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- (73) Patenthaver: **Knaus Tabbert AG, Helmut-Knaus-Strasse 1, 94118 Jandelsbrunn, Tyskland**
- (72) Opfinder: **Kornexl, Christian, Kapellenstr. 13, 94133 Röhrnbach, Tyskland**
- (74) Fuldmægtig i Danmark: **CHAS. HUDE A/S, Langebrogade 3B, 1411 København K, Danmark**
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Description

[0001] The present invention relates to an insulating element for the production of frame parts, in particular of frame parts for the production of recreational vehicles (as e.g. trailers, camper vans etc.), and to a method for producing an insulating element of this kind. Such insulating elements and methods for producing such insulating elements are known from the state of the art. Thus, such insulating elements are often produced in the form of PU mold parts in special casting tools by introducing, for example, polyurethane into a correspondingly formed casting tool. There, the polyurethane can foam and cure so that, after the cured polyurethane has been removed, a mold part corresponding to the shape of the casting tool is present.

[0002] In order to achieve a higher stability, the mold parts produced in such a manner are often encased with a sheath which usually also consists of polyurethane. Thus, it is known from DE 10 2010 025 137 B4 to embed a lightweight construction core made of a polyurethane lightweight foam with a supporting, fiber-reinforced polyurethane system in foam. The disadvantage of the mold parts produced by means of a method of this kind consists in the reinforcing fibers in the sheath showing on the surface of the mold part, which, of course, has negative effects on the look and feel of the mold part. Furthermore, the rigidity and stability of the mold parts produced in such a manner is not optimal.

[0003] US 5 173 227 A describes an insulating element having a base body made of a hardenable plastic and at least two sheet-like reinforcing elements integrated into the hardenable plastic.

[0004] A similar element is also disclosed in US 2016/0214548 A1.

[0005] DE 10 2015 005 504 A1 describes a method for producing a fiber-reinforced plastic component in an RTM process. In this method, a fiber semi-finished product is three-dimensionally shaped in a preforming step to form a preform. In an injection step, this preform is inserted into a tool cavity of an injection tool. After that, the fiber semi-finished product is embedded in foam.

[0006] DE 10 2013 006 300 A1 relates to a method for producing a structural component by providing a lightweight construction core which is surrounded by a foam mass.

5 **[0007]** JP H03 124411 A describes a method for producing a lightweight component in a tool cavity using polyurethane.

[0008] US 4 379 103 A describes a method having the features of the preamble of claim 1.

[0009] GB 1 163 501 A describes fiber-reinforced plastic products which can comprise among other things polyurethane.

10 **[0010]** The object of the invention at hand is to provide an insulating element and a method for producing an insulating element of this kind with which the disadvantages from the state of the art can be overcome. The object of the invention is in particular to provide an insulating element which has, in addition to an optimal look, also an improved stability and rigidity.

15 **[0011]** This object is attained by a method having the features of claim 1.

[0012] Since, in work step b) of the method according to the invention, at least two sheet-like reinforcing elements which are present separately from each other are inserted into the molding tool, an insulating element in which at least two sheet-like reinforcing elements, which are independent of each other, are integrated is
20 produced after subsequent work steps c) to e) have been performed. It has been found that, in particular due to the presence of two sheet-like reinforcing elements, for example of two glass fiber mats, a particularly high rigidity and stability of the insulating element can be achieved. This is of great advantage in particular when used in the production of elongated vehicle frame parts (as e.g. of rear pillars).

25 **[0013]** Moreover, the insulating element produced in such a manner can be used excellently as a core for further use in the production of special frame parts. Thus, the insulating element produced according to the invention can, in addition, be surrounded by an encasement, as for example a sheath made of compact

polyurethane. Such a further processing also reliably prevents the reinforcing elements located in the core from showing on the surface.

5 **[0014]** The polyurethane used in the method according to the invention contains a mold release agent. This mold release agent moves in the direction of the warm mold surfaces of the molding tool during the molding process and wets them.

10 **[0015]** In a particularly preferred variant of the method according to the invention, the sheet-like reinforcing elements are mats, woven fabric or knitted fabric, said sheet-like reinforcing elements being made preferably of glass fibers. It has been found that in particular glass fiber mats or glass fiber woven fabrics have a particularly positive influence on the rigidity and stability of the insulating element.

15 **[0016]** Advantageously, the sheet-like reinforcing elements are glass fiber mats having a weight of about 240 to 360 g/m². With glass fiber mats of this kind, particularly rigid and stable components can be produced which are as well characterized by a particular lightness.

20 **[0017]** In a particularly preferred variant of the method according to the invention, the flowable, curable plastic mass is polyurethane, in particular polyurethane having a foam density of about 70 kg/m³. In particular in the case of a polyurethane having the named foam density, insulating elements having a high rigidity and at the same time a particularly low weight can be produced.

25 Advantageously, the finished polyurethane foam has a U value comparable with polystyrene. With a polyurethane foam of this kind as a material for an insulating element to be produced, a particularly advantageous insulating effect can be obtained.

30 **[0018]** Advantageously, the mold parts of the molding tool are coated with a mold release agent before the sheet-like reinforcing elements are positioned on them. This ensures that the finished insulating element can again be removed without any problem.

35 **[0019]** Method step e) is followed by the following steps:

- f) disposing spacers at the insulating element;
- g) inserting the insulating element into a closeable foaming tool, the entire surface of the insulating element being kept at a distance from mold surfaces of the foaming tool by the spacers projecting from said insulating element;
- 5 h) surrounding the insulating element in the closed foaming tool with a curable plastic mass;
- i) allowing the plastic mass to cure in the foaming tool;
- j) opening the foaming tool and removing the now sheathed insulating element.

[0020] With the mentioned method steps, a sheathed insulating element having a
10 complete polyurethane foam core which has no defects can be produced. With a plastic sheath of this kind, a high rigidity at low weight is achieved. The sheath (outer layer) is completely closed and it is—depending on the thickness of the sheath—virtually precluded that reinforcing elements show on the surface of the insulating element. Preferably, the mold surfaces of the foaming tool are coated with
15 a mold release agent and/or a coating, in particular an in-mold coating, before work step g). Coating the mold surfaces with a mold release agent has the advantage that the finished insulating element can be removed from the foaming tool without any problem.

[0021] Coating the mold surfaces of the foaming tool with an in-mold coating is
20 particularly advantageous. This eliminates an entire work step in the form of a coating step. A further advantage with this procedure consists in the fact that the insulating element does not have to be ground or otherwise machined before being inserted into the foaming tool. During the in-mold coating, the coating forms a material bond with the plastic mass, in particular with the polyurethane foam.
25 Thereby, a UV stable, high-gloss surface of the finished insulating element is obtained. Between the foam core and the outer layer also exists a form-fitting connection and a material bond. As an example of such a coating, a water thinnable 2-component PU system (e.g. 2K-Hydro-IMC-Topcoat of the company Fujichem Sonnenbom Limited) shall be named.

[0022] Advantageously, the curable plastic mass of the sheath is polyurethane,
30 in particular a compact polyurethane having a density of about $1,000 \text{ kg/m}^3$. With a

polyurethane of this kind, it is possible to envelop a polyurethane core produced in lightweight construction with a particularly rigid sheath. In such a manner, a particularly rigid and stable component is produced, said component, in addition, being characterized by a particularly low weight.

5 **[0023]** Advantageously, the spacers are pressed into the insulating element in step f). For this purpose, the spacers preferably have needle-like or nail-like elements which allow the spacers to be pressed into the insulating element particularly simply and easily. Due to the pressable spacers, it is easily possible to completely freely select the position of these spacers. This, in turn, makes it possible
10 to produce an optimal position of the insulating element in the foaming tool.

[0024] The invention at hand furthermore relates to an insulating element produced by means of a method according to the invention and comprising a base body made of a hardenable plastic and at least two sheet-like reinforcing elements integrated into the hardenable plastic, the hardenable plastic being polyurethane.

15 **[0025]** The advantages of the insulating element according to the invention have already been presented in the context of the method according to the invention. At this point, the advantageous effect which can be achieved by means of the at least two sheet-like reinforcing elements shall be pointed out once again. By means of the at least two sheet-like reinforcing elements which are independent of each other a
20 particularly high rigidity and stability of the insulating element is achieved. This is of great use in particular with elongated frame parts of vehicles, in particular of recreational vehicles.

[0026] As also presented in the context of the method according to the invention, the sheet-like reinforcing elements preferably are mats, woven fabric or
25 knitted fabric. Advantageously, these structures are made of glass fibers.

[0027] Preferably at least two sheet-like reinforcing elements are disposed at a distance from each other. This contributes to an even higher rigidity and stability of the insulating element.

5 **[0028]** Advantageously, the hardenable plastic is polyurethane having a foam density of about 70 kg/m^3 . This polyurethane preferably has a U value comparable with polystyrene. The advantages of this material have already been discussed in the context of the method according to the invention and also apply to the insulating element according to the invention.

[0029] Advantageously, the base body of the insulating element according to the invention has a sheathing, in particular a sheathing made of polyurethane. The advantages of a sheathing of this kind have also already been presented above.

10 **[0030]** The subsequent description of preferred exemplary embodiments of the invention in connection with the drawings and the dependent claims provides further features of the invention. The individual features can be realized individually or in combination with each other.

[0031] In the drawings:

15 Figures 1 to 6: show the schematic flow of a method according to the invention;

 Figure 7a: shows a side view of a spacer used in the method according to the invention and/or in the insulating element according to the invention;

 Figure 7b: shows a top view of the spacer of Figure 7a.

20 **[0032]** With reference to Figures 1 to 6, now, a preferred method variant of the method according to the invention shall be illustrated:

 As shown in Figure 1, initially, a two-part openable and closable molding tool 1 having a lower mold part 1a and an upper mold part 1b is provided. Figure 1 shows molding tool 1 in the opened state in which mold parts 1a and 1b are separated from
25 each other.

[0033] In Figures 1 to 3, molding tool 1 and mold parts 1a and 1b are illustrated in cross section.

[0034] Initially, mold surfaces 16a and 16b of mold parts 1a and 1b are coated with a mold release agent (not shown in the case at hand). Subsequently, a glass fiber mat 2a is molded onto mold surface 16a of lower mold part 1a. A glass fiber mat 2b is also molded onto mold surface 16b of upper mold part 1b.

5 **[0035]** In a next step, molding tool 1 is closed. The closed state of molding tool 1 is illustrated in Figure 2. In the closed state of molding tool 1, mold parts 1a and 1b form a cavity 3, said cavity representing the three-dimensional outer shape of the insulating element which is to be produced in a first step. In the closed state of the molding tool, mold parts 1a and 1b are connected to each other. In the closed state
10 of molding tool 1 shown in Figure 2, glass fiber mats 2a and 2b are located in cavity 3, glass fiber mats 2a and 2b being disposed at a distance from each other in cavity 3 and not contacting each other.

[0036] In a next step, a flowable, curable plastic mass in the form of polyurethane 4 having a foam density of approximately 70 kg/m^3 is introduced into
15 cavity 3 of molding tool 1. Then, initially flowable polyurethane 4 is allowed to cure in cavity 3. After polyurethane 4 is cured, molding tool 1 is opened by separating mold parts 1a and 1b and finished insulating element 5 according to the invention can be taken out. This is illustrated in Figure 3. On its surface, insulating element 5 has the two glass fiber mats 2a and 2b which are present separately from each other.
20 In the example at hand, the glass fiber mats are mats having a weight of approximately 300 g/m^2 .

[0037] In the method variant at hand, insulating element 5 is further processed, wherein, now, the following further method steps follow.

25 **[0038]** Initially, spacers in the form of fixing pins 6 are pressed into insulating element 5 which is illustrated in cross section in Figure 3. This method step is also illustrated in Figure 3 which shows insulating element 5 with fixing pins 6. An example of a fixing pin is illustrated in Figures 7a and 7b. Fixing pins 6 have a piercing spike 7 which is pressed into insulating element 5. Piercing spike 7 of a fixing pin 6 is positioned in the center of a circular base plate 8. On the other side of

base plate 8, a rounded spacer knob is disposed also centrally. Fixing pins 6 are manufactured of thermoplastic.

5 **[0039]** Figure 4 also again shows insulating element 5 with fixing pins 6, insulating element 5 being illustrated in cross section in an upper illustration and in a top view in a lower illustration.

10 **[0040]** In a next step, insulating element 5 with fixing pins 6, which serve as spacers, is now inserted into a foaming tool 10. Foaming tool 10 also comprises— analogous to molding tool 1—a lower mold part 11a and an upper mold part 11b. In advance, mold surfaces 12 of mold parts 11a and 11b of foaming tool 10 have been coated with an in-mold coating.

15 **[0041]** Mold parts 11a and 11b are separated from each other in the opened state of foaming tool 10. In this state, insulating element 5 is also inserted into foaming tool 10. Then, molding tool 10 is closed by joining mold parts 11a and 11b together. This state is illustrated in Figure 5. By means of fixing pins 6, the entire surface of insulating element 5 is kept at a distance from mold surfaces 12 of foaming tool 10. As can be well seen in Figure 5, in particular spacer knobs 9 of fixing pins 6 keep the surface of insulating element 5 at a distance from mold surfaces 12 of foaming tool 10 by spacer knobs 9 contacting mold surfaces 12 of foaming tool 10.

20 **[0042]** In the illustration at hand (Figure 5), the illustration of glass fiber mats 2a and 2b located at the periphery of insulating element 5 was dispensed with for a better overview.

25 **[0043]** In the next step, insulating element 5 in closed foaming tool 10 is surrounded with a curable plastic mass in the form of compact polyurethane which has a density of approximately $1,000 \text{ kg/m}^3$.

[0044] Then, the polyurethane is allowed to cure in the foaming tool. After that, foaming tool 10 is opened by separating mold parts 11a and 11b and insulating element 5 which is now sheathed is taken out of the foaming tool. This insulating element 5 is illustrated in Figure 6. It comprises now a core 13 made of lightweight polyurethane having two glass fiber mats disposed at the periphery of the core. This

core is surrounded by a sheath 14 of compact polyurethane. Since mold surfaces 12 of foaming tool 10 have been coated with in-mold coating before insulating element 5 is inserted into foaming tool 10, sheath 14 has a thin layer 15 of in-mold coating on its surface. Due to this procedure, an entire coating step can be eliminated. Base plates 8 and spacer knobs 9 of fixing pins 6 are laid in foam in sheath 14.

[0045] As already pointed out in the description introduction, the insulating element produced by means of the above-described method has different advantages. By means of foam core 13 having integrated glass fiber mats 2a and 2b, a high rigidity of foam core 13 is achieved. By sheathing core 13 with sheath 14, a high rigidity of the entire element at low weight is achieved. Furthermore, a completely closed outer layer is obtained. A material bond exists between core 13 and sheath 14.

[0046] The material of core 13 preferably has the following technical properties:

- compressive stiffness 700 mPa +/- 150 mPa;
- shrinkage behavior 0.2 % +/- 0.1;
- weight/density 70 kg/m³ +/- 30 kg/m³.

[0047] Concerning the technical properties of the sheath material:

- shrinkage behavior 0.1 % +/- 0.2;
- weight/density 1,000 kg/m³ +/- 200 kg/m³;
- viscosity of the individual components approximately 1,000 mPa*s -500/+ 200 mPa*s.

[0048] It is also advantageous that both the core material and the sheath material can be set to be incombustible or at least flame-retardant.

[0049] Concerning the technical properties of the in-mold coating:

- solvent-containing or water-based
- quick-drying—approximately 60 seconds at a tool temperature of 50°C;
- UV-resistant
- weather-resistant—analogue to a general vehicle coating

[0050] Insulating element 5 illustrated above is in the present case the rear pillar of a motor home.

Patentkrav

1. Fremgangsmåde til fremstilling af et isoleringselement til fremstilling af ram-
5 medele, omfattende følgende trin:

- 10 a) tilvejebringelse af et mindst to-delt formeværktøj (1), som kan åbnes og lukkes, med mindst en første støbt formdel (1a) og en anden formdel (1b), hvilke formdele i den lukkede tilstand for formeværktøjet danner et hulrum (3) og gengiver den tredimensionale, ydre form af isoleringselementet, hvorved formdelene i den lukkede tilstand for formeværktøjet er forbundet med hinanden og i den åbnede tilstand for formeværktøjet i det mindste delvist er adskilt fra hinanden;
- 15 b) anbringelse af mindst et plade-lignende forstærkningselement (2a) på den første støbeformdel (1a) og mindst et plade-lignende forstærkningselement (2b) på den anden formdel (1b), hvorved de plade-lignende forstærkningselementer i den lukkede tilstand for formeværktøjet befinder sig i det af formdelene dannede hulrum (3);
- 20 c) indføring af den flydbare, hærdbare plastmasse (4) i det af formeværktøjets formdele dannede hulrum (3);
- d) hærdning af plastmassen i formeværktøjet;
- e) åbning af formeværktøjet og fjernelse af det således dannede isoleringselement (5),
- 25 hvorved det ved den flydbare, hærdbare plastmasse drejer sig om polyurethan (4),
- hvorved polyurethanet indeholder adskillelsesmidler, hvorved der til fremgangsmådetrinnet e) slutter sig følgende trin:

f) anbringelse af afstandsholdere (6) på isoleringselementet (5);

- g) indsættelse af isoleringselementet (5) i et opskumningsværktøj (10), der kan åbnes og lukkes, hvorved hele overfladen af isoleringselementet holdes i en afstand fra opskumningsværktøjets (10) formeflader (12) ved hjælp af afstandsholderne (6), som rager ud fra isoleringselementerne;
- h) omgivelse af isoleringselementet (5) i det lukkede opskumningsværktøj (10) med en hærdbar plastmasse (14);
- i) tilladelse for plastmassen til at hærde i opskumningsværktøjet (10);
- j) åbning af formeværktøjet og fjernelse af det nu omsluttede isoleringselement (5).

2. Fremgangsmåde ifølge krav 1,
kendetegnet ved, at de plade-lignende forstærkningselementer er måtter (2a, 2b) af vævet eller strikket stof, hvorved disse fortrinsvis er fremstillet af glasfibre.

3. Fremgangsmåde ifølge krav 2,
kendetegnet ved, at de plade-lignende forstærkningselementer er glasfibermåtter med en vægt på cirka 240 til 360 g/m².

4. Fremgangsmåde ifølge et af de foregående krav,
kendetegnet ved, at den flydbare, hærdbare plastmasse er polyurethan (4) med en skumdensitet på cirka 70 kg/m³, hvorved det færdige polyurethanskum fortrinsvis har en U-værdi, der er sammenlignelig med polystyrens.

5. Fremgangsmåde ifølge et af de foregående krav,
kendetegnet ved, at formefladerne (12) i opskumningsværktøjet (10) coats med et adskillelsesmiddel og/eller en coating, navnlig en i-formen-coating (15) før arbejdsstrin g).

6. Fremgangsmåde ifølge et af de foregående krav,
kendetegnet ved, at den hærdbare plastmasse er polyurethan (14), navnlig en kompakt polyurethan med en densitet på cirka 1000 kg/m³.

7. Fremgangsmåde ifølge et af de foregående krav,

kendetegnet ved, at afstandsholderne (6) presses ind i isoleringselementet (5) i trin f).

5

8. Isoleringselement, realiseret ved en fremgangsmåde ifølge et af kravene 1 til 8, hvilket isoleringselement omfatter et basislegeme af hærdbar plast (4) og i det mindste to plade-lignende forstærkningselementer (2a, 2b), som er integreret i den hærbare plast, hvorved den hærbare plast er polyurethan.

10

9. Isoleringselement ifølge krav 8,

kendetegnet ved, at de respektive mindst to plade-lignende forstærkningselementer er en måtte (2a, 2b), et vævet stof og/eller et strikket stof, hvorved det fortrinsvis er fremstillet af glasfibre.

15

10. Isoleringselement ifølge krav 8 eller 9,

kendetegnet ved, at de mindst to plade-lignende forstærkningselementer (2a, 2b) er anbragt med en indbyrdes afstand.

20

11. Isoleringselement ifølge et af kravene 8 til 10,

kendetegnet ved, at den hærbare plast er polyurethan med en skumdensitet på cirka 70 kg/m^3 , hvorved polyurethanet fortrinsvis har en U-værdi, som er sammenlignelig med polyurethans U-værdi.

25

12. Isoleringselement ifølge et af kravene 8 til 11,

kendetegnet ved, at det omfatter en kappe af hærdbar plastmasse, fortrinsvis polyurethan, navnlig kompakt polyurethan med en densitet på cirka 1000 kg/m^3 .

1/6

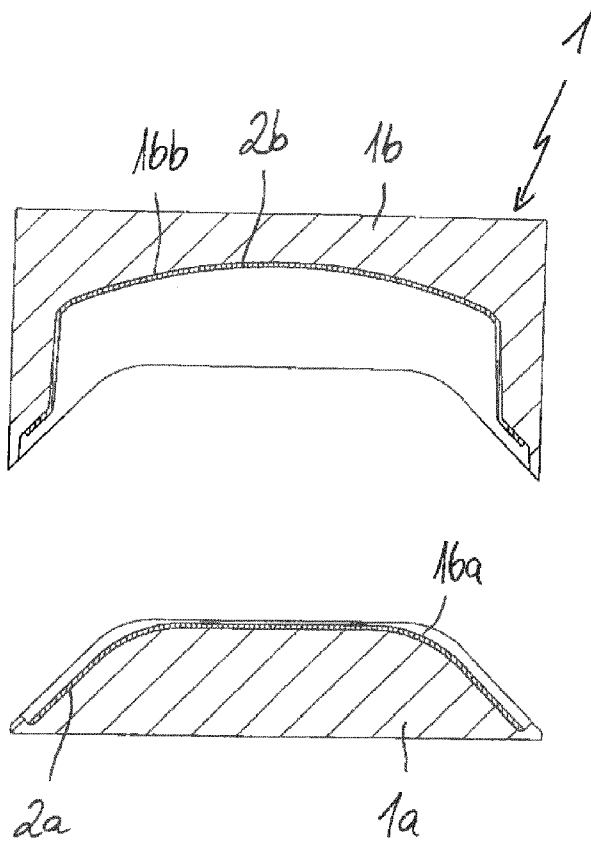


Fig. 1

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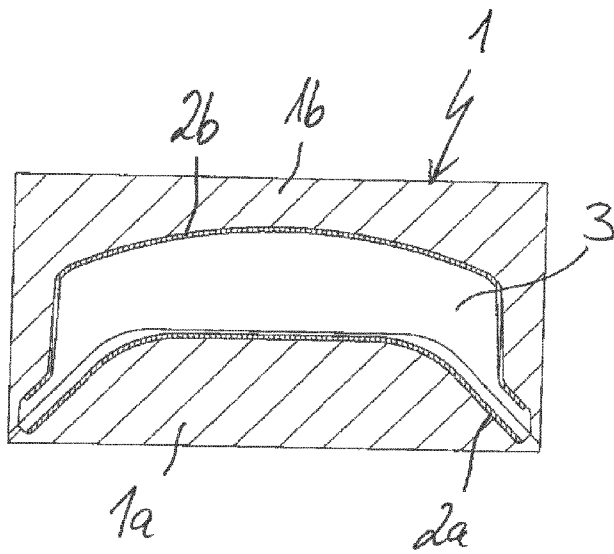


Fig. 2

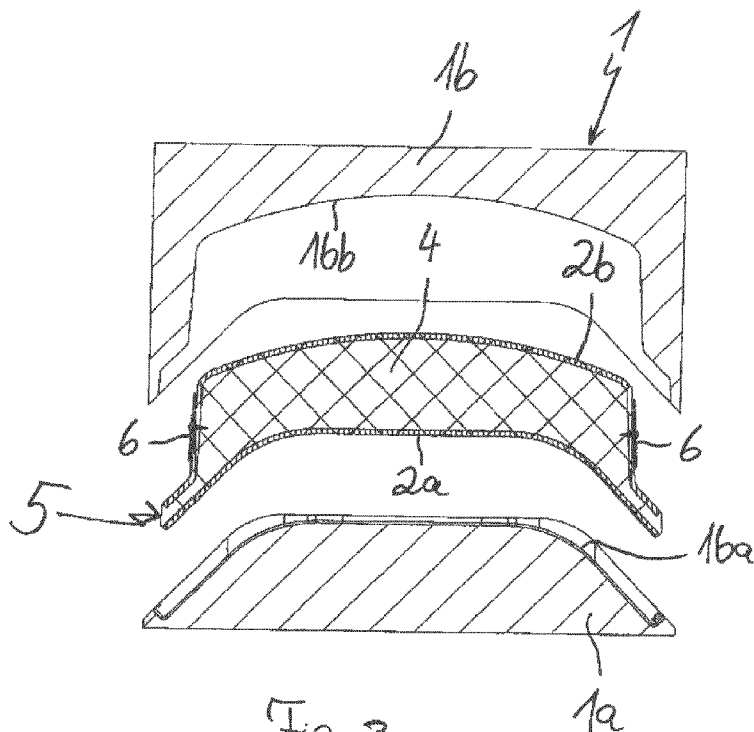
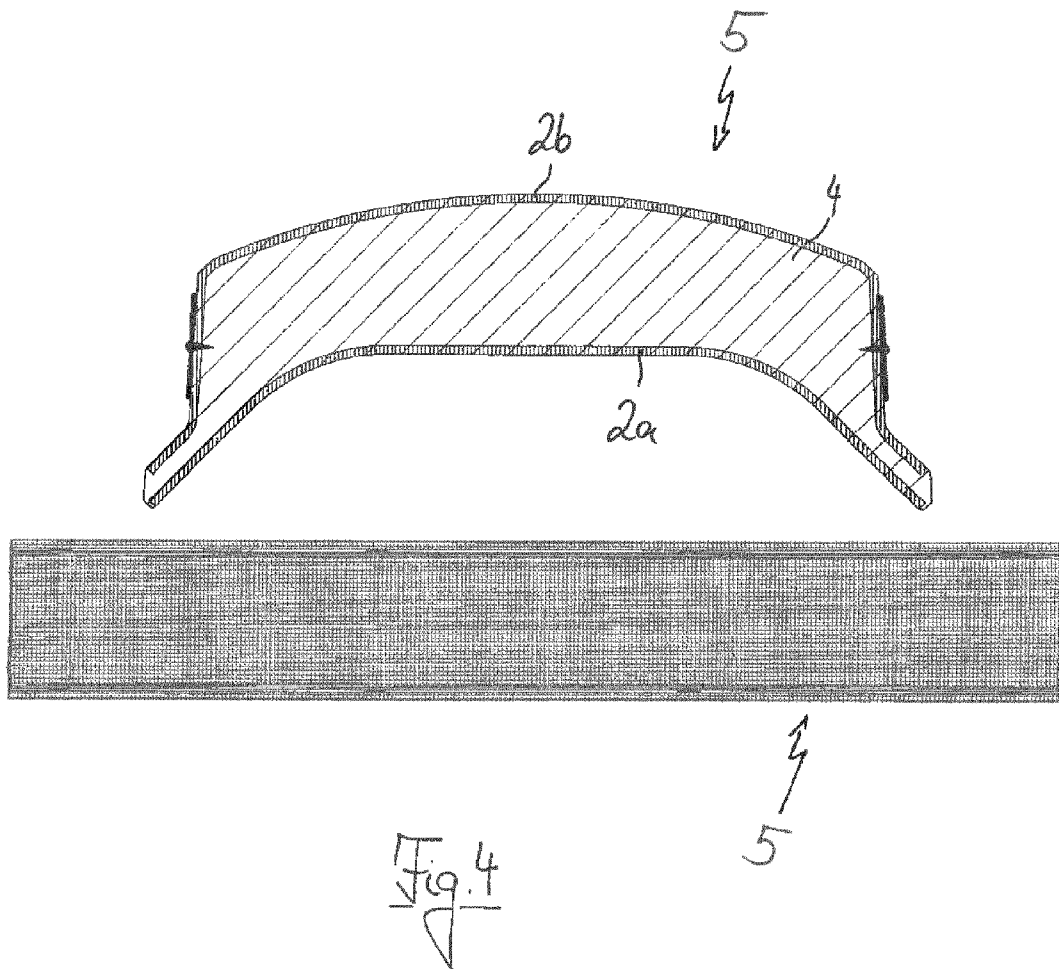


Fig. 3

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4/6

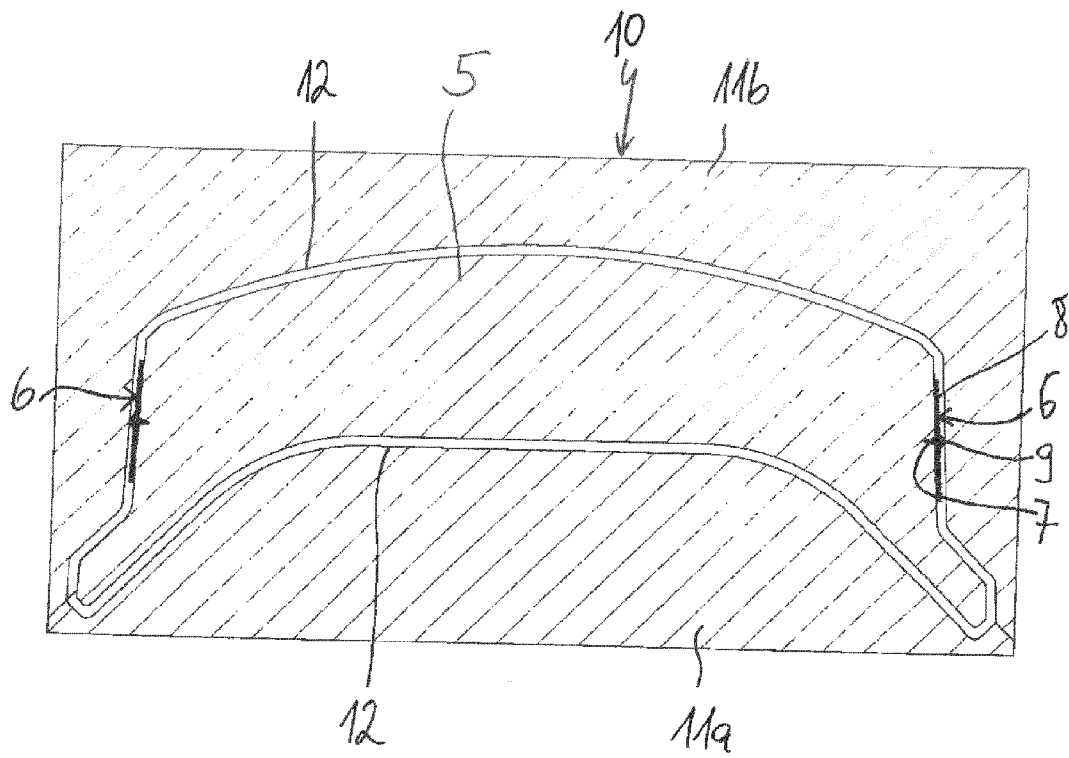


Fig. 5

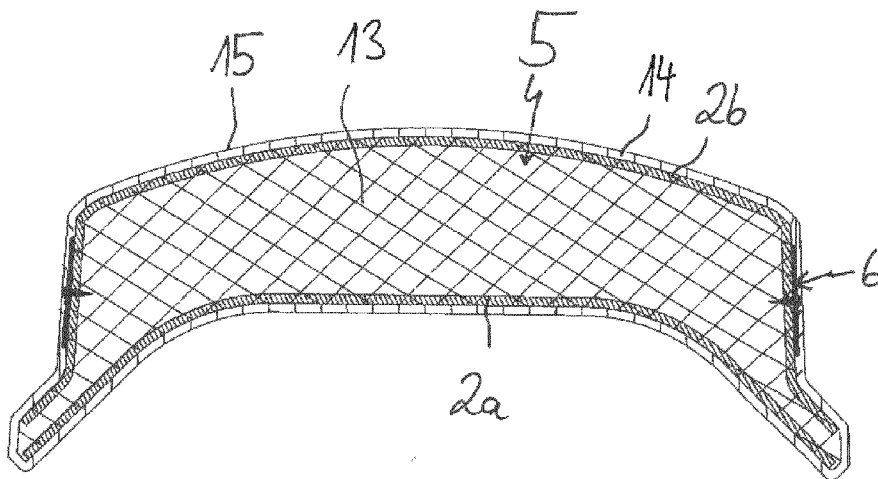


Fig. 6

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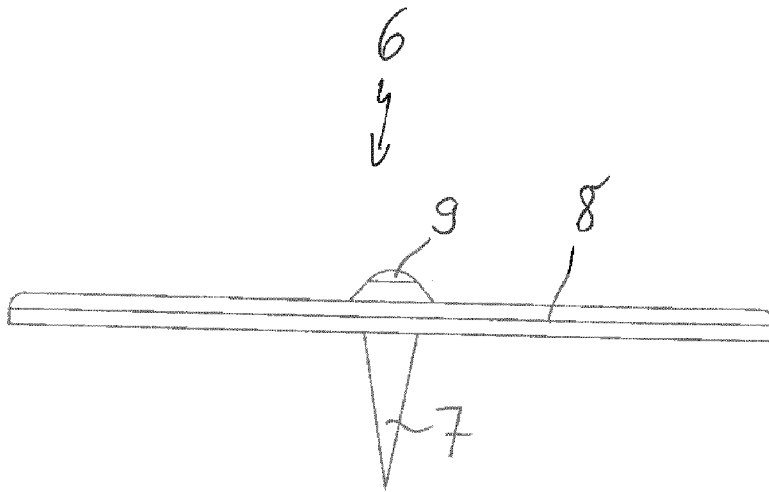


Fig. 7a

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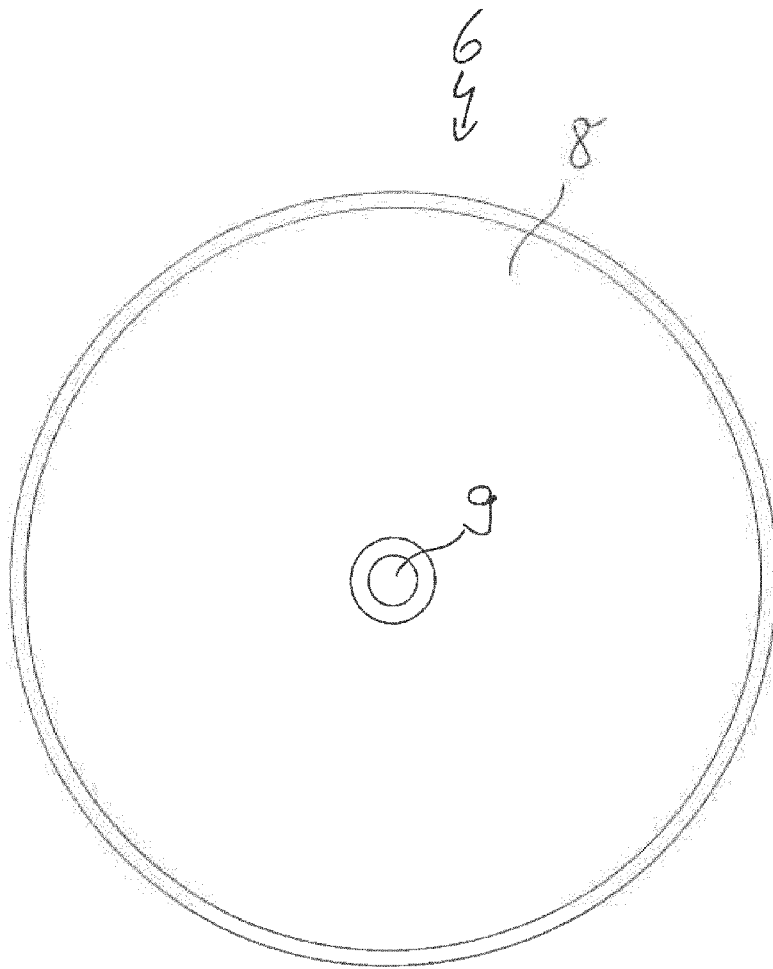


Fig. 7b