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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC., Petitioner,

v.

COREPHOTONICS LTD., Patent Owner.

> IPR2018-01146 Patent 9,568,712 B2

Before MARC S. HOFF, BRYAN MOORE, and MONICA S. ULLAGADDI, *Administrative Patent Judges*.

ULLAGADDI, Administrative Patent Judge.

JUDGMENT Final Written Decision 35 U.S.C. § 318(a)

I. INTRODUCTION

Apple Inc. ("Petitioner") requested an *inter partes* review of claims 1, 2, 6, 7, 12–17, and 19 (the "challenged claims") of U.S. Patent No. 9,568,712 B2 (Ex. 1001, "the '712 patent"). Paper 2 ("Petition" or "Pet."). Corephotonics Ltd. ("Patent Owner") did not file a Preliminary Response.

On December 7, 2018, we entered a Decision on Institution ("Inst. Dec." Paper 8) instituting an *inter partes* review as to all of the challenged claims on all of the grounds set forth in the Petition.

After institution of trial, Patent Owner filed a Patent Owner Response ("PO Resp." Paper 14)¹, to which Petitioner filed a Reply ("Reply" Paper 22). Thereafter, Patent Owner filed a Sur-Reply ("Sur-Reply" Paper 24). A hearing was held on October 8, 2019 for this proceeding and for IPR2018-01140 and IPR2018-01133. The transcript of the hearing has been entered into the record. Paper 31 ("Transcript" or "Tr."). On October 28, 2019, we ordered additional briefing on matters concerning claim construction and enablement in the context of anticipation. Paper 30 ("Order"). Petitioner and Patent Owner filed opening briefs (Paper 32 (Petitioner), Paper 33 (Patent Owner)) and responsive briefs (Paper 34 (Petitioner), Paper 35 (Patent Owner)).

We have jurisdiction under 35 U.S.C. § 6. This final written decision is issued pursuant to 35 U.S.C. § 318(a).

¹ We refer to the corrected Patent Owner Response, the earlier-filed Patent Owner Response (Paper 13) having been inadvertently submitted and thereafter expunged.

II. BACKGROUND

A. Related Proceedings

The '712 patent is asserted in *Corephotonics Ltd. v. Apple Inc.*, 5-17cv-06457 (N.D. Cal.) filed November 6, 2017, and in *Corephotonics Ltd. v. Apple Inc.*, 3-18-cv-02555 (N.D. Cal.) filed April 30, 2018. Pet. 1–2; Paper 4, 2.

This proceeding is related to IPR2018-01140 ("the 1140IPR"), an *inter partes* review proceeding instituted based on Petitioner's challenge to U.S. Patent No. 9,402,032 ("the '032 patent"). This proceeding is also related to IPR2019-00030, an *inter partes* review proceeding instituted based on Petitioner's challenge to U.S. Patent No. 9,857,568 ("the '568 patent").

The '712, '032, and '568 patents are part of a chain of continuity that includes PCT/IB2014/062465.

B. The '712 Patent (Ex. 1001)

The '712 patent issued on February 14, 2017 based on an application filed June 1, 2016, which claimed priority back to a provisional application filed July 4, 2013.² Ex. 1001, [63]. The '712 patent concerns an optical lens assembly with five lens elements. *Id.* at [57]. Figure 1A of the '712 patent is reproduced below.

² Because the effective filing date of this patent is March 16, 2013 or later, post-AIA § 103 applies to this proceeding.



FIG. 1A

Figure 1A of the '712 patent illustrates an arrangement of lens elements in a first embodiment of an optical lens system.

In order from an object side to an image side, optical lens assembly 100 comprises: optional stop 101; first plastic lens element 102 with positive refractive power having a convex, object-side surface 102*a*; second plastic lens element 104 with negative refractive power having a meniscus, convex, object-side surface 104*a*; third plastic lens element 106 with negative refractive power having a concave, object-side surface 106*a*; fourth plastic lens element 108 with positive refractive power having a positive meniscus with a concave, object-side surface 108*a*; fifth plastic lens element 110 with negative refractive power having a negative meniscus with a concave, object-side surface 108*a*; fifth plastic lens element 110 with negative refractive power having a negative meniscus with a concave, object-side surface 108*a*; fifth plastic lens element 110 with negative refractive power having a negative meniscus with a concave, object-side surface 110*a*. *Id*. at 2:63–3:11.

In Table 1, reproduced below, the '712 patent discloses radiuses of curvature, R, for the lens elements, lens element thicknesses and/or distances between each of the lens elements, and a refractive index, Nd, for each lens element.

#	Comment	Radius R [mm]	Distances [mm]	Nd/Vd	Diameter [mm]
1	Stop	Infinite	-0.466		2.4
2	L11	1.5800	0.894	1.5345/57.095	2.5
3	L12	-11.2003	0.020		2.4
4	L21	33.8670	0.246	1.63549/23.91	2.2
5	L22	3.2281	0.449		1.9
6	L31	-12.2843	0.290	1.5345/57.095	1.9
7	L32	7.7138	2.020		1.8
8	L41	-2.3755	0.597	1.63549/23.91	3.3
9	L42	-1.8801	0.068		3.6
10	L51	-1.8100	0.293	1.5345/57.095	3.9
11	L52	-5.2768	0.617		4.3
12	Window	Infinite	0.210	1.5168/64.17	3.0
13		Infinite	0.200		3.0

TABLE 1

Table 1 of the '712 patent sets forth optical parameters for the optical lens assembly.

The '712 patent discloses that,

[T]he distances between various elements (and/or surfaces) are marked "Lmn" (where m refers to the lens element number, n=1 refers to the element thickness and n=2 refers to the air gap to the next element) and are measured on the optical axis z, wherein the stop is at z=0. Each number is measured from the previous surface. Thus, the first distance -0.466 mm is measured from the stop to surface 102*a*, the distance L11 from surface 102*a* to surface 102*b* (i.e. the thickness of first lens element 102) is 0.894 mm, the gap L12 between surfaces 102*b* and 104*a* is 0.020 mm, the distance L21 between surfaces 104*a* and 104*b* (i.e. thickness d2 of second lens element 104) is 0.246 mm, etc. Also, L21=d₂ and L51=d₅.

Id. at 3:54–67.

C. Challenged Claims

Claims 1 and 15 are independent. Challenged claims 2, 6, 7, and 12– 14 depend from claim 1. Challenged claims 16, 17, and 19 depend from claim 15. Independent claims 1 and 15 are reproduced below.

> 1. A lens assembly, comprising: a plurality of refractive lens elements arranged along an optical axis, wherein at least one surface of at least one of the plurality of lens elements is aspheric, wherein the lens assembly has an effective focal length (EFL), a total track length (TTL) of 6.5 millimeters or less and a ratio TTL/EFL of less than 1.0, and wherein the plurality of lens elements comprises, in order from an object side to an image side, a first lens element with a focal length f1 and positive refractive power, a second lens element with a focal length f2 and negative refractive power and a third lens element with a focal length f3, the focal length f1, the focal length f2 and the focal length f3 fulfilling the condition $1.2 \times |f3| > |f2| > 1.5 \times f1$.

Ex. 1001, 7:55–67.

15. A lens assembly, comprising: a plurality of refractive lens elements arranged along an optical axis, wherein the lens assembly has an effective focal length (EFL) and a total track length (TTL) smaller than the effective focal length (EFL), the plurality of refractive lens elements comprising, in order from an object plane to an image plane along the optical axis, a first lens element having positive optical power, a pair of second and third lens elements having together a negative optical power, and a combination of fourth and fifth lens elements, the fourth lens element separated from the third lens element by an air gap greater than TTL/5.

Id. at 8:62–9:6.

D. Proposed Grounds of Unpatentability

Petitioner advances the following challenges supported by the first and second declarations of Dr. José Sasián (Exs. 1003, 1026).

Claims Challenged	35 U.S.C. §	Reference(s)
1, 2, 7, 12, 13, 15,	§ 102	Konno ³
16, 19		

³ Ex. 1015, English Translation of JP 2013-106289 published May 30, 2013 ("Konno"). The original publication in Japanese is Exhibit 1014.

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Claims Challenged	35 U.S.C. §	Reference(s)
6, 14	§ 103	Konno and Bareau ⁴
15–17	§ 102	Eggert ⁵

Patent Owner supports its Patent Owner Response and Sur-Reply with the declaration of Dr. Duncan Moore (Ex. 2013).

III. ANALYSIS

A. Claim Construction

For petitions filed before November 13, 2018, claims of an unexpired patent that will not expire before issuance of a final written decision are interpreted using the broadest reasonable interpretation in light of the specification. *See* 37 CFR § 42.100(b) (2017); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016). As the present Petition was filed in May of 2018, this standard applies.

Under the broadest reasonable construction standard, claim terms generally are given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire disclosure. *See In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). The claims, however, "'should always be read in light of the specification and teachings in the underlying patent," and "[e]ven under the broadest reasonable interpretation, the Board's construction 'cannot be divorced from the specification and the record evidence." *Microsoft Corp. Proxyconn, Inc.*, 789 F.3d 1292, 1298 (Fed. Cir. 2015) (citations omitted). Further, any special definition for a claim term must be set forth in the

⁴ Ex. 1012, *The Optics of Miniature Digital Cameras* by Jane Bareau et al., SPIE Proceedings Volume 6342, *International Optical Design Conference* 2006; 63421F (2006) ("Bareau").

⁵ Ex. 1013, U.S. Patent No. 3,388,956 issued June 18, 1968 ("Eggert").

specification with reasonable clarity, deliberateness, and precision. *See In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994). In the absence of such a definition, limitations are not to be read from the specification into the claims. *See In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993).

We address below Petitioner's and Patent Owner's proposed constructions for the terms "effective focal length," "total track length," and "optical power."

1. Effective Focal Length (EFL)

Independent claims 1 and 15 each recite "wherein the lens assembly has an effective focal length (EFL)." Petitioner contends that although the specification of the '712 patent does not expressly define EFL, "its meaning is well known in the art, as exemplified in Li (Ex. 1007), which states that '[t]he focal length of a lens assembly [is] also referred to as the effective focal length[.]" Pet. 10 (quoting Ex. 1007, 2:59–60). In its Patent Owner Response, Patent Owner contends that "[t]o the extent that the Board deems construction necessary, Corephotonics does not dispute Apple's construction for the purposes of this proceeding." PO Resp. 20.

Based upon the complete trial record, Petitioner persuades us that Li supports the conclusion that the term "effective focal length" should be construed as "the focal length of a lens assembly." For the foregoing reasons, we construe the term "effective focal length" in this manner.

2. Total Track Length (TTL)

According to Petitioner, the '712 patent discloses that TTL is the "total track length on an optical axis between the object-side surface of the first lens element and the electronic sensor." Pet. 9 (quoting Ex. 1001, 1:63– 65). Petitioner contends the '712 patent discloses that "the electronic sensor

or image sensor 'is disposed at the image plane 114 for the image formation.'" *Id.* (quoting Ex.1001, 3:14–16). Petitioner further contends that "[t]his is consistent with other examples in the art," such as Chen (Ex. 1008), which states that "TTL is defined as the on-axis spacing between the object-side surface of the first lens element and the image plane when the first lens element is positioned closest to the imaged object." *Id.* (quoting Ex. 1008, 3:24–26). Petitioner also contends that the disclosure in column 1 of the '712 patent "is not an express definition," because it does not "clearly set forth a definition of the disputed claim term [sic] other than its plain and ordinary meaning." Reply 5 (quoting *Thorner v. Sony Comput. Entm't Am. LLC*, 669 F. 3d 1362, 1365 (Fed. Cir. 2012)).

Based on these contentions, Petitioner proposes that we construe TTL "to include 'the length of the optical axis spacing between the object-side surface of the first lens element and the image plane." Pet. 10 (citing Ex.1003, 18–19) (emphasis omitted). We understand Petitioner's position to encompass an image plane absent or independent of a sensor. Paper 34, 1 ("Not a single embodiment defines the image plane as the surface of a sensor. Rather, the image plane is where a sensor can be placed but is not required.") (emphasis omitted). To this end, Petitioner argues that

[P]ortions of the Specification, including the description of each embodiment, all measure "TTL" to an image plane where a sensor would be placed without requiring that a sensor be present. *See* Petitioner's Reply, Paper 22, at 5-6 (citing to Ex. 1001, 5:16-17, 6:33-34, claims 1, 15). Moreover, the term "image plane" cannot be ambiguous as Patent Owner alleges in its Sur-Reply since claim 15 recites lens elements arranged "in order from an object plane to an *image plane* along the optical axis," not to an actual image plane or a surface of a sensor.

Id. at 2 (emphasis in the original).

In our Institution Decision, we preliminarily concluded that TTL should be construed as "the length of the optical axis spacing between the object-side surface of the first lens element and the image plane." Inst. Dec. 8.

Patent Owner contends, with respect to intrinsic evidence, that "[t]he '712 patent expressly defines how a POSITA should measure the 'total track length (TTL)" based on the disclosure that "the total track length on an optical axis between the object-side surface of the first lens element and the electronic sensor is marked 'TTL'." PO Resp. 14 (quoting Ex. 1001, 1:63-65) (emphasis omitted). Based on this disclosure, Patent Owner contends that the '712 patent defines this term as "the length on an optical axis between the object-side surface of the first lens element and the electronic sensor." Id. (emphasis omitted). Patent Owner thus contends that this "definition" "takes into account all of the elements of the lens system." Id. at 15 (quoting Ex. 2013 ¶ 51). More particularly, Patent Owner contends that "[t]he '712 patent expressly instructs that if a lens system includes the lens elements as well as, for example, a glass window element, the '712 patent states that it should be included in the measurement of TTL when comparing the system to the '712 patent's claims." Id. (citing Ex. 1001, 1:55–59). Patent Owner further contends that, to the extent it is argued that the disclosure of TTL in the '712 patent fails to constitute an express definition, an explicit statement of redefinition is not required. Sur-Reply 3.

Patent Owner contends, with respect to extrinsic evidence, that Chen "provides its own express definition of . . . 'image plane.'" PO Resp. 17 (citing Ex. 1008). Patent Owner, instead, urges us to look to what it considers intrinsic evidence, Tang (Ex. 2004), a reference cited in the '712

patent. Patent Owner further urges us to consider other extrinsic evidence defining "TTL." *Id.* at 18 (citing Exs. 2005, 2006, 2007).

In its Sur-Reply, Patent Owner contends that "Apple's proposed construction introduces ambiguity as to how the TTL would be measured," because "the term 'image plane' is subject to multiple definitions whose differences materially affect the scope of the '712 patent's claims." Sur-Reply 3. Specifically, Patent Owner contends that "[w]hile 'image plane' can coincide with the physical electronic sensor, it is clear that Apple is using 'image plane' to refer to a theoretical, calculated image plane, which may differ from the location of the physical image sensor." *Id.* Patent Owner further contends that "[t]he '712 patent uses image plane to refer to the physical surface of the electronic image sensor: 'an image sensor with an image plane on which an image of the object is formed." *Id.* (quoting Ex. 1001, 1:60–62).

The Board invited the parties to provide further briefing concerning whether TTL should be construed as "the length of the optical axis spacing between the object-side surface of the first lens element and one of: an electronic sensor, a film sensor, and an image plane corresponding to either the electronic sensor or a film sensor," in light of Patent Owner's position during oral argument and in light of conflicting extrinsic definitions cited by the parties. Order, 3–4. Petitioner took issue with the Board's construction, arguing that "[n]ot a single embodiment defines the image plane as the surface of a sensor," but that, instead, "the image plane is where a sensor can be placed but is not required," as set forth above. Paper 34, 1 (emphasis omitted). Patent Owner argued that the construction proposed in the Order "should be adopted" (*see* Paper 33, 1–2) and further argued that the Board's

proposed construction does not make an image sensor a *required* element of the claims (*see* Paper 35, 1).

As both parties have noted, the '712 patent discloses that "the total track length on an optical axis between the object-side surface of the first lens element and the electronic sensor is marked 'TTL'." Ex. 1001, 1:63– 65. With respect to the sensor, the '712 patent further discloses "[a]n optical lens system incorporating the lens assembly may further include ... an *image sensor with an image plane* on which an image of the object is formed." Id. at 1:58–62 (emphasis added). The '712 patent discloses that "[t]he optical lens system further comprises . . . an image plane 114 for image formation of an object," and that "an image sensor (not shown) is disposed at image plane 114 for the image formation." Id. at 3:12–16 (emphasis added). The figures of the '712 patent do not depict a sensor, nor is a sensor mentioned with respect to other disclosures of the image plane. See id. at 5:16–17 (disclosing "an image plane 214 for image formation of an object" absent an accompanying sensor), 6:30-34 (disclosing "an image plane 214 for image formation of an object" absent an accompanying sensor).

We are not persuaded that the intrinsic evidence supports Petitioner's construction, which encompasses a TTL measured with respect to an image plane that is independent or absent a corresponding image sensor. *See* Paper 34, 1–2. Some of the disclosures of image plane in the '712 patent are accompanied by a disclosure of a sensor. *See* Ex. 1001, 1:58–62, 3:12–16.

Nor are we persuaded that the extrinsic evidence cited by Petitioner supports Petitioner's construction. Although Chen discloses that the TTL is defined with respect to "the image plane when the first lens element is

positioned closest to the imaged object," each embodiment of Chen discloses, either implicitly or explicitly, the image plane in conjunction with an image sensor. Ex. 1008, 3:24–26, 6:5–6 (disclosing "an image plane 170 disposed behind the sensor cover glass 160" with respect to Chen's first embodiment), 7:59–60 (disclosing "an image plane 370 disposed behind the sensor cover glass 360" with respect to Chen's second embodiment), 10:20– 21 (disclosing "the image plane 570 is provided with an electronic sensor on which an object is imaged" with respect to Chen's third embodiment).

With respect to Patent Owner's contentions, we are not persuaded that the cited disclosure in column 1, lines 63 through 65 of the '712 patent "clearly set[s] forth a definition of the disputed claim term' other than its plain and ordinary meaning." See Thorner v. Sony Comput. Entm't Am. LLC, 669 F.3d 1362, 1365 (quoting CCS Fitness, Inc. v. Brunswick Corp., 288 F.3d 1359, 1366 (Fed. Cir. 2002)). "We depart from the plain and ordinary meaning of claim terms based on the specification in only two instances: lexicography and disavowal." Hill-Rom Servs., Inc. v. Stryker Corp., 755 F.3d 1367, 1371 (Fed. Cir. 2014) (citing Thorner, 669 F.3d at 1365). "To act as its own lexicographer, a patentee must clearly set forth a definition of the disputed claim term other than its plain and ordinary meaning' and must 'clearly express an intent to redefine the term." Id. (citing *Thorner*, 669 F.3d at 1365). "Disavowal requires that 'the specification [or prosecution history] make[] clear that the invention does not include a particular feature,'... or is clearly limited to a particular form of the invention." Id. at 1372 (internal citations omitted).

In the present proceeding, the disclosure in column 1, lines 63 through 65 of the '712 patent is not characterized in terms of the present invention.

Id. Like in *Hill-Rom*, there is neither "disclaimer or lexicography" nor "words of manifest exclusion or restriction." *Id.* More particularly, there is no disclosure "expressing the advantages, importance, or essentiality" of measuring TTL with respect to an electronic sensor as opposed to, for example, film. *Id.* Nor is there disclosure of "language of limitation or restriction" of the TTL with respect to the electronic sensor. *Id.* Stated differently, the '712 patent specification does not describe the invention as limited to a TTL measured with respect to *only* an electronic sensor.

According to Patent Owner, TTL would have been understood by one of ordinary skill in the art at the time of the invention as having meaning(s). *See* Ex. 1025, 68:9–17 (Dr. Moore's testimony concerning how a person of ordinary skill in the art would have understood TTL to be measured with respect to film for a camera), 66:21–67:3 (Dr. Moore's testimony concerning how a person of ordinary skill in the art would have understood that TTL could have been measured prior to electronic sensors). Patent Owner's evidence supports the finding that a person of ordinary skill in the art would have further understood TTL to be measured with respect to an electronic sensor. *See e.g.*, Ex. 2004, 2:20–22; Ex. 2005 ¶ 60; Ex. 2006 ¶ 51; Ex. 2007 ¶ 41. So, too, does Petitioner's evidence, Chen. *See e.g.*, Ex. 1008, 3:24–26, 10:20–21.

Based on the '712 patent specification discussed above and the extrinsic evidence discussed in the immediately preceding paragraph, we construe TTL to encompass "the length of the optical axis spacing between the object-side surface of the first lens element and one of: an electronic sensor, film, and an image plane corresponding to either the electronic sensor or a film sensor," as initially proposed in our Order.

¹⁴ Appx0014

3. Optical Power

Petitioner contends that "the specification of the '712 patent refers to the terms 'refractive power' and 'optical power' interchangeably." Pet. 11 (citing Ex.1001, 1:46–47; Ex.1003, 19⁶). Petitioner notes that claims 15 and 17 recite "optical power" in conjunction with lens elements, and that the specification refers to refractive power with reference to the same lens elements. *Id.*; *compare* Ex. 1001, 1:47–51, *with* claims 15, 17. In its Patent Owner Response, Patent Owner contends that "[t]o the extent that the Board deems construction necessary, Corephotonics does not dispute Apple's construction for the purposes of this proceeding." PO Resp. 20.

Based upon the complete trial record, Petitioner persuades us that one of ordinary skill in the art at the time of the invention would have understood the claim term "optical power" to mean refractive power, in light of the specification. Pet. 10–11. For the foregoing reasons, we conclude the term "optical power" should be construed in this manner.

B. Principles of Law

"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. of California*, 814 F.2d 628, 631 (Fed. Cir. 1987).

A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

⁶ The Petition references pages of Dr. Sasián's declaration (Ex. 1003), not paragraphs, even though each paragraph in the declaration is numbered. Where we deem appropriate (e.g., in quoting the Petition and its citations), we refer to page numbers.

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) objective evidence of nonobviousness, i.e., secondary considerations. *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

"In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable." *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify "with particularity . . . the evidence that supports the grounds for the challenge to each claim")). The burden of persuasion never shifts to Patent Owner. *See Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (citing *Tech. Licensing Corp. Videotek, Inc.*, 545 F.3d 1316, 1326–27 (Fed. Cir. 2008)) (discussing the burden of proof in an *inter partes* review). Furthermore, Petitioner cannot satisfy its burden of proving obviousness by employing "mere conclusory statements." *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016).

Thus, to prevail in an *inter partes* review, Petitioner must explain how the prior art anticipates the challenged claims and how the proposed combinations of prior art would have rendered the challenged claims unpatentable. We analyze the challenges presented in the Petition in accordance with the above-stated principles.

¹⁶ Appx0016

C. Level of Ordinary Skill in the Art

We review the grounds of unpatentability in view of the

understanding of a person of ordinary skill in the art at the time of the

invention. Graham, 383 U.S. at 17. Petitioner contends that

[A] person of ordinary skill in the art ("POSITA") would include someone who had, at the priority date of the '712 patent (i) a Bachelor's degree in Physics, Optical Sciences, or equivalent training, as well as (ii) approximately three years of experience in designing multilens optical systems. Ex.1003, p.9. Such a person would have had experience in analyzing, tolerancing, adjusting, and optimizing multilens systems, and would have been familiar with the specifications of lens systems. Ex.1003, p.9. In addition, a POSITA would have known how to use lens design software such as Codev (sic, "CODE V"), Oslo, or Zemax, and would have taken a lens design course. Ex.1003, p.9. Lack of work experience can be remedied by additional education, and vice versa.

Pet. 8 (citing Ex. 1003, 10).

Patent Owner contends

A person of ordinary skill in the art ("POSITA") would have possessed an undergraduate degree in optical engineering, electrical engineering, or physics, with the equivalent of three years of experience in optical design at the time of the effective filing date of the '712 patent, July 4, 2013.

PO Resp. 12 (citing Ex. 2013 ¶ 15). Patent Owner further contends

"Apple vaguely, and inappositely, asserts that a POSITA would be

'familiar with the specifications of lens systems.'" Id. (citing Pet. 8).

Patent Owner also contends "Apple provides no evidence that a

POSITA would be familiar with the specifications of lens systems for

miniature cameras, let alone miniature telephoto cameras." Id. at 12-

13.

Although there are differences between the definitions proposed, our conclusions rendered in this decision do not turn on selecting a particular definition for level of ordinary skill in the art. We determine on the current record that the level of ordinary skill proposed by Petitioner is consistent with the '712 patent and the asserted prior art.

D. Anticipation by Konno

Petitioner contends that claims 1, 2, 7, 12, 13, 15, 16, and 19 are anticipated under 35 U.S.C. § 102 by Konno. Pet. 13–56. For the reasons that follow, we are not persuaded that Petitioner establishes, by a preponderance of the evidence, that claims 1, 2, 7, 12, 13, 15, 16, and 19 are anticipated by Konno.

1. Overview of Konno

Konno discloses multiple embodiments of an imaging optical system with five lens elements. Ex. $1015 \ \figure 16$ of Konno depicts the exemplary imaging optical system of embodiment EX2-m and is reproduced below.

<u>EX2-m</u>



Figure 16 of Konno depicts a lens cross-sectional view of an imaging optical system according to an embodiment of the invention.

Konno discloses that

[I]n order from the object side, an aperture diaphragm ST, a positive first lens L1, a negative second lens L2, a positive third lens L3, a negative fourth lens L4, and a negative fifth lens L5, and all lens faces are aspherical. When viewed from the paraxial face, the first lens L1 is a convex positive meniscus lens toward the object side, a second lens L2 is a concave negative meniscus lens toward the image side, a third lens L3 is a convex positive meniscus lens L4 is a concave negative meniscus lens toward the object side, a fourth lens L4 is a fifth lens L5 is a biconcave negative lens.

Id. ¶ 67.

Independent Claims 1 and 15 and Dependent Claims 2, 7, 12, 13, 16, and 19

Independent claim 1 recites "[a] lens assembly, comprising: a plurality of refractive lens elements arranged along an optical axis, wherein at least one surface of at least one of the plurality of lens elements is aspheric." Independent claim 15 recites similar subject matter.

Petitioner contends that "Konno discloses a five-lens system for use in portable devices." Pet. 13 (citing Ex.1015, Abstract, ¶¶ 12, 25). As shown in Figure 16, reproduced above, Konno depicts lenses L1 to L5 arranged along optical axis AX2. Ex. 1015, Fig. 16. The example reproduced above is Konno's "Ex2-m" or "Ex2-LN2" exemplary embodiment. *See* Pet. 13.

Patent Owner contends that "Konno's 'Ex2-m', instead, [is] a mathematical abstraction of an impossible lens assembly in which the fourth and fifth lenses (counting from the object-side to image-side) would overlap – collide in space." PO Resp. 21 (citing Ex. 2013 ¶ 98). Patent Owner further contends that "Konno's disclosure is thus hypothetical—not truly a 'lens assembly,' because "[w]ithout further adaptation and changes, cannot

itself anticipate claims to a physical lens assembly." *Id.* at 22 (citing Ex. 2013 \P 98).

Concerning such adaptations and changes to Konno, Patent Owner notes that "Apple may argue on reply that Konno's disclosure is simply incorrect and needs to be 'fixed' [by] a skilled artisan," but that "Apple cannot belatedly add new evidence on reply to remedy its failure." *Id.* (citing *Magnum*, 829 F.3d at 1381; *Ariosa Diagnostics v. Verinata Health, Inc.*, 805 F.3d 1359, 1367 (Fed. Cir. 2015); *Wasica Fin. GMBH v. Cont'l Auto. Sys.*, 853 F.3d 1272, 1286 (Fed. Cir. 2017)). With respect to burden and timing, Patent Owner further argues that "the error in Konno was obvious on its face and acknowledged by Petitioner in its opening papers," and that "because Petitioner recognized the error in Konno in its Petition, it was incumbent on Petitioner to address it in the Petition." Paper 33, 7 (citing Ex. 1003, 79). More particularly, Patent Owner argues that

[*T*]*he Petition itself* establishes that the disclosed Konno embodiment is physically impossible (because the lenses overlap) and relies on that fact to motivate its separate obviousness ground. Having affirmatively relied upon the impossibility of Konno's lens assembly in the petition, Petitioner negated the presumption of enablement. If it wanted to argue anticipation based upon a modification of Konno, Petitioner should have explained that in its petition, as it did for obviousness on claims 6 and 14.

Paper 35, 5 (citing Paper 2, 63; Ex. 1003, 69–70).

In its Reply, Petitioner responds that a person of ordinary skill in the art "would have been able to make and use Konno's Ex2-LN2 embodiment without undue experimentation," and provides an analysis under the factors set forth in *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1998). Reply 9 (emphasis omitted). In its post-hearing briefing, Petitioner argues that the

"error" in Konno's Ex2-LN2 embodiment "does not impact how Konno anticipates the challenged claims in any way, because *the Petition only relies on the first four lens elements of Konno, not the fifth.*" Paper 34, 3 (citing Pet. 13–56; Ex. 1026 ¶ 4) (emphasis added).

In a post-hearing order, we invited the parties to address, among other matters, "the issue of burden in arguing enablement, i.e. whether the burden should be placed on Petitioner to present its enablement argument in the Petition." Paper 30, 4. Although both parties cited many cases that held the burden rests on the Patent Owner to raise the issue of non-enablement, none of these cases were in the context of AIA trial proceedings. *See* Paper 32, 6 (citing *In re Antor Media Corp.*, 689 F.3d 1282, 1288 (Fed. Cir. 2012); *Impax Labs. v. Aventis Pharms.*, 468 F.3d 1366, 1382 (Fed. Cir. 2006); *Amgen Inc. v. Hoechst Marion Roussel, Inc.*, 314 F.3d 1313, 1355 (Fed. Cir. 2003)); Paper 33, 7 (citing *In re Morsa*, 713 F.3d 104, 110 (Fed. Cir. 2013)). More importantly, in each of these cases, the presumption of enablement was not overcome as it is here.

It is settled that in district court proceedings and during examination, there is a presumption of enablement. *Antor*, 689 F.3d at 1288; *Amgen*, 314 F.3d at 1355. A patent claim is invalid for anticipation under 35 U.S.C. § 102 when a prior art reference describes "each and every claim limitation *and* enable[s] one of skill in the art to practice an embodiment of the claimed invention without undue experimentation." *ClearValue, Inc. v. Pearl River Polymers, Inc.*, 668 F.3d 1340, 1344 (Fed. Cir. 2012) (quotation marks and citation omitted) (emphasis added). "Prior art that must be modified to meet the disputed claim limitation does not anticipate the claim." *Enplas Display Device Corp. v. Seoul Semiconductor Co., Ltd.*, 909 F.3d 398, 405 (Fed. Cir.

2018). The Federal Circuit has long cautioned that it would be legal error to conclude that "it is sufficient for an anticipation if the general aspects are the same and the differences in minor matters is only such as would suggest itself to one of ordinary skill in the art." *Cornell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed. Cir. 1983).

In the discussion of its challenge applying Konno in view of Bareau, Petitioner argues that "a POSITA would have been motivated to adjust Konno's Example 2-LN2 lens," which "would have been routine for a POSITA to correct the errors of Konno and decrease the F number." Pet. 63 (citing Ex. 1003, 69–70). Dr. Sasián's testimony acknowledges that "there is an error in Konno's Example 2-LN2 lens system, as lenses L4 and L5 overlap (i.e., occupy the same space)," and testifies that "[t]his error can be corrected by adjusting the aspherical surfaces of the lenses[.]" Ex. 1003 ¶ 64. It is evident from Petitioner's discussion of challenge applying Konno and Bareau and Dr. Sasián's testimony, that Petitioner was aware of the error in Konno—the lens overlap between lenses L4 and L5—at the time of filing its Petition.

We are not persuaded that Petitioner intended to rely only on lenses L1 through L4 of Konno's lens assembly. In the cited portions of the Petition in pages 13 through 56, there are numerous references to lens L5, not one of which is accompanied by any argument or indication that Petitioner did not intend to rely on this portion of Konno's lens assembly. *See* Pet. 13–56.

We find that the error in Konno is sufficient to render Konno's Example 2-LN2 lens assembly non-enabled. We are persuaded by Patent Owner's argument that "the enablement question turns on whether a

POSITA could achieve what is disclosed in the asserted prior art, not whether a POSITA could easily modify the prior art to meet the challenged claims," i.e., without undue experimentation, as Petitioner contends. *See* Paper 33, 4 (emphasis omitted). In *In re Chudik*, 851 F.3d 1365, 1373 (Fed. Cir. 2017), "[t]he Board found that because the surfaces of element 27b 'can still be arranged to' engage the glenoid regions, Rambert anticipates claims 1 and its dependent claims 15 and 33–39." The Federal Circuit reversed the Board's decision, finding that "element 27b's protruding surface cannot be 'arranged to engage' the glenoid cavity surface without removing element 27a." *Id.* at 1373–74. In this case, we are similarly persuaded that lens L4 and L5 of Konno's lens assembly "cannot be arranged" to provide "[a] lens assembly . . . [that] has an effective focal length (EFL), a total track length (TTL) of 6.5 millimeters or less" as claimed without removing the overlap between lens L4 and L5.

We are further persuaded by Patent Owner's argument that the presumption of enablement is overcome by Petitioner's early identification of the error. *See* Paper 35, 5 (citing Paper 2, 63; Ex. 1003, 69–70). We are also persuaded that Petitioner's failure to address the issue of enablement in connection with the challenge applying Konno alone prior to institution means that Petitioner has failed to carry its burden of establishing anticipation of claims 1, 2, 7, 12, 13, 15, 16, and 19 by a preponderance of the evidence.

E. Obviousness over Konno and Bareau

Petitioner contends that claims 6 and 14 are unpatentable under 35 U.S.C. § 103 as obvious over Konno and Bareau. Pet. 56–74. For the reasons that follow, we are not persuaded that Petitioner establishes, by a

preponderance of the evidence, that claims 6 and 14 are unpatentable as obvious over Konno and Bareau.

1. Overview of Bareau

Bareau concerns "the design and manufacturing of consumer and commercial imaging systems using lens elements" that have millimeter-scale diameters. Ex. 1012, 1.

2. Dependent Claims 6 and 14

"[W]here a lens assembly F# is smaller than 2.9"

Bareau discloses "typical lens specifications for a ¹/₄" sensor format" which include a TTL of 5.0 mm and an F number ("fno") of 2.8. Pet. 57 (citing Ex.1012, 3). Petitioner contends it would have been obvious to one of ordinary skill in the art at the time of the invention to "modify[] Konno to have an F number of 2.8, as taught in Bareau," because such modification would have amounted to nothing more than applying "Bareau's known technique of using [a] lower F number for lens assemblies in cellular telephones to improve Konno's five-lens assembly in the same way." Pet. 58 (citing Ex. 1003, 64).

Petitioner argues

With the understanding of the relationship between the F number and the diameter of the entrance pupil laid out by the above formula, a POSITA would have recognized that by changing the diameter of the entrance pupil (i.e., changing the aperture stop diameter), the F number can be changed. Ex.1003, p. 66. Furthermore, a POSITA would have known that this diameter is most easily varied through the aperture stop diameter[.]

Pet. 60. Petitioner further argues

As shown above, the aperture diaphragm ST is placed well in front of the object-side surface of the first lens L1, and blocks

> a significant amount of light passing through the lens assembly. Ex.1003, pp. 68-69. In view of Fig. 1 above, a POSITA would have been motivated to adjust Konno's Example 2-LN2 lens assembly to decrease the F number and allow more light to pass through to conform to modern cellphone camera lens specifications. Ex.1003, p. 69. This kind of adjustment would have been routine for a POSITA to correct the errors of Konno and decrease the F number.

Id. at 63 (citing Ex. 1003, 70)

Dr. Sasián testifies that

A POSITA would have been aware that the F number of a lens assembly can by varied, as evidenced by "Optical Engineering Fundamentals" by Walker ("Walker", Ex. 1016). For example, a POSITA would have known the well-known formula for F number as stated by Walker: The diameter of the thin lens is a function of its EFL and f number, based on the following relationship:

f number = $\frac{\text{EFL}}{\text{diameter}}$

Ex. 1003 ¶ 60 (quoting Ex. 1016, 59). Dr. Sasián further testifies that "a POSITA would have known that this diameter is most easily varied through the aperture stop diameter," and thus, "a POSITA would have known that the F number of the lens system of Konno could be decreased to a preferable F number described in Bareau by varying the aperture size." Ex. 1003 ¶ 61 (citing Ex. 1016, 59).

Patent Owner's Contentions

Patent Owner contends that "[t]he entirety of the Petition's asserted 'rational underpinning' for combining Konno and Bareau . . . is based on impermissible hindsight." PO Resp. 26 (citing *Zoltek Corp. v. United States*, 815 F.3d 1302, 1313 (Fed. Cir. 2016)); *see id.* at 27 (citing Pet. 59). Patent

Owner notes that the '712 patent discusses Tang (Ex. 2004), which Patent

Owner argues

[D]iscloses standard, wide-angle lens assembly designs that Tang characterizes as having F# of 2.8 or less. *See, e.g.*, Ex. [sic] Ex. 2004, 15 ("Fno = 2.6"). But, as the '712 patent states, the problem in the prior art, like Tang, was that these lens assemblies had too small an EFL as compared to the TTL to provide a narrower angle field of view, i.e., to provide a telephoto lens with TTL/EFL < 1 and F# < 2.9 . . . By contrast, challenged claims 6 and 14 are directed to lens assemblies with an EFL larger than the TTL, i.e., "a ratio TTL/EFL of less than 1.0." Ex. 1001, cl. 1. Such telephoto lens assemblies provide a much lower field of view angle.

PO Resp. 28–29 (citing-in-part Ex. 1001, 1:36–38; Ex. 2013 ¶ 104) (emphasis omitted).

Noting that "Konno expressly teaches that the narrower angle lens assembly, 'should be *darker*, i.e., have a *higher* F# than the wider-angle lens assembly," Patent Owner contends that "Konno, therefore, *teaches away* from reducing the F# to lower than 3.0 in order to maintain the shorter TTL properties of the camera." *Id.* at 30–31 (citing Ex. 1015, 11) (emphasis added).

Petitioner's Responsive Contentions

Petitioner relies on Iwasaki (Ex. 1021)⁷ to refute Patent Owner's contention regarding impermissible hindsight. Reply 16 (citing Ex. 1021, 17:5 (Table 7)). Petitioner contends that "[t]he need for miniature high-performance lens system with TTL/EFL < 1.0 and F# < 2.9 was therefore

⁷ Iwasaki was cited in Case No. IPR2018-01356 in which we denied institution based on 35 U.S.C. § 325(d) without reaching the merits of Petitioner's challenge.

known prior to the '712 patent and therefore cannot be the basis for Patent Owner's supposed hindsight argument." *Id.* (citing Ex. 1027, Tables 1–5). Petitioner further contends that Konno's disclosure that, "[t]o slim down the entire apparatus, it is advantageous to make the second imaging optical system darker than the first imaging optical system" is "specific to the nature of its dual lens apparatus and does not apply when the second lens (i.e., Ex2-LN2) is used separate and independent from the apparatus." *Id.* at 17–18 (emphasis omitted).

We determine, as explained below, that Petitioner's rationale for combining Konno and Bareau is not supported by sufficient rational underpinning. As we do not make a determination on hindsight, Petitioner's argument regarding Iwasaki is moot. "[E]ven if a reference is not found to teach away, its statements regarding preferences are relevant to a finding regarding whether a skilled artisan would be motivated to combine that reference with another reference." *Polaris Indus., Inc. v. Arctic Cat, Inc.,* 882 F.3d 1056, 1069 (Fed. Cir 2018). We also need not specifically reach the issue of teaching away because we are persuaded by Patent Owner's argument that Petitioner's rationale for combining Konno and Bareau is not supported by sufficient rational underpinning.

Konno discloses both a wide-angle lens assembly, alternately termed a first imaging optical system, ("Ex2-w" or "EX2-LN1") and a telephoto lens assembly, alternately termed a second imaging optical system, ("Ex2-m" or "Ex2-LN2") that form a dual camera apparatus. *See e.g.*, Ex. 1015 ¶¶ 48, 55. With respect to this dual camera apparatus, Konno discloses that

When F-numbers are different from each other at switching, the impression of blurring greatly changes, giving an unnatural feeling to the user. Thus, it is preferred that the F-numbers of the

> first and second imaging optical systems are close to each other so as to satisfy the conditional expression (5). To slim down the entire apparatus, *it is advantageous to make the second imaging optical system darker than the first imaging optical system*.

Ex. 1015 ¶ 38 (emphasis added). Dr. Moore explains that "Konno thus discloses that, for example, the 'Ex2-w' (also known as 'Ex2-LN1') assembly would have a F# of 3.0, and 'Ex2-m' ('Ex2-LN2') would have a F# of 4.0." Ex. 2013 ¶ 107 (citing Ex. 1015, 21). Konno's conditional expression (5) is disclosed as "FNOw/FNOm," the ratio of the F number for a wide-angle lens assembly to the F number for telephoto lens assembly, which is 0.8 for Example 2. *Id.* ¶¶ 76, 77. In the combination proposed by Petitioner, FNOm is lowered to 2.8, based on the teachings of Bareau, thus failing to satisfy Konno's conditional expression (5). With respect to Bareau, Dr. Moore explains that

Bareau addresses only conventional wide-angle cameras in mobile devices. Bareau expressly describes cell phone cameras as having a relatively short EFL as compared to TTL ratio, resulting in a field of view of 60 degrees. Ex. 1012, 3. Bareau further describes exemplary lens specifications that have an EFL of 3.8 mm and a TTL of 5.0 mm, which would have a TTL/EFL ratio of 1.3, which is much larger than 1.

Ex. 2013 ¶ 106 (citing Ex. 1012, 3, Ex. 2008, 165:2–17); see PO Resp. 28 (citing Ex. 1012, 3; Ex. 2013 ¶ 106). Dr. Sasián concedes that the cited portions of Bareau concern only wide-angle lens assemblies in his deposition testimony. See Ex. 2008, 165:8–21.

For the foregoing reasons, we are not persuaded that the ordinarily skilled artisan would have looked to lower the FNOm value of Konno's telephoto lens assembly based on Bareau's teachings of a general preference to lower the F number in cellphone cameras with wide-angle lens

assemblies. Konno discloses a wide-angle lens assembly with a lower F number than the F number of the telephoto lens assembly—Petitioner does not persuasively explain why the ordinarily skilled artisan would disregard Konno's own intrinsic teaching of a lower F number (i.e., for a wide-angle lens assembly) and look to another reference, Bareau, also concerning wideangle lens assemblies, to lower the F number of Konno's *telephoto* lens assembly. Accordingly, Petitioner does not establish, by a preponderance of the evidence, that claims 6 and 14 are obvious in view of Konno and Bareau.

F. Anticipation by Eggert

Petitioner contends that claims 15–17 are anticipated under 35 U.S.C. § 102 by Eggert. Pet. 74–96. For the reasons that follow, we are persuaded that the evidence supports Petitioner's arguments and Dr. Sasián's testimony and that Petitioner establishes, by a preponderance of the evidence, that claims 15–17 are unpatentable as anticipated by Eggert.

1. Overview of Eggert

Eggert concerns a telephoto lens including "a tele-positive in front and a telenegative facing the film and separated by a large air space." Ex.1013, 1:14–17. Eggert's lens assembly includes a plurality of lens I, II, III, IV, and V that are arranged along an optical axis, s'. *Id.* at Fig. 2. Reproduced below, Figure 2 illustrates that Eggert's lens assembly also includes an air gap between the third and fourth lens. *See id.* at 3:73–4:2.



Figure 2 of Eggert illustrates an arrangement of lenses in an exemplary telephoto lens assembly system.

The lens assembly is defined by optical parameters including: (1) the radius of curvature of each lens surface (*R*); (2) the thickness of each individual lens along the optical axis (*d*) and the distance between each lens element (*a*); (3) the refractive index of each lens element (*n*); (4) the Abbe number of each lens; (5) the refractive powers of the lens surfaces φ_1 , φ_1 ', φ_2 , φ_2 ', φ_3 , and φ_3 '; and (6) and the refractive powers, $\varphi_I - \varphi V$, of lenses I to V, respectively. *See e.g., id.* at Table (a), Table (b), 5:8–15; 9:52–54; 9:58.

2. Independent Claim 15

"A lens assembly, comprising: a plurality of refractive lens elements arranged along an optical axis"

According to Petitioner, Eggert discloses "[a] telephoto lens for photographic purposes having a high telephoto power." Pet. 78 (quoting Ex.1013, 1:14–16). Petitioner contends "Eggert's telephoto lens is a lens assembly because it includes a 'distribution of the refractive powers of lenses limiting or defining a large air space between the telepositive in the

front of the lens and the tele-negative in the rear thereof." *Id.* (quoting Ex.1013, 2:20–24). Petitioner further contends that Eggert discloses "a plurality of refractive lenses (labeled I-V) arranged along an optical axis[.]" *Id.* at 79 (citing Ex.1003, 86; Ex.1013, Fig. 2). As illustrated in Figure 2 of Eggert reproduced above, the lens assembly system includes refractive lenses I, II, III, IV, and IV.

According to Petitioner, "[e]ach of Eggert's lenses I-V is a refractive lens as indicated in Table (b) of Example 1, which shows each lens's refractive power, $\varphi_I - \varphi_V[.]$ " *Id.* at 79–80 (citing Ex. 1003, 87; Ex.1013, 5:45– 65).

Based on our review of the complete record and the preponderance of the evidence standard, we determine that the record supports Petitioner's contentions because Eggert discloses the refractive powers of the lenses shown in Eggert's lens assembly system (Ex. 1013, 5:8–11) and that the lenses are "measured along the optical axis of the objective" (Pet. 79 (quoting Ex.1013, 4:7–14)).

"[W]herein the lens assembly has an effective focal length (EFL) and a total track length (TTL) smaller than the effective focal length (EFL)"

According to Petitioner, "[i]n Eggert, the EFL of the lens system in Fig. 2 is represented in Table (a) of Example 1 as f=1.00[.]" Pet. 80–81 (citing Ex.1003, 87; Ex.1013, 5:17–22).

Petitioner contends that the "TTL of Eggert's Example 1 lens assembly can be calculated by summing the thicknesses of all lens elements d, the distances between each lens element a, and the distance from the last lens to the image plane s'." Pet. 83 (citing Ex.1013, 4:7–26). Petitioner explains that Table (a) of Eggert, reproduced below, has columns of values

including: "(1) the radius of curvature of each lens surface (R), (2) the thickness of each individual lens along the optical axis (d) and the distance between each lens element (a), (3) the refractive index of each lens element (n), and (4) the Abbe number of each lens element (v)." *Id.* at 75 (citing Ex.1013, 4:7–17, 9:56–60).

(a) Table of design parameters

[f=1.00 Relative aperture, 1:4]				
$R_1 = +0.42156$ $R_1' = -0.88214$	$d_{I} = 0.06676$ $a_{1} = 0$ (cemented)	$n_{\rm I} = 1.64250$	µ1≈58.09	
$R_2 = -0.88214$ $R_2' = -18.00073$ $R_3 = -1.37288$ $R_3' = -5.30649$	$d_{II} = 0.01945$ $a_2 = 0.01183$ $d_{III} = 0.01945$ $a_{3V} = 0.40290$	n _{II} =1.72830 air n _{III} =1.65446	ν _{II} =28.66 ν _{III} =33.79	
$R_4 = +0.34202$ $R_4' = +1.17496$ $R_5 = -0.31069$ $R_5' = +0.69782$	$diaphragm a_{3H} = 0.11913 d_{IV} = 0.02234 a_{4} = 0.03859 d_{V} = 0.00526$	$\begin{cases} a_1 = 0.52203 \text{ air} \\ n_1 v = 1.75787 \\ air \\ n_V = 1.65016 \end{cases}$	v1v=31.56 ×v=39.31	

Intercept length s'=0.20324. Telephoto effect: 4.9.

Table (a) of Eggert includes optical parameters for the optical lens assembly of Example 1.

Eggert discloses that "d [is] the axial thicknesses of the individual lenses, and a [is] the axial distances between lenses, \dots s' is \dots the axial distance from the apex of the last lens (V) to the plane F of the image." Ex.1013, 4:7–26.

Based on our review of the complete record and the preponderance of the evidence standard, we determine that the record supports Petitioner's contentions because we are persuaded Eggert discloses that "based on the data provided in Table (a), the lens system in Fig. 2 of Eggert has a

calculated TTL of 0.90895, which is smaller than the EFL of 1.00." Pet. 84 (citing Ex.1003, 90–91) (emphasis omitted).

Patent Owner's Contentions

Patent Owner contends that "the '712 patent expressly defines TTL as a quantity measured from the object-side of the first lens to the electronic sensor." PO Resp. 40 (citing Ex. 1001, 1:63–65) (emphasis omitted). Patent Owner further contends that "[u]nder the correct construction of TTL, and consistent with the '712 patent, Eggert cannot disclose a TTL / EFL < 1.0. Eggert expressly discloses that the plane F is 'the image plane of film placed in the camera." *Id.* (citing Ex. 1013, 4:23–24) (emphasis omitted). According to Patent Owner, Eggert neither expressly nor inherently discloses an electronic sensor as required by its construction of the claim term, TTL.

As discussed above in Section III.A.2, we construe TTL to encompass both a measurement to an electronic sensor and a measurement to film.⁸ Dr.

⁸ With respect to the related IPR2018-01140 proceeding, Patent

Owner did not dispute our construction:

JUDGE ULLAGADDI: So if [TTL] is [measured] to a physical surface upon which the image is formed, then is there a different definition for TTL depending on whether you have a digital camera or a film camera?

MR. FENSTER: Your Honor, the 032 is clearly at 032 and I would offer as a compromise that if you wanted to use actual image plane or physical surface of the imaging device, that would be fine. So I don't think that TTL has a different meaning, whether it's a digital or not. The TTL is defined as to the physical surface on which the image is captured. It's expressly defined as to the electronic sensor because that is the context of the 032 but I don't have any problem if Your Honor wants to put in the

Moore testifies how a person of ordinary skill in the art would have understood TTL to be measured with respect to film for a camera and how a person of ordinary skill in the art would have understood that TTL could have been measured prior to electronic sensors. *See* Ex. 1025, 68:9–17; 66:21–67:3. For the foregoing reasons, we are not persuaded by Patent Owner's contentions with respect to Eggert.

"[T]he plurality of refractive lens elements comprising, in order from an object plane to an image plane along the optical axis, a first lens element having positive optical power, a pair of second and third lens elements having together a negative optical power, and a combination of fourth and fifth lens elements"

As discussed above, Eggert discloses lenses I, II, III, IV, and V. Petitioner contends that Table (b) of Eggert, reproduced below, shows that "the refractive power of lens I (φ_I) is positive because it has an optical power of +2.2524[.]" Pet. 86 (citing Ex.1003, 92; Ex.1013, 5:43–65).

Tr. 28:15–29:3 (emphasis added).

definition that it doesn't have to be an electronic sensor, *it's just* to the physical surface of the imaging device whether it be an electronic sensor, sensor film or otherwise.

(b) Table of distribution of the refractive powers

 $\varphi_1 = +1.5241\Phi$ $\varphi_1 = +2.2524\Phi$
 $\varphi_1' = +0.7283\Phi$ $\varphi_1 = +2.2524\Phi$
 $\varphi_2 = -0.8256\Phi$ $\varphi_{II} = -0.7851\Phi$
 $\varphi_2' = +0.0405\Phi$ $\varphi_{III} = -0.7851\Phi$
 $\varphi_3 = -0.4767\Phi$ $\varphi_{III} = -0.3534\Phi$
 $\varphi_3' = +0.1233\Phi$ Large air space

 $\varphi_4 = +2.2159\Phi$ $\varphi_{IV} = +1.5709\Phi$
 $\varphi_4' = -0.6450\Phi$ $\varphi_{IV} = +1.5709\Phi$

 φ_{V} -3.0243 Φ

Table (b) of Eggert illustrates refractive powers of lenses I, II, III, IV, and V of the lens assembly system.

 $\varphi_5 = -2.0926\Phi$

 $\varphi_5' = -0.9317\Phi$

Petitioner further contends that Table (b) shows that the refractive power of the second lens (φ_{II}) is negative (-0.7851) and the refractive power of the third lens (φ_{III}) is also negative (-0.3534). *Id.* at 88.

Petitioner explains that using the refractive power values from Eggert's Table (b) "in the equation of Walker . . . yields the following equation: $\varphi_{combined} = (-0.7851) + (-0.3534) - (0.01183)(-0.7851)(-0.3534) = -$ 1.1418 mm," and that because "this value is negative, the second and third lenses of Eggert combined have a negative power." Pet. 89–90 (citing Ex.1003, 95). Based on our review of the complete record and the preponderance of the evidence standard, we determine that the cited portions of Eggert and Petitioner's mathematical manipulation of Eggert's disclosed values support Petitioner's contentions.

"[T]he fourth lens element separated from the third lens element by an air gap greater than TTL/5."

Petitioner contends that Table (a) shows that "the distance between the third and fourth lenses is designated as α_3 =0.52203 of air." Pet. 92 (citing Ex. 1003, 97). As discussed above, Petitioner contends that "the TTL of the lens system in Fig. 2 is determined by adding the thickness of each lens, the distance between each lens element, and the distance between the last lens element and the image plane," and asserts that "the TTL of the lens system in Fig. 2 is 0.90895." Pet. 91 (citing Ex. 1003, 96). Petitioner explains, and we are persuaded, that the "distance of the air gap α_3 between the third and fourth lenses is greater than TTL/5 because the value of α_3 is 0.52203 and the TTL of the lens system in Fig. 2 (i.e., 0.90895) divided by 5 is 0.18179." *Id.* at 93 (citing Ex. 1003, 98).

We have reviewed the Petition and the supporting evidence and briefs, and we determine that the record supports Petitioner's contentions that Eggert anticipates independent claim 15. Accordingly, in light of the foregoing, we determine that Petitioner has shown by a preponderance of the evidence that claim 15 is anticipated by Eggert.

3. Dependent Claims 16 and 17

We have reviewed Petitioner's arguments and evidence concerning claims 16 and 17 and are persuaded that Petitioner has also shown by a preponderance of the evidence that these claims are also anticipated by Eggert.

According to Petitioner, "[a]s indicated in Table (a), the Abbe number $v_{\rm I}$ of the first lens I is 58.09 (i.e., greater than 50) and the Abbe number $v_{\rm II}$ of the second lens II is 28.66 (i.e., smaller than 30)[.]" Pet. 94 (citing Ex. 1003,

99; Ex. 1013, 5:17–40 (Table (a) of Example 1)). We have reviewed the cited evidence and are persuaded that Petitioner demonstrates, by a preponderance of the evidence, that Eggert discloses "the first lens element has an Abbe number greater than 50 and wherein the second lens element has an Abbe number smaller than 30," as recited in claim 16. Patent Owner does not present arguments with respect to dependent claims 16 or 17. *See generally* PO Resp.

Petitioner further contends "as shown in Table (b), the refractive power (i.e., optical power) of the second lens is -0.7851 and the refractive power of the third lens is -0.3534, which are both negative[.]" *Id.* at 96 (citing Ex. 1003, 101; Ex. 1013, Table 2). We have reviewed the cited evidence and are persuaded that Petitioner demonstrates, by a preponderance of the evidence that Eggert discloses "wherein the second and third lens elements have each a negative optical power," as recited in claim 17.

IV. CONCLUSION⁹

We conclude that Petitioner has demonstrated, by a preponderance of the evidence, that claims 15–17 of the '712 patent are anticipated by Eggert. We further conclude that Petitioner has not demonstrated, by a preponderance of the evidence, that claims 1, 2, 7, 12, 13, 15, 16, and 19 are

⁹ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding. See 84 Fed. Reg. 16654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. §§ 42.8(a)(3), (b)(2).

anticipated by Konno. We also conclude that Petitioner has not demonstrated, by a preponderance of the evidence, that claims 6 and 14 are unpatentable over the combination of Konno and Bareau. The chart below summarizes our conclusions.

Claims Challenged	35. U.S.C.	References	Claims Shown Unpatentable	Claims Not shown Unpatentable
15–17	§ 102	Eggert	15–17	
1, 2, 7, 12, 13, 15, 16, 19	§ 102	Konno		1, 2, 7, 12, 13, 15, 16, 19
6, 14	§ 103	Konno and Bareau		6, 14
Overall Outcome			15–17	1, 2, 6, 7, 12– 16, 19

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that claims 15–17 of the '712 patent have been shown by a preponderance of the evidence to be *unpatentable*;

FURTHER ORDERED that claims 1, 2, 6, 7, 12–16, and 19 are not held unpatentable; and

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

PETITIONER:

Michael S. Parsons Andrew S. Ehmke Jordan Maucotel Philip Woo David OBrien HAYNES AND BOONE, LLP michael.parsons.ipr@haynesboone.com andy.ehmke.ipr@haynesboone.com jordan.maucotel@haynesboone.com Philip.woo.ipr@haynesboone.com David.obrien.ipr@haynesboone.com

PATENT OWNER:

Neil A. Rubin C. Jay Chung Reza Mirzaie RUSS AUGUST & KABAT nrubin@raklaw.com jchung@raklaw.com rmirzaie@raklaw.com