

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MOTOROLA MOBILITY LLC, Petitioner,

v.

LARGAN PRECISION CO., LTD.,
Patent Owner.

IPR2024-00689
Patent 9,366,845 B2

Before JON M. JURGOVAN, NORMAN H. BEAMER, and
NABEEL U. KHAN, *Administrative Patent Judges*.

BEAMER, *Administrative Patent Judge*.

DECISION
Denying Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

Motorola Mobility LLC, Petitioner, filed a Petition (Paper 2, “Pet.”) requesting an *inter partes* review of claims 1–34 of U.S. Patent No. 9,366,845 B2 (Ex. 1001, the “’845 patent”). Pet. 1. Largan Precision Co. Ltd., Patent Owner, filed a Preliminary Response (Paper 6, “Prelim. Resp.”). With the Board’s authorization, Petitioner filed a Preliminary Reply and Patent Owner a Preliminary Sur-Reply directed to the issues of discretionary denial under Section 325(d) and the availability of prior art background references in a Section 103 challenge. Papers 7 (“Reply”); 8 (“Sur-Reply”).

The standard for instituting an *inter partes* review is set forth in 35 U.S.C. § 314(a), which provides that an *inter partes* review may not be instituted unless the information presented in the Petition and any preliminary response shows that “there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.”

For the reasons set forth below, we determine that Petitioner does not show a reasonable likelihood of prevailing with respect to at least one of the claims. Accordingly, we do not institute an *inter partes* review of the ’845 patent.

II. BACKGROUND

A. *Real Parties in Interest*

Each party identifies itself as the real party in interest. Pet. xi; Paper 3, 2.

B. Related Matters

The parties identify various pending patent applications and issued patents as related matters. Pet. xi; Paper 3, 2.

C. The '845 Patent

The '845 patent relates to a “photographing optical lens assembly.” Ex. 1001, code (57), 1:14–15. The patent states that “with the popularity of electronic devices having camera functionalities, the demand of miniaturized optical systems has been increasing.” *Id.* at 1:20–22. The '845 patent explains that a “conventional optical system employed in a portable electronic product mainly adopts a lens structure with fewer lens elements, such as four or five lens elements,” and asserts “the conventional optical systems cannot satisfy these requirements of the compact optical systems.” *Id.* at 1:31–39.

To improve resolution and image quality, the '845 patent describes an optical imaging system comprising seven lens elements having specific characteristics and properties. Ex. 1001, 1:52–2:13. Figure 1 of the '845 patent, reproduced below, illustrates a first embodiment of the '845 patent's optical imaging system. *Id.* at 2:61–62.

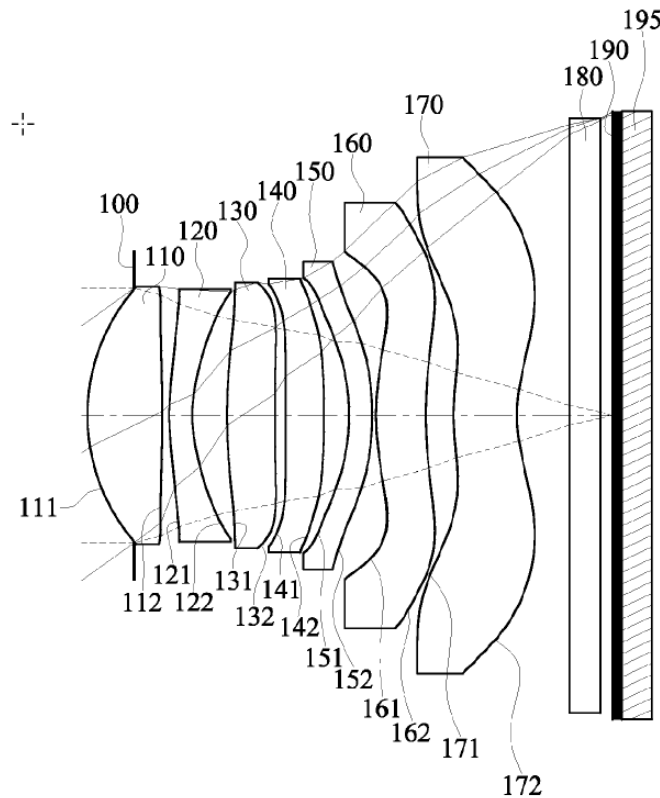


FIG. 1

Figure 1 shows an optical lens assembly that includes, from object (left) side to image (right) side, a first (110), second (120), third (130), fourth (140), fifth (150), sixth (160), and seventh (170) lens elements with object side and image side surfaces. Ex. 1001, 10:37–45. The optical lens assembly also includes aperture stop 100, IR-cut filter 180 an image surface 190. *Id.*

The first lens element 110 with positive refractive power has an object-side surface 111 being convex in a paraxial region thereof and an image-side surface 112 being convex in a paraxial region thereof, and has the object-side surface 111 and the image-side surface 112 being both aspheric. Ex. 1001, 10:46–51. The second lens element 120 with negative refractive power has an object-side surface 121 being convex in a paraxial region thereof and an image-side surface 122 being concave in a paraxial

region thereof, and has the object-side surface 121 and the image-side surface 122 being both aspheric. *Id.* at 10:52–57. The third lens element 130 with positive refractive power has an object-side surface 131 being convex in a paraxial region thereof and an image-side surface 132 being concave in a paraxial region thereof, and has the object-side surface 131 and the image-side surface 132 being both aspheric. *Id.* at 10:58–63. The fourth lens element 140 with positive refractive power has an object-side surface 141 being convex in a paraxial region thereof and an image-side surface 142 being convex in a paraxial region thereof, and has the object-side surface 141 and the image-side surface 142 being both aspheric. *Id.* at 10:64–11:2. The fifth lens element 150 with negative refractive power has an object-side surface 151 being concave in a paraxial region thereof and an image-side surface 152 being convex in a paraxial region thereof, and has the object-side surface 151 and the image-side surface 152 being both aspheric. *Id.* at 11:3–8. The sixth lens element 160 with positive refractive power has an object-side surface 161 being convex in a paraxial region thereof and an image-side surface 162 being concave in a paraxial region thereof, and has the object-side surface 161 and the image-side surface 162 being both aspheric, and the image-side surface 162 has at least one inflection point. *Id.* at 11:9–15. The seventh lens element 170 with negative refractive power has an object-side surface 171 being convex in a paraxial region thereof and an image-side surface 172 being concave in a paraxial region thereof, and has the object-side surface 171 and the image-side surface 172 being both aspheric, and the image-side surface 172 has at least one inflection point. *Id.* at 11:16–23.

The shape of the sixth and seventh lenses is referred to as a “gullwing” shape based on its similarity to the “outspread wings of a flying gull.” Ex. 1003 ¶¶ 50, 62. The paraxial regions of the sixth and seventh lenses have a “meniscus” shape — meaning that the object surface is convex and the image surface is concave. Ex. 1001, 4:39–41, 4:49–51; Ex. 1019, 2:30–32. The ’845 patent describes the advantages of using the disclosed shapes for the sixth and seventh lenses;

[The sixth lens shape] is favorable for further correcting the astigmatism of the photographing optical lens assembly. Furthermore, it is favorable for balancing the arrangement of the refractive powers so as to avoid excessive aberration and improve the image quality.

. . . .

[The seventh lens shape] is favorable for reducing a back focal length of the photographing optical lens assembly so as to keep a compact size. Furthermore, it is favorable for correcting the aberration of the off-axis so as to improve the image quality.

Ex. 1001, 4:43–59.

The ’845 patent specifies specific values for selected parameters of the above-described first embodiment, including the focal length f of the overall optical lens assembly ($f=3.89$ mm), and the focal lengths f_1 and f_7 of the first and seventh lens elements, respectively ($f_1=3.31$ mm, $f_7=-9.57$ mm). Ex. 1001, Table 1. The patent also defines measurements Y_{c62} and Y_{c72} , which are illustrated in Figure 27 reproduced below.

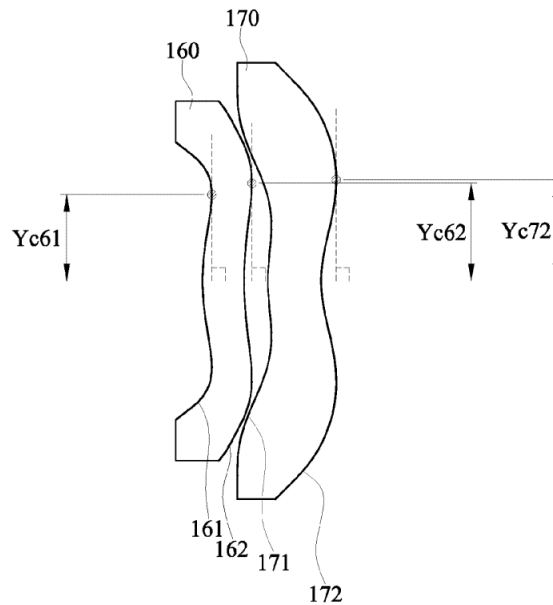


FIG.27

As shown in Figure 27, Yc62 is the distance from a “critical point” on the image-side surface 162 of the sixth lens element 160 to the optical axis, where the critical point is a non-axial point on the surface where its tangent is perpendicular to the optical axis. Ex. 1001, 9:35–47. Yc72 is the corresponding distance for the seventh lens element. *Id.* at 9:47–50.

The '845 patent further calculates certain relationships between various lens parameters, including, for the above described parameters for first embodiment, $Yc62/Yc72=0.97$; $Yc72/f=0.29$; and $|f1/f7|=0.35$. *Id.* at 13:4, 13:36, 14:7. Other values for these and other parameter relationships are specified for the remaining twelve embodiments disclosed in the '845 patent. *See, generally* Ex. 1001. The patent specifies “conditions” that these relationships preferably satisfy, and explains the advantages of complying with those conditions. For example:

[The] condition . . . $0.1 < Yc72/f < 0.9$. . . is favorable for controlling the incident angle of the light projecting onto the image sensor so as to keep sufficient illumination in the

peripheral region of the image. Furthermore, it is favorable for correcting the aberration of the off-axis so as to enhance the resolution of the photographing optical lens assembly.

Ex. 1001, 4:63–5:2.

[The] condition . . . $|f1/f7| < 3.0$. . . is favorable for properly distributing the refractive power of the photographing optical lens assembly adjacent to the object side so as to avoid excessive aberration.

Ex. 1001, 5:4–8.

[The] condition . . . $0.5 < Y_{c62}/Y_{c72} < 1.5$ is favorable for correcting the aberration of the off-axis so as to improve the image quality.

Ex. 1001, 6:25–27.

D. Illustrative Claim

Independent claim 1 is illustrative of the challenged claims, and follows:

[1.1] A photographing optical lens assembly comprising, in order from an object side to an image side:

[1.2] a first lens element having positive refractive power;

[1.3] a second lens element having negative refractive power;

[1.4] a third lens element;

[1.5] a fourth lens element having positive refractive power;

[1.6] a fifth lens element with negative refractive power having an object-side surface being concave in a paraxial region thereof and an image-side surface being convex in a paraxial region thereof;

[1.7] a sixth lens element having an image-side surface being concave in a paraxial region thereof, wherein both of an object-side surface and the image-side surface of the sixth lens element are aspheric, and the image-side surface of the sixth lens element has at least one inflection point; and

[1.8] a seventh lens element having an image-side surface being concave in a paraxial region thereof, wherein both of an object-side surface and the image-side surface of the seventh lens element are aspheric, and the image-side surface of the seventh lens element has at least one inflection point;

[1.9] wherein the photographing optical lens assembly has a total of seven lens elements,

[1.10] there is a non-axial critical point on the image-side surface of the sixth lens element at which a tangent to the image-side surface of the sixth lens element is perpendicular to an optical axis, there is a non-axial critical point on the image-side surface of the seventh lens element at which a tangent to the image-side surface of the seventh lens element is perpendicular to the optical axis, a vertical distance between the non-axial critical point on the image-side surface of the sixth lens element and the optical axis is Y_{c62} , a vertical distance between the non-axial critical point on the image-side surface of the seventh lens element and the optical axis is Y_{c72} , a focal length of the photographing optical lens assembly is f , a focal length of the first lens element is f_1 , a focal length of the seventh lens element is f_7 , and the following conditions are satisfied:

$$0.5 < Y_{c62}/Y_{c72} < 1.5;$$

$$0.1 < Y_{c72}/f < 0.9; \text{ and}$$

$$|f_1/f_7| < 3.0.$$

Pet. 16–17 (bracketed numbering by Petitioner); Ex. 1001, 58:43–59:20.

E. Asserted Grounds of Unpatentability

Petitioner contends that claims 1–34 are unpatentable as follows:¹

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–14, 16–27, 30, 32–34	103(a)	Fukaya ²
1–4, 7, 9–13, 15, 16, 18–21, 23, 24, 28–31	103(a)	Cai ³

Pet. 2. Petitioner supports its Petition with a Declaration of Tom D. Milster, Ph.D. Ex. 1003.

F. Discretionary Denial Pursuant To 35 U.S.C. § 325(d)

As a threshold matter, Patent Owner argues that institution should be denied pursuant to 35 U.S.C. § 325(d) because Fukaya and Tsai, the latter of which has a specification substantially identical to that of Cai, were of record in the '845 patent's prosecution. Prelim. Resp. 4–13 (citing Ex. 1001, code (56); Ex. 1002, 810, 828; Exs. 1004, 1005, 1032). Also, the Baik patent, which Petitioner relies on as evidence of the state of the art, was the primary reference cited by the Examiner during prosecution. *Id.* at 6 (citing Pet. 4, 10; Ex. 1007); *see also* Ex. 1002, 810). In addition, a number of

¹ The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) ("AIA"), amended 35 U.S.C. §§ 102, 103 effective March 16, 2013, which is before the '845 patent's assumed August 1, 2014 effective filing date. *See* Ex. 1001, code (30); Pet. 12; Prelim. Resp. 2, n. 2. Therefore, the AIA version of Section 103 applies.

² Fukaya, US 2014/0139719 A1, filed September 17, 2013, published May 22, 2014. Ex. 1004.

³ Cai et al., CN 202886720 U, filed October 16, 2012, issued April 17, 2013. Ex. 1005.

other references that Petitioner relies on as evidence of the state of the art were cited during the prosecution. Prelim. Resp. 19–21.

Patent Owner further argues that Petitioner has failed to demonstrate that the Examiner made a material error in allowing the issued claims over this art, and in particular challenges Petitioner’s assertion that the Examiner did not realize that Baik discloses the claimed *Yc62/Yc72* condition. Prelim. Resp. 6. Patent Owner argues that Petitioner relies on figures in Baik not drawn to scale, and engages in “forbidden” hindsight analysis and unsupported attorney argument. Pet. 6–12; Sur-Reply 2–3.

Under 35 U.S.C. § 325(d), the Board may exercise discretion to deny a petition that presents the same or substantially the same art or arguments as were previously presented to the Office. *See* 35 U.S.C. § 325(d); 37 C.F.R. § 42.4(a) (providing that the Board institutes on behalf of the Director). The Board has outlined factors it considers in determining whether to exercise discretion to deny institution under § 325(d):

(a) the similarities and material differences between the asserted art and the prior art involved during examination; (b) the cumulative nature of the asserted art and the prior art evaluated during examination; (c) the extent to which the asserted art was evaluated during examination, including whether the prior art was the basis for rejection; (d) the extent of the overlap between the arguments made during examination and the manner in which Petitioner relies on the prior art or Patent Owner distinguishes the prior art; (e) whether Petitioner has pointed out sufficiently how the Examiner erred in its evaluation of the asserted prior art; and (f) the extent to which additional evidence and facts presented in the Petition warrant reconsideration of the prior art or arguments.

Becton, Dickinson & Co. v. B. Braun Melsungen AG, IPR2017-01586, Paper 8, 17–18 (PTAB Dec. 15, 2017) (precedential as to § III.C.5, first

paragraph) (“*Becton Dickinson*”). The *Becton Dickinson* factors apply when a petition relies on art or arguments previously presented to the Office during any proceeding pertaining to the challenged patent, including reexamination, reissue, and AIA post-grant proceedings. *Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6, 8–10 (PTAB Feb. 13, 2020) (precedential). *Advanced Bionics* explains how the *Becton Dickinson* factors fit into a two-part framework that examines:

(1) whether the same or substantially the same art previously was presented to the Office or whether the same or substantially the same arguments previously were presented to the Office; and (2) if either condition of first part of the framework is satisfied, whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of challenged claims. If a condition in the first part of the framework is satisfied and the petitioner fails to make a showing of material error, the Director generally will exercise discretion not to institute *inter partes* review.

Id. at 8–9.

Here, as discussed above, the same art that Petitioner relies on — Fukaya and Tsai/Cai — was previously presented to the Office. Thus, Patent Owner has shown that the first part of the *Advanced Bionics* framework is satisfied. Turning to the second part of the *Advanced Bionics* framework, we determine that Petitioner has demonstrated that the Office erred in a manner material to the patentability of the challenged claims.

As Petitioner points out, during the prosecution of the application that led to the ’845 patent, the Examiner found that the art of record did not teach the *Yc62/Yc72* condition, or the requirements “wherein the fifth lens element has negative refractive power,” and “wherein the sixth lens element has

positive refractive power.” Pet. 15 (citing Ex. 1002, 823–824). However, as Petitioner demonstrates, Baik’s disclosed fifth embodiment satisfies the $Yc62/Yc72$ condition. Pet. 3–4 (citing Ex. 1007, Fig. 13, Tables 9, 10; Ex. 1003 ¶ 68); Reply 1–4 (citing Ex. 1003 ¶¶ 51, 58–59, 202). Also, both Fukaya and Tsai disclose that the fifth lens element has negative refractive power and the sixth lens element has positive refractive power. Pet. 4–5 (citing Ex. 1032, 8:11–18, 22:5–13; Ex. 1004, Table 1, ¶ 125); Reply 1 (citing Ex. 1004, Table 1); Ex. 1005, Table 1; Ex. 1032, 8:11–18, Table 1).

Patent Owner’s arguments that Baik’s figures are not drawn to scale, and that Petitioner’s assertions that Baik’s disclosure satisfies the $Yc62/Yc72$ condition are based on hindsight and unsupported attorney argument, ignore the fact that the $Yc62/Yc72$ value is readily calculated, and verified as meeting the claimed condition, using the disclosed tables of lens parameters in Baik. Ex. 1003 ¶ 68 (“a lens designer would have readily determined these values from the lens data disclosed by Baik . . . such as by inputting the lens data into the aspheric surface equation disclosed by Baik . . . via Excel or another spreadsheet software, using lens design software . . .”). Also, Patent Owner does not address the fact that both Fukaya and Tsai disclose that the supposedly missing refractive power requirements. Pet. 4–5.

We conclude that the Examiner made material errors by “misapprehending or overlooking specific teachings of the relevant prior art where those teachings impact patentability of the challenged claims.” *Advanced Bionics*, Paper 6 at 8 n.9. Accordingly, we do not exercise our discretion under § 325(d) to deny the Petition.

III. ANALYSIS OF PETITIONER'S CHALLENGES

A. *The Obviousness Standard*

Pursuant to the AIA, a patent claim is unpatentable under 35 U.S.C. § 103 if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. 35 U.S.C. § 103. The obviousness question involves resolving underlying factual determinations including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and when presented (not so here), (4) objective evidence of non-obviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

“[I]n appropriate circumstances, a patent can be obvious in light of a single prior art reference if it would have been obvious to modify that reference to arrive at the patented invention.” *Arendi S.A.R.L. v. Apple Inc.*, 832 F.3d 1355, 1361 (Fed. Cir. 2016).

B. *Level of Ordinary Skill in the Art*

Determining whether an invention would have been obvious under 35 U.S.C. § 103 requires resolving the level of ordinary skill in the pertinent art at the time of the effective filing date of the claimed invention. *Graham*, 383 U.S. at 17. The person of ordinary skill in the art is a hypothetical person who knows the relevant art. *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995). Factors in determining the level of ordinary skill in the art include the types of problems encountered in the art, the sophistication of the

technology, and educational level of active workers in the field. *Id.* One or more factors may predominate. *Id.*

Petitioner's expert contends that person of ordinary skill in the art (POSITA)

would include someone who had, in 2014, (i) a Bachelor's degree in Physics, Optical Sciences, or equivalent training, as well as (ii) approximately three years of experience in designing multi-lens optical systems. Lack of work experience could have been offset by additional education, and vice versa.

Ex. 1003 ¶ 33. Petitioner's expert further states that such person had experience in analyzing, adjusting, and optimizing multi-lens imaging systems, and would have been familiar with the specifications of lens systems, would have understood the fundamentals of optical aberration theory and understood and used standard techniques for improving lenses, and knew how to use lens design software and regularly used such software to create new lens designs, often using pre-existing lens designs as a starting point and then performing routine optimizations to reach a desired design.

Id. at ¶¶ 34–42.

Patent Owner does not offer a specific definition of a person of ordinary skill in the art. *See, generally*, Prelim. Resp.

Based on a review of the record, we adopt Petitioner's proposed level of ordinary skill in the art because it is consistent with the evidence of record, including the asserted prior art and '845 patent specification.

Okajima v. Bourdeau, 261 F.3d 1350, 1355 (Fed. Cir. 2001).

C. Claim Construction

In *inter partes* reviews, the Board interprets claim language using the district-court-type standard, as described in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). *See* 37 C.F.R. § 42.100(b) (2023).

Under this standard, claim terms have their ordinary and customary meaning, as would be understood by a person of ordinary skill in the art at the time of the invention, in light of the language of the claims, the specification, and the prosecution history. *See Phillips*, 415 F.3d at 1313–14.

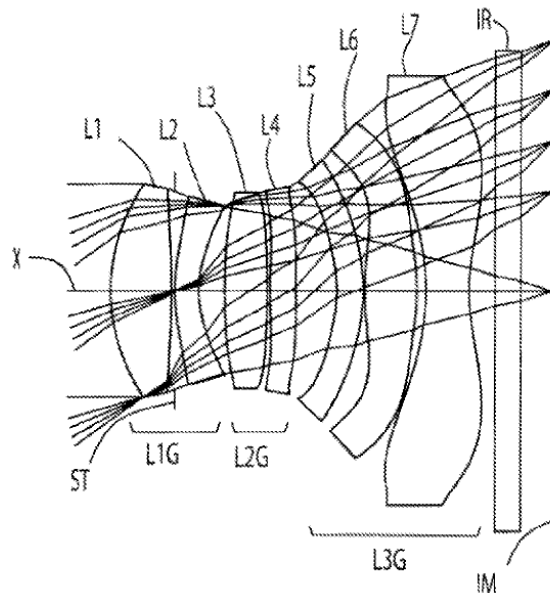
Petitioner states that it applies the plain and ordinary meaning of all claim terms. Pet. 18. Patent Owner does not specifically address claim construction. *See, generally*, Prelim. Resp. For purposes of this Decision, we do not define any claim terms.

D. Alleged Obviousness of Claims 1–14, 16–27, 30, and 32–34 over Fukaya

Petitioner contends that claims 1–14, 16–27, 30, and 32–34 would have been obvious over Fukaya. Pet. 18–75.

Fukaya discloses various embodiments of seven-lens systems, including a first embodiment depicted in Figure 1 reproduced below. Ex. 1004 ¶ 72.

FIG. 1

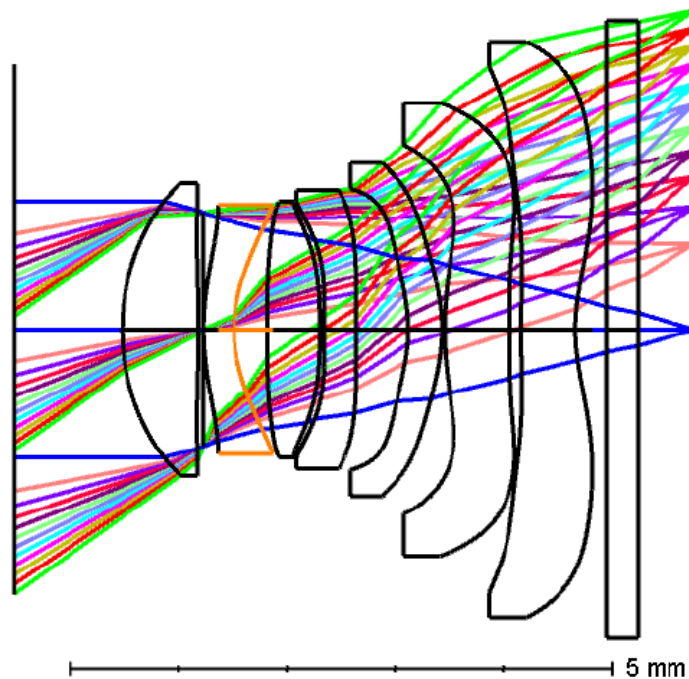


Fukaya includes a detailed disclosure of the characteristics and parameters of the Figure 1 first embodiment. Ex. 1004, Figs. 1, 2, Tables 1, 12, ¶¶ 94–127. Significantly, unlike the sixth lens of the '845 patent, the sixth lens of Figure 1 does not have a gullwing shape, and has a double convex area at the paraxial region rather than a meniscus shape. Ex. 1004 ¶ 104. Also, although the seventh lens of Fukaya has a gullwing shape, it has a double concave area at the paraxial region rather than a meniscus shape. *Id.* As a result, although the first embodiment of Fukaya satisfies all of the other requirements of claim 1 of the '845 patent, it does not satisfy the claim 1 requirements that the sixth lens element has a concave image-side surface in its paraxial region, or the condition that $0.5 < Y_{c62}/Y_{c72} < 1.5$. Ex. 1003 ¶¶ 76, 88–102.

1. Petitioner's Arguments In Support Of Modifying Fukaya

Petitioner argues that it would have been obvious to one of ordinary skill in the art as of the August 2014 priority date of the '845 patent to

modify the first embodiment of Fukaya so that the sixth lens would have had a gullwing shape, and both the sixth and seventh lenses would have had a meniscus in the paraxial region, in which case Fukaya would satisfy all of the claim 1 requirements. Pet. 20–26 (citing Ex. 1003 ¶¶ 77–81, 86–87). Using a widely-available lens design software, Petitioner’s expert provides a version of the first embodiment of Fukaya, which Petitioner argues would have been an obvious redesign, reproduced below. Pet. 24 (citing Ex. 1003 ¶¶ 82–85).



The redesign, depicted above, modifies the double convex shape of the sixth lens to have a gullwing design with a meniscus paraxial region, and modifies the gullwing shape of the seventh lens to also have a meniscus paraxial region. According to Petitioner, this modified version of the first embodiment of Fukaya satisfies all of the limitations of claim 1. Pet. 27–43 (citing Ex. 1003 ¶¶ 88–102).

In arguing that one of ordinary skill would have been motivated to modify the sixth and seventh lenses of Fukaya as described, Petitioner submits that lens designers commonly started with a known lens design, such as a lens design disclosed in a patent, and applied well-known iterative software techniques to improve the design by adjusting such lens parameters as curvature radius, conic constant, and aspheric coefficients. Pet. 5–7 (citing Ex. 1009, 8, 11, 80, 98; Ex. 1010, 3–4, 7, 11–69; Ex. 1011, 168, 171–176; Ex. 1012, 6–7; Ex. 1030, 9–10, 516; Ex. 1003 ¶¶ 43–49). In particular, relying on expert testimony, textbooks, patents, and patent applications, Petitioner asserts that, as of the August 2014 priority date of the '845 patent, it was well known that gullwing-shaped lenses positioned near the image plane were useful in controlling aberration and other design issues, specifically including use of seven-lens designs with gullwing-meniscus shapes for the sixth and seventh lenses to effectively reduce aberration, improve field of view, and minimize track length. Pet. 8–12 (citing Ex. 1003 ¶¶ 50–59); Reply 2–3.⁴

Given this evidence of the state of art, and the level of ordinary skill in the art as set forth in Section III.B above, Petitioner argues that one of ordinary skill would have been motivated, with a reasonable expectation of

⁴ Petitioner and its expert rely on Ex. 1006, Fig. 1, ¶¶ 5–13, 23–24, 35–38, 102, 104, 110–111; Ex. 1007, Fig. 1, ¶¶ 3–10, 52, 90–91; Ex. 1008 ¶¶ 5–11, 18, 34–35; Ex. 1009, Fig. 4, 14, 93–94; Ex. 1011, 123, 125; Ex. 1013, 7–8; Ex. 1015, 78–79; Ex. 1016, 61; Ex. 1018, 66:22–24, 67:15–69:2, 71:5–15, 75:11–16, 76:12–13; Ex. 1019, Fig. 1A, 2:53–57; Ex. 1020, Fig. 1, 2:18–21; Ex. 1021, Fig. 1, 2:20–23; Ex. 1022, Figs. 1–2, 4:46–64; Ex. 1024, Fig. 1, ¶¶ 64–68; Ex. 1025, Fig. 7, 4:37–58, 6:1–22, 6:41–62, 9:22–53; Ex. 1026, Fig. 4, 7:4–67; Ex. 1027, Fig. 1, 3:18–29, 4:11–30, 7:24–42, 10:17–58; Ex. 1028, Fig. 13; and Ex. 1029, Figs. 1, 4, 7, 10, 10:13–40.

success, to redesign the imaging lens of Fukaya to have two gullwing lenses as described above. Pet. 20–26 (citing Ex. 1003 ¶¶ 77–87). Petitioner argues that a double gullwing-double meniscus design for the sixth and seventh lenses of Fukaya reduce the burden on the lenses for correcting aberrations and controlling the chief ray angle across the image height. *Id.* at 20–21 (citing Ex. 1006 ¶ 36; Ex. 1003 ¶ 77). Petitioner cites statements in Fukaya that the aspheric surfaces of the sixth and seventh lenses facilitated correction of aberrations and control of the angle of incidence of principal light rays. *Id.* at 21 (citing Ex. 1004 ¶¶ 22–23; Ex. 1003 ¶ 78). Petitioner argues that one of ordinary skill would have been motivated to further improve the optical properties made possible by the aspheric shapes of these lenses by “simply making the image-side surface of the sixth lens concave near the optical axis” and “simply making the object-side surface of the seventh lens convex on axis,” resulting in the sixth and seventh lens having the desired double gullwing-double meniscus design. *Id.* at 21–22 (citing Ex. 1010, 47; Ex. 1027, 10:17–58; Ex. 1003 ¶¶ 79–80).

Petitioner also relies on the statement in Fukaya regarding ensuring high brightness and wide field of view. Pet 24 (citing Ex. 1004 ¶ 6). However, argues Petitioner, the Fukaya design produces a relative illumination below 50% at image edge, whereas, according to Petitioner, lens specifications require greater than 50%. Pet. 24–25 (citing Ex. 1005 ¶ 128; Ex. 1006 ¶ 38; Ex. 1013, 7; Ex. 1003 ¶ 86). Petitioner submits that the modified Fukaya design achieves relative illumination above 50% across the image plane, thus further motivating that modification. *Id.* at 25–26 (citing Ex. 1003 ¶¶ 86–87).

2. *Patent Owner's Response To Petitioner's Modification Arguments*

Patent Owner argues that Petitioner has failed to show a reasonable likelihood that a person of ordinary skill in the art would have been motivated to modify Fukaya to change Fukaya's sixth lens element from bi-convex to meniscus, to add an inflection point to the image-side surface of the sixth lens element, and to change the seventh lens element from bi-concave to meniscus. Prelim. Resp. 13–36. In contrast to Petitioner's characterization, Patent Owner argues that lens design was (and is) “extraordinarily complicated, requiring protracted trial-and-error experimentation” Prelim. Resp. 13–14 (citing Ex. 1010, 11; Ex. 1011, 169 (“[a] lens system consists of a nearly infinite number of possible solutions in a highly multidimensional space”), 172, 174–175).

Patent Owner further argues that Petitioner's reliance on numerous texts, articles and patent publications to establish the state of the art as of the August 2014 priority date of the '845 patent is flawed, in that such reliance in a single-reference obviousness challenge is not appropriate to supply a missing claim limitation, with the possible exception when “the limitation in question was unusually simple and the technology particularly straightforward.” Prelim. Resp. 14–15 (citing *Arendi S.A.R.L. v. Apple Inc.*, 832 F.3d 1355, 1361 (Fed. Cir. 2016); *Perfect Web Techs., Inc. v. InfoUSA, Inc.*, 587 F.3d 1324, 1326 (Fed. Cir. 2009)). Patent Owner argues that this is not a case involving such simple technology. *Id.* In addition, Patent Owner points out that most of the references relied on that disclose seven-lens designs using gullwing/meniscus shapes for the sixth and seventh lenses were not published until after the August 2014 priority date of the '845 patent. Pet. 17–18 (citing Exs. 1006, 1024–1027); Sur-Reply 4–5 (“All

but two of the cited references [were] published after the '845 patent's effective filing date"). Therefore, argues Patent Owner, those references "are ineffective for establishing what POSAs knew before that date."

Pet. 18–19 (citing *In re Glass*, 492 F.2d 1228, 1232 (C.C.P.A. 1974); *Eli Lilly & Co. v. Sicor Pharms., Inc.*, 705 F. Supp. 2d 971, 996 n. 30 (S.D. Ind. 2010)); Sur-Reply 5.

Patent Owner also argues that Fukaya-type bi-convex/bi-concave designs of the sixth and seventh lenses continued to be used even after the gullwing/meniscus designs were published. Prelim. Resp. 21–22 (citing Exs. 2007, 2008). Patent Owner argues that this undercuts Petitioner's arguments that the latter designs were perceived by persons of ordinary skill to be a superior approach such that there would have been a motivation to abandon the former design for the latter. *Id.*

Based on these arguments, Patent Owner submits that at most Petitioner has shown that Fukaya could have been redesigned as argued, but Petitioner has not provided sufficient evidence that a person of ordinary skill in the art would have done so. *Id.* at 25. Patent Owner argues that the asserted modification would only have been motivated by improper hindsight. *Id.* at 26.

In further support, Patent Owner argues that the evidence that Petitioner relies on does not justify an assumption that the double gullwing design was freely transferrable to other lens systems, and that "there is no evidence that Fukaya was in need of *any* improvements to its compactness, aberrations, or chief ray angle." Prelim. Resp. 27. For example, Patent Owner points out that the track length — a parameter that is desirably minimized to allow for compact lens systems employed in portable

electronic products — is actually shorter for the original Fukaya embodiments than the track length of the redesigned lens systems proposed by Petitioner. *Id.* at 27–29 (citing Ex. 1004, Table 12, ¶¶ 119, 159; Ex. 1003 ¶ 85. Patent Owner cites the statement in Fukaya that emphasizes the role of the bi-convex/bi-concave design of the sixth and seventh lenses in minimizing track length. *Id.* at 29 (citing Ex. 1004 ¶¶ 22, 104).

Patent Owner further argues that Fukaya discloses that, for its lens designs, “aberrations are *properly corrected*,” a further reason why one of ordinary skill would not have sought to redesign the lenses. *Id.* at 29–31 (citing Ex. 1004, Fig. 2, ¶¶ 127, 130, 133, 136, 139, 142, 145, 148, 151, 154, 157). Also, Patent Owner argues that Fukaya states that its bi-convex/bi-concave design of the sixth and seventh lenses correctly controls the angle of principal light rays, and challenges Petitioner’s assertion that there was a requirement that relative illumination had to be greater than 50% at the edge of the field. *Id.* at 32–33 (citing Ex. 1004 ¶ 104; Ex. 1013, 7). Patent Owner disputes that the difference in relative illumination between the unmodified versus modified Fukaya designs (48% before, 52% after) was a sufficiently meaningful difference to motivate the proposed modification. *Id.* at 33.

3. Analysis

Petitioner has not shown a reasonable likelihood that a person of ordinary skill, as of the August 2014 priority date of the ’845 patent, would have been motivated to modify the Fukaya seven-lens system to change the bi-convex/bi-concave design of the sixth and seventh lenses to a double gullwing/meniscus design. Redesigning a lens system is extraordinarily complicated, requiring protracted trial-and-error experimentation with nearly an infinite number of possible solutions in a highly multidimensional space.

Ex. 1010, 11; Ex. 1011, 169. We conclude that Petitioner and its expert navigate along one path out of many to the particular redesign they propose using improper result-oriented hindsight as a guide.

Petitioner's expert's recitation of the at least 25 steps taken to journey from the original Fukaya design to the modified design is instructive:

(i) inputting into lens design software the original Fukaya lens parameters; (ii) evaluating its off-axis performance; (iii) increasing the number of analysis field points; (iv) deciding to focus on lenses 5–7, which requires that all aspherics be varied; (v) modifying lens 6 aspherics; (vi) adding CARD operands in the merit function to change the curvature radius values on the lens surfaces; (vii) adding FTGT operands to control spacing between the lenses and lens thicknesses; (viii) adjusting CENY to set the field height; (ix) using a 20x20 rectangular grid of rays for the spot rms part of the merit function; (x) making all aspherics and conics variable, except on the object-side surface of the seventh lens; (xi) increasing the f-number to 2; (xii) increasing sampling to 40x40; (xiii) targeting a positive curvature on the image-side surface of lens 6 with the CVGT 0 operand; (xiv) increasing FTGT to 0.2 on lens 7; (xv) increasing the focal length of lens 6 to 3mm; (xvi) targeting a positive curvature on the object side of lens 7 with the CVGT 0 operand; (xvii) reducing the power of lens 7; (xviii) increasing the target focal length on lens 6; (xix) releasing the focal length constraint on lens 7; (xx) releasing the focal length constraints on lenses 5 and 6; (xxi) reducing f-number in steps to 1.65; (xxii) adding DIMX operands; (xxiii) freezing the conics on surfaces 10 and 14; (xxiv) adding FCGT and FCGS commands to limit field curvature; (xxv) adding LONAs into the merit function — thus “resulting” in the Fukaya lens system with a

meniscus-gullwing lens pair for lenses 6 and 7.⁵ Ex. 1001 ¶¶ 82–85. We are not persuaded that this exercise is sufficiently free of hindsight motivation.

For purposes of this Decision, we accept that gullwing/meniscus designs were well-known as of the priority date.⁶ However, the fact that such designs were available and *could* have been used does not mean that they *would* have been used. *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015). We agree with Patent Owner that there is no evidence that that Fukaya was in need of any improvements to its compactness, aberrations, or chief ray angle. Prelim. Resp. 27. As Patent Owner establishes, the original Fukaya track length is actually shorter than the track length of the redesigned lens systems proposed by Petitioner, aberrations are properly corrected in the unmodified Fukaya lens system, and Petitioner’s redesign provides only minimally improved off-axis relative illumination. *Id.* at 27–33.

Moreover, given that Petitioner relies on a single reference to argue obviousness, its reliance on numerous additional texts, articles and patent

⁵ We note that many of the expert’s references to acronyms and other technical terms are not further explained in the record, but are nevertheless informative as to demonstrating the complexity of Petitioner’s expert’s analysis. Also, we note that Patent Owner objects to this portion of the expert declaration as an improper attempt to incorporate by reference voluminous testimony into the Petition. Prelim. Resp. 28, n. 17. However, we consider it here for the purpose indicated.

⁶ Our analysis assumes that Petitioner is correct that patents or patent applications that are prior art to the ’845 patent pursuant to AIA 35 U.S.C. § 102(a)(2) are eligible to show the state of the art, notwithstanding that such references were not issued or published until after the ’845 patent priority date. Reply 4–5. Patent Owner’s arguments to the contrary rely on authorities that deal with Section 112 disclosure issues, not Section 103 obviousness issues. *Id.*

publications — purportedly used to establish the state of the art as of the August 2014 priority date of the '845 patent — but actually used to fill in missing claim requirements absent from Fukaya — is not appropriate. The Court of Appeals for the Federal Circuit has held that the Board is permitted to rely on general knowledge to supply a missing claim limitation in an inter partes review when “the missing limitation in question [is] unusually simple and the technology particularly straightforward.” *Koninklijke Philips v. Google LLC*, 948 F.3d 1330, 1337–38 (quoting *Arendi SARL v. Apple Inc.*, 832 F.3d 1355, 1361–1362 (Fed. Cir. 2016)) (emphasis added). Here, Petitioner does not have a likelihood of success of showing that the proposed Fukaya redesign is “unusually simple” or that “the technology particularly straightforward.”

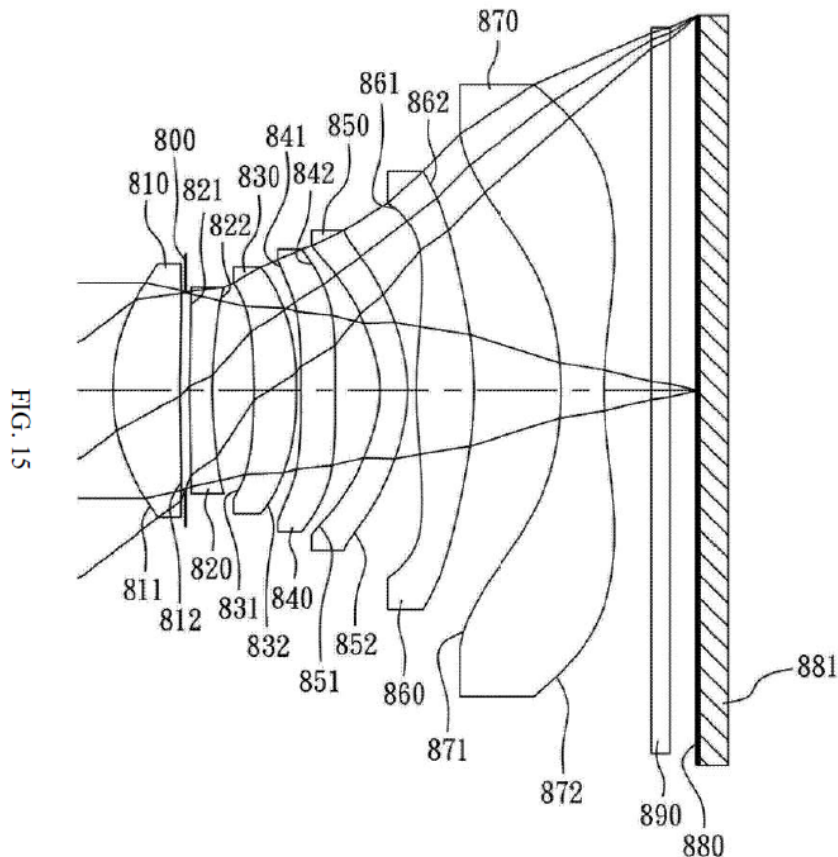
Accordingly, based on our analysis set forth above, including our analysis of Patent Owner’s arguments, we determine that Petitioner has not presented a reasonable likelihood to prevail in demonstrating unpatentability of claim 1 as obvious over Fukaya.

Petitioner’s challenges to claims 2–14, 16–27, 30, and 32–34 are based on the same proposed redesign of Fukaya. Pet. 43–75. Therefore, for the reasons explained for claim 1, Petitioner has not demonstrated a reasonable likelihood to prevail in showing that claims 2–14, 16–27, 30, and 32–34 would have been obvious over Fukaya.

E. Alleged Obviousness of Claims 1–4, 7, 9–13, 15, 16, 18–21, 23, 24, and 28–31 over Cai

Petitioner contends that claims 1–4, 7, 9–13, 15, 16, 18–21, 23, 24, and 28–31 would have been obvious over Cai. Pet. 75–124.

Cai discloses various embodiments of seven-lens systems, including an eighth embodiment depicted in Figure 15 reproduced below. Ex. 1005 ¶ 71.



For purposes of this Decision, the relied-on disclosures of Cai are substantially similar to those of Fukaya, as are Petitioner's bases for its obviousness challenges and Patent Owner's responses thereto. Pet. 75–124; Prelim. Resp. 36–46.

Accordingly, based on our analysis set forth above, including our analysis of Patent Owner's arguments, we determine that Petitioner has not presented a reasonable likelihood to prevail in demonstrating unpatentability of claims 1–4, 7, 9–13, 15, 16, 18–21, 23, 24, and 28–31 as obvious over Cai.

IV. CONCLUSION

After considering the evidence and arguments of record, we determine that Petitioner has not demonstrated a reasonable likelihood of success with respect to at least one of the challenged claims. Accordingly, we do not institute an *inter partes* review. *See* 37 C.F.R. § 42.108(a).

V. ORDER

In consideration of the foregoing, it is hereby ORDERED that the Petition is denied and no *inter partes* review is instituted in this proceeding.

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PETITIONER:

Andrew Mason
Frank Morton-Park
KLARQUIST SPARKMAN, LLP
andrew.mason@klarquist.com
frank.morton-park@klarquist.com

PATENT OWNER:

Parrish Freeman
Eric Maschoff
Paul Johnson
MASCHOFF BRENNAN PLLC
pfreeman@mabr.com
emaschoff@mabr.com
pjohnson@mabr.com