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(54) **BICYCLE HELMET WITH VENTILATION PLATE**

(57) A bicycle helmet (20) includes a front portion, a rear portion, an overall length, and an overall width. The bicycle helmet (20) includes a liner (22) having a plurality of vents (30, 32, 34) at the front portion of the bicycle helmet (20) and being impact-absorbing. The bicycle helmet (20) further includes a shell (24) over an outer surface of the liner (22) at the front portion of the bicycle helmet (20), and a plate (26) over the outer surface of the liner

(22) at the rear portion of the bicycle helmet (20). The plate (26) is devoid of vents in a narrow region starting at approximately 45% to 65% of the overall length from a front of the bicycle helmet (20) and extending to a rear of the bicycle helmet (20). The narrow region is laterally centered on the bicycle helmet (20) and has a width of approximately 30% to 50% of the overall width.

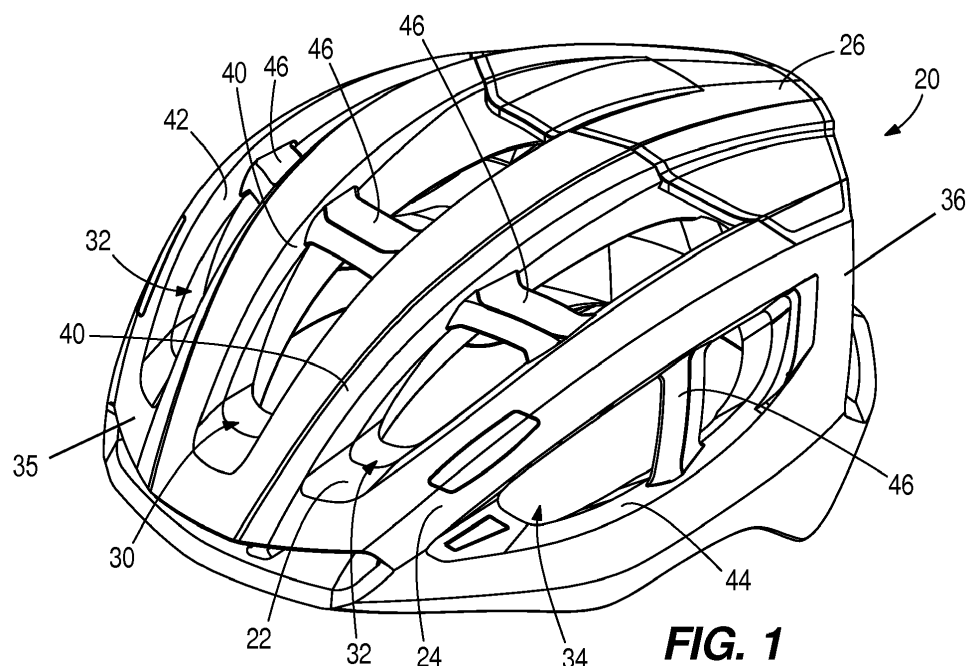


FIG. 1

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Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to U.S. Provisional Application No. 62/599,565, filed December 15, 2017.

BACKGROUND

[0002] The present invention relates generally to the field of bicycle helmets and specifically to bicycle helmets designed for improved ventilation.

[0003] Bicycle helmets are designed to protect a user's head in the event of an accident. Bicycle helmets typically include a thick liner of expanded polystyrene (EPS) covered with a thin shell of a hard plastic material, such as lexan, polycarbonate, or acrylonitrile butadiene styrene (ABS).

[0004] In order to increase a user's comfort when riding a bicycle, bicycle helmets may be designed to be lightweight and/or to have ventilation so that the user's head is cooled while riding. For example, ventilation may include inlet ventilation ports on the front of the bicycle helmet and outlet ventilation ports on the rear of the bicycle helmet, thereby facilitating the flow of air through the bicycle helmet. As bicycle helmet design has evolved, ventilation ports have generally become larger and more numerous in order to increase the amount of air flowing through the helmet.

[0005] As the size of ventilation ports have increased, reinforcing struts have been added to enhance the strength of the bicycle helmet. These struts can extend laterally across the ventilation ports in order to provide strength to the underlying liner. Struts can be made of a variety of materials, such as plastic mesh or plastic strip, and the struts are often covered with a layer of EPS.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006]

Fig. 1 is front perspective view of a bicycle helmet embodying the present invention.

Fig. 2 is a rear perspective view of the bicycle helmet of Fig. 1.

Fig. 3 is a front view of the bicycle helmet of Fig. 1.

Fig. 4 is a rear view of the bicycle helmet of Fig. 1.

Fig. 5 is a left side view of the bicycle helmet of Fig. 1.

Fig. 6 is a right side view of the bicycle helmet of Fig. 1.

Fig. 7 is a top view of the bicycle helmet of Fig. 1.

Fig. 8 is a section view of the bicycle helmet of FIG. 1 taken along the line 8-8 in Fig. 5.

Fig. 9 is a section view of the bicycle helmet of FIG. 1 taken along the line 9-9 in Fig. 5.

Fig. 10 is a section view of the bicycle helmet of FIG. 1 taken along the line 10-10 in Fig. 5.

Fig. 11 is an enlarged view of the section of Fig. 8.

Fig. 12 is an enlarged view of the section of Fig. 9.

DETAILED DESCRIPTION

[0007] In some embodiments, a bicycle helmet has a front portion, a rear portion, an overall length, and an overall width. The bicycle helmet includes a liner having a plurality of vents at the front portion of the bicycle helmet and being impact-absorbing. The bicycle helmet further includes a shell over an outer surface of the liner at the front portion of the bicycle helmet, and a plate over the outer surface of the liner at the rear portion of the bicycle helmet. The plate is devoid of vents in a narrow region starting at approximately 45% to 65% of the overall length from a front of the bicycle helmet and extending to a rear of the bicycle helmet. The narrow region is laterally centered on the bicycle helmet and has a width of approximately 30% to 50% of the overall width.

[0008] In yet other embodiments, a bicycle helmet has a front portion, a rear portion, an overall length, and an overall width. The bicycle helmet includes a liner including a plurality of rails defining vents at the front portion of the bicycle helmet, and a plurality of struts extending between the plurality of rails. The bicycle helmet further includes a shell over an outer surface of the liner at the front portion of the bicycle helmet, and a plate over the outer surface of the liner at the rear portion of the bicycle helmet. The plate is devoid of vents and defines air channels beneath the plate and between the plurality of rails. The plate extends approximately from a center of the bicycle helmet to a rear of the bicycle helmet.

[0009] The plate can be made from a very stiff material, such as a carbon fiber composite, and thus substantially adds to the strength and stiffness of the rear portion of the bicycle helmet. As a result of this increased strength and stiffness, less liner material can be needed in this region of the bicycle helmet, resulting in larger air channels for cooling the rider. In addition, the lack of vents in this region of the bicycle helmet results in cooling air being channeled parallel and close to the surface of a user's head, which can enhance the cooling provided by the airflow.

[0010] Other elements of the invention will become apparent by consideration of the detailed description and drawings.

[0011] Before any embodiments of the invention are explained in detail, it is to be understood that the invention

is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the following drawings. The invention is capable of other embodiments and of being practiced or of being carried out in various ways.

[0012] The bicycle helmet 20 illustrated in Figs. 1-10 comprises a liner 22, a shell 24, and a plate 26. The bicycle helmet 20 can be configured to receive a head of a user, such as, for example, to protect the head of the user from impacts. For example, the bicycle helmet 20 can receive the head of the user at an interior surface 48 (FIG. 11) of the liner 22. Meanwhile, as discussed below, the shell 24 and/or the plate 26 can be over (e.g., partially over) and/or secured (e.g., partially secured) to an outer surface of the liner 22 opposite the interior surface 48 (FIG. 11) of the liner 22. In some embodiments, as discussed below, part or all of the liner 22 can be omitted from under the plate 26.

[0013] Although not shown in the drawings, the bicycle helmet 20 also can include one or more pads between the liner 22 and a user's head to enhance comfort and to absorb sweat. For example, the pad(s) can be located at the interior surface 48 (FIG. 11) of liner 22. In addition, head straps and buckles of bicycle helmet 20 are not shown, but can be used for securing the bicycle helmet 20 to a user's head.

[0014] The liner 22 can surround a portion (e.g., a large portion) of the user's head when bicycle helmet 20 is worn by the user. Further, the liner 22 can be impact-absorbing. The liner 22 can comprise a layer of at least one material. One of more of the material(s) implemented for liner 22 can be lightweight and/or energy-absorbing. For example, one or more of the material(s) implemented for liner 22 can be EPS and/or polyurethane foam. The liner 22 can have a thickness of up to approximately 20 millimeters or more. The thickness can be measured between the interior surface 48 (FIG. 11) and outer surface of the liner 22. In some embodiments, the thickness can be approximately constant. However, in other embodiments, the thickness can vary at different portions of the liner 22. For example, in some embodiments, the thickness of the liner 22 under at least part of the plate 26 can be less than the thickness of the liner 22 under at least part of the shell 24.

[0015] The liner 22 can include a plurality of vents (i.e., ventilation ports) that facilitate airflow through the bicycle helmet 20 when the user is riding. In some embodiments, the bicycle helmet 20 can include five longitudinal vents: a center vent 30, right and left frontal vents 32, and right and left temporal vents 34. Each of these longitudinal vents can extend generally from a frontal region (e.g., front portion) 35 of the bicycle helmet 20 to a parietal region (e.g., rear portion) 36 of the bicycle helmet 20, as illustrated in FIGS. 1 and 2. The five longitudinal vents can divide the liner 22 into six longitudinally extending rails: left and right center rails 40, left and right parietal rails 42, and left and right temporal rails 44. In other embodiments, other numbers of longitudinal vents and/or

longitudinally extending rails can be implemented. For example, in some embodiments, three longitudinal vents and four longitudinally extending rails can be implemented, or seven longitudinal vents and eight longitudinally extending rails can be implemented

[0016] In order to enhance the strength of the longitudinally extending rails, the bicycle helmet 20 further can include lateral struts 46 spanning one or more of the longitudinal vents between adjacent rails of the longitudinally extending rails. In many embodiments, the lateral struts 46 can be generally thinner (e.g., approximately 5 to 20 mm from the head, upward) than the liner 22. However, in other embodiments, the lateral struts 46 can be the same thickness or thicker than the liner 22. Further, the lateral struts 46 can comprise polycarbonate plastic or another suitable reinforcing material, such as, for example, injected nylon. In some embodiments, the lateral struts 46 can be molded into the liner 22 during a process of molding the liner 22. In some embodiments, one or more of lateral struts 46 can be implemented for one or more of the longitudinal vents.

[0017] In many embodiments, the shell 24 can be secured to the outer surface of the liner 22. For example, the shell 24 and liner 22 can be bonded together, or the liner 22 can be molded into the shell 24. In some embodiments, the shell 24 can comprise polycarbonate that is approximately 0.5 to 1 millimeter thick, but in other embodiments, different or additional materials can be implemented, such as, for example, ultra-high molecular weight polyurethane (e.g., Dyneema composite sold by Royal DSM N.V. of Heerlen, Netherlands)), injected nylon, graphene, ABS, Polyethylene, etc.; and/or a different thickness can be implemented. In many embodiments, the shell 24 can cover the outer surface of the liner 22, except for the region covered by the plate 26, as described below in more detail. In other embodiments, the shell 24 can cover part or all of the region covered by the plate 26. For example, in these embodiments, the plate 26 can cover part of the shell 24 and/or can be secured to part of the shell 24.

[0018] The plate 26 can be positioned over the parietal, or rear, region 36 and as illustrated in FIG. 2 can provide a connection between rear regions or ends 37 of the center rails 40 and parietal rails 42. In many embodiments, the plate 26 can be approximately 1 millimeter to 5 millimeters thick and can be made from at least one material. The material(s) used to implement the plate 26 can be strong and/or impact resistant. For example, the material(s) used to implement the plate 26 can comprise a composite reinforced polymer. Different or additional material(s) can be implemented for the plate 26, such as ultra-high molecular weight polyurethane (e.g., Dyneema composite sold by Royal DSM N.V. of Heerlen, Netherlands), a fiberglass fabric and epoxy matrix (e.g., Texalium composite sold by Hexcel Corporation of Stamford, Connecticut, United States of America), a polypropylene weave composite (e.g., Curv composite sold by Propex, Inc. of Chattanooga, Tennessee, United State of Amer-

ica), fiberglass, a tri-weave of Kevlar/fiberglass/carbon, or polycarbonate folded onto itself with a midlayer for support/adhesion.

[0019] The plate 26 can be positioned over and/or adjacent the outer surface of the liner 22 over the center rails 40, spaced from the interior surface 48, thereby creating large airflow channels 50 between the longitudinally extending rails. The plate 26 can provide strength and/or impact resistance over the parietal region, thus reducing the amount of material (e.g., a thickness of the liner 22) needed in that region. For example, part or all of the liner 22 can be omitted from under the plate 26 in the airflow channels 50. However, a thin layer of material (e.g., EPS, expanded polypropylene (EPP), ethylene vinyl acetate (EVA), polycarbonate, etc.) can be implemented for the liner 22 under the plate 26. In some embodiments, the material(s) implemented for the liner 22 under the plate 26 can be the same as a remainder of the liner 22, or in other embodiments, can be different or additional material(s). The plate 26 further can permit reinforcing struts to be reduced or omitted under the plate 26. Accordingly, positioning the plate 26 on the outer surface of the liner 22 can reduce or eliminate the liner 22 under the plate 26, and/or reduce or eliminate reinforcing struts under the plate 26, and as a result, a larger amount of airflow can be accommodated, thereby enhancing the cooling effect and reducing the choking of airflow under the plate 26.

[0020] It is further noted that the plate 26 can be devoid of vents and/or a portion of the liner 22 under the plate 26, which can encourage airflow close to the user's head (e.g., at interior surface 48 (FIG. 11)), instead of out exit vents, thereby enhancing the cooling effect. The portion of the bicycle helmet 20 with no vents can include a narrow region or area 52 and wider region or area 54. The precise dimensions of these regions can vary depending on the size of the bicycle helmet 20, and can be generally proportional to the overall length L1 (FIG. 7) and overall width W1 (FIG. 4) of the bicycle helmet 20. For example, in some embodiments, the bicycle helmet 20 can have an overall length L1 of approximately 270 millimeters and/or an overall width W1 of approximately 210 millimeters. In this example, the illustrated narrow region 52 can be centered on the bicycle helmet 20 and/or can have a width W2 (FIGs. 4 & 7) of approximately 86 millimeters, which can be approximately 41% of the overall width (FIG. 4) of the bicycle helmet 20. The narrow region 52 can start at the back of the bicycle helmet 20 and/or can have a length L2 (FIG. 7) of approximately 118 millimeters, which can be approximately 44% of the overall length L1 (FIG. 7) of the bicycle helmet 20. The wider region 54 in this example can be centered in the bicycle helmet 20 and/or can have a width W3 (FIGs. 4 & 7) of approximately 174 millimeters, which can be approximately 83% of the overall width W1 (FIG. 4) of the bicycle helmet 20. The wider region 54 can start at the back of the bicycle helmet 20 and/or can have a length L3 (FIGs. 4 & 7) of approximately 85 millimeters, which can be ap-

proximately 31% of the overall length L1 (FIG. 7) of the bicycle helmet 20. In other embodiments, these ratios of lengths and/or widths can be applied to different dimensions of the overall length L1 (FIG. 7) and the overall width W1 (FIG. 4).

[0021] In further embodiments, the positioning of the narrow and wide regions 52, 54 can vary. For example, while the narrow region 52 of the illustrated embodiment starts approximately 56% of the overall length L1 (FIG. 7) from a front or foremost point 58 (FIG. 7) of the bicycle helmet 20, this could vary from approximately 45% to 65% (the length L1 being measured from the front or foremost point 58 to a rear or rearmost point 60). Similarly, while the wider region 54 of the illustrated embodiment starts approximately 69% of the overall length L1 (FIG. 7) from the front or foremost point 58 of the bicycle helmet 20, this could vary from approximately 55% to 80%. Furthermore, the width W2 (FIGs. 4 & 7) of the narrow region 52 can be approximately 30%-50% of the overall width W1 (FIG. 7), and the width W3 (FIGs. 4 & 7) of the wider region 54 can be approximately 70%-90% of the overall width W1 (FIG. 4).

[0022] The illustrated airflow channels 50 created by the plate 26 can be large and can facilitate enhanced cooling. Fig. 11 shows the size of the center channel 56 relative to the adjacent center rails 40 rearward of the front of the narrow region 52 of the bicycle helmet 20 (corresponding with the section of Fig. 8). In this embodiment or other embodiments, the center rails 40 can have a thickness T1 of approximately 25 millimeters and/or have an average width W4 of approximately 21 millimeters, resulting in a total cross sectional area of the center two rails 40 of about 1050 millimeters². In that same section, the center channel 56 can have a thickness T2 of approximately 25 millimeters and/or a width W5 of approximately 36 millimeters, for a total cross sectional area of approximately 900 millimeters². Accordingly, in this section, the area of the airflow channel can be approximately 86% of the cross-sectional area of the liner 22, but that can vary from approximately 70% to 100% in other embodiments. For example, the thicknesses T1 and/or T2, and/or the widths W4 and/or W5 can be different in other embodiments. In some embodiments the total cross sectional area of the center two rails 40 is approximately 1080 millimeters², and the area of the airflow channel can be approximately 89% of the cross-sectional area of the liner 22.

[0023] Fig. 12 shows the size of the center channel 56 relative to the adjacent center rails 40 rearward of the front of the wider region 54 of the bicycle helmet 20 (corresponding with the section of Fig. 9). In this embodiment, the center rails 40 can have a thickness T3 of approximately 25 millimeters and/or can have an average width W6 of approximately 20 millimeters, resulting in a total cross sectional area of the center two rails 40 of approximately 1000 millimeters². In that same section, the center channel 56 can have a thickness T4 of approximately 25 millimeters and a width W7 of approximately 30 mil-

limeters, for a total cross sectional area of about 750mm². Accordingly, in this section, the area of the airflow channel is approximately 75% of the cross-sectional area of the liner 22, but that can vary from approximately 65% to 90%, in other embodiments. For example, the thicknesses T3 and/or T4, and/or the widths W6 and/or W7 can be different in other embodiments.

[0024] Various features of the invention are set forth in the following claims.

[0025] When used in this specification and claims, the terms "comprises" and "comprising" and variations thereof mean that the specified features, steps or integers are included. The terms are not to be interpreted to exclude the presence of other features, steps or components.

[0026] The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

Claims

1. A bicycle helmet having a front portion, a rear portion, an overall length, and an overall width, the bicycle helmet comprising:

a liner including a plurality of vents at the front portion of the bicycle helmet and being impact-absorbing;
a shell over an outer surface of the liner at the front portion of the bicycle helmet; and
a plate over the outer surface of the liner at the rear portion of the bicycle helmet, the plate being devoid of vents in a narrow region starting approximately 45% to 65% of the overall length from a front of the bicycle helmet and extending to a rear of the bicycle helmet, the narrow region being laterally centered on the bicycle helmet and having a width of approximately 30% to 50% of the overall width.

2. The bicycle helmet of claim 1, wherein the plate defines airflow channels.
3. The bicycle helmet of any of the preceding claims, wherein the liner includes two center rails, two parietal rails, and two temporal rails that together define the plurality of vents.
4. The bicycle helmet of claim 3, wherein the plate provides a connection between rear ends of the center rails and the parietal rails, and wherein reinforcing struts extend between the center rails and the parietal rails in the front portion of the helmet.

5. The bicycle helmet of any of the preceding claims, wherein the liner includes two center rails, wherein the plate is positioned adjacent outer surfaces of the center rails and defines airflow channels underneath the plate.
6. The helmet of claim 5, wherein the airflow channels under the plate include a center channel disposed between the two center rails, wherein in a first area of the helmet the center channel has an area in cross section that is between 70% - 100% of a combined cross-sectional area of the two center rails.
7. The helmet of claim 6, wherein in the first area the center rails have a thickness of about 25mm and have an averaged width of about 21mm, and wherein the center channel has a thickness of about 25mm and a width of about 36mm.
8. The bicycle helmet of claim 6, wherein in a second area of the helmet disposed rearward of the first area, the center channel has an area in cross section that is between 65% - 95% of a combined cross-sectional area of the two center rails.
9. The bicycle helmet of claim 8, wherein in the second area the center rails have a thickness of about 25mm and have an averaged width of about 20mm, and wherein the center channel has a thickness of about 25mm and a width of about 30mm.
10. The bicycle helmet of any of the preceding claims, wherein the plate is between 1mm to 5mm in thickness.
11. The bicycle helmet of any of the preceding claims, wherein the plate is made of at least one selected from a group consisting of an injection molded material, a composite reinforced polymer, an ultra-high molecular weight polyethylene, a fiberglass fabric and epoxy matrix, a polypropylene weave composite, fiberglass, carbon, or a polycarbonate material folded onto itself with a midlayer for support and adhesion.
12. The bicycle helmet of any of the preceding claims, wherein the plate further includes a wider region, wherein the overall length of the helmet is approximately 270mm and the overall width of the helmet is approximately 210mm, wherein the narrow region has a length of approximately 118 mm and a width of approximately 86mm, and wherein the wider region has a length of approximately 85mm and a width of approximately 174mm.
13. The bicycle helmet of any of the preceding claims, wherein the plate further includes a wider region, wherein both the narrow region and the wider region

extend to the rear of the helmet.

14. The bicycle helmet of any of the preceding claims,
wherein the liner is made of expanded polystyrene.

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15. The bicycle helmet of any of the preceding claims,
wherein the narrow region extends about 44% of the
overall length of the helmet.

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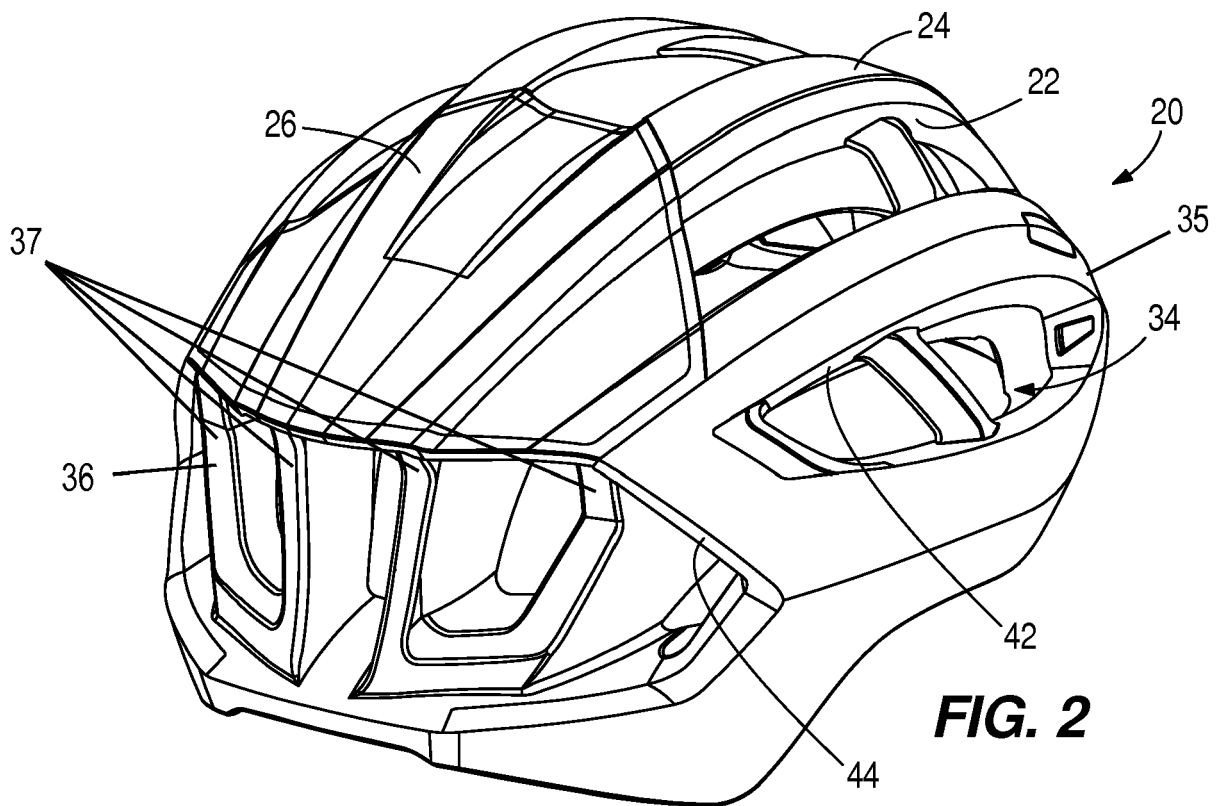
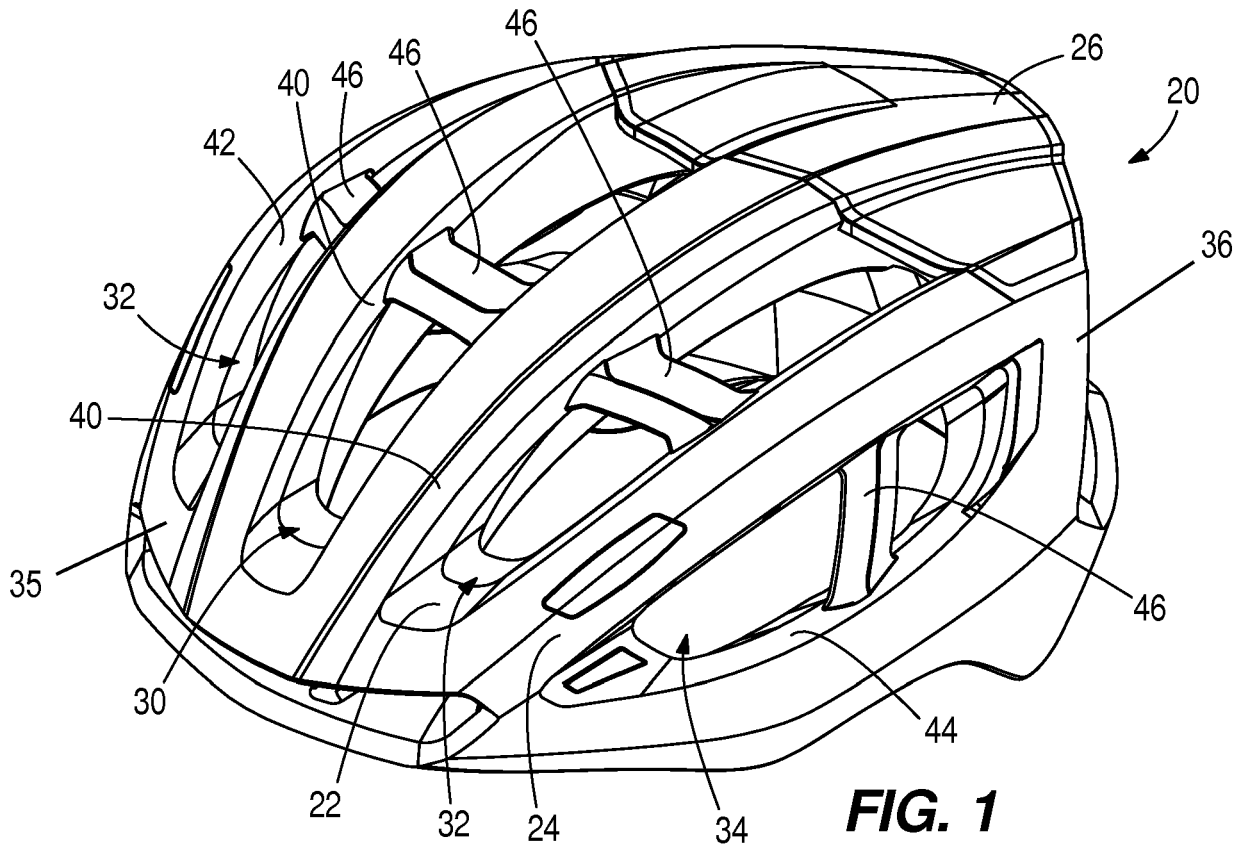
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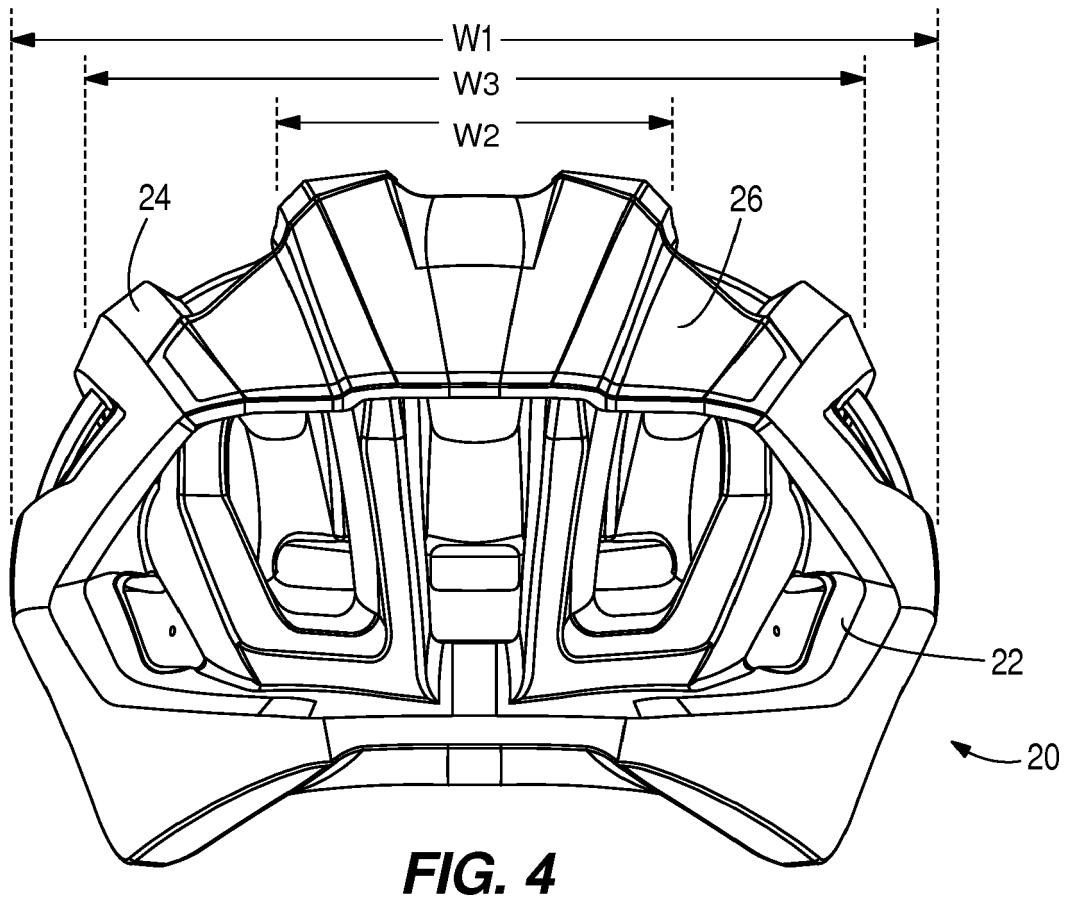
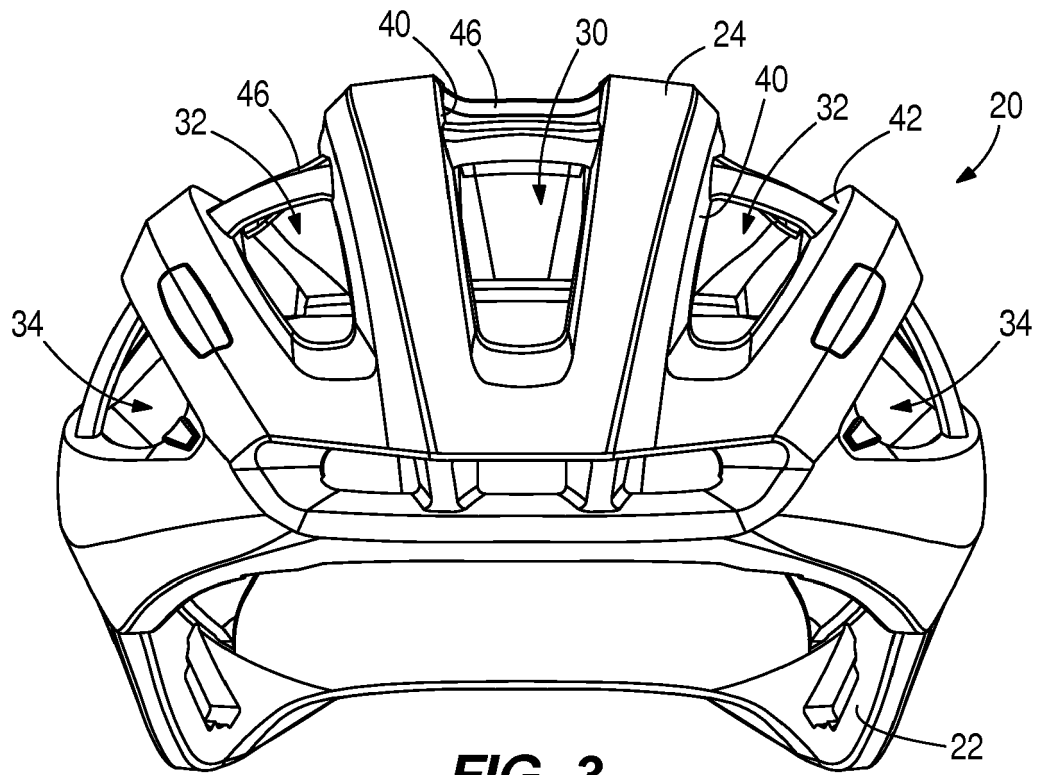
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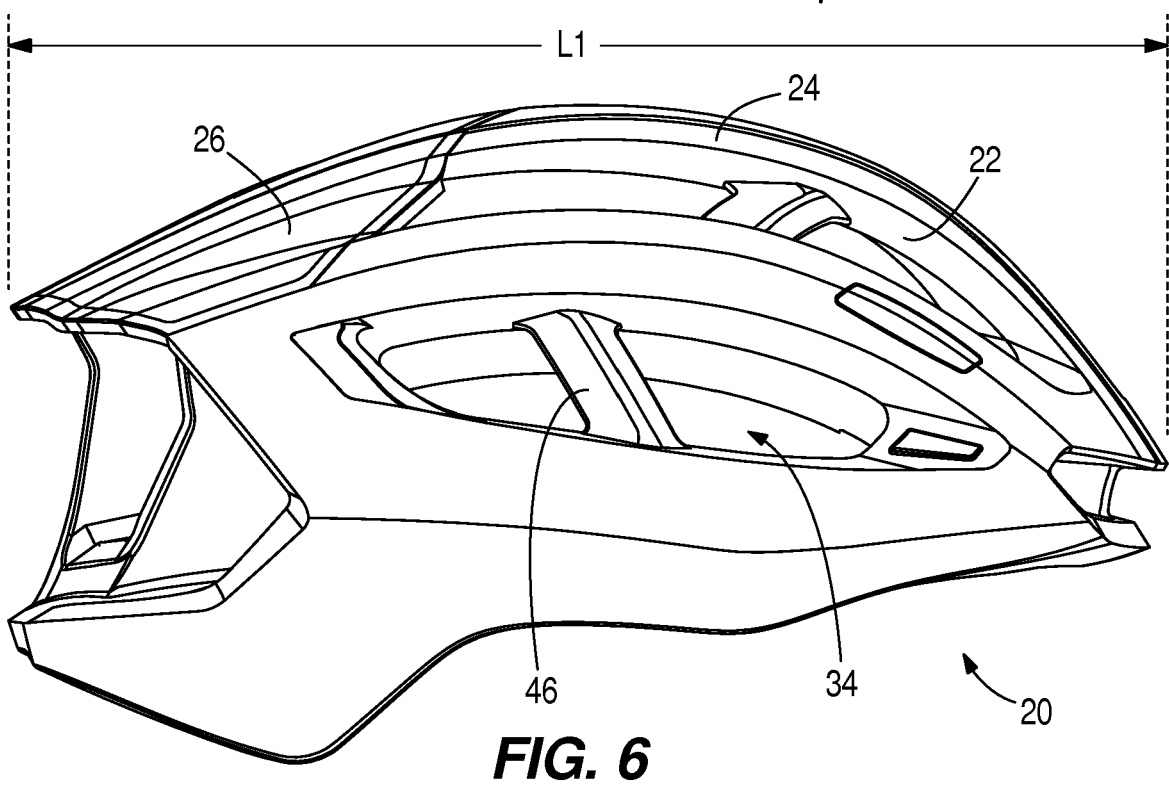
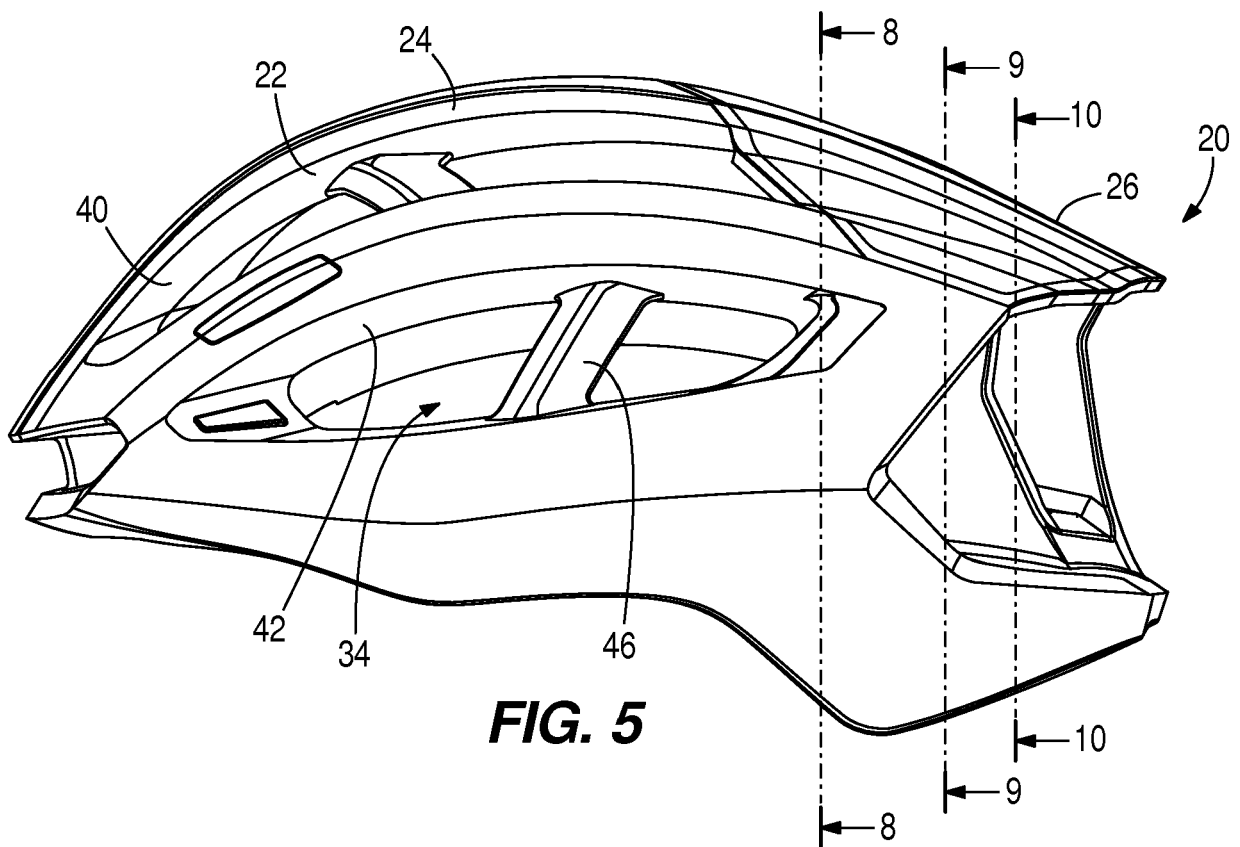
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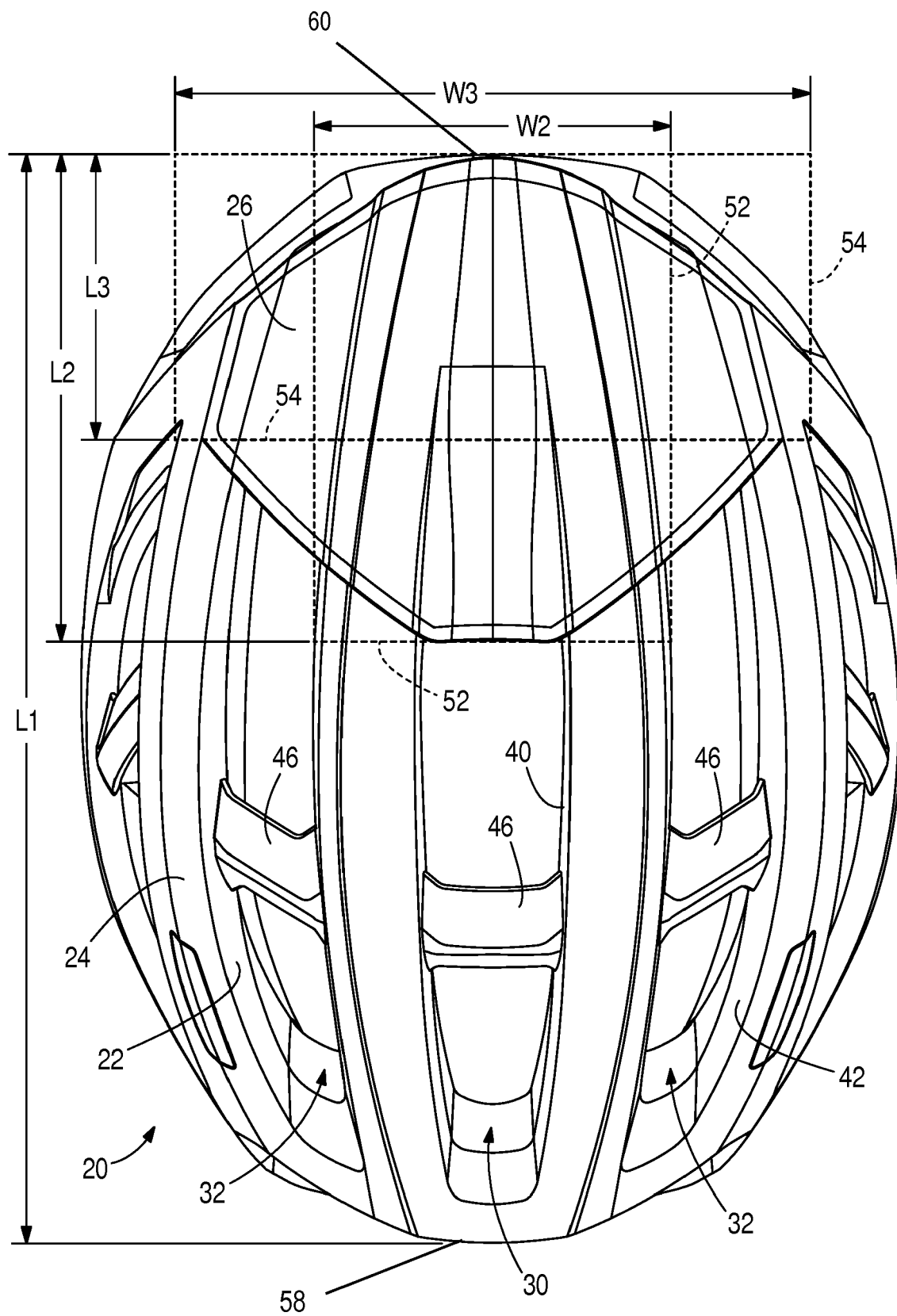


FIG. 7

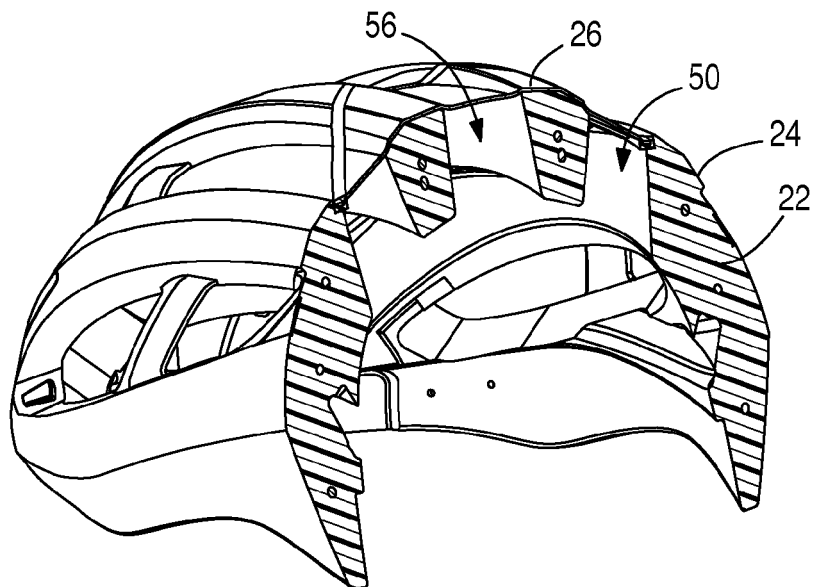


FIG. 8

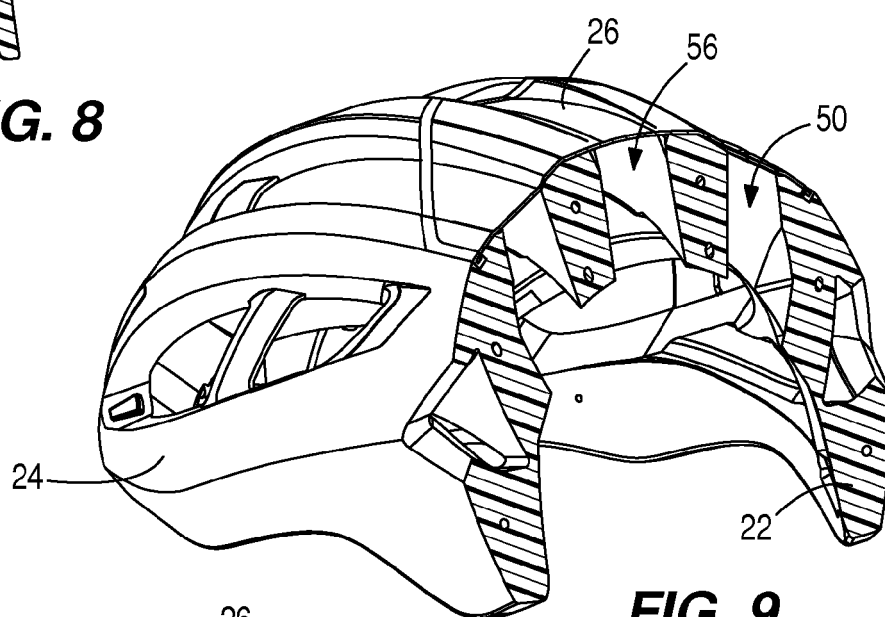


FIG. 9

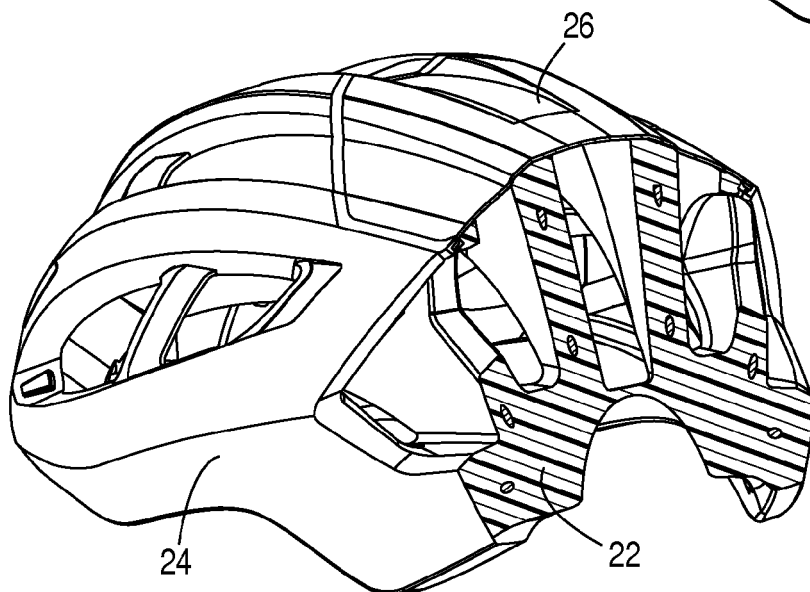


FIG. 10

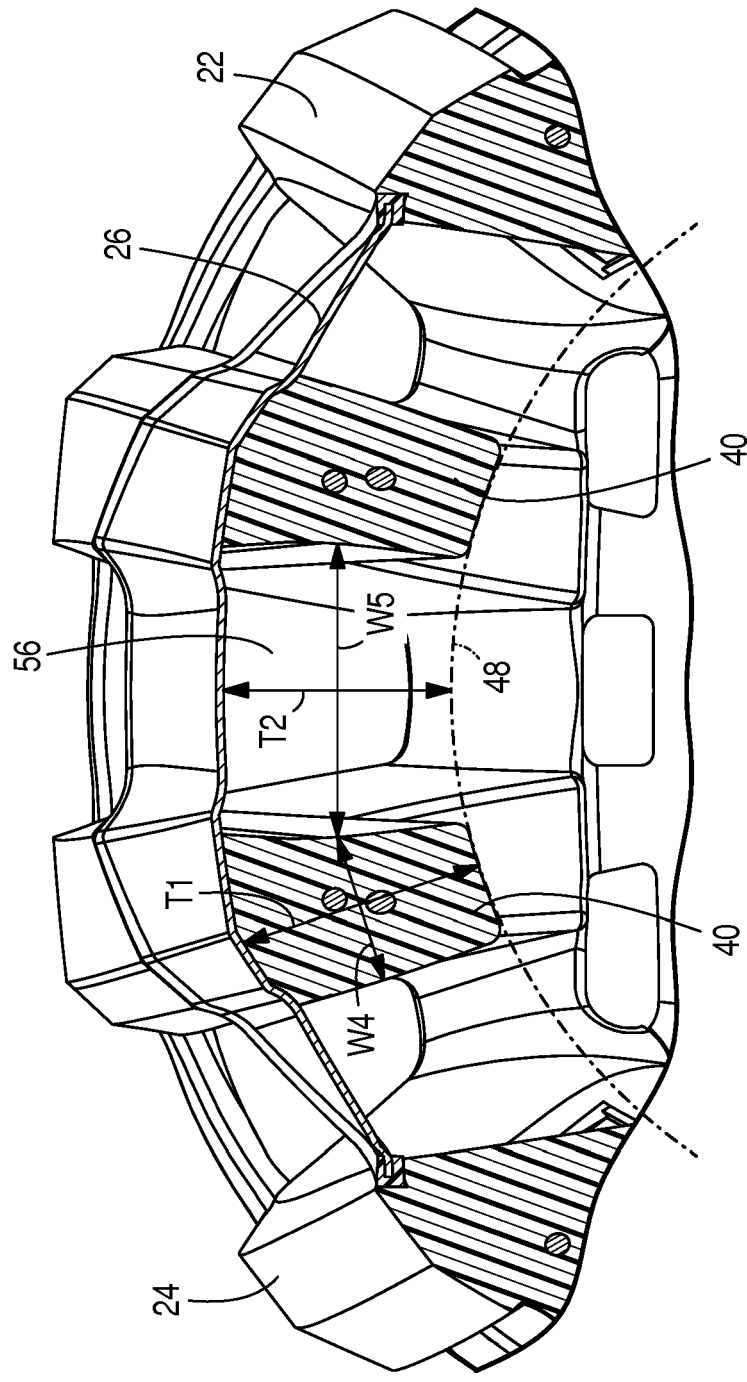


FIG. 11

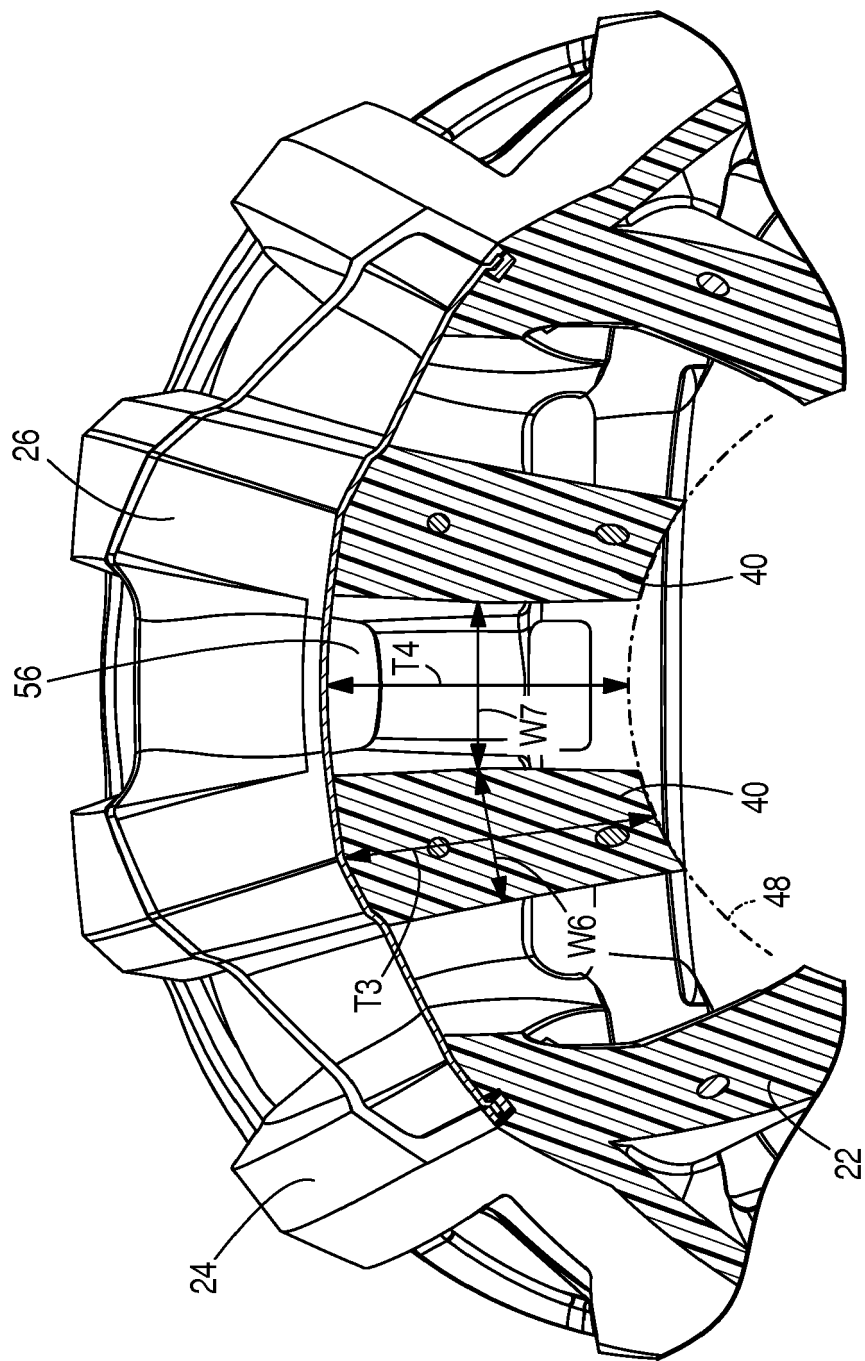


FIG. 12



EUROPEAN SEARCH REPORT

 Application Number
 EP 18 21 1541

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2013/340151 A1 (BRADLEY DUNCAN JAMES [GB] ET AL) 26 December 2013 (2013-12-26)	1,10-15	INV.
A	* paragraph [0028] - paragraph [0029] *	2-9	A42B3/06
	* paragraph [0032] - paragraph [0033] *		A42B3/28
	* figures 1,3,4,5,7 *		

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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		6 May 2019	Guisan, Thierry
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 18 21 1541

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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REFERENCES CITED IN THE DESCRIPTION

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