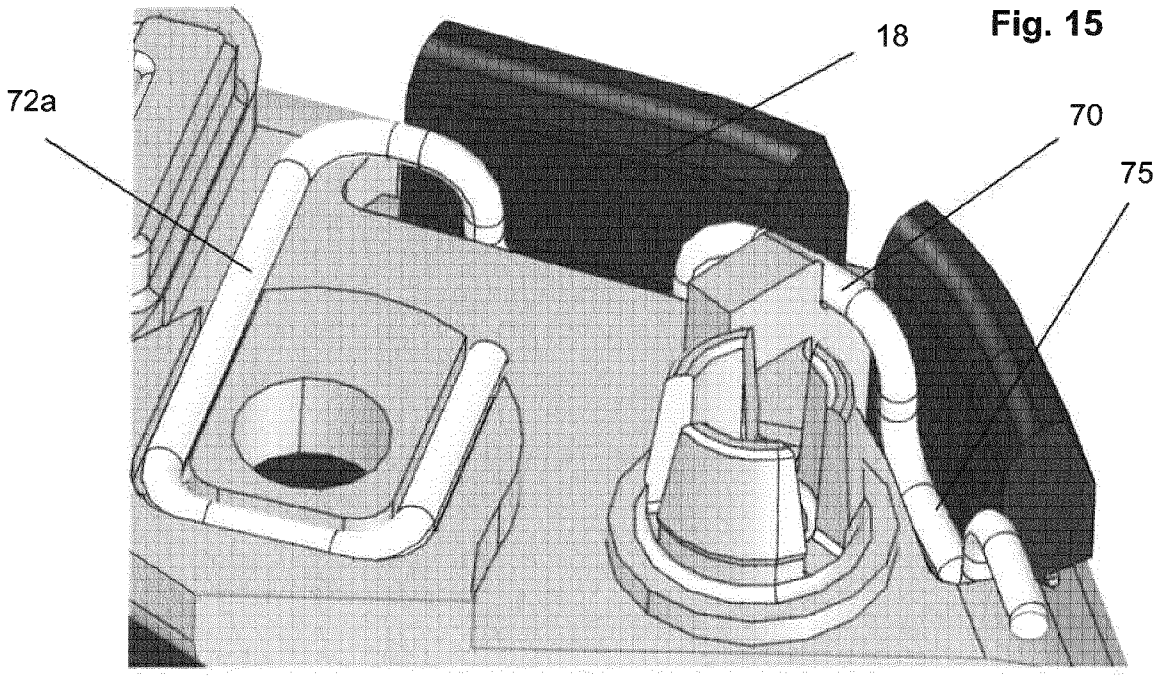



Fig. 15

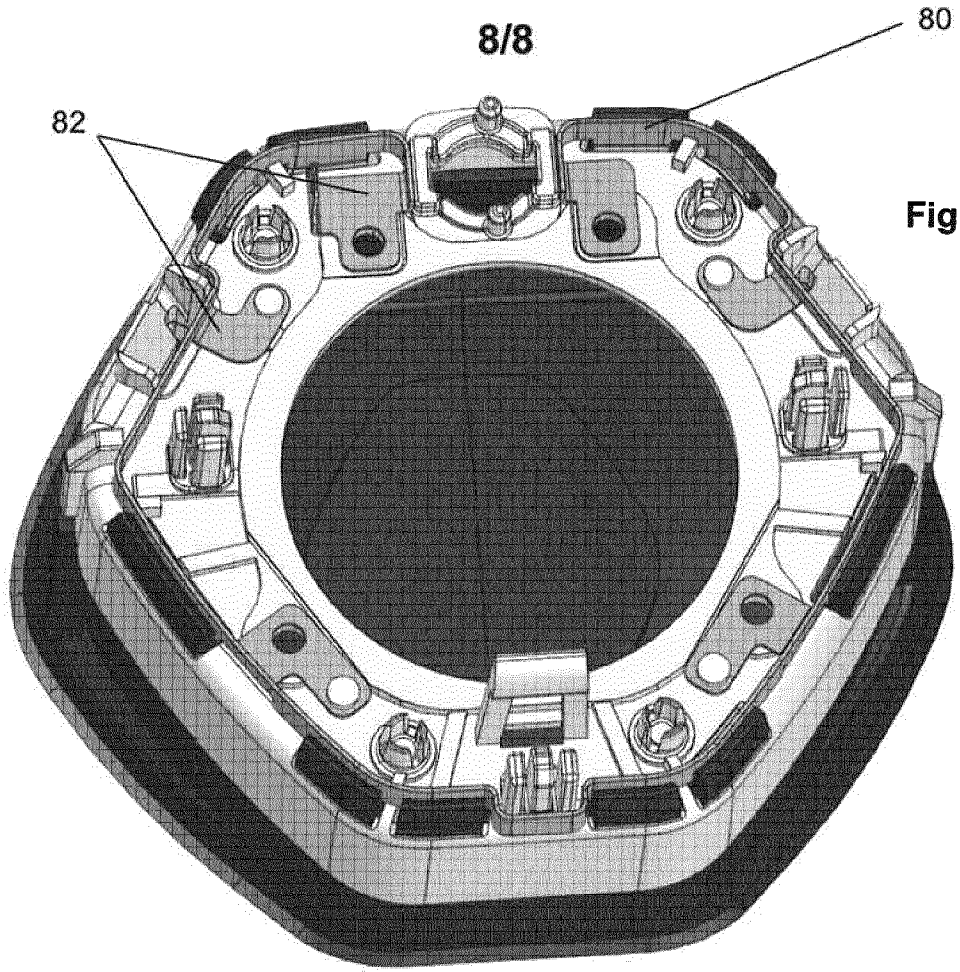



Fig. 16

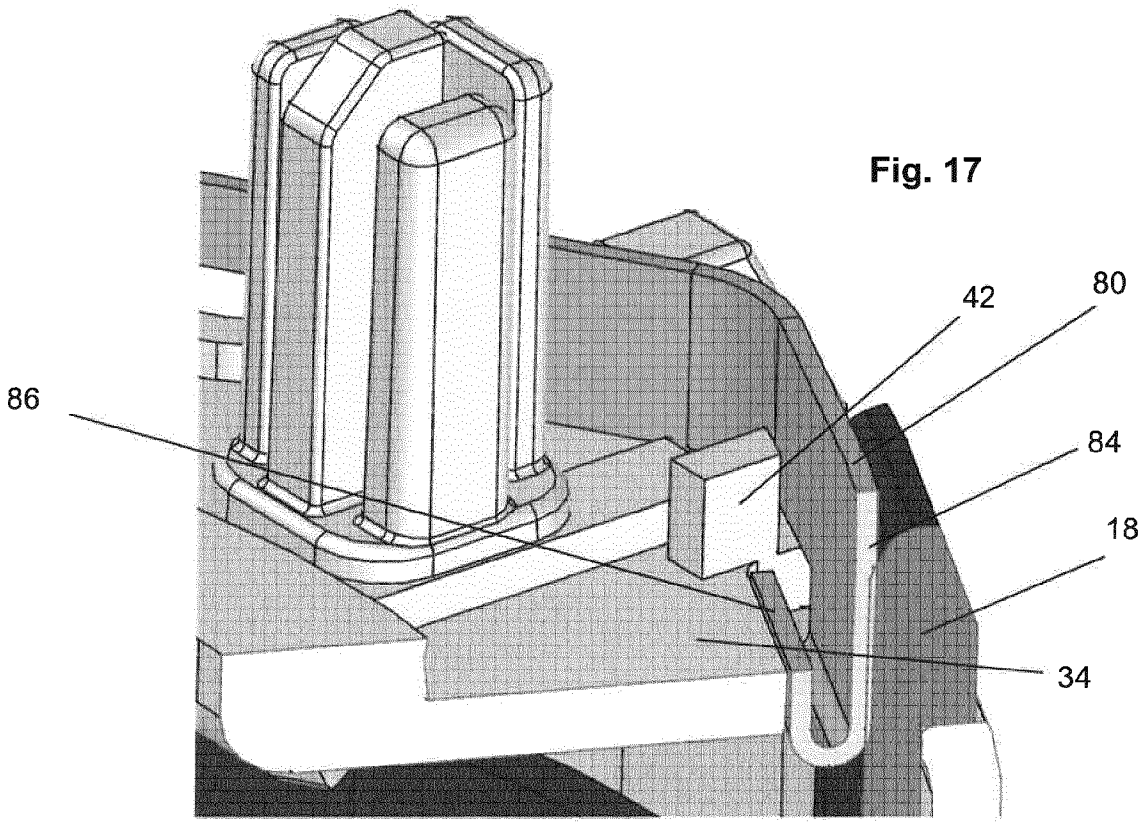



Fig. 17

# INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2019/052970

A. CLASSIFICATION OF SUBJECT MATTER
INV. B60R21/217 B60R21/203 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

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 | EP 1 251 045 A2 (TRW AUTOMOTIVE SAFETY SYS GMBH [DE]) 23 October 2002 (2002-10-23) paragraphs [0009] - [0016]; figures 1,2 | 1-3,5-7, 12,14-17 |
| X | US 5 685 557 A (PERSSON DAN [SE] ET AL) 11 November 1997 (1997-11-11) column 2, line 27 - column 3, line 5; figures 2,3 | 1-3,5,6 |
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| A | US 2002/043786 A1 (SCHUTZ DOMINIK [DE]) 18 April 2002 (2002-04-18) paragraphs [0020] - [0025]; figures 1-4 | 14-17 |

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

☒ See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"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

"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

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"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 20 March 2019 | 28/03/2019 |

| Name and mailing address of the ISA/ | Authorized officer |
|---|---|
| European Patent Office, P.B. 5818 Patentlaan 2<br>NL - 2280 HV Rijswijk<br>Tel. (+31-70) 340-2040,<br>Fax: (+31-70) 340-3016 | Petersson, Magnus |

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2019/052970

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