



(11)

EP 4 509 001 A1

(12)

## EUROPEAN PATENT APPLICATION

(43) Date of publication:  
19.02.2025 Bulletin 2025/08

(51) International Patent Classification (IPC):  
A42B 3/12 (2006.01)

(21) Application number: 23192526.4

(52) Cooperative Patent Classification (CPC):  
A42B 3/127; A42B 3/125

(22) Date of filing: 21.08.2023

(84) Designated Contracting States:  
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB  
GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL  
NO PL PT RO RS SE SI SK SM TR  
Designated Extension States:  
BA  
Designated Validation States:  
KH MA MD TN

(30) Priority: 17.08.2023 PT 2023118872

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## (54) A REINFORCED INNER STRUCTURE FOR A HELMET

(57) The present disclosure generally relates to an inner structure for a helmet which is a helmet, such as a safety helmet having a main body which includes the inner structure (or shell) and an outer shell, where the safety helmet may consist of a motorcycle helmet. The present disclosure includes a reinforced inner structure for a helmet comprising an inner shell comprising a plurality of inner shell parts which engage and interlock

forming a unitary inner shell and providing a space in which the head of a user is placeable and which is protective against an impact. The said inner shell parts are plastic parts, and are configured to engage in each other by pressure fit and are such that each inner shell part covers only a portion of the head of the user. The present solution provides a glue-less solution of an inner structure for a helmet.

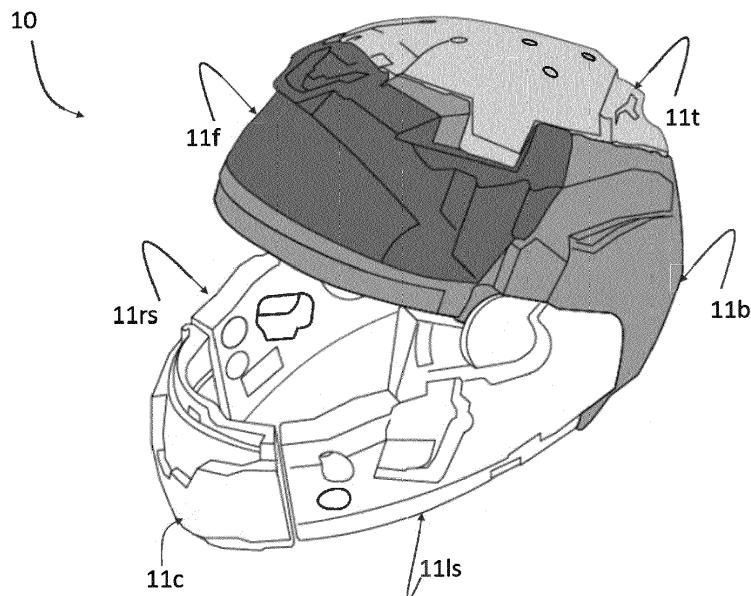


Figure 1

**Description****AREA OF THE DISCLOSURE**

**[0001]** The present disclosure generally relates to an inner structure for a helmet which is a helmet, such as a safety helmet having a main body which includes the inner structure (or shell) and an outer shell, where the safety helmet may consist of a motorcycle helmet.

**PRIOR ART**

**[0002]** Safety helmets and, in particular, motorcycle safety helmets, are known in the art as having several different details which seek to protect the user as much as possible in case of impact, while maintaining a balance with other relevant features, such as usability, which may include a proper breathability or visibility, or other aspects such as the ease of assembly and disassembly.

**[0003]** As referred, typically helmets are formed as generally having an outer shell and an inner structure which couples to the outer shell, forming the helmet.

**[0004]** Inner structures are usually composed of different parts, these parts being coupled through known coupling means and further glued to each other, to guarantee a proper maintenance of integrity of the helmet while in use and in case of crash.

**[0005]** Common solutions include the provision of support plates which couple to the outer shell and of cushion means which are glued to the support plates. Other variations exist.

**[0006]** Whichever is the case, glue is employed, highly hindering the ability to disassembly and reuse/recycle the inner structure and thereby the helmet.

**[0007]** The present solution thereby provides an alternative and improved solution as regards prior art, while maintaining a full protection for the user.

**SUMMARY OF THE DISCLOSURE**

**[0008]** The present disclosure includes a reinforced inner structure for a helmet. The inner structure comprises an inner shell which in turn comprises a plurality of inner shell parts which engage and interlock in each other forming a unitary inner shell and providing a space in which the head of a user is placeable and which is protective against an impact.

**[0009]** The said inner shell parts are plastic parts, and are configured to engage in each other by pressure fit and are such that each inner shell part covers only a portion of the head of the user.

**[0010]** The present disclosure also comprises a reinforced helmet which in turn comprises the inner structure of the present disclosure and an outer shell, the inner structure being at least partially provided within the outer shell, and wherein the inner structure and outer shell are removably couplable to one another.

**[0011]** The present disclosure may further comprise

the use of the inner structure of the present disclosure as an inner structure of a helmet. Such helmet may be a helmet according to the UN ECE 22.06 regulation, or a motorcycle helmet.

**DESCRIPTION OF THE FIGURES****[0012]**

5 **Figure 1** - a perspective representation of an inner structure (10) according to the present disclosure, such inner structure (10) being suitable to, when combined with an outer shell, provide a helmet, in particular a motorcycle safety helmet. The inner structure (10) comprises six inner shell parts. A base inner shell part (11b) is provided, as well as four further inner shell parts. Moreover, a chin inner shell part (11c) is provided.

10 One of the further inner shell parts is a forehead inner shell part (11f) which, as represented in the figure, covers the forehead of a user. Another further shell part consists of a top inner shell part (11t). This further inner shell part engages and interlocks with the base inner shell part (11b) is provided, as well as with the forehead inner shell part (11f). In addition, two side inner shell parts are provided. Each of the side inner shell parts individually engages and interlocks with the base inner shell part (11b). Thus, a left (11ls) and a right side inner shell part (11rs) are provided. The chin inner shell part (11c) engages and interlocks with each of the side inner shell parts, thus providing a unitary inner shell.

15 **Figure 2** - a side exploded view of the inner structure (10) of figure 1.

20 **Figure 3a** - a side view representation of an inner shell with two inner shell parts, in particular a base inner shell part (11b) and a further inner shell part which consists of a forehead inner shell part (11f). The forehead inner shell part (11f) comprises projections which engage and interlock in corresponding cavities (21) provided in the base inner shell part (11b). In particular the forehead inner shell part (11f) comprises two front projections (22), which engage and interlock with corresponding cavities (21) of the base inner shell part (11b) (only one of the projections is shown). Moreover, the forehead inner shell part (11f) comprises two rear projections (24), which engage and interlock with corresponding cavities (21) of the base inner shell part (11b) (only one of the cavities (21) is shown). While assembling an inner structure (10), this engagement and interlocking may be the first step being performed.

25 **Figure 3b** - a side view representation of an inner shell with three inner shell parts. This stage of assembly is subsequent to that of Figure 3a. Thus, Figure 3b contains one additional further inner shell part, which consists of a top inner shell part (11t). The top inner shell part (11t) comprises projections which

engage and interlock in corresponding cavities (21) provided in the base inner shell part (11b) and forehead inner shell part (11f). In particular the top inner shell part (11t) comprises two front projections (22), which engage and interlock with corresponding cavities (21) of the forehead inner shell part (11f) and base inner shell part (11b) [the two projections are shown, as well as one of the corresponding cavities (21) of each of the base (11b) and forehead inner shell parts (11f)]. Moreover, the top inner shell part (11t) comprises two rear projections (24), which engage and interlock with corresponding cavities (21) of the base inner shell part (11b) (not shown). While assembling an inner structure (10), this engagement and interlocking may be the second step being performed.

Figure 3c - a side view representation of an inner shell with five inner shell parts. This stage of assembly is subsequent to that of Figure 3b. Thus, Figure 3c contains two additional further inner shell parts, which consists of two side inner shell parts (11ls, 11rs). Each of the side inner shell parts (11ls, 11rs) comprises a projection which engages and interlocks in a corresponding cavity (21) provided in the base inner shell part (11b) (only one projection is shown). While assembling an inner structure (10), this engagement and interlocking may be the third step being performed.

Figure 4 - a cross-section representation of an inner shell with five inner shell parts of figure 3b. The cross-section highlights the extension of a projection in a corresponding cavity (21), thus providing engagement and interlocking between inner shell parts.

Figure 5 - a perspective representation of an inner shell with five inner shell parts of figure 3b. The view highlights the engagement between the top inner shell part (11t) and the base (11b) and forehead inner shell parts (11f), in such a way that the engagement between projection of the top inner shell part (11t) and cavities (21) of the forehead and base inner shell part (11b) makes it impossible for the forehead inner shell part (11f) to move forward or up, thus promoting the interlocking between the inner shell parts and the formation of a unitary inner shell. The arrow pointing upwards in the figure represents a direction in which it is impossible for the two parts to move in relation to one another, due to the coupling between projection and corresponding cavity. In the same way, the arrow pointing left in the figure represents a direction in which it is impossible for the two parts to move in relation to one another, due to the coupling between projection and corresponding cavity.

Figure 6 - a cross-section representation of inner shell with five inner shell parts of figure 3b. The view highlights the engagement between the top inner shell part (11t) and the base (11b) and forehead inner shell parts (11f), in such a way that the engagement between projection of the top inner shell part (11t)

and cavities (21) of the forehead and base inner shell parts (11b) makes it impossible for the forehead inner shell part (11f) to move down, thus promoting the interlocking between the inner shell parts and the formation of a unitary inner shell. The arrows pointing downwards in the figure represent a direction in which it is impossible for the two parts to move in relation to one another, due to the coupling between projections and corresponding cavities.

Figure 7 - A top-perspective view of the inner shell with five inner shell parts of figure 3b, highlighting how the projections of the top inner shell part (11t) extend and engage with the cavities (21) of the forehead (11f) and base inner shell parts (11b).

Figure 8 - a cross-section representation of a helmet (100) according to the present disclosure, in which the inner structure (10) of figure 3c is coupled to an outer shell (50), being entirely provided within the outer shell (50). Moreover, two screws or bolts (30) cross through holes (31) formed in a side inner shell part (11rs, 11ls) providing engagement to the outer shell, and thus improving the coupling between the two.

## 25 DETAILED DESCRIPTION

**[0013]** The present disclosure includes a reinforced inner structure for a helmet.

**[0014]** The inner structure comprises an inner shell 30 which in turn comprises a plurality of inner shell parts which engage and interlock in each other forming a unitary inner shell.

**[0015]** The engagement of inner shell parts between 35 themselves, in such a way that they interlock between each other, provides the unitary inner shell. The inner shell parts are plastic parts, and such engagement and interlocking between plastic inner shell parts is such that they engage by pressure fit, again providing the unitary inner shell. which, when associated with the outer shell by means of the inner structure, provides the helmet.

**[0016]** The inner shell moreover provides a space in which the head of a user is placeable and which thereby 40 protects the head of the user against an impact, for instance upon a crash.

**[0017]** Each inner shell part covers only a portion of the head of the user and, thus, it is the engagement and interlocking of inner shell parts that overall provides the inner shell and the protection of the head of the user.

**[0018]** The inner shell parts may consist of 3, 4, 5, 6, 7 45 or more parts.

**[0019]** The engagement and interlocking of parts providing a unitary inner shell thereby enable that the inner structure is obtained without resource to glue. Avoiding the usage of glue in such way allows to simply the assembly and disassembly of the inner structure and, thus, of a helmet which comprises such inner structure. It thereby also reduces the ecological footprint of the inner structure and helmet.

**[0020]** The interlocking between at least two inner shell parts may be such that it prevents the movement of those two inner shell parts in one or more directions. Such interlocking enables that, through engaging/interlocking, the inner shell parts mutually prevent each other from moving in specific directions, promoting the integrity of the unitary inner shell.

**[0021]** The interlocking between at least two inner shell parts may be such that it prevents such two inner shell parts to move towards the top, the bottom, the front or the rear of the inner shell.

**[0022]** The composition of the inner shell parts may be styrene-based. Such composition promotes the absorption of energy during a collision. Advantageously, the inner shell parts are composed of expanded polystyrene (EPS), thereby better absorbing the energy from an impact through compression.

The pressure fit engageable inner shell parts are not glued to each other.

**[0023]** The inner shell parts may all have a same composition, thus improving the engagement of such parts.

**[0024]** The inner shell parts may comprise a base inner shell part and a plurality of further inner shell parts, wherein the further inner shell parts interlock at least with the base inner shell part to form the unitary inner shell, each of the base and further inner shell parts covering only a portion of the head of the user.

**[0025]** A further inner shell part may consist of a forehead inner shell part, being adapted to, when interlocked with the base inner shell part, cover the forehead of a user.

**[0026]** A further inner shell part may consist of a top inner shell part, being adapted to, when interlocked with the base inner shell part and the forehead inner shell part, cover the top of the head of a user.

**[0027]** A further inner shell part may consist of a side inner shell part, being adapted to, when interlocked with the base inner shell part, cover a cheek and at least part of the jaw of a user.

**[0028]** The inner structure may comprise two side inner shell parts, each of the side inner shell parts being adapted to, when interlocked with the base inner shell part, cover one of the cheeks and corresponding part of the jaw of a user.

**[0029]** The inner structure may further comprise a chin inner shell part, the chin inner shell part being adapted to, when interlocked with the two side inner shell parts, cover the chin of a user.

**[0030]** The inner structure may be so configured that a section for the user to look through and in which a face shield is attachable is provided.

**[0031]** The inner shell parts may be such that the interlocking is provided by one or more cavities formed in one inner shell part and one or more projections in a corresponding interlocking inner shell part, the pressure fit interlocking being provided by the pressure fit coupling between a cavity and a projection.

**[0032]** Each inner shell part may comprise either one or more cavities or one or more projections for the coupling with another inner shell part.

**[0033]** The present disclosure further includes a reinforced inner structure for a helmet.

**[0034]** The helmet comprises the inner structure of the present disclosure and an outer shell, the inner structure being at least partially provided within the outer shell, and wherein the inner structure and outer shell are removably couplable to one another.

**[0035]** The inner structure may be entirely provided within the outer shell.

**[0036]** The helmet may comprise a movable face shield, whereby the face shield provides an area for the user to see through while using the helmet. The assembly formed by the inner structure and the outer shell engages with the movable face shield.

**[0037]** The helmet may be further configured such that it is according to the UN ECE 22.06 regulation.

**[0038]** The helmet may consist of a motorcycle helmet, a motorcycle safety helmet.

**[0039]** Further examples of the inner structure of the present disclosure are herein presented.

**[0040]** This system is composed by several Internal parts of EPS, composed by Main EPS, Front reinforcement EPS and Top EPS attached to motorcycle helmet shell without the using of glue.

**[0041]** As will be clear to one skilled in the art, the present invention should not be limited to the embodiments described herein, and a number of changes are possible which remain within the scope of the present invention.

**[0042]** Of course, the preferred embodiments shown above are combinable, in the different possible forms, being herein avoided the repetition all such combinations.

## Claims

**1.** A reinforced inner structure for a helmet, the inner structure comprising an inner shell which in turn comprises a plurality of inner shell parts which engage and interlock in each other forming a unitary inner shell and providing a space in which the head of a user is placeable and which is protective against an impact, wherein the said inner shell parts are plastic parts, are configured to engage in each other by pressure fit and are such that each inner shell part covers only a portion of the head of the user.

**2.** An inner structure according to the previous claim wherein the interlocking between at least two inner shell parts is such that it prevents the movement of those two inner shell parts in one or more directions, optionally preventing the two inner shell parts to move towards the top, the bottom, the front or the

rear of the inner shell.

3. An inner structure according to any of the preceding claims wherein the composition of the inner shell parts is styrene-based. 5

4. An inner structure according to the previous claim wherein the inner shell parts are composed of expanded polystyrene (EPS). 10

5. An inner structure according to any of the preceding claims wherein the pressure fit engageable inner shell parts are not glued to each other. 15

6. An inner structure according to any of the preceding claims wherein the inner shell parts all have a same composition. 20

7. An inner structure according to any of the preceding claims wherein the inner shell parts comprise a base inner shell part and a plurality of further inner shell parts, wherein the further inner shell parts interlock at least with the base inner shell part to form the unitary inner shell, each of the base and further inner shell parts covering only a portion of the head of the user. 25

8. An inner structure according to the previous claim wherein a further inner shell part consists of a forehead inner shell part, being adapted to, when interlocked with the base inner shell part, cover the forehead of a user. 30

9. An inner structure according to the previous claim wherein a further inner shell part consists of a top inner shell part, being adapted to, when interlocked with the base inner shell part and the forehead inner shell part, cover the top of the head of a user. 35

10. An inner structure according to any of the claims 6-9 wherein a further inner shell part consists of a side inner shell part, being adapted to, when interlocked with the base inner shell part, cover a cheek and at least part of the jaw of a user. 40

11. An inner structure according to the previous claim wherein it comprises two side inner shell parts, each of the side inner shell parts being adapted to, when interlocked with the base inner shell part, cover one of the cheeks and corresponding part of the jaw of a user and, optionally, it further comprises a chin inner shell part, the chin inner shell part being adapted to, when interlocked with the two side inner shell parts, cover the chin of a user. 45 50

12. An inner structure according to any of the preceding claims wherein the inner structure is so configured that a section for the user to look through and in which a face shield is attachable is provided. 55

13. An inner structure according to any of the preceding claims wherein the inner shell parts are such that the interlocking is provided by one or more cavities formed in one inner shell part and one or more projections in a corresponding interlocking inner shell part, the pressure fit interlocking being provided by the pressure fit coupling between a cavity and a projection and, optionally, each inner shell part comprises either one or more cavities or one or more projections for the coupling with another inner shell part.

14. A reinforced helmet comprising an inner structure according to any of the preceding claims and an outer shell, the inner structure being at least partially provided within the outer shell, and wherein the inner structure and outer shell are removably couplable to one another, wherein, optionally:

the helmet comprises a movable face shield, is configured such that it is according to the UN ECE 22.06 regulation, and/or is a motorcycle helmet.

15. Use of the inner structure of any of the claims 1-13 as an inner structure of a helmet, such as a helmet according to the UN ECE 22.06 regulation, or such as a motorcycle helmet.

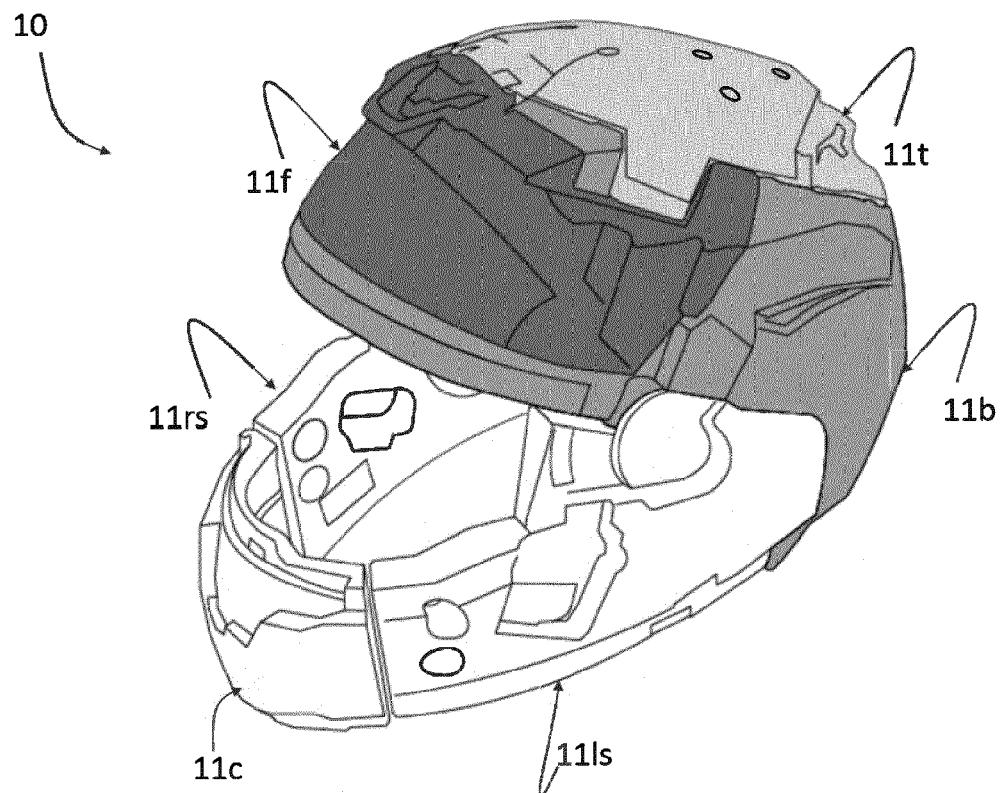


Figure 1

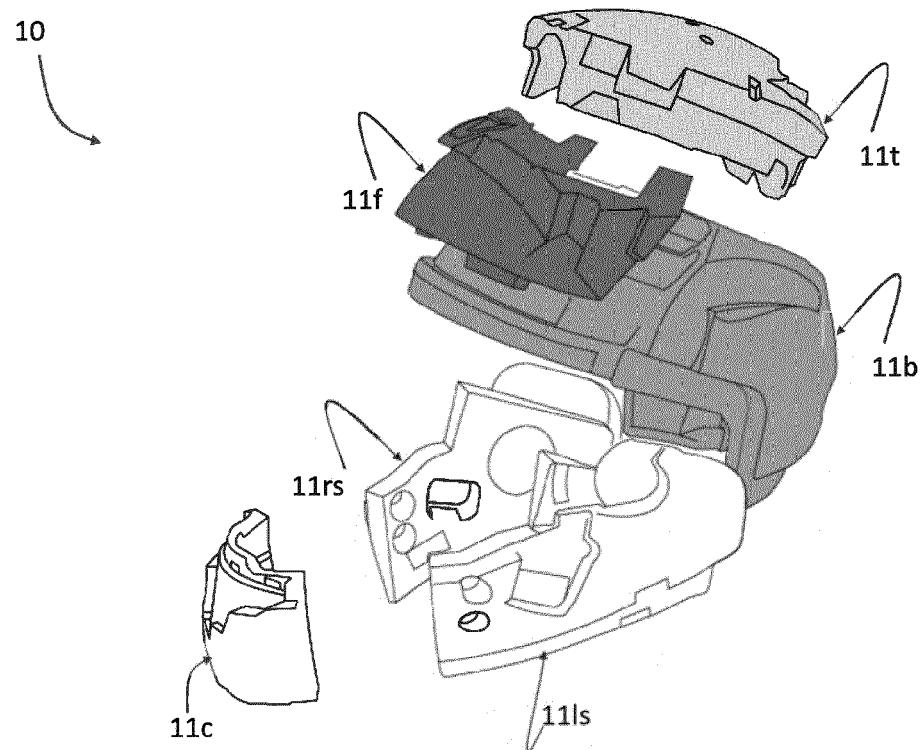


Figure 2

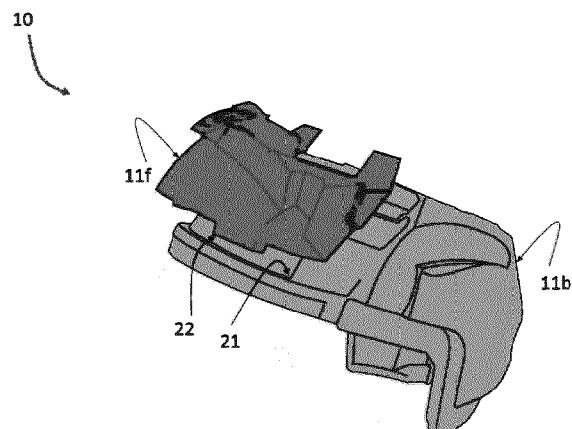


Figure 3a

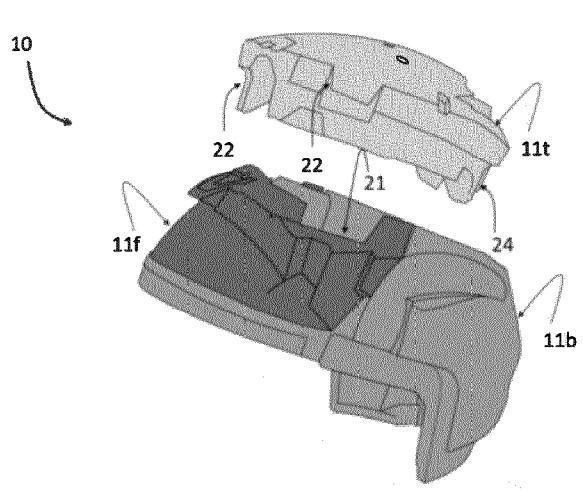


Figure 3b

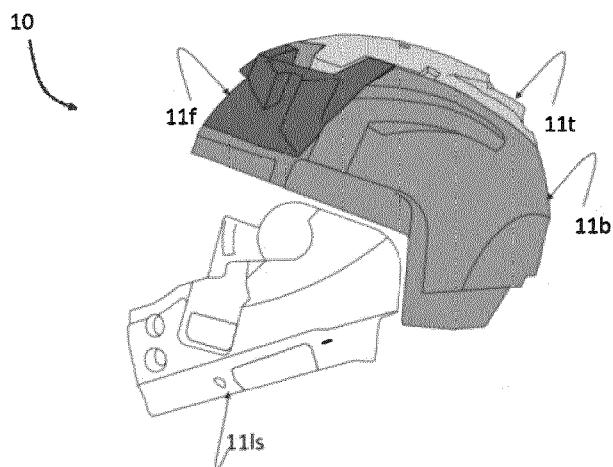


Figure 3c

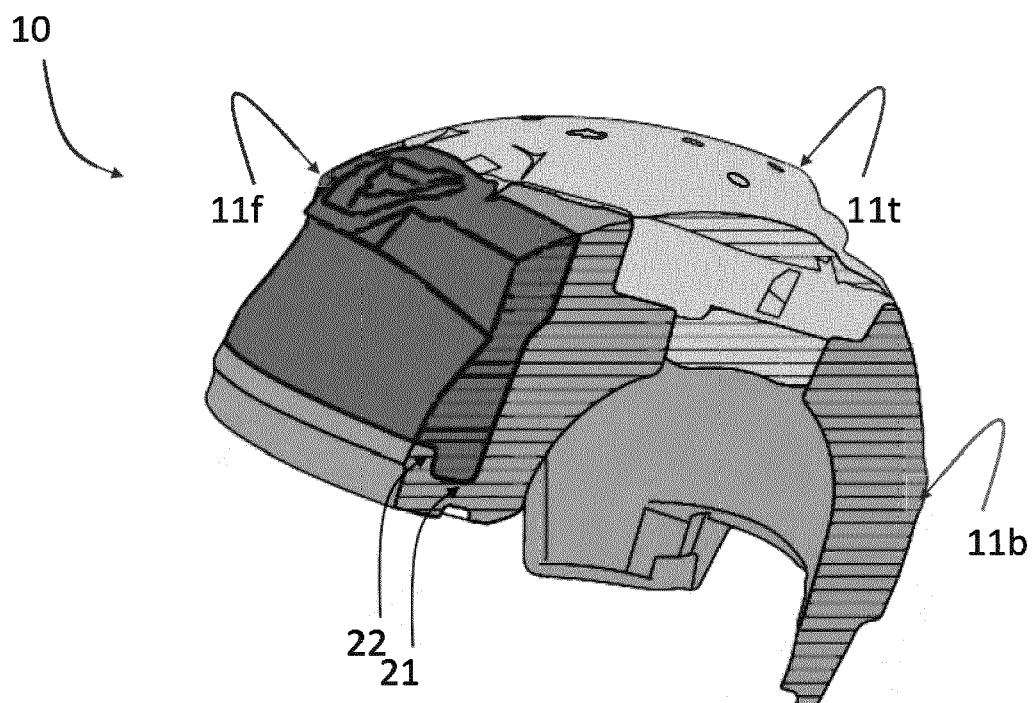


Figure 4

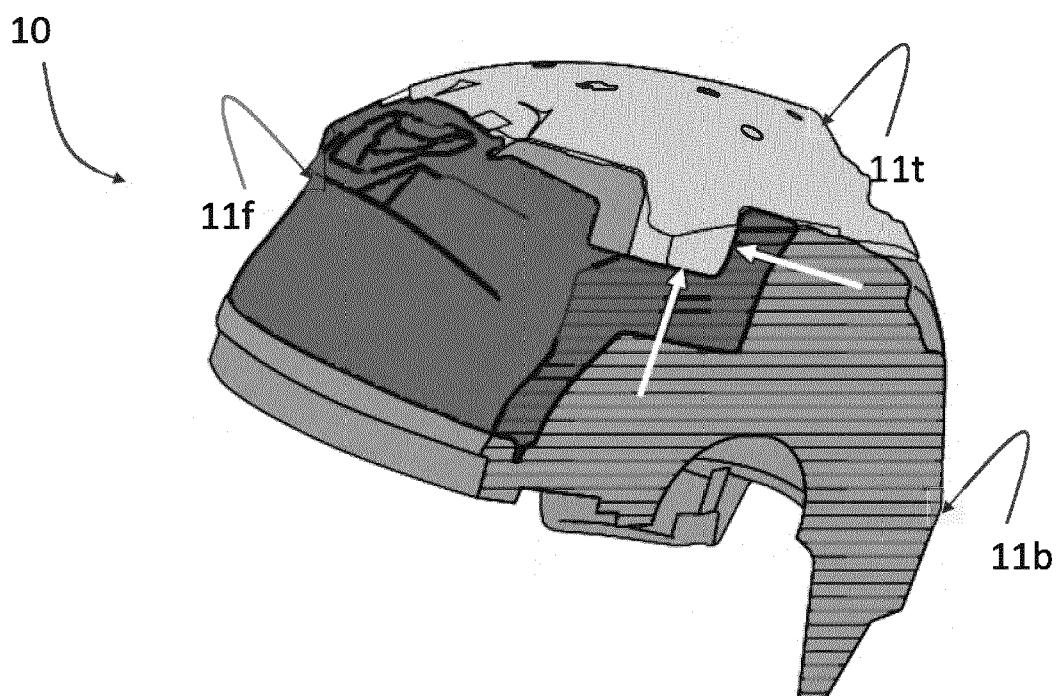


Figure 5

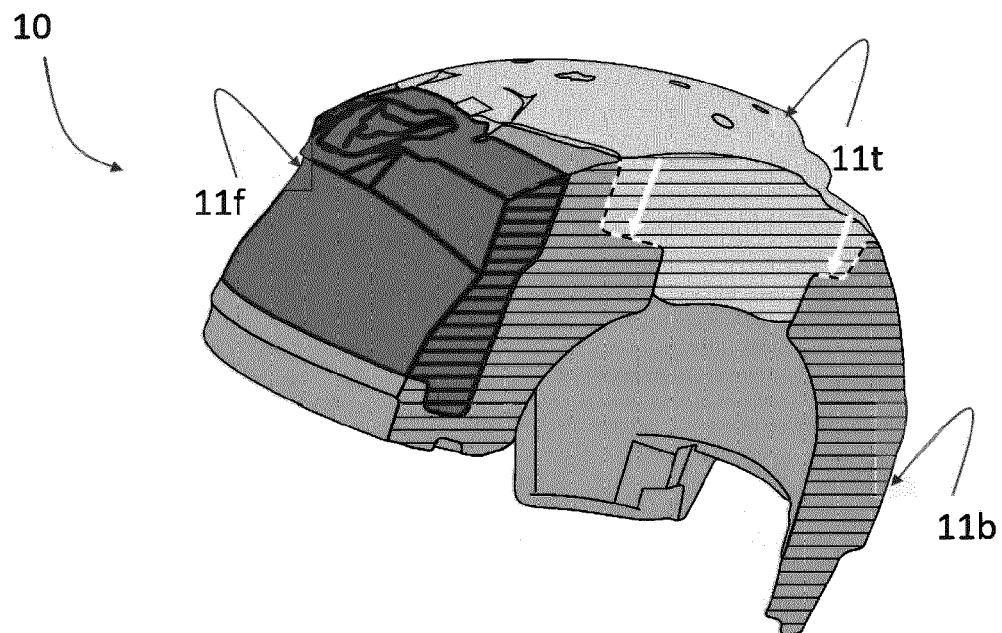


Figure 6

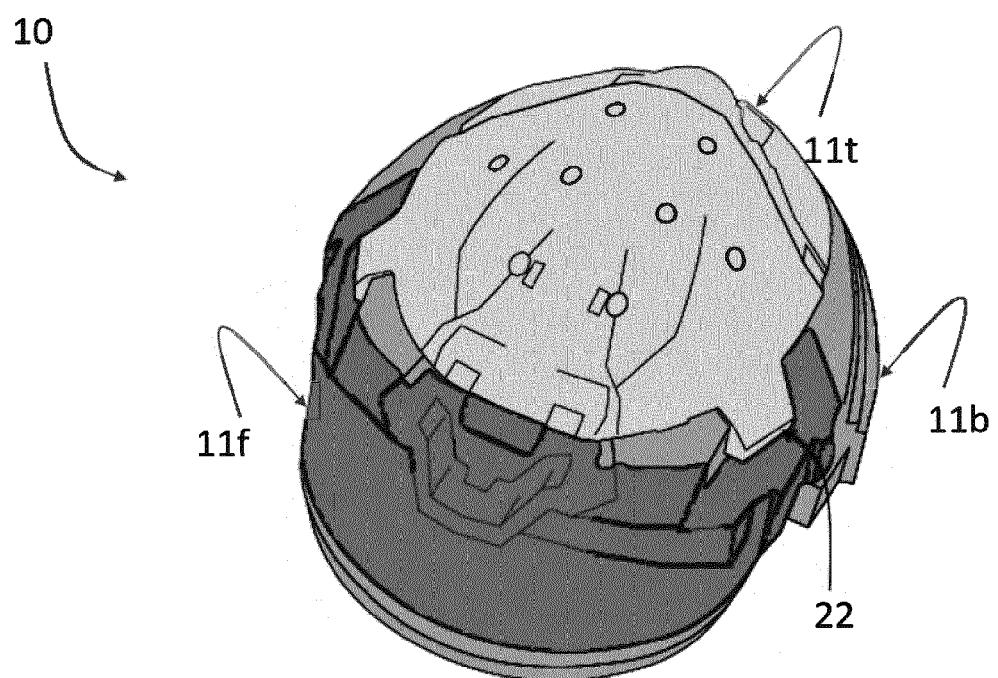


Figure 7

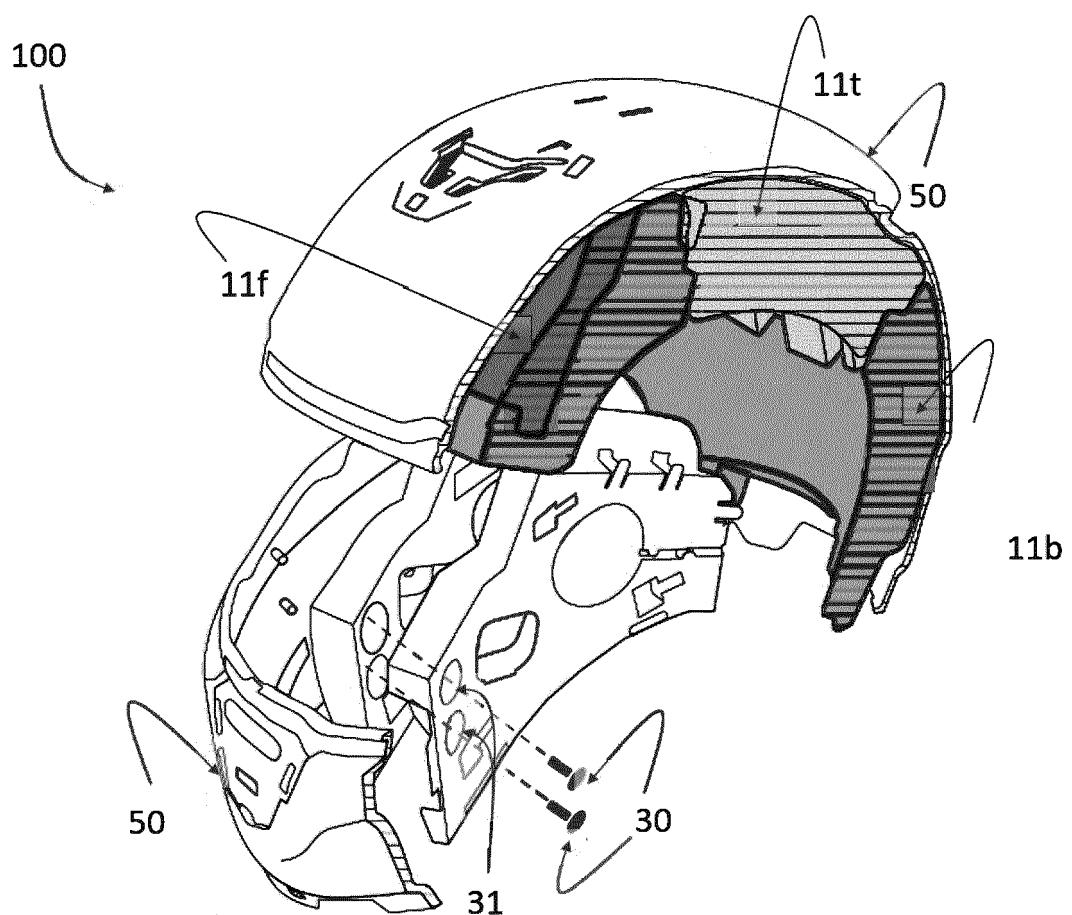


Figure 8



## EUROPEAN SEARCH REPORT

Application Number

EP 23 19 2526

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10	<p><b>X</b> JP H07 109609 A (SHOEI KAKO KK) 25 April 1995 (1995-04-25) * paragraphs [0010], [0011]; figures 1-3 *</p> <p>-----</p>	1-15	INV. A42B3/12
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30			TECHNICAL FIELDS SEARCHED (IPC)
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50	The present search report has been drawn up for all claims		
55	<p>1</p> <p>Place of search <b>The Hague</b></p> <p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p>	<p>Date of completion of the search <b>5 February 2024</b></p>	<p>Examiner <b>D'Souza, Jennifer</b></p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... &amp; : member of the same patent family, corresponding document</p>

**ANNEX TO THE EUROPEAN SEARCH REPORT  
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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