UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD., AND
SAMSUNG ELECTRONICS AMERICA, INC.
Petitioner

v.

SINOTECHNIX LLC
Patent Owner

Case No. IPR2025-00336
U.S. PATENT No. 7,901,113

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 7,901,113

CHALLENGING CLAIMS 1-11
UNDER 35 U.S.C. §312 AND 37 C.F.R. §42.104

TABLE OF CONTENTS

Page

I. Introduction....1
II. Mandatory Notices....3
A. Real Party-In-Interest (37 C.F.R. §42.8(b)(1)) 3
B. Related Matters (37 C.F.R. §42.8(b)(2))....3
C. Lead And Back-up Counsel (37 C.F.R. §42.8(b)(3))....4
D. Service Information (37 C.F.R. §42.8(b)(4)) 4
III. Fees 5
IV. Certification Of Grounds For Standing 5
V. Identification Of Challenge And Relief Requested....5
A. Identification Of Prior Art....5
B. Statutory Grounds Of Unpatentability 6
VI. Overview Of The '113 Patent....6
A. State Of The Art Prior To The '113 Patent 6
B. Purported Invention Of The '113 Patent....9
C. Prosecution History Of The '113 Patent 10
VII. Overview Of Prior Art References 11
A. Odawara (EX1004)....11
B. Sommers (EX1006)....12
C. West (EX1005)....13
VIII. Level Of Ordinary Skill In The Art....15
IX. Claim Construction....16

Page

A. "the linear refractive surface is bent more than once" 17

X. Specific Grounds For Challenge 20

A. Grounds I And II: Odawara Anticipates Or Renders Obvious Claims 1, 2, 4, 5, 7, 8, And 10 20

1. Independent Claim 1 And Dependent Claim 2 20

2. Dependent Claims 4 And 8 33

3. Dependent Claims 5 And 10 34

4. Dependent Claim 7 36

B. Ground III: Odawara In Combination With West Renders Obvious Claims 1, 2, 4-8, And 10 36

1. Independent Claim 1 And Dependent Claim 2 36

2. Dependent Claims 4 And 8 41

3. Dependent Claims 5 And 10 41

4. Dependent Claims 5 And 10 42

5. Dependent Claim 6 48

6. Dependent Claim 7 51

C. Grounds IV And V: Sommers Anticipates Or Renders Obvious Claims 1, 3, 4, 7, And 9 51

1. Independent Claim 1 And Dependent Claim 3 51

2. Dependent Claims 4 And 9 59

3. Dependent Claim 7 60

D. Ground VI: Sommers In Combination With West Renders Obvious Claims 1, 3-7, 9, And 11 61

1. Independent Claim 1 And Dependent Claim 3 61

Page

2. Dependent Claims 4 And 9 65

3. Dependent Claims 5 and 11 65

4. Dependent Claim 6 68

5. Dependent Claim 7 72

XI. Discretionary Factors 73

A. Discretionary Denial Under *Advanced Bionics* Is Not Appropriate 73

1. Substantially Same Art/Arguments Not Considered 73

2. Office Erred 74

B. Discretionary Denial Under *Fintiv* Is Not Appropriate 75

1. No Evidence Regarding A Stay 75

2. Parallel Proceeding Trial Date 75

3. Investment In Parallel Proceeding 76

4. Overlapping Issues With The Parallel Proceeding 77

5. Identity Of Parties 77

6. Other Circumstances, Including The Merits 78

C. *General Plastic* Factors Favor Institution 78

XII. Conclusion 79

TABLE OF AUTHORITIES

Page(s)

Cases

2985 LLC d/b/a Mountain Voyage Co. v. The Ridge Wallet, LLC,
IPR2024-00692, Paper 18 74

Advanced Bionics LLC v. MED-EL Elektromedizinische Geräte GmbH,
IPR2019-01469, Paper 6 (PTAB Feb. 13, 2020).....73, 74, 75

Apple Inc. v. Fintiv, Inc.,
IPR2020-00019, Paper 11 (PTAB Mar. 20, 2020).....75, 78

Env't Designs, Ltd. v. Union Oil Co. of California,
713 F.2d 693 (Fed. Cir. 1983) 15

In re Mraz,
455 F.2d 1069 (CCPA 1972).....28, 50, 59, 71

Nidec Motor Corp. v. Zhongshan Broad Ocean Motor, Co.,
868 F.3d 1013 (Fed. Cir. 2017) 16

In re Paulsen,
30 F.3d 1475, Fed. Cir. 1994.....16

PEAG LLC v. Varta Microbattery GmbH,
IPR2020-01214, Paper 8 (PTAB Jan. 6, 2021) 76, 77

Phillips v. AWH Corp.,
415 F.3d 1303 (Fed. Cir. 2005) 16

Sand Revolution II LLC v. Continental Intermodal Group – Trucking LLC,
IPR2019-01393, Paper 24 (PTAB June 16, 2020) 77

Seoul Semiconductor Co., Ltd. et al., v. Sharp Kabushiki Kaisha et al.,
IPR2014-00879, Paper 33 (PTAB Oct. 15, 2025).....28, 50, 59, 71

Statutes **Page(s)**

35 U.S.C. §102 6

35 U.S.C. §102(b) 5, 6

35 U.S.C. §103 6

35 U.S.C. §112 ..... 27, 57

35 U.S.C. §314(a) 6

35 U.S.C. § 325(d) 73

Other Authorities

37 C.F.R. § 42.100(b) 16

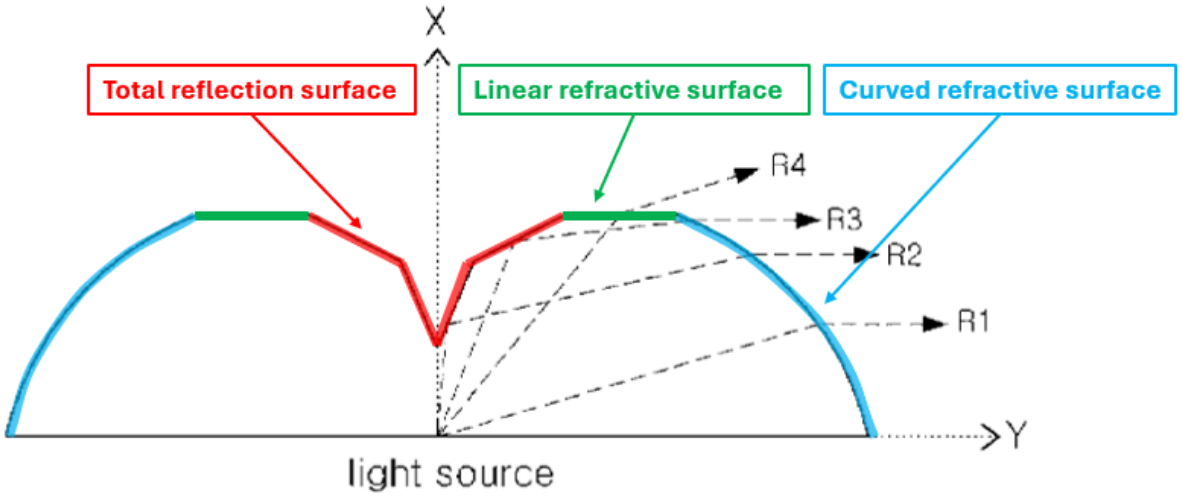
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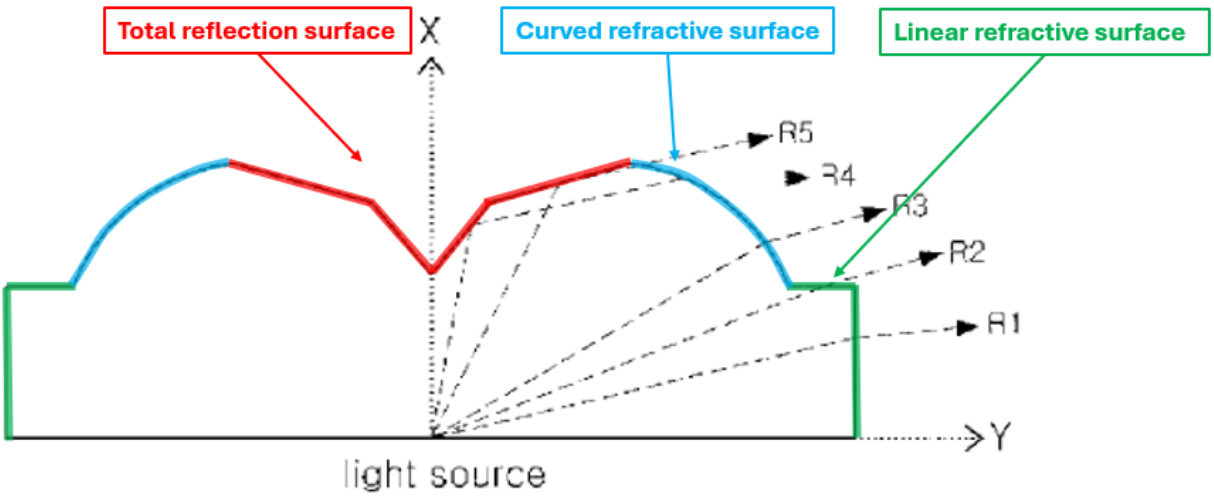
Exhibit No.	DESCRIPTION
1001	U.S. Patent No. 7,901,113 ('113 Patent)
1002	Declaration of Dr. Tom Milster
1003	File History of U.S. Patent No. 7,901,113
1004	Certified Translation of JP 2002-344027 ("Odawara")
1005	U.S. Patent No. 6,598,998 ("West")
1006	U.S. Patent No. 6,674,096 ("Sommers")
1007	U.S. Patent No. 7,748,873 (the '873 Patent)
1008	File History of U.S. Patent No. 7,748,873
1009	J. Strong "Evaporated Aluminum Films For Astronomical Mirrors" 1934 *PASP* **46** 18
1010	Docket Control Order in *Sinotechnix LLC v. Samsung Electronics et al.,* 2:24-cv-544-JRG-RSP
1011	Judicial Caseload For Eastern District of Texas
1012	Judge Gilstrap's Case Schedule (May 4, 2026)
1013	U.S. Patent No. 3,774,021 ("Johnson")
1014	Certificate of Translation Accuracy of JP 2002-344027 ("Odawara")

All annotations, coloring, and emphases have been added unless indicated otherwise.

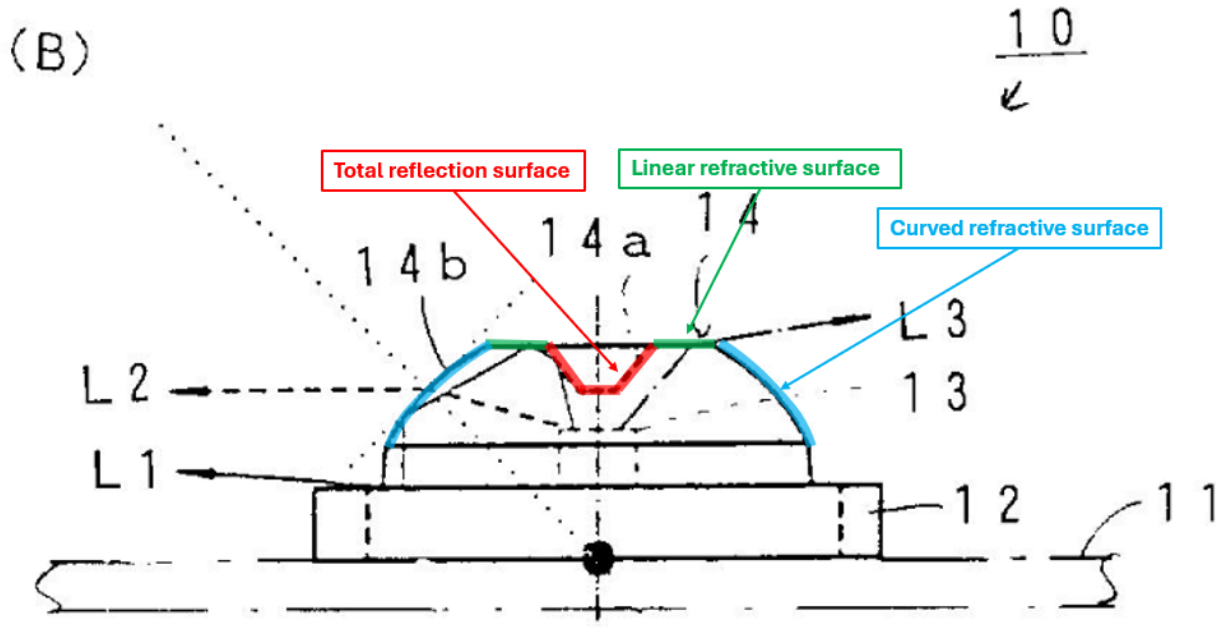
I. Introduction

U.S. Patent No. 7,901,113 ("'113 Patent") is directed to a "light emitting device" having "a lens … comprising a **total reflection surface** … and at least one of a **linear refractive surface** and a **curved refractive surface** formed to extend away from the central axis and beyond a periphery of the **total reflection surface**." EX1001, claim 1. Two exemplary configurations are shown below.





EX1001, Figures 31 and 35. As shown, light emitted from the light source reflects off the "**total reflection surface**" and refracts out sideways through the "**linear refractive surface**" and/or the "**curved refractive surface**." However, as illustrated below, devices with such side illumination lenses were known long before the '113 Patent.



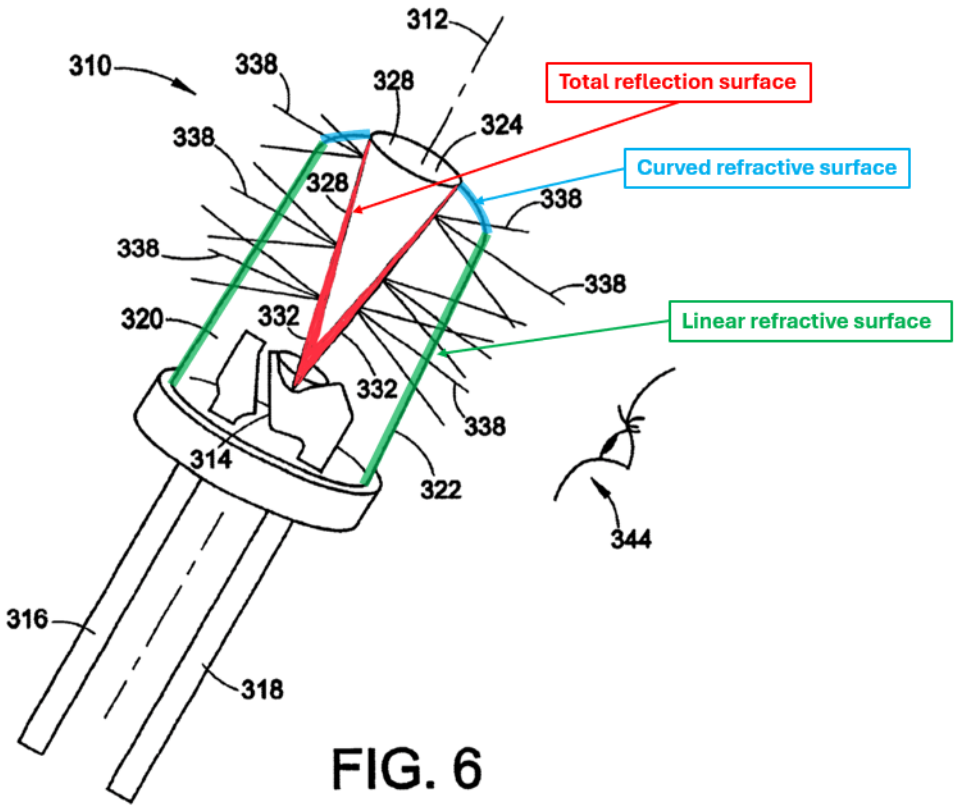


FIG. 6

EX1004, Figure 1; EX1006, Figure 6.

II. Mandatory Notices

A. Real Party-In-Interest (37 C.F.R. §42.8(b)(1))

Petitioner identifies itself as a real party-in-interest ("RPI").

B. Related Matters (37 C.F.R. §42.8(b)(2))

The '113 Patent is currently asserted against Petitioner by Patent Owner in *Sinotechnix LLC v. Samsung Electronics Co., Ltd. et al.,* No. 2:24-cv-00544 (EDTX) ("Litigation"). Petitioner has filed petitions for inter partes review of U.S. Patent Nos. 8,132,952 (IPR2025-00335) and 7,748,873 (IPR2025-00333) and will

file petitions for *inter partes* review of U.S. Patent Nos. 7,618,162, 7,951,626, and 9,412,913, each of which is being asserted against Petitioner in the Litigation.

C. Lead And Back-up Counsel (37 C.F.R. §42.8(b)(3))

Petitioner is filing a Power of Attorney appointing the practitioners associated with Customer Number 132,593. Petitioner designates the following lead and back-up counsels:

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to electronic service by email at Samsung-Sinotechnix-IPR@desmaraisllp.com

III. Fees

Petitioner is concurrently electronically submitting the required fees for this Petition. The Board is authorized to charge Desmarais LLP's deposit account, No. 50-6822, for any fee deficiency.

IV. Certification Of Grounds For Standing

Petitioner certifies that the '113 Patent is available for *inter partes* review and that Petitioner is not barred or estopped from requesting *inter partes* review.

V. Identification Of Challenge And Relief Requested

Under 37 C.F.R. §§42.22(a)(1) and 42.104(b)(1)-(2), Petitioner requests cancellation of claims 1-11 ("Challenged Claims") of the '113 Patent.

A. Identification Of Prior Art

The following references are pertinent to the grounds of unpatentability explained below:

1. Japanese Patent Publication No. 2002-344027 ("Odawara") (EX1004), published on November 29, 2002, is prior art under 35 U.S.C. §102(b).[1]

[1] The '113 Patent is a continuation of U.S. Patent No. 7,748,873 Patent, which entered national stage in the U.S. based on a PCT application that was filed on

2. U.S. Patent No. 6,598,998 ("West") (EX1005), issued on July 29, 2003, is prior art under 35 U.S.C. §102(b).

3. U.S. Patent No. 6,674,096 ("Sommers") (EX1006), issued on January 6, 2004, is prior art under 35 U.S.C. §102(b).

B. Statutory Grounds Of Unpatentability

Petitioner requests cancellation of claims 1-11 of the '113 Patent under 35 U.S.C. §102 and §103 based on the following Grounds.

Grounds	35 U.S.C.	Claims	Prior Art Reference Relied Upon
I and II	§102/§103	1, 2, 4, 5, 7, 8, 10	Odawara
III	§103	1, 2, 4-8, 10	Odawara and West
IV and V	§102/§103	1, 3, 4, 7, 9	Sommers
VI	§103	1, 3-7, 9, 11	Sommers and West

This Petition demonstrates that there is a reasonable likelihood that Petitioner would prevail with respect to at least one of the challenged claims. *See* 35 U.S.C. §314(a).

VI. Overview Of The '113 Patent

A. State Of The Art Prior To The '113 Patent

Light emitting diodes (LEDs) emit light in random directions, so lenses were developed to direct the light in a desired direction. *See* EX1001, 1:43-53. Lenses

October 7, 2005. This Petition applies the pre-AIA provisions of 35 U.S.C. §§102 and 103.

that emit light sideways were admittedly well-known. *See* EX1001, 1:53-60 ("[S]tudies on development of a device capable of emitting light in side directions of a lens have been actively conducted using the total internal reflection (TIR) property of light."). EX1002, ¶33.

One such "[c]onventional lens[] using [total internal reflection] TIR [is] disclosed in U.S. Pat. No[]. … 6,598,998 [West]." EX1001, 1:60-61. Figure 5F of West [EX1005] below, shows the **light** being reflected off the **TIR surface 58** and towards the **refractive surfaces**.

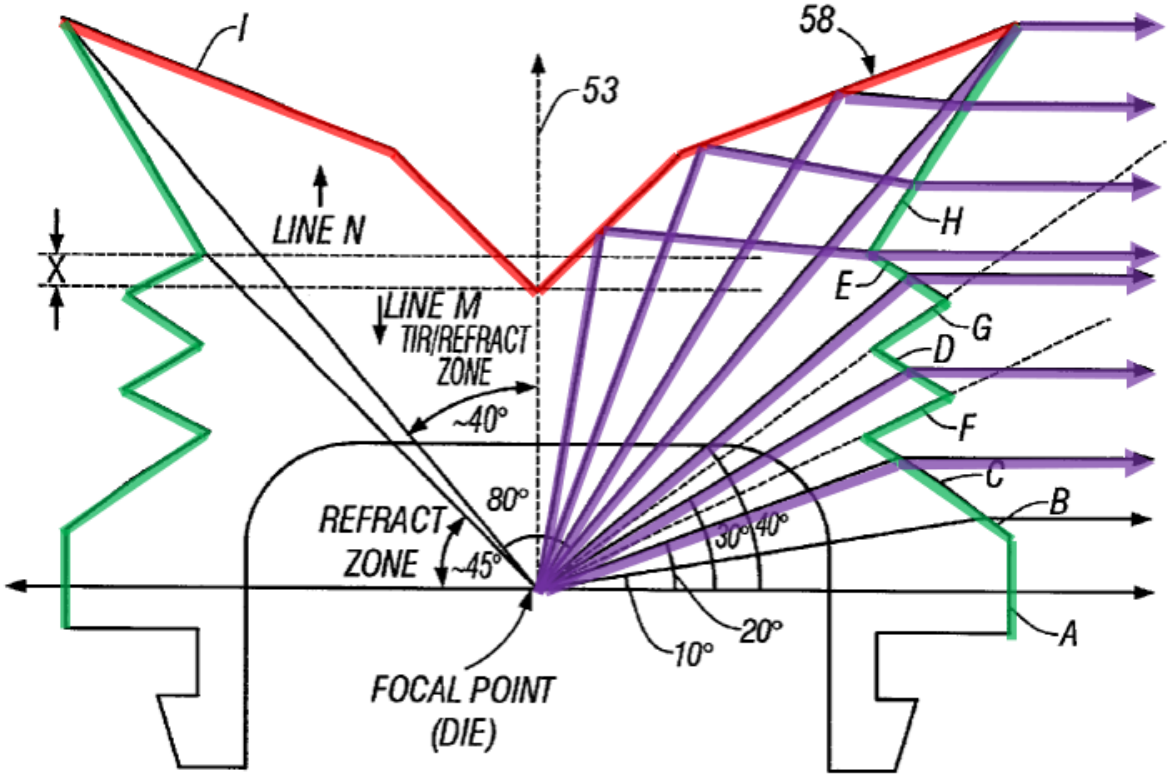


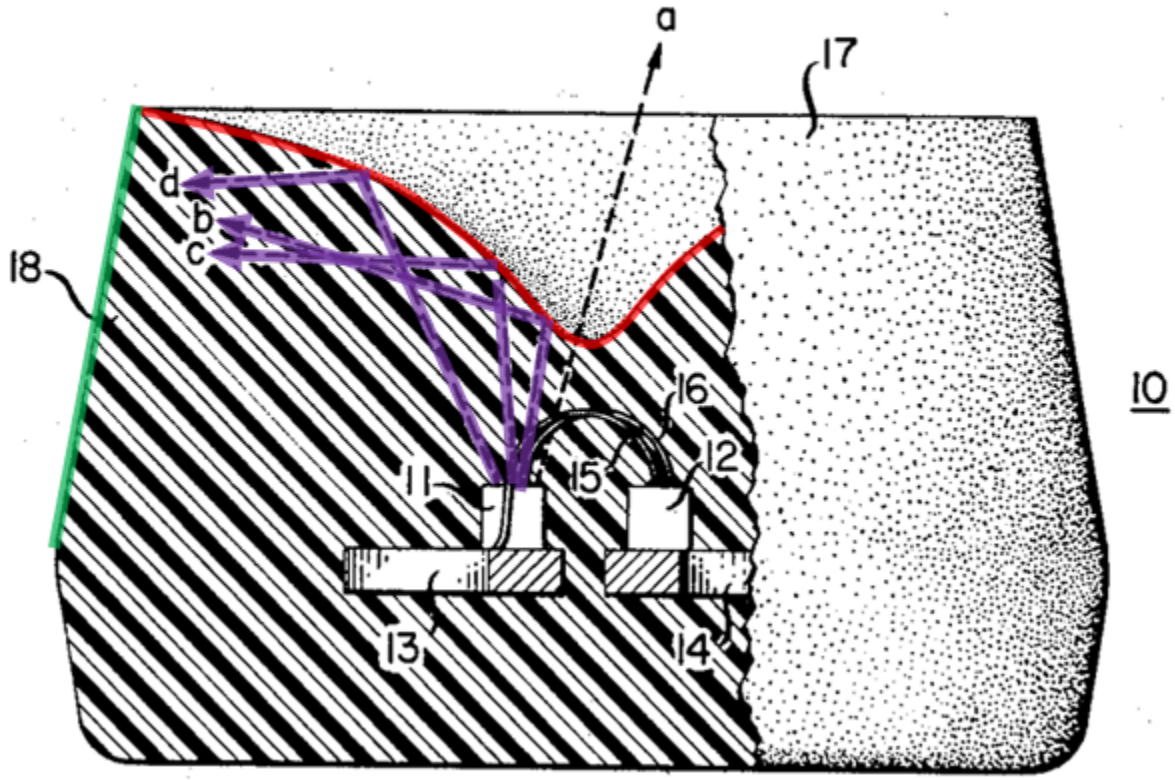
FIG. 5F

EX1005, Figure 5F. EX1002, ¶34.

The '113 Patent alleges, however, that "the plurality of **refractive surfaces** formed on right and left sides of the **total reflection surface**" complicates fabrication (*e.g.*, because it requires four separate mold parts). EX1001, 1:66-2:7. EX1002, ¶35.

But such side illumination lenses were also known long before the alleged priority date of the '113 Patent. For example, U.S. Patent No. 3,774,021, which issued in 1973, shows a side illumination lens having a **TIR surface** and **refractive sides** that meet challenged claim 1.

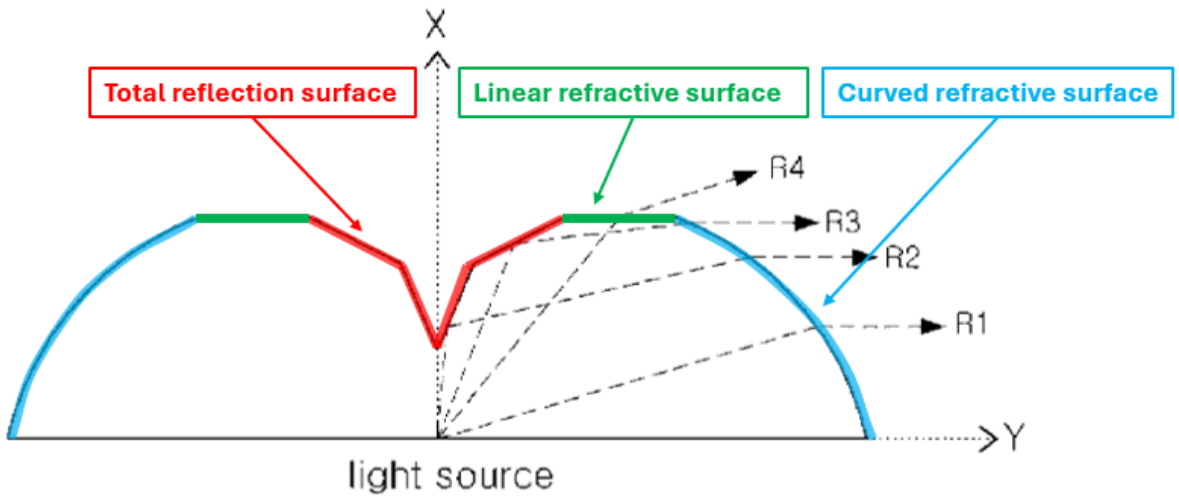
FIG. 1



EX1013, Figure 1. *See* EX1013, 1:23-27, 2:24-29 ("Light reflected from this **surface [17]** has a high probability of exiting the dome through the **sidewall 18**, the ultimate goal."). EX1002, ¶¶31-32.

B. Purported Invention Of The '113 Patent

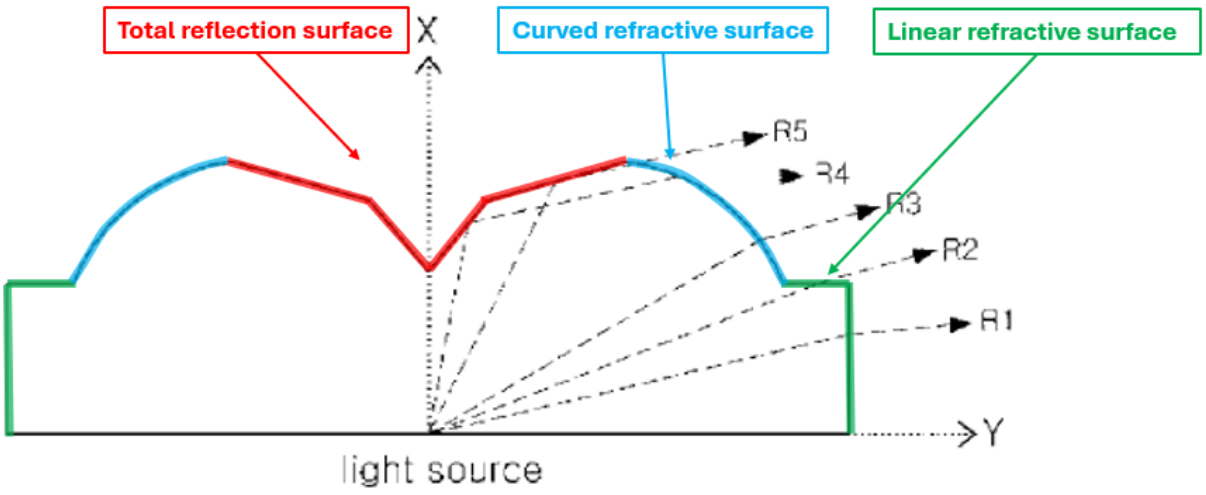
The '113 Patent's lens includes a **total reflection surface** and at least one of a **linear refractive surface** and a **curved refractive surface** that "extend away from the central axis and beyond the periphery of the **total reflection surface**." *See* EX1001, claim 1. Figure 31 is one example. As shown, light incident on the **total reflection surface** is reflected toward the **linear refractive surface** and the **curved refractive surface**, which causes the light rays to generally emit out of the lens sideways. *See* EX1001, 17:31-38.



EX1001, Figure 31. EX1002, ¶¶36-37.

Figure 35 below shows another example: light incident on the **total reflection**

surface is reflected and emitted sideways through the **curved refractive surface** and the **linear refractive surface**. *See* EX1001, 18:41-48.



EX1001, Figure 35. EX1002, ¶38.

According to the '113 Patent, these side illumination lenses can be incorporated into a light emitting device, which further includes a light-emitting diode. EX1001, claim 1. EX1002, ¶39.

C. Prosecution History Of The '113 Patent

The application for the '113 Patent, which included original claims 1-11 was filed on March 24, 2010, as a continuation of U.S. Patent Application No. 11/576,882 (now U.S. 7,748,873) claiming priority to four Korean Patent Applications. *See* EX1001, Cover; EX1003, 76-78. EX1002, ¶40.

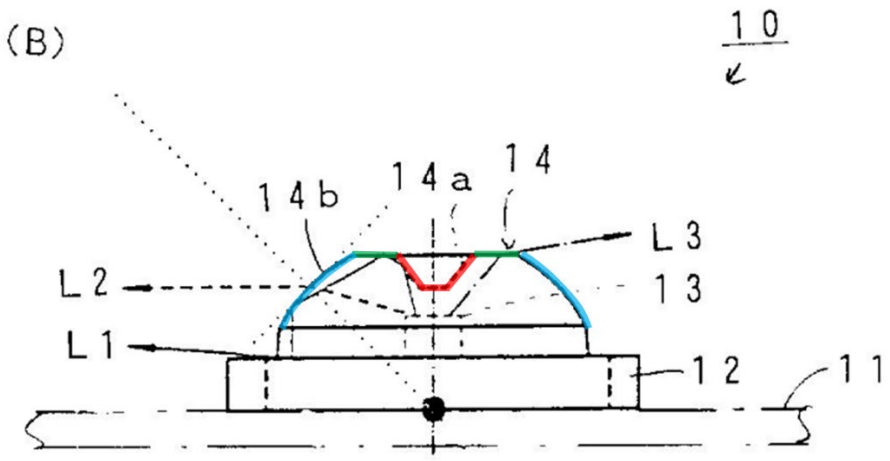
On November 15, 2010, the Examiner issued a Notice of Allowance noting that "[t]he prior art when taken separately or combined fails to teach and/or show a

light emitting device as set forth in Claim 1 having a light emitting diode, a lens having a total reflection surface having a total reflection slope with respect to a central axis of the light emitting diode, and at least one of a linear refractive surface and a curved refractive surface formed to extend away from the central axis and beyond a periphery of the total reflection surface. EX1003, 121-127. The '113 Patent issued on March 8, 2011. EX1001, Cover. EX1002, ¶¶41-42.

VII. Overview Of Prior Art References

A. Odawara (EX1004)

Odawara describes a lens in which "the light that is emitted from the LED chip … travels in an almost horizontal direction." EX1004, [0018]. As shown in Figure 1 below, the lens includes a **cone-shaped recessed part**, a **linear upper surface**, and a curved **side surface** that extends away from the central axis and beyond the periphery of the **recessed part**. Moreover, light incident on the **recessed part** is reflected toward the **linear upper surface** and a curved **side surface**, which causes the light rays to emit out of the lens generally along the horizontal direction. *See* EX1004, [0016], [0018], [0020], [0031], [0032], [0034].



EX1004, Figure 1. EX1002, ¶¶47-50.

B. Sommers (EX1006)

Sommers is directed to a side-emitting lens, as shown by light rays 338 in Figure 6 below. *See* EX1006, 5:63-66 ("[A]nd this is indicated in FIG. 6 by a plurality of rays 338 emanating from each point where an incident ray 332 scatters off inner surface 328."). As shown, the lens includes a **depression 324 with surface 328** having a reflective coating. EX1006, 6:6-10 ("For example, the scattering strength may be increased either by coating the outer surface 328 with a reflective coating…"). Moreover, Figure 6 of Sommers shows a side surface 322 that has a **curved refractive surface** portion and a **linear refractive surface** portion. *See* EX1006, 6:26-29 ("Additionally, because the light is scattered diffusely, any refraction occurring at side surface 322 will not significantly change the intensity distribution, and so the detailed curvature of the side surfaces is also not critical.").

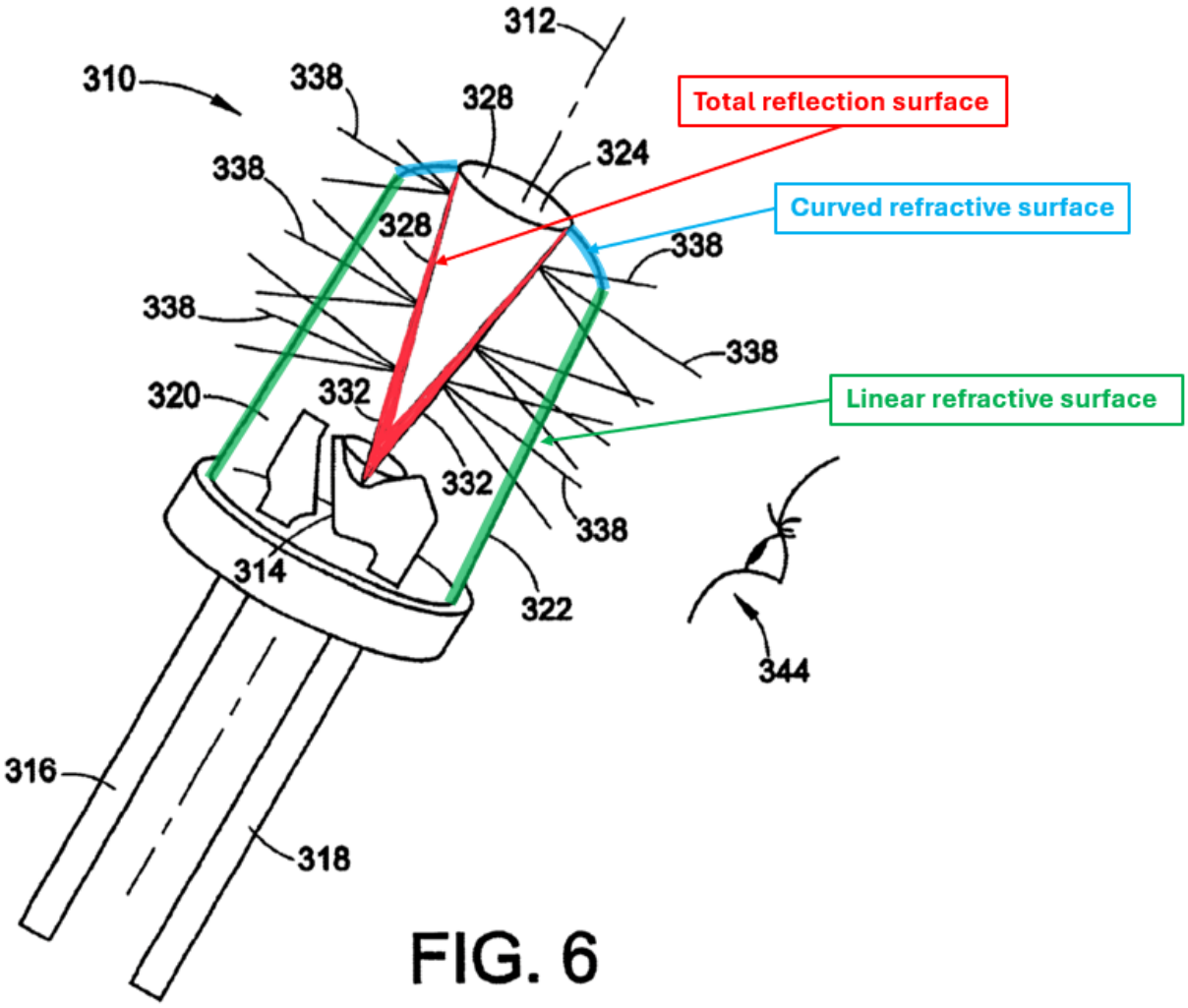


FIG. 6

EX1006, Figure 6. EX1002, ¶¶51-53.

C. West (EX1005)

West is directed to "side emitting light emitting device." EX1005, Title. As shown below in Figure 5F, West teaches a lens that includes a "**[f]unnel portion 58** [that] is designed as a TIR surface. The TIR surface reflects light." EX1005, 4:12-15. In addition, West teaches a "**sawtooth portion 56** [that] is designed to refract and bend light so that the **light exits** from the lens 44 as close to 90 degrees to the

longitudinal package axis 43 as possible." EX1005, 4:2-9.

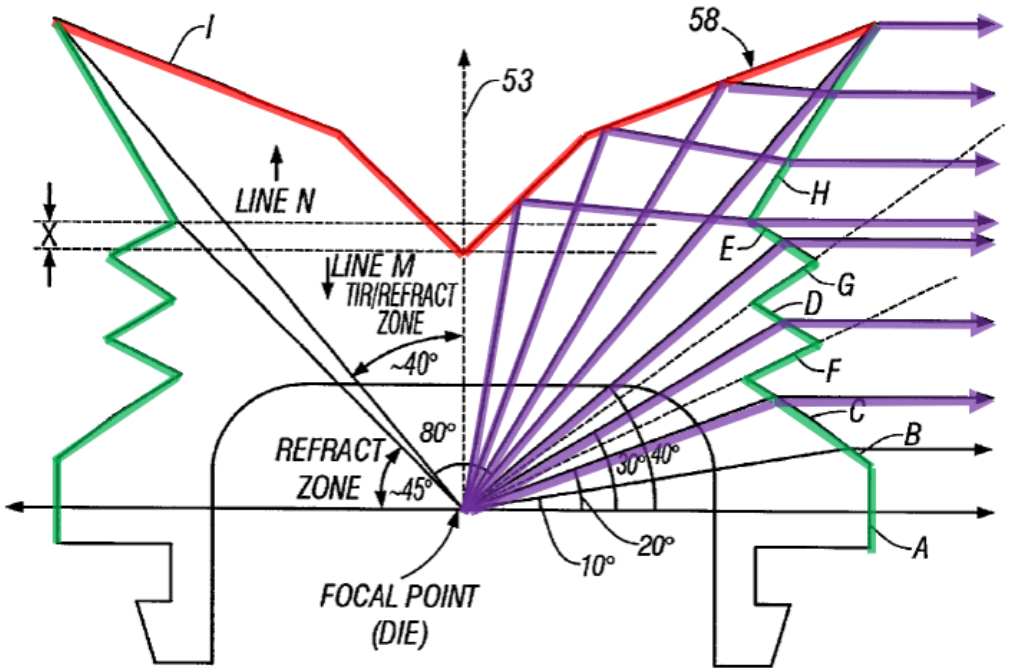


FIG. 5F

EX1005, Figure 5F. EX1002, ¶¶54-55.

West was relied upon by the Examiner during prosecution of U.S. 7,748,873 (the '873 Patent), which is the parent of the '113 Patent. West was overcome by the patentee by amending independent claim 1 of the '873 Patent to recite "at least one of a linear refractive surface and[[/or]] a curved refractive surface[[(s)]] formed to extend away from the central axis and beyond a periphery of the total reflection surface." EX1008, 415-418, 431. Independent claim 1 of the '113 Patent recites the same limitation. EX1001, claim 1. This Petition does not rely on West for these limitations that allowed the Applicant for the '113 Patent and the parent '873 Patent

to overcome West. EX1002, ¶56.

VIII. Level Of Ordinary Skill In The Art

"Factors that may be considered in determining level of ordinary skill in the art include: (1) the educational level of the inventor; (2) type of problems encountered in the art; (3) prior art solutions to those problems; (4) rapidity with which innovations are made; (5) sophistication of the technology; and (6) educational level of active workers in the field." *Env't Designs, Ltd. v. Union Oil Co. of California*, 713 F.2d 693, 696 (Fed. Cir. 1983). However, "[n]ot all such factors may be present in every case, and one or more of these or other factors may predominate." *Id*.

The '113 Patent is directed to a side illumination lens and devices with such a lens. *See* EX1001, Title, Abstract. Side illumination lenses were known since at least the early 1970s. *See* EX1013, Cover, 2:24-29. The prior art references considered during prosecution generally relate to lenses. *See* EX1001, Cover (References Cited). Although the education level of the inventors is not readily ascertainable, given the type of art and the purported solutions that are claimed, the inventors would likely have had at least a bachelor's degree with some engineering and/or optics understanding. EX1002, ¶¶44.

Accordingly, a person of ordinary skill in the relevant field or art ("POSITA") as of the claimed priority date of the '113 Patent (October 7, 2004) would have had

a bachelor's degree in engineering (e.g., optical engineering), physics, or a related field. Additionally, a POSITA would have had at least a minimum of two years of experience in designing optical systems, knowing how light rays reflect and refract off different surfaces and how lenses are incorporated in light emitting devices. Less work experience may be compensated by a higher level of education and vice versa. EX1002, ¶45.

IX. Claim Construction

The claims should be construed "in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent." 37 C.F.R. § 42.100(b); *see also Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (*en banc*). The Patent Owner can act as his own lexicographer. *See In re Paulsen,* 30 F.3d 1475, 1480, Fed. Cir. 1994) (holding that an inventor may define specific terms used to describe invention). Moreover, the Board "need[s] only construe terms 'that are in controversy, and only to the extent necessary to resolve the controversy.'" *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor, Co.,* 868 F.3d 1013, 1017 (Fed. Cir.

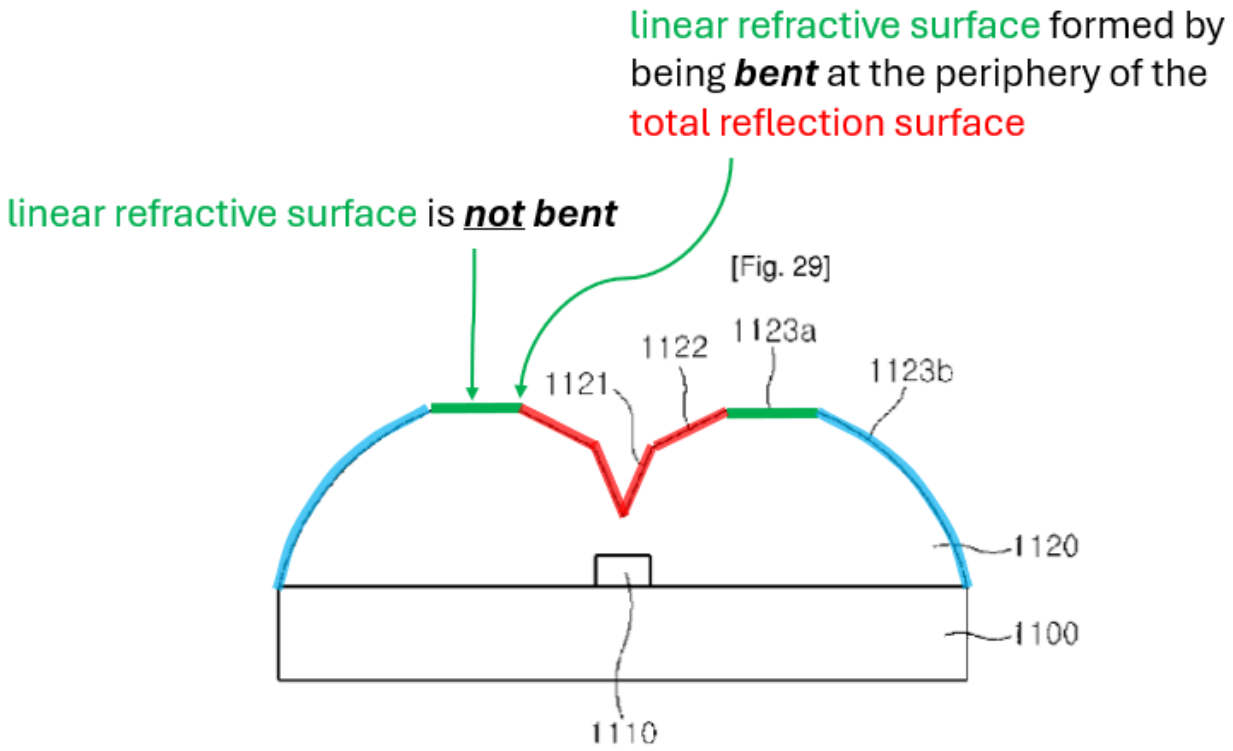
2017). Petitioner submits that construction of the following term is sufficient for the purposes of this Petition.[2]

A. "the linear refractive surface is bent more than once"

Challenged claims 5, 10 and 11 recite "wherein the **linear refractive surface** is bent more than once." As properly construed, the term requires the claimed "**linear refractive surface**" to have at least two bends. EX1002, ¶58.

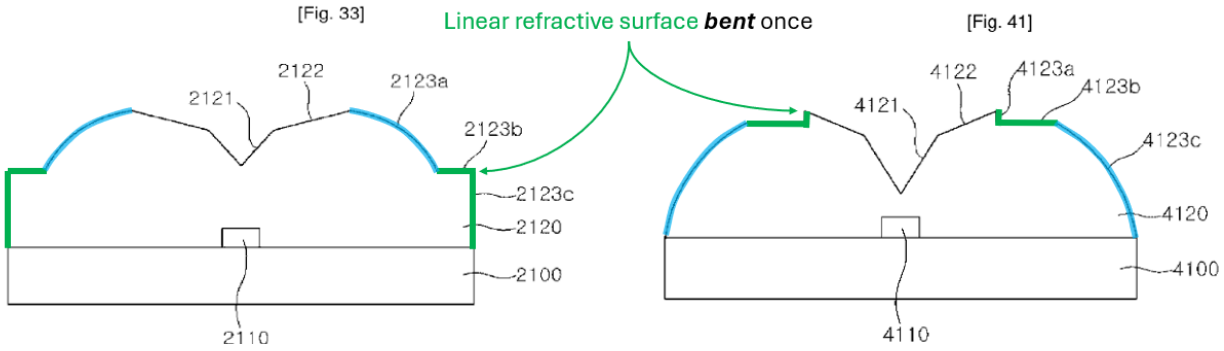
At the outset, the term "wherein the **linear refractive surface** is bent more than once" does ***not*** include bends that occur between either (1) the **total reflection surface** and the **linear refractive surface** or (2) the **linear refractive surface** and the **curved refractive surface**. For example, in Figure 29 shown below, although the **linear refractive surface** is formed by being bent at the periphery of the **total reflection surface**, the **linear refractive surface** itself is not bent.

[2] Petitioner reserves all rights to raise other claim construction arguments in other forums.



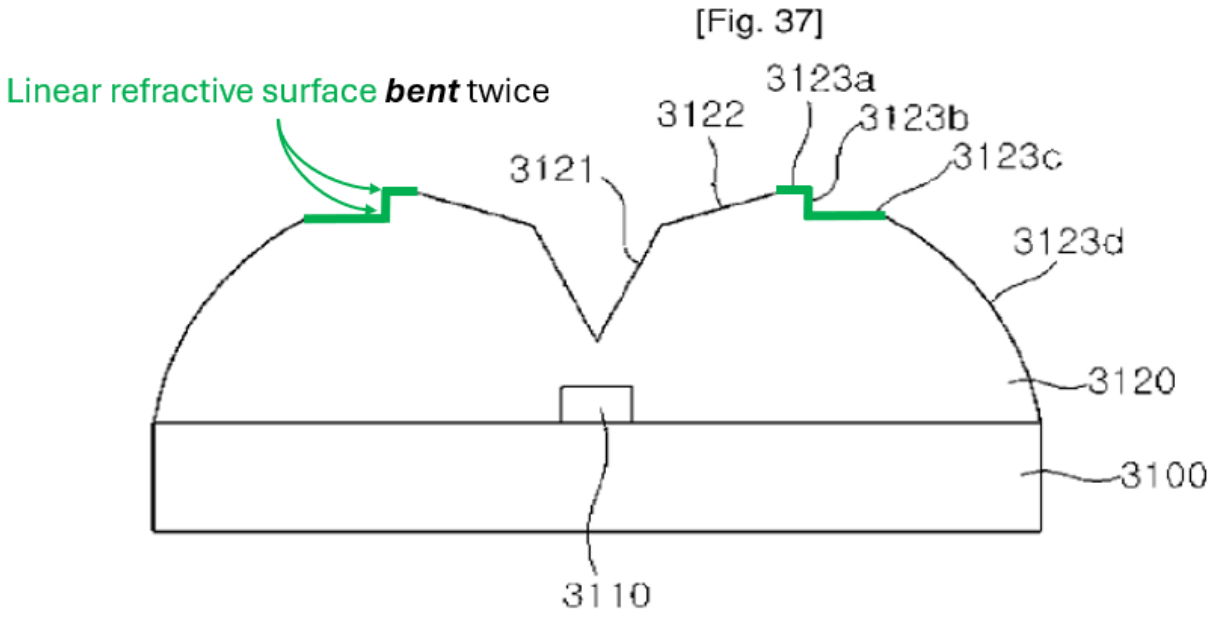
EX1001, Figure 29. EX1002, ¶59.

Nor does the term encompass a **linear refractive surface** that is bent only once. For example, Figure 33 shows a lens "with a **linear surface** extending from a **curved surface** and ***bent once***" (EX1001, 18:28-32), between the **linear refractive surfaces 2123b and 2123c**. Similarly, Figure 41 shows a "side illumination lens with a **linear surface *bent once*** (EX1001, 21:7-10) as evidenced by **4123a and 4123b**.



EX1001, Figures 33 and 41. EX1002, ¶60.

In contrast, Figure 37 below shows a lens "with a **linear surface *bent twice***," (EX1001, 19:54-57) as evidenced by **3123a, 3123b, and 3123c**.



EX1001, Figure 37. Hence, according to the '113 Patent and consistent with the plain and ordinary meaning, the term "wherein the **linear refractive surface** is bent more than once" requires the **linear refractive surface** to have at least two bends. EX1002, ¶¶61-62.

X. Specific Grounds For Challenge

A. Grounds I And II: Odawara Anticipates Or Renders Obvious Claims 1, 2, 4, 5, 7, 8, And 10

1. Independent Claim 1 And Dependent Claim 2

i. [1pre] A light emitting device, comprising:

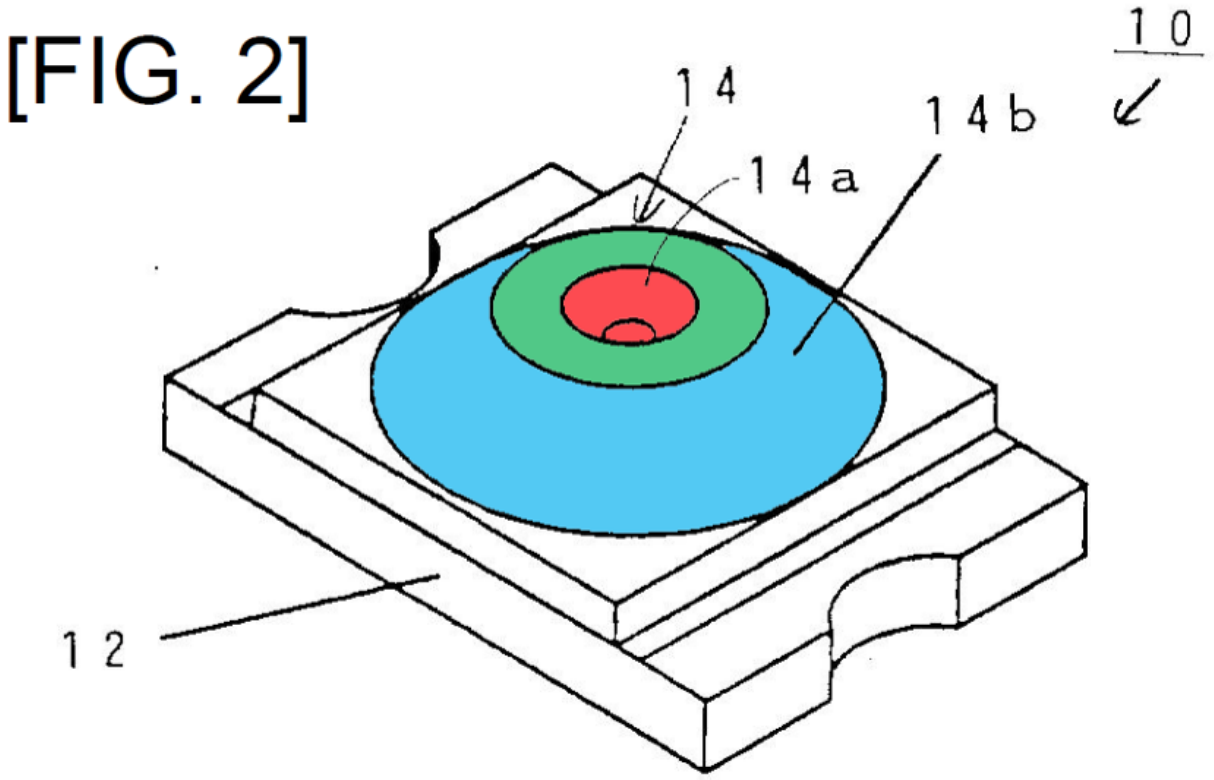
Odawara teaches [1pre]. Odawara teaches a surface mounted LED "containing: a chip substrate having a surface mounted terminal part; an LED chip mounted on the chip substrate; and a lens part formed of a transparent or translucent resin on the chip substrate so as to surround the LED chip," to e.g., "illuminate the keys of a mobile phone". EX1004, [0007], [0009]. EX1002, ¶¶64-65.

ii. [1a] a light emitting diode,

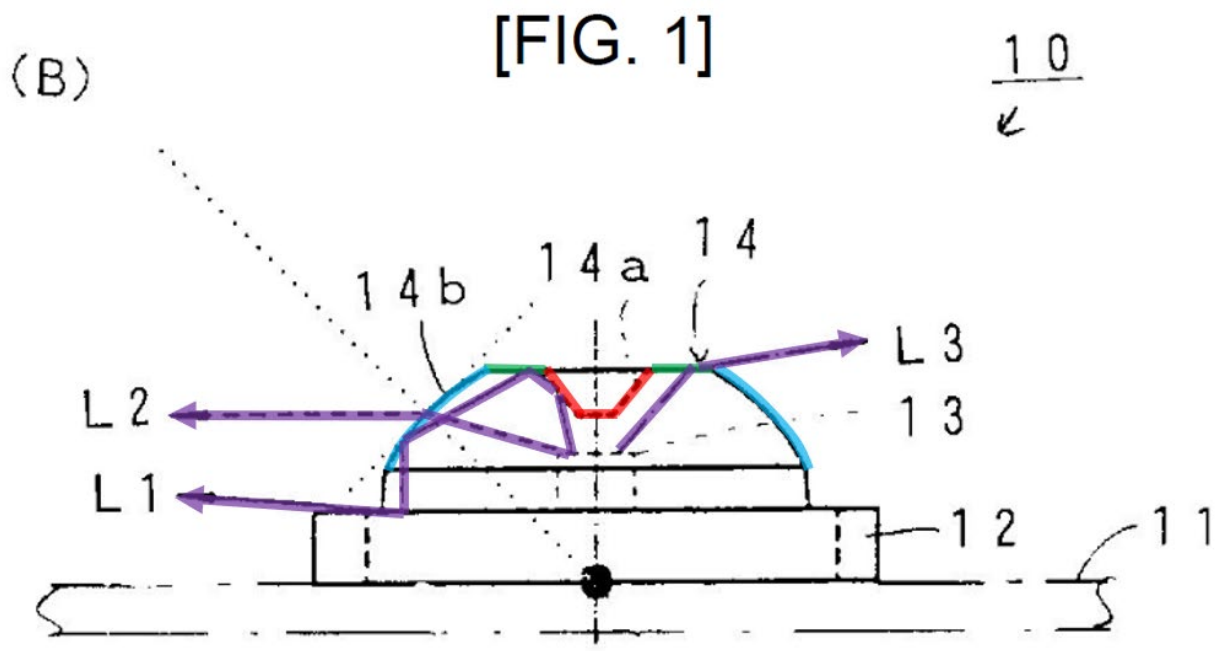
Odawara teaches [1a]. Specifically, Odawara teaches that its device includes an LED chip. EX1004, [0009]. LED is an acronym for a light-emitting diode. EX1002, ¶¶66-67.

iii. [1b] a lens arranged to receive light from the light emitting diode,

Odawara teaches [1b]. As shown below in Figure 1, Odawara teaches a "lens part 14". EX1004, Abstract, [0024] ("The lens part 14 functions as a light emitting part by emitting light from the LED chip 13…").



EX1004, Figure 2. As shown in Figure 1B, the lens part 14 receives **light** from the LED chip 13. *See* EX1004, [0004]-[0007], [0009], [0016]-[0020], [0022], [0028] ("[T]he **light** from the LED chip 13 passes through the lens part 14 and is emitted to the outside."), [0029]-[0032] (describing **light L1-L3** emitted from LED chip 13 being received by different parts of the lens part 14), [0033]-[0034], Figures 1-3.



EX1004, Figure 1B. EX1002, ¶¶68-70.

iv. [1c] the lens comprising a total reflection surface having a total reflection slope with respect to a central axis of the light emitting diode; and

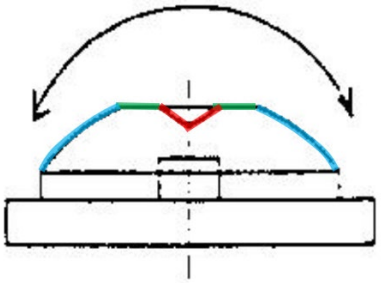
At the outset, the plain and ordinary meaning of this term is "a surface that totally reflects light." The '113 Patent provides three examples of a "**total reflection surface**." ***One example*** of a "**total reflection surface**" may include a surface that reflects light using a phenomenon called total internal reflection (TIR). *See, e.g.,* EX1001, 1:60-66 ("Conventional lenses using TIR are disclosed in U.S. Patent Nos. 6,679,621, 6,607,286, and 6,598,998. In the patents, a lens comprises **a total reflection surface**…"). Although the '113 Patent mentions "total internal reflection" throughout the specification, the Patentee chose a broader term "**total**

reflection surface" in the claims. *See, e.g.,* EX1001, 2:14-20 ("An object of the present invention is to provide a side illumination lens, which comprises a total internal reflection surface with a total reflection slope…"), claim 1 (reciting "**total reflection surface**"). ***A second example*** of a "**total reflection surface**" may include a surface that has been lined or coated with a reflective material that totally reflects light. *See, e.g.,* EX1001, 1:43-56 (discussing lens 12 lined with "reflection cups 14" to reflect light). ***A third example*** may be a total internal reflection surface that has been lined or coated with a reflective material. Indeed, the '113 Patent mentions U.S. Patent No. 6,598,998 (West), noting that "[i]n the patent[], a lens comprises a **total reflection surface** which is formed on the lens and has a predetermined slope." EX1001, 1:61-66. West describes a "**[f]unnel portion 58** [that] is designed as a TIR surface," in which a "metallization layer (e.g., aluminum) may be placed on top of **funnel portion 58** to prevent light transmission through the TIR surface." EX1005, 4:12-19. In short, the plain and ordinary meaning of the term "**total reflection surface**" is "a surface that totally reflects light." EX1002, ¶¶71-76.

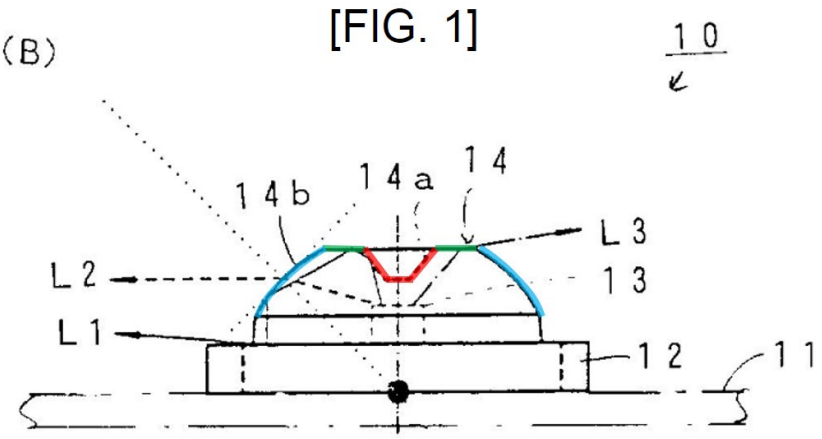
Under this plain and ordinary meaning of the term "**total reflection surface**," Odawara teaches and/or renders obvious [1c]. As shown below in Figure 1 and 3, Odawara teaches a **recessed part** in which the "light emitted from the LED chip upward in the optical axis direction is ***totally reflected*** by the inner surface of the recessed part and travels along the entire periphery in the lateral direction." EX1004,

[0034]; *see also* EX1004, [0014], [0017], [0029]. The total reflection occurs "along the entire periphery in the lateral direction," "resulting in an approximately uniform reflection around the entire periphery." EX1004, [0016], [0017]; *see also* EX1004, [0007], [0020], [0029], [0034].

[FIG. 3]



[FIG. 1]



EX1004, Figures 3 and 1B. EX1002, ¶¶77-78.

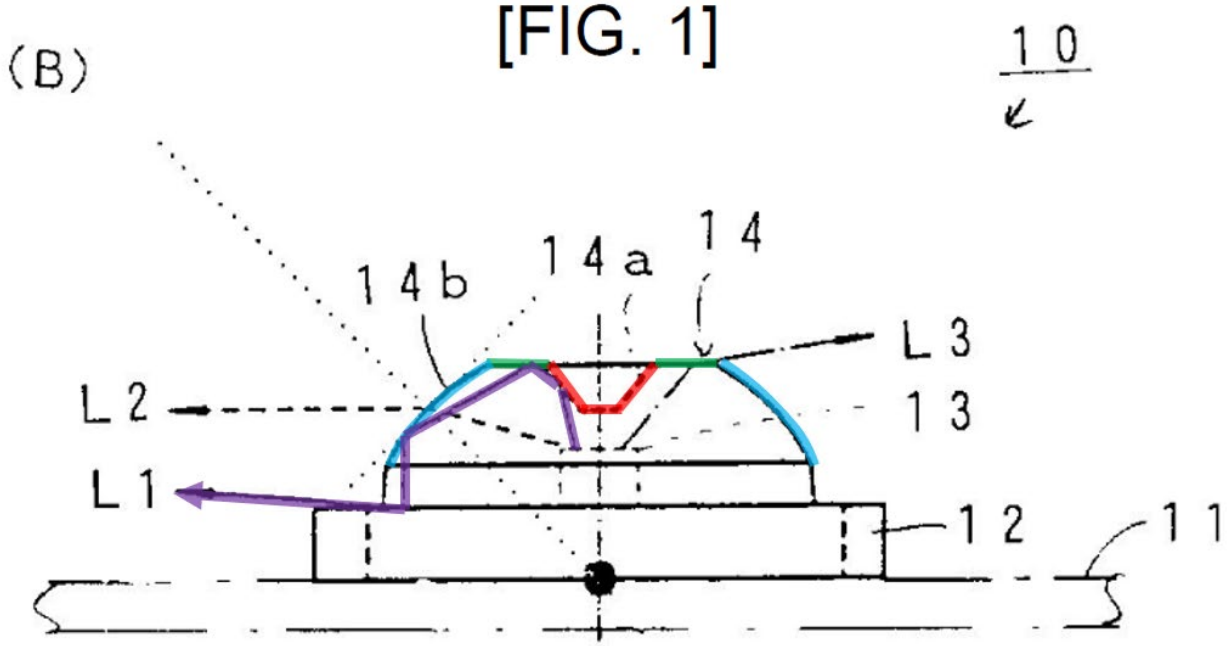
Moreover, the **recessed part** has a slope with respect to the optical axis that runs vertically through the center of the lens. Odawara explains that the **recessed part** is "cone shaped," two examples of which are shown in Figures 1B and 3 above. *See* EX1004, Abstract, claims 1, 2, [0009], [0016]-[0018], [0020], [0025], [0034]. As shown, the **recessed part**'s "center axis substantially coincides with the optical axis perpendicular to the LED chip 13 and the chip substrate 12." EX1004, [0026]. EX1002, ¶79.

To the extent that Figures 1 and 3 are directed to different embodiments or that Figure 1 only is cone-shaped with a flat bottom that somehow does not have a

"a total reflection slope," it would have been obvious to substitute the **recessed part** shown in Figure 1 with the **recessed part** shown in Figure 3, as explained in Section X.A.1.vii [Grounds I/II, Reasons To Combine]. EX1002, ¶80.

Finally, to the extent Patent Owner argues that "**total reflection surface**" requires a surface that reflects light utilizing total internal reflection, a POSITA would have found Odawara teaches or at least renders obvious [1c]. As shown below in Figure 1B, Odawara teaches that "**light L1** incident on the **recessed part 14a** of the lens part 14 is ***totally reflected***, as depicted in FIG. 1(B), and travels laterally, and is ***totally reflected*** again by the **side surface 14b** of the lens part 14, and is incident on the surface of the chip substrate 12." EX1004, [0029].

[FIG. 1]



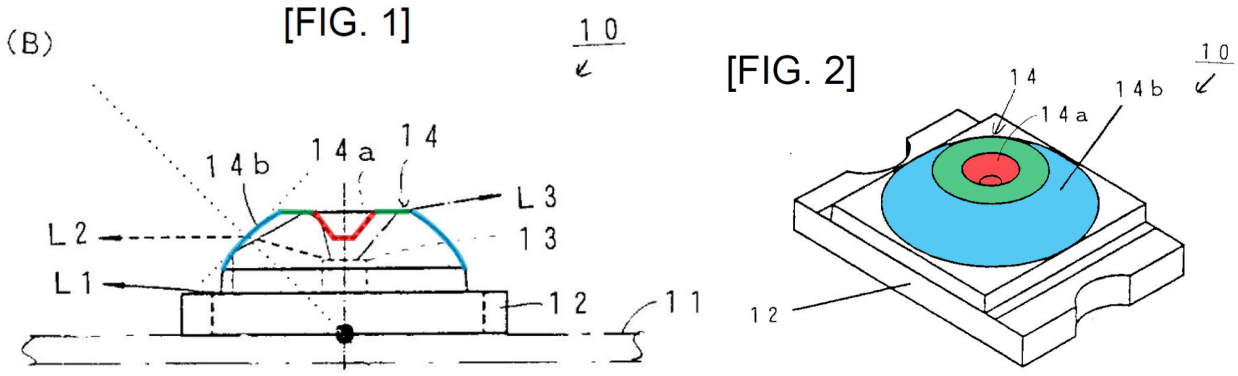
EX1004, Figure 1B. A POSITA would have understood that **light L1** being "totally reflected" by the **side surface 14b** is caused by total internal reflection because other light rays, such as light L2, which arrive at the **side surface 14b** at an angle less than the critical angle required to cause total internal reflection, refract out of **side surface 14b**. However, **light L1** arriving at **side surface 14b** is "totally reflected" because it arrives at an angle greater than the critical angle needed to cause total internal reflection. Odawara utilizes the same term "***totally reflected***" for the reflections that occur at both the **recessed part** and the **side surface 14b**. *See* EX1004, [0029]. Indeed, Odawara does not explicitly mention that **recessed part 14a** is provided with a metallization to cause the light to be "***totally reflected***." Hence, a POSITA would have found that Odawara teaches, or at a minimum suggests, total internal reflection to be occurring at the **recessed part**. EX1002, ¶¶81-83.

v. **[1d] at least one of a linear refractive surface and a curved refractive surface formed to extend away from the central axis and beyond a periphery of the total reflection surface.**

vi. **[2] The light emitting device as claimed in claim 1, wherein the refractive surface comprises: a linear refractive surface formed by being bent at the periphery of the total reflection surface; and a curved refractive surface formed to extend from a periphery of the linear refractive surface.**[3]

Odawara teaches [1d] and [2]. As shown below, Odawara teaches both a **linear refractive surface** and a **curved refractive surface**.

[3] Claim 2 recites "***the*** *refractive* surface" whereas claim 1 recites "***a linear*** *refractive* surface" and "***a curved*** *refractive* surface." In addition, claim 2 again recites "***a linear*** *refractive* surface" and "***a curved*** *refractive* surface." Petitioner is treating claim 2 to recite "wherein ~~the refractive surface comprises a~~ ***[the] linear*** refractive surface [is] formed by being bent at the periphery of the total reflection surface; and ~~a~~ ***[the] curved*** refractive surface [is] formed to extend from a periphery of the linear refractive surface." EX1002, ¶85. Petitioner reserves the right to challenge the claim under 35 U.S.C. §112.

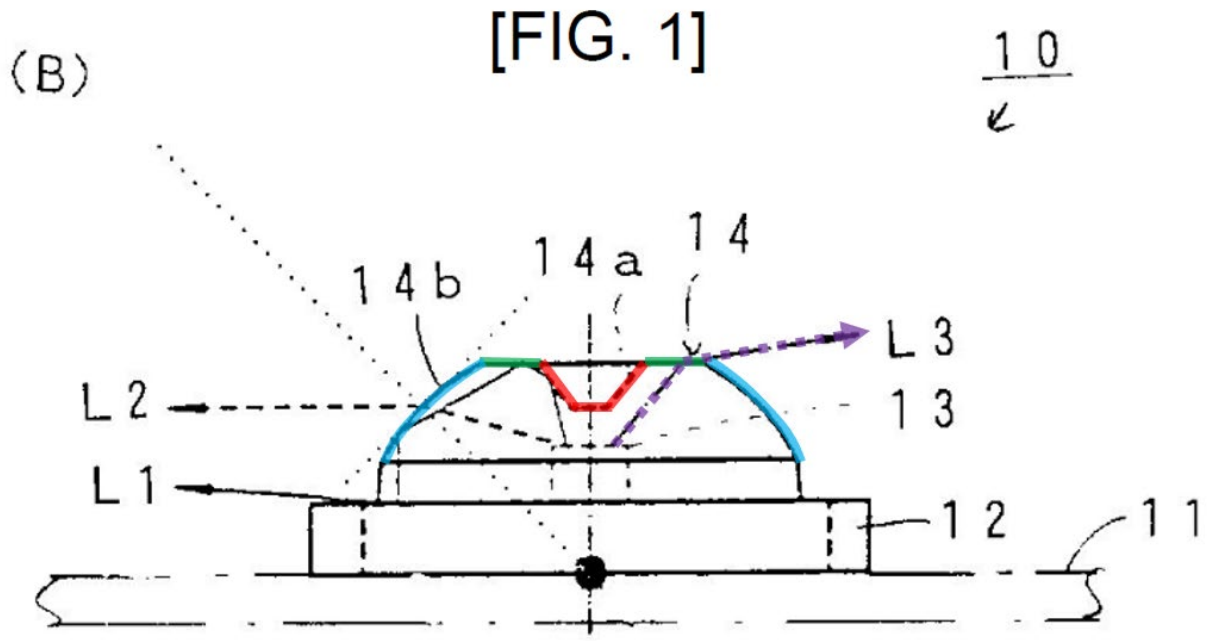


EX1004, Figures 1B and 2; *see also* EX1004, Figures 1-3. EX1002, ¶86.

First, the **linear refractive upper surface** is formed to extend away from the central axis and beyond a periphery of the **recessed part**. Moreover, the **linear refractive upper surface** is formed by being bent at the periphery of the **recessed part**. EX1002, ¶87.

As shown in Figures 1-3, the lens part 14 includes an **upper surface** that is linear. Figures 1 and 3 clearly show that the **upper surface** is linear, in contrast to other features such as the **side surface 14b** that is depicted and explained as being curved (as more fully described further below in this section). *See In re Mraz*, 455 F.2d 1069, 1072 (CCPA 1972) (explaining that clear teachings from patent drawings are ***not*** to be disregarded.); *see also Seoul Semiconductor Co., Ltd. et al., v. Sharp Kabushiki Kaisha et al.,* IPR2014-00879, Paper 33, 10 ("A drawing is evaluated on the basis of what it reasonably discloses and suggests to a person of ordinary skill in the art.") (citing *In re Aslanian*, 590 F.2d 911, 914 (CCPA 1979)). EX1002, ¶88.

The **upper surface** is also refractive because Odawara explains that "**light L3** incident on the **upper surface** of the lens part 14 … ***is refracted*** at the **upper surface** of the lens part 14…" EX1004, [0031].



EX1004, Figure 1B; *see also* EX1004, Figures 1-3. EX1002, ¶89.

At a minimum, a POSITA would have found that Odawara renders obvious the claimed "**linear refractive surface**." Odawara explains that the "**upper surface** of the lens part 14 … is appropriately adjusted … based on the intended use of the surface mounted LED 10." EX1004, [0031]. Choosing the **upper surface** to be linear would have involved nothing more than routine experimentation using optical engineering methods that were well-known in the art. A POSITA would have been able to make the **upper surface** be linear with a reasonable expectation of success as it would have merely involved making a flat surface that an optical engineer

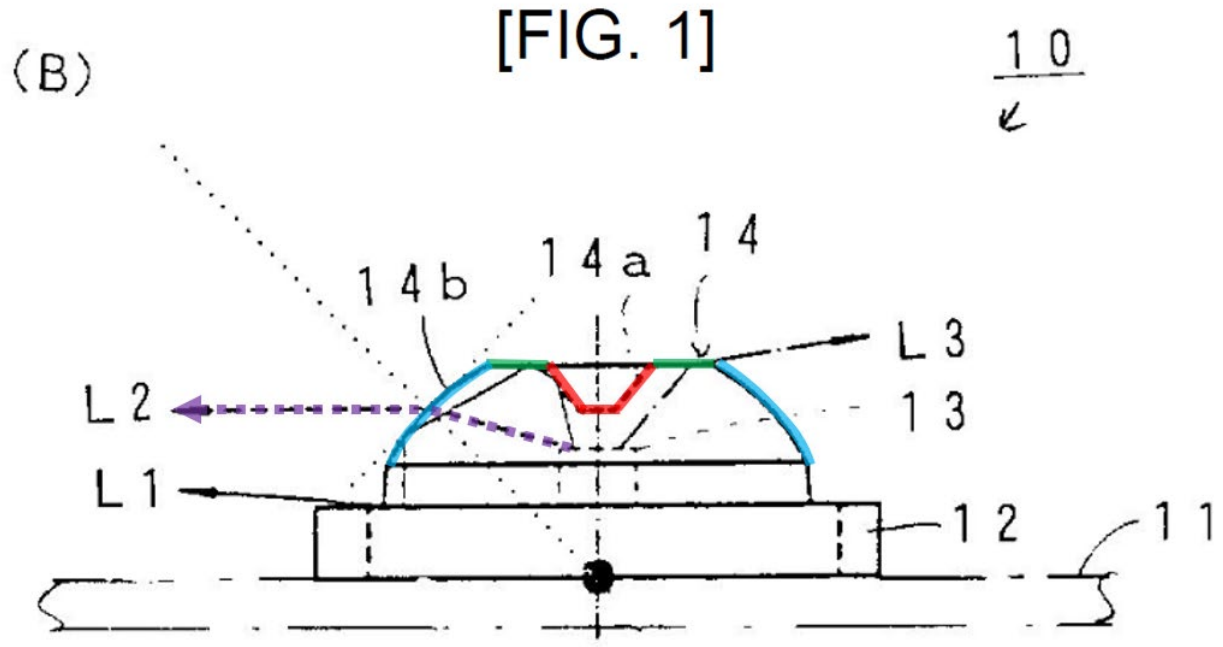
would have been able to readily determine how light refracts out of that region of the lens part 14. EX1002, ¶90.

Furthermore, as shown in Figures 1-3, the **upper surface** extends away from the central optical axis and beyond a periphery of the **recessed part**. Moreover, the **upper surface** is formed by being bent at the periphery of the **recessed part**. EX1002, ¶91.

Second, the **curved refractive surface** is formed to extend away from the central axis and beyond a periphery of the **recessed part**. Moreover, as shown in Figures 1-3, **side surface 14b** is formed to extend from the periphery of the **linear refractive surface**. EX1002, ¶92.

Odawara teaches "the surrounding **side surface 14b** is formed so as to ***taper upward***." EX1004, [0025]; *see also* EX1004, claim 3, [0011], [0018], [0020], [0025], [0033]. One specific example of how the taper curves is as a sphere. *See* EX1004, claim 4 ("wherein the **peripheral side surface** of the lens part is formed as a portion of ***a sphere*** having a center below an upper surface of the LED chip."); *see also* EX1004, [0012], [0018]. EX1002, ¶93.

Side surface 14b is also a refractive surface. Odawara explains that "**light L2** incident on the **side surface 14b** of the lens part 14 is ***refracted*** slightly downward when passing through the **side surface 14b**, as depicted in FIG. 1(B), …" EX1004, [0030].



EX1004, Figure 1B. EX1002, ¶94.

vii. Reasons To Combine Different Embodiments Of Odawara

To the extent Patent Owner argues Figures 1-3 are directed to different embodiments, a POSITA would have recognized that any one of the embodiments of Odawara can be combined with each other. Odawara teaches that Figures 1-3 collectively describe "[a] preferred embodiment." EX1004, [0021] ("A preferred embodiment of the present invention will be described in detail with reference to FIG. 1 to FIG. 3."). Odawara further teaches that they merely represent "preferred specific examples" and that "various technically preferable limitations are applied." EX1004, [0021]. Indeed, Odawara itself discusses how light rays L1-L3 reflects and/or refracts in the embodiment shown in Fig. 1B and concludes that "FIG. 3 is a

graph depicting the light distribution characteristics of the surface mounted LED of FIG. 1." EX1004, [0034]. In other words, Odawara treats the **recessed part** in FIGS. 1 and 3 to be similar to each other and concludes that "the light has wide directivity of approximately 180 degrees, and a particularly large amount of light is emitted in the horizontal directions…." EX1004, [0032]; *see also* EX1004, [0029]-[0032]. In other words, a POSITA would have readily recognized that any one of these embodiments achieves the desired goal of light emission in the horizontal direction—regardless of whether the **recessed part** shown in Figure 1 or Figure 3 is utilized. EX1002, ¶¶95-98.

Finally, a POSITA would have been able to use either of the **recessed part** shown in Figure 1 or Figure 3 with a reasonable expectation of success because the modification merely entails carrying out simple substitution of one the **recessed part** for another based on well-known optical calculations related to reflection of light off the **recessed part**, to achieve the same predictable result of increased light emission in the horizontal direction. *See* EX1004, [0029]-[0032]. EX1002, ¶99.

2. Dependent Claims 4 And 8

i. [4] The light emitting device as claimed in claim 1, wherein the curved refractive surface takes the shape of an ellipse, and a ratio of minor and major axes of the ellipse is 1:4 or less.

ii. [8] The light emitting device as claimed in claim 2, wherein the curved refractive surface takes the shape of an ellipse, and a ratio of minor and major axes of the ellipse is 1:4 or less.

Odawara teaches [4] and [8]. At the outset, the '113 Patent teaches that an ellipse includes a circle. EX1001, 17:3-6 ("The second refractive surface 1123b is made in the form of an ellipse as shown in FIG. 29, and a ratio of minor and major axes of the ellipse is in a range of 1:4 or less. ***That is, it may be a circle***."). In other words, the claimed ratio of minor and major axes of the ellipse can be 1:1. EX1002, ¶101.

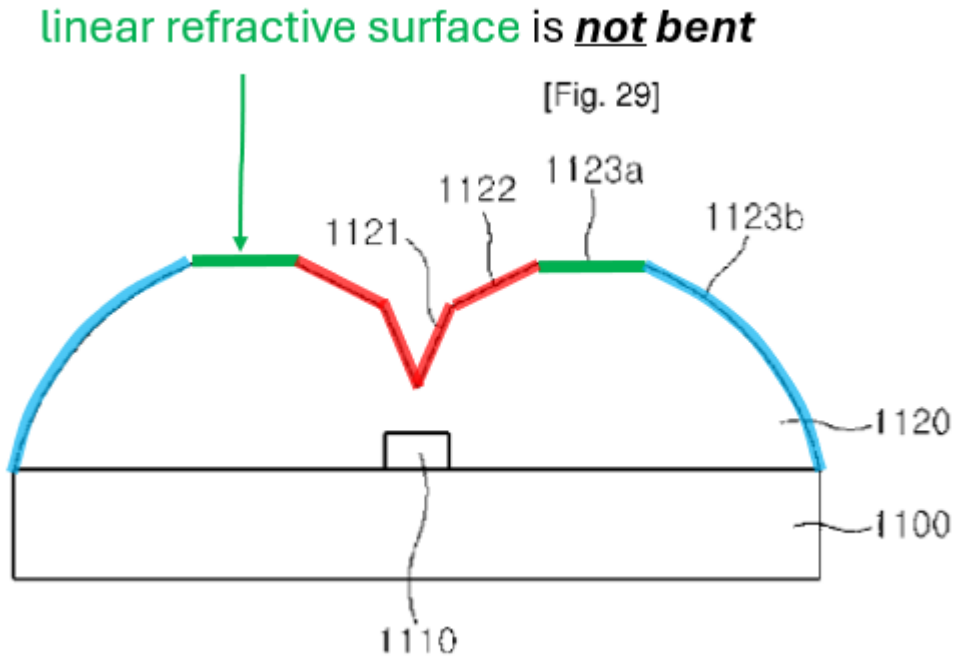
Odawara teaches that "the peripheral **side surface** of the lens part is formed as a portion of ***a sphere*** having a center below an upper surface of the LED chip." EX1004, claim 4; *see also* EX1004, [0012], [0018]. Therefore, Odawara teaches that the **side surface 14b** can take the shape of a circle when viewed in two dimensional cross-section, which has the ratio of minor and major axes of about 1:1. EX1002, ¶102.

3. Dependent Claims 5 And 10

i. [5] The light emitting device as claimed in claim 1, wherein the linear refractive surface is bent more than once.

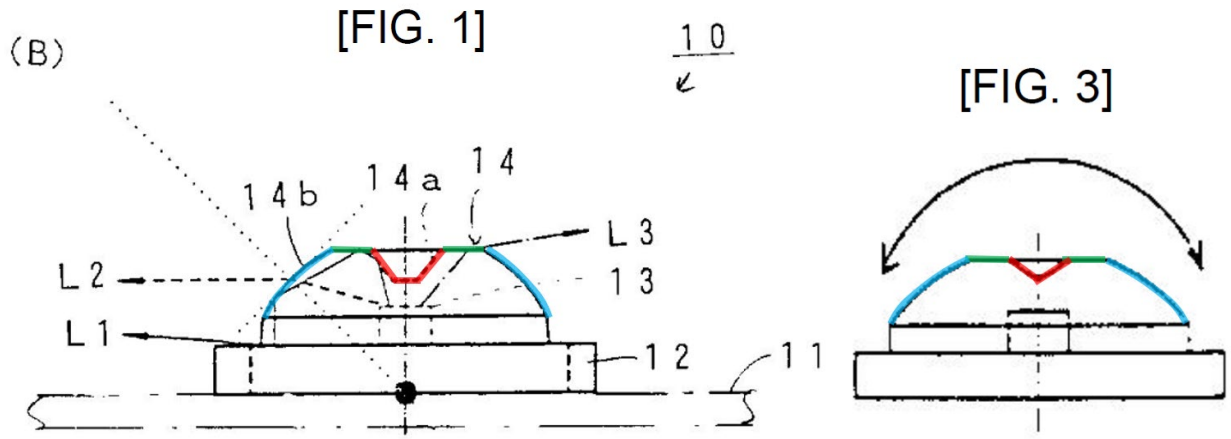
ii. [10] The light emitting device as claimed in claim 2, wherein the linear refractive surface is bent more than once.

As explained in Section IX.A [Claim Construction], under the plain and ordinary meaning, the term "wherein the **linear refractive surface** is bent more than once" does ***not*** include the bends that occur between (1) the **total reflection surface** and the **linear refractive surface** or (2) the **linear refractive surface** and the **curved refractive surface**, such as illustrated below.



EX1001, Figure 29. EX1002, ¶103.

However, to the extent Patent Owner asserts that the term "wherein the **linear refractive surface** is bent more than once" is so broad to encompass Figure 29 of the '113 Patent because it has (1) one bend between the **total reflection surface** and the **linear refractive surface** and (2) a second bend between the **linear refractive surface** and the **curved refractive surface**, Odawara teaches [5] and [10]. Odawara teaches the same **linear refractive surface** located in between the **total reflection surface** and the **curved refractive surface**, as shown below in Figure 1B and 3 below.



EX1004, Figures 1B and 3. EX1002, ¶¶104-105.

4. Dependent Claim 7

i. [7] The light emitting device as claimed in claim 1, wherein the refractive index of the body[4] is 1.2 to 2.0.

Odawara teaches and/or renders obvious [7]. Odawara teaches that the "lens part 14 is made of a transparent or translucent material, such as a thermosetting epoxy resin." EX1004, [0024]. Epoxy resin has a refractive index that is well-known to be about 1.5. *See* EX1006, 1:40-41 ("The encapsulant material is usually an epoxy resin or the like, with a refractive index n~1.5."). EX1002, ¶¶106-108.

B. Ground III: Odawara In Combination With West Renders Obvious Claims 1, 2, 4-8, And 10

1. Independent Claim 1 And Dependent Claim 2

i. [1pre] A light emitting device, comprising:

Odawara teaches [1pre]. *See* Section X.A.1.i [Grounds I/II, 1pre]. EX1002, ¶109.

ii. [1a] a light emitting diode,

Odawara teaches [1a]. *See* Section X.A.1.ii [Grounds I/II, 1a]. EX1002, ¶110.

[4] Claim 7, which depends from claim 1, recites "*the* body." Claim 1 does not recite "a body." Petitioner is treating claim 7 to recite "the lens" instead of "the body."

i. [1b] a lens arranged to receive light from the light emitting diode;

Odawara teaches [1b]. *See* Section X.A.1.iii [Grounds I/II, 1b]. EX1002, ¶111.

ii. [1c] the lens comprising a total reflection surface having a total reflection slope with respect to a central axis of the light emitting diode; and

To the extent Patent Owner argues that "**total reflection surface**" is not taught or suggested by Odawara, Odawara and West render obvious [1c]. At the outset, the '113 Patent admits that a "total reflection surface" that satisfies total internal reflection conditions was well-known in the art. *See* EX1001, 1:57-2:7 (explaining that conventional lenses using TIR were known, and admitting that "[i]n the [West] patent[], a lens comprises a **total reflection surface** which is formed on the lens and has a predetermined slope"). Indeed, West teaches a "[l]ens 44 [that] includes … a **total internal reflection (TIR) funnel portion 58**" that is "designed as a TIR surface. The TIR surface reflects light such that light exits from lens 44 as close to 90 degrees to a longitudinal package axis 43 of LED package 40 as possible." EX1005, 4:1-15.

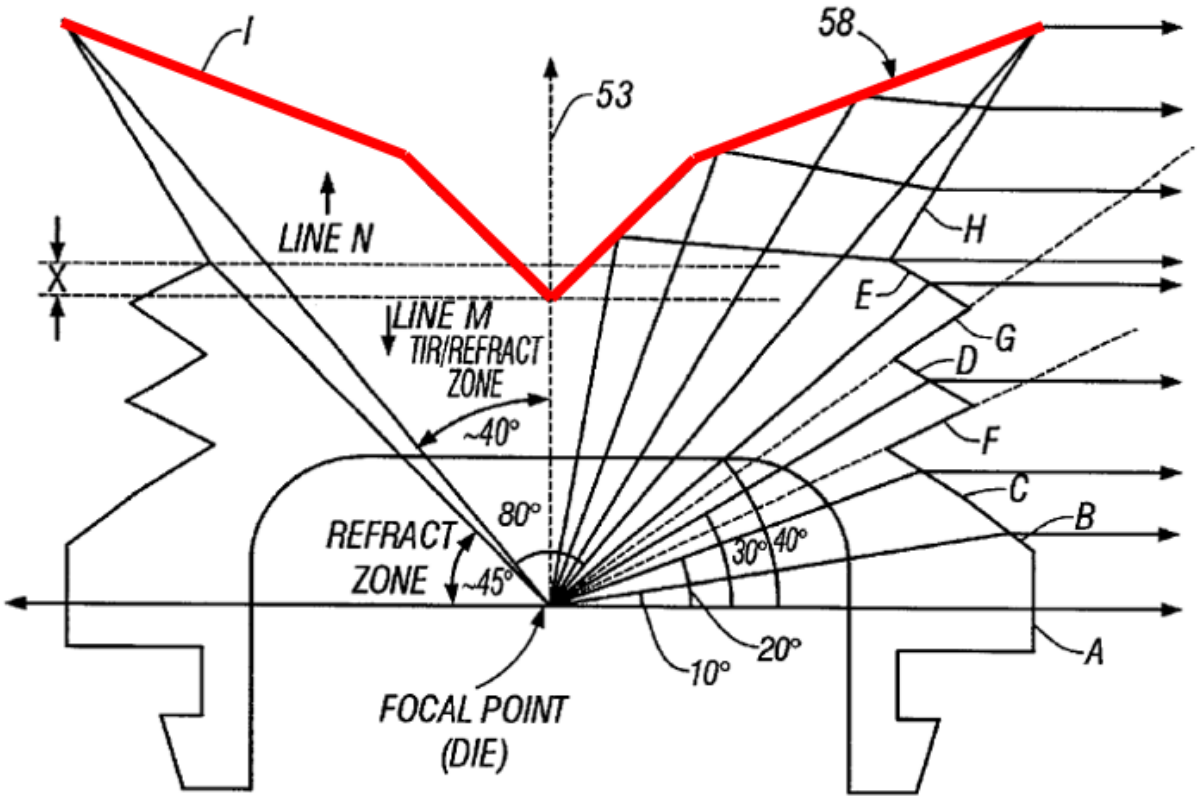


FIG. 5F

EX1005, Figure 5F. EX1002, ¶¶112-114.

iii. **[1d] at least one of a linear refractive surface and a curved refractive surface formed to extend away from the central axis and beyond a periphery of the total reflection surface.**

iv. **[2] The light emitting device as claimed in claim 1, wherein the refractive surface comprises: a linear refractive surface formed by being bent at the periphery of the total reflection surface; and a curved refractive surface formed to extend from a periphery of the linear refractive surface.**[5]

Odawara teaches [1d] and [2]. *See* Sections X.A.1.v and X.A.1.vi [Grounds I/II, 1d and 2]. EX1002, ¶115.

v. Reasons To Combine Odawara With West

A POSITA would have found it obvious to replace Odawara's **recessed part** with West's **TIR funnel portion 58** with a reasonable expectation of success. ***First***, both Odawara and West are directed to side emitting LEDs. *See* EX1004, [0032] (explaining that "a particularly large amount of light is emitted in the horizontal directions"); EX1005, Abstract ("A lens mounted to a light emitting diode package internally redirects light within the lens so that a majority of light is emitted from the lens approximately perpendicular to a package axis of the light emitting diode package."). A POSITA would therefore have been motivated to look at the teachings of either Odawara or West to achieve the desired goal of horizontal light emission,

[5] *See* n.3.

one of which is achieved by reflecting the light emitted by the LED towards the side as described in Odawara or West. EX1002, ¶116.

Second, the modification amounts to nothing more than applying a known technique to a known device to yield predictable results. As explained in Section X.A.1.iv [Grounds I/II, 1c], Odawara teaches the **recessed part** is designed to "totally reflect" the light that is emitted in an upwards direction. *See* EX1004, [0034] ("As described above, the present invention provides a **cone shaped recessed part** at the center of the upper surface of the lens part surrounding the LED chip, so light emitted from the LED chip upward in the optical axis direction is ***totally*** reflected by the inner surface of the recessed part and travels along the entire periphery in the lateral direction."); *see also* EX1004, [0014], [0017], [0029]. West's **funnel portion 58** provides the same function of reflecting light from the LED using the well-known concept of total internal reflection. *See* EX1005, 4:1-22 ("Funnel portion 58 is designed as a TIR surface. The TIR surface reflects light such that light exits from lens 44 as close to 90 degrees to a longitudinal package axis 43 of LED package 40 as possible."). A POSITA would have been able to readily substitute Odawara's **recessed part** with West's **funnel portion 58** to achieve the same desired goal of reflecting light horizontally towards the periphery of the lens to increase the amount of light being output to the side. A POSITA would have been able to make the modification with a reasonable expectation of success because the modification

merely entails carrying out simple substitution of one known reflective surface with another to achieve the same predictable result of increased emission of light in the horizontal direction. EX1002, ¶¶117-119.

2. Dependent Claims 4 And 8

i. [4] The light emitting device as claimed in claim 1, wherein the curved refractive surface takes the shape of an ellipse, and a ratio of minor and major axes of the ellipse is 1:4 or less.

ii. [8] The light emitting device as claimed in claim 2, wherein the curved refractive surface takes the shape of an ellipse, and a ratio of minor and major axes of the ellipse is 1:4 or less.

Odawara teaches [4] and [8]. *See* Sections X.A.2.i and X.A.2.ii [Grounds I/II, 4 and 8]. EX1002, ¶120.

3. Dependent Claims 5 And 10

i. [5] The light emitting device as claimed in claim 1, wherein the linear refractive surface is bent more than once.

ii. [10] The light emitting device as claimed in claim 2, wherein the linear refractive surface is bent more than once.

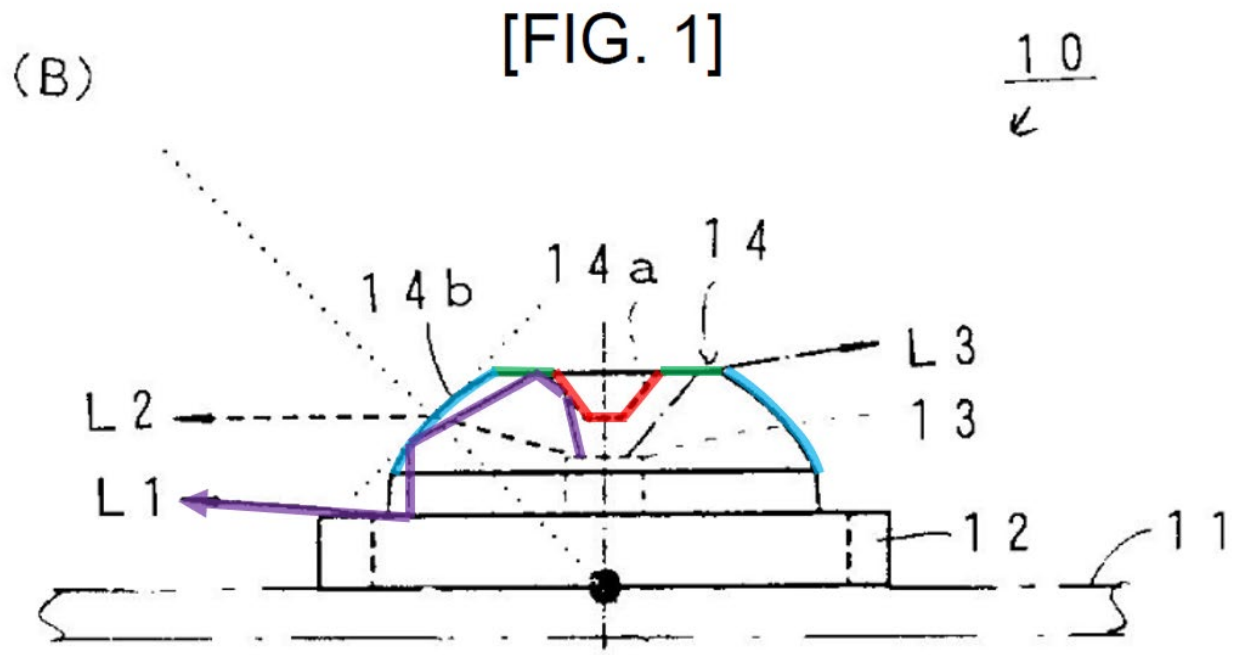
To the extent Patent Owner asserts that the term "wherein the **linear refractive surface** is bent more than once" is broad as to encompass Figure 29 of the '113 Patent, Odawara teaches [5]. *See* Sections X.A.3.i and X.A.3.ii [Grounds I/II, 5 and 10]. EX1002, ¶121.

4. Dependent Claims 5 And 10

i. [5] The light emitting device as claimed in claim 1, wherein the linear refractive surface is bent more than once.

ii. [10] The light emitting device as claimed in claim 2, wherein the linear refractive surface is bent more than once.

As explained in Section IX.A [Claim Construction], the term "wherein the **linear refractive surface** is bent more than once" requires the claimed "**linear refractive surface**" to have at least two bends. As properly construed, Odawara in combination with West render obvious [5] and [10]. Odawara teaches in Figure 1B that **light rays L1** that "totally reflect" off the **recessed part** also reflect off the **upper surface** of the lens, which then further "totally reflects" off the **side surface 14b**, which in turn reflects off the chip substrate 12 and exits the lens. *See* EX1004, [0029] ("At this time, the **light L1** incident on the **recessed part 14a** of the lens part 14 is totally reflected, as depicted in FIG. 1(B), and travels laterally, and is totally reflected again by the **side surface 14b** of the lens part 14, and is incident on the surface of the chip substrate 12."). However, Odawara notes that "the surface of the chip substrate 12 is rough, so the **light L1** is ***diffusely reflected*** by the surface of the chip substrate." EX1004, [0029]. In other words, the portion of the **light L1** being emitted sideways is only achieved through diffuse reflections off the rough chip substrate 12, which a POSITA would readily recognize would lead to various losses.



EX1004, Figure 1B. EX1002, ¶¶122-123.

A POSITA would have been motivated to further try to improve the light output by increasing the side emission of the lens by reducing light rays that reflect downward toward chip substrate 12. As shown above in Figure 1B, a POSITA would have recognized that light rays that reflect off the **upper surface** through TIR. And a POSITA would have also recognized that one well-known way to reduce TIR that occurs on the **upper surface** would have been to introduce additional bends, such as using a sawtooth pattern, to remove conditions that cause total internal reflection. EX1002, ¶124.

West shows in Figure 1B below "a known light emitting diode (LED) package 30 … [that] includes an LED chip 38, a lens 32 with **straight vertical sidewall 35**

and a funnel-shaped top surface 37." EX1005, 1:29-32. West explains that the "**second light path P2** is emitted from chip 38 toward **sidewall 35** at an angle causing TIR or a reflection from **sidewall 35** causing the light to exit package 30 at an angle not close to perpendicular to the longitudinal axis. This path is not desirable and limits the efficiency of side extracted light." EX1005, 1:38-43. West removes such undesirable total internal reflection by introducing a "**sawtooth portion 56** [that] is designed to refract and bend light so that the **light exits** from the lens 44 as close to 90 degrees to the longitudinal package axis 43 as possible." EX1005, 4:2-5. "The **sawteeth** or **refractive surfaces 59 of the sawtooth portion 56** are all light transmissive." EX1005, 4:5-7. Moreover, West teaches that "[a]ny number of **sawteeth 69** may be used within a sawtooth portion of a given length; preferably there is at least one sawtooth." EX1005, 4:7-9.

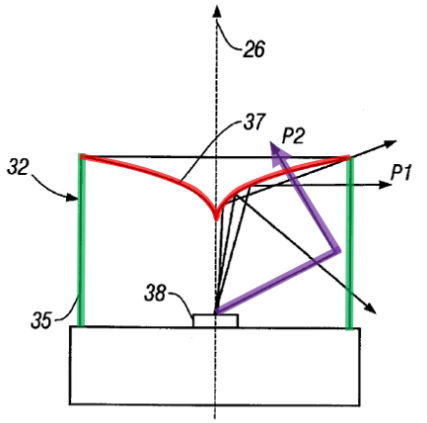


FIG. 1B
(Prior Art)

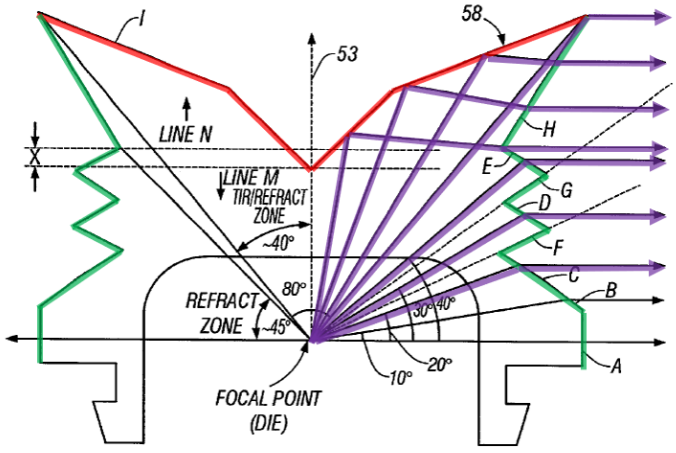
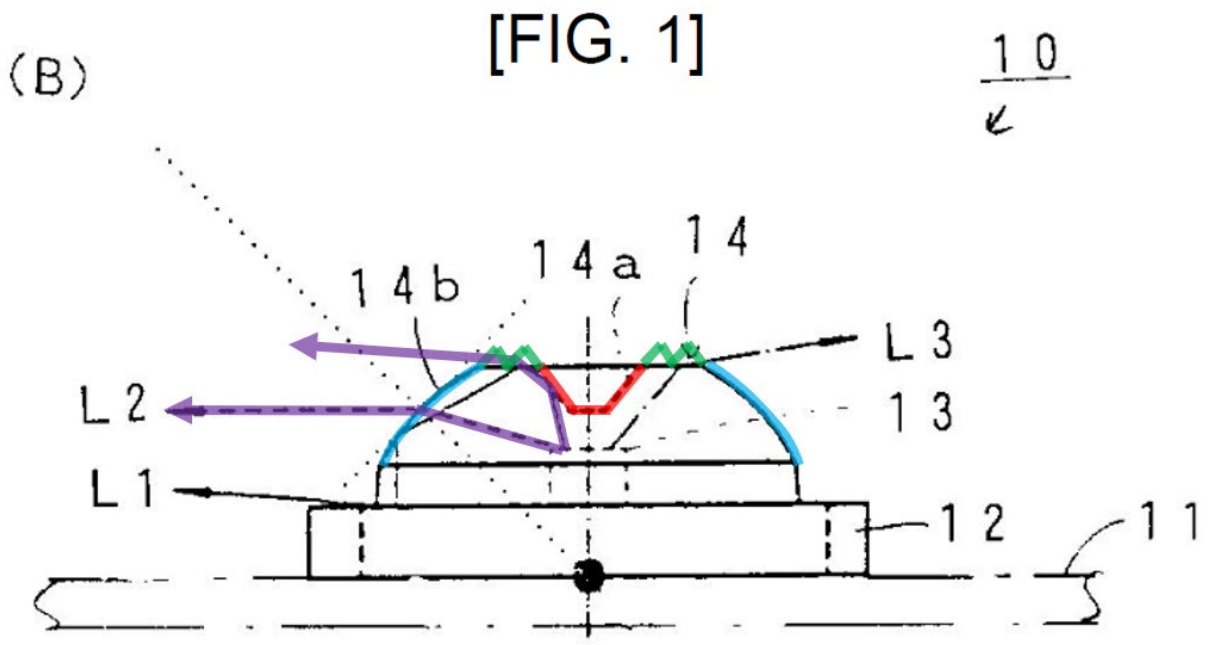


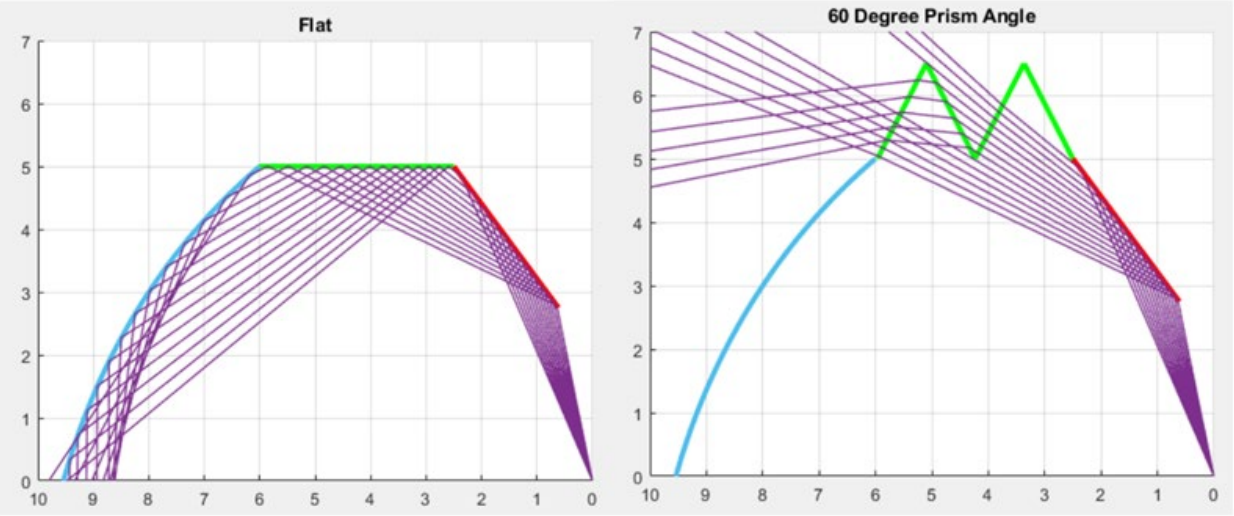
FIG. 5F

EX1005, Figures 1B and 5F. EX1002, ¶¶125-126.

Accordingly, as illustrated below, it would have been obvious to replace the flat **upper surface** of Odawara's lens with **two or more sawtooth patterns**, as taught by West, with the well-recognized result that total internal reflection conditions can be avoided to further promote light to refract out of the lens sideways. Specifically, it would have been obvious to angle the **two or more sawtooth patterns** at an angle that is roughly similar to the local slope of the **side surface 14b** where **light rays L2** refract out sideways. As such, rather than light rays L1 totally internally reflecting downwards (as shown in Figure 1B below), to eventually leak out sideways through a "***diffuse***" reflection off the rough chip substrate 12, (EX1004, [0029]), losses associated with such diffuse reflections can be avoided by having the **light rays L1** directly refract out sideways. As a result, a POSITA would have readily recognized that such modification would have led to the desirable result of increased side emission.



EX1004, Figure 1B (as modified with West). Indeed, Dr. Milster's simulations, using simple optical geometry, demonstrate that a near two-fold increase in the amount of light emitted sideways can be achieved by replacing the **flat upper surface** with two **sawteeth patterns**.



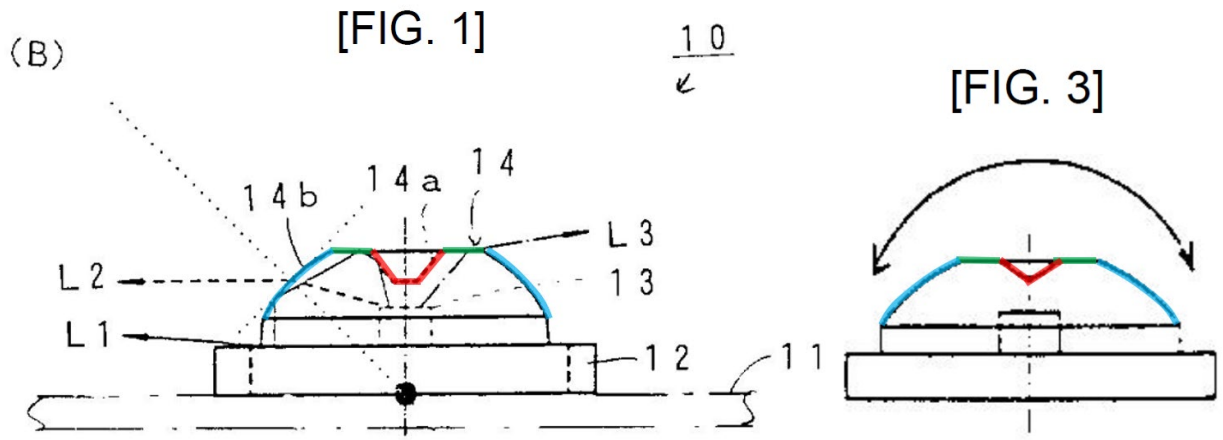
EX1002, ¶¶127-132

And because the modification is a simple substitution of one known **linear refractive surface** (as taught by Odawara) with **another that has a sawtooth pattern** (as taught by West) with the predictable result of removing total internal reflection conditions and promote sideways emission through refraction, a POSITA would have been motivated to make the modification with a reasonable expectation of success. EX1002, ¶133.

5. Dependent Claim 6

i. [6] The light emitting device as claimed in claim 1, wherein the total reflection surface comprises: a first total reflection surface having a section in the form of a V-shaped recess with a predetermined slope; and a second total reflection surface extending upward from a periphery of the first total reflection surface and formed to be sloped with a gradient smaller than that of the first total reflection surface.

Odawara in combination with West renders obvious [6]. As discussed in Section X.A.1.iv [Grounds I/II, 1c], Odawara teaches cone-shaped **recessed part**, as shown in Figures 1B and 3.



EX1004, Figures 1B and 3. EX1002, ¶135.

Side-emitting lenses that have multiple sloped regions for their **total reflection surface** were well-known in the art. For example, West, in Figure 5F below, shows "a total internal reflection (TIR) **funnel portion 58**" that is "designed as a TIR surface" that "reflects light such that light exits from lens 44 as close to 90

degrees to a longitudinal package axis 43 of LED package 40 as possible." EX1005, 4:1-15.

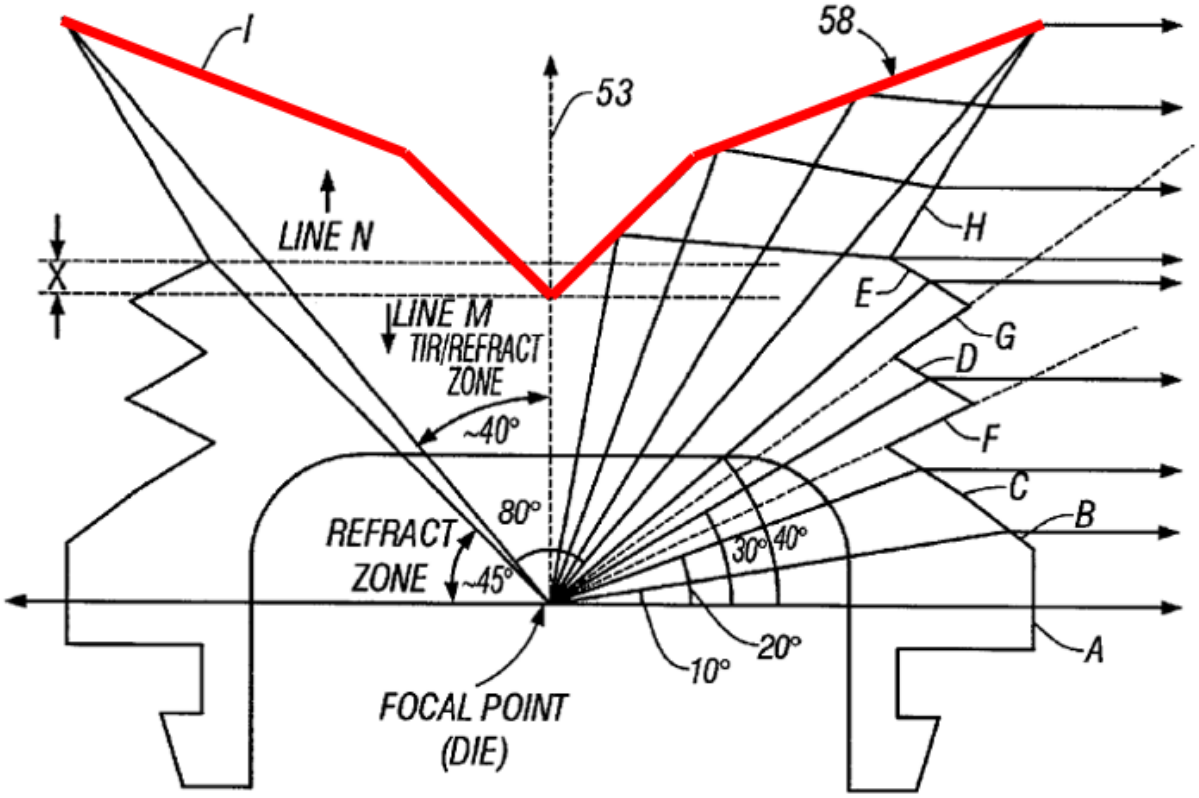


FIG. 5F

EX1005, Figure 5F. More specifically, "FIG. 5F illustrates a bent-line **funnel-shaped portion 58** where Surface I is defined from a ***line bent into two linear portions***, each portion at an angle greater than the critical angle for TIR but directs the light out of the package roughly at 90 degrees to the package axis." EX1005, 4:64-5:2. As illustrated in Figure 5F, the **central region** forms a V-shaped recess with a predetermined slope. Extending therefrom is a **second region** that has a slope that is smaller than that of the **V-shaped central region**.

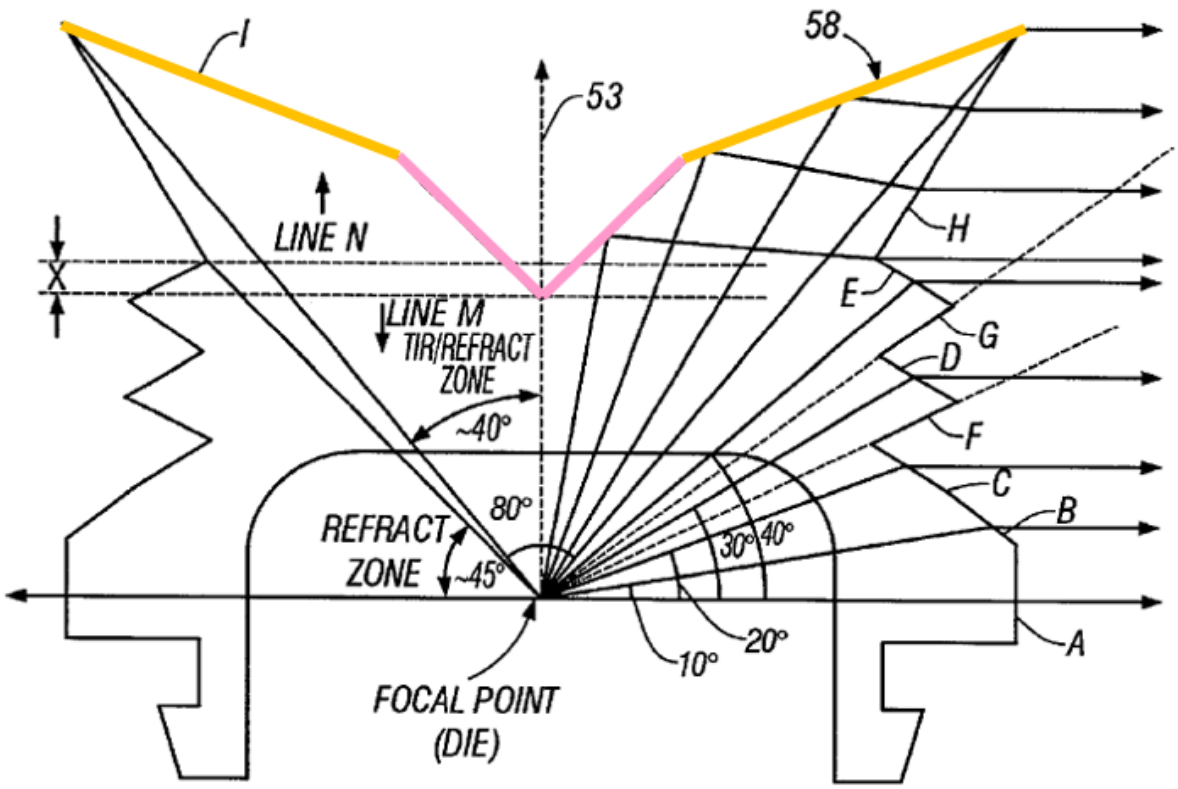


FIG. 5F

EX1005, Figure 5F. *See In re Mraz*, 455 F.2d 1069, 1072 (CCPA 1972) (explaining that clear teachings from patent drawings are ***not*** to be disregarded.); *see also* IPR2014-00879, Paper 33, 10 ("A drawing is evaluated on the basis of what it reasonably discloses and suggests to a person of ordinary skill in the art.") citing *In re Aslanian*, 590 F.2d 911, 914 (CCPA 1979). EX1002, ¶¶136-137.

It would have been possible to replace Odawara's **recessed part** with West's bent-line **funnel-shaped portion 58** with the well-recognized result that two different slopes may be desirable to achieve improved total internal reflection conditions. As a result, a POSITA would have readily recognized that such

modification would have led to the desirable result of increasing side emission light output performance. And because the modification is a simple substitution of one known cone-shaped **recessed part** that totally reflects light (as taught by Odawara) with another bent-line **funnel-shaped portion 58** (as taught by West) with the predictable result of maintaining reflection of light to the side for side emission, a POSITA would have been motivated to make that modification with a reasonable expectation of success. EX1002, ¶¶138-139.

6. Dependent Claim 7

i. [7] The light emitting device as claimed in claim 1, wherein the refractive index of the body[6] is 1.2 to 2.0.

Odawara teaches and/or renders obvious [7]. *See* Section X.A.4.i [Grounds I/II, 7]. EX1002, ¶140.

C. Grounds IV And V: Sommers Anticipates Or Renders Obvious Claims 1, 3, 4, 7, And 9

1. Independent Claim 1 And Dependent Claim 3

i. [1pre] A light emitting device, comprising:

Sommers teaches [1pre]. As shown below in Figure 6, Sommers teaches an "LED package 310." EX1006, 5:49-50. "The LED package includes a lead frame 314 with an LED die (not shown) mounted thereon." EX1006, 5:50-51. Overlying

[6] *See* n. 4.

the LED die is an encapsulant 320 that functions as a lens. Specifically, Sommers teaches that "light 332 emanating from the LED die when electrically energized through leads 376, 378 scatters off surface 328. The scattering produces a diffuse reflection rather than a specular reflection, and this is indicated in FIG. 6 by a plurality of rays 338 emanating from each point where an incident ray 332 scatter off inner surface 328." EX1006, 5:60-6:3.

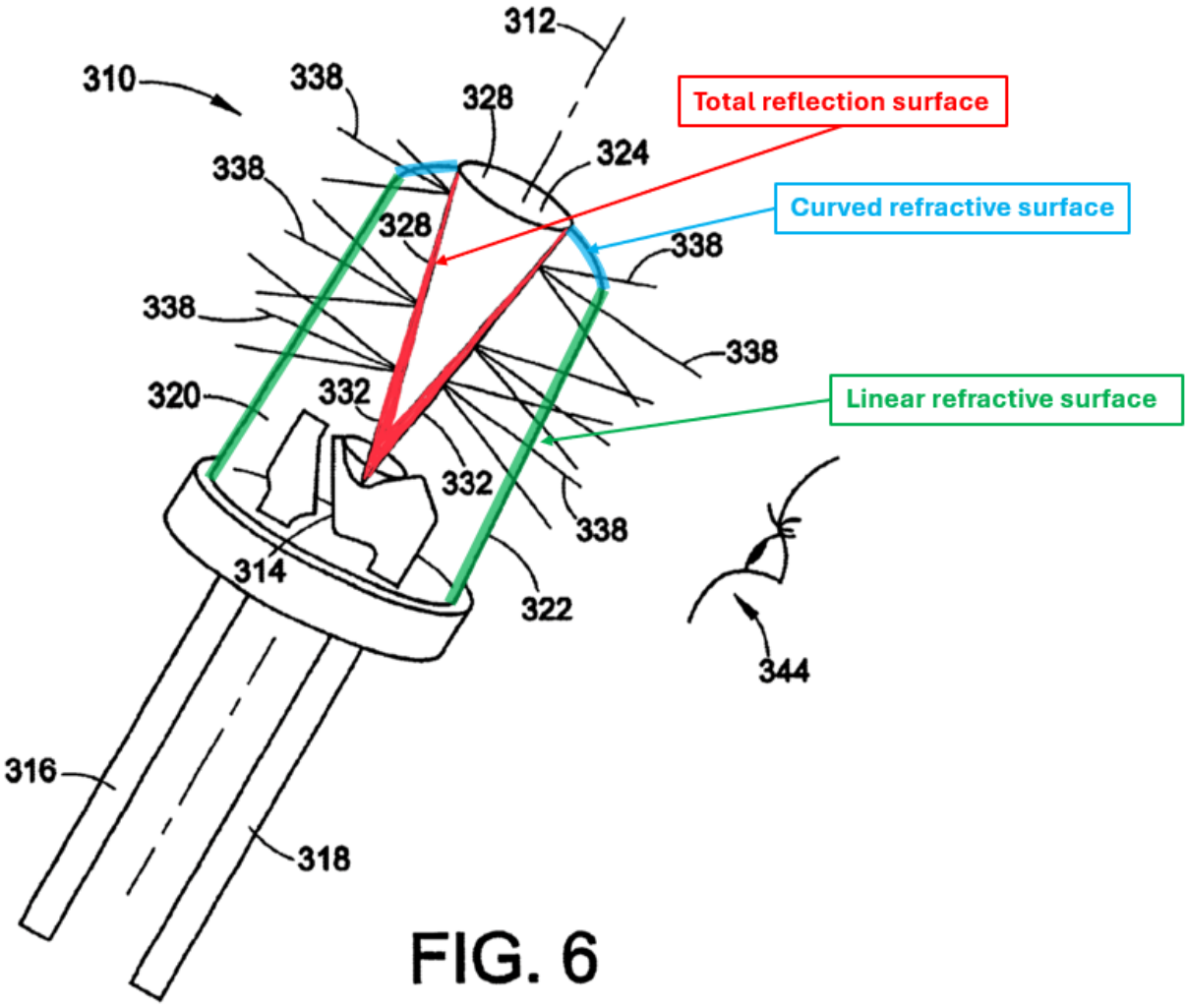


FIG. 6

EX1006, Figure 6. EX1002, ¶¶141-142.

ii. [1a] a light emitting diode,

Sommers teaches [1a]. Sommers teaches that although not shown in Figure 6 below, an LED die is mounted on lead frame 314. EX1006, 5:50-51 ("The LED package includes a lead frame 314 with an LED die (not shown) mounted thereon."); *see also* EX1006, 5:51-55 ("[E]ncapsulant 320 [that] exhibits radial symmetry about a central axis 312 centered approximately on the LED die and approximately parallel to the LED die surface normal (not shown)."). LED is an acronym for a "light-emitting diode."

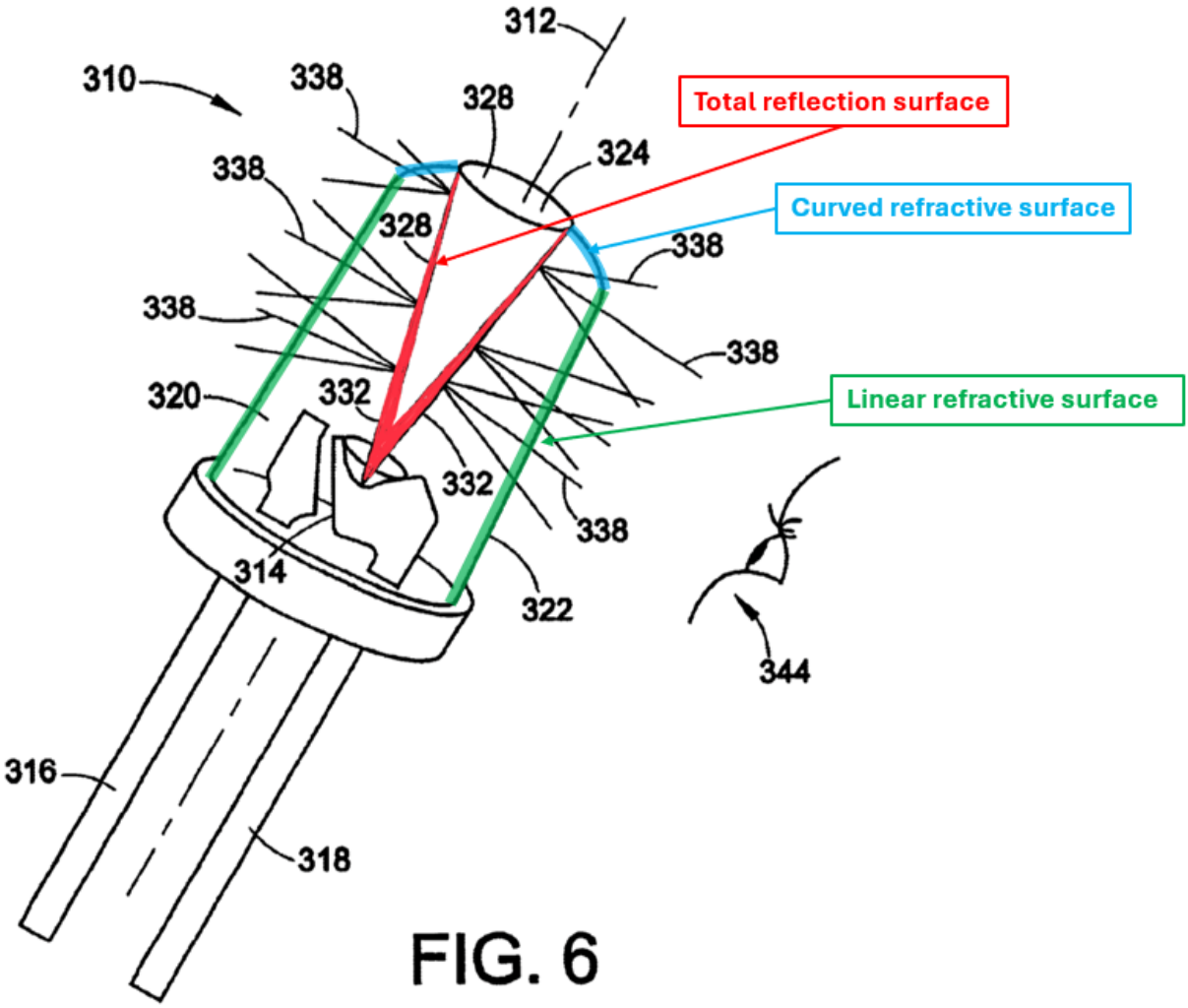


FIG. 6

EX1006, Figure 6. EX1002, ¶¶143-144.

iii. [1b] a lens arranged to receive light from the light emitting diode;

Sommers teaches [1b]. Sommers teaches that the "encapsulant 320" is "centered approximately on the LED die and approximately parallel to the LED die surface normal" and has a "depression surface 328." EX1006, 5:50-60. Sommers further teaches that "[l]ight 332 emanating from the LED die when electrically energized through leads 376, 378 scatters off surface 328," and therefore the

encapsulant 320, which is a lens is arranged to receive light from the light emitting diode. EX1006, 5:55-66. EX1002, ¶¶145-146.

iv. [1c] the lens comprising a total reflection surface having a total reflection slope with respect to a central axis of the light emitting diode; and

Under the plain and ordinary meaning of the term "**total reflection surface**" (*i.e.,* "a surface that completely reflects light"), Sommers teaches [1c]. Sommers teaches that encapsulant 320 has a "depression 324 with a metal or other reflective filling material which is pressed against outer surface 328" that reflects the light towards the side portions 322 (hereinafter "reflective surface 328"). EX1006, 6:6-10 ("For example, the scattering strength may be increased either by coating the outer surface 328 with a reflective coating, or by filling depression 324 with a metal or other reflective filling material which is pressed against outer surface 328 and conforms to the roughness of that surface."), 6:26-29 ("Additionally, because the light is scattered diffusely, any refraction occurring at side surface 322 will not significantly change the intensity distribution, and so the detailed curvature of the side surfaces is also not critical."). A POSITA would have readily recognized that a surface coated with a reflective metal coating would have totally reflected all of the light incident upon it. Indeed, mirrors are formed by coating glass with a metal coating, such as aluminum. See, e.g., EX1009, 18. EX1002, ¶¶147-149.

The **reflective surface 328** also has a "total reflection slope with respect to a central axis" of encapsulant 320. For example, in Figure 6, "the encapsulant 320 exhibits radial symmetry about a central axis 312 centered approximately on the LED die." EX1006, 5:51-55. "Depression 324 defined by **curved surfaces 328** is centered approximately on symmetry axis 312 and is essentially conical in shape." EX1006, 5:55-57. As shown below in Figure 6, the **reflective surface 328** is sloped with respect to the central axis 312.

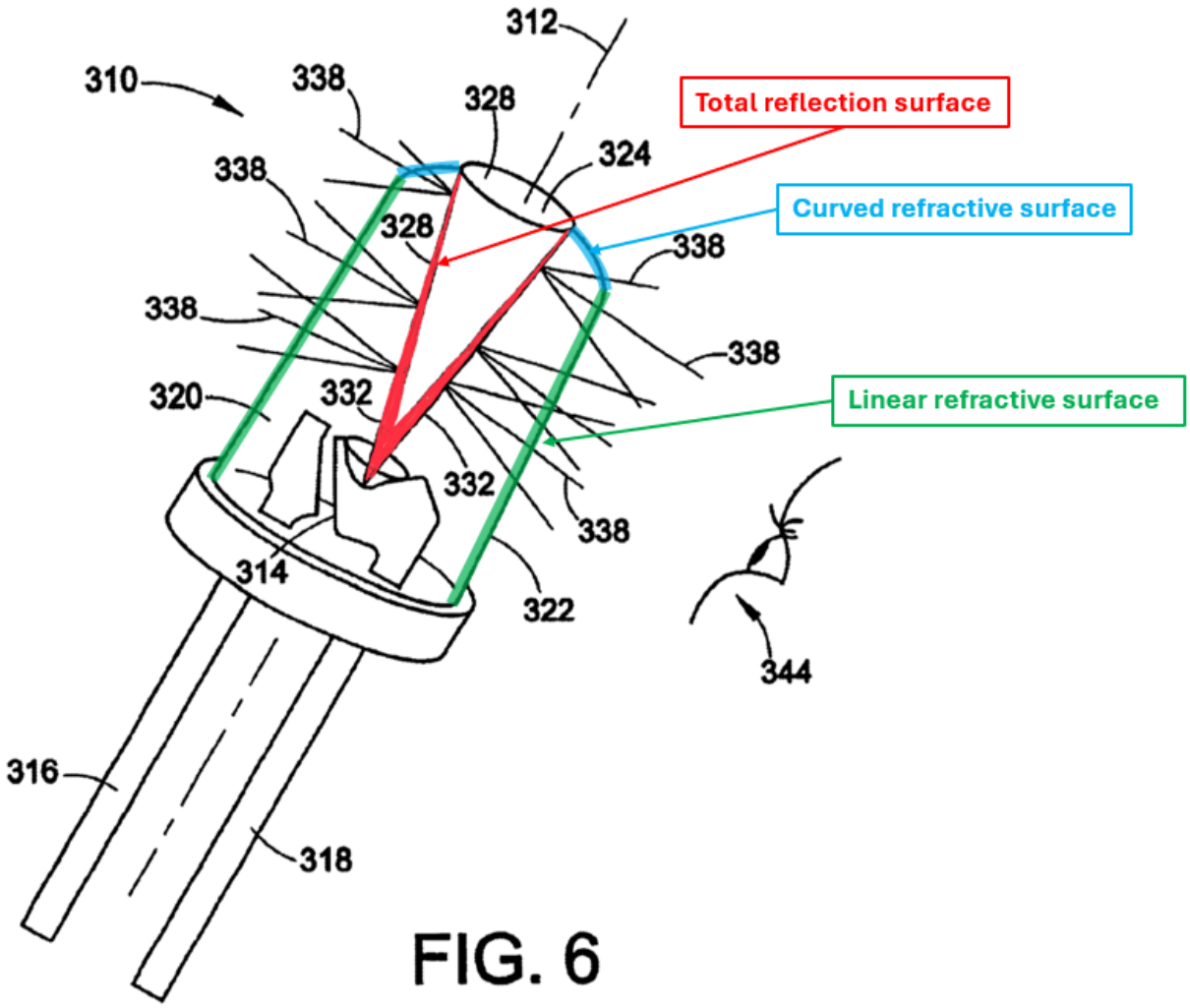


FIG. 6

EX1006, Figure 6. EX1002, ¶150.

v. **[1d] at least one of a linear refractive surface and a curved refractive surface formed to extend away from the central axis and beyond a periphery of the total reflection surface.**

vi. **[3] The light emitting device as claimed in claim 1, wherein the refractive surface comprises: a curved refractive surface formed to extend from the periphery of the total reflection surface; and a linear refractive surface formed by being bent at a periphery of the curved refractive surface.** [7]

Sommers teaches [1d] and [3]. Sommers teaches a side surface 322 that refracts light and has two portions. *See* EX1006, 6:26-29 ("Additionally, because the light is scattered diffusely, any refraction occurring at side surface 322 will not significantly change the intensity distribution, and so the detailed curvature of the

[7] Claim 3 recites "***the*** *refractive* surface" whereas claim 1 recites "***a linear*** *refractive* surface" and "***a curved*** *refractive* surface." In addition, claim 3 again recites "***a linear*** *refractive* surface" and "***a curved*** *refractive* surface." Petitioner is treating claim 3 to recite "wherein ~~the refractive surface comprises a~~ ***[the] curved*** refractive surface [is] formed to extend from a periphery of the total reflection surface; and ***[the] linear*** refractive surface [is] formed by being bent at the periphery of the curved refractive surface." EX1002, ¶152. Petitioner reserves the right to challenge the claim under 35 U.S.C. §112.

side surfaces is also not critical."). First, as shown below in Figure 6, side surface 322 has a curved portion (hereinafter "**curved portion of side surface 322**") that extends from the periphery of the **total reflection surface** extending away from the formed to extend away from the central axis and beyond a periphery of the **total reflection surface**.

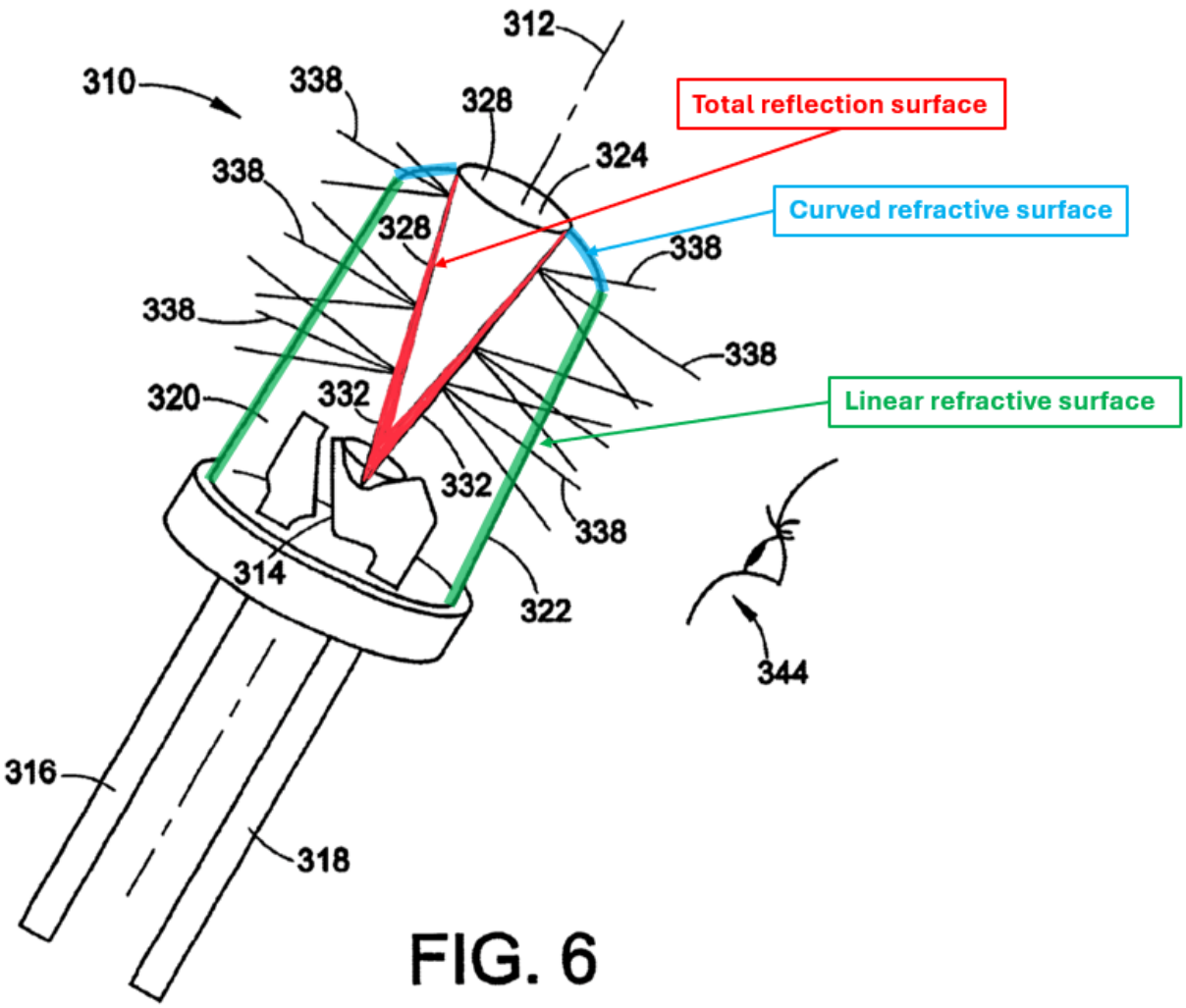


FIG. 6

EX1006, Figure 6. Second, as shown above in Figure 6, the side surface 322 shows a linear portion (hereinafter "**linear portion of side surface 322**") hat is formed by

being bent at a periphery of the **curved portion of side surface 322**. And, as shown in Figure 6, the **linear portion of side surface 322** is formed to extend away from the central axis. *See In re Mraz*, 455 F.2d 1069, 1072 (CCPA 1972) (explaining that clear teachings from patent drawings are ***not*** to be disregarded.); *see also* IPR2014-00879, Paper 33, 10 ("A drawing is evaluated on the basis of what it reasonably discloses and suggests to a person of ordinary skill in the art.") (citing *In re Aslanian*, 590 F.2d 911, 914 (CCPA 1979)). EX1002, ¶¶151-154.

2. Dependent Claims 4 And 9

i. [4] The light emitting device as claimed in claim 1, wherein the curved refractive surface takes the shape of an ellipse, and a ratio of minor and major axes of the ellipse is 1:4 or less.

ii. [9] The light emitting device as claimed in claim 3, wherein the curved refractive surface takes the shape of an ellipse, and a ratio of minor and major axes of the ellipse is 1:4 or less.

Sommers teaches or renders obvious [4] and [9]. At the outset, the '113 Patent teaches that an ellipse includes a circle. EX1001, 17:3-6. *See* Section X.A.2.i and X.A.2.ii [Grounds I/II, 4 and 8]. EX1002, ¶155.

Sommers teaches an encapsulant that "has a preselected shape which is preferably ***essentially hemispherical***." EX1006, 3:53-56. *See also* EX1006, claims 1 and 9. In other words, Sommers teaches that the **curved portion of side surface 322** can take the shape that is "essentially" a circle when viewed in two dimensional

cross-section, which has the ratio of minor and major axes of about or "essentially" 1:1. At minimum, a POSITA would have found it obvious that the curved part of the encapsulant 320 can have such a shape. EX1002, ¶156.

3. Dependent Claim 7

i. [7] The light emitting device as claimed in claim 1, wherein the refractive index of the body[8] is 1.2 to 2.0.

Sommers renders obvious [7]. Sommers teaches encapsulant 320. EX1006, 5:51-55. While Sommers does not explicitly teach the material for encapsulant 320, Sommers teaches that epoxy resin can be a suitable encapsulant in other embodiments. *See* EX1006, Abstract ("An encapsulant (20), preferably an epoxy resin…"), claim 5 ("wherein the encapsulant is an epoxy."). Sommers teaches that epoxies have a refractive index that is about 1.5. EX1006, 1:40-41 ("The encapsulant material is usually an epoxy resin or the like, with a refractive index n~1.5."). A POSITA would have found it obvious to utilize epoxy in the embodiment associated with Figure 6, as it is describing the same encapsulant as in the other embodiments and it amounts to nothing more than utilizing a well-known material taught by Sommers to be useful as an encapsulant. EX1002, ¶¶157-159.

[8] *See* n. 4.

D. Ground VI: Sommers In Combination With West Renders Obvious Claims 1, 3-7, 9, And 11

1. Independent Claim 1 And Dependent Claim 3

i. [1pre] A light emitting device, comprising:

Sommers teaches [1pre]. *See* Section X.C.1.i [Grounds IV/V, 1pre]. EX1002, ¶160.

ii. [1a] a light emitting diode,

Sommers teaches [1a]. *See* Section X.C.1.ii [Grounds IV/V, 1a]. EX1002, ¶161.

iii. [1b] a lens arranged to receive light from the light emitting diode;

Sommers teaches [1b]. *See* Section X.C.1.iii [Grounds IV/V, 1b]. EX1002, ¶162.

iv. [1c] the lens comprising a total reflection surface having a total reflection slope with respect to a central axis of the light emitting diode; and

To the extent Patent Owner argues that "**total reflection surface**" requires a surface that reflects light utilizing total internal reflection, this was well-known in the art. West teaches a lens that includes a "**[f]unnel portion 58** [that] is designed as a TIR surface. The TIR surface reflects light such that light exits from lens 44 as close to 90 degrees to a longitudinal package axis 43 of LED package 40 as possible." EX1005, 4:12-15.

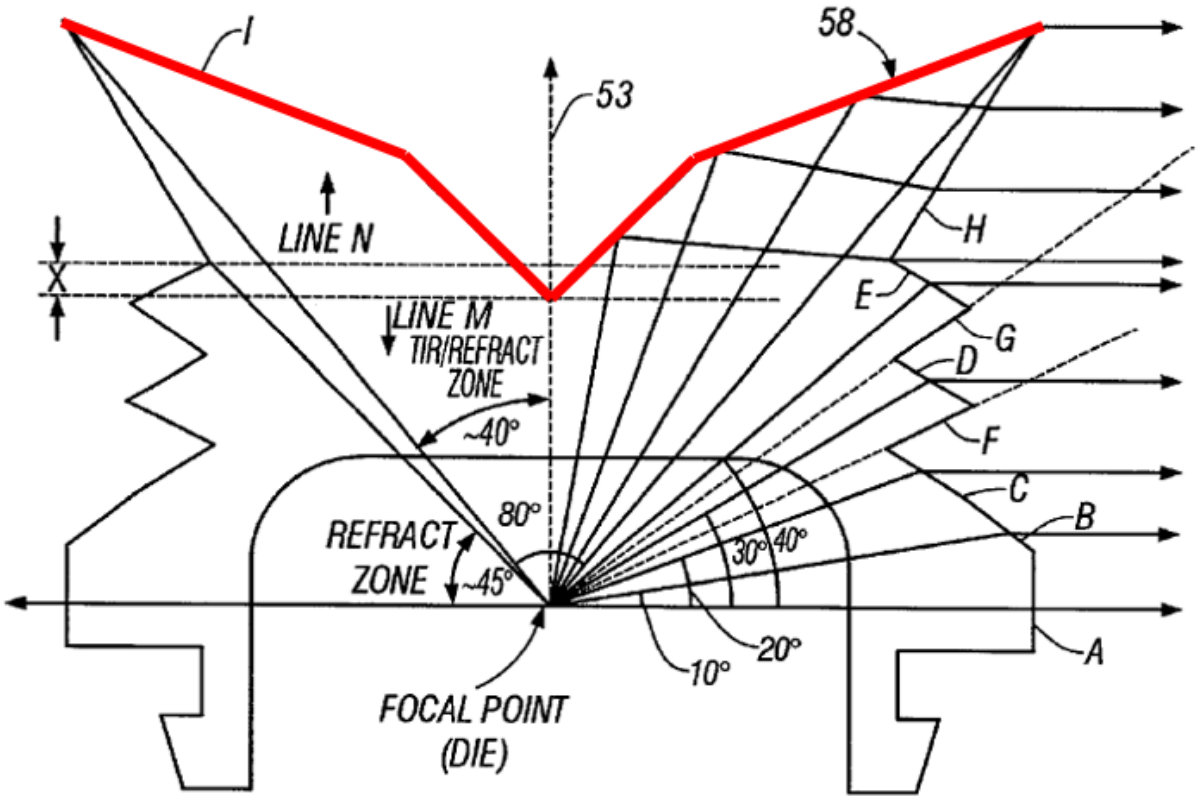


FIG. 5F

EX1005, Figure 5F. EX1002, ¶¶163-165.

Indeed, Sommers teaches that the slope of the **reflecting surface 328** can be adjusted as desired by using well-known conventional optical engineering methods. EX1006, 4:43-48 ("The precise preselection of the curvatures of the reflecting and refracting surfaces so as to achieve an optimal apparent approximate point light source 42 involves conventional optical engineering methods which are well known to those skilled in the art and which need not be described here for an enabling disclosure of the invention."). Hence, a POSITA would have found it obvious to

modify the slope of Sommers's **reflecting surface 328** to be slope such that total internal reflection can occur, such as taught by West. EX1002, ¶¶166-167.

v. **[1d] at least one of a linear refractive surface and a curved refractive surface formed to extend away from the central axis and beyond a periphery of the total reflection surface.**

vi. **[3] The light emitting device as claimed in claim 1, wherein the refractive surface comprises: a curved refractive surface formed to extend from the periphery of the total reflection surface; and a linear refractive surface formed by being bent at a periphery of the curved refractive surface.**

Sommers teaches [1d] and [3]. *See* Section X.C.1.v and X.C.1.vi [Grounds IV/V, 1d and 3]. EX1002, ¶168.

vii. Reasons To Combine Sommers With West

A POSITA would have been able to replace Sommers' **reflective surface 328** with West's **TIR funnel portion 58** with a reasonable expectation of success. ***First***, both Sommers and West are directed to side emitting LEDs. *See* EX1006, 5:60-6:3 (showing "plurality of rays 338 emanating" to the side of the LED package 310); EX1005, Abstract ("A lens mounted to a light emitting diode package internally redirects light within the lens so that a majority of light is emitted from the lens approximately perpendicular to a package axis of the light emitting diode package."). A POSITA would therefore have been motivated to look at the teachings of either Sommers or West to achieve the desired goal of horizontal light emission,

one of which is achieved by reflecting the light emitted by the LED towards the side as described in Sommers or West. EX1002, ¶¶169-170.

Second, the modification amounts to nothing more than applying a known technique to a known device to yield predictable results. As explained in Section X.C.1.iv [Grounds IV/V, 1c], Sommers teaches the **reflective surface 328** is designed to reflect the light sideways, the degree which can be controlled as desired. *See* EX1006, 6:4-10 (explaining "the scattering strength may be increased either by coating the outer surface 328 with a reflective coating, or by filling depression 324 with a metal or other reflective filling material"). West's **funnel portion 58** provides the same function of reflecting light from the LED using the well-known concept of total internal reflection. *See* EX1005, 4:1-22 ("Funnel portion 58 is designed as a TIR surface. The TIR surface reflects light such that light exits from lens 44 as close to 90 degrees to a longitudinal package axis 43 of LED package 40 as possible."). A POSITA would have been able to readily substitute Sommers's **reflective surface 328** with West's **funnel portion 58** to achieve the same desired goal of reflecting light horizontally towards the periphery of the lens to increase the amount of light being output to the side. A POSITA would have been able to make the modification with a reasonable expectation of success because the modification merely entails carrying out simple substitution of one known reflective surface with another to

achieve the same predictable result of increased emission of light in the horizontal direction. EX1002, ¶¶171-172.

2. Dependent Claims 4 And 9

i. [4] The light emitting device as claimed in 1, wherein the curved refractive surface takes the shape of an ellipse, and a ratio of minor and major axes of the ellipse is 1:4 or less.

ii. [9] The light emitting device as claimed in 3, wherein the curved refractive surface takes the shape of an ellipse, and a ratio of minor and major axes of the ellipse is 1:4 or less.

Sommers teaches or renders obvious [4] and [9]. *See* Section X.C.2.i and X.C.2.ii [Grounds IV/V, 4 and 9]. EX1002, ¶173.

3. Dependent Claims 5 and 11

i. [5] The light emitting device as claimed in claim 1, wherein the linear refractive surface is bent more than once.

ii. [11] The light emitting device as claimed in claim 3, wherein the linear refractive surface is bent more than once.

As explained in Section IX.A [Claim Construction], the term "wherein the **linear refractive surface** is bent more than once" requires the claimed "**linear refractive surface**" to have at least two bends. Under this plain and ordinary meaning, Sommers in combination with West renders obvious [5] and [11]. EX1002, ¶174.

West teaches a "**sawtooth portion 56** [that] is designed to refract and bend light so that the **light exits** from the lens 44 as close to 90 degrees to the longitudinal package axis 43 as possible. The **sawteeth** or **refractive surfaces 59 of the sawtooth portion 56** are all light transmissive. Any number of **sawteeth 69** may be used within a sawtooth portion of a given length; preferably there is at least one sawtooth." EX1005, 4:2-9.

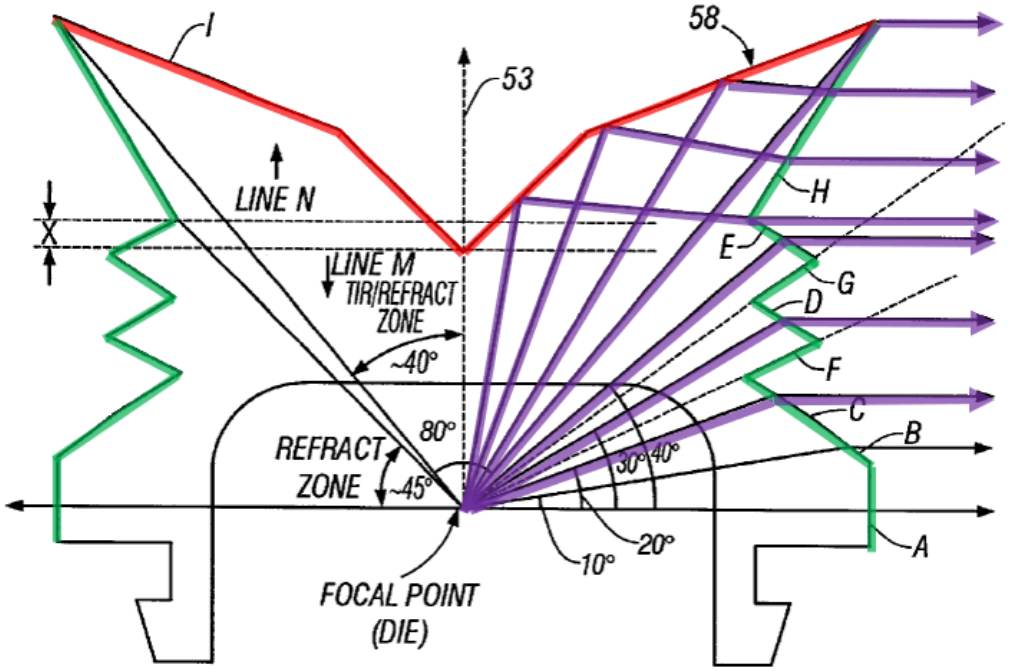


FIG. 5F

EX1005, Figure 5F. EX1002, ¶175.

Adding West's **sawtooth patterns** to Sommers's **linear portion of side surface 322** would have been nothing more than applying a known technique (adding a sawtooth pattern) to a known device (Sommers's **linear portion of side**

surface 322) to yield the predictable result of light that refract out to the side of the LED package 310 to result in an improved system (light exiting the lens as close to 90 degrees as possible). The modification would have been a simple modified configuration having a structure, such as shown below.

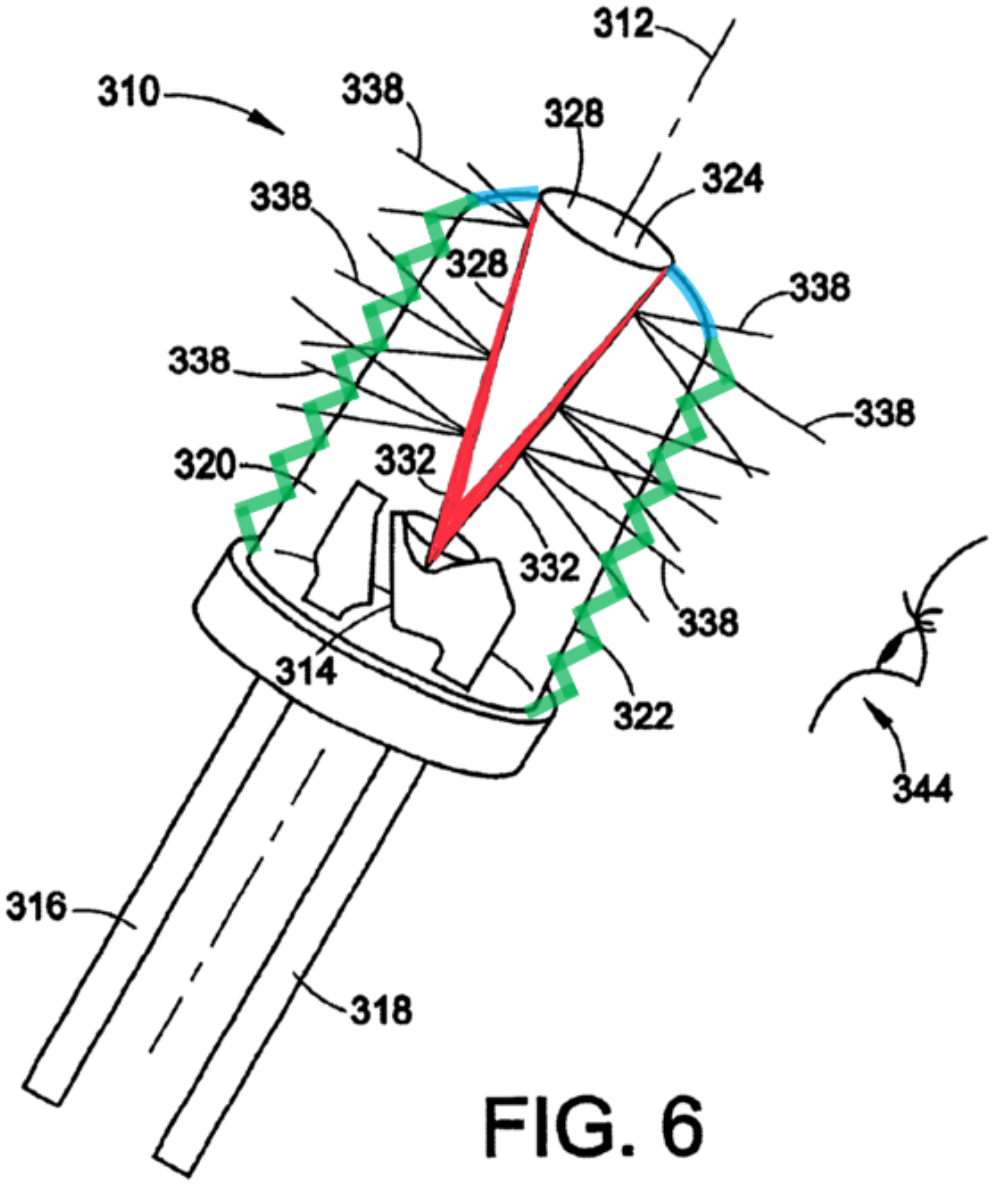


FIG. 6

EX1006, Figure 6 (as modified with West). EX1002, ¶176.

4. Dependent Claim 6

i. [6] The light emitting device as claimed in claim 1, wherein the total reflection surface comprises: a first total reflection surface having a section in the form of a V-shaped recess with a predetermined slope; and a second total reflection surface extending upward from a periphery of the first total reflection surface and formed to be sloped with a gradient smaller than that of the first total reflection surface.

Sommers in combination with West renders obvious [6]. As discussed in Section X.C.1.iv [Grounds IV/V, 1c], Sommers teaches a conically-shaped **reflective surface 328** that reflects the light towards the side portions 322.

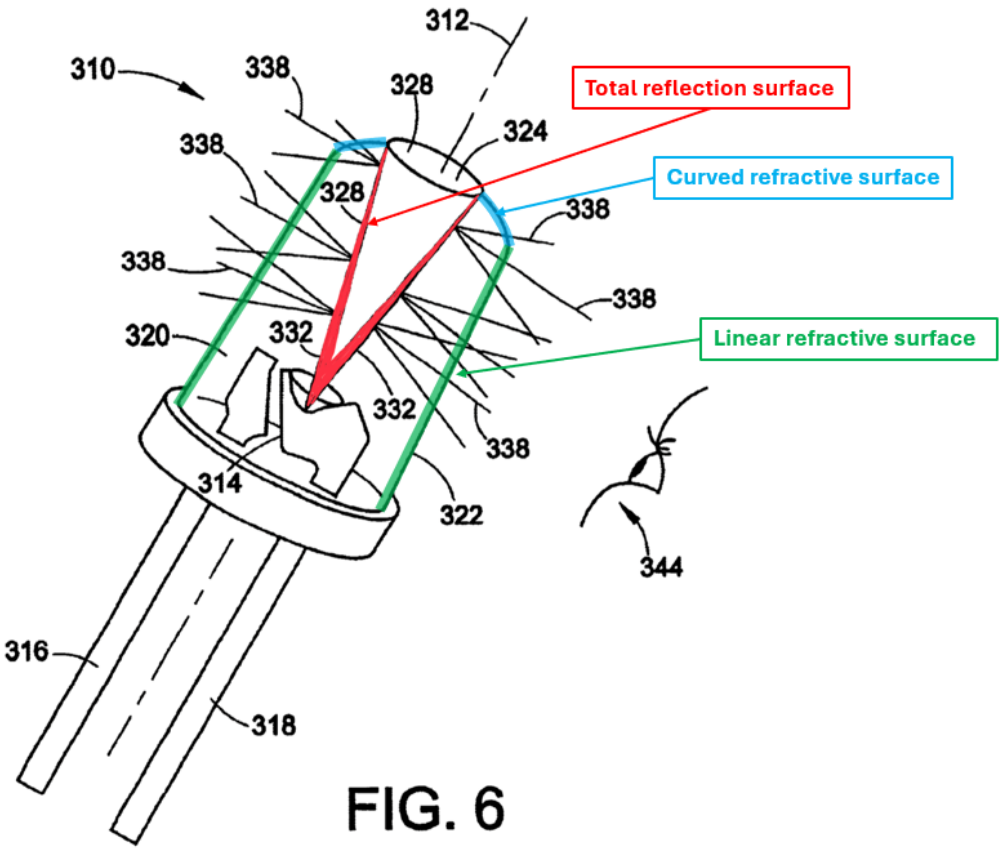


FIG. 6

EX1006, Figure 6. EX1002, ¶¶177-178.

Side-emitting lenses that have multiple sloped regions for its **total reflection surface** were well-known in the art. For example, Sommers itself shows in Figure 4 multiple "**linear depressions**" that are differently sloped that have a reflective coating to reflect light. *See* EX1006, 5:5-9 ("Depression 124 defined by curved surfaces 128 is an essentially linear depression preferably centered on the plane of symmetry, and reflective coating 126 is disposed on at least a portion of surface 128."), 5:26-30, claim 7, 3:53-64, 4:18-25.

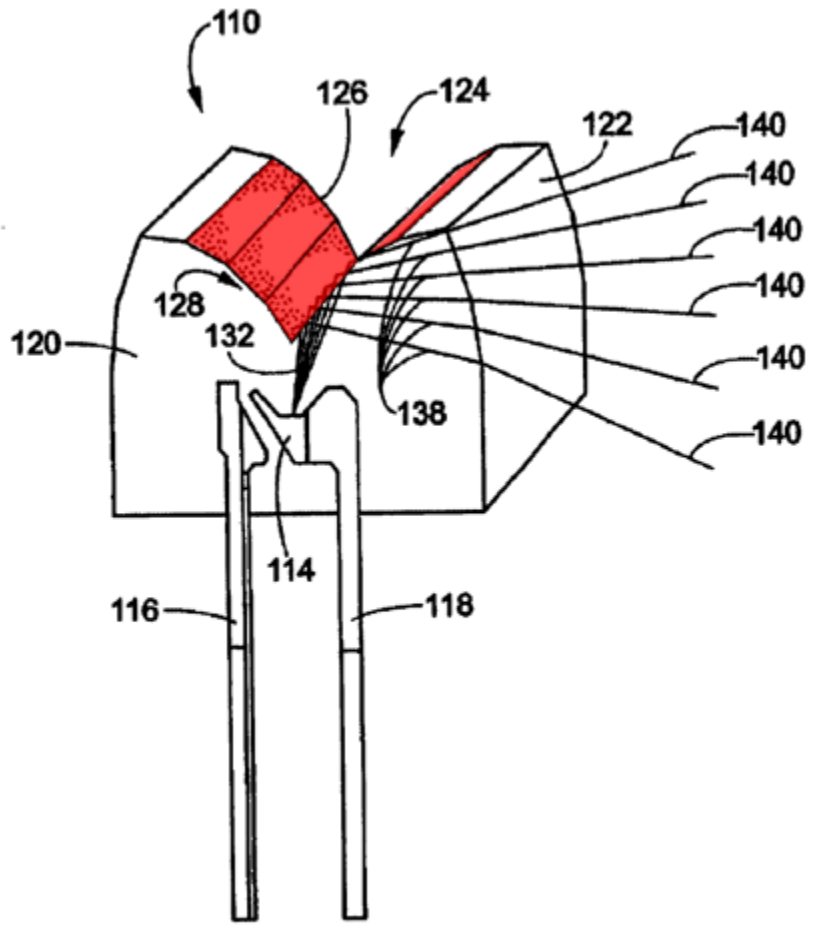


FIG. 4

EX1006, Figure 4. EX1002, ¶¶179-180.

As another example, West, in Figure 5F below, shows "a total internal reflection (TIR) **funnel portion 58**" that is "designed as a TIR surface" that "reflects light such that light exits from lens 44 as close to 90 degrees to a longitudinal package axis 43 of LED package 40 as possible." EX1005, 4:1-15.

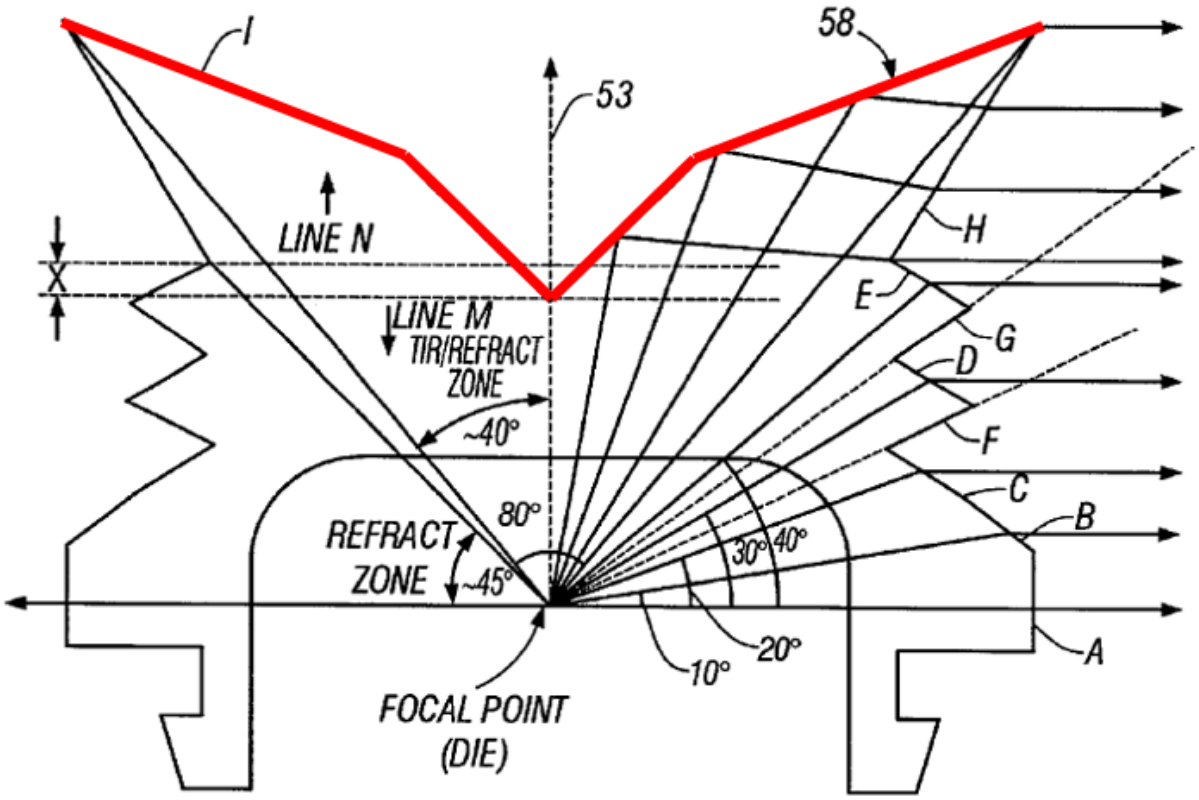


FIG. 5F

EX1005, Figure 5F. More specifically, "FIG. 5F illustrates a bent-line **funnel-shaped portion 58** where Surface I is defined from a ***line bent into two linear portions***, each portion at an angle greater than the critical angle for TIR but directs the light out of the package roughly at 90 degrees to the package axis." EX1005,

4:64-5:2. As illustrated in Figure 5F, the **central region** forms a V-shaped recess with a predetermined slope. Extending therefrom is a **second region** that has a slope that is smaller than that of the **V-shaped central region**.

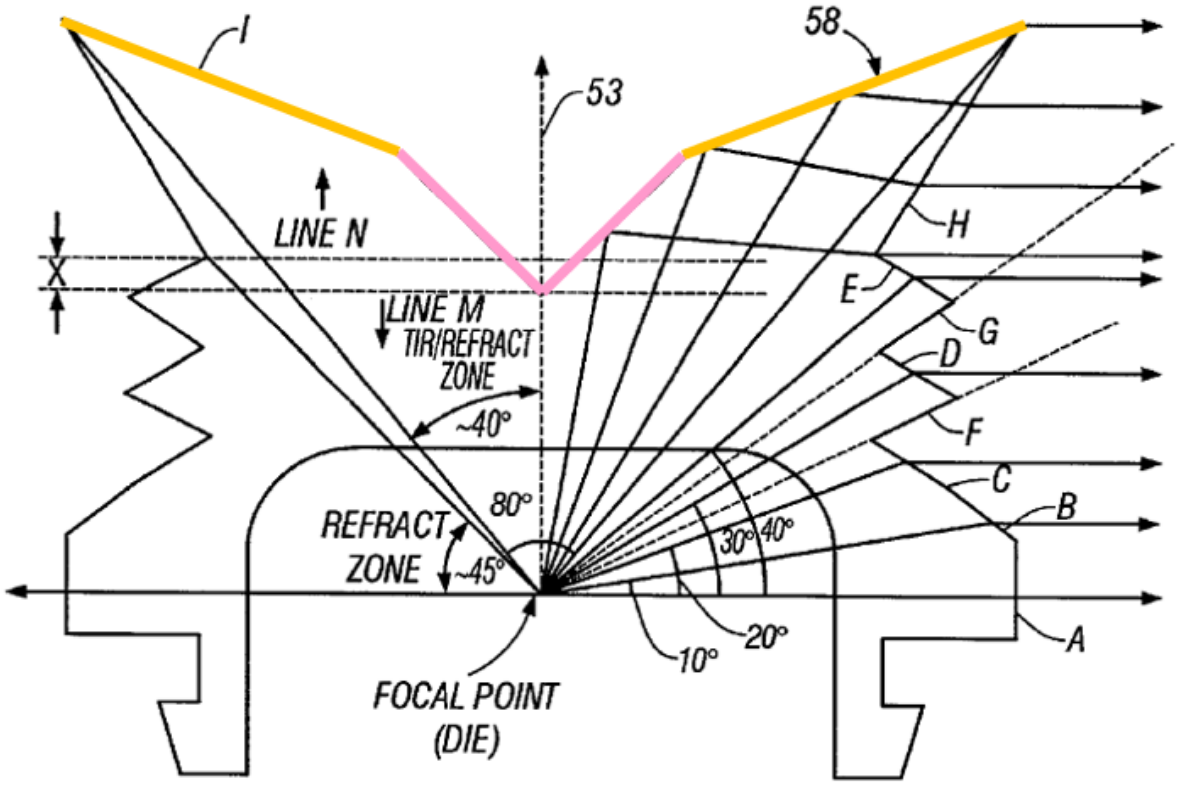


FIG. 5F

EX1005, Figure 5F. *See In re Mraz*, 455 F.2d 1069, 1072 (CCPA 1972) (explaining that clear teachings from patent drawings are ***not*** to be disregarded.); *see also* IPR2014-00879, Paper 33, 10 ("A drawing is evaluated on the basis of what it reasonably discloses and suggests to a person of ordinary skill in the art.") citing *In re Aslanian*, 590 F.2d 911, 914 (CCPA 1979). EX1002, ¶¶181-182.

It would have been possible to replace Sommers's **reflective surface 328** with Sommers multiple **linear depressions** and/or West's bent-line **funnel-shaped portion 58**, as taught by West, with the well-recognized result that two different slopes may be desirable to achieve improved total internal reflection conditions. As a result, a POSITA would have readily recognized that such modification would have led to the desirable result of increasing side emission light output performance. And because the modification is a simple substitution of one known **reflective surface 328** that reflects light sideways (as taught by Sommers) with another multiply sloped **linear depressions** (as taught by Sommers) or bent-line **funnel-shaped portion 58** (as taught by West) with the predictable result of maintaining reflection of light to the side for side emission, a POSITA would have been motivated to make that modification with a reasonable expectation of success. EX1002, ¶183.

5. Dependent Claim 7

i. [7] The light emitting device as claimed in claim 1, wherein the refractive index of the body[9] is 1.2 to 2.0.

Sommers renders obvious [7]. *See* Section X.C.3.i [Grounds IV/V, 7]. EX1002, ¶184.

[9] *See* n. 4.

XI. Discretionary Factors

A. Discretionary Denial Under *Advanced Bionics* Is Not Appropriate

The Board uses a two-pronged test to determine whether it will deny institution under 35 U.S.C. § 325(d): (1) whether the same or substantially the same art or arguments were previously presented to the Office; and (2) if so, whether the Office erred in a manner material to patentability. *See Advanced Bionics LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 (precedential).

1. Substantially Same Art/Arguments Not Considered

Odawara and Sommers were never considered during prosecution. West was mentioned in the Background section of the ’113 Patent and applied by the Examiner in the parent ’873 Patent during prosecution. EX1008, 392-398.

Hence, the asserted prior art references have material differences and are not cumulative over the art considered during prosecution. Moreover, Grounds I, II, IV, and V rely solely on Odawara and Sommers—references never previously considered by the Office in the ’113 Patent or the parent ’873 Patent. And all remaining Grounds rely on Odawara or Sommers in conjunction with West. So there is no overlap between the arguments made during examination and the Grounds presented herein. Therefore, the first prong of *Advanced Bionics* favors institution.

2. Office Erred

To the extent Board finds the first prong of *Advanced Bionics* to be met because West was previously considered in the parent '873 Patent or mentioned in the Background section of the '113 Patent, the Office erred.

West is being applied against the independent claims for the narrow propositions that utilizing total ***internal*** reflection as a suitable means to reflect light rays were known, which is admitted by the '113 Patent as being taught by West. *See* EX1001, 1:43-51. West is also being applied against dependent claims 5 and 6 in substantially the same manner as applied by the Examiner during prosecution of the parent '873 Patent. EX1008, 394. However, during prosecution of the parent '873 Patent, in order to overcome West, Patentee acquiesced to the Examiner's assertions regarding dependent claims 5 and 6 (which are identical to claims 5 and 6 of the '113 Patent) and amended the independent claims to include features that are also recited in independent claim 1 of the '113 Patent. EX1008, 415, 419-420. But Odawara and/or Sommers teaches the amendments made in the parent '873 Patent, which the instant Petition relies on. *See* Sections X [All Grounds]. "Office's prior failure to apply [Odawara and Sommers] against the pending claims was an error that was material to the patentability of these claims." *2985 LLC d/b/a Mountain Voyage Co. v. The Ridge Wallet, LLC*, IPR2024-00692, Paper 18, 45; *see also*

Advanced Bionics, 10. Hence, the second prong of *Advanced Bionics* also favors institution.

B. Discretionary Denial Under *Fintiv* Is Not Appropriate

At the outset, Petitioner filed a motion to transfer the pending case from the Eastern District of Texas to the District of New Jersey, where the headquarters of Samsung Electronics America Inc. resides. *See Sinotechnix LLC v. Samsung Electronics Co. Ltd et al*., Case No. 2:24-cv-00544, Dkt. No. 53 (EDTX). While Petitioner will inform the Board of the latest developments related to the *Fintiv* factors as relevant updates become available, the following analysis is based on the *current* venue in the Eastern District of Texas for the parallel district court litigation.

Based on the current facts, the six *Fintiv* factors guide against discretionary denial. *See Apple Inc. v. Fintiv, Inc*., IPR2020-00019, Paper 11 (precedential).

1. No Evidence Regarding A Stay

Factor 1 is neutral, because no motion to stay has been filed.

2. Parallel Proceeding Trial Date

Factor 2 is neutral. Trial in co-pending litigation is scheduled for May 4, 2026. *See* EX1010. The expected trial date based on the court's median time-to-trial date statistics is also approximately May 2026. *See* EX1011 (showing the median time-to-trial date is approximately 21.9 months from the filing of the case

(*i.e.*, July 17, 2024). Both of these dates are close to the expected final written decision date, which is around July 2026.

However, there is significant uncertainty over the trial date. Judge Gilstrap has scheduled trials for seven other patent cases for May 4, 2026. *See* EX1012. It is at the very least uncertain that the '113 Patent will be tried on May 4, 2026. Hence, this factor is neutral.

As the interim guideline notes, "when other relevant factors weigh against exercising discretion to deny institution or are neutral, the proximity to trial should not alone outweigh all of those other factors." Memorandum Regarding Interim Procedure for Discretional Denials[10], 8 (*citing In re Genentech, Inc.,* 566 F.3d 1338, 1347 (Fed. Cir. 2009)).

3. Investment In Parallel Proceeding

Factor 3 favors institution. The co-pending litigation is in its early stages, and the investment in it has been minimal. *See* EX1010. The parties have not exchanged preliminary positions on claim construction, and discovery opened only recently on December 17, 2024. *See PEAG LLC v. Varta Microbattery GmbH*,

[10] Available online at https://www.uspto.gov/sites/default/files/documents/interim_proc_discretionary_denials_aia_parallel_district_court_litigation_memo_20220621_.pdf

IPR2020-01214, Paper 8, 17 (Jan. 6, 2021). Invalidity contentions will not be exchanged until February 14, 2025. *See* EX1010, 5. Moreover, the Markman hearing is not scheduled until November 7, 2025, and expert discovery is scheduled for completion on January 20, 2026—both of which are after the expected institution decision date of June-July 2025 for this instant IPR. *Id.* Hence, this factor favors institution.

4. Overlapping Issues With The Parallel Proceeding

Factor 4 favors institution. Petitioner stipulates that if the IPR is instituted, Petitioner will not pursue the same grounds in the district court litigation. *Sand Revolution II LLC v. Continental Intermodal Group – Trucking LLC*, IPR2019-01393, Paper 24 at 7 (June 16, 2020) (informative). As such, the Grounds presented in the instant IPR will be materially different from the grounds that will be presented in the district court.

Petitioner may further update the stipulation in this instant proceeding after invalidity contentions have been exchanged with Patent Owner on February 14, 2025 in the parallel district court litigation.

5. Identity Of Parties

Factor 5 is neutral. Petitioner is the defendant in the litigation. This factor should not be a basis for denying institution.

6. Other Circumstances, Including The Merits

Factor 6 favors institution. "[W]here the PTAB determines that the information presented at the institution stage presents a compelling unpatentability challenge, that determination alone demonstrates that the PTAB should not discretionarily deny institution under *Fintiv*." Memo, 4-5. Here, the evidence of unpatentability is compelling, as evidenced by Grounds laid out above.

Accordingly, *Fintiv* factors favor institution.

C. *General Plastic* Factors Favor Institution

The '113 Patent has not been challenged in any prior IPR petition. Thus, the *General Plastic* factors favor institution.

XII. Conclusion

Petitioner respectfully requests that the Board institute *inter partes* review, hold the challenged claims unpatentable, and cancel the challenged claims.

Dated: January 17, 2025

Respectfully submitted,

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CERTIFICATION UNDER 37 C.F.R. § 42.24(d)

I hereby certify that this Petition for *Inter Partes* Review of U.S. Patent No. 7,901,113 has, excluding the portions exempted under 37 C.F.R. § 42.24(a), 11,483 words as counted by the word-processing system used to prepare this document, in compliance with 37 C.F.R. § 42.24(d).

Dated: January 17, 2025

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CERTIFICATE OF SERVICE

Under 37 C.F.R. §§ 42.6(e) and 42.105, the undersigned certifies that on January 17, 2025, complete copies of the foregoing and any accompanying exhibits were caused to be served by sending them via Federal Express Priority Overnight shipping, which is at least as fast and reliable as U.S. Priority Mail Express, to the correspondence address of record for U.S. Patent No. 7,901,113 as indicated in Patent Center:

H.C. Park & Associates, PLC
1894 Preston White Drive
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Petitioner is also serving courtesy copies to counsels of record in the Litigation via Federal Express Priority Overnight shipping at:

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