

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MEDIT CORPORATION,
Petitioner,

v.

3SHAPE A/S,
Patent Owner.

IPR2023-01316
Patent 11,076,146 B1

Before HUBERT C. LORIN, FRANCES L. IPPOLITO, and
MICHELLE N. WORMMEESTER, *Administrative Patent Judges*.

LORIN, *Administrative Patent Judge*.

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

I. INTRODUCTION

A. Background

Medit Corporation (“Petitioner”) filed a Petition (Paper 1, “Pet.”) requesting *inter partes* review of claims 1, 3–6, 8–13, 15, 16, 21–27, and 29 of U.S. Patent No. 11,076,146 B1 (Ex. 1001, “the ’146 patent”). 3Shape A/S (“Patent Owner”) filed a Preliminary Response (Paper 5, “Prelim. Resp.”).

We have authority under 35 U.S.C. § 314, which provides that an *inter partes* review may not be instituted unless the information presented in the Petition and the Preliminary Response shows that “there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314(a) (2018).

After considering the Petition, the Preliminary Response, and the evidence of record, we deny Petitioner’s request to institute an *inter partes* review as to the challenged claims of the ’146 patent on the grounds of unpatentability presented.

B. Related Proceedings

Petitioner indicates, and Patent Owner agrees, that the ’146 patent is asserted in *3Shape A/S v. Carestream Dental, LLC*, 1:22-cv-01829 (N.D. Ga.) and *3Shape A/S v. Medit Corp.*, 6:22-cv-00443 (W.D. Tex.). Pet. 62; Paper 3, 1. The parties indicate that the Georgia district court litigation was transferred from the Western District of Texas and was previously styled as *3Shape A/S v. Carestream Dental LLC*, 6:21-cv-01110 (W.D. Tex.). *Id.*

The parties also make us aware that the ’146 patent was the subject of Office proceeding IPR2023-00387 (P.T.A.B.) (filed Dec. 20, 2022). Pet. 62, Paper 3, 1. A decision denying institution issued in the proceeding.

IPR2023–01316
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IPR2022-00387, Paper 8.

Patent Owner also identifies Office proceedings IPR2023-00411 (P.T.A.B.) (filed Dec. 23, 2022) and IPR2023-01317 (P.T.A.B.) (filed Aug. 18, 2023) involving related U.S. Patent No. 11,368,667 B2. Paper 3, 3. A decision denying institution issued in the IPR2022-00411 proceeding. IPR2023-00411, Paper 8. The IPR2023-01317 proceeding is pending.

Patent Owner also identifies Office proceedings IPR2021-01473 (P.T.A.B.) (filed Sept. 3, 2021) and IPR2023-01474 (P.T.A.B.) (filed Sept. 3, 2021) involving related U.S. Patent No. 10,097,815 B2. Paper 3, 3–4. Both proceedings were settled prior to a decision on institution. *See* Paper 11 in both proceedings.

Patent Owner also identifies Office proceedings IPR2020-01087 (P.T.A.B.) (filed June 18, 2020), IPR2020-01088 (P.T.A.B.) (filed June 18, 2020), and IPR2020-01089 (P.T.A.B.) (filed June 18, 2020) involving related U.S. Patent No. 10,349,042 B1. Paper 3, 4. A final written decision issued in the IPR2020-01087 proceeding. IPR2020-1087, Paper 38. Decisions denying institution issued in the IPR2020-01088 and IPR2020-01089 proceedings. *See* Paper 14 in both proceedings.

C. The '146 patent (Ex. 1001)

1. Disclosure

The '146 patent, titled “Focus Scanning Apparatus,” “relates to an apparatus and a method for optical 3D scanning of surfaces.” Ex. 1001, code (54), 1:24–25. For example, one “embodiment of the invention is particularly suited for intraoral scanning, i.e. direct scanning of teeth and surrounding soft-tissue in the oral cavity.” *Id.* at 1:27–30.

The '146 patent describes “providing a 3D surface registration of objects using light as a non-contact probing agent,” wherein “[t]he light is provided in the form of an illumination pattern to provide a light oscillation on the object.” Ex. 1001 at 3:8–11. “The variation/oscillation in the pattern may be spatial, e.g. a static checkerboard pattern, and/or it may be time varying, for example by moving a pattern across the object being scanned.” *Id.* at 3:11–14.

The '146 patent discloses that “[h]andheld embodiments of the invention preferably include motion sensors such as accelerometers and/or gyros.” Ex. 1001, 24:15–16. “Preferably, these motion sensors are small like microelectromechanical systems (MEMS) motion sensors” and “should preferably measure all motion in 3D, i.e., both translations and rotations for the three principal coordinate axes.” *Id.* at 24:17–21. Figure 8, reproduced below, depicts a color 3D scanner according to an embodiment of the '146 patent. *Id.* at 33:46–47.

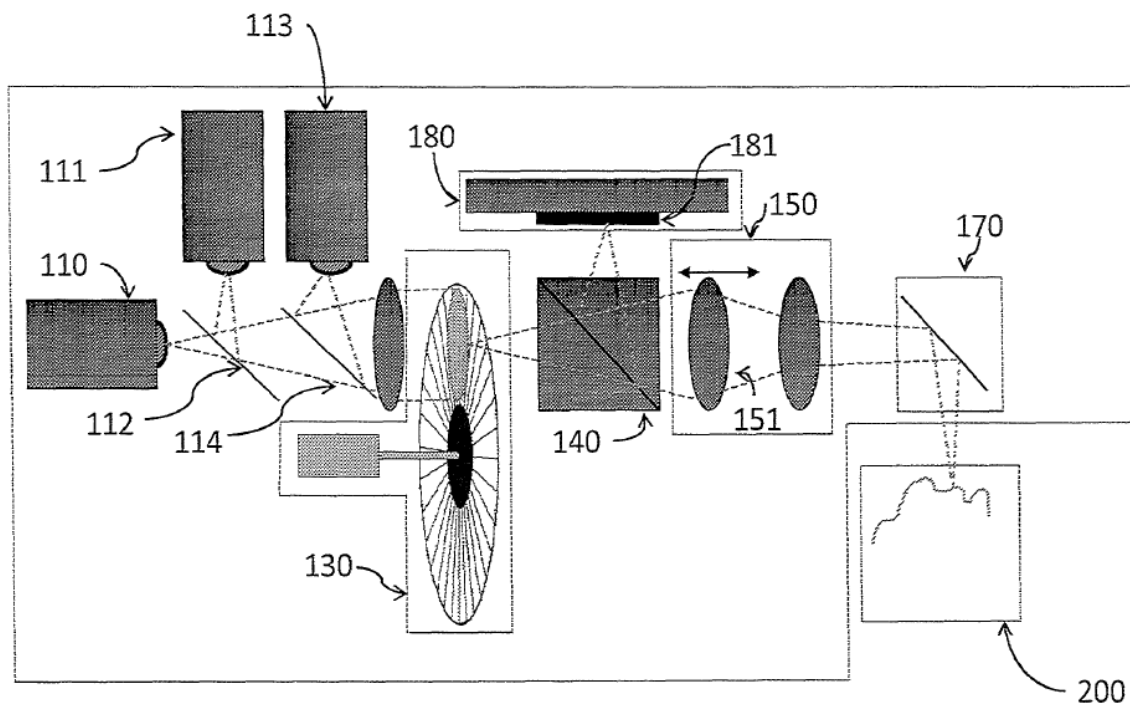


Fig. 8

Figure 8 of the '146 patent depicts a color 3D scanner for scanning an object 200. The scanner comprises three light sources 110, 111, and 113, two appropriately coated plates 112 and 114, pattern generation means 130, beam splitter 140, an optical system 150 including a focusing element 151, folding optics 170, and a camera 180 including an image sensor 181. Ex. 1001, 33:46-53; *Id.* at 27:20-32.

The '146 patent explains that “light sources 110, 111, and 113 emit red, green, and blue light” and the “light is merged together to overlap or essentially overlap.” Ex. 1001, 33:46-49. “This may be achieved by means of two appropriately coated plates 112 and 114.” *Id.* at 33:50-51. A color measurement is performed using sensor 181 to measure the amplitude of the time-varying pattern projected onto the probed object at a given focus position. *Id.* at 33:53-58. The '146 patent describes a preferred embodiment wherein “only one light source is switched on at the time, and the light sources are switched on after turn.” *Id.* at 33:59-60. “After determining the amplitude for each light source[,], the focus position is shifted to the next position and the process is repeated.” *Id.* at 33:62-64.

2. Claims 1, 3-6, 8-13, 15, 16, 21-27, and 29

Petitioner challenges claims 1, 3-6, 8-13, 15, 16, 21-27, and 29. Pet. 1. Claims 1 and 21 are independent claims. Claims 3-6, 8-13, 15, and 16, and 22-27, and 29 depend from claims 1 and 21, respectively.

Claim 1 is reproduced below with bracketing added to assist in referring to the claim elements.

1. [Claim 1 pre]¹ An intraoral scanner for determining the 3D geometry and color of at least a part of the surface of an object in an oral cavity, the intraoral scanner comprising:

[Claim 1a] at least one camera accommodating an array of sensor elements;

[Claim 1b] a pattern generator configured to generate, using a light source, a probe light with a plurality of configurations in the form of a time-varying illumination pattern;

[Claim 1c] an optical system for transmitting the probe light towards the object along an optical path thereby illuminating at least a part of the object with the time-varying illumination pattern, and [Claim 1d] for transmitting at least a part of the light returned from the object to the at least one camera to form a plurality of 2D images, [Claim 1e] wherein the 3D geometry is determined based on the plurality of 2D images and the time-varying illumination pattern;

[Claim 1f] a tip configured to be inserted into the oral cavity; and

[Claim 1g] a hardware processor configured to:

selectively switch a color of the probe light, thereby illuminating the object with different colors at different times;

[Claim 1h] record different images by the at least one camera at the different times, thereby recording images of the object with the different colors; and

[Claim 1i] combine the different colors from the different images, thereby obtaining the color of the surface of the object,

[Claim 1j] wherein the intraoral scanner is wireless, and [Claim 1k] wherein the at least one camera is a high-speed camera.

¹ Petitioner's designations to reference the elements of claim 1 are set forth in brackets. Pet. vii. Herein we refer to the elements of claim 1 using Petitioner's designations.

Ex. 1001, 37:24–52.

D. Asserted References and Testimonial Evidence

Petitioner relies on the following references:

Name	Reference	Ex. No.
Breton	U.S. Patent No. 6,008,905, issued Dec. 28, 1999	1003
Faul	U.S. Patent No. US 7,336,375 B1, issued Feb. 26, 2008	1004
Orametrix ²	WIPO Patent Publication No. WO 01/84479 A1, published Nov. 8, 2001	1005
Durbin	U.S. Patent No. 7,494,338 B2, issued Feb. 24, 2009	1008

Petitioner also relies on the Declaration of Rongguang Liang Ph.D. (Ex. 1012, “Liang Decl.”) and excerpts from the prosecution file for the ’146 patent (Ex. 1002) as support for the various contentions.

E. Asserted Grounds

Petitioner contends that claims 1, 3–6, 8–13, 15, 16, 21–27, and 29 of the ’146 patent are unpatentable under the following grounds:

² The application as published misspells the applicant’s name as Orametirix, Inc. *See* Ex. 1005, 1.

Claims Challenged	35 U.S.C. §	Reference(s)/Basis
1, 3–6, 8–13, 15, 21–27, 29	103(a) ³	Orametrix, Faul, Breton
16	103(a)	Orametrix, Faul, Breton, Durbin

Pet. 2–3.

II. ANALYSIS

A. Principles of Law for Patentability

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, “would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and, (4) when in evidence, objective evidence of nonobviousness.⁴ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

³ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284 (2011), amended 35 U.S.C. § 103, effective March 16, 2013. Because the application from which the ’146 patent issued claims the benefit of priority to an application that was filed before this date, and the parties do not dispute the priority claim, we apply the pre-AIA version of § 103. *See* Ex. 1001, code (60), (63), 1:6–20.

⁴ The record does not include evidence or argument regarding objective indicia of nonobviousness.

“In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)). This burden of persuasion does not shift to Patent Owner, except in limited circumstances not present here. *See Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review).

B. Level of Ordinary Skill in the Art

Petitioner asserts that a person of ordinary skill in the art “[a]s of June of 2009, the priority date of the ’146 patent,” “would have had a bachelor’s degree in computer engineering, computer science, electrical engineering, physics, or an equivalent field, as well as at least one or two years of design experience, or alternatively, at least five years of comparable industry experience.” Pet. 5 (citing Ex. 1002 ¶¶ 51–53). Petitioner also asserts that a person of ordinary skill in the art “would have had experience with and knowledge of, 3D imaging systems and 3D modeling techniques.” *Id.*

Patent Owner does not address Petitioner’s characterization of a person of ordinary skill in the art at this stage of the proceeding. *See generally* Prelim. Resp.

Based on the record before us, we adopt Petitioner’s undisputed proposal as reasonable and consistent with the prior art and apply that definition for our analysis in this Decision.

C. Claim Construction

We determine that this Decision does not require construing any claim terms. *See Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those 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))).

D. Overview of the Prior Art References

1. Orametrix (Ex. 1005)

Orametrix is titled “Method and System for Scanning a Surface and Generating a Three-Dimensional Object.” Ex. 1005, code (54). Orametrix relates “to creating three-dimensional models of objects.” *Id.* at 1:16–22. The “invention preferably allows measuring color and accounting for translucency and reflectivity of the tooth at which the color is measured,” using a spectrometer. *Id.* at 2:23–42.

Orametrix discloses a method that begins with projecting an image, including a pattern of individual shapes, on a surface. *Id.* at 14:2–4. The shapes, which include encoding information, are detectable “in a direction parallel to the plane formed by a projection axis of the projected shapes and a point associated with a view axis.” *Id.* at 14:4–9. The encoding information is used to register frames from a multi-frame scanning to each other. *Id.* at 14:16–18.

Figure 10, reproduced below, illustrates the Orametrix system.

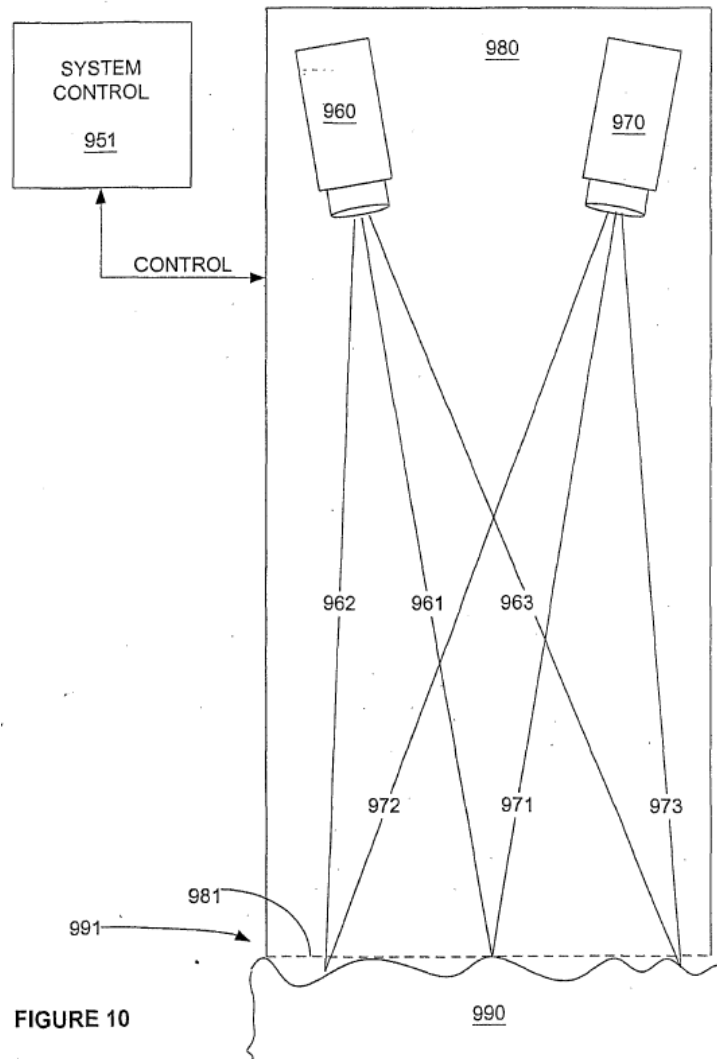


FIGURE 10

Figure 10 illustrates a system controller 951 that provides control signals to the scanning device 980, which projects an image bound by lines 962 and 963, and retrieves the images within the reflected lines 972 and 973. Ex. 1005, 15:15–18.

The image data received at the controller 951 is analyzed in order to determine the shape of the surface 991. *Id.* at 16:2–4. Orametrix describes an embodiment where “multiple 3D image frames are received by using a hand-held scanner to scan an object one frame at a time to obtain a plurality of frames, where each frame captures only a portion of the object.” *Id.* at 30:16–19. In this case, the “hand-held scanner that projects a pattern in successive frames having measuring features and encoding features. This

allows each viewed point of a frame to have a known corresponding projected point, thereby enabling the 2D frame 5 data to be converted into 3D frame data.” *Id.* at 31:1–5.

The system controller 951 shown in Figure 10 is illustrated in greater detail in Figure 11, reproduced below.

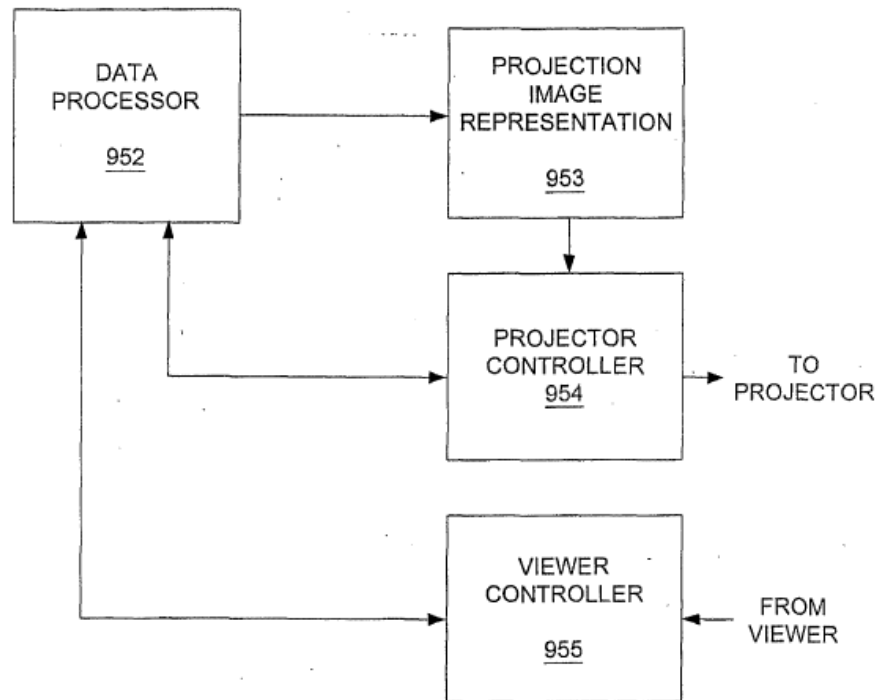


FIGURE 11

Figure 11 illustrates a system controller 951 that “includes data processor 952, a projection image representation 953, the projector controller 954, and a viewer controller 955.” Ex. 1005, 16:20–22.

2. *Faul (Ex. 1004)*

Faul is titled “Wireless Methods and Systems for Three-Dimensional Non-Contact Shape Sensing,” and “relates to methods and systems for wireless, non-contact mensuration of the surface shape of a three-dimensional object.” Ex. 1004, code (54), 1:12–14. Faul describes that

most prior-art scanners are “tethered at least by an electronic cable, if not by further mechanical linkage.” *Id.* at 2:36–38. Faul discloses methods and systems “which generate a virtual 3-dimensional model approximating the surface geometry of the object.” *Id.* at 2:45–47.

Faul’s system “uses a 3-dimensional (3D) object coordinate system in a fixed or otherwise known relationship to the object, and the system uses a non-contact scanner.” *Id.* at 2:63–66. Faul’s “non-contact scanner employs a source of a pattern of structured light, an electro-optical imager, an image processor, a wireless data transmitter, and a scanner position indicator.” *Id.* at 2:65–3:1.

The non-contact scanner projects the structured light pattern onto the object. The light reflected from the illuminated intersection of the light pattern with the object at a particular moment is imaged by the electro-optical imager. The image processor generates surface point data which characterize the locations of points on the intersection relative to the scanner position indicator.

Id. at 3:2–3:8. Faul’s “system also uses a scanner tracking subsystem which essentially continuously determines the 3D position (location and orientation) of the scanner position indicator, over time and with respect to the object.” *Id.* at 3:10–14.

The computing module correlates each received surface point datum temporally with the position of the scanner position indicator at the time the intersection containing the surface point was imaged, transforms the received surface point data according to the correlated scanner positions, and generates a set of 3D surface point coordinates which are relative to the object coordinate system. The set of surface points are used to model approximately the objects surface.

Id. at 3:16–24.

Figure 2, reproduced below, is a perspective illustration of a handheld wireless scanner and object being scanned.

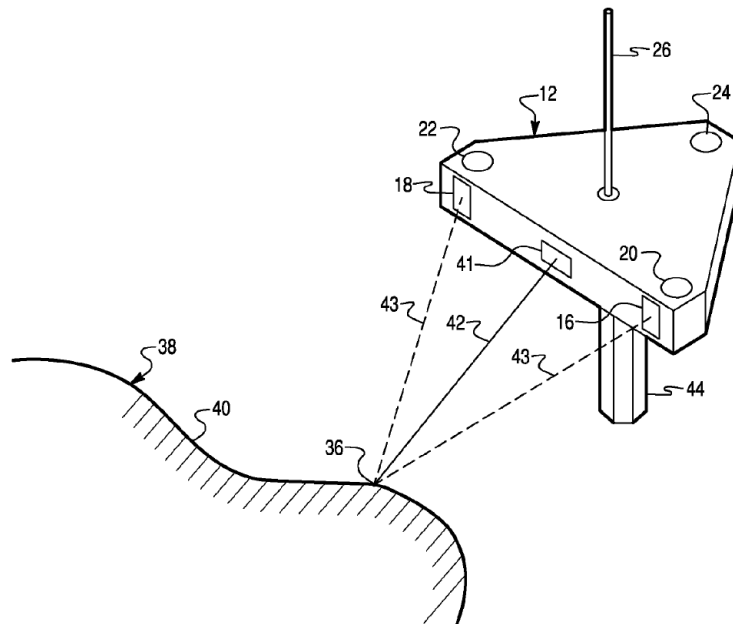


Figure 2 illustrates scanner 12, source 41 of pattern of structured light 42, object 38 with surface 40, and imaging sensors 16 and 18. *Id.* at 10:37–43.

3. Breton (*Ex. 1003*)

Breton relates to “determining the appearance of an object such as, for example, a tooth.” *Ex. 103*, 1:6–10. Breton describes that “while the shape information can be acquired with molding technique, the measurement of the color shade and translucency of the tooth proves to be more challenging.” *Id.* at 1:19–22. Using the human eye to determine tooth color is subjective, and affected by illumination of the tooth and the color shade charts with which the tooth is compared. *Id.* at 1:28–34.

Breton discloses a device, a diagram of which is reproduced below, for measuring the appearance of an object.

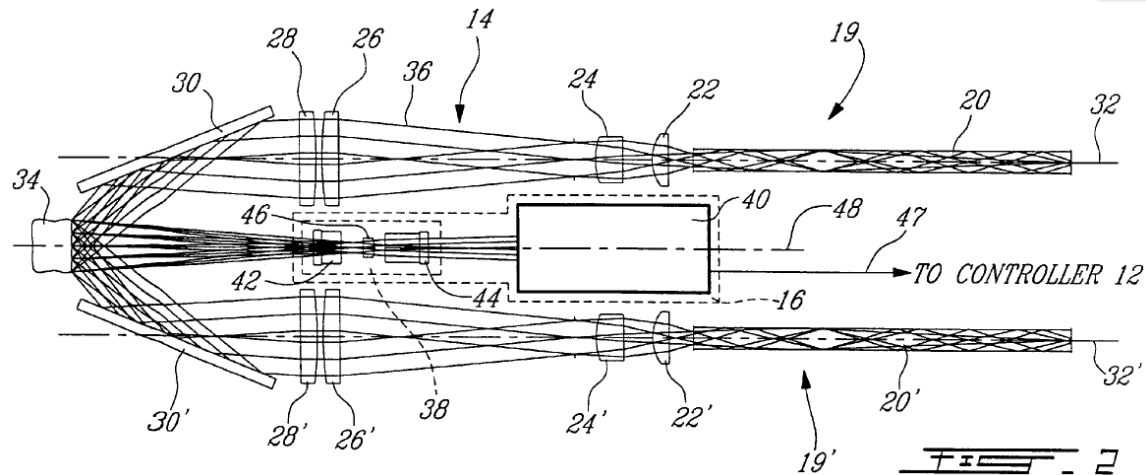


Figure 2, showing illumination paths 19 and 19', mirrors 30 and 30', and optical lenses 22, 22', 24, 24', 26, 26', 28, and 28'. *Id.* at 3:53–57. “The mirrors 30, 30' are angled and positioned as to reflect on the surfaces of a tooth 34 the light coming from the light sources and passing through the above mentioned elements forming the illumination paths 19 and 19'.” *Id.* at 4:10–14. The figure also includes CCD camera 16, camera lenses 42 and 44, and filter 46. *Id.* at 4:30–32.

One of the disclosed methods of obtaining an image includes “taking images of the tooth 34 using different wavelength illuminations.” *Id.* at 6:59–61.

4. Durbin (Ex. 1008)

Durbin describes an “intra-oral 3D imaging system,” shown in Figure 1 reproduced below Ex. 1008, ¶ 24.

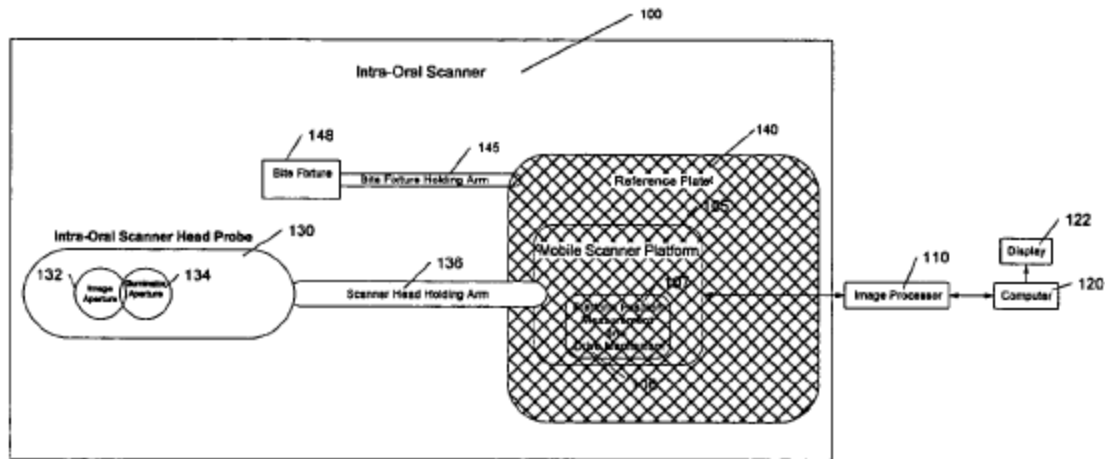


Figure 1

Figure 1 of Durbin shows “a system block diagram depicting instrumentation used in scanning teeth and other dental structure images in vivo and in generating 3D models.” Ex. 1008, 8:49–51.

Durbin’s 3D dental scanner comprises a scanner head probe (130) which includes an image aperture (132) and an illuminator aperture (134). Ex. 1008, 9:38–40, *see* Figure 1. “The image aperture 132 can capture images of the dental structures.” *Id.* at 9:41–42. “In one implementation, the output of the image aperture 132 is provided to a camera” *Id.* at 9:49–50.

E. Ground I

Petitioner challenges claims 1, 3–6, 8–13, 15, 21–27, and 29 as unpatentable under 35 U.S.C. § 103(a) over the combination of Orametrix, Faul, and Breton. Pet. 18–31.

a. Independent claim 1

For our purposes, the relevant issue is whether one of ordinary skill in the art at the time of the invention would have been motivated to combine Orametrix, Faul, and Breton to achieve “[a]n intraoral scanner for

determining the 3D geometry and color of at least a part of the surface of an object in an oral cavity, the intraoral scanner comprising” [Claim 1g] with a reasonable expectation of success.

[Claim 1g] recites: “a hardware processor configured to selectively switch a color of the probe light” - that is, “a probe light with a plurality of configurations in the form of a time-varying illumination pattern” ([Claim 1b]) – for illuminating an object “with different colors at different times.” Ex. 1001, 37:29–31, 41–44.

Petitioner contends that either Orametrix or Faul teaches a “a probe light with a plurality of configurations in the form of a time-varying illumination pattern” ([Claim 1b]). Pet. 19–20.

To show that Orametrix teaches [Claim 1b], Petitioner relies on, *inter alia*, Figures 10 and 11 (reproduced in § II.D.1.) and explains that Orametrix’s “[s]ystem controller 951 provides specific information to scanner 980 specifying a specific image to be projected onto surface 991 of object 990.” Pet. 19 (citing Ex. 1005, 15:19–21; Ex. 1012 ¶ 70); *see* Ex. 1005, Figure 11. Petitioner further explains that Orametrix teaches a scanning process whereby “different patterns can be projected over different periods of time” and “that changing the projected patterns with different encoding and measuring features over time allows for more information to be obtained about the surface.” *Id.* at 19–20 (citing Ex. 1005, 29:8–19, Figures 16, 19, 23; Ex. 1012 ¶ 70). According to Petitioner, a person of ordinary skill in the art “would have considered the digital image projection of Orametrix . . . to be ‘a probe light with a plurality of configurations in the form of a time-varying illumination pattern’ [[Claim 1b]],” as claimed. *Id.* at 20 (citing Ex. 1012 ¶ 72).

To show that Faul teaches [Claim 1b], Petitioner explains, *inter alia*, that Faul describes “projecting a time-varying pattern of structured light to determine the shape of an object.” Pet. 20 (citing, *inter alia*, Ex. 1004, 4:36–53; Ex. 1012 ¶ 71). According to Petitioner, a person of ordinary skill in the art “would have considered . . . Faul’s projected pattern of structured light to be ‘a probe light with a plurality of configurations in the form of a time-varying illumination pattern’ [[Claim 1b]],” as claimed. *Id.* (citing Ex. 1012 ¶ 72).

Patent Owner does not dispute Petitioner’s contention that either Orametrix’s digital image projection or Faul’s time-varying pattern of structured light satisfies [Claim 1b]. *See generally* Prelim. Resp. 11–38.

We turn now to the issue of whether one of ordinary skill in the art at the time of the invention would have been motivated to combine Orametrix, Faul, and Breton to achieve “a hardware processor configured to selectively switch a color of the probe light [i.e., either Orametrix’s digital image projection or Faul’s time-varying pattern of structured light], thereby illuminating the object with different colors at different times.”

Petitioner contends that “Orametrix and Faul, further in view of Breton, teach “a hardware processor configured to: selectively switch a color of the probe light, thereby illuminating the object with different colors at different times,” as recited [Claim 1g]. Pet. 28 (citing Ex. 1012 ¶ 92).

Patent Owner disagrees. Prelim. Resp. 15–23.

Scope and content of the prior art

[Claim 1g] contains two limitations, one structural – a “hardware processor” - and the other functional - “configured to: selectively switch a

color of the probe light, thereby illuminating the object with different colors at different times.”

There is no dispute that Orametrix and Faul teach hardware processors. Regarding Orametrix, *see* Pet. 26 (citing Ex. 1005, 16:19–22, 64:6–15, 69:15–70:10, Figure 46; Ex. 1012 ¶ 89); *see*, e.g., Ex. 1005, 16:20 (“The system controller 951 further includes data processor 952”) (referring to Figure 11, reproduced in reproduced in § II.D.1) and *id.* at 69:15–16 (“The steps and methods described herein may be executed on a processing module”). Regarding Faul, *see* Pet. 26 (citing Ex. 1004, 7:49–8:8 (“a microprocessor in scanner”)).

Petitioner does not address whether Breton teaches a “hardware processor” as claimed. *See* Pet. 12–13, 27.

We now evaluate the evidence to see if it sufficiently supports Petitioner’s contention that Orametrix and Faul, further in view of Breton, teach a processor “configured to: selectively switch a color of the probe light, thereby illuminating the object with different colors at different times” ([Claim 1g]). Pet. 28 (citing Ex. 1012 ¶ 92).

Orametrix

According to Petitioner, Orametrix teaches that its hardware processor may implement and execute “*measurement techniques*.” Pet. 26 (citing Ex. 1005, 16:19–22, 64:6–15, 69:15–70:10, Figure 46; Ex. 1012 ¶ 89) (emphasis added).

According to Petitioner, Orametrix’s hardware processor may also “change the color of projected *encoding* features, and is configured to introduce color information from photo data into the three-dimensional model.” Pet. 27 (citing Ex. 1012 ¶ 92) (emphasis added). Petitioner explains that “Orametrix describes changing the color of projected encoded

features used for registration in multiframe scanning.” *Id.* at 26 (Ex. 1005, 14:13–17, 25:11–26:5, Figure 16; Ex. 1012 ¶ 89); *see also id.* (“photo data containing color information can be added to the digital data of the 3D virtual model of the anatomical structure”) (citing Ex. 1005, 64:6–15; Ex. 1012 ¶ 89).

Thus, as Petitioner indicates, Orametrix teaches “changing the projected patterns [i.e., the probe light] with different *encoding* and *measuring* features over time.” Pet. 20 (discussing [Claim 1b]), (citing Ex. 1005, 29:8–19; Figures 16, 19, 23; Ex. 1012 ¶ 70) (emphasis added).

Patent Owner disputes that Orametrix teaches a processor configured as claimed; that is, “to: selectively switch a color of the probe light, *thereby illuminating* the object with different colors at different times” ([Claim 1g]). Prelim. Resp. 15–18.

First, Patent Owner explains that the evidence Petitioner cites in support of its contentions “discuss[es] processing data obtained from the viewer/camera, i.e., a process that occurs *after* the object has been illuminated.” Prelim. Resp. 16 (referring to Pet. 26 (citing Ex. 1005, 14:13–17, 54:8–13, 64:6–15, 69:15–70:10)) (*cf.* [Claim 1g] which requires “illuminating the object”) (emphasis added). Patent Owner provides an example:

The text at 16:19-22 [of Ex. 1005] states that “[t]he system controller 951 further includes data processor 952.” However, the following text at 17:1-19 indicates that “data processor 952” is provided “reflected image data [] received from the view 970 at the viewer controller 955.” Further, “the projection image is a digital image (electrically generated), [and] the representation can be stored in memory by data processor 952, thereby allowing the data processor 952 to modify the projection image representation.”

Id. (referring to Pet. 26 (citing, *inter alia*, Ex. 1005, 16:19–22)).

Second, although “Orametrix describes ‘encoding features’ and ‘measuring features’” “at best, ***it is the measuring features of Orametrix that relate to the illumination pattern of the probe light in the ’146 Patent.***” Prelim. Resp. 16–17 (citing, *inter alia*, Ex. 1005, 14:2–9). Patent Owner argues that, given that “color features are described as encoding features by Orametrix ([Ex. 1005], 25) and ***not*** as measuring features, Orametrix fails to disclose ‘switch[ing] a color of the probe light, thereby illuminating the object with different colors at different times’ ([Claim 1g]).” *Id.* at 18.

After reviewing the evidence on this record, we agree with Patent Owner that, although Orametrix teaches a hardware processor as Petitioner has shown (*see* Pet. 26), Orametrix does not teach a processor configured as claimed.

Orametrix describes projecting an image “having a plurality of individual shapes to *measure* and map the surface.” Ex. 1005, 14:3–4 (emphasis added); *see* Prelim. Resp. 17. This describes Orametrix’s probe light (i.e., the projected image) having a measurement feature. This measurement feature matches the characteristic and purpose of the probe light as it is claimed. *See e.g.*, [Claim 1b] (“a probe light with a plurality of configurations in the form of a time-varying illumination pattern”) and [Claim 1c] (*inter alia*, “at least a part of the light returned from the object to the at least one camera to form a plurality of 2D images, wherein the 3D geometry is determined based on the plurality of 2D images and the time-varying illumination pattern”). Thus, we agree with Patent Owner that Orametrix’s measuring feature relates to the illumination pattern of the probe light as claimed. *See* Prelim. Resp. 16–17.

As to Orametrix’s color features, the parties agree that they are encoding features, not measurement features. *See* Pet. 26 (“Orametrix describes changing the color of projected encoded features”; Prelim. Resp. 18 (“color features are described as encoding features by Orametrix ([Ex. 1005], 25”); see, e.g., Ex. 1005, 25:17–19 (“Note that some types of encoding features, including color features, can be implemented as an integral part of a measuring feature as well as an encoding feature separate from the measuring feature.”). *See* also Ex. 1005, 8–9 (Orametrix’s “encoding” feature “contain[s] encoding information for *identifying* the plurality of shapes individually”) (emphasis added).

In that regard, Petitioner does not sufficiently explain how switching Orametrix’s color features, *as encoding features*, illuminates the object with different colors at different times ([Claim 1g]). Petitioner states that “Orametrix describes changing the color of projected encoded features” Pet. 26. But Petitioner does not explain how that satisfies what [Claim 1g] calls for. Petitioner does not explain, for example, how changing the encoding features of Orametrix’s digital image projection (i.e., probe light (see discussion *supra* regarding [Claim 1b])) yields an object illuminated with different colors at different times. Even assuming, *arguendo*, that Orametrix’s color features, as encoding features, corresponds to the illuminating “color of the probe light” ([Claim 1g]), Petitioner does not adequately explain how Orametrix’s processor (e.g., data processor 952 (see Ex. 1005, 16:20, Figure 11 (reproduced in § II.D.1))) is configured to “selectively switch” the encoding features so that the object is illuminated with different colors at different times as [Claim 1g] requires. Petitioner relies on Dr. Liang’s testimony as support for its contention that Orametrix teaches a processor configured to “change the color of projected encoding

features” but the testimony simply repeats what is said in the Petition without any discussion of objective facts. *Compare* Pet. 27, with Ex. 1012 ¶ 92 (“the processor of Orametrix is already configured to change the color of projected encoding features, and is configured to introduce color information from photo data into the three-dimensional model”).

The cited evidence does not adequately show that Orametrix’s processor “selectively switch[es]” the color of Orametrix’s digital image projection to thereby illuminate an object with different colors at different times and thereby teach [Claim 1g].

We agree with Patent Owner that Orametrix does not teach a hardware processor “configured to: selectively switch a color of the probe light, thereby illuminating the object with different colors at different times” ([Claim 1g]). Prelim. Resp. 18.

Faul

Patent Owner argues that Faul does *not* teach a hardware processor “configured to: selectively switch a color of the probe light, thereby illuminating the object with different colors at different times” ([Claim 1g]). Prelim. Resp. 18–21. We agree.

The passage Petitioner cites in Faul as evidence that Faul discloses a microprocessor states: “[t]he scanner 12 may include memory accessible from a built-in microprocessor so that calibration data, identification, and other descriptive information characterizing the scanner 12 may be available.” Pet. 26; Ex. 1004, 7:64–67. We agree with Patent Owner that such a built-in microprocessor that can access stored information does not meet the processor as claimed; that is, one that is “configured to: selectively switch a color of the probe light, thereby illuminating the object with different colors at different times” ([Claim 1g]). Prelim. Resp. 18–19.

Patent Owner addresses other disclosures of “microprocessor” in Faul and correctly explains that “[n]one of [the disclosed] *storage and image processing* activities [for the microprocessor] amounts to ‘selectively switch[ing] a color of the probe light, thereby illuminating the object with different colors at different times.’” Prelim. Resp. 19 (quoting [Claim 1g]; addressing Ex. 1004, 2:67, 3:5–8, 4:64–66, 5:12–15, 5:41–43, 5:65–6:2, 6:38–42, 7:21–24, 7:51–63, 7:64–8:8, and 12:28–32). Patent Owner notes that “the Abstract of Faul vaguely references ‘a processor configured for projecting a pattern of structured light on the object,’ [but] no further details as to whether this processor is or can be ‘configured to selectively switch a color of the probe light, thereby illuminating the object with different colors at different times’ are provided.” *Id.* (quoting Ex. 1004, Abstract; [Claim 1g]).

Petitioner contends that Faul teaches “color *measurement* and suggests dynamically changing the color of the projected time-varying structured light.” Pet. 28 (citing Ex. 1012 ¶ 92) (emphasis added). Petitioner explains that Faul “describes measuring the color of the scanned surface.” *Id.* at 27 (citing Ex. 1004, 6:60–67; Ex. 1012 ¶ 90). Petitioner further explains that Faul “describes dynamically altering the color of the projected structured light.” *Id.* (citing Ex. 1004, 10:64–11:4; Ex. 1012 ¶ 90). But Petitioner does not adequately explain how that information would have led one of ordinary skill in the art to include a microprocessor configured to switch colors of the probe light (i.e., Faul’s time-varying pattern of structured light) as claimed.

Petitioner argues that a person of ordinary skill in the art “would understand that [Faul’s] microprocessor would be utilized to implement the measurement process, including light source and camera control, as well as

image processing.” Pet. 26–27 (citing Ex. 1012 ¶ 90). But Dr. Liang’s testimony relied on to support Petitioner’s argument simply repeats the argument without further elaboration. *Compare* Pet. 26–27, *with* Ex. 1012 ¶ 90 (“a person of ordinary skill in the art “would understand that this microprocessor would be utilized to implement the measurement process, including light source and camera control, as well as image processing”).

The evidence on this record does not adequately show that one of ordinary skill in the art would understand that Faul’s processor would be used to “selectively switch” the color of the projected time-varying structured light to thereby illuminate an object with different colors at different times as [Claim 1g] requires.

We agree with Patent Owner that Faul does not teach a hardware processor “configured to: selectively switch a color of the probe light, thereby illuminating the object with different colors at different times” ([Claim 1g]). Prelim. Resp. 21.

Breton

Petitioner explains that Breton “describes changing the wavelength of projected light from a controlled monochromatic light source over time to illuminate the scanned object with different colors at different times to measure the color of the surface of the scanned object.” Pet. 27 (citing Ex. 1003, 6:62–7:20, Figure 2; Ex. 1012 ¶ 91). According to Petitioner, “Breton describes that the wavelength of the light source needs to be stepped through a number of discrete spectral bands at a maximum bandwidth in order to achieve adequate spectral resolution for the spectral map that corresponds to the color of the tooth surface.” *Id.* (citing Ex. 1003, 6:62–7:20, Figure 2; Ex. 1012 ¶ 91). “Breton further discloses that the color of the teeth can be accurately measured using only three sampling bands in the red, blue, and

green portions of the wavelength spectrum, and that limiting the spectral bands can reduce computation time.” *Id.* (citing Ex. 1003, 8:24–36; Ex. 1012 ¶ 91).

Petitioner’s explanation shows that Breton describes changing the wavelength of projected light. But that does not address whether Breton teaches a “hardware processor,” let alone a processor that is configured as claimed ([Claim 1g]). We agree with Patent Owner that “Breton too suffers from the same deficiency [as Orametrix and Faul] because none of the citations to Breton discuss ‘a hardware processor configured to: selectively switch a color of the probe light, thereby illuminating the object with different colors at different times.’” Prelim. Resp. 21–22 (quoting [Claim 1g]; addressing Ex. 1003, 6:62–7:20, 8:24–36, Figure 2 (reproduced in § II.D.3.)).

For the reasons discussed, the factual support for the contention that “Orametrix and Faul, further in view of Breton, teach ‘a hardware processor configured to: selectively switch a color of the probe light, thereby illuminating the object with different colors at different times,’ as recited by [] claim element [Claim 1g]” (Pet. 28), is insufficient. We find that Petitioner insufficiently supports its contention that Orametrix, Faul and Breton teach [Claim 1g].

Reason to combine

In order to demonstrate obviousness, a petitioner must demonstrate that a skilled artisan would have had a reason to combine the teachings of the prior art in the manner claimed in the patent. *KSR*, 550 U.S. at 406 (2007). “To facilitate review, this analysis should be made explicit. *See In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) (‘[R]ejections on obviousness

grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness’).” *Id.* at 418.

According to Petitioner, a person of ordinary skill in the art “would understand that the processors described by Orametrix and Faul would be configured to implement the color changing scheme as taught by Breton in the structured light projection in order to obtain sufficient spectral resolution to achieve an accurate color measurement of the scanned object surface.” Pet. 28 (citing Ex. 1012 ¶ 92).

A principal difficulty with Petitioner’s position is that Petitioner does not sufficiently explain why one of ordinary skill in the art would have configured the Orametrix and Faul processors as claimed given that, unlike Orametrix and Faul, Breton is not drawn to transmitting a “probe light towards [an] object along an optical path thereby illuminating at least a part of the object with the time-varying illumination pattern” ([Claim 1b]) based on which, in part, a 3D geometry of at least a part of the surface of an object in an oral cavity is determined ([Claim 1 pre]). As Patent Owner points out, “[b]oth Orametrix and Faul disclose methodologies to process the obtained data and construct three-dimensional representations of the scanned object.” Prelim. Resp. 24 (citing Ex. 1005, 30:7–34:11, Ex. 1004, 13:28–16:6. We agree with Patent Owner that “Breton is silent on this aspect.” *Id.* Patent Owner quotes various passages from Breton to show that “[a]t best, Breton discusses two-dimensional mapping and measurement of tooth color for the purposes of ensuring the accurate color shade of replacement teeth.” *Id.* at 24 (quoting Ex. 1003, Abstract, 2:43–47, 2:60–64; also citing Title, 1:7–18, 2:50–52, Figure 3). We agree that the cited passages do not provide adequate support for determining a 3D geometry as Petitioner has shown for

Orametrix and Faul. For example, the passage at 2:43-47 discloses: “[a] general drawback of the prior art lies in that the notion of comparison between the measured tooth and a duplicate is limited to a single point to point comparison. Thus, area defects cannot be detected where no measurement has been taken.” *Id.* at 2:43-47. There is no mention or suggestion of determining a 3D geometry for a tooth.

Another difficulty with Petitioner’s position is that Petitioner does not sufficiently explain why one of ordinary skill in the art would have configured the Orametrix and Faul processors as claimed given that, unlike Orametrix and Faul, Breton is not drawn to “[a]n intraoral scanner for determining the 3D geometry and color of at least a part of the surface of an object in an oral cavity” ([Claim 1 pre]). We agree with Patent Owner that Breton “is silent on this aspect.” Prelim. Resp. 25 (citing Ex. 1003, Figure 16; Ex. 1004, Abstract). “At most, Breton employs the use [of] square glass integrator rods, integrating spheres, optic fibers, and custom made lenses.” *Id.* at 25–26 (citing Ex. 1003, 3:52–57, 11:35–38, 11:40-41, 11:47-49; referring to Figure 2 (“square glass integrator rods 20, 20”), Figure 4 (“integrating sphere 152”). “None of these light sources result in an ‘illumination pattern,’ much less a ‘time-varying illumination pattern.’” *Id.* at 26.

Petitioner does not address these differences between the Breton apparatus and those of Orametrix and Faul. Petitioner does not explain why a person of ordinary skill in the art would have been led to modify Orametrix or Faul in light of Breton given these differences.

Instead, to support its contention that a person of ordinary skill in the art “would understand that the processors described by Orametrix and Faul would be configured to implement the color changing scheme as taught by

Breton,” Petitioner relies on Dr. Liang’s testimony. Pet. 28 (citing Ex. 1012 ¶ 92). But the testimony simply repeats what the Petition says without any discussion addressing the differences between the Breton apparatus and those of Orametrix and Faul. *See* Ex. 1012 ¶ 92.

For the foregoing reasons, Petitioner provides insufficient reasoning with rational underpinnings in support of its contention that a person of ordinary skill in the art would have been motivated to modify Orametrix and Faul in view of Breton and thereby reach an intraoral scanner comprising [Claim 1g].

Reasonable expectation of success

Petitioner contends that a person of ordinary skill in the art “would have had a reasonable expectation of success in combining the features and teachings of Orametrix, Faul, and Breton, because these optical systems all rely on similar scanning arrangements, and the substitution and combinations of features would be simple and yield the expected results of more accurate and objective optical measurements to make three-dimensional models of real-world objects.” Pet. 16 (citing Ex. 1012 ¶ 65). To support said contention, Petitioner relies on Dr. Liang’s testimony. *Id.* But the testimony simply repeats what the Petition says. *Compare id.*, with Ex. 1012 ¶ 65.

We agree with Patent Owner’s identified deficiencies in the proposed combination of Orametrix, Faul, and Breton. *See*, for example, the discussion *supra* under “Scope and content of the prior art.” Petitioner does not explain sufficiently how one of ordinary skill in the art would incorporate Breton in Orametrix or Faul and reasonably expect to successfully arrive at the claimed subject matter. *See generally* Pet. 26–28.

We find that the evidence on this record weighs in favor of Patent Owner’s position that “the Petition fails to provide rational underpinnings for modifying either of Orametrix or Faul with Breton so as to provide a [person of ordinary skill in the art] with a reasonable expectation of success in combining the cited references to meet the limitations of the claimed invention,” i.e., [Claim 1g]. Prelim. Resp. 28.

For example, Petitioner does not explain how Breton is to be *incorporated* into the Orametrix or Faul apparatuses. *See generally* Pet. 26–28. As Patent Owner puts it,

the Petitioner does not explain which components of Breton’s monochromatic light source should be combined with the scanners of Orametrix or Faul. Which of the square glass integrator rods, integrating spheres, optic fibers, and/or the custom-made lenses of Breton is to be included in Petitioner’s combination?

Prelim. Resp. 27 (citing Ex. 1003, 2:42–45, 11:35–38, 11:40–41, 11:47–49, Figures 2, 4); *see also id.* (“neither Petitioner nor its expert describe how the monochromatic light source of Breton can be integrated into the scanners of Orametrix or Faul . . . Neither the Petitioner nor its expert discuss any of these engineering details”), 28 (“the Petitioner does not discuss substitution of any of the scanning elements of Orametrix or Faul with the scanning elements of Breton in any particularity”).

Neither Petitioner nor Dr. Liang explains how one of ordinary skill in the art would have been led or motivated to select the particular combination of functionalities from the numerous possible functional combinations that would result from combining Orametrix, Faul, and Breton and reasonably expect to successfully arrive at [Claim 1g]. The possible variety of combinations are numerous and not all would arrive at an intraoral scanner

for determining the 3D geometry and color of at least a part of the surface of an object comprising “a hardware processor configured to: selectively switch a color of the probe light for illuminating an object with different colors at different times” ([Claim 1g]). Petitioner’s position amounts to arguing that one of ordinary skill in the art could pick and choose from Orametrix, Faul, and Breton, and combine them into an intraoral scanner comprising [Claim 1g] as claimed with a reasonable expectation of success. But “to have a reasonable expectation of success, one must be motivated to do more than merely to vary all parameters or try each of numerous possible choices until one possibly arrived at a successful result.” *Pfizer, Inc. v. Apotex, Inc.*, 480 F.3d 1348, 1365 (Fed. Cir. 2007) (quoting *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006)).

Conclusion as to claim 1

After reviewing the record, we find Petitioner has not adequately explained with sufficient evidence that “Orametrix and Faul, further in view of Breton, teach ‘a hardware processor configured to: selectively switch a color of the probe light, thereby illuminating the object with different colors at different times,’ as recited by [] claim element [Claim 1g].” Pet. 28 (citing Ex. 1012 ¶ 92). We find Petitioner has not provided sufficient reasoning with rational underpinnings in support of its contention that a person of ordinary skill in the art would have been motivated to modify Orametrix and Faul in view of Breton and thereby reach an intraoral scanner comprising [Claim 1g] with a reasonable expectation of success.

On this record, for the above reasons, we are unpersuaded that the Petition establishes a reasonable likelihood that claim 1 is unpatentable over the combination of Orametrix, Faul, and Breton.

b. Independent claim 21

Independent claim 21 is a method claim that recites the same functional limitation set forth in [Claim 1g] but in terms of a step; that is, “selectively switching a color of the probe light, thereby illuminating the object with different colors at different.” *See* Ex. 1001, 39: 9–11 (claim 21).

Petitioner’s position is nearly identical to that taken with respect to [Claim 1g]. *See* Pet. 46–48 (discussing limitation [Claim 21e]). For example, Petitioner identically contends that “a [person of ordinary skill in the art] would understand that the processors described by Orametrix and Faul would be configured to implement the color changing scheme as taught by Breton in the structured light projection in order to obtain sufficient spectral resolution to achieve an accurate color measurement of the scanned object surface.” Pet. 48 (citing Ex. 1012 ¶ 158); cf. Pet. 28 (citing Ex. 1012 ¶ 92). Here, too, Dr. Liang’s testimony simply repeats what the Petition says. *See* Ex. 1012 ¶ 158, compare to Pet. 48.

For the same reasons, therefore, as set forth above for the corresponding limitation of independent claim 1, the Petition does not establish a reasonable likelihood that claim 21 is unpatentable over Orametrix, Faul, and Breton.

c. Dependent claims 3–6, 8–13, 15, 22–27, and 29

Claims 3–6, 8–13, and 15, and 22–27, and 29 depend from claims 1 and 21, respectively.

For the same reasons as set forth above, namely, that Petitioner provides insufficient reasoning with rational underpinnings in support of its contention that “a [person of ordinary skill in the art] would understand that the processors described by Orametrix and Faul would be configured to

implement the color changing scheme as taught by Breton in the structured light projection in order to obtain sufficient spectral resolution to achieve an accurate color measurement of the scanned object surface” and thereby arrive at the claimed inventions comprising [Claim 1g] and [Claim 21e] with a reasonable expectation, the Petition does not establish a reasonable likelihood that claims 3–6, 8–13, 15, 22–27, and 29 are unpatentable over Orametrix, Faul, and Breton. Pet. 48 (citing Ex. 1012 ¶ 158); cf. Pet. 28 (citing Ex. 1012 ¶ 92).

F. Ground II

Petitioner challenges claim 16 as unpatentable under 35 U.S.C. § 103(a) over the combination of Orametrix, Faul, Breton, and Durbin. Pet. 57–60.

Petitioner relies on its position with respect to claim 1 under Ground I in challenging the patentability of claim 1. Pet. 57 (“Orametrix in view of Faul and Breton teaches all the claim elements of claim 1.”).

For the same reasons as set forth in section II.E.1.a., the Petition does not establish a reasonable likelihood that claim 16 is unpatentable over Orametrix, Faul, Breton, and Durbin.

III. CONCLUSION

For the foregoing reasons, we determine that Petitioner has not demonstrated a reasonable likelihood that it would prevail with respect to at least one of the claims challenged in the Petition. We do not institute an

inter partes review on any of claims 1, 3–6, 8–13, 15, 16, 21–27, and 29 of the '146 patent on any ground.⁵

IV. ORDER

It is

ORDERED that the Petition is denied, and that we do not institute an *inter partes* review of any claim of claims 1, 3–6, 8–13, 15, 16, 21–27, and 29 of the '146 patent.

⁵ Because we deny the Petition on the merits, we do not reach Patent Owner's request that we exercise our discretion to deny the Petition under 35 U.S.C. § 314(a). *See* Prelim. Resp. 38–40.

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