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3:05-CV-00979 MISSION I-TECH V. OAKLEY INCORPORATED

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1 DAVID B. ABEL (CA SBN 156744)
2 MICHAEL T. PURLSKI (CA SBN 216307)
3 MARK N. HURVITZ (CA SBN 222981)
4 SQUIRE, SANDERS & DEMPSEY L.L.P.
5 801 S. Figueroa Street, 14th Floor
6 Los Angeles, California 90017-5554
7 Telephone: (213) 624-2500
8 Facsimile: (213) 623-4581

9 Attorneys for Plaintiff
10 MISSION I-TECH HOCKEY, LTD.

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CLERK, U.S. DISTRICT COURT
SOUTHERN DISTRICT OF CALIFORNIA

BY: *[Signature]* DEPUTY

11 UNITED STATES DISTRICT COURT
12 SOUTHERN DISTRICT OF CALIFORNIA

13 MISSION I-TECH HOCKEY, Ltd., a
14 Nova Scotia, Canada corporation,

15 Plaintiff,

16 v.

17 OAKLEY, INC., a Washington
18 corporation;

19 Defendant.

Case **05 CV 0979** (RBB)

**PLAINTIFF MISSION I-TECH
HOCKEY LTD.'S COMPLAINT
FOR BREACH OF SETTLEMENT
AND LICENSE AGREEMENT,
AND PATENT INFRINGEMENT**

DEMAND FOR JURY TRIAL

20 Plaintiff Mission I-TECH Hockey, Ltd., for its Complaint for Breach of
21 Settlement and License Agreement and Patent Infringement alleges as follows:

22 **THE PARTIES**

23 1. Plaintiff Mission I-TECH Hockey, Ltd. ("Mission I-TECH") is a Nova
24 Scotia, Canada holding corporation with its principal places of business located in
25 Irvine, California. Mission I-TECH is a leading manufacturer and seller of hockey
26 equipment in the U.S., Canada, and other countries.

27 2. Defendant Oakley, Inc. ("Oakley") is a Washington corporation with
28 its principal place of business located in Foothill Ranch, California. Oakley does
business in this District and, more particularly, it manufactures and sells face-shield

1 sports gear protection products as well as eyewear, sunglasses, goggles, and other
2 products in the U.S. and other countries.

3 JURISDICTION AND VENUE

4 3. This Court has jurisdiction over the subject matter of this action
5 pursuant to 28 U.S.C. §§ 1331, 1367 and 1338. Claim 1 of this action arises from a
6 Settlement and License Agreement dated January 31, 2003, entered by Oakley and
7 Mission I-TECH ("Agreement") to settle a patent infringement suit brought in this
8 District, entitled *Oakley, Inc. v. I-TECH Sport Products, Inc.*, Case No. 01-CV-
9 2374 JM (LSP) (S.D. Cal.) (filed Dec. 28, 2001) (the "underlying infringement
10 suit"). That underlying infringement suit related to U.S. Patent No. 5,815,848 (the
11 "848 Patent"). A copy of the '848 Patent is submitted as Exhibit A. The
12 Agreement specifically provides that this Court shall have jurisdiction to resolve
13 any disputes relating to the enforcement of its terms and provisions. Claim 2 of this
14 action is for infringement of the '848 patent by Oakley.

15 4. Personal jurisdiction and venue for this action are proper in this Court
16 pursuant to 28 U.S.C. §§ 1391(b) and 1400(b) because: (a) defendant Oakley
17 regularly does business within this District; (b) defendant Oakley has committed,
18 and has threatened to commit, acts in this District in violation of both the express
19 terms and the intent of the Agreement and Mission I-TECH's rights thereunder; (c)
20 both the underlying infringement suit and the Agreement between Oakley and
21 Mission I-TECH were conducted in this District; and, on information and belief,
22 defendant Oakley has infringed the '848 patent in this District.

23 FACTUAL BACKGROUND

24 5. On December 28, 2001, Oakley brought a patent infringement action
25 in this District against I-TECH Sport Products, Inc. ("ITECH"). *See Oakley, Inc. v.*
26 *ITECH Sport Products, Inc.*, Case No. 01-CV-2374 JM (LSP) (S.D. Cal.) (filed
27 Dec. 28, 2001).

1 6. In the underlying infringement suit, Oakley alleged that ITECH sold
2 hockey face-shield products infringing the “‘848 patent”, the rights to which
3 Oakley had previously acquired by assignment. The ‘848 patent discloses an
4 impact-resistant face shield for use in protecting an individual’s face in sporting
5 events such as hockey.

6 7. In the interests of an expeditious and mutually beneficial compromise,
7 and without any admission of liability on the part of ITECH, Oakley and ITECH
8 entered into the Agreement.

9 8. As a result of a subsequent merger, Plaintiff Mission I-TECH is the
10 parent corporation and successor-in-interest to ITECH Sport Products, Inc., and the
11 present owner of the rights and obligations under the Agreement.

12 9. Pursuant to the Agreement, Mission I-TECH has an *exclusive*,
13 renewable license to manufacture, sell, and offer for sale hockey face-shield
14 products incorporating the ‘848 patent technology, in exchange for certain agreed
15 annual royalty payments, or a minimum annual payment. The exclusive license
16 rights became effective as of January 1, 2003. Under the Agreement, Mission I-
17 TECH has the right to renew its exclusive license for additional two-year terms, as
18 long as certain minimum annual sales targets are met. The exclusive license also
19 extends to all US and foreign patents related to the ‘848 patent, including U.S.
20 Patent No. 6,038,705 (the “‘705 patent,” submitted herewith as Exhibit B) and a
21 Canadian patent.

22 10. For its part, Oakley was obligated under the Agreement to enforce the
23 ‘848 patent against any third-party infringers. A Mandatory Enforcement List
24 (attached as Exhibit B to the Agreement) specified six companies, including “The
25 Hockey Company/Heaton,” against whom Oakley was obligated to enforce the ‘848
26 patent. The Hockey Company (hereinafter “THC”) is a Delaware corporation with
27 its principal place of business located in Westmount, Quebec, Canada. THC is a
28 subsidiary of Reebok, International, Ltd. (“Reebok”).

1 11. The Agreement specifically provided that Oakley shall use
2 commercially reasonable efforts to resolve disputes against third-party
3 infringement, but shall *not* license any third-party infringer *nor* manufacture for the
4 benefit of any third party similar products incorporating the '848 patent, the '705
5 patent or any foreign equivalent thereof.

6 12. The Agreement thus expressly prohibited Oakley from licensing the
7 '848 and '705 patents to other parties in the hockey face-shield market *and* from
8 manufacturing hockey face-shield products covered by the '848 and/or '705 patents
9 for the benefit of any third-party infringers, including specifically THC.

10 13. At the time the Agreement was executed, both parties intended that
11 ITECH would have an exclusive license to the '848 patent for hockey face-shield
12 products, and that during the term of the Agreement no party other than ITECH
13 would thereafter have the right to manufacture, sell, or offer for sale products
14 covered by the '848 patent in this market with ITECH's prior approval.

15 14. According to the sworn declaration of Oakley's Chief Executive
16 Officer and Chairman of its Board of Directors, James H. Jannard, Oakley had
17 chosen to enter into the Agreement because Oakley: lacked the ability to effectively
18 market and supply patented hockey shield products in quantities to meet consumer
19 demand; needed a "business partner;" and determined that of all the companies
20 making hockey shields at that time, "Itech was the most desirable." (See
21 Declaration of James H. Jannard, filed in *Oakley, Inc. v. Jofa AB, et al.*, Case No.
22 SACV 03-1185 DOC (ANx) (C.D. Cal.)). Jannard further declared under penalty
23 of perjury that as a result of the Agreement, "Oakley and Itech together can meet
24 the customer demand for optically correct hockey shields."

25 15. On or about July 29, 2003, Oakley filed suit against THC, THC
26 Holdings, and related companies for infringement of the '848 patent. See *Oakley,*
27 *Inc. v. Jofa AB, et al.*, Case No. SACV 03-1185 DOC (ANx) (C.D. Cal.) (the
28

1 “THC Infringement Action”). As discussed above, THC was one of the six
2 companies included in the Mandatory Enforcement List attached to the Agreement.

3 16. In its complaint filed in the THC Infringement Action, Oakley made a
4 judicially binding admission that as a result of the Agreement, “the *only* entities
5 authorized to use, manufacture, sell, or offer for sale products embodying the
6 claimed technology of the ‘848 patent are Oakley and Itech.” (See Plaintiff Oakley,
7 Inc.’s Second Amended Complaint for Patent Infringement, ¶ 11, retitled *Oakley*,
8 *Inc. v. The Hockey Company Holdings, Inc., Reebok International, Ltd. et al.*, Case
9 No. SACV 03-1185 DOC (ANx) (C.D. Cal.) (emphasis added)).

10 17. On information and belief, to protect the validity of its patents and
11 their protection of the lucrative market for clear face shields for football helmets
12 against competition from Reebok, and to gain substantial income from a second
13 source in the hockey face-shield market, Oakley recently entered into a distribution
14 agreement with THC to resolve the THC Infringement Action, whereby THC has
15 become the exclusive worldwide distributor of Oakley’s hockey shield products
16 covered by the ‘848 and ‘705 patents and related Canadian patent. Under the
17 distribution agreement, THC is now authorized to sell and offer for sale hockey
18 shield products embodying the technology of the ‘848 and ‘705 patents, in direct
19 contravention of Oakley’s earlier Agreement with Mission I-TECH.

20 18. Upon learning of the prospect of a distribution agreement between
21 Oakley and THC, Mission I-TECH notified Oakley that any such arrangement
22 would violate the Agreement and Mission I-TECH’s rights thereunder. Undeterred,
23 Oakley continued its discussions with THC to finalize the above-referenced
24 distribution agreement without Mission I-TECH’s approval or participation.

25 19. On information and belief, Oakley is manufacturing, for the benefit of
26 THC, hockey face-shield products that utilize the technology of the ‘848 and ‘705
27 patents. Such hockey face-shield products are being advertised by THC as being
28 protected by the Oakley patents.

1 20. As the exclusive licensee of the '848 and '705 patents in the limited
2 field of hockey shield products, Mission I-TECH has standing to assert the claim of
3 patent infringement of the '848 and '705 Patents as against Oakley. *See U.S.*
4 *Values, Inc. v. Dray*, 212 F.3d 1368 (Fed. Cir. 2000).

5 21. Accordingly, this action is brought to enforce the Agreement against
6 Oakley, to vindicate Mission I-TECH's rights thereunder, and to seek remedies for
7 Oakley's breach of the Agreement and infringement of the '848 and '705 patents.

8 **FIRST CAUSE OF ACTION AGAINST DEFENDANT OAKLEY, INC.**

9 **(BREACH OF SETTLEMENT AND LICENSE AGREEMENT)**

10 22. The allegations of Paragraphs 1 through 21 of the Complaint are re-
11 alleged and incorporated by reference as though fully set forth herein.

12 23. The Agreement between Oakley and Mission I-TECH was and is a
13 valid contract.

14 24. Mission I-TECH has performed all of its obligations under the
15 Agreement and it has made the requisite sales volumes and paid the requisite
16 royalties to maintain and continue the exclusive license. Mission I-TECH has the
17 capacity and intent to perform all future obligations under the Agreement.

18 25. Pursuant to the Agreement, Oakley was and is prohibited from
19 licensing any third-party under the '848 and/or '705 patents in the field of hockey
20 face-shields and from manufacturing for the benefit of any third party any similar
21 hockey face-shield products that incorporate the '848 and/or '705 patents or any
22 foreign equivalents thereof.

23 26. Oakley has breached, and on information and belief will continue to
24 breach, its duties under the Agreement. In particular, on information and belief,
25 Oakley has entered into a distribution agreement with THC in which Oakley
26 intends to and does manufacture hockey face-shield products covered by the '848
27 and/or '705 patents for the benefit of THC, allowing THC to sell and offer for sale
28 such hockey face-shield products to its customers and to the general public. Such a

1 distribution arrangement is a direct breach of the exclusive rights in the '848 and
2 '705 patents earlier granted by Oakley to Mission I-TECH.

3 27. As a result of Oakley's actions, Mission I-TECH has suffered and will
4 suffer monetary damages in an amount to be determined at trial.

5 28. Unless enjoined by this Court, Oakley will continue to engage in
6 actions that constitute a breach of its duties under the Agreement, including but not
7 limited to implementing the distribution agreement with THC. Mission I-TECH
8 will continue to suffer irreparable harm for which there is no adequate remedy at
9 law, including but not limited harm that is very difficult to quantify, such as harm
10 to Mission I-TECH's business relationships and its reputation in the marketplace.
11 Accordingly, Mission I-TECH is entitled to preliminary and/or permanent
12 injunctive relief requiring Oakley to specifically perform its duties under the
13 Agreement including but not limited to by canceling or assigning to Mission I-
14 TECH the distribution agreement with THC, and further prohibiting Oakley from
15 repudiating the terms and provisions of the Agreement.

16 **SECOND CAUSE OF ACTION**

17 **(PATENT INFRINGEMENT OF THE '848 AND '705 PATENTS)**

18 29. The allegations of Paragraphs 1 through 21 and 23 through 28 of the
19 Complaint are re-alleged and incorporated by reference as though fully set forth
20 herein.

21 30. At all times relevant hereto, Mission I-TECH was and is the exclusive
22 licensee of the '848 and '705 patents in the field of hockey face-shields pursuant to
23 the Agreement between Oakley and Mission I-TECH.

24 31. As the assignee of the '848 and '705 patents, Oakley is precluded by
25 the doctrine of assignee estoppel from asserting invalidity or unenforceability of the
26 '848 and '705 patents.
27
28

34. As a result of Oakley's actions, Mission I-TECH has suffered and will continue to suffer damages in an amount to be determined at trial.

PRAYER FOR RELIEF

1. That Mission I-TECH be awarded damages against Oakley, in an amount to be determined at trial;

2. That the Court issue a preliminary and/or permanent injunction preventing Oakley from violating or performing on any arrangement that violates the Agreement or infringing on the '848 and '705 patents, including but not limited to any arrangement whereby THC is allowed to distribute, sell, or offer for sale products incorporating the technology of the '848 and '705 patents;

1 3. That Oakley assign to Mission I-TECH all of the rights under the
2 distribution agreement it has made with THC.

3 4. That Mission I-TECH be awarded its costs of suit hereunder; and

4 5. Such further and other relief as the Court deems just and proper.

5
6 Dated: May 4, 2005

SQUIRE, SANDERS & DEMPSEY L.L.P.

7
8 By: _____

David B. Abel

9 Attorneys for Plaintiff
10 MISSION I-TECH HOCKEY, LTD.
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JURY TRIAL DEMAND

Plaintiff demands a trial by jury of all issues so triable, pursuant to Rule 38 of the Federal Rules of Civil Procedure.

Dated: May4, 2005

SQUIRE, SANDERS & DEMPSEY L.L.P.

By: 
David B. Abel

Attorneys for Plaintiff
MISSION I-TECH HOCKEY, LTD.



US005815848A

United States Patent [19]
Jarvis

[11] **Patent Number:** **5,815,848**
[45] **Date of Patent:** **Oct. 6, 1998**

[54] **IMPACT RESISTANT FACE SHIELD FOR SPORTING HELMETS**

[75] Inventor: **Edward C. Jarvis, Boxford, Mass.**

[73] Assignee: **Oakley, Inc., Foothill Ranch, Calif.**

[21] Appl. No.: **502,598**

[22] Filed: **Jul. 14, 1995**

[51] Int. Cl.⁶ **A42B 3/20**

[52] U.S. Cl. **2/424; 2/9; 2/425; 351/175**

[58] Field of Search **2/9, 10, 424, 425, 2/427, 428, 430; 351/170, 175, 41**

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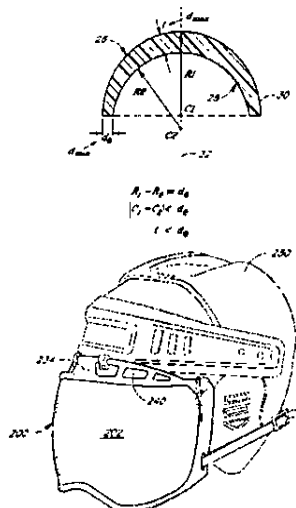
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Primary Examiner—Peter Nerbun
Attorney, Agent, or Firm—Knobbe, Martens, Olson & Bear, LLP

[57] **ABSTRACT**

An impact resistant face shield that includes a single formed arcuate lens portion that, in a first orientation, has a first curvature extending in a horizontal direction and a second curvature extending in a vertical direction. The lens portion has a top portion and a bottom portion that extends relatively inwardly towards the face of the wearer relative to an intermediate portion disposed between the top and bottom portions. Each curvature of the lens defines an arc of a circle having a substantially uniform radius to produce nominal levels of distortion, thereby reducing the prism effects created by the lens, and providing an optically corrected viewing window.

25 Claims, 8 Drawing Sheets



U.S. Patent

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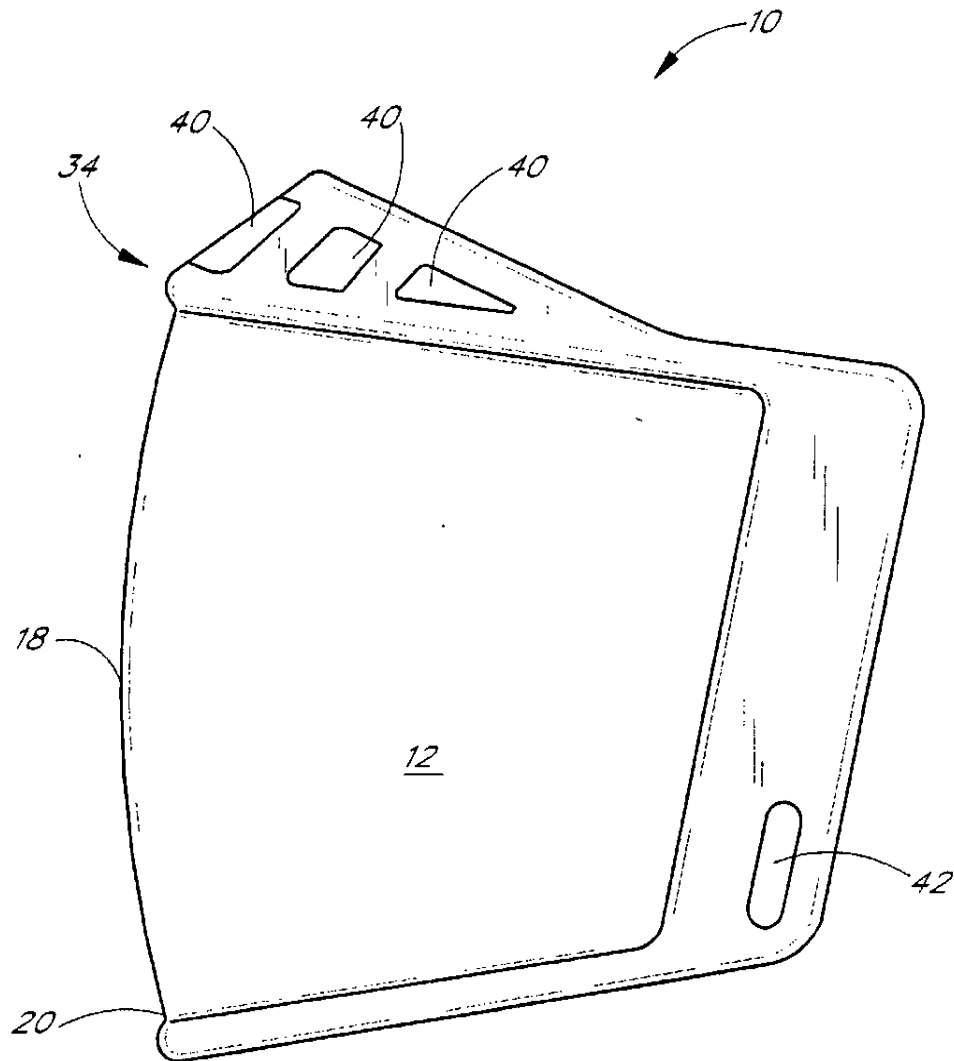


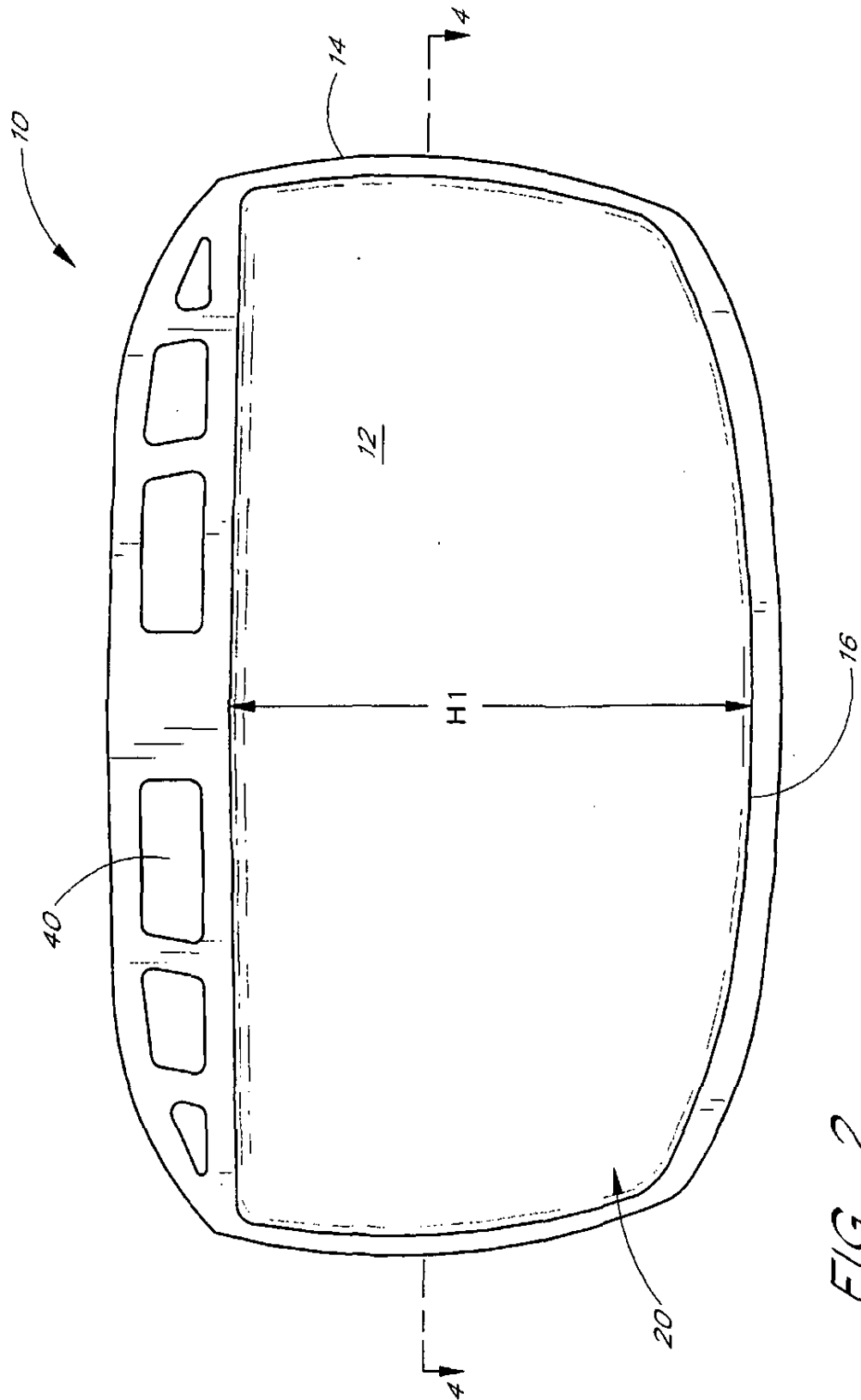
FIG. 1

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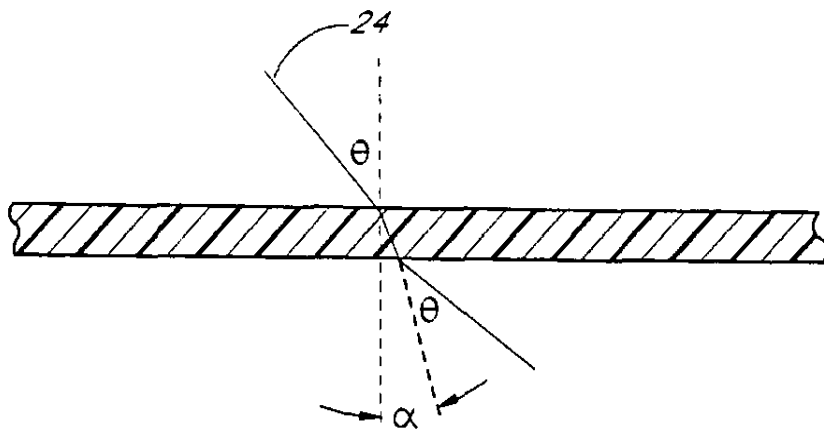
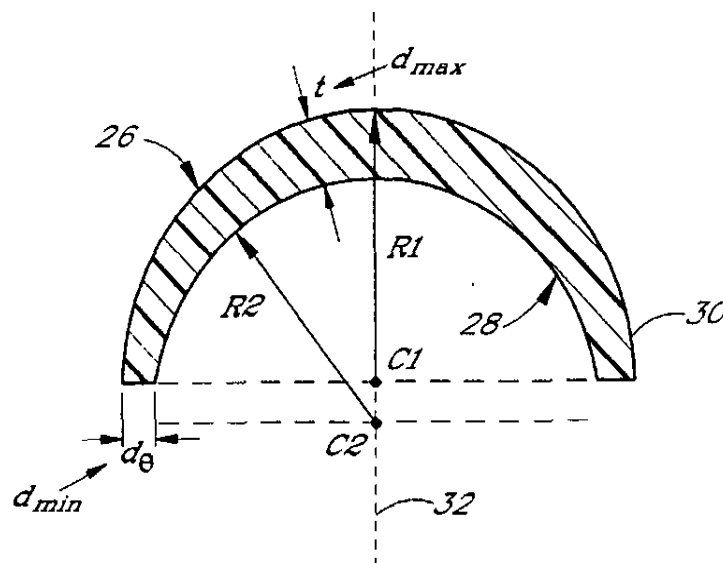


FIG. 3



$$R_1 - R_2 \approx d_\theta$$

$$|C_1 - C_2| < d_\theta$$

$$t < d_\theta$$

FIG. 4

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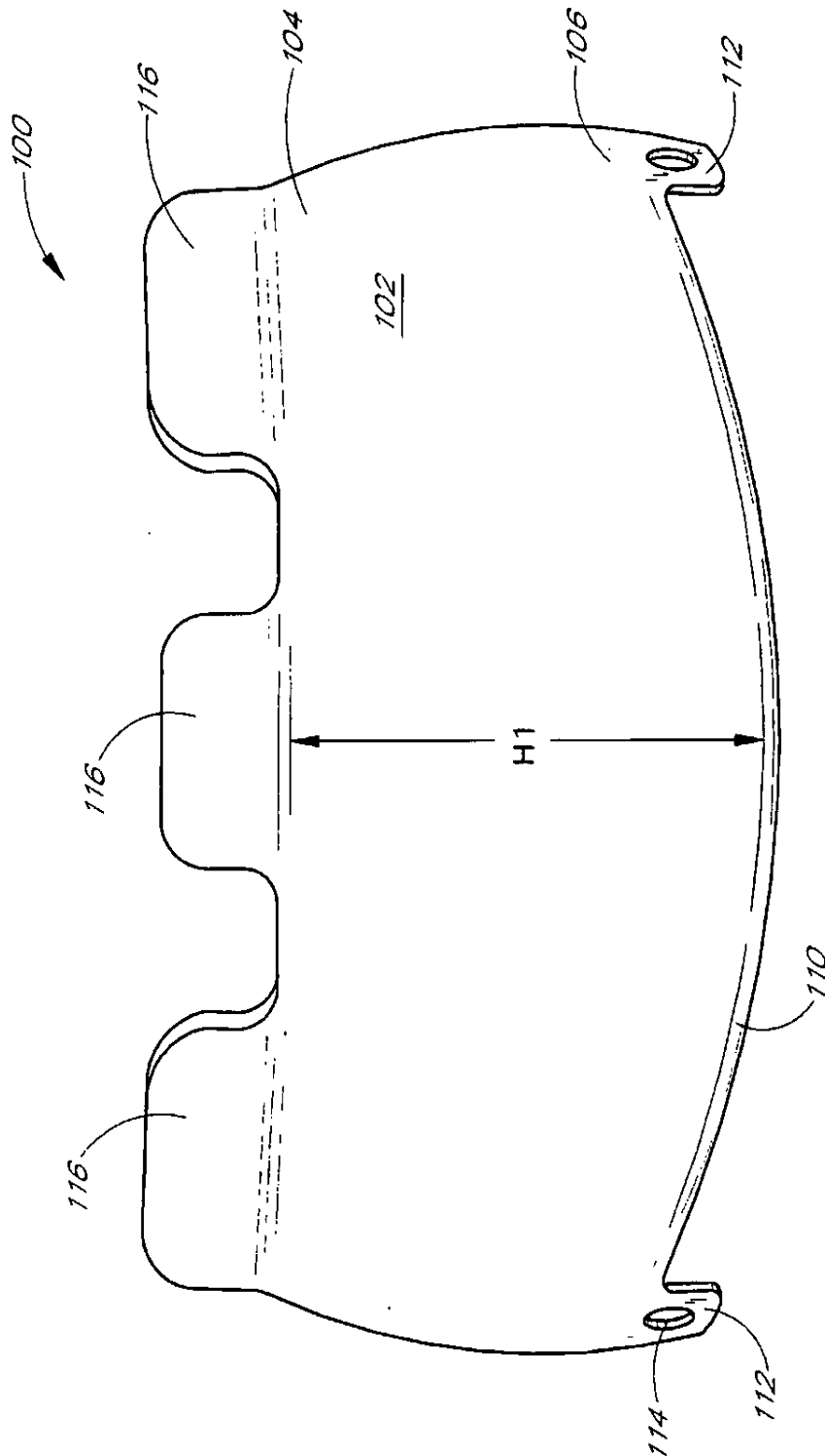


FIG. 5

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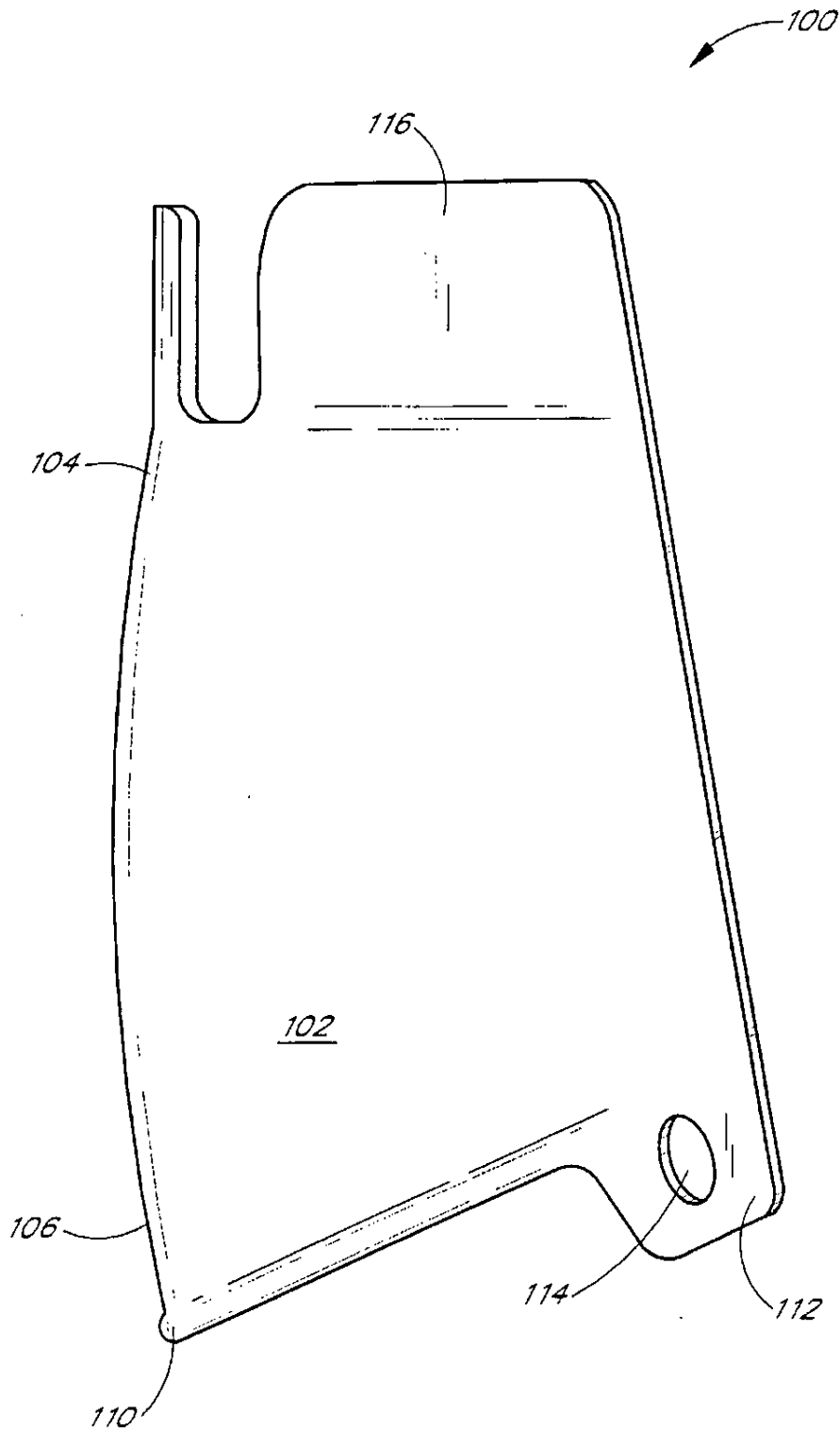


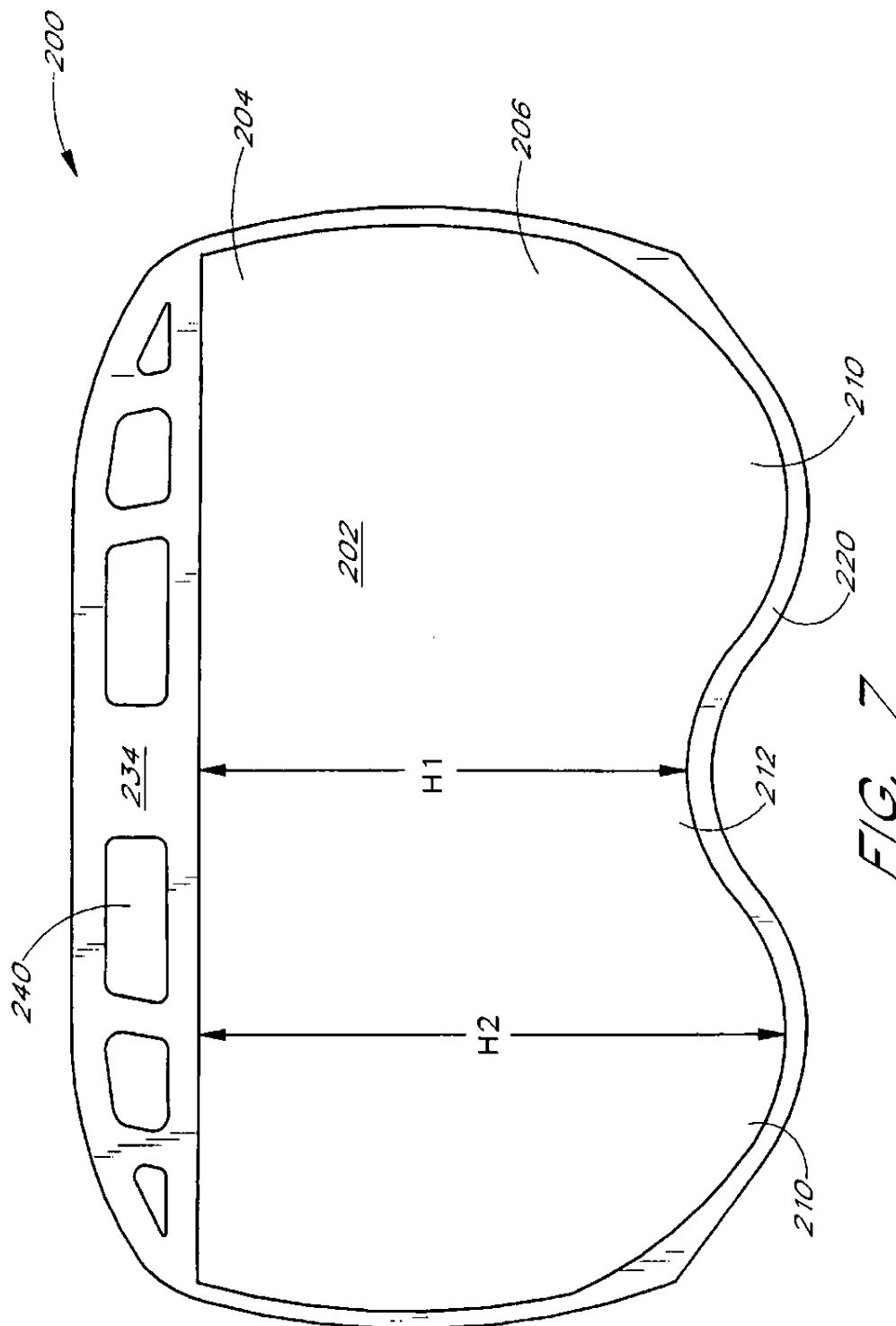
FIG. 6

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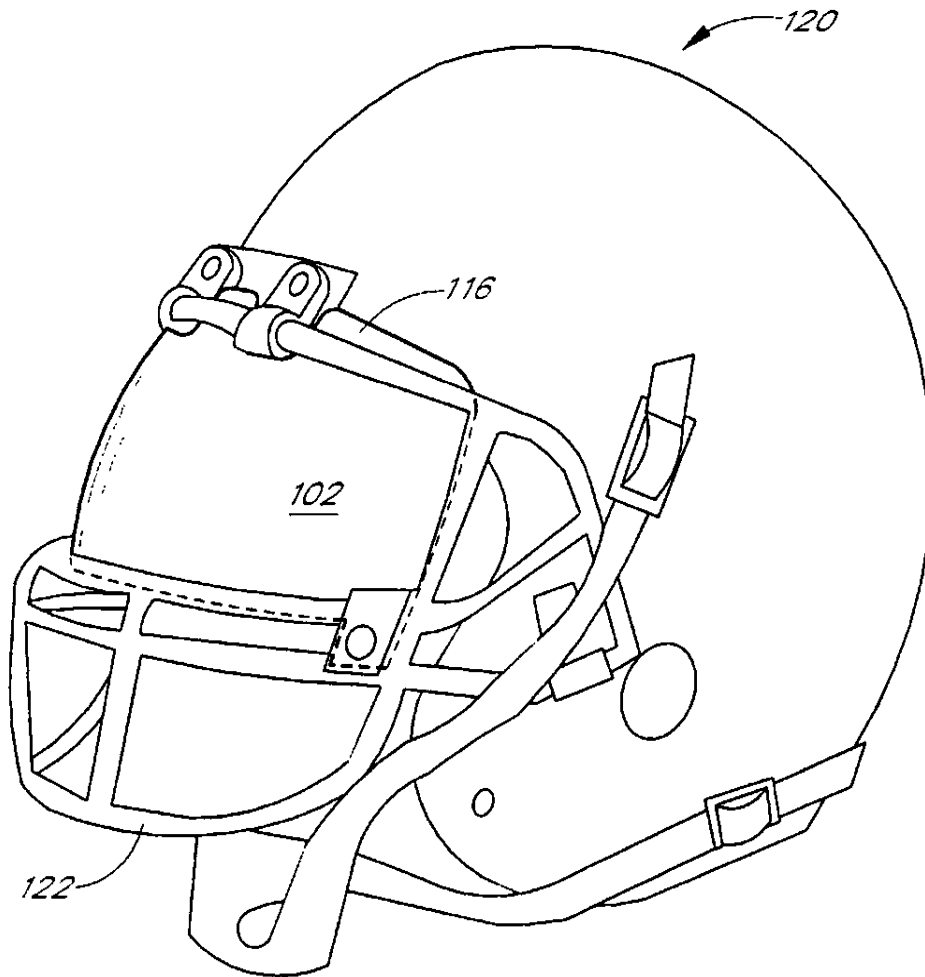


FIG. 8

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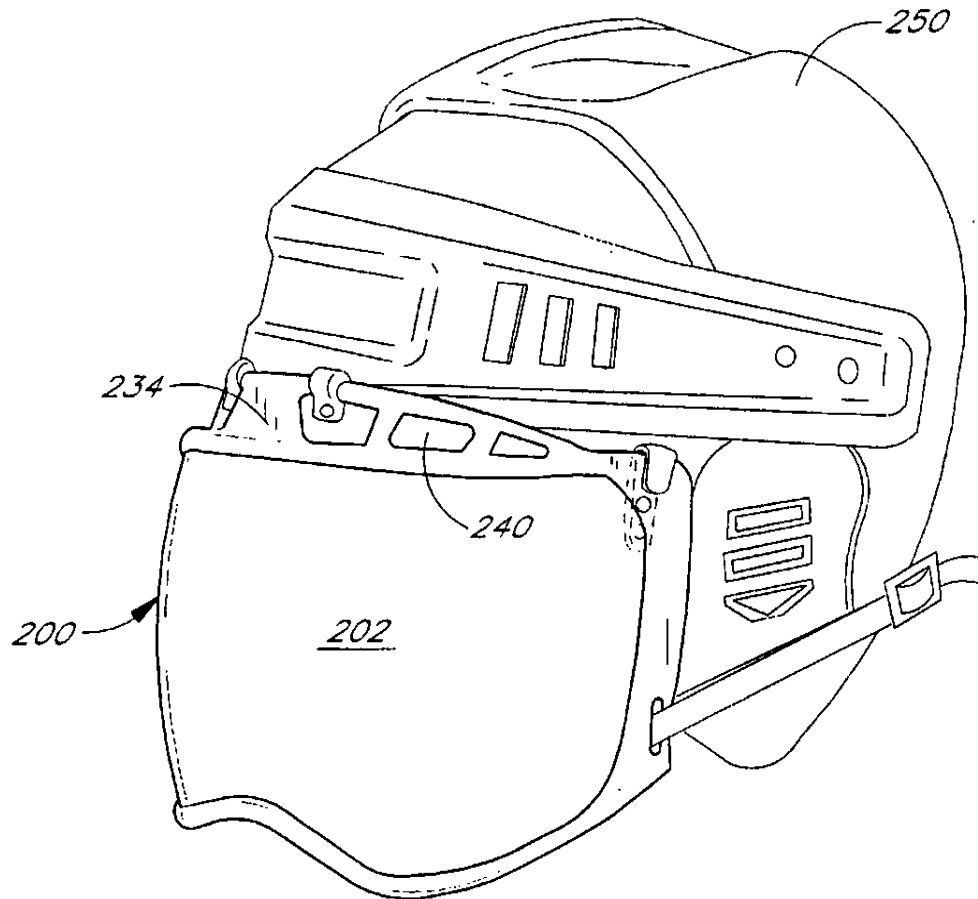


FIG. 9

5,815,848

1

IMPACT RESISTANT FACE SHIELD FOR SPORTING HELMETS

BACKGROUND OF THE INVENTION

This invention relates to mechanical protective devices, and more particularly to impact resistant face shields for use in protecting the face of an individual.

Today, sports are more popular than ever. This increase in popularity has resulted in an increase in the number of amateur and professional sport participants. Unfortunately, increased participation has resulted in an increase in the number of injuries suffered by individuals, and particularly in the number of facial injuries. Consequently, some sports now recommend and/or require the use of face shields or other facial protective devices when participating in the sport. One such sport is hockey.

Conventional face shields suitable for use in sports, such as those manufactured by Itech Sports Products, Inc. under the trade designation ITECH® Type IV sports protector, typically consist of a transparent polycarbonate blank that is formed or molded into a convex shield, which is adapted for mounting to existing sport helmets. The shield, when mounted to the helmet, extends generally outwardly and away from the wearer's face. As a result of this mounting configuration, objects located in the external environment appear at least partially distorted. Thus, the molded polycarbonate blank introduces some distortion over a portion of the individual's field of view.

The distorting effects of conventional face shields creates a unique set of problems for the wearer. The shield can cause strain on the wearer's eyes, which over a period of time can have deleterious effects. Additionally, rapidly viewing objects through the face shield and conversely not through the face shield produces further eye strain by requiring the individual to focus differently for each different field of view.

Due to the foregoing and other shortcomings of existing face shields, an object of this invention is to provide a face shield that reduces optical distortion.

Another object of this invention is to provide a protective face shield that has relatively high optical clarity and resolution.

Still another object of the invention is to provide a face shield that reduces the eye strain.

Yet another object of the invention is to provide a face shield that is relatively strong and durable and relatively lightweight.

Other general and more specific objects of the invention will in part be obvious and will in part appear from the drawings and description which follow.

SUMMARY OF THE INVENTION

The present invention relates to protective face shields that provide for higher image resolution and contrast during use. The improved contrast and resolution is achieved by providing an impact resistant face shield that addresses optical and mechanical concerns. Specifically, the present invention provides for an optically-correct face shield.

The invention attains an optically correct face shield by structuring the face shield to have an inner radius, an outer radius, a thickness and a refractive index, where the foregoing are mated to provide for a shield that lies between a truly plano lens and a lens having concentric geometry, e.g., constant thickness. The optical qualities of the lens are such that the prism and dioptric power are relatively low, and preferably between about 0.01 diopter and about 0.10 diopter.

2

The face shield preferably includes a single formed arcuate lens portion that, in a first orientation, has a first curvature extending in a horizontal direction and a second curvature extending in a vertical direction. The lens portion has a top portion and a bottom portion that extends relatively inwardly towards the face of the wearer relative to an intermediate portion disposed between the top and bottom portions. Each curvature of the lens defines an arc of a circle having a substantially uniform radius to produce nominal levels of distortion, thereby reducing the prism effects, e.g., non-uniform distortions of the field, created by the lens, and providing an optically corrected viewing window.

According to one aspect, the lens portion of the face shield of the present invention has a thickness defined between outer and inner surfaces. The surfaces preferably have different radii of curvatures about centers that are shifted relative to each other. This eccentricity shifts one surface with respect to the other, to create a curved lens that has a thickness d that varies along the arc length of the face shield. The diametral lines of the surfaces are shifted such that the inner surface is moved back from a concentric position, thickening the central portion of the lens, and creating edges that are thinner relative to the central thickened region. This variable thickness, and particularly the thinning effect of the lens at the edges, optically corrects the lens at the peripheral regions by reducing the occurrence of prismatic deviations and overall prism imbalance.

According to another aspect of the invention, the shield preferably includes a frame structure that is formed about at least a portion of the lens. According to one embodiment, the frame includes ventilation apertures formed in a top portion of the face shield. The ventilation apertures allow air to flow through the mask to provide for proper ventilation of the shield to resist or remove fogging.

According to another practice of the invention, the face shield surrounds a substantial portion of the wearer's face when situated properly thereabout. In this position, the inside surface of the lens is substantially non-oblique relative to the wearer's face and the wearer's field of view is substantially normal to the inside surface of the lens about most of the field of view. Additionally, the face shield extends in the vertical direction a distance sufficient to include a substantial portion of the downward field of view without imposing upon the wearer the distortions and aberrations created by the edges of the shield.

The present invention further pertains to a face protective shield having a shield body formed of strong clear polymeric material having a peripheral region and a central region. The peripheral region includes an attachment element for securing the shield body in front of the wearer's face. The central region is preferably formed as a viewing window sized to extend around in front of the wearer's face. According to one aspect, the shield has a thickness effective to survive impact without cracking and curves in both horizontal and vertical planes over substantially the entire central region to introduce a degree of lensing and correct viewing aberrations.

According to another aspect, the central region has front and rear surfaces. The front surface has a radius of curvature R_f greater than the rear surface radius of curvature R_r , such that $R_f - R_r = \delta$. According to still another aspect, the centers of curvature of the front and rear surfaces are spaced closer than δ .

According to another aspect, the lensing power of the shield is negative in at least the horizontal plane.

Other general and more specific objects of the invention will in part be obvious and will in part be evident from the drawings and description which follow.

5,815,848

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BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features and advantages of the invention will be apparent from the following description and apparent from the accompanying drawings, in which like reference characters refer to the same parts throughout the different views. The drawings illustrate principles of the invention and, although not to scale, show relative dimensions.

FIG. 1 is a side view of a first embodiment of the face shield of the present invention.

FIG. 2 is a front view of the face shield of FIG. 1.

FIG. 3 is a schematic representation of light rays impinging upon a conventional plano lens.

FIG. 4 is a cross-sectional view of the face shield of FIG. 2 taken along lines 4—4 illustrating the varying thickness of the shield of the present invention.

FIG. 5 is a front view of a second embodiment of the face shield of the present invention.

FIG. 6 is a side view of the face shield of FIG. 5.

FIG. 7 is a front view of a third embodiment of the face shield of the present invention.

FIG. 8 is a perspective view of the face shield of FIG. 5 mounted to a conventional sporting helmet.

FIG. 9 is a perspective view of the face shield of FIG. 7 mounted to a conventional sporting helmet.

DESCRIPTION OF ILLUSTRATED EMBODIMENTS

FIGS. 1—4 illustrate the general principles of the protective face shield of the present invention. These general principles pertain to each of the additional face shield embodiments set forth and described below.

FIGS. 1 and 2 illustrate a first embodiment of the face shield 10 of the present invention. The face shield 10 includes a unitary curved lens portion 12 that is encompassed by a beaded frame structure 14 disposed about a substantial portion of the periphery of the lens. Preferably, the beaded frame 14 is integrally molded with the lens portion 12.

The lens portion 12 has a first or horizontal curvature 16 (as seen in a horizontal plane), and a second vertical curvature 18. The horizontal curvature 16 has a circular cross-section and approximates a complete semi-circle, e.g., subtends an arc of about 180°, and thus provides a wrap-around face shield that covers and protects the face of the wearer while providing a window portion that extends about a substantial portion of the wearer's potential field of view. The potential field of view is substantially greater than the actual view of any moment, and includes the extremes at each side that become visible as the wearer rotates his eyes, but without re-orienting his head. The vertical curvature 18 has a circular cross-section, and a bottom portion 20 that extends relatively inwardly towards the face of the wearer relative to an intermediate portion 22 of the lens 12. The wrap-around configuration of the lens 12 in both the horizontal and vertical directions provides a single view pane through which the wearer observes the external environment. This configuration allows the wearer to observe objects at any location through the lens portion 12 without requiring the wearer to change viewing environments, for example, view one object through the lens and another object at a different location outside of the view frame of the lens. A significant advantage of this is that it reduces eye strain by allowing the wearer to view the environment through a single wrap-around window.

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It is known that light rays striking a plano lens of known construction at a selected angle θ emerge from the lens at the angle θ but offset by a selected displacement α determinable by known formulae, as shown in FIG. 3. For example, a light ray 24 that impinges upon the lens is offset the distance α , which is dependent upon the lens thickness, the angle of incidence and the refractive index of the lens material. The light ray 24 exits the lens at the angle of incidence θ . These variations in the refraction of light introduce distortions into the field of view, particularly when viewing objects along a sight line that intersects the window obliquely. Thus, an object located at or near the periphery of the field of view may appear elongated and/or shifted in space relative to the actual spatial location of the object. This phenomena represents a common problem with conventional impact resistant face shields. Since the shields must be sufficiently thick to attain strength, they necessarily introduce distortion effects.

Referring again to FIGS. 1 and 2, each curvature 16 and 18 of the lens portion 12 defines an arc of a circle having a substantially uniform radius. This dual-curvature configuration provides a viewing window that is oriented almost normal to the line of sight as the wearer's eyes rotate to view objects. It produces only nominal levels of distortion, reducing the prism effects, e.g., non-uniform distortions of the field, created by the lens portion 12, and provides an optically corrected viewing window. Although a variety of radii might accrue the advantages of the present invention, the radius of the horizontal curvature 16 is preferably in the range between about 3 inches and about 5 inches, and most preferably is about 4 inches. The radius of the vertical curvature is preferably in the range between about 6.5 inches and about 8.5 inches, and most preferably is about 7.4 inches. The foregoing radius dimensions represent the distance from arbitrary center of curvature points to the arc defined by each curvature of the illustrated face shield 10. This construction defines a uniform distance to allow a full and unobstructed viewing hemisphere.

Those of ordinary skill will readily recognize that the lens portion 12 of the face shield 10 of the present invention has a thickness defined between outer and inner surfaces, and thus could be defined as having merely a single radius only when it has constant thickness. However, preferably, as shown in FIG. 4, which is a cross-sectional view of the face shield 10 of FIG. 2 taken along line 4—4, the lens portion 12 has a thickness or depth dimension d_0 along its entire arc length, which is defined between an outer facing (convex) surface 26 having a radius $R1$ and an inner facing (concave) surface 28 having a radius $R2$. In this embodiment, the radius $R2$ is less than the radius $R1$ and eccentric relative thereto. Specifically, the surfaces 26 and 28 have different radii of curvatures about centers that are shifted relative to each other. This eccentricity shifts one surface with respect to the other, to create a curved lens that has a thickness d_0 that varies monotonically away from a centerpoint, e.g., is tapered toward the edge, along the arc length of the face shield. Preferably, the inner concave surface 28 is not completely circular, but rather one surface at least is non-diametral to produce a minimum thickness d_{min} at the edges 30 of the face shield. Furthermore, the diametral lines of the two surfaces are shifted such that the rear surface is moved back from a concentric position, thickening the central portion of the lens to produce a maximum thickness d_{max} at or near centerline 32. As illustrated, the distance between the centerpoint $C1$ for radius $R1$ and the centerpoint $C2$ for radius $R2$ is preferably between 1 and 2 mm, but those of ordinary skill will recognize that this distance can vary

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depending upon the desired thickness of the shield at the center or at the edges of the lens in order to achieve a particular degree of bending, breaking, tensile or impact strength. According to one practice the absolute value of the difference in centerpoints is less than the lens thickness d_0 .

As set forth above, plano (or constant-thickness) lenses introduce distortions or prismatic deviations into the field of view of the wearer by non-uniformly shifting light entering and exiting the lens. Lenses having truly concentric inner and outer radii, e.g., a plano lens bent into a circular shape, introduce prismatic deviations. This prism effect distorts, e.g., elongates or displaces, objects viewed by the wearer and this distortion is particularly exaggerated at the peripheral viewing regions of the lens. With reference to the present invention, the variable thickness d_0 , and particularly the thinning effect of the lens at the edge regions 30, optically corrects the lens at the peripheral regions by reducing the occurrence of prismatic deviations and overall prism imbalance. Specifically, the lensing effect of the lens 12 in conjunction with the relatively thinner edge regions 30 introduce relatively low levels of distortion and serve to optically correct the view over substantially the entire lens area. Thus, the term "optically-correct" as used herein is intended to refer to the reduction in prismatic deviations created by the particular design and geometry of each embodiment of the face shield of the invention as described above in relation to FIGS. 1 and 2 and below in relation to FIGS. 5-7, and further is intended to include a face shield that exhibits a relatively low dioptric power and a relatively low prism power over a substantial portion of the wearer's field of view. Preferably, the shield includes only a few hundredths of a diopter of controlled dioptric power, and has a negative lensing effect which compensates for the prism aberrations. Furthermore, by shifting the front and rear curved surfaces, a structural thickening is achieved in a central region of low distortion, allowing a lower prism thickness to be safely employed peripherally.

According to the face shield embodiment of FIGS. 1 and 2, the thickness d_{max} of the lens 12 at the centerline 32 is about 4 mm (0.157 inches) with a minimum thickness d_{min} at the edges 30 ranging between about 2 mm (0.0787 inches) and about 2.7 mm (0.102 inches). According to one practice, the lens thickness d_0 varies smoothly with increasing angle from d_{max} to d_{min} . The radius R1 preferably ranges between about 95 mm and about 110 mm, and most preferably about 100 mm and about 105 mm, and the radius R2 ranges between about 96 mm and about 103 mm, and most preferably is about 100 mm. For the vertical curvature 18 of the lens, R1 preferably ranges between about 180 mm and 192 mm, and most preferably is about 187 mm, and R2 ranges between about 178 mm and about 186 mm, and most preferably is about 183 mm.

Furthermore, the illustrated face shield 10 has a height H1 that varies about the length of the shield in the horizontal direction. The vertical height H1 preferably varies between about 3.75 inches and about 4.75 inches along the curvature of the shield, and preferably is about 4.25 inches as measured at the centerline.

Referring again to FIGS. 1 and 2, the illustrated frame structure 14 includes ventilation apertures 40 formed in a peripheral band of the top portion 34 of the face shield 10. The ventilation apertures allow air to flow through the mask, either in an upward or downward direction, to provide for proper ventilation of the shield to resist or remove fogging. The size and number of the ventilation apertures is not important to the teachings of the present invention. A thickness web may provide added strength about the ventilation openings.

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According to one practice, the face shield can be mounted to the head of the wearer or to various sport helmets by known retention mechanisms. For example, the face shield or protector 10 can be attached to a hockey helmet by way of conventional securing and mounting pins, hooks, straps, and like retention elements. One end of a securing strap preferably seats in the strap aperture 42 formed on either side of the frame member 14 to help secure the face shield to the helmet and about the face of the wearer.

When mounted on the helmet, the face shield 10 surrounds a substantial portion of the wearer's face, and particularly surrounds the upper portion of the face as well as the nose and portions of the cheeks. More particularly, the shield surrounds the face such that the inside surface of the lens is substantially non-oblique relative to the wearer's face and the wearer's field of view is substantially normal to the inside surface of the lens portion 12 of the shield 10 about most of the field of view. Additionally, the face shield 10 extends in the vertical direction a distance sufficient to include a substantial portion of the downward field of view without imposing upon the wearer the distortions and aberrations created by the edges of the shield. Specifically, the bottom portion of the face shield extends inwardly towards the wearer's face to allow the wearer to view the external environment through the lens portion at close distances, and through a contour which reduces obliqueness of incident rays.

The face shield 10 is composed of a transparent impact resistant material, such as polycarbonate, which has a refractive index of 1.586 at the helium d line. The face shield preferably meets selected strength and impact tests, including the Canadian impact testing standard CSA § 5.3.4. Those of ordinary skill will readily recognize that other suitable polymer materials can be used.

FIGS. 5 and 6 illustrate a second embodiment of the face shield of the present invention. The illustrated face shield 100 has a unitary lens portion 102 that has a top portion 104 and a bottom portion 106. The lens portion 102 also includes a horizontal curvature and a vertical curvature that exhibit the same properties as those described above in relation to the face shield 10 of FIGS. 1 and 2. The horizontal curvature of the face shield approximates a semi-circle and thus provides a wrap-around face shield that covers and protects the face of the wearer while providing a window portion that extends about a substantial portion of the wearer's field of view. This wrap-around configuration of the lens 102 in both the horizontal and vertical directions provides a single view pane through which the wearer observes the external environment. This configuration allows the wearer to observe objects at any location through the lens portion 102 without requiring the wearer to change viewing environments, for example, view one object through the lens and another object at a different location outside of the view frame of the lens.

According to one practice, the radius of the horizontal curvature is preferably between about 3.25 inches and about 5.25 inches, and the radius of the vertical curvature is preferably in the range between about 6.35 inches and about 8.35 inches, and most preferably is about 7.4 inches. The foregoing radius dimensions represent the distance from an arbitrary center point to the arc defined by each curvature of the illustrated face shield 100.

The illustrated face shield 100 also has a thickness d_0 that is defined by outer and inner curved surfaces, as described above in relation to FIGS. 1-2 and 4. the illustrated face shield 100 preferably has an outer radius R1 that ranges

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between about 95 mm and about 110 mm, and most preferably is about 103 mm, and the radius R2 ranges between about 96 mm and about 103 mm, and most preferably is about 101 mm. For the vertical curvature of the lens 102, R1 preferably ranges between about 180 mm and 192 mm, and most preferably is about 187 mm, and R2 ranges between about 178 mm and about 186 mm, and most preferably is about 183 mm.

The illustrated face shield 100 further has a height H1 that varies about the length of the shield in the horizontal direction. The height H1 preferably varies between about 2.3 inches and about 4.3 inches, and preferably is about 3.3 inches at the center.

The optical and physical design properties described above in relation to shield 10 accrue to this embodiment to form an optically correct face shield that withstands the impact of foreign bodies, without cracking or breaking.

Referring again to FIGS. 5 and 6, the bottom portion 106 has formed thereon a molded beaded portion 110 that reinforces the bottom edge of the shield while eliminating sharp contours. The bottom portion 106 further includes a pair of downwardly projecting tabs 112 that include a mounting aperture 114 that extends therethrough. The top portion of the face shield 100 includes a set of upwardly projecting mounting protrusions 116.

The face shield can be mounted to various sport helmets by known retention mechanisms. For example, the face shield or protector 100 can be attached to a football helmet 120 by way of conventional securing and mounting straps and like retention elements, as shown in FIG. 8. The shield 100 is secured to the face guard 122 of the helmet 120 by a set of T-bolts and nuts, and the top portion 104 of the shield 100 is wedged into the top of the face guard frame mounted directly to the helmet 120.

When mounted on the helmet, the face shield 100 surrounds a substantial portion of the wearer's face, and particularly surrounds the nose and portions of the cheeks. More particularly, the shield surrounds the face such that the inside surface is substantially non-oblique relative to the wearer's face and the wearer's field of view is substantially normal to the inside surface of the lens portion 12 of the shield 10. The face shield also extends about the face in the horizontal direction a distance sufficient to include at least a substantial portion of the field of view of the wearer.

FIG. 7 illustrates a third embodiment of the face shield 200 of the present invention. The illustrated face shield 200 has a unitary lens portion 202 that has a top portion 204 and a bottom portion 206. The lens portion 202 also includes a horizontal curvature and a vertical curvature that exhibit the same properties as those described above in relation to the face shield 10 of FIGS. 1 and 2. The horizontal curvature of the face shield approximates a semi-circle and thus provides a wrap-around face shield that covers and protects the face of the wearer while providing a window portion that extends about a substantial portion of the wearer's field of view. This wrap-around configuration of the lens 202 in both the horizontal and vertical directions provides a single view pane through which the wearer observes the external environment. This configuration allows the wearer to observe objects at any location through the lens portion 202 without requiring the wearer to change viewing environments, for example, view one object through the lens and another object at a different location outside of the view frame of the lens.

According to one practice, the radius of the horizontal curvature of the face shield 202 is preferably between about

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3 inches and about 5.5 inches, and most preferably is about 4 inches, and the radius of the vertical curvature is preferably in the range between about 6.5 inches and about 8.5 inches, and most preferably is about 7.4 inches. The foregoing radius dimensions represent the distance from an arbitrary center point to the arc defined by each curvature of the illustrated face shield 200.

The illustrated face shield 100 also has a thickness d_0 that is defined by outer and inner curved surfaces, as described above in relation to FIGS. 1-2 and 4. The illustrated face shield 200 preferably has an outer radius R1 that ranges between about 95 mm and about 110 mm, and most preferably is about 104 mm, and the radius R2 ranges between about 96 mm and about 105 mm, and most preferably is about 101 mm. For the vertical curvature of the lens 202, R1 preferably ranges between about 180 mm and 192 mm, and most preferably is about 188 mm, and R2 ranges between about 178 mm and about 186 mm, and most preferably is about 184 mm.

The lens portion further has a pair of downwardly projecting portions 210 that extend below an intermediate portion 212 to form secondary lens portions. These portions preferably have a radius between about 1.0 inch and 2.0 inches. The illustrated face shield 200 has a height H1 defined at the intermediate portion 212 that ranges between 3.5 inches and about 4.1 inches. The height H2 of the lens portion other than at the intermediate portion varies about the length of the shield in the horizontal direction. The height H2 preferably varies between about 4 inches and about 5 inches, and preferably is about 4.25 inches.

The optical and physical design properties described above in relation to shield 10 accrue to this embodiment to form an optically correct face shield that withstands the impact of foreign bodies, without cracking or breaking.

Referring again to FIG. 7, the bottom portion 206 has formed thereon a molded beaded portion 220 that reinforces the bottom edge of the shield while eliminating sharp contours. The beaded portion extends substantially about the entire periphery of the shield 200. The shield also includes ventilation apertures 240 formed in the top portion 234 of the bead. The ventilation apertures allow air to flow through the mask, either in an upward or downward direction, to provide for proper ventilation of the shield to resist fogging and aid clearing of the lens. The size and number of the ventilation apertures is not important to the teachings of the present invention.

The face shield can be mounted to various sport helmets by known retention mechanisms. For example, the face shield 200 can be attached to a hockey helmet 250 by way of conventional pins, hooks, and securing and mounting straps, and like retention elements, as shown in FIG. 9.

When mounted on the helmet, the face shield 200 surrounds a substantial portion of the wearer's face, and particularly surrounds the nose and portions of the cheeks. More particularly, the shield surrounds the face such that the inside surface is substantially non-oblique relative to the wearer's face and the wearer's field of view is substantially normal to the inside surface of the lens portion 202 of the shield 200. The face shield also extends about the face in the horizontal direction a distance sufficient to include substantially the entire field of view of the wearer. The secondary lens portions 210 further project downwardly to ensure capture of a substantial portion of the downward field of view.

The face shields of the invention shown and described above can be made from known processes and techniques, such as injection molding.

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The impact resistant face shield constructed according to the features of the present invention can be employed in a wide range of environments and for a wide range of uses. For example, the face shield shown and described above in relation to FIGS. 1-7 can be used by individuals for recreational and sporting activities in addition to football and hockey, such as skiing, roller-blading, soccer, basketball, baseball, lacrosse and other like activities. The face shield can also be employed in other industries by amateurs and/or professionals, such as by carpenters and medical personnel.

It will thus be seen that the invention efficiently attains the objects set forth above, among those made apparent from the preceding description. Since certain changes may be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are to cover all generic and specific features of the invention described herein, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. An arcuately molded face shield for mounting to sporting helmets suitable for use in sporting events, said face shield comprising:

a unitary, optically-correct lens portion for shielding against mechanical impact a substantial portion of a sport participant's face having, in a first orientation, a first curvature extending in a horizontal direction and a second curvature extending in a vertical direction, said vertical curvature terminating in a top portion and a bottom portion, said bottom portion extending relatively inwardly towards the face of the participant relative to an intermediate portion of said lens disposed between the top and bottom portions when mounted to the sporting helmet, and

frame means forming a frame integrally formed with and disposed about a portion of the periphery of said optically-correct lens portion in an as-molded condition, wherein said frame has a top portion, and further including ventilation means formed in said top portion of said frame for allowing air to pass freely therethrough.

2. A face protective shield for activity, comprising:

a shield body formed of strong clear polymeric material and having a peripheral region and a central region, the peripheral region including means for attaching to secure the shield body in front of a wearer's face, and the central region forming a viewing window sized to extend substantially entirely around in front of the wearer's face and having a thickness effective to survive impact without cracking, said thickness further introducing prism viewing aberrations, and said central region curves in horizontal and vertical planes over substantially the entire central region to introduce a degree of lensing and correct said viewing aberrations, wherein the central region has front and rear surfaces, wherein a radius of curvature R_f of said front surface is greater than a radius of curvature R_r of said rear surface, and wherein $R_f - R_r = \delta$, and centers of curvature of said front and rear surfaces are spaced closer than δ .

3. A face protective shield according to claim 2, wherein said central region has different front and back surface curvatures in a horizontal plane, and different front and back

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surface curvatures in a vertical plane, forming an arched central region having lensing power in two dimensions and with a greater central thickness than edge thickness.

4. A face protective shield according to claim 3, wherein said lensing power is negative in at least said horizontal plane.

5. A face protective shield consisting of a single molded sheet of polycarbonate curving about substantially 180° in a horizontal plane with a front diameter effective to fit around the face of a wearer and having different front and back surface radii of curvature about centers that are shifted to effectively correct vision throughout said shield while enhancing strength thereof.

6. An arcuately molded face shield for mounting to sporting helmets suitable for use in sporting events, said face shield comprising:

a unitary, optically-correct lens portion for shielding against mechanical impact a substantial portion of a sport participant's face, having, in a first orientation, a first curvature extending in a horizontal direction and a second curvature extending in a vertical direction, said vertical curvature terminating in a top portion and a bottom portion, said bottom portion extending relatively inwardly towards the face of the participant relative to an intermediate portion of said lens disposed between the top and bottom portions when mounted to the sporting helmet, wherein said optically-correct lens portion has a variable thickness that reduces distortions about the participant's field of view.

7. The face shield of claim 6, wherein said thickness of said optically-correct lens varies monotonically away from a centerpoint of said lens along said horizontal direction.

8. A face protective shield for activity, comprising:

a shield body formed of strong clear polymeric material and having a peripheral region and a central region, the peripheral region including means for attaching to secure the shield body in front of a wearer's face, and the central region forming a viewing window sized to extend substantially entirely around in front of the wearer's face and having a thickness effective to survive impact without cracking, said thickness further introducing prism viewing aberrations, and said central region curves in horizontal and vertical planes over substantially the entire central region to introduce a degree of lensing and correct said viewing aberrations, wherein said optically-correct lens portion has a variable thickness that reduces distortions about the participant's field of view.

9. The face shield of claim 6, wherein said thickness of said optically-correct lens varies monotonically away from a centerpoint of said lens along said horizontal plane.

10. An arcuately molded face shield for mounting to sporting helmets suitable for use in sporting events, said face shield comprising

a unitary, optically-correct viewing window defining a field of view for shielding against mechanical impact a substantial portion of a sport participant's face having, in a first orientation, a first curvature extending in a horizontal direction and a second curvature extending in a vertical direction, and wherein said optically-correct viewing window has a variable thickness to reduce distortions in said field of view.

11. The face shield of claim 10, wherein said thickness of said viewing window varies monotonically away from a centerpoint of said window.

12. The face shield of claim 10, wherein said optically-correct viewing window comprises ventilation means formed in a top portion thereof for allowing air to pass freely therethrough.

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13. The face shield of claim 10 wherein said optically-correct viewing window has a first distal end portion disposed on one end of the horizontal curvature of the lens, a second distal end portion disposed on an opposed end of the horizontal curvature, and a generally vertically extending intermediate portion disposed between the first and second distal portions, wherein at least portions of said first and second distal portions extend downwardly beyond said vertically-extending intermediate portion to form secondary window portions.

14. The face shield of claim 13, wherein said vertically extending intermediate portion of said optically-correct viewing window has a first selected height h_1 measured between the top and bottom portions of the optically-correct window that is in the range between about 3.5 inches and about 4.1 inches, and

said secondary window portions having a height h_2 defined between the top portion of the lens and the bottom portion of the lens that is in the range between about 4.0 inches and about 5.0 inches.

15. The face shield of claim 10, wherein said first curvature of said optically-correct viewing window has a radius in the range between about 3.0 inches and about 5.0 inches.

16. The face shield of claim 10, wherein said second curvature of said optically-correct viewing window has a radius in the range between about 6.5 inches and about 8.5 inches.

17. The face shield of claim 10, wherein each said secondary window portion has a radius in the range between about 1.0 inches and about 2.0 inches.

18. The face shield of claim 10, wherein said horizontal portion of said optically-correct viewing window has a first distal portion and an opposed second distal portion and an

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intermediate portion disposed therebetween, and wherein said lens portion has a height h_1 measured between the top and bottom portions of the lens that varies between the first and second distal portions, said height h_1 being in the range between about 3.75 inches and about 4.75 inches.

19. The face shield of claim 10, wherein said first curvature has a radius in the range between about 6.35 inches and about 8.35 inches.

20. The face shield of claim 19, wherein said second curvature has a radius in the range between about 6.35 inches and about 8.35 inches.

21. The face shield of claim 10, wherein said viewing window has an inner surface and an outer surface that define said thickness of said window, said outer surface having a radius of curvature different from the radius of curvature of said inner surface.

22. The face shield of claim 10, wherein said variable thickness of said window has a maximum thickness d_{max} of about 4 mm, and a minimum thickness d_{min} in the range between about 2 mm and about 2.7 mm.

23. The face shield of claim 21, wherein said radius of curvature of said inner surface is eccentric relative to said radius of curvature of said outer surface and smaller than said radius of said outer surface.

24. The face shield of claim 21, wherein said radius of curvature of said outer surface ranges between about 95 mm and about 110 mm.

25. The face shield of claim 21, wherein said radius of curvature of said inner surface ranges between about 96 mm and about 103 mm.

* * * * *



US006038705A

United States Patent [19]

Jarvis

[11] Patent Number: **6,038,705**[45] Date of Patent: ***Mar. 21, 2000**[54] **IMPACT RESISTANT FACE SHIELD**[75] Inventor: **Edward C. Jarvis, Boxford, Mass.**[73] Assignee: **Oakley, Inc., Foothill Ranch, Calif.**

[*] Notice: This patent is subject to a terminal disclaimer.

[21] Appl. No.: **09/167,056**[22] Filed: **Oct. 6, 1998**[51] Int. Cl.⁷ **A42B 3/20**[52] U.S. Cl. **2/424; 2/9; 2/425; 351/175**[58] Field of Search **2/9, 10, 424, 425, 2/427, 428, 430; 351/170, 175, 41**[56] **References Cited****U.S. PATENT DOCUMENTS**

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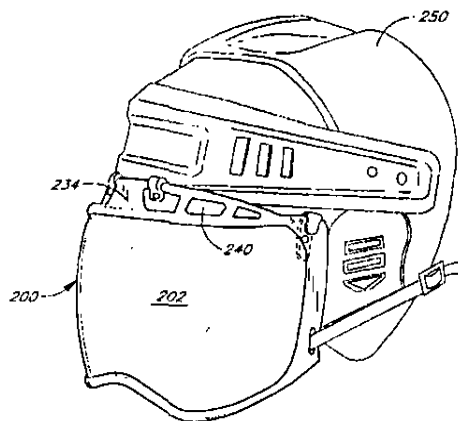
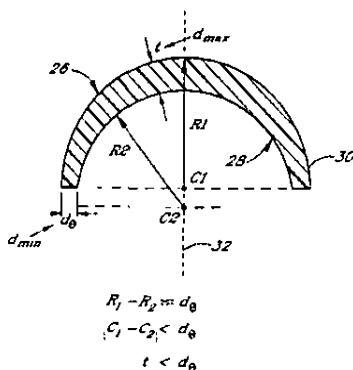
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Primary Examiner—Peter Nerbun*Attorney, Agent, or Firm*—Knobbe, Martens, Olson & Bear, LLP[57] **ABSTRACT**

An impact resistant face shield that includes a single formed arcuate lens portion that, in a first orientation, has a first curvature extending in a horizontal direction and a second curvature extending in a vertical direction. The lens portion has a top portion and a bottom portion that extends relatively inwardly towards the face of the wearer relative to an intermediate portion disposed between the top and bottom portions. Each curvature of the lens defines an arc of a circle having a substantially uniform radius to produce nominal levels of distortion, thereby reducing the prism effects created by the lens, and providing an optically corrected viewing window.

15 Claims, 8 Drawing Sheets

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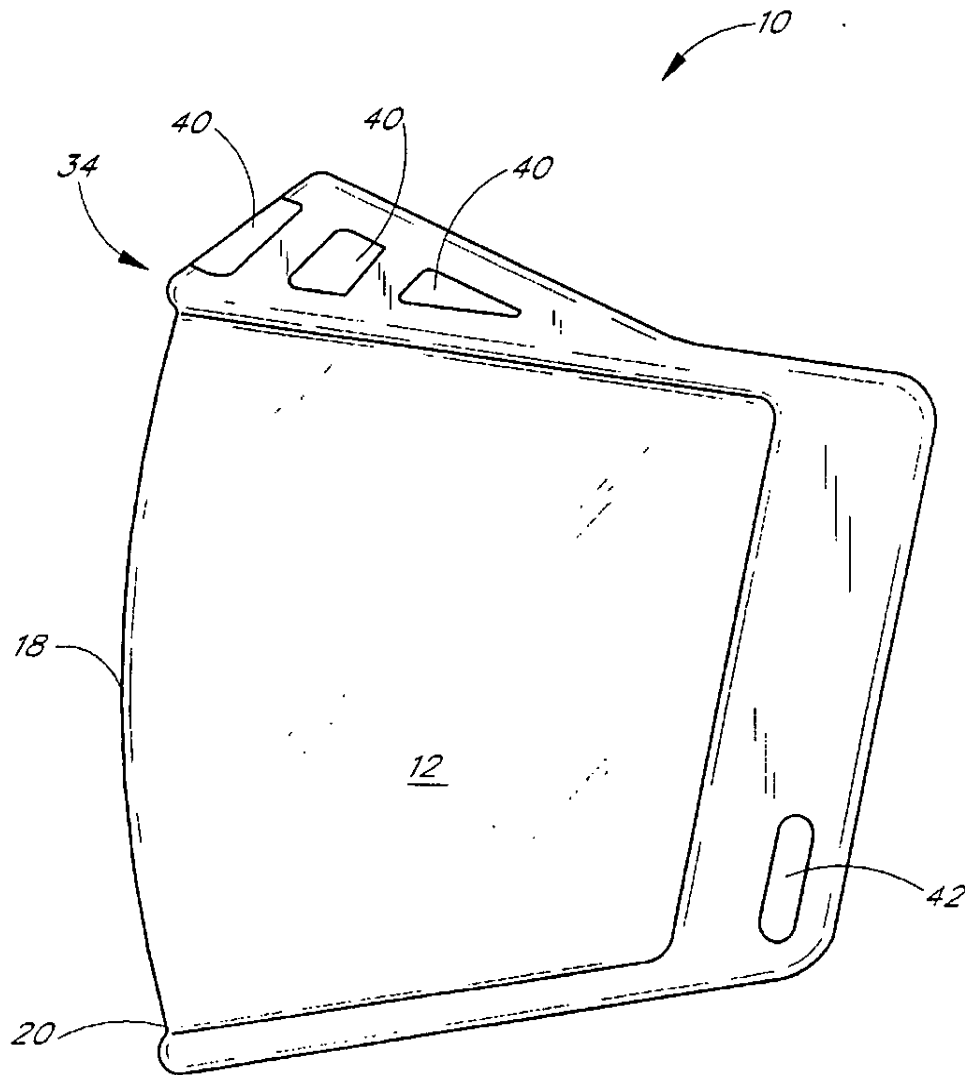


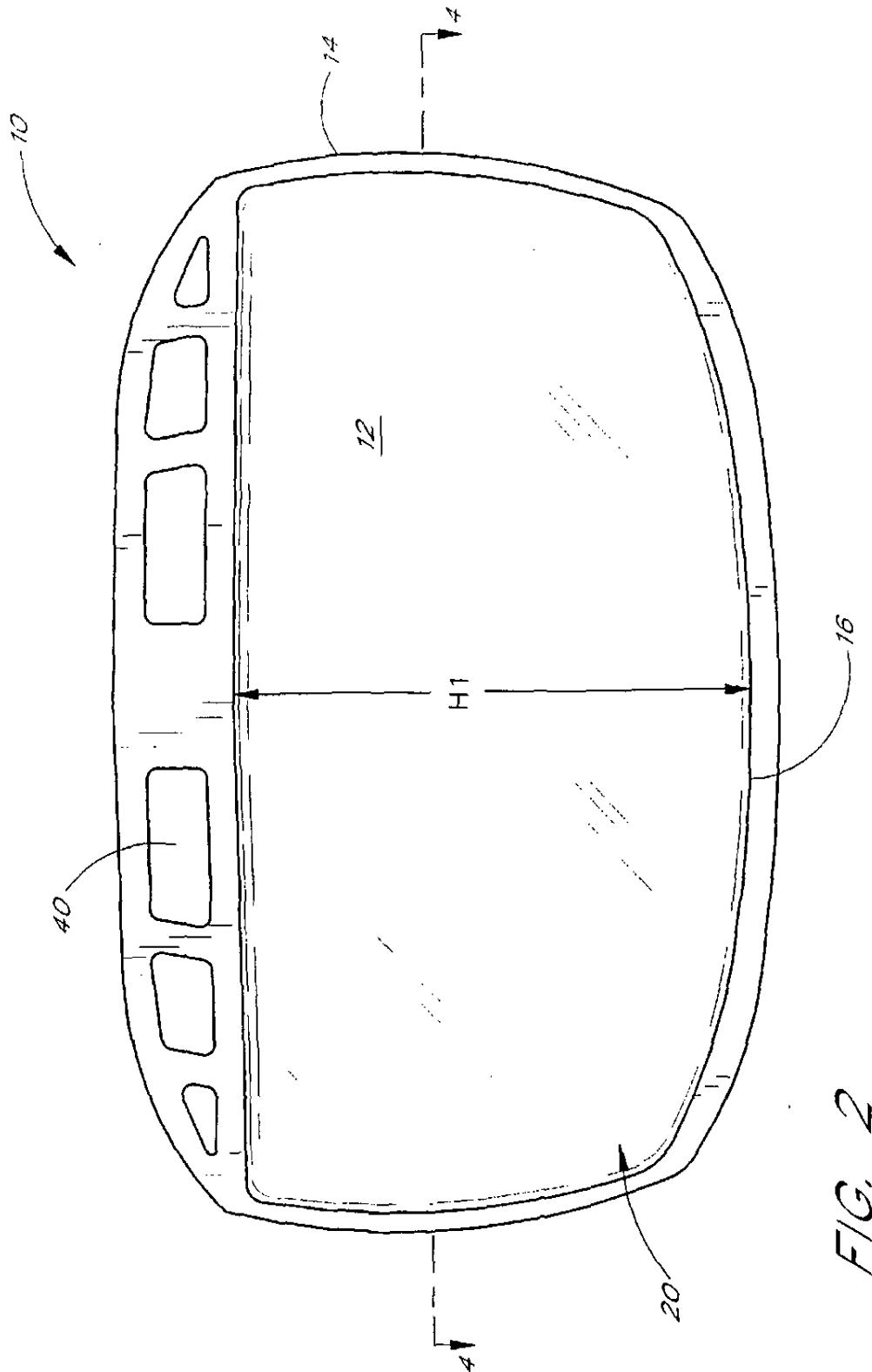
FIG. 1

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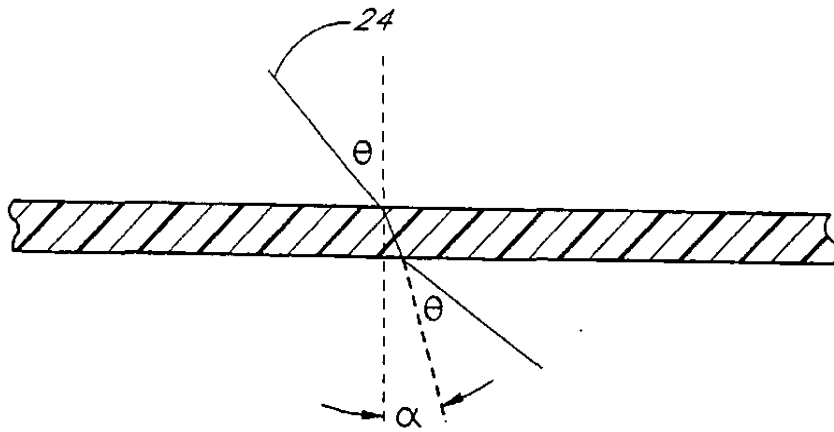
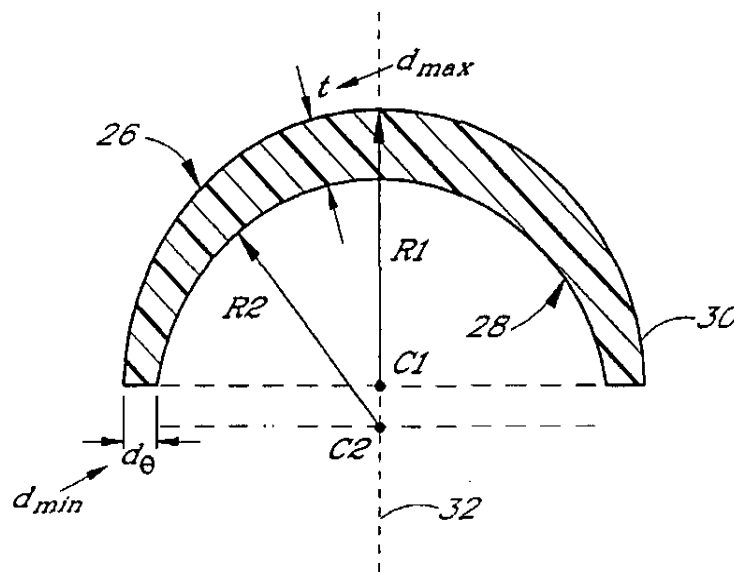


FIG. 3



$$R_1 - R_2 \approx d_\theta$$

$$|C_1 - C_2| < d_\theta$$

$$t < d_\theta$$

FIG. 4

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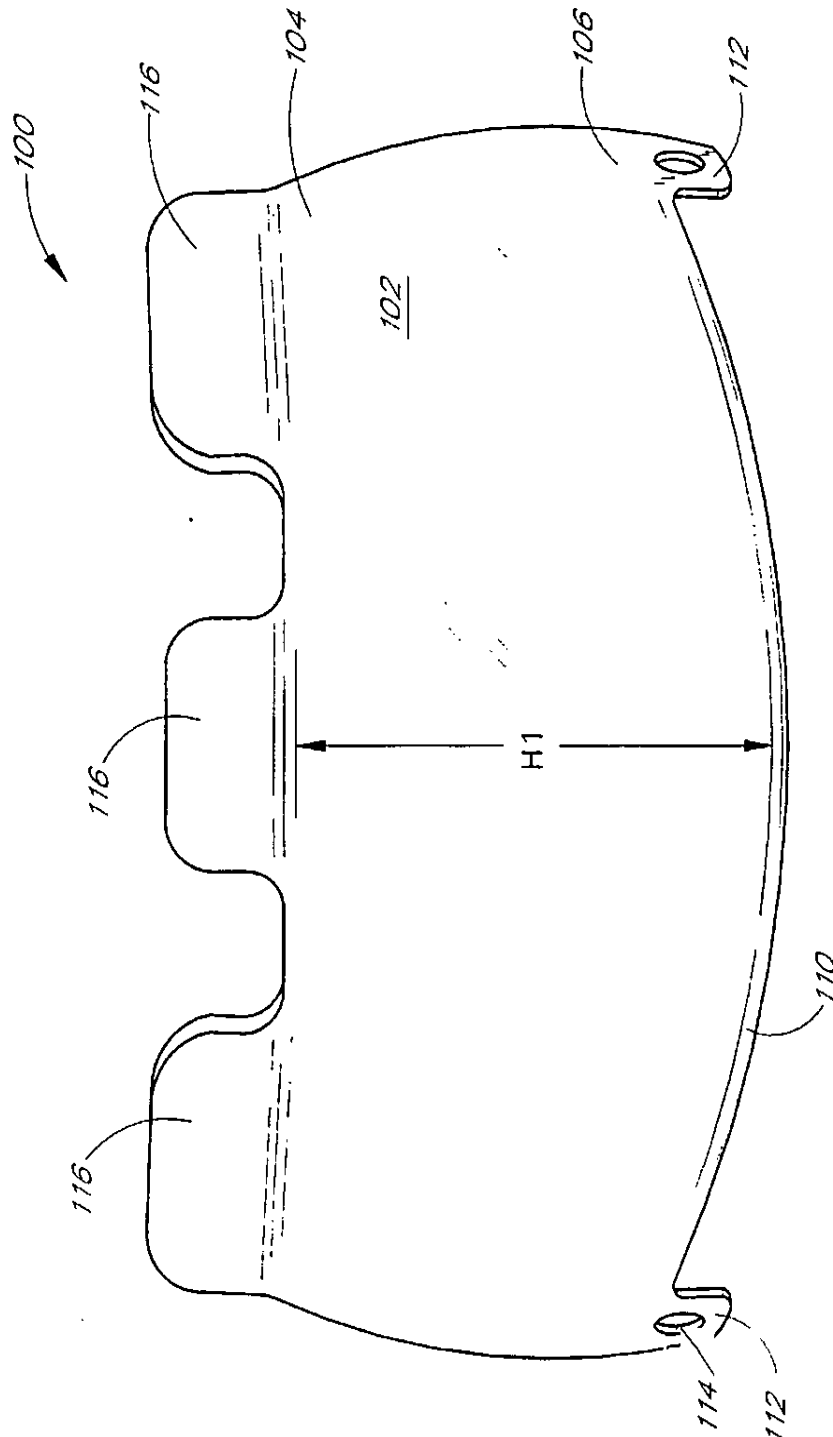


FIG. 5

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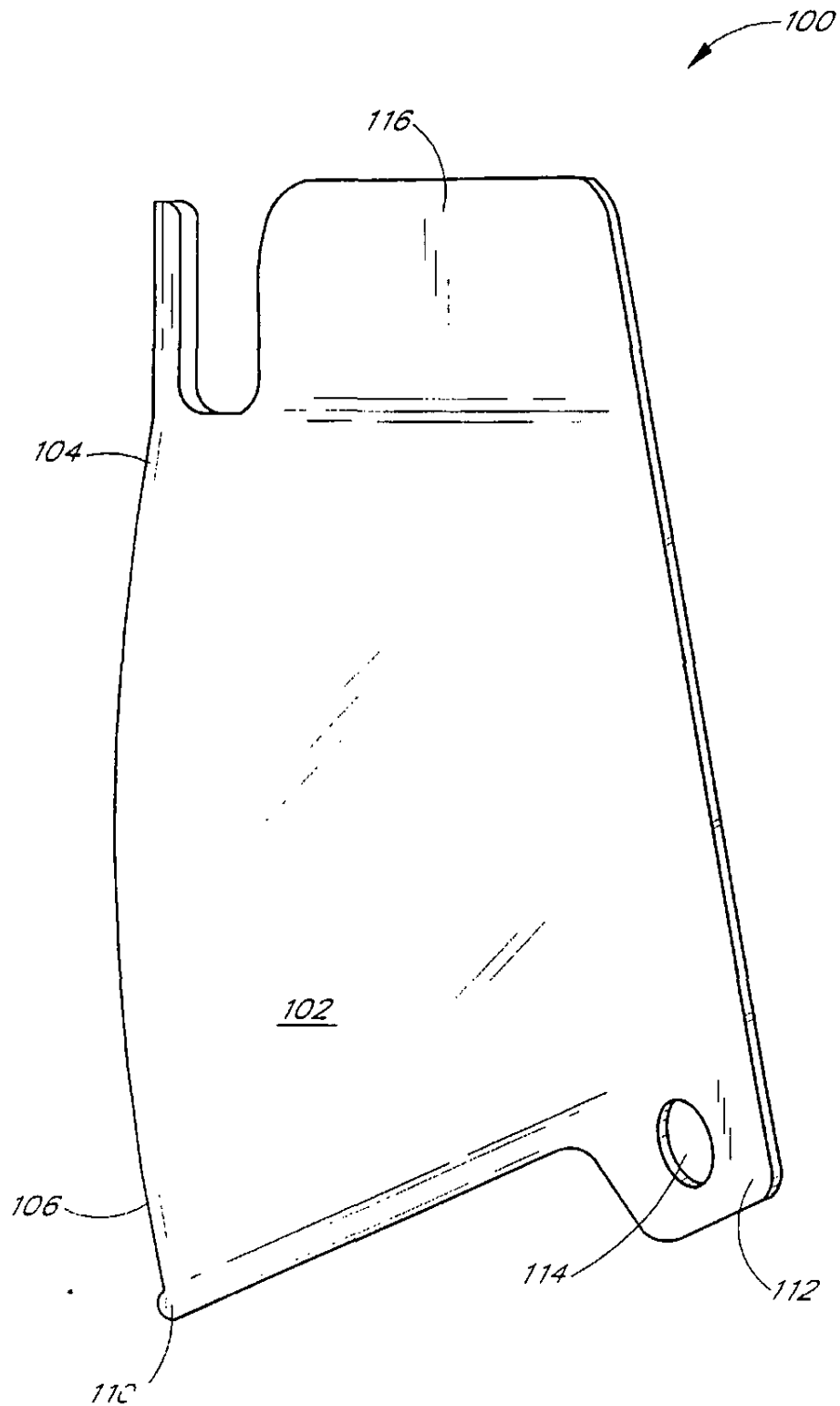


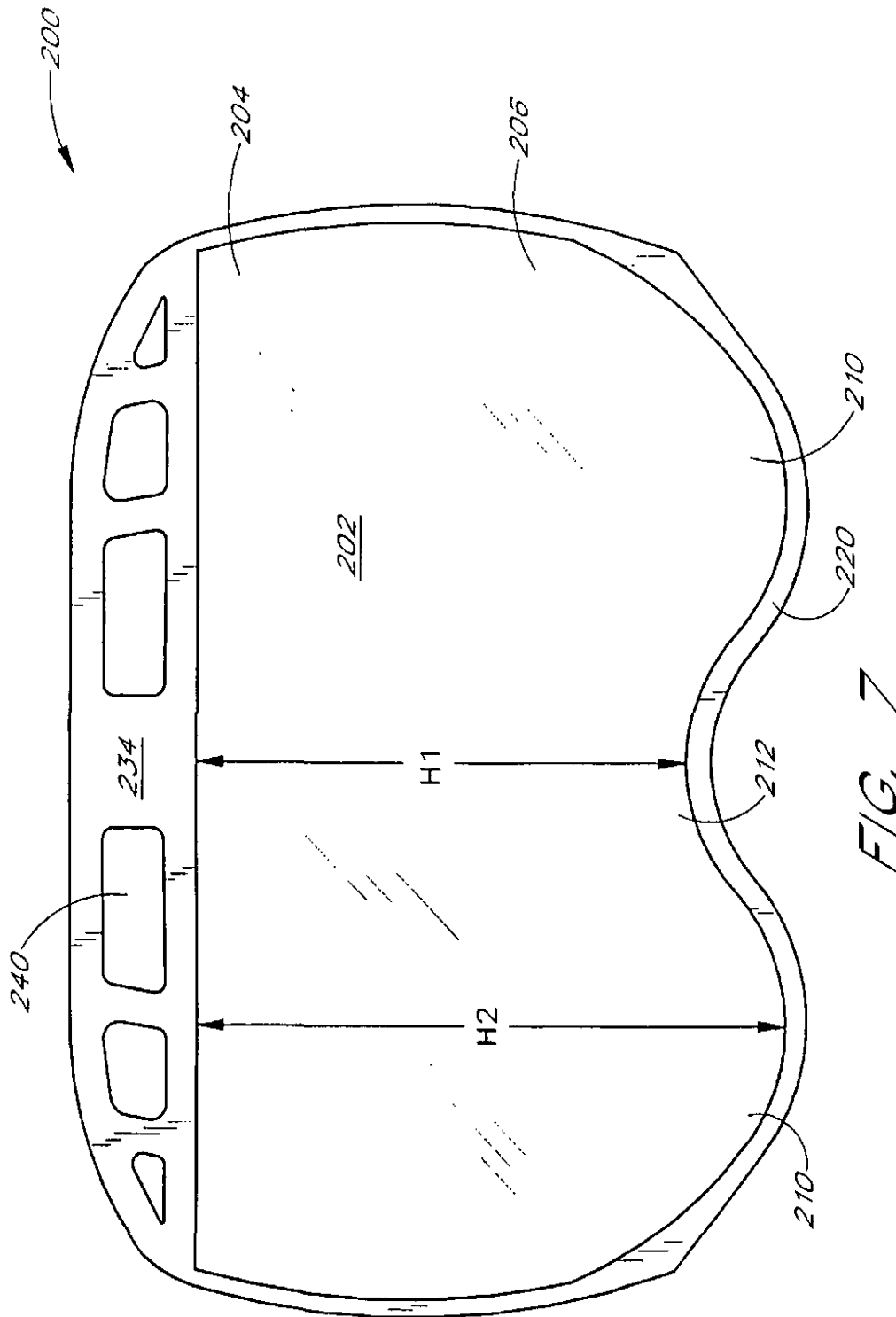
FIG. 6

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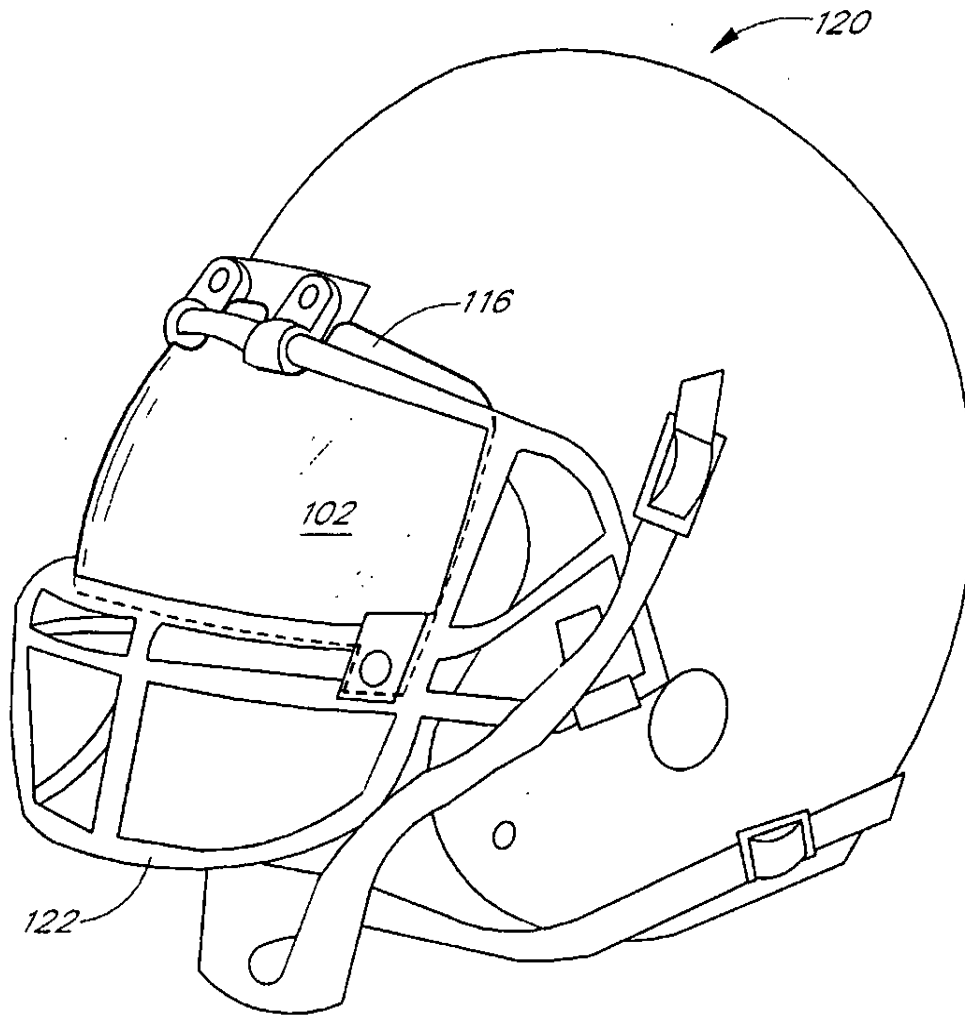


FIG. 8

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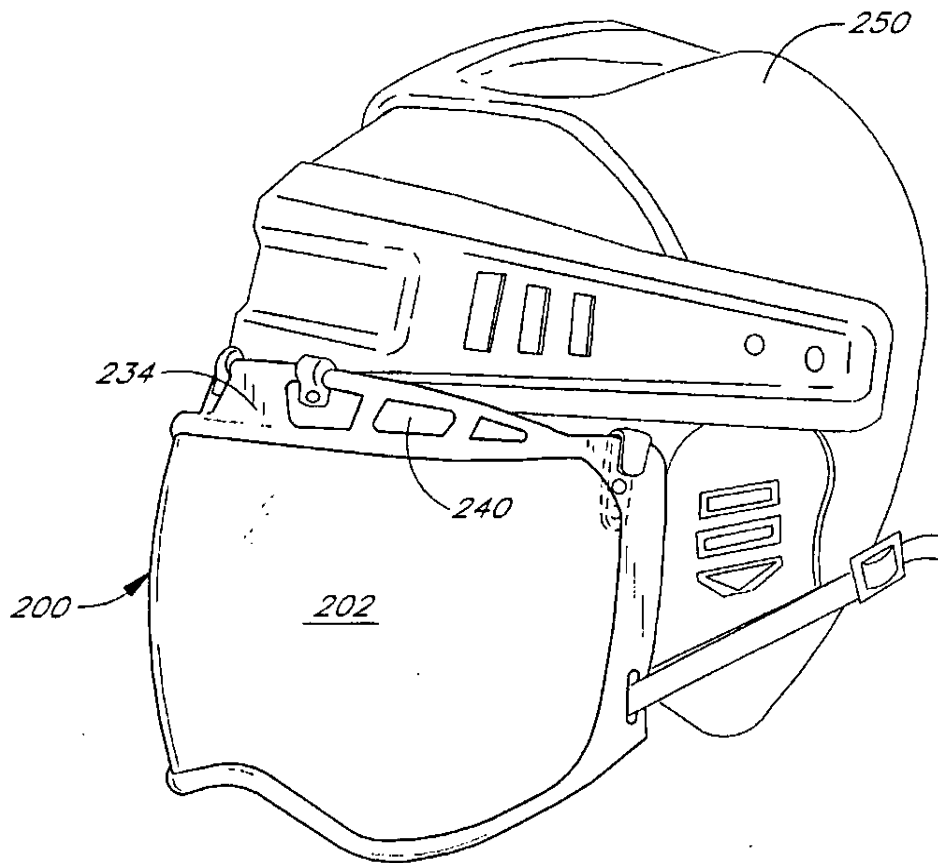


FIG. 9

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IMPACT RESISTANT FACE SHIELD

BACKGROUND OF THE INVENTION

This invention relates to mechanical protective devices, and more particularly to impact resistant face shields for use in protecting the face of an individual.

Today, sports are more popular than ever. This increase in popularity has resulted in an increase in the number of amateur and professional sport participants. Unfortunately, increased participation has resulted in an increase in the number of injuries suffered by individuals, and particularly in the number of facial injuries. Consequently, some sports now recommend and/or require the use of face shields or other facial protective devices when participating in the sport. One such sport is hockey.

Conventional face shields suitable for use in sports, such as those manufactured by Itech Sports Products, Inc. under the trade designation ITECH® Type IV sports protector, typically consist of a transparent polycarbonate blank that is formed or molded into a convex shield, which is adapted for mounting to existing sport helmets. The shield, when mounted to the helmet, extends generally outwardly and away from the wearer's face. As a result of this mounting configuration, objects located in the external environment appear at least partially distorted. Thus, the molded polycarbonate blank introduces some distortion over a portion of the individual's field of view.

The distorting effects of conventional face shields creates a unique set of problems for the wearer. The shield can cause strain on the wearer's eyes, which over a period of time can have deleterious effects. Additionally, rapidly viewing objects through the face shield and conversely not through the face shield produces further eye strain by requiring the individual to focus differently for each different field of view.

Due to the foregoing and other shortcomings of existing face shields, an object of this invention is to provide a face shield that reduces optical distortion.

Another object of this invention is to provide a protective face shield that has relatively high optical clarity and resolution.

Still another object of the invention is to provide a face shield that reduces the eye strain.

Yet another object of the invention is to provide a face shield that is relatively strong and durable and relatively lightweight.

Other general and more specific objects of the invention will in part be obvious and will in part appear from the drawings and description which follow.

SUMMARY OF THE INVENTION

The present invention relates to protective face shields that provide for higher image resolution and contrast during use. The improved contrast and resolution is achieved by providing an impact resistant face shield that addresses optical and mechanical concerns. Specifically, the present invention provides for an optically-correct face shield.

The invention attains an optically correct face shield by structuring the face shield to have an inner radius, an outer radius, a thickness and a refractive index, where the foregoing are mated to provide for a shield that lies between a truly plano lens and a lens having concentric geometry, e.g., constant thickness. The optical qualities of the lens are such that the prism and dioptric power are relatively low, and preferably between about 0.01 diopter and about 0.10 diopter.

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The face shield preferably includes a single formed arcuate lens portion that, in a first orientation, has a first curvature extending in a horizontal direction and a second curvature extending in a vertical direction. The lens portion has a top portion and a bottom portion that extends relatively inwardly towards the face of the wearer relative to an intermediate portion disposed between the top and bottom portions. Each curvature of the lens defines an arc of a circle having a substantially uniform radius to produce nominal levels of distortion, thereby reducing the prism effects, e.g., non-uniform distortions of the field, created by the lens, and providing an optically corrected viewing window.

According to one aspect, the lens portion of the face shield of the present invention has a thickness defined between outer and inner surfaces. The surfaces preferably have different radii of curvatures about centers that are shifted relative to each other. This eccentricity shifts one surface with respect to the other, to create a curved lens that has a thickness d that varies along the arc length of the face shield. The diametral lines of the surfaces are shifted such that the inner surface is moved back from a concentric position, thickening the central portion of the lens, and creating edges that are thinner relative to the central thickened region. This variable thickness, and particularly the thinning effect of the lens at the edges, optically corrects the lens at the peripheral regions by reducing the occurrence of prismatic deviations and overall prism imbalance.

According to another aspect of the invention, the shield preferably includes a frame structure that is formed about at least a portion of the lens. According to one embodiment, the frame includes ventilation apertures formed in a top portion of the face shield. The ventilation apertures allow air to flow through the mask to provide for proper ventilation of the shield to resist or remove fogging.

According to another practice of the invention, the face shield surrounds a substantial portion of the wearer's face when situated properly thereabout. In this position, the inside surface of the lens is substantially non-oblique relative to the wearer's face and the wearer's field of view is substantially normal to the inside surface of the lens about most of the field of view. Additionally, the face shield extends in the vertical direction a distance sufficient to include a substantial portion of the downward field of view without imposing upon the wearer the distortions and aberrations created by the edges of the shield.

The present invention further pertains to a face protective shield having a shield body formed of strong clear polymeric material having a peripheral region and a central region. The peripheral region includes an attachment element for securing the shield body in front of the wearer's face. The central region is preferably formed as a viewing window sized to extend around in front of the wearer's face. According to one aspect, the shield has a thickness effective to survive impact without cracking and curves in both horizontal and vertical planes over substantially the entire central region to introduce a degree of lensing and correct viewing aberrations.

According to another aspect, the central region has front and rear surfaces. The front surface has a radius of curvature R_f greater than the rear surface radius of curvature R_r , such that $R_f - R_r = \delta$. According to still another aspect, the centers of curvature of the front and rear surfaces are spaced closer than δ .

According to another aspect, the lensing power of the shield is negative in at least the horizontal plane.

Other general and more specific objects of the invention will in part be obvious and will in part be evident from the drawings and description which follow.

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BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features and advantages of the invention will be apparent from the following description and apparent from the accompanying drawings, in which like reference characters refer to the same parts throughout the different views. The drawings illustrate principles of the invention and, although not to scale, show relative dimensions.

FIG. 1 is a side view of a first embodiment of the face shield of the present invention.

FIG. 2 is a front view of the face shield of FIG. 1.

FIG. 3 is a schematic representation of light rays impinging upon a conventional plano lens.

FIG. 4 is a cross-sectional view of the face shield of FIG. 2 taken along lines 4—4 illustrating the varying thickness of the shield of the present invention.

FIG. 5 is a front view of a second embodiment of the face shield of the present invention.

FIG. 6 is a side view of the face shield of FIG. 5.

FIG. 7 is a front view of a third embodiment of the face shield of the present invention.

FIG. 8 is a perspective view of the face shield of FIG. 5 mounted to a conventional sporting helmet.

FIG. 9 is a perspective view of the face shield of FIG. 7 mounted to a conventional sporting helmet.

DESCRIPTION OF ILLUSTRATED EMBODIMENTS

FIGS. 1–4 illustrate the general principles of the protective face shield of the present invention. These general principles pertain to each of the additional face shield embodiments set forth and described below.

FIGS. 1 and 2 illustrate a first embodiment of the face shield 10 of the present invention. The face shield 10 includes a unitary curved lens portion 12 that is encompassed by a beaded frame structure 14 disposed about a substantial portion of the periphery of the lens. Preferably, the beaded frame 14 is integrally molded with the lens portion 12.

The lens portion 12 has a first or horizontal curvature 16 (as seen in a horizontal plane), and a second vertical curvature 18. The horizontal curvature 16 has a circular cross-section and approximates a complete semi-circle, e.g., subtends an arc of about 180°, and thus provides a wrap-around face shield that covers and protects the face of the wearer while providing a window portion that extends about a substantial portion of the wearer's potential field of view. The potential field of view is substantially greater than the actual view of any moment, and includes the extremes at each side that become visible as the wearer rotates his eyes, but without re-orienting his head. The vertical curvature 18 has a circular cross-section, and a bottom portion 20 that extends relatively inwardly towards the face of the wearer relative to an intermediate portion 22 of the lens 12. The wrap-around configuration of the lens 12 in both the horizontal and vertical directions provides a single view pane through which the wearer observes the external environment. This configuration allows the wearer to observe objects at any location through the lens portion 12 without requiring the wearer to change viewing environments, for example, view one object through the lens and another object at a different location outside of the view frame of the lens. A significant advantage of this is that it reduces eye strain by allowing the wearer to view the environment through a single wrap-around window.

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It is known that light rays striking a plano lens of known construction at a selected angle θ emerge from the lens at the angle θ but offset by a selected displacement α determinable by known formulae, as shown in FIG. 3. For example, a light ray 24 that impinges upon the lens is offset the distance α , which is dependent upon the lens thickness, the angle of incidence and the refractive index of the lens material. The light ray 24 exits the lens at the angle of incidence θ . These variations in the refraction of light introduce distortions into the field of view, particularly when viewing objects along a sight line that intersects the window obliquely. Thus, an object located at or near the periphery of the field of view may appear elongated and/or shifted in space relative to the actual spatial location of the object. This phenomena represents a common problem with conventional impact resistant face shields. Since the shields must be sufficiently thick to attain strength, they necessarily introduce distortion effects.

Referring again to FIGS. 1 and 2, each curvature 16 and 18 of the lens portion 12 defines an arc of a circle having a substantially uniform radius. This dual-curvature configuration provides a viewing window that is oriented almost normal to the line of sight as the wearer's eyes rotate to view objects. It produces only nominal levels of distortion, reducing the prism effects, e.g., non-uniform distortions of the field, created by the lens portion 12, and provides an optically corrected viewing window. Although a variety of radii might accrue the advantages of the present invention, the radius of the horizontal curvature 16 is preferably in the range between about 3 inches and about 5 inches, and most preferably is about 4 inches. The radius of the vertical curvature is preferably in the range between about 6.5 inches and about 8.5 inches, and most preferably is about 7.4 inches. The foregoing radius dimensions represent the distance from arbitrary center of curvature points to the arc defined by each curvature of the illustrated face shield 10. This construction defines a uniform distance to allow a full and unobstructed viewing hemisphere.

Those of ordinary skill will readily recognize that the lens portion 12 of the face shield 10 of the present invention has a thickness defined between outer and inner surfaces, and thus could be defined as having merely a single radius only when it has constant thickness. However, preferably, as shown in FIG. 4, which is a cross-sectional view of the face shield 10 of FIG. 2 taken along line 4—4, the lens portion 12 has a thickness or depth dimension d_0 along its entire arc length, which is defined between an outer facing (convex) surface 26 having a radius R1 and an inner facing (concave) surface 28 having a radius R2. In this embodiment, the radius R2 is less than the radius R1 and eccentric relative thereto. Specifically, the surfaces 26 and 28 have different radii of curvatures about centers that are shifted relative to each other. This eccentricity shifts one surface with respect to the other, to create a curved lens that has a thickness d_0 that varies monotonically away from a centerpoint, e.g., is tapered toward the edge, along the arc length of the face shield. Preferably, the inner concave surface 28 is not completely circular, but rather one surface at least is non-diametral to produce a minimum thickness d_{min} at the edges 30 of the face shield. Furthermore, the diametral lines of the two surfaces are shifted such that the rear surface is moved back from a concentric position, thickening the central portion of the lens to produce a maximum thickness d_{max} at or near centerline 32. As illustrated, the distance between the centerpoint C1 for radius R1 and the centerpoint C2 for radius R2 is preferably between 1 and 2 mm, but those of ordinary skill will recognize that this distance can vary

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depending upon the desired thickness of the shield at the center or at the edges of the lens in order to achieve a particular degree of bending, breaking, tensile or impact strength. According to one practice the absolute value of the difference in centerpoints is less than the lens thickness d_0 .

As set forth above, plano (or constant-thickness) lenses introduce distortions or prismatic deviations into the field of view of the wearer by non-uniformly shifting light entering and exiting the lens. Lenses having truly concentric inner and outer radii, e.g., a plano lens bent into a circular shape, introduce prismatic deviations. This prism effect distorts, e.g., elongates or displaces, objects viewed by the wearer, and this distortion is particularly exaggerated at the peripheral viewing regions of the lens. With reference to the present invention, the variable thickness d_0 , and particularly the thinning effect of the lens at the edge regions 30, optically corrects the lens at the peripheral regions by reducing the occurrence of prismatic deviations and overall prism imbalance. Specifically, the lensing effect of the lens 12 in conjunction with the relatively thinner edge regions 30 introduce relatively low levels of distortion and serve to optically correct the view over substantially the entire lens area. Thus, the term "optically-correct" as used herein is intended to refer to the reduction in prismatic deviations created by the particular design and geometry of each embodiment of the face shield of the invention as described above in relation to FIGS. 1 and 2 and below in relation to FIGS. 5-7, and further is intended to include a face shield that exhibits a relatively low dioptric power and a relatively low prism power over a substantial portion of the wearer's field of view. Preferably, the shield includes only a few hundredths of a diopter of controlled dioptric power, and has a negative lensing effect which compensates for the prism aberrations. Furthermore, by shifting the front and rear curved surfaces, a structural thickening is achieved in a central region of low distortion, allowing a lower prism thickness to be safely employed peripherally.

According to the face shield embodiment of FIGS. 1 and 2, the thickness d_{max} of the lens 12 at the centerline 32 is about 4 mm (0.157 inches) with a minimum thickness d_{min} at the edges 30 ranging between about 2 mm (0.0787 inches) and about 2.7 mm (0.102 inches). According to one practice, the lens thickness d_0 varies smoothly with increasing angle from d_{max} to d_{min} . The radius R1 preferably ranges between about 95 mm and about 110 mm, and most preferably between about 100 mm and about 105 mm, and the radius R2 ranges between about 96 mm and about 103 mm, and most preferably is about 100 mm. For the vertical curvature 18 of the lens, R1 preferably ranges between about 180 mm and 192 mm, and most preferably is about 187 mm, and R2 ranges between about 178 mm and about 186 mm, and most preferably is about 183 mm.

Furthermore, the illustrated face shield 10 has a height H1 that varies about the length of the shield in the horizontal direction. The vertical height H1 preferably varies between about 3.75 inches and about 4.75 inches along the curvature of the shield, and preferably is about 4.25 inches as measured at the centerline.

Referring again to FIGS. 1 and 2, the illustrated frame structure 14 includes ventilation apertures 40 formed in a peripheral band of the top portion 34 of the face shield 10. The ventilation apertures allow air to flow through the mask, either in an upward or downward direction, to provide for proper ventilation of the shield to resist or remove fogging. The size and number of the ventilation apertures is not important to the teachings of the present invention. A thickness web may provide added strength about the ventilation openings.

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According to one practice, the face shield can be mounted to the head of the wearer or to various sport helmets by known retention mechanisms. For example, the face shield or protector 10 can be attached to a hockey helmet by way of conventional securing and mounting pins, hooks, straps, and like retention elements. One end of a securing strap preferably seats in the strap aperture 42 formed on either side of the frame member 14 to help secure the face shield to the helmet and about the face of the wearer.

When mounted on the helmet, the face shield 10 surrounds a substantial portion of the wearer's face, and particularly surrounds the upper portion of the face as well as the nose and portions of the cheeks. More particularly, the shield surrounds the face such that the inside surface of the lens is substantially non-oblique relative to the wearer's face and the wearer's field of view is substantially normal to the inside surface of the lens portion 12 of the shield 10 about most of the field of view. Additionally, the face shield 10 extends in the vertical direction a distance sufficient to include a substantial portion of the downward field of view without imposing upon the wearer the distortions and aberrations created by the edges of the shield. Specifically, the bottom portion of the face shield extends inwardly towards the wearer's face to allow the wearer to view the external environment through the lens portion at close distances, and through a contour which reduces obliqueness of incident rays.

The face shield 10 is composed of a transparent impact resistant material, such as polycarbonate, which has a refractive index of 1.586 at the helium d line. The face shield preferably meets selected strength and impact tests, including the Canadian impact testing standard CSA § 5.3.4. Those of ordinary skill will readily recognize that other suitable polymer materials can be used.

FIGS. 5 and 6 illustrate a second embodiment of the face shield of the present invention. The illustrated face shield 100 has a unitary lens portion 102 that has a top portion 104 and a bottom portion 106. The lens portion 102 also includes a horizontal curvature and a vertical curvature that exhibit the same properties as those described above in relation to the face shield 10 of FIGS. 1 and 2. The horizontal curvature of the face shield approximates a semi-circle and thus provides a wrap-around face shield that covers and protects the face of the wearer while providing a window portion that extends about a substantial portion of the wearer's field of view. This wrap-around configuration of the lens 102 in both the horizontal and vertical directions provides a single view pane through which the wearer observes the external environment. This configuration allows the wearer to observe objects at any location through the lens portion 102 without requiring the wearer to change viewing environments, for example, view one object through the lens and another object at a different location outside of the view frame of the lens.

According to one practice, the radius of the horizontal curvature is preferably between about 3.25 inches and about 5.25 inches, and the radius of the vertical curvature is preferably in the range between about 6.35 inches and about 8.35 inches, and most preferably is about 7.4 inches. The foregoing radius dimensions represent the distance from an arbitrary center point to the arc defined by each curvature of the illustrated face shield 100.

The illustrated face shield 100 also has a thickness d_0 that is defined by outer and inner curved surfaces, as described above in relation to FIGS. 1-2 and 4. The illustrated face shield 100 preferably has an outer radius R1 that ranges

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between about 95 mm and about 110 mm, and most preferably is about 103 mm, and the radius R2 ranges between about 96 mm and about 103 mm, and most preferably is about 101 mm. For the vertical curvature of the lens 102, R1 preferably ranges between about 180 mm and 192 mm, and most preferably is about 187 mm, and R2 ranges between about 178 mm and about 186 mm, and most preferably is about 183 mm.

The illustrated face shield 100 further has a height H1 that varies about the length of the shield in the horizontal direction. The height H1 preferably varies between about 2.3 inches and about 4.3 inches, and preferably is about 3.3 inches at the center.

The optical and physical design properties described above in relation to shield 10 accrue to this embodiment to form an optically correct face shield that withstands the impact of foreign bodies, without cracking or breaking.

Referring again to FIGS. 5 and 6, the bottom portion 106 has formed thereon a molded beaded portion 110 that reinforces the bottom edge of the shield while eliminating sharp contours. The bottom portion 106 further includes a pair of downwardly projecting tabs 112 that include a mounting aperture 114 that extends therethrough. The top portion of the face shield 100 includes a set of upwardly projecting mounting protrusions 116.

The face shield can be mounted to various sport helmets by known retention mechanisms. For example, the face shield or protector 100 can be attached to a football helmet 120 by way of conventional securing and mounting straps and like retention elements, as shown in FIG. 8. The shield 100 is secured to the face guard 122 of the helmet 120 by a set of T-bolts and nuts, and the top portion 104 of the shield 100 is wedged into the top of the face guard frame mounted directly to the helmet 120.

When mounted on the helmet, the face shield 100 surrounds a substantial portion of the wearer's face, and particularly surrounds the nose and portions of the cheeks. More particularly, the shield surrounds the face such that the inside surface is substantially non-oblique relative to the wearer's face and the wearer's field of view is substantially normal to the inside surface of the lens portion 12 of the shield 10. The face shield also extends about the face in the horizontal direction a distance sufficient to include at least a substantial portion of the field of view of the wearer.

FIG. 7 illustrates a third embodiment of the face shield 200 of the present invention. The illustrated face shield 200 has a unitary lens portion 202 that has a top portion 204 and a bottom portion 206. The lens portion 202 also includes a horizontal curvature and a vertical curvature that exhibit the same properties as those described above in relation to the face shield 10 of FIGS. 1 and 2. The horizontal curvature of the face shield approximates a semi-circle and thus provides a wrap-around face shield that covers and protects the face of the wearer while providing a window portion that extends about a substantial portion of the wearer's field of view. This wrap-around configuration of the lens 202 in both the horizontal and vertical directions provides a single view pane through which the wearer observes the external environment. This configuration allows the wearer to observe objects at any location through the lens portion 202 without requiring the wearer to change viewing environments, for example, view one object through the lens and another object at a different location outside of the view frame of the lens.

According to one practice, the radius of the horizontal curvature of the face shield 202 is preferably between about

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3 inches and about 5.5 inches, and most preferably is about 4 inches, and the radius of the vertical curvature is preferably in the range between about 6.5 inches and about 8.5 inches, and most preferably is about 7.4 inches. The foregoing radius dimensions represent the distance from an arbitrary center point to the arc defined by each curvature of the illustrated face shield 200.

The illustrated face shield 100 also has a thickness d_0 that is defined by outer and inner curved surfaces, as described above in relation to FIGS. 1-2 and 4. The illustrated face shield 200 preferably has an outer radius R1 that ranges between about 95 mm and about 110 mm, and most preferably is about 104 mm, and the radius R2 ranges between about 96 mm and about 105 mm, and most preferably is about 101 mm. For the vertical curvature of the lens 202, R1 preferably ranges between about 180 mm and 192 mm, and most preferably is about 188 mm, and R2 ranges between about 178 mm and about 186 mm, and most preferably is about 184 mm.

The lens portion further has a pair of downwardly projecting portions 210 that extend below an intermediate portion 212 to form secondary lens portions. These portions preferably have a radius between about 1.0 inch and 2.0 inches. The illustrated face shield 200 has a height H1 defined at the intermediate portion 212 that ranges between 3.5 inches and about 4.1 inches. The height H2 of the lens portion other than at the intermediate portion varies about the length of the shield in the horizontal direction. The height H2 preferably varies between about 4 inches and about 5 inches, and preferably is about 4.25 inches.

The optical and physical design properties described above in relation to shield 10 accrue to this embodiment to form an optically correct face shield that withstands the impact of foreign bodies, without cracking or breaking.

Referring again to FIG. 7, the bottom portion 206 has formed thereon a molded beaded portion 220 that reinforces the bottom edge of the shield while eliminating sharp contours. The beaded portion extends substantially about the entire periphery of the shield 200. The shield also includes ventilation apertures 240 formed in the top portion 234 of the bead. The ventilation apertures allow air to flow through the mask, either in an upward or downward direction, to provide for proper ventilation of the shield to resist fogging and aid clearing of the lens. The size and number of the ventilation apertures is not important to the teachings of the present invention.

The face shield can be mounted to various sport helmets by known retention mechanisms. For example, the face shield 200 can be attached to a hockey helmet 250 by way of conventional pins, hooks, and securing and mounting straps, and like retention elements, as shown in FIG. 9.

When mounted on the helmet, the face shield 200 surrounds a substantial portion of the wearer's face, and particularly surrounds the nose and portions of the cheeks. More particularly, the shield surrounds the face such that the inside surface is substantially non-oblique relative to the wearer's face and the wearer's field of view is substantially normal to the inside surface of the lens portion 202 of the shield 200. The face shield also extends about the face in the horizontal direction a distance sufficient to include substantially the entire field of view of the wearer. The secondary lens portions 210 further project downwardly to ensure capture of a substantial portion of the downward field of view.

The face shields of the invention shown and described above can be made from known processes and techniques, such as injection molding.

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The impact resistant face shield constructed according to the features of the present invention can be employed in a wide range of environments and for a wide range of uses. For example, the face shield shown and described above in relation to FIGS. 1-7 can be used by individuals for recreational and sporting activities in addition to football and hockey, such as skiing, roller-blading, soccer, basketball, baseball, lacrosse and other like activities. The face shield can also be employed in other industries by amateurs and/or professionals, such as by carpenters and medical personnel.

It will thus be seen that the invention efficiently attains the objects set forth above, among those made apparent from the preceding description. Since certain changes may be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are to cover all generic and specific features of the invention described herein, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. An arcuately molded face shield for mounting to sporting helmets suitable for use in sporting events, said face shield comprising:

a unitary, optically-correct lens portion for shielding against mechanical impact a substantial portion of a sport participant's face having, in a first orientation, a first curvature extending in a horizontal direction and a second curvature extending in a vertical direction, said vertical curvature terminating in a top portion and a bottom portion, said bottom portion extending relatively inwardly towards the face of the participant relative to an intermediate portion of said lens disposed between the top and bottom portions when mounted to the sporting helmet.

2. The face shield of claim 1 further including frame means forming a frame integrally formed with and disposed about a portion of the periphery of said optically-correct lens portion in an as-molded condition.

3. The face shield of claim 1 wherein said optically-correct lens portion has a first distal end portion disposed on one end of the horizontal curvature of the lens, a second distal end portion disposed on an opposed end of the horizontal curvature, and a generally vertically extending intermediate portion disposed between the first and second distal portions, wherein at least portions of said first and second distal portions extend downwardly beyond said vertically-extending intermediate portion to form secondary lens portions.

4. The face shield of claim 3 wherein said vertically extending intermediate portion of said optically-correct lens portion has a first selected height h_1 measured between the top and bottom portions of the optically-correct lens portion that is in the range between about 3.5 inches and about 4.1 inches, and

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said secondary lens portions having a height h_2 defined between the top portion of the lens and the bottom portion of the lens that is in the range between about 4.0 inches and about 5.0 inches.

5. The face shield of claim 1 wherein said first curvature of said optically-correct lens portion has a radius in the range between about 3.0 inches and about 5.0 inches.

6. The face shield of claim 1 wherein said second curvature of said optically-correct lens portion has a radius in the range between about 6.5 inches and about 8.5 inches.

7. The face shield of claim 4 wherein each said secondary lens portion has a radius in the range between about 1.0 inches and 2.0 inches.

8. The face shield of claim 1 wherein the face shield is adapted for use in a hockey helmet.

9. The face shield of claim 1 wherein said horizontal portion of said optically-correct lens portion has a first distal portion and an opposed second distal portion and an intermediate portion disposed therebetween, and wherein said lens portion has a height h_1 measured between the top and bottom portions of the lens that varies between the first and second distal portions, said height h_1 being in the range between about 3.75 inches and about 4.75 inches.

10. The face shield of claim 1 wherein said first curvature has a radius in the range between about 6.35 inches and about 8.35 inches.

11. The face shield of claim 10 wherein said second curvature has a radius in the range between about 6.35 inches and about 8.35 inches.

12. The face shield of claim 11 wherein said horizontal curvature of said optically-correct lens portion has a first distal portion and a second distal portion and an intermediate portion disposed therebetween, and wherein said lens portion has a height h_1 measured between the top and bottom portions of the lens that varies between the first and second distal portions, said height h_1 being in the range between about 2.3 inches and about 4.3 inches.

13. A face protective shield for activity, comprising a shield body formed of strong clear polymeric material and having a peripheral region and a central region, the peripheral region including means for attaching to secure the shield body in front of a wearer's face, and the central region forming a viewing window sized to extend substantially entirely around in front of the wearer's face and having a thickness effective to survive impact without cracking, said thickness further introducing prism viewing aberrations, and said central region curves in horizontal and vertical planes over substantially the entire central region to introduce a degree of lensing and correct said viewing aberrations.

14. A face protective shield according to claim 13, wherein the face shield is formed of polycarbonate.

15. A face protective shield to claim 13, wherein said peripheral region includes a circumferential bead forming a frame about said central region.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 6,038,705
DATED : March 21, 2000
INVENTOR(S) : Edward C. Jarvis

Page 1 of 1

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Title page,

Item [22], after "Filed: Oct. 6, 1998" should read:

-- Related U.S. Application Data

Continuation of U.S. Application 08/502,598, filed July 14, 1995, now U.S. Patent 5,815,848. --

Column 1,

Line 3, prior to "BACKGROUND OF THE INVENTION" should read:

-- REFERENCE TO RELATED APPLICATION

This application is a continuation of U.S. Application 08/502,598, filed July 14, 1995, now U.S. Patent 5,815,848. The entire disclosure of U.S. Application 08/502,598 is considered as being part of this application and is incorporated by reference herein. --

Signed and Sealed this

Fourteenth Day of October, 2003

A handwritten signature in black ink, appearing to read "James E. Rogan", with a horizontal line drawn underneath it.

JAMES E. ROGAN
Director of the United States Patent and Trademark Office

05 CV 0979 W

AO 120 (Rev. 3/04)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
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In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court California on the following ☒ Patents or ☐ Trademarks:

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT Southern District of California
PLAINTIFF Mission I-TECH Hockey, Ltd., a Nova Scotia, Canada corporation		DEFENDANT Oakley, Inc., a Washington corporation
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 5,815,848	Oct. 6, 1998	Oakley, Inc., Foothill Ranch, Calif.
2 6,038,705	Mar. 21, 2000	Oakley, Inc., Foothill Ranch, Calif.
3		
4		
5		

In the above-entitled case, the following patent(s)/trademark(s) have been included:

DATE INCLUDED	INCLUDED BY <input type="checkbox"/> Amendment <input type="checkbox"/> Answer <input type="checkbox"/> Cross Bill <input type="checkbox"/> Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above-entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE
-------	-------------------	------

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
 Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

JS 44
(Rev. 07/89)

CIVIL COVER SHEET

The JS-44 civil cover sheet and the information contained herein neither replace nor supplement the filing and service of pleadings or other papers as required by law, except as provided by local rules of court. This form, approved by the Judicial Conference of the United States in September 1974, is required for the use of the Clerk of Court for the purpose of initiating the civil docket sheet. (SEE INSTRUCTIONS ON THE SECOND PAGE OF THIS FORM.)

I. (a) PLAINTIFFS

Mission I-TECH Hockey, Ltd., a Nova Scotia, Canada corporation

DEFENDANTS

Oakley, Inc., a Washington corporation

FILED
05 MAY -5 PM 3:37

CLERK, U.S. DISTRICT COURT
SOUTHERN DISTRICT OF CALIFORNIA

(b) COUNTY OF RESIDENCE OF FIRST LISTED PLAINTIFF
(EXCEPT IN U.S. PLAINTIFF CASES)

COUNTY OF RESIDENCE OF FIRST LISTED DEFENDANT

(IN U.S. PLAINTIFF CASES ONLY)

NOTE: IN LAND CONDEMNATION CASES, USE THE LOCATION OF THE TRACT OF LAND INVOLVED. DEPUTY

(c) ATTORNEYS (FIRM NAME, ADDRESS, AND TELEPHONE NUMBER)

David B. Abel (CA SBN 156744)
Squire, Sanders & Dempsey L.L.P.
801 S. Figueroa Street, 14th Floor
Los Angeles, CA 90017-5554
Telephone: (213) 624-2500

ATTORNEYS (IF KNOWN)

05 CV 0979

(RBB)

II. BASIS OF JURISDICTION (PLACE AN "X" IN ONE BOX ONLY)

- ☐ 1 U.S. Government Plaintiff
☐ 2 U.S. Government Defendant
☒ 3 Federal Question (U.S. Government Not a Party)
☐ 4 Diversity (Indicate Citizenship of Parties in Item III)

III. CITIZENSHIP OF PRINCIPAL PARTIES (PLACE AN "X" IN ONE BOX FOR PLAINTIFF AND ONE BOX FOR DEFENDANT)

- | | PT | DEF | | PT | DEF |
|---|---------------------------------------|---------------------------------------|---|----------------------------|----------------------------|
| Citizen of This State | <input checked="" type="checkbox"/> 1 | <input type="checkbox"/> 1 | Incorporated or Principal Place of Business in This State | <input type="checkbox"/> 4 | <input type="checkbox"/> 4 |
| Citizen of Another State | <input type="checkbox"/> 2 | <input checked="" type="checkbox"/> 2 | Incorporated and Principal Place of Business in Another State | <input type="checkbox"/> 5 | <input type="checkbox"/> 5 |
| Citizen or Subject of a Foreign Country | <input type="checkbox"/> 3 | <input type="checkbox"/> 3 | Foreign Nation | <input type="checkbox"/> 6 | <input type="checkbox"/> 6 |

IV. CAUSE OF ACTION (CITE THE U.S. CIVIL STATUTE UNDER WHICH YOU ARE FILING AND WRITE A BRIEF STATEMENT OF CAUSE.)

DO NOT CITE JURISDICTIONAL STATUTES UNLESS DIVERSITY.)

28 USC § 1331, 1367, 1338. Patent Infringement, Breach of Settlement Agreement

15:1126

V. NATURE OF SUIT (PLACE AN "X" IN ONE BOX ONLY)

CONTRACT	TORTS	FORFEITURE/PENALTY	BANKRUPTCY	OTHER STATUTES
<input type="checkbox"/> 110 Insurance <input type="checkbox"/> 120 Marine <input type="checkbox"/> 130 Miller Act <input type="checkbox"/> 140 Negotiable Instrument <input type="checkbox"/> 150 Recovery of Overpayment & Enforcement of Judgment <input type="checkbox"/> 151 Medicare Act <input type="checkbox"/> 152 Recovery of Defaulted Student Loans (Excl. Veterans) <input type="checkbox"/> 153 Recovery of Overpayment of Veteran's Benefits <input type="checkbox"/> 160 Stockholders' Suits <input type="checkbox"/> 190 Other Contract <input type="checkbox"/> 195 Contract Product Liability	PERSONAL INJURY <input type="checkbox"/> 310 Airplane <input type="checkbox"/> 315 Airplane Product Liability <input type="checkbox"/> 320 Assault, Libel & Slander <input type="checkbox"/> 330 Federal Employers' Liability <input type="checkbox"/> 340 Marine <input type="checkbox"/> 345 Marine Product Liability <input type="checkbox"/> 350 Motor Vehicle <input type="checkbox"/> 355 Motor Vehicle Product Liability <input type="checkbox"/> 360 Other Personal Injury PERSONAL INJURY <input type="checkbox"/> 362 Personal Injury - Medical Malpractice <input type="checkbox"/> 365 Personal Injury - Product Liability <input type="checkbox"/> 368 Asbestos Personal Injury Product Liability PERSONAL PROPERTY <input type="checkbox"/> 370 Other Fraud <input type="checkbox"/> 371 Truth in Lending <input type="checkbox"/> 380 Other Personal Property Damage <input type="checkbox"/> 385 Property Damage Product Liability	<input type="checkbox"/> 610 Agriculture <input type="checkbox"/> 620 Other Food & Drug <input type="checkbox"/> 625 Drug Related Seizure of Property 21 USC 881 <input type="checkbox"/> 630 Liquor Laws <input type="checkbox"/> 640 R.R. & Truck <input type="checkbox"/> 650 Airline Regs. <input type="checkbox"/> 660 Occupational Safety/Health <input type="checkbox"/> 690 Other LABOR <input type="checkbox"/> 710 Fair Labor Standards Act <input type="checkbox"/> 720 Labor/Mgmt. Relations <input type="checkbox"/> 730 Labor/Mgmt. Reporting & Disclosure Act <input type="checkbox"/> 740 Railway Labor Act <input type="checkbox"/> 790 Other Labor Litigation <input type="checkbox"/> 791 Empl. Ret. Inc. Security Act	<input type="checkbox"/> 422 Appeal 28 USC 158 <input type="checkbox"/> 423 Withdrawal 28 USC 157 PROPERTY RIGHTS <input type="checkbox"/> 820 Copyrights <input checked="" type="checkbox"/> 830 Patent <input type="checkbox"/> 840 Trademark SOCIAL SECURITY <input type="checkbox"/> 861 HIA (13958) <input type="checkbox"/> 862 Black Lung (923) <input type="checkbox"/> 863 DIWC/DIWW (405(g)) <input type="checkbox"/> 864 SSID Title XVI <input type="checkbox"/> 865 RSI (405(g)) FEDERAL TAX SUITS <input type="checkbox"/> 870 Taxes (U.S. Plaintiff or Defendant) <input type="checkbox"/> 871 IRS - Third Party 26 USC 7609	<input type="checkbox"/> 400 State Reappointment <input type="checkbox"/> 410 Antitrust <input type="checkbox"/> 430 Banks and Banking <input type="checkbox"/> 450 Commerce/ICC Rates/etc. <input type="checkbox"/> 460 Deportation <input type="checkbox"/> 470 Racketeer Influenced and Corrupt Organizations <input type="checkbox"/> 810 Selective Service <input type="checkbox"/> 850 Securities/Commodities/Exchange <input type="checkbox"/> 875 Customer Challenge 12 USC 3410 <input type="checkbox"/> 891 Agricultural Acts <input type="checkbox"/> 892 Economic Stabilization Act <input type="checkbox"/> 893 Environmental Matters <input type="checkbox"/> 894 Energy Allocation Act <input type="checkbox"/> 895 Freedom of Information Act <input type="checkbox"/> 900 Appeal of Fee Determination Under Equal Access to Justice <input type="checkbox"/> 950 Constitutionality of State Statutes <input type="checkbox"/> 890 Other Statutory Actions
REAL PROPERTY <input type="checkbox"/> 210 Land Condemnation <input type="checkbox"/> 220 Foreclosure <input type="checkbox"/> 230 Rent Lease & Ejectment <input type="checkbox"/> 240 Torts to Land <input type="checkbox"/> 245 Tort Product Liability <input type="checkbox"/> 290 All Other Real Property	CIVIL RIGHTS <input type="checkbox"/> 441 Voting <input type="checkbox"/> 442 Employment <input type="checkbox"/> 443 Housing/Accommodations <input type="checkbox"/> 444 Welfare <input type="checkbox"/> 440 Other Civil Rights	PRISONER PETITIONS <input type="checkbox"/> 510 Motion to Vacate Sentence HABEAS CORPUS: <input type="checkbox"/> 530 General <input type="checkbox"/> 535 Death Penalty <input type="checkbox"/> 540 Mandamus & Other <input type="checkbox"/> 550 Civil Rights <input type="checkbox"/> 555 Prison Conditions		

VI. ORIGIN

(PLACE AN "X" IN ONE BOX ONLY)

- ☒ 1 Original Proceeding
☐ 2 Removal from State Court
☐ 3 Remanded from Appellate Court
☐ 4 Reinstated or Reopened
☐ 5 Transferred from another district (specify)
☐ 6 Multidistrict Litigation
☐ 7 Appeal to District Judge from Magistrate Judgment

VII. REQUESTED IN COMPLAINT:

☐ CHECK IF THIS IS A CLASS ACTION UNDER F.R.C.P. 23 DEMAND \$ 0.00

CHECK YES only if demanded in complaint:
JURY DEMAND: ☒ YES ☐ NO

VIII. RELATED CASE(S) IF ANY

(See instructions): JUDGE Leo S. Papas

Docket Number 01-CV-2374 JM (LSP)

DATE May 4, 2005 SIGNATURE OF ATTORNEY OF RECORD

#113556 250- ME

ORIGINAL

INSTRUCTIONS FOR ATTORNEYS COMPLETING CIVIL COVER SHEET FORM JS-44**Authority For Civil Cover Sheet**

The JS-44 civil cover sheet and the information contained herein neither replaces nor supplements the filings and service of pleading or other papers as required by law, except as provided by local rules of court. This form, approved by the Judicial Conference of the United States in September 1974, is required for the use of the Clerk of Court for the purpose of initiating the civil docket sheet. Consequently a civil cover sheet is submitted to the Clerk of Court for each civil complaint filed. The attorney filing a case should complete the form as follows:

I. (a) **Plaintiffs - Defendants.** Enter names (last, first, middle initial) of plaintiff and defendant. If the plaintiff or defendant is a government agency, use only the full name or standard abbreviations. If the plaintiff or defendant is an official within a government agency, identify first the agency and then the official, giving both name and title.

(b) **County of Residence.** For each civil case filed, except U.S. plaintiff cases, enter the name of the county where the first listed plaintiff resides at the time of filing. In U.S. plaintiff cases, enter the name of the county in which the first listed defendant resides at the time of filing. (NOTE: In land condemnation cases, the county of residence of the "defendant" is the location of the tract of land involved.)

(c) **Attorneys.** Enter the firm name, address, telephone number, and attorney of record. If there are several attorneys, list them on an attachment, noting in this section "(see attachment)".

II. **Jurisdiction.** The basis of jurisdiction is set forth under Rule 8(a), F.R.C.P., which requires that jurisdictions be shown in pleadings. Place an "X" in one of the boxes. If there is more than one basis of jurisdiction, precedence is given in the order shown below.

United States plaintiff. (1) Jurisdiction based on 28 U.S.C. 1345 and 1348. Suits by agencies and officers of the United States are included here.

United States defendant. (2) When the plaintiff is suing the United States, its officers or agencies, place an "X" in this box.

Federal question. (3) This refers to suits under 28 U.S.C. 1331, where jurisdiction arises under the Constitution of the United States, an amendment to the Constitution, an act of Congress or a treaty of the United States. In cases where the U.S. is a party, the U.S. plaintiff or defendant code takes precedence, and box 1 or 2 should be marked.

Diversity of citizenship. (4) This refers to suits under 28 U.S.C. 1332, where parties are citizens of different states. When Box 4 is checked, the citizenship of the different parties must be checked. (See Section III below; federal question actions take precedence over diversity cases.)

III. **Residence (citizenship) of Principal Parties.** This section of the JS-44 is to be completed if diversity of citizenship was indicated above. Mark this section for each principal party.

IV. **Cause of Action.** Report the civil statute directly related to the cause of action and give a brief description of the cause.

V. **Nature of Suit.** Place an "X" in the appropriate box. If the nature of suit cannot be determined, be sure the cause of action, in Section IV above, is sufficient to enable the deputy clerk or the statistical clerks in the Administrative Office to determine the nature of suit. If the cause fits more than one nature of suit, select the most definitive.

VI. **Origin.** Place an "X" in one of the seven boxes.

Original Proceedings. (1) Cases which originate in the United States district courts.

Removed from State Court. (2) Proceedings initiated in state courts may be removed to the district courts under Title 28 U.S.C., Section 1441. When the petition for removal is granted, check this box.

Remanded from Appellate Court. (3) Check this box for cases remanded to the district court for further action. Use the date of remand as the filing date.

Reinstated or Reopened. (4) Check this box for cases reinstated or reopened in the district court. Use the reopening date as the filing date.

Transferred from Another District. (5) For cases transferred under Title 28 U.S.C. Section 1404(a). Do not use this for within district transfers or multidistrict litigation transfers.

Multidistrict Litigation. (6) Check this box when a multidistrict case is transferred into the district under authority of Title 28 U.S.C. Section 1407. When this box is checked, do not check (5) above.

Appeal to District Judge from Magistrate Judgment. (7) Check this box for an appeal from a magistrate's decision.

VII. **Requested in Complaint. Class Action.** Place an "X" in this box if you are filing a class action under Rule 23, F.R.Cv.P.

Demand. In this space enter the dollar amount (in thousands of dollars) being demanded or indicate other demand such as a preliminary injunction.

Jury Demand. Check the appropriate box to indicate whether or not a jury is being demanded.

VIII. **Related Cases.** This section of the JS-44 is used to reference relating pending cases if any. If there are related pending cases, insert the docket numbers and the corresponding judge names for such cases.

Date and Attorney Signature. Date and sign the civil cover sheet.

(rev. 07/89)

\\ODMA\PCDOCS\WORDPERFECT\22816\1 January 24, 2000 (3:10pm)