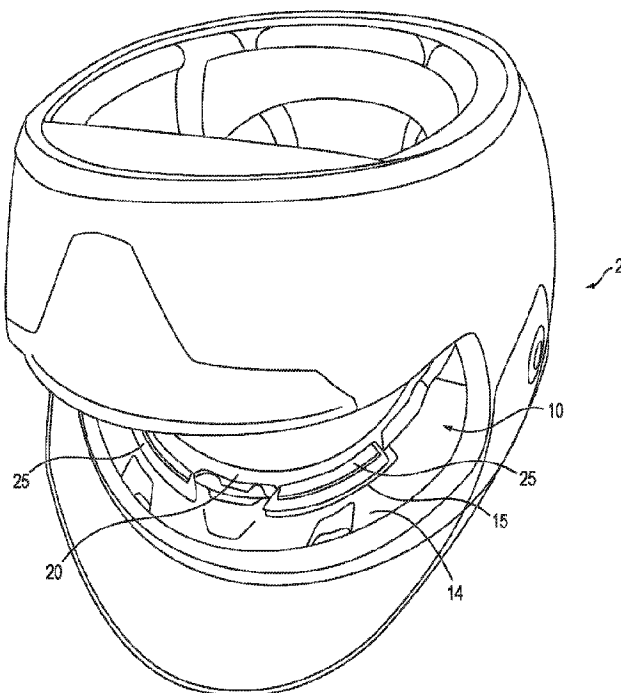




(86) Date de dépôt PCT/PCT Filing Date: 2015/10/28
(87) Date publication PCT/PCT Publication Date: 2016/05/06
(45) Date de délivrance/Issue Date: 2023/09/26
(85) Entrée phase nationale/National Entry: 2017/04/27
(86) N° demande PCT/PCT Application No.: US 2015/057894
(87) N° publication PCT/PCT Publication No.: 2016/069798
(30) Priorités/Priorities: 2014/10/28 (US62/069,679);
2015/10/28 (US14/925,874)

(51) Cl.Int./Int.Cl. *A42B 3/00* (2006.01)
(72) Inventeur/Inventor:
LOWE, MICHAEL W., US
(73) Propriétaire/Owner:
BELL SPORTS, INC., US
(74) Agent: DEETH WILLIAMS WALL LLP

(54) Titre : CASQUE PROTECTEUR
(54) Title: PROTECTIVE HELMET



(57) Abrégé/Abstract:

A protective helmet having a protective shell, a low friction layer, and a comfort liner is disclosed. The protective shell includes an energy absorbing material and an inner surface. The low friction layer is coupled to the inner surface of the protective shell. The low friction layer may be plastic having a thickness of less than approximately 3 mm. The comfort liner is removably coupled to the low friction layer opposite the protective shell, and includes a low friction material, such as brushed nylon, adjacent the low friction liner. The comfort liner may be removably coupled protective shell with either clips that removably couple to receivers embedded in the brow of the helmet, with elastically deformable couplings that extend from the comfort liner to the protective shell, or both.

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

(19) World Intellectual Property
Organization
International Bureau



(10) International Publication Number
WO 2016/069798 A1

(43) International Publication Date
6 May 2016 (06.05.2016)

(51) International Patent Classification:
A42B 3/00 (2006.01)

(21) International Application Number:
PCT/US2015/057894

(22) International Filing Date:
28 October 2015 (28.10.2015)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
62/069,679 28 October 2014 (28.10.2014) US
14/925,874 28 October 2015 (28.10.2015) US

(71) Applicant: BELL SPORTS, INC. [US/US]; 5550 Scotts Valley Road, Scotts Valley, CA 95066-3438 (US).

(72) Inventor: LOWE, Michael W.; 910 Pellegrini Street, Santa Cruz, CA 95062 (US).

(74) Agent: BOOTH, Kenneth C.; Booth Udall Fuller, PLC, 1255 W. Rio Salado Pkwy., Ste. 215, Tempe, AZ 85281 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: IN-MOLD ROTATION HELMET

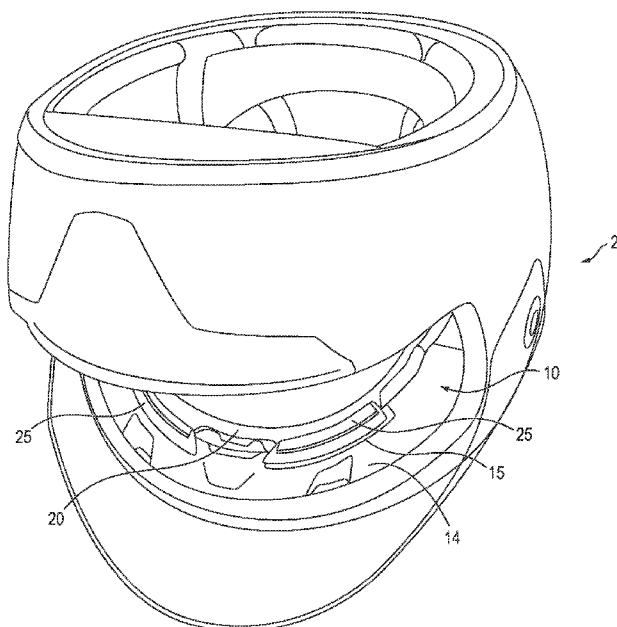


FIG. 2

(57) Abstract: A protective helmet having a protective shell, a low friction layer, and a comfort liner is disclosed. The protective shell includes an energy absorbing material and an inner surface. The low friction layer is coupled to the inner surface of the protective shell. The low friction layer may be plastic having a thickness of less than approximately 3 mm. The comfort liner is removably coupled to the low friction layer opposite the protective shell, and includes a low friction material, such as brushed nylon, adjacent the low friction liner. The comfort liner may be removably coupled protective shell with either clips that removably couple to receivers embedded in the brow of the helmet, with elastically deformable couplings that extend from the comfort liner to the protective shell, or both.

WO 2016/069798 A1



Declarations under Rule 4.17:

- | | | | |
|---|---|---|---|
| — | <i>as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))</i> | — | <i>before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))</i> |
|---|---|---|---|

Published:

- *with international search report (Art. 21(3))*

PROTECTIVE HELMET

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This document claims the benefit of the filing date of U.S. Provisional Patent Application 62/069,679 entitled “In-Mold Rotation Helmet” to Lowe, which was filed on October 28, 2015.

BACKGROUND

1. Technical Field

[0002] Aspects of this document relate generally to protective helmets.

2. Background Art

[0003] Conventional helmet system include comfort liners adjacent a protective shell of the helmet. While the comfort liner may improve comfort the wearer, the rotational movement of the comfort liner with respect to the protective shell is limited during impact due to the friction between the comfort liner and the protective shell.

SUMMARY

[0004] According to one aspect, a protective helmet comprises a protective shell, a low friction layer, and a comfort liner. The protective shell comprises an energy absorbing material and an inner surface. The low friction layer is coupled to the inner surface of the protective shell. The comfort liner is removably coupled to the low friction layer opposite the protective shell, and comprises a low friction material adjacent the low friction liner.

[0005] Various implementations and embodiments may comprise one or more of the following. The low friction material of the comfort liner may comprise brushed nylon. The low friction layer may comprise a plastic low friction layer comprising a thickness less than approximately 3 mm. The comfort liner may be removably coupled to the protective shell with one or more elastically deformable couplings that extend from the comfort liner through the low friction layer to the protective shell. The protective shell may comprise a receiver on a lower edge of the protective shell, the receiver extending into the protective shell from the lower edge of the protective shell, and the comfort liner may comprise a clip removably coupled within the receiver to couple the comfort liner to the protective shell with the low friction layer positioned

between the protective shell and the comfort liner. A neck roll pad coupled to the comfort liner with a four-way stretch fabric.

[0006] According to another aspect, a protective helmet comprises a protective shell, a low friction layer and a comfort liner. The protective shell comprises an energy absorbing material and an inner surface. The low friction layer is coupled to the inner surface of the protective shell. The comfort liner is removably coupled to the low friction layer opposite the protective shell with one or more elastically deformable couplings that extend from the comfort liner through the low friction layer to the protective shell.

[0007] Various implementations and embodiments may comprise one or more of the following. The low friction layer may comprise a plastic low friction layer having a thickness of approximately 3 mm or less. The comfort liner may comprise a low friction material adjacent the low friction layer. The low friction material of the comfort liner may comprise brushed nylon. The protective shell may comprise a receiver on a lower edge of the protective shell, the receiver extending into the protective shell from the lower edge of the protective shell, and the comfort liner may comprise a clip removably coupled within the receiver to couple the comfort liner to the protective shell with the low friction layer positioned between the protective shell and the comfort liner. A neck roll pad coupled to the comfort liner with a four-way stretch fabric.

[0008] According to another aspect, a protective helmet comprises a protective shell and a comfort liner. The protective shell comprises an energy absorbing material, an inner surface, and a receiver on a lower edge of the protective shell, the receiver extending into the protective shell from the lower edge of the protective shell. The comfort liner is removably coupled to the inner surface of protective shell, and comprises a clip removably coupled within the receiver to removably couple the comfort liner to the protective shell.

[0009] Various implementations and embodiments may further comprise one or more of the following. The receiver may comprise a U-shaped slot extending inward into the protective shell from the bottom edge and a plurality of tabs extending inward within the U-shaped slot. A low friction layer coupled to the inner surface of the protective shell between the comfort liner and the protective shell. The low friction layer may comprise a plastic low friction layer having a thickness of approximately 3 mm or less. The comfort liner may comprise a low friction material adjacent the low friction layer. The low friction material comprises brushed nylon. The comfort

liner may be removably coupled to the protective shell with one or more elastically deformable couplings that extend from the comfort liner through the low friction layer to the protective shell. A neck roll pad coupled to the comfort liner with a four-way stretch fabric.

[0010] The foregoing and other aspects, features, and advantages will be apparent to those artisans of ordinary skill in the art from the DESCRIPTION and DRAWINGS, and from the CLAIMS.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The invention will hereinafter be described in conjunction with the appended drawings, where like designations denote like elements, and:

[0012] FIG. 1 is a top perspective view of a first embodiment of a protective helmet;

[0013] FIG. 2 is a bottom perspective view of a first embodiment of a protective helmet;

[0014] FIG. 3 is a bottom view of a brow of a first embodiment of a protective helmet with a clip of a comfort liner coupled to a receiver on the protective shell;

[0015] FIG. 4 is a bottom view of a brow of a first embodiment of a protective helmet with a clip of a comfort liner detached from a receiver on the protective shell;

[0016] FIG. 5 is a bottom view of a second embodiment of a protective helmet;

[0017] FIG. 6 is a side view of a first embodiment of a comfort liner; and

[0018] FIG. 7 is a bottom view of a second embodiment of a comfort liner.

DESCRIPTION

[0019] Protective head gear and helmets have been used in a wide variety of applications and across a number of industries including sports, athletics, construction, mining, military defense, and others, to prevent damage to a users head and brain. Damage and injury to a user can be prevented or reduced by preventing hard objects or sharp objects from directly contacting the user's head, and also from absorbing, distributing, or otherwise managing energy of the impact.

[0020] This disclosure, its aspects and implementations, are not limited to the specific material types, components, methods, or other examples disclosed herein. Many additional material types, components, methods, and procedures known in the art are contemplated for use

with particular implementations from this disclosure. Accordingly, for example, although particular implementations are disclosed, such implementations and implementing components may comprise any components, models, types, materials, versions, quantities, and/or the like as is known in the art for such systems and implementing components, consistent with the intended operation.

[0021] The words "exemplary," "example," or various forms thereof are used herein to mean serving as an example, instance, or illustration. Any aspect or design described herein as "exemplary" or as an "example" is not necessarily to be construed as preferred or advantageous over other aspects or designs. Furthermore, examples are provided solely for purposes of clarity and understanding and are not meant to limit or restrict the disclosed subject matter or relevant portions of this disclosure in any manner. It is to be appreciated that a myriad of additional or alternate examples of varying scope could have been presented, but have been omitted for purposes of brevity.

[0022] While this disclosure includes embodiments of many different forms, there is shown in the drawings and will herein be described in detail particular embodiments with the understanding that the present disclosure is to be considered as an exemplification of the principles of the disclosed methods and systems, and is not intended to limit the broad aspect of the disclosed concepts to the embodiments illustrated.

[0023] Accordingly, this disclosure discloses protective headgear, as well as a system and method for providing a helmet or protective headgear, that can be used for a cyclist, football player, hockey player, baseball player, lacrosse player, polo player, climber, auto racer, motorcycle rider, motocross racer, skier, snowboarder or other snow or water athlete, sky diver or any other athlete, recreational or professional, in a sport. Other non-athlete users such as workers involved in industry, including without limitation construction workers or other workers or persons in dangerous work environments can also benefit from the protective headgear described herein, as well as the system and method for providing the protective head gear.

[0001] Various implementations and embodiments of protective helmets according to this disclosure comprise a protective shell. The protective shell can be made of an energy absorbing material, such as expanded polystyrene (EPS), expanded polyurethane (EPU), expanded polyolefin (EPO), expanded polypropylene (EPP), or other suitable energy managing

material. The energy absorbing material can be part of a hard-shell helmet such as a skate bucket helmets, motorcycle helmets, snow sport helmets, football helmets, batting helmets, catcher's helmets, or hockey helmets, and include an additional outer protective shell disposed outside, or over, the protective shell. In hard shell applications, the energy absorbing material can comprise one or more layers of EPP and provide more flexibility than available with conventional in-molded helmets. Alternatively, the energy absorbing material can be part of an in-molded helmet such as bicycle helmet or cycling helmet. Because bicycle helmets typically include openings in the energy absorbing material for ventilation to airflow can through the helmet and cooling of a wearer's head, cycling applications could require modified low friction layers. As an energy-absorbing layer in an in-molded helmet, the protective shell can comprise rigid materials such as EPS and EPU. An outer shell layer, such as a layer of stamped polyethylene terephthalate (PET) or a polycarbonate shell, can be included on an outer surface of the protective shell of the helmet and be bonded directly to the expanding foam (e.g. PET layer added the to the EPS as it is expanding such that the foam is molded in the shell).

[0024] FIGs. 1-4 depict a non-limiting embodiment of a protective helmet 2 according to this disclosure. In one or more embodiments, a protective shell 10 comprises a plurality of layers of energy absorbing material coupled to one another. For example, in the non-limiting embodiment of a protective helmet 2 shown in FIGs. 3 and 4, the protective shell comprises a first layer 11, a second layer 12, and a third layer 13 of energy absorbing material coupled to one another to form a protective shell 10. In embodiments comprising a plurality of layers of energy absorbing material coupled to one another, the inner surface of the protective shell 10 is the inner surface of the innermost layer of energy absorbing material. For example, in the non-limiting embodiment shown in FIGs. 3 and 4, the inner surface of the protective shell 110 is the inner surface of the third layer 13 of energy absorbing material (not visible in FIGs. 3 and 4), the inner surface of the third layer 13 of energy absorbing material being directed to or facing the head of the wearer when the protective helmet 2 is worn. In other embodiments, such as the non-limiting embodiment of a protective helmet 4 depicted in FIG. 5, a protective shell 8 may comprise a single layer of energy absorbing material. In such an embodiment, the inner surface 9 is also directed to or facing the head of the wearer when the protective helmet 4 is worn. Embodiments

of a protective shell may also include an outer surface formed opposite the inner surface that may be oriented away from the wearer's head.

[0025] Various implementations and embodiments of protective helmets contemplated in this disclosure may further comprise a low friction layer 30 (shown in FIG. 5) coupled to an inner surface 9 of a protective helmet. Although a low friction layer 30 is not visible in the non-limiting embodiment shown in FIGs. 1-4, one of ordinary skill in the art will understand how the low friction layer 30 shown coupled to a protective helmet 4 in FIG. 5 may be applied to other protective helmets. The non-limiting example of a low friction layer 30 in FIG. 5 is formed of a transparent plastic. Although reference is made below to the inner surface 9 of the protective shell 8 of the protective helmet 4 shown in FIG. 5, it is contemplated that a low friction layer 30 having similar features may be applied to the protective helmet 2 shown in FIGs. 1-4. By forming a thin low friction layer 30, such as is described herein, the low friction layer 30 may provide for rotational energy management without requiring additional thick or bulky layers between the outer surface of the helmet and the wearer's head. As such, embodiments of providing rotational energy management contemplated as part of this disclosure may be implemented with conventional helmet designs, sizes, and dimensions, without interfering with helmet fit, or requiring helmet redesigns to accommodate improvements for rotational energy management.

[0026] According to some aspects, a low friction layer 30 may be formed of plastic, such as PET or polycarbonate, as well as other materials such as carbon fiber, fiberglass, or any other suitable material that provides a low friction inner surface that is oriented towards the head of a wearer and positioned to interface a comfort liner (described in greater detail below). In one or more embodiments, a low friction layer 30 comprises a contoured surface that follows a contour, topography, or shape of the inner surface 9 of the protective shell 8. A topography, shape, or geometry of the low friction layer 30 may also account for helmet ventilation. According to some aspects, a low friction layer 30, whether contoured or not contoured, comprises a thickness in a range of 0-3mm, or a thickness less than 1mm. A low friction layer 30 may also include projections, tabs, or pegs that can be perpendicular with, or extend away from, the contoured surface of the low friction layer 30 and be imbedded within the protective shell 8 to secure the low friction layer 30 to the protective shell 8, as shown in FIG. 5. A low friction layer 30 may be coupled to the inner surface 9 of a protective shell 8, especially for in-molded helmets, as a

plastic shell formed of in-molded polycarbonate, PET, or other suitable plastic in a way that is the same or similar to a way in which outer plastic shells can be coupled to in-molded helmets. A low friction layer 30 may also be coupled to the protective shell 8 after the protective shell 8 is fully formed. In some instances, a protective shell 8 is added or retrofitted to an existing helmet as part of an after-purchase or after market upgrade to increase protection and management of energy through rotational movement.

[0027] Various implementations and embodiments of a protective helmet according to this disclosure may further comprise a comfort liner coupled to the protective shell of the helmet. In some embodiments, a comfort liner is removably coupled to a protective shell of a helmet with the low friction layer positioned between the comfort liner and the protective shell. Various embodiment of comfort liners according to this disclosure may be removably coupled to a protective shell with multiple embodiments of couplings, which shall be described in greater detail below. When coupled to a protective shell, a comfort liner may be disposed within the protective shell of helmet and oriented towards the inner surface of the protective shell of the helmet to provide additional cushion and padding to a wearer's head, while also minimizing, reducing, and filling-in gaps or offsets that might exists between the wearer's head and the protective shell.

[0028] FIG. 6 depicts a non-limiting embodiment of a comfort liner 40 according to this disclosure. In one or more embodiments, an outer surface 41 (i.e. the surface that is oriented towards the protective shell of the helmet and away from the wearer's head) comprises exposed padding or raw foam. In other embodiments, a comfort liner 40 comprises an outer surface 41 having a low friction material covering the padding or raw foam. A low friction material may comprise brushed nylon or an equivalent fabric. By including a low friction material such as brushed nylon on an outer surface 41 of the comfort liner 40, slipping, rotation, and relative movement between the comfort liner 40 and the low friction layer 30 may be promoted or increased such that a wearer's head remains in fixed contact relative to the comfort liner 40 while slipping, rotating, and moving against the low friction liner 30 with respect to the protective shell of the helmet.

[0029] A comfort liner 40 according to this disclosure may be formed as unitary or monolithic padded interiors, such as those formed with one-piece sewn basket construction.

Unitary construction of the comfort liner allows for reducing or minimizing a number of attachment devices or anchoring points, as discussed in greater detail below. When a comfort liner 40 is disposed adjacent the low friction layer, the comfort liner 40 may be coupled to the protective shell of the helmet with at least one elastically deformable coupling that facilitates rotation and relative movement of the comfort liner 40 with respect to the low friction layer 30. In the non-limiting embodiment shown in FIG. 6, a comfort liner comprises at least one front elastically deformable coupling 42 and at least one rear elastically deformable coupling 43. The elastically deformable coupling may be displaced and absorb energy during an impact and then return to an original position after impact.

[0030] One or more embodiments of a comfort liner 20, such as the comfort liner 20 shown in the non-limiting embodiment depicted in FIGs. 3 and 4, comprise one or more straps 24 extending from the body of the comfort liner 20 and a clip 25 couple to each of the one or more straps 24. In the non-limiting embodiment shown in FIGs. 3 and 4, the comfort liner 20 comprises two front straps 24 and a different clip 25 coupled to each of the two front straps 24. The front straps 24 and clips 25 are positioned to allow a user to removably couple the clips 25 to a front brow or front lower edge 14 of a protective shell 10 of the helmet 2. In some embodiments, a comfort liner 20 may comprise one or more rear straps and clips similar to that shown in FIGs. 3 and 4 positioned to removably couple the comfort liner 25 to a rear brow or lower edge of a helmet 2. The straps 24 may be adjustable straps 24 that allow a user to adjust a length of the strap 24. In particular embodiments, the clips 25 may couple into the front brow of the helmet substantially perpendicularly to the front brow surface. Various embodiments may comprise one or more clips 25 and one or more elastically deformable couplings. For example, a comfort liner 20 may comprise two front clips 25 and two rear elastically deformable couplings 43. Other embodiments may comprise two front clips 25, two front elastically deformable couplings 42, and two rear elastically deformable couplings 43. Still other embodiments may comprise two rear clips 25 and two front elastically deformable couplings 42. Other embodiments may comprise any combination thereof.

[0031] As noted above, one or more embodiments of a helmet 4 may comprise at least one elastically deformable coupling 42, 43 coupling the comfort liner 40 to the protective shell 8 of the helmet 4. An elastically deformable coupling 42, 43 may comprise a rubber snap, stopper, or

bungees that can be releasably or permanently coupled to the comfort liner 40 and to the protective shell 8. However, any number or type of suitable attachment devices can be used, as desired, according to the particular needs and application of the helmet. For example, while any number of attachment devices can be used for power sports helmets, some power sports helmets can include four attachment devices (like clips 25) disposed along a lower edge or perimeter of the comfort liner, as shall be described in greater detail below. For some power sports helmets, a comfort liner 40 or padding can be coupled to the exterior perimeter or lower drip-line of the helmet. Accordingly, the padding can be coupled to the helmet by being sandwiched between an energy absorbing layer (such as EPS) and an outer shell without any additional attachment devices, such as snaps, because the fit between the outer shell and the energy absorbing layer can function as the attachment device.

[0032] For applications involving snow helmets, a sewn basket style pad assembly may be used and coupled to the low friction layer 30 of the protective shell 8. For applications involving bike or cycling helmets, the comfort liner 30 can be coupled to the low friction layer 30 or protective shell 8 as a mesh layer or with openings to accommodate ventilation openings and airflow through the helmet, and a comfort liner comprising plurality of smaller portions or discrete pieces may be used.

[0033] In one or more embodiments, an elastically deformable coupling 42, 43 may couple the comfort liner 40 to the protective shell 8 by at least one of the elastically deformable couplings 42, 43 extending through an opening 31, hole, or cut-out of the low friction layer 30. Alternatively, a shape of the low friction layer 30 can be such that the elastically deformable coupling 42, 43 may couple the low friction layer 30 to the protective shell 8 without passing through the low friction layer 30, such as being disposed around a periphery of the low friction layer 30. In yet another embodiment, the elastically deformable coupling may couple the comfort liner 40 directly to the low friction layer 30. In the non-limiting embodiment shown in FIG. 6, each elastically deformable coupling 42, 43 is configured to extend away from the comfort liner 40, through the low friction layer 30 and be coupled directly to the protective shell 8.

[0034] As a non-limiting example, an elastically deformable coupling 42, 43 may pass through a circular opening 31 in the clear plastic shell of the low friction layer 30, and snap into a circular opening 7, 6 on the inner surface 9 of the protective shell 8 aligned with the circular

opening 31 in the low friction layer 30. Each elastically deformable coupling 42, 43 may thus be coupled at its ends to the protective shell 8 and the comfort liner 40, with a distance or length in-between that allows for elastic movement. Each elastically deformable coupling 42, 43 may be held at its respective ends in the protective shell 8 and comfort layer 40 by a chemical attachment, such as by an adhesive, or by mechanical attachment. Mechanical attachment can include sewing, interlocking, or friction.

[0035] In some instances, each elastically deformable coupling 42, 43 comprises an “I” shape with top and bottom widened portions and a narrower central portion. The top widened portion can include a head, tab, or flange, an underside of which contacts the comfort liner 40 around an opening in the comfort liner 40 through which the elastically deformable coupling 42, 43 can pass. The bottom-widened portion can include a head, tab, flange or barbs that contact an inner portion of the opening in the protective shell for receiving the elastically deformable coupling. In any event, the elastically deformable couplings 42, 43 can couple the comfort liner 40 to the protective shell in such a way as to allow a range of motion or relative movement along the low friction layer 30 and with respect to the protective shell 8. The range of motion can be adjusted to a desirable layer amount or distance by adjusting a size, elasticity, or other feature of the elastically deformable couplings.

[0036] According to some aspects and as noted above, a comfort liner 20 may be coupled to a protective shell 10 with one or more clips 25. Each clip 25 may comprise an elongated clip 25 sized to friction or compression fit within a receiver 15 on the protective shell 10 of the helmet 2. In other embodiments, the clip 25 may comprise a buckle or any other coupling configured to allow a user to removably couple the clip 25 to the brow or lower edge 14 of the helmet 2. As noted, various embodiments of a protective helmet 2 comprise one or more receivers 15 embedded within a protective shell 10 of the helmet 2 and positioned to receive a clip 25. As used herein, the brow or lower edge 14 of the helmet 2 is the portion of the protective shell 10 just above the eyebrows of the user. The lower edge may also include the edge just above the rear side of the neck of the user. In any event, as used herein, the brow or lower edge 14 of the helmet 2 extends at an angle away from the face or neck of the wearer or from the center of the helmet 2. The lower edge 14, then, comprises a latitudinal edge on the helmet 2 extending outward from the center of the helmet 2. When a clip 25 is detachably

coupled to receiver 15, the clip 25 extends into the receiver substantially perpendicular to the latitudinal lower edge 14 of the protective shell 10. In one or more embodiments, the clip 25 is substantially perpendicular to a surface upon which the helmet 2 rests (or the ground upon which the wearer stands) when the clip 25 is detachably coupled to the receiver 15 embedded within the protective shell of the helmet 2 (assuming the helmet 2 is upright).

[0037] Each receiver 15 is configured to removably couple the clip 25 to the receiver 15 and thus the protective shell 10 in which the receiver 15 is embedded. Each receiver 15 may comprise one or more teeth 16 configured to pinch a portion of the clip 25 and hold the clip 25 partially within the receiver 15. Like the elastically deformable couplings 42, 43, the clips 25 and receivers 15 couple the comfort liner 20 to the protective shell 10 in such a way as to allow a range of motion or relative movement along the low friction layer 30 and with respect to the protective shell 10. The range of motion can be adjusted to a desirable layer amount or distance by adjusting the length of the strap 14.

[0038] Also contemplated in this disclosure is a comfort liner 50 comprising a four-way stretch fabric 52 coupling a neck roll 51 of the comfort liner 50 the main body of the comfort liner 50. FIG. 7 depicts a bottom view of a comfort liner 50 comprising a four-way stretch fabric 52 coupling a neck roll 51 to the comfort liner 50. Such a configuration provides more free movement of the comfort liner 50 against the low friction layer 30 described above. In some embodiments, the neck roll 51 is directly and removably coupled to either the low friction layer 30 or the protective shell with elastically deformable couplings 43 or clips 25, as described above. In other embodiments, the neck roll 51 is not directly coupled to either the protective shell or the low friction layer 30.

[0039] It will be understood that implementations are not limited to the specific components disclosed herein, as virtually any components consistent with the intended operation of a method and/or system implementation for helmets may be utilized. Accordingly, for example, although particular protective shells and comfort liners may be disclosed, such components may comprise any shape, size, style, type, model, version, class, grade, measurement, concentration, material, weight, quantity, and/or the like consistent with the intended operation of a method and/or system implementation for a helmet may be used.

[0040] In places where the description above refers to particular implementations of helmets, it should be readily apparent that a number of modifications may be made without departing from the spirit thereof and that these implementations may be applied to other helmets. The accompanying claims are intended to cover such modifications as would fall within the true spirit and scope of the disclosure set forth in this document. The presently disclosed implementations are, therefore, to be considered in all respects as illustrative and not restrictive, the scope of the disclosure being indicated by the appended claims rather than the foregoing description. All changes that come within the meaning of and range of equivalency of the claims are intended to be embraced therein.

CLAIMS

1. A protective helmet, comprising:
 - an outer shell having an inner surface and a lower edge;
 - an energy absorbing material having an inner surface and an outer surface, wherein the outer surface of the energy absorbing material is directly connected to the inner surface of the outer shell;
 - a front receiver positioned adjacent to the lower edge of the outer shell and between the inner surface and the outer surface of a front region of the energy absorbing material;
 - a comfort liner configured to contact a head of a wearer of the protective helmet, the comfort liner has: (i) a body, (ii) a front strap that extends from the body and includes a front attachment device, and (iii) an elastically deformable coupling that extends from an outer surface of the comfort liner; and
 - wherein the comfort liner is removably coupled within the protective helmet when an extent of the front attachment device is connected to the front receiver to provide a front connection that is positioned between the inner surface of the energy absorbing material and the outer surface of the energy absorbing material.
2. The protective helmet of claim 1, wherein the outer surface of the comfort liner is covered with a material comprised of brushed nylon.
3. The protective helmet of claim 1, further comprising a plastic layer positioned between the comfort liner and the energy absorbing material.
4. The protective helmet of claim 3, wherein the plastic layer includes a plurality of projections that extend away from an outer surface of the plastic layer.
5. The protective helmet of claim 4, wherein when the plastic layer is coupled to the energy absorbing material, an extent of said plurality of projections are imbedded within the energy absorbing material.
6. The protective helmet of claim 3, wherein said plastic layer has a thickness that does not exceed 3 mm.
7. The protective helmet of claim 3, wherein the plastic layer underlies a majority of the inner surface of the energy absorbing material.

8. The protective helmet of claim 3, wherein the plastic layer has an outer periphery and the energy absorbing material has an outer periphery, and wherein the outer periphery of the plastic layer is less than the outer periphery of the energy absorbing material whereby at least an extent of the outer periphery of the energy absorbing material is exposed.
9. The protective helmet of claim 3, wherein an inner portion of the energy absorbing material defines an interface area, and an outer surface of the plastic layer defines an interface area, and
wherein the interface area of the plastic layer is less than the interface area of the energy absorbing material.
10. The protective helmet of claim 3, wherein said plastic layer has an opening formed therethrough; and
wherein the comfort liner includes a foam layer and the elastically deformable coupling is configured to be inserted into the opening formed in the plastic layer to removably secure the comfort liner within the helmet.
11. The protective helmet of claim 10, wherein the elastically deformable coupling is not integrally formed with the comfort liner.
12. The protective helmet of claim 10, wherein the elastically deformable coupling is configured to facilitate relative movement between the comfort liner and the plastic layer.
13. The protective helmet of claim 10, wherein the elastically deformable coupling is configured to be displaced during an impact and then return to an original position after the impact.
14. The protective helmet of claim 10, wherein the elastically deformable coupling includes:
(i) a base portion adjacent to said outer surface, (ii) an intermediate portion with a first width, and (iii) an end portion with a second width that is greater than the first width of the intermediate portion.
15. The protective helmet of claim 14, wherein when the elastically deformable coupling extends through said opening in the plastic layer, the end portion of the elastically deformable coupling (i) extends past the plastic layer, and (ii) is positioned within an extent of the energy absorbing material.
16. The protective helmet of claim 14, wherein the intermediate portion and the end portion of the elastically deformable coupling provide the elastically deformable coupling with a

barb-shaped configuration that facilitates the removable securement of the elastically deformable coupling with the plastic layer.

17. The protective helmet of claim 1, wherein the energy absorbing material is made from polyurethane.
18. The protective helmet of claim 1, wherein the extent of the front attachment device is positioned substantially perpendicular to a lower front edge of the energy absorbing material, when the extent of the front attachment device is connected to the front receiver.
19. The protective helmet of claim 1, wherein the front receiver includes a recessed structure that is positioned within an extent of the energy absorbing material.
20. The protective helmet of claim 1, wherein the front receiver includes at least one tooth.
21. The protective helmet of claim 1, wherein the front region of the energy absorbing material includes a first layer and a second layer, and wherein said first layer is made from polyurethane.
22. A protective helmet, comprising:
 - an outer shell having an inner surface and a lower edge;
 - an energy absorbing layer having an inner surface and an outer surface, wherein the outer surface of the energy absorbing layer is directly connected to the inner surface of the outer shell;
 - a front receiver positioned directly adjacent to the lower edge of the outer shell and between the inner surface and the outer surface of a front region of the energy absorbing layer;
 - a plastic layer coupled to an extent of the inner surface of the energy absorbing layer;
 - a comfort liner configured to contact a head of a wearer of the protective helmet, said comfort liner has: i) a body, ii) a front strap that extends from the body and includes a front attachment device, and iii) at least two elastically deformable couplers that extend from an outer surface of the comfort liner; and
 - wherein the outer surface of the comfort liner is removably positioned adjacent to the plastic layer when: (i) the front attachment device is connected to the front receiver to provide a front connection that is positioned inward of the outer surface of the energy

- absorbing layer, and (ii) each of the elastically deformable couplers extend into a hole in the plastic layer.
23. The protective helmet of claim 22, wherein the plastic layer has a thickness of 3 mm or less.
 24. The protective helmet of claim 22, wherein the outer surface of the comfort liner is comprised of brushed nylon.
 25. The protective helmet of claim 22, wherein the front region of the energy absorbing layer includes a first layer and a second layer, said first layer is made from polyurethane.
 26. The protective helmet of claim 22, wherein an extent of the front attachment device is positioned substantially perpendicular to a lower front edge of the energy absorbing layer.
 27. The protective helmet of claim 22, wherein the front receiver includes at least one tooth.
 28. The protective helmet of claim 22, wherein the plastic layer includes a plurality of projections that extend away from an outer surface of the plastic layer.
 29. The protective helmet of claim 28, wherein when the plastic layer is coupled to the energy absorbing layer, an extent of said plurality of projections are imbedded within the energy absorbing layer.
 30. The protective helmet of claim 22, wherein the plastic layer underlies a majority of the inner surface of the energy absorbing layer.
 31. The protective helmet of claim 22, wherein the plastic layer has an outer periphery and the energy absorbing layer has an outer periphery, and wherein the outer periphery of the plastic layer is less than the outer periphery of the energy absorbing layer whereby at least an extent of the outer periphery of the energy absorbing layer is exposed.
 32. The protective helmet of claim 22, wherein an inner portion of the energy absorbing layer defines an interface area, and an outer surface of the plastic layer defines an interface area, and
wherein the interface area of the plastic layer is less than the interface area of the energy absorbing layer.
 33. The protective helmet of claim 22, wherein the elastically deformable couplers are not integrally formed with an extent of the comfort liner.

34. The protective helmet of claim 22, wherein the elastically deformable couplers include: (i) a base portion adjacent to an outer surface, (ii) an intermediate portion with a first width, and (iii) an end portion with a second width that is greater than the first width of the intermediate portion.
35. The protective helmet of claim 22, wherein when an elastically deformable coupler extends through the hole in the plastic layer, an end portion of the elastically deformable coupler (i) extends past the plastic layer, and (ii) is positioned within an extent of the energy absorbing layer.
36. The protective helmet of claim 34, wherein the intermediate portion and the end portion of the elastically deformable coupler provide the elastically deformable coupler with a barb-shaped configuration that facilitates the removable securement of the elastically deformable coupler with the plastic layer.
37. The protective helmet of any one of claims 22 through 36, wherein the elastically deformable coupler is configured to be displaced during an impact and then return to an original position after the impact.
38. The protective helmet of any one of claims 22 through 36, wherein the elastically deformable couplers are configured to facilitate relative movement between the comfort liner and the plastic layer.
39. A protective helmet, comprising:
- an outer shell having an inner surface and a lower edge;
 - an energy absorbing layer having an inner surface and an outer surface, wherein the outer surface of the energy absorbing layer is directly connected to the inner surface of the outer shell;
 - a front coupler bordering the lower edge of the outer shell and positioned between the inner surface and the outer surface of a front region of the energy absorbing layer;
 - a plastic layer coupled to the inner surface of the energy absorbing layer, wherein the plastic layer has at least one projection that extends from the plastic layer into the energy absorbing layer;
 - a comfort liner configured to contact a head of a wearer of the protective helmet, the comfort liner having: (i) a body that includes a foam layer and (ii) a front attachment device; and

wherein the comfort liner is removably secured adjacent to the plastic layer and within the protective helmet when an extent of the front attachment device is coupled with the front coupler.

- 40. The protective helmet of claim 39, wherein the front coupler comprise a U-shaped slot extending inward into the energy absorbing layer from a bottom edge of the energy absorbing layer.
- 41. The protective helmet of claim 39, wherein the plastic layer has a thickness of 3 mm or less.
- 42. The protective helmet of claim 39, wherein the plastic layer underlies a majority of the inner surface of the energy absorbing layer.
- 43. The protective helmet of claim 39, wherein the plastic layer has an outer periphery and the energy absorbing layer has an outer periphery, and wherein the outer periphery of the plastic layer is less than the outer periphery of the energy absorbing layer whereby at least an extent of the outer periphery of the energy absorbing layer is exposed.
- 44. The protective helmet of claim 39, wherein an inner portion of the energy absorbing layer defines an interface area, and an outer surface of the plastic layer defines an interface area, and

wherein the interface area of the plastic layer is less than the interface area of the energy absorbing layer.

- 45. The protective helmet of claim 39, wherein the comfort liner includes a second elastically deformable coupler that extends from an outer surface of the comfort liner.
- 46. The protective helmet of claim 45, wherein said second elastically deformable coupler removably connects the comfort liner to the energy absorbing layer when an extent of the second elastically deformable coupler extends through a hole in the plastic layer.
- 47. The protective helmet of claim 45, wherein the second elastically deformable coupler is not integrally formed with the comfort liner.
- 48. The protective helmet of claim 45, wherein the second elastically deformable coupler is configured to facilitate relative movement between the comfort liner and the plastic layer.
- 49. The protective helmet of claim 45, wherein the second elastically deformable coupler includes: (i) a base portion adjacent to said outer surface, (ii) an intermediate portion with

- a first width, and (iii) an end portion with a second width that is greater than the first width of the intermediate portion.
50. The protective helmet of claim 49, wherein when the second elastically deformable coupler extends through an opening in the plastic layer, the end portion of the second elastically deformable coupler (i) extends past the plastic layer, and (ii) is positioned within an extent of the energy absorbing layer.
 51. The protective helmet of claim 49, wherein the intermediate portion and the end portion of the second elastically deformable coupler provide the second elastically deformable coupler with a barb-shaped configuration that facilitates the removable securement of the second elastically deformable coupler with the plastic layer.
 52. The protective helmet of claim 39, wherein the energy absorbing layer is made from polyurethane.
 53. The protective helmet of claim 39, wherein the extent of the front attachment device is positioned substantially perpendicular to a lower front edge of the energy absorbing layer, when the extent of the front attachment device is connected to the front coupler.
 54. The protective helmet of claim 39, wherein the front coupler includes a recessed structure that is positioned within an extent of the energy absorbing layer.
 55. The protective helmet of claim 39, wherein the front coupler includes at least one tooth.
 56. The protective helmet of claim 39, wherein the front coupler includes a front receiver having a plurality of teeth.
 57. The protective helmet of claim 39, wherein the front region of the energy absorbing layer includes a first layer and a second layer, said first layer is made from polyurethane.
 58. The protective helmet of claim 39, wherein the comfort liner has an outer layer that is comprised of brushed nylon.
 59. The protective helmet of claim 39, wherein recesses are formed in an inner surface of the plastic layer.
 60. A protective helmet comprising:
 - an outer shell having an inner surface;
 - an energy absorbing layer having an inner portion and an outer portion, the outer portion of the energy absorbing layer being positioned adjacent to the inner surface of the outer shell;

a plastic layer positioned adjacent to the inner portion of the energy absorbing layer, the plastic layer having an opening formed therethrough;

a comfort liner assembly having an outer surface, a foam layer, and an elastically deformable coupling that extends from said outer surface, wherein the elastically deformable coupling has: (i) a base portion adjacent to said outer surface, (ii) an intermediate portion with a first width, and (iii) an end portion with a second width that is greater than the first width of the intermediate portion, and

wherein the comfort liner assembly is removably secured to the plastic layer by inserting the elastically deformable coupling through said opening in the plastic layer whereby said end portion of the elastically deformable coupling (i) extends past the plastic layer, and (ii) is positioned within an extent of the energy absorbing layer.

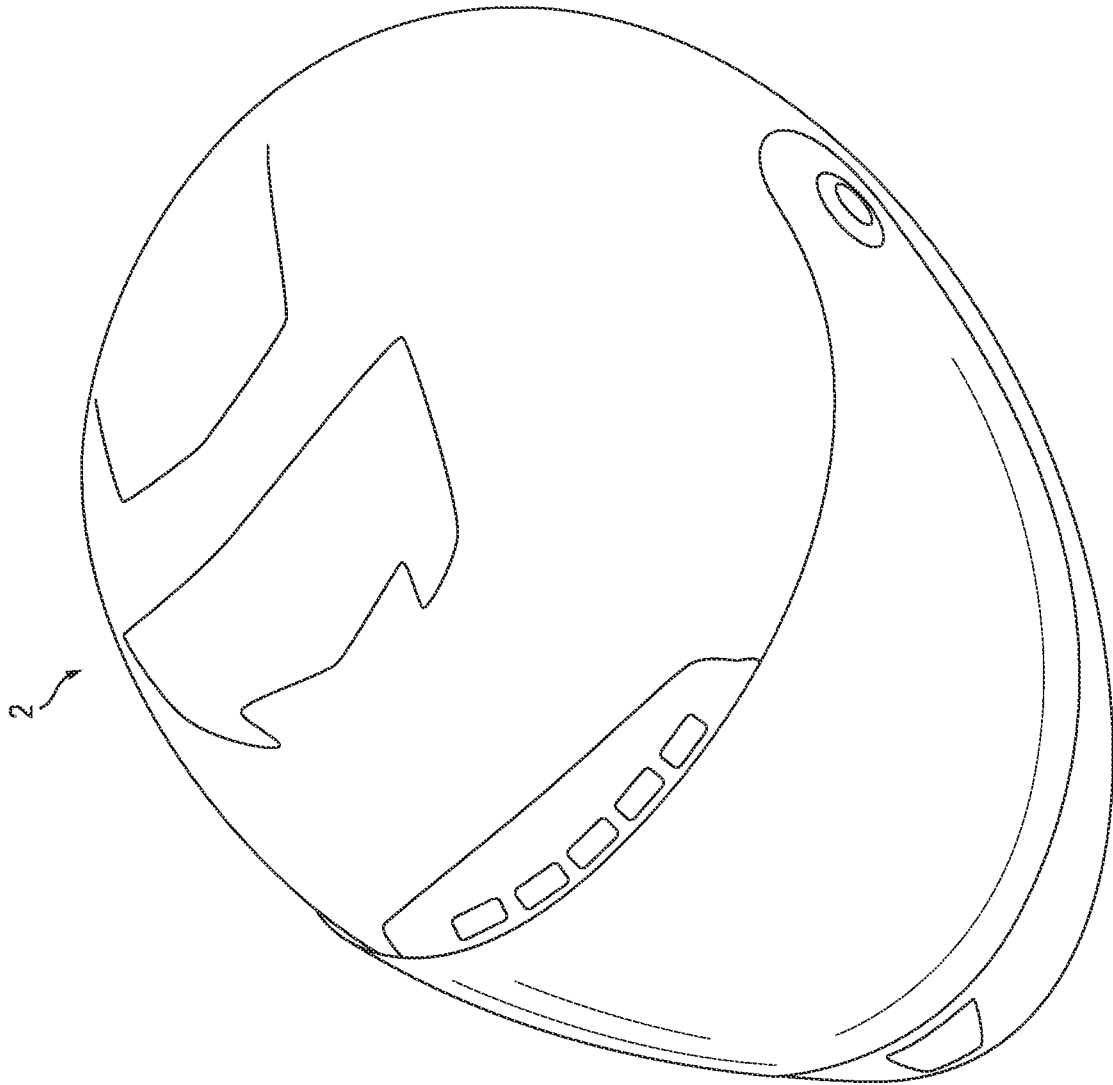
61. The protective helmet of claim 60, wherein the plastic layer underlies a majority of the inner portion of the energy absorbing layer.
62. The protective helmet of claim 60, wherein the plastic layer has an outer periphery and the energy absorbing layer has an outer periphery, and wherein the outer periphery of the plastic layer is less than the outer periphery of the energy absorbing layer whereby at least an extent of the outer periphery of the energy absorbing layer is exposed.
63. The protective helmet of claim 60, wherein (i) the inner portion of the energy absorbing layer defines an interface area, and (ii) an outer surface of the plastic layer defines an interface area, and
wherein the interface area of the plastic layer is less than the interface area of the energy absorbing layer.
64. The protective helmet of claim 60, wherein the comfort liner assembly includes a main body portion and a strap, wherein said strap extends between the main body portion and an inner surface of a brow region of the outer shell.
65. The protective helmet of claim 64, wherein the strap includes an attachment device to releasably couple the strap to the inner surface of the brow region of the outer shell.
66. The protective helmet of claim 65, wherein the attachment device is an elongated clip configured to be retained within a receiver formed in the energy absorbing layer in the brow region of the outer shell.

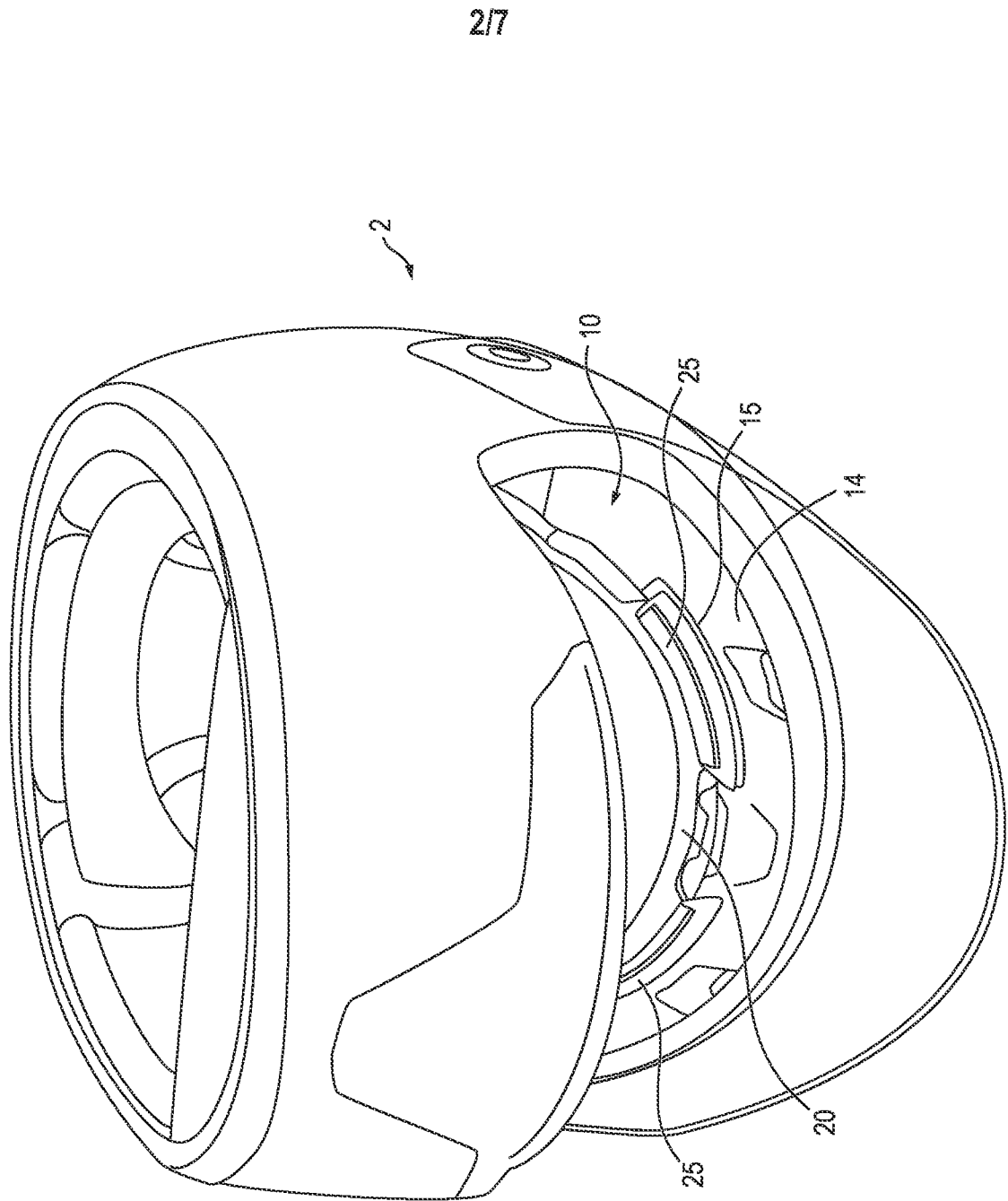
67. The protective helmet of claim 60, wherein the elastically deformable coupling is not integrally formed with the comfort liner assembly.
68. The protective helmet of claim 60, wherein the base portion of the elastically deformable coupling has a third width that is greater than the first width of the intermediate portion of the elastically deformable coupling.
69. The protective helmet of claim 60, wherein the comfort liner assembly has a monolithic construction.
70. The protective helmet of claim 60, wherein the elastically deformable coupling is configured to facilitate relative movement between the comfort liner assembly and the plastic layer.
71. The protective helmet of claim 60, wherein the intermediate portion and the end portion of the elastically deformable coupling provide the elastically deformable coupling with a barb-shaped configuration that facilitates the removable securement of the elastically deformable coupling with the plastic layer.
72. The protective helmet of claim 60, wherein the plastic layer has a thickness in at least one region that is less than 3 mm.
73. A protective helmet comprising:
- an outer shell having an inner surface and a brow region;
 - an energy absorbing layer having an inner portion and an outer portion, the outer portion of the energy absorbing layer being connected to the inner surface of the outer shell;
 - a plastic layer coupled to the inner portion of the energy absorbing layer;
 - a comfort liner assembly configured to be positioned between the plastic layer and a head of a wearer when the helmet is worn by the wearer, the comfort liner assembly including a foam layer and an elastically deformable coupling that outwardly extends from an outer surface of the comfort liner assembly;
 - wherein the comfort liner assembly is removably secured to the plastic layer by inserting the elastically deformable coupling through an opening in the plastic layer to define an installed position; and
 - wherein in the installed position: (i) an end portion of the elastically deformable coupling extends past the plastic layer and resides within an extent of the energy

absorbing layer, and (ii) an intermediate portion of the elastically deformable coupling resides within the opening formed in the plastic layer.

74. The protective helmet of claim 73, wherein the intermediate portion of the elastically deformable coupling has a first width, and the elastically deformable coupling further includes a base portion that: (a) is positioned adjacent to the outer surface of the comfort liner assembly, (b) is positioned between the outer surface of the comfort liner assembly and the intermediate portion, and (c) has a second width that is greater than the first width.
75. The protective helmet of claim 74, wherein the end portion that extends outwardly from the intermediate portion, and has a third width that is greater than the first width.
76. The protective helmet of claim 75, wherein the intermediate portion and the end portion of the elastically deformable coupling provide the elastically deformable coupling with a barb-shaped configuration that facilitates the removable securement of the elastically deformable coupling with the plastic layer.
77. The protective helmet of claim 73, wherein the elastically deformable coupling is not integrally formed with the comfort liner assembly.
78. The protective helmet of claim 73, wherein the plastic layer has an outer periphery and the energy absorbing layer has an outer periphery, and wherein the outer periphery of the plastic layer is less than the outer periphery of the energy absorbing layer whereby at least an extent of the outer periphery of the energy absorbing layer is exposed.
79. The protective helmet of claim 73, wherein (i) the inner portion of the energy absorbing layer defines an interface area, and (ii) an outer surface of the plastic layer defines an interface area, and
wherein the interface area of the plastic layer is less than the interface area of the energy absorbing layer.
80. The protective helmet of claim 73, wherein the comfort liner assembly includes a main body portion and a strap, wherein said strap extends between the main body portion and an inner surface of the brow region of the outer shell.
81. The protective helmet of claim 73, wherein the elastically deformable coupling is configured to facilitate relative movement between the comfort liner assembly and the plastic layer.

1/7





3/7

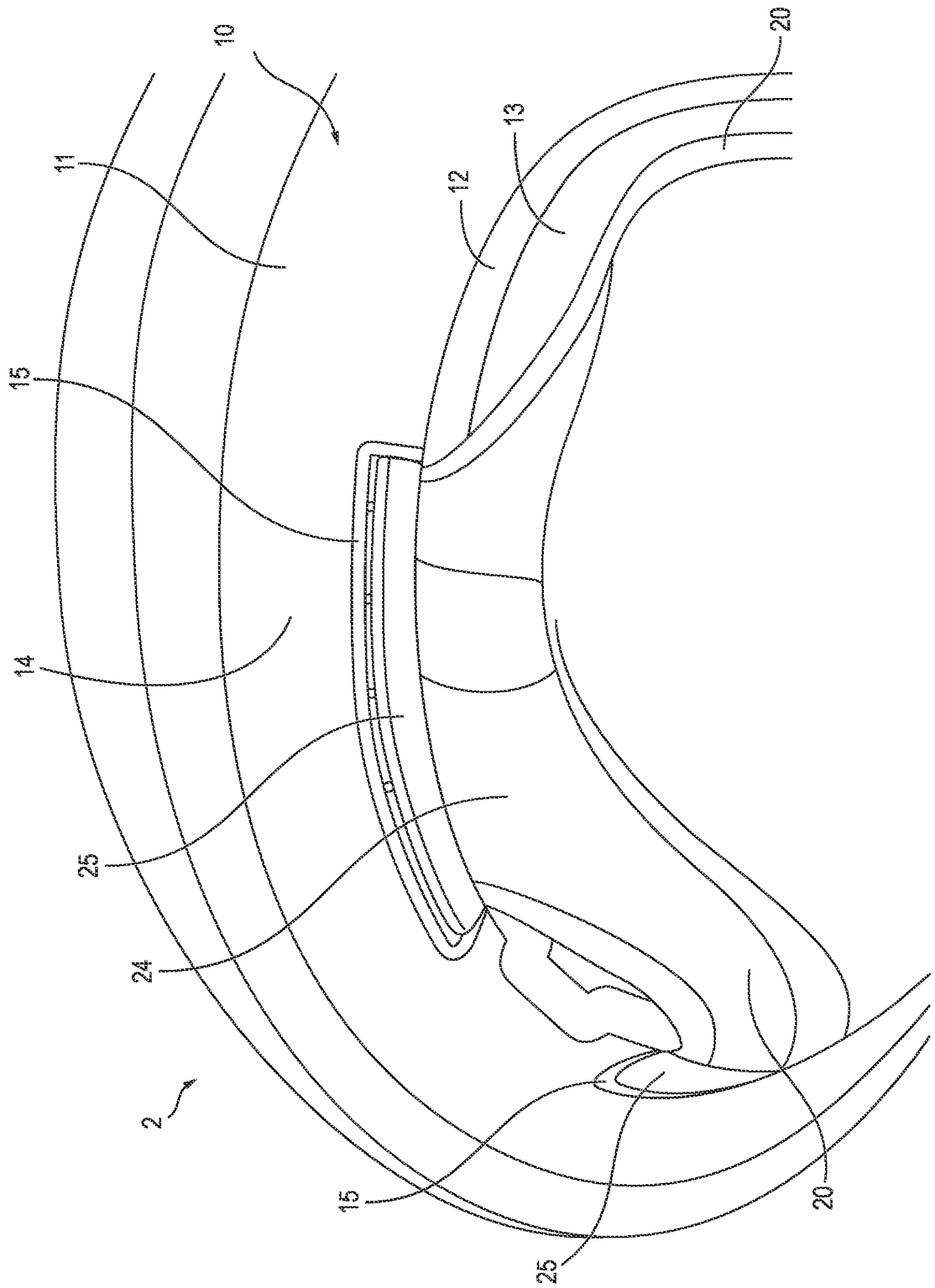


FIG. 3

4/7

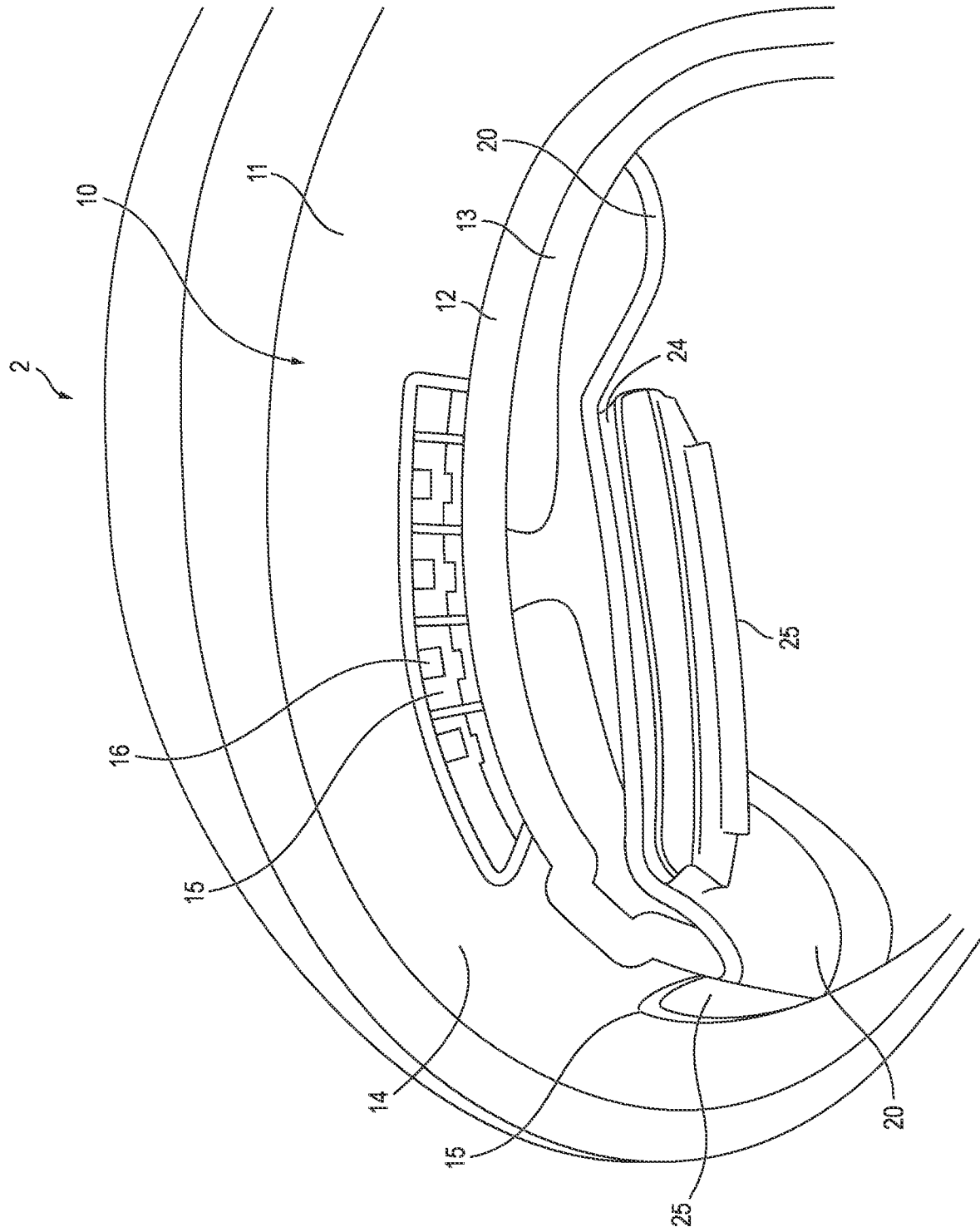


FIG. 4

5/7

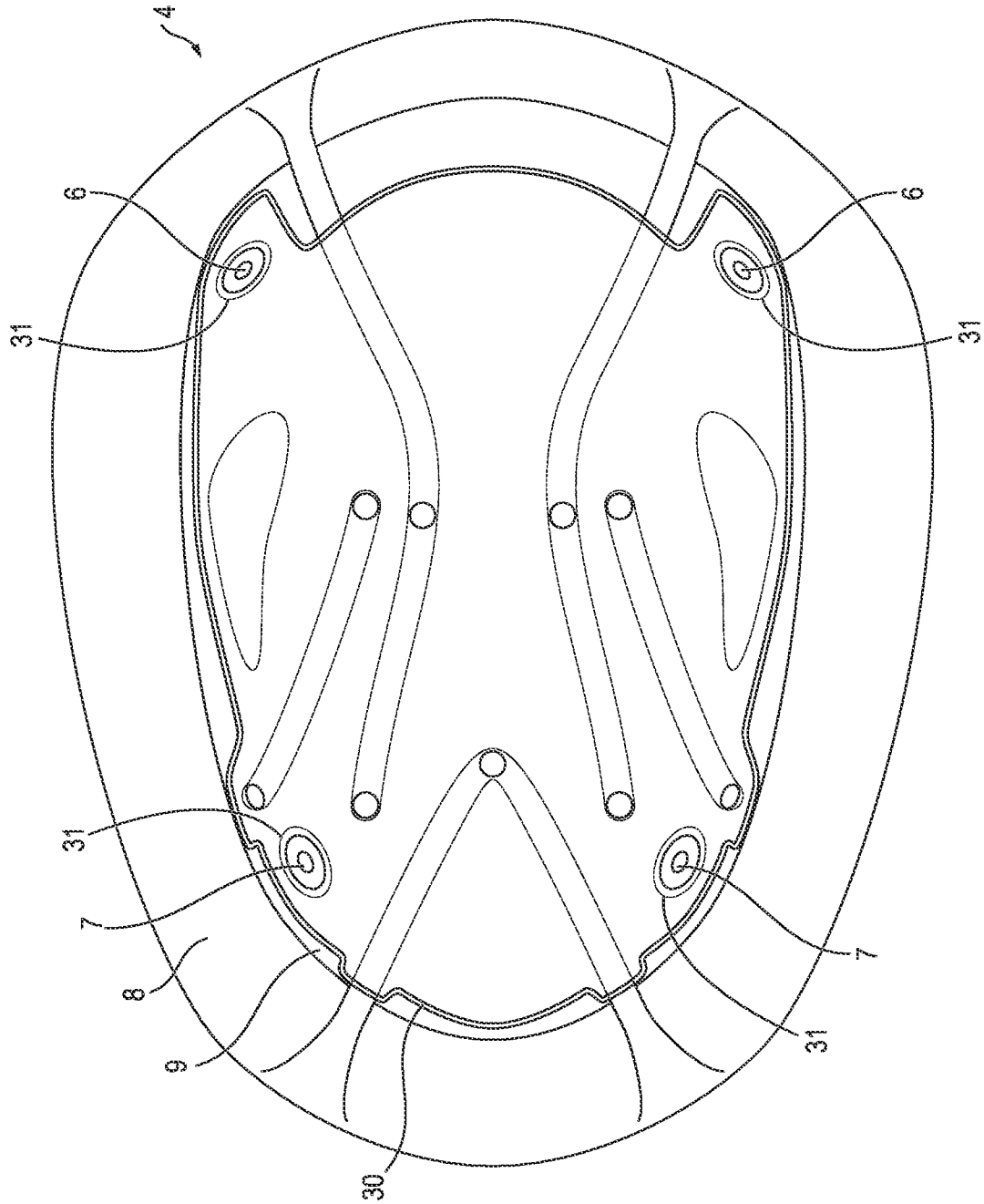


FIG. 5

6/7

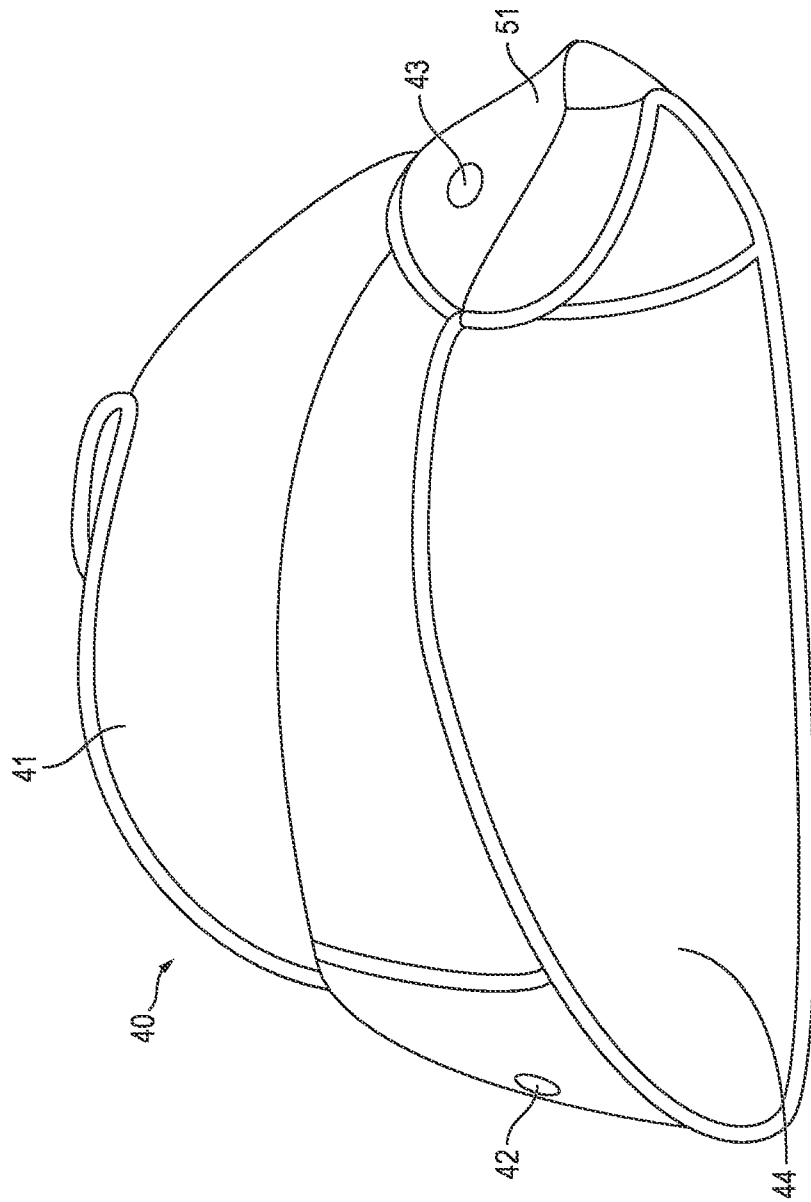


FIG. 6

7/7

