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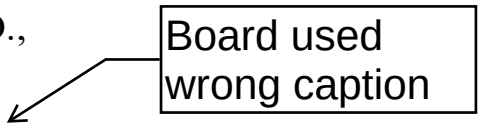
Paper 9
Date: January 4, 2023

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HEWLETT PACKARD ENTERPRISE CO.,
Petitioner,



v.

INTELLECTUAL VENTURES II LLC,
Patent Owner.

IPR2022-01023
Patent 8,310,767 B2

Before NORMAN H. BEAMER, NABEEL U. KHAN, and JOHN D. HAMANN, *Administrative Patent Judges.*

KHAN, *Administrative Patent Judge*.

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

I. INTRODUCTION

A. Background and Summary

Motorola Mobility LLC ("Petitioner") filed a Petition (Paper 2, "Pet.") requesting an *inter partes* review of claims 16–20 and 22–24 ("the challenged claims") of U.S. Patent No. 8,310,767 B2 ("the '767 patent," Ex. 1001). Largan Precision Co. Ltd. ("Patent Owner") timely filed a Preliminary Response (Paper 6, "Prelim. Resp."). With our authorization, Petitioner filed a Preliminary Reply (Paper 7, "Prelim. Reply") addressing the issue of real parties-in-interest, and Patent Owner filed a Preliminary Sur-reply (Paper 8, "Prelim. Sur-reply") in response.

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 not demonstrated a reasonable likelihood of prevailing on any of the challenged claims of the '767 patent and therefore we do not institute *inter partes* review as to the challenged claims of the '767 patent.

B. Related Proceedings

The parties identify the following pending matter as involving the '767 patent: *Largan Precision Co., Ltd. v. Motorola Mobility LLC*, Case No. 4:21-cv-09138-JSW (N.D. Cal.). Pet. viii; Paper 4, 2.

C. Real Parties-in-Interest

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

D. The '767 Patent (Ex. 1001)

The '767 patent, titled "Image Capturing Lens Assembly," relates to "a compact image capturing lens assembly used electronic products." Ex. 1001, code (54), 1:14–16. The patent describes "[t]he demand for compact imaging lens assembly has grown in recent years as the popularity of portable electronic products with the photographing function has increased." *Id.* at 1:18–20. The '767 patent explains that a conventional compact imaging lens system with high image quality equipped on a portable electronic product is often composed of five lens elements." *Id.* at 1:29–31. With the "demand for the pixel size and image quality of compact imaging lens system increase[ing] . . . the conventional lens system with five lens elements can no longer satisfy the imaging lens systems of even higher level." *Id.* at 1:32–38. Thus, "a need exists in the art for an image capturing lens assembly that features better image quality and is compact while maintaining a moderate total track length." *Id.* at 1:40–42.

To address this need, the '767 patent describes an image capturing lens assembly comprising six lens elements having specific characteristics and properties. Ex. 1001, 1:47–2:2.

An embodiment of the invention is shown in Figure 1A, reproduced below.

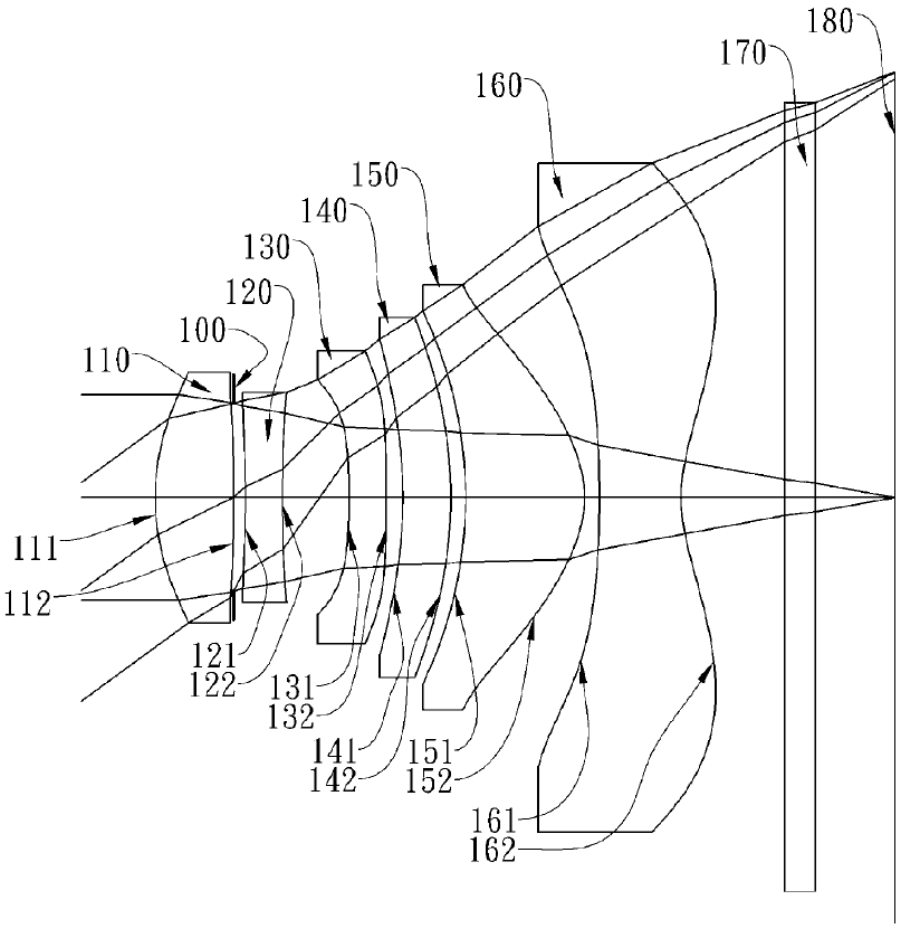


Fig. 1A

Figure 1A shows an image capturing lens assembly comprising six lens elements. Ex. 1001, 6:54–57. In order from the object side to an image side, the lens assembly consists of elements are as follows: a plastic first lens element 110 with positive refractive power having a convex object-side surface 111 and a convex image-side surface 112, the object-side and image-side surfaces 111 and 112 being aspheric (*id.* at 6:58–61); a plastic second lens element 120 with negative refractive power having a concave object-side surface 121 and a concave image-side surface 122, the object-side and image-side surfaces 121 and 122 being aspheric (*id.* at 6:62–65); a plastic third lens element 130 with negative refractive power having a concave object-side surface 131 and a concave image-side surface 132, the object-

side and image-side surfaces 131 and 132 being aspheric (*id.* at 6:66–7:2); a plastic fourth lens element 140 with positive refractive power having a concave object-side surface 141 and a convex image-side surface 142, the object-side and image-side surfaces 141 and 142 being aspheric (*id.* at 7:3–6); a plastic fifth lens element 150 with positive refractive power having a concave object-side surface 151 and a convex image-side surface 152, the object-side and image-side surfaces 151 and 152 being aspheric and at least one inflection point is formed on the image-side surface 152 (*id.* at 7:7–12); and a plastic sixth lens element 160 with negative refractive power having a concave object-side surface 161 and a concave image-side surface 162, the object-side and image-side surfaces 161 and 162 being aspheric, and at least one inflection point is formed on the image-side surface 162 (*id.* at 7:14–8:3); wherein an aperture stop 100 is disposed between the first lens element 110 and the second lens element 120 (*id.* at 8:4–5); the image capturing lens assembly further comprises an IR filter 170 disposed between the image-side surface 162 of the sixth lens element 160 and an image plane 180, and the IR filter 170 is made of glass and has no influence on the focal length of the image capturing lens assembly (*id.* at 8:6–10); the image capturing lens assembly further comprises an image sensor provided on the image plane 180 (*id.* at 8:10–8:12).

By having such a lens assembly arrangement, the photo-sensitivity and the total track length of the image capturing lens assembly can be reduced. Furthermore, the aberration and astigmatism of the assembly can be effectively corrected for obtaining high image resolution. Ex. 1001, 2:22–26. For example, the arrangement described above, the first lens element has positive refractive power, and thereby the sensitivity of the assembly can be reduced. *Id.* at 2:27–29. The second lens element has

negative refractive power, and thereby the aberration of the assembly can be favorably corrected. *Id*. at 2:29–31. The fifth lens element has positive refractive power and can provide the main refractive power for reducing the total track length favorably. *Id*. at 2:31–34. The sixth lens element has negative refractive power, and thereby the aberration of the assembly can be favorably corrected. *Id*. at 2:34–36. When the first lens element has a convex object-side surface, the total track length can be reduced favorably. *Id.* at 2:37–39. When the second lens element has a concave image-side surface, the astigmatism of the assembly can be favorably corrected. *Id.* at 2:39–41. When the fifth lens element has a convex object-side surface, the total track length can be reduced. *Id*. at 2:42–43. When the sixth lens element has a concave object-side surface and makes the sixth lens element as a concave-concave lens element, the aberration of the assembly can be corrected. *Id.* at 2:43–46. When the sixth lens element has a concave image-side surface, the principal point of the assembly can be positioned away from the image plane so that reducing the total track length of the assembly.

E. Illustrative Claims

Claim 16, the sole independent claim challenged in this Petition, is reproduced below with limitation identifiers in brackets corresponding to claim analysis headings in the Petition. *See, e.g.*, Pet. 31–43.

> [16.1] An image capturing lens assembly comprising, in order from an object side to an image side:
>
> [16.2] a first lens element with positive refractive power having a convex object-side surface;
>
> [16.3] a second lens element with negative refractive power;
>
> [16.4] a third lens element;

> [16.5] a fourth lens element having at least one of an object-side surface and an image-side surface thereof being aspheric;
>
> [16.6] a fifth lens element with positive refractive power having a convex image-side surface, and at least one of an object-side surface and the image-side surface thereof being aspheric; and
>
> [16.7] a sixth lens element with negative refractive power having a concave image-side surface, and at least one inflection point is formed on at least one of an object-side surface and the image-side surface thereof;
>
> [16.8] wherein a focal length of the fifth lens element is f5, a focal length of the sixth lens element is f6, a focal length of the third lens element is f3, a focal length of the fourth lens element is f4, and they satisfy the following relation:
>
> $(|f5|+|f6|) / (|f3|+|f4|) < 0.4$.

Ex. 1001, 32:59–33:13.

F. Evidence

The Petition relies on the following references:

Reference	**Exhibit No.**
US 2010/0220229 Al; filed Dec. 15, 2009; published Sept. 2, 2010; ("Sano").	1004
Korean Pat. App. Pub. No. 10-2010-0040357; filed Oct. 10, 2008; issued Apr. 20, 2010; ("KR357").	1005

Petitioner also relies on the Declaration of Tom D. Milster, Ph.D., (Ex. 1003) in support of its arguments. Patent Owner relies on the Declaration of Julie L. Bentley, Ph.D. (Ex. 2001) in support of its arguments. The parties rely on other exhibits as discussed below.

G. 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
16–20, 22–24	103(a)	Sano
16–20, 22–24	103(a)	KR357

II. REAL PARTIES-IN-INTEREST

Patent Owner argues that Petitioner "purposefully omitted a real party-in-interest to gain an advantage in this forum." Prelim. Resp. 10. More specifically, Patent Owner argues that 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, "[t]he advantage gained is that of avoiding estoppel if [Petitioner] ultimately loses in a final written decision," because 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." *Id.*

Notably, the parties do not dispute that Sunny is not time-barred from filing a Petition challenging the '767 patent. 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

[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 '841 patent was filed before this date, the pre-AIA versions of 35 U.S.C. §§ 102 and 103 apply.

for purposes of institution that a litigation co-defendant should be named as 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).

Moreover, we disagree with Patent Owner that *SharkNinja* is not controlling here. Prelim. Sur-reply 2. While we agree that *SharkNinja* made additional findings (i.e., no allegations of purposefully omitting a party to gain advantage and that the petitioner had offered to add the party as a real party-in-interest), those findings do not limit the reasoning of *SharkNinja*'s holding, which is based on there being no time bar. *SharkNinja*, Paper 11 at 18–20.

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.

III. 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 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") at the time of the filing of '767 Patent (January 2011) "would include someone who had, in January 2011, (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 (citing Milster ¶ 33).

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. *Id.* at 13–14. A POSITA would have regularly used such software to create new lens designs, often using pre-existing lens designs as a starting point and then performing routine optimizations to reach a desired design. *Id.* at 14. Petitioner further argues that a POSITA would have followed and regularly consulted books, articles, and other publications by the Society of Photo-Optical Instrumentation Engineers ("SPIE"). *Id.*

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. 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." Pet. 20–21. Patent Owner similarly does not propose any specific constructions in their Preliminary Response. *See* Ex. 2001 ¶¶ 14–16.

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

D. Obviousness over Sano (Ground 1)

Petitioner argues claims 16–20 and 22–24 of the '767 patent would have been obvious over Sano. Pet. 22–53. Below we provide a brief overview of the prior art reference, and then analyze Petitioner's contentions in light of Patent Owner's arguments.

1. Overview of Sano

Sano relates to an image pickup lens suitable for a small-sized image pickup apparatus, such as a mobile device, employing a solid-state image pickup element such as a Charged Coupled Device (CCD) type image sensor or Complementary Metal Oxide Semiconductor (CMOS) type image sensor, and to an image pickup apparatus and a mobile terminal. Ex. 1004 ¶ 2. Sano proposes an image pickup lens composed of five elements "because it

can provide higher property than a lens composed of three elements or four elements." *Id.* ¶ 4.

Sano discloses several embodiments of the five-element image pickup lens. Petitioner relies on one such embodiment disclosed in example 3 of Sano. Pet. 22. Example 3 of Sano is depicted in Figure 9 reproduced below.

FIG. 9

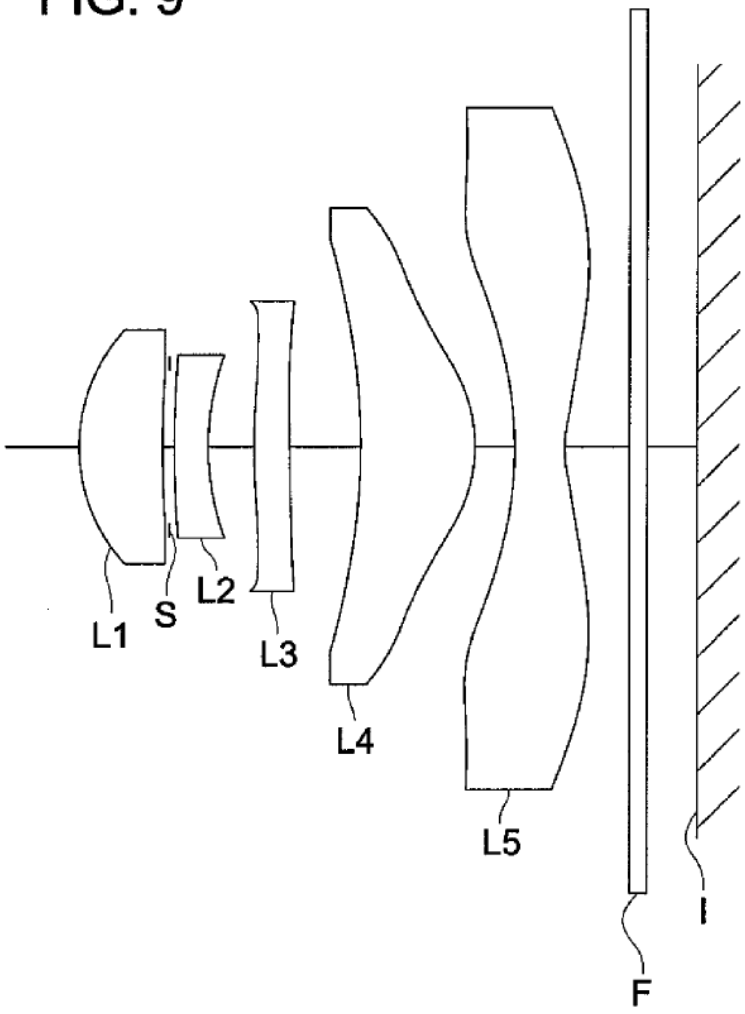


Figure 9 of Sano, depicted above, illustrates a sectional view in the direction of the optical axis of the image pickup lens of Example 3. Ex. 1004 ¶ 20. Figure 9 shows first lens L1, second lens L2, third lens L3, fourth lens L4, fifth lens L5, aperture stop S, imaging surface I, and parallel flat plate F. *Id.* ¶ 141. The second lens L2 includes an image side surface in

an aspheric shape on which the negative refractive power is reduced as one goes from the optical axis toward the periphery. *Id.* The third lens L3 has a positive refractive power and is in a meniscus shape whose convex surface faces the object side. *Id.* The fourth lens L4 is in a meniscus shape whose convex surface faces the image side, and the image side surface of the fourth lens is in an aspheric surface on which the positive refractive power is reduced as one goes from the optical axis toward the periphery. *Id.* The fifth lens LS includes an aspheric surface facing the image side, and the surface includes an inflection point located on an area excluding the intersection point of the optical axis and the image side surface of the fifth lens. *Id.*

Lens data of the image pickup of Example 3 is show in Table 3 of Sano, reproduced below.

TABLE 3

Example 3
f = 4.81 mm fB = 0.5 mm F = 2.88 2Y = 7.056 mm
ENTP = 0.66 mm EXTP = −2.66 mm H1 = −1.84 mm
H2 = −4.31 mm

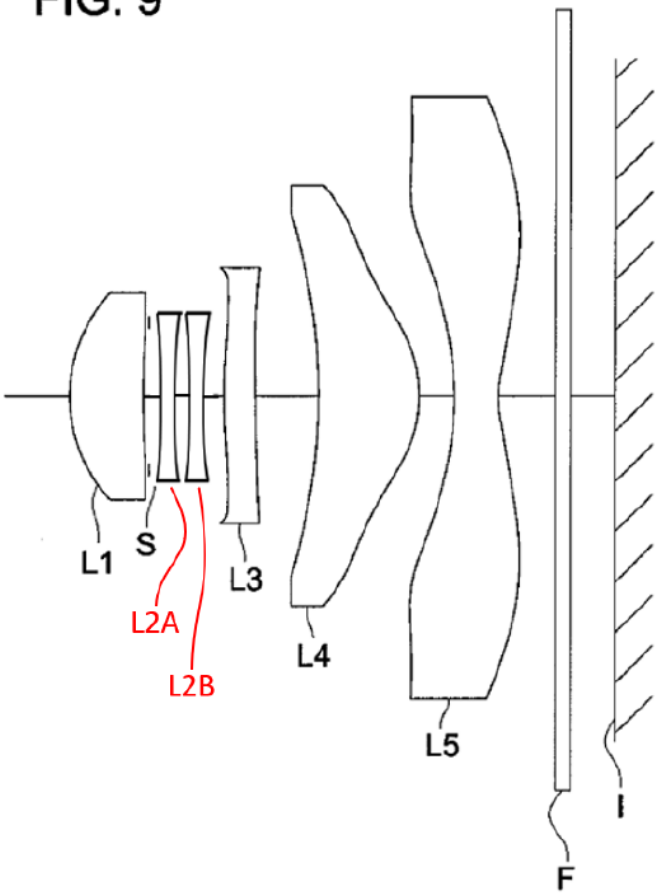
Surface No.	R (mm)	D (mm)	Nd	vd	Effective radius (mm)
1*	1.792	0.78	1.54470	56.2	1.10
2*	57.549	0.05			0.78
3 (Stop)	∞	0.05			0.71
4*	15.461	0.30	1.63200	23.4	0.75
5*	2.544	0.41			0.86
6*	6.186	0.36	1.63200	23.4	1.16
7*	8.531	0.64			1.35
8*	−9.117	1.06	1.54470	56.2	1.94
9*	−1.182	0.40			2.19
10*	−2.455	0.45	1.54470	56.2	2.87
11*	2.057	0.56			3.21
12	∞	0.15	1.51630	64.1	3.49
13	∞				3.53

2. Motivation to Modify Sano

As explained above, Sano discloses a five-element image pickup lens. Petitioner, however, relies on a modification of Sano's five-element lens in which the second lens is split into two lenses, creating a six-element lens, as required by the challenged claims. Pet. 24–43. Petitioner argues that a POSITA would have implemented Sano's Example 3 with a split second lens to improve image quality and tolerancing. *Id.* 24–26. Petitioner argues that the angles of incidence for rays incident upon the surface of the second lens are relatively large because of the shorter focal length of the second lens compared to the third lens and that these increased angles of incidence increase aberrations in the system, thus reducing lens performance. *Id.* at 25 (citing Ex. 1003 ¶ 83). Petitioner argues that one common technique for reducing angles of incidence was to split a lens into two or more equal parts. *Id.* (citing Ex. 1010, 52–54; Ex. 1012, 74; Ex. 1003 ¶ 84). Thus, Petitioner argues, "in order to reduce aberrations, improve image quality, and improve tolerance to manufacturing errors, the POSITA would have been motivated to split lens L2 in Sano Example 3 such that the overall power remained the same but the angles of refraction were reduced." *Id.* at 27. Petitioner also argues that ZEMAX modeling confirms that splitting lens L2 reduces the angles of incidence and improves performance. *Id.* (citing Ex. 1003 ¶ 86).

Petitioner's modified version of Example 3 of Sano is reproduced below with annotations from Petitioner.

FIG. 9



The modified version of Figure 9 shows the second lens L2 of Sano split into two lenses L2A and L2B. Pet. 30.

Patent Owner argues that a five-lens optical system is structurally very different than a six-lens optical system. Prelim. Resp. 30. According to Patent Owner, splitting an aspheric lens element completely alters the optical system such that the other elements in the optical system must be redesigned to accommodate the addition or removal of the lens element. *Id.* (citing Ex. 2001 ¶ 56). Patent Owner argues that Sano itself recognizes that optical systems having a given number of lens elements are different and patentably distinguishable from optical systems having a different number of lens elements. *Id.* at 32 (citing Ex. 1004 ¶¶ 4–5). Patent Owner argues that the USPTO recognizes five-lens optical systems are different and patentably

distinguished from six-lens optical systems as evident from the different USPTO classifications of five and six lens optical systems. *Id.* at 32–33.

Patent Owner further argues that moving from a five-lens optical system to a six-lens optical system would not have been obvious and would have required undue experimentation. Prelim. Resp. 35–36. This is because several factors and parameters must be considered and adjusted when making the modification such as the power of the sixth element, where to add the sixth element, spacing between sixth element and adjacent elements, the radii, thickness, and Abbe number of the lens. *Id.* at 35–37. Thus, Patent Owner argues that "undue experimentation is required for a POSITA to generate a workable optical design for a six-lens optical system when starting from a five-lens optical system." *Id.* at 37.

Patent Owner argues that splitting Sano's second lens L2 into two elements to reduce aberrations was unnecessary because Sano's five lens optical system was already well-corrected. Prelim. Resp. 37–42. In fact, Patent Owner argues that Petitioner's six lens redesign has worse aberrations than Sano's original five-lens design. *Id.* at 42 (citing Ex. 2001 ¶ 71).

Patent Owner argues that a POSITA would not have been motivated to specifically split Sano's second lens element because Sano's second lens has relatively low refractive power compared to the other lenses in Sano's system. Prelim. Resp. 43–45. Patent Owner argues that according to Petitioner themselves, splitting a lens was a common technique when applied to a high powered element made of glass. *Id.* at 43 (citing Ex. 1012, 88; Ex. 2001 ¶ 72). Sano's second lens is the second weakest lens element and thus, according to Patent Owner, not a suitable candidate for splitting. *Id.* at 43–44 (citing Ex. 2001 ¶ 73). Patent Owner also argues that a POSITA would not have been motivated to split the second lens to reduce

cost. *Id.* 45–48. Patent Owner argues that that a POSITA would not have been motivated to split Sano's second lens because of the resulting increase in total track length (TTL) especially since Sano's invention relates to an image pick up lens suitable for a small-sized apparatus. *Id.* at 48–51.

Having reviewed Petitioner's contentions and evidence in light of Patent Owner's arguments, we determine Petitioner has not sufficiently established that a POSITA would have modified Sano in the manner proposed by Petitioner for two primary reasons. First, we agree with Patent Owner that a five-lens optical system, such as the one disclosed in Sano, is structurally very different than a six-lens system claimed in claim 1. Patent Owner's arguments find support in credible testimony from Dr. Bentley. Dr. Bentley testifies that a "five-lens optical system such as disclosed in Sano is very structurally different from a six-lens optical system as claimed" and that "[e]ach lens element has a specific role in the formation of an image and therefore, the number of lens elements in an optical system cannot be modified without a complete redesign." Ex. 2001 ¶ 56. Dr. Bentley explains that if a lens element is added or removed from a system without other modifications, such as when Sano's second lens is split into two lenses, "the focal length, image height, f-number, and TTL of the optical system will change and the image quality of the optical system will deteriorate." *Id.*

Second, even considering Petitioner's modification of a five-lens system into a six-lens system, we determine Petitioner has not provided sufficient support for specifically targeting the second lens of Sano's five lenses for splitting and has improperly relied on hindsight reasoning instead. Petitioner argues that the motivation for modifying Sano is to "reduce aberrations, improve image quality, and improve tolerance to manufacturing

errors." Pet. 27. Petitioner argues that a "POSITA would have been motivated to split lens L2 in Sano Example 3 such that the overall power remained the same but the angles of refraction were reduced." *Id.* The primary reason Petitioner provides for specifically splitting Sano's second lens is that the second lens "has relatively strong refractive power compared to the third lens." *Id.* 24–25 (citing Ex. 1004 ¶ 140; Ex. 1003 ¶ 82). But Patent Owner points out that Petitioner's own reference (Schaub) suggests splitting a *highly powered* element into two or more elements to reduce the angles of incidence. Prelim. Resp. 43 (citing Ex. 1012, 88). Patent Owner demonstrates that three other lenses of Sano's five-lens system have higher refractive power than the second lens. *Id.* at 44. Dr. Bentley testifies that "[i]n view of both Schaub's teaching to consider lens elements with high optical power for splitting and the relatively weak optical power of the second lens element L2, a POSITA would not have been motivated to split the second lens element L2 of Sano's five-lens optical system." Ex. 2001 ¶ 74. In light of Patent Owner demonstrating that Sano's second lens is the second weakest lens of Sano's five-lens system, we find Dr. Bentley's testimony to be credible. Claim 16 requires negative refractive power for the second lens and, therefore, the choice of which lens to split is significant to the obviousness analysis. Here, Petitioner has not persuasively established that the second lens would specifically be a more suitable candidate to split as compared to the other lenses of Sano.

3. Conclusion – Obviousness over Sano (Ground 1)

Accordingly, we are not persuaded of a reasonable likelihood that a POSITA would have modified Sano to split the second lens as proposed by Petitioner and thus are not persuaded that Petitioner has established a reasonable likelihood that the challenged claims are obvious over Sano.

E. Obviousness over KR357 (Ground 2)

Petitioner argues claims 16–20 and 22–24 of the '767 patent would have been obvious over KR357. Pet. 54–92. Below we provide a brief overview of the prior art reference, and then analyze Petitioner's contentions in light of Patent Owner's arguments.

1. Overview of KR357 (Ex. 1005)

KR357 discloses an imaging lens used in a camera module comprising six lenses where the first lens has a positive power, the second lens has a negative power, the third lens has positive power, the fourth lens has positive power, the fifth lens has negative power, and the sixth lens as negative power. Ex. 1005, code (57), ¶ 2. KR357 explains that "an imaging lens having excellent aberration characteristics can be realized by implementing an imaging lens in which all surfaces of the first lens, the second lens, the third lens, the fourth lens, the fifth lens, and the sixth lens are aspherical and using the sixth lens having at least one aspherical inflection point." *Id.* ¶ 6.

Figure 1 of KR357 is reproduced below.

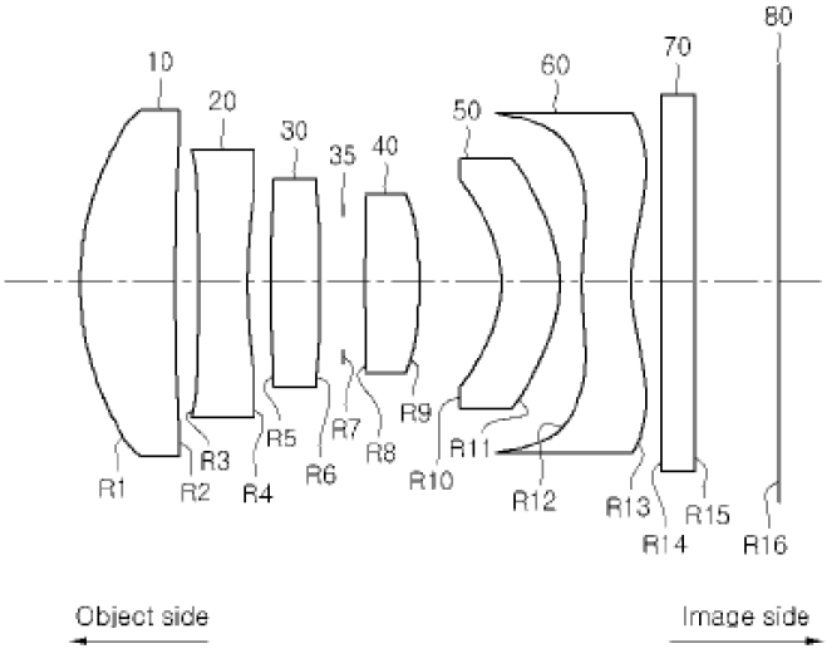


Figure 1 of KR357 depicted above illustrates a side cross-sectional view schematically illustrating the internal structure of an imaging lens according to the embodiment. Ex. 1005 ¶ 8. The imaging lens of Figure 1 comprises a first lens (10), a second lens (20), a third lens (30), an iris (35), a fourth lens (40), a fifth lens (50), a sixth lens (60), a filter (70), and a light receiving element (80), sequentially from the object side toward the image field (R16) side. *Id.* ¶ 9. The first lens (10) has positive power (+) and has a convex surface on the object side, and the second lens (20) is formed to be a lens having negative power. *Id.* ¶ 11. The third lens (30) and the fourth lens (40) have positive power, and an iris (35) is disposed between the third lens (30) and the fourth lens (40). *Id.* ¶ 12. The fifth lens (50) has negative power and may be formed to be a lens of a meniscus type having a concave surface on the object side. *Id.* ¶ 14. The sixth lens (60) has negative power and comprises at least one aspherical inflection point. *Id.* ¶ 15. KR357 explains that the first lens (10) may be formed of a glass material, and the

second lens (20), the third lens (30), the fourth lens (40), the fifth lens (50), and the sixth lens (60) may all be formed of a plastic material. *Id.* ¶ 21.

Table 1 of KR357 shows the optical characteristics of the imaging lens of Figure 1.

Lens surface	Radius of curvature (mm)	Thickness (mm)	Refractive index (N)	Note
R1*	2.53	0.83	1.58	glass
R2*	87.56	0.2		
R3*	-28.72	0.43	1.61	plastic
R4*	5.19	0.2		
R5*	12.54	0.43	1.53	plastic
R6*	-35.2	0.2		
R7	∞	0.2		iris
R8*	7.18	0.46	1.53	plastic
R9*	-3.89	0.72		
R10*	-1.01	0.5	1.61	plastic
R11*	-1.27	0.2		
R12*	3.21	0.43	1.53	plastic
R13*	1.64	0.25		
R14	∞	0.3	1.52	filter
R15	∞	0.73		filter
R16	∞	0		sensor

Table 2 of KR357 shows the aspheric coefficient values of the aspheric lenses of the imaging lens of Figure 1. Ex. 1005 ¶ 37.

Lens surface	K	A_1	A_2	A_3	A_4
R1	0	-0.170770×10^{-2}	0.532367×10^{-2}	-0.162382×10^{-1}	0.215139×10^{-1}
R2	0	0.125653×10^{-1}	-0.161798×10^{-2}	0.177699×10^{-1}	-0.210512×10^{-1}
R3	-1633.563875	-0.141596×10^{-1}	0.223480×10^{-1}	-0.109349×10^{-1}	-0.183460×10^{-1}
R4	-17.673899	0.135415×10^{-2}	0.508368×10^{-2}	-0.189173×10^{-1}	-0.270758×10^{-1}
R5	152.194321	0.560688×10^{-3}	-0.292138×10^{-1}	-0.539585×10^{-1}	-0.146307×10^{-1}
R6	1779.381109	-0.193974×10^{-1}	-0.419479×10^{-1}	-0.203299×10^{-1}	-0.343162×10^{-1}
R8	91.768593	-0.114000	-0.742252×10^{-1}	-0.202829	-0.400345×10^{-1}
R9	15.610423	-0.309774×10^{-1}	-0.214085×10^{-1}	-0.589200×10^{-1}	0.133618×10^{-1}
R10	-0.021182	0.180223	0.107395×10^{-1}	0.204318×10^{-1}	0.564446×10^{-1}
R11	-0.455606	0.842674×10^{-1}	-0.379476×10^{-1}	0.396371×10^{-1}	-0.117242×10^{-1}
R12	-26.859248	-0.133892	-0.198606×10^{-1}	-0.326429×10^{-2}	0.114178×10^{-1}
R13	-6.361442	-0.102361	0.950258×10^{-2}	-0.332042×10^{-2}	-0.209939×10^{-3}

Table 3 of KR357 shows the focal lengths of the lenses of the imaging lens of Figure 1.

Focal length of the first lens (f1)	4.463634 mm
Focal length of the second lens (f2)	-7.120773 mm
Focal length of the third lens (f3)	17.499062 mm
Focal length of the fourth lens (f4)	4.836387 mm
Focal length of the fifth lens (f5)	-30.304228 mm
Focal length of the sixth lens (f6)	-6.988166 m

2. Analysis of Claim 16

a) [16.1] - An image capturing lens assembly comprising, in order from an object side to an image side:

Petitioner argues that KR357 teaches the preamble by disclosing "an imaging lens used in a camera module using a high-resolution image sensor." Pet. 64 (quoting Ex. 1005 ¶ 1). Petitioner argues that "KR357 discloses an 'imaging lens for forming an image' that includes six lenses." *Id.* (citing Ex. 1005 ¶¶ 2, 4, Fig. 1). Patent Owner does not separately dispute Petitioner's contentions for the preamble.

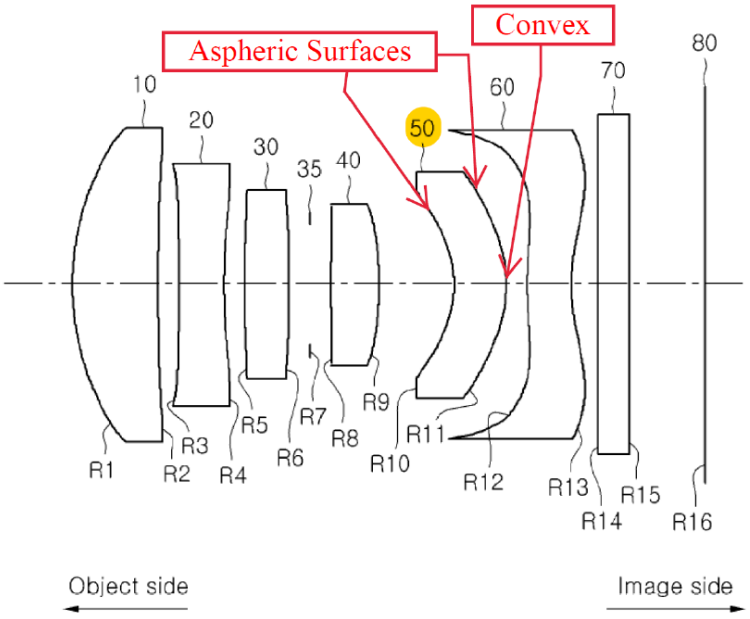
b) [16.2] a first lens element with positive refractive power having a convex object-side surface; [16.3] a second lens element with negative refractive power;[16.4] a third lens element; [16.5] a fourth lens element having at least one of an object-side surface and an image-side surface thereof being aspheric; [16.7] a sixth lens element with negative refractive power having a concave image-side surface, and at least one inflection point is formed on at least one of an object-side surface and the image-side surface thereof

Petitioner argues that "KR357 discloses 'a first lens (10)' where '[t]he first lens (10) has positive power (+) and has a convex surface on the object side.'" Pet. 65 (quoting KR357 ¶¶ 9, 11, Fig. 1). Petitioner argues that a "POSITA would have understood that 'positive power' means positive refractive power." *Id.* (citing Ex. 1003 ¶ 134). Petitioner argues that "KR357 discloses 'a second lens (20),' where 'the second lens (20) is formed to be a lens having negative (-) power.'" *Id.* at 67. Petitioner also

relies on Table 3 of KR357 as showing that the first and second lenses have the recited refractive powers. *Id.* at 67, 68 (citing Ex. 1005, Table 3). Petitioner argues that KR357 discloses a third lens. *Id.* at 68 (citing Ex. 1005 ¶ 9, Fig. 1). Petitioner argues that "KR357 discloses 'a fourth lens (40),' where both the object-side and image-side surfaces are 'aspherical surfaces.'" *Id.* at 69 (citing Ex. 1005 ¶¶ 9, 22, Fig. 1, Table 1, 2). Petitioner argues that KR357 discloses a sixth lens with negative refractive power and that Figure 1 of KR357 "depicts the sixth lens 60 with a concave image-side surface and with at least two aspherical inflection points on the object-side surface (R12) and at least two aspherical inflection points on the image-side surface (R13)." *Id.* at 75 (citing Ex. 1005 ¶¶ 9, 15, Fig. 1; Ex. 1003 ¶ 147). Patent Owner does not separately dispute Petitioner's contentions for limitations 16.2–16.5 and 16.7.

c) [16.6] a fifth lens element with positive refractive power having a convex image-side surface, and at least one of an object-side surface and the image-side surface thereof being aspheric; [16.8] wherein a focal length of the fifth lens element is f5, a focal length of the sixth lens element is f6, a focal length of the third lens element is f3, a focal length of the fourth lens element is f4, and they satisfy the following relation: (|f5|+|f6|) / (|f3|+|f4|) < 0.4;

Regarding limitation 16.6, Petitioner argues that KR357 discloses a fifth lens (50) with a convex image-side surface and both surfaces being aspheric, as shown in Fig. 1. *Id.* at 72 (citing Ex. 1005 ¶¶ 9, 14, 22). Petitioner annotates Figure 1 of KR357, reproduced below, to show the fifth lens with the recited convex image-side surface and aspheric surfaces. *Id.*



KR357, Fig. 1.

Petitioner acknowledges that KR357 discloses that the fifth lens has negative power. Pet. 74 (citing Ex. 1005 ¶ 14). Petitioner argues, however, that a POSITA would have been motivated to optimize the KR357 design, in order to reduce aberrations, increase FOV, and shorten the TTL and that such an optimized design would have a fifth lens of positive refractive power, with other relevant lenses remaining the same power, which is confirmed by ZEMAX modeling. Pet. 74 (citing Ex. 1003 ¶ 145).

Regarding limitation 16.8, Petitioner acknowledges that, as shown in Table 3 of KR357, the focal lengths of the third, fourth fifth and sixth lenses, when applied to the equation of limitation 16.8 ((|f5|+|f6|)/(|f3|+|f4|)), lead to a result of 1.66965 which is greater than, rather than less than, 0.4. Pet. 77 (citing Ex. 1005, Table 3). Petitioner argues, however, that in the modified version of the KR357 design, optimized to reduce TTL and aberrations, the resulting design would have

the following focal lengths shown in the below table reproduced from the Petition.

focal length f3	3.57mm
focal length f4	-51.29mm
focal length f5	4.74mm
focal length f6	-2.42mm

Id. at 78. As a result, the focal length of the fourth lens becomes negative along with the refractive power of the fifth lens becoming positive. Under these modifications, (|f5|+|f6|)/(|f3|+|f4|) = 0.13 for Petitioner's optimized design, which satisfies the claimed ratio of less than 0.4. *Id.*

Patent Owner argues that a POSITA would not have been motivated to change the refractive power of KR357's fifth lens in order to reduce aberrations, as contended by Petitioner, because, according to Patent Owner, "KR357 states that its optical design 'provides an imaging lens having excellent optical aberration characteristics.'" Prelim. Resp. 63 (quoting Ex. 1005 ¶ 3). Patent Owner further argues that the negative power of the fifth lens of KR357 is a critical characteristic of KR357's imaging lens. *Id.* at 62–63 (citing Ex. 2001 ¶ 100). Patent Owner relies on Petitioner's declarant's (Dr. Milster) testimony from a different proceeding as indicating that when a designer specifies the power of a lens, that power is a critical characteristic defining the lens system. *Id.* at 64 (citing Ex. 2009 ¶ 18).

Patent Owner points out that the original value of (|f5|+|f6|)/(|f3|+|f4|) in KR357 is 1.66965, which is four times greater than the upper limit of 0.4 recited in limitation 16.8. Prelim. Resp. 65 (citing Ex. 2001 ¶ 104). Patent Owner argues that Petitioner's optimized redesign has totally different power structure and values, as evidenced by the

fact that it switches the refractive power of the fourth lens from positive to negative and the refractive power of the fifth lens from negative to positive. *Id*. at 65–66. Patent Owner argues that the redesign is a different lens system with a different nature than that originally disclosed in KR357 and that "extent of the foregoing changes to the power structure and refractive powers of original KR357 suggests that Motorola's KR357 Redesign has gone far beyond 'standard optimizations' and is the product of impermissible hindsight." Prelim. Resp. 66–67 (citing Ex. 2001 ¶ 106).

Having reviewed Petitioner's contentions and evidence in light of Patent Owner's arguments, we determine Petitioner has not sufficiently established that a POSITA would have modified KR357 in the manner proposed by Petitioner. Petitioner's modifications include switching the refractive power of its fourth lens from positive to negative and the refractive power of the fifth lens from negative to positive. We agree with Patent Owner that such changes would create a very different lens system than the one disclosed in KR357.

We find Dr. Bentley's testimony credible in this regard. Dr. Bentley testifies that "[a] POSITA would not have modified KR357's lens system to change the power of the fifth lens element from [negative] to [positive], as this would define a different lens system with a different nature than that disclosed in KR357." Ex. 2001 ¶ 103. Similarly, Dr. Bentley testifies that Petitioner's "Redesign has totally different power structure . . . , For example . . . [Petitioner] switches the power of the fourth lens from positive to negative (from a focal length of 4.836 mm to -51.29 mm) and the power of the fifth lens from negative to positive (from a focal length of -30.304 mm to 4.74 mm)." *Id.* ¶ 105.

Petitioner's primary reason for modifying KR357 is "to reduce longitudinal chromatic aberrations through changing the radii of curvature of certain lenses." Pet. 59. We determine, however, that such a reason is insufficient to support modifying the refractive power of KR357's fourth and fifth lenses in light of KR357's explicit statements that the specifically described refractive powers of its lenses are the solution to having "excellent optical aberration characteristics." Ex. 1005 ¶¶ 3, 4. As Patent Owner argues, every discussion of the fourth and fifth lens of KR357 describes them as having positive and negative power, respectively. Ex. 1005 ¶¶ 4, 5, 14, 63, Table 3. KR357, on its own, does not indicate that modification of the refractive power of its lenses would lead to any benefit. Indeed, in light of the statements describing the refractive powers of its lenses as crucial to reducing aberrations, we determine that the opposite inference would be reached by a POSITA.

In summary, Petitioner's proposal to change the refractive power of the fourth and fifth lenses goes far afield from the original disclosure of KR357. Petitioner's reliance on the general knowledge of a POSITA does not persuade us that the differences between the lens system of KR357 and that of claim 16 would have been obvious in light of the explicit and specific nature of KR357's description of its lenses and the critical role their characteristics play in achieving KR357's goals.

d) Conclusion as to Claim 16

For the foregoing reasons, we determine Petitioner has not established a reasonable likelihood that KR357 teaches the limitations of claim 16.

3. Claims 17–20 and 22–24

Claims 17–20 and 22–24 depend directly or indirectly from claim 16. Because we determine Petitioner has not established a reasonable likelihood

that KR357 teaches the limitations of claim 16, we also determine that Petitioner has not established a reasonable likelihood that KR357 teaches the limitations of claims 17–20 and 22–24.

4. Conclusion – Obviousness over KR357 (Ground 2)

Accordingly, having considered the arguments and evidence, we are not persuaded that Petitioner has demonstrated a reasonable likelihood of prevailing on its challenge to claims 16–20 and 22–24 of the '767 patent as obvious over KR357.

IV. CONCLUSION

Petitioner has not demonstrated a reasonable likelihood of prevailing in showing the unpatentability of at least one challenged claim of the '767 patent.

V. ORDER

For the foregoing reasons, it is

ORDERED that the Petition is *denied*, and no trial is instituted.

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