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(54) **A composite crash helmet**

Verbundhelm

Casque composite

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WO-A-91/13560 WO-A-93/05672
US-A- 4 464 799**

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Description

[0001] The present invention relates to a crash helmet for motor-cyclists, and, more generally, people engaged in various activities requiring a protective helmet.

[0002] For a better understanding of the state of the art and problems related thereto, there will be at first described a crash helmet of the kind known from European patent application EP 1 627 575, reference being made to figures 1 and 2 of the appended drawings. A crash helmet 10 comprises an outer shell 11 which forms a bubble 12 with a base portion 12a and a chin protector 13. A layer 30 of expanded polystyrene covers the inner surface of the bubble and fills an annular gap bounded on the outside by the chin protector and the bubble base portion, and on the inside by an annular wall 20 located within and at a distance from the base portion of the bubble and from the chin protector. The polystyrene layer 30 firmly connects the inner band 20 to the outer shell 11.

[0003] In order to fix the straps to fasten under the chin of the user to hold the helmet fast, two anchoring devices 23 are used, each including a tubular spacer 24 radially extending from the outer shell 11 to the inner wall 20. The spacers 24 are rigidly fixed to an anchoring member 31 having a large surface. The anchoring member 31 is embedded in the polystyrene which is injected within the shell 11. Formed in the inner wall 20 and the outer shell 11 are aligned bores 27, 22, respectively, for fitting an expansion stud 35 in the tubular spacer 24 from the inside, and a cap 36 on the outside.

[0004] In the event of an impact, tensile forces are transmitted from the strap to the inner wall 20, and part of them are transferred to the anchoring device 23 and so to the outer shell 11. During the impact, the spacer acts as a fulcrum, and the outer shell provides an essentially shearing reaction, indicated by arrow A.

[0005] It is a general object of the present invention to provide a crash helmet having an improved structure in order to optimize the transmission and distribution of the forces that occur during an impact. Another object of the invention is to simplify the manufacturing process of the helmet and cut down relevant costs.

[0006] These and other objects and advantages which will be seen more clearly herein after, are achieved in accordance with the invention, by a crash helmet having the features defined in the appended claims.

[0007] A few preferred, but not limiting embodiments of the invention will now be described, reference being made to the attached drawings, in which:

Figure 1 is a side view in vertical cross-section of a crash helmet of known design;

Figure 2 is a partial cross-sectional view, to an enlarged scale, showing an anchoring device for strap of the helmet of figure 1;

Figure 3 is a front view in vertical cross-section of a first embodiment of a crash helmet according to the present invention;

Figure 3A is an enlarged view of a detail of Figure 3; Figure 4 is a side view in vertical cross-section of the crash helmet of Figure 3;

Figure 5 is a side view of a tension member incorporated in the helmet according to the invention; and Figures 6 and 7 are side views of further embodiments of the crash helmet according to the invention.

[0008] Referring now to Figures 3 to 7, a crash helmet 10 according to the invention comprises an outer shell 11 forming a bubble 12, a reinforcing wall 20 located within and at a distance from the shell 11, and a layer 30 of expanded polystyrene injected onto the inner surface of the bubble and into the intermediate gap 14 delimited by the inner reinforcing wall 20 and the outer shell 11.

[0009] In many of its aspects, the invention is equally applicable to full-face crash helmets with a chin protector (Figure 4) and open-face crash helmets, i.e. having no chin protector. Depending on requirements and the kind of helmet, the inner wall 20 may take a closed loop shape in plan view, or an open ring shape, or an arched U-shape.

[0010] In Figure 3, two straps for fastening the crash helmet are labelled 26a, 26b. For anchoring each strap, on each of the opposite (left and right) sides of the helmet, a respective anchoring body is provided. The anchoring body, indicated overall at 31, is variously shaped and embedded in the polystyrene 30. According to an important feature of this invention, the anchoring device performs the function of a tension member between the relevant strap and the outer shell 11. The tension member 31, shown separately in Figure 6, extends between a first, lower inner stud 35 and a second, upper outer stud 40. The first stud is fixed to an end of the strap and passes through an opening 27 (indicated in Figure 3A) formed in the inner reinforcing wall 20. The second stud 40 co-operates in a tensile relationship with the shell 11 by means of a plate 41. The plate 41, per se of known design, bears upon a relatively large area of the outer surface of the shell 11. The visor 42 is pivotally mounted on the plate 41. The tension member 31 has bores 43, 44, more clearly visible in Figure 6, for engaging the studs 35, 40, respectively.

[0011] When a crash occurs, tensile forces exerted by the fastening straps are transmitted by the tension members 31 to the plates 41 and distributed on the contact surfaces at the interface between the plates and the outer shell 11.

[0012] In a preferred embodiment, each plate 41 is accommodated in a relevant recess 45 formed by the outer shell and having a shape congruent with the outer peripheral edge of the plate. This allows to increase the contribution given by the shell in terms of reaction to the tensile forces exerted by the tensile member. If, as in the illustrated embodiment of figures 3 and 3A, the plate is rotationally locked on the outer shell by means of a screw 46, the tensile member 31 may advantageously exploit that screw as a further grip for binding it to the outer shell.

A special bore 47 for the screw 46 is also provided in the tension member 31 (Figure 5). Preferably, the tension member 31 is so shaped as to have a high surface/volume ratio, in order to remain firmly anchored in the polystyrene and therefore tightly connected to the other parts of the helmet. The particular reticular construction shown in figure 5 is a preferred, exemplary embodiment.

[0013] Still referring to the inner wall 20, the embodiments shown in Figures 4 and 6 are particularly preferred. In those variant embodiments, the inner wall 20 extends continuously, following an arched or closed loop path within the shell, and includes a portion 20a running along the front or forehead area of the helmet above the opening closed by the visor. Also along this forehead area, which is particularly critical for accidents, the wall 20 defines with the inside of the shell 11 a space or gap in which the polystyrene 30 is injected. Thus, also in this area the inner wall 20 is firmly fixed by the polystyrene to the outer shell. Should an impact occur on this forehead portion of the helmet, the wall 20 will actively cooperate with the outer shell in resisting the crash, diffusing and dissipating the energy of the impact to other parts of the helmet. Due to the contribution given by the inner wall and the polystyrene layer interposed between this and the outer shell, the thickness of the shell may be reduced, and consequently the overall weight of the helmet. The wall 20, which extends as a crown along the inside of the helmet, besides reinforcing the forehead zone, is further helpful in positioning the tension members correctly during the polystyrene injection step due to protruding portions 20b (Figure 3A) engaging each tension member.

[0014] Whereas in the embodiment of Figure 6 the inner wall 20 consists of an extended structural element made in one piece, in the embodiment of Figure 4 the wall 20 is made up jointly by two separately formed members: a front, arched strip 20a running across the forehead area, and a back arched strip 20c joined to the front strip 20a by two pairs of rivets 20d near the ends of these strips. In a different embodiment of the invention, as shown in figure 7, the wall 20 is made up, on each side of the helmet, by a relevant plate portion 20e of limited extent.

[0015] The chin protector may be manufactured separately from the bubble 12, as shown in Figure 4. The chin protector 13 is formed by a separate member having a U shape in plan view. The chin protector 13 is fixed to the bubble 12 by two sets of horizontal plastic pins 48 protruding from the two arms of the chin protector and fitted into bore provided in a folded edge of the inner wall 20. According to requirements, the chin protector can be made of a material different from the one of the bubble, for example a more elastically yieldable material. Advantageously, the end surfaces 15 of the arch of the chin protector are concave so as to allow a form fitting with corresponding convex surfaces 16 of the bubble. This arrangement makes the chin protector more resistant to shearing stress in a vertical direction, and allows the man-

ufacturer to use a same mould for manufacturing either full face or open face crash helmets. An elastic gasket (not shown) may be located at the interface between the chin protector and the bubble.

[0016] As will be appreciated, due to the tension members 31 the tensile forces acting on the straps are transferred to the outer shell, which is a very strong structural member. Forces are spread uniformly distributed over a large area at the interface between the plates 41 and outer shell. The resulting stresses are low and therefore it will not be necessary to provide any thickened portion, not even locally, in the outer shell; this favours the overall lightness of the crash helmet.

[0017] The absence of a bore to be made through the outer shell, aligned with the bore for the strap fixing stud entails a simplified manufacture, since it is not required to ensure accurate alignment between the bore in the inner reinforcing wall 20 and the (absent) bore in the outer shell. Furthermore, a closure cap on either side of the crash helmet is disposed of.

[0018] Since the tensile forces are transferred from the straps to the outer shell through the tensile members, and do not have to be borne conspicuously by the inner wall 20, this wall may be thin and therefore light.

[0019] Moreover, it will be noted that the crash helmet according to the invention is free of rigid spacers extending radially inwards from the outer shell. The absence of spacing members of that kind, which are capable of transferring side impacts without shortening appreciably, makes the helmet safer in case of side collisions occurring.

[0020] The invention is not intended to be limited to the embodiments described and illustrated herein, which should be considered as exemplary embodiments of the crash helmet; rather, the invention may be modified with regard to the shape, the size, the arrangement of parts, and to constructional and materials used. For example, in a further embodiment (not shown), the tension members 31 and the inner wall 20 may be formed as a single piece.

Claims

1. A crash helmet comprising:

- an outer shell (11),
- binding means for binding the ends of a pair of fastening straps (26a, 26b) located at the left and right sides within the helmet,
- at least one inner wall (20) spaced apart from the shell at least at the zones of the ends of the straps,
- an expanded-polystyrene layer (30) injected between the shell and the inner wall (20),
- for each strap, an anchoring element (31) embedded in the polystyrene (30) and first connecting means (35) between the anchoring element

and the end of the strap,

each anchoring element (31) extends as a tension member between the inner wall (20) and the shell (11) and is firmly fixed to the shell by means of second connecting means (40), whereby each strap cooperates in tensile relation with the outer shell so as to transmit tensile forces thereto through the anchoring element (31),

characterized in that each of the second connecting means (40) is associated with a relevant plate (41) having an extended surface of contact with the outer shell so as to distribute on this shell the forces transmitted through the anchoring tension member (31).

2. A crash helmet according to claim 1, **characterized in that** each plate (41) is accommodated in a relevant recess (45) of the outer shell (11) having a shape substantially congruent to that of the plate (41).
3. A crash helmet according to claim 1 or 2, **characterized in that** the second connecting means (40) are located at positions which are higher up with respect to the first connection means (35).
4. A crash helmet according to claim 1, **characterized in that** the anchoring tension member (31) is an element having an extended surface with respective bores (43, 44) for the passage of the first and second connecting means (35, 40).
5. A crash helmet according to claim 1, **characterized in that** the anchoring tension member (31) has a reticular structure.
6. A crash helmet according to any one of the preceding claims, **characterized in that** the inner wall (20) extends continuously adjoining the lateral zones where the straps are anchored and comprises a portion (20a) running along a forehead area of the helmet above an opening closed by a visor (42), said inner wall portion (20a) being connected to the outer shell (11) by expanded-polystyrene (30) injected between these two components.
7. A crash helmet according to claim 6, **characterized in that** the inner wall (20) extends continuously along a substantially closed-loop path within the shell (11).
8. A crash helmet according to claim 6 or 7, **characterized in that** the inner wall (20) consists of an extended structural element formed in one piece.
9. A crash helmet according to claim 6 or 7, **characterized in that** the inner wall (20) is the wall 20 is made up jointly by two separately formed members:

a front, arched strip (20a) running across the forehead area, and a back arched strip (20c) joined to the front strip (20a) by fastening means (20d).

10. A crash helmet according to any one of the preceding claims, **characterized in that** the inner wall (20) and the anchoring tension members (31) are formed as a single piece.
11. A crash helmet according to any one of the preceding claims, **characterized in that** it is a full face crash helmet.
12. A crash helmet according claim 11, **characterized by** comprising a substantially U-shaped chin protector (13) manufactured separately from the bubble (12) and fixed thereto.
13. A crash helmet according claim 12, **characterized in that** the chin protector (13) has concave end surfaces (15) coupled with corresponding convex surfaces (16) of the bubble (12).
14. A crash helmet according to claim 11, **characterized in that** the chin protector (13) is made of materials being mechanically more resistant than those which the bubble (12) is made of.
15. A crash helmet according to any one of claims 1 to 10, **characterized in that** it is an open face crash helmet, without a chin protector.
16. A crash helmet according to any one of the preceding claims, **characterized in that** the inner wall (20) provides, on both the left and right sides of the helmet, respective formations (20b) adapted for engaging a respective anchoring tension member (31) so as to keep it correctly positioned during the manufacturing step of injecting the expanded-polystyrene.
17. A crash helmet according to claim 1, **characterized in that** the wall (20) is provided, on each side of the helmet, with a relevant plate portion (20e) of limited extent.

Patentansprüche

1. Schutzhelm, der umfasst:

- eine äußere Schale (11),
- eine Befestigungseinrichtung, um die Enden von einem Paar von Befestigungsbändern (26a, 26b) zu befestigen, die links und rechts im Helm angeordnet sind,
- zumindest eine innere Wand (20), die von der Schale zumindest in den Bereichen der Enden der Bänder beabstandet ist,

- eine Schicht aus geschäumten Polystyrol (30), die zwischen die Schale und die innere Wand (20) eingespritzt wird,
- ein Verankerungselement (31) für jedes Band, das im Polystyrol (30) eingebettet ist, sowie eine erste Verbindungseinrichtung (35) zwischen dem Verankerungselement und dem Ende des Bands,

wobei sich jedes Verankerungselement (31) als Zuelement zwischen der inneren Wand (20) und der Schale (11) erstreckt und an der Schale fest über eine zweite Verbindungseinrichtung (40) befestigt ist, wodurch jedes Band in Hinblick auf eine Zugbelastung mit der äußeren Schale zusammenwirkt, um Zugkräfte über das Verankerungselement (31) darauf zu übertragen,

dadurch gekennzeichnet, dass jeder zweiten Verbindungseinrichtung (40) eine entsprechende Platte (41) zugeordnet ist, die eine erweiterte Berührungsfläche mit der äußeren Schale besitzt, um auf diese Schale die Kräfte zu verteilen, die über das Verankerungselement (31) übertragen werden.

2. Schutzhelm gemäß Anspruch 1, **dadurch gekennzeichnet, dass** jede Platte (41) in einer entsprechenden Ausnehmung (45) der äußeren Schale (11) aufgenommen wird, die eine Form besitzt, die im Wesentlichen kongruent zur Form der Platte (41) ist.
3. Schutzhelm gemäß Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die zweite Verbindungseinrichtung (40) an Stellen angeordnet ist, die im Hinblick auf die erste Verbindungseinrichtung (35) höher angeordnet sind.
4. Schutzhelm gemäß Anspruch 1, **dadurch gekennzeichnet, dass** das Verankerungselement (31) ein Element ist, das im Hinblick auf die entsprechenden Bohrungen (43, 44), durch die die erste und die zweite Verbindungseinrichtung (35, 40) verlaufen, eine erweiterte Fläche besitzt.
5. Schutzhelm gemäß Anspruch 1, **dadurch gekennzeichnet, dass** das Verankerungselement (31) einen netzartigen Aufbau besitzt.
6. Schutzhelm gemäß irgendeinem der bisherigen Ansprüche, **dadurch gekennzeichnet, dass** die innere Wand (20) durchgehend neben den seitlichen Bereichen verläuft, wo die Bänder verankert sind, und einen Teil (20a) umfasst, der entlang eines Stirnbereichs des Helms oberhalb von einer Öffnung verläuft, die mit einem Visier (42) verschlossen wird, wobei der innere Wandteil (20a) mit der äußeren Schale (11) über geschäumtes Polystyrol (30) verbunden ist, das zwischen diese beiden Bauteile eingespritzt wird.

7. Schutzhelm gemäß Anspruch 6, **dadurch gekennzeichnet, dass** die innere Wand (20) durchgehend entlang einer im Wesentlichen geschlossenen Schleife innerhalb der Schale (11) verläuft.
8. Schutzhelm gemäß Anspruch 6 oder 7, **dadurch gekennzeichnet, dass** die innere Wand (20) aus einem erweiterten Strukturelement besteht, das in einem Stück geformt ist.
9. Schutzhelm gemäß Anspruch 6 oder 7, **dadurch gekennzeichnet, dass** die innere Wand (20) als Wand 20 gemeinsam aus zwei getrennt geformten Elementen hergestellt wird: aus einem vorderen, bogenförmigen Streifen (20a), der über den Stirnbereich verläuft, sowie aus einem hinteren bogenförmigen Streifen (20c), der mit dem vorderen Streifen (20a) über eine Befestigungseinrichtung (20d) verbunden ist.
10. Schutzhelm gemäß irgendeinem der bisherigen Ansprüche, **dadurch gekennzeichnet, dass** die innere Wand (20) und die Verankerungselemente (31) als ein einziges Stück geformt sind.
11. Schutzhelm gemäß irgendeinem der bisherigen Ansprüche, **dadurch gekennzeichnet, dass** der Helm ein Vollhelm ist.
12. Schutzhelm gemäß Anspruch 11, **dadurch gekennzeichnet, dass** der Helm einen im Wesentlichen U-förmigen Kinnschutz (13) umfasst, der getrennt von der Kugel (12) hergestellt und an dieser befestigt wird.
13. Schutzhelm gemäß Anspruch 12, **dadurch gekennzeichnet, dass** der Kinnschutz (13) konkave Endflächen (15) besitzt, die mit entsprechenden konvexen Flächen (16) der Kugel (12) gekuppelt werden.
14. Schutzhelm gemäß Anspruch 11, **dadurch gekennzeichnet, dass** der Kinnschutz (13) aus Materialien hergestellt ist, die mechanisch widerstandsfähiger als jene Materialien sind, aus denen die Kugel (12) hergestellt ist.
15. Schutzhelm gemäß irgendeinem der Ansprüche 1 bis 10, **dadurch gekennzeichnet, dass** der Helm ein offener Helm ist, der keinen Kinnschutz besitzt.
16. Schutzhelm gemäß irgendeinem der bisherigen Ansprüche, **dadurch gekennzeichnet, dass** die innere Wand (20) sowohl an der linken als auch an der rechten Seite des Helms entsprechende Ausformungen (20b) vorsieht, die so ausgebildet sind, dass sie in ein entsprechendes Verankerungselement (31) eingreifen können, um dieses während des Fertigungsschritts, bei dem das geschäumte Polystyrol

eingspritzt wird, richtig in Stellung zu halten.

17. Schutzhelm gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die Wand (20) an jeder Seite des Helms mit einem entsprechenden Plattenteil (20e) versehen ist, der eine beschränkte Ausdehnung besitzt.

Revendications

1. Casque protecteur comprenant :

- une coque extérieure (11),
- des moyens d'attache pour attacher les extrémités d'une paire de sangles de fixation (26a, 26b) situées sur les côtés gauche et droit à l'intérieur du casque,
- au moins une paroi intérieure (20) espacée de la coque au moins dans les zones des extrémités des sangles,
- une couche en polystyrène expansé (30) injectée entre la coque et la paroi intérieure (20),
- pour chaque sangle, un élément d'ancrage (31) incorporé dans le polystyrène (30) et des premiers moyens de raccordement (35) situés entre l'élément d'ancrage et l'extrémité de la sangle,

chaque élément d'ancrage (31) se prolongeant sous la forme d'un élément de tension entre la paroi intérieure (20) et la coque (11) et étant solidement fixé à la coque au moyen de deuxièmes moyens de raccordement (40), de façon que chaque sangle coopère en relation de traction avec la coque extérieure afin de lui transmettre des forces de traction par l'intermédiaire de l'élément d'ancrage (31), **caractérisé en ce que** chacun des deuxièmes moyens de raccordement (40) est associé à une plaque appropriée (41) ayant une surface de contact étendue avec la coque extérieure afin de répartir sur cette coque les forces transmises par l'intermédiaire de l'élément de tension d'ancrage (31).

2. Casque protecteur selon la revendication 1, **caractérisé en ce que** chaque plaque (41) est reçue dans une cavité appropriée (45) de la coque extérieure (11) ayant une forme sensiblement congruente avec celle de la plaque (41).
3. Casque protecteur selon la revendication 1 ou 2, **caractérisé en ce que** les deuxièmes moyens de raccordement (40) sont disposés dans des positions qui sont plus hautes que les premiers moyens de raccordement (35).
4. Casque protecteur selon la revendication 1, **caractérisé en ce que** l'élément de tension d'ancrage (31)

est un élément ayant une surface étendue avec des alésages respectifs (43, 44) pour le passage des premiers et deuxième éléments de raccordement (35, 40).

5. Casque protecteur selon la revendication 1, **caractérisé en ce que** l'élément de tension d'ancrage (31) a une structure réticulaire.
6. Casque protecteur selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la paroi intérieure (20) s'étend en continu de manière attenante aux zones latérales ou sont ancrées les sangles et comprend une partie (20a) s'étendant le long d'une zone de front du casque au-dessus d'une partie fermée par un viseur (42), ladite partie de paroi intérieure (20a) étant raccordée à la coque extérieure (11) par du polystyrène expansé (30) injecté entre ces deux composants.
7. Casque protecteur selon la revendication 6, **caractérisé en ce que** la paroi intérieure (20) s'étend en continu le long d'un chemin sensiblement en boucle fermée à l'intérieur de la coque (11).
8. Casque protecteur selon la revendication 6 ou 7, **caractérisé en ce que** la paroi intérieure (20) est constituée d'un élément structurel étendu formé d'une seule pièce.
9. Casque protecteur selon la revendication 6 ou 7, **caractérisé en ce que** la paroi intérieure (20) est réalisée conjointement par deux éléments formés séparément : une sangle frontale incurvée (20a) s'étendant sur la zone de front, et une sangle arrière incurvée (20c) reliée à la sangle avant (20a) par des moyens de fixation (20d).
10. Casque protecteur selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la paroi intérieure (20) et les éléments de tension d'ancrage (31) sont formés d'une seule pièce.
11. Casque protecteur selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'il** s'agit d'un casque protecteur intégral.
12. Casque protecteur selon la revendication 11, **caractérisé en ce qu'il** comprend une mentonnière sensiblement en forme de U (13) fabriquée séparément du bulbe (12) et fixée à celui-ci.
13. Casque protecteur selon la revendication 12, **caractérisé en ce que** la mentonnière (13) possède des surfaces d'extrémité concave (15) couplées avec des surfaces convexes correspondantes (16) du bulbe (12).

14. Casque protecteur selon la revendication 11, **caractérisé en ce que** la mentonnière (13) est faite de matériaux mécaniquement plus résistants que ceux dont est constitué le bulbe (12). 5
15. Casque protecteur selon l'une quelconque des revendications 1 à 10, **caractérisé en ce qu'il** s'agit d'un demi-casque protecteur, sans mentonnière.
16. Casque protecteur selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la paroi intérieure (20) comporte à la fois sur les côtés gauche et droit du casque, des formations respectives (20b) adaptées à recevoir en prise un élément de tension d'ancrage respectif (31) de façon à le maintenir correctement positionné pendant l'étape d'injection du polystyrène expansé lors de la fabrication. 10 15
17. Casque protecteur selon la revendication 1, **caractérisé en ce que** la paroi (20) est munie, de chaque côté du casque, d'une partie plate appropriée (20e) d'une étendue limitée. 20

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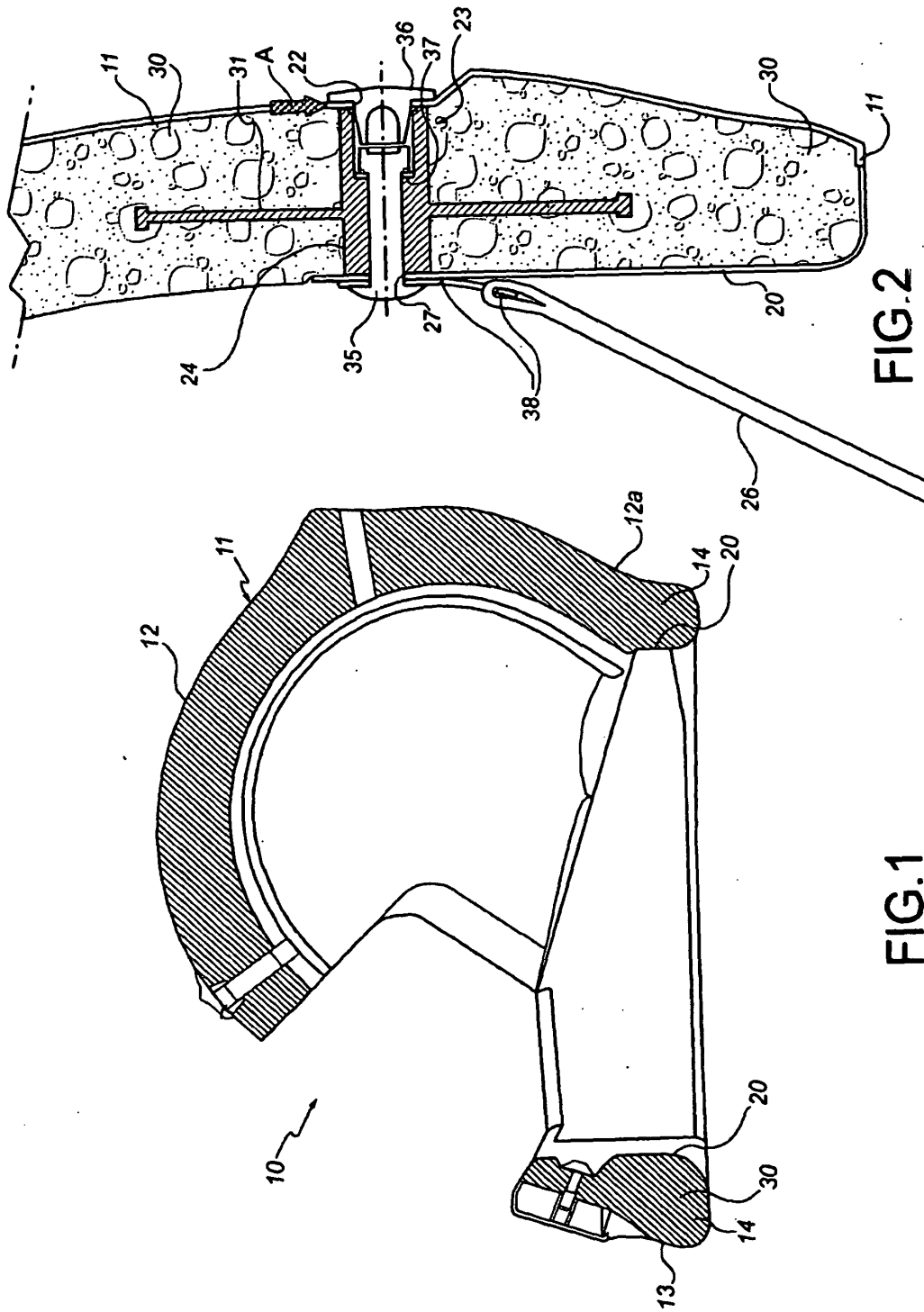
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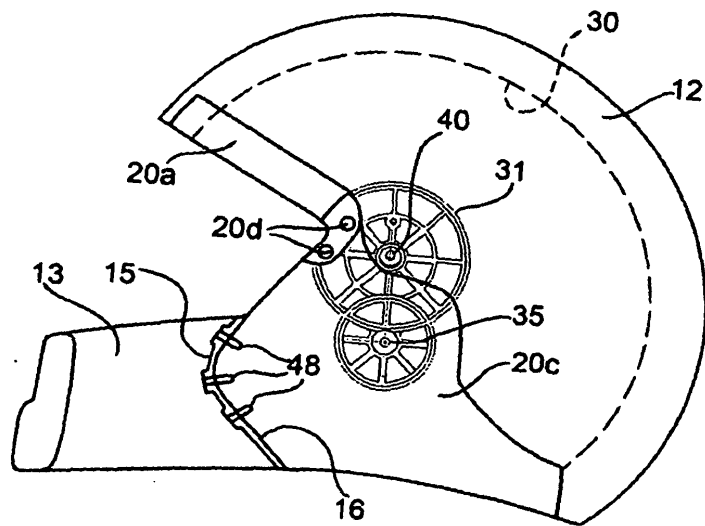
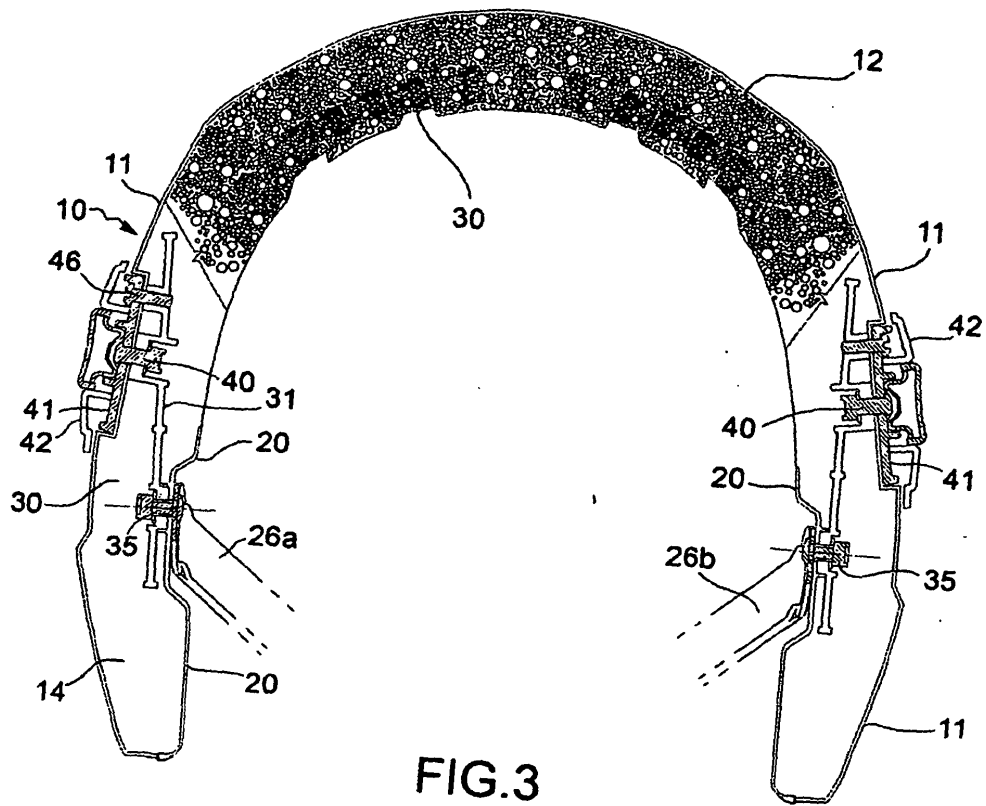
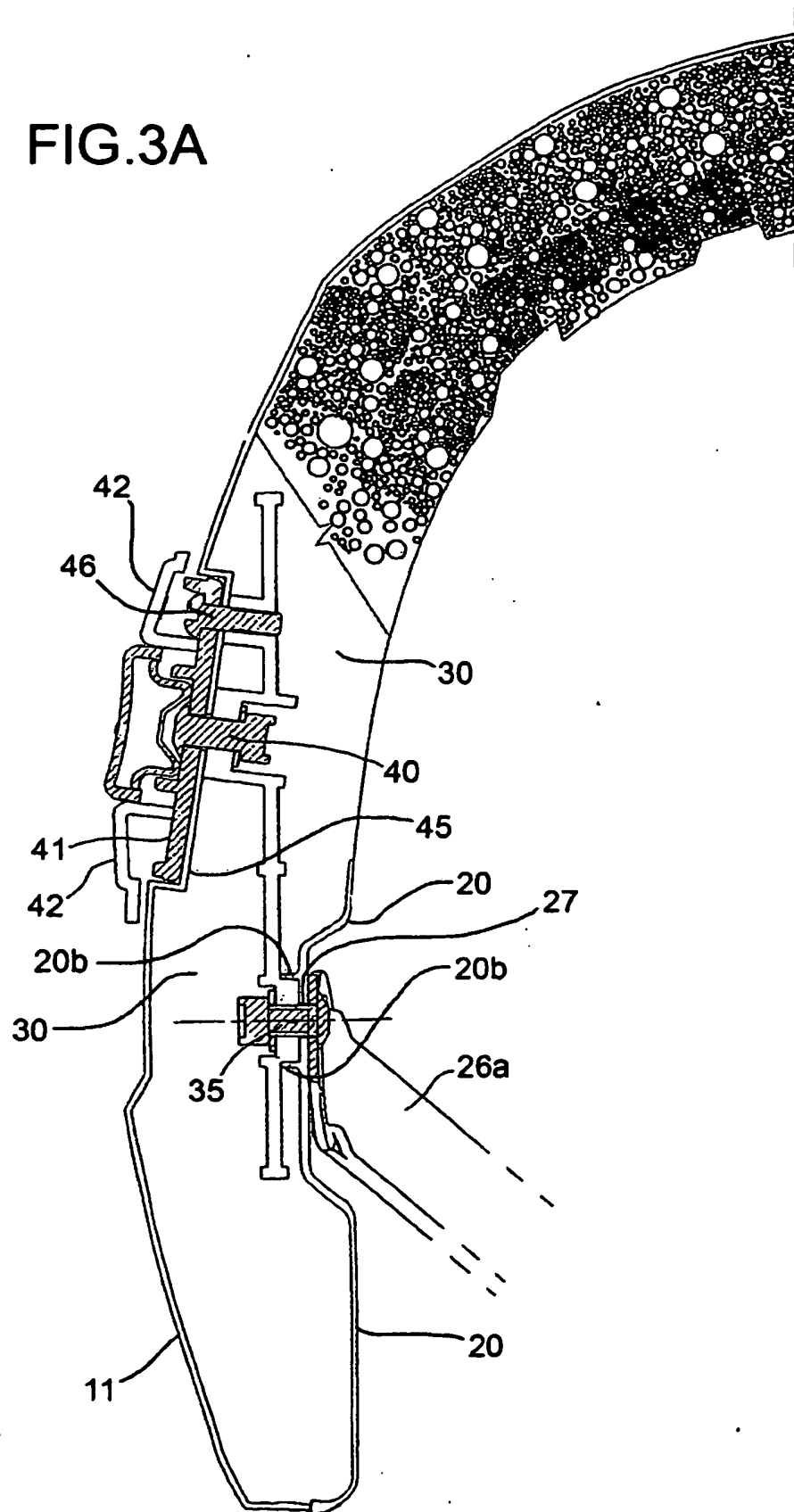


FIG.3A



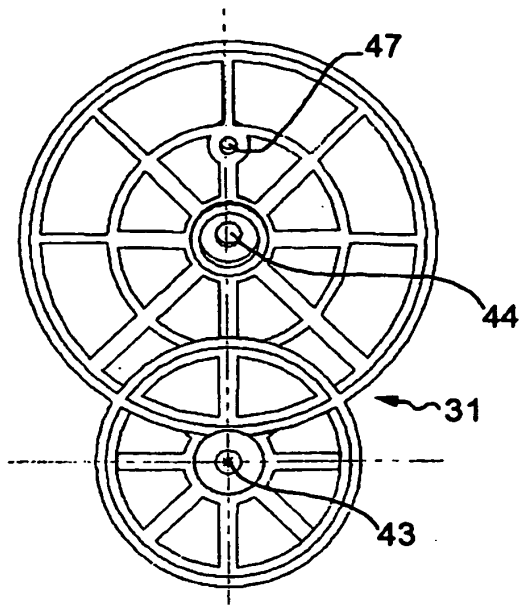


FIG. 5

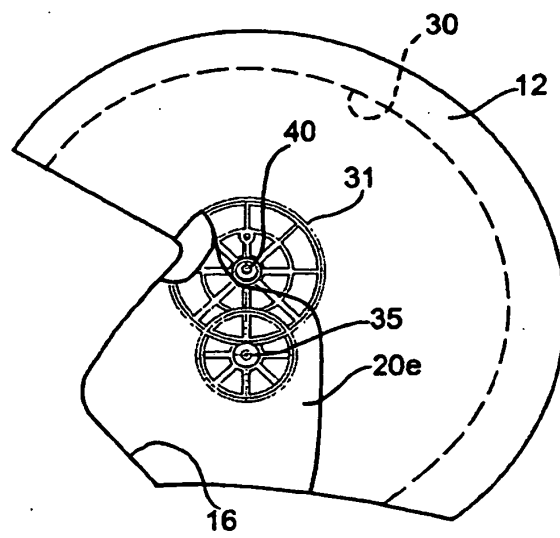


FIG. 7

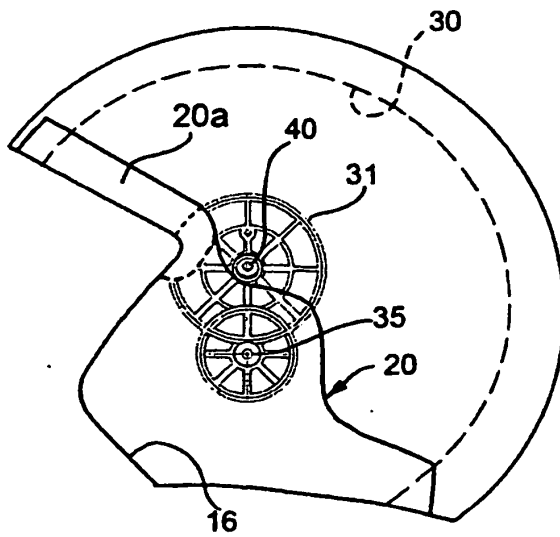


FIG. 6

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1627575 A [0002]