Trials@uspto.gov
571-272-7822

Paper 11
Entered: January 26, 2023

UNITED STATES PATENT AND TRADEMARK OFFICE

---

BEFORE THE PATENT TRIAL AND APPEAL BOARD

---

MOTOROLA MOBILITY LLC,
Petitioner,

v.

LARGAN PRECISION CO., LTD.,
Patent Owner.

---

IPR2022-01170
Patent 10,209,487 B2

---

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

KHAN, *Administrative Patent Judge*.

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

# I. INTRODUCTION

## *A. Background and Summary*

Motorola Mobility LLC ("Petitioner") filed a Petition (Paper 1, "Pet.") requesting an *inter partes* review of claims 1–2 and 6–10 ("the challenged claims") of U.S. Patent No. 10,209,487 B2 ("the '487 patent," Ex. 1001). Largan Precision Co. Ltd. ("Patent Owner") timely filed a Preliminary Response (Paper 7, "Prelim. Resp."). With our authorization, Petitioner filed a Preliminary Reply (Paper 8, "Prelim. Reply") and Patent Owner filed a Preliminary Sur-reply (Paper 9, "Prelim. Sur-reply") addressing the issue of real parties-in-interest.

An *inter partes* review may not be instituted "unless . . . the information presented in the petition . . . 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." 35 U.S.C. § 314(a) (2018). Having considered the arguments and evidence presented by Petitioner and Patent Owner, we determine that Petitioner has demonstrated a reasonable likelihood of prevailing on the challenged claims of the '487 patent and we institute *inter partes* review as to the challenged claims of the '487 patent on all the grounds of unpatentability set forth in the Petition.

## *B. Related Proceedings*

The parties identify the following pending matter as involving the '487 patent: *Largan Precision Co., Ltd. v. Motorola Mobility LLC*, Case No. 4:21-cv-09138 (N.D. Cal.). Pet. xii; Paper 4, 2.

## *C. Real Parties-in-Interest*

Petitioner identifies itself as the sole real party-in-interest. Pet. xii. Patent Owner identifies itself as the sole real party-in-interest. Paper 4, 2.

### *D. The '487 Patent (Ex. 1001)*

The '487 patent, titled "Optical Imaging System," relates to "an optical imaging system having multiple lens elements." Ex. 1001, code (54), 1:26–28. The patent describes "due to the popularity of the mobile electronics such as smart phones and personal digital assistants (PDAs), the standards for the resolution and the imaging quality of the miniature camera lens assemblies have been raised." *Id.* at 1:46–50. The '487 patent explains that a "conventional four-element lens assembly cannot meet the requirement of the higher order camera lens module." *Id.* at 1:50–52. Thus, "an optical imaging system capable of improving the imaging quality of mobile electronics as well as minimizing the overall size of the camera lens assembly equipped therewith is urgently needed." *Id.* at 1:54–58.

To address this need, the '487 patent describes an optical imaging system comprising five lens elements having specific characteristics and properties. Ex. 1001, 1:60–2:29. Figure 1A of the '487 patent, reproduced below, illustrates one embodiment of the '487 patent's optical imaging system.

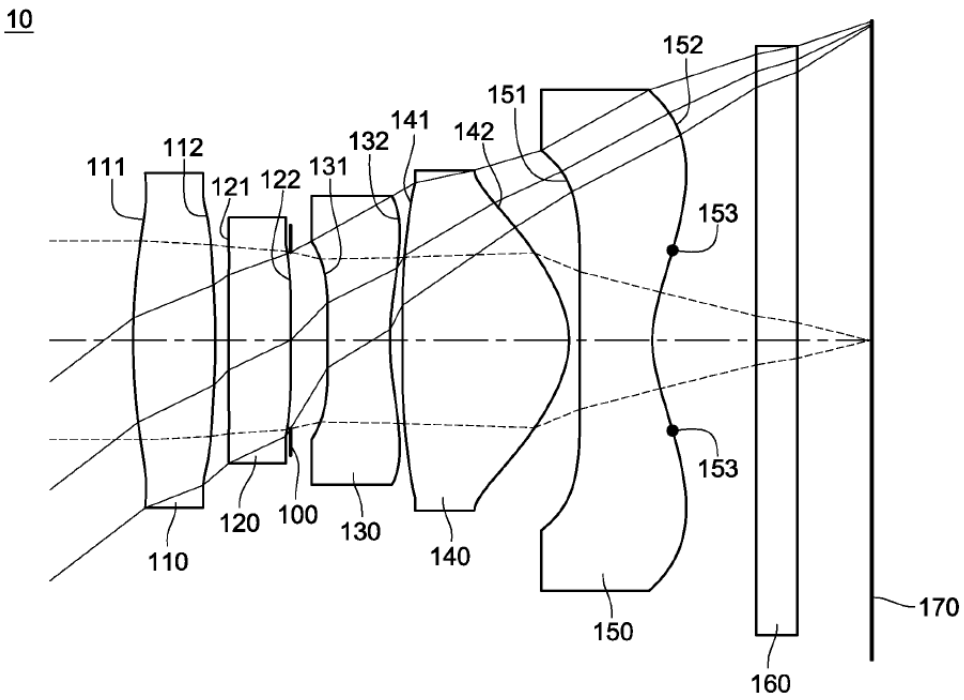


FIG.1A

Figure 1A shows an optical imaging system 10 that includes, from object side to image side, a first (110), second (120), third (130), fourth (140), and fifth (150) lens elements with object side and image side surfaces. Ex. 1001, 6:4–9. The optical imaging system further comprises a stop 100 and an image plane 170. *Id.* at 6:10–11.

The first lens element 110 has positive refractive power that may provide partial refractive power needed by the optical imaging system 10 and reduce the total optical length. Ex. 1001, 6:15–19. Moreover, the object-side surface 111 of the first lens element 110 can be a convex surface to enhance the positive refractive power of the first lens element 110 and to further reduce the total length of the optical imaging system. *Id.* at 6:15–23.

The second lens element 120 has positive refractive power may enhance the positive refractive power configuration. Ex. 1001, 6:24–27.

The third lens element 130 has negative refractive power and may correct the aberration and the chromatic aberration of the optical imaging system 10 at the same time. Ex. 1001, 6:28–32. Furthermore, the image-side surface 132 of the third lens element 130 may be a concave surface to enhance the negative refractive power of the third lens element 130, so as to correct the aberration of the optical imaging system 10. *Id.* at 6:32–36. The third lens element 130 may include at least one inflection point for reducing the angle of incidence on the electronic sensor (not shown) from the off-axis field. *Id.* at 6:36–39.

The fourth lens element 140 comprises an object-side surface 141 and an image-side surface 142. Ex. 1001, 6:40–41. Furthermore, at least one of the object-side surface 141 of the fourth lens element 140 and the image-side surface 142 of the fourth lens element 140 is aspheric. *Id.* at 6:41–44. Moreover, the image-side surface 142 of the second lens element 140 may be a convex surface for enhancing the positive refractive power of the fourth lens element 140 and further reducing the total optical length. *Id.* at 6:44–48.

The fifth lens element 150 comprises an object-side surface 151 and a concave image-side surface 152. Ex. 1001, 6:49–50. The fourth lens element 140 with positive refractive power forms a telephoto lens with the fifth lens element 150 with negative refractive power, in order to reduce the total optical length and miniaturize the optical imaging system 10. *Id.* at 6:50–54. In addition, at least one of the object-side surface 151 and the image-side surface 152 of the fifth lens element 150 is aspheric. *Id.* at 6:54–56. Moreover, the object-side surface 151 of the fifth lens element 150 may be convex near the optical axis, and the concave image-side surface 152 of the fifth lens element 150 can reduce the total optical length by increasing

the distance from a principal point of the optical imaging system 10 to the image plane 170. *Id.* at 6:57–62. Accordingly, the optical imaging system 10 becomes more compact. The fifth lens element 150 may include at least one inflection point for correcting the off-axis aberration. *Id.* 6:62–65.

### *E. Priority Chain of the '487 Patent*

The '487 Patent issued from U.S. Patent Application No. 15/468,079, ("the 2017 application") filed on March 23, 2017. Ex. 1001, codes (21), (22). The 2017 application is a continuation of application no. 14/746,475 ("the 2015 application") filed on June 22, 2015, now Pat. No. 9,645,356. *Id.*, code (63). The 2015 application is a continuation of application no. 14/096/750 ("the 2013 application") filed on Dec. 4, 2013, now Pat. No. 9,128,276. *Id.* The 2013 application is a continuation of application no. 13/091,817 ("the 2011 application") filed on April 21, 2011, now Pat. No. 8,687,293 which claims priority to Taiwan Application Serial No. 099140051 A ("the Taiwan application"), filed on Nov. 19, 2010. *Id.*, codes (63), (30).

### *F. Illustrative Claims*

Of the challenged claims only claim 1 is independent. Claim 1 is representative and is reproduced below with limitation identifiers in brackets corresponding to claim analysis headings in the Petition. *See, e.g.*, Pet. 39–50.

> [1.1] An optical imaging system comprising five lens elements, the five lens elements being, in order from an object side to an image side:
>
> [1.2] a first lens element;
>
> [1.3] a second lens element having positive refractive power;
>
> [1.4] a third lens element having negative refractive power;

[1.5] a fourth lens element with positive 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; and

[1.6] a fifth lens element with negative refractive power having an object-side surface being convex in a paraxial region thereof and an image-side surface being concave in a paraxial region thereof, wherein at least one of the object-side surface and the image-side surface of the fifth lens element is aspheric, and the image-side surface of the fifth lens element has at least one inflection point;

[1.7] wherein a central thickness of the first lens element is larger than an axial distance between the third lens element and the fourth lens element, an Abbe number of the first lens element is V1, an Abbe number of the third lens element is V3, a radius of curvature of the image-side surface of the fifth lens element is R10, a focal length of the optical imaging system is f, and the following conditions are satisfied:

$29<V1-V3<45$; and

$0.1<R10/f<0.5$.

Ex. 1001, 31:61–32:44.

*G. Evidence*

The Petition relies on the following reference:

| **Reference** | **Exhibit No.** |
|---|---|
| US 2012/0127359 Al; filed April 21, 2011; published May. 24, 2012; ("Chen359"). | 1006 |
| US 2010/0053776 A1; filed Aug. 24, 2009; published March 4, 2010; ("Tanaka") | 1007 |
| Jane Bareau & Peter P. Clark, *The Optics of Miniature Digital Camera Modules* (2006) ("Bareau") | 1011 |

Petitioner also relies on the Declaration of Tom D. Milster, Ph.D., (Ex. 1003) in support of its Petition. Patent Owner relies on the Declaration

of Julie L. Bentley, Ph.D. (Ex. 2001) in support of its Preliminary Response. The parties may rely on other exhibits as noted below.

### *H. Asserted Grounds of Unpatentability*

Petitioner asserts that the challenged claims would have been unpatentable on the following grounds:

| Claim(s) Challenged | 35 U.S.C. §[1] | Reference(s)/Basis |
|---|---|---|
| 1, 2, 6–10 | 102 | Chen359 |
| 1, 2, 6–10 | 103 | Tanaka, Bareau |

## II. DISCRETIONARY DENIAL

### *A. Anticipation by Chen359 – Ground 1*

Under the first ground, Petitioner argues that Chen359 anticipates the challenged claims. Pet. 3, 35–58. Chen359 is the publication of the 2011 application that is an ancestor of the '487 patent and shares the same disclosure as the '487 patent. *Id.* Petitioner argues that Chen359 is prior art to the '487 patent, even though it is an ancestor of the '487 patent, because the challenged claims are not entitled to claim priority to the 2011 application, which, according to Petitioner, fails to provide written description support for the full scope of the challenged claims. *Id.* at 30–33, 36.

Patent Owner argues that discretionary denial is warranted under 35 U.S.C. § 325(d) because the "Office issued the claims that [Petitioner] now challenges in this IPR without any objection or suggestion that any lacks written description support." Prelim. Resp. 16 (citing Ex. 1002, 226–

[1] The Leahy-Smith America Invents Act ("AIA"), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended 35 U.S.C. §§ 102 and 103 and became effective March 16, 2013. Because the '487 patent was filed before this date, the pre-AIA versions of 35 U.S.C. §§ 102 and 103 apply.

235). Patent Owner argues that "[b]ecause the priority issue raised in the Petition was already evaluated and decided by the examiner during prosecution, [Patent Owner] submits that the Board should exercise its discretion and deny institution as to Ground 1." *Id.* at 16.

Section 325(d) provides that, in determining whether to institute an *inter partes* review, "the Director may take into account whether, and reject the petition or request because, the same or substantially the same prior art or arguments previously were presented to the Office." 35 U.S.C. § 325(d) (2018). The Board uses a two-part framework in determining whether to exercise its discretion under § 325(d), specifically:

> (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 [the] 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.

*Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 at 8 (PTAB Feb. 13, 2020) (precedential) ("*Advanced Bionics*"); *see also Becton, Dickinson & Co. v. B. Braun Melsungen AG*, IPR2017-01586, Paper 8 at 17–18 (PTAB Dec. 15, 2017) (precedential as to Section III.C.5, first paragraph) (listing non-exclusive factors to consider in evaluating the applicability of § 325(d)) ("*Becton Dickinson*").

Turning to the first part of the framework, there is no dispute that, although Chen359 is an ancestor to the '487 patent, it was not previously presented to the Office in the context of determining patentability of the claims of the '487 patent. Instead, Patent Owner argues that the Examiner

issued the challenged claims without finding that they lack written description support from the Specification of the '487 patent, and therefore, implicitly, also from the 2011 application. Prelim. Resp. 16 (citing Ex. 1002, 226–235). A review of the prosecution history of the '487 patent, however, shows that there were no arguments raised regarding written description support or whether any of the prior applications in the chain constituted prior art to the '487 patent. Nor were there any arguments otherwise calling into question the priority date of the '487 patent. And there certainly were no arguments made that Chen359 was prior art to the '487 patent. The Examiner, therefore, did not analyze written description support in relation to these prior applications. We therefore conclude that, as to the first ground, the same or substantially the same art or arguments were not previously presented to the Office. Because we determine that the facts do not satisfy the first part of the *Advanced Bionics* framework, we need not address the second part of the framework.

*B. Obviousness over Tanaka and Bareau – Ground 2*

Under the second ground, Petitioner argues that the challenged claims would have been obvious over Tanaka and Bareau. Pet. 3. Patent Owner argues that the Petition should be denied because the Office has already considered whether the challenged claims are patentable over Tanaka. Prelim. Resp. 18–24. The Petition contains two grounds and three references, and Tanaka is involved only in the second ground. Pet. 3. As explained above, we determine that for the first ground, the same art or arguments were not previously presented to the Office. Thus, Patent Owner's § 325(d) arguments regarding the second ground do not implicate sufficiently the Petition as a whole, or demonstrate that the same or

substantially the same art or arguments that are set forth in the Petition were previously presented to the Office.

Moreover, Petitioner proposes to combine Tanaka with Bareau. Bareau was not previously before the Examiner, which further supports that, under the first part of the *Advanced Bionics* framework, the same art or arguments were not previously presented to the Office.

*C. Impermissible § 112 Challenge*

Patent Owner also argues Petitioner's "challenge amounts to a backdoor way of asserting an impermissible challenge under 35 U.S.C. § 112 and the Board should deny institution on that basis." Prelim. Resp. 16–18. This is because, "the § 112 issue must be decided as a predicate to making any determination concerning the prior art status" of Chen359. *Id.* at 17. Thus, according to Patent Owner, "the Petition's assertion that the 2011 application does not provide written description support for the Challenged Claims is really an assertion that the '487 patent specification itself lacks written description support for the Challenged Claims." *Id*. at 18.

We disagree. In determining patentability based on asserted prior art patents and printed publications under 35 U.S.C. § 311(b), the Board routinely makes determinations regarding priority dates of challenged claims and in doing so, often analyzes whether the challenged claims have written description support from earlier applications in a priority chain. *See, e.g.*, *Droplets, Inc. v. E*TRADE Bank*, 887 F.3d 1309 (Fed. Cir. 2018); *Paice LLC v. Ford Motor Co.*, 881 F.3d 894 (Fed. Cir. 2018); *Enzo Life Scis., Inc. v. Becton, Dickinson & Co.*, 780 F. App'x 903 (Fed. Cir. Aug. 16, 2019); *Nintendo of Am., Inc. v. iLife Techs., Inc.*, 717 F. App'x 996 (Fed. Cir. Dec. 27, 2017). Doing so, however, is not tantamount to finding claims

unpatentable under 35 U.S.C. § 112. The fact that the asserted art and the '487 patent share the same disclosure does not change this fact.

*D. Conclusion Regarding Discretionary Denial*

For the reasons stated above, we decline to exercise our discretion to deny institution.

## III. REAL PARTIES-IN-INTEREST

Patent Owner argues that Petitioner "purposefully omitted an RPI to gain an advantage in this forum." Prelim. Resp. 10. More specifically, Patent Owner argues Petitioner failed to disclose Sunny Optical Technology Company Limited ("Sunny"), which Patent Owner identifies as Petitioner's "supplier of the lens assemblies accused of infringement in the related litigation." *Id.* According to Patent Owner, "Sunny, as the supplier and the party that benefits most directly from cancelation of the Challenged Claims, will remain free to mount a second attack if [Petitioner] ultimately loses in a final written decision." *Id.*

Notably, Petitioner argues that "Sunny is not time-barred" from filing a Petition challenging the '487 patent and Patent Owner does not dispute this contention. We thus find that for purposes of institution, we need not address whether Sunny is an unnamed real party-in-interest "because, even if it were, it would not create a time bar or estoppel under 35 U.S.C. § 315." *SharkNinja Operating LLC v. iRobot Corp.*, IPR2020-00734, Paper 11 at 18 (PTAB Oct. 6, 2020) (precedential); *see also Intel Corp. v. Alacritech, Inc.*, IPR2017-01391, Paper 8 at 3–6 (PTAB Nov. 28, 2017) (holding that the Board will not address the argument for purposes of institution that a litigation co-defendant should be a named a real party-in-interest in the absence of an allegation that the co-defendant would be time barred under

section 315(b)). We find that this "approach better serves the interest of cost and efficiency." *SharkNinja*, Paper 11 at 20; 37 C.F.R. § 42.1(b).

Accordingly, we find that Patent Owner's arguments concerning Sunny not being named as a real party-in-interest do not form a basis to deny institution under our circumstances.

## IV. ANALYSIS OF ASSERTED GROUNDS

### *A. Principles of Law*

Petitioner bears the burden of persuasion to prove unpatentability of the claims challenged in the Petition, and that burden never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. Inc., v. Union Oil Co.*, 814 F.2d 628, 631 (Fed. Cir. 1987); *see also Finisar Corp. v. DirecTV Group, Inc.*, 523 F.3d 1323, 1334 (Fed. Cir. 2008) (to anticipate a patent claim under 35 U.S.C. § 102, "a single prior art reference must expressly or inherently disclose each claim limitation"). Moreover, "[b]ecause the hallmark of anticipation is prior invention, the prior art reference—in order to anticipate under 35 U.S.C. § 102—must not only disclose all elements of the claim within the four corners of the document, but must also disclose those elements 'arranged as in the claim.'" *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008) (quoting *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed. Cir. 1983)). Whether a reference anticipates is assessed from the perspective of one of ordinary skill in the art. *See Dayco Prods., Inc. v. Total Containment, Inc.*, 329 F.3d 1358, 1368–69 (Fed. Cir. 2003) ("'[T]he dispositive question regarding anticipation [i]s whether *one*

*skilled in the art* would reasonably understand or infer from the [prior art reference's] teaching' that every claim element was disclosed in that single reference." (second and third alterations in original) (quoting *In re Baxter Travenol Labs.*, 952 F.2d 388, 390 (Fed. Cir. 1991))).

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of 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 skill in the art; and (4) any objective evidence of obviousness or non-obviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

*B. Level of Ordinary Skill in the Art*

In determining the level of ordinary skill in the art, various factors may be considered, including the "type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field." *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (internal quotation marks and citation omitted).

Petitioner argues that a person of ordinary skill in the art ("POSITA") "would include someone who had (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." Pet. 13–14 (citing Ex. 1003 ¶ 34). In addition, Petitioner argues that a

POSITA would have had experience in analyzing, tolerancing, adjusting, and optimizing multi-lens systems for manufacturing, and would have been familiar with the specifications of lens systems and their fabrication. Pet. 13. According to Petitioner, a "POSITA would have understood the fundamentals of optical aberration theory, and understood and used standard techniques for making lenses cheaper and more effective, especially for lens systems used in mobile devices." *Id.* In addition, Petitioner argues, "a POSITA would have known how to use lens design software such as Code V, Oslo, and ZEMAX, and would have taken a lens design course or had equivalent training. A POSITA would have regularly used such software to create new lens designs, including through optimizing pre-existing lens designs to reach a desired design." Pet. 14 (citing Ex. 1003 ¶ 13). Petitioner argues a "POSITA would have followed and regularly consulted books, articles, and other publications by the Society of Photo-Optical Instrumentation Engineers ("SPIE"). The knowledge and skill of a POSITA is reflected in numerous prior art textbooks and publications discussed herein, including Smith (EX1010), Kingslake (EX1019), and Fischer (EX1029)." Pet. 14 (Ex. 1003 ¶¶ 35–46).

Patent Owner's declarant, Dr. Bentley, testifies that "a person of ordinary skill in the art around the time of the invention would have had a bachelor's degree in physics or optics, and at least three years of experience in the field of optical design, or its equivalent experience." Ex. 2001 ¶ 28.

For purposes of this Decision, we adopt Petitioner's proposed level of ordinary skill. We note, however, that the two proposed levels of ordinary skill are nearly identical and our analysis and conclusions would not change under Patent Owner's proposed level of ordinary skill.

### *C. Claim Construction*

We apply the same claim construction standard used in district court actions under 35 U.S.C. § 282(b), namely that articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). *See* 37 C.F.R. § 42.100(b) (2020).

In applying that standard, claim terms generally are given their ordinary and customary meaning as would have been understood by a person of ordinary skill in the art at the time of the invention and in the context of the entire patent disclosure. *Phillips*, 415 F.3d at 1312–13. "In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence." *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips*, 415 F.3d at 1312–17). Only claim terms in controversy require express construction, "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); *see also Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) ("[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.").

Petitioner does not propose a specific construction for any terms and instead argues that "no claim terms require specific construction to resolve the unpatentability issues presented" in their Petition. Pet. 21. Patent Owner also does not propose any specific constructions in their Preliminary Response, nor does their declarant, Dr. Bentley.

We determine that, at this stage of the proceeding, no explicit constructions are required to resolve the dispute between the parties. A final

determination as to claim construction will be made at the close of the proceeding, after any hearing, based on all the evidence of record. The parties are expected to assert all their claim construction arguments and evidence in the Petition, Patent Owner's Response, Petitioner's Reply, Patent Owner's Sur-reply, or otherwise during trial, as permitted by our rules.

### *D. Anticipation by Chen359*

Petitioner argues claims 1, 2, 6–10 of the '487 patent are anticipated by Chen359. Pet. 35–58. Below we analyze Petitioner's contentions in light of Patent Owner's arguments.

#### *1. Overview of Chen359 (Ex. 1006)*

Chen359 is the published version of U.S. Application No. 13/091,817 ("the 2011 application") which is an ancestor of the '487 patent. Ex. 1001 code (63); Ex. 1006, codes (10), (21). Chen359 was published on May 24, 2012. *Id.* at code (43). Chen359 shares its disclosure with the '487 patent with only minor differences. For an overview of Chen359, we refer to the overview of the '487 patent found above.

#### *2. Whether Chen359 is Prior Art*

Petitioner argues Chen359, which was published more than a year before the '487 patent's filing date, is prior art to the '487 patent even though Chen359 is a published ancestor application in the priority chain of the '487 patent. Pet. 42–44. This is because, according to Petitioner, the '487 patent does not benefit from the priority of the 2011 application in its chain and because the 2011 application does not support the full breadth of the challenged claims. *Id.* at 22–40.

Petitioner argues that the 2011 application does not support the full breadth of the challenged claims because the 2011 application discloses only

systems with a first lens element with positive refractive power. Pet. 28–35. Petitioner argues that the Abstract, Summary of the Invention, and Detailed Description of the 2011 application disclose a first lens element with positive refractive power and all eight embodiments of the optical imaging system disclosed in the 2011 application include a first lens element with a positive refractive power. *Id.* at 28–30 (citing Ex. 1005, 3, 45). Petitioner argues that the challenged claims, however, encompass a first lens element having either a positive or negative refractive power. *Id.* at 30 (citing Ex. 1003 ¶ 109). This is because, according to Petitioner, the independent claims generically recite "a first lens element" and the dependent claims are silent regarding the refractive power of the first lens element. *Id.*

Patent Owner argues that "the Petition errs in contending the '487 patent discloses five-element lens systems only having a first lens element with positive refractive power." Prelim. Resp. 25. Patent Owner points out that Petitioner refers to systems with negative-powered first lens as wide-angle camera systems and then argues that "[t]here is nothing in the written description of the '487 patent (or of the 2011 priority application) that suggests the inventors ever intended to exclude wide-angle camera systems." *Id.* at 25–26.

Patent Owner also argues the Petition errs in focusing solely on the first lens element to the exclusion of the second, third, fourth and fifth lens elements. Prelim. Resp. at 26. According to Patent Owner, "the Examiner understood that the patentable features of the '487 patent have nothing to do with the power of the first lens element, but rather concern the thickness of the first lens element in relation to the air gap between the third and fourth lens elements." *Id.* Thus, Patent Owner argues, it was "within its rights to file additional continuation applications, such as the continuation application

leading to the '487 patent, that sought to obtain patent protection for the various combinations of patentable features of its patented lens system." *Id.* at 28.

Patent Owner next argues that "the Petition is asserting a claim construction argument that the 'first lens element' recited in the challenged claims should be restricted to a positive refractive power." Prelim. Resp. 29. Patent Owner argues that "without such restrictions, the Petition's argument that the Challenged Claims lack written description support also fails." *Id.* at 32–33.

Patent Owner argues that in order to shift the burden from Petitioner to Patent Owner on establishing the priority date of the '487 patent, Petitioner was required to introduce prior art that predates the apparent effective date of the challenged claims. Prelim. Resp. 33–34 (citing *Tech. Licensing Corp. v. Videotek, Inc.*, 545 F.3d 1316, 1329 (Fed. Cir. 2008)). The '487 patent's apparent effective date is at least the filing date of the 2011 application which predates the publication date of the 2011 application. *Id*. at 34. Thus, Patent Owner argues that Petitioner has not brought forward evidence of prior art that predates the apparent effective date of the '487 patent and thus has not met its burden. *Id.*

At this stage of the proceeding, we are persuaded Chen359 is prior art to the '487 patent. 35 U.S.C. § 120 states:

> An application for patent for an invention disclosed in the manner provided by section 112(a) (other than the requirement to disclose the best mode) in an application previously filed in the United States, or as provided by section 363 or 385, which names an inventor or joint inventor in the previously filed application shall have the same effect, as to such invention, as though filed on the date of the prior application.

Thus, "a patent application is entitled to the benefit of the filing date of an earlier filed application only if the disclosure of the earlier application provides support for the claims of the later application, as required by 35 U.S.C. § 112." *PowerOasis, Inc. v. T-Mobile USA, Inc.*, 522 F.3d 1299, 1306 (Fed. Cir. 2008).

In order to determine whether the 2011 application provides written description support for the claims of the '487 patent, we look to see whether the specification of the 2011 application "reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter [of the challenged claims] as of the filing date [of the 2011 application]." *Ariad Pharm., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc). "[T]he purpose of the written description requirement is to 'ensure that the scope of the right to exclude, as set forth in the claims, does not overreach the scope of the inventor's contribution to the field of art as described in the patent specification.'" *Id*. at 1353 (quoting *University of Rochester v. G.D. Searle & Co., Inc.,* 358 F.3d 916, 920 (Fed. Cir. 2004)). Thus, whether the specification complies with the written description requirement calls for the comparison of the scope of the claim with the scope of the description to determine whether the inventor has demonstrated possession of the claimed invention.

First, we look to the claims to determine their scope. Here we agree with Petitioner that independent claim 1 of the '478 patent does not limit the first lens element to having a particular refractive power. The plain language of claim 1 recites "a first lens element" without specifying the lens as having a specific refractive power. Ex. 1001, 31:65. This is in contrast to the second, third, fourth, and fifth lenses each of which are specifically limited to a positive, negative, positive, and negative refractive power,

respectively. *Id.* at 31:66–32:27. We determine that the scope of claim 1 encompasses a first lens having either a positive or negative refractive power.

Next, we look at the written description of the 2011 application. The Summary of the Invention section of the 2011 application repeatedly describes the invention as having "a first lens element with positive refractive power." Ex. 1005, 2:10–11; *see* 2:22–23 ("the first lens element with a positive refractive power"); 3:9–11 ("the first lens element with the positive power provides partial refractive power needed by the optical imaging system and reduces the total optical length."). The Detailed Description of the Preferred Embodiments likewise describes a "first lens element 110 with a positive refractive power." *Id.* at 7:13. Each of the eight embodiments and associated figures show the first lens as having a positive refractive power. *Id.* at 18:2, 21:2, 24:2, 27:2, 30:2, 33:2, 36:2, Tables 1-2, 2-2, 3-2, 4-2, 5-2, 6-2, 7-2, 8-2, Figs. 1A, 2A, 3A, 4A, 5A, 6A, 7A, 8A.

Based on the disclosure of the 2011 application, we determine that it does not describe an imaging lens system with a first lens with negative refractive power, yet as explained above, such a lens fall under the scope of the claim 1 of the '487 patent. None of the challenged dependent claims limit the first lens to having positive refractive power. Thus, the written description of the 2011 application does not support the full breadth of the challenged claims. We therefore determine, at this stage of the proceeding, that the challenged claims of the '487 patent do not benefit from the priority date of the 2011 application.

Patent Owner argues that "the Petition errs in contending the '487 patent discloses five-element lens systems only having a first lens element with positive refractive power." Prelim. Resp. 25. However, Patent Owner

does not point to any disclosure in the 2011 application that indicates that the inventor had possession of a lens system with a first lens element with a negative refractive power at the time the 2011 application was filed.

Patent Owner's argument that the Petition errs in focusing solely on the first lens element to the exclusion of the second, third, fourth and fifth lens elements (Prelim. Resp. 26) is not relevant to the question of whether the 2011 application provides written description support for the claims of the '487 patent. Regardless of where the novel or patentable features of the '487 patent lie, the claims include a first lens as a limitation and these limitations must be supported by the 2011 application in order for the claim to benefit from the priority date of the 2011 application.

We disagree with Patent Owner's argument that "the Petition is asserting a claim construction argument that the 'first lens element' recited in the challenged claims should be restricted to a positive refractive power." Prelim. Resp. 29. In fact, Petitioner explicitly argues the opposite, stating that "the full scope of the Challenged Claims encompasses a first lens element having *either* positive refractive power or negative refractive power." Pet. 30.

Finally, for the reasons explained above, we disagree with Patent Owner's argument that Petitioner has not carried its burden in showing that the '478 patent does not benefit from the priority date of the 2011 application.

Chen359 was published May 24, 2012, more than one year before the filing date of the '487 patent. Therefore, at this stage of the proceeding, we determine that Chen359 is prior art to the '487 patent.

*3. Analysis of Claim 1*

Petitioner argues embodiment 8 of Chen359 discloses the preamble and the recited limitations of claim 1. Pet. 39–50.

For example, the preamble recites "An optical imaging system comprising five lens elements, the five lens elements being, in order from an object side to an image side." Petitioner argues "Chen359 discloses 'an optical imaging system compris[ing]' five lens elements arranged 'in order from an object side to an image side.'" Pet. 39 (citing Ex. 1006 ¶ 8).

Limitation 1.2 recites "a first lens element." Petitioner argues "Chen359 Embodiment 8 includes a first lens element 810." Pet. 39 (citing Ex. 1006 ¶¶ 155, 157, Fig. 8A.

Limitation 1.3 recites "a second lens element having positive refractive power." Petitioner argues "Chen359 Embodiment 8 includes a second lens element 820" that Table 8-2 shows has a positive focal length of 2.89mm, thus indicating a second lens with positive refractive power. Pet. 40–42 (citing Ex. 1006 ¶ 157, Table 8-2, Fig. 8A; Ex. 1003 ¶ 120–121).

Limitation 1.4 recites "a third lens element having negative refractive power." Petitioner argues "Chen 359 Embodiment 8 includes a third lens element 830" that Table 8-2 shows has a negative focal length of -1.26mm, thus indicating a third lens with negative refractive power. Pet. 42–44 (citing Ex. 1006 ¶¶ 155, 157, Table 8-2, Fig. 8A).

Limitation 1.5 recites "a fourth lens element with positive 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." Petitioner argues "Chen359 Embodiment 8 includes a 'fourth lens element' with 'positive refractive power.'" Pet. 44 (citing Ex. 1006 ¶ 155, Fig. 8A). According to Petitioner, fourth lens element 840 has a positive

focal length of 0.84mm which indicates a positive refractive power. *Id.* (citing Ex. 1006 Table 8-2). Petitioner further argues that Chen359's Figure 8A and Table 8-2 confirm that fourth lens 840 has a concave object-side surface and a convex image-side surface. *Id.* at 45–46.

Limitation 1.6 recites "a fifth lens element with negative refractive power having an object-side surface being convex in a paraxial region thereof and an image-side surface being concave in a paraxial region thereof, wherein at least one of the object-side surface and the image-side surface of the fifth lens element is aspheric, and the image-side surface of the fifth lens element has at least one inflection point." Petitioner argues "Chen359 Embodiment 8 includes a 'fifth lens element' with 'negative refractive power.'" Pet. 46 (citing Ex. 1006 ¶ 155). According to Petitioner Figure 8A of Chen359 and its associated description "depicts the fifth lens element 850 with a convex object-side surface, a concave image-side surface, aspheric object- and image-side surfaces, and at least two inflection points on the image-side surface." *Id.* at 46–47 (citing Ex. 1006 ¶¶ 155–156, Fig. 8A). Petitioner argues that Table 8-2 confirms "that the object-side surface (Surface 10) is concave because the curvature radius is positive, the image-side surface (Surface 11) is convex because the curvature radius is positive, the object- and image-side surfaces are aspheric (ASP), and the refractive power is negative because the focal length is negative." *Id.*

Limitation 1.7 recites:

> wherein a central thickness of the first lens element is larger than an axial distance between the third lens element and the fourth lens element, an Abbe number of the first lens element is V1, an Abbe number of the third lens element is V3, a radius of curvature of the image-side surface of the fifth lens element is R10, a focal length of the optical imaging system is f, and the

> following conditions are satisfied: $29<V1-V3<45$; and $0.1<R10/f<0.5$.

Petitioner argues Table 8-2 shows that embodiment 8 has a first lens with central thickness of 0.432mm that is larger than an axial distance of 0.071mm between the third and fourth lens elements. Pet. 48–49. Petitioner argues that Table 8-2 shows an Abbe number of the first lens as V1=55.9 and an Abbe number of the third lens as V3=23.4, resulting in V1-V3=32.5 which, according to Petitioner, satisfies the claimed condition of $29<V1-V3<45$. *Id.* at 49. Petitioner argues that Table 8-2 shows a curvature radius of the image-side surface of the fifth lens (R10 = 0.58537mm) (Surface #11) and a focal length (f=2.00mm) that result in R10/f=0.29, satisfying the condition $0.1<R10/f<0.5$. *Id.* at 49–50 (citing Ex. 1006 ¶ 157, Table 8-2; Ex. 1003 ¶ 128).

Patent Owner does not separately dispute Petitioner's contentions for any of these aforementioned limitations and instead relies on the arguments that we have already analyzed above. *See* Prelim. Resp. 34. Having reviewed the arguments and evidence of the present record, at this stage of the proceeding, for the reasons provided by Petitioner, we determine Petitioner has set forth sufficient evidence and reasoning establishing a reasonable likelihood that Chen359 discloses the preamble[2] and each of the limitations of claim 1 and therefore anticipates claim 1.

*4. Remaining Challenged Claims*

Petitioner contends claims 2, 6–10 are anticipated by Chen359 and provides evidence and reasoning supporting its contentions. Pet. 50–58. Patent Owner does not separately dispute Petitioner's contentions for these

[2] Because we determine Chen359 teaches the preamble, we need not determine at this juncture whether the preamble is limiting.

claims. We determine Petitioner has presented sufficient evidence to establish that Chen359 discloses the limitations of the remaining challenged claims.

### *E. Obviousness over Tanaka and Bareau*

Petitioner argues claims 1, 2, and 6–10 would have been obvious over Tanaka and Bareau. Pet. 58–101. Below we provide a brief overview of Tanka and Bareau and then analyze Petitioner's contentions in light of Patent Owner's arguments.

#### *1. Overview of Tanaka*

Tanaka relates to an imaging lens for a small-size image pickup apparatus using solid state image pickup device, such as a Charge Coupled Devices (CCD) type image sensor and a Complementary Metal-Oxide Semiconductor (CMOS) type image sensor. Ex. 1007 ¶ 2. Tanaka discloses that its imaging lens may be used in a compact and thin electronic device, such as a mobile phone. *Id.* ¶ 3. With the small size of such mobile device, Tanaka explains that "there is a strong demand for both miniaturization and high definition." *Id.*

Tanaka discloses several examples of its invention. Figure 5 of Tanaka is reproduced below.

FIG. 5

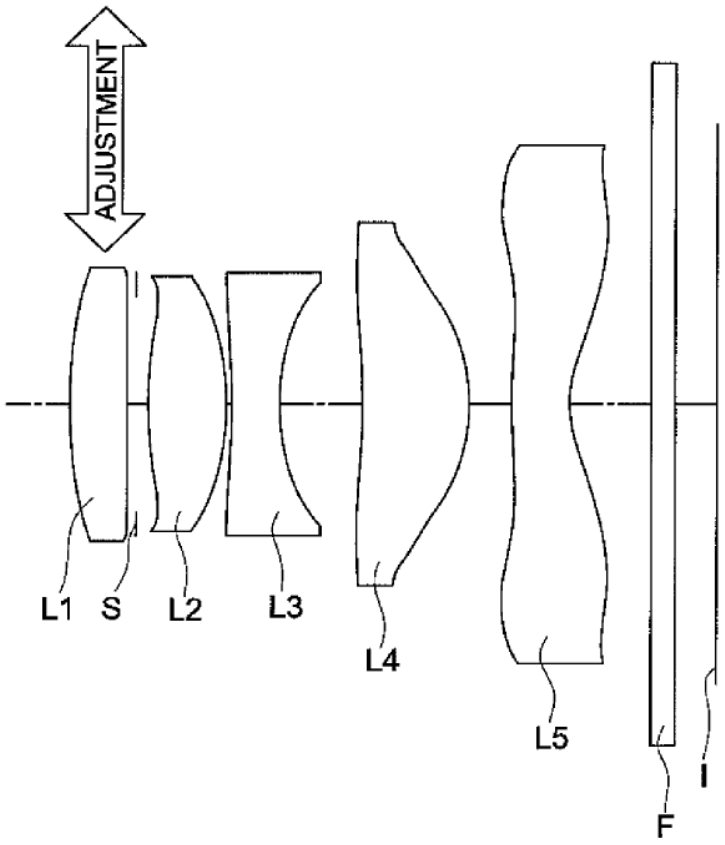


Figure 5 above illustrates a sectional view of an imaging lens of a first example of Tanaka. Ex. 1007 ¶ 72. In Figure 5

> L1 indicates a positive first lens that can be adjusted in the direction perpendicular to the optical axis, L2 indicates a positive second lens, L3 indicates a negative third lens, L4 indicates a positive fourth lens, L5 indicates a negative fifth lens on the most image side, S indicates an aperture diaphragm arranged between L1 and L2, and "I" indicates an image pickup surface. The rear lens group is the lenses L2-L5. F indicates a parallel plate assumed to be an optical low pass filter, an IR cut filter and a seal glass of a solid state image pickup device.

*Id.* ¶ 72.

The lens data of the first example is shown in Table 1, part of which is reproduced below.

TABLE 1

First example
f = 5.910 mm fB = 0.536 mm F = 2.0 2Y = 7.2 mm

| Surface number | R (mm) | D (mm) | Nd | νd |
|---|---|---|---|---|
| 1* | 6.603 | 0.688 | 1.5305 | 55.7 |
| 2* | −44.176 | 0.100 | | |
| 3 (aperture diaphragm) | ∞ | 0.152 | | |
| 4* | 6.390 | 0.977 | 1.5305 | 55.7 |
| 5* | −4.395 | 0.050 | | |
| 6* | 42.925 | 0.600 | 1.5834 | 30.2 |
| 7* | 2.268 | 1.020 | | |
| 8* | −14.845 | 1.331 | 1.5305 | 55.7 |
| 9* | −1.779 | 0.531 | | |
| 10* | 8.019 | 0.715 | 1.5305 | 55.7 |
| 11* | 1.595 | 1.000 | | |
| 12 | ∞ | 0.300 | 1.5168 | 64.2 |
| 13 | ∞ | | | |

### *2. Overview of Bareau*

Bareau is a paper by Jane Bareau and Peter P. Clark titled "The Optics of Miniature Digital Camera Modules" published August 30, 2006 by the Optical Society of America and the International Society for Optical Engineering. Ex. 1011, ii, 1. Bareau is focused on the challenges of designing cell phone camera systems created by their small scale. *Id.* at 1. Bareau provides the typical lens specifications for ¼ inch sensor format:

| | |
|---|---|
| FOV | 60 degrees |
| Image Circle | 4.6 mm |
| TTL | 5.0 mm |
| f/no | f/2.8 |
| Distortion | <2% |
| Chief Ray Angle | <22 degrees |
| Relative Illumination | >50% |

*Id.* at 3. Bareau explains that the total track length (TTL) is the distance from the front of the barrel to the image plane and that it is "extremely important to the cell phone designers because of the market pressure to produce thinner phones." *Id.*

*3. Combination of Tanaka with Bareau*

Petitioner argue that a "POSITA implementing Tanaka Example 1 would have been motivated to make the system as compact as possible, while still maintaining good image quality." Pet. 64 (Ex. 1003 ¶ 143). According to Petitioner "to achieve this compactness, the POSITA would have optimized the design to shorten TTL by decreasing larger air gaps between lens elements and reducing the Abbe number of [the] L3 lens." *Id.*

As support, Petitioner points out that "Tanaka itself notes the '***strong demand for both miniaturization*** and high definition'" (Pet. 64 citing Ex. 1007 ¶ 3) and that "Tanaka aims to create an optical lens system 'for a ***small-size image pickup apparatus***'" (*id.* (citing Ex. 1007 ¶ 7)). But "[w]hile Tanaka teaches generally to miniaturize the lens system, Bareau provides specific teachings on how to do so. *Id.* at 65. Petitioner argues that Bareau teaches achieving miniaturization or compactness by shortening TTL. Pet. 64 (citing Ex. 1011, 3). For example, Bareau "notes that 'lens designers are being pressured to design lenses with shorter and shorter TTLs'" (*id.* 64–65 (quoting Ex. 1011, 11)) and "explains how TTL was 'extremely important to the cell phone designers because of the market pressure to produce thinner phones'" (*id.* citing Ex. 1011, 3).

Based on the aforementioned teachings of Tanaka and Bareau, Petitioner argues that "[a] POSITA implementing Tanaka would have been motivated, based on Bareau's teachings, to decrease the total track length . . . as much as possible . . . given the market pressure for 'shorter and shorter TTLs.'" Pet. 65 (citing Ex. 1011, 3, 11; Ex. 1003 ¶ 144; Ex. 1013, 3). Petitioner argues that "[i]n reducing TTL, a POSITA knew to focus on decreasing large airspaces and thick lenses" and thus would have focused on "reducing the large air gaps between the third, fourth, and fifth lenses, with

the predictable result of reducing the TTL." *Id.* at 67 (citing Ex. 1003 ¶ 147; Ex. 1012, 88; Ex. 1010, 45). According to Petitioner, in reducing airspaces, a POSITA would have noted that the image-side curvature of third lens L3 was an impediment to reducing the gap between L3 and L4 and thus an impediment to reducing TTL. *Id.* at 70 ¶¶ 149–150. Petitioner argues that a POSITA would know that one common way to reduce a negative lens's surface curvature was to decrease its Abbe number and thus a POSITA would have been motivated to implement L3 with a lower Abbe number. *Id.* at 70–71 (citing Ex. 1010, 52; Ex. 1003 ¶¶ 150–151).

Additionally, Petitioner argues that because L1 and L3 function together as an achromat a POSITA would choose a material with an Abbe number of 23.4 for the third lens L3 in order to reduce chromatic aberrations with a reasonable expectation of success. Pet. 71–72 (citing Ex. 1003 ¶ 152; Ex. 1007 ¶¶ 72, 73). This is in light of Tanaka disclosing a negative lens with an Abbe number of 23.4 for its fourth example. *Id.* at 72 (citing Ex. 1007 ¶¶ 77, 78; Ex. 1003 ¶ 153).

Petitioner argues that ZEMAX modeling shows that reducing the axial distances between the third, fourth, and fifth lenses, implementing the third lens with a material having an Abbe number of 23.4 and reducing its image-side curvature, and performing routine system optimization results in a more compact lens system with good performance. Pet. 72 (citing Ex. 1003 ¶ 154).

Patent Owner argues Petitioner's modification of Tanaka in light of Bareau is driven by hindsight. Prelim. Resp. 40–52. Patent Owner argues that beyond simply scaling down the embodiment of Tanaka's first example, Petitioner "changed the radii of curvature of all lens surfaces, the air gap between the second and third lens elements ("T23") (referenced in claim 6),

the air gap between the third and fourth lens elements ("T34") (referenced in claims 1 and 7), the air gap between the fourth and fifth lens elements ("T45") (referenced in claim 6), and the material of the third lens." *Id.* at 45. At the same time, according to Patent Owner, Petitioner failed to change the air gap between the first and second lens or to reduce the thickness of any of the lenses, something a POSITA would have done if they were motivated to reduce TTL as alleged by Petitioner. *Id.* at 47. Similarly, Patent Owner argues that Petitioner actually increased the air gap between lenses two and three just to satisfy the requirements of claim 6. *Id.* at 50–51 (citing Ex. 2001 ¶¶ 54–55). In addition to the changes outlined above, Patent Owner argues that Petitioner's modifications also lead to a smaller focal length, but Petitioner does not explain what would have motivated a POSITA to use a smaller focal length in its alleged optimization, according to Patent Owner. Prelim. Resp. 49–50 (citing Ex. 2001 ¶ 52). Thus, Patent Owner argues that Petitioner used the challenged claims as a template to create the proposed modification to Tanaka's Example 1 embodiment. *Id.* at 47, 52.

Patent Owner further argues that the modifications to Tanaka proposed by Petitioner are inconsistent with the references Petitioner relies upon to support those modifications. Prelim. Resp. 53–56. For example, Patent Owner argues that Schaub's teaching of decreasing air gaps applies in the context of splitting a lens or adding a lens and involves not just decreasing spacing but also decreasing lens thickness, both of which are not present in Petitioner's proposed modifications. *Id.* at 53–54 (citing Ex. 1012, 88). Similarly, according to Patent Owner Smith also teaches decreasing airspaces *and* decreasing lens thickness. *Id.* at 54–55 (citing Ex. 1010, 45). Thus, according to Patent Owner, a POSITA following the

techniques of Smith and Schaub would have decreased the thickness of Tanaka's lenses and all possible air gaps, instead of decreasing only the air gaps required to satisfy the challenged claims. *Id.* at 56.

Patent Owner argues that Petitioner's proposed modification to Tanaka is completely different than the design of Tanaka's first example, and thus a new system altogether generated by Petitioner in 2022. Prelim. Resp. 63. As such it is not proper prior art according to Patent Owner. *Id.* Additionally, Patent Owner argues that Petitioner has not established that it used lens design software contemporary to the priority date of the challenged claims in generating the modified Tanaka system. *Id.*

Based on a review of the current record, we determine Petitioner has made a sufficient showing of reasonable likelihood that a POSITA would have combined the teachings of Tanaka and Bareau as proposed by Petitioner. We find persuasive Petitioner's contention that in view of both Tanaka and Bareau, a POSITA would have been motivated to miniaturize Tanaka's first example in order to create a system for use in cell phones. Tanaka itself explains the trend of thin and compact mobile phones that led to a strong demand for miniaturization and high definition of the image pickup apparatus in those phones. Ex. 1007 ¶¶ 2–3. Bareau also focuses on cell phone cameras and identifies their compact size as the primary challenge in their design. Ex. 1011, 1–3. We also agree with Petitioner that in order to create a compact system, a POSITA would have been motivated to shorten the system's TTL and would do so in a variety of ways including by decreasing the air gaps between the various lenses of the system. Petitioner's contentions are supported by Bareau which states that the TTL is "extremely important to the cell phone designers because of the market pressure to produce thinner phones." Ex. 1011, 3. Dr. Milster also provides

credible testimony in this regard, stating that "[i]n reducing TTL, a POSITA knew to focus on decreasing large airspaces and thick lenses." Ex. 1003 ¶ 147 (citing Ex. 1010, 45). This applies to "the substantial air gaps between the third and fourth lenses (L3-L4) and the fourth and fifth lenses (L4-L5)." *Id.* ¶ 148. Further, Dr. Milster testifies that "the image-side curvature of third lens L3 was an impediment to reducing the gap between L3 and L4" and that therefore a POSITA would have been motivated to reduce its surface curvature by decreasing its Abbe number and that 23.4 would be a suitable Abbe number for the third lens. *Id.* ¶¶ 150–152.

Although we determine Petitioner has demonstrated a reasonable likelihood, for purposes of institution, that a POSITA would have combined the teachings of Tanaka and Bareau, we find that by arguing Petitioner's contentions are driven by hindsight, Patent Owner raises issues worthy of further development by the parties at trial consistent with our rules.

*4. Claim 1*

*a) [1.1] – An optical imaging system comprising five lens elements, the five lens elements being, in order from an object side to an image side: [1.2] a first lens element; [1.3] a second lens element having positive refractive power; [1.4] a third lens element having negative refractive power; [1.5] a fourth lens element with positive 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; and [1.6] a fifth lens element with negative refractive power having an object-side surface being convex in a paraxial region thereof and an image-side surface being concave in a paraxial region thereof, wherein at least one of the object-side surface and the image-side surface of the fifth lens element is aspheric, and the image-side surface of the fifth lens element has at least one inflection point*

Regarding the preamble, Petitioner argues that Example 1 of Tanaka, as shown in Figure 5 of Tanaka includes five lens elements arranged in order

from an object side to an image side as shown in Figure 5 of Tanaka. Pet. 74 (citing Ex. 1007 ¶ 7).

With respect to limitation 1.2, Petitioner argues that Tanaka discloses a first lens L1 also shown in Figure 5 of Tanaka. *Id*. at 75 (citing Ex. 1007 ¶ 72).

Regarding limitation 1.3, Petitioner further argues that Tanaka discloses a positive second lens with positive refractive power as confirmed by Figure 5 and by the fact that it has a positive focal length. *Id.* at 76 (citing Ex. 1007 ¶ 73, Fig. 5).

Regarding limitation 1.4, Petitioner argues Tanaka discloses a third lens with negative refractive power as confirmed by the fact that it has negative focal length. *Id.* at 77–78 (citing Ex. 1007 ¶¶ 72–73).

With respect to limitation 1.5, Petitioner argues Tanaka discloses a fourth lens with positive refractive power as confirmed by the fact that it has a positive focal length. *Id.* at 79–80 (citing Ex. 1007 ¶ 73). Furthermore, Petitioner argues that the fourth lens has a concave object-side surface and a convex image-side surface as confirmed by the radii of curvature of the respective surfaces listed in Table 1. *Id*. 80 (citing Ex. 1007 ¶ 72, Table 1).

Regarding limitation 1.6, Petitioner argues Tanaka discloses a fifth lens with negative refractive power as confirmed by the fact that it has a negative focal length. *Id.* at 81–82 (citing Ex. 1007 ¶ 73; Ex. 1003 ¶¶ 167–168). Furthermore, Petitioner argues that the fifth lens has a convex object-side surface and a concave image-side surface as confirmed by the radii of curvature of the respective surfaces listed in Table 1. *Id*. 83 (citing Ex. 1007 ¶ 72, Table 1). Petitioner argues that Table 1 also confirms that the object and image side surfaces are aspheric as denoted by the asterisk next to their surface numbers in Table 1. *Id.* at 83 (citing Ex. 1007 ¶ 72, Table 1).

Petitioner argues that these surfaces remain aspheric even after being modified as proposed by Petitioner. *Id.* 85 (citing Ex. 1003 ¶ 170).

Patent Owner does not separately dispute Petitioner's contentions for the preamble and limitations 1.2–1.6. At this stage of the proceeding we determine, for the reasons summarized above, that Petitioner has demonstrated a reasonable likelihood that Tanaka and Bareau teach the preamble and limitations 1.2–1.6.

*b) [1.7] wherein a central thickness of the first lens element is larger than an axial distance between the third lens element and the fourth lens element, an Abbe number of the first lens element is V1, an Abbe number of the third lens element is V3, a radius of curvature of the image-side surface of the fifth lens element is R10, a focal length of the optical imaging system is f, and the following conditions are satisfied: 29<V1–V3<45; and 0.1<R10/f<0.5*

As explained above in our analysis of whether a POSITA would have been motivated to combine Tanaka with Bareau, Petitioner argues that a POSITA would have been motivated to reduce air gaps between lenses in Tanaka to shorten its TTL. Pet. 67, 70, 87 (citing Ex. 1003 ¶¶ 147, 149–150; Ex. 1012, 88; Ex. 1010, 45). Petitioner argues that "this would have resulted in an axial distance between the third lens element and the fourth lens element less than the thickness of Lens 1 L1." *Id.* at 87–89 (citing Ex. 1003 ¶ 173). Specifically, after the modifications Petitioner argues that the thickness of Tanaka lens L1 is 0.37241mm and the distance between L3 and L4 is 0.27065mm. *Id.* at 89 (citing Ex. 1003 ¶ 174). Thus, the central thickness of the first lens element is larger than the axial distance between the third lens element and the fourth lens element. *Id.*

Furthermore, as explained above, Petitioner argues that a POSITA would have been motivated to implement L3 of Tanaka Example 1 using a material having an Abbe number of 23.4 in order to achieve shorter TTL and

a better overall state of correction. *Id*. 89–90. According to Petitioner, doing so "would have resulted in V3=23.4 and thus V1–V3 = 55.7–23.4 = 32.3 which would satisfy the requirement of *29<V1–V3<45*. *Id*. at 89–90 (citing Ex. 1003 ¶ 175).

Finally, Petitioner argues that Tanaka discloses a focal length f = 5.910mm, and a radius of curvature of the image-side surface (Surface number 11) of the fifth lens L5 of 1.595mm. Pet. 90 (citing Ex. 1007 ¶ 72, Table 1). Thus, R10/f = 0.2699 which satisfies the requirement of 0.1<R10/f<0.5.

Patent Owner argues that "Smith makes clear that the general preference for higher index applies to positive elements but not necessarily to negative elements." Prelim. Resp. 58 (citing Ex. 1010, 51–52).[3] Similarly, Patent Owner argues that Tanaka itself shows a lack of preference for using higher index for negative lens elements. *Id.* (citing Ex. 1007 ¶¶ 73, 75, 76, 78, 80, 82, 84; Ex. 2001 ¶ 65). In addition, Patent Owner argues that "Smith never equates higher index to lower Abbe number." *Id.* at 59 (citing Ex. 1010, 52; Ex. 2001 ¶ 65). Based on this, Patent Owner argues "[b]ecause increasing refractive index is not equivalent to decreasing Abbe number, a POSITA would not necessarily have decreased the Abbe number of Tanaka's L3 in furtherance of Smith's teaching of increasing refractive index." *Id.* at 62. Consequently, "[w]ithout any clear motivation to decrease the Abbe number of Tanaka's L3, a POSITA would not have decreased the

[3] Patent Owner's argument appears in the section of its Preliminary Response disputing Petitioner's motivation to modify Tanaka in view of Bareau. *See* Prelim. Resp. 56–62. We feel this argument is better addressed as part of our analysis of limitation 1.7. The context in which we address Patent Owner's argument does not affect our analysis.

Abbe number of Tanaka's L3 and would therefore not have arrived at a design in which "29<*V*1-*V*3<45" as required by claim 1." *Id.* (citing Ex. 2001 ¶ 69).

At this stage of the proceeding, we determine Petitioner has demonstrated a reasonable likelihood that Tanaka and Bareau teach limitation 1.7 for the reasons summarized above and in our analysis Petitioner's combination of Tanaka and Bareau. Specifically, on the current record, we find Patent Owner's argument that a POSITA would not have been motivated to decrease the Abbe number of Tanaka's lens L3 to be unavailing. Instead, for purposes of institution, we are persuaded on the current record that a POSITA would have been motivated to decrease the Abbe number of L3 in Tanaka's Example 1 in order to shorten the TTL of the lens system. Petitioner supports its argument with testimony from Dr. Milster who states that a "POSITA knew that one common way to reduce a negative lens's surface curvature was to decrease its Abbe number." Ex. 1003 ¶ 150. Addressing Patent Owner's argument that a POSITA would not have been motivated to decrease lens L3's Abbe number because L3 is a negative lens element (Prelim. Resp. 58), Dr. Milster testifies that "[i]t was well-known that for negative lenses (such as L3), 'in general, a higher index is better,' thus meaning a lower Abbe number is better." Ex. 1003 ¶ 151 (citing Ex. 1010, 52). Dr. Milster further testifies that "a POSITA would have recognized that positive-powered, high-Abbe L1 and negative-powered, low-Abbe L3 functioned together as an airspaced achromatic doublet" and that therefore, "[t]his would have further motivated a POSITA to choose a material with an Abbe number of 23.4 for the third lens L3 in order to increase the difference V1-V3 in order to reduce chromatic aberrations with a reasonable expectation of success."

Accordingly, at this stage of the proceeding, we determine Petitioner has demonstrated a reasonable likelihood that Tanaka and Bareau teach limitation 1.7. Patent Owner's arguments that a POSITA would not have decreased the Abbe number of Tanaka's third lens, however, raises issues that the parties may wish to develop further at trial.

*5. Remaining Dependent Claims*

Petitioner contends claims 2, 6–10 would have been obvious in light of the combination of Tanaka and Bareau and provides evidence and reasoning supporting its contentions. Pet. 91–101. Patent Owner does not separately dispute Petitioner's contentions for these claims. We determine Petitioner has presented sufficient evidence to establish that the combination of Tanaka and Bareau teaches the limitations of the remaining challenged claims.

## V. CONCLUSION

Petitioner has demonstrated a reasonable likelihood of prevailing in showing the unpatentability of at least one challenged claim of the '487 patent. At this stage of the proceeding, however, we have not made a final determination with respect to the patentability of the challenged claims.

## VI. ORDER

For the foregoing reasons, it is

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review of claims 1, 2, 6–10 of the '487 patent is instituted with respect to all grounds of unpatentability set forth in the Petition; and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4(b), *inter partes* review of the '487 patent shall commence

on the entry date of this Order, and notice is hereby given of the institution of a trial.

For PETITIONER:

Andrew Mason
Todd Siegel
Roy Chamcharas
Michael Loy
Frank Morton-Park
Sara Slabisak
KLARQUIST SPARKMAN, LLP
andrew.mason@klarquist.com
todd.siegel@klarquist.com
roy.chamcharas@klarquist.com
michael.loy@klarquist.com
frank.morton-park@klarquist.com
sara.slabisak@klarquist.com

For PATENT OWNER:

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