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(71) Applicant: **Ku, Cheng-Huei**
Beilun District
315800 Ningbo City, Zhejiang Province (CN)

(72) Inventor: **Ku, Cheng-Huei**
Beilun District
315800 Ningbo City, Zhejiang Province (CN)

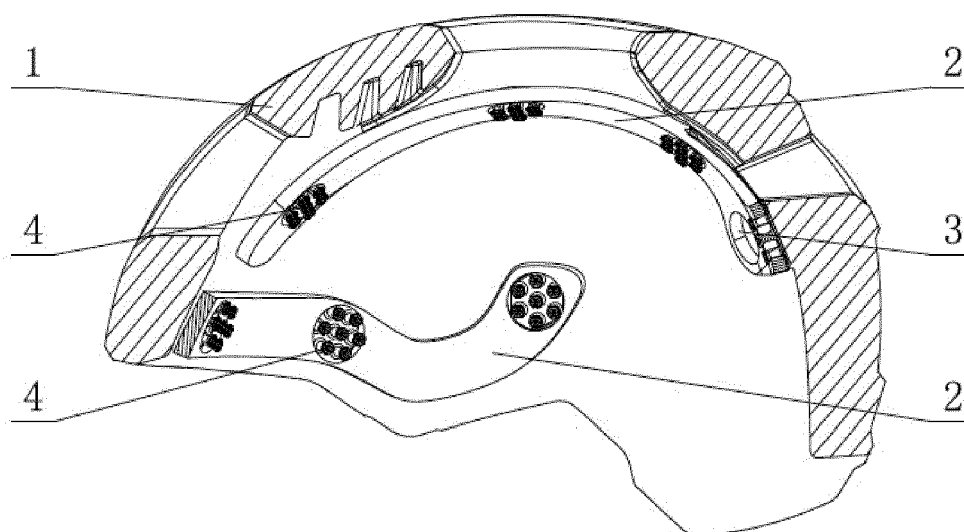
(74) Representative: **Elzaburu S.L.P.**
Miguel Angel 21, 2nd floor
28010 Madrid (ES)

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(54) BUFFER STRUCTURE OF HELMET

(57) The present invention discloses a buffer structure of a helmet. An elastic lining is arranged on an inner side of a shell of the helmet, a plurality of through holes are formed in the elastic lining, buffer elements composed of an elastic material are arranged at the through holes, each buffer element includes a top plate fixed to the shell and a plurality of buffer columns arranged on the top plate, lower end portions of the buffer columns stretch out of the through holes and protrude out of an

inner surface of the elastic lining, and clearances are formed between the adjacent buffer columns and between the buffer columns and inner walls of the through holes correspondingly. The helmet of the present invention has a quite good normal and tangential buffer effect, the head of a user is not prone to being injured and the sense of comfort of the user is good when the helmet is subjected to impact of external force, and the protection effect of the helmet on the user is greatly improved.

**FIG. 1**

Description

Technical Field

[0001] The present invention relates to the field of safety protection, and more particularly relates to a buffer structure of a helmet.

Background Art

[0002] Helmets (safety helmets) are essential safety protection articles for riders. A helmet in the prior art generally adopts a three-layer structure, that is, the structure includes a shell layer, a liner layer and a buffer structure layer fixed between the shell layer and the liner layer, the buffer structure layer generally adopts structures similar to buffer columns which are distributed in a punctiform shape, wherein outer ends of the buffer columns are fixed to the shell layer, inner ends of the buffer columns are fixed to the liner layer, the shell layer and the liner layer of the helmet adopting the buffer form are connected to form an integrated structure through the buffer columns, therefore, the overall stability is good, when the helmet bears impact of external force, the buffer columns has small deformation, shortcomings that absorbed kinetic energy is less and a buffer effect is poor exist, and the head of a user is prone to being injured. On the other hand, the traditional helmet mainly has a protection effect against normal impact of the exterior to the helmet. Along with in-depth study on collision by people, it is found that when a rider falls on the ground, a tangential rotation angular velocity further exists besides forward collision at a moment when the helmet makes contact with the ground, that is, when a safety accident actually occurs, a probability that the helmet bears pure normal impact force is small, it is more often that tangential impact force further exists besides the normal impact force, under the effect of the tangential impact force, the helmet is prone to normal rotation at a certain angle, accordingly, the brain of the rider rubs with a skull, and injuries are caused. In addition, when the helmet of the three-layer structure in the prior art is used, the liner layer of the helmet makes contact with the head of the user, an area of contact between the liner layer and the head of the user is large, the liner layer is usually made of an airtight elastic material, therefore, the air permeability is quite poor, and the sense of comfort of the user is poor. The Chinese patent document with the publication date being August 14th, 2013 and the publication number being CN 103238973A discloses a safety helmet with a novel buffering and damping structure. The safety helmet adopts a double-shell structure, elastic connection is adopted between two shells, and the specific structure includes an outer shell, an inner shell, an elastic buffer body connecting the outer shell and the inner shell, and a chin strap used for fixing the safety helmet and the head; and the safety helmet adopts a damping and buffering mechanism in a wood pecking process of a woodpecker, an

interior of the elastic buffer body is composed of three sets of mutually perpendicular springs, with the design, the elastic buffer body can provide elastic buffer in all directions, accordingly, protection against radial impact loads (top and side directions) and tangential impact loads is achieved, the impact resistance of the safety helmet is improved, and the head is protected against injuries. The Chinese patent document with the publication date being September 8th, 2017 and the publication number being CN107136615A discloses a hard hat capable of mitigating impulse force. The hard hat includes an outer hat body and an inner hat body. The outer hat body and the inner hat body are each in a cover shell shape, and the inner hat body is arranged in the outer hat body. An installation groove is formed in a top of an inner side of the outer hat body. A rotary shaft embedded and inserted into the installation groove is arranged at a top of an outer side of the inner hat body. A first bearing is arranged at a position where the rotary shaft is connected with the installation groove. A second bearing is arranged between a bottom of an outer side wall of the inner hat body and a bottom of an inner side wall of the outer hat body. An inner ring and an outer ring of the second bearing are fixedly connected with the inner hat body and the outer hat body correspondingly. A plurality of centrally symmetrical cambered convex ribs with skew patterns are annularly arranged at a top of the outer hat body. While the hard hat rotates, pressure relief can be conducted on heavy stuff so that the safety of the hard hat can be better improved. The two types of helmets both adopt the three-layer structure, the overall stability is good, but the buffer structure layers have small deformation when the helmet bears impact of external force, and particularly has poor buffer capability when the helmet bears external rotary impact, the head of the user is prone to being injured, and the sense of comfort of the user is poor.

Summary of the Invention

[0003] The present invention provides a buffer structure of a helmet, which has a good normal and tangential buffer effect and enables the head of a user not prone to being injured and the sense of comfort of the user to be good during impact of external force, so as to solve the problems that when an existing helmet bears impact of external force, a buffer structure layer has small deformation and particularly has poor buffer capability when the helmet bears external rotary impact, resulting in that the head of the user is prone to being injured, and the sense of comfort of the user is poor.

[0004] The technical solution adopted for solving the foregoing technical problems of the present invention is that according to the buffer structure of the helmet, the helmet includes a shell, an elastic lining is arranged on an inner side of the shell, a plurality of through holes are formed in the elastic lining, buffer elements composed of an elastic material are arranged at the through holes,

each buffer element includes a top plate fixed to the shell and a plurality of buffer columns arranged on the top plate, lower end portions of the buffer columns stretch out of the through holes and protrude out of an inner surface of the elastic lining, and clearances are formed between the adjacent buffer columns and between the buffer columns and inner walls of the through holes correspondingly. The elastic lining is arranged on the inner side of the shell of the helmet of the present invention, the multiple through holes penetrating through the elastic lining are formed in the elastic lining, the buffer elements are arranged at the through holes, each buffer element includes the multiple buffer columns located in the corresponding through hole, the lower end portions of the buffer columns stretch out of the through holes, and the clearances are formed between the adjacent buffer columns and between the buffer columns and the inner walls of the through holes correspondingly. Thus, when the helmet of the present invention is used, the head of a user makes direct contact with the buffer columns, when the helmet is subjected to impact of external force, the external force applied on the helmet directly acts on the head of the user after being subjected to elastic buffer of the buffer columns rather than acts on the head of the user through the elastic lining, since the clearances are formed between the adjacent buffer columns and between the buffer columns and the inner walls of the through holes correspondingly, the buffer columns can be compressed, so that the buffer elements of the present invention have sufficient buffer space, compared with a helmet of a traditional three-layer structure, the longitudinal compression amount of the buffer columns of the helmet is larger, and therefore, more impact force can be absorbed. When the external force applied on the helmet is large, and a height of compressed buffer columns is equivalent to a thickness of the elastic lining, the elastic lining has a limit effect on further compression of the buffer columns, at this moment, the elastic lining and the buffer columns bear the impact force at the same time, and the situation that part of the head of the user is stressed excessively and injured is avoided. On the other hand, the buffer columns of the present invention can deflect within the ranges of the through holes, that is, damage of rotational acceleration to the brain of the user can be reduced through the elastic buffer elements which are distributed at various positions of the helmet and provided with the plurality of buffer columns; and when a deflection angle of the buffer columns is excessively large, the inner walls of the through holes have a limit effect on excessively large deflection of the buffer columns, so that deflection of the buffer elements is prevented from being excessively large. In addition, the head of the user only makes contact with the end portions of the buffer columns when the helmet of the present invention is normally worn. Compared with the helmet of the three-layer structure in the prior art, an area of contact between the helmet and the head of the user is small and distributed in a punctiform shape, therefore, the air per-

meability is good, and the sense of comfort of the user is obviously improved. Thus, the present invention overcomes the shortcomings that the existing helmet is small in absorbed kinetic energy and poor in buffer effect when bearing impact of the external force, and the head of the user is prone to being injured are overcome, and the protection effect of the helmet on the user is greatly improved.

[0005] Preferably, the buffer columns are parallel to one another and perpendicular to the top plates, and transition bosses are arranged at positions where the buffer columns are connected with the top plates. The transition bosses have an enhancing effect on the strength of connection between the buffer columns and the top plates.

[0006] Preferably, each buffer column includes a column body connected with the corresponding top plate, and an abutting portion arranged at a tail end of the column body, a bottom surface of each abutting portion forms an abutting surface, each abutting surface is annular, an expansion groove is formed in the center of each abutting surface, and the top plates, the column bodies and the abutting portions are of integrated homogeneous structures. The expansion grooves are formed in the centers of the abutting surfaces. When the helmet is normally used, the annular abutting surfaces make contact with the head of the user, the contact surfaces are relatively small, therefore, the air permeability is better, and the sense of wearing comfort is better. When the helmet is subjected to impact of the external force, the annular abutting surfaces are stressed and expand outwards, the expansion grooves make contact with the head of the user, the area of contact is greatly increased, and a further buffer effect can be achieved.

[0007] Preferably, the column body of each buffer column is in a big-end-up circular truncated cone shape, each abutting portion is of a hexagonal blocky structure, a diameter of an incircle of each hexagon is greater than a maximum diameter of each column body (the diameter of a position where the column body is connected with the corresponding transition boss), and a necking portion is arranged at a position where each abutting portion is connected with the corresponding column body, wherein the connecting position adopts arc-shaped transition; and the expansion groove formed in the center of each abutting surface is in a hexagonal pyramid shape, an included angle between two opposite oblique high lines of each hexagonal pyramid is 80 to 100 degrees, and arc-shaped transition structures are arranged at edges and corners of the hexagons and the hexagonal pyramids correspondingly. The big-end-up column bodies are beneficial for structural stability when the buffer columns are pressed, the necking portions are arranged at the positions where the abutting portions are connected with the column bodies, the abutting portions can deflect relative to the column bodies to a certain extent, and accordingly, a better buffer effect can be achieved when the helmet is subjected to tangential impact force.

[0008] Preferably, a height of the column body of each

buffer column is 75% to 85% of a total height of the buffer column, the height of each column body is equivalent to a thickness of the elastic lining, and the abutting portions protrude out of the inner surface of the elastic lining. A height, protruding out of the inner surface of the elastic lining, of each abutting portion is 15% to 25% of the total height of the corresponding buffer column, that is, the total compression amount of the buffer column is limited to 15% to 25% of the total height of the buffer column, when the buffer column is compressed and the abutting surface of the buffer column is flush with the inner surface of the elastic lining, the head of the user makes direct contact with the elastic lining, and the situation that part of the head of the user is stressed excessively and injured can be avoided.

[0009] Preferably, the elastic lining is composed of a plurality of foam belts in a connected mode, the foam belts include a U-shaped belt located at a top of the head and a semicircular belt surrounding a front side of the head, and the through holes are formed in the foam belts. The U-shaped belt located at the top of the head mainly provides protection for the top of the head and the afterbrain of the user, wherein two straight-line segments of the U-shaped belt are located at the top of the head, and an arc-shaped segment of the U-shaped belt is located at the afterbrain position; and the semicircular belt surrounding the front side of the head mainly provides protection for the forehead and two side parts of the user.

[0010] Preferably, four to ten buffer elements are arranged on the semicircular belt, wherein at least two of the buffer elements are located at a forehead portion of the helmet, and two of the buffer elements are located on two sides of the helmet; and five to twelve buffer elements are arranged on the U-shaped belt, wherein two of the buffer elements are at least arranged on each of the two straight-line segments, located at the top of the helmet, of the U-shaped belt, and one of the buffer elements is at least arranged on an arc-shaped segment, located on a rear portion of the helmet, of the U-shaped belt. Three through holes are formed in the arc-shaped segment, located on the rear portion of the helmet, of the U-shaped belt, and one to three buffer elements can be arranged according to actual needs, so that the afterbrain of the user is protected.

[0011] Preferably, each top plate is polygonal or circular, and the five to fifteen buffer columns are uniformly arranged on each top plate.

[0012] Preferably, hook & loop fasteners are arranged between the top plates and the shell, the top plates are connected and fixed to the shell through the hook & loop fasteners, and the buffer elements are arranged on the helmet in a bilateral symmetry mode. The hook & loop fasteners are used for fixing the buffer elements. During assembling, the hook & loop fasteners are placed in the helmet and fixed at first, then the buffer elements are fixed to the hook & loop fasteners, and finally, the buffer elements are placed into the elastic lining composed of foam belts.

[0013] The present invention has the beneficial effects that the problems that when the existing helmet bears impact of external force, the buffer structure layer has small deformation and particularly has poor buffer capability when the helmet bears the external rotary impact, the head of the user is prone to being injured, and the sense of comfort of the user is poor are solved, the helmet of the present invention has the quite good normal and tangential buffer effect, the head of the user is not prone to being injured and the sense of comfort is good when the helmet is subjected to impact of the external force, the protection effect of the helmet on the user is greatly improved, and the practical value is quite high.

15 Brief Description of the Drawings

[0014]

Fig. 1 is a structural sectional view of a helmet of the present invention;

Fig. 2 is an upward view of the helmet of the present invention;

Fig. 3 is a cooperative relationship schematic diagram of an elastic lining and buffer elements of the helmet of the present invention;

Fig. 4 is a three-dimensional structure schematic diagram of the buffer elements of the present invention; and

Fig. 5 is an outline structure schematic diagram of the helmet of the present invention.

[0015] In the drawings: 1. shell, 2. elastic lining, 3. through hole, 4. buffer element, 5. top plate, 6. buffer column, 7. clearance, 8. transition boss, 9. column body, 10. abutting portion, 11. abutting surface, 12. expansion groove, 13. necking portion, 14. U-shaped belt, 15. semicircular belt, and 16. hook & loop fastener.

Detailed Description of the Invention

[0016] The technical solution of the present invention is further described with reference to the embodiments and accompanying drawings as follows.

Embodiment 1

[0017] A buffer structure of a helmet is provided in embodiment 1 as shown in Fig. 1 and Fig. 2. The helmet includes a shell 1 (see Fig. 5), an elastic lining 2 is arranged on an inner side of the shell, through holes 3 (see Fig. 3) are formed in the elastic lining, buffer elements 4 (see Fig. 4) composed of an elastic material are arranged at the through holes, each buffer element includes a top plate 5 fixed to the shell and buffer columns 6 arranged

on the top plate, each top plate is hexagonal, the buffer columns are parallel to one another and perpendicular to the top plates, there are seven buffer columns on each buffer element of the present embodiment, which are uniformly arranged on the corresponding top plate in a hexagonal shape, transition bosses 8 are arranged at positions where the buffer columns are connected with the top plates, lower end portions of the buffer columns stretch out of the through holes and protrude out of an inner surface of the elastic lining, clearances 7 are formed between the adjacent buffer columns and between the buffer columns and inner walls of the through holes correspondingly, hook & loop fasteners 16 are arranged between the top plates and the shell, and the top plates are connected and fixed to the shell through the hook & loop fasteners.

[0018] Each buffer column includes a column body 9 connected with the corresponding top plate and an abutting portion 10 arranged at a tail end of the column body, and the top plates, the column bodies and the abutting portions are of integrated homogenous structures. The column body of each buffer column is in a big-end-up circular truncated cone shape, a bottom surface of each abutting portion forms an abutting surface 11, each abutting surface of the present embodiment is annular, an expansion groove 12 is formed in the center of each abutting surface, and a height of the column body of each buffer column is 80% of a total height of the buffer column. The elastic lining is composed of a plurality of foam belts in a connected mode, the foam belts include a U-shaped belt 14 located at the top of a head and a semicircular belt 15 surrounding a front side of the head, the through holes are formed in the foam belts, a thickness of the elastic lining is the same as the height of the column bodies, and the abutting portions of the buffer columns protrude out of the inner surface of the elastic lining.

[0019] Each abutting portion is of a hexagonal blocky structure, a diameter of an incircle of each hexagon is greater than a maximum diameter of each column body (the diameter of a position where the column body is connected with the corresponding transition boss), and a necking portion 13 is arranged at a position where each abutting portion is connected with the corresponding column body, wherein the connecting position adopts arc-shaped transition; and the expansion groove formed in the center of each abutting surface is in a hexagonal pyramid shape, an included angle between two opposite oblique high lines of each hexagonal pyramid is 90 degrees, and arc-shaped transition structures are arranged at edges and corners of the hexagons and the hexagonal pyramids correspondingly.

[0020] Six buffer elements are arranged on the semicircular belt in the present embodiment, wherein two of the buffer elements are located on a forehead portion of the helmet, two of the buffer elements are located on two sides of the helmet, and the other two are located between the forehead portion of the helmet and the two sides of the helmet; and seven buffer elements are ar-

ranged on the U-shaped belt, wherein three of the buffer elements are arranged on each of two straight-line segments, located at the top of the helmet, of the U-shaped belt, and one of the buffer elements is arranged on an arc-shaped segment, located on a rear portion of the helmet, of the U-shaped belt. The buffer elements in the embodiment are arranged on the helmet in a bilateral symmetry mode.

10 Embodiment 2

[0021] In embodiment 2, ten buffer columns are arranged on each buffer element, and are arranged in three rows in a staggered mode, wherein four buffer columns are arranged in the middle row, and three buffer columns are arranged in each of two rows on two sides; eight buffer elements are arranged on the semicircular belt in embodiment 2, wherein two of the buffer elements are located on a forehead portion of a helmet, two of the buffer elements are located on two sides of the helmet, and the other four buffer elements are located between the forehead portion of the helmet and the two sides of the helmet. Four buffer elements are arranged on each of two straight-line segments of a U-shaped belt, three buffer elements are arranged on an arc-shaped segment, located on a rear portion of the helmet, of the U-shaped belt (three through holes are formed in the arc-shaped segment, located on the rear portion of the helmet, of the U-shaped belt as shown in Fig. 2), and the rest is the same as those in the embodiment 1.

[0022] The elastic lining is arranged on the inner side of the shell of the helmet of the present invention, the multiple through holes penetrating through the elastic lining are formed in the elastic lining, the buffer elements are arranged at the through holes, each buffer element includes the multiple buffer columns located in the corresponding through hole, the lower end portions of the buffer columns stretch out of the through holes, and meanwhile, the clearances are formed between the adjacent buffer columns and between the buffer columns and the inner walls of the through holes correspondingly. Thus, when the helmet of the present invention is used, the head of a user makes direct contact with the buffer columns, when the helmet is subjected to impact of external force, the external force applied on the helmet directly acts on the head of the user after being subjected to elastic buffer of the buffer columns rather than acts on the head of the user through the elastic lining, since the clearances are formed between the adjacent buffer columns and between the buffer columns and the inner walls of the through holes correspondingly, the buffer columns can be compressed, so that the buffer elements of the present invention have sufficient buffer space, compared with a helmet of a traditional three-layer structure, the longitudinal compression amount of the buffer columns of the helmet is larger, and therefore, more impact force can be absorbed. When the external force applied on the helmet is large, the height of compressed buffer columns

is equivalent to the thickness of the elastic lining, the elastic lining has a limit effect on further compression of the buffer columns, at this moment, the elastic lining and the buffer columns bear the impact force at the same time, and the situation that part of the head of the user is stressed excessively and injured is avoided. On the other hand, the buffer columns of the present invention can deflect within the ranges of the through holes, that is, damage of rotational acceleration to the brain of the user can be reduced through the elastic buffer elements which are distributed at all positions of the helmet and provided with the multiple buffer columns; and when the deflection angle of the buffer columns is excessively large, the inner walls of the through holes have a limit effect on excessively large deflection of the buffer columns, so that deflection of the buffer elements is prevented from being excessively large. In addition, the head of the user only makes contact with the end portions of the buffer columns when the helmet of the present invention is normally worn. Compared with the helmet of the three-layer structure in the prior art, the area of contact between the helmet and the head of the user is small and distributed in a punctiform shape, therefore, the air permeability is good, and the sense of comfort of the user is obviously improved. Thus, the present invention overcomes the shortcomings that the existing helmet is small in absorbed kinetic energy and poor in buffer effect when bearing impact of the external force, and the head of the user is prone to being injured are overcome, and the protection effect of the helmet on the user is greatly improved.

[0023] Besides the embodiments of the present invention, within the scope of the claims and the description of the present invention, the technical characteristics or technical data of the present invention may be reselected and combined to form new embodiments by those skilled in the art without paying creative work, and therefore these embodiments not specifically described by the present invention shall fall within the protection scope of the present invention as specific embodiments of the present invention.

Claims

1. A buffer structure of a helmet comprising a shell (1), **characterized in that** an elastic lining (2) is arranged on an inner side of the shell, a plurality of through holes (3) are formed in the elastic lining, buffer elements (4) composed of an elastic material are arranged at the through holes, each buffer element comprises a top plate (5) fixed to the shell and a plurality of buffer columns (6) arranged on the top plate, lower end portions of the buffer columns stretch out of the through holes and protrude out of an inner surface of the elastic lining, and clearances (7) are formed between the adjacent buffer columns and between the buffer columns and inner walls of

the through holes correspondingly.

2. The buffer structure of the helmet according to claim 1, **characterized in that** the buffer columns are parallel to one another and perpendicular to the top plates, and transition bosses (8) are arranged at positions where the buffer columns are connected with the top plates.
3. The buffer structure of the helmet according to claim 1, **characterized in that** each buffer column comprises a column body (9) connected with the corresponding top plate and an abutting portion (10) arranged at a tail end of the column body, a bottom surface of each abutting portion forms an abutting surface (11), each abutting surface is annular, an expansion groove (12) is formed in a center of each abutting surface, and the top plates, the column bodies and the abutting portions are of integrated homogeneous structures.
4. The buffer structure of the helmet according to claim 3, **characterized in that** the column body of each buffer column is in a big-end-up circular truncated cone shape, each abutting portion is of a hexagonal blocky structure, a diameter of an incircle of each hexagon is greater than a maximum diameter of the corresponding column body, and a necking portion (13) is arranged at a position where each abutting portion is connected with the corresponding column body, wherein the connecting position adopts arc-shaped transition; and the expansion groove formed in the center of each abutting surface is in a hexagonal pyramid shape, an included angle between two opposite oblique high lines of each hexagonal pyramid is 80 to 100 degrees, and arc-shaped transition structures are arranged at edges and corners of the hexagons and the hexagonal pyramids correspondingly.
5. The buffer structure of the helmet according to claim 3, **characterized in that** a height of the column body of each buffer column is 75% to 85% of a total height of the buffer column, the height of each column body is equivalent to a thickness of the elastic lining, and the abutting portions protrude out of the inner surface of the elastic lining.
6. The buffer structure of the helmet according to claim 1, **characterized in that** the elastic lining is composed of a plurality of foam belts in a connected mode, the foam belts include a U-shaped belt (14) located at a top of a head and a semicircular belt (15) surrounding a front side of the head, and the through holes are formed in the foam belts.
7. The buffer structure of the helmet according to claim 6, **characterized in that** four to ten buffer elements

are arranged on the semicircular belt, wherein at least two of the buffer elements are located on a forehead portion of the helmet, and two of the buffer elements are located on two sides of the helmet; and five to twelve buffer elements are arranged on the U-shaped belt, wherein two of the buffer elements are at least arranged on each of two straight-line segments, located at a top of the helmet, of the U-shaped belt, and one of the buffer elements is at least arranged at an arc-shaped segment, located on a rear portion of the helmet, of the U-shaped belt.

8. The buffer structure of the helmet according to claim 1, **characterized in that** the top plates are polygonal or circular, and the five to fifteen buffer columns are uniformly arranged on each top plate.
9. The buffer structure of the helmet according to any one of claims 1 to 8, **characterized in that** hook & loop fasteners (16) are arranged between the top plates and the shell, the top plates are connected and fixed to the shell through the hook & loop fasteners, and the buffer elements are arranged on the helmet in a bilateral symmetry mode.

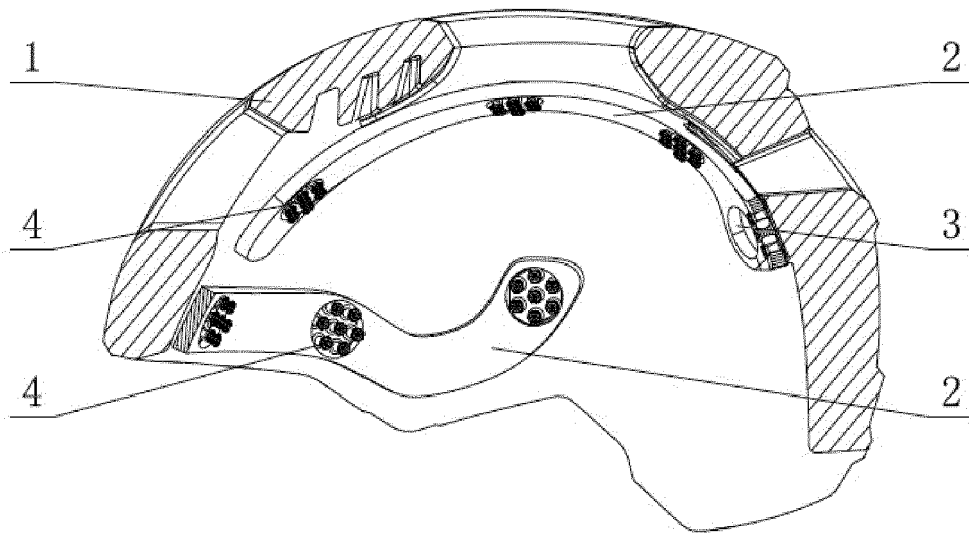


FIG. 1

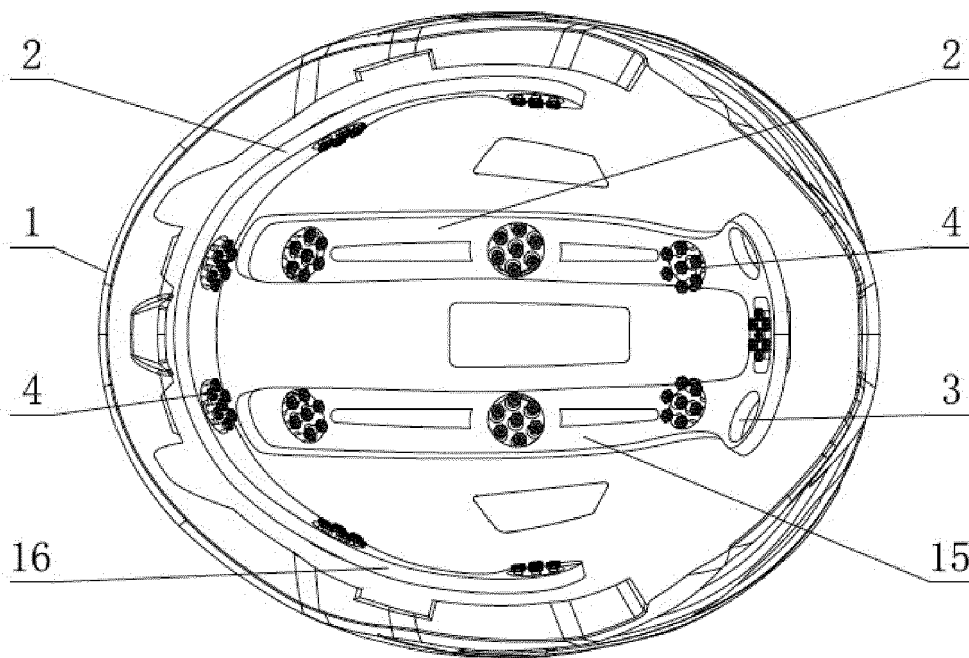


FIG. 2

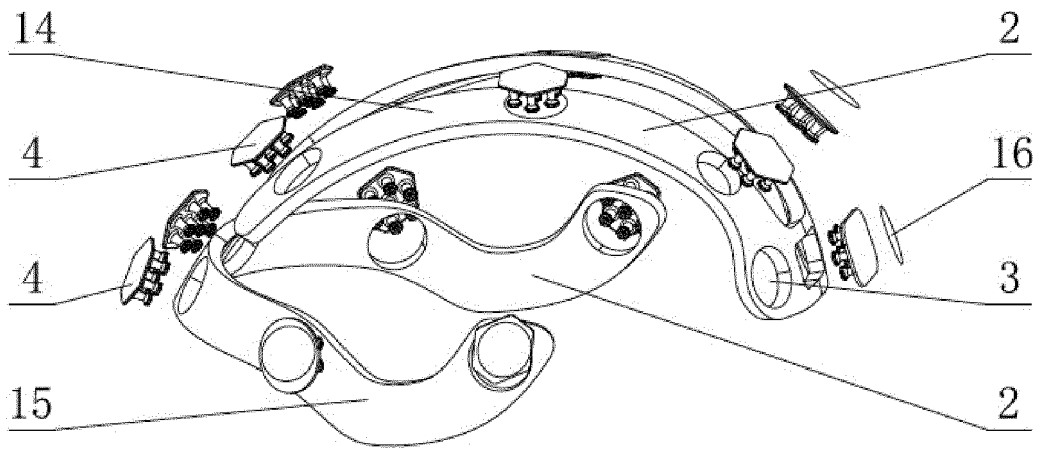


FIG. 3

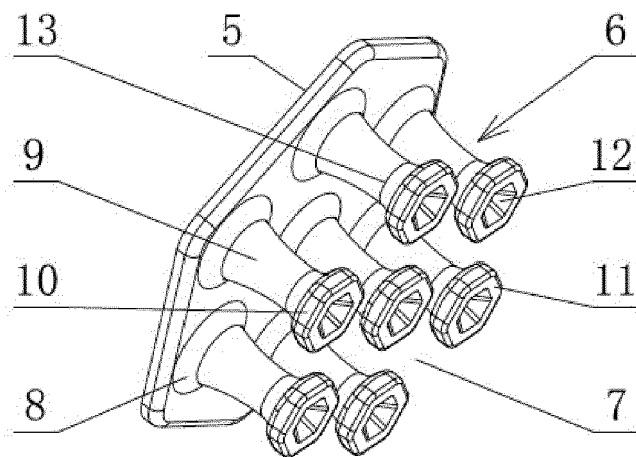


FIG. 4

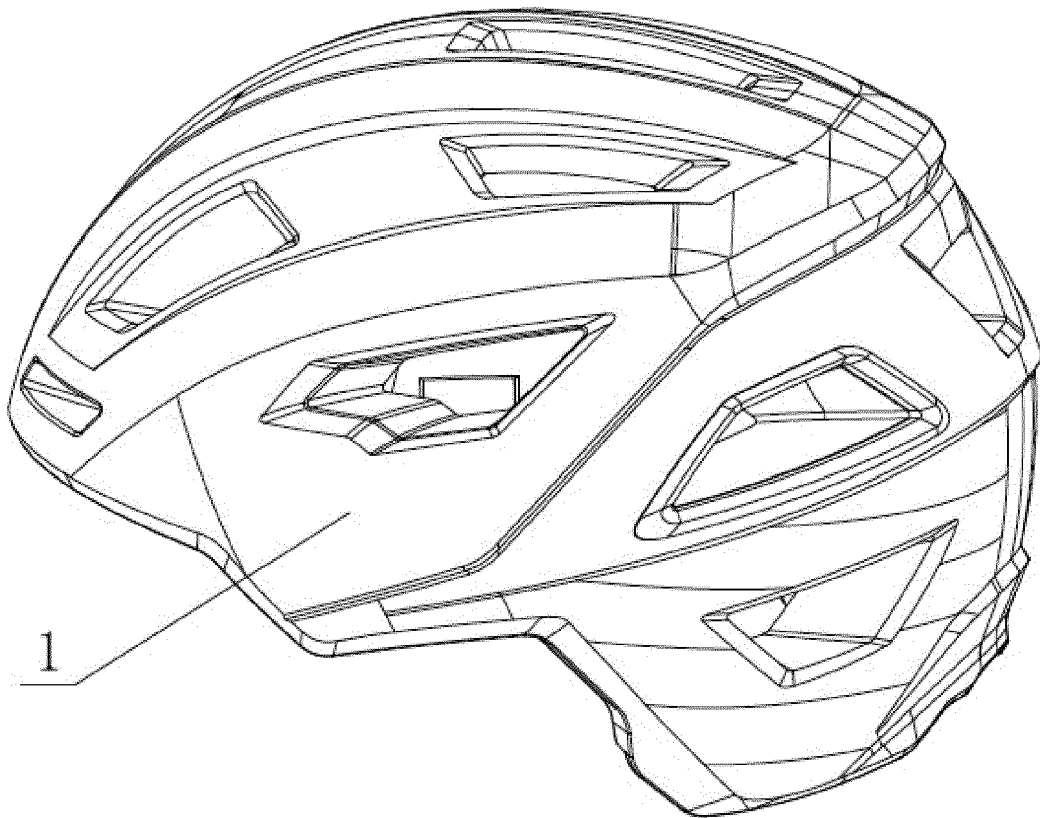


FIG. 5



EUROPEAN SEARCH REPORT

 Application Number
 EP 19 16 7400

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A	US 2014/068841 A1 (BROWN GEORGE MALCOLM [US]) 13 March 2014 (2014-03-13) * paragraphs [0012] - [0015]; figures 1-6 *	1-9	INV. A42B3/12
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 25 September 2019	Examiner D'Souza, Jennifer
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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