In the Matter of:

CERTAIN LIGHT-EMITTING DIODE PRODUCTS, FIXTURES, AND COMPONENTS THEREOF

Inv. No. 337-TA-1213

Jack Josefowicz, Ph.D.

Honorable Clark S. Cheney

Administrative Law Judge

Dr. Jack Josefowicz

- Basic research at Harvard University
- R&D at Hughes Research Laboratories
- Professor of Material Science and Engineering (University of Pennsylvania)
- Global Director of Technology and R&D at Tyco Electronics
- Oversaw design of Light Emitting Diode (LED) lighting fixtures at LED Roadway Lighting Ltd. (LRL)
- Executive VP of Technology at LRL

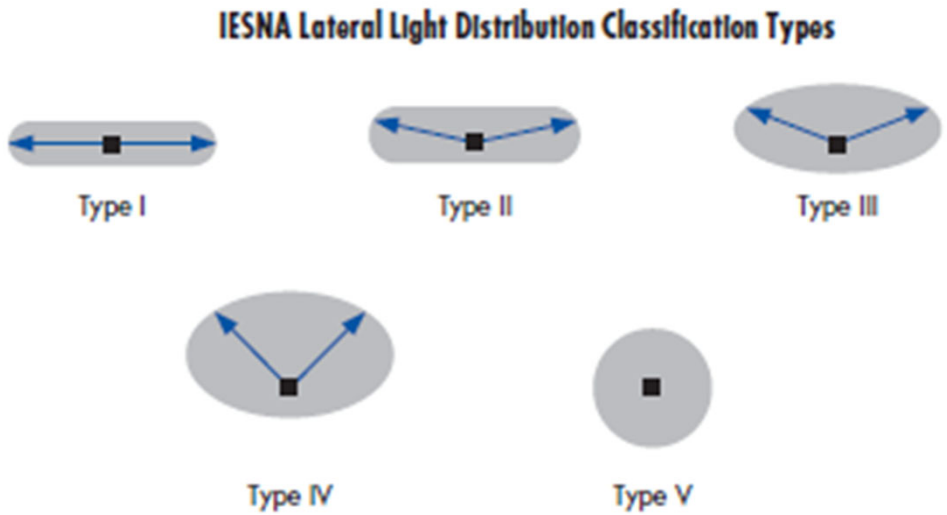
RX-0854 (CV)

Level of Ordinary Skill in the Art

- For the ’570 patent, a person of ordinary skill in the art would have had:
  - At least a bachelor’s degree in physics, electrical engineering, or optoelectronics or an equivalent field of study; and
  - At least three to four years of experience in designing optics.
    - A more advanced degree would reduce the threshold for years of experience in designing optics.

Standard Illumination Output Distributions

- Illumination Engineering Society of North America – Committee on Roadway Lighting is more than 90 years old
- Luminaire distribution classification systems are defined in IESNA RP-8-1983



"Type III, IV, and V distributions are often used for parking lot and area lighting, while Type I, II, and III distributions are often used for roadway lighting."

’570 Patent – Overview

(12) **United States Patent**
Wilcox et al.

(10) **Patent No.: US 9,476,570 B2**
(45) **Date of Patent: *Oct. 25, 2016**

(54) **LENS WITH CONTROLLED BACKLIGHT MANAGEMENT**

(71) Applicant: **Cree, Inc.**, Durham, NC (US)

(72) Inventors: **Kurt S. Wilcox**, Libertyville, IL (US); **Christopher Strom**, Racine, WI (US)

(73) Assignee: **Cree, Inc.**, Durham, NC (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 513 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **13/735,701**

(22) Filed: **Jan. 7, 2013**

(65) **Prior Publication Data**

US 2014/0022797 A1 Jan. 23, 2014

Related U.S. Application Data

(63) Continuation of application No. 12/475,194, filed on May 29, 2009, now Pat. No. 8,348,475, which is a continuation-in-part of application No. 12/173,721, filed on Jul. 15, 2008, now Pat. No. 8,388,193.

(60) Provisional application No. 61/055,958, filed on May 23, 2008.

JX-0005

RDX-0006.005

’570 Patent – Claim Construction

’570 Patent	
“preferential side”	“off-axis direction with respect to the emitter axis to which a majority of light is distributed.”

Order No. 19 (Construing Certain Claims) at 18.

’570 Patent and Its Sole Illustrated Embodiment

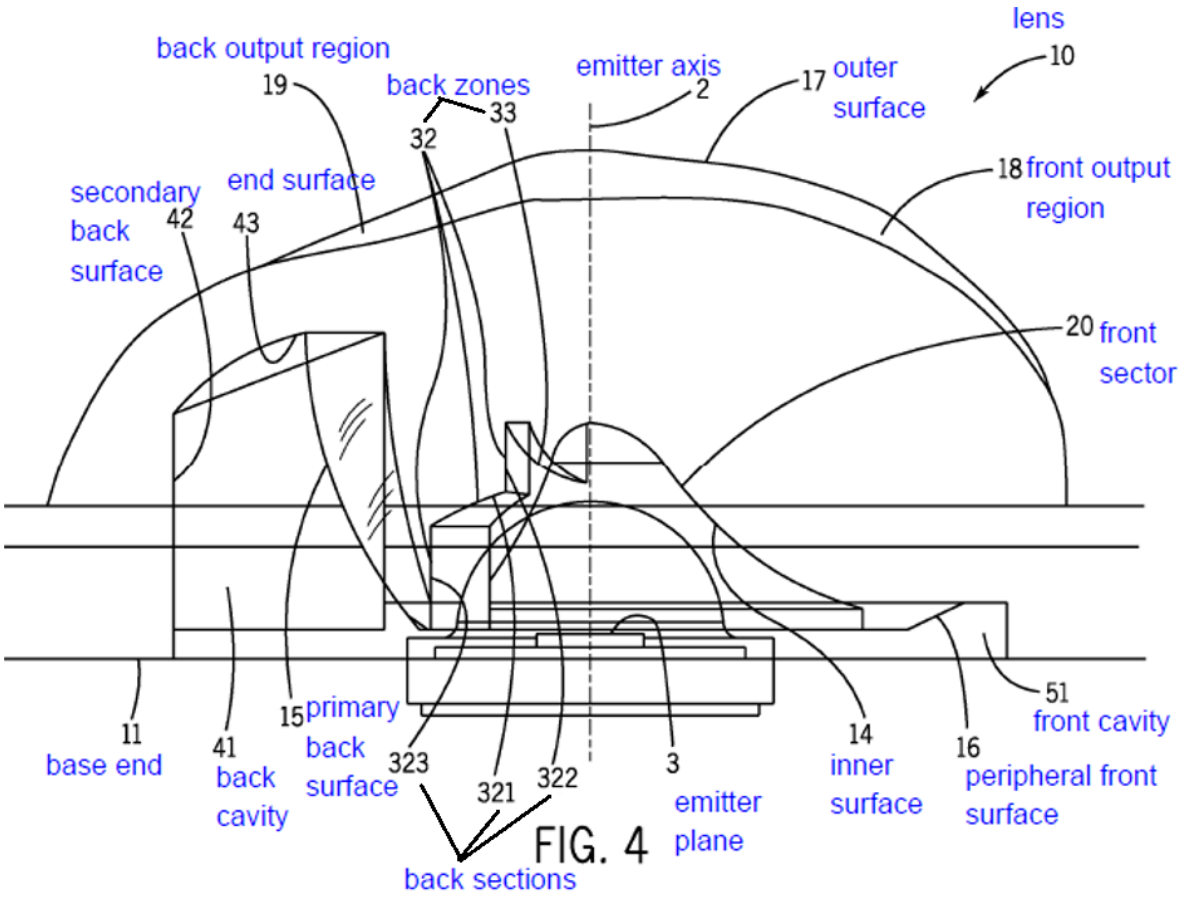


FIG. 4

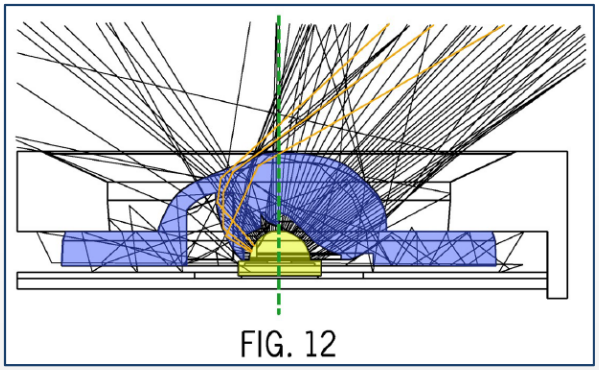


FIG. 12

- **Directs light toward preferential side**
- **Figures 1-20**

JX-0005.0007, 11

RDX-0006.007

’570 Patent – Asserted Claims 1, 3-5, 10

Claim 1*	A lens for distribution of light predominantly toward a preferential side from a light emitter having an emitter axis and defining an emitter plane, comprising: an outer surface configured for refracting emitter light predominantly toward the preferential side; and a refracting inner surface configured for refracting light from the emitter, the refracting inner surface comprising: a front sector centered on the preferential side; and a back sector centered on the non-preferential side radially opposite the preferential side and having a surface configuration differing from a surface configuration of the front sector.
Claim 3	The lens of claim 1 wherein the inner refracting surface defines an emitter-surrounding cavity with an emitter-receiving opening in an emitter-adjacent base end of the lens.
Claim 4	The lens of claim 3 further comprising a reflecting primary back surface positioned to receive light from at least a portion of the refracting-inner-surface back sector and configured for total internal reflection (TIR) thereof toward the lens outer surface.

*Independent Claim

’570 Patent – Asserted Claims 1, 3-5, 10 (cont’d)

Claim 5	The lens of claim 4 wherein the emitter-adjacent base end forms a back opening to a back cavity substantially centered on the non-preferential side and partially bounded by the primary back surface.
Claim 10*	A lens for distribution of light predominantly toward a preferential side from a light emitter having an emitter axis and defining an emitter plane, the lens comprising; an outer surface; a refracting inner surface configured for refracting light from the emitter, the refracting inner surface comprising: a front sector centered on the preferential side; and a back sector centered on the non-preferential side radially opposite the preferential side and having a surface configuration differing from a surface configuration of the front sector; and a reflecting primary back surface positioned to receive light from at least a portion of the refracting-inner-surface back sector and configured for total internal reflection (TIR) thereof toward the lens outer surface.

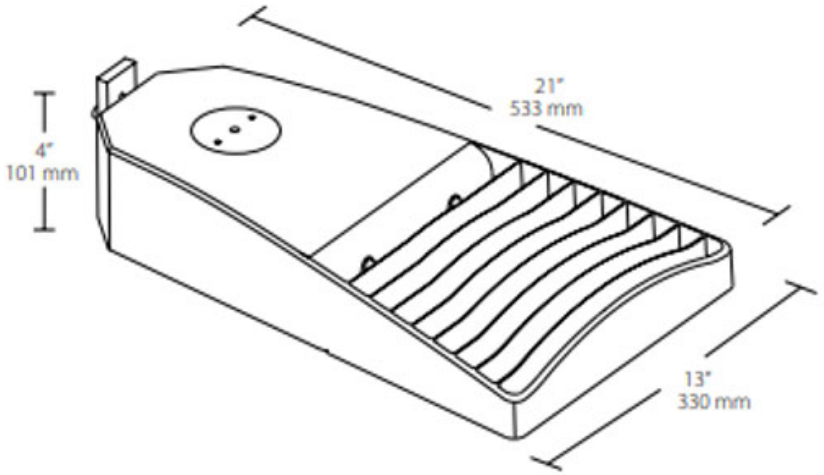
*Independent Claim

’570 Patent – Non-Infringement

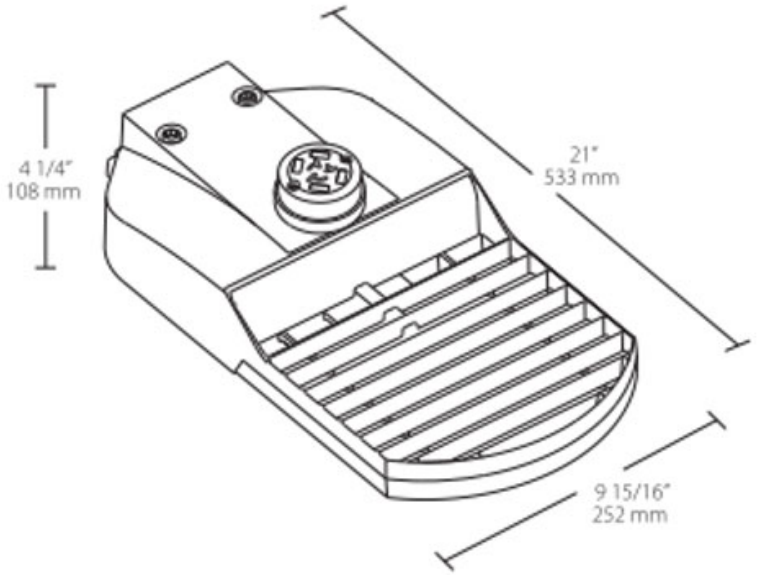
Products: LOTBLASTER and TRIBORO	Limitation Missing
Claims 1 and 10	“a front sector centered on the preferential side” and
Claims 1 and 10	“a back sector centered on the non-preferential side”

The LOTBLASTER & TRIBORO Products

T2, T3, T4 = Type II, III, IV



LOTBLASTER 160W



TRIBORO 95W

In this investigation: IES Type II, III and IV

JX-0085; JX-0086

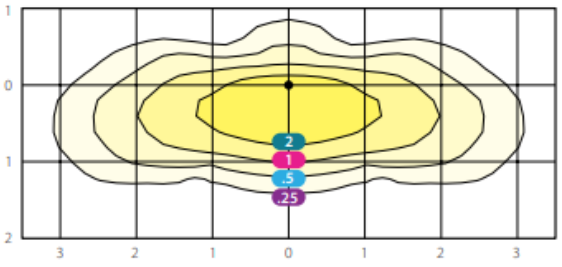
Claim 1 – Preamble

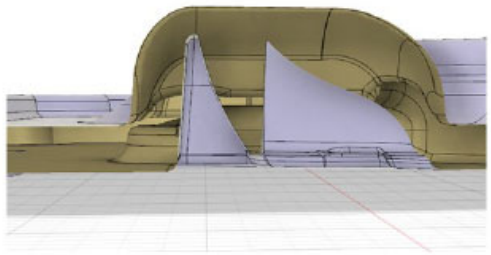
Preamble – Claim 1. A lens for distribution of light predominantly toward a preferential side from a light emitter having an emitter axis and defining an emitter plane, comprising:

LOTBLASTER 160W

Type II - 35 ft. mounting height

Photometric Report #RAB02511MOD16050

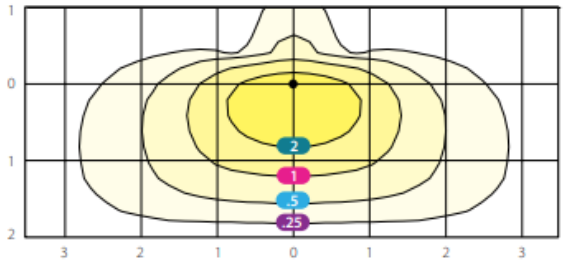


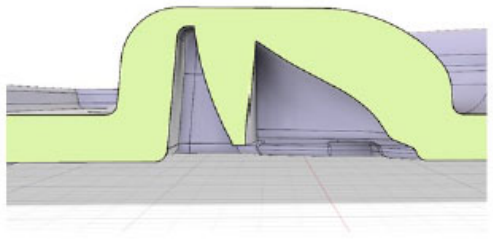


LOTBLASTER 160W

Type III - 35 ft. mounting height

Photometric Report #RAB02512MOD16050

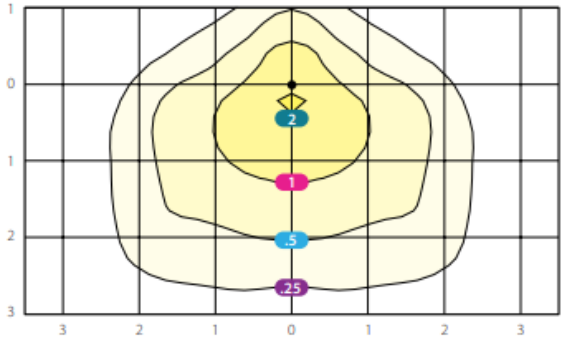


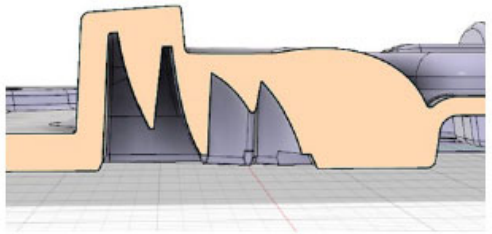


LOTBLASTER 160W

Type IV - 35 ft. mounting height

Photometric Report #RAB02639MOD50



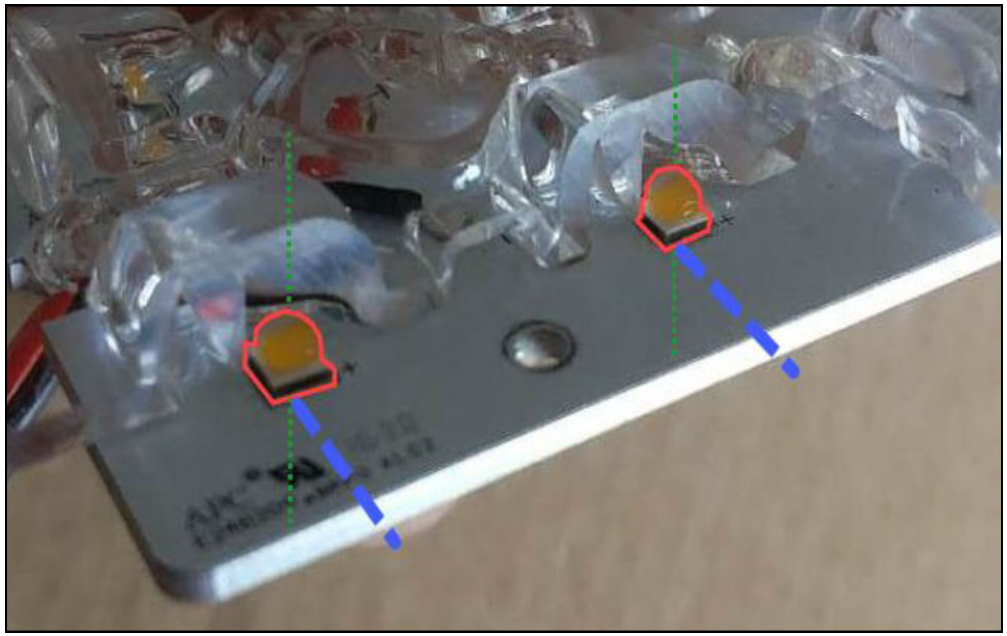


CDX-0002.0007, 0012

RDX-0006.012

Claim 1 – Preamble (cont.)

Preamble – Claim 1. A lens for distribution of light predominantly toward a preferential side from a light emitter having an emitter axis and defining an emitter plane, comprising:



Blue = emitter plane

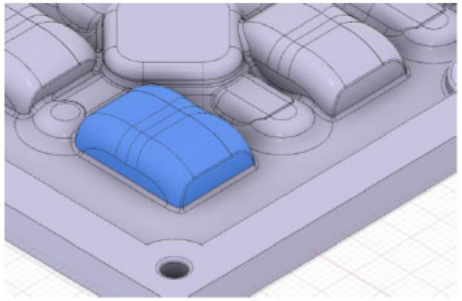
Green = emitter axis

Red = emitter

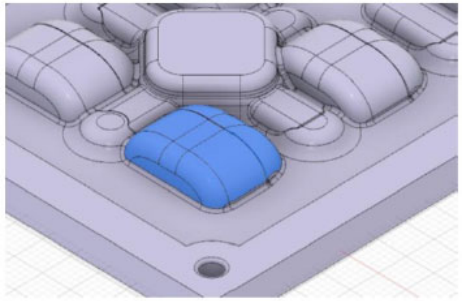
Claim 1 – Outer and Inner Surface Limitations

1a. "an outer surface configured for refracting emitter light predominantly toward the preferential side"

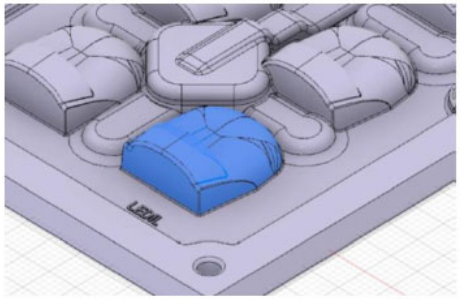
T2



T3

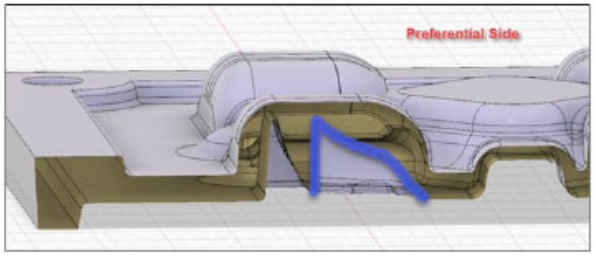


T4

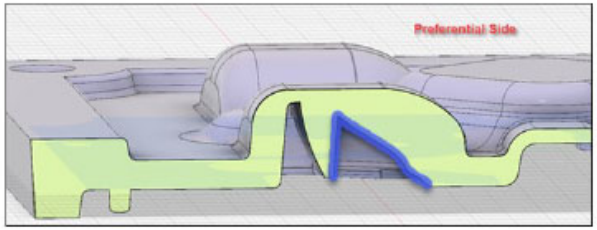


1b. "a refracting inner surface configured for refracting light from the emitter, the refracting inner surface comprising:"

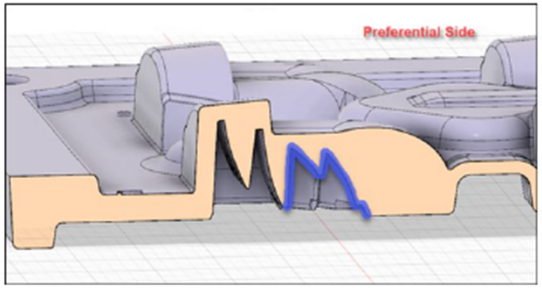
T2



T3



T4



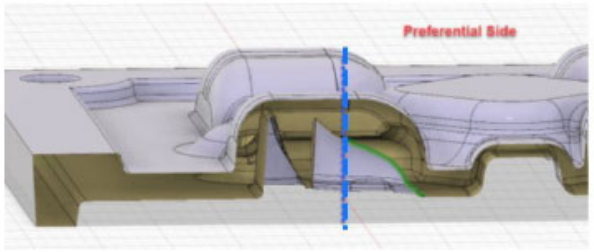
CDX-0002.0016, 0020

RDX-0006.014

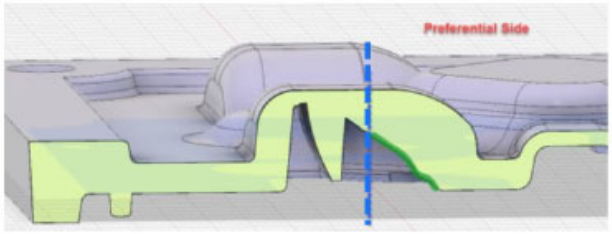
Claim 1 – Front Sector Limitation

Claim 1c. – "a front sector centered on the preferential side"

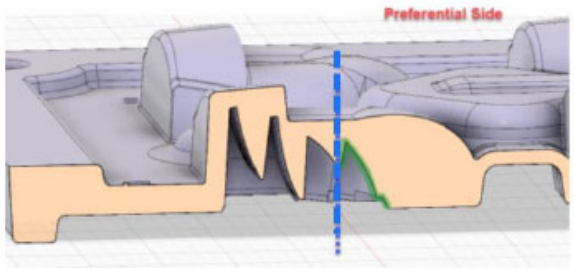
T2



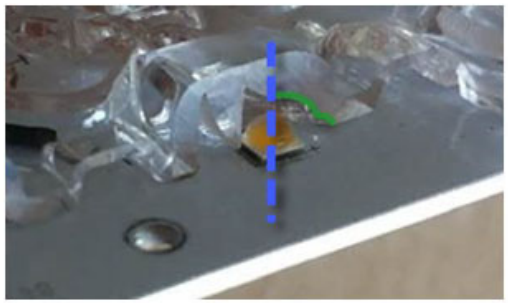
T3



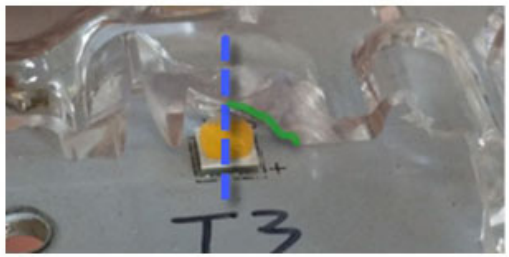
T4



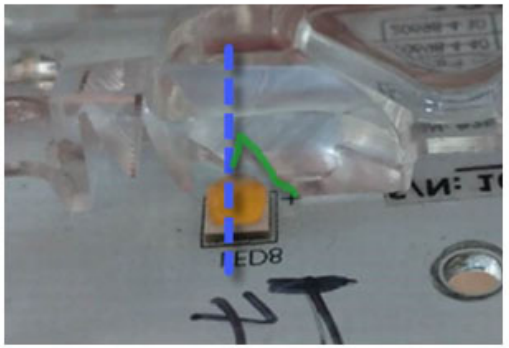
T2



T3



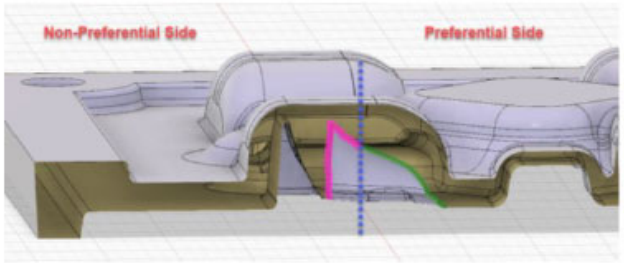
T4



Claim 1 – Back Sector Limitation

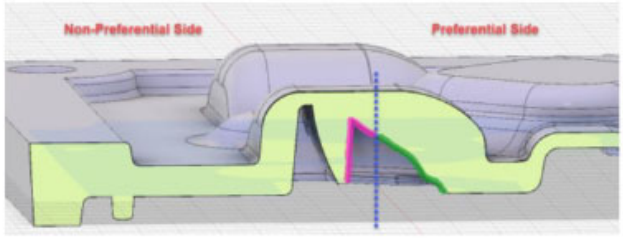
Claim 1d. – "a back sector centered on the non-preferential side radially opposite the preferential side and having a surface configuration differing from a surface configuration of the front sector."

T2



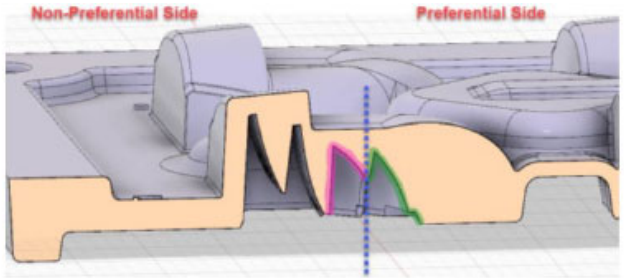
CPX-1893

T3



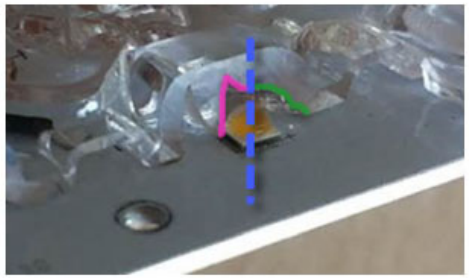
CPX-1894

T4



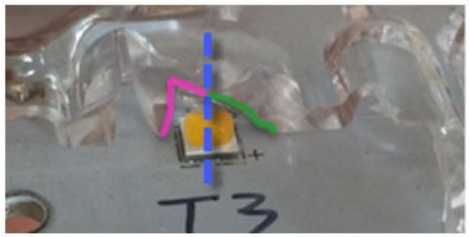
CPX-1895

T2



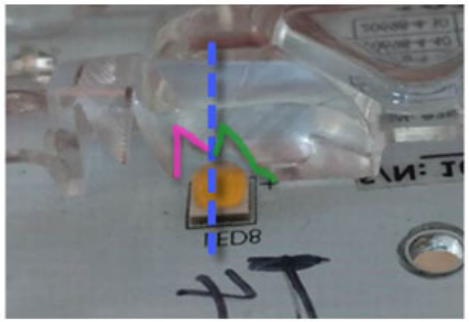
CX-0661

T3



CX-0662

T4



CX-0664

CDX-0002.0024

RDX-0006.016

“Front Sector” and “Back Sector,” ’570 Patent, Figure 6

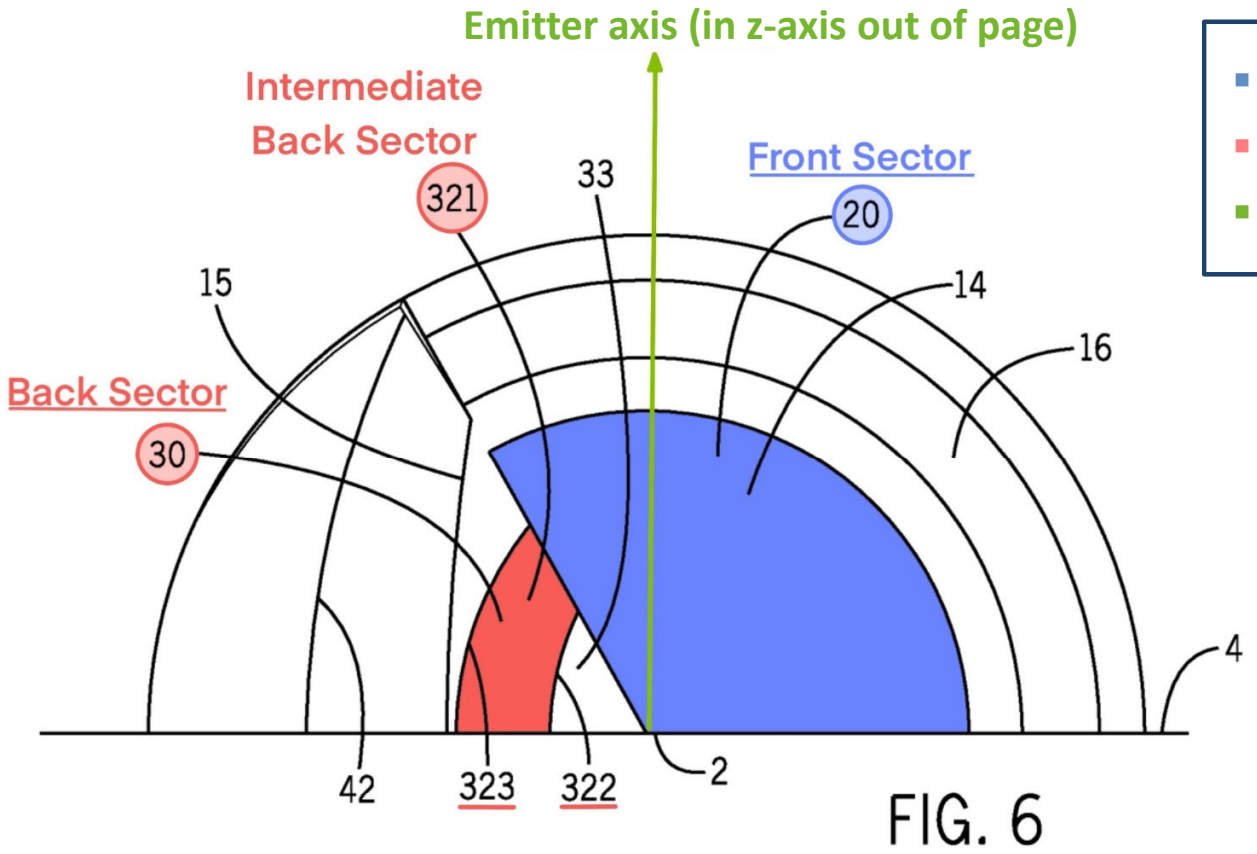
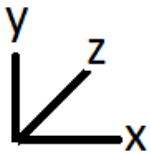
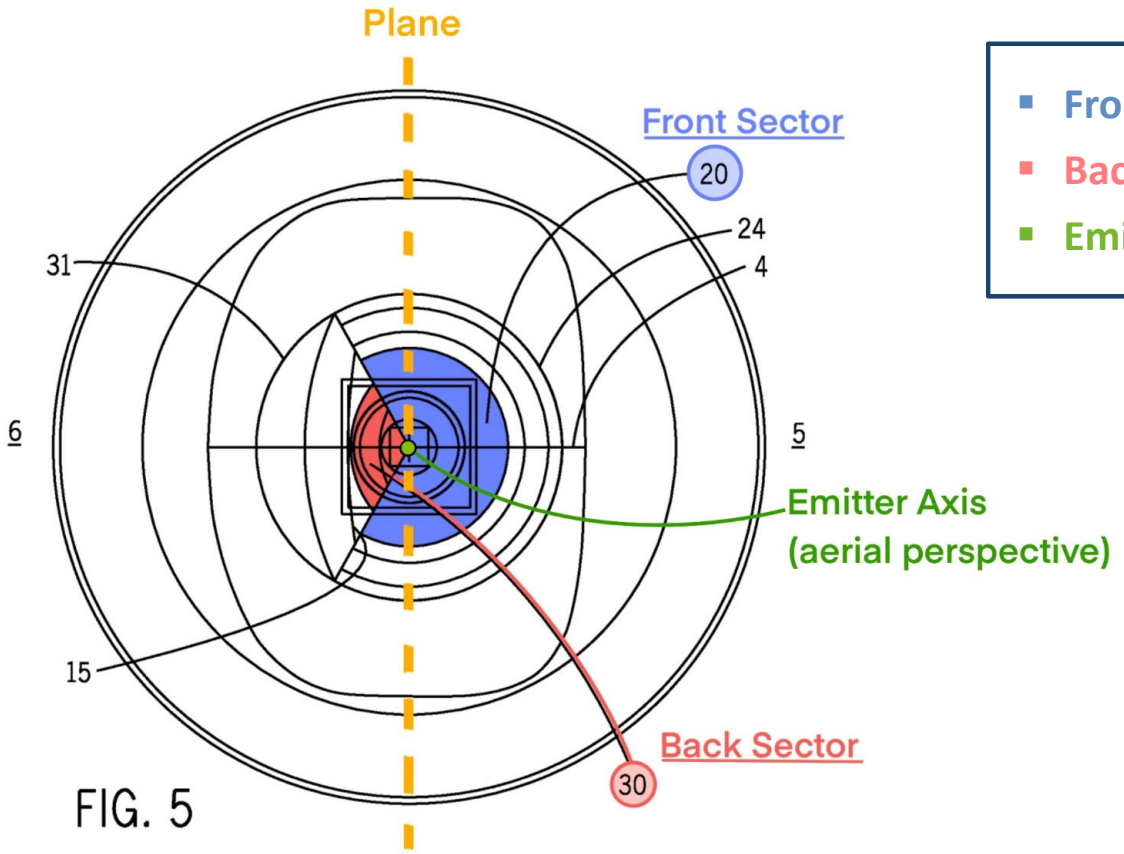


FIG. 6

- Front sector 20
- Back sector 30
- Emitter axis 2



“Front Sector” and “Back Sector,” ’570 Patent, Figure 5



- Front sector 20
- Back sector 30
- Emitter axis 2

JX-0005.0008

RDX-0006.018

“Front Sector” and “Back Sector,” ’570 Patent, Figure 4

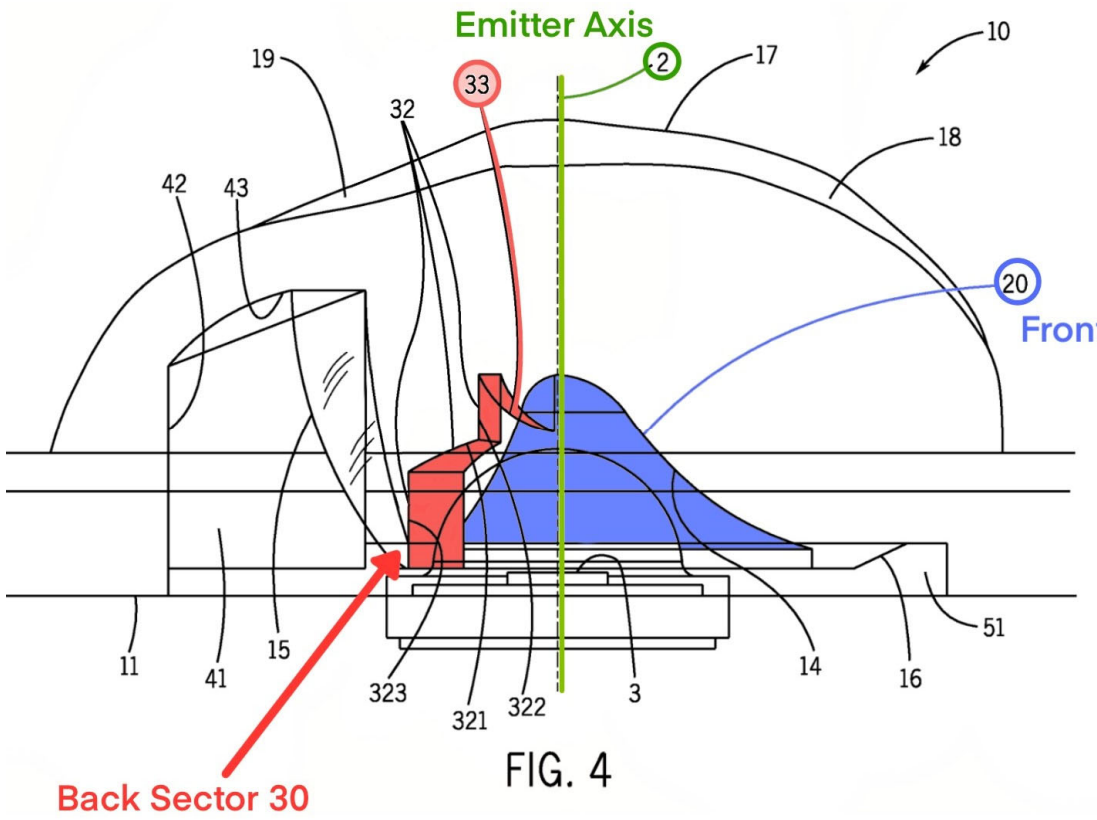
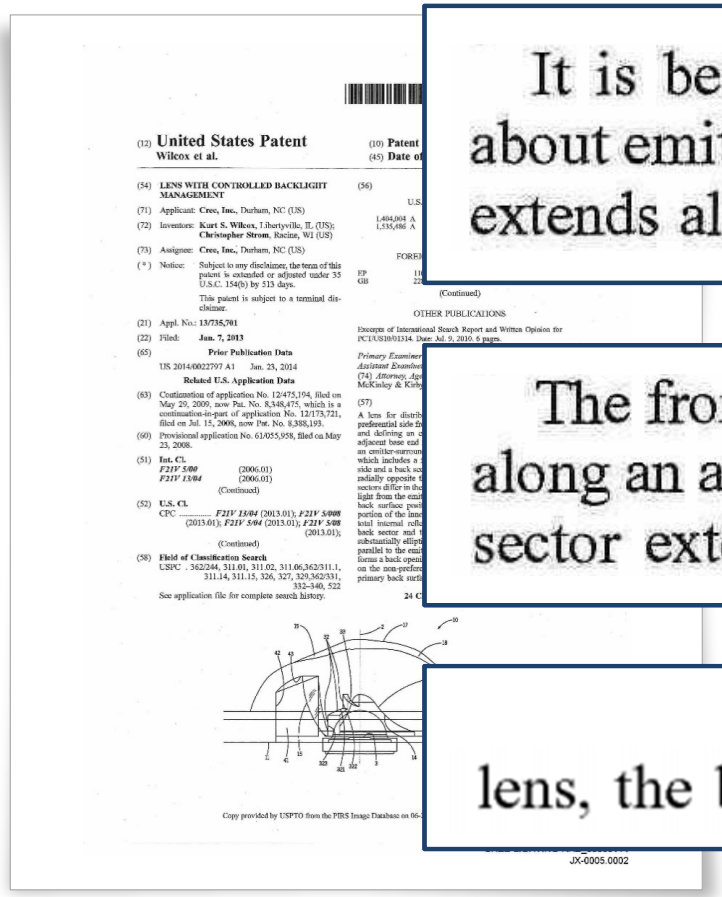


FIG. 4

- Front sector 20
- Back sector 30
- Emitter axis 2

‘570 Patent – Location of Sectors



(12) **United States Patent**
Wilcox et al.

(10) Patent
(45) Date of

(54) **LENS WITH CONTROLLED BACKLIGHT MANAGEMENT**

(71) Applicant: **Cree, Inc.**, Durham, NC (US)

(72) Inventors: **Kurt S. Wilcox**, Libertyville, IL (US); **Christopher Strom**, Racine, WI (US)

(73) Assignee: **Cree, Inc.**, Durham, NC (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 513 days.

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(22) Filed: **Jan. 7, 2013**

(65) **Prior Publication Data**

US 2014/0022797 A1 Jan. 23, 2014

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(60) Provisional application No. 61/055,958, filed on May 23, 2008.

(51) **Int. Cl.**
F21V 5/00 (2006.01)
F21V 13/04 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***F21V 13/04*** (2013.01); ***F21V 5/008*** (2013.01); ***F21V 5/04*** (2013.01); ***F21V 5/08*** (2013.01);
(Continued)

(58) **Field of Classification Search**
USPC . 362/244, 311.01, 311.02, 311.06,362/311.1, 311.14, 311.15, 326, 327, 329,362/331, 332–340, 522
See application file for complete search history.

(56)

U.S.
1,404,004 A
1,535,486 A

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EP
GB

(Continued)

OTHER PUBLICATIONS

Excerpts of International Search Report and Written Opinion for PCT/US10/01314. Date: Jul. 9, 2010. 6 pages.

Primary Examiner
Assistant Examiner
(74) *Attorney, Ag*
McKinley & Kirby

(57)

A lens for distrib
preferential side fl
and defining an e
adjacent base end
an emitter-surroun
which includes a
side and a back se
radially opposite t
sectors differ in the
light from the emit
back surface posi
portion of the inne
total internal refle
back sector and t
substantially ellipti
parallel to the emi
forms a back openi
on the non-prefer
primary back surfa

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JX-0005.0002

It is best shown in FIG. **5** that front sector **20** extends about emitter axis **2** along an arc **24** and that the back sector extends along an arc **31**.

The front sector preferably extends about the emitter axis along an arc that is greater than the arc along which the back sector extends.

In preferred embodiments of the inventive lens, the back-sector arc is about half the front-sector arc.

Relationship of Front and Back Sector

Claim 8 of U.S. Application No. 13/735,701 as filed:

"The lens of claim 6 wherein the front sector of the refracting inner surface has a substantially smooth surface configuration extending to the **juncture** of the front and back sectors."

Claim 19 of '570 Patent as granted:

"A lens for distribution of light predominantly toward a preferential side from a light emitter having an emitter axis and defining an emitter plane, the lens comprising an outer surface and a refracting inner surface comprising: … a back sector centered on a non-preferential side radially opposite the preferential side and having a surface configuration differing from a surface configuration of the front sector which has a substantially smooth surface configuration extending to the **juncture** of the front and back sectors."

JX-0010.0023, JX-0005

Dr. Lebby's Inconsistent Identification of "Boundary Condition"

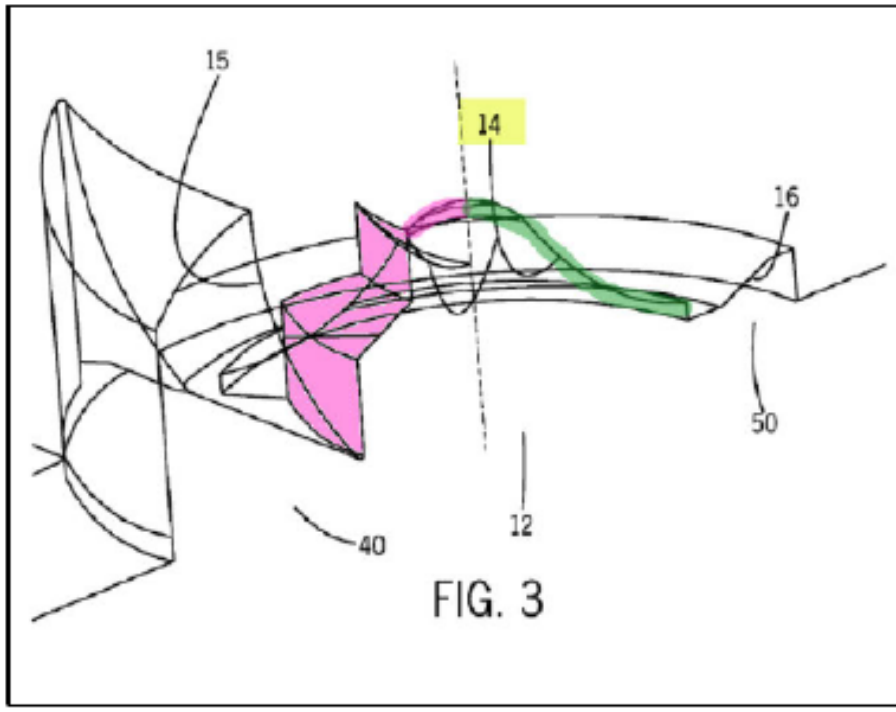


FIG. 3

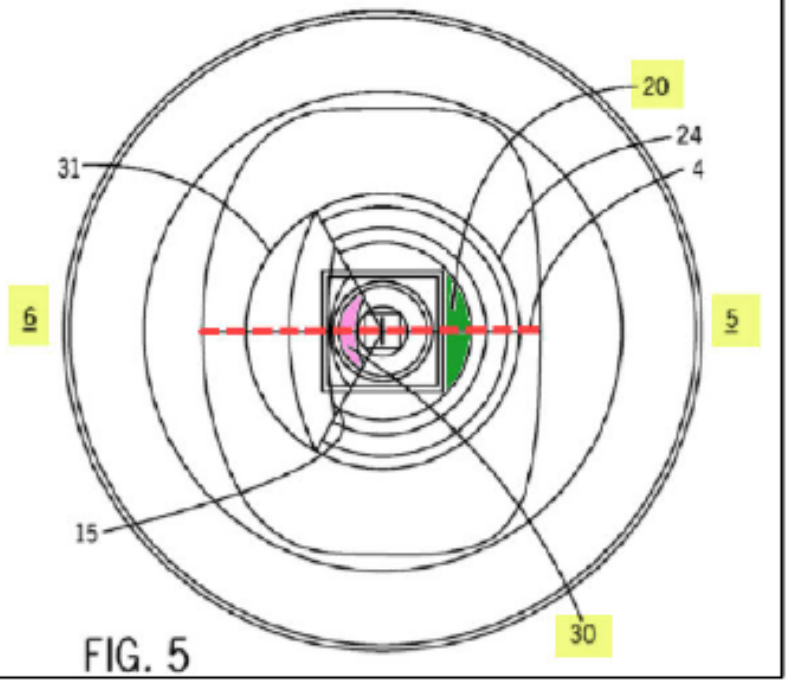
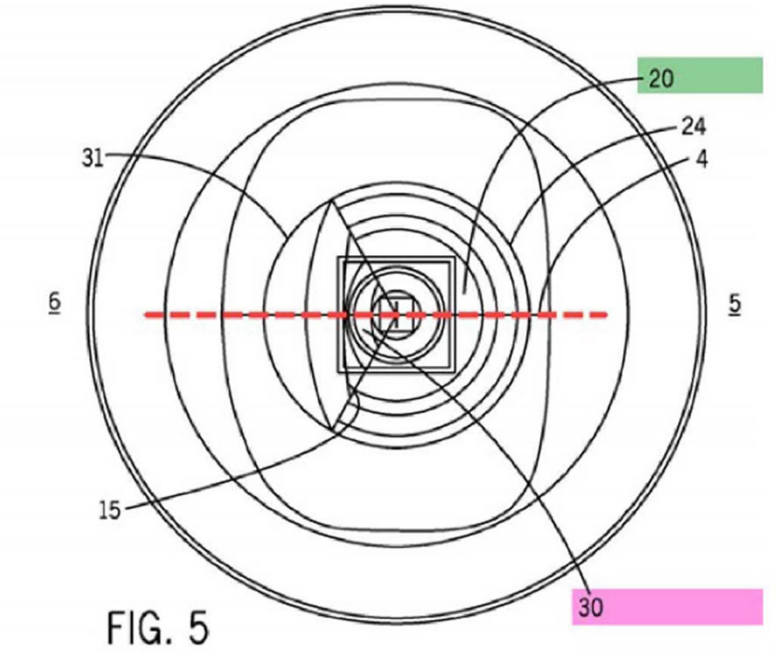
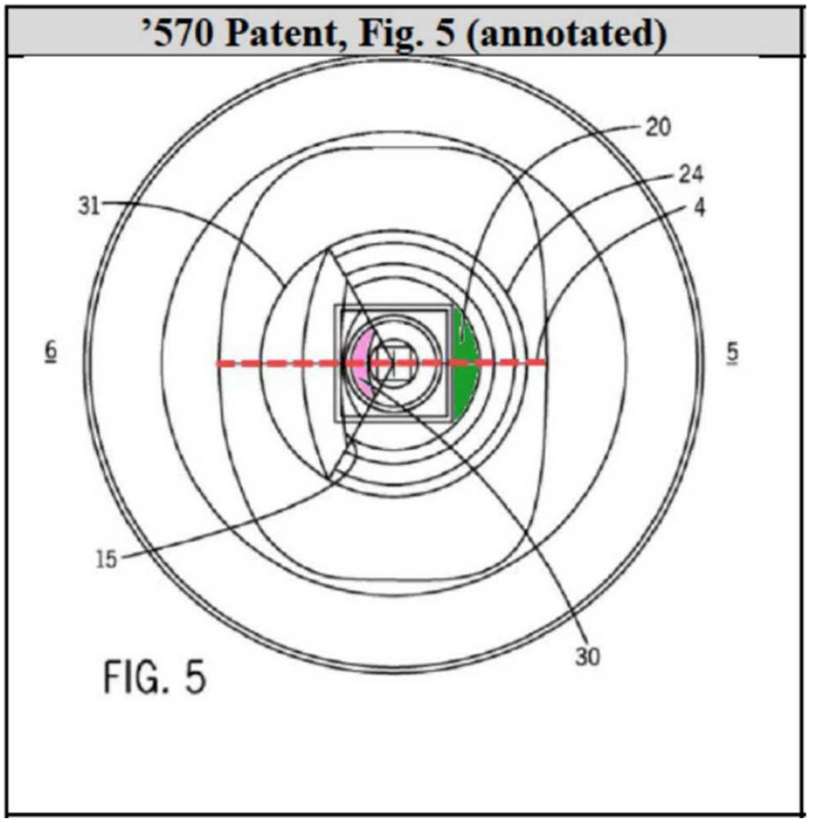


FIG. 5

Lebby Op. Rpt., p. 62

Dr. Lebby's Inconsistent Identification of "Boundary Condition"





JX-0005.0017-18, CDX-0002.0022; Lebby Op. Rpt., p. 62

Dr. Lebby's Inconsistent Identification of "Boundary Condition"

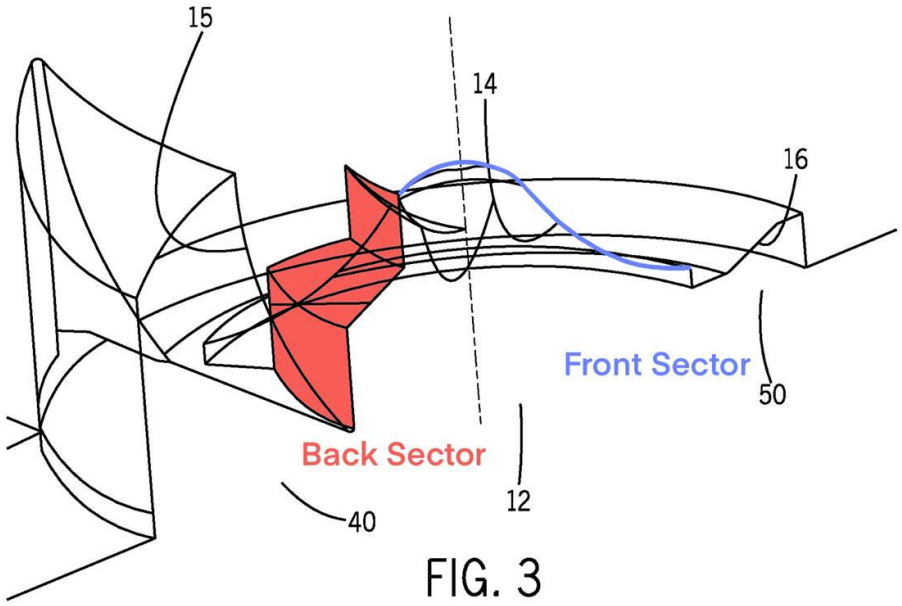


FIG. 3

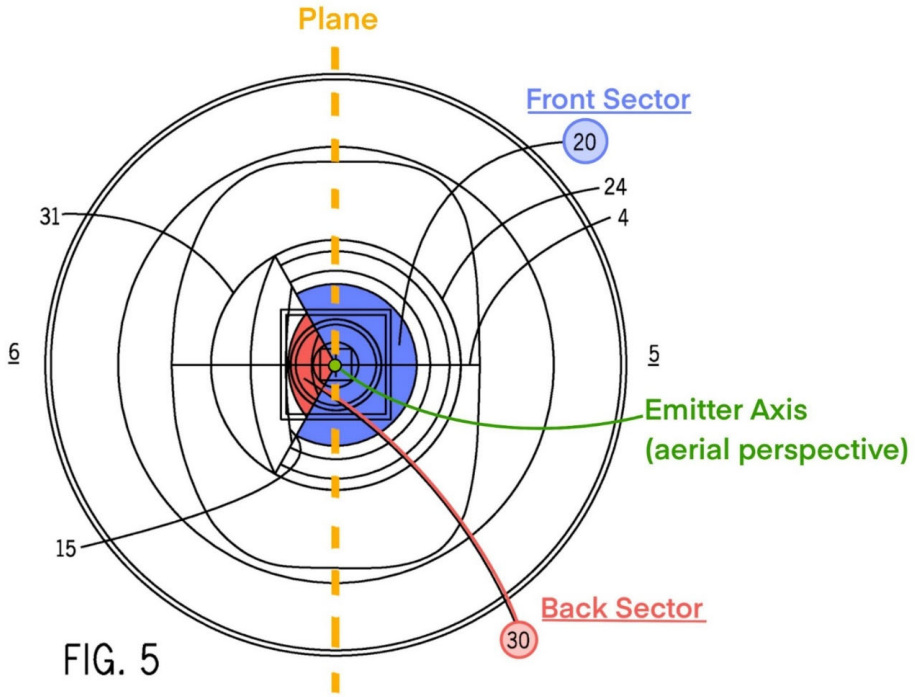
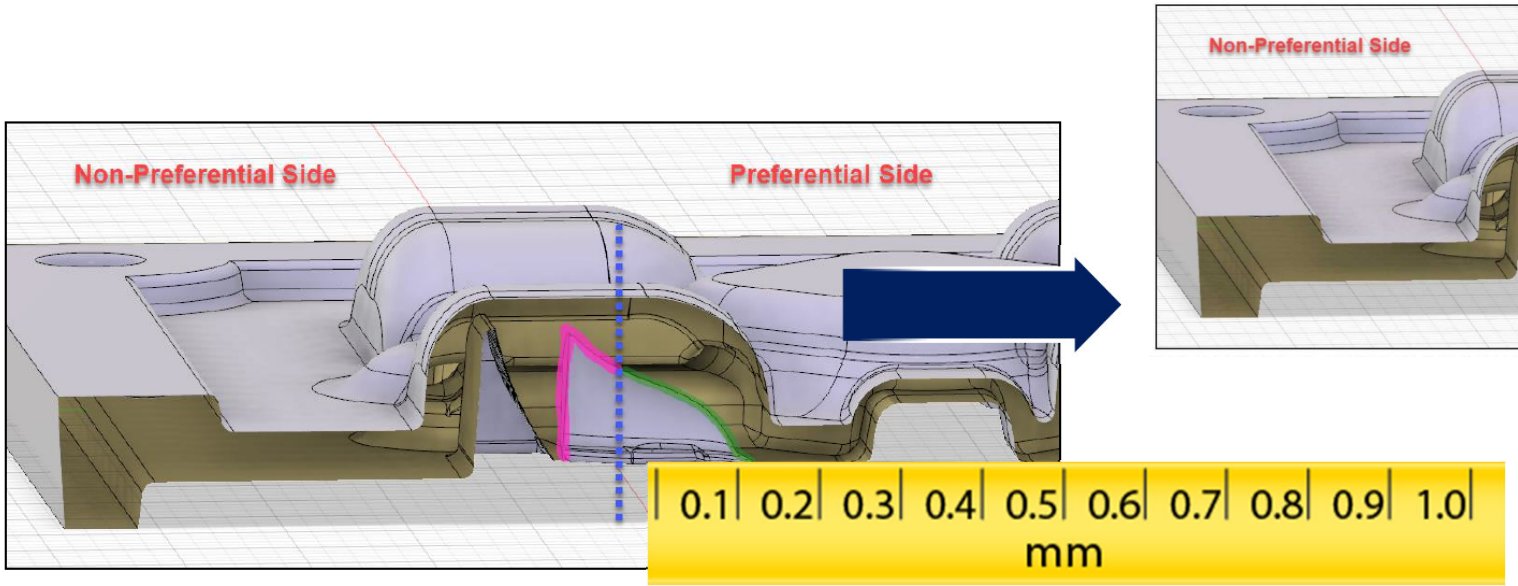


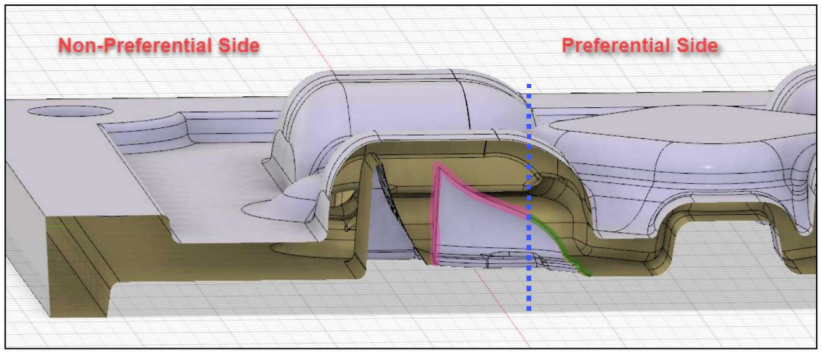
FIG. 5

JX-0005; Lebby Op. Rpt., p. 62

Dr. Lebby's Reliance on the Emitter Axis Is Inconsistent with USP '570

- Not a property of the lens but instead property of emitter
- Moves with the emitter
- No optical functionality to "front sector" and "back sector"





CDX-0002.0024, RDX-0012-003

RDX-0006.025

RAB's Products Do Not Infringe The Asserted Claims

- RAB's lenses do not employ a front and back sector as recited in asserted independent claims 1 and 10
- They use optical elements to achieve standard IES distributions to direct light toward a preferential side

Claim 1	A lens for distribution of light predominantly toward a preferential side from a light emitter having an emitter axis and defining an emitter plane, comprising: an outer surface configured for refracting emitter light predominantly toward the preferential side; and a refracting inner surface configured for refracting light from the emitter, the refracting inner surface comprising: ~~a front sector centered on the preferential side; and~~ ~~a back sector centered on the non-preferential side radially opposite the preferential side and having a surface configuration differing from a surface configuration of the front sector~~.
Claim 10	A lens for distribution of light predominantly toward a preferential side from a light emitter having an emitter axis and defining an emitter plane, the lens comprising; an outer surface; a refracting inner surface configured for refracting light from the emitter, the refracting inner surface comprising: ~~a front sector centered on the preferential side; and~~ ~~a back sector centered on the non-preferential side radially opposite the preferential side and having a surface configuration differing from a surface configuration of the front sector~~; and a reflecting primary back surface positioned to receive light from at least a portion of the refracting-inner-surface back sector and configured for total internal reflection (TIR) thereof toward the lens outer surface.

Invalidity: '570 Patent Purported Invention

From background section of the '570 patent:

1) **Improved efficiency** – "Even though these [prior lens] configurations were deemed necessary to achieve desired illumination patterns and to prevent so-called lighting "trespass," they tended to result in lost light and decreased efficiency of LED illuminators. It would be highly desirable to improve efficiency of the use of light emitted by LEDs in lighting fixtures."

2) **Improved control** – "A typical LED emits light over a wide range of angles such that light from the LED reaches a particular area of the output surface of the lens at somewhat different angles. This has made it very difficult to control refraction of such light .... It would be desirable to provide improved control of the direction of light exiting such lenses."

3) **Managing trespass lighting** – "Trespass lighting can be evaluated by more than just the amount of light emitted in an undes[ir]ed direction; also to be considered is how far from the desired direction such light is directed. It would be highly beneficial to provide a lighting apparatus which produces a desired illumination pattern with a maximum amount of light emitted toward the space intended to be illuminated, in typical commercial applications."

Mandaluniz

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 920 973 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
14.05.2008 Bulletin 2008/20

(51) Int Cl.:
B60Q 1/56 *(2006.01)*

(21) Application number: **07380284.5**

(22) Date of filing: **22.10.2007**

Mandaluniz Teaches Claim 1 under Dr. Lebby's Interpretation

1 [Preamble]. A lens (**lens 3**) for distribution of light predominantly toward a preferential side (**toward registration plate 2**) from a light emitter (**light source 1**) having an emitter axis and defining an emitter plane, comprising:

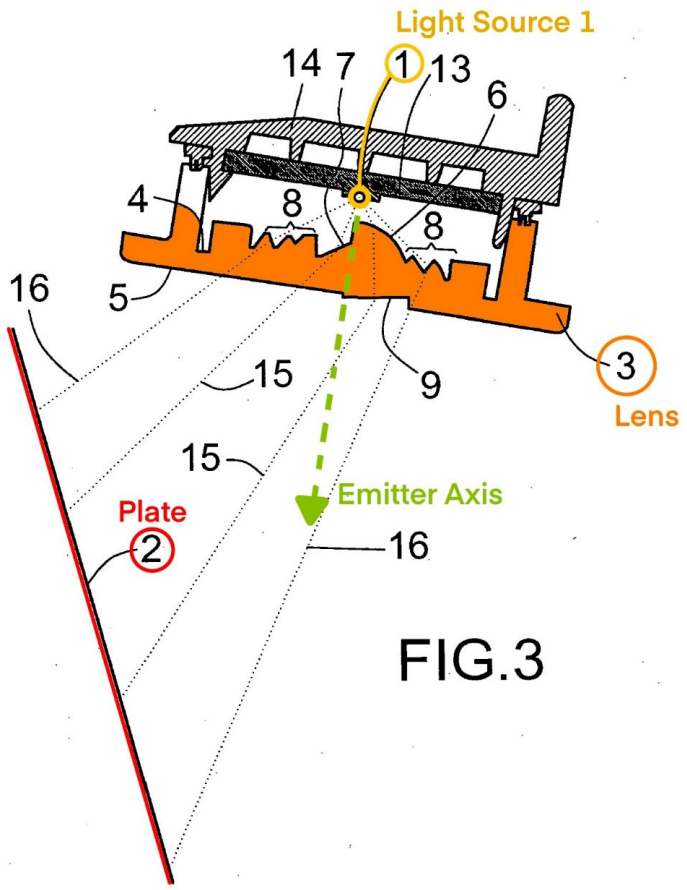


FIG.3

Mandaluniz Teaches Claim 1 under Dr. Lebby's Interpretation

1 [Preamble]. A lens (**lens 3**) for distribution of light predominantly toward a preferential side (**toward registration plate 2**) from a light emitter (**light source 1**) having an emitter axis and defining an emitter plane, comprising:
1a. an outer surface (**surface 9**) configured for refracting emitter light predominantly toward the preferential side; and

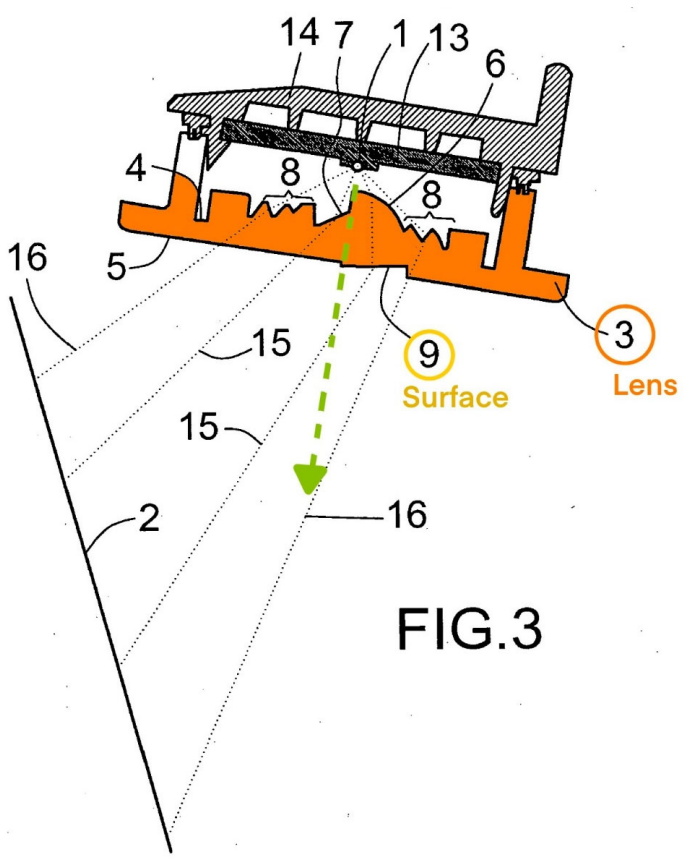


FIG.3

Mandaluniz Teaches Claim 1 under Dr. Lebby's Interpretation

1 [Preamble]. A lens (**lens 3**) for distribution of light predominantly toward a preferential side (**toward registration plate 2**) from a light emitter (**light source 1**) having an emitter axis and defining an emitter plane, comprising:
1a. an outer surface (**surface 9**) configured for refracting emitter light predominantly toward the preferential side; and
1b. a refracting inner surface (**inner face 4**) configured for refracting light from the emitter, the refracting inner surface comprising

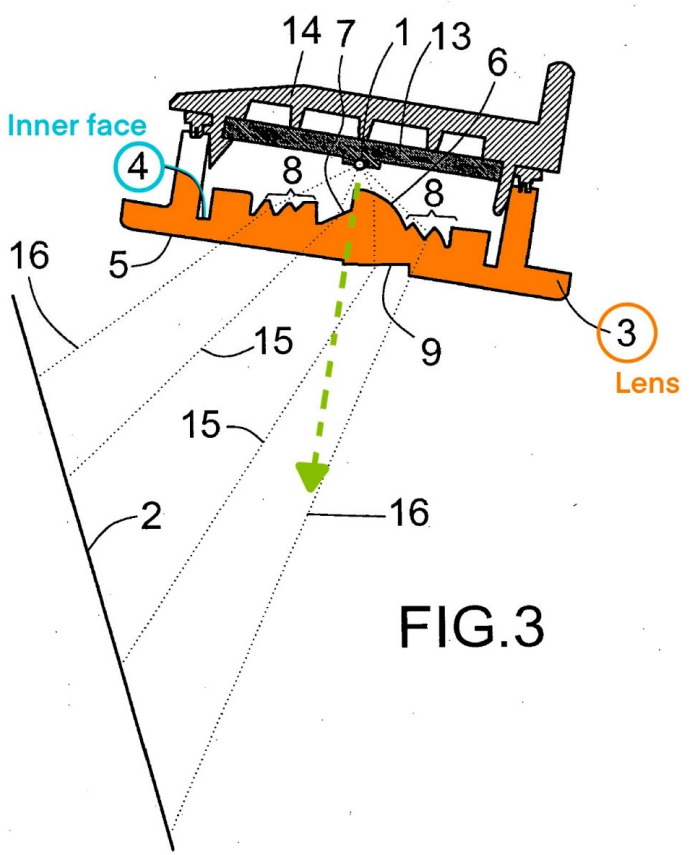


FIG.3

Mandaluniz Teaches Claim 1 under Dr. Lebby's Interpretation

1 [Preamble]. A lens (**lens 3**) for distribution of light predominantly toward a preferential side (**toward registration plate 2**) from a light emitter (**light source 1**) having an emitter axis and defining an emitter plane, comprising:
1a. an outer surface (**surface 9**) configured for refracting emitter light predominantly toward the preferential side; and
1b. a refracting inner surface (**inner face 4**) configured for refracting light from the emitter, the refracting inner surface comprising
1c. a front sector (**portion of collimation areas 8 to left of emitter axis**) centered on the preferential side; and

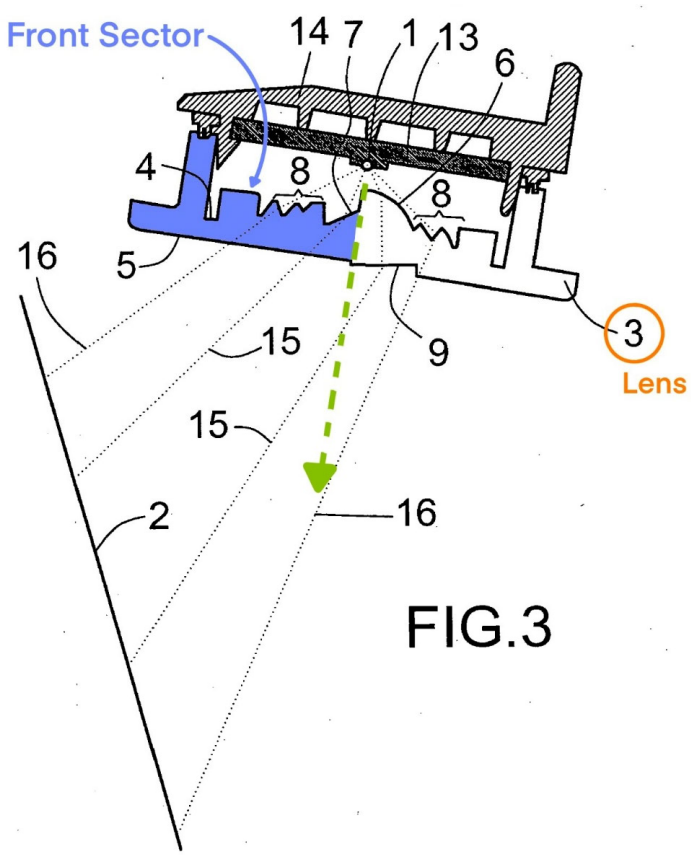


FIG.3

Mandaluniz Teaches Claim 1 under Dr. Lebby's Interpretation

1 [Preamble]. A lens (**lens 3**) for distribution of light predominantly toward a preferential side (**toward registration plate 2**) from a light emitter (**light source 1**) having an emitter axis and defining an emitter plane, comprising:
1a. an outer surface (**surface 9**) configured for refracting emitter light predominantly toward the preferential side; and
1b. a refracting inner surface (**inner face 4**) configured for refracting light from the emitter, the refracting inner surface comprising
1c. a front sector (**portion of collimation areas 8 to left of emitter axis**) centered on the preferential side; and
1d. a back sector (**portion of collimation areas 8 to right of emitter axis 4**) centered on the non-preferential side radially opposite the preferential side and having a surface configuration differing from a surface configuration of the front sector (**asymmetric central element of collimation areas 8**).

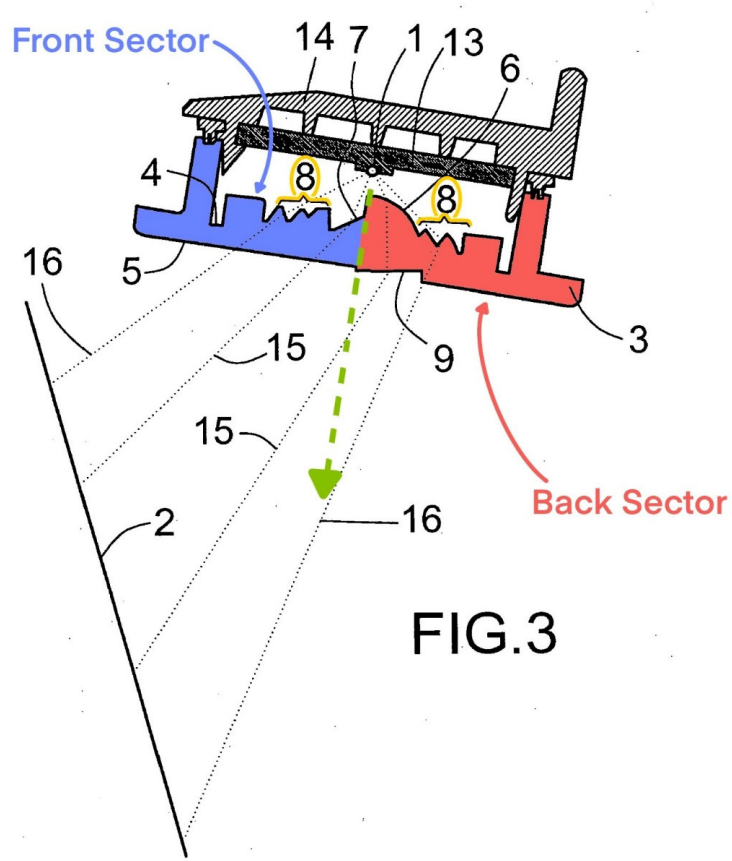


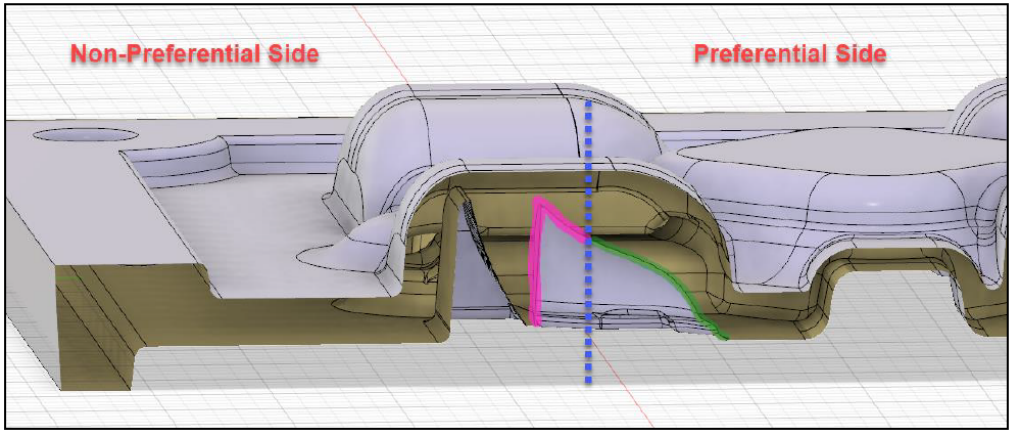
FIG.3

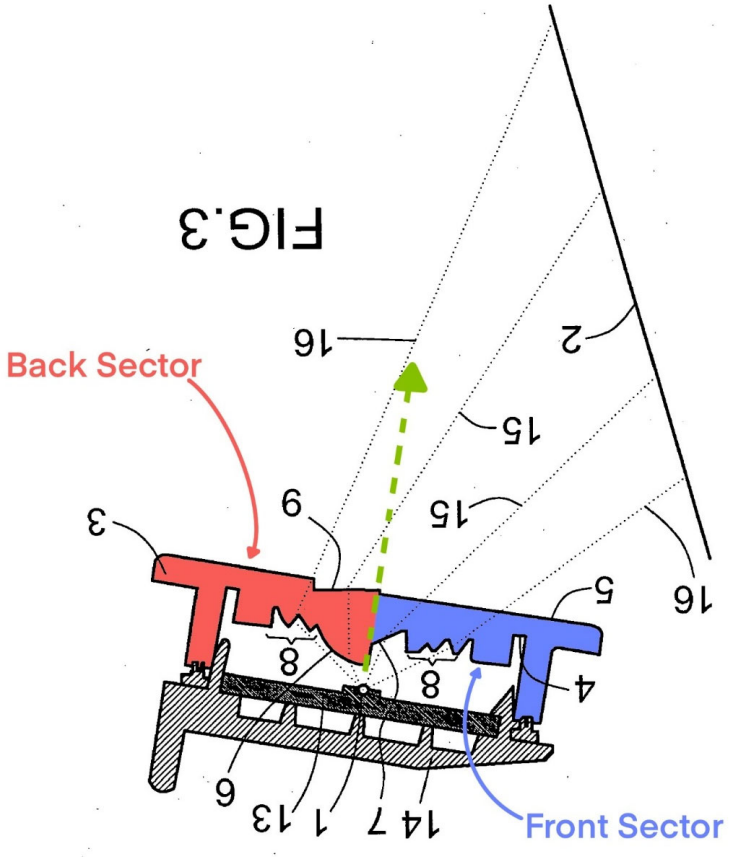
RX-0759

RDX-0006.033

Mandaluniz Teaches Claim 1 under Dr. Lebby's Interpretation

Comparison of accused RAB product having T2 lens to Mandaluniz





CDX-0002.0024, RX-0759

RDX-0006.034

Mandaluniz Teaches Claim 3 under Dr. Lebby's Interpretation

3. The lens of claim 1 wherein the inner refracting surface (inner face 4) defines an emitter-surrounding cavity (cavity surrounding area where light source (1)) with an emitter-receiving opening (area to accommodate light source (1)) in an emitter-adjacent base end of the lens (end where board 13 is located).

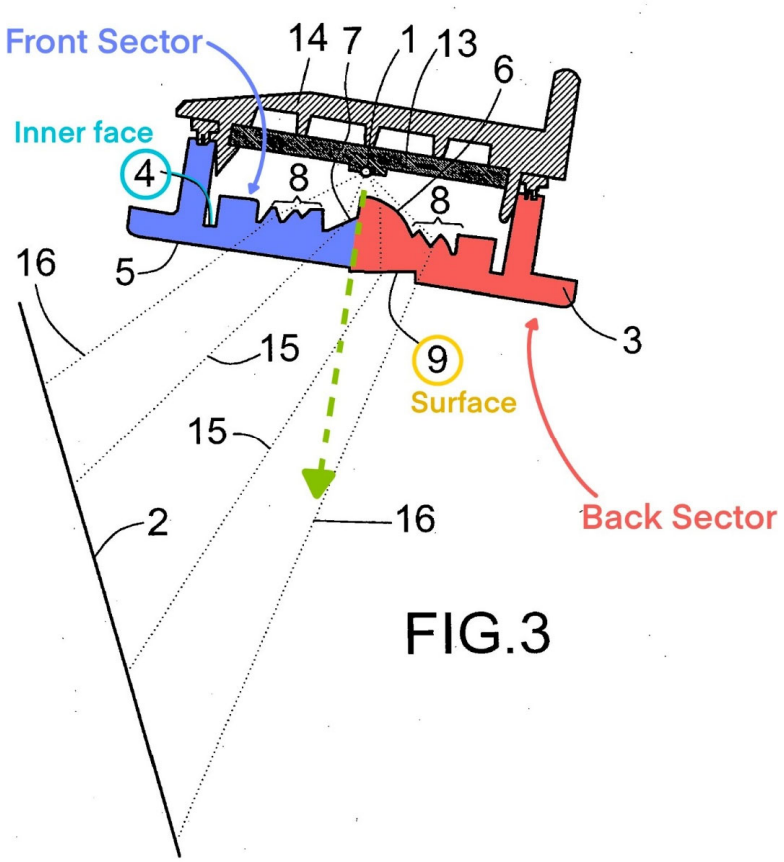


FIG.3

Parkyn

(12) **United States Patent**
Parkyn et al.

(10) **Patent No.: US 7,273,299 B2**
(45) **Date of Patent: Sep. 25, 2007**

(54) **CYLINDRICAL IRRADIANCE-MAPPING LENS AND ITS APPLICATIONS TO LED SHELF-LIGHTING**

(75) Inventors: **William A. Parkyn**, Lomita, CA (US); **David G. Pelka**, Los Angeles, CA (US)

(73) Assignee: **Pelka & Associates**, Los Angeles, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/332,738**

(22) Filed: **Jan. 17, 2006**

(65) **Prior Publication Data**

US 2006/0164833 A1 Jul. 27, 2006

FIG. **9**A shows asymmetric illumination lens **90** positioned over LED **91**. Lens **90** has two quite dissimilar halves **90**L and **90**R. The coordinated action of these two halves can be seen in FIG. **9**B, showing the refractive deflection by lens **90** of planar ray-fan **92**, transforming it into asymmetric output fan **93**. FIG. **9**C shows lens **90** illuminating **1**-meter-wide target **94** from 1' above one edge, with output ray-fan **92**.

RX-0758, RX-0758, Col. 5, lines 56-63

Parkyn Teaches Claim 1 under Dr. Lebby's Interpretation

1 [Preamble]. A lens (**lens 90**) for distribution of light predominantly toward a preferential side (**asymmetric output fan 93 has preferential side labeled to right of lens element 90R**) from a light emitter (**LED 91**) having an emitter axis and defining an emitter plane, comprising:

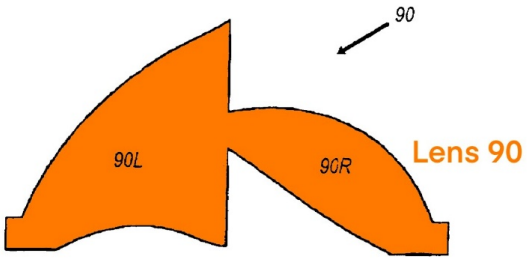


FIG. 9A

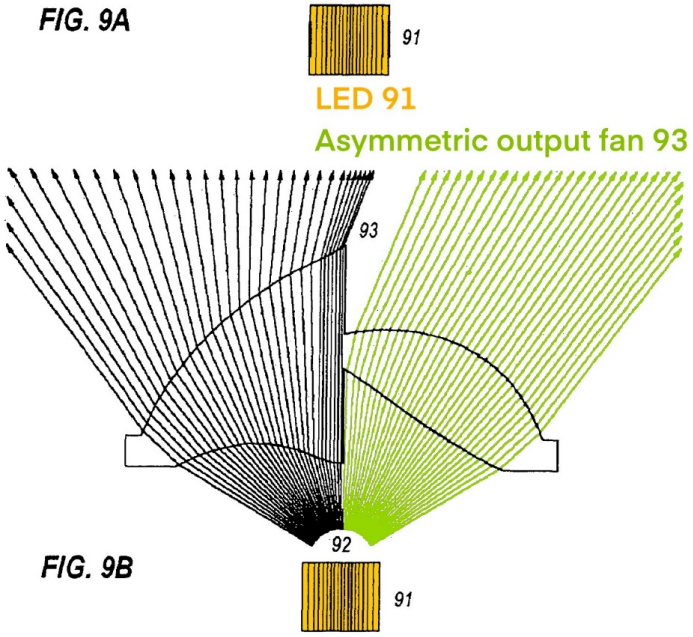


FIG. 9B

RX-0758

RDX-0006.037

Parkyn Teaches Claim 1 under Dr. Lebby's Interpretation

1 [Preamble]. A lens (**lens 90**) for distribution of light predominantly toward a preferential side (**asymmetric output fan 93 has preferential side labeled to right of lens element 90R**) from a light emitter (**LED 91**) having an emitter axis and defining an emitter plane, comprising:

1a. an outer surface (**outer surface of lens elements 90L, 90R**) configured for refracting emitter light predominantly toward the preferential side; and

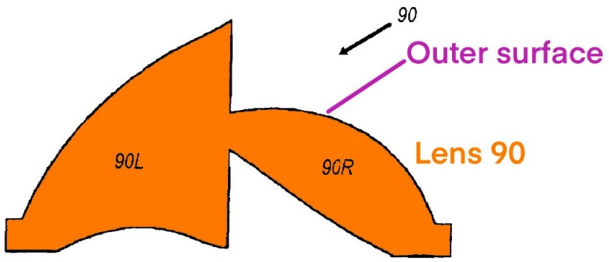


FIG. 9A

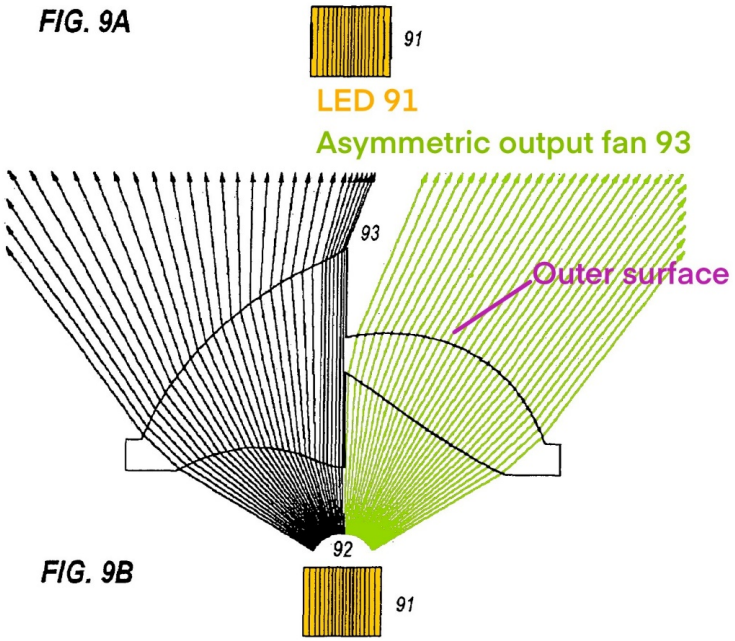


FIG. 9B

RX-0758

RDX-0006.038

Parkyn Teaches Claim 1 under Dr. Lebby's Interpretation

1 [Preamble]. A lens (**lens 90**) for distribution of light predominantly toward a preferential side (**asymmetric output fan 93 has preferential side labeled to right of lens element 90R**) from a light emitter (**LED 91**) having an emitter axis and defining an emitter plane, comprising:

1a. an outer surface (**outer surface of lens elements 90L, 90R**) configured for refracting emitter light predominantly toward the preferential side; and

1b. a refracting inner surface (**inner surfaces of 90L, 90R**) configured for refracting light from the emitter, the refracting inner surface comprising

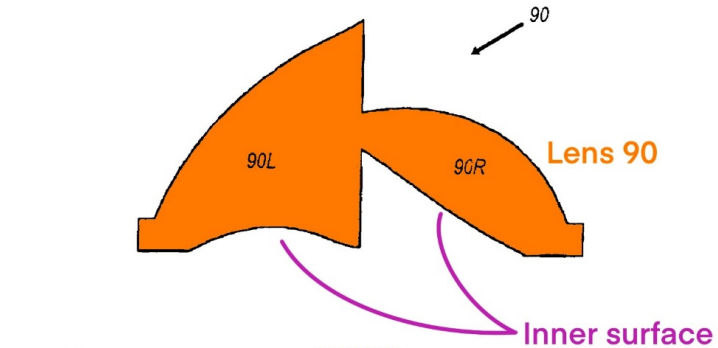


FIG. 9A

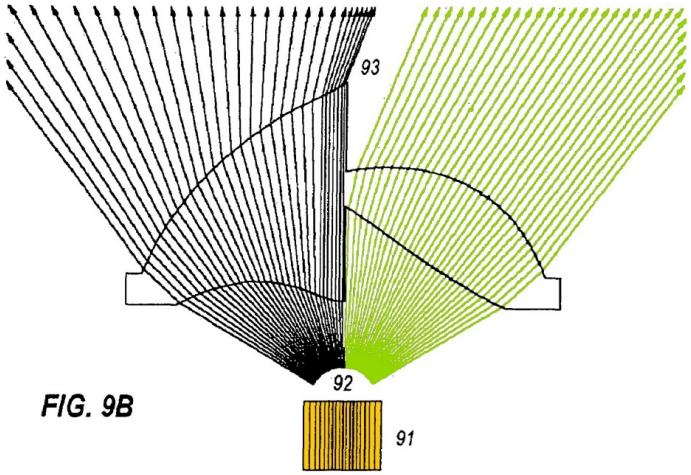


FIG. 9B

RX-0758

RDX-0006.039

Parkyn Teaches Claim 1 under Dr. Lebby's Interpretation

1 [Preamble]. A lens (**lens 90**) for distribution of light predominantly toward a preferential side (**asymmetric output fan 93 has preferential side labeled to right of lens element 90R**) from a light emitter (**LED 91**) having an emitter axis and defining an emitter plane, comprising:
1a. an outer surface (**outer surface of lens elements 90L, 90R**) configured for refracting emitter light predominantly toward the preferential side; and
1b. a refracting inner surface (**inner surfaces of 90L, 90R**) configured for refracting light from the emitter, the refracting inner surface comprising
1c. a front sector (**90R**) centered on the preferential side; and

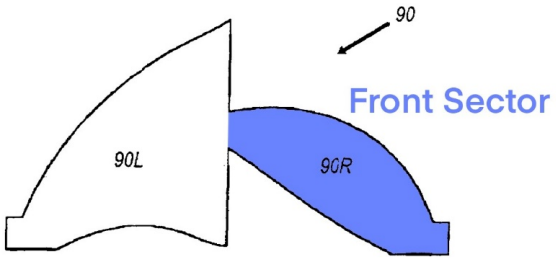


FIG. 9A

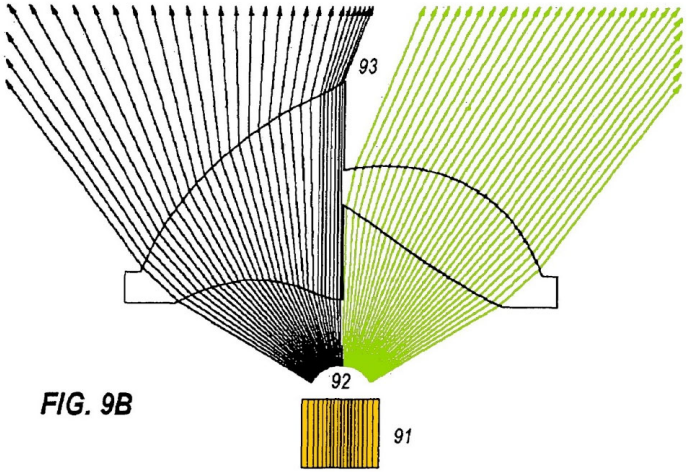


FIG. 9B

Parkyn Teaches Claim 1 under Dr. Lebby's Interpretation

1 [Preamble]. A lens (**lens 90**) for distribution of light predominantly toward a preferential side (**asymmetric output fan 93 has preferential side labeled to right of lens element 90R**) from a light emitter (**LED 91**) having an emitter axis and defining an emitter plane, comprising:

1a. an outer surface (**outer surface of lens elements 90L, 90R**) configured for refracting emitter light predominantly toward the preferential side; and

1b. a refracting inner surface (**inner surfaces of 90L, 90R**) configured for refracting light from the emitter, the refracting inner surface comprising

1c. a front sector (**90R**) centered on the preferential side; and

1d. a back sector (**90L**) centered on the non-preferential side radially opposite the preferential side and having a surface configuration differing from a surface configuration of the front sector (**"two quite dissimilar halves,"** Col. 5, lines 56-63).

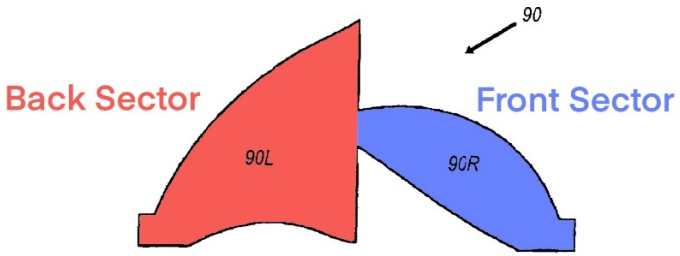


FIG. 9A

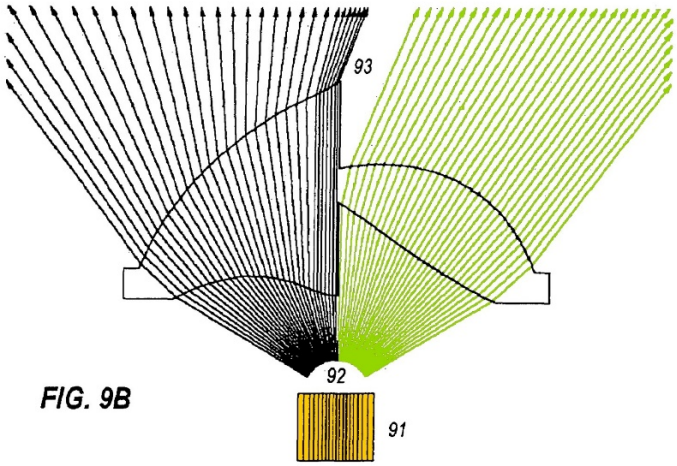


FIG. 9B

RX-0758

RDX-0006.041

Minano

(12) **United States Patent**
Minano et al.

(10) **Patent No.: US 7,377,671 B2**
(45) **Date of Patent: May 27, 2008**

(54) **ETENDUE-SQUEEZING ILLUMINATION OPTICS**

(21) Appl. No.: **10/772,088**

(22) Filed: **Feb. 3, 2004**

(65) **Prior Publication Data**

US 2005/0088758 A1 Apr. 28, 2005

Related U.S. Application Data

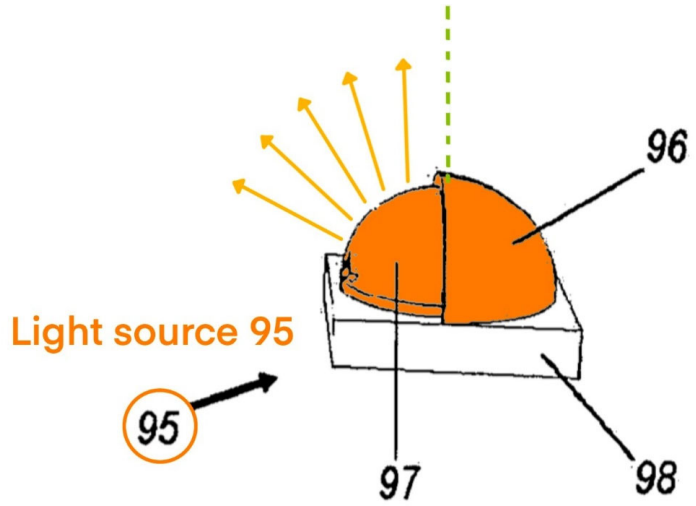
(60) Provisional application No. 60/445,059, filed on Feb. 4, 2003.

(57) **ABSTRACT**

In some embodiments, an apparatus for use generating illumination is provided that comprises a reflective base, a first light source positioned proximate the reflective base, and a reimaging reflector positioned partially about the first light source, where a percentage of light emitted from the first light source is reflected from the reimaging reflector to the reflective base adjacent the first light source establishing a first real image. The reimaging reflector can further comprise a first sector of a first ellipsoid and a second sector of a second ellipsoid, where the first and second sectors establish the first and a second real image. Further embodiments provide a lens that includes a reimaging reflector that receives light and reflects the light establishing a first real image. The reimaging reflector can further comprise a plurality of sectors that reflect light to establish first and second real images.

Minano Teaches Claim 1 under Dr. Lebby's Interpretation

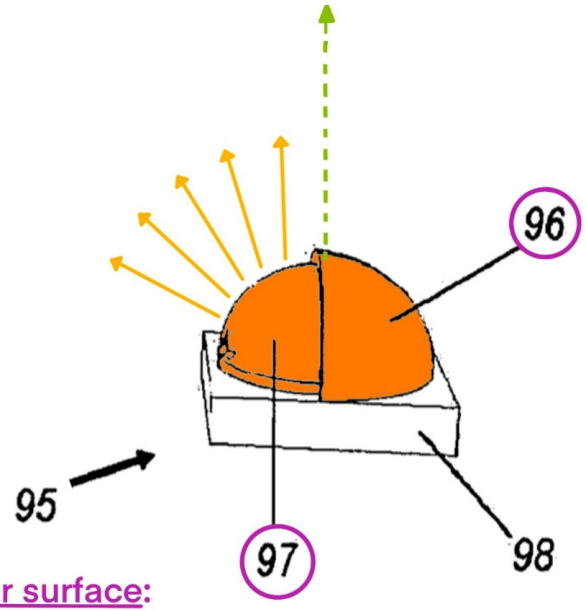
1 [Preamble]. A lens (**light source 95; embodiment in Figs. 28-30 showing totally internally reflecting lens 90 provided with light source 95**) for distribution of light predominantly toward a preferential side (**side where light from exit face 97 is directed**) from a light emitter (**"chip-on-board LED source," col. 19, lines 18-21**) having an emitter axis and defining an emitter plane, comprising:



Minano Teaches Claim 1 under Dr. Lebby's Interpretation

1 [Preamble]. A lens (**light source 95; embodiment in Figs. 28-30 showing totally internally reflecting lens 90 provided with light source 95**) for distribution of light predominantly toward a preferential side (**side where light from exit face 97 is directed**) from a light emitter (**"chip-on-board LED source," col. 19, lines 18-21**) having an emitter axis and defining an emitter plane, comprising:

1a. an outer surface (**exit face 97 and outer surface of reimaging reflector 96**) configured for refracting emitter light predominantly toward the preferential side; and



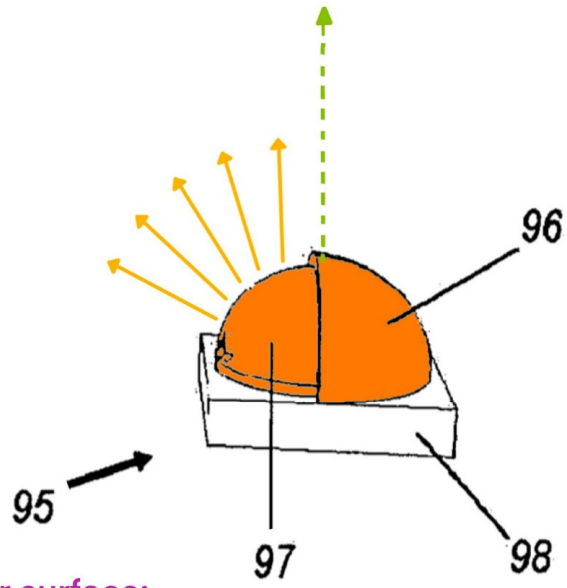
Outer surface:
- Exit Face 97
- Surface of Reimaging Reflector 96

Minano Teaches Claim 1 under Dr. Lebby's Interpretation

1 [Preamble]. A lens (**light source 95; embodiment in Figs. 28-30 showing totally internally reflecting lens 90 provided with light source 95**) for distribution of light predominantly toward a preferential side (**side where light from exit face 97 is directed**) from a light emitter (**"chip-on-board LED source," col. 19, lines 18-21**) having an emitter axis and defining an emitter plane, comprising:

1a. an outer surface (**exit face 97 and outer surface of reimaging reflector 96**) configured for refracting emitter light predominantly toward the preferential side; and

1b. a refracting inner surface (**inner surface of light source 95**) configured for refracting light from the emitter, the refracting inner surface comprising

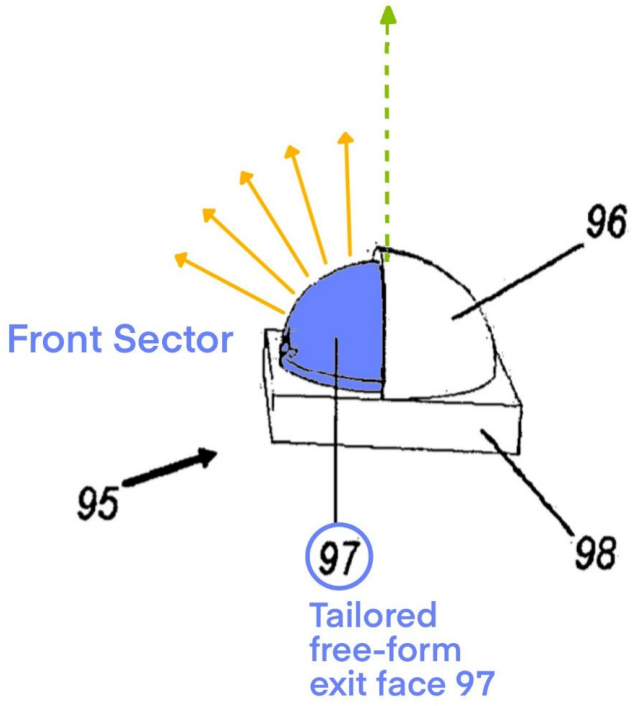


Outer surface:
- Exit Face 97
- Surface of Reimaging Reflector 96

Inner surface of light source 95

Minano Teaches Claim 1 under Dr. Lebby's Interpretation

1 [Preamble]. A lens (**light source 95; embodiment in Figs. 28-30 showing totally internally reflecting lens 90 provided with light source 95**) for distribution of light predominantly toward a preferential side (**side where light from exit face 97 is directed**) from a light emitter (**"chip-on-board LED source," col. 19, lines 18-21**) having an emitter axis and defining an emitter plane, comprising:
1a. an outer surface (**exit face 97 and outer surface of reimaging reflector 96**) configured for refracting emitter light predominantly toward the preferential side; and
1b. a refracting inner surface (**inner surface of light source 95**) configured for refracting light from the emitter, the refracting inner surface comprising
1c. a front sector (**exit face 97**) centered on the preferential side; and



Minano Teaches Claim 1 under Dr. Lebby's Interpretation

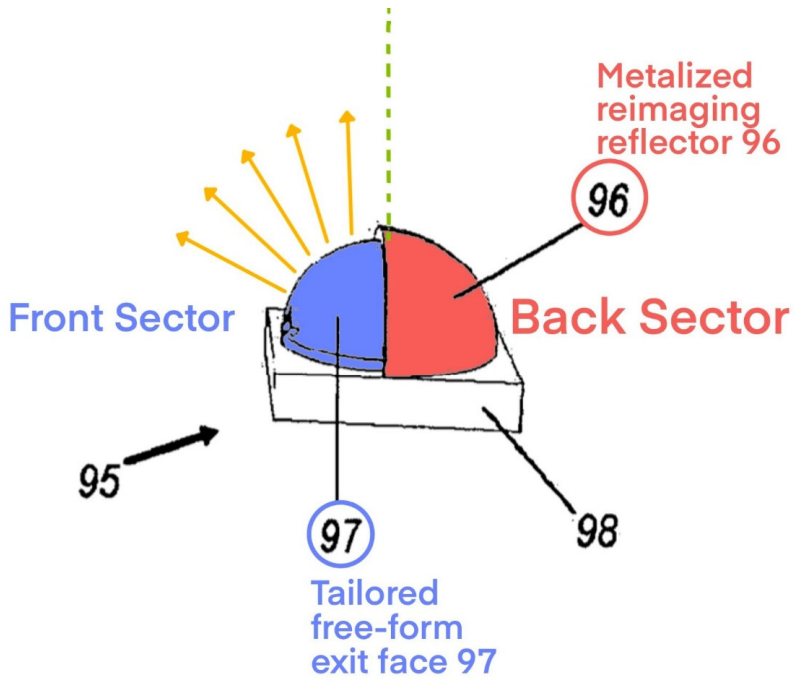
1 [Preamble]. A lens (**light source 95; embodiment in Figs. 28-30 showing totally internally reflecting lens 90 provided with light source 95**) for distribution of light predominantly toward a preferential side (**side where light from exit face 97 is directed**) from a light emitter (**"chip-on-board LED source," col. 19, lines 18-21**) having an emitter axis and defining an emitter plane, comprising:

1a. an outer surface (**exit face 97 and outer surface of reimaging reflector 96**) configured for refracting emitter light predominantly toward the preferential side; and

1b. a refracting inner surface (**inner surface of light source 95**) configured for refracting light from the emitter, the refracting inner surface comprising

1c. a front sector (**exit face 97**) centered on the preferential side; and

1d. a back sector (**reflector 96**) centered on the non-preferential side radially opposite the preferential side and having a surface configuration differing from a surface configuration of the front sector

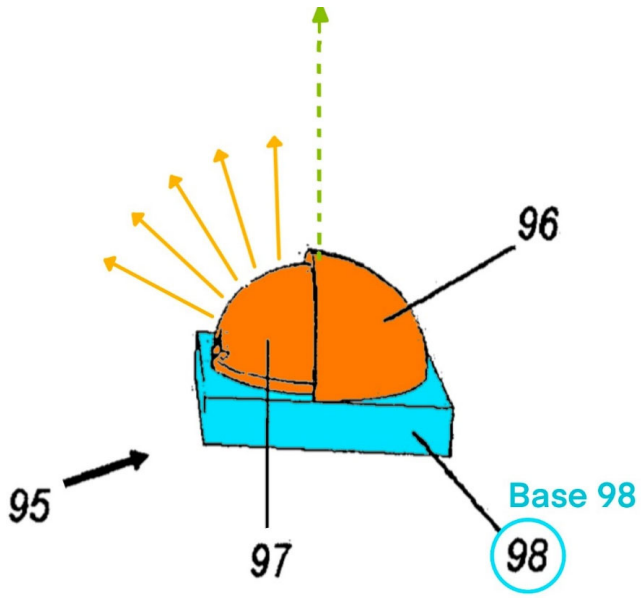


RX-0733

RDX-0006.047

Minano Teaches Claim 3 under Dr. Lebby's Interpretation

3. The lens of claim 1 wherein the inner refracting surface (**inner surface of light source 95**) defines an emitter-surrounding cavity ("**a smaller injection-molded configuration surrounds the chip-on-board LED source, comprising a reimaging reflector and a free-form surface**," col. 19, lines 18-21) with an emitter-receiving opening in an emitter-adjacent base end (**base 98**) of the lens.



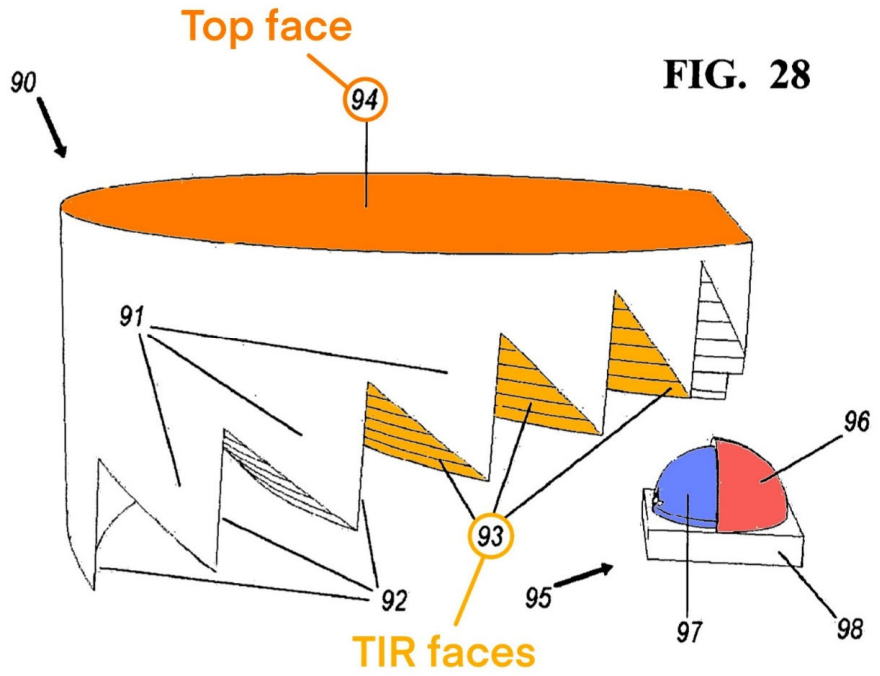
Inner surface of light source 95

Minano Teaches Claims 4 and 10 under Dr. Lebby's Interpretation

4. The lens of claim 3 further comprising a reflecting primary back surface (TIR faces 93) positioned to receive light from at least a portion of the refracting-inner-surface back sector and configured for total internal reflection (TIR) thereof toward the lens outer surface (top face 94).

10. Claims 1 + 4

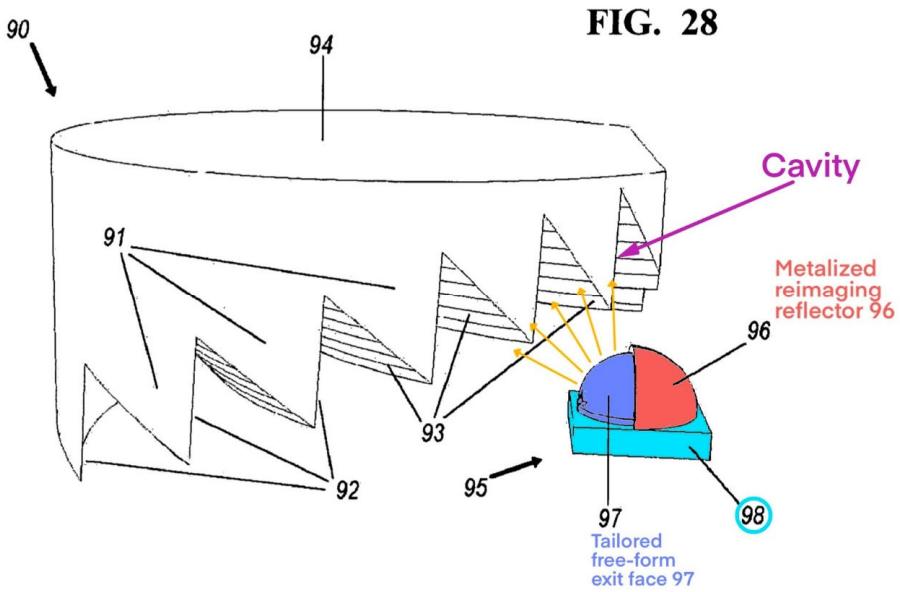
"FIGS. 28, 29, and 30 show … decentered circular totally internally reflecting (TIR) lens 90 and stand-alone light source 95. TIR lens 90 is formed from a complete circular TIR lens as a cutout generally circular section half the original diameter, with one edge at the circle's center and the other at its periphery. Decentered lens 90 includes central refractive lens 90 c, grooved facets 91 with entry faces 92 to receive light and totally internally reflecting faces 93 to redirect upwards to exit through circular top face 94. Light source 95 comprises metalized reimaging reflector 96 which can be similar to reimaging reflectors of FIGS. 3-4, tailored free-form exit face 97, and base 98 configured to produce an etendue-squeezed output beam that is directed towards the TIR lens 90."



RX-0733, Col. 19:29-43.

Minano Teaches Claim 5 under Dr. Lebby's Interpretation

5. The lens of claim 4 wherein the emitter-adjacent base end (**base 98**) forms a back opening to a back cavity (**near metallized reimaging reflector 96**) substantially centered on the non-preferential side and partially bounded by the primary back surface (**primary back surface is a limit or boundary on back cavity**).



Laporte

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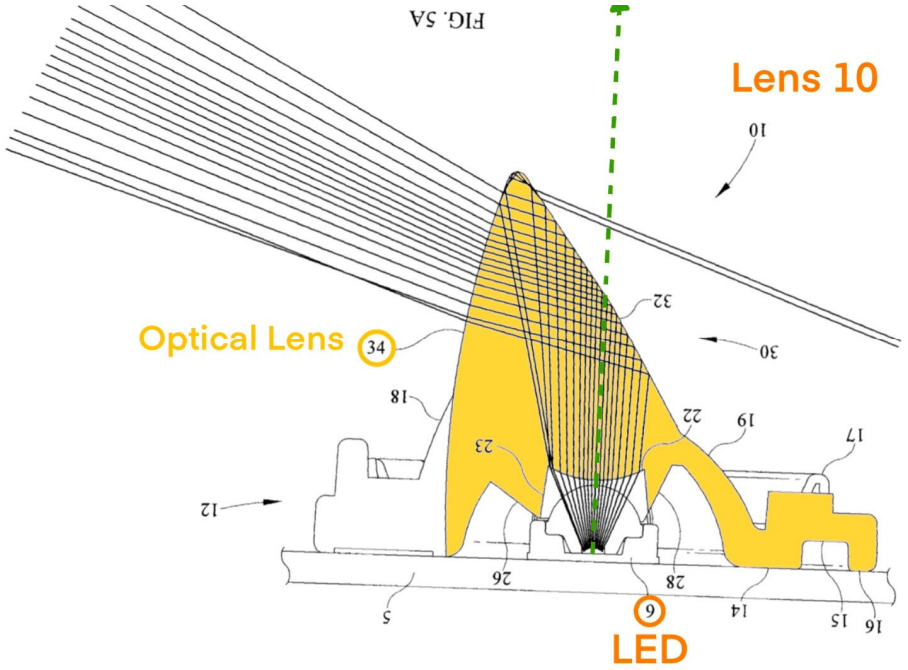
RX-0735

Laporte Teaches Claim 1 under Dr. Lebby's Interpretation

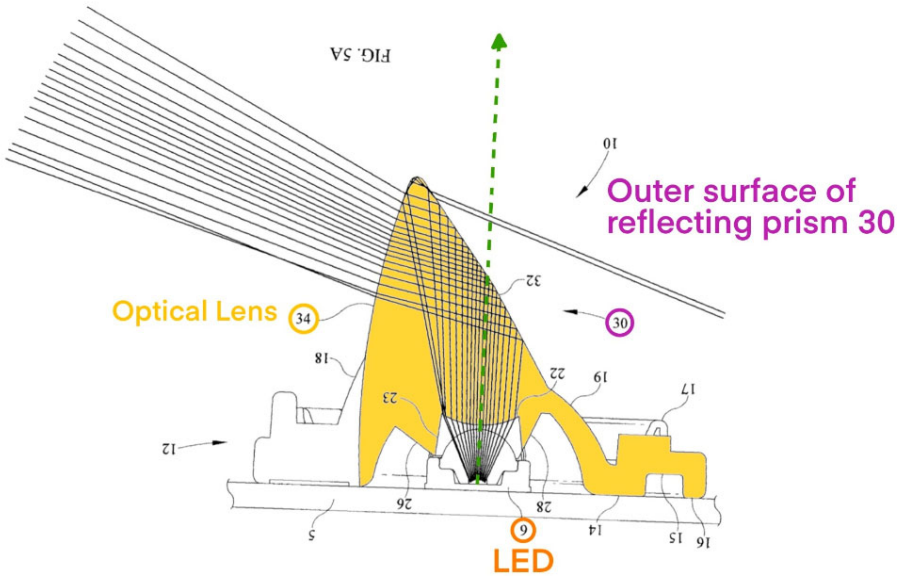
1 [Preamble]. A lens (lens 10) for distribution of light predominantly toward a preferential side (side of optical lens 34) from a light emitter (LED 9) having an emitter axis and defining an emitter plane, comprising:



Laporte Teaches Claim 1 under Dr. Lebby's Interpretation

1 [Preamble]. A lens (lens 10) for distribution of light predominantly toward a preferential side (side of optical lens 34) from a light emitter (LED 9) having an emitter axis and defining an emitter plane, comprising:

1a) an outer surface (**outer surface of reflecting prism 30**) configured for refracting emitter light predominantly toward the preferential side ("other rays emanating from LED 9 will be incident upon sidewall 23 proximal surface 26, pass therethrough at an altered angle and will be directed towards an optical lens 34 of reflecting prism 30, such as the exemplary rays shown in FIG. 5B. A majority of these rays will pass through optical lens 34" "); and

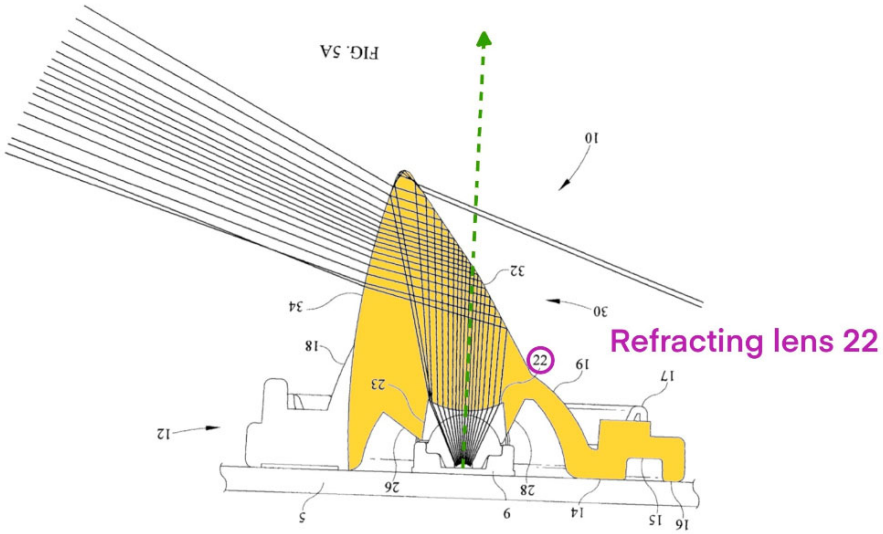


Laporte Teaches Claim 1 under Dr. Lebby's Interpretation

1 [Preamble]. A lens (**lens 10**) for distribution of light predominantly toward a preferential side (**side of optical lens 34**) from a light emitter (**LED 9**) having an emitter axis and defining an emitter plane, comprising:

1a) an outer surface (**outer surface of reflecting prism 30**) configured for refracting emitter light predominantly toward the preferential side ("other rays emanating from LED 9 will be incident upon sidewall 23 proximal surface 26, pass therethrough at an altered angle and will be directed towards an optical lens 34 of reflecting prism 30, such as the exemplary rays shown in FIG. 5B. A majority of these rays will pass through optical lens 34" "); and

1b) a refracting inner surface (**refracting lens 22**) configured for refracting light from the emitter, the refracting inner surface comprising



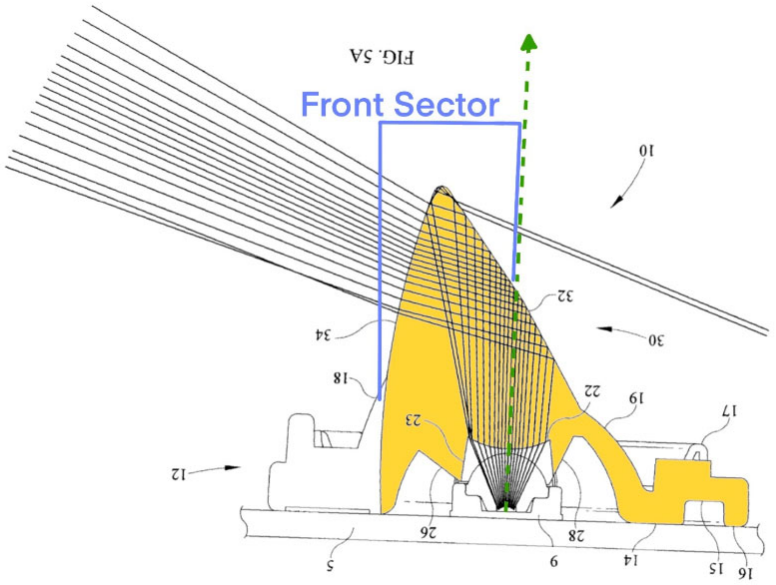
Laporte Teaches Claim 1 under Dr. Lebby's Interpretation

1 [Preamble]. A lens (**lens 10**) for distribution of light predominantly toward a preferential side (**side of optical lens 34**) from a light emitter (**LED 9**) having an emitter axis and defining an emitter plane, comprising:

1a) an outer surface (**outer surface of reflecting prism 30**) configured for refracting emitter light predominantly toward the preferential side ("other rays emanating from LED 9 will be incident upon sidewall 23 proximal surface 26, pass therethrough at an altered angle and will be directed towards an optical lens 34 of reflecting prism 30, such as the exemplary rays shown in FIG. 5B. A majority of these rays will pass through optical lens 34" "); and

1b) a refracting inner surface (**refracting lens 22**) configured for refracting light from the emitter, the refracting inner surface comprising

1c) a front sector (**area to left of emitter axis**) centered on the preferential side; and



Laporte Teaches Claim 1 under Dr. Lebby's Interpretation

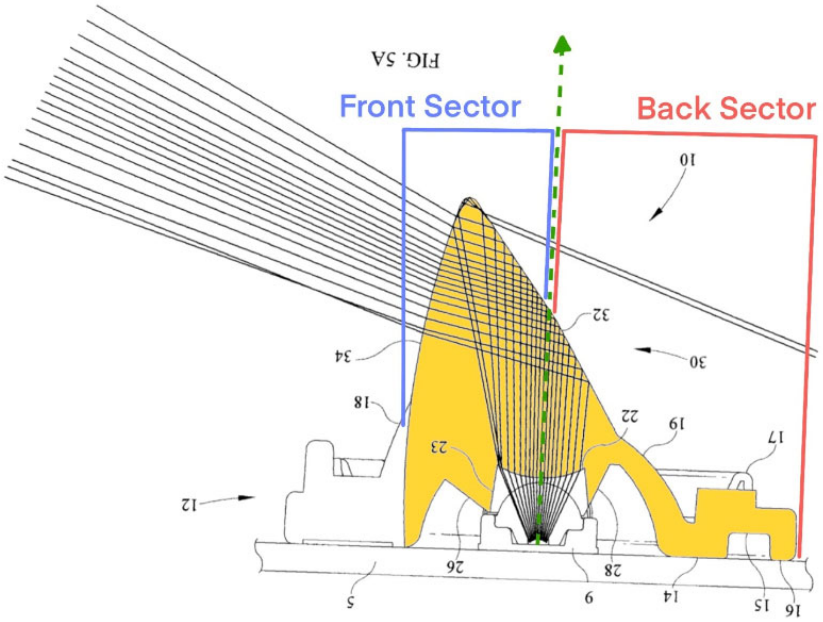
1 [Preamble]. A lens (lens 10) for distribution of light predominantly toward a preferential side (side of optical lens 34) from a light emitter (LED 9) having an emitter axis and defining an emitter plane, comprising:

1a) an outer surface (**outer surface of reflecting prism 30**) configured for refracting emitter light predominantly toward the preferential side ("other rays emanating from LED 9 will be incident upon sidewall 23 proximal surface 26, pass therethrough at an altered angle and will be directed towards an optical lens 34 of reflecting prism 30, such as the exemplary rays shown in FIG. 5B. A majority of these rays will pass through optical lens 34" "); and

1b) a refracting inner surface (refracting lens 22) configured for refracting light from the emitter, the refracting inner surface comprising

1c) a front sector (area to left of emitter axis) centered on the preferential side; and

1d) a back sector (area to right of emitter axis) centered on the non-preferential side radially opposite the preferential side and having a surface configuration differing from a surface configuration of the front sector.

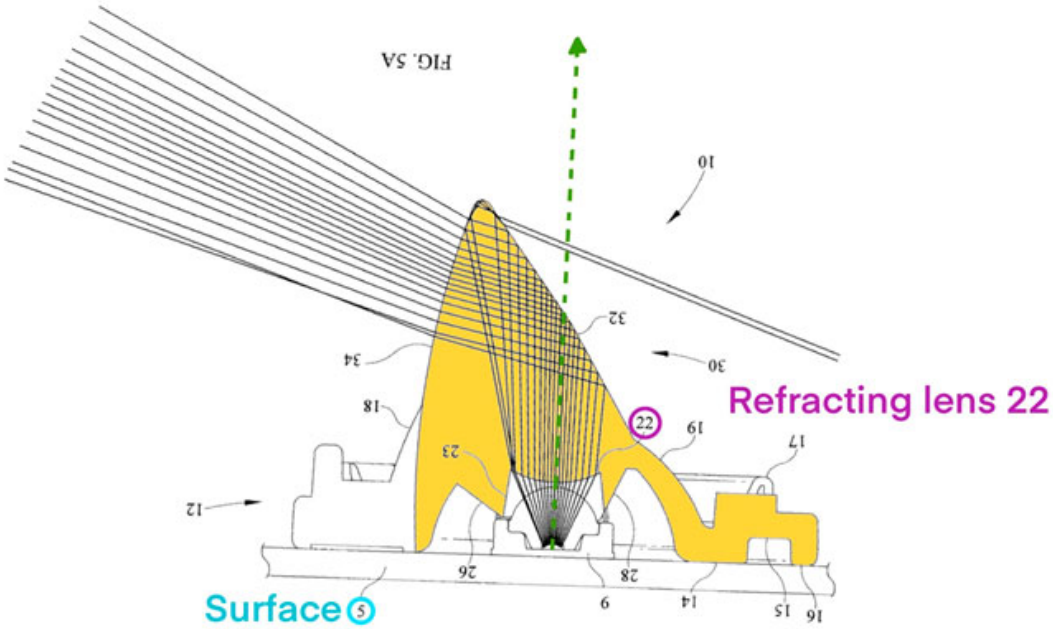


RX-0733

RDX-0006.056

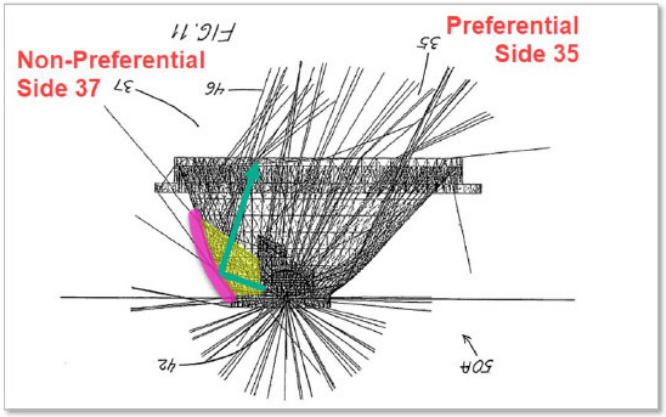
Laporte Teaches Claim 3 under Dr. Lebby's Interpretation

3. The lens of claim 1 wherein the inner refracting surface (**inner surface of refracting lens 22**) defines an emitter-surrounding cavity (area for LED 9) with an emitter-receiving opening in an emitter-adjacent base end (**surface 5**) of the lens.



Laporte Teaches Claim 4 under Dr. Lebby's Interpretation

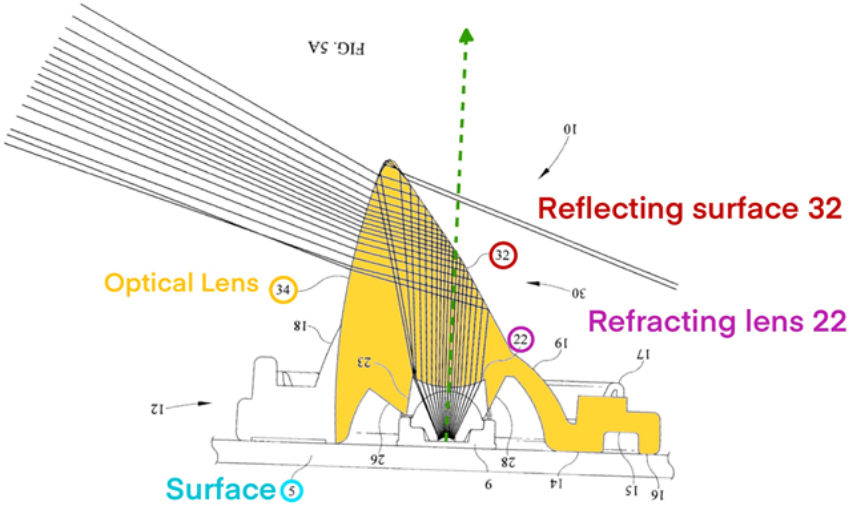
4. The lens of claim 3 further comprising a reflecting primary back surface (reflective surface 32) positioned to receive light from at least a portion of the refracting-inner-surface back sector and configured for total internal reflection (TIR) thereof toward the lens outer surface (**outer surface of optical lens 34**).



CDX-0002 (CX-0965.0036)

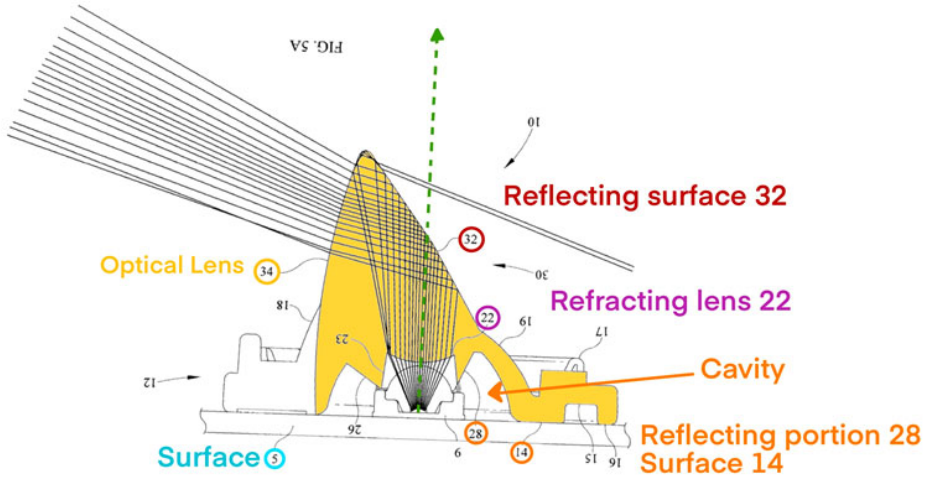
Dr. Lebby's presentation:
'958 application:

- **Reflecting primary back surface**
- **Light**
- **TIR**



Laporte Teaches Claim 5 under Dr. Lebby's Interpretation

5. The lens of claim 4 wherein the emitter-adjacent base end forms a back opening (to right of reflecting portion 28) to a back cavity (**between reflecting portion 28 and surface 14**) substantially centered on the non-preferential side and partially bounded by the primary back surface.



RX-0733

RDX-0006.059

Holder

(12) **United States Patent**
Holder et al.

(10) **Patent No.: US 7,674,018 B2**
(45) **Date of Patent: Mar. 9, 2010**

(54) **LED DEVICE FOR WIDE BEAM GENERATION**

(75) Inventors: **Ronald G. Holder**, Niguel, CA (US); **Greg Rhoads**, Irvine, CA (US)

(73) Assignee: **Illumination Management Solutions Inc.**

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **11/711,218**

(22) Filed: **Feb. 26, 2007**

(65) **Prior Publication Data**

US 2007/0201225 A1 Aug. 30, 2007

Related U.S. Application Data

(60) Provisional application No. 60/777,310, filed on Feb. 27, 2006, provisional application No. 60/838,035, filed on Aug. 15, 2006, provisional application No. 60/861,789, filed on Nov. 29, 2006.

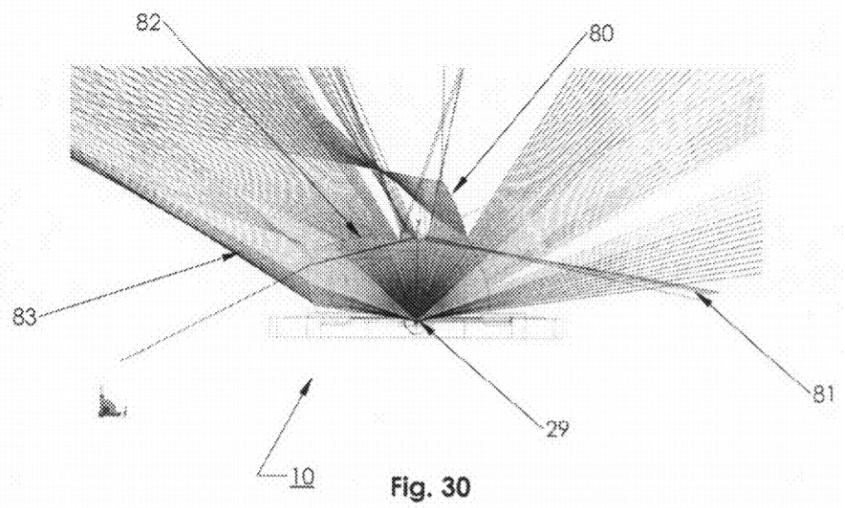


Fig. 30

RX-0095.0013

RDX-0006.060

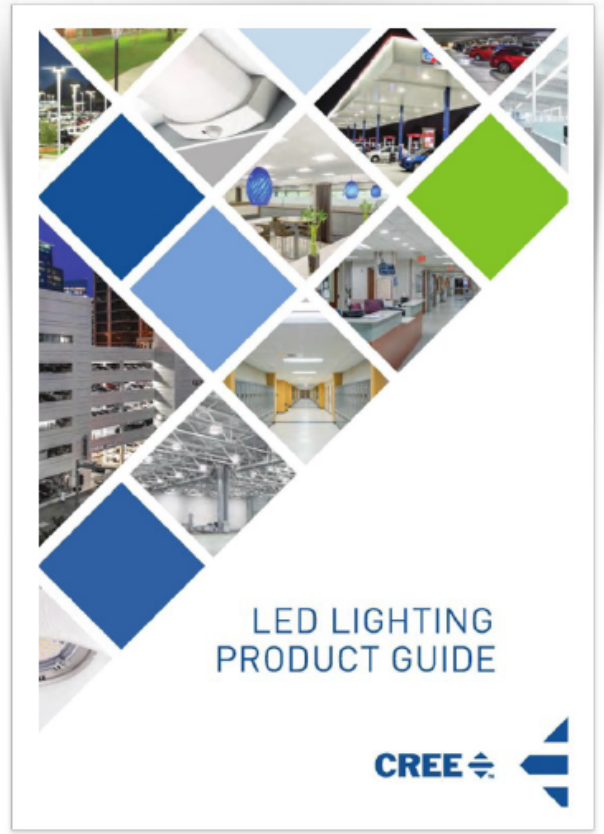
Holder – Software-Implemented Lens Design

"Once a three dimensional lens shape is determined at step 102 as shown in FIGS. 1-9, 16-20 and 21-26, the three dimensional candela plot as shown in FIGS. 11, 27 and 28 and as suggested by the ray tracings of FIGS. 12, 13, 30 and 31 can be mathematically derived using conventional optical computer aided design programs, such PhotopiaR) sold by Lighting Technologies of Denver, Colo. assuming the three dimensional energy distribution of the light Source, e.g. a Lambertian distribution in the case of an LED." Col. 17:55-64.

"It should be noted in FIG. 30 that rays 80 which are redirected from surface 51 show that surface 51 is acting as a TIR reflector of the beam energy from the LED on the curb side to transfer energy to the street side." Col. 16:44-48

"[T]he invention can create a beam profile that generates the full-cutoffbeam type required by IES standards for roadway and outdoor lighting." Col. 8:21-24.

Secondary Considerations – Long Felt, Unmet Need



NANOOPTIC® TECHNOLOGY

With patented NanoOptic® Technology available in multiple distributions, Cree® outdoor LED fixtures provide precise optical control for exceptional application performance and energy savings. The NanoOptic® refractor system offers superior light control with more lumens delivered in the target area, improved uniformity ratios and controlled high-angle brightness.

High Pressure Sodium Lighting

Cree Edge Series™ Lighting

CDX-0002 (CX-0649)

Secondary Considerations – Long Felt, Unmet Need

CREE Wolfspeed.

Cree Introduces Industry's First $99 LED Street Light as a Direct Replacement for Residential Street Lights

AUGUST

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and Rapid P

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Cree, Inc. (N
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Extending the technical breakthroughs of the XSP Series LED Street Light portfolio, the 25-watt and 42-watt XSPR street light is designed to replace up to 100-watt high-pressure sodium street lights, reducing energy consumption while improving lighting performance. Cree's NanoOptic® Precision Delivery Grid™ optic technology achieves better optical control than traditional street lighting fixtures and efficiently delivers white uniform light for safer-feeling communities. In addition to a low initial cost and significant energy savings, the XSPR street light is backed by Cree's 10-year industry-leading warranty.

JX-0084

‘570 Patent Invalidity: Indefiniteness

“Centered on” is indefinite.

Claim 1*	A lens for distribution of light predominantly toward a preferential side from a light emitter having an emitter axis and defining an emitter plane, comprising: an outer surface configured for refracting emitter light predominantly toward the preferential side; and a refracting inner surface configured for refracting light from the emitter, the refracting inner surface comprising: a front sector **centered on** the preferential side; and a back sector **centered on** the non-preferential side radially opposite the preferential side and having a surface configuration differing from a surface configuration of the front sector.
Claim 5	The lens of claim 4 wherein the emitter-adjacent base end forms a back opening to a back cavity **substantially centered** on the non-preferential side and partially bounded by the primary back surface.

*Independent Claim

Dr. Lebby's use of "centered on"

Claim 1.3, 10.3	**"centered on the preferential side" =** "bilaterally symmetric about a central axis of the lens **and on** the preferential side"	RX-0845 (Lebby Op. Rpt.), ¶¶ 140-42, 147, 157)
Claim 1.4, 10.4	**"centered on the non-preferential side" =** "bilaterally symmetric about a central axis of the lens **and on** the non-preferential side"	RX-0845, ¶¶ 153, 157
Claim 5	**"substantially centered on the non-preferential side" =** "bilaterally symmetric about a central axis of the lens **and close to** the non-preferential side"	RX-0845, ¶ 180

Dr. Lebby's use of "centered on" Cree Lighting DI Products

Claim 1.3, 10.3	**"centered on the preferential side" =** "bilaterally symmetric about a central axis along the cross-section line"	RX-0845, PP 277-79
Claim 1.4, 10.4	**"centered on the non-preferential side" =** "bilaterally symmetric about a central axis along the cross-section line"	RX-0845, PP 277-79
Claim 5	**"substantially centered on the non-preferential side" =** "bilaterally symmetric about a central axis of the lens **and close** to the non-preferential side"	RX-0845, P 335