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Paper 29
Date: January 5, 2021

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC., SAMSUNG ELECTRONICS CO., LTD., and
SAMSUNG ELECTRONICS AMERICA, INC.,
Petitioners,

v.

YU ET AL.,
Patent Owners.

IPR2019-01258[1]
Patent 6,611,289 B1

Before WILLIAM V. SAINDON, MINN CHUNG, and MATTHEW J. McNEILL, *Administrative Patent Judges.*

McNEILL, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining Some Challenged Claims Unpatentable
35 U.S.C. § 318(a)

Denying Motion to Exclude
37 C.F.R. § 42.64

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[1] Samsung Electronics Co. Ltd. and Samsung Electronics America, Inc., who filed a petition in IPR2020-00492, have been joined as petitioners in this proceeding.

In this *inter partes* review, instituted pursuant to 35 U.S.C. § 314, Apple Inc., Samsung Electronics Co., Ltd., and Samsung Electronics America, Inc. ("Petitioners") challenge the patentability of claims 1–5 of U.S. Patent No. 6,611,289 ("the '289 patent"). This Final Written Decision is entered pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons discussed below, we determine Petitioners have shown by a preponderance of the evidence that claims 1 and 3–5 of the '289 patent are unpatentable, but have not proven by a preponderance of the evidence that claim 2 is unpatentable.

I. BACKGROUND

A. Procedural History

On June 21, 2019, Apple Inc. filed a Petition (Paper 1, "Pet.") requesting an *inter partes* review of claims 1–5 of the '289 patent (Ex. 1001). Patent Owners did not file a Preliminary Response.

On January 8, 2020, applying the standard set forth in 35 U.S.C. § 314(a), which requires demonstration of a reasonable likelihood that Petitioner would prevail with respect to at least one challenged claim, we instituted an *inter partes* review of the challenged claims. Paper 6 ("Inst. Dec."). In the Institution Decision, we determined Petitioner demonstrated a reasonable likelihood of prevailing as to at least one challenged claim, and we instituted trial on all claims and all grounds in the Petition. Inst. Dec. 40–41.

On February 4, 2020, Samsung Electronics Co. Ltd. and Samsung Electronics America, Inc. filed a Petition requesting *inter partes* review of claims 1–5 of the '289 patent and a motion for joinder to this proceeding in IPR2020-00492. On August 12, 2020, we granted the motion for joinder and

joined Samsung Electronics Co. Ltd. and Samsung Electronics America, Inc. as petitioners in this proceeding. *See* IPR2020-00492, Paper 6.

Patent Owners filed a Patent Owners Response (Paper 9, "PO Resp."), Petitioners filed a Reply to Patent Owners Response (Paper 15, "Reply"), and Patent Owners filed a Sur-reply (Paper 17, "Sur-reply"). In addition, Petitioners moved to exclude (Paper 22) Exhibits 2005–2010, as well as related testimony relied on by Patent Owners (Exhibit 2002 ¶¶ 4–8); Patent Owners opposed (Paper 25).

An oral hearing was held on October 13, 2020, and a copy of the hearing transcript has been entered into the record. Paper 28 ("Tr.").

B. Related Matters

Petitioners indicate that Patent Owners asserted the '289 patent against Apple Inc. in *Yu et al. v. Apple Inc.*, No. 3-18-cv-06181 (N.D. Cal.). Pet. 1–2.

Petitioners indicate that Patent Owners asserted the '289 patent against Samsung Electronics Co. Ltd. and Samsung Electronics America, Inc. in *Yu et al. v. Samsung Electronics Co., Ltd. et al.*, Case No. 3-18-cv-06339 (N.D. Cal.). IPR2020-00492, Paper 3 at 1–2.

C. The '289 Patent

The '289 patent relates to a digital camera that uses multiple image sensors and multiple lenses. Ex. 1001, Abstract. The '289 patent teaches that at the time of the invention, digital cameras typically used photosensitive chips that comprised a plurality of photocells arranged in an array. *Id.* at 1:50–52. The photocells were covered with selectively transmissive filters such that selected groups of photocells sense different ranges of the visible light spectrum, such as one group sensing red, one group sensing blue, and

one group sensing green. *Id.* at 1:52–57. The number of photocells determines the resolution of the resultant digital images. *Id.* at 1:57–59. To increase the resolution of the images, additional photocells were needed, which significantly increased the cost of the chip. *Id.* at 1:66–2:7.

The ’289 patent states that its digital camera takes higher resolution images while minimizing the need for additional photocells. *Id.* at 2:25–35. Figure 3 of the ’289 patent, which is reproduced below, illustrates an embodiment of the invention.

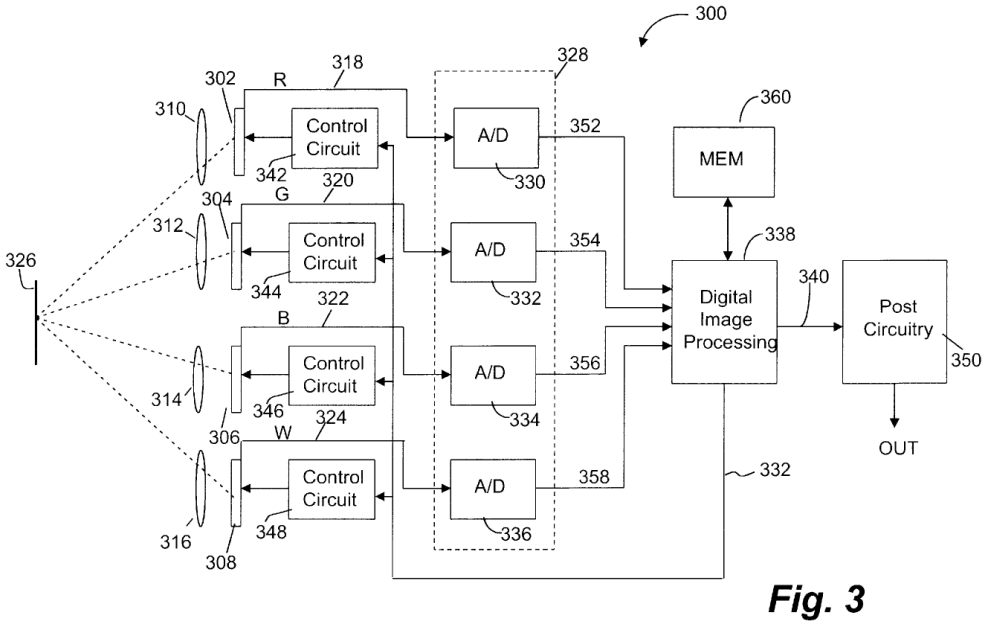


Fig. 3

Figure 3 depicts digital camera 300. *Id.* at 4:62–64. Digital camera 300 includes lenses 310, 312, 314, 316. Each lens has a corresponding imaging sensor 302, 304, 306, 308. *Id.* at 4:64–67. Each imaging sensor is integrated with a transmissive filter. *Id.* at 5:14–17. In the preferred embodiment, imaging sensor 302 uses a red filter, imaging sensor 304 uses a green filter, and imaging sensor 306 uses a blue filter. *Id.* at 5:17–21. Imaging sensor 308

is integrated with a fully transparent filter, allowing the full range of visible light to pass through. *Id.* at 5:28–32.

Digital camera 300 further includes A/D circuitry 328, which comprises four individual A/D converters 330, 332, 334, 336. *Id.* at 5:40–45. The A/D converters output digital images to digital image processing circuitry 338. *Id.* at 5:58–61.

Petitioners note that the '289 patent issued from U.S. Application No. 09/232,769, filed January 15, 1999. Pet. 5. Of the challenged claims, claim 1 is independent. Claims 2–5 depend from claim 1. Claim 1 is illustrative of the challenged claims and recites:

> 1. An improved digital camera comprising:
>
> a first and a second image sensor closely positioned with respect to a common plane, said second image sensor sensitive to a full region of visible color spectrum;
>
> two lenses, each being mounted in front of one of said two image sensors;
>
> said first image sensor producing a first image and said second image sensor producing a second image;
>
> an analog-to-digital converting circuitry coupled to said first and said second image sensor and digitizing said first and said second intensity images to produce correspondingly a first digital image and a second digital image;
>
> an image memory, coupled to said analog-to-digital converting circuitry, for storing said first digital image and said second digital image; and
>
> a digital image processor, coupled to said image memory and receiving said first digital image and said second digital image, producing a resultant digital image from said first digital image enhanced with said second digital image.

Ex. 1001, 10:37–58.

D. Applied References and Declarations

Petitioners rely on the following prior art:

United States Patent No. 5,694,165, issued December 2, 1997 (Ex. 1005, "Yamazaki");

United States Patent No. 6,400,824 B1, issued June 4, 2002 (Ex. 1006, "Mansoorian");

European Patent Application, EP 0 858 208 A1, published August 12, 1998 (Ex. 1007, "Weldy");

World Intellectual Property Organization International Publication No. WO 93/11631, published June 10, 1993 (Ex. 1008, "Denyer");

United States Patent No. 4,506,294, issued March 19, 1985 (Ex. 1009, "Nagumo"); and

United States Patent No. 5,801,773, issued September 1, 1998 (Ex. 1010, "Ikeda").

Petitioners also cite the Declaration of Dr. Alan C. Bovik (Ex. 1003) and the Supporting Declaration of Dr. Bovik (Ex. 1017). Patent Owners cite the Declaration of Kenneth R. Castleman, Ph.D. (Ex. 2001) and the Declarations of Yanbin Yu, Ph.D. (Ex. 2002) and Zhongxuan Zhang, Ph.D. (Ex. 2003).

E. The Asserted Grounds

Petitioners assert the following grounds of unpatentability (Pet. 15–16):

Claim(s) Challenged	35 U.S.C. §[2]	Reference(s)/Basis
1, 2	102(b)	Yamazaki
1, 2	103(a)	Yamazaki
4	103(a)	Yamazaki, Mansoorian
1, 3	103(a)	Weldy, Denyer, Nagumo
4	103(a)	Weldy, Denyer, Nagumo, Mansoorian
5	103(a)	Weldy, Denyer, Nagumo, Ikeda

II. ANALYSIS

A. Level of Ordinary Skill in the Art

With regard to the level of ordinary skill in the art, Petitioners state a person of ordinary skill in the art at the time of the alleged invention "would have a bachelor's or the equivalent degree in electrical and/or computer engineering or a related field and 2-3 years of experience in imaging systems including optics and image processing." Pet. 6. Petitioners further state that "a person with less formal education but more experience, or more formal education but less experience, could have also met the relevant standard." *Id.* Dr. Bovik offers testimony in support of Petitioners' position. Ex. 1003 ¶ 22.

Patent Owners state a person of ordinary skill in the art at the time of the alleged invention "would have at least a master's degree in electrical

[2] The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) ("AIA"), amended 35 U.S.C. §§ 102 and 103. Because the priority date of the '289 patent is before the effective date of the applicable AIA amendments, the pre-AIA versions of 35 U.S.C. §§ 102 and 103 apply.

engineering or applied physics and approximately three to five years of experience in the fields of digital image processing and optics." PO Resp. 11. Patent Owners further state that a person of ordinary skill in the art

> would specifically have experience in the design, arrangement, function, and operation of optics and digital camera components such as image sensors, lenses, analog-to-digital ("A/D") converting circuitry, systems-on-a-chip ("SOCs") and the components thereof, including central processing units ("CPUs"), digital signal processors ("DSPs"), and image signal processors ("ISPs"), as well as concepts relating to digital image processing such as image enhancement, image fusion, digital zoom, and depth mapping.

Id. at 11–12. Dr. Castleman offers testimony in support of Patent Owners' position. Ex. 2001 ¶¶ 8–11.

In the Reply, Petitioners disagree with Patent Owners' proposed level of skill in the art, but state that Patent Owners have not shown that its standard would make any difference in the substantive analysis of the proposed grounds. Reply 2 n.1. Petitioners assert that the different proposed levels of skill in the art do not materially change Petitioners' analysis. *Id.* Patent Owners did not dispute Petitioners' assertions in the Sur-reply.

Despite the differences in wording between the parties' proposals, these proposals are not materially different. *See* Pet. 6; Reply 2; PO Resp. 11–12. These proposals are similar for all purposes relevant to this Final Written Decision, and both are consistent with the level of ordinary skill in the art reflected in the disclosure of the '289 patent and the prior art of record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001); *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995).

Nonetheless, for this Final Written Decision, we adopt Patent Owners' definition of a person of ordinary skill in the art at the time of the claimed

invention because Patent Owner's definition includes, among other things, a helpful, more detailed list of the types of things a person of ordinary skill would know. *See, e.g.*, PO Resp. 11–12. That is, a person of ordinary skill in the art at the time of the claimed invention would have had "at least a master's degree in electrical engineering or applied physics and approximately three to five years of experience in the fields of digital image processing and optics." A person of ordinary skill in the art would have had "experience in the design, arrangement, function, and operation of optics and digital camera components such as image sensors, lenses, analog-to-digital ('A/D') converting circuitry, systems-on-a-chip ('SOCs') and the components thereof, including central processing units ('CPUs'), digital signal processors ('DSPs'), and image signal processors ('ISPs'), as well as concepts relating to digital image processing such as image enhancement, image fusion, digital zoom, and depth mapping."

B. Claim Construction

In an *inter partes* review, we apply the same claim construction standard that would be used in a civil action under 35 U.S.C. § 282(b), following the standard articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). *See* Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51,340, 51,340, 51,358 (Oct. 11, 2018) (amending 37 C.F.R. § 42.100(b) effective November 13, 2018) (now codified at 37 C.F.R. § 42.100(b) (2019)). In particular, claim terms are generally given their ordinary and customary meaning, as would be 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).

In the Petition, Petitioners proposed construing the term "image sensor sensitive to [a/said] full region of visible color spectrum" to mean "image sensor that does not use any filter or uses a filter that does not obstruct any portion of the visible color spectrum, such that the entire image sensor is responsive to the full visible color spectrum." Pet. 7–12. Petitioners also proposed construing the term "image sensor sensitive to a selected range of said full region of visible color spectrum" to mean "image sensor with a single-color color filter, such that each pixel of the image sensor is responsive to a same selected range of said full region of visible color spectrum." *Id.* at 12–15.

In our Decision on Institution, we determined that neither of these proposed phrases required construction. Inst. Dec. 6–8. The parties do not dispute the constructions of these terms in their Patent Owners' Response or Petitioners' Reply. *See* PO Resp. 12; Reply 8. Upon considering the complete record, we see no reason to deviate from our preliminary determination and conclude that neither of these terms requires explicit construction for this Final Written Decision. *See, e.g.*, *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) ("[W]e need only construe terms 'that are in controversy, and only to the

extent necessary to resolve the controversy.'" (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

In the Response, Patent Owners propose construing "closely positioned with respect to a common plane" to mean

> Projections [of the image sensors] from the same reference point onto the same plane being positioned sufficiently close to one another to enable registration of a first image produced by the first image sensor with a second image produced by the second image sensor, and to enable enhancement of a first image produced by the first image sensor with a second image produced by the second image sensor.

PO Resp. 13–16 (alteration in original). Petitioners propose construing this term according to its plain and ordinary meaning. Reply 1–5. Both parties discuss the meaning of this term in the context of Patent Owners' arguments that Yamazaki does not teach or suggest this limitation. *See* PO Resp. 22–24; Reply 15–18; Sur-reply 10–11. Although the parties' arguments raise an issue of claim construction, the arguments are closely related to and interspersed with the arguments regarding Yamazaki's teachings. Thus, for efficiency and completeness, we address this issue in the context of the patentability discussion below.

Patent Owners also propose construing "producing a resultant digital image from said first digital image enhanced with said second digital image" to mean "[d]eriving an enhanced digital image by modifying the qualities of the first digital image using the second digital image, where the first and second digital images represent the same scene." PO Resp. 16. Petitioners propose construing this term according to its plain and ordinary meaning. Reply 5–7. Both parties discuss the meaning of this term in the context of Patent Owners' arguments that Yamazaki does not teach or suggest this

limitation. *See* PO Resp. 18–22; Reply 8–15, 18–20; Sur-reply 8–14. Although the parties' arguments raise an issue of claim construction, the arguments are closely related to and interspersed with the arguments regarding Yamazaki's teachings. Thus, for efficiency and completeness, we address this issue in the context of the patentability discussion below.

No other claim terms need to be construed expressly for purposes of this Final Written Decision. *See Nidec Motor Corp.*, 868 F.3d at 1017 (Fed. Cir. 2017).

C. Ground 1: Alleged Anticipation of Claims 1 and 2 by Yamazaki

Petitioners contend that claims 1 and 2 are unpatentable under 35 U.S.C. § 102 as anticipated by Yamazaki.

1. Yamazaki

Yamazaki is a United States Patent directed to an image taking apparatus that includes multiple lens units that produce images that are combined into a single image. Ex. 1005, Abstract. Figure 1 of Yamazaki illustrates an example of the image taking apparatus and is reproduced below.

FIG. 1

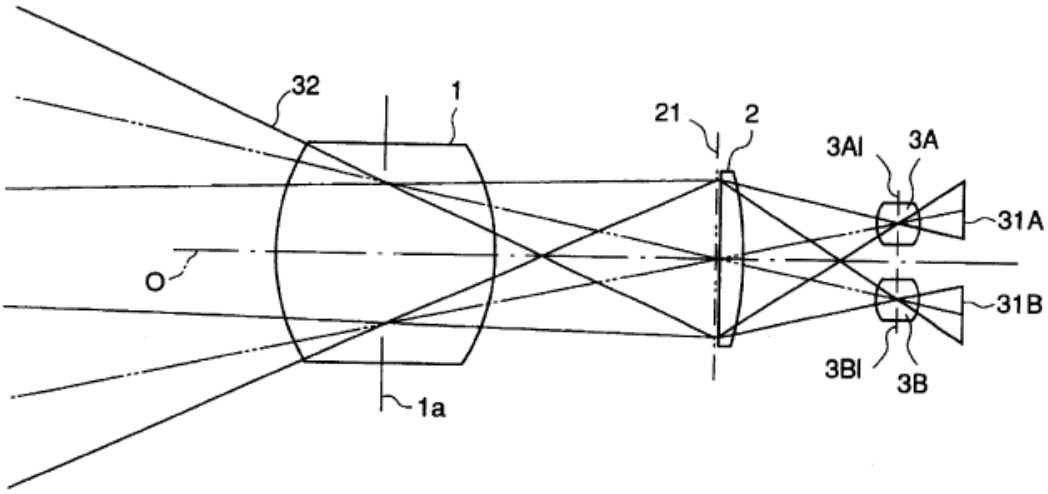


Figure 1 depicts a cross-sectional view of an optical system of one embodiment disclosed by Yamazaki. *Id.* at 3:37–39. In this embodiment, lenses 3A and 3B are positioned behind image sensor elements 31A and 31B. *Id.* at 3:54–60.

On this record, we agree with Petitioners (Pet. 16) that Yamazaki qualifies as prior art under 35 U.S.C. § 102(b) because Yamazaki's issue date of December 2, 1997, is more than one year before the filing date of the '289 patent, which is January 15, 1999. *See* Ex. 1001, code (22); Ex. 1005, code (45).

2. Independent Claim 1

A claim is anticipated only if each and every element as set forth in the claims is found, either expressly or inherently, described in a single prior art reference, and arranged as required by the claim. *Verdegaal Bros., Inc. v. Union Oil. Co. of Cal.*, 814 F.2d 628, 631 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the . . . claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236 (Fed. Cir. 1989).

Petitioners assert claim 1 is anticipated by Yamazaki. Pet. 22–40. We address each limitation in turn.

a) Preamble

The preamble of claim 1 recites: "[a]n improved digital camera." Ex. 1001, 10:37. Petitioners assert Yamazaki discloses this limitation. Pet. 22–23. In particular, Petitioners assert Yamazaki discloses an image taking apparatus that includes image sensor elements 31A and 31B that generate electrical signals that are converted into digital signals. *Id.* (citing Ex. 1005, Abstract, 1:10–61, 4:28–37). Petitioners assert this information is read from memory circuits and combined into a high resolution image. *Id.* at 23 (citing Ex. 1005, 4:37–40; Ex. 1003 ¶¶ 74–75). Dr. Bovik offers testimony in support of Petitioners' assertions with regard to the preamble. Ex. 1003 ¶¶ 73–76.

Patent Owners do not specifically dispute that Yamazaki discloses the preamble of claim 1. *See generally* PO Resp. Based on the complete record and for the reasons explained by Petitioners, we are persuaded that Petitioners have demonstrated sufficiently that Yamazaki discloses the preamble of claim 1.[3]

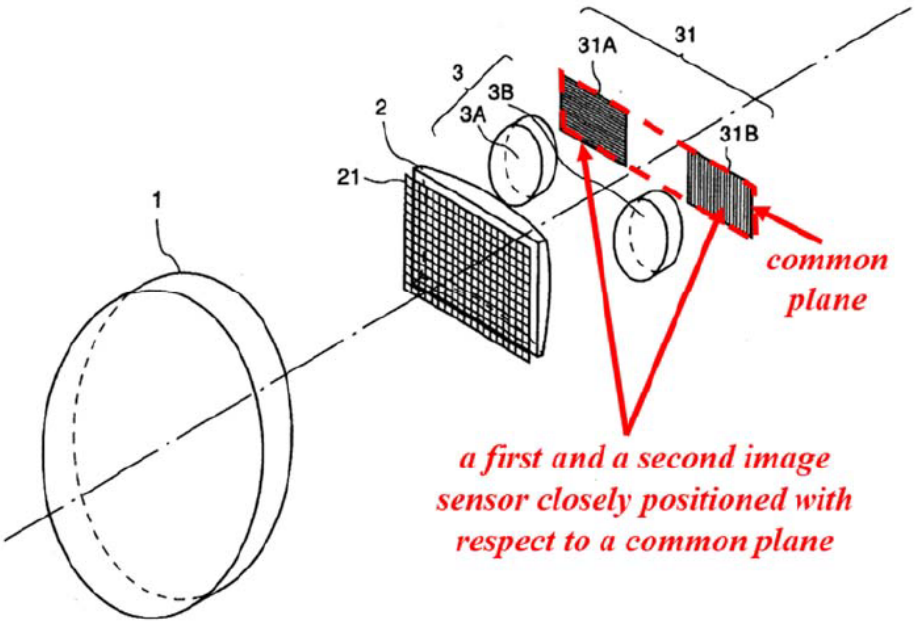
b) "a first and a second image sensor closely positioned with respect to a common plane"

Claim 1 further recites "a first and a second image sensor closely positioned with respect to a common plane." Ex. 1001, 10:38–39. Petitioners assert Yamazaki discloses this limitation. Pet. 24–26. In particular,

[3] Because Petitioners have shown sufficiently that the recitations in the preamble are satisfied by Yamazaki, we need not determine whether the preamble is limiting. *See Vivid Techs.*, 200 F.3d at 803.

Petitioners assert Yamazaki discloses image sensor elements 31A and 31B are positioned behind lens units 3A and 3B. *Id.* at 24 (citing Ex. 1005, 3:54–56). Petitioners argue an ordinarily skilled artisan would have understood from Figure 1 (shown above) and Figure 2 (shown below) that the imaging planes of lens units 3A and 3B are on a common plane and that image sensors 31A and 31B are closely positioned with respect to that common plane. *Id.* (citing Ex. 1003 ¶ 78). Petitioners argue that the limitation "closely positioned with respect to a common plane" requires that the image sensors are positioned closely to the common plane, but does not require that the image sensors are closely positioned to one another. Tr. 44:14–45:11. Petitioners argue Yamazaki discloses such positioning, and Petitioners annotate Figure 2 as shown below to illustrate this contention. Pet. 25.

FIG. 2



(APPL-1005), Fig. 2, annotated

Annotated Figure 2 depicts lenses 3A and 3B and image sensors 31A and 31B, with annotations identifying a common plane and the positions of image sensors 31A and 31B relative to that plane. *Id.* Petitioners offer Dr. Bovik's testimony in support of their assertions with regard to this limitation. Ex. 1003 ¶¶ 77–81.

Patent Owners argue "a first and a second image sensor closely positioned with respect to a common plane" should be construed to mean:

> Projections [of the image sensors] from the same reference point onto the same plane being positioned sufficiently close to one another to enable registration of a first image produced by the first image sensor with a second image produced by the second image sensor, and to enable enhancement of a first image produced by the first image sensor with a second image produced by the second image sensor

PO Resp. 13–16 (alteration in original); Sur-reply 2–4. Patent Owners argue Yamazaki does not disclose this limitation under its proposed construction. *See* PO Resp. 22–24; Sur-reply 10–11. In particular, Patent Owners argue this limitation requires that the first image sensor and second image sensor be positioned closely to one another. *See* Sur-reply 10–11. Patent Owners argue this limitation does not restrict the positioning of the sensors relative to the common plane. *See id.* Patent Owners argue the close positioning of the image sensors relative to each other must enable image registration and enable image enhancement. *See id.*

We first consider the claim construction of "a first and a second image sensor closely positioned with respect to a common plane." Patent Owners propose a lengthy construction of "a first and a second image sensor closely positioned with respect to a common plane," arguing that this construction reflects functional language that explains the teachings of the '289 patent.

See PO Resp. 15. Patent Owners argue this construction does not import limitations from the Specification because the construction merely requires close positioning to enable registration and to enable image enhancement without requiring these to be performed. *See* Sur-reply 3–4.

Petitioners argue this limitation should be given its plain and ordinary meaning. *See* Reply 1–5. Petitioners argue Patent Owners do not contend that the patentee acts as his own lexicographer for this term, nor do Patent Owners contend the patentee disavowed the full scope of the claim term either in prosecution or in the specification. *See id.* at 3.

Claim terms are generally given their ordinary and customary meaning, as would be 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. "There are only two exceptions to this general rule: 1) when a patentee sets out a definition and acts as his own lexicographer, or 2) when the patentee disavows the full scope of a claim term either in the specification or during prosecution." *Thorner v. Sony Computer Entm't Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012). Thus, in general, "a particular embodiment appearing in the written description may not be read into a claim when the claim language is broader than the embodiment." *SuperGuide Corp. v. DirecTV Enters., Inc.*, 358 F.3d 870, 875 (Fed. Cir. 2004).

We agree with Petitioners that the plain and ordinary meaning of this limitation applies. As argued by Petitioners, Patent Owners' expert witness, Dr. Castleman, admits that this limitation only addresses the image sensors positioning without any requirements related to image registration. *See* Reply 4–5 (citing Ex. 1019, 106–107 (Castleman deposition)). Patent

Owners' proposed construction imports limitations linking the positioning of the image sensors with image registration and image enhancement that are not present in the claims. The proposed construction does not clarify the meaning of the disputed limitation, and instead imports limitations from the specification into the claims without adequate justification. Accordingly, we do not adopt Patent Owners' proposed construction. Instead, we agree with Petitioners that "a first and a second image sensor closely positioned with respect to a common plane" should be construed according to its plain and ordinary meaning.

However, adopting the plain and ordinary meaning of the limitation does not settle the dispute over the meaning of this limitation. In particular, the parties dispute whether "closely positioned with respect to a common plane" refers to (1) the positioning of the image sensors relative to the common plane, as argued by Petitioners, or (2) the positioning of the image sensors relative to one another as viewed with respect to the common plane, as argued by Patent Owners. *See* Tr. 44:14–45:11; Sur-reply 10–11.[4]

We agree with Patent Owners that "closely positioned with respect to a common plane" refers to the positioning of the image sensors relative to one another and that this positioning is assessed with respect to the common plane. *See* Sur-reply 10–11. The '289 Patent discusses the relative positioning of the image sensors to one another, not relative to the common plane. In particular, the '289 patent discloses image sensors 502, 504, 506,

[4] By way of example, imagine a desk top as the plane and two coins as the sensors. Petitioners' construction assumes the coins are not necessarily on the desk top, and seeks to measure how close the coins are to the desk top. Patent Owner's construction assumes the coins are on the desk top, and seeks to measure how close they are to one another. *See* Tr. 44:14–45:11.

and 508 are "very close[ly] positioned." Ex. 1001, 7:66–8:1. "As described before, image sensors are closely positioned, the special position offset is normally small." *Id.* 8:30–32.

To summarize, for this Final Written Decision, we construe "a first and a second image sensor closely positioned with respect to a common plane" according to its plain and ordinary meaning with the understanding that "closely positioned with respect to a common plane" refers to the positioning of the image sensors relative to one another and that this positioning is assessed with respect to the common plane. For the reasons explained below, Petitioners demonstrate sufficiently that Yamazaki discloses "a first and a second image sensor closely positioned with respect to a common plane" under this construction.

In arguing that Yamazaki discloses this limitation under the plain and ordinary meaning of the term (*see* Pet. 24–25; Reply 15–18), Petitioners assert Yamazaki discloses

> image sensors 31A and 31B are closely positioned in the common plane because in Yamazaki, "with respect to the position of the image sensor element 31A, the image sensor element 31B is positioned with a pixel displacement by a half of the pixel width t in the horizontal (main scanning) direction, and the images formed on said image sensor elements 31A, 31B are combined by an image combination process circuit (not shown) to double the resolving power in the horizontal direction."

Reply 17 (quoting Ex. 1005, 4:13–20). These disclosures relate to image sensors that lie in a common plane and are closely positioned, relative to one another, with respect to that common plane. *See, e.g.*, Ex. 1005, Fig. 5.

Dr. Bovik offers testimony in support of Petitioners' argument. *See* Pet. 24–26 (citing Ex. 1003 ¶¶ 79–81); Reply 15–18 (citing Ex. 1017 ¶¶ 20–

23). Dr. Bovik testifies that an ordinarily skilled artisan would have understood that Yamazaki discloses image sensors "closely positioned with respect to a common plane" because the image sensors "are both positioned at that common plane." Ex. 1003 ¶ 78.

Dr. Bovik testifies that an ordinarily skilled artisan would have understood that image sensors 31A and 31B "are closely positioned in the common plane" because the image sensors are positioned with a half-pixel width displacement in the horizontal direction. Ex. 1017 ¶ 22 (citing Ex. 1005, 4:13–20). Dr. Bovik testifies that because the image sensors are closely positioned in a common plane, the image sensors are closely positioned with respect to a common plane. *Id.* That is, Dr. Bovik testifies that Yamazaki discloses image sensors that are closely positioned relative to one another as viewed with respect to a common plane, consistent with our interpretation of the "closely positioned" limitation discussed above. In other words, and using the analogy above in footnote 4 to illustrate, the sensors are both on the desk (the common plane) and close to each other on the desk.[5]

Patent Owners argue Yamazaki does not disclose image sensors closely positioned relative to one another as viewed with respect to a common plane. In particular, Patent Owners argue Yamazaki's figures are merely schematics that are not drawn to scale, and, therefore, cannot be relied upon as showing image sensors closely positioned relative to one

[5] Dr. Bovik also testifies that Yamazaki's image sensors are "closely positioned" to the common plane, in support of Petitioners' interpretation of the term. For example, Dr. Bovik testifies that each image sensors' spatial position offset "with respect to the common plane is small (equal to or close to zero), because each image sensor is positioned at the common plane." Ex. 1003 ¶ 79.

another. *See* Sur-reply 10. Patent Owners also argue Yamazaki "does not include any description whatsoever of how close or far apart the image sensors . . . are positioned relative to one another." *Id.* Patent Owners argue Yamazaki's optical unit 2 obviates the need to position the image sensors close to one another, which undermines any contention this feature is present without being explicitly described. *Id.* at 11 (citing Ex. 2001 ¶ 36).

Considering the evidence as a whole, we are persuaded that Petitioners have demonstrated by a preponderance of the evidence that Yamazaki discloses this limitation under our construction set forth above. Of particular note, Petitioners identify teachings in Yamazaki that indicate that image sensors 31A and 31B are "positioned with a pixel displacement by a half a pixel width t in the horizontal (main scanning) direction." Reply 17 (quoting Ex. 1005, 4:13–20). Thus, Yamazaki addresses the position of image sensors 31A and 31B relative to one another as viewed with respect to a common plane.

Although neither party argues for particular metes and bounds of the term "closely," we are persuaded that a pixel displacement of half a pixel falls within the bounds of this term of degree. Indeed, Patent Owners' argument regarding whether Yamazaki provides an enabling disclosure of the "producing" limitation (discussed below) highlights the extremely small distance represented by a half pixel. *See* PO Resp. 20–22; Sur-reply 18–20. Patent Owners' arguments do not demonstrate that this disclosure fails to show closely positioned image sensors. In particular, Patent Owners' argument regarding Yamazaki's figures not being drawn to scale (*see* Sur-reply 10) is unpersuasive because Yamazaki's textual disclosures also indicate that the image sensors are closely positioned (*see* Ex. 1005, 4:13–

20). Yamazaki's figures support this teaching regardless of whether the figures are drawn to scale. Also, Patent Owners' argument regarding Yamazaki's optical unit obviating the need for closely positioning the image sensors (*see* Sur-reply 11) is not persuasive because the presence of the optical unit does not indicate, one way or the other, whether the image sensors are closely positioned. As discussed above, we do not adopt Patent Owners' proposed construction, which imports the requirement that the image sensors' close positioning enables image registration and image enhancement. Thus, even if we agreed that Yamazaki's optical unit obviates the need for the image sensors to be closely positioned, the close positioning of the image sensors need not be the only or primary factor that enables image registration and image enhancement.

Thus, based on the complete record, we are persuaded that Petitioners have demonstrated sufficiently that Yamazaki discloses this limitation.

c) "said second image sensor sensitive to a full region of visible color spectrum"

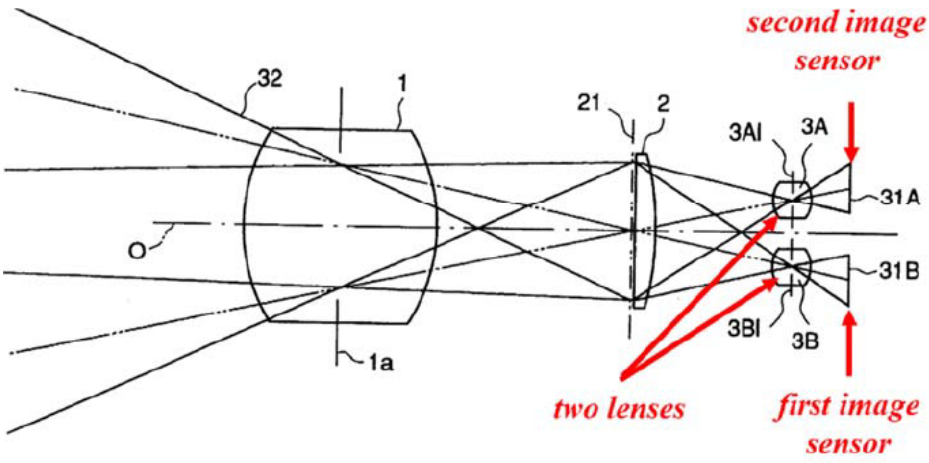
Claim 1 further recites "said second image sensor sensitive to a full region of visible color spectrum." Ex. 1001, 10:39–40. Petitioners assert Yamazaki discloses this limitation. Pet. 26–27. In particular, Petitioners assert that in Yamazaki's first embodiment, image sensor elements 31A and 31B are provided without a color filter. *Id.* at 26 (citing Ex. 1005, 5:32–39, Ex. 1003 ¶¶ 83–84). Petitioners assert that an image sensor without a color filter is an image sensor sensitive to a full region of visible color spectrum. *Id.* at 27 (citing Ex. 1003 ¶ 87). Dr. Bovik offers testimony in support of Petitioners' assertions with regard to this limitation. Ex. 1003 ¶¶ 82–89.

Patent Owners do not specifically dispute that Yamazaki discloses this limitation. *See generally* PO Resp. Based on the complete record and for the reasons explained by Petitioners, we are persuaded that Petitioners have demonstrated sufficiently that Yamazaki discloses this limitation.

d) "two lenses, each being mounted in front of one of said two image sensors"

Claim 1 further recites "two lenses, each being mounted in front of one of said two image sensors." Ex. 1001, 10:41–42. Petitioners assert Yamazaki discloses this limitation. Pet. 28–29. In particular, Petitioners assert that lens units 3A and 3B are mounted in front of image sensors 31A and 31B, respectively. *Id.* at 28 (citing Ex. 1005, 3:54–56, 3:61–64, 4:3–9; Ex. 1003 ¶ 91). To illustrate this contention, Petitioners annotate Figure 1 as shown below. *Id.*

FIG. 1



(APPL-1005), Fig. 1, annotated

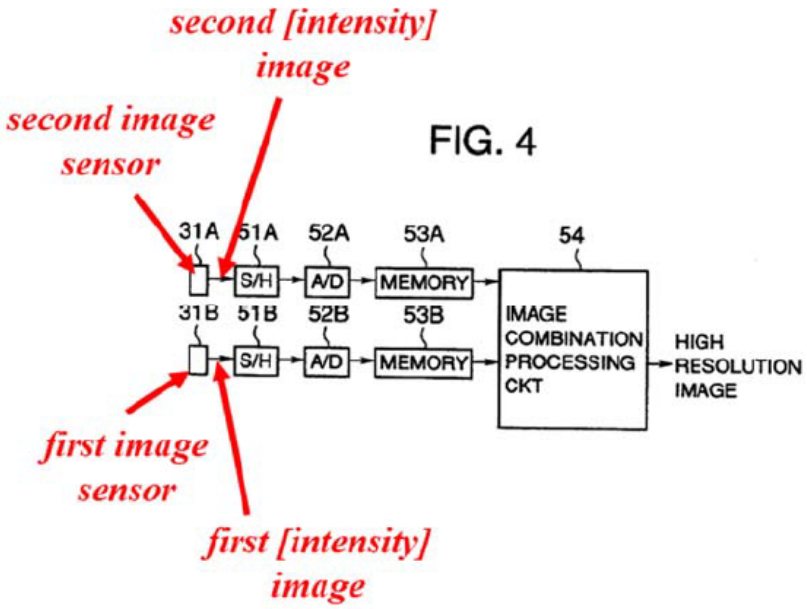
Annotated Figure 1 depicts lenses 3A and 3B positioned behind image sensors 31A and 31B, with Petitioners' annotations identifying the lenses

and image sensors. *Id.* Dr. Bovik offers testimony in support of Petitioners' assertions with regard to this limitation. Ex. 1003 ¶¶ 90–93.

Patent Owners do not specifically dispute that Yamazaki discloses this limitation. *See generally* PO Resp. Based on the complete record and for the reasons explained by Petitioners, we are persuaded that Petitioners have demonstrated sufficiently that Yamazaki discloses this limitation.

e) "said first image sensor producing a first image and said second image sensor producing a second image"

Claim 1 further recites "said first image sensor producing a first image and said second image sensor producing a second image." Ex. 1001, 10:44–45. Petitioners assert Yamazaki discloses this limitation. Pet. 29–31. In particular, Petitioners assert image sensors 31A and 31B each produce an electrical signal (the claimed first and second "[intensity] image[s]"). Pet. 29–30 (citing Ex. 1005, Fig. 4, 4:33–37; Ex. 1003 ¶¶ 95–96). To illustrate this contention, Petitioners annotate Figure 4 as shown below. *Id.* at 30.



(APPL-1005), Fig. 4, annotated

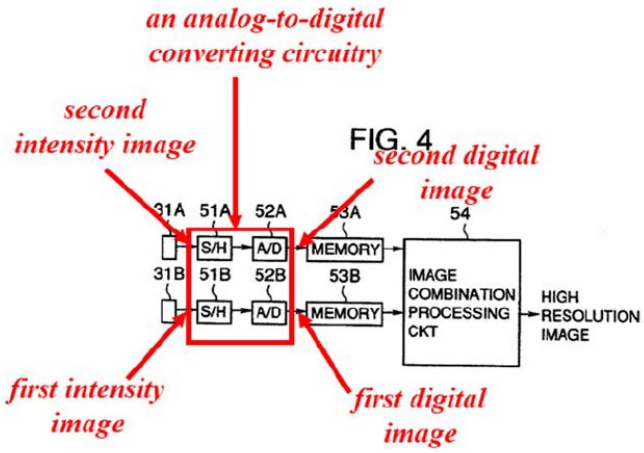
Annotated Figure 4 depicts image sensors 31A and 31B, labeled in red as second image sensor and first image sensor, respectively, providing output signals, labeled in red as second [intensity] image and first [intensity] image, to sample-hold (S/H) circuits 51A and 51B, which provide output signals to analog-digital (A/D) conversion circuits 52A, 52B. Ex. 1005, 4:33–37; Pet. 30. Dr. Bovik offers testimony in support of Petitioners' assertions with regard to this limitation. Ex. 1003 ¶¶ 94–100.

Patent Owners do not specifically dispute that Yamazaki discloses this limitation. *See generally* PO Resp. Based on the complete record and for the reasons explained by Petitioners, we are persuaded that Petitioners have demonstrated sufficiently that Yamazaki discloses this limitation.

f) "an analog-to-digital converting circuitry coupled to said first and said second image sensor and digitizing said first and said second intensity images to produce correspondingly a first digital image and a second digital image"

Claim 1 further recites "an analog-to-digital converting circuitry coupled to said first and said second image sensor and digitizing said first and said second intensity images to produce correspondingly a first digital image and a second digital image." Ex. 1001, 10:46–50. Petitioners assert Yamazaki discloses this limitation. Pet. 31–32. In particular, Petitioners assert first and second image sensors 31A, 31B are coupled to S/H circuits 51A, 51B and A/D conversion circuits 52A, 52B. *Id.* at 31. Petitioners assert S/H circuits 51A, 51B and A/D conversion circuits 52A, 52B combine to form analog-to-digital converting circuitry for each respective image sensor. *Id.* Petitioners assert Yamazaki teaches A/D conversion circuits 52A, 52B output first and second digital signals that correspond to digital images. *Id.*

at 31–32 (citing Ex. 1005, 4:33–37; Ex. 1003 ¶¶ 103–104). To illustrate this contention, Petitioners annotate Figure 4 as shown below. *Id.* at 32.



(APPL-1005), Fig. 4, annotated

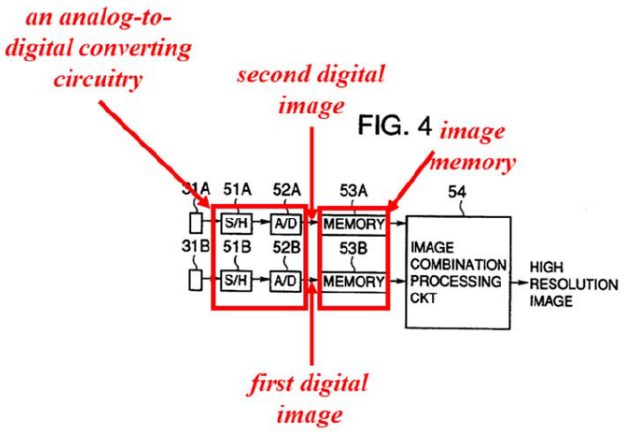
Annotated Figure 4 depicts S/H circuits 51A, 51B and A/D conversion circuits 52A, 52B, collectively labeled in red as "analog-to-digital converting circuitry," receiving input signals from image sensors 31A, 31B and outputting signals labeled in red as first and second "digital image[s]" to memory 53A and memory 53B. *Id.* Dr. Bovik offers testimony in support of Petitioners' assertions with regard to this limitation. Ex. 1003 ¶¶ 101–105.

Patent Owners do not specifically dispute that Yamazaki discloses this limitation. *See generally* PO Resp. Based on the complete record and for the reasons explained by Petitioners, we are persuaded that Petitioners have demonstrated sufficiently that Yamazaki discloses this limitation.

g) "an image memory, coupled to said analog-to-digital converting circuitry, for storing said first digital image and said second digital image"

Claim 1 further recites "an image memory, coupled to said analog-to-digital converting circuitry, for storing said first digital image and said second digital image." Ex. 1001, 10:51–53. Petitioners assert Yamazaki

discloses this limitation. Pet. 33–34. In particular, Petitioners assert the first and second digital images that are output from A/D circuits 52A, 52B are stored in memory 53A, 53B, respectively. *Id.* at 33. To illustrate this contention, Petitioners annotate Figure 4 as shown below. *Id.*



(APPL-1005), Fig. 4, annotated

Annotated Figure 4 depicts analog-to-digital converting circuitry outputting first and second digital images to memory 53A, 53B, which collectively have been annotated as "image memory." *Id.* Dr. Bovik offers testimony in support of Petitioners' assertions with regard to this limitation. Ex. 1003 ¶¶ 106–109.

Patent Owners do not specifically dispute that Yamazaki discloses this limitation. *See generally* PO Resp. Based on the complete record and for the reasons explained by Petitioners, we are persuaded that Petitioners have demonstrated sufficiently that Yamazaki discloses this limitation.

h) "a digital image processor, coupled to said image memory and receiving said first digital image and said second digital image, producing a resultant digital image from said first digital image enhanced with said second digital image"

Claim 1 further recites "a digital image processor, coupled to said image memory and receiving said first digital image and said second digital

image, producing a resultant digital image from said first digital image enhanced with said second digital image." Ex. 1001, 10:54–58. Petitioners assert Yamazaki discloses this limitation. Pet. 34–36. In particular, Petitioners assert that the first and second digital images stored in memory 53A, 53B are combined by image combination processing circuit 54. *Id.* at 34 (citing Ex. 1005, 4:37–40; Ex. 1003 ¶ 112). Petitioners assert that the image combination processing circuit is a processor that obtains a high definition image from the input. *Id.* at 34–35 (citing Ex. 1005, Abstract; Ex. 1003 ¶ 112). Dr. Bovik offers testimony in support of Petitioners' assertions with regard to this limitation. Ex. 1003 ¶¶ 110–117.

Patent Owners argue Yamazaki does not disclose "producing a resultant digital image from said first image enhanced with said second digital image" for two reasons. *See* PO Resp. 18–22; Sur-reply 8–14. First, Patent Owners argue Yamazaki does not provide an operable and enabling disclosure of combining images to double resolving power. *See* PO Resp. 19–22; Sur-reply 11–14. Second, Patent Owners argue that even if Yamazaki's disclosure were enabling, Yamazaki does not disclose this limitation under Patent Owners' proposed construction. *See* PO Resp. 18–19; Sur-reply 8–10.

First, Patent Owners argue Petitioners rely on Yamazaki's disclosure of doubling the resolving power of images to satisfy the "producing" limitation. *See* PO Resp. 18–19. Patent Owners argue Yamazaki teaches doubling the resolving power of images by producing images that are precisely offset from one another by a distance of half a pixel, but Yamazaki does not teach how to achieve this precise offset. *Id.* at 21 (citing Ex. 2001 ¶ 35). Patent Owners argue producing images that are precisely offset in this

manner would require aligning Yamazaki's components within a small fraction of a pixel both translationally and rotationally. *Id.* (citing Ex. 1005, Fig. 2). Patent Owners argue Yamazaki does not teach how to achieve such precise alignment, and an ordinarily skilled artisan would have understood that such precise alignment could not be achieved during manufacturing or maintained after manufacturing due to environmental factors such as thermal expansion. *Id.* at 22.

Dr. Castleman offers testimony in support of Patent Owners' assertions. *See* Ex. 2001 ¶ 35. Dr. Castleman testifies that the manufacturing difficulties are exacerbated by the small size of individual pixels on the image sensors. *Id.* Dr. Castleman testifies that Yamazaki discloses that typical image sensors at the time of the invention included about 400,000 pixels, with pixel dimensions were in the range of 10–20 microns. *Id.* Dr. Castleman testifies that Yamazaki does not teach how to manufacture a camera to achieve this resolution improvement. *Id.*

Petitioners respond that Patent Owners fail to prove that Yamazaki does not provide an enabling disclosure. *See* Reply 18–20. In particular, Petitioners argue Yamazaki discloses how to achieve the disclosed pixel displacement, including receiving light beams split by an optical element with plural solid-state area sensors positioned with mutual displacement by a half of the pitch of the pixels or less. *Id.* at 19 (citing Ex. 1005, 1:52–65). Petitioners argue relative position displacement, including half-pixel displacement, was well known in the art. *Id.* at 19–20 (citing Ex. 1009, Fig. 1, 2:54–56, 1:28–29; Ex. 1022, Fig. 9, 1:10–44; Ex. 1017 ¶ 26).

Dr. Bovik offers testimony in support of Petitioners' arguments. *See* Ex. 1017 ¶¶ 24–26. Dr. Bovik testifies that it was well known in the art how to achieve a half-pixel alignment between two image sensors. *Id.* ¶¶ 25–26.

Yamazaki is a United States Patent, and as such its disclosures "are presumptively enabling." *In re Antor Media Corp.*, 689 F.3d 1282, 1287–88 (Fed. Cir. 2012) (citing *Amgen Inc. v. Hoechst Marion Roussel, Inc.*, 314 F.3d 1313, 1355 (Fed. Cir. 2003)). This presumption applies before this Board, and places the burden on Patent Owners to show that Yamazaki's disclosures are not enabling. *Id.* at 1288; *see also* Tr. 26:1–7 (Patent Owner's counsel acknowledging it bears the burden of showing non-enablement).

Dr. Bovik testifies that it was well known in the art how to achieve half-pixel relative displacement. Ex. 1017 ¶¶ 24–26. Dr. Bovik's testimony is supported by the disclosures of Nagumo and U.S. Patent No. 5,754,226 to Yamada et al (Ex. 1022). Nagumo and Yamada are both United States Patents and, therefore, are presumptively enabling for their disclosures. Nagumo discloses, in its description of the related art, charge-coupled devices that are displaced by one-half of the alignment pitch of the picture sensing units. Ex. 1009, 1:13–29. Yamada discloses, in its description of the related art, images displaced by a half pixel on imaging plates 21 and 22. Ex. 1022, 1:16–27, Fig. 9. Yamada discloses that this half-pixel displacement can be used as part of a process to double resolving power of an image. *Id.* at 1:36–44. Thus, both of these references disclose that it was well known in the art how to achieve half-pixel displacement, and Yamada specifically discloses using half-pixel displacement to double image resolving power. We, therefore, credit Dr. Bovik's testimony that it was well

known in the art how to achieve half-pixel relative displacement. Considering the foregoing and based on the complete record, Patent Owners have not overcome the presumption that Yamazaki's disclosure is enabling for its teaching of doubling the resolving power of images.

Second, Patent Owners argue Yamazaki does not disclose this limitation as the term is properly construed. In particular, Patent Owners argue Yamazaki discloses combining a first unaltered image with a second unaltered image to create an image with twice the resolution of the original images. *See* PO Resp. 18–19; Sur-reply 8–10. Patent Owners argue this combination of unaltered images does not disclose enhancing a first image with a second image, as claimed. *See* PO Resp. 18–19; Sur-reply 8–10. Patent Owners argue "producing a resultant digital image from said first digital image enhanced with said second digital image" should be construed to mean "[d]eriving an enhanced digital image by modifying the qualities of the first digital image using the second digital image, where the first and second digital images represent the same scene." PO Resp. 16. Patent Owners argue Yamazaki's combination of unaltered images does not modify the qualities of the first digital image using the second digital image, as required by its construction. *See* PO Resp. 18–19; Sur-reply 8–10.

Petitioners argue that enhancing a first image with a second image does not require modifying the qualities of an image, nor does it require modifying pixel values of precisely aligned images. *See* Reply 8–9. Petitioners argue Yamazaki's disclosure of combining a first image and second image to create a resultant image with double the resolution constitutes "image fusion," which Petitioners allege is described as an

example of image enhancement by Dr. Castleman. *See id.* at 9–12 (citing Ex. 1019, 36–37).

Petitioners also argue that Yamazaki discloses this limitation even under Patent Owners' proposed construction because Yamazaki discloses image combination processing circuit 54 "generates the resultant digital image (enhanced image) by modifying the qualities of the first digital image (*e.g.*, by doubling the resolution and resolving power of the first digital image in the horizontal direction) using the second digital image." Reply 13. According to Petitioners, resolution and resolving power are qualities of a digital image and Yamazaki's resultant image are enhanced from the first digital image using the second digital image. *Id.* at 14.

As discussed above with respect to claim construction, the parties propose different constructions for the limitation "producing a resultant digital image from said first digital image enhanced with said second digital image." We do not find it necessary to explicitly construe the term to resolve the parties' dispute. However, we note that the crux of Patent Owners' argument and proposed construction is that the "producing" limitation requires that a resultant image is produced from a first image that is modified using a second image, and that modification must constitute an enhancement of the first image. We agree with Patent Owners on this point.

Claim 1 recites "digitizing said first and said second intensity images to produce correspondingly a first digital image and a second digital image." Ex. 1001, 10:46–50. These first and second digital images are then stored in an image memory. *Id.* at 10:51–53. Next, a "digital image processor" receives these first and second digital images, "producing a resultant digital image from said first digital image enhanced with said second digital

image." *Id.* at 10:54–58. Thus, the plain language of the claim requires that the first image is enhanced with the second image.

The Specification of the '289 patent provides examples of enhancing a first image with a second image. For example, the '289 patent states an image obtained from an additional image sensor "can help to modify image qualities of the original image from the monochromatic image sensor." *Id.* at 7:40–43. The '289 patent also states that "[o]ne of the key features of the present multiple sensors is to use the intensity image from B/W sensor 308 to expand the dynamic ranges of images from sensors 302, 304 and 306 so as to increase overall dynamic range of the resultant color images." *Id.* at 9:23–27. The '289 patent also explicitly refers to an image with a larger dynamic range as an image that has been "enhanced." *Id.* at 9:46–50.

The '289 patent also states that "with images of the same imaging target from the multiple sensors, it is possible to enhance images, such as noise removal and color correction at 820." *Id.* at 10:12–15. The '289 patent explains further, stating:

> What sets the present invention fundamentally apart from existing technologies is the use of the black-and-white intensity image from the image sensor with a full transparent 20 filter or no filter at all. The B/W image sensor can capture full information including details that may be missed by those color image sensors. The intensity image from the B/W image sensor is then repeatedly used in the image processing processes in the DSP chip that subsequently 25 produces a high quality and film-like digital image.

Id. at 10:17–25.

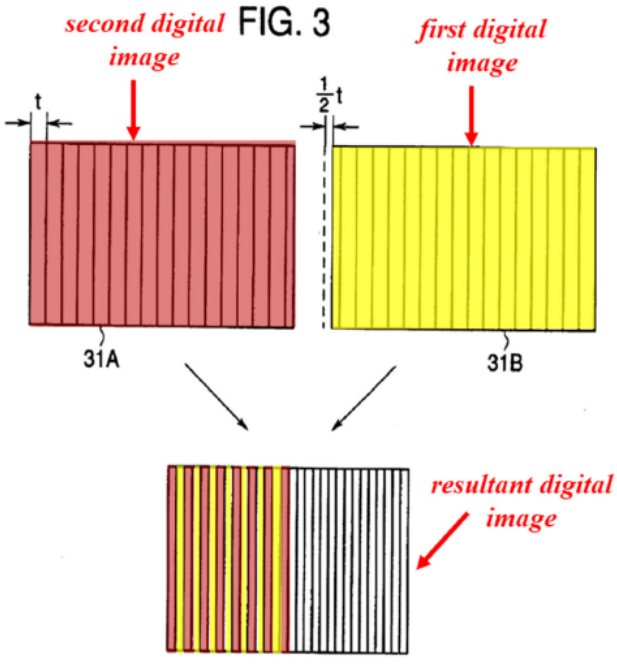
In each of these disclosures, the '289 patent describes using an image captured from a "B/W" image sensor or a sensor that is responsive to a full region of visible color spectrum (i.e., the claimed "second image" that is

obtained from the "second image sensor sensitive to a full region of visible color spectrum") to enhance images obtained from other image sensors. The examples of enhancement include enhancing the dynamic range, noise removal, and color correction. *See, e.g.*, Ex. 1001, 10:6–16. These examples are consistent with the plain language of the claim requiring that the first image is enhanced with the second image in that the Specification's examples describe the resulting image being produced by starting with the first image and *enhancing* it with the second in some manner.

Petitioners do not cite, nor do we discern, any disclosure in the Specification that describes producing a resulting image by merely combining a first image and a second image. Instead, consistent with the plain language of the claim, the Specification describes only producing a resulting image by starting with the first image and enhancing it with the second image. Thus, although we do not consider it necessary to explicitly construe the "producing" limitation, we determine that claim 1 requires that the "first digital image" be "enhanced with the second digital image" in some manner. *See Route1 Inc. v. AirWatch LLC*, 829 F. App'x 957, 961–62 (Fed. Cir. 2020) (finding that the district court's construction of "sending an instruction, from the controller to the selected host, to establish a connection to the remote device" to add "*for the host*" to the phrase "to establish a connection to the remote device" was proper when "the specification's disclosing only host-initiated connections . . . suggest[s] the patent's claim does not encompass an embodiment contrary to these descriptions" and "the plain terms of the instruction limitation are entirely consistent with and even support the specification's exclusive depiction of host-initiated connections" (alterations omitted) (internal quotation marks omitted) (citations omitted))

(nonprecedential); *cf. Apple Inc. v. Andrea Elecs. Corp.*, 949 F.3d 697, 707 (Fed. Cir. 2020) ("We recognize that preferred embodiments do not act as claim limitations, but when the invention as claimed covers only the preferred embodiment described in the written description, it is questionable whether a [party] may assert a proposed construction that is broader than the plain language of the claim.").

Patent Owners argue that Yamazaki discloses combining a first image and a second image to create a third image, but the first image is not enhanced with the second image. *See* Sur-reply 8–10. Yamazaki discloses combining a digital image obtained from a first image sensor with a digital image obtained from a second image sensor to create a digital image with twice the resolution in the horizontal direction. Figure 3, as annotated by Petitioners, illustrates this procedure:

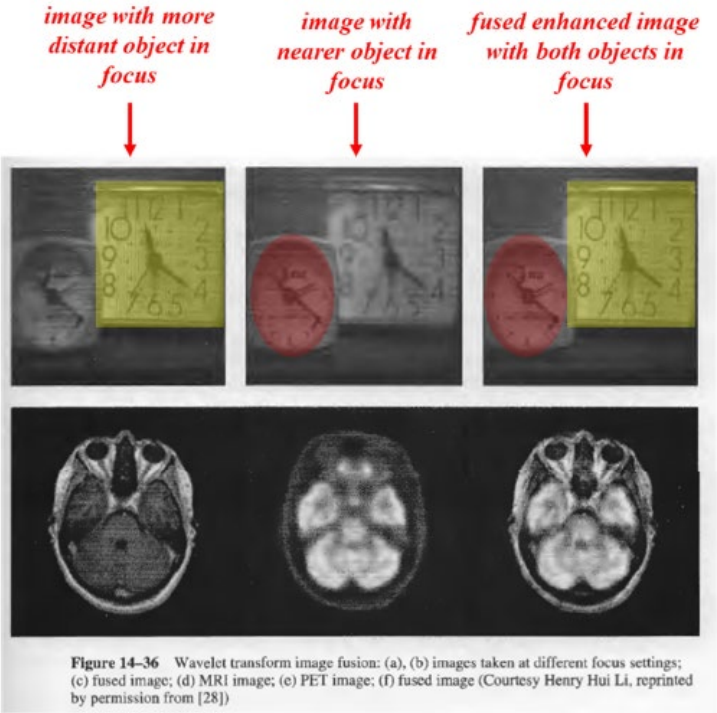


**(APPL-1005), Yamazaki, FIG. 3
annotated including red and yellow highlights**

Annotated Figure 3 of Yamazaki discloses two digital images, colored yellow (first digital image) and red (second digital image), and depicts these digital images are interleaved to create the resultant digital image, which includes alternating red- and yellow-colored stripes illustrating that alternating columns of pixels were obtained from each of the original digital images. Reply 12.

Petitioners argue that this example constitutes image enhancement because the resultant image has double the resolution of the original (*see* Reply 12–13), but Petitioners have failed to adequately establish that the first digital image is enhanced with the second digital image in the manner required by the claim. Indeed, Petitioners have not identified any teaching in Yamazaki that the first digital image is in any way modified in the creation of the resultant image. *See id.* at 8–15. Instead, the first digital image remains intact; the resultant digital image differs from the first image because the resultant digital image alternates between pixels from the first digital image and pixels from the second digital image, resulting in twice the resolution. In effect, Petitioner is arguing that the claim merely requires taking two images and ending up with a resulting image, but, as discussed above, the claim specifically requires that the resulting image is achieved by starting with the first image and *enhancing* it with the second.

Petitioners' argument that Dr. Castleman's example of "image fusion" confirms that Yamazaki's image combination constitutes image enhancement is unpersuasive. *See id.* at 8–10. Petitioners' annotated figure from Dr. Castleman's textbook illustrates this example and is shown below.



**(APPL-1018) at 347, FIG. 14-36,
annotated including red and yellow highlights**

This annotated figure illustrates two examples of image fusion in separate rows; the top row depicts an example using images of clocks and the bottom row depicts an example using MRI images. Reply 11 (citing Ex. 1018, 347). In the top row of the annotated figure, two images of clocks are depicted in the left and center panels and an enhanced image fusing the two images is depicted in the right panel. Petitioners annotated the top row using yellow and red highlighting to illustrate the example. In particular, in the left panel the clock further from the camera is in sharper focus and is highlighted yellow. In the center panel the clock that is closer to the camera is in sharper focus and is highlighted red. The image in the right panel results from using the yellow clock from the left panel and the red clock from the center panel. This example is consistent with the disclosures of image enhancement in the ’289 patent. For example, the ’289 patent discloses an image from a B/W

image sensor (a "second digital image") "can capture full information including details that may be missed by those color image sensors. The intensity image from the B/W image sensor is then repeatedly used in the image processing process in the DSP chip that subsequently produces a high quality and film-like digital image." Ex. 1001, 10:20–25.

However, the example from Dr. Castleman's textbook differs from Yamazaki's disclosure of interleaved images because each of the original images in the textbook example is modified by replacing one of the clocks with the clock from the other image, thereby enhancing that image. In contrast, nothing in Yamazaki's disclosure indicates that any portion of the first digital image is replaced (or otherwise modified) in creating the resultant digital image. Thus, contrary to Petitioners' argument, Dr. Castleman's example reinforces our conclusion that enhancing an image requires modifying that image.

In consideration of the foregoing and based on the complete record, we find that Petitioners have not shown sufficiently how Yamazaki discloses the "producing a resultant image" limitation addressed above. Accordingly, we determine that Petitioners have not demonstrated by a preponderance of the evidence that claim 1 is unpatentable under 35 U.S.C. § 102 as anticipated by Yamazaki. We also determine that Petitioners have not demonstrated by a preponderance of the evidence that dependent claim 2, which depends from claim 1, is unpatentable under 35 U.S.C. § 102 as anticipated by Yamazaki for the same reasons.

D. Ground 2: Alleged Obviousness of Claims 1 and 2 over Yamazaki

A 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." *See 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) where in evidence, so-called secondary considerations.[6] *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). We analyze Petitioners' obviousness grounds with the principles identified above in mind.

Petitioners did not separately analyze claims 1 and 2 under the anticipation and obviousness standards. *See* Pet. 18–40. Instead, Petitioners assert Yamazaki teaches each limitation of claims 1 and 2 in embodiment 1. *See id.* Petitioners also assert Yamazaki teaches each limitation of claims 1 and 2 in embodiment 2. *See id.* at 39–40. However, Petitioners do not identify any differences between the claimed subject matter and the prior art or address any of the other underlying factual determinations particular to an obviousness analysis. *See generally id.* at 18–40. That said, Petitioners do make a few statements characterizing how a person of ordinary skill in the art would have understood the disclosure of Yamazaki. *See, e.g.*, Pet. 27 (asserting that a person of ordinary skill in the art would understand "that each pixel of an image sensor corresponds to a pixel of the image captured by that image sensor"); *see also id.* at 26, 30. We understand such statements to indicate Petitioners' alternative obviousness ground that, to the extent

[6] The parties do not address secondary considerations, which therefore do not constitute part of our analysis.

such disclosure is not sufficient for anticipation, it is sufficient for obviousness.

We have found already that Petitioners have not established by a preponderance of the evidence that Yamazaki discloses the "producing a resultant image" limitation as required by the claim and addressed above. Reviewing this ground, we find no further discussion by Petitioner on the limitation that would persuade us that the claim would have been obvious in view of Yamazaki. Accordingly, we determine that Petitioners have not demonstrated by a preponderance of the evidence that claim 1 is unpatentable under 35 U.S.C. § 103(a) as obvious over Yamazaki. We also determine that Petitioners have not demonstrated by a preponderance of the evidence that dependent claim 2, which depends from claim 1, is unpatentable under 35 U.S.C. § 103(a) as obvious over Yamazaki for the same reasons.

E. Ground 3: Alleged Obviousness of Claim 4 over Yamazaki and Mansoorian

1. Mansoorian

Mansoorian is a United States Patent directed to an imaging device that integrates a photosensing array and analog-to-digital converter on a single substrate. Ex. 1006, Abstract. Figure 1 of Mansoorian illustrates an example of imaging device 100 and is reproduced below.

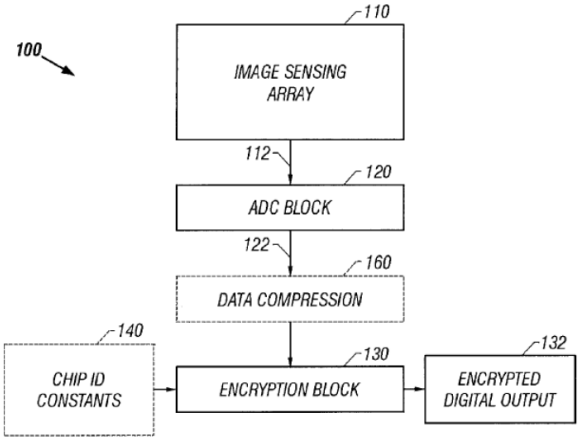


FIG. 1

Figure 1 depicts imaging device 100 comprising image sensing array 110, which outputs analog image signal 112 and ADC block 120, which outputs digital image signal 122. *Id.* at 3:24–33.

On this record, we agree with Petitioners (Pet. 16) that Mansoorian qualifies as prior art under 35 U.S.C. § 102(e) because Mansoorian issued on June 4, 2002, from an application filed on November 12, 1997, which is before the filing date of the '289 patent, which is January 15, 1999. *See* Ex. 1001, code (22); Ex. 1006, codes (22) and (45).

2. Claim 4

Claim 4 recites "[t]he improved digital camera as recited in claim 1, wherein said analog-to-digital converting circuitry comprises two individual analog-to-digital converters, each integrated with one of said first and second image sensors so that said first and second digital images are digitized independently and in parallel to increase signal throughput rate." Ex. 1001, 11:1–6. Petitioners assert the combination of Yamazaki and Mansoorian teaches or suggests this limitation. Pet. 44–49.

Petitioners do not assert that Mansoorian teaches or suggests the limitation, "a digital image processor, coupled to said image memory and

receiving said first digital image and said second digital image, producing a resultant digital image from said first digital image enhanced with said second digital image," as recited in claim 1. *See id.* Accordingly, we determine that Petitioners have not demonstrated by a preponderance of the evidence that claim 4 is unpatentable under 35 U.S.C. § 103(a) as obvious over Yamazaki and Mansoorian for the same reasons as discussed above with respect to claim 1.

F. Ground 4: Alleged Obviousness of Claims 1 and 3 over Weldy, Denyer, and Nagumo

Petitioners contend that claims 1 and 3 are unpatentable under 35 U.S.C. § 103(a) as obvious over Weldy, Denyer, and Nagumo.

1. Weldy

Weldy is a European Patent Application directed to a method of producing a digital image that includes capturing two digital images of a scene and combining them with improved performance characteristics. Ex. 1007, Abstract. Figure 1b of Weldy illustrates an example digital camera that performs the disclosed method and is reproduced below.

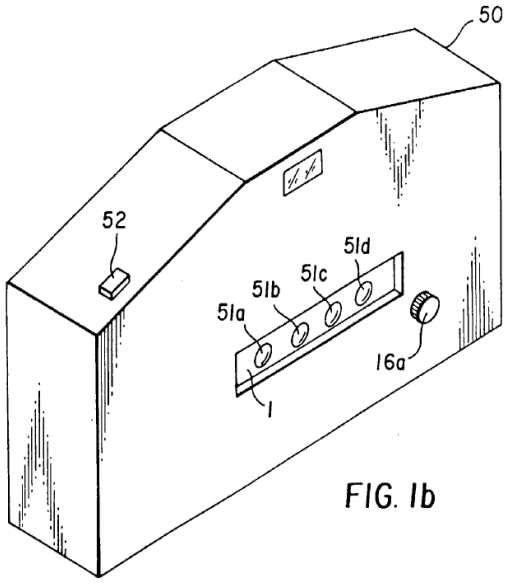


FIG. 1b

Figure 1b depicts a multi-lens camera with main body 50 containing four imaging lenses 51a, 51b, 51c, 51d. *Id.* at 5:16–18.

As discussed below, we agree with Petitioners that Weldy qualifies as prior art under 35 U.S.C. § 102(a).

2. Denyer

Denyer is a WIPO International Application directed to an image capture system that comprises an integrated circuit having at least two sensor arrays, where each sensor array has an image sensing surface and a respective lens system. Ex. 1008, Abstract. Figure 1 of Denyer illustrates an example of the image capture system and is reproduced below.

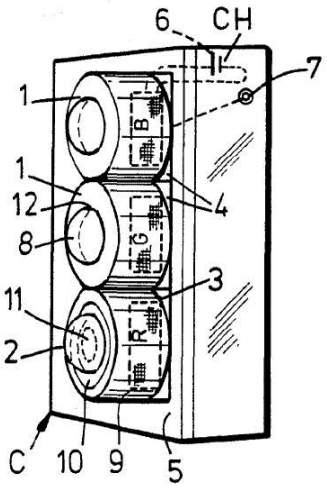


FIG. 1

Figure 1 depicts a video camera system having three cameras 1, each comprising lens system 2 mounted on image sensing surface 3 of image array sensor 4. *Id.* at 9:20–28.

On this record, we agree with Petitioners (Pet. 16) that Denyer qualifies as prior art under 35 U.S.C. § 102(b) because Denyer's publication date of June 10, 1993, is more than one year before the filing date of the

'289 patent, which is January 15, 1999. *See* Ex. 1001, code (22); Ex. 1008, code (43).

3. Nagumo

Nagumo is a United States Patent directed to a solid state camera that includes a plurality of image sensors. Ex. 1009, Abstract. Figure 7 of Nagumo illustrates a block diagram showing an example of the solid state camera and is reproduced below.

FIG. 7

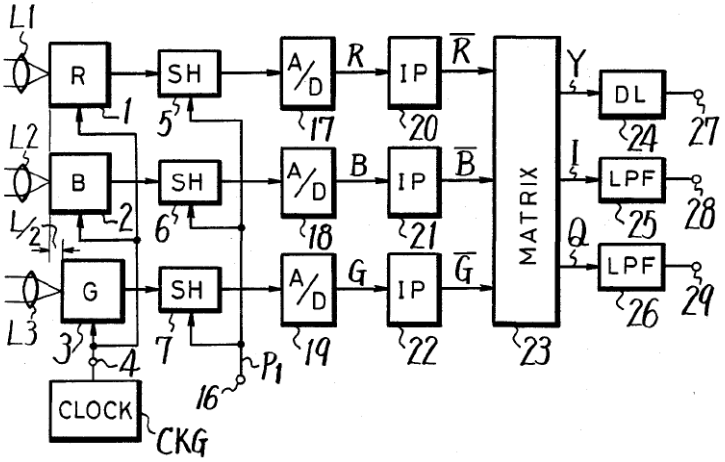


Figure 7 depicts a block diagram of the solid state camera comprising cameras 1, 2, 3, each of which output an analog image to sample and holding circuits 5, 6, 7, which in turn provide the analog image to A/D converters 17, 18, 19. *Id.* at 4:40–50.

On this record, we agree with Petitioners (Pet. 16) that Nagumo qualifies as prior art under 35 U.S.C. § 102(b) because Nagumo's issue date of March 19, 1985, is more than one year before the filing date of the '289 patent, which is January 15, 1999. *See* Ex. 1001, code (22); Ex. 1009, code (45).

4. Prior Art Status of Weldy

Petitioners argue (Pet. 16) that Weldy qualifies as prior art under 35 U.S.C. § 102(a) because Weldy's publication date of August 12, 1998, is before the filing date of the '289 patent, which is January 15, 1999. *See* Ex. 1001, code (22); Ex. 1007, code (43).

Patent Owners argue that Weldy does not qualify as prior art. *See* PO Resp. 26–27; Sur-reply 14–20. In particular, Patent Owners argue that prior to Weldy's publication on August 12, 1998, an essentially final draft (the "August Draft") of the application that ultimately issued as the '289 patent was faxed to one of the inventors, Yanbin Yu, from Patent Owners' patent agent. Sur-reply 14 (citing Ex. 2007; Ex. 2002 ¶ 6). Patent Owners argue the August Draft establishes that Patent Owners conceived of the invention no later than August 8, 1998. PO Resp. 27. Patent Owners further argue inventors Yu and Zhang worked continuously and diligently on refining the invention from August 8, 1998 until the application was filed on January 15, 1999. *Id.* (citing Ex. 2002 ¶ 9, Ex. 2003 ¶ 6). Patent Owners offer the testimony of the inventors, Yu and Zhang, to support these assertions. Ex. 2002 ¶ 9, Ex. 2003 ¶ 6.

Petitioners argue Patent Owners fail to meet the burden to establish an earlier priority date for the '289 patent. *See* Reply 20–25. In particular, Petitioners argue Patent Owners bear the burden of production to produce evidence that Weldy is not prior art to the '289 patent. *Id.* at 20–21 (citing *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378–80 (Fed. Cir. 2015)). Petitioners argue Patent Owners' sole basis for swearing behind Weldy's publication date is the testimony of inventors Yanbin Yu and Zhongxuan Zhang and accompanying exhibits. *Id.* at 21. Petitioners

argue the accompanying exhibits, including the August Draft, necessarily rely on the uncorroborated testimony of the inventors. *Id.* Petitioners argue Patent Owners have failed to corroborate any inventor testimony or document and, therefore, cannot establish an earlier priority date for the '289 patent. *Id.* at 21–23.

Patent Owners argue that the August Draft establishes conception of the invention prior to the publication date of Weldy. To support the argument that the August Draft supports prior conception, Patent Owners rely on the testimony of inventor Yanbin Yu (*see* PO Resp. 26 (citing Ex. 2002 ¶ 6)) and the August Draft itself (*see* PO Resp. 26 (citing Ex. 2007)). *See* PO Resp. 26 (citing Ex. 2002 ¶ 6, Ex. 2007)); Sur-reply 14 (citing Ex. 2007). Patent Owners argue the August Draft is a physical exhibit and, therefore, does not require corroboration. Sur-reply 15 (citing *Mahurkar v. C.R. Bard, Inc.*, 79 F.3d 1572, 1577–78 (Fed. Cir. 1996)).

To support the argument that the inventors worked continuously and diligently refining the invention from the time of conception to the time the patent application was filed, Patent Owners rely on the testimony of inventors Yanbin Yu (*see* PO Resp. 27 (citing Ex. 2002 ¶ 9)) and Zhongxuan Zhang (*see id.* at 27 (citing Ex. 2003 ¶ 6)). Patent Owners have not offered any evidence corroborating diligence between conception and filing of the application that does not depend solely on the inventors themselves.

"The person 'who first conceives, and, in a mental sense, first invents . . . may date his patentable invention back to the time of its conception, if he connects the conception with its reduction to practice by reasonable diligence on his part, so that they are substantially one continuous act.'"

Mahurkar, 79 F.3d at 1577 (quoting *Christie v. Seybold*, 55 F. 69, 76 (6th Cir. 1893)).

"It is well established, however, that when a party seeks to prove conception through an inventor's testimony the party must proffer evidence, 'in addition to [the inventor's] own statements and documents,' corroborating the inventor's testimony." *Apator Miitors ApS v. Kamstrup A/S*, 887 F.3d 1293, 1295 (Fed. Cir. 2018) (quoting *Mahurkar*, 79 F.3d at 1577). "The sufficiency of the proffered corroboration is determined by a 'rule of reason' analysis in which all pertinent evidence is examined." *Id.* (citing *In re NTP, Inc.,* 654 F.3d 1279, 1291 (Fed. Cir. 2011)). "Even under the 'rule of reason' analysis, however, the 'evidence of corroboration must not depend solely on the inventor himself.'" *Id.* (quoting *Cooper v. Goldfarb,* 154 F.3d 1321, 1330 (Fed. Cir. 1998)).

As noted by our reviewing court, when a party seeks to prove conception through an inventor's testimony, the party must proffer corroborating evidence "in addition to [the inventor's] own statements and documents." *Apator Miitors ApS*, 887 F.3d 1293 (Fed. Cir. 2018). Corroborating evidence "must not depend solely on the inventor himself." *Cooper*, 154 F.3d at 1330. Patent Owners have not offered any persuasive evidence corroborating conception that does not depend solely on the inventors themselves or their documents. We disagree with Patent Owners' contention that the August Draft does not need corroboration because it is a physical exhibit. *See* Sur-reply 15. The August Draft is a document that has been authenticated only by the testimony of the inventors. Thus, this document is one of the inventors' "own statements and documents" that depends "solely on the inventor himself" and, therefore, requires

corroboration. Accordingly, Patent Owners have failed to sufficiently corroborate an earlier conception date and, on this record, have not sworn behind Weldy.

We also note that Patent Owners have failed to proffer sufficient corroborating evidence to support the inventors' testimony regarding reasonable diligence in reducing the invention to practice between the alleged date of conception (the date of the August Draft) and the filing of the application that ultimately issued as the '289 patent, which filing came over five months after the alleged conception. *See* PO Resp. 26–27 (alleging the "inventors . . . worked continuously and diligently on refining the invention . . . until the time the patent application was filed") (citing Ex. 2002 ¶ 9, Ex. 2003 ¶ 6). Patent Owners' evidence on this topic is limited to declaration testimony of the inventors, who merely state that they were refining the design through the filing of the application. *See* Ex. 2002 ¶ 9, Ex. 2003 ¶ 6. Both of these declarations are uncorroborated and contain little more than a cursory statement that the inventors were diligent. *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1170–71 (Fed. Cir. 2006) ("The requirement of independent knowledge remains key to the corroboration inquiry."). Accordingly, Patent Owners have failed to sufficiently corroborate reasonable diligence in reducing the invention to practice and, on this record, have not sworn behind Weldy for this additional reason.

For these reasons and based on the complete record, we agree with Petitioners (Pet. 16) that Weldy qualifies as prior art under 35 U.S.C. § 102(a) because Weldy's publication date of August 12, 1998, is before the filing date of the '289 patent, which is January 15, 1999. *See* Ex. 1001, code (22); Ex. 1007, code (43).

5. Independent Claim 1

Petitioners assert claim 1 is rendered obvious by Weldy, Denyer, and Nagumo. Pet. 49–76. We address each limitation in turn.

a) Preamble

The preamble of claim 1 recites: "[a]n improved digital camera." Ex. 1001, 10:37. Petitioners assert Weldy teaches or suggests the preamble. Pet. 58. In particular, Petitioners assert Weldy teaches producing digital images from a multi-lens camera with four imaging lenses. *Id.* (citing Ex. 1007, 2:3–4, 5:16–17; Ex. 1003 ¶ 174). Dr. Bovik offers testimony in support of Petitioners' assertions with regard to the preamble. Ex. 1003 ¶¶ 173–175.

Patent Owners do not specifically dispute that Weldy teaches or suggests the preamble of claim 1. *See generally* PO Resp. Based on the complete record and for the reasons explained by Petitioners, we are persuaded that Petitioners have demonstrated sufficiently that Weldy teaches or suggests the preamble of claim 1.[7]

b) "a first and a second image sensor closely positioned with respect to a common plane"

Claim 1 further recites "a first and a second image sensor closely positioned with respect to a common plane." Ex. 1001, 10:38–39. Petitioners assert Weldy in combination with Denyer renders obvious this limitation. Pet. 59–61. In particular, Petitioners assert Weldy teaches a four-lens digital camera that includes three image sensors with corresponding single-color

[7] Because Petitioners have shown sufficiently that the recitations in the preamble are satisfied by Weldy, we need not determine whether the preamble is limiting. *See Vivid Techs.*, 200 F.3d at 803.

color filters (the claimed "first image sensor") and a second image sensor without a color filter (the claimed "second image sensor"). *Id.* at 59. Petitioners assert that lenses 51a and 51b are closely positioned with respect to a plane, as illustrated in Figure 1b, which is shown below.

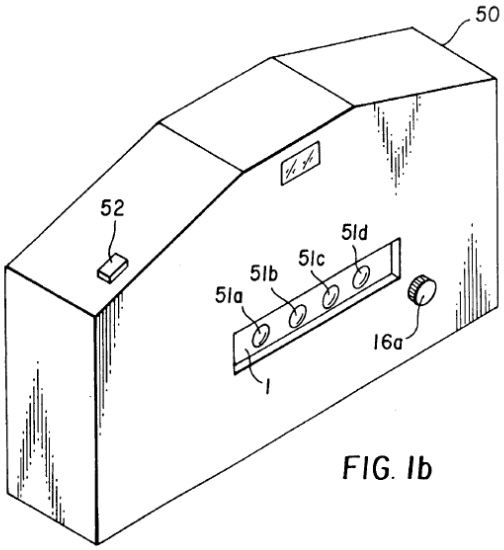


FIG. 1b

Figure 1b depicts a perspective view of a digital camera with four lenses 51a–51d. Ex. 1007, 5:16–18. Petitioners assert an ordinarily skilled artisan would have understood from Figure 1b that the image sensors corresponding to lenses 51a and 51b are closely positioned with respect to a common plane. Pet. 59 (citing Ex. 1003 ¶ 178).

However, Petitioners acknowledges that Weldy does not explicitly disclose first and second image sensors closely positioned with respect to a common plane. *Id.* at 60. Petitioners assert Denyer discloses multiple image sensors 4 that all lie in the same plane. *Id.* (citing Ex. 1008, Figs. 1, 5, 2:13–18, 9:24–26, 16:19–21). To illustrate this contention, Petitioners annotate Denyer's Figure 1 as shown below. *Id.*

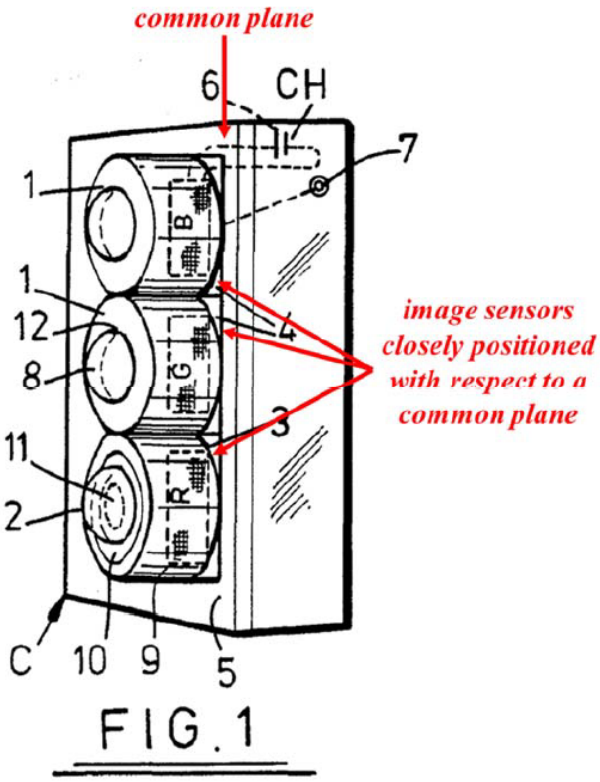


FIG. 1

Annotated Figure 1 depicts a video camera system having three cameras 1, each comprising lens system 2 mounted on image sensing surface 3 of image array sensor 4 with annotations identifying the image sensors and their relative positions with respect to a common plane. Ex. 1008, 9:20–28; Pet. 60. Dr. Bovik offers testimony in support of Petitioners' assertions with regard to this limitation. Ex. 1003 ¶¶ 176–183.

Petitioners assert an ordinarily skilled artisan would have been motivated to apply Denyer's teachings of two image sensors closely positioned with respect to a common plane" to Weldy's digital camera "to produce the obvious, beneficial, and predictable results of reduced alignment errors, easier calibration and electronic correction, and a resulting picture of very high quality." Pet. 55 (citing Ex. 1003 ¶¶ 165–168). Petitioners assert

Weldy and Denyer are analogous art that both relate to digital cameras. *Id.* Petitioners assert Denyer teaches that when combining images captured by multiple sensors, aligning the sensors improves the quality of the combined picture. *Id.* (citing Ex. 1008, 3:11–14). Finally, Petitioners assert the combination of Weldy and Denyer involves no more than the combination of known elements according to known methods. *Id.* at 56.

Patent Owners do not specifically dispute that Denyer teaches or suggests this limitation. *See generally* PO Resp. We agree with Petitioners that Denyer teaches image sensors that are closely positioned with respect to a common plane. In particular, Denyer's image sensor array 4 contains image sensors that lie in a common plane and are positioned closely to one another with respect to that common plane. *See* Ex. 1008, Figs. 1, 5, 2:13–18, 9:24–26, 16:19–21.

However, Patent Owners argue Petitioners have not established that an ordinarily skilled artisan would have been motivated to combine Weldy with Denyer for two reasons. *See* PO Resp. 27–28. First, Patent Owners argue an ordinarily skilled artisan would understand that Weldy requires different lens-to-sensor spacing for each sensor, but Denyer teaches the lens-to-sensor spacing for each sensor is the same. *Id.* at 27 (citing Ex. 1008, 2:11–18, Ex. 2001 ¶ 40). Second, Patent Owners argue Weldy includes a focus mechanism that requires variable spacing between the lenses and sensors, but Denyer discloses fixed spacing between the lens system and the sensor array. *Id.* at 28 (citing Ex. 2001 ¶ 41). Dr. Castleman offers testimony in support of both of these assertions. *See* Ex. 2001 ¶¶ 38–41.

Petitioners dispute both of Patent Owners' arguments regarding combining Weldy and Denyer. First, Petitioners argue Weldy does not

require different lens-to-sensor spacing for each sensor. Reply 27–28. Petitioners argue Patent Owners' expert, Dr. Castleman, admitted as much during his deposition. *Id.* at 28 (citing Ex. 1019, 129). Second, Petitioners argue Weldy does not require adjustable focus systems. *Id.* at 28–29 (citing Ex. 1017 ¶ 30). Dr. Bovik offers testimony in support of both of these assertions. *See* Ex. 1017 ¶¶ 29–30.

Based on the complete record, Petitioners have demonstrated by a preponderance of the evidence that an ordinarily skilled artisan would have been motivated to combine Weldy and Denyer in the manner proposed. Weldy teaches a digital camera with lenses that lie in a common plane, where each lens has a corresponding image sensor within the camera. Ex. 1007, Fig. 1b, 5:48–57, 6:13–16. Denyer teaches a digital camera with an image sensor array that includes multiple image sensors 4 on a single chip 5. Ex. 1008, Figs. 1, 5, 2:13–18, 9:24–26, 16:19–21. As explained in further detail below, we agree with Petitioners that an ordinarily skilled artisan would have applied Denyer's teachings of image sensors closely positioned with respect to a common plane on an image sensor array in Weldy's digital camera to reduce alignment errors, ease calibration and electronic correction, and produce high quality pictures. *See* Pet. 55 (citing Ex. 1003 ¶¶ 165–168).

Patent Owners argue an ordinarily skilled artisan would not have been motivated to combine Weldy and Denyer based on Weldy's lens-to-sensor spacing and Weldy's focus mechanism. *See* PO Resp. 27–28. This argument is unpersuasive for two reasons. First, Patent Owners' argument focuses on the ability to combine Denyer's physical structure into the physical structure of Weldy in light of these characteristics of Weldy. But, "[t]he test for obviousness is not whether the features of a secondary reference may be

bodily incorporated into the structure of the primary reference,[] but rather whether a skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention." *Allied Erecting and Dismantling Co., Ind. v. Genesis Attachments, LLC*, 825 F.3d 1373, 1381 (Fed. Cir. 2016) (citation and quotation marks omitted); *see also In re Nievelt*, 482 F.2d 965, 968 (CCPA 1973) ("Combining the teachings of references does not involve an ability to combine their specific structures." (emphasis omitted)).

Second, we agree with Petitioners that Weldy does not describe either the lens-to-sensor spacing or the focus mechanism as required. *See* Reply 27–29. Dr. Castleman's testimony regarding Weldy's lens-to-sensor spacing is based on assumptions regarding focal length, image sensor size, and image sensor angle of view of the scene. Ex. 2001, 33. However, as Dr. Bovik testifies, the characteristics assumed by Dr. Castleman are not required by Weldy. *See* Ex. 1017 ¶ 29. Indeed, Dr. Castleman testifies that Weldy does not require image sensors to be the same size, which undercuts the testimony that Weldy requires different lens-to-sensor spacing. *See* Ex. 1019, 129.

We also credit Dr. Bovik's testimony that Weldy does not require adjustable focus systems. *See* Ex. 1017 ¶ 30. Weldy describes embodiments that include focus mechanisms (*see, e.g.*, Ex. 1007, 3:6–8, 5:16–17), but Weldy does not discuss the focus mechanism in its explanation of how its invention overcomes the problems of the prior art (*see id.* at 2:39–58).

Applying Denyer's image sensor array may have necessitated modifying Weldy's lens-to-sensor spacing and focus mechanism, but an ordinarily skilled artisan would have been able to assess the advantages and

disadvantages of modifying Weldy's lens-to-sensor spacing and focus mechanism according to the teachings of Denyer. *See Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006) ("A given course of action often has simultaneous advantages and disadvantages, and this does not necessarily obviate motivation to combine."). Petitioners have identified sufficient rationale for such modifications, asserting that applying Denyer's image sensor array with closely positioned image sensors would reduce Weldy's alignment errors, ease calibration and electronic correction, and produce high quality pictures. *See* Pet. 55 (citing Ex. 1003 ¶¶ 165–168). Petitioner's assertions are supported by Denyer, which teaches that when image sensors are positioned on an image sensor array "the problem of alignment is greatly reduced by the fabrication of the various sensors required on[] one chip. This ensures that the sensors all lie in the same plane and have the same rotational orientation, and this is an important advantage." Ex. 1008, 2:13–18. Denyer teaches that this positioning "provides a composite image camera of particularly simple and economic construction." *Id.* at 3:4–6. Denyer also teaches that "[i]t is relatively easy though to calibrate these camera after assembly and electronically to correct for [simple orthogonal] translations." *Id.* at 2:22–25.

Based on the complete record and for the reasons explained by Petitioners, we are persuaded that Petitioners have demonstrated sufficiently that (1) the combination of Weldy and Denyer teaches "a first and a second image sensor closely positioned with respect to a common plane," as recited in claim 1 and (2) an ordinarily skilled artisan would have a reason to combine the teachings of Weldy and Denyer as proposed by Petitioners.

c) "said second image sensor sensitive to a full region of visible color spectrum"

Claim 1 further recites "said second image sensor sensitive to a full region of visible color spectrum." Ex. 1001, 10:39–40. Petitioners assert Weldy discloses this limitation. Pet. 62. In particular, Petitioners assert that Weldy discloses a four-lens digital camera where each lens has a corresponding image sensor. *Id.* (citing Ex. 1007, Fig. 1b, 5:48–57, 6:13–16; Ex. 1003 ¶ 185). Petitioners assert one of these image sensors (the claimed "second image sensor") is provided without a color filter. *Id.* Petitioners assert that an image sensor without a color filter is an image sensor sensitive to a full region of visible color spectrum. *Id.* (citing Ex. 1003 ¶ 186). Dr. Bovik offers testimony in support of Petitioners' assertions with regard to this limitation. Ex. 1003 ¶¶ 184–187.

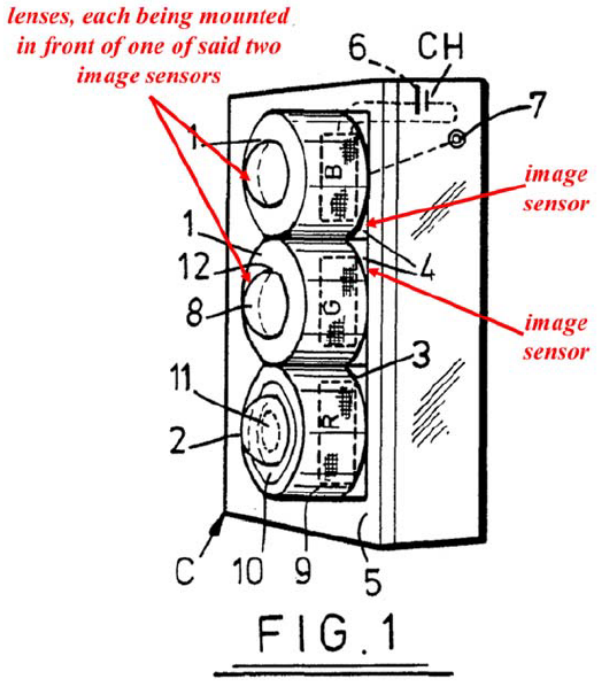
Patent Owners do not specifically dispute that Weldy teaches or suggests this limitation. *See generally* PO Resp. Based on the complete record and for the reasons explained by Petitioners, we are persuaded that Petitioners have demonstrated sufficiently that Weldy teaches an image sensor that does not have a color filter and is thus sensitive to a full region of visible color spectrum.

d) "two lenses, each being mounted in front of one of said two image sensors"

Claim 1 further recites "two lenses, each being mounted in front of one of said two image sensors." Ex. 1001, 10:41–42. Petitioners assert Weldy in combination with Denyer renders obvious this limitation. Pet. 63–66. In particular, Petitioners assert Weldy teaches four imaging lenses, 51a, 51b, 51c, 51d, and an ordinarily skilled artisan would have understood that each lens is mounted in front of one of the four image sensors for producing

corresponding images. *Id.* at 63 (citing Ex. 1007, 2:49–51, 3:1–2, 5:16–17, 6:13–16; Ex. 1003 ¶ 190).

However, Petitioners acknowledge that Weldy does not explicitly teach the spatial relation that each of the two lenses is mounted in front of one of the image sensors. *Id.* at 64. Petitioners assert Denyer teaches this arrangement. *Id.* at 64–66. In particular, Petitioners assert Denyer teaches two lenses 8, each being mounted in front of one of image sensors 4. *Id.* at 64 (citing Ex. 1008, 9:20–24, 9:29–30, 15:29–30; Ex. 1003 ¶ 191). To illustrate this contention, Petitioners annotate Figure 1 of Denyer as shown below. *Id.* at 65.



(APPL-1008), Fig. 1, annotated

Annotated Figure 1 depicts lenses 8 mounted in front of image sensors 4, with Petitioners' annotations identifying these respective elements. *Id.* Dr. Bovik offers testimony in support of Petitioners' assertions with regard to this limitation. Ex. 1003 ¶¶ 188–192.

Patent Owners do not specifically dispute that the combination of Weldy and Denyer teaches or suggests this limitation. *See generally* PO Resp. Based on the complete record and for the reasons explained by Petitioners, we are persuaded that Petitioners have demonstrated sufficiently that the combination of Weldy's disclosure of imaging lenses, 51a, 51b, 51c, 51d and Denyer's disclosure of two lenses mounted in front of image sensors satisfies this limitation.

e) "said first image sensor producing a first image and said second image sensor producing a second image"

Claim 1 further recites "said first image sensor producing a first image and said second image sensor producing a second image." Ex. 1001, 10:44–45. Petitioners assert Weldy discloses this limitation. Pet. 66–68. In particular, Petitioners assert Weldy teaches a first image sensor (one of the three image sensors with a single-color color filter) that produces a first "electronic image," which is a first intensity image where each pixel has a single value that represents the light intensity from the selected spectral range. *Id.* at 66–67 (citing Ex. 1007, Abstract, 2:39–51, 7:5–6; Ex. 1003 ¶ 196). Petitioners assert Weldy teaches a second image sensor with no color filter, where the second image sensor produces a second "electronic image," which is a second intensity image where each pixel has a single value that represents the light intensity from the entire visible color spectrum. *Id.* at 67 (citing Ex. 1007, Abstract, 2:39–51, 7:5–6; Ex. 1003 ¶ 198). Dr. Bovik offers testimony in support of Petitioners' assertions with regard to this limitation. Ex. 1003 ¶¶ 193–199.

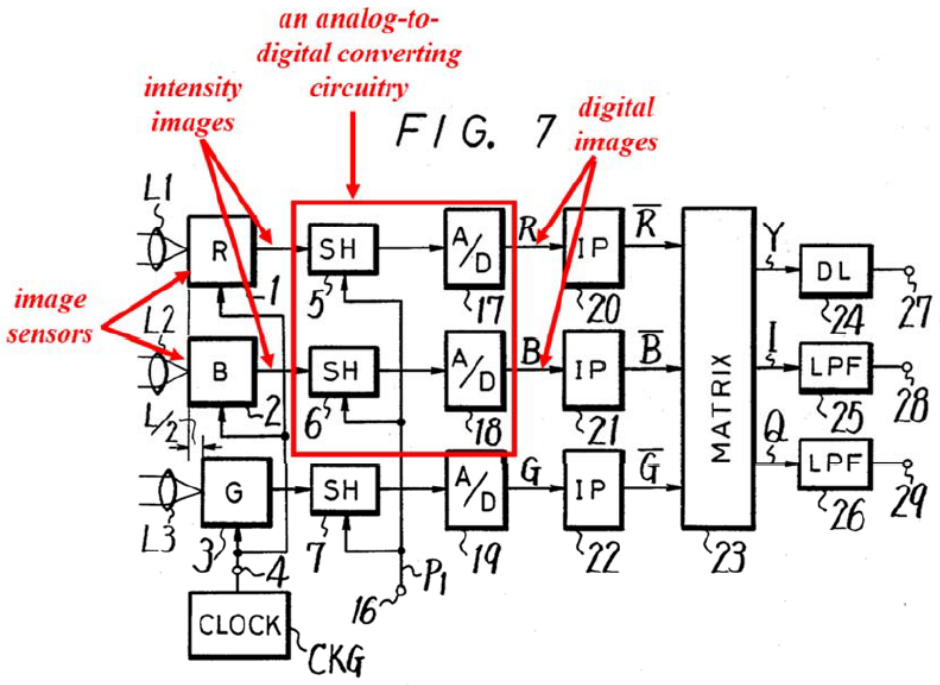
Patent Owners do not specifically dispute that Weldy teaches or suggests this limitation. *See generally* PO Resp. Based on the complete

record and for the reasons explained by Petitioners, we are persuaded that Petitioners have demonstrated sufficiently that Weldy teaches this limitation.

f) "an analog-to-digital converting circuitry coupled to said first and said second image sensor and digitizing said first and said second intensity images to produce correspondingly a first digital image and a second digital image"

Claim 1 further recites "an analog-to-digital converting circuitry coupled to said first and said second image sensor and digitizing said first and said second intensity images to produce correspondingly a first digital image and a second digital image." Ex. 1001, 10:46–50. Petitioners assert Weldy in combination with Denyer and Nagumo renders obvious this limitation. Pet. 68–71. In particular, Petitioners assert Weldy teaches digitizing the two electronic images (the claimed "first and second intensity images") to generate "at least two digitized digital images" (the claimed "first" and "second digital image[s]"). *Id.* at 68 (citing Ex. 1007, Fig. 3, 2:39–51, 7:5–6; Ex. 1003 ¶¶ 202–203). According to Petitioners, this teaching at least suggests analog-to-digital conversion. *Id.* at 68 (citing Ex. 1003 ¶ 203).

However, Petitioners assert that to the extent Weldy does not explicitly teach circuitry for analog-to-digital conversion, Nagumo teaches analog-to-digital converting circuitry coupled to image sensors 1, 2. *Id.* at 69–70 (citing Ex. 1009, 1:18–31, 4:34–50; Ex. 1003 ¶¶ 204–206). To illustrate this contention, Petitioners annotate Figure 7 of Nagumo as shown below. Pet. 70.



Annotated Figure 7 depicts image sensors 1, 2 coupled to sample and holding circuits 5, 6, which in turn are coupled to A/D converters 17, 18, with annotations to identify the combination of S/H circuits 5, 6 and A/D circuits 17, 18 as the claimed "analog-to-digital converting circuitry" that produces first and second "digital image[s]" from first and second "intensity image[s]." Ex. 1009, 4:63–67; Pet. 70. Dr. Bovik offers testimony in support of Petitioners' assertions with regard to this limitation. Ex. 1003 ¶¶ 200–207.

Petitioners assert an ordinarily skilled artisan would have been motivated to combine Weldy, Denyer, and Nagumo to obtain the benefit of parallel image digitization and increased signal throughput. Pet. 70 (citing Ex. 1003 ¶ 206). Petitioners also assert Weldy teaches that it is more efficient to perform two image processing steps simultaneously, which would have led an ordinarily skilled artisan to be motivated to apply Nagumo's teachings of multiple image sensors with corresponding

individual analog-to-digital converters to achieve these benefits. *Id.* at 57 (citing Ex. 1007, 4:57–58; Ex. 1003 ¶ 171).

Patent Owners do not specifically dispute that the combination of Weldy, Denyer, and Nagumo teaches or suggests this limitation. *See generally* PO Resp. Patent Owners also do not specifically dispute that an ordinarily skilled artisan would have been motivated to combine Nagumo's teachings with the teachings of Weldy and Denyer. *See generally id.*

Based on the complete record and for the reasons explained by Petitioners, we are persuaded that Petitioners have demonstrated sufficiently that Weldy's teaching of digitizing electronic images into digital images suggests this limitation. We are also persuaded that Petitioners have demonstrated sufficiently that (1) the combination of Weldy's teaching of digitizing electronic images into digital images and Nagumo's sample and holding circuits and A/D converters that are connected to image sensors teaches this limitation and (2) an ordinarily skilled artisan would have been motivated to combine the teachings of Weldy, Denyer, and Nagumo as proposed by Petitioners.

g) "an image memory, coupled to said analog-to-digital converting circuitry, for storing said first digital image and said second digital image"

Claim 1 further recites "an image memory, coupled to said analog-to-digital converting circuitry, for storing said first digital image and said second digital image." Ex. 1001, 10:51–53. Petitioners assert Weldy in combination with Nagumo renders obvious this limitation. Pet. 71–72. In particular, Petitioners assert Weldy teaches extracting digitized digital images (the claimed "first" and "second digital image") from digital storage (the claimed "image memory") and transferring these images to central

processing unit 78. Pet. 71–72 (citing Ex. 1007, 3:9–10). Petitioners assert an ordinarily skilled artisan would have understood that in the combined Weldy and Nagumo system described above, digital storage is coupled to the analog-to-digital converting circuitry. *Id.* at 72 (citing Ex. 1003 ¶ 211). Dr. Bovik offers testimony in support of Petitioners' assertions with regard to this limitation. Ex. 1003 ¶¶ 208–212.

Patent Owners do not specifically dispute that the combination of Weldy and Nagumo teaches or suggests this limitation. *See generally* PO Resp. Based on the complete record and for the reasons explained by Petitioners, we are persuaded that Petitioners have demonstrated sufficiently that the digital storage taught by the combined Weldy and Nagumo system renders obvious this limitation.

h) "a digital image processor, coupled to said image memory and receiving said first digital image and said second digital image, producing a resultant digital image from said first digital image enhanced with said second digital image"

Claim 1 further recites "a digital image processor, coupled to said image memory and receiving said first digital image and said second digital image, producing a resultant digital image from said first digital image enhanced with said second digital image." Ex. 1001, 10:54–58. Petitioners assert Weldy discloses this limitation. Pet. 73–76. In particular, Weldy teaches central processing unit 78 (the claimed "digital image processor") is coupled to digital storage (the claimed "image memory") within camera 76. *Id.* at 73 (citing Ex. 1007, Fig. 2, 3:9–16). Petitioners assert Weldy teaches central processing unit 78 combines and processes at least two digitized electronic images to produce a combined digital image with improved

performance characteristics. *Id.* at 74 (citing Ex. 1007, Figs. 2, 3, 7:7–8; Ex. 1003 ¶ 216).

Petitioners assert Weldy teaches enhancing the monochrome digital image produced by the first image sensor with a single-color color filter with the second digital image produced by the second image sensor without a color filter. *Id.* at 74 (citing Ex. 1007, Fig. 3, 3:18–22, 3:26–4:45, 6:8–12; Ex. 1003 ¶ 217). Dr. Bovik offers testimony in support of Petitioners' assertions with regard to this limitation. Ex. 1003 ¶¶ 213–219.

Patent Owners do not specifically dispute that the combination of Weldy and Denyer teaches or suggests this limitation. *See generally* PO Resp. Based on the complete record and for the reasons explained by Petitioners, we are persuaded that Petitioners have demonstrated sufficiently that Weldy's enhancement of a first digital image produced by a first image sensor with a second digital image produced by a second image sensor discloses this limitation.

i) Conclusion

In consideration of the foregoing and based on the complete record, we are persuaded by Petitioners' arguments and evidence, notwithstanding Patent Owners' arguments, addressed above. Having weighed each of the *Graham* factors, including the scope and content of the prior art, and the differences between the prior art and the challenged claim, we determine that Petitioners have demonstrated by a preponderance of the evidence that claim 1 is unpatentable under 35 U.S.C. § 103(a) as obvious over the combination of Weldy, Denyer, and Nagumo.

6. Claim 3

Claim 3 recites "[t]he improved digital camera as recited in claim 1, wherein one of said two lenses is configured to allow said first image sensor sensitive to a selected range of said full region of visible color spectrum, and the other one of said two lenses is configured to allow said second image sensors sensitive to said full region of visible color spectrum." Ex. 1001, 10:62–67. Petitioners assert the combination of Weldy, Denyer, and Nagumo teaches or suggests claim 3. Pet. 76–78.

In particular, Petitioners assert Weldy teaches a four-lens digital camera including a first lens corresponding to a first image sensor with a single-color color filter. *Id.* at 76 (citing Ex. 1007, Fig. 1b, 6:13–16; Ex. 1003 ¶ 221). Petitioners further assert Weldy teaches a second lens corresponding to the second image sensor without a color filter. *Id.* at 78 (citing Ex. 1007, Fig. 1b, 6:13–16; Ex. 1003 ¶ 225). Dr. Bovik offers testimony in support of Petitioners' assertions with regard to this limitation. Ex. 1003 ¶¶ 220–223.

Patent Owners do not specifically dispute that the combination of Weldy, Denyer, and Nagumo teaches or suggests claim 3. *See generally* PO Resp. Based on the complete record and for the reasons explained by Petitioners, we are persuaded that the combination of Weldy, Denyer, and Nagumo teaches a first image sensor with a single-color color filter that is sensitive to a selected range of the visible color spectrum and a second image sensor that is sensitive to the full visible color spectrum, which renders obvious this limitation. We determine that Petitioners have demonstrated by a preponderance of the evidence that claim 3 is

unpatentable under 35 U.S.C. § 103(a) as obvious over Weldy, Denyer, and Nagumo.

G. Ground 5: Alleged Obviousness of Claim 4 over Weldy, Denyer, Nagumo, and Mansoorian

Claim 4 depends from claim 1. Petitioners assert the combination of Weldy, Denyer, Nagumo, and Mansoorian teaches or suggests this limitation. Pet. 79–85.

1. Claim 4

Claim 4 recites "[t]he improved digital camera as recited in claim 1, wherein said analog-to-digital converting circuitry comprises two individual analog-to-digital converters, each integrated with one of said first and second image sensors so that said first and second digital images are digitized independently and in parallel to increase signal throughput rate." Ex. 1001, 11:1–6. Petitioners assert the combination of Weldy, Denyer, Nagumo, and Mansoorian teaches or suggests this limitation. Pet. 79–85.

In particular, Petitioners assert Weldy in combination with Denyer and Nagumo renders obvious analog-to-digital converting circuitry coupled to first and second image sensors and digitizing the first and second intensity images to produce corresponding first and second digital images. *Id.* at 80–81 (citing Ex. 1003 ¶ 236). Petitioners assert Nagumo teaches that analog-to-digital converting circuitry comprises two individual analog-to-digital converters coupled to image sensors 1 and 2, respectively. *Id.* at 81 (citing Ex. 1009, 4:40–50). Petitioners identify sample and holding circuit 5 and A/D converter 17 as comprising one individual analog-to-digital converter coupled to image sensor 1 and sample and holding circuit 6 and A/D converter 18 as comprising a second individual analog-to-digital

converter coupled to image sensor 2. *Id.* at 82 (citing Ex. 1009, 4:40–50; Ex. 1003 ¶ 240). Petitioners assert an ordinarily skilled artisan would have understood that each individual analog-to-digital converter digitizes the respective first and second digital images independently and in parallel in two separate processing paths, thereby increasing the signal throughput rate. *Id.*

Petitioners assert that to the extent that the limitation "integrated with one of said first and second image sensors" requires that each individual analog-to-digital converter and its corresponding image sensor are on the same chip, Mansoorian teaches this limitation for the same reasons discussed above with respect to Ground 3. *Id.* at 83–84.

Petitioners also provide an explanation as to why an ordinarily skilled artisan would have combined the teachings of Mansoorian with the Weldy, Denyer, and Nagumo system relied upon with respect to claim 1. *Id.* at 79–80, 84–85. In particular, Petitioners assert an ordinarily skilled artisan would have been motivated to apply Mansoorian's integrated chips to reduce chip size, power consumption, and manufacturing and design cost and to improve system reliability, noise resistance, and chip-to-chip interfacing. *Id.* at 84–85 (citing Ex. 1006, 4:23–28; Ex. 1003 ¶ 243). Dr. Bovik offers testimony in support of Petitioners' assertions with regard to claim 4. Ex. 1003 ¶¶ 235–238.

Petitioners identify a potential issue regarding the construction of the term "integrated," in particular whether it requires that the analog-to-digital converters are integrated with their respective image sensors on the same chip. Petitioners have not argued for a particular construction of this term, but have adequately accounted for the "integrated" limitation under this

alternative construction because Mansoorian's individual analog-to-digital converter 120 is integrated on the same chip with image sensing array 110.

Patent Owners do not specifically dispute that the combination of Weldy, Denyer, Nagumo, and Mansoorian teaches or suggests claim 4. *See generally* PO Resp. Based on the complete record and for the reasons explained by Petitioners, we are persuaded that the combination of Weldy, Denyer, Nagumo, and Mansoorian teaches or suggests claim 4. We are also persuaded that an ordinarily skilled artisan would have combined Weldy, Denyer, Nagumo, and Mansoorian for the reasons set forth by Petitioners. Accordingly, we determine that Petitioners have demonstrated by a preponderance of the evidence that claim 4 is unpatentable under 35 U.S.C. § 103(a) as obvious over Weldy, Denyer, Nagumo, and Mansoorian.

H. Ground 6: Alleged Obviousness of Claim 5 over Weldy, Denyer, Nagumo, and Ikeda

Claim 5 depends from claim 1. Petitioners assert the combination of Weldy, Denyer, Nagumo, and Ikeda renders obvious claim 5.

1. Ikeda

Ikeda is a United States Patent directed to an image data processing apparatus that processes combined image signals to extend dynamic range. Ex. 1010, Abstract. Ikeda discloses obtaining a plurality of image signals using different image sensors with different color filters. *Id.* at 16:33–45; Ex. 1003 ¶¶ 247–249. Ikeda discloses replacing a dark- or white-corrupted portion of an image with a corresponding non-corrupted portion of a second image to improve the dynamic range of an image. Ex. 1010, 13:63–65, 15:5–9, 16:40–45, 17:67–18:4; Ex. 1003 ¶¶ 257–260.

On this record, we agree with Petitioners (Pet. 16) that Ikeda qualifies as prior art under 35 U.S.C. § 102(e) because Ikeda issued on September 1, 1998, from an application filed on November October 26, 1994, which is before the filing date of the '289 patent, which is January 15, 1999. *See* Ex. 1001, code (22); Ex. 1010, code (45).

2. Claim 5

Claim 5 recites "[t]he improved digital camera as recited in claim 1, wherein said digital image processor increases the dynamic range of said first digital image by incorporating a portion of said second digital image into said first digital image." Ex. 1001, 11:7–10. Petitioners assert the combination of Weldy, Denyer, Nagumo, and Ikeda teaches or suggests this limitation. Pet. 85–91.

In particular, Petitioners assert Weldy teaches a digital image processor producing a resultant digital image from a first digital image where the resultant digital image is enhanced with a second digital image. *Id.* at 89 (citing Ex. 1007, 3:18–19, 3:26–4:45, 6:2–12; Ex. 1003 ¶ 256). Petitioners assert Ikeda teaches replacing a dark- or white-corrupted portion of an image with a corresponding non-corrupted portion of a second image to improve the dynamic range of an image. *Id.* at 89 (citing Ex. 1010, 13:63–65, 15:5–9, 16:40–45, 17:67–18:4; Ex. 1003 ¶¶ 257–260).

Petitioners assert an ordinarily skilled artisan would have been motivated to combine Ikeda's teachings with the Weldy, Denyer, and Nagumo system to achieve the benefit of improved performance characteristics, specifically enlarged dynamic range. *Id.* at 90 (citing Ex. 1003 ¶ 261). Petitioners assert the resulting combination renders obvious

this limitation. *Id.* at 85–91. Dr. Bovik offers testimony in support of Petitioners' assertions with regard to claim 5. Ex. 1003 ¶¶ 245–262.

Patent Owners do not specifically dispute that the combination of Weldy, Denyer, Nagumo, and Ikeda teaches or suggests claim 4. *See generally* PO Resp. Based on the complete record and for the reasons explained by Petitioners, we are persuaded that (1) Ikeda teaches replacing a corrupted portion of a first image with a non-corrupted portion of a second image to improve the dynamic range of the first image and (2) Petitioners have provided persuasive reasoning, supported by rational underpinning, regarding why a person of ordinary skill in the art would have combined Weldy, Denyer, Nagumo, and Ikeda. Accordingly, we determine that Petitioners have demonstrated by a preponderance of the evidence that claim 5 is unpatentable under 35 U.S.C. § 103(a) as obvious over Weldy, Denyer, Nagumo, and Ikeda.

I. Petitioners' Motion to Exclude

Petitioners filed a Motion to Exclude (Paper 22) Exhibits 2005–2010 and testimony that relies on those exhibits, including portions of the Declaration of Inventor Yanbin Yu (Ex. 2002 ¶¶ 4–8). Patent Owners filed an Opposition to Petitioners' Motion to Exclude (Paper 25).

Petitioners argue (1) Patent Owners fail to sufficiently authenticate Exhibits 2005–2010 under FRE 901 and to establish that these exhibits are reliable; (2) Exhibits 2005, 2006, and 2008–2010 are irrelevant; and (3) Exhibits 2005–2010 violate the doctrine of completeness (FRE 106) and "best evidence" rule (FRE 1001–1003). Paper 22, 2.

First, Petitioners argue Patent Owners fail to sufficiently authenticate Exhibits 2005–2010 and to establish that these exhibits are reliable. In

particular, Petitioners argue Exhibits 2005–2010 have not been sufficiently authenticated because Patent Owners rely on uncorroborated testimony of inventor Yanbin Yu to authenticate these documents. *See* Paper 22, 3–4 (Ex. 2005), 5–7 (Ex. 2006), 9–10 (Ex. 2007), 12–13 (Exs. 2008–2010). Petitioners argue Mr. Yu's testimony authenticating these documents is unreliable, identifying purported inconsistencies in Mr. Yu's testimony for various exhibits. *See id.*

Second, Petitioners argue Exhibits 2005, 2006, and 2008–2010 are irrelevant because Patent Owners do not cite any of these exhibits in Patent Owners' Response or Sur-reply and these documents are only cited in Mr. Yu's Declaration. *See* Paper 22, 3 (Ex. 2005), 5 (Ex. 2006), 12 (Exs. 2008–2010).

Third, Petitioners argue Exhibits 2005–2010 are incomplete and violate the best evidence rule because Patent Owners fail to provide all relevant evidence and context, including prior and successive pages and any witnessing or indicia of dates. *See* Paper 22, 4–5 (Ex. 2005), 7 (Ex. 2006), 11 (Ex. 2007), 13 (Exs. 2008–2010).

Patent Owners oppose Petitioners' Motion to Exclude, arguing, among other things, that Petitioners' arguments each go to the weight of the evidence, not its admissibility. *See, e.g.*, Paper 25, 3–4. We agree with Patent Owners. Petitioners argue Patent Owners have failed to sufficiently authenticate Exhibits 2005–2010, but courts "do not require conclusive proof of authenticity before allowing the admission of disputed evidence." *United States v. Isiwele*, 635 F.3d 196, 200 (5th Cir. 2011) (quoting *United States v. Watkins*, 591 F.3d 780, 787 (5th Cir. 2009)). The flaws identified by Petitioners go to the weight of the exhibits, not their admissibility, and

are considered in the context of Patent Owners' reliance, if any, on these exhibits. Accordingly, we deny Petitioner's Motion to Exclude.

III. CONCLUSION

For the foregoing reasons, we conclude that Petitioners have demonstrated, by a preponderance of the evidence, that claims 1 and 3–5 of the '289 patent are unpatentable. For the reasons discussed above, Petitioners have not demonstrated, by a preponderance of the evidence, that claim 2 of the '289 patent is unpatentable. The chart below summarizes our conclusions.

Claims	**35 U.S.C. §**	**References/ Basis**	**Claim(s) Shown Unpatentable**	**Claim(s) Not Shown Unpatentable**
1, 2	102(b)	Yamazaki		1, 2
1, 2	103(a)	Yamazaki		1, 2
4	103(a)	Yamazaki, Mansoorian		4
1, 3	103(a)	Weldy, Denyer, Nagumo	1, 3	
4	103(a)	Weldy, Denyer, Nagumo, Mansoorian	4	
5	103(a)	Weldy, Denyer, Nagumo, Ikeda	5	
Overall Outcome			1, 3–5	2

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that claims 1 and 3–5 of the '289 patent are determined to be unpatentable;

FURTHER ORDERED that claim 2 of the '289 patent is not determined to be unpatentable;

FURTHER ORDERED that Patent Owners' Motion to Exclude is denied; and

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

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