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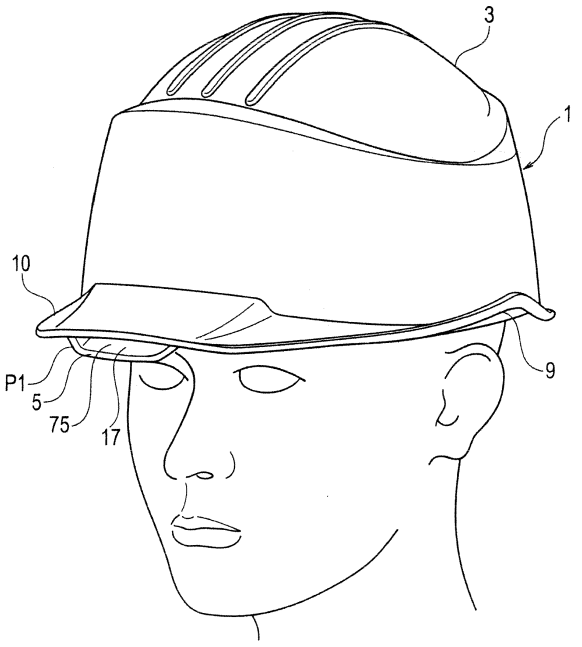
(54) SHIELD MEMBER AND PROTECTIVE CAP

(57) In a shield member for covering a face of a wearer and a protective cap in which the shield member is provided, image distortion is made as small as possible even when he or she sees an object through its peripheral portions of the shield member. In a shield member 5 for covering a face of a wearer installed in a cap body 3 for protecting a hear of the wearer, it is a shield member 5 formed of a transparent body or a translucent body in a curved plate-like form and gradually becoming thinner as going from its central portion to its peripheral portion.

FIG. 1



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Description

TECHNICAL FIELD

[0001] The present invention relates to a shield member and a protective cap, and in particular relates to that configured to cover a face of a wearer.

BACKGROUND ART

[0002] There is so far known a protective cap (helmet) with a shield (transparent or translucent shield plate) for protecting eyes of a worker as a measure against accidents in which nails bounce back out of nailers to stick in worker's eyes or any others occur during works of construction of a house (see PTL1-PTL3, for example).

CITATION LIST

PATENT LITERATURE

[0003]

PTL 1: Japanese Unexamined Patent Publication No. 2003-049316
PTL 2: Japanese Unexamined Patent Publication No. 2003-253519
PTL 3: Japanese Unexamined Patent Publication No. 2003-082518

SUMMARY OF INVENTION

PROBLEM TO BE SOLVED

[0004] However, in regard to a shield plates provided in any of the aforementioned conventional protective caps, a base material formed of a transparent material such as a resin in a plate-like shape is heated, deformed and then formed into a curved shape.

[0005] Thus the thickness of the shield plate is constant regardless of places, and it gives rise to a problem that, when a wearer see an object through the shield plate, he or she will not see a distorted image through its central portion but will see distorted images through its peripheries.

[0006] More specifically, while an image a wearer see is not distorted in a case where he or she looks his or her front (right in front), images will be distorted when he or she moves his or her eyes left or right, or up or down, to look in a left, right, upper or lower direction.

[0007] The present invention has been achieved in view of the above problem, and is intended for providing a shield member and a protective cap which can make images distortion as small as possible in a shield member for covering a face of a wearer and a protective cap in which the shield member is provided even when he or she sees an object through its peripheral portions.

[0008] A shield member based on a first aspect of the present invention is a shield member formed of a transparent body or a translucent body into a curved plate-like shape and being gradually thinner as going from a central portion to a peripheral portion in a shield member provided in a cap body for protecting a head of a wearer, for covering a face of the wearer.

[0009] A shield member based on a second aspect of the present invention is a shield member in that a surface at an inside opposed to the face of the wearer is formed in a concave shape, a curvature radius in a left-and-right direction is formed to be smaller than a curvature radius in a upper-and-lower direction, and a ratio of change in a thickness in the left-and-right direction is formed to be larger than a ratio of change in a thickness in the upper-and-lower direction in the shield member based on the first aspect.

[0010] A shield member based on a third aspect of the present invention is constituted to comprise a main body portion and a visor portion, and that the main body portion is formed in the curved plate-like shape, and the visor portion is bent below the main body portion to project in a direction opposite to the main body portion in the shield member based on the first aspect or the second aspect.

[0011] A shield member based on a fourth aspect of the present invention is a shield member in that a concave portion dented toward an inside of the main body portion with a predetermined width is formed at a central portion in a lateral direction of the visor portion in the shield member based on the fourth aspect.

[0012] A shield member based on a fifth aspect of the present invention is a shield member having a main body portion for covering a face of the wearer, the main body being formed of a transparent body or a translucent body in a curved plate-like shape and a visor portion for preventing a flying object from contacting a body of the wearer, the visor portion being formed integrally with a lowermost end portion of the main body portion in a shield member provided in a cap body for protecting a head of a wearer, for covering a face of the wearer.

[0013] A shield member based on a sixth aspect of the present invention is a shield member in that a concave portion dented toward the wearer to open to a lowermost end side is provided at a central portion in a lateral direction of the visor portion in the shield member based on the fifth aspect.

[0014] A shield member based on a seventh aspect of the present invention is a shield member having a cap body for protecting a head of a wearer, guide means for guiding the shield member to move between a housing position where the shield member is housed in the cap body and a shielding position where the shield member covers a face of the wearer, wherein a gap is formed between a visor portion of the shield member and a visor portion of the cap body in a state where the shield member is positioned at the housing position in the shielding member based on the fifth aspect or the sixth aspect.

[0015] A protective cap based on an eighth aspect of the present invention is a protective cap having the shield

member according to any of the first aspect through the seventh aspect, a cap body for protecting a head of the wearer, and guide means for guiding the shield member to move between a housing position where the shield member is housed in the cap body and a shielding position where the shield member covers a face of the wearer, wherein a gap is formed between a visor portion of the shield member and a visor portion of the cap body in a state where the shield member is positioned at the housing position.

EFFECT OF THE INVENTION

[0016] According to the present invention, in a shield member for covering a face of a wearer and a protective cap in which the shield member is provided, an effect in which image distortion is made as small as possible even when he or she sees an object through its peripheral portions of the shield members is provided.

BRIER DESCRIPTION OF THE DRAWING

[0017]

[FIG. 1] FIG. 1 is a perspective view when a wearer wears a protective cap 1 in accordance with a first embodiment of the present invention.
[FIG. 2] FIG. 2 is an elevational view when the wearer wears the protective cap 1.
[FIG. 3] FIG. 3 is a side view when the wearer wears the protective cap 1.
[FIG. 4] FIG. 4 is a perspective view when the wearer wears the protective cap 1.
[FIG. 5] FIG. 5 is an elevational view when the wearer wears the protective cap 1.
[FIG. 6] FIG. 6 is a side view when the wearer wears the protective cap 1.
[FIG. 7] FIG. 7 is a cross sectional view of the protective cap 1.
[FIG. 8] FIG. 8 is a view of the protective cap 1 viewed from its inside.
[FIG. 9] FIG. 9 is a plan view showing a state where the guide member 11 and the shield plate 5 are assembled.
[FIG. 10] FIG. 10 is a plan view showing a state where the guide member 11 and the shield plate 5 are assembled.
[FIG. 11] FIG. 11 is a perspective view showing a summarized configuration of the shield plate 5.
[FIG. 12] FIG. 12 is an elevational view showing a summarized configuration of the shield plate 5.
[FIG. 13] FIG. 13 is a side view showing a summarized configuration of the shield plate 5.
FIG. 14] FIG. 14 is a drawing viewed from an arrow XIV in FIG. 12.
[FIG. 1-5] FIG. 15 is a drawing showing a cross section XV-XV in FIG. 12.
[FIG. 16] FIG. 16 is a drawing showing a cross section XVI-XVI in FIG. 12.
[FIG. 17] FIG. 17 is an elevational view showing a summarized configuration of the guide member 11.
[FIG. 18] FIG. 18 is a drawing viewed from an arrow XVIII in FIG. 17.
[FIG. 19] FIG. 19 is a drawing viewed from an arrow XIX in FIG. 17.
[FIG. 20] FIG. 20 is a drawing showing a cross section of the shield plate 5, which is corresponding to FIG. 16.
[FIG. 21] FIG. 21 is a perspective view when a wearer wears a protective cap 201 in accordance with a second embodiment of the present invention.
[FIG. 22] FIG. 22 is a perspective view when the wearer wears the protective cap 201.
[FIG. 23] FIG. 23 is a cross sectional view of the protective cay 201.
[FIG. 24] FIG. 24 is a view of the protective cap 201 viewed from its inside.
[FIG. 25, FIG. 25 is a view of the protective cap 201 viewed from its inside.
FIG. 26] FIG. 26 is a drawing showing a cross section XXVI-XXVI in FIG. 23.
[FIG. 27] FIG. 27 is a drawing showing a concrete configuration of a protective means 261.
[FIG. 28] FIG. 28 is a drawing showing a summarized configuration of a protective cap 301 in accordance with a third embodiment of the present invention.
[FIG. 29] FIG. 29 is drawing showing differences in outlines of a cap body 303 of the protective cap 301 and a cap body 300 of a widely-used protective cap.
[FIG. 30] FIG. 30 is a cross sectional view of the protective cap 301.
[FIG. 31] FIG. 31 is a drawing showing a state where a wearer wears the protective cap 301.
[FIG. 32] FIG. 32 is a perspective view showing a summarized configuration of an internal member 321.
[FIG. 33] FIG. 33 is a drawing showing a cross section XXXIII-XXXIII in FIG. 28.
[FIG. 34] FIG. 34 is a drawing showing a modification of the protective cap 301.
[FIG. 35] FIG. 35 is a drawing showing a summarized configuration of a protective cap 351 in accordance with a fourth embodiment of the present invention.
[FIG. 36] FIG. 36 is a drawing showing a summarized configuration of the protective cap.
[FIG. 37] FIG. 37 is an enlarged view of a part X in FIG. 36.
[FIG. 38] FIG. 38 is an exploded perspective view showing a summarized configuration of a protective cap in accordance with a fifth embodiment of the present invention.
[FIG. 39] FIG. 39 is a cross sectional view showing a summarized configuration of the protective cap.
[FIG. 40] FIG. 40 is an elevational view of the protective cap, viewed from an arrow XL in FIG. 39.
[FIG. 41] FIG. 41 is a bottom view of the protective

cap, viewed from an arrow XLI in FIG. 39.

[FIG. 42] FIG. 42 is a drawing showing a state of engagement between a cap body and a guide member, and a state of engagement among the cap body, a chin-strap and a hammock.

[FIG. 43] FIG. 43 is a drawing showing an assembly of the guide member and the shied plate.

[FIG. 44] FIG. 44 is a drawing showing the assembly of the guide member and the shield plate.

[FIG. 45] FIG. 45 is a drawing showing details of a guide portion and such of the guide member.

[FIG. 46] FIG. 46 is a drawling showing a summarized configuration of the cap body.

[FIG. 47] FIG. 47 is a drawing showing a side portion to-be-engaged portion provided in the cap body.

[FIG. 48] FTG. 48 is a drawing showing a central portion to-be-engaged portion provided in the cap body.

[FIG. 49] FIG. 49 is a drawing showing a guide member.

[FIG. 50] FIG. 50 is a drawing showing the guide member.

[FIG. 51] FIG. 51 is a drawing showing a guide member locking portion.

[FIG. 52] FIG. 52 is a drawing showing to shield member. [FIG. 53] FIG. 53 is a drawing showing the shield member.

DESCRIPTION OF EMBODIMENTS

[FIRST EMBODIMENT]

[0018] FIG. 1 and FIG. 4 are perspective views when a wearer wears a protective cap 1 in accordance with a first embodiment of the present invention, FIG. 2 and FIG. 5 are elevational views when the wearer wears the protective cap 1, and FIG. 3 and FIG. 6 are side views when the wearer wears the protective cap 1.

[0019] Meanwhile, FIG. 1, FIG. 2 and FIG. 3 show a state where the shield plate 5 is positioned at a housing position P1, and FIG. 4, FIG. 5 and FIG. 6 show a state where the shield plate 5 is positioned at a shielding position P3.

[0020] FIG. 7 is a cross sectional view of the protective cap 1 taken from a plane extending in a front-and-rear and upper-and-rear directions relative to the protective cap 1 through a center of the protective cap 1.

[0021] FIG. 9 and FIG. 10 are perspective views showing a state where the guide member 11 and the shield plate 5 are assembled. Meanwhile, FIG. 9 shows a state where the shield plate 5 is positioned at the housing position P1, and FIG. 10 shows a state where the shield plate 5 is positioned at the shielding position P3.

[0022] FIG. 11 is a perspective view showing a summarized configuration of the shield plate 5, FIG. 12 is an elevational view showing a summarized configuration of the shield plate 5, FIG. 13 is a side view showing a summarized configuration of the shield plate 5, FIG. 14 is a drawing viewed from an arrow XIV in FIG. 12, FIG. 15 is a drawing showing a cross section XV-XV in FIG. 12, and FIG. 16 is a drawing showing a cross section XVI-XVI in FIG. 12.

[0023] FIG. 17 is an elevational view showing a summarized configuration of the guide member 11, FIG. 18 is a drawing viewed from an arrow XVIII in FIG. 17, and FIG. 19 is a drawing viewed from an arrow XIX in FIG. 17.

[0024] Meanwhile, respective directions in a protective cap (a cap body, a shield plate, a guide member and such) may be a lateral direction (left-and-right direction), a front-and-rear direction, and an upper-and-lower direction hereinafter, and descriptions will be given with reference to terms of "right", "left", "upper", "lower", "front" and "rear". The aforementioned respective directions are directions in a case where a standing (uprightly standing) wearer wears the protective cap, and these three directions are substantially perpendicular to each other.

[0025] The protective cap (helmet with a shield face) 1 is constituted to for example comprise a cap body 3 formed to be substantially bilaterally symmetrical, a shield plate 5, and a guide means 7 for guiding the shield plate 5.

[0026] The cap body 3 is to protect a head of a wearer, and is for example constituted of a resin or such to form a bowl form (semi-spherical-shell-like form).

[0027] Here, the semi-spherical shell is one of bodies two bodies formed by dividing a body with a shape formed by removing a second sphere of a slightly smaller radius than a radius of a first sphere having a predetermined radius, which has a common center with the first sphere, into two.

[0028] The cap body 3 is formed in a "semi-spherical-shell-like" form and is thus not formed in a perfect semi-spherical shell form. More specifically, the cap body 3 is formed in a shape in which the curvature radius properly changes to fit it with a shape of a head of a wearer. Further an opening portion (an edge; a lowermost end) 9 of the cap body 3 is not a perfect circular shape and is formed in a circle-like shape in which the curvature radius properly changes to fit it with a shape of a head of a wearer.

[0029] As the cap body 3 is formed in a semi-spherical-shell-like form, when a standing upright wearer wears the protective cap 1, the opening portion 9 of the cap body 3 becomes substantially horizontal and the opening portion 9 positions at the slightly upper side than wearer's ears, thereby exposing the ears of the wearer (see FIG. 1 - FIG. 6). Meanwhile, a visor portion 10 is provided at the front of the opening portion 9 of the cap body 3.

[0030] The shield plate (face body; a shield member) 5 is to protect almost all of a face of a wearer and is constituted of a transparent (including colored transparency) or translucent material such as a resin.

[0031] The guide means 7 is a means for guiding the shield plate 5 at a time when the shield plate 5 moves relative to the cap body 3, and it is so structured that the shield member 5 moves to draw a circle-like trajectory between a housing position P1 and a shielding position

P3. The housing position P1 is a position where the shield plate 5 is housed in the front interior of the cap body 3, and the shielding position P3 is a position where the shield plate 5 covers almost all of a face of a wearer (front face of a head). Meanwhile it is regulated that ears of a wearer hide behind the shield plate 5 when viewed from the front of the wearer in a state where the upright standing wearer wears the protective cap 1 and the shield plate 5 is positioned at the shielding position P3.

[0032] As well as the shield plate 5 guided by the guide means 7 is made unlikely to be separated from the cap body 3, the shield plate 5 does not move in the left-and-right direction but moves (swings) with having a predetermined axis C1 (see FIG. 3) extending in the left-and-right direction of the protective cap 1 (cap body 3) as a pivotal center. The predetermined axis C1 extends through positions at the rears of left and right ears of a wearer in the left-and-right direction (a direction perpendicular to a paper face of FIG. 3).

[0033] The guide means 7 is constituted to comprise a guide portion 13 provided at the guide member 11 and an engagement portion 15 provided at the shield plate 5 for example.

[0034] The guide portion 13 is formed in an arc-like shape. In a state where the guide member 11 is installed in the cap body 3, the guide portion 13 is provided integrally with the cap body 3 in the interior of the cap body with having a predetermined axis C1 as a center. Further, the guide portion 13 is provided at both end portions in the lateral direction and a central portion of the guide members 11 for example.

[0035] The shield plate 5 is formed in a curved plate-like form. The shield plate 5 is provided with an engagement portion 15 at both end portions and a central portion in the lateral direction of the shield plate 5. Further, as the engagement portion 15 engages with the guide portion 13, the shield plate 5 moves between the housing position P1 and the shielding position P3.

[0036] Describing the state where the shield plate 5 positions at the housing position P1 in more detail, the shield plate 5 is not thoroughly housed in the interior of the cap body 3 in this state but a lowermost end portion (the lowermost end portion where a visor 17 is provided) of the shield plate 5 and its vicinities protrudes out of the lowermost end portion 9 of the cap body 3 (the opening portion of the front side of the cap body 3) downward. Meanwhile the visor (visor portion) 17 turns over at the lowermost end portion of the shield plate 5. More specifically, the visor 17 bends in its reverse direction (a direction falling apart from a face of a wearer) and then extends out. Thereby, even if a flying object hits the shield plate (the shield plate at the shielding position P3) 5, a situation in which the flying object slides on the shield plate 5 to contact a body of a wearer can be avoided.

[0037] Even if the lowermost end portion or its vicinities of the shield plate 5 projects out of the lowermost end portion 9 of the cap body 3 downward in a state where the shield plate 5 is positioned at the housing position P1 it does not interfere with a wearer and the wearer can wear the protective cap 1 without being aware of existence of the shield plate 5 in his or her visual afield. Further an uppermost end portion of the shield plate 5 is positioned at the vicinity of the top portion of the cap body 3. In the meantime, it is allowed to omit the visor of the shield plate 5 and apply a configuration in which the shield plate 5 is thoroughly housed in the interior of the cap body 3 in a state where the shield plate 5 is positioned at the housing position P1.

[0038] In a state where the shield plate 5 is positioned at the shielding position P3, the lowermost end portion of the shield is positioned below a chin of a wearer and then the shield plate 5 covers almost all of a face of the wearer. More specifically, when viewed from the front, all of the face of the wearer is covered with the shield plate 5 (see FIG. 4 - FIG. 6). The uppermost end portion of the shield plate 5 is positioned in the interior of the cap body 3 in the vicinity of the lowermost end portion of the cap body 3 (the opening portion 9 of the front side of the cap body 3).

[0039] The guide member 11 is formed of a resin for example and is integrally constituted to comprise a first side portion 21 and a second side portion 23. A central portion 19 is formed in a plate-like form (curved plate-like form) to comprise a sphere-like curved surface. The first side portion 21 is integrally provided on the central portion 19 at one end portion side in the lateral direction of the central portion 19. The second side portion 23 is integrally provided on the central portion 19 at another end portion side in the lateral direction of the central portion 19.

[0040] The first side portion 21. is constituted of a proximal end portion side portion (a portion at the central portion 19 side) and a tip end portion side portion 27, and the second side portion 23 is likewise constituted of a proximal end portion side portion (a portion at the central portion 19 side) 29 and a tip end portion side portion 31. Further, on the respectively portions 25 and 29, a part of the guide portion 13 is formed.

[0041] Further, a tip end portion side portion 27 of the first side portion 21 and a tip end portion side portion 31 of the second side portion 23 engage with the cap body 3 (in face contact with lower internal surfaces at sides of the cap body 3, for example) to provide the cap body 11 integrally with the guide member 11.

[0042] The shield plate 5 enters into a space formed among the cap body 3, the central portion 19 and the proximal portion side portions 25 and 29 of the respective side portions 21 and 23, thereby being housed in the cap body 3.

[0043] The tip end portion side portion 27 of the first side portion 21 is formed in a plate-like form (curved plate-like form) comprising a curved surface in face contact with the lower internal surface at one side of the cap body 3, and the tip end portion side portion 31 of the second side portion 23 is likewise formed in a plate-like form (curved plate-like form) comprising a curved surface in face contact with the lower internal surface at another

side of the cap body 3.

[0044] The proximal end portion side portion 25 of the first side portion 21 is constituted to comprise a standing portion 33 and a connection portion 35. The standing portion 33 is formed in an elongated plate-like form so to have its lateral direction in a direction of standing to stand from the tip end portion side portion 27 of the first side portion 21 in a direction, for example, substantially perpendicular thereto. The connection portion 35 is formed in an elongated plate-like form. One end portion in the lateral direction thereof is provided integrally with the central portion 19 and another end portion in the lateral direction thereof is provided integrally with the standing portion 33, thereby connecting the standing portion 33 with the central portion 19.

[0045] In a state where the guide member 11 is provided integrally with the cap body 3, the standing portion 33 stands in an obliquely forward direction from the internal surface of the cap body 3 (a direction to the interior of the cap body 3) and the connection portion 35 (respective surfaces in its thickness direction of the connection portion 35) extends in substantially front-and-rear and upper-and-lower directions.

[0046] Likewise the proximal end portion side portion 29 of the second side portion 23 is constituted of a standing portion 41 and a connection portion 43.

[0047] The guide portion 13 of the guide, member 11 is constituted of an elongated slot 39 of an arc-like shape formed on the connection portion 35, an elongated slot 47 of an arc-like shape formed on the connection portion 43, and a to-be-engaged portion 63 (a groove 65; a central portion of the central portion 19) formed to extend in the upper-and-lower direction of the guide member 11 at a central portion in the lateral direction of the guide member 11.

[0048] The engagement portion 15 of the shield plate 5 is constituted of respective engagement pieces 51, 59 provided at both end portions in the lateral direction of the shield plate 5, and a projection 37 provided on the shield plate 5.

[0049] The engagement piece 51, as shown in FIG. 8, FIG. 9, FIG. 10 and FIG. 26, projects inward relative to the shield plate 5 at the upper end portion side of one end side in the lateral direction of the shield plate 5, and is provided integrally with the shield plate 5. The engagement piece 51 is formed in an umbrella-like shape comprising a proximal end portion 53 in a cylindrical shape and an umbrella portion 55 formed in a circular disc-like shape having a larger outer diameter than the proximal end portion 53. The engagement piece 51 has the proximal end portion 53 with a diameter slightly smaller than a width of the elongated slot 39 entering into the elongated slot 39 to engage therewith with forming a sliding contraposition. Meanwhile the outer diameter of the umbrella portion 55 is made larger than the width of the elongated slot 39. Likewise at another side in the lateral direction of the shield plate 5, the engagement piece 59 is provided and the engagement piece 59 engages with the elongated slot 47.

[0050] The projection 37, as shown in FIG. 12 - FIG. 14, projects toward the inside (the concave surface side) of the shield plate 5 at the central portion in the lateral direction of the shield plate 5 and at the uppermost end portion side in the upper-and-lower direction of the shield plate 5, and is then provided integrally with the shield plate 5.

[0051] At both end portions in the longitudinal direction of the groove 65, portions 67, 69 penetrating the guide member 11 are formed. At the central portion in the longitudinal direction of the groove 65, a guide concave portion 70 of an elongated plate-like shape dented toward the inside of the guide member 11 is formed. Further, as the engagement piece 51 engages with the elongated slot 39, the engagement piece 59 engages with the elongated slot 47, and a tip end portion of the projection 37 engages with the guide concave portion 70 to form a sliding contraposition, it is made that the shield plate 5 is guided to move.

[0052] It has a double structure In which the cap body 3 is disposed outside and the guide member 11 is disposed inside in the front of the protective cap 1 as shown in FIG. 7 when the guide member 11 is installed in the interior of the cap body 3. Then the shield plate 5 enters in between the cap body 3 and the guide member 11.

[0053] When the guide member 11 is installed in the cap body 3, a center of the arc-like elongated slot 39(47) substantially corresponds to a predetermined axis C1 (see FIG. 3, FIG. 6 and FIG. 7). Thus the shield plate 5 is made to swing to have the axis C1 as its pivotal center.

[0054] Further, a cross section of the central portion 19 of the guide member 11 (a cross section shown in FIG. 7) is formed in an arc-like shape having the predetermined axis C1 as its center. Further, a cross section of the shield plate 5 (a cross section shown in FIG. 7) is formed in an arc-like shape having a predetermined axis C3 as its center. The predetermined axis C3 runs in parallel with the predetermined axis C1 and is positioned slightly beyond and at the rear of the predetermined axis C1.

[0055] A curvature radius of the central portion 19 of the guide member 11 is made larger than a curvature radius of the elongated slot 39(47), and a curvature radius of the central portion 19 of the guide member 11 and a curvature radius of the shield plate 5 are substantially equal to each others

[0056] Further, in the cross section shown in FIG. 7, in a Case where the shield plate 5 is positioned at the housing position P1, an uppermost end portion or the central portion 19 of the guide member 11 and an uppermost end portion of the shield plate 5 are positioned at the upper side of the cap body 3 in the upper-and-lower direction of the cap body 3, and positioned at a central portion of the cap body 3 in the front-and-rear direction of the cap body 3. Further, a lowermost end portion of the central portion 19 of the guide member 11 and a lowermost end portion of the shield plate 5 are positioned

close to a lowermost end portion at the front of the cap body 3.

[0057] Further, the protective cap 1 is provided with a retaining means 61 for retaining the shield plate 5. The retaining means 61 is to retain the shield plate 5 not to readily move the shield plate 5 relative to the cap body 3 when the shield plate 5 is positioned at the housing position P1 or the shielding position P3.

[0058] The retaining means 61 is for example constituted of a projection 37 provided in the shield plate 5 and a to-be-engaged portion 63 provided in the guide member 11. The to-be-engaged portion 63 is constituted to comprise a groove 65 formed to extend in the upper-and-lower direction of the guide member 11 at the central portion in the lateral direction of the guide member 11.

[0059] A portion 67 at a side of one end portion (uppermost end portion) in the longitudinal direction of the guide groove 65 is formed to have a width B1 narrowed than its central portion, and a portion 69 at a side of another end portion (lowermost end portion) in the longitudinal direction of the guide groove 65 is also likewise formed to have a narrow width B1. Further, an outer diameter D1 of the columnar projection 37 provided on the shield plate 5 is formed to be very slightly larger than the width B1.

[0060] Further, when the shield plate 5 is positioned at the housing position P1, the projection 37 enters in the portion 67 at the side of the uppermost end portion so that the shield plate 5 does not readily move. Further, when the shield plate 5 is positioned at the shielding position P3, the projection 37 enters in the portion 69 at the side of the lowermost end portion so that the shield plate 5 does not readily move.

[0061] By the way, the protective cap 1 is provided with a not-shown interior body (a hammock for example), and the cap body 3 and the guide member 11 are provided with a plurality of locking portions 71 for locking the hammock. Among the locking portions 71, the respective locking portions 71A positioned at the rear side are provided on the internal surface of the cap body 3 in an integral manner, and the respective locking portions 71 B positioned at the front side are provided on the internal surface of the guide member 11 in an integral manner.

[0062] Here, the shield plate 5 will be described in more detail.

[0063] The shield plate 5 is, as described above, installed in the cap body 3 for protecting a head of a wearer to cover almost all, for example, of a face of the wearer, and is formed of a transparent body or a translucent body in a curved plate-like form.

[0064] The shield plate 5 is formed in a curved plate-like shape with a convex shape at one side in the thickness direction and a concave shape at another side in the thickness direction. Further, the thickness is gradually reduced as going from a central portion to a peripheral portion (see FIG. 15 and FIG. 16). Meanwhile the shield plate 5 is constituted of a resin such as acryl or polycarbonate, and is formed by injection molding. Further the shield plate 5 is formed in accordance with the ANSI regulation into a thickness about from 1.6 mm to 2.0 mm. It is made unbreakable even if it is subject to a highspeed impact test.

[0065] As the shield plate 5 is formed in a curved plate-like shape, the internal surface (one surface in the thickness direction) of the shield plate 5 opposed to a face of a wearer is formed into a concave shape and the external surface as another surface in the thickness direction is formed into a convex shape. Further, the shield plate 5 is so formed that the curvature radius in the left-and-right direction is smaller than the curvature radius in the upper-and-lower direction and also a ratio of change in thickness in the left-and-right direction is made larger than a ratio of change in thickness in the upper-and-lower direction (see FIG. 15 and FIG. 16). Meanwhile a center of the arc in the upper-and-lower direction of the shield plate corresponds with the axis C3. On the other hand, a center of an arc in the left-and-right direction of the shield plate 5 substantially corresponds with an axis through a center of the opening portion 9 of the cap body 3, for example.

[0066] Further the shield plate 5 is constituted to comprise a main body portion 73 and a visor portion 17, and the main body portion 73 is formed in a curved plate-like shape as described above. The convex surface (concave surface) of the main body portion 73 of the shield plate 5 is formed in a predetermined shape close to a predetermined three-dimensional curved surface. The aforementioned three-dimensional curved surface is one of four three-dimensional curved surfaces obtained from a side surface of a barrel-like solid which is a columnar shape with a swelling central portion in the axial direction by cutting it in a first plane including the axis and a second plane including the axis and intersecting the first plane in a predetermined angle.

[0067] Meanwhile, as shown in FIG. 12, the uppermost end of the main body portion 73 of the shield plate 5 and both ends in the left-and-right direction are formed in linear shapes when viewed from the front, and the lowermost end of the main body portion 73 of the shield plate 5 is formed in a downward convex arc-like shape.

[0068] The visor 17 is as described above bent as opposed to the main body portion 73 below the main body portion 73 and projects.

[0069] As described in more detail, the visor portion 17 is as shown in FIG. 12 formed in a crescent shape when viewed from the front and in a plate-like shape, and a portion formed in a convex shape in the crescent shape connects with the lowermost end of the main body portion 73 of the shield plate 5 and then projects downward from the lowermost end of the main body portion 73 to be integral with the main body portion 73. Further, as shown in FIG. 13 (FIG. 6), when a upright wearer wears the cap body 3 and covers his or her face with the shield plate 5, the visor portion 17 projects toward to gradually fall apart (forward) from the face of the wearer as going from the uppermost end (the end at the side of the main body 73)

to the lowermost end.

[0070] Further, at the central portion in the lateral direction of the visor portion 17, a concave portion 75 dented into the interior of the main body portion 73 (to the rear: to a face of a wearer) with a predetermined width is formed.

[0071] Operation for getting the shield plate 5 in and out when the protective cap 1 is worn will be described hereinafter.

[0072] First, in a state where the shield plate 5 is positioned at the shielding position P1, a wearer wears the protective cap 1. In a case where he or she needs to position the shield plate 5 at the shielding position P3 and then work, he or she pulls the lowermost end portion (the visor portion 17 for example) of the shield plate 5 downward so as to move the shield plate 5 downward, the projection 37 enters into the portion 69 at the lowermost end portion side of the guide groove 65 and then the shield plate 5 is positioned at the shielding position P3, thereby the shield plate 5 is made not to easily move from the shielding position P203.

[0073] On the other hand, in a case where he or she seeks to change the shield plate 5 at the shielding position P3 into the housing position P1, he or she pushes the shield plate 5 upward so as to move it upward, the projection 37 enters into the portion 67 at the uppermost end side of the guide groove 65, then the shield plate 5 is positioned at the housing position P1, thereby the shield plate 5 is made not to easily move from the housing position P1.

[0074] According to the protective cap 1, as the shield plate 5 has a configuration in that its thickness is Gradually reduced as going from the central portion to the peripheral portions, a difference between an optical path length (an optical path length in the shield plate) in a case where a wearer see the front via the shield plate 5 and an optical path length (an optical path length in the shield plate) in a case where the wearer see peripheries via the shield plate 5 can be made smaller. Even if a wearer see a matter via peripheral portions of the shield plate 5, distortion of images can be made as small as possible.

[0075] More specifically, as shown in FIG. 20 (the drawing showing the cross section of the shield plate 5 and corresponding to FIG. 16), as a difference between the optical path length L11 and the optical path length L21 in the shield plate 5 is made smaller and a difference between the optical path length L11 and the optical path length L31 is made smaller, distortion of images can be made as small as possible.

[0076] Here, the reference sign shown in FIG. 20 denotes a surface (convex surface) at the outside of the shield plate 5 in accordance with the present embodiment, and the reference sign F1 denotes a surface (concave surface) at the inside of the shield plate 5 in accordance with the present embodiment. Thereby the thickness of the shield plate 5 in accordance with the present embodiment gradually gets thinner as going from the central portion to the peripheral portion. On the other hand, the reference sign F0 denotes a surface at the outside of the conventional shield plate and the reference sign F2 denotes a surface at the inside of the conventional shield plate, thereby the thickness of the conventional shield plate is constant.

[0077] The reference sign R1 denotes an optical path of light impinging from the front onto an eye EY of a wearer, the reference signs R2, R2a denote optical paths of light impinging from sides (peripheral portions of the shield plate) onto the eye EY of the wearer, and the reference signs R3, R3a denote optical paths of light impinging from sides further away onto the eye EY of the wearer.

[0078] The optical path length L11 of the light (the light through the optical path R1) from the front onto the eye EY of the wearer in the shield plate 205 and the optical path length (the optical path length in the conventional shield plate) L12 are equal to each other.

[0079] On the other hand, because the shield plate has a considerably large refractive index as compared with that of air, on the basis of the Snell's law, the optical path length (the optical path length in the shield plate 5 in accordance with the present embodiment) L21 is made shorter than the optical path length (the optical path length in the conventional shield plate) L22 in the shield plate by light from the side surfaces to the eye EY of the wearer (light in the optical path R2, R2a), and the optical path length L21 is substantially equal to the optical path length L11. Likewise, the optical path length L31 is made shorter than the optical path length L32 and the optical path length L31 is substantially equal to the optical path length L11. Thereby it allows that distortion of images is made as small as possible.

[0080] Further, in accordance with the protective cap 1, as the curvature radius of the shield plate 5 in the left-and-right direction is formed smaller than the curvature radius in the upper-and-lower direction and the rate of change in thickness in the left-and-right direction is formed larger than the rate of change in thickness in the upper-and-lower directions, distortion of images when a wearer see objects via peripheral portions of the shield plate 5 can be made as small as possible according to a shape of a face of the wearer.

[0081] More specifically, as the curvature radius in the upper-and-lower direction of the shield plate 5 is made larger than the curvature radius in the left-and-right direction, it fits with the shape of the face of the wearer to cover the face of the wearer. Further, as the curvature radius in the upper-and-lower direction of the shield plate 5 is made larger than the curvature radius in the left-and-right direction, the rate of change in thickness in then upper-and-lower directions of the shield plate 5 is made smaller than the rate of change in thickness in the left-and-right direction, distortion of images is made as small as possible.

[0082] Further according to the protective cap 1, as the visor portion 17 of the shield plate 5 is bent to project in a direction opposed to the main body 73 (a direction fall-

ing apart from a face of a wearer) below the main body 73, as described above, even if a flying object hits the shield plate 5, a situation in which the flying object slides on the shield plate 5 to contact a body of a wearer can be avoided.

[0083] More specifically, as shown in FIG. 6 by an arrow A13, if a flying object flying from a direction obliquely forward collides with the lower part of the shield plate 5 in a shallow angle, it gives rise to a case where the aforementioned flying object colliding and bouncing back reaches a breast or a stomach of the wearer. Meanwhile, as a wearer in FIG. 6 turns in a horizontal direction, the aforementioned suspicion is not so considerably, however, when he or she works with keeping his or her face upward, a suspicion in which a flying object colliding and bouncing back reaches a breast or a stomach under influence of the gravity. However, as the visor portion 17 is provided, the flying object colliding and bouncing back is made to re-collide with the visor portion 17 and then falls down to any sites apart from the wearer. It can be avoided that it reaches the body of the wearer.

[0084] Further, according to the protective cap 1, as the concave portion 75 is provided, a wearer of the protective cap 1 can conveniently operate the shield plate 5

[0085] More specifically, in a state where the shield plate 5 exists at the housing position P1 for example, as the concave portion 75 is provided on the visor 17 of the shield plate 5, a gap into which a wearer can put his or her fingers is held between the visor portion 17 of the shield plate 5 and the visor portion 10 of the cap body 3. Further, the shield plate 5 existing at the housing position P1 is easily moved downward and then can be made positioned at the shielding position P3.

[0086] Further according to the protective cap 1, as the shield plate 5 is steadily installed in the cap body 5 and the guide means 7 makes the shield plate 5 swing with having the predetermined axis C1 as its center, failure to attach the shield plate 5 is prevented and the movement stroke of the shield plate 5 is elongated with keeping the conventional shape and without making the cap body 3 bigger. Further, although the length (height) of the shield plate 5 is sufficiently long to cover almost all of a face of a wearer, the shield plate 5 can be substantially housed In the interior of the cap body 3 not to interfere with the wearer.

[0087] Further, as the cap body 3 is formed in a semi-spherical-shell-like shape from which portions to cover ears of a wearer are removed, the protective cap 1 is small-sized and then its weight is reduced, and further it gives a feeling of being liberated to the wearer.

[0088] Further, in accordance with the protective cap 1, as the shield plate 5 is guided by the arc-like guide portion 13 to move to draw a trajectory of an arc-like shape, the movement stroke of the shield plate 5 can be further elongated and, although the shield plate 5 having a sufficient length to cover almost all of a face of a wearer is used, it is made further easier to substantially house the shield plate 5 in the interior of the cap body 3 not to interfere with the wearer.

[0089] Further in accordance with the protective cap 1, as the guide portion 13 in the arc-like shape is formed in the arc-like shape having the predetermined axis C 1 as its center and then provided in the interior of the cap body 3, the cap body 3 in the semi-spherical-shell-like shape which does not cover ears of a wearer can be used. More specifically, if it has a configuration in which the shield plate 5 is made supported by the cap body at the predetermined axis C1, a swinging axis for supporting the shield plate 5 (an axis positioned at the axis C1 of the shield plate 5) needs to be additionally provided, thereby ear portions (portions to cover ears of a wearer) or such are necessary to be provided in the cap body 3 and therefore the cap body 3 must not be made in a semi-spherical-shell-like shape. However, the protective cap 1 allows it not to have the cap body 3 provided with the ear portions and make a shape of the cap body 3 be in a semi-spherical-shell-like shape.

[0090] Further, in accordance with the protective cap 1, as the guide member 11 is integrally constituted and also made contact with the cap body 3 at two portions in the left-and-right direction of the cap body 3 to be integrally provided, stiffness of the guide member 11 of itself and attachment stiffness when the guide member 11 is attached to the cap body 3 are increased.

[0091] Further, the locking portion 71 B for locking the hammock constituting the interior body can be provided in the interior of the central portion 19 of the guide member 11 so as not to interfere with the shield plate 5 of the guide portion 13.

[0092] Meanwhile, as the shield plate, that of a half type covering an upper half of a face of a wearer can be used.

[FIFTH EMBODIMENT]

[0093] What mainly differs in a protective cap 501 in accordance with the fifth embodiment as compared with the protective cap 1 in accordance with the first embodiment and the protective cap 201 in accordance with the second embodiment is a configuration (structure) of a guide means 505 for guiding a shield plate 503. The other points are constituted substantially in the same way as the protective cap 1 in accordance with the first embodiment and the protective cap 201 in accordance with the second embodiment, and serve substantially the same effects.

[0094] The shield plate 503 guided by the guide means 505 is constituted substantially in the same way as those in accordance with the aforementioned respective embodiments (the first embodiment for example). A visor 217 comprising a concave portion 275 is provided as with the protective cap 1 in accordance with the first embodiment and the protective cap 201 in accordance with the second embodiment, and moves between a housing position P501 and a shielding position P503 with having an axis C501 as its pivotal center.

[0095] FIG. 38 is an exploded perspective view showing a summarized configuration of the protective cap 501 in accordance with the fifth embodiment.

[0096] The protective cap 501 in accordance with the fifth embodiment is constituted to comprise a guide member 509 constituting a cap body 507 and a guide means 505, a shield plate 503, a shock absorber (a shock absorbing liner) 513, a chin-strap 515 and an interior body (hammock) 517. The shock absorbing 513 is, for example, formed of a foamed polystyrene in a bowl-like shape. Further, inside the cap body 507, after installing an assembly 511 of the guide member 509 and the shield plate 503 in the cap body 507, by installing the shock absorbing member 513 in the inside of the cap body 507 and the assembly 511, and thereafter installing the chin-strap 515 and the hammock 517 in the cap body 507 and the guide member 509, then the protective cap 501 is assembled and then generated.

[0097] Meanwhile, in the protective caps in accordance with the aforementioned embodiments, a shock absorbing member and a chin-strap are not mentioned, however, in the protective caps in accordance with these embodiments, a configuration in which a shock absorbing member and a chin-strap is provided may be applied.

[0098] The cap body 507 is constituted in substantially the same way as the cases of the protective cap 1 in accordance with the first embodiment and the protective cap 201 in accordance with the second embodiment. More specifically, the protective cap 507 is to protect a head of a wearer and is for example constituted of a material such as resin and formed in a bowl-Like shape (a semi-spherical-shell-like shape for example) as shown in FIG. 46 (a drawing showing a summarized configuration of the cap body 507). Meanwhile, FiG. 46(a) is a side view of the cap body 507, FIG. 46(b) is an elevational view of the cap body 507 and also a view viewed from an arrow XLVIB in FIG. 46(a), and FIG. 46(c) is a bottom view of the cap body 507 and also a view viewed from an arrow XLVIC in FIG. 46(a).

[0099] The cap body 507 of the protective cap 501 is constituted of a cap body main body portion 519 and a cap body visor portion 521, and is formed in two colors for example. The cap body main body portion 519 is constituted of an opaque resin, and the cap body visor portion 521 is constituted of a transparent (including colored transparency) resin or a translucent resin. In the protective caps in accordance with the respective embodiments, the cap body may be constituted of a cap body main body portion and a cap body visor portion.

[0100] The shield plate 503 is, as described above, constituted substantially in a similar way to that of the protective cap 201 in accordance with the first embodiment but a portion related to the guide means 505 (a portion engaging with the guide member 509).

[0101] Here, the guide means 505 will be described in more detail hereinafter.

[0102] FIG. 39 is a cross sectional view showing a summarized configuration of the protective cap, FIG. 40 is an elevational view of the protective cap, viewed from an arrow XL in FIG. 39 and FIG. 41 is a bottom view of the protective cap, viewed from an arrow XLI in FIG. 39.

[0103] FIG. 43 and FIG. 44 are drawings showing an assembly 511 of the guide member 509 and the shield plate 503, in which FIG. 43(a) is a side view of the assembly 511, FIG. 43(b) is a plan view of the assembly 511 and also a view viewed from an arrow XLIIIB in FIG. 43(a), FIG. 44(a) is a bottom view of the assembly 511 and also a view viewed from an arrow XLIVA in FIG. 43(a), and FIG. 44(b) is a drawing showing a cross section XLIVB-XLIVB in FIG. 43(b).

[0104] FIG. 45 is a drawing showing details of a guide portion 523 and such of the guide member 509. FIG. 45(a) is an enlarged view of a part XLVA in FIG. 44(b). FIG. 45(b) is a view viewed from an arrow XLVB in FIG. 45(a), or an enlarged view of a part XLVB in FIG. 49(b). Meanwhile, in FIG. 45(a), the shield plate 503 and such are drawn, however, in FIG. 45(b), illustration of the shield plate 503 and such is omitted and only the guide member 509 is drawn.

[0105] FIG. 49 and FIG. 50 are drawings showing the guide member 509, in which FIG. 49(a) is a side view of the guide member 509, FIG. 49(b) is a plan view of the guide member 509 and also a view viewed from an arrow XLIXB in FIG. 49(a), FIG. 50(a) is an elevational view of the guide member 509 and also a view viewed from an arrow LA in FIG. 49(a), FIG. 50(b) is a drawing showing a cross section LB-LB in FIG. 50(a), and FIG. 50(c) is a drawing showing a cross section LC-LC in FIG. 50(a).

[0106] FIG. 52 and FIG. 53 are drawings showing the shield plate 503, in which F1G. 52(a) is an elevational view of the shield plate 503, FIG. 52(b) is a plan view of the shield plate 503 and also a view viewed from an arrow LIIB in FIG. 52(a), FIG. 52(c) is a partial view viewed from an arrow LIIC in FIG. 52(b), FIG. 52(d) is a partial cross sectional view of the shield plate 503 and also a view showing a cross section LIID-LIID in FIG. 52(b), FIG. 53(a) is a side view of the shield plate 503 and also a view viewed from an arrow LIIIA in FIG. 52(a), and FIG. 53(b) is a drawing showing a cross section LIIIB-LIIIB in FIG. 52(a). Meanwhile, a part 510 shaded in FIG. 52(a) and FIG. 53(a) is an optical property range in the ANSI regulation (a range which provides good optical properties for a wearer of the protective cap 501 viewing an object via the shield plate 503).

[0107] The guide means 505 is constituted to comprise guide portions 523 provided in the guide member 509 for example constituted of a resin, and engagement portions 525 provided in the shield plate 503 constituted of a transparent or translucent resin.

[0108] The guide member 509 comprises a central portion 527 having a spher-like curved surface to form a plate-like shape, and the guide portions 523 are formed at the central portion 527. Further, the guide portions 523 are formed in an elongated shape to guide the shield plate 503 when the shield plate 503 moves between the housing position P501 and the shielding position P503

and are provided in the plural number. The guide portions 523 run substantially in parallel with each other and are provided close to the center of the central portion 527 in its lateral direction (left-and-right direction).

[0109] Describing in more detail, the central portion 527 is formed in a spherical-shell-of-quarter-like shape. Here a spherical-shell-of-quarter (quarter-spherical-shell) shape is a body formed by the following way. First, from a first sphere of a predetermined radius, a body (spherical-shell) of a shape in which a second sphere having a common center with the first sphere and a slightly smaller radius than the first sphere is removed therefrom is obtained.

[0110] Next, the spherical-shell is divided by a first plane through the center, or its vicinity, of the respective spheres into two, and then a semi-spherical-shell as one of the two bodies is obtained.

[0111] Next, the semi-spherical-sheli is divided by a second plane through the center, or its vicinity, of the respective spheres and substantially perpendicular to the first plane into two, and then a quarter-spherical-shell as One of the two bodies is obtained. Meanwhile, as the guide member 509 is to be installed in the interior (inside) of the cap body 507, a curvature radius (a curvature radius of the aforementioned first sphere) of the central portion 527 of the guide member 509 is made slightly smaller than a curvature radius of the cap body 507.

[0112] The central portion 527 is formed in a "quarter-spherical-shell-like" form and is thus not formed in a perfect quarter-spherical-shell form. More specifically, the central portion 527 is, as with the cap body 507, formed in a shape in which the curvature radius properly changes to fit it with a shape of a head of a wearer.

[0113] End portions of the central portion 527 are not formed in a perfect arc form but are formed in an arc-like shape in which the curvature radius properly changes to fit it with a shape of a head of a wearer. Here a portion (first semi-circular-end portion curved line 529) in an arc-like form (semi-arc-like form) formed by dividing by the aforementioned first plane and a portion (second semi-circular-end portion curved line 531) in an arc-like form (semi-arc-like form) formed by dividing by the aforementioned second plane are referred to as the end portions of the central portion 527.

[0114] The first semi-circular-end portion curved line 529 is for example positioned substantially on the first plane and forms to have substantially no convexes and concaves in a direction perpendicular to the first plane. Meanwhile, as the central portion 527 comprises a thickness (a difference between the radius of the first sphere and the radius of the second sphere), the first semi-circular-end portion curved line 529 can be, to be more precise, referred to as a first semi-circular-end portion curved surface.

[0115] The second semi-circular-end portion curved line 531 for example goes in and out of the second plane in a direction perpendicular to the second plane. More specifically, there are some convexes and concaves in the direction perpendicular to the second plane. Meanwhile, as with the first semi-circular-end portion curved line 529, the second semi-circular-end portion curved line 531 can be, to be more precise, referred to as a second semi-circular-end portion curved surface.

[0116] In a state where the guide member 509 is installed in the cap body 507, the central portion 527 of the guide member 509 is slightly deviated from the cap body 507 in the front inside of the cap body 507 and is then provided integrally with the cap body 507. Thereby a space 533 of a quarter-spherical-shell-like form having a predetermined thickness thicker than a thickness of the cap body 507 and a thickness of the central portion 527, and the shield plate (the shield plate positioned as the housing position P501) 503 is made to enter into he space 533 of the quarter-spherical-shell-like form.

[0117] Describing further, the first semi-circular-end portion curved line 529 is slightly apart from the internal wall of the cap body 507 and also along the internal wall of the cap body 507, and extends from the vicinity of a left end of a circular rim positioned at the lowermost end of the cap body 507 through the vicinity of a point just above the cap body 507 to the vicinity of a right end of a circular rim positioned at the lowermost end of the cap body 507. More specifically, the first semi-circular-end portion curved line 529 extends from a point above a left ear of a wearer through the vicinity of a head top of the wearer to a point above a right ear of the wearer.

[0118] Further, the second semi-circular-end portion curved line 531 is slightly apart from the front semi-circular rim at the lowermost end of the cap body 507 and also along the front semicircular rim at the lowermost end of the cap body 507, and extends from the vicinity of the left end of the circular rim at the lowermost end of the cap body 507 through the vicinity of the front end of the rim of the cap body 507 to the right end of the circular rim at the lowermost end of the cap body 507. More specifically, the second semi-circular-end portion curved line 531 extends from a point above the left ear of the wearer through the vicinity of a forehead of the wearer to a point above the right ear of the wearer.

[0119] The guide portions 523 provided at the central portion 527 of the guide member 509 are for example provided in the number of three. The respective guide portions 523 are constituted of through holes (through holes penetrating the central portion 527 in its thickness direction) 535, 537, 539 of respectively elongated circular forms and are provided at the center, the left side and the right side of the central portion 527 in the lateral direction.

[0120] The guide portions 523 (through holes 535) provided at the center of the central portion 527 is formed from the vicinity of the center of the second semi-circular-end portion curved line 531 to the vicinity of the center of the first semi-circular-end portion curved line 529. More specifically, the through hole 535 provided at the center keeps the position of the center in the sideways direction (lateral direction; left-and-right direction) to ex-

tend from the vicinity of the center of the forehead of the wearer through a center of a frontal portion of the wearer to the vicinity of the head top of the wearer.

[0121] The left guide portions 523 (through holes 537) are provided in parallel with the through hole 535 provided at the center and is formed from the vicinity of the obliquely front portion at the left side of the second semi-circular-end portion curved line 531 to the vicinity of the obliquely upper portion of the left side of the first semi-circular-end portion curved line 529. More specifically, the through hole 537 provided at the left side extends from the vicinity of the left front portion of a chin of a wearer through an obliquely left front portion of a frontal portion of the wearer to the vicinity of an obliquely left upper portion of a head top portion of the wearer.

[0122] The right guide portions 523 (through holes 539) are provided symmetrical with the through hole 537 at the left side having the through hole 535 at the center interposed therebetween. More specifically, the right through hole 539 is provided symmetrical with the left through hole 537 relative to a plane extending in the upper-and-lower and front-and-rear directions through a center of the guide member 509.

[0123] Here, positional relations of the three guide portions 523 (through holes 535, 537, 539) will be described in more detail hereinafter. For convenience of explanation, existence of the respective side portions 541, 543 (see FIG. 39 and such) of the guide portion will be neglected (it is supposed that the side portions 541, 543 of the guide member 509 do not exist).

[0124] Intersection points between respective extrapolations of the three through holes 535, 537, 539 (central lines of the elongated circular through holes 535, 537, 539 in the lateral direction which are elongated in the longitudinal direction of the through holes 535, 537, 539) and the second semi-circular-end portion curved line 531 will be referred to as a lower portion left side intersection point 545, a lower portion central intersection point 547 and a lower portion right side intersection point 549, respectively (see FIG. 49(a), (b), FIG. 50(a)).

[0125] Then a distance between a left end 551 of the second semi-circular-end portion curved line 531 (a left end consistent with a left end of the first semi-circular-end portion curved line 529; see FIG. 49(a)) and the lower portion left side intersection point 545 is equal to or slightly larger than a distance between the lower portion left side intersection point 545 and the lower portion central intersection point 547 (a distance along the second semi-circular-end portion curved line 531).

[0126] Further, likewise, a distance between a right end 553 of the second semi-circular-end portion curved line 531 (a right end consistent with a right end of the first semi-circular-end portion curved line 529; see FIG. 49(a)) and the lower portion right side intersection point 549 (a distance along the second semi-circular-end portion curved line 531) is equal to or slightly larger than a distance between the lower portion right side intersection point 549 and the lower portion central intersection point 547 (a distance along the second semi-circular-end portion curved line 531).

[0127] Further, intersection points between the respective extrapolations of the three through holes 535, 537, 539 and the first semi-circular-end portion curved line 529 will be referred to as an upper portion left side intersection point 555, an upper central intersection point 557, and an upper portion right side intersection point 559, respectively, as shown in FIG. 49(b).

[0128] Then a distance between the left end 551 of the first semi-circular-end portion curved line 529 and the upper portion left side intersection point 555 is equal to or slightly larger than a distance between the upper portion left side intersection point 55 and the upper portion central intersection point 557 (a distance along the first semi-circular-end portion curved line 529).

[0129] Further, Likewise, a distance between the right end 553 of the first semi-circular-end portion curved line 529 and the upper portion right side intersection point 559 (a distance along the first semi-circular-end portion curved line 529) is equal to or slightly larger than a distance between the upper portion right side intersection point 559 and the upper portion central intersection point 557 (a distance along the first semi-circular-end portion curved line 529).

[0130] Thus as the guide portions 523 are provided, the guide portions 523 (through holes 535, 537, 539) are provided to extend in the upper-and-lower and front-and-rear directions at the central portion side of the central portion 527 (in the lateral direction and close to the central portion).

[0131] Meanwhile a configuration in which the guide portion 523 (through hole 535) at the center is omitted and the guide portions 523 are provided in two may be used, or a configuration in which the guide portion 523 (through hole 535) at the center is provided in two and one of the guide portions is slightly moved leftward relative to the center and the other is slightly moved rightward relative to the center so that four guide portions (elongated circular through holes) may be used. Further, a configuration in which five guide portions elongated in the upper-and-lower and front-and-rear directions are provided at the side of the center of the central portion 527 (close to the center in the lateral direction) may be used.

[0132] Further, the guide member 509 is constituted to comprise the aforementioned central portion 527 and a first side portion (side portion at the left side) 541 in a plate-like farm and a second side portion (side portion at the right side) 543 in a plate-like form. The first side portion 541 is provided integrally with the central portion 527 at one end portion side (left side) in the lateral direction of the central portion 527 and at the lower side of the central portion 527. The second side portion 543 is provided integrally with the central portion 527 at another end portion side (right side) in the lateral direction of the central portion 527 and at the lower side of the central portion 527.

[0133] Further, a pair of central portion engagement

portions 561 (see FIG. 49(b)) engage with a pair of central portion to-be-engaged portions 563 (see FIG. 46(c)), first side portion engagement portions 565 at the left (see FIG. 49(a)) engage with first side portion to-be-engaged portions 567 (see FIG. 46(c)), and second side portion engagement portions 569 (see FIG. 49(a)) at the right engage with second side portion to-be-engaged portions 571 (see FIG. 46(c)), thereby the guide member 509 is constituted to be provided integrally with the cap body 507.

[0134] The pair of central portion engagement portions 561 are formed in the vicinity of the respective side portions 541, 543 on the central portion 527, and the pair of central portion to-be-engaged portion 563 are provided at the sides of the cap body 507. The first side portion engagement 565 is provided on the first side portion 541, and the first side portion to-be-engaged portion 567 is provided at the leftward obliquely rear side of the cap body 507. The second side portion engagement portion 569 is provided on the second side portion 543, and the second side portion to-be-engaged portion 571 is provided at the rightward obliquely rear side of the cap body 507.

[0135] Describing in more detail, the first side portion 541 is formed with a thickness substantially identical to the central portion 527 in a short belt-like form. Further, one end portion in the longitudinal direction of the first side portion 541 is connected to the lowermost end portion side (left and lower end portion side) of the first semi-circular-end portion curved line 529. Further, the second side portion 543 is provided symmetrical to the first side portion 541 relative to a plane extending in the upper-and-lower and front-and-rear direction through the center of the guide member 509. Thereby, substantially on an extrapolation at the left of the second semi-circular-end portion curved line 531 of the central portion 527 positioned is one end portion (lower end portion) in the lateral direction of the first side portion 541, and substantially on an extrapolation at the right of the second semi-circular-end portion curved line 531 of the central portion 527 positioned is one end portion (lower end portion) in the lateral direction of the second side portion 543.

[0136] The guide member 509 is detachably attached to the cap body 507, and as the pair of central portion engagement portions 561 formed on the central portion 527 of the guide member 509 engage with the pair of central portion to-be-engaged portions 563 provided on the cap body 507, the guide member 509 installed on the cap body 507 is made uneasy to separate from the cap body 507.

[0137] The central portion engagement portions 561 are for example constituted of first central portion engagement portions (projections slightly projecting outward from the central portion 527) 573 (see FIG. 49(a)) acknowledged as a rigid body and second central portion engagement portions 575 (see FIG. 49(a)) having elasticity. The central portion to-be-engaged portions 563 are constituted of portions 577 (projections slightly projecting from the inner wall of the cap body toward the interior of the cap body 507; see FIG. 46(c), FIG. 48) acknowledged as rigid bodies. Meanwhile FIG. 48(a) is a side view of the central portion to-be-engaged portion 563 and FIG. 48(b) is a view viewed from an arrow XLVIIIB in FIG. 48(a).

[0138] Further when the guide member 509 is installed on the cap body 507 (when the first central portion engagement portions 573 are made engaged with the central portion to-be-engaged portions 563), the second central portion engagement portions 575 butt on the cap body 507 (the central portion to-be-engaged portions 563 and its peripheries) to elastically deform. After installing the guide member 509 on the cap body 507 (after having the first central portion engagement portions 573 engaging with the central portion to-be-engaged portions 563), the second central portion engagement portions 575 are made to restore the original shape. By the restored second central portion engagement portions 575, the guide member 509 once installed on the cap body 507 is made uneasy to separate from the cap body 507.

[0139] More specifically, when the shield plate 503 is in motion or such for example, even in a case where an external force is loaded on the cap body 507, the guide member 509 or the shield plate 503, the guide member 509 is made to uneasy to separate from the cap body 507. Meanwhile the central portion engagement portions 561 and the central portion to-be-engaged portions 563 are provided at positions where they do not interfere with the shield plate 503.

[0140] Meanwhile FIG. 42(a) is a drawing showing a state where the central portion engagement portions 561 of the guide member 509 engage with the central portion to-be-engaged portions 563 of the cap body 507 and is a drawing showing a partial cross section XLIIA-XLIIA shown in FIG. 41.

[0141] A value of a length of the first side portion 541 in a band-like form or the second side portion 543 is slightly smaller than a value of a half of a length of the second semi-circular-end portion curved line 531. The first side portion engagement portion 55 is constituted of two through holes 579, 581 penetrating the first side portion 541 in the thickness direction.

[0142] One through hole (rear through hole) 581 of the two through holes 579, 581 constituting the first side portion engagement portions 565 is provided at she vicinity of a tip end portion of the first side portion 541 (an end portion opposed to the central portion 527 in the longitudinal direction of the first side portion 541) and another through hole (front through hole) 579 of the two through holes 579, 581 constituting the first side portion engagement portion 565 is provided in between the central portion engagement portions 561 in the longitudinal direction of the first side portion 541 and the rear through holes 581 (substantially at the central portion for example).

[0143] The second side portion engagement 569 is also, as with the case of the first side portion engagement portion 565, constituted of a rear through hole 581 and

a front through hole 579, and the respective through holes 579, 581 of the side portion engagement portion 569 are provided symmetrical to the respective through holes 579, 581 of the first side portion engagement portion 565 relative to a plane extending in the upper-and-lower and front-and-rear directions through the center of the guide member 509.

[0144] The first side portion to-be-engaged portion 567 is as shown in FIG. 46(c) and FIG. 47 constituted of two projections (a front side projection and a rear side projection) 583 slightly projecting from the inner wall of the cap body 507 at the vicinity of an opening portion (a rim at the lowermost end portion) of the cap body 507 toward the interior of the cap body 507. The second side portion to-be-engaged portion 571 is provided symmetrical with the first side portion to-be-engaged portion 567 relative to a plane extending in the upper-and-lower and front-and-rear direction through the center of the cap body 507. More specifically, the side portion to-be-engaged portions 567, 571 are constituted of two front side projections 583 and two rear side projections 583.

[0145] Meanwhile, FIG. 47(a) is a side view of the side portion to-be-engaged portion 567, 571 and a later described cap body locking portion 585, FIG. 47(c) is a view viewed from an arrow XLVIIC in FIG. 47(a), FIG. 47(b) is a view viewed from an arrow XLVIIB in FIG. 47(c), and FIG. 47(d) is drawing showing a cross section XLVIID-XLVIID in FIG. 47(b).

[0146] In a state where the first side portion engagement portions 565 engage with the first side portion to-be-engaged portions 567, the first side portion 541 is in contact with the inner wall of the cap body 507. Further, in a state where the first side portion engagement portions 565 engage with the first side portion to-be-engaged portions 567, the guide member 509 (first side portion 541) is limited in its movement in the upper-and-lower direction relative to the cap body 507 and is allowed to slightly move in the front-and-rear direction of the cap body 507 (a direction toward inner peripheries of the cap body 507) relative to the cap body 507. Meanwhile movement of the cap body 507 in the thickness direction is constituted to be regulated by installing the hammock 517 in the cap body 507. A state where the second side portion engagement portion 569 engages with the second side portion to-be-engaged portion 571 is similar to a state where the first side portion engagement portions 565 engage with the first side portion to-be-engaged portions 567.

[0147] In a state where it is finished to install the guide member 509 in the cap body 507, the first side portion engagement portions 565 engage with the first side portion to-be-engaged portions 567, the second side portion engagement portions 569 engage with the second side portion to-be-engaged portions 571, and the central portion engagement portions 561 engage with the central portion to-be-engaged portions 563. Further, the guide member 509 is rely installed in the cap body 507.

[0148] Further, in a state where it is finished to install the guide member 509 in the cap body 507, a rim at the lower side of the guide member 509 (a lowermost end portion of the second semi-circular-end portion curved line 531 and the respective side portions 541, 543) extends along a rim of the cap body 507 at the vicinity of the inside of the rim (opening portion) of the cap body 507. Further, in a state where it is finished to install the guide portion 509 in the cap body 507, when viewing the cap body 507 and the guide member 509 from these lower side toward these upper side, the rim of the cap body 507 is formed in a circle-like form (a circle-like form having a diameter in the front-and-rear direction larger than a diameter in the lateral direction). As compared therewith, the guide member 509 is formed in a horseshoe shape having a narrow portion unconnected at the rear (tip end portions of the respective side portions 541, 543 are slightly apart from each other). Meanwhile, the guide member 509 is so constituted as to be a circle-like form as with the cap body 507.

[0149] At the first side portion to-be-engaged portions 567 and at the side portion to-be-engaged portions 571 formed are locking portions (cap body locking portion constituted of four projections) 585 constituted of projections having a projecting length (a projecting length toward the interior of the cap body 507) than the projections 583 constituting the to-be-engaged portions 567, 571 (see FIG. 46(c), FIG. 47). Cap body engagement portions 585 are portions for locking the hammock 517.

[0150] At the inside of the central portion 527 of the guide member 509 and at the vicinity of the second semi-circular-end portion curved line 531 formed are locking portions (guide member locking portions constituted of four projections) constituted as similar to the cap body locking portions 585 (see FIG. 49(b) and FIG. 51). Guide member locking portions 587 are also portions for locking the hammock 517.

[0151] Meanwhile, FIG. 51 (a) is a side view of the guide member locking portion 587 which is positioned at the front among the guide member locking portions, FIG. 51 (c) is a view viewed from an arrow LIC in FIG. 51 (a), FIG. 51 (b) is a view viewed from an arrow LIB in FIG. 51 (c), and FIG. 51 (d) is a drawing showing a cross section LID-LID in FIG. 51 (b).

[0152] Moreover, FIG. 51(e) is a side view of the guide member locking portion 587 which is positioned at the front among the guide member locking portions, FIG. 51 (g) is a view viewed from an arrow LIG in FIG. 51 (e), FIG. 51 (f) is a view viewed from an arrow LIF in FIG. 51 (g), and FIG. 51 (h) is a drawing showing a cross section LIH-LIH in FIG. 51 (g).

[0153] The guide member locking portions 587 of the guide member 509 are provided symmetrical relative to a plane extending in the upper-and-lower and front-and-rear directions through the center of the guide member 509. Thereby, in a state where it is finished to install the guide member 509 in the cap body 507, the locking portions 585, 587 are provided at eight points in total.

[0154] Further, in a state where it is finished to install

the guide member 509 in the cap body 507, when to-be-engaged portions 589 of the hammock 517 are locked to the cap body engagement portions 585 and the guide member locking portions 587 so as to finish installation of the hammock 517 in the cap body 507, it is made that the respective side portions 541, 543 of the guide member 509 is caught between the cap body 507 and the to-be-engaged portions 589 of the hammock 517 so that the respective side portions 541, 543 of the guide member 509 get contact on the inner wall of the cap body 507, thereby the respective side portions 541, 543 of the guide portion 509 are fixed to the cap body 507 and then installed therein as described above (see FIG. 42(b) and FIG. 42(c)). Meanwhile, FIG. 42(b) is a drawing showing a cross section XLIIB-XLIIB in FIG. 41 and FIG. 42(c) is a drawing showing a cross section XLIIC-XLIIC in FIG. 41.

[0155] The respective side portions 541, 543 are so formed that these corner portions are rounded. More specifically, outlines of two corner portions (corner portions positioned at both end portions in the upper-and-lower direction) at the tip end portions (tip end portions opposed to the central portion 527) in the longitudinal direction of the first side portion 541 and the second side portion 543 are formed in a quarter arc-like form when viewed from the thickness direction of the side portions 541, 543 (see the reference sign 591 in FIG. 49(a)). Further, at the other portions of the side portions 541, 543 (central portions in the longitudinal direction and lowermost end portions in the upper-and-lower direction), corner portions are formed to be rounded (see the reference sign 593 in FIG. 49(a)).

[0156] As the corner portions of the respective side portions 541, 543 are formed to be rounded, damage to the guide member 509 by stress concentration can be prevented, and scratches on the cap body 507, the shield plate 503 and a wearer of the protective cap 501 by the guide member 509 can be prevented.

[0157] By the way, the guide portions 523 of the guide member 509 are, as described above, constituted of the three elongated circular through holes 535, 537, 539 for example. In accordance with this, the engagement portions 525 of the shield plate 503 are constituted of three columnar portions 595 (see FIG. 45).

[0158] Further, as the columnar portions 595 constituting the engagement portions 525 respectively engage with the three through holes 535, 537, 539 constituting the guide portions 523 of the guide member 509 (the columnar portions 595 enter into the through holes 535, 537, 539), the shield plate 503 is guided to move between the housing position P501 and the shielding position P503.

[0159] Describing in more detail, the thickness B501 of the elongated through holes 535, 537, 539 is very slightly larger than the outer diameter D501 of the columnar portions 595 (see FIG. 45(b)). Further, at both end portions of the columnar portions 595, disc-like flange portions 599, 601 larger than the columnar portions 595 in diameter are formed integrally so as to form an engagement member 597 (see FIG. 45(a)).

[0160] At the uppermost end portion of the shield plate 503, as shown in FIG. 52(a), semi-disc-like installation portions 603 for installation of the engagement member 597 are formed integrally. At the central portions of the semi-disc-like installation portions 603 formed are through holes (through holes, the inner diameter of which is slightly larger than the outer diameter D501 of the columnar portions 595 of the engagement member 597) 605 penetrating the semi-disc-like installation portions 603 in its thickness direction. Meanwhile, the installation portions 603 and the through holes 605 are provided at three sites in accordance with the three through holes 535, 537, 539 of the guide member 509.

[0161] Further, in between the respective flange portions 599, 601 provided at both end portions of the columnar portion 595, the installation portions 603 of the shield plate 503 and the central portion 527 of the guide member 509 enter into slot that the installation portions 603 of the shield plate 503 and the central portion 527 of the guide member 509 are caught between the flange portions 599, 601 and the columnar portion 595 penetrates the elongated circular through holes 535, 537, 539 of the guide portions 523 and the circular through holes 605 of the installation portions 603. Thereby, when the shield plate 503 moves relative to the cap body 507 and the guide member 509, the shield plate 503 is made to move substantially only in the longitudinal direction of the through holes 535, 537, 539 constituting the guide portions 523.

[0162] Meanwhile, the engagement member (the member with the flange) 597 is constituted of a first tubular member 607 comprising a flange portion 599 at its one end portion, a second tubular member 609 comprising a flange portion 601 at its another end portion, a rivet 611 penetrating the tubular members 607, 609 along these central axes and is caulked to make the respective tubular member 607, 609 be a unitary body.

[0163] In a state where the shield plate 503 is positioned at the housing position P501, the portions 595 of the columnar form of the members 597 with the flanges are in contact with the uppermost end portions of the respective elongated circular through holes 535, 537, 539. On the other hand, in a state where the shield plate 503 is positioned at the shielding position P503, the portions 595 of the columnar form of the members 597 with the flanges are in contact with the lowermost end portions of the respective elongated circular through holes 535, 537, 539.

[0164] Further, in the protective cap 501, as with the protective caps 1, 201, a retaining means 613 for retaining states in which the shield plate 503 is positioned at the housing position P501 and the shielding position P503 is provided. The retaining means 613 will be described in detail hereinafter.

[0165] The widths of two through holes 537, 539, which exist at left and right sides among the three elongated

circular through holes 535, 537, 539 forming the guide portions 523, are made constant. On the other hand, the elongated circular through hole 535 existing at the center among the three elongated circular through holes 535, 537, 539 forming the guide portions 523 are made slightly smaller in its width at the vicinity of the end portion of its longitudinal direction (see FIG. 45(b)). Thereby, the shield plate 503 is made to retain its position at either the housing position P501 or the shielding position P503.

[0166] Describing in more details, as shown in FIG. 45(b), an upper most portion 615 of the elongated circular through hole (central through hole) 535 existing at the center of the guide members 509 is formed in an arc-like horseshoe shape. A diameter D503 of an arc of the uppermost portion 615 formed in the arc-like horseshoe shape is equal to or slightly larger than the outer diameter D501 of the columnar portion 595 of the member 597 with the flange.

[0167] A distance L501 between both end portions 617 of the uppermost portion 615 (a distance in the lateral direction in exits of uppermost end portions of the arc-like and horseshoe shape) is slightly smaller than the outer diameter D501 of the columnar portion 595 of the member 597 with the flange. Then, when the member 597 with the flange existing at the central portion in the longitudinal direction of the elongated circular central through hole 535 moves to the uppermost portion 615 of the elongated circular central through hole 535, it is constituted that the columnar portion 595 of the member 597 with the flange comes into contact with said both end portions 617 of the uppermost end portion 615 and a part of the guide member 509 elastically deforms and the distance L501 between said both end portions 617 becomes large up to the value of the outer diameter D501 of the columnar portion 595. Further, when the member 597 with the flange is moved so that the columnar portion 595 of the member 597 with the flange is positioned at the uppermost portion 615, said both end portions 617 restore its original positions to retain the position of the member 597 with the flange.

[0168] Between said both end portions 617 and separated portions 619 which are separated from said end portions 617 toward the lowermost end side of the elongated circular through hole 535 by a predetermined distance, the width of the elongated circular through hole 535 is gradually reduced as going from the separated portions 619 toward said both end portions 617. More specifically, a taper portion 621 is formed between the separated portions 619 and said both end portions 617. Thereby it is prevented that the columnar portion 595 of the member 597 with the flange abruptly abuts on said both end portions 617 of the uppermost portion 615 of the horseshoe form when the shield plate 503 moves from the shielding position P503 to the housing position P501, and thus damage to said both end portions 617 of the uppermost portion 615 can be prevented.

[0169] Meanwhile the lowermost end portion side of the elongated circular through hole 535 is also formed to comprise a taper portion and such like as those of the uppermost portion side. Further, to have elastic deformation of said both end portions 617 of the horseshoe shape easier, a pair of through holes (two through holes of a circle-like form penetrating the central portion of the guide member 509 in its thickness direction) 623 are provided.

[0170] Meanwhile, in addition to, or instead of, providing the uppermost portion side of the elongated circular through hole 535 with the aforementioned through hole 623, it may be provided at the lowermost end portion side of the through hole 535 of the elongated circular shape.

[0171] Further, in addition to, or instead of, providing the aforementioned retaining means 613 at the central elongated circular through hole 535, it may be provided at the left and right elongated circular through holes 537, 539.

[0172] By the way, concave portions 625 dented toward the insides of the central portions 527 are provided at the peripheries of the elongated circular through holes 535, 537, 539 provided at the central portion 527 of the guide member 509. The concave portions 625 comprise predetermined widths and are provided so as to enclose the elongated circular through holes 535, 537, 539. Further, the installation portions 603 provided at the uppermost end portion of the shield plate 503 as described above are provided to dent slightly toward the inside of the shield plate 503 (see FIG. 52(b) and FIG. 53). In the vicinities of the three concave portions 625 and at the second semi-circular-end portion curved line 531 of the central portion 527 of the guide member 509, three projections 627 are provided. These three projections 627 project toward the front side (outside) of the central portion 527 in the thickness direction of the central portion 527 of the guide member 509.

[0173] In a state where the shield plate is installed in the guide member 509 by using three members 597 with the flanges provided accordingly to the three through holes 535, 537, 539, three parts of the uppermost end portion of the shield plate 503 are supported by the guide member 509 via the members 597 with the flanges, the installation portion 603 provided at the uppermost end portion of the shield plate 503 enters into the concave portions 625 provided at the central portion 527, and a face at the inside of the shield plate 503 indirectly, with having a packing 631 interposed therebetween, which will be described later in detail, abuts on the respective projections 627 of the central portion 527.

[0174] Further, in a state where the guide member 509 provided in the shield plate 503 is installed in the cap body 507, a small gap 629 is formed between a surface at the outside of the shield plate 503 and a semi-circular rim at a front side of the cap body 507 (see FIG. 39).

[0175] Thereby, in a regular state (a state where an uprightly standing wearer simply wears the protective cap 501) three parts of the uppermost end portion of the shield plate 503 are supported by the guide member 509 via the members 597 with the flanges, the surface at the

inside of the shield plate 503 are indirectly supported by the projection 627 of the central portion 527 with having the packing 631 which will be described later in detail interposed therebetween, and the shield plate 503 is supported by the guide member 509, thereby the shield plate 503 moves in an arc-like trajectory between the housing position P501 and the shielding position P503.

[0176] Further, in a case where an external force in a direction for lifting up the lowermost end of the shield plate 503 or drawing the shield plate 503 apart from a face of a wearer is applied to the shield plate 503 in a state where the guide member 509 in which the shield plate 503 is installed is installed in the cap body 507, the small gap 629 between the surface at the outside of the shield plate 503 and the arc-like rim at the front side of the cap body 507 is gone, and then the face at the outside of the shield plate 503 indirectly, with having the packing 631 interposed therebetween, which will be described later in detail, abuts on the arc-like rim at the front side of the cap body 507, thereby limiting swing of the shield plate 503 by the aforementioned external force.

[0177] More specifically, the shield plate 503 engages with the guide member 509 at the installation portion 603 of the uppermost end portion thereof. Further, the shield plate 503 engages with any of the projection 627 and the semi-arc-like rim at the front side of the cap body 507 at a portion at the lower portion (a portion covering a face of a wearer of the cap body 507) with being caught between the projection 627 and the semi-arc-like rim at the front side of the cap body 507. Then it is prevented that the shield plate 503 shakes to a great extent.

[0178] Meanwhile, portions of the shield plate 503 other than the aforementioned engaging portion are opposed to the guide member 509 and the cap body 507 with having a small gap therebetween.

[0179] At the three projections 627 provided at the central portion 527 of the guide member 509 and its peripheries, and at the rim of the cap body 507 forming the gap 629 and its vicinities, the packing (low friction member; scratch prevention member) 631 of a plate-like form for example is adhered (see FIG. 44(a) and FIG. 46(c)). Thereby the shield plate 503 (excepting the installation portions 603 and the visor 217) does not contact with the guide portion 509 and the cap body 507, the shield plate 503 can move with small frictional resistance between the housing position P501 and the shielding position P503, and further any portions of the shield plate 503 which come into view of a wearer of the cap body 507 (optical property range 510 regulated in the ANSI regulation as shown in FIG. 52(a) or such) are prevented from being given scratches.

[0180] A packing 631A provided at the central portion of the guide member 509 is formed in a U-letter shape, and is provided from the lowermost end toward the uppermost end of the guide member 509 to be longer than the other packing 631. Thereby giving scratches to the shield plate 503 is further surely prevented.

[0181] Positional relationships among respective elongated circular through holes 535, 537, 539 provided at the central portion 527 of the guide member 509, the concavity portions 625 formed around the through holes 535, 537, 539, and the guide member locking portions 587 will be described in more detail hereinafter.

[0182] The guide member locking portions 587 are as described above provided by four as shown in FIG. 43(b). The guide member locking portion 587A positioned at the leftmost side is positioned substantially at the center between the central portion engagement portion 561A at the left side and the through hole 537 at the left in an extending direction of the second semi-circular-end portion curved line 531, and the guide member locking portion 5878 positioned at the next to the leftmost side is positioned adjacent to the concave portion 625 of the through hole 537 at the left side and between the through hole 537 at the left and the central through hole 535 in the extending direction of the second semi-circular-end portion curved line 531. Further the two guide member locking portions 587C, 587D at the right side are provided symmetrically to the guide member locking portions 587A, 587B at the right side relative to a plane extending in the upper-and-lower and front-and-rear directions through the center of the guide member 509.

[0183] As the guide member locking portions 587 are provided at these positions, the hammock 517 can be installed at any proper position of the guide member 509 with avoiding interference by the guide member locking portions 587 and the guide portions 523 of the guide member 509, and is, with the hammock 517, capable of properly receiving an external force applied to the cap body 507.

[0184] Further, by engaging to-be-locked portions 633 of an ear-strap (chin-strap) 515 with the locking portion 585A provided at the leftmost side among the cap body locking portions 585 (see FIG. 46(c)) and the locking portion 587A provided at the leftmost side among the guide member locking portions 587 (see FIG. 43(b)), and further by engaging the other ear-strap (chin-strap) 515 with the locking portion 585D provided at the rightmost side among the cap body locking portions 585 or the locking portion 585C next thereto (see FIG. 46(c)) and the locking portion 587D provided at the rightmost side among the guide member locking portions 587 (see FIG. 43(b)), the respective chin-straps 515 can be installed at any proper positions of the cap body 507 or the guide member 509, and then a wearer of the protective cap 501 can wear the protective cap 501 without feeling wrong and can fix the protective cap 501 with his or her head by using the respective chin-straps 515.

[0185] Meanwhile, as being understood already, as the cap body locking portions 585 are provided at the rear side of the cap body 507 and the guide member 509 is provided at the front side of the cap body 507, the cap body locking portion 585 is positioned at the rear side relative to the guide members locking portions 587.

[0186] After engaging the to-be-locked portions 633 of the chin-strap 515 with the cap body locking portions 585

or the guide member locking portions 587, by engaging the to-be-locked portions 589 of the hammock 517 with the cap body locking portions 585 or the guide member locking portion 587, the chin-strap 515 (the to-be-locked portions 633) and the hammock 517 (the to-be-locked portions 589) are made to be installed integrally with the cap body 507 and the guide member 509. Meanwhile the hammock 517 is made to be easily detachably attached to the cap body 507 and the guide member 509 and then it is made that the once installed hammock 517 is not easily detached from the cap body 507 and the guide member 509.

[0187] Further, in the protective cap 501, the respective side portions 541, 543 of the guide member 509 and the to-be-engaged portions 633 of the chin-strap 515 are caught between the cap body 507 and the to-be-engaged portions 589 of the hammock 517 and then installed integrally with the cap body 507 (see FIG. 42(b)).

[0188] According to the protective cap 501, as the guide member 509 comprises the central portions 527 formed in the plate-like shape comprising the curved surface of the sphere-like shape and she guide portions 523 is formed at the central portion (close to the center of the central portion 527 in the lateral direction, for example) 527, a so-called narrow guide is formed and getting the shield plate 503 in and out (movement between the housing position P501 and the shielding position P503) can be carried out smoothly as compared with a case where the guide portion 523 is provided at sides of the sides (at the sides of respective end portions in the lateral direction) of the central portion 527.

[0189] Further, according to the protective cap 501, as the guide member 509 is constituted to comprise the central portion 527 of the guide member 509 and the side portions 541, 543, the pair of central portion engagement portions 561 (561A, 561 B) formed in the vicinity of the respective side portions 541, 543 and at the central portion 527 engage with the pair of central portion to-be-engaged portions 563 provided in the cap body 507, and the side portion engagement portions 565, 569 formed at the respective side portions 541, 543 engage with the side portion to-be-engaged portions 567, 571, the degree of how the guide member 509 shakes relative to cap bods 507 can be reduced.

[0190] More specifically, in a case where one gets the shield plate 503 in and out, as the guide member 509 guides the shield plate 503, while a rotation moment about the axis C501 extending in the lateral direction of the cap body 507 is applied to the guide member 509 and this rotation moment is transmitted through the guide member 509 to the cap body 507, the central portion engagement portions 561 of the guide member 509 engaging with the central portion to-be-engaged portions 563 of the cap body 507 function as pivots and the side portion engagement portions 565, 569 of the guide member 509 engaging with the side portion to-be-engaged portion 567, 571 of the cap body 507 receive the rotation moment, thereby reducing the degree of shaking as described above.

[0191] Further, as the side portion engagement portions 565, 569 of the guide member 509 are provided at two sites at the left and two sites at the right, the degree of shaking can be further reduced. Further the side portion engagement portion (through hole 581) at the rear side among the two side portion engagement portions 565 at the left side and the side portion engagement portion (through hole 581) at the rear side among the two side portion engagement portions 565 at the right side are positioned in the vicinity of the rearmost end portion of the cap body 507, the distance between the central portion engagement portions 561 to be the pivots and the side portion engagement portions 565 at the rear side is made greater, thereby further reducing the degree of shaking.

[0192] Further, according to the protective cap 501, as the guide portions to, 523 of the guide member 509 are constituted of the three elongated circular through holes 535, 537, 539, the columnar portions 595 respectively engage with the three through holes 535, 537, 539 to guide the shield plate 503 to move between the housing position P501 and the shielding position P503, the shield plate 503 is allowed to smoothly move relative to the guide member 509 although the configuration is simple, as well as a degree of shaking the shield plate 503 is reduced.

[0193] Meanwhile, as the shield plate 503, that of a half type covering only an upper half of a face of a wearer can be used. Further, the shield plate 503 may be formed in a similar way to the shield plate in accordance with the first embodiment. More specifically, as shown in FIG. 15 and FIG. 16 for example, it may be formed in a shape in which a thickness is gradually reduced as going from a central portion to a periphery portion.

[0194] A shield member provided in a cap body for protecting a head of a wearer, for covering a face of the wearer, is characterized by:

being formed of a transparent body or a translucent body into a curved plate-like shape and
being gradually thinner as going from a central portion to a peripheral portion.

[0195] The shield member is preferably characterized in that:

a surface at an inside opposed to the face of the wearer is formed in a concave shape, a curvature radius in a left-and-right direction is formed to be smaller than a curvature radius in a upper-and-lower direction, and a ratio of change in a thickness in the left-and-right direction is formed to be larger than a ratio of change in a thickness in the upper-and-lower direction.

[0196] The shield member is preferably characterized by:

being constituted to comprise a main body portion and a visor portion, and that the main body portion is formed in the curved plate-like shape, and
the visor portion is bent below the main body portion to project in a direction opposite to the main body portion.

[0197] The shield member is preferably characterized by:

being constituted to comprise a main body portion and a visor portion, and that the main body portion is formed in the curved plate-like shape, and
the visor portion is bent below the main body portion to project in a direction opposite to the main body portion.

[0198] The shield member is preferably characterized in that:

a concave portion dented toward an inside of the main body portion with a predetermined width is formed at a central portion in a lateral direction of the visor portion.

[0199] The shield member is preferably characterized in that:

a concave portion dented toward an inside of the main body portion with a predetermined width is formed at a central portion in a lateral direction of the visor portion.

[0200] A shield member attached to a cap body for protecting a head of a wearer, for covering a face of the wearer, is characterized by having:

a main body portion for covering a face of che wearer, the main body being formed of a transparent body or a translucent body in a curved plate-like shape; and
a visor portion for preventing a flying object from contacting a body of the wearer, the visor portion being formed integrally with a lowermost end portion of the main body portion.

[0201] The shield member as mentioned before is preferably characterized in that:

a concave portion dented toward the wearer to open to a lowermost end side is provided at a central portion in a lateral direction of the visor portion.

[0202] A protective cap is characterized by having:

the shield member as recited in [0199];
a cap body for protecting a head of the wearer; and
guide means for guiding the shield member to move between a housing position where the shield member is housed in the cap body and a shielding position where the shield member covers a face of the wearer,
wherein a gap is formed between a visor portion of the shield member and a visor portion of the cap body in a state where the shield member is positioned at the housing position.

[0203] A protective cap is characterized by having:

the shield member as recited in [0201],
a cap body for protecting a head of the wearer;
guide means for guiding the shield member to move between a housing position where the shield member is housed in the cap body and a shielding position where the shield member covers a face of the wearer,
wherein a gap is formed between a visor portion of the shield member and a visor portion of the cap body in a state where the shield member is positioned at the housing position.

Claims

1. A protective cap (1), comprising:

a cap body (3) for protecting a head of a wearer and having a visor portion;
a shield member (5), attached to the cap body (3), for covering a face of the wearer; and
a guide means (7) for guiding the shield member (5) for movement between a housing position where the shield member (5) is housed in the cap body (3) and a shielding position where the shield member (5) covers a face of the wearer,
wherein an opening portion (9) of the cap body (3) is substantially horizontal and positioned at a slightly upper side than the wearer's ears when a standing upright wearer wears the protective cap (1), and
the shield member (5) comprises,
a main body portion (73) for covering a face of the wearer, the main body being formed of a transparent body or a translucent body in a curved plate-like shape; and
a visor portion (17) for preventing a flying object from contacting a body of the wearer, the visor portion (17) being formed integrally with a lowermost end portion of the main body portion (73),
wherein a gap is present between the visor portion (17) of the shield member and the visor portion (10) of the cap body (3) when the shield member (5) is positioned at the housing position, and wherein
the guide means (7) comprises a guide portion (13) provided at a guide member (11), and

an engagement portion (15) provided at the shield plate (5) to engage with the guide portion (13), and the guide member (11) is integrally provided in the interior of the cap body (3).

2. A protective cap (1) of the claim 1, wherein the main body portion (73) of the shield member (5) is formed in the curved plate-like shape, and the visor portion (17) of the shield member (5) is bent below the main body portion (73) to project in a direction opposite to the main body portion (73).

3. A protective cap (1) of one of the claims 1-2, wherein when the shield plate (5) is positioned at the housing position (P1), the shield plate (5) does not interfere with a wearer so that the wearer can wear the protective cap 1 without being aware of existence of the shield plate 5 in his or her visual afield.

4. A protective cap (1) of one of the claims 1-3, wherein when the shield plate (5) is positioned at the shielding position (P3), the lowermost end portion of the shield is positioned below a chin of a wearer so that the shield plate (5) covers almost all of a face of the wearer, and when a flying object flying from a direction obliquely forward collides with the lower part of the shield plate 5 in a shallow angle, the flying object colliding and bouncing back is made to re-collide with the visor portion (17).

5. A protective cap (1) of one of the claims 1-4, wherein the guide portion (13) includes a to-be-engaged portion (63) formed to extend in the upper-and-lower direction of the guide member (11) at a central portion in the lateral direction of the guide member (11).

6. A protective cap (1) of one of the claims 1-5, wherein the guide portion (13) is provided at both end portions in the lateral direction and a central portion of the guide members (11).

FIG. 1

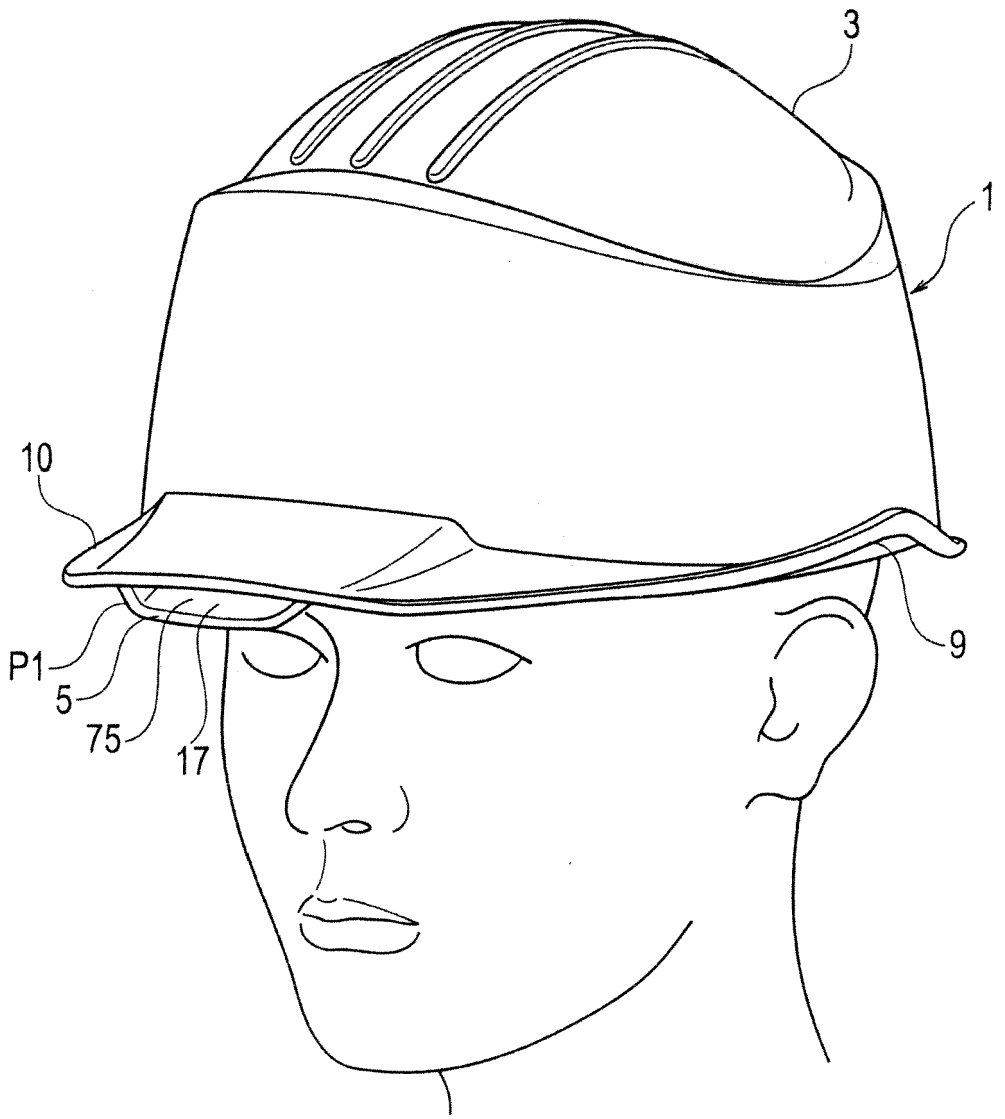


FIG. 2

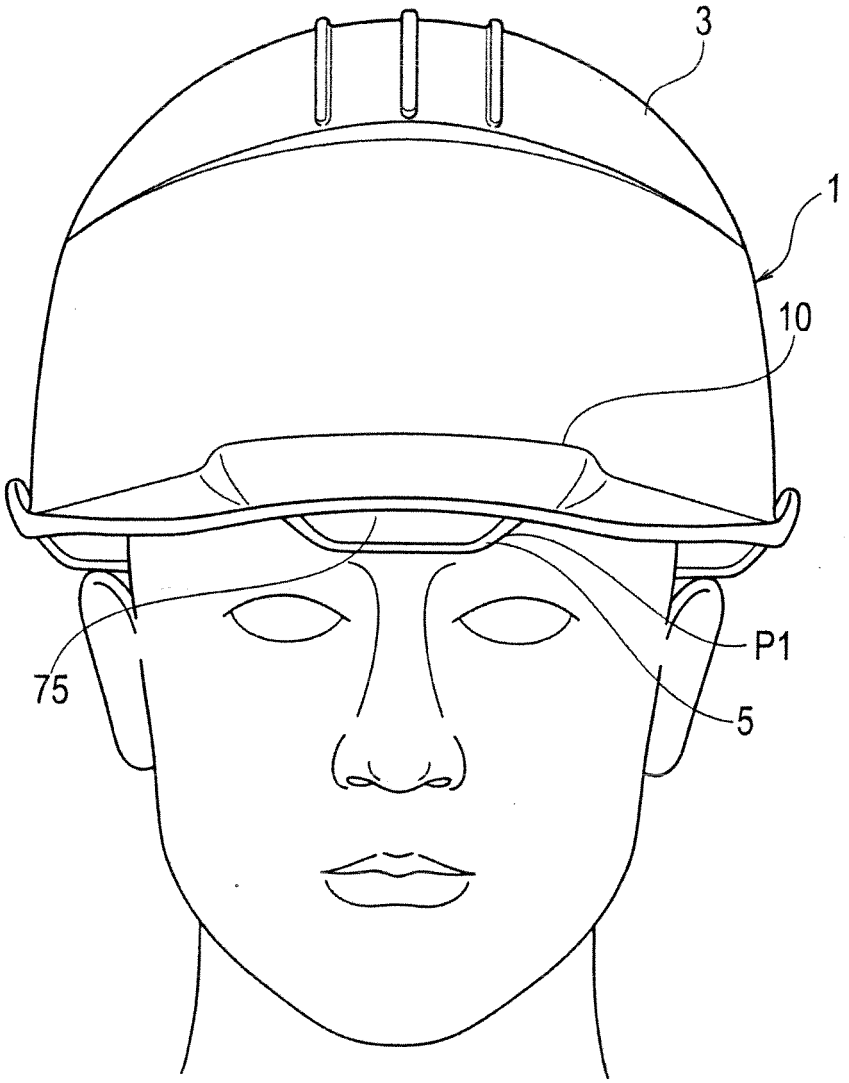


FIG. 3

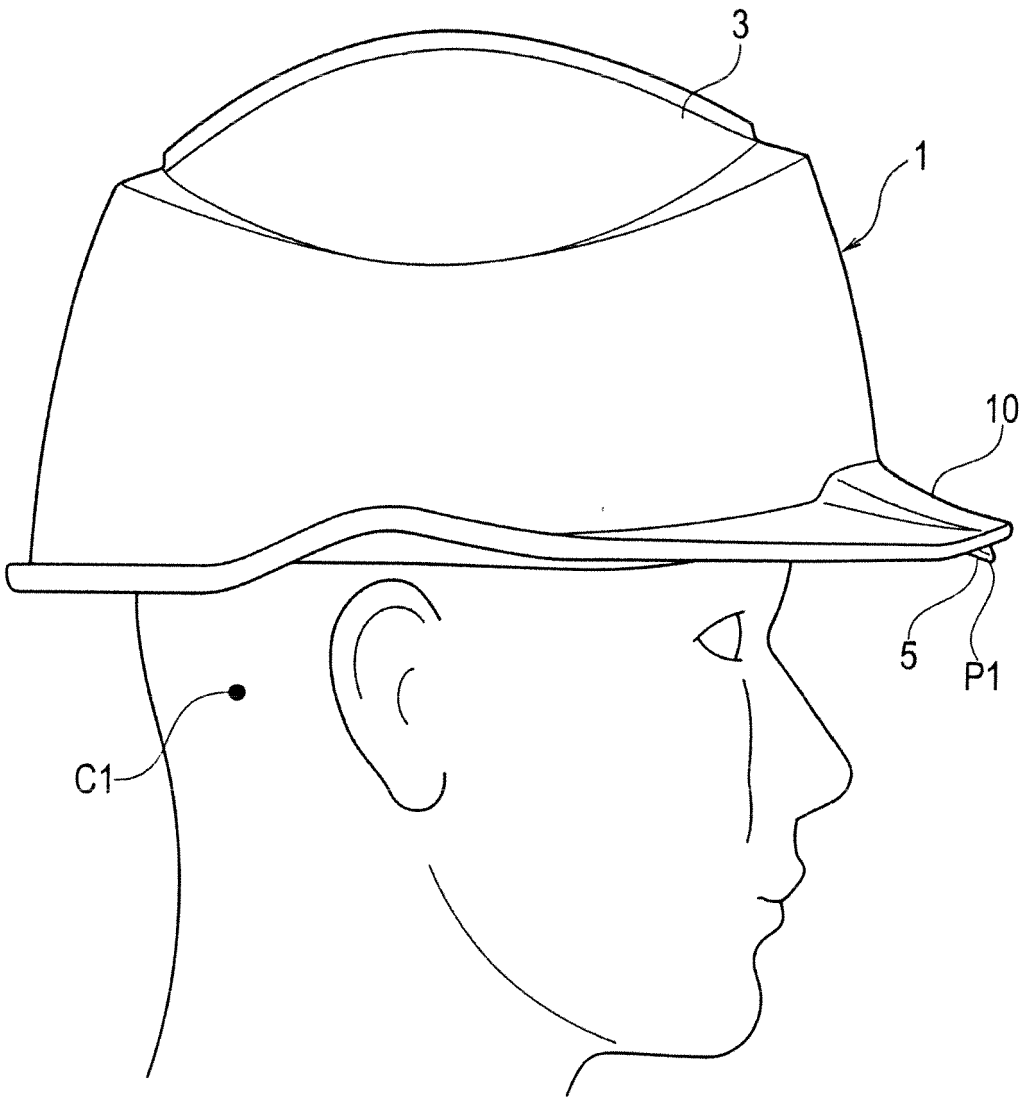


FIG. 4

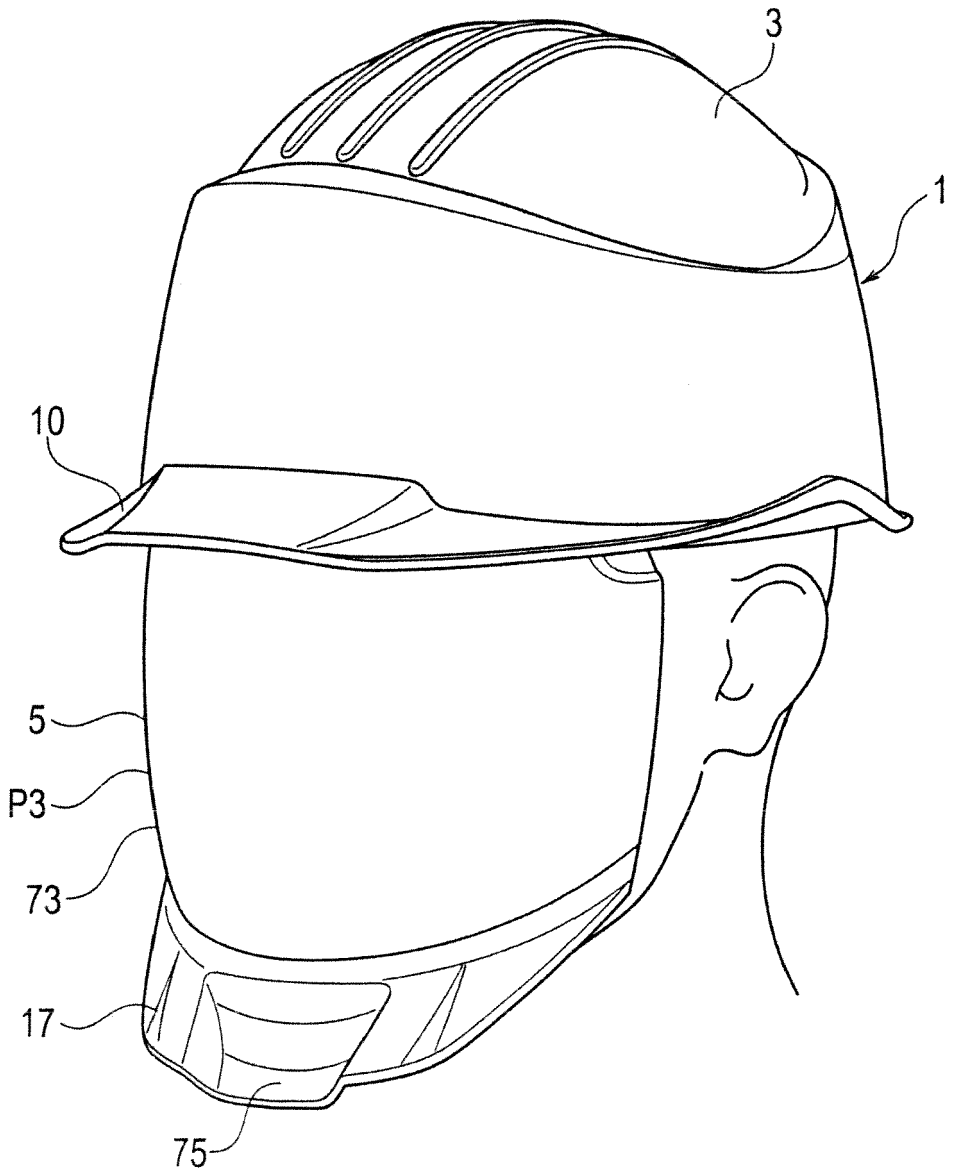


FIG. 5

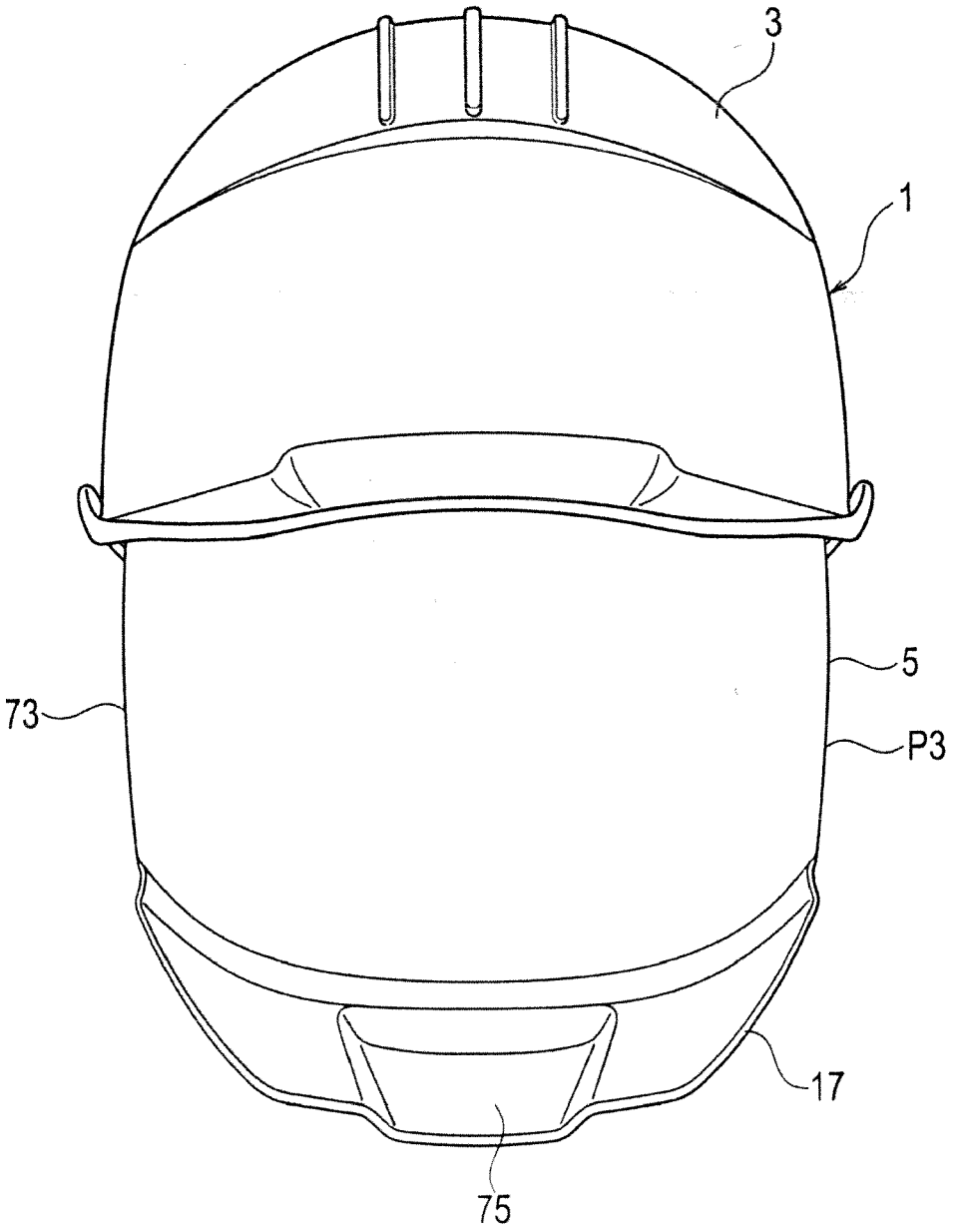


FIG. 6

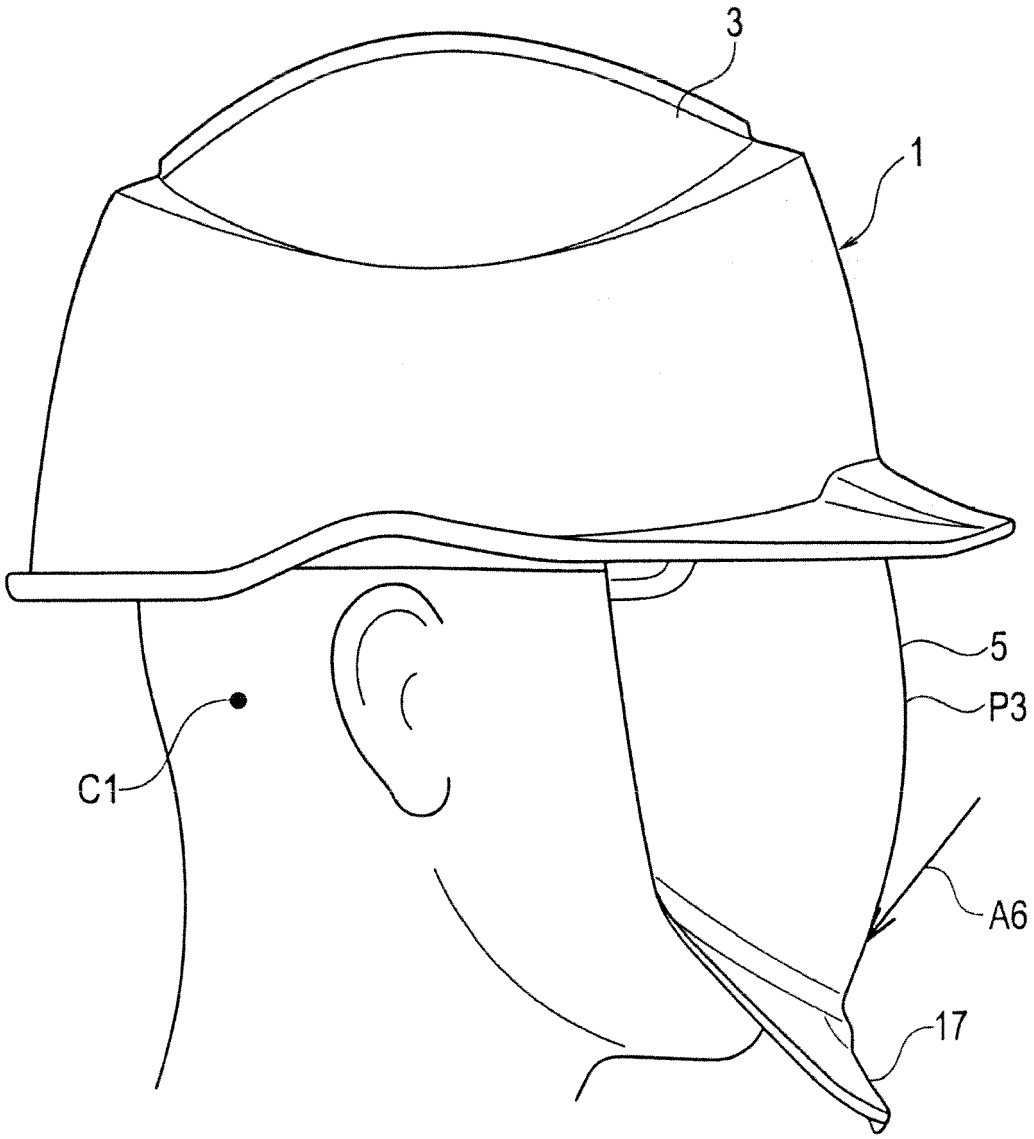


FIG. 7

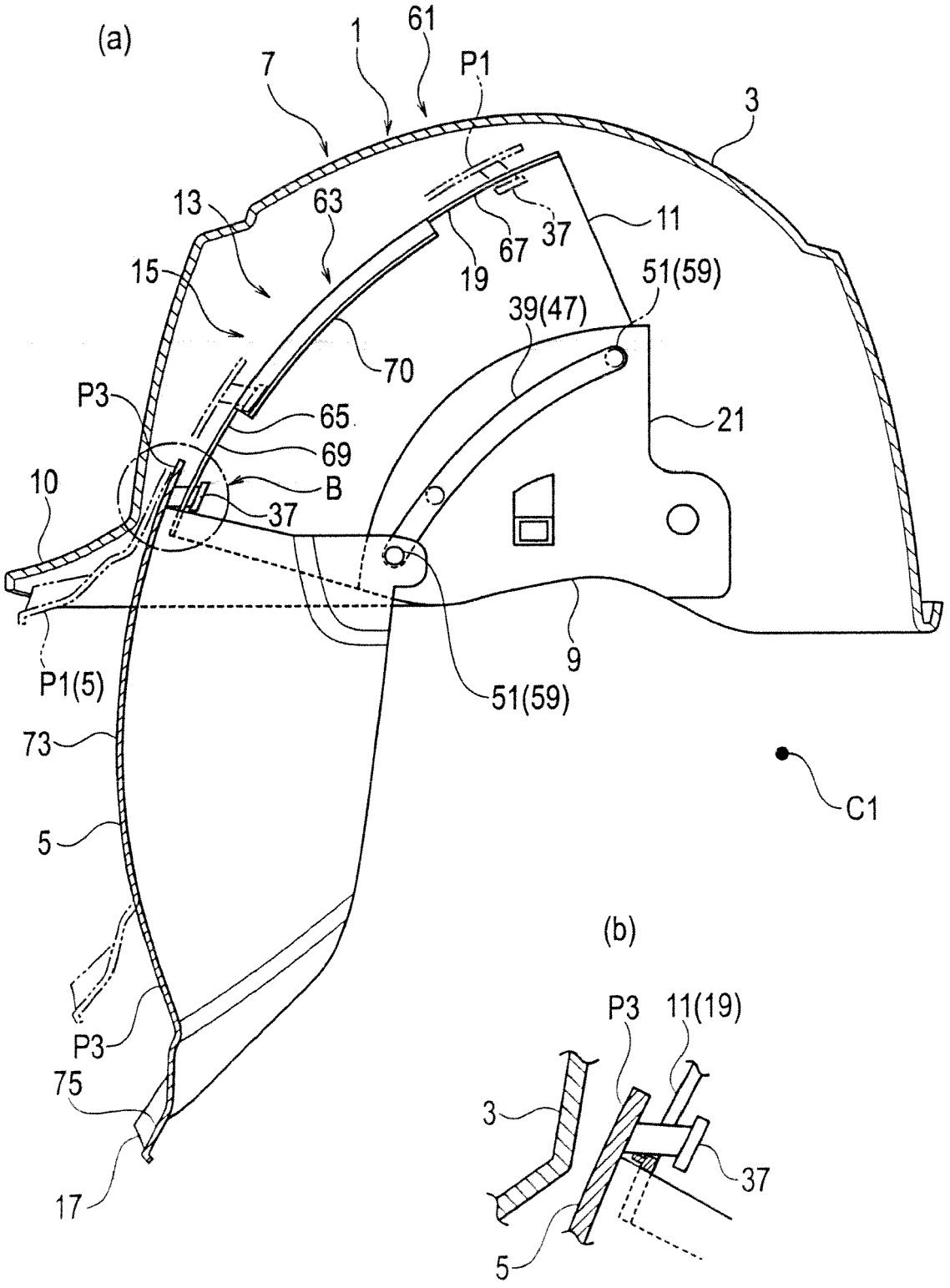

(a)
1
61
7
P1
3
13
63
11
37
67
19
15
51(59)
39(47)
70
P3
65
21
69
B
10
37
9
P1(5)
51(59)
73
C1
5
(b)
P3
11(19)
3
37
75
5
17
P3

FIG. 8

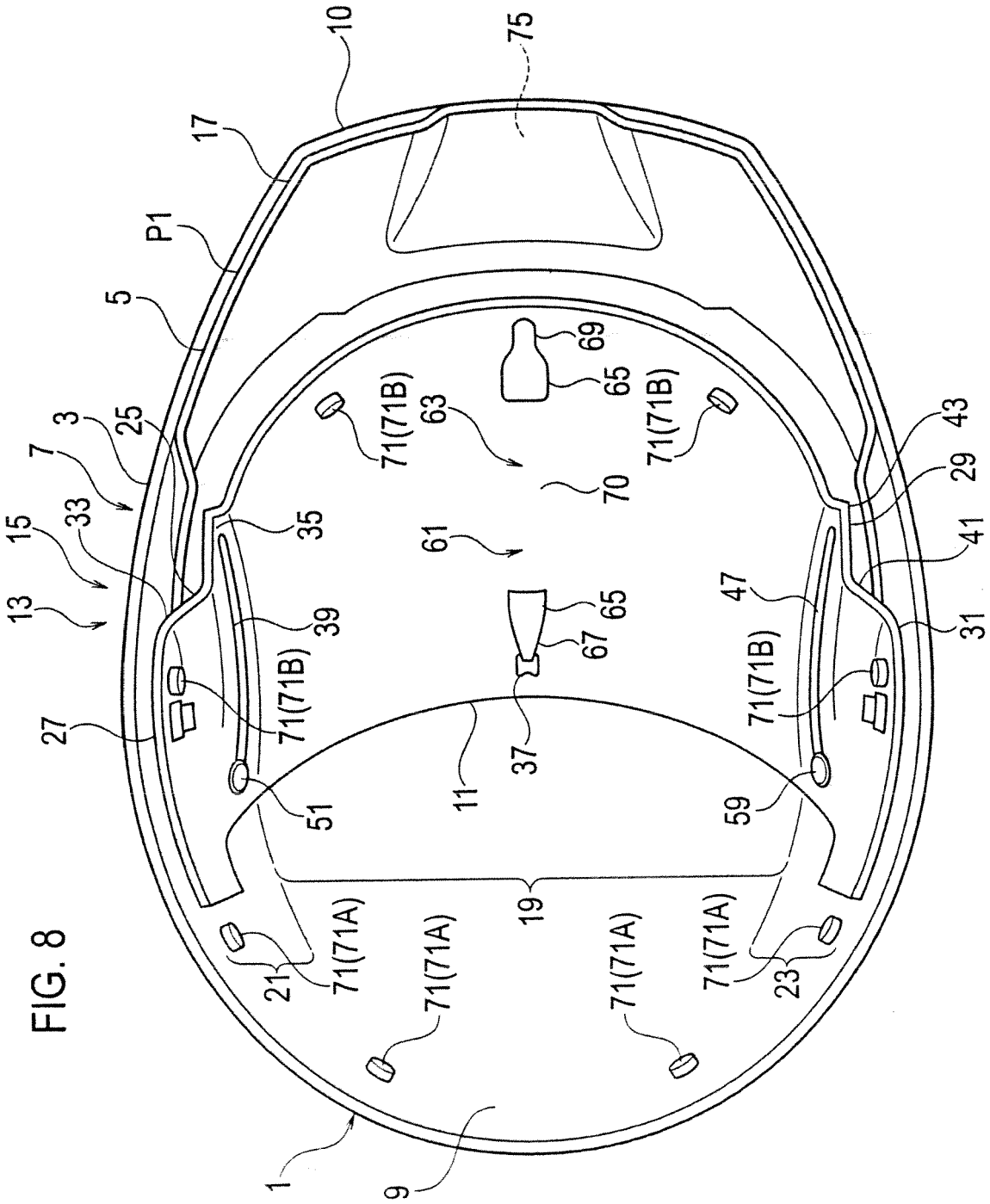
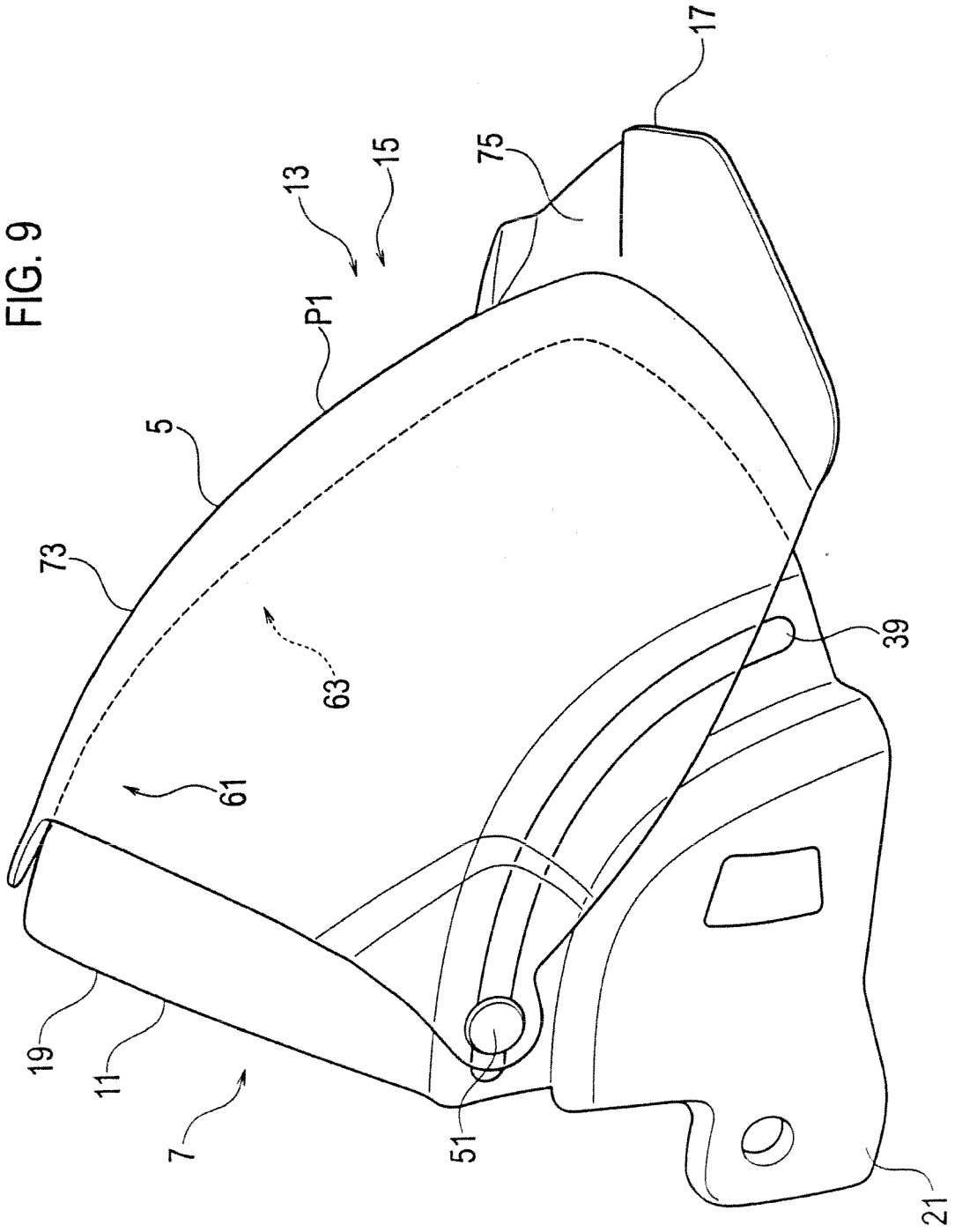

10
75
17
P1
5
69
65
71(71B)
63
71(71B)
3
25
43
7
70
29
33
35
61
41
15
47
13
39
65
67
31
27
71(71B)
71(71B)
37
11
51
59
19
21
71(71A)
71(71A)
71(71A)
71(71A)
23
1
9

FIG. 9



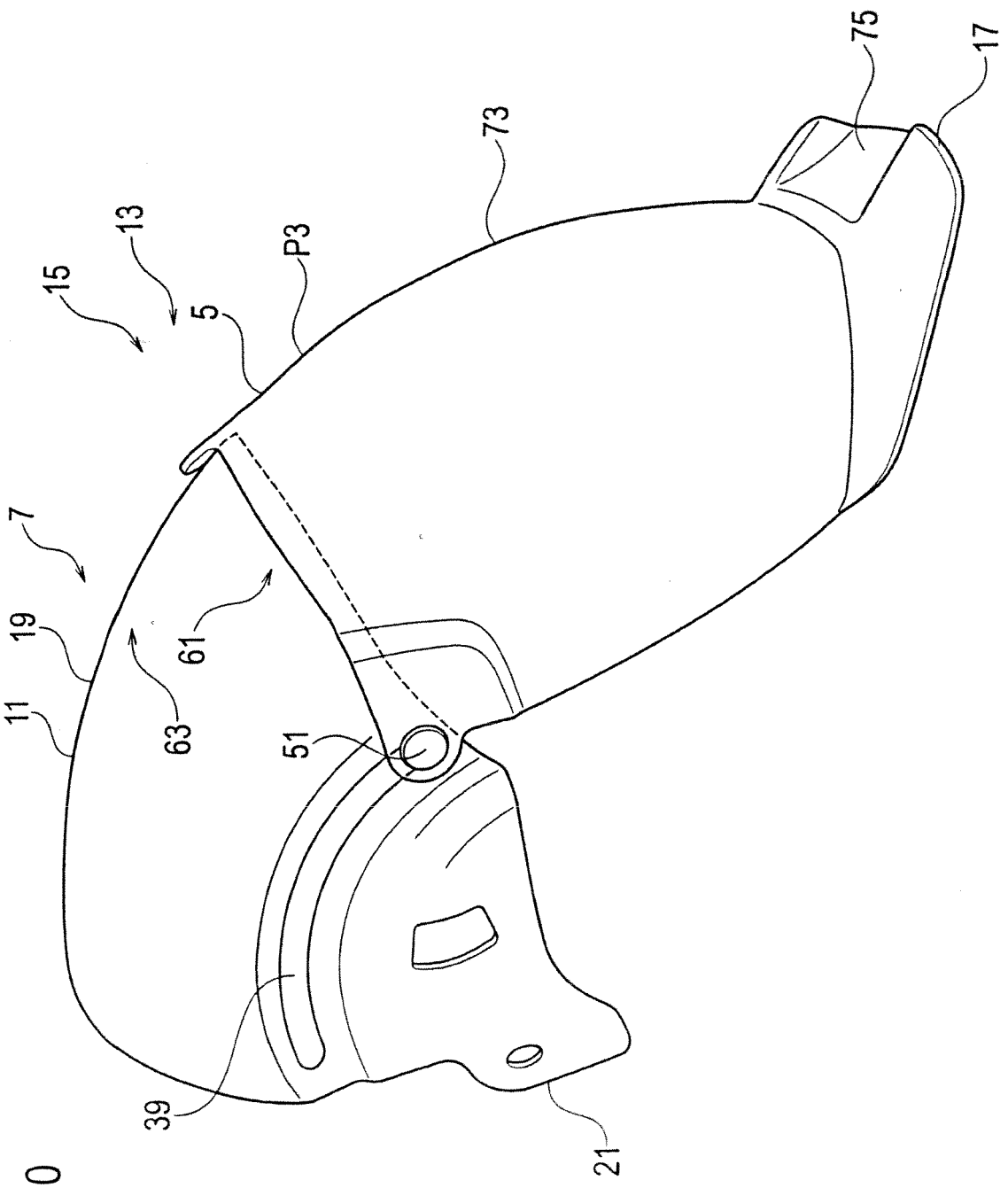


FIG. 10

FIG. 11

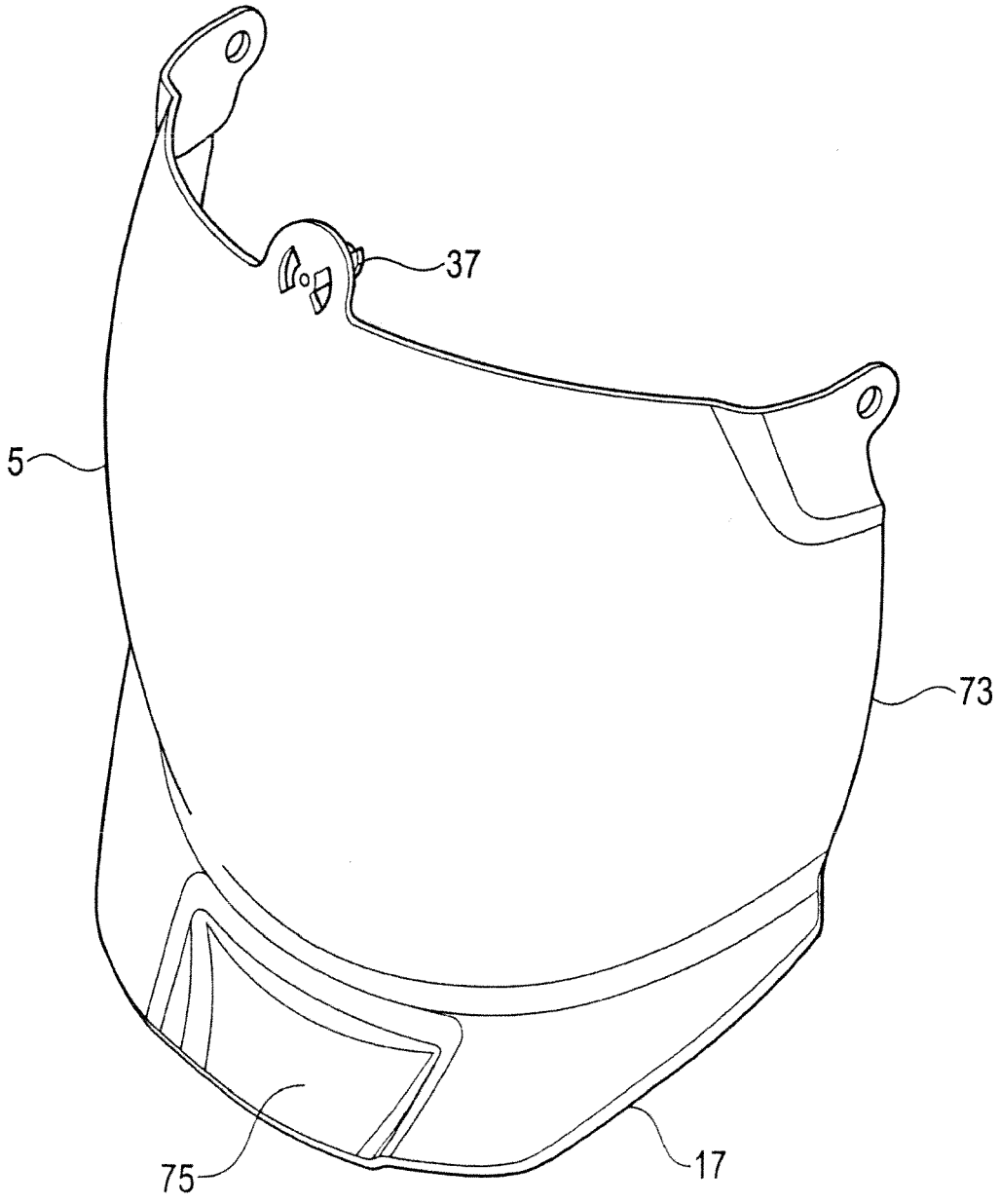


FIG. 12

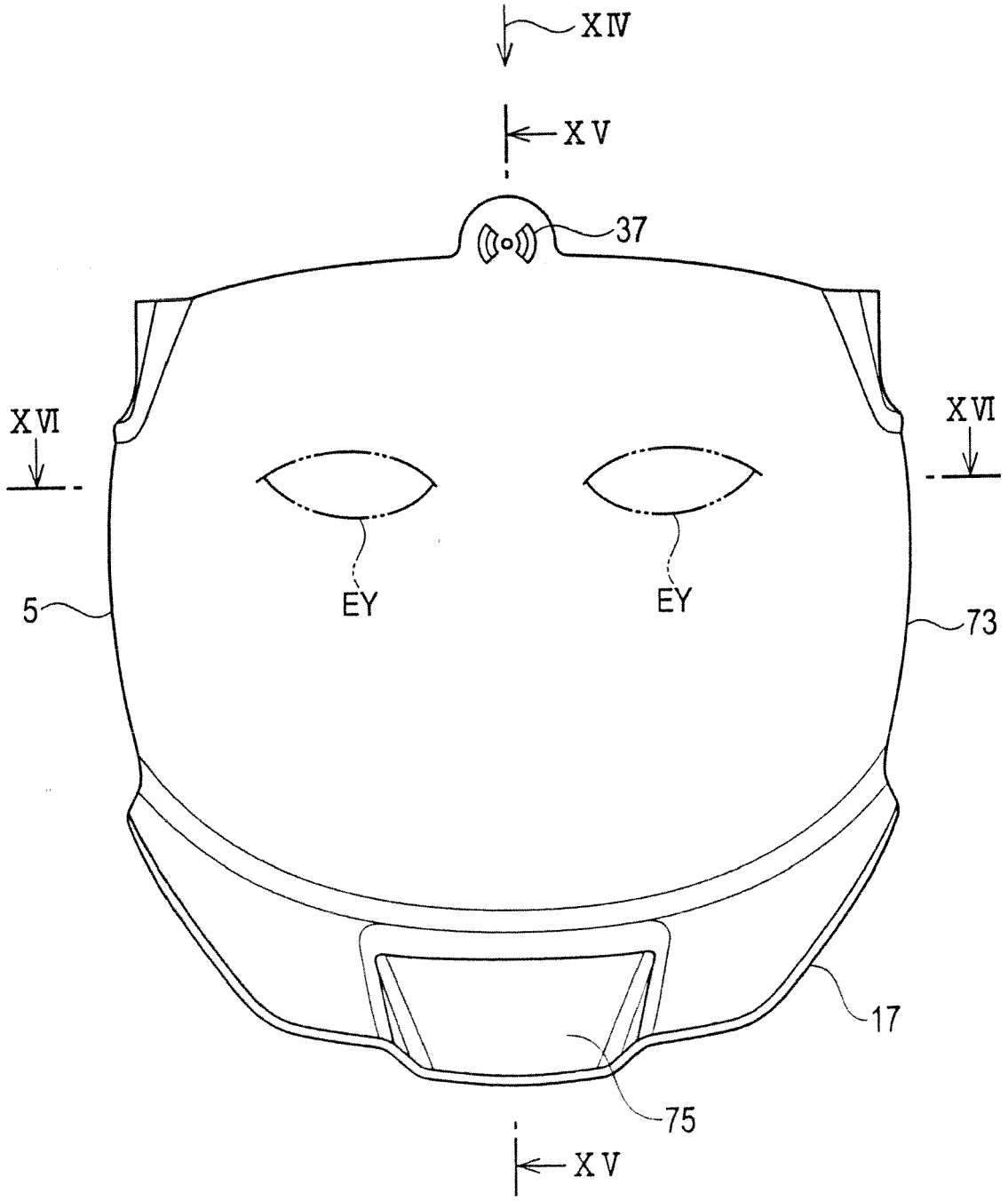


FIG. 13

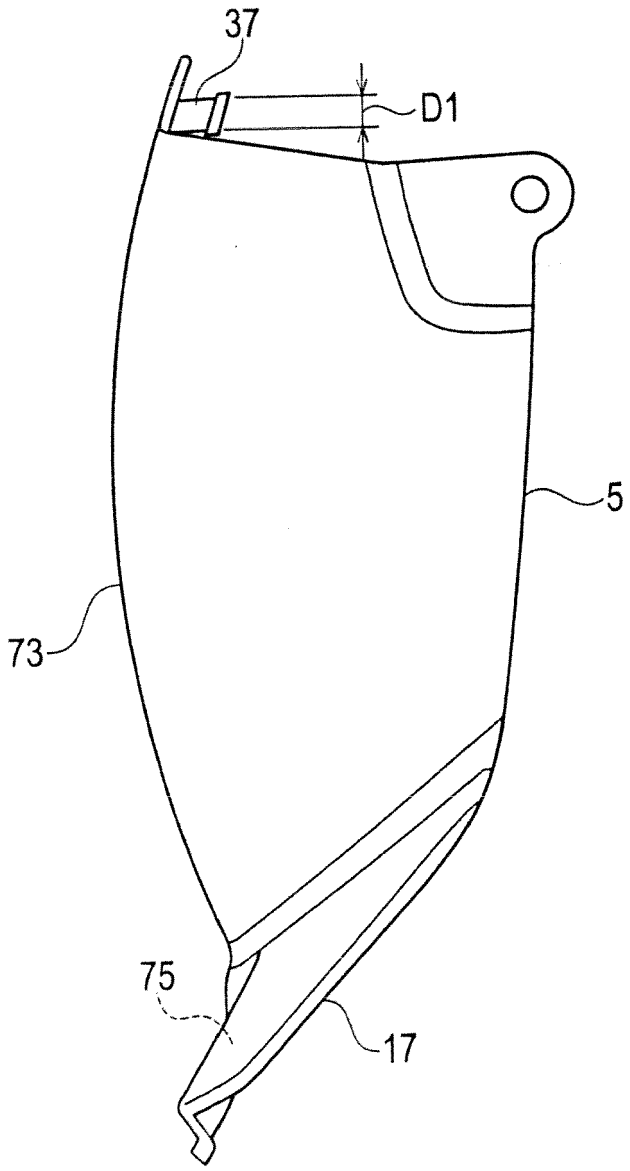


FIG. 14

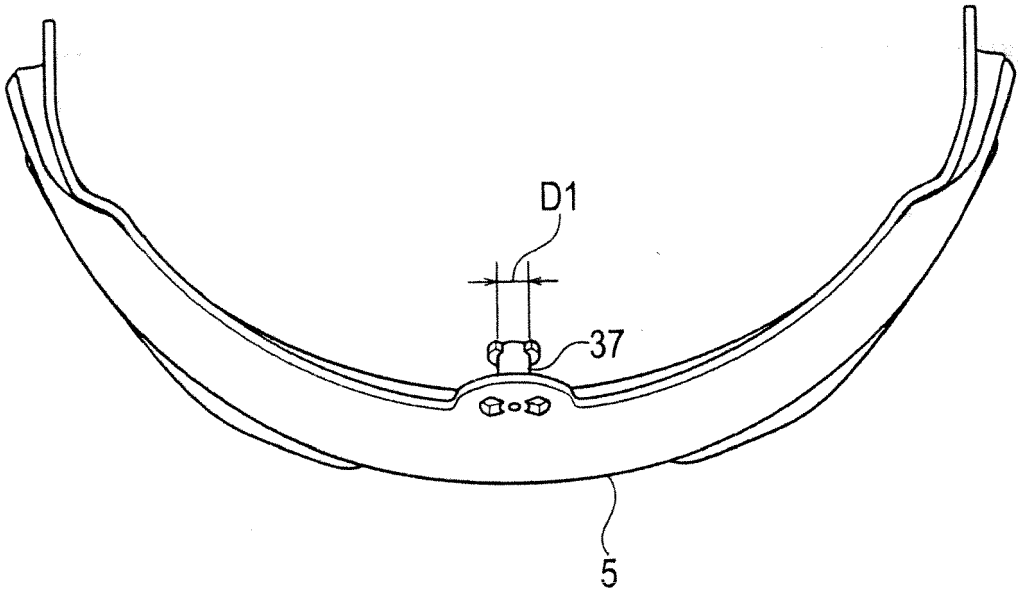


FIG. 15

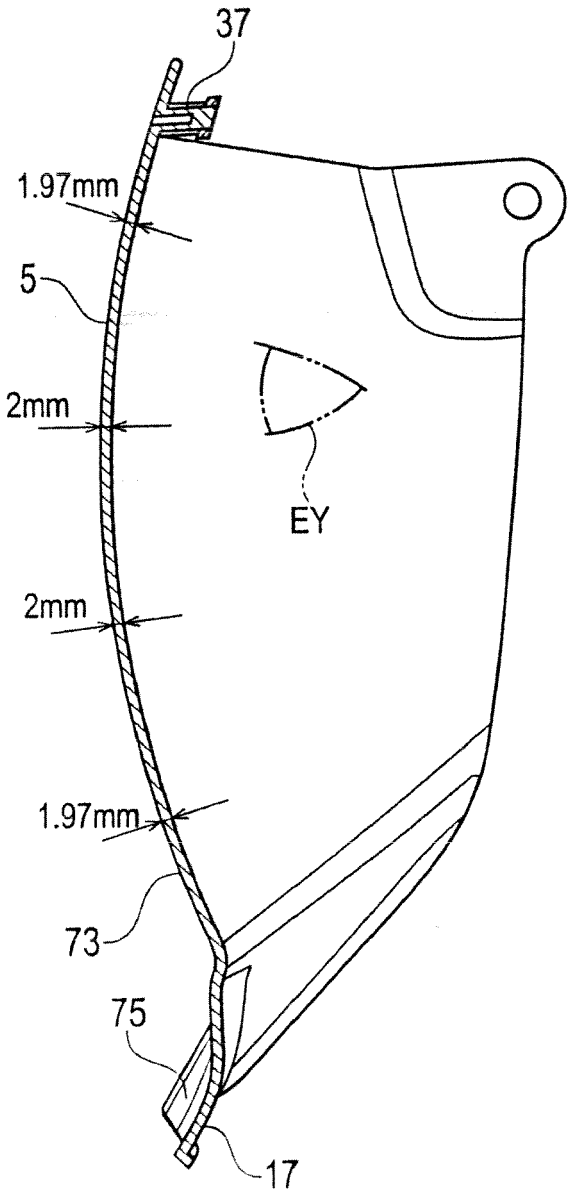


FIG. 16

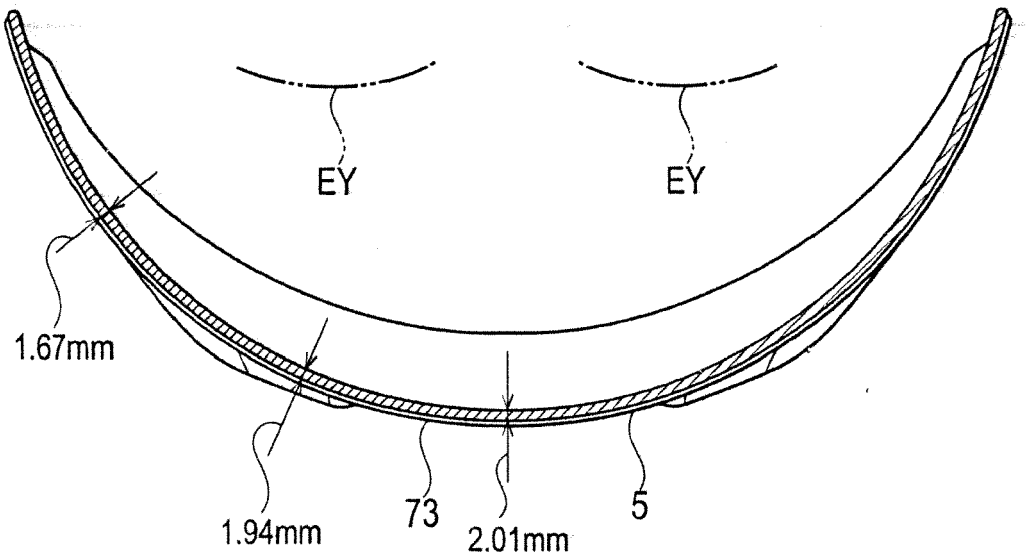


FIG. 17

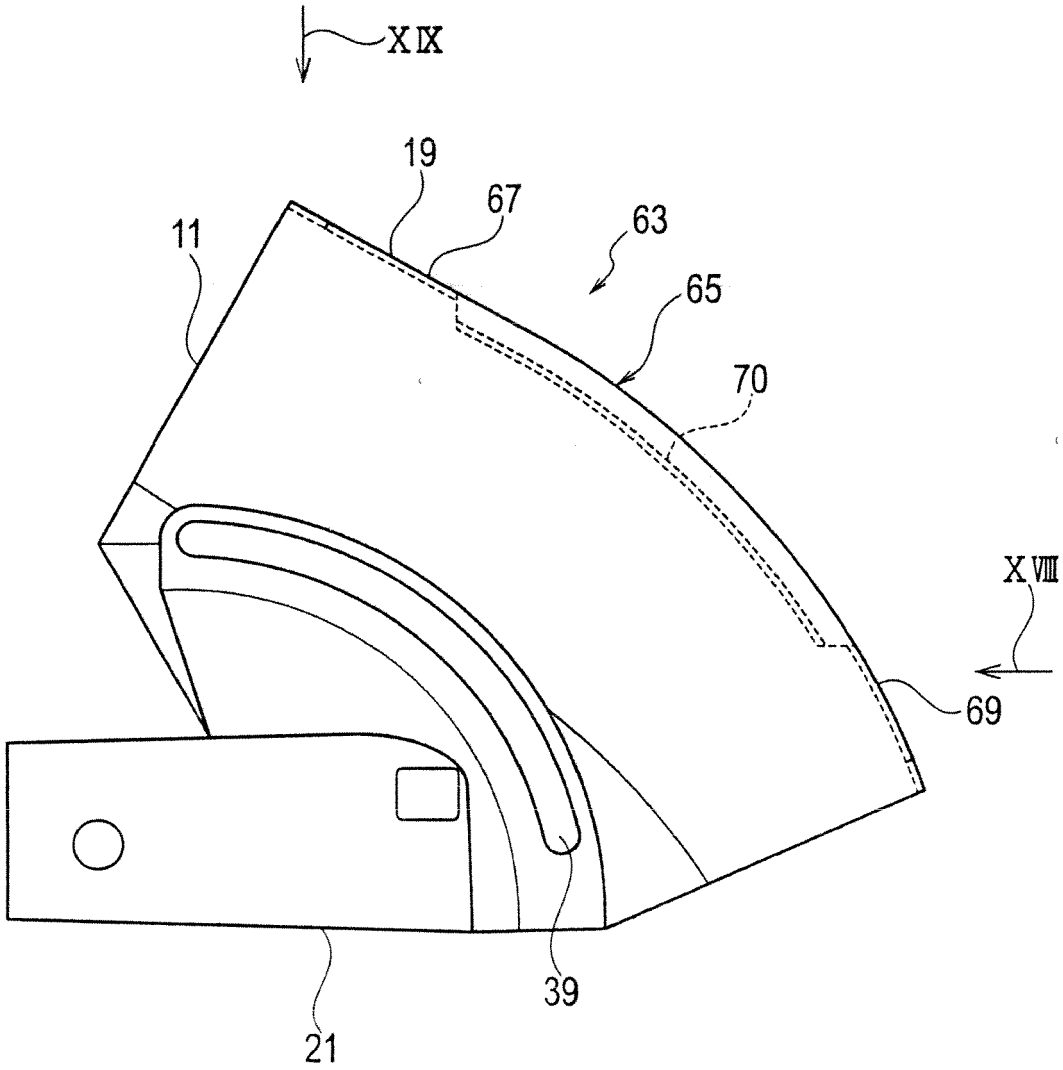


FIG. 18

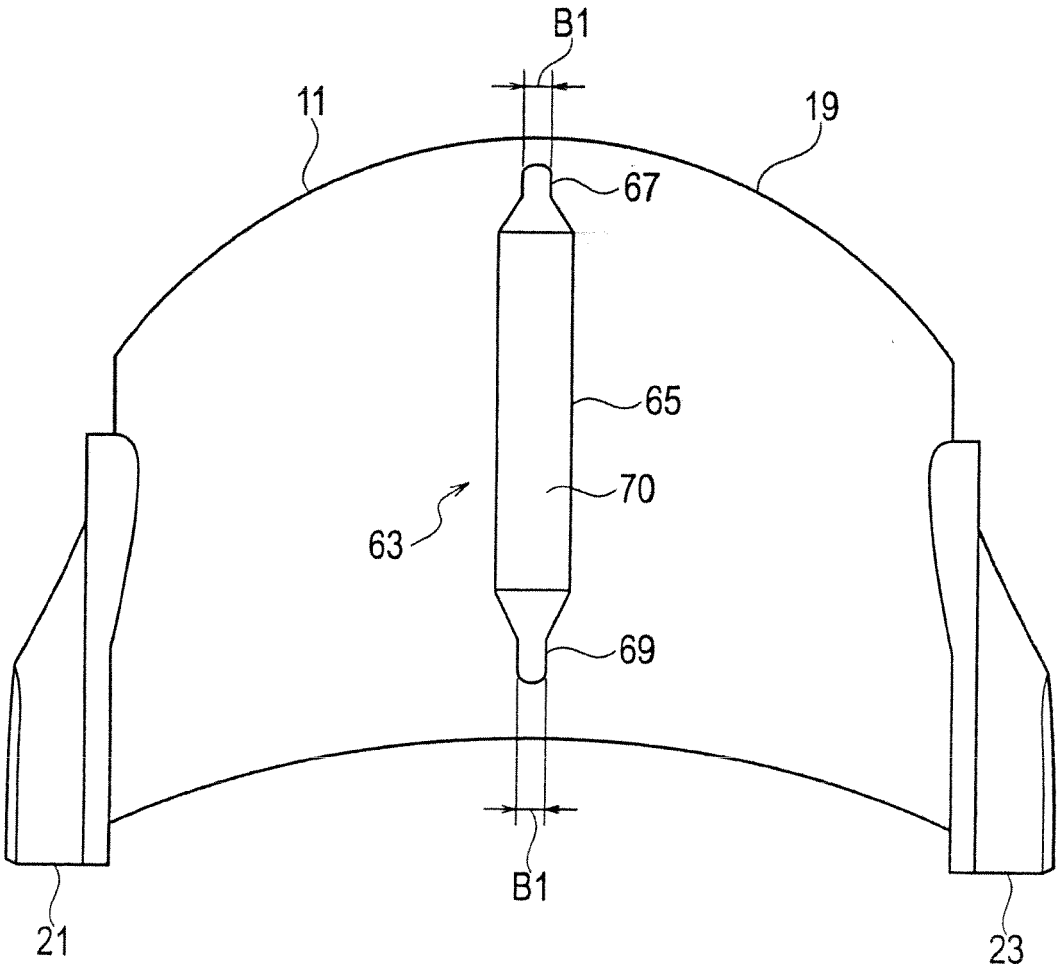


FIG. 19

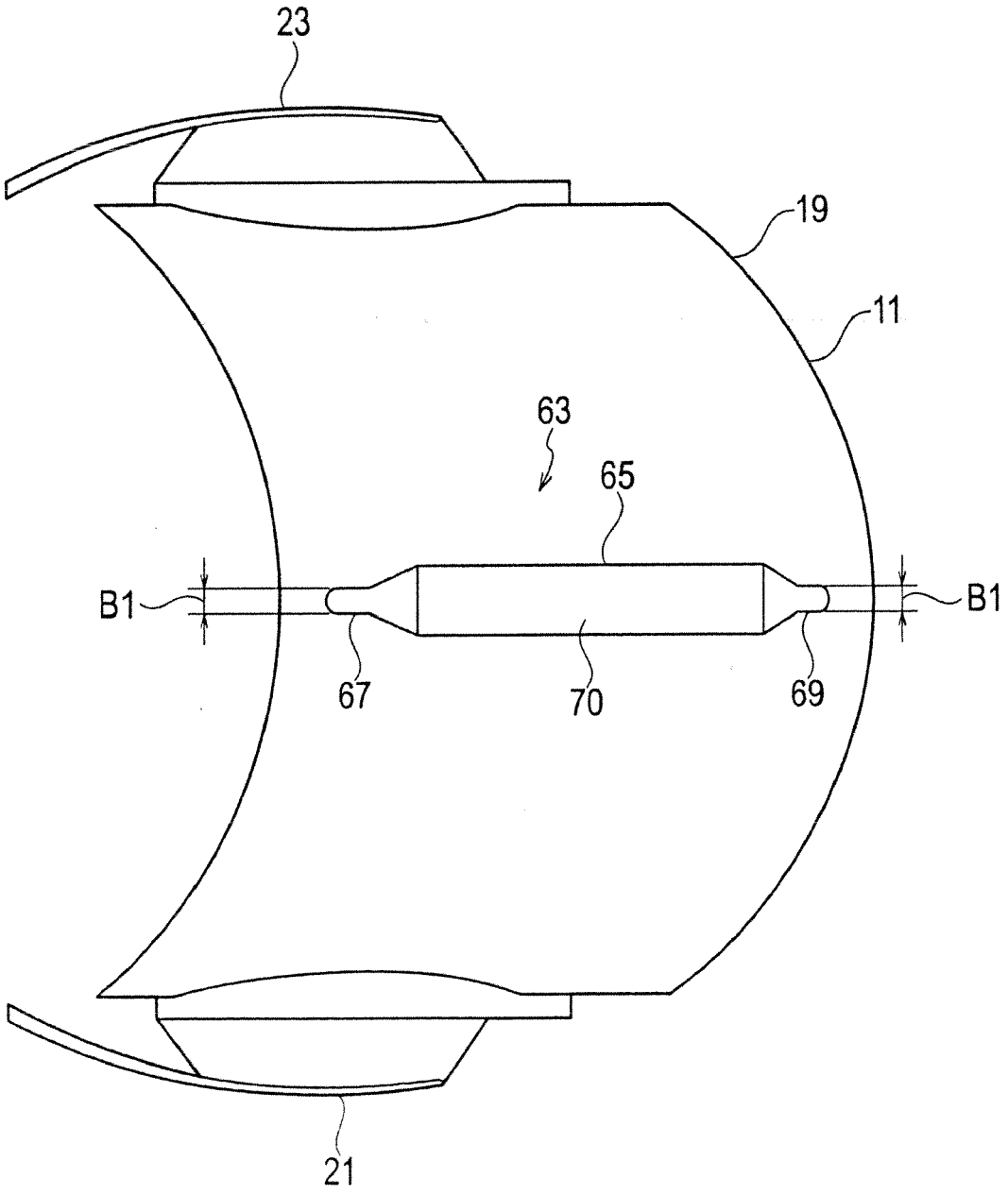


FIG. 20

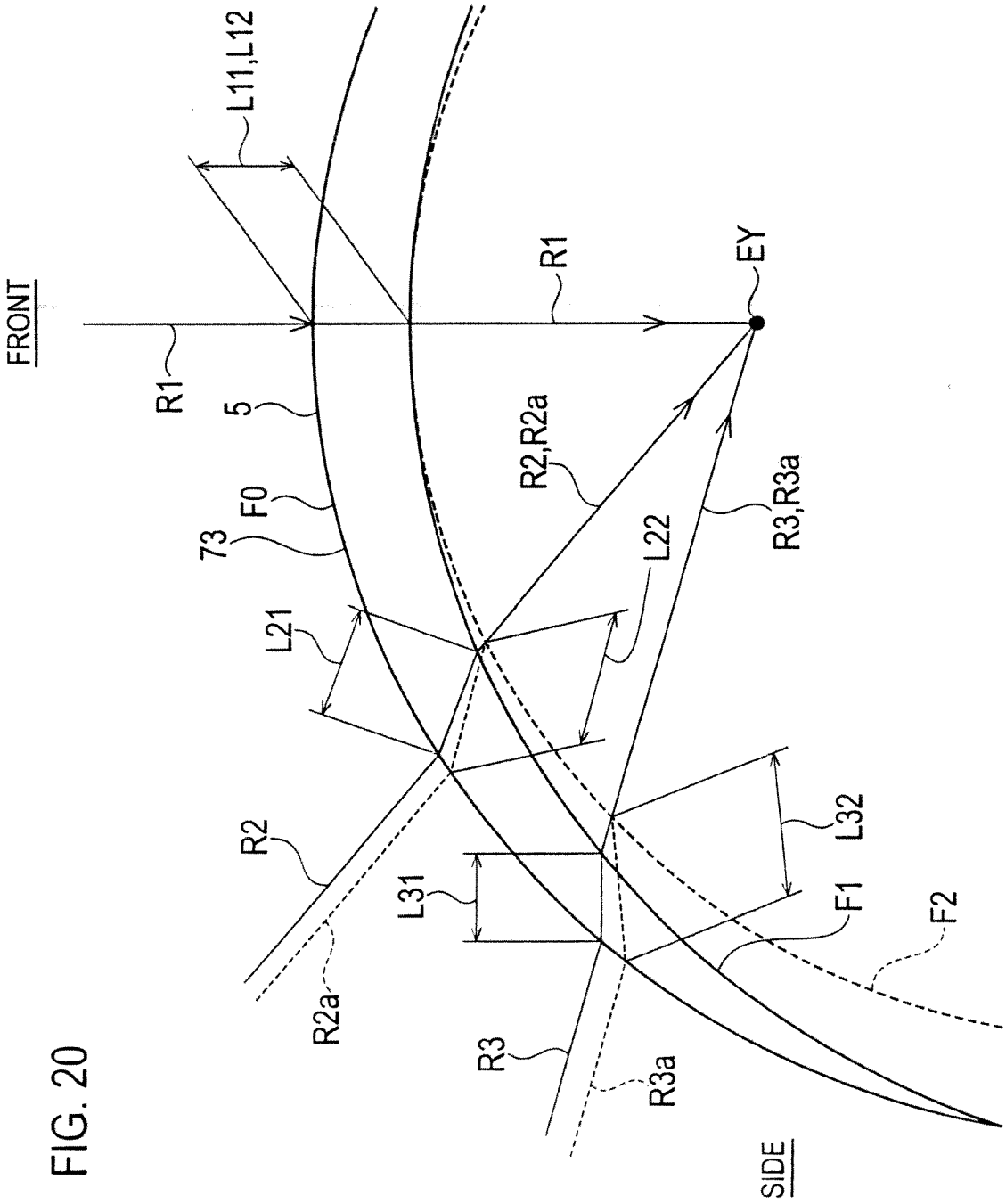
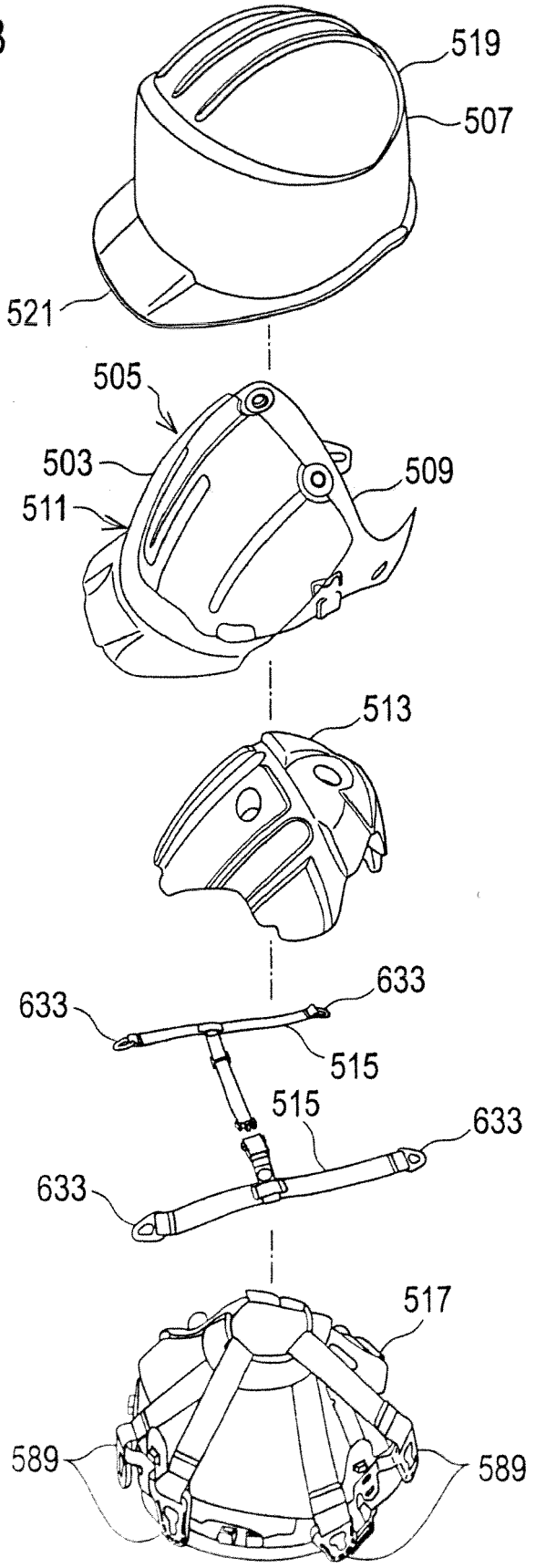

FRONT
L11,L12
R1
EY
R1
5
F0
73
R2,R2a
R3,R3a
L22
L21
R2
L31
L32
F1
F2
R2a
R3
R3a
SIDE

FIG. 38


519
501
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521
505
503
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511
513
633
633
515
515
633
633
517
589
589

FIG. 39

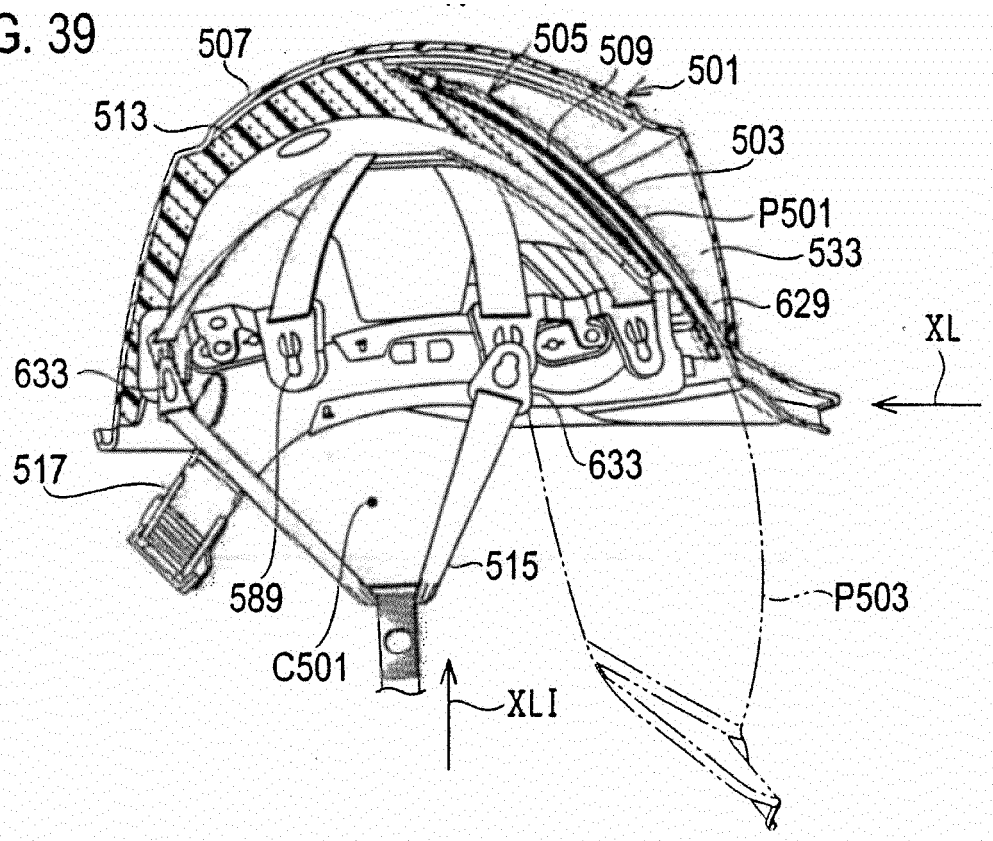
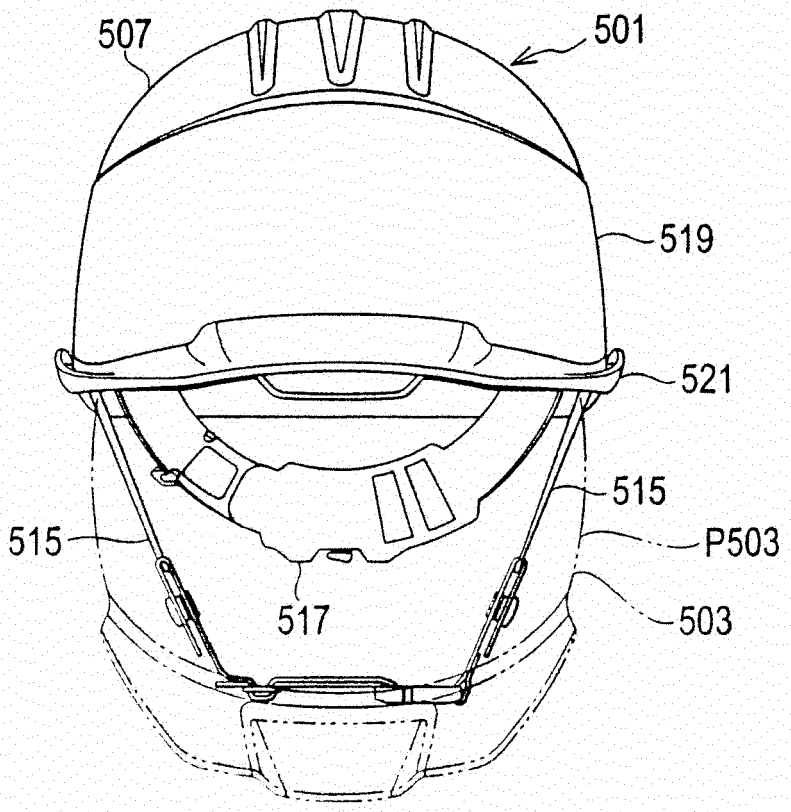

507
505
509
501
513
503
P501
533
629
XL
633
517
633
515
589
P503
C501
XLI

FIG. 40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515
515
P503
517
503

FIG. 41

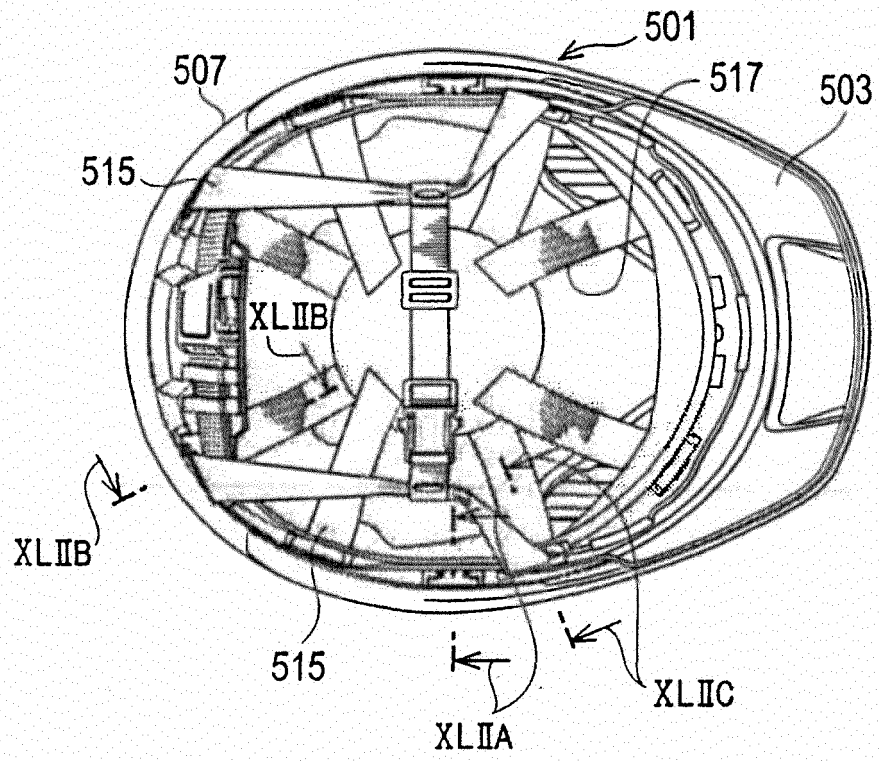
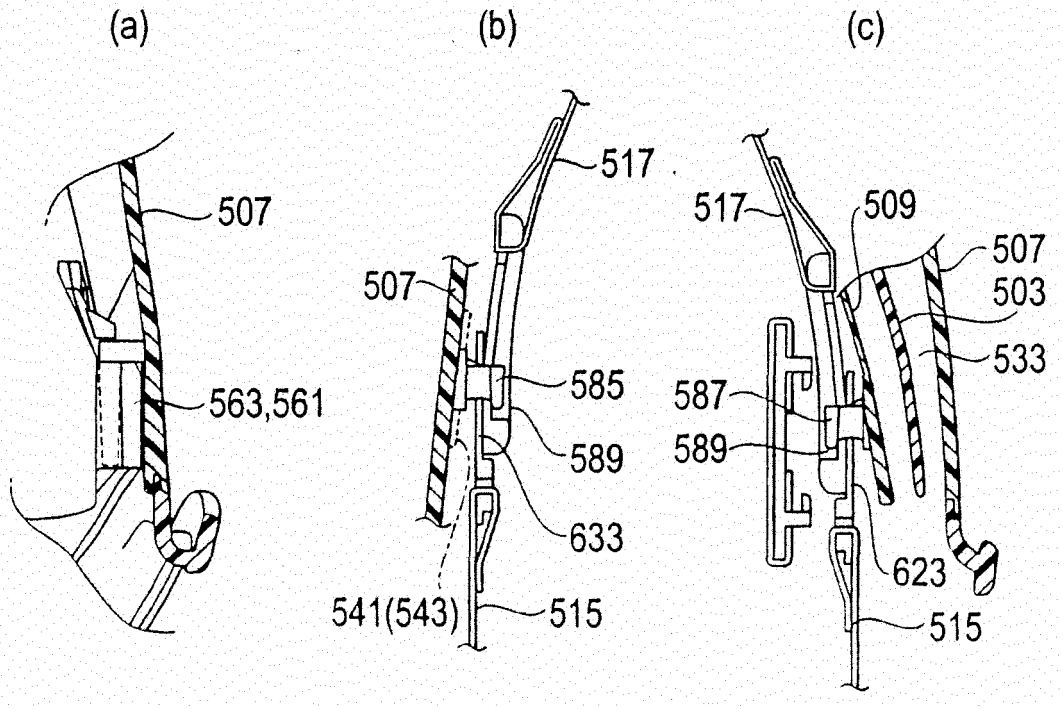

501
507
517
503
515
XLIIB
XLIIB
515
XLIIA
XLIIC

FIG. 42


(a)
(b)
(c)
507
563,561
517
507
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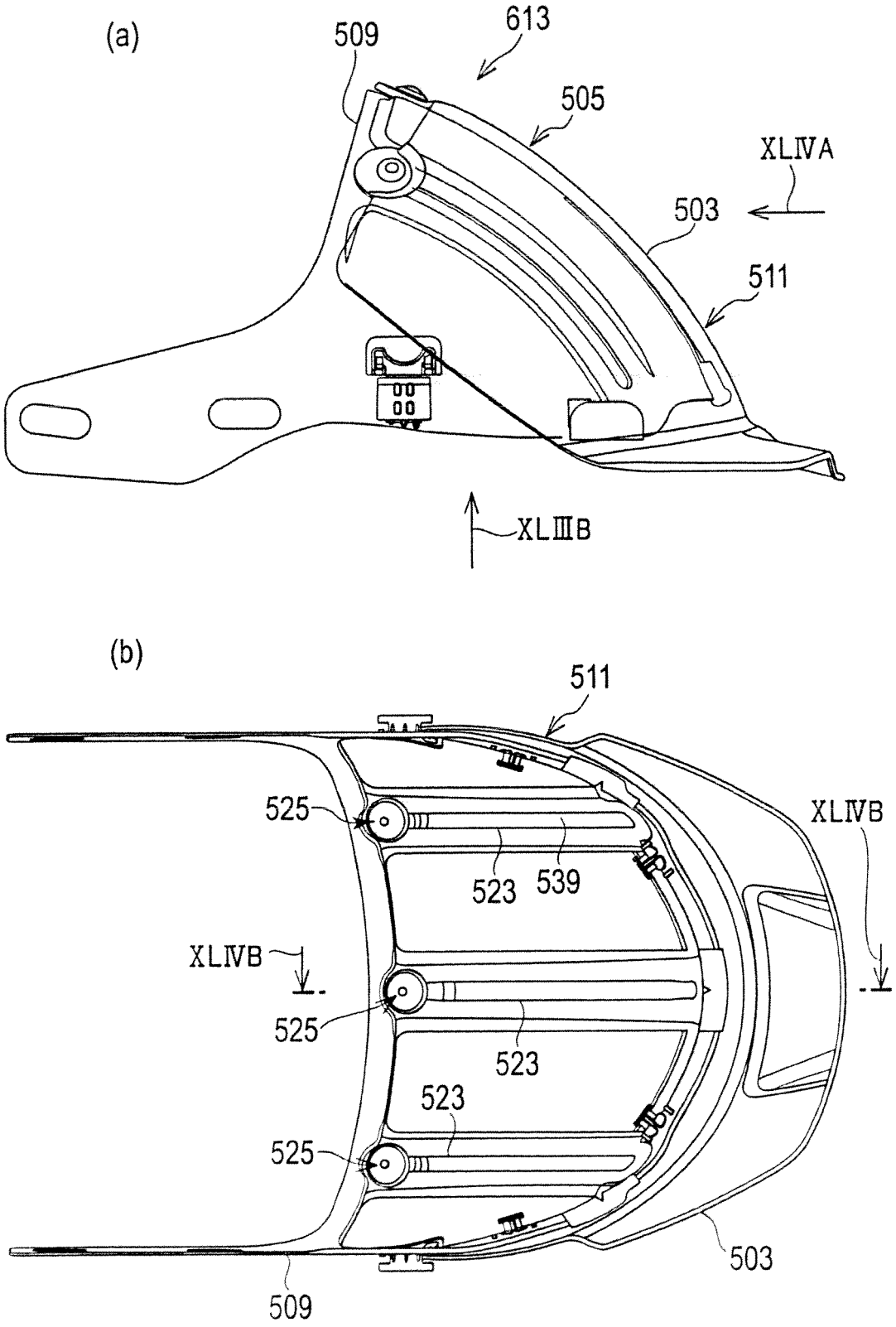
589
633
541(543)
515
517
509
507
503
533
587
589
623
515

FIG. 43


(a)
509
613
505
XLIVA
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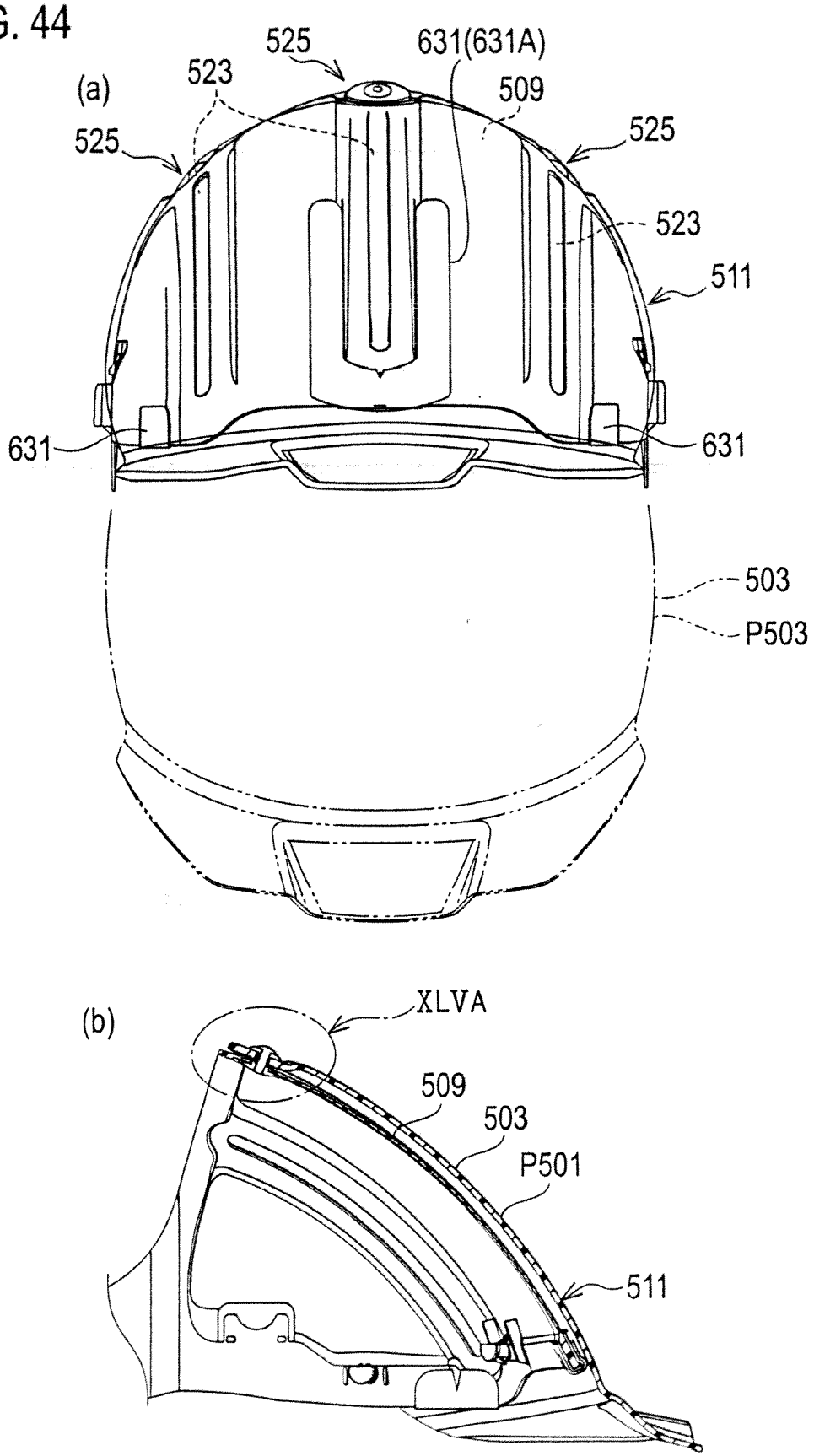
511
XLIIIB
(b)
511
525
523
539
XLIVB
XLIVB
525
523
523
525
503
509

FIG. 44


(a)
525
523
631(631A)
509
525
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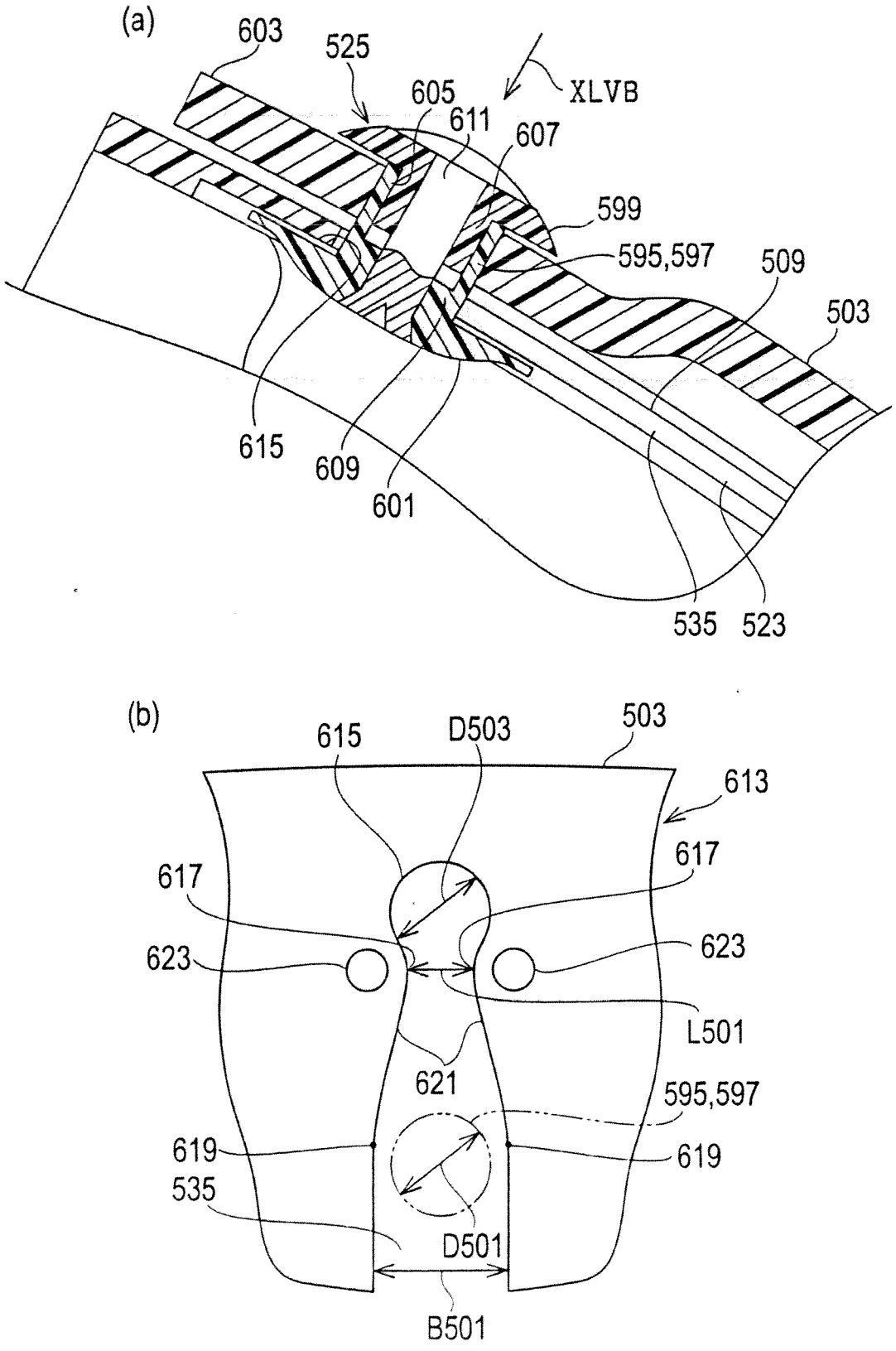
511
631
631
503
P503
(b)
XLVA
509
503
P501
511

FIG. 45


(a)
603
525
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611
607
XLVB
599
595,597
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503
615
609
601
535
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(b)
615
D503
503
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617
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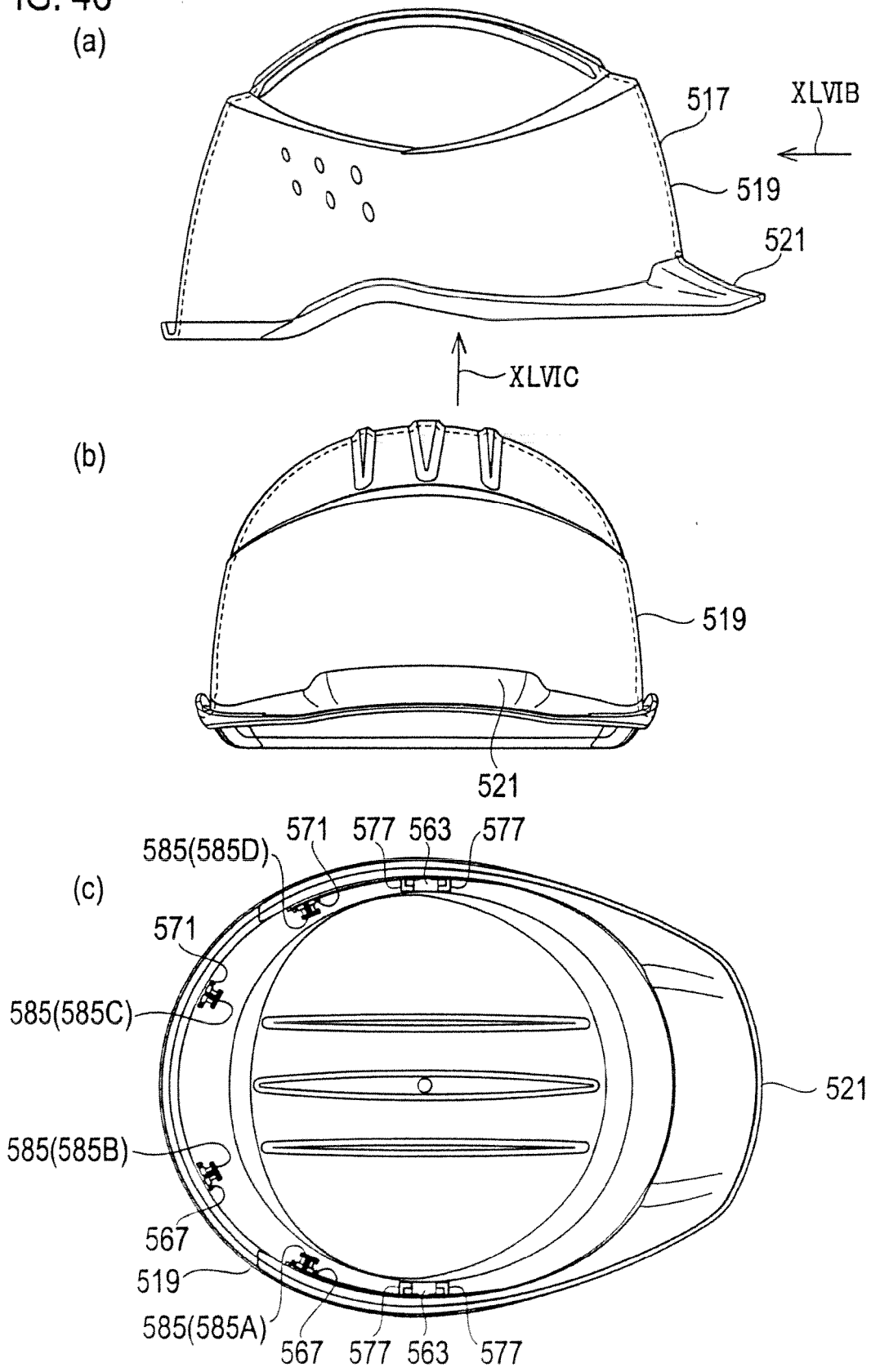
595,597
619
619
535
D501
B501

FIG. 46


(a)
517
XLVIB
519
521
XLVIC
(b)
519
521
(c)
571
577
563
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585(585D)
571
585(585C)
585(585B)
567
519
585(585A)
567
577
563
577
521

FIG. 47

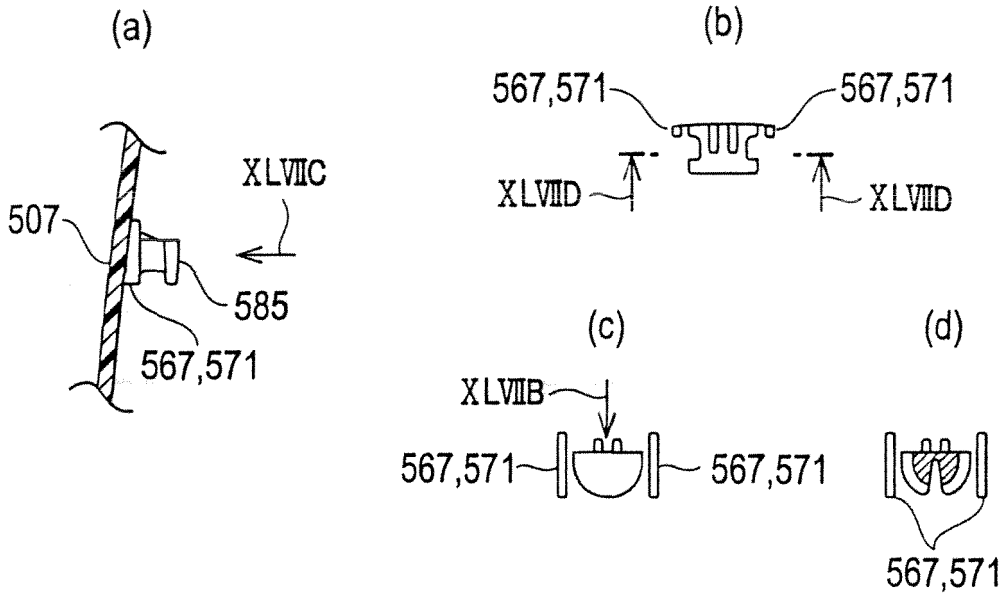

(a)
XLVIIC
507
585
567,571
(b)
567,571
567,571
XLVIID
XLVIID
(c)
(d)
XLVIIB
567,571
567,571
567,571

FIG. 48

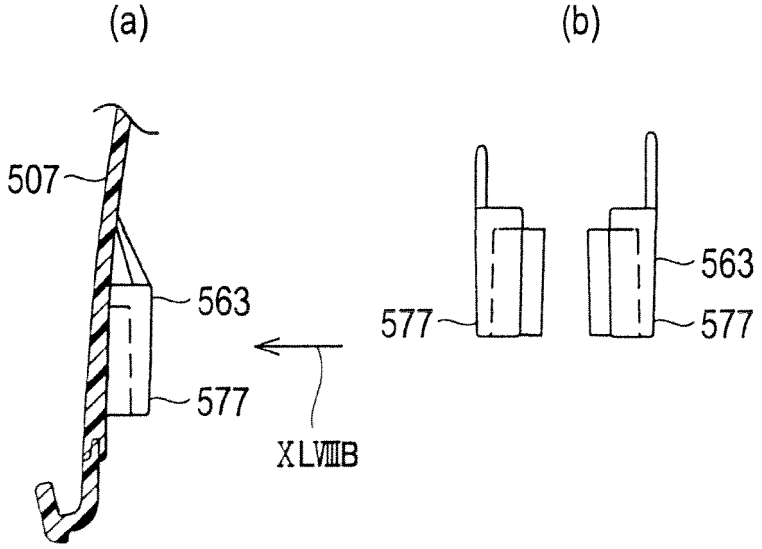
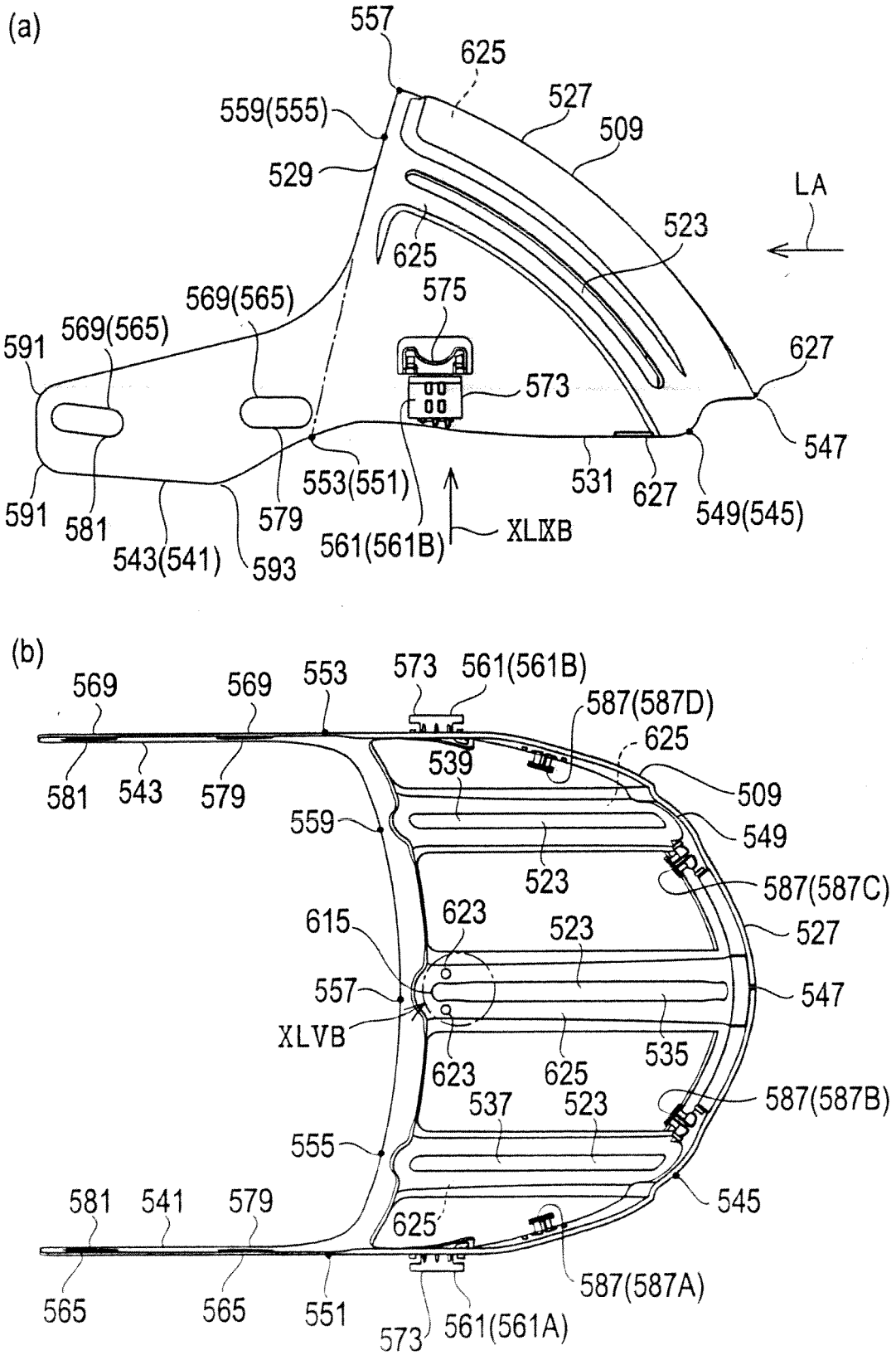

(a)
(b)
507
563
577
XLVIIB
563
577
577

FIG. 49


(a)
557
625
559(555)
527
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529
LA
523
625
575
569(565)
569(565)
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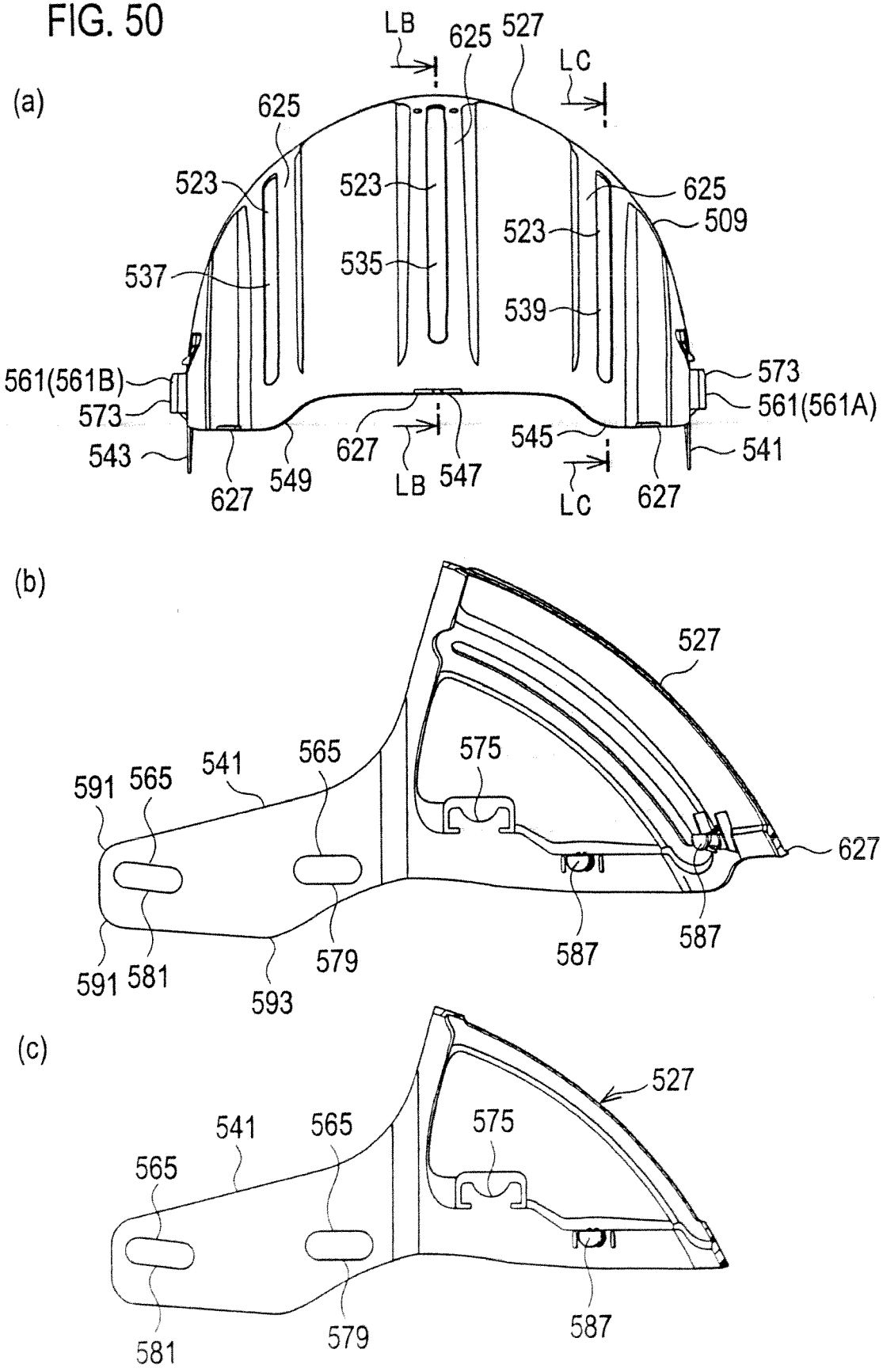
573
547
553(551)
531
627
591
581
579
561(561B)
XLIXB
549(545)
543(541)
593
(b)
569
569
553
573
561(561B)
587(587D)
625
581
543
579
539
509
559
549
523
587(587C)
615
623
523
527
557
547
XLVB
623
625
535
537
523
587(587B)
555
581
541
579
625
545
565
565
551
573
561(561A)
587(587A)

FIG. 50


(a)
LB
625
527
LC
625
523
523
625
509
523
537
535
539
561(561B)
573
573
561(561A)
543
627
549
627
LB
547
545
LC
627
541
(b)
527
591
565
541
565
575
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581
579
593
587
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(c)
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541
565
575
565
581
579
587

FIG. 51

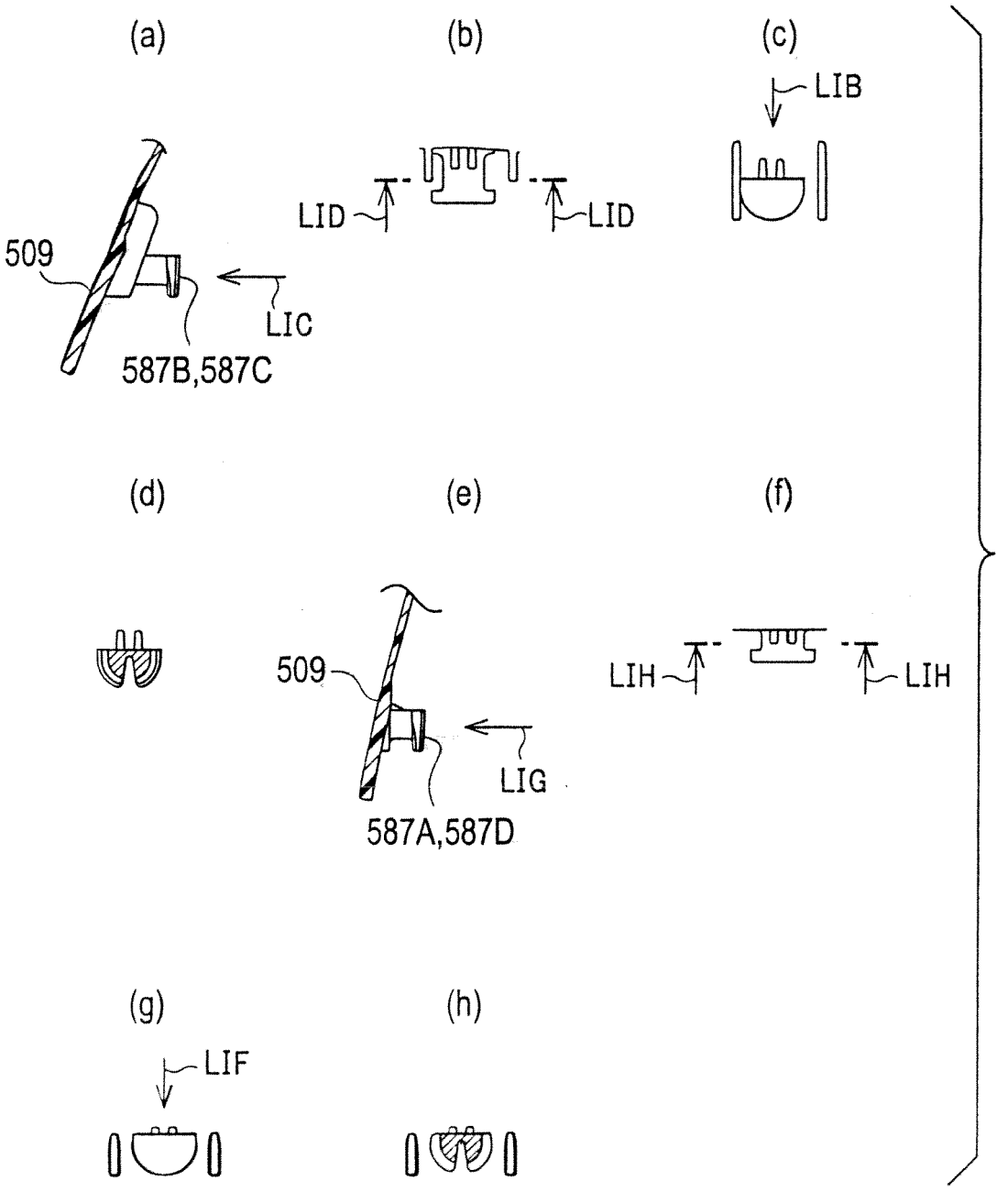
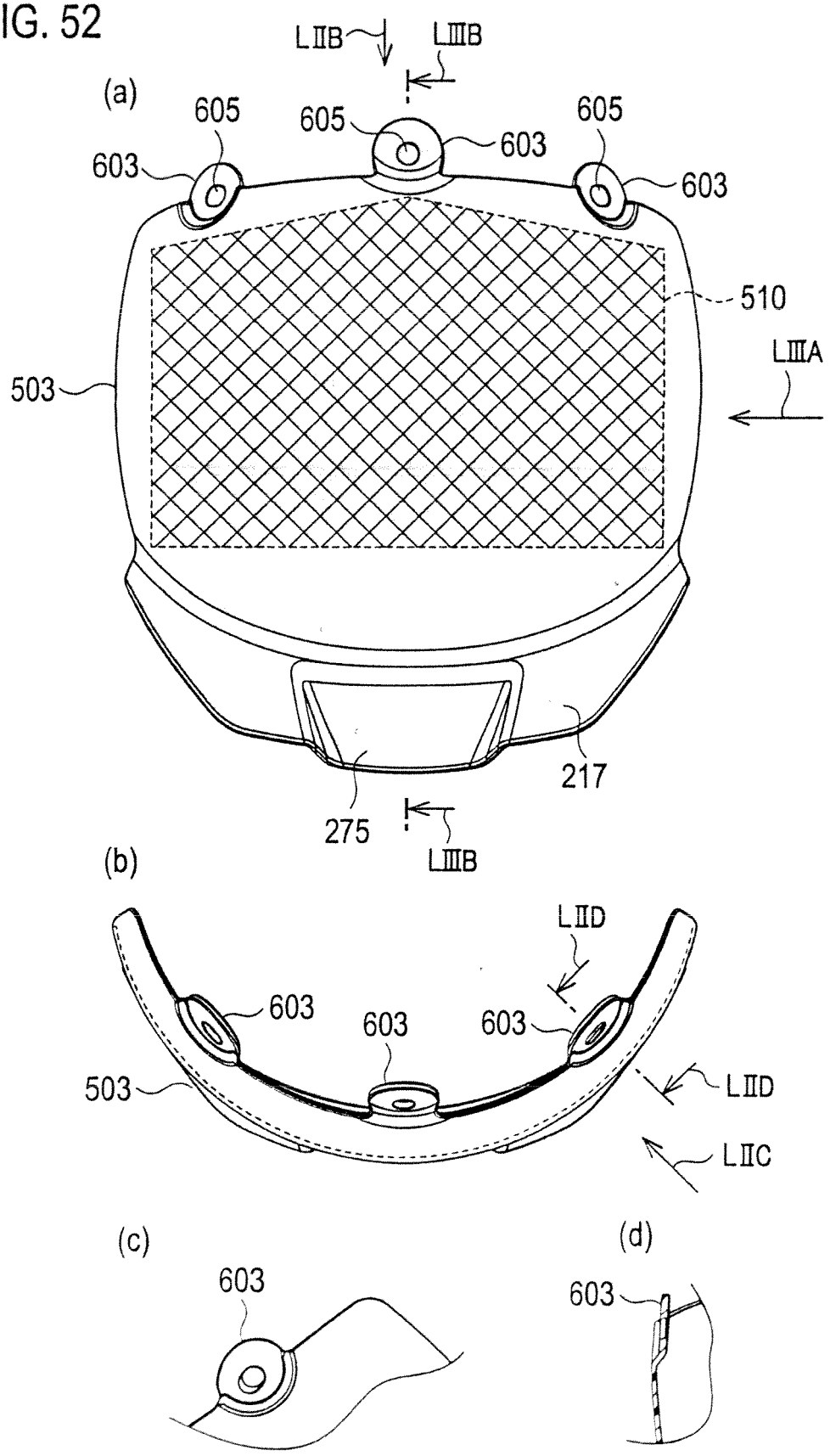

(a)
(b)
(c)
LIB
509
LID
LID
LIC
587B,587C
(d)
(e)
(f)
509
LIH
LIH
LIG
587A,587D
(g)
(h)
LIF

FIG. 52


(a)
LIIB
LIIIB
605
605
605
603
603
603
510
LIIIA
503
217
275
LIIIB
(b)
LIID
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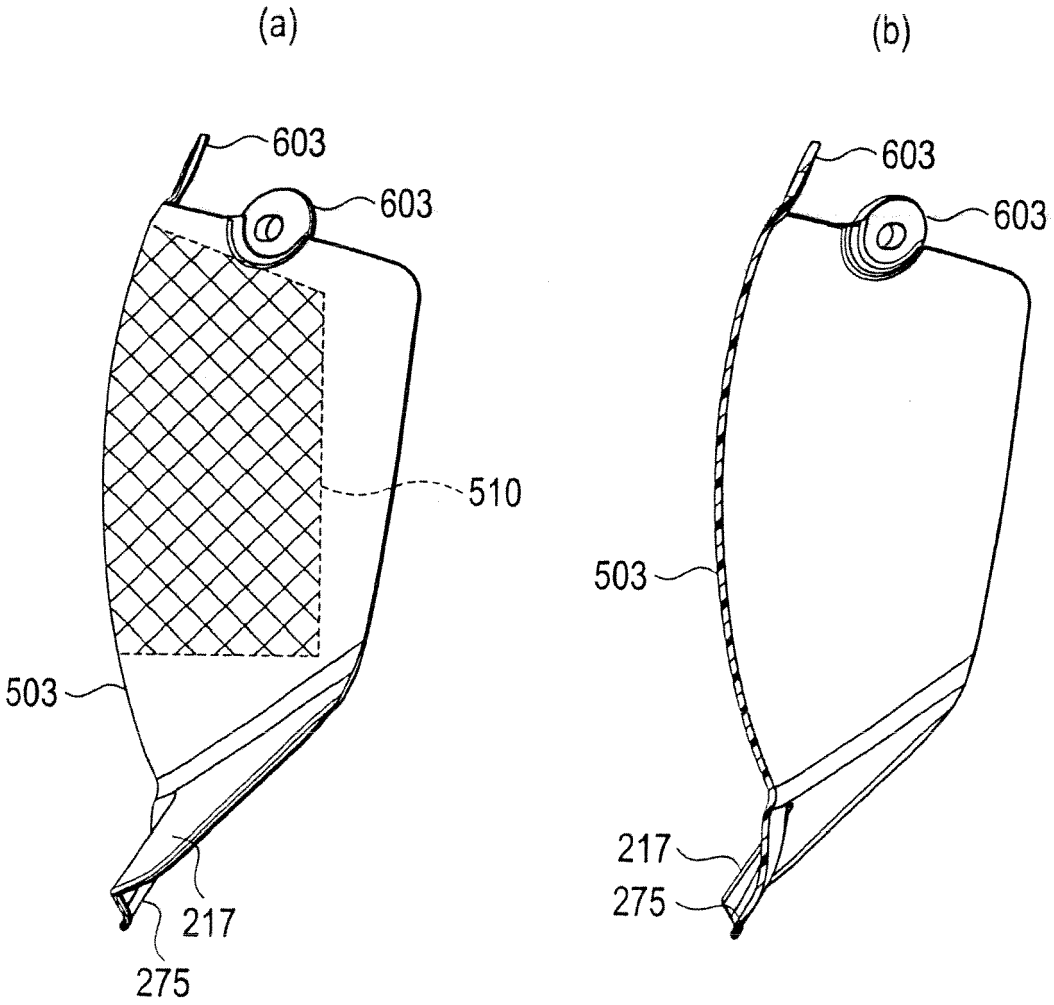
603
603
503
LIID
LIIC
(c)
603
(d)
603

FIG. 53



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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