

(19)



(11)

EP 3 581 052 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
24.03.2021 Bulletin 2021/12

(51) Int Cl.:
A42B 3/06 (2006.01)

(21) Application number: **18178470.3**

(22) Date of filing: **19.06.2018**

(54) **SAFETY HELMET CAPABLE OF ABSORBING MULTI-DIRECTION IMPACT**

ZUR ABSORPTION VON MULTIDIREKTIONALEN STÖSSEN FÄHIGER SICHERHEITSHELM
 CASQUE DE SÉCURITÉ CAPABLE D'ABSORBER LES CHOCS MULTIDIRECTIONNELS

(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 MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **12.06.2018 TW 107120239**

(43) Date of publication of application:
18.12.2019 Bulletin 2019/51

(60) Divisional application:
20189808.7 / 3 756 496

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Description

BACKGROUND OF THE INVENTION

1. Technical Field

[0001] The present invention relates to safety helmets, and more particularly to a safety helmet that absorbs impact from multiple directions.

2. Description of Related Art

[0002] Most existing safety helmets are formed by a rigid casing and a buffer layer filled under the rigidity casing. When impact acts on such a known safety helmet, the rigidity casing first bears a part of the impact energy, and the buffer layer later absorbs a part of the energy. The remaining energy has to be borne by the user's head and cervical vertebra. For safety helmets, incoming impact can be divided into three types, namely radial impact, tangential impact, and diagonal impact. Radial impact can cause linear acceleration of a user's head that may lead to skull fracture and/or traumatic brain injury. Tangential impact can cause angular acceleration of a user's head that may bring about shear-based injury to brain and/or cervical vertebra. However, according to statistics, there have been seldom cases about pure radial or tangential impact. The most common type of injury is damage caused by diagonal impact, which is a combination of the two foregoing types of impact. When being subject to diagonal impact, a human head can have linear acceleration and slew acceleration at the same time, making it more vulnerable to grievous injury, such as cerebral concussion, traumatic brain injury (TBI), subdural hematoma (SDH) and diffuse axonal injury (DAI).

[0003] For ensuring protective capability of safety helmets, the relevant manufactures usually test their helmet products for impact absorption before shipment. Nevertheless, since these tests are usually designed for radial impact, the existing safety helmets may be good at absorbing radial impact, but are likely to fail to protect their user from impact acting in different directions (especially diagonal impact). US 2017347736 discloses a helmet that includes an energy absorbing shell including an outer surface and an inner surface opposite the outer surface. A fit system member can be coupled to a rear of the energy absorbing shell to adjust a fit of the helmet for a user. A sliding layer can include an outer sliding layer surface oriented towards the inner surface of the energy absorbing shell and an inner sliding layer surface opposite the outer surface. The sliding layer can include at least one attachment member and at least one integrated fit system arm. The at least one integrated fit system arm can be coupled to the fit system member. An elastomeric member can include a first end coupled to the energy absorbing shell and a second end coupled to the attachment member of the sliding layer. WO2018107286 A1 discloses a cushion for use in a helmet comprising an

outer shell for impact with an incoming force, the cushion disposed between the outer shell and a head when the helmet is worn, the cushion comprising: a sealed bladder comprising a flexible membrane; a pad housed within the bladder, comprising a compressible member having interstices open to the exterior of the pad; and a liquid within the interior of the bladder. The pad absorbs at least some of said liquid when uncompressed and expels said liquid when compressed. The volume of liquid is sufficient to allow opposing surfaces of the bladder to be displaced in a shearing motion when the cushion is subjected to shear forces.

BRIEF SUMMARY OF THE INVENTION

[0004] The primary objective of the present invention is to provide a safety helmet that absorbs multi-direction and thereby provides improved protection to its user's head.

[0005] To achieve the foregoing objective, the disclosed safety helmet comprises a shell, a flexible frame, and a slide-facilitating member. The flexible frame is attached to the inner surface of the shell, and the slide-facilitating member is attached to the inner surface of the flexible frame. Therein, the flexible frame supports the shell, while retaining the slide-facilitating member, so that the slide-facilitating member can fittingly and comfortably embrace a user's head. The slide-facilitating member facilitates slide of the shell. Thereby, when the shell receives incoming impact, especially diagonal impact, the slide-facilitating member allows the shell to slide with respect to the user's head. The slide-facilitating member has a covering and a slide-facilitating medium, in which the covering is attached to the inner surface of the flexible frame and the slide-facilitating medium is wrapped by the covering. The slide-facilitating medium has a substrate and a plurality of flexible bars connected to the substrates. The flexible bars have deforming property that allows such slide. In this way, the impact force otherwise acting on the user's head can be absorbed and converted into other forms of energy, thereby providing better protection to the user's head.

[0006] In some preferred embodiments the slide-facilitating medium may be realized in various aspects.

[0007] More information about the configuration, features, fabrication and uses of the safety helmet of the present invention will be provided in the following description in detail. However, people skilled in the art shall appreciate that the detailed description and embodiments as well as aspects are for illustration only, and by no means intended to limit the scope of the present invention.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0008]

FIG. 1 is a perspective view of a safety helmet of the present invention.

FIG. 2 is an exploded view of the disclosed safety helmet.

FIG. 3 is a cross-sectional applied view of the disclosed safety helmet.

FIG. 4, similar to FIG. 3, shows the shell receiving impact.

FIGs. 5a-5g illustrate different aspects of the slide-facilitating medium of the disclosed safety helmet (5g according to the invention).

DETAILED DESCRIPTION OF THE INVENTION

[0009] This is to be first emphasized herein that like elements or features will be identified by identical numbers throughout all figures.

[0010] Referring to FIGs. 1 and 2, a safety helmet 10 of the present invention comprises a shell 20, a flexible frame 30, and a slide-facilitating member 40.

[0011] The shell 20 has a casing 21 and a buffer layer 22. The buffer layer 22 is adhered to the inner surface of the casing 21 using an adhesive. The casing 21 is made of a rigid material, such as hard plastic, and serves to provide first-line protection. The buffer layer 22 is made of a shock-absorbing material, such as foam, for damping shock and buffering.

[0012] The flexible frame 30 is made of an elastic material, such as elastic plastic. As shown in FIG. 2, the flexible frame 30 has two symmetrical top ribs 32 and a side rib 34. The two top ribs 32 each have one end integrally connected to the front end of the side rib 34, and the rear end of the side rib 34 is provided with an adjuster 36, which can be used to adjust the circumference of the side rib 34 so that the side rib 34 can fittingly wrap different sizes of users' heads. Furthermore, the top ribs 32 and the side rib 34 are each detachably attached to the inner surface of the buffer layer 22 of the shell 20 inner surface through a fastener (not shown) such as a Velcro™ tape. Moreover, as shown in FIG. 3, the top ribs 32 and the side rib 34 may each have its outer surface provided with a plurality of tenons 38, so that in addition to the adhesion of the fasteners to the inner surface of the buffer layer 22 of the shell 20, these tenons 38 can engage with mortises 23 correspondingly arranged on the buffer layer 22 to enhance the combination between the flexible frame 30 and the shell 20 while allowing easy detachment of the flexible frame 30 for convenient adjustment.

[0013] The slide-facilitating member 40 has a covering 41, which is made of a low-friction material, such as flannel. The covering 41 has one side adhered to the inner surface of the flexible frame 30 through fasteners (not shown) such as velcro tapes, so that the slide-facilitating member 40 can be retained by the flexible frame 30 to have the reverse side of the covering 41 contact a user's head 12 directly. In this way, the covering 41 can be easily detached for convenient cleaning when staining. The slide-facilitating member 40 further has a slide-facilitating

medium 42 wrapped by the covering 41. As shown in FIG. 5g, the slide-facilitating medium 42 has a substrate 60 and a plurality of flexible bars 62 connected to the substrate 60, so that the elasticity of the flexible bars 62 allows the shell 20 to slide. It is to be also noted that, the slide-facilitating member 40 shown in FIG. 2 contains two units, one corresponding to head top and the other embracing the head peripherally. However, in practice, the two units may be integrated into a unity, or alternatively be divided into three or more units, depending on practical needs.

[0014] With the foregoing configuration, when the shell 20 is subject to incoming impact, the casing 21 of the shell 20 bears part of the energy, and the buffer layer 22 of the shell 20 absorbs a part of energy. Then when the remaining energy is transmitted to the slide-facilitating member 40, as shown in FIGs. 3 and 4, the slide-facilitating member 40 has the slide-facilitating medium 42 allow the shell 20 to slide with respect to the head 12, so that the impact force reaching the slide-facilitating member 40 is converted into potential energy generated by the relative displacement. The slide-facilitating member 40 can even slide with respect to the head 12 due to the low friction of the covering 41, so that the impact force reaching the slide-facilitating member 40 can be further converted into thermal energy generated by mutual friction. This makes the user's head 12 and cervical vertebra only have to bear the last remaining energy. In other words, when the disclosed safety helmet 10 is subject to incoming impact, it uses the deformation of the shell 20 itself, the relative slide between the shell 20 and the head 12, and the friction between the covering 41 and the head 12 to multiply absorb and convert the impact force otherwise directly acting on the head 12 into other forms of energy, so as to reliably protect the head 12 from impact coming in multiple directions, especially diagonal impact.

[0015] It is further to be noted that the slide-facilitating medium 42 may be embodied in various forms..

Claims

1. A safety helmet, comprising:

- a shell (20);
 - a flexible frame (30), being attached to an inner surface of the shell (20); and
 - a slide-facilitating member (40), being attached to an inner surface of the flexible frame (30), and serving to allow the shell (20) to slide with respect to a user head wearing it when the shell (20) receives incoming impact;
- characterized in that**
- the slide-facilitating member (40) has a covering (41) and a slide-facilitating medium (42), in which the covering (41) is attached to the inner surface of the flexible frame (30) and the slide-facilitating medium (42) is wrapped by the cov-

ering (41);
 wherein the slide-facilitating medium (42) has a substrate (60) and a plurality of flexible bars (62) connected to the substrate (60).

2. The safety helmet of claim 1, wherein the shell (20) has a casing (21) and a buffer layer (22), in which the buffer layer (22) has an outer surface thereof attached to the inner face of the casing (21), and the flexible frame (30) is attached to an inner surface of the buffer layer (22), and is also detachable.
3. The safety helmet of claim 2, wherein the flexible frame (30) is attached to the inner surface of the buffer layer (22) through a fastener.
4. The safety helmet of claim 3, wherein the flexible frame (30) has two symmetrical top ribs (32) and a side rib (34), in which the two top ribs (32) each have a front end thereof integratedly connected to a front end of the side rib (34), and the side rib (34) has a rear end thereof provided with an adjuster (36) that is used to adjust a circumference defined by the side rib (34).
5. The safety helmet of claim 2, wherein the inner surface of the buffer layer (22) has a plurality of mortise (23) and an outer surface of the flexible frame (30) has a plurality of tenons (38), so that the tenons (38) of the flexible frame (30) engage with the mortises (23) of the buffer layer (22), respectively.
6. The safety helmet of claim 5, wherein the flexible frame (30) has two symmetrical top ribs (32) and a side rib (34), in which the two top ribs (32) each have a front end thereof integratedly connected to a front end of the side rib (34), and the side rib (34) has a rear end thereof provided with an adjuster (36) that is used to adjust a circumference defined by the side rib (34).

Patentansprüche

1. Schutzhelm, welcher umfasst:

eine Schale (20);
 einen flexiblen Rahmen (30), der an einer inneren Oberfläche der Schale (20) angefügt ist; und ein gleitförderndes Element (40), das an eine innere Oberfläche des flexiblen Rahmens (30) angefügt ist, damit die Schale (20) im Bezug zu dem Kopf eines Nutzers, der diese trägt, gleiten kann, wenn die Schale (20) einen einwirkenden Anprall empfängt;

dadurch gekennzeichnet, dass
 das gleitfördernde Element (40) eine Abdeckung (41) und ein gleitförderndes Medium (42)

aufweist, in welchem die Abdeckung (41) an die innere Oberfläche des flexiblen Rahmens (30) angefügt ist und das gleitfördernde Medium (42) durch die Abdeckung (41) umhüllt ist;
 worin das gleitfördernde Medium (42) ein Substrat (60) und mehrere flexible Stäbe (62) aufweist, die mit dem Substrat (60) verbunden sind.

2. Schutzhelm nach Anspruch 1, worin die Schale (20) ein Gehäuse (21) und eine Pufferschicht (22) aufweist, worin die Pufferschicht (22) eine äußere Oberfläche aufweist, die an die innere Fläche des Gehäuses (21) angefügt ist, und der flexible Rahmen (30) an eine innere Oberfläche der Pufferschicht (22) angefügt ist, und zudem entfernbar ist.
3. Schutzhelm nach Anspruch 2, worin der flexible Rahmen (30) durch ein Befestigungselement an die innere Oberfläche der Pufferschicht (22) angefügt ist.
4. Schutzhelm nach Anspruch 3, worin der flexible Rahmen (30) zwei symmetrische Oberrippen (32) und eine Seitenrippe (34) aufweist, worin die zwei Oberrippen (32) jeweils ein Vorderende aufweisen, das mit einem Vorderende der Seitenrippe (34) einstückig verbunden ist, und worin die Seitenrippe (34) ein Hinterende aufweist, das mit einem Anpassungselement (36) versehen ist, das verwendet wird, um einen durch die Seitenrippe (34) definierten Umfang anzupassen.
5. Schutzhelm nach Anspruch 2, worin die innere Oberfläche der Pufferschicht (22) mehrere Zapfenlöcher (23) und eine äußere Oberfläche des flexiblen Rahmens (30) mehrere Zapfen (38) aufweist, so dass die Zapfen (38) des flexiblen Rahmens (30) mit den Zapfenlöchern (23) der Pufferschicht (22) entsprechend in Eingriff kommen.
6. Schutzhelm nach Anspruch 5, worin der flexible Rahmen (30) zwei symmetrische Oberrippen (32) und eine Seitenrippe (34) aufweist, worin die zwei Oberrippen (32) jeweils ein Vorderende aufweisen, das mit einem Vorderende der Seitenrippe (34) einstückig verbunden ist, und die Seitenrippe (34) ein Hinterende aufweist, das mit einem Anpassungselement (36) versehen ist, das verwendet wird, um einen durch die Seitenrippe (34) definierten Umfang anzupassen.

Revendications

1. Casque de sécurité comprenant:

une coque (20);
 une structure souple (30) fixée à une surface interne de la coque (20); et

un élément facilitant le coulissement (40) fixé à une surface interne de la structure souple (30) et servant à permettre le coulissement de la coque (20) par rapport à une tête d'utilisateur portant ledit casque lorsque la coque (20) reçoit un impact entrant;

caractérisé en ce que

l'élément facilitant le coulissement (40) présente un revêtement (41) et un moyen facilitant le coulissement (42), dans lequel le revêtement (41) est fixé à la surface interne de la structure souple (30) et le moyen facilitant le coulissement (42) est enveloppé par le revêtement (41); le moyen facilitant le coulissement (42) présentant un substrat (60) et une pluralité de barres souples (62) reliées au substrat (60).

de réglage (36) qui est utilisé pour régler une circonférence définie par la nervure latérale (34).

2. Casque de sécurité selon la revendication 1, la coque (20) présentant une carcasse (21) et une couche tampon (22), dans lequel la couche tampon (22) présente une surface externe correspondante fixée à la face interne de la carcasse (21) et la structure souple (30) est fixée à une surface interne de la couche tampon (22) et est également détachable.
3. Casque de sécurité selon la revendication 2, la structure souple (30) étant fixée à la surface interne de la couche tampon (22) par l'intermédiaire d'un élément de fixation.
4. Casque de sécurité selon la revendication 3, la structure souple (30) présentant deux nervures supérieures symétriques (32) et une nervure latérale (34), les deux nervures supérieures (32) présentant chacune une extrémité avant correspondante reliée d'un seul tenant à une extrémité avant de la nervure latérale (34) et la nervure latérale (34) présentant une extrémité arrière correspondante pourvue d'un dispositif de réglage (36) qui est utilisé pour régler une circonférence définie par la nervure latérale (34).
5. Casque de sécurité selon la revendication 2, la surface interne de la couche tampon (22) présentant une pluralité de mortaises (23) et une surface externe de la structure souple (30) présentant une pluralité de tenons (38), de telle sorte que les tenons (38) de la structure souple (30) viennent respectivement en prise avec les mortaises (23) de la couche tampon (22).
6. Casque de sécurité selon la revendication 5, la structure souple (30) présentant deux nervures supérieures symétriques (32) et une nervure latérale (34), les deux nervures supérieures (32) présentant chacune une extrémité avant correspondante reliée d'un seul tenant à une extrémité avant de la nervure latérale (34) et la nervure latérale (34) présentant une extrémité arrière correspondante pourvue d'un dispositif

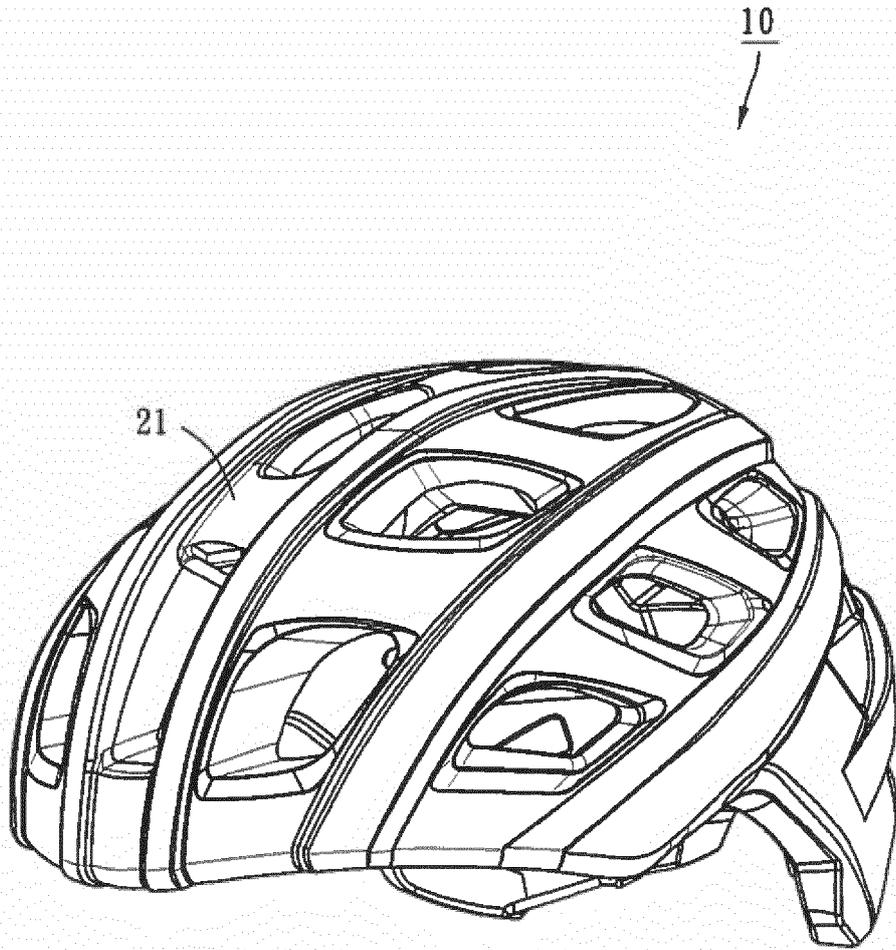


FIG. 1

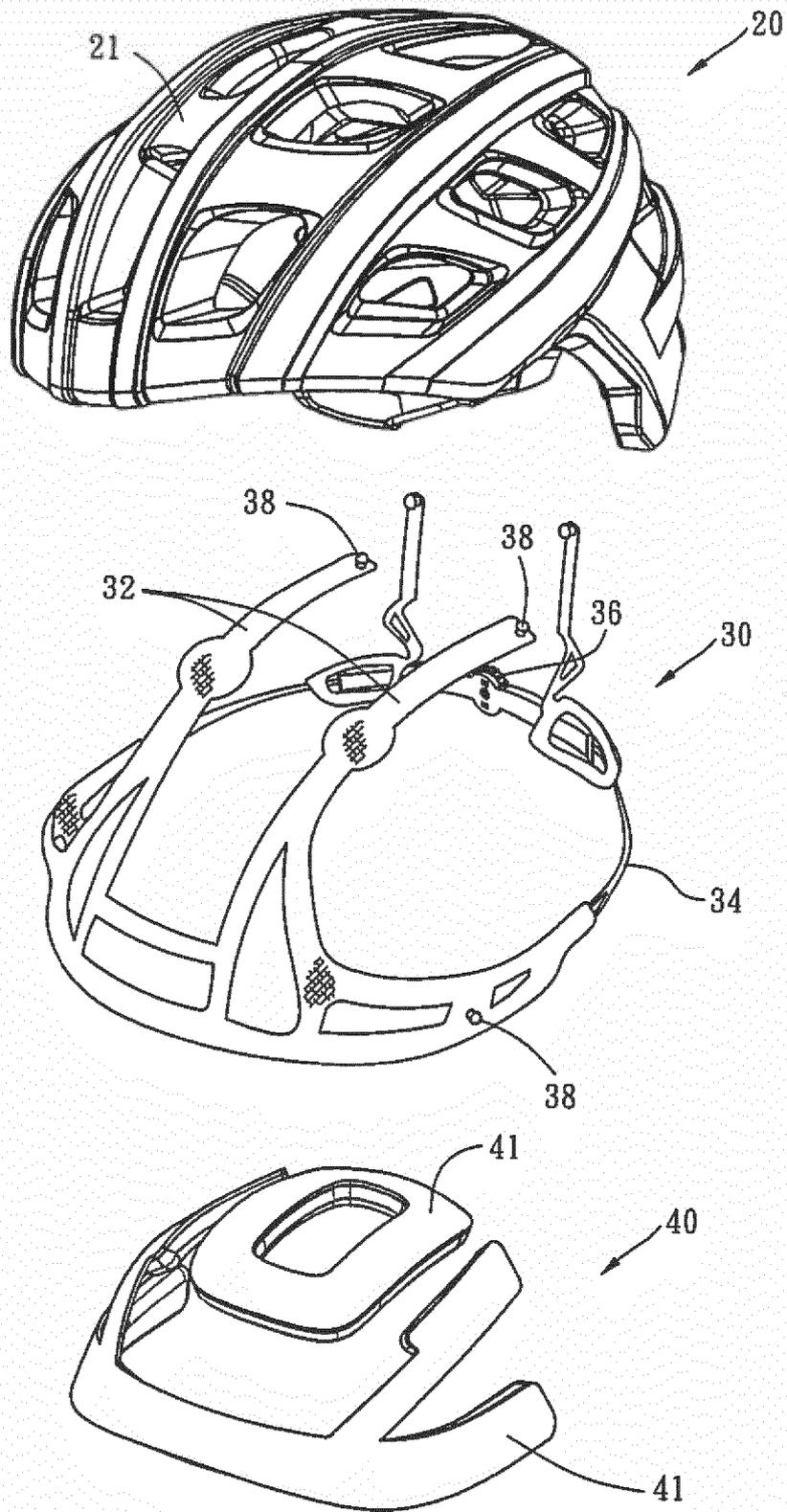


FIG. 2

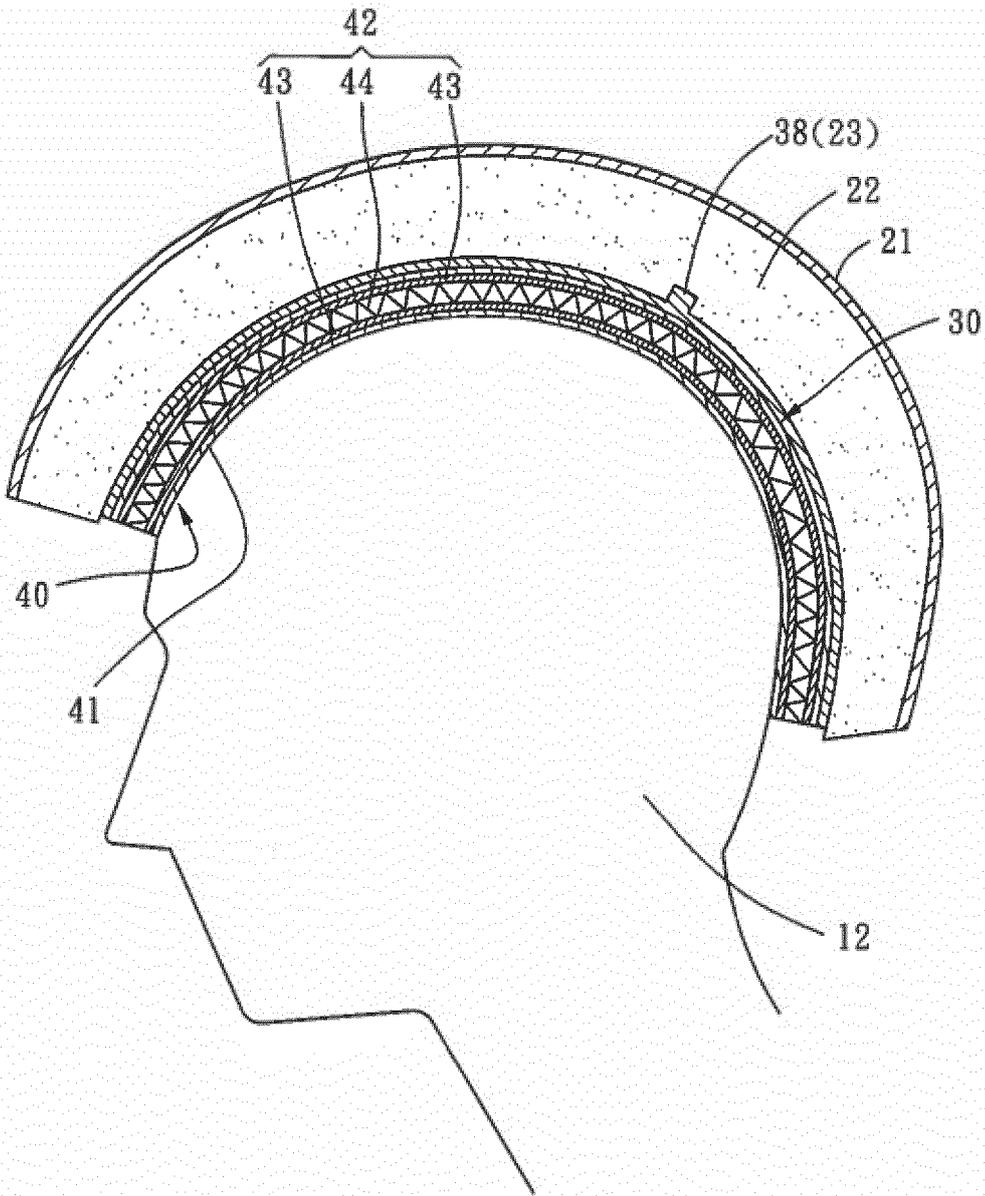


FIG. 3

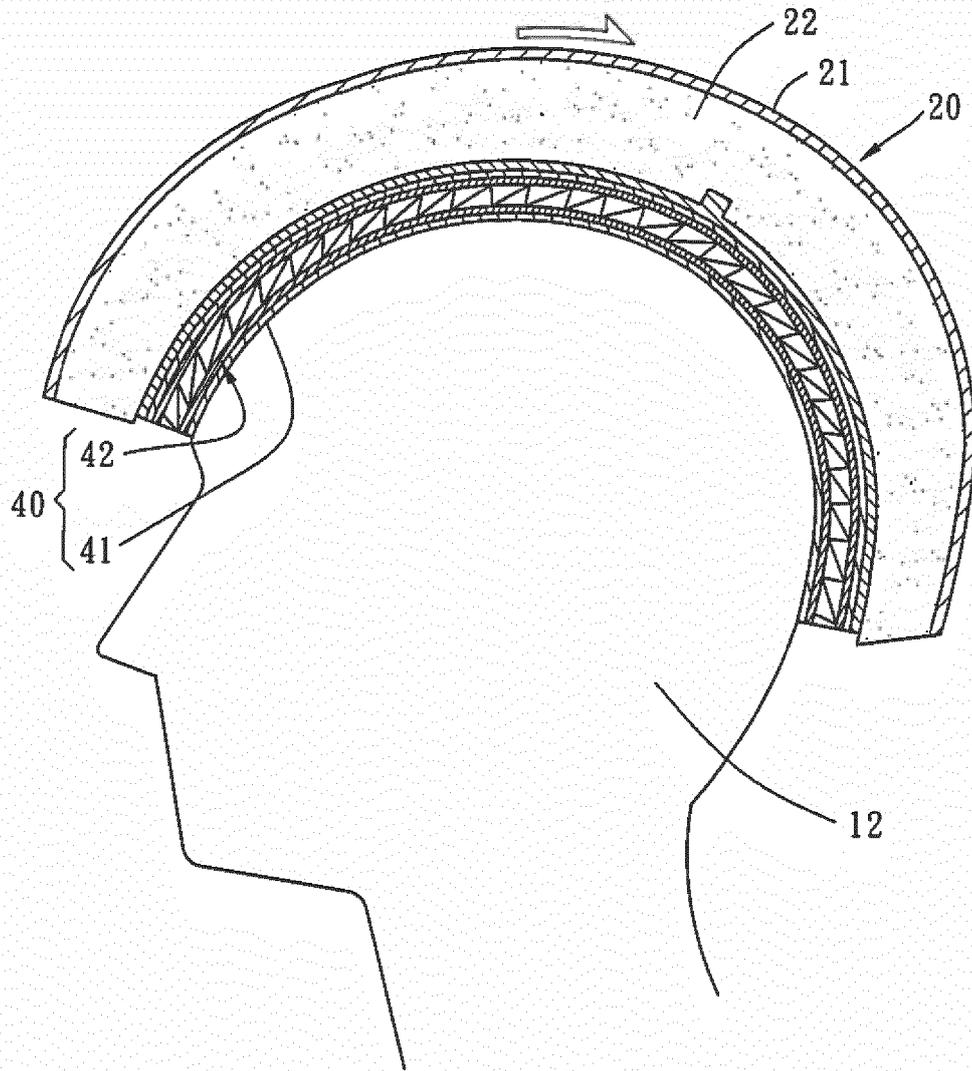


FIG. 4

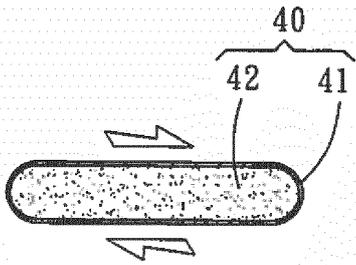


FIG. 5a

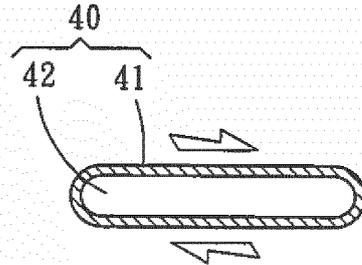


FIG. 5b

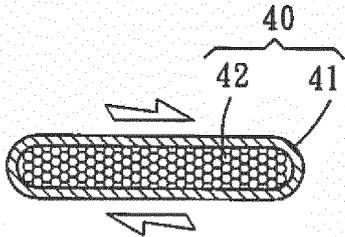


FIG. 5c

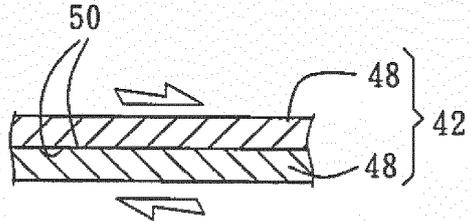


FIG. 5d

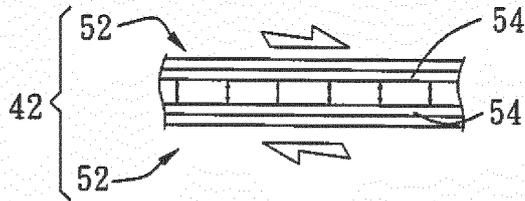


FIG. 5e

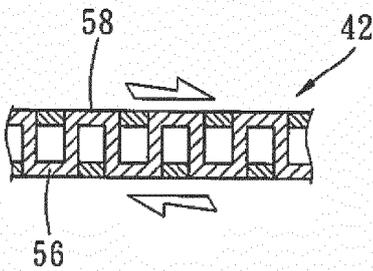


FIG. 5f

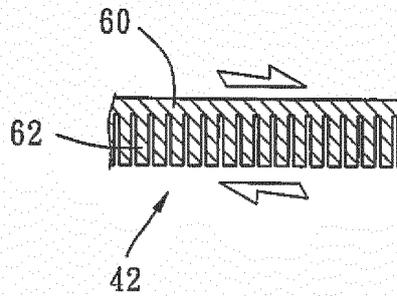


FIG. 5g

REFERENCES CITED IN THE DESCRIPTION

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