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Paper 12
Entered: May 13, 2019

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ALIGN TECHNOLOGY, INC.,
Petitioner,

v.

3SHAPE A/S,
Patent Owner.

Case PGR2018-00103
Patent 9,962,244 B2

Before SALLY C. MEDLEY, IRVIN E. BRANCH, and JESSICA C. KAISER, *Administrative Patent Judges.*

KAISER, *Administrative Patent Judge.*

DECISION
Denying Institution of Post-Grant Review
35 U.S.C. § 324 and 37 C.F.R. § 41.208

Align Technology, Inc. ("Petitioner") filed a Petition pursuant to 35 U.S.C. §§ 321–329 requesting a post-grant review of claims 1–5, 7–10, 12, 15, 16, 18, 21, 22, 24, 26, 28, and 29 of U.S. Patent No. 9,962,244 B2, issued on May 8, 2018 (Ex. 1001, "the '244 patent"). Paper 6 ("Pet.").[1] 3Shape A/S ("Patent Owner") filed a Preliminary Response. Paper 10 ("Prelim. Resp."). Applying the standard set forth in 35 U.S.C. § 324(a), which requires demonstration that it is more likely than not that at least 1 of the claims challenged in the petition is unpatentable, we deny Petitioner's request and do not institute a post-grant review of any challenged claim.

I. BACKGROUND

A. The '244 Patent (Ex. 1001)

The '244 patent, titled "Focus Scanning Apparatus Recording Color," issued on May 8, 2018. Ex. 1001, at [45], [54]. The '244 patent describes a scanning system and method to generate a digital three-dimensional (3D) representation of an object that has been scanned. *Id.* at 1:6–9, 2:5–13. The scanning system generates the digital 3D representation based on surface geometry and surface color derived from a series of captured two-dimensional (2D) images of the object. *Id.* at 1:64–2:13. Figure 1 of the '244 patent illustrates an exemplary scanner system and associated components and is reproduced below.

[1] Petitioner filed an Original Petition (Paper 2), a Corrected Petition (Paper 3), and a Second Corrected Petition (Paper 6). We address Petitioner's Second Corrected Petition.

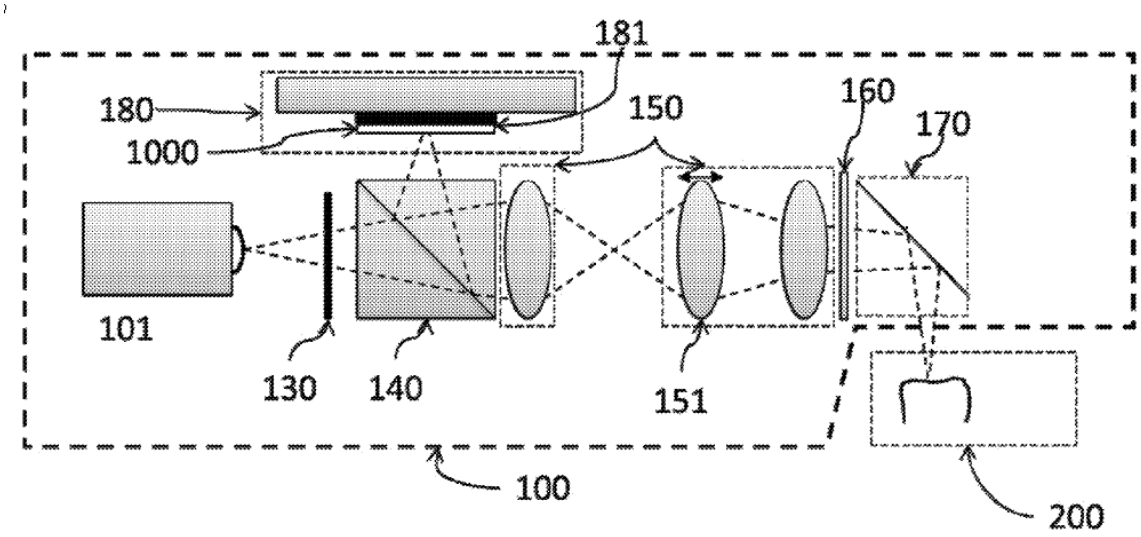

Figure 1 depicts a handheld embodiment of a scanner used to perform intraoral scanning. Ex. 1001, 15:63–64.

As shown in Figure 1, the scanner system includes a multichromatic light source 101, which can be a multi-die LED with green, red, and blue dies. *Id.* at 15:63–66, 16:36–37. The light from the light source travels through optical system 150 and illuminates the object to be scanned 200, e.g., a tooth. *Id.* at 16:4–6, 17:65–66. Color image sensor 180 and associated image sensor 181 capture a 2D image of the illuminated object 200. *Id.* at 16:1–9. The image sensor comprises pixels, which capture the images. *See id.* at 16:52–56. The system captures additional 2D images of the object 200 at different focal imaging planes by shifting a focusing element 151, e.g., a lens, back and forth, thereby capturing a series of 2D images of the object 200 at each focal plane position. *Id.* at 16:14–18, 18:4–7, 65–67; *see id.* at Fig. 6A.

Using one or more of the captured 2D images, the system derives both surface geometry information and surface color information for a block of image sensor pixels. *Id.* at 16:52–56, 18:8–10. To determine surface geometry information, first, a correlation measure is determined using 2D

images in the series of 2D images; based on those correlation measures, a correlation measure function is determined. *Id.* at 18:24–26, 33–37, 19:6–11; *see id.* at Fig. 6B. That correlation measure function has a maximum. *Id.* at 19:8–11; *see id.* at Fig. 6B. That maximum is then used to derive surface geometry information. *Id.* at 19:12–15. Accordingly, because the correlation measure function maximum is based on 2D images in the series of 2D images, the derived surface geometry information is based on 2D images in the series of 2D images.

Further, surface color information for the block of pixels is derived from the same 2D images from which surface geometry information was derived. *Id.* at 2:48–59, 19:37–29; *see id.* at Fig. 6C. In particular, surface color information is derived from the same 2D images that were previously used to determine the correlation measure function maximum for deriving surface geometry information. *Id.* at 18:41–47. For example, the color values of two 2D images which previously were used to determine the correlation measure function maximum are averaged to determine surface color information for the block of pixels. *Id.* at 19:21–29; *see id.* Figs. 6A–6C.

The derived surface geometry information and derived surface color information are used to generate sub-scans, i.e., portions of the digital 3D model. *Id.* at 18:8–15. Those sub-scans are combined to generate a digital 3D representation of the object. *Id.* at 10:45–50, 18:16–20.

B. Illustrative Claims

Of the challenged claims, claims 1 and 29 are independent claims and are reproduced below.

1. A focus scanner for recording surface geometry and surface color of an object, the focus scanner comprising:

a multichromatic light source configured for providing a multichromatic probe light for illumination of the object,

a color image sensor comprising an array of image sensor pixels for capturing one or more 2D images of light received from said object,

wherein the focus scanner is configured to operate by translating a focus plane along an optical axis of the focus scanner and capturing a series of the 2D images, each 2D image of the series is at a different focus plane position such that the series of captured 2D images forms a stack of 2D images; and

a data processing system configured to derive surface geometry information for a block of said image sensor pixels from the 2D images in the stack of 2D images captured by said color image sensor, the data processing system also configured to derive surface color information for the block of said image sensor pixels from at least one of the 2D images used to derive the surface geometry information;

wherein the data processing system further is configured to combining a number of sub-scans to generate a digital 3D representation of the object, and determining object color of a least one point of the generated digital 3D representation of the object from sub-scan color of the sub-scans combined to generate the digital 3D representation, such that the digital 3D representation expresses both geometry and color profile of the object, and

wherein determining the object color comprises computing a weighted average of sub-scan color values derived for corresponding points in overlapping sub-scans at that point of the object surface.

29. A focus scanner for recording surface geometry and surface color of an object, the focus scanner comprising:

a multichromatic light source configured for providing a multichromatic probe light for illumination of the object,

> a color image sensor comprising an array of image sensor pixels for capturing one or more 2D images of light received from said object,
>
> wherein the focus scanner is configured to operate by translating a focus plane along an optical axis of the focus scanner and capturing a series of the 2D images, each 2D image of the series is at a different focus plane position such that the series of captured 2D images forms a stack of 2D images; and
>
> a data processing system configured to derive surface geometry information for a block of said image sensor pixels from the 2D images in the stack of 2D images captured by said color image sensor, the data processing system also configured to derive surface color information for the block of said image sensor pixels from at least one of the 2D images used to derive the surface geometry information, and
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> where the data processing system further is configured to detecting saturated pixels in the captured 2D images and for mitigating or removing the error in the derived surface color information or the sub-scan color caused by the pixel saturation.

C. Related Proceedings

Petitioner identifies a related litigation in the District of Delaware involving the '244 patent, titled *3Shape A/S v. Align Technology, Inc.*, Case No. 1-18-cv-00697 (DED), filed May 8, 2018. Pet. 96. Additionally, Petitioner and Patent Owner identify one other post-grant review and two additional *inter partes* reviews filed by the Petitioner regarding the '244 patent: PGR2018-00104, IPR2019-00117, and IPR2019-00118. *Id.* at 5–6, 96; Prelim. Resp. 48.

D. References

Petitioner relies on the following references:

1. "Fisker" (US 2012/0092461 A1; published Apr. 19, 2012) (Ex. 1005);
2. "Szeliski" (US Pat. No. 6,097,854; issued Aug. 1, 2000) (Ex. 1006);
3. "Matsumoto" (US Pat. No. 7,106,348 B2; issued Sept. 12, 2006) (Ex. 1007);
4. "Yamada" (US 2007/0035641 A1; published Feb. 15, 2007) (Ex. 1008);
5. "Suzuki" (US 2013/0070128 A1; published Mar. 21, 2013) (Ex. 1009);
6. "Thiel '425" (US2012/0075425A1; published Mar. 29, 2012) (Ex. 1012); and
7. "Thiel '576" (US 2011/0080576 A1; published Apr. 7, 2011) (Ex. 1013).

E. Grounds Asserted

Petitioner challenges the patentability of the claims at issue on the following grounds:

References	Basis	Claim(s)
Fisker and Szeliski	35 U.S.C. § 103	1–5, 7–10, 15, 16, 18, 21–22, 24, 26, and 28
Fisker and Matsumoto	35 U.S.C. § 103	1–5, 7–10, 15, 16, 18, 21–22, 24, 26, and 28
Fisker and Yamada	35 U.S.C. § 103	29
Fisker and Suzuki	35 U.S.C. § 103	29
Fisker, Szeliski, and Yamada	35 U.S.C. § 103	12
Fisker, Szeliski, and Suzuki	35 U.S.C. § 103	12
Fisker, Matsumoto, and Yamada	35 U.S.C. § 103	12

Fisker, Matsumoto, and Suzuki	35 U.S.C. § 103	12
Thiel '425, Thiel '576, and Szeliski	35 U.S.C. § 103	1, 22, and 24
Thiel '425, Thiel '576, and Matsumoto	35 U.S.C. § 103	1, 22, and 24
Thiel '425, Thiel '576, Szeliski, and Fisker	35 U.S.C. § 103	2–5, 7–10, 15, 16, 18, 21, 26, and 28
Thiel '425, Thiel '576, Matsumoto, and Fisker	35 U.S.C. § 103	2–5, 7–10, 15, 16, 18, 21, 26, and 28
Thiel '425, Thiel '576, and Yamada	35 U.S.C. § 103	29
Thiel '425, Thiel '576, and Suzuki	35 U.S.C. § 103	29

Petitioner also relies on expert testimony from Dr. Chandra Bajaj (Ex. 1003, "Bajaj Decl.").

II. ANALYSIS

A. Discretionary Denial

1. Post-Grant Review Eligibility

Petitioner contends that, in order to challenge the '244 patent, Petitioner is required to file a post-grant review ("PGR"). Pet. 5–6. Specifically, Petitioner argues that the provisional application to which the '244 patent claims priority (Ex. 1029) "has no written description support for at least claims 19, 25, and 32" and so, "the earliest effective priority date for at least these claims is post-March 2013, requiring Petitioner to file a PGR." *Id.* at 6.

We determine Petitioner has sufficiently shown for purposes of this decision that the '244 patent is eligible for post-grant review. The '244 patent issued on May 8, 2018. Ex. 1001, at [45]. The Petition in this PGR

was accorded a filing date of October 30, 2018 (i.e., less than nine months after the patent issued). Whether a petition for PGR or a petition for *inter partes* review is the appropriate vehicle to challenge claims of the '244 patent less than nine months after issuance depends on whether the '244 patent is a patent described in § 3(n)(1) of the AIA.[2] Section 3(n)(1) provides the first-inventor-to-file provisions of the AIA "shall apply to any application for patent, and any patent issuing thereon, that contains or contained at any time—(A) a claim to a claimed invention that has an effective filing date in Section 100(i) of title 35, United States Code, that is on or after the effective date described in this paragraph." AIA § 3(n)(1), 125 Stat. at 293. The AIA passed on September 16, 2011. *See* 125 Stat. 284. The effective date under § 3(n)(1) is 18 months after the date of passage—i.e., March 16, 2013. Thus, we evaluate whether Petitioner has adequately shown a claim of the '244 patent has an effective filing date on or after March 16, 2013.

The '244 patent claims priority to a provisional application that was filed on February 13, 2013. Ex. 1001, at [60]. Petitioner contends that at least claims 19, 25, and 32 of the '244 patent lack written description support in that provisional, and thus do not have an effective filing date prior to March 16, 2013. Pet. 17–21. Petitioner's contentions are supported by the testimony of Dr. Bajaj. Ex. 1003 ¶¶ 66–74. We have reviewed Petitioner's contentions as supported by Dr. Bajaj's testimony, and we find Petitioner has adequately shown on the current record that claims 19, 25, and 32 of the '244 patent have an effective filing date after March 16, 2013.

[2] Leahy–Smith America Invents Act, Pub. L. No. 112–29, 125 Stat. 284 (2011) ("AIA").

Thus, we find Petitioner has adequately shown the ’244 patent is a PGR-eligible patent.

Patent Owner does not address Petitioner’s contentions as to the effective filing date of claims 19, 25, and 32. *See* Prelim, Resp. 48–49, 53–54. Instead, Patent Owner argues the Board should not institute this post-grant review “because doing so would be judicially inefficient, particularly in light of Petitioner’s admission that the prior art issues in the” corresponding *inter partes* review (i.e., IPR2019-00117) are “virtually identical.” Prelim. Resp. 48. Patent Owner further argues “allowing petitioners to file PGR and IPR petitions taking equivocating positions concerning PGR eligibility unfairly places the burden of adjudicating such additional proceedings upon the Patent Office and patent owners.” *Id.* at 49. Patent Owner also argues “the Patent Office has already determined that the ’244 Patent is subject to pre-AIA law and, as such, the ’244 patent is not eligible for post-grant review,” and thus we should find the ’244 patent not PGR eligible as part of exercising our discretion under 35 U.S.C. § 325(d). *Id.* at 53–54.

We are not persuaded that Petitioner’s filing of a nearly identical *inter partes* review means we should find the challenged patent is not PGR eligible. Petitioner does not take equivocating positions but rather contends the ’244 patent is PGR eligible. Pet. 6. Petitioner contends it filed a nearly identical *inter partes* review corresponding to this PGR because Patent Owner “may be able to provide [evidence] during trial that might dissuade the Board from holding the ’244 patent is PGR eligible.” *Id.* We find Petitioner’s explanation sufficient.

We are also not persuaded that we should exercise our discretion under 35 U.S.C. § 325(d) to deny institution of this PGR because "the Patent Office has already determined that the '244 Patent is subject to pre-AIA law and, as such, the '244 patent is not eligible for post-grant review." Prelim. Resp. 53–54. During the prosecution of the application leading to the '244 patent, the examiner stated "[t]he present application is being examined under the pre-AIA first to invent provisions." Ex. 1002, 870 (July 17, 2017 Non-Final Office Action). In making this statement, the examiner did not provide reasoning or further analysis, and that issue was not further discussed by either the examiner or the applicant during prosecution. *See* Ex. 1002.

We determine not to exercise our discretion under 35 U.S.C. § 325(d) to deny institution of this PGR on this basis. In making this determination, we have considered the non-binding Board decisions that Patent Owner cites in support of our exercising discretion (Prelim. Resp. 54). Although we agree with Patent Owner that an examiner's determination to examine an application under the pre-AIA first-to-invent provisions is an appropriate factor to consider in assessing PGR eligibility, we disagree that it is determinative absent other considerations. Here, as discussed above, Petitioner has presented evidence, including expert testimony, that certain claims in the '244 patent do not have support in the provisional application and thus have an effective filing date after March 16, 2013. This argument and evidence was not before the examiner.

For the reasons discussed above, we find Petitioner has adequately shown the '244 patent is PGR eligible for purposes of this decision.

2. 35 U.S.C. § 325(d)

Patent Owner contends that the Board also should deny the Petition under § 325(d) because "Fisker was considered by the Examiner and applied in a rejection during prosecution of the '244 Patent" and "the Examiner determined that the art of record (including Fisker) does not disclose the claimed 'multichromatic light source', 'color image sensor', and 'data processing system', i.e., the features common to independent claims 1 [and] 29." Prelim. Resp. 50 (citing Ex. 1002, 0873–74, 0921). Patent Owner states that "Petitioner now requests the PTAB to readjudicate the same cited art (Fisker) and the same issue (whether Fisker discloses 'a multichromatic light source', 'color image sensor', and 'data processing system')." *Id.* at 50–51.

In the Petition, Petitioner analyzes the factors the Board typically considers in determining whether to exercise its discretion under § 325(d). Pet. 8–11. Petitioner argues that "Petitioner's obviousness argument relies on Fisker for the features that the Examiner found obvious over Fisker in the first Office Action, and on new references not considered by the Examiner for the dependent-claim limitations that the Examiner allowed." *Id.* at 8. That is, Petitioner argues that "the newly cited prior art is only provided to teach the limitations that the Examiner failed to reject" and so there is "no overlap between the examination arguments and the instant Petition." *Id.* at 11.

We have reviewed both parties arguments and agree with Petitioner that we should not exercise our discretion under § 325(d) for the reasons stated in the Petition. *See* Pet. 7–11. Thus, we proceed to address the merits of the challenges presented in the Petition as discussed further below.

B. Claim Construction

For this Petition filed before November 13, 2018, the Board interprets claim terms in an unexpired patent according to their broadest reasonable interpretation in light of the specification of the patent in which they appear. *See* 37 C.F.R. § 42.200(b) (2018); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016); *see also* Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51,340 (Oct. 11, 2018) (amending 37 C.F.R. § 42.200(b) effective November 13, 2018). Under that standard, claim terms are generally given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art, in the context of the entire disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007).

Petitioner does not propose construction of any particular claim terms. *See* Pet. Patent Owner proposes a construction for "the data processing system also configured to derive surface color information . . . from at least one of the 2D images used to derive the surface geometry information," as recited in independent claims 1 and 29. Prelim. Resp. 7 (citing Ex. 1001, 19:48–52, 22:21–25). In particular, Patent Owner argues that that "recitation requires the data processing system to be configured to derive both surface geometry information *and* surface color information *from the same at least one 2D image* captured by said color image sensor." *Id.* at 8 (emphasis in original). We agree with Patent Owner's construction because it is based on the plain language of the claims which require "the data processing system also configured to *derive surface color information* for the block of said image sensor pixels *from at least one of the 2D images used to derive the*

surface geometry information." We determine this recitation requires that surface color information be derived from at least one of the 2D images that was used to derive surface geometry (i.e., at least one of the images must be used to derive both types of information).

Only terms in controversy need to be construed, and then only to the extent necessary to resolve the controversy. *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))). For purposes of this Decision, we determine no other claim terms require express construction.

C. Legal Principles

A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the 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 ordinary skill in the art;[3] and (4) when in the record,

[3] Petitioner contends a person having ordinary skill in the art at the time of the invention would have a bachelor's degree in computer engineering, computer science, electrical engineering, physics, computer vision, or an equivalent field and at least one or two years of industry experience, or at least five years of comparable industry experience. Pet. 17. Petitioner

objective evidence of nonobviousness. *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). In that regard, an obviousness analysis "need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ." *KSR*, 550 U.S. at 418.

D. Asserted Obviousness over Fisker and Szeliski

1. Overview of Fisker (Ex. 1005) and Szeliski (Ex. 1006)

Fisker is titled "Focus Scanning Apparatus," and was effectively filed June 17, 2009 and published April 19, 2012. Ex. 1005, at [43], [60]. Petitioner contends Fisker is prior art under 35 U.S.C. § 102(a)(1). Pet. 3. Fisker's abstract describes its subject matter as follows: "a handheld scanner for obtaining and/or measuring the 3D geometry of at least a part of the surface of an object using confocal pattern projection techniques." Ex. 1005, at [57].

Szeliski is titled "Image Mosaic Construction System and Apparatus with Patch-Based Alignment, Global Block Adjustment and Pair-Wise Motion-Based Local Warping," and was issued August 1, 2000. Ex. 1006, at [45]. Petitioner contends Szeliski is prior art under 35 U.S.C. § 102(a)(1). Pet. 3. Szeliski's abstract describes its subject matter as follows: a system that

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further contends a person of ordinary skill in the art "would have had experience with and knowledge of three-dimensional imaging systems and three-dimensional modeling techniques." *Id.* Patent Owner does not provide its own definition of a person of ordinary skill, but states that "Petitioner fails to satisfy its burden even assuming, for purposes of determining whether to institute, that Petitioner's definition of a person of ordinary skill in the art [] at page 17 of the Petition is correct." Prelim. Resp. 8 n.3. For purposes of this Decision, we apply Petitioner's definition.

> aligns a set plural overlapping images useful in constructing a mosaic by performing patch-based alignment of the set of overlapping images to produce a set of warped images, performing block adjustment of the set of warped images to produce a set of block-adjusted images, and then performing pair-wise motion-based local warping of the set of block-adjusted images.

Ex. 1006, at [57].

2. Analysis

Petitioner contends that claims 1–5, 7–10, 15, 16, 18, 21, 22, 24, 26, and 28 would have been obvious over Fisker and Szeliski. Pet. 21–34, 37–58. For the reasons discussed below, we determine Petitioner has not shown it is more likely than not any claim challenged as obvious over Fisker and Szeliski is unpatentable.

We focus our analysis on claim 1's recitation: "the data processing system also configured to derive surface color information for the block of said image sensor pixels from at least one of the 2D images used to derive the surface geometry information." Ex. 1001, 19:48–52. Petitioner contends Fisker teaches this limitation. Pet. 26–28. In particular, Petitioner relies on Fisker's teaching of "'*simultaneous* scanning of a surface shape and color' using one image sensor 181," "obtain[ing] the color of the surface being scanned, i.e. capable of registering the color of the individual surface elements of the object *being scanned together with* the surface topology of the object being scanned," and "at every focus position, the amplitude of light received at the sensor elements is used to determine surface topology and the surface color for each image sensor element in the sensor." Pet. 26–28 (citing Ex. 1005 ¶¶ 151–158, 228, 244, 279, Fig. 9; Ex. 1003 ¶¶ 105, 107).

Patent Owner contends that claim 1 requires "a data processing system configured to derive *both* surface geometry information *and* surface color information *from the same at least one 2D image* captured by said color image sensor," but Fisker's "simultaneous scanning" does not disclose or suggest such a system. Prelim. Resp. 9. In particular, Patent Owner argues that Fisker's process of "simultaneously scanning . . . a surface shape and color" does not "demonstrate that the *same* particular 2D image within the enormous amount of data obtained from Fisker's scanning is used to derive both surface geometry information *and* surface color information *from the same at least one 2D image*." *Id.* at 10. Further, Patent Owner argues that "[e]ven if Fisker simultaneously obtains surface shape and color information . . . this does not necessarily mean that the *same* at least one particular 2D image within the enormous amount of data obtained from Fisker's scanning must be used to derive *both* surface geometry information *and* surface color information." *Id.* at 12–13. Still further, Patent Owner argues that Fisker's simultaneous scanning "encompasses obtaining multiple images at varying times" and so Fisker "cannot . . . obtain[] surface geometry and color at the same single moment in time." *Id.* at 14–16. Patent Owner also argues that Fisker's "simultaneous scanning" would not "somehow inherently result in deriving surface color information from at least one of the 2D images from which the surface geometry information is derived." *Id.* at 18.

We agree with Patent Owner that Petitioner has not sufficiently shown Fisker teaches this limitation. In the portions of Fisker on which Petitioner relies, Fisker teaches an "exemplary embodiment of a device for simultaneous scanning of a surface shape and color" (Ex. 1005 ¶ 228),

which is "capable of registering the color of the individual surface elements of the object being scanned together with the surface topology of the object being scanned" (*id.* ¶ 151). Pet. 27–28 (also citing Ex. 1005 ¶¶ 151–158, 279). Neither Petitioner nor its declarant (Ex. 1003 ¶¶ 105–107), however, adequately explains how these portions of Fisker show that surface color information is derived from at least one of the 2D images used to derive surface geometry information. That Fisker's device may collect data that is used to derive both is insufficient to meet the limitation of claim 1 that at least one 2D image must be used to derive both.

Petitioner does not rely on Szeliski as teaching this limitation. *See* Pet. 26–28. Accordingly, we determine Petitioner has not shown it is more likely than not that claim 1 is unpatentable based on this challenge.

Claims 2–5, 7–10, 15, 16, 18, 21, 22, 24, 26, and 28 all depend directly or indirectly from claim 1. Petitioner provides further analysis detailing where it contends each of the additional limitations of these claims is taught in Fisker or Szeliski. *Id.* at 44–58. These contentions, however, do not cure the deficiency we discuss above with respect to claim 1. Thus, we determine Petitioner has not shown it is more likely than not that claims 2–5, 7–10, 15, 16, 18, 21, 22, 24, 26, and 28 are unpatentable based on this challenge.

E. Remaining Grounds Based on Fisker and Additional References

Petitioner contends that claims 1–5, 7–10, 15, 16, 18, 21, 22, 24, 26, and 28 would have been obvious over Fisker and Matsumoto (Pet. 21–31, 34–58); claim 29 would have been obvious over Fisker and Yamada and Fisker and Suzuki (*id.* at 58–66); and claim 12 would have been obvious over Fisker, Szeliski, and Yamada; over Fisker, Szeliski, and Suzuki; over

Fisker, Matsumoto, and Yamada; and over Fisker, Matsumoto, and Suzuki (*id.* at 58–61, 66–67).

We find Petitioner has not shown claim 1 is more likely than not unpatentable for the same reasons as those discussed above. Claims 2–5, 7–10, 12, 15, 16, 18, 21, 22, 24, 26, and 28 all depend directly or indirectly from claim 1. Petitioner provides further analysis detailing where it contends each of the additional limitations of these claims is taught in the cited references. *Id.* at 44–58, 66–67. These contentions, however, do not cure the deficiency we discuss above with respect to claim 1. Thus, we determine Petitioner has not shown it is more likely than not that claims 2–5, 7–10, 12, 15, 16, 18, 21, 22, 24, 26, and 28 are unpatentable based on these challenges.

Claim 29 is an independent claim, which recites a substantially similar limitation to the limitation of claim 1 discussed above. Ex. 1001, 22:21–25. In its challenges to claim 29, Petitioner relies on its analysis of the similar limitation of claim 1. Pet. 58–59; *see* Prelim. Resp. 27–28. Accordingly, for the same reasons discussed above for claim 1, we determine Petitioner has not shown it is more likely than not that claim 29 is unpatentable based on these challenges.

F. Asserted Obviousness over Thiel '425, Thiel '576, and Szeliski

1. Overview of Thiel '425 (Ex. 1012) and Thiel '576 (Ex. 1013)

Thiel '425 is titled "Handheld Dental Camera and Method for Carrying Out Optical 3D Measurement," claims priority to a continuation application filed on February 23, 2010, and published on March 29, 2012. Ex. 1012, at [42], [63]. Petitioner contends Thiel '425 is prior art under 35 U.S.C. § 102(a)(1). Pet. 4. Thiel '425's abstract describes its subject matter

as follows: a "handheld dental camera performs three-dimensional, optical measurements" including

> a light source that emits an illuminating beam, a scanning unit, a color sensor, and a deflector. The scanning unit focuses the illuminating beam onto a surface of an object to be measured. The surface of the object reflects the illuminating beam and forms a monitoring beam, which is detected by the color sensor. Focal points of wavelengths of the illuminating beam form chromatic depth measurement ranges.

Ex. 1012, at [57].

Thiel '576 is titled "Device and Method for Optical 3D Measurement and for Color Measurement," claims priority to a continuation application filed on April 2, 2009, and published April 7, 2011. Ex. 1013, at [43], [63]. Petitioner contends Thiel '576 is prior art under 35 U.S.C. § 102(a)(1). Pet. 4. Thiel '576's abstract describes its subject matter as follows: "a device and a method for optical 3D measurement, wherein said device can be switched between a first mode for optical 3D measurement using a chromatic confocal measurement method or the triangulation measurement method and a second mode for colorimetric measurement." Ex. 1013, at [57].

2. Analysis

Petitioner contends that claims 1, 22, and 24 would have been obvious over Thiel '425, Thiel '576, and Szeliski. Pet. 67–88. For the reasons discussed below, we determine Petitioner has not shown it is more likely than not any claim challenged as obvious over Thiel '425, Thiel '576, and Szeliski is unpatentable.

We focus our analysis on claim 1's recitation: "the data processing system also configured to derive surface color information for the block of

said image sensor pixels from at least one of the 2D images used to derive the surface geometry information." Ex. 1001, 19:48–52. Petitioner contends the combination of Thiel '425 and Thiel '576 teaches this limitation. Pet. 76–77. Specifically, Petitioner contends Thiel '425 "teaches a stack of 2D images derived from wavelengths having different focus depths being emitted onto the object." Pet. 76; *see id.* at 75–76 (citing Ex. 1012 ¶¶ 83–85). Petitioner contends Thiel '425 teaches "determining surface geometry information of the object of interest from an image in the stack of 2D images," but acknowledges that Thiel '425 "does not explicitly disclose determining surface color information of the object of interest from at least one of the images in the stack of 2D images." *Id.* at 76. Petitioner then relies on Thiel '576 as teaching "a device (focus scanner) that emits a broad-band illuminating beam on an object and an objective for focusing the illuminating beam at two focus depths, one on the object's surface and the other along the optical axis." *Id.* at 76–77; *see id.* at 68 (citing Ex. 1013 ¶¶ 8, 16, 87). Petitioner contends Thiel '576 teaches that "the device receive[s] [the] beam reflected from the object's surface . . . [which] is used to determine the surface color measurements." *Id.* at 77; *see id.* at 68 (citing Ex. 1013 ¶ 18). Petitioner contends a person having ordinary skill in the art "would have found it obvious to enhance [Thiel '425's] image processing methods with the methods of [Thiel '576]." *Id.* at 77–78.

Patent Owner contends Thiel '576 "does not measure both surface topology and color from the same at least one 2D image." Prelim Resp. 35–35. In particular, Patent Owner argues Thiel '576 "discloses a device having two modes – *namely, a first mode for optical 3D depth measurement and a second mode for colorimetric measurement*." *Id.* at 33 (citing Ex. 1013,

Abstract) (emphasis in original). Patent Owner notes that "in the first mode for surface topology measurement, a broad-band illuminating beam is focused onto a first plane 15" while "in the second mode for colorimetric measurement, the broad-band illuminating beam is focused onto a second plane 30 *other than the first plane 15*." *Id.* (citing Ex. 1013 ¶¶ 105–106, Fig. 2) (emphasis in original). As such, "the image data captured from the first focus plane to measure 3D surface topology is not the same as the image data captured from the second focus plane to measure color." *Id.* at 34.

Patent Owner further contends Petitioner improperly combined Thiel '425 and Thiel '576. Prelim. Resp. 35–41. Specifically, Patent Owner argues "Petitioner and its expert cite to no evidence, underlying facts, or data which demonstrate that the claim limitation missing from [Thiel '425] and [Thiel '576] would have been obvious" and further "Petitioner fails to explain how and why a POSITA would have combined [Thiel '425] with [Thiel '576] to arrive at the claimed invention." *Id.* at 35.

We agree with Patent Owner that Petitioner has not adequately shown how the combination of Thiel '425 and Thiel '576 teaches this limitation ("the data processing system also configured to derive surface color information for the block of said image sensor pixels from at least one of the 2D images used to derive the surface geometry information"). As discussed above, Petitioner acknowledges that Thiel '425 does not teach "determining surface color information of the object of interest from at least one of the images in the stack of 2D images." Pet. 76. Although Petitioner relies on Thiel '576 for its teachings regarding surface color information (*id.* at 76–77), Petitioner does not show Thiel '576 teaches deriving that information from "at least one of the 2D images used to derive the surface geometry

information." Instead, as Patent Owner points out (Prelim. Resp. 33–35), Thiel '576 teaches two different modes, one for surface topology (i.e., surface geometry) measurement and one for colorimetric (i.e., surface color) measurement. We have also reviewed Petitioner's contentions regarding the reason to combine these references' teachings (Pet. 69–72, 77–78) as well as Petitioner's expert's testimony (Ex. 1003 ¶¶ 434–442, 456–466), and we determine these contentions do not adequately show a person of ordinary skill in the art would have found this limitation obvious from the combined teachings of Thiel '425 and Thiel '576. Accordingly, we determine Petitioner has not shown it is more likely than not that claim 1 is unpatentable based on this challenge.

Claims 22 and 24 depend directly or indirectly from claim 1. Petitioner provides further analysis detailing where it contends each of the additional limitations of these claims is taught in Thiel '425 or Thiel '576. *Id.* at 86–88. These contentions, however, do not cure the deficiency we discuss above with respect to claim 1. Thus, we determine Petitioner has not shown it is more likely than not that claims 22 and 24 are unpatentable based on this challenge.

G. Remaining Grounds Based on Thiel '425, Thiel '576, and Additional References

Petitioner contends that claims 1, 22, and 24 would have been obvious over Thiel '425, Thiel '576, and Matsumoto (Pet. 67–88); claim 29 would have been obvious over Thiel '425, Thiel '576, and Yamada; and over Thiel '425, Thiel '576, and Suzuki (*id.* at 88–92); and claims 2–5, 7–10, 15, 16, 18, 21, 26, and 28 would have been obvious over Thiel '425, Thiel '576, Szeliski, and Fisker; and over Thiel '425, Thiel '576, Szeliski, and Matsumoto (*id.* at 92–95).

We find Petitioner has not shown claim 1 is more likely than not unpatentable for the same reasons as those discussed above. Claims 2–5, 7–10, 15, 16, 18, 21, 22, 24, 26, and 28 all depend directly or indirectly from claim 1. Petitioner provides further analysis detailing where it contends each of the additional limitations of these claims is taught in the cited references. *Id.* at 86–88, 92–95. These contentions, however, do not cure the deficiency we discuss above with respect to claim 1. Thus, we determine Petitioner has not shown it is more likely than not that claims 2–5, 7–10, 15, 16, 18, 21, 22, 24, 26, and 28 are unpatentable based on these challenges.

Claim 29 is an independent claim, which recites a substantially similar limitation to the limitation of claim 1 discussed above. Ex. 1001, 22:21–25. In its challenges to claim 29, Petitioner relies on its analysis of the similar limitation of claim 1. Pet. 88; *see* Prelim. Resp. 43–45. Accordingly, for the same reasons discussed above for claim 1, we determine Petitioner has not shown it is more likely than not that claim 29 is unpatentable based on these challenges.

III. SUMMARY

We may not authorize a post-grant review to be instituted "unless . . . the information presented in the petition filed under section 321, if such information is not rebutted, would demonstrate that it is more likely than not that at least 1 of the claims challenged in the petition is unpatentable." 35 U.S.C. § 324(a). Applying that standard, and based on the information before us, we determine that Petitioner has not demonstrated it is more likely than not that at least one of the challenged claims is unpatentable. On this

record, we decline to institute post-grant review of 1–5, 7–10, 12, 15, 16, 18, 21, 22, 24, 26, 28, and 29 of the ’244 Patent.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that the Petition is *denied* as to all challenged claims and no trial is instituted.

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