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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

3SHAPE A/S and 3SHAPE INC.
Petitioners

v.

ALIGN TECHNOLOGY, INC.
Patent Owner

Case No. IPR2019-00157
Patent 8,363,228

PETITION FOR INTER PARTES REVIEW OF U.S. PATENT NO. 8,363,228 B2 UNDER 35 U.S.C. §§ 311-319 and 37 C.F.R. § 42.100 *et seq*.

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I. INTRODUCTION

3Shape A/S and 3Shape Inc. ("Petitioners") respectfully request *inter partes* review for Claims 1-7 and 26 of U.S. Patent No. 8,363,228 ("the '228 Patent") (Ex. 1001) in accordance with 35 U.S.C. §§ 311-319 and 37 C.F.R. § 42.100 *et seq*.

II. MANDATORY NOTICES PURSUANT TO 37 C.F.R. § 42.8(a)(1)

A. Real Party-In-Interest

Pursuant to 37 C.F.R. § 42.8(b)(1), Petitioners certify that 3Shape A/S, 3Shape Inc., 3Shape Holding A/S, 3Shape Trios A/S, and 3Shape Poland sp. z.o.o. are real parties-in-interest. Out of an abundance of caution, 3Shape Medical A/S, 3Shape Germany GmbH, 3Shape France SAS, 3Shape Italy SRL, 3Shape S.A.S., 3Shape (Shanghai) Co., Ltd., 3Shape Do Brasil Soluções Tecnologicas Para Saude Ltda, 3Shape Australia Pty Ltd., 3Shape Trios Sociedad Limitade, 3Shape Japan GK, 3Shape Ukraine Ltd., 3Shape (UK branch), SC Investment Company, LLC, FULLCONTOUR, LLC, Full Contour USA, FULLCONTOUR S.R.L., Full Contour Limitada, Full Contour Costa Rica Limitada, BOSQUES HUMEDOS DEL SUR S.A., FullContour Bosques, Full Contour Costa Rica Boscues, SHENZHEN FULLCONTOUR DESIGN COMPANY LTD., Full Contour China, DROPDENTAL LLC, 3Shape Medical Equipment Manufacture Shanghai Ltd., 3Shape Korea Ltd., 3Shape Manufacturing US LLC, Clausen Engineering APS, Tais Clausen, Deichmann Media APS, Nikolaj Hoffmann Deichmann, and the individuals listed in Appendix B are also identified as real parties-in-interest, for purposes of compliance with 35 U.S.C. § 312(a)(2).

B. Identification of Related Matters Under 37 C.F.R. § 42.8(b)(2)

The following is a list of any judicial or administrative matters that would affect, or be affected by, a decision in this proceeding:

Align Technology, Inc. v. 3Shape A/S, Civil Action No. 1:17-cv-01649 (D. Del.) (Complaint filed November 14, 2017) ("Delaware litigation");

In the Matter of Certain Intraoral Scanners and Related Hardware and Software, Inv. No. 337-TA-1091 (U.S. International Trade Commission) (Complaint filed November 14, 2017) ("ITC investigation");

3Shape A/S v. Align Technology, Inc., Petition for *Inter Partes* Review of U.S. Patent No. 8,363,228, IPR2019-00154 (to be filed);

3Shape A/S v. Align Technology, Inc., Petition for *Inter Partes* Review of U.S. Patent No. 8,451,456, IPR2019-00155 (to be filed);

3Shape A/S v. Align Technology, Inc., Petition for *Inter Partes* Review of U.S. Patent No. 8,363,456, IPR2019-00159 (to be filed);

3Shape A/S v. Align Technology, Inc., Petition for *Inter Partes* Review of U.S. Patent No. 8,675,207, IPR2019-00156 (to be filed);

3Shape A/S v. Align Technology, Inc., Petition for *Inter Partes* Review of U.S. Patent No. 8,675,207, IPR2019-00160 (to be filed);

3Shape A/S v. Align Technology, Inc., Petition for *Inter Partes* Review of U.S. Patent No. 9,101,433, IPR2019-00163 (to be filed);

U.S. Patent Application No. 15/175,267, filed on June 7, 2016 (pending);

U.S. Patent Application No. 14/755,171, filed on June 30, 2015, which issued as U.S. Patent No. 9,404,740 on August 2, 2016;

U.S. Patent Application No. 14/511,091, filed on October 9, 2014, which issued as U.S. Patent No. 9,101,433 on August 11, 2015;

U.S. Patent Application No. 14/150,505, filed on January 8, 2014, which issued as U.S. Patent No. 8,885,175 on November 11, 2014;

U.S. Patent Application No. 13/868,926, filed on April 23, 2013, which issued as U.S. Patent No. 8,675,207 on March 18, 2014;

U.S. Patent Application No. 13/620,159, filed on September 14, 2012, which issued as U.S. Patent No. 8,451,456 on May 28, 2013 ("the '456 Patent");

U.S. Patent Application No. 12/770,379, filed on April 29, 2010, which issued as U.S. Patent No. 8,102,538 on January 24, 2012 ("the '538 Patent");

U.S. Patent Application No. 12/379,343, filed on February 19, 2009, which issued as U.S. Patent No. 7,724,378 on May 25, 2010 ("the '378 Patent");

U.S. Patent Application No. 11/889,112, filed on August 9, 2007, which issued as U.S. Patent No. 7,511,829 on March 31, 2009 ("the '829 Patent");

U.S. Patent Application No. 11/154,520, filed on June 17, 2005, which issued as U.S. Patent No. 7,319,529 on January 15, 2008 ("the '529 Patent");

U.S. Provisional Application No. 60/580,109, filed on June 17, 2004; and

U.S. Provisional Application No. 60/580,108, filed on June 17, 2004.

C. Lead and Backup Counsel

Pursuant to 37 C.F.R. §§ 42.8(b)(3) and 42.10(a), Petitioners hereby identify its lead and backup counsel as follows:

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Powers of Attorney are being filed concurrently herewith in accordance with 37 C.F.R. § 42.10(b).

D. Service Information Under 37 C.F.R. § 42.8(b)(4)

Petitioners consent to e-mail service at the addresses listed above.

III. PAYMENT OF FEES

The undersigned authorizes the Office to charge Deposit Account No. 02-4800 for fees required by 37 C.F.R. § 42.15(a).

IV. REQUIREMENTS UNDER 37 C.F.R. § 42.104

A. Grounds for Standing

Pursuant to 37 C.F.R. § 42.104(a), Petitioners hereby certify that the ’228 Patent is available for *inter partes* review in accordance with 37 C.F.R. § 42.102(a)(2). Petitioners are not barred or estopped from requesting *inter partes* review challenging the claims of the ’228 Patent on the grounds identified herein.

This Petition is filed within one year from the date on which Petitioners were served a Complaint by Patent Owner in the Delaware litigation, which asserted infringement of the ’228 Patent.

Neither Petitioners nor its privies have received a final written decision under 35 U.S.C. § 318(a) regarding any claim of the ’228 Patent on any ground that was raised or could have been raised by Petitioners or its privies in any *inter partes* review, post grant review, or covered business method patent review.

B. Identification of Challenges and Precise Relief Requested

Pursuant to 37 C.F.R. § 42.104(b), Petitioners challenge Claims 1-7 and 26 of the ’228 Patent, and request that these claims be found unpatentable over the prior art for the reasons given below. Petitioners' Grounds for challenging the validity of Claims 1-7 and 26 are as follows:

Ground	References	Basis	Claims Challenged
1	PCT Publ. No. WO 00/08415 ("Babayoff") (Ex. 1003) in view of Japanese Patent Publication No. 2001-82935 ("Okamoto")[1] (Ex. 1004) and U.S. Patent No. 6,263,234 ("Engelhardt") (Ex. 1005)	35 U.S.C. § 103	1-5, 7, 26
2	Babayoff in view of Okamoto, Engelhardt, and U.S. Patent Application Publication No. 2004/0197727 ("Sachdeva") (Ex. 1006)	35 U.S.C. § 103	6

In addition to the above prior art, Petitioners rely upon evidence listed in the Exhibit List, including the Declaration and *Curriculum Vitae* of Sohail Dianat. (Exs. 1024 at 1025).

C. The Grounds Are Not Redundant

A related IPR Petition identified in the Mandatory Notices section asserts that Claims 1-26 are unpatentable under 35 U.S.C. § 103 over different prior art. The challenges presented herein are not redundant with those of the related Petition, at least because the challenges presented in the related Petition rely on alternative

[1]Ex. 1004 includes the original Japanese Patent Publication No. 2001-82935, and a certified English-language translation of the same.

additional documents (*e.g.*, Exs. 1034, 1035, 1037) for disclosing certain claimed features. Further, the challenges presented in the related Petition are based on the contention that Claims 1-26 of the ’228 patent are not entitled to an effective filing date of earlier than December 21, 2011, due to a lack of written description support for certain claim features prior to that date. Grounds 1-2 presented in this Petition are not based on that contention.

D. Prior Art Qualification of Asserted References

The ’228 Patent was filed on December 21, 2011 as U.S. Patent Application No. 13/333,351 (“the ’351 application”). For the reasons provided in the related Petition, Petitioners assert that the ’228 Patent is not entitled to an effective filing date of earlier than December 21, 2011. However, for the purposes of the present Petition, Petitioners assume the earliest effective filing date of the ’228 Patent is June 17, 2004—the filing date of priority U.S. Provisional Application Nos. 60/580,108 and 60/580,109 (Exs. 1018, 1019).[2] Even if the ’228 Patent is deemed entitled to its earliest priority date, all the references asserted herein are prior art. Babayoff published on February 17, 2000, and is prior art under 35 U.S.C. § 102(b). Okamoto published on March 30, 2001, and is prior art under 35 U.S.C.

[2] Petitioners do not concede herein that any challenged claim is entitled to an effective filing date of June 17, 2004.

§ 102(b). Engelhardt issued on July 17, 2001, and is prior art under 35 U.S.C. § 102(b). Sachdeva was filed on July 14, 2003 and published on October 7, 2004, and is prior art under 35 U.S.C. § 102(e).

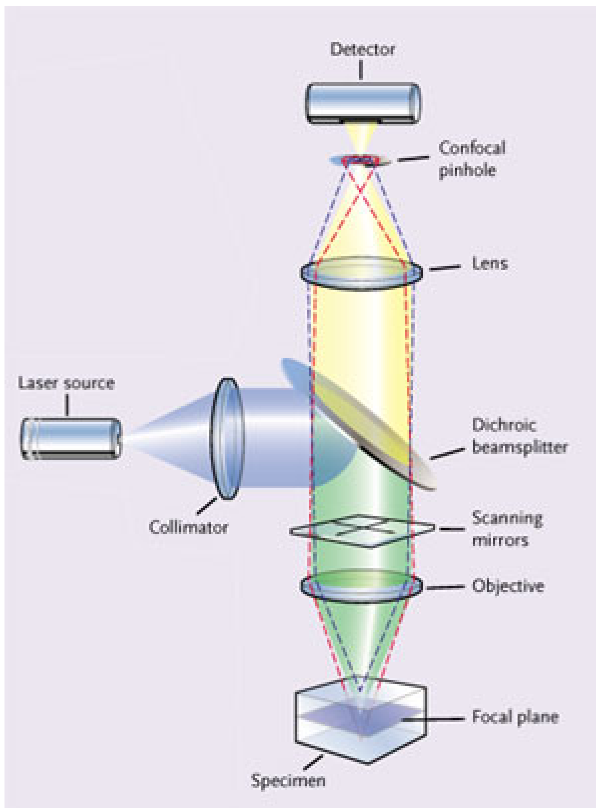
V. BACKGROUND

The purported invention of the ’228 Patent is a method for determining the surface topology of a sample (tooth) and its associated color (Ex. 1001 at Claim 1, 25:41-52) by providing an optical scanning system for determining such topology (*id*. at Claim 1, 25:44-47), coupled with a separate two-dimensional (“2D”) color scanning system (*id*. at Claim 1, 25:48-50), and a means for associating the color image data with the depth data provided by the scanning system (*id.* at Claim 1, 25:51:52; *see also id.* at 1:49-64). The optics for the scanning and imaging systems are described as being housed in a handheld device and coupled to a suitable processor. *Id*. at 24:48-51; Ex. 1024 at ¶28.

A. Optical scanning systems for determining surface topology were well-known prior to the ’228 Patent.

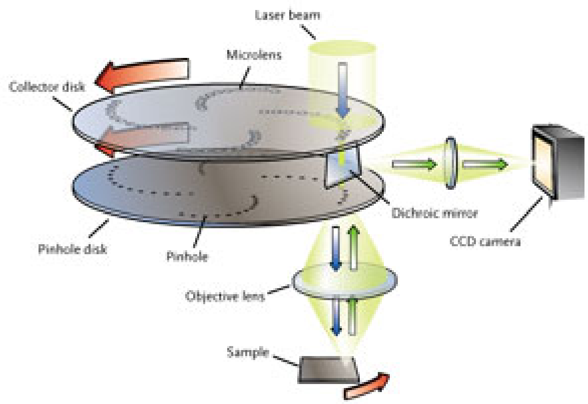
Techniques for determining surface topology using optical scanning systems were known before the priority date. Ex. 1003 at Abstract; Ex. 1001 at 1:28-48. One such prior art optical scanning system makes use of well-known confocal imaging techniques that allow for true depth discrimination. Ex. 1001 at 1:43-45; Ex. 1024 at ¶29.

Confocal imaging techniques date back to the late 1950s when such methods were used in microscopes to improve the resolution of objects within the field of view. Ex. 1009 at 1:34-40. The basic confocal imaging principle involves using a spatial filter (pinhole) to limit the collected light from the object to a single plane, corresponding to the adjusted point of focus of the system. *See* Ex. 1060 at 32, reproduced below; Ex. 1024 at ¶¶30-31.



However, a fixed single pinhole located on the optic axis will only collect light from one small spot on the object surface. *Id*. To image a larger surface, the entire plane has to be scanned. *Id*.

One approach to scanning the entire plane is to make use of a rotating disk with numerous holes (called a Nipkow disk) that effectively moves the position of the pinhole in the plane at the focal length of the lens. Ex. 1060 at 32, reproduced below; Ex. 1024 at ¶32.



Taking a number of images at different focus settings ("z-stack") allows a Confocal Scanning Optical Microscope (CSOM) to build up a 3D representation of a surface based on this determination of "depth by focus," or "spot-specific position," as it is described in the '228 Patent. *Id.* Microscopes using such CSOM principles have been sold commercially by vendors such as Biorad, Zeiss, Leica Nikon, and Olympus since at least the early 1990s. *See* Ex. 1062 at 355; Ex. 1024 at ¶33.

A second approach to scanning the entire plane is to obtain monochromatic images at different depths using multi-colored illumination. Ex. 1003 at 14. Using a lens with high chromatic aberration ensures that each scanned plane in the z-stack corresponds to a different wavelength of illuminated light, so the desired depth scan can be accomplished with a simple color filter or similar device. Ex. 1010; Ex. 1024 at ¶34.

Finally, the aspect of incorporating sophisticated optical systems, such as confocal scanners, into handheld or portable devices was also common practice before the priority date. Ex. 1003 at 4:15-17; Ex. 1063 at 32. For example, biomedical researchers in the 1990s were using *in vivo* confocal microscopy using a portable device with a movable scanning head. Ex. 1073 at 1:9-13; Ex. 1024 at ¶35.

Thus, the system features for the optical scanning system described in the ’228 Patent had already been developed well before the priority date. Ex. 1011 at 4:5-8, 4:18-27, 4:40-5:33, and 9:50-52; Ex. 1012 at ¶¶[0006]-[0007]; Ex. 1024 at ¶36.

B. Associating color image data with depth data was well-known prior to the ’228 Patent.

Visualizing a 3D surface using accurate color mapping is now quite commonplace, but was also the subject of intense investigation in the early to mid-1990s. Exs. 1013 and 1014. Manufacturers had offered camera attachments for microscope eyepieces before the priority date. Ex. 1062 at 438 and 440; Ex. 1064 at 994; *see also* Ex. 1065 at 274, 277; Ex. 1066 at Abstract; and Ex. 1067 at Abstract. Thus, the operation of taking a color image photograph and confocal depth scan at the same location of an object was well-established in the prior art. That is, associating color image data with depth data as described in the ’228 Patent had already been developed well before the priority date. Ex. 1024 at ¶37.

C. Summary of Examination History of the ’228 Patent

The ’228 Patent issued from Application No. 13/333,351 (the ’351 application) filed on December 21, 2011. A Preliminary Amendment was filed with the application, cancelling claims 2-42. Ex. 1002 at 195-199. A non-final Office Action issued on March 19, 2012, rejecting claim 1 as being not patentably distinct over claim 1 of U.S. Patent No. 7,319,529. *Id.* at 131-180. Claim 1 was also rejected as being anticipated by U.S. Patent No. 7,098,435 (“Mueller”) (Ex. 1054) *Id.*

An Amendment was filed on July 19, 2012 that included changes to claim 1, and the addition of new claims 43-67. *Id.* at 104-118. Patent Owner argued Mueller failed “to teach each and every element of claim 1” including “a scanning system configured to provide depth data, an imaging system configured to provide two dimensional color image data, and a processor configured to associate the depth data with the color image data.” *Id.*

A Notice of Allowance issued on August 31, 2012. An Amendment After Allowance was submitted on November 30, 2012. The ’228 Patent issued on January 29, 2013. *Id.* at 5-101.

The ’351 application claims priority through a chain of continuation applications to U.S. Application No. 11/889,112 (“the ’112 application”) , now U.S. Patent No. 7,511,829 (Ex. 1022).

During prosecution of the ’112 application, Patent Owner distinguished the claims from Mueller by arguing that Mueller teaches away from a processing means for associating color data with depth data:

> Mueller does not disclose, teach or suggest a “processing means for associating said color data with said depth data for corresponding data points of said reference array” as recited in claim 1… Mueller … actually teaches against it. See, for example (*emphasis added*):
>
> col. 2, lines 17-22:
>
> > What is needed is a way of generating a set of three dimensional points representing a surface in such way that the three dimensional points are already associated with color data so that **conformally mapping separately generated color data onto the set of three dimensional surface points is not necessary**….
>
> col. 8, lines 54-57:
>
> > The system does **NOT** identify the surface of the object independent of color image information and then match the surface points to color information….

Ex. 1023 at 109-110 (response filed Jul. 11, 2008 at 14-15, citing Ex. 1054 at 2:17-22, 3:40-44, 17:30-33, 8:54-57 (emphasis in original). Unlike the rejection based on Mueller—typical of the ’228 Patent family—the obviousness rationales presented in this Petition rely on Okamoto which explicitly discloses associating color image data with depth data. Such obviousness rationales were not before the Examiner during prosecution of the ’228 family.

D. Person of Ordinary Skill in the Art ("POSITA")

A POSITA is presumed to be aware of all pertinent art, thinks along conventional wisdom in the art, and is a person of ordinary creativity. Regarding the '228 Patent, a POSITA would have at least (1) a bachelor's degree in electrical engineering, optical engineering, or physics (or equivalent course work) and three to four years of work experience in the areas of optical imaging systems and image processing or (2) a master's degree in electrical engineering or physics (or equivalent course work) with a focus in the area of optical imaging systems and image processing. Ex. 1024 at ¶27.

E. Overview of the Prior Art

1. PCT Publ. No. WO 00/08415 ("Babayoff")

Babayoff describes a method and apparatus for noncontact imaging of 3D structures (*e.g.,* teeth) by "confocal focusing an array of light beams." Ex. 1003 at 54, Title. This confocal imaging technique allows for the scanning apparatus in Babayoff to determine the surface topology of the scanned 3D structure. *Id.* at Abstract, 3; Ex. 1024 at ¶40.

The surface topology of the scanned 3D structure is determined by illuminating the surface with an array of incident light beams. Ex. 1003 at 3:3-4:14. Babayoff teaches that this array of incident light beams is formed by a laser beam that is passed through a grating or a micro lens array to split the laser beam into a plurality of incident light beams. *Id.* at 8:26-9:2. The light beams are then passed through "telecentric main confocal optics." *Id.* at 9:18-24, component 42 in Fig. 4A. The telecentric optics are connected to a motor, which changes the relative position of the distal part of the telecentric optics along the Z-axis. *Id.* at 11:10-13. In other words, the plane at which the light beams are focused can be scanned along the Z-direction. *Id.* at 9:18-24; Ex. 1024 at ¶41.

When the array of incident light beams impinge on the surface of the 3D structure being scanned, a corresponding array of illumination spots are formed on the surface of the scanned object. Ex. 1003 at 9:18-24. Each of the illumination spots has a spatially separate X-Y position. *Id.* at 5:1-21. The illumination of the 3D structure with the incident light beams is illustrated in annotated Fig. 1A of Babayoff, elements 48 and 52 (circled in red), provided below:

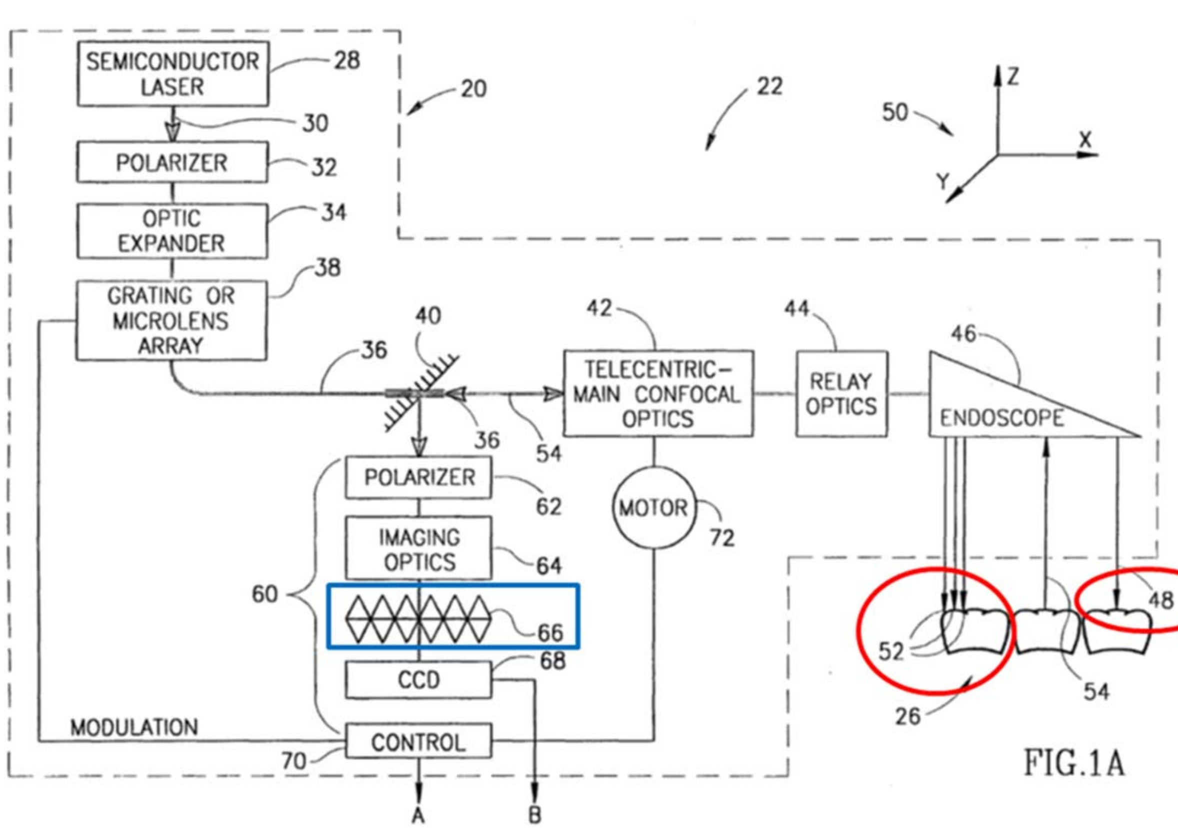


FIG.1A

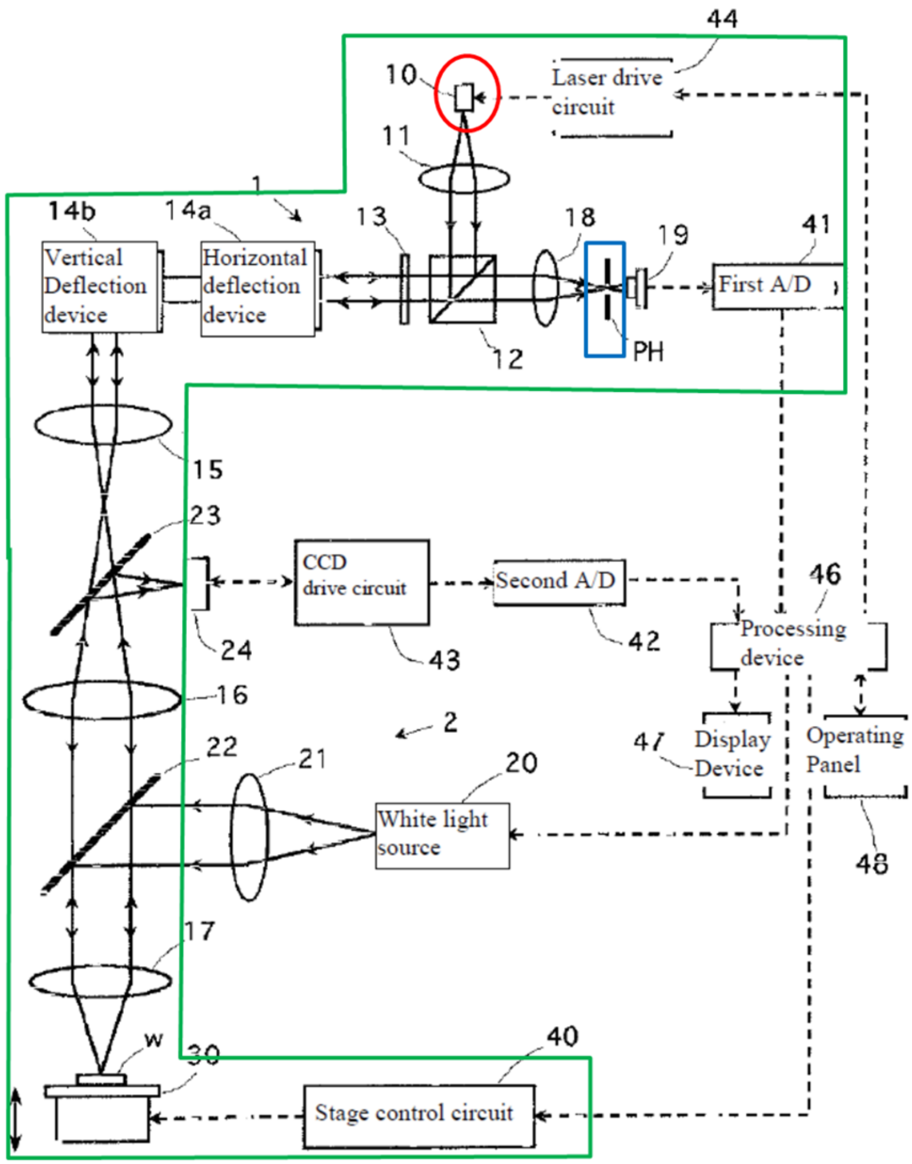
The illumination spots will be in-focus if the surface of the 3D structure is coincident with the focal plane, otherwise they will be out-of-focus. *Id.* Whether the illumination spot is in-focus or not is determined by measuring the intensity of the light returned from each illumination spot as the focal plane is shifted along the Z-direction, with the maximum light intensity corresponding to the in-focus position. *Id.* at 4:18-29. This is referred to in Babayoff as the "spot-specific position" (SSP). *Id*; Ex. 1024 at ¶¶42-43.

The intensity of each returned light beam is measured by passing each returned light beam through a corresponding pinhole in pinhole array 66 (annotated in Fig. 1 above in blue box). Ex. 1003 at 10:29-11:5. The pinhole acts as a spatial filter to exclude the out-of-focus light from the CCD image sensor, thereby allowing the pixels in the image sensor to measure the differences in intensity of the return light beam as the focal plane is moved along the Z-direction. *Id.* This is a well-known, conventional implementation of confocal optics. Ex. 1024 at ¶44.

The surface topology of the scanned 3D structure can be obtained from the maximum measured intensities. Ex. 1003 at 5:1-6. This is possible because "[t]he SSP for each illuminated spot will be different for different spots"–meaning that the in-focus position of each illuminated spot is independent from the other spots. *Id.* This is also a part of conventional confocal scanning systems. Ex. 1024 at ¶45.

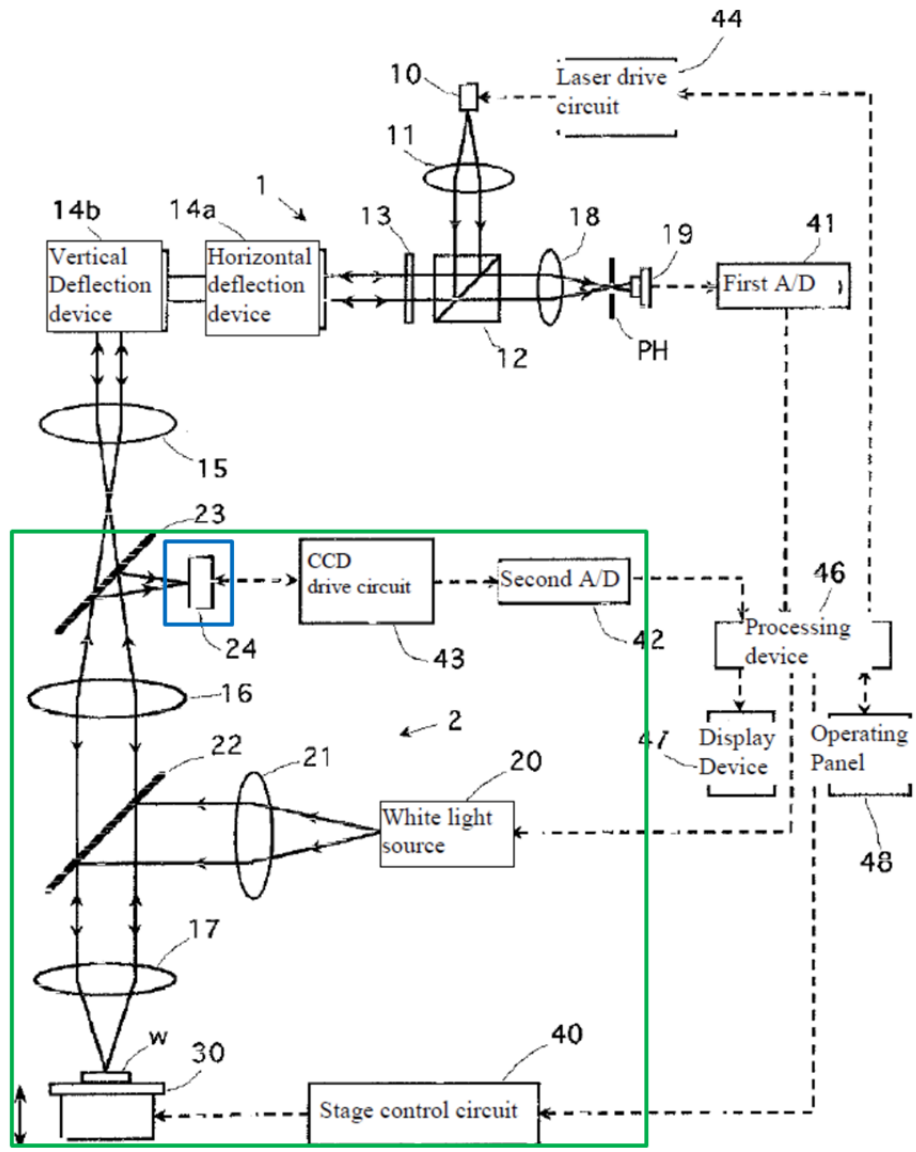
2. Japanese Patent Application No. 2001-082935 ("Okamoto")

Okamoto describes a 3D measurement device that also obtains color information. Okamoto describes that the 3D measurement is obtained using a confocal optical system. Ex. 1004 at ¶¶[0012], [0015]-[0025]. Okamoto's confocal optical system is illustrated in the following annotated figure (green box):



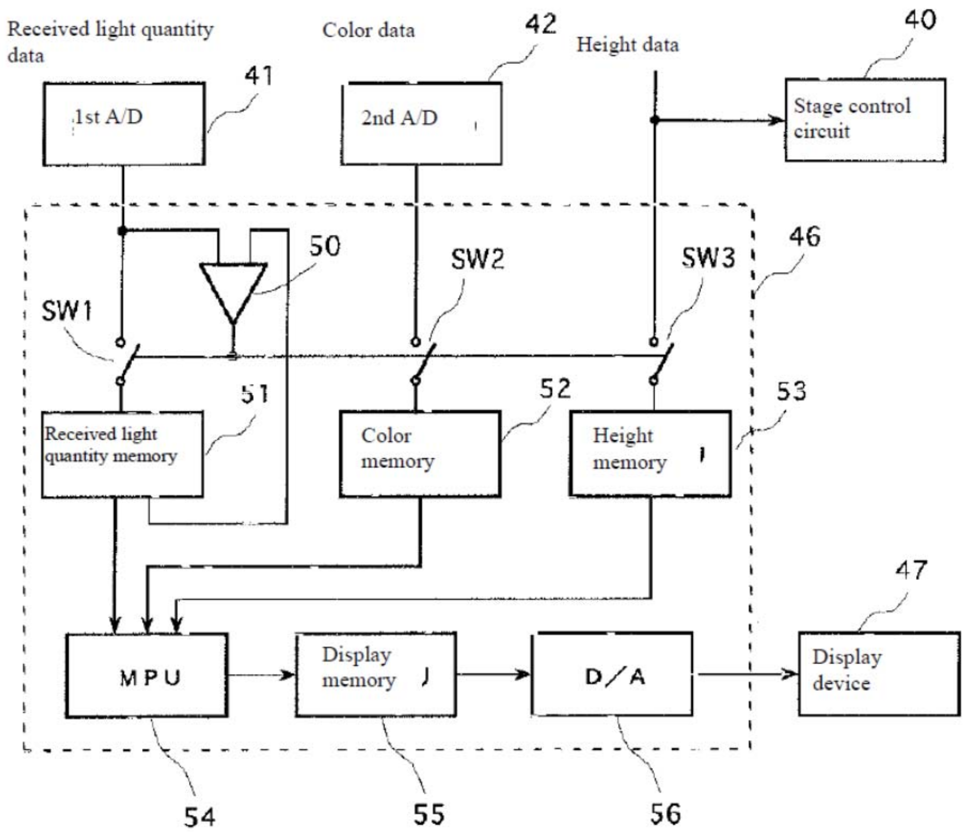
The confocal optical system includes a semiconductor light source, which emits a red laser beam (red circle). *Id*. at ¶¶[0016]-[0017]. The laser beam can be biased in the horizontal and vertical direction to different X, Y positions. *Id*. at ¶[0018]. The focal point of the laser can be adjusted by driving the objective lens of the confocal optical system in the Z-direction. *Id*. at ¶[0019]. When the laser beam impinges on the surface of the target, the laser beam is reflected back through the confocal optical system and through a pinhole (blue box) onto a photodiode to convert the returned laser beam into an electrical signal. *Id.* at ¶[0022]. The pinhole acts to block out a significant part of the returned laser beam when out-of-focus, while letting through almost all of the laser beam when in-focus. *Id*. The height position is determined at the point where the measured intensity of the returned laser light beam is at a maximum. *Id*. at ¶[0023]; Ex. 1024 at ¶46.

Okamoto also describes a color imaging system, which is based on a non-confocal optical system. Ex. 1004 at ¶[0028]. Elements of Okamoto's color imaging system are illustrated in the following annotated figure (green box):



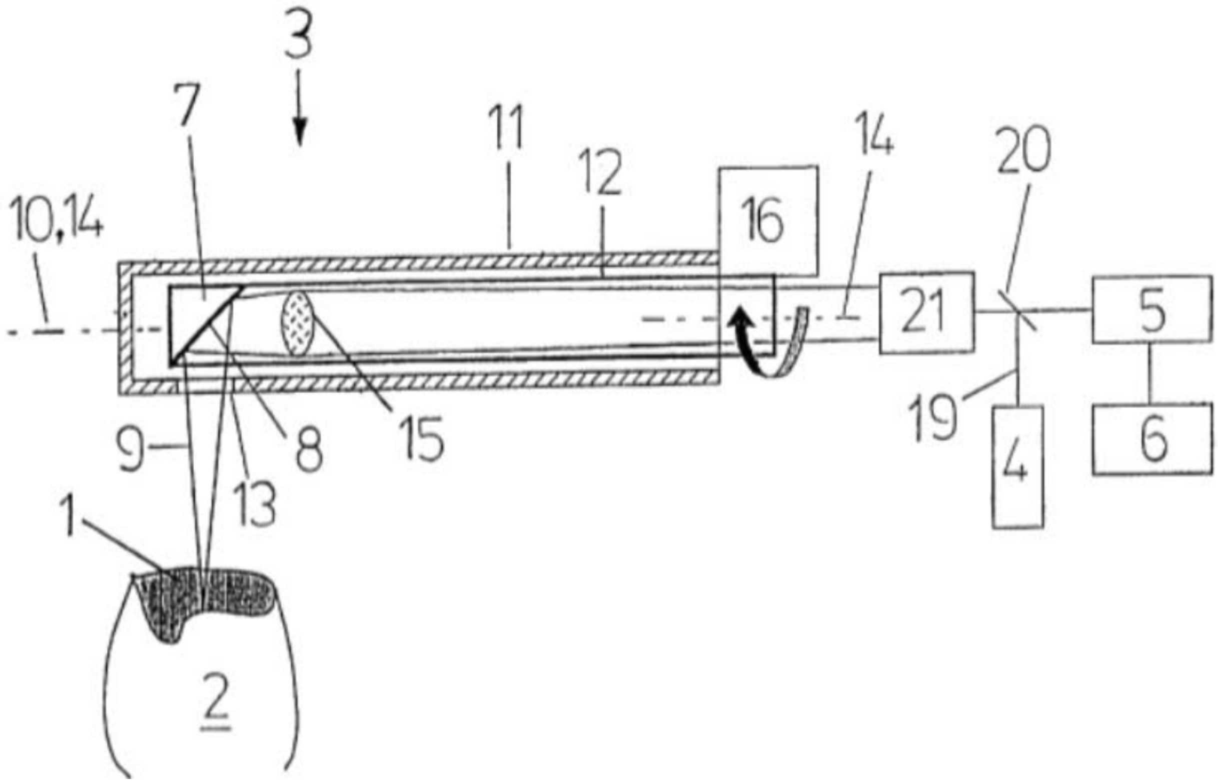
The color imaging system includes a white light source that illuminates the target with a white light. A color CCD is used to capture the color information (blue box, above). *Id.* Fig. 4 depicts additional elements of the color imaging system. Okamoto further explains that "light receiving elements for each color R, G, and B may be used instead of a color CCD," indicating that instead of a color CCD, a monochromatic CCD can be used to receive red, green, and blue light instead. *Id.*

Okamoto describes that the height information obtained from the confocal system is then associated with the color image from the (non-confocal) optical system. *Id.* at ¶[0031]. This is accomplished by correlating the height at each position in the X-Y plane with the corresponding color image data. *Id.* at ¶¶[0031]-[0037]. The association of the color image data with the height data is performed by processing device 46, as illustrated in Fig. 4 of Okamoto. Ex. 1024 at ¶47.



3. U.S. Patent No. 6,263,234 (“Engelhardt”)

Engelhardt describes a confocal surface-measuring device for body cavities. Ex. 1005 at 2:20-25. Engelhardt’s device includes a probe that is small enough to be introduced into a patient's oral cavity. *Id.* One embodiment of the confocal device is shown in Fig. 1. Ex. 1024 at ¶48.



The probe 3 includes a light source 4 that is used to illuminate the tooth 2 with an illuminating beam 9 and a detector 5, which is used to detect the light reflected back from the tooth and through the probe. Ex. 1005 at 6:45-62. The light source used to produce the illuminating beam 9 is a laser light source. *Id.* at 5:44-45. The probe 3 also includes a rotor 12, which includes an optical system 15 to focus the illuminating beam 9. *Id.* at 7:1-9. The optical system 15 can be linearly advanced within the housing 11 by rotating rotor 12. *Id.* at 7:1-15. By linearly advancing the optical system 15, the illuminating beam can focus the illuminating beam 9 to different focal planes. *Id.* at 5:4-9; 6:50-62; *see also id.* at Figs. 4, 5, reproduced below (illustrating different focal planes). Ex. 1024 at ¶49.

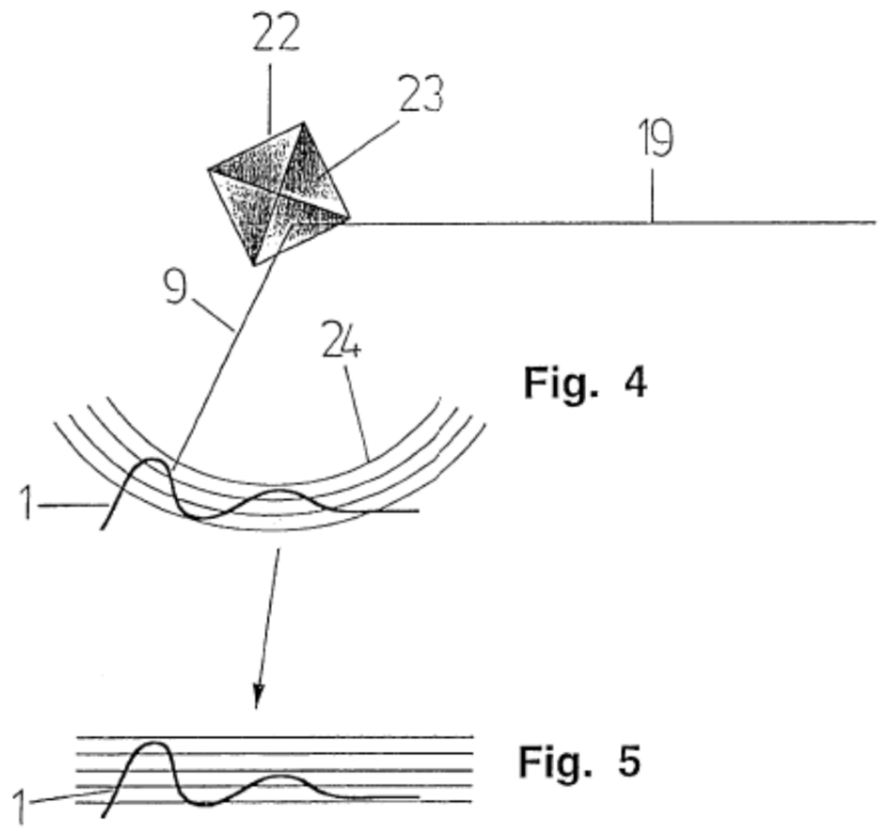


Fig. 4

Fig. 5

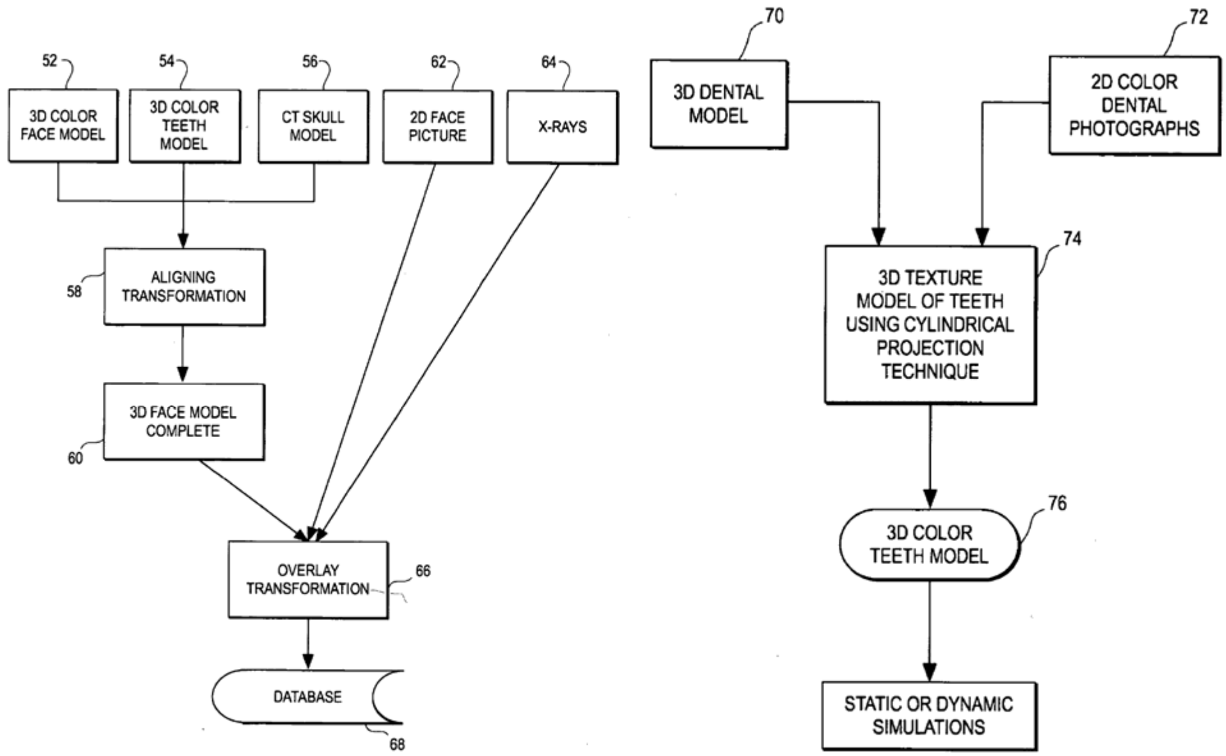
Engelhardt explains that one way to create a compact system is to integrate functional units into the housing including, the processor. Ex. 1005 at 5:64-6:7. By incorporating these units into the housing, "a compact system needing only connection to the proper power supply" is possible. *Id.* Engelhardt describes using a laser or a polyfocal light source to provide the light source for the compact confocal system. *Id.,* 7:28-38; Ex. 1024 at ¶50.

4. U.S. Patent Application Publication No. 2004/0197727 ("Sachdeva")

Sachdeva published with the exact same claims as were originally filed on July 14, 2003. *See, e.g.,* Ex. 1006 at 27-33; Ex. 1015 at 699-719. In fact, other than correcting minor typographical errors in the figure legends through a Preliminary Amendment dated December 1, 2003, the published specification of Sachdeva is exactly the same as that originally filed on July 14, 2003. Ex. 1015 at 604-698. As such, Sachdeva qualifies as prior art under 35 U.S.C. § 102(e) as of July 14, 2003.

Sachdeva discloses a "hand-held scanner" that obtains "intra-oral 3D scan data." Ex. 1006 at ¶[0053]. The hand-held scanner includes a camera that obtains color image data "separate and apart from the acquisition of 3D image data." *Id.* at ¶[0080], Fig. 4. Sachdeva discloses that "each surface is assigned a value associated with a particular color" and "[t]he result is a 3D color model of the teeth." *Id.* at ¶[0081], Fig. 4; Ex. 1024 at ¶52.

Sachdeva discloses that the depth data ("3D image data") and the color image data are associated ("associated with a particular color") by using an alignment procedure ("alignment transformation process 58") comprising an optical character recognition technique ("X, Y and Z translations and rotations to place the data sets into a common coordinate system such that common anatomical structures overlap each other"). Ex. 1006 at ¶¶[0081], [0079], Figs. 3, 4, reproduced below; Ex. 1024 at ¶53.



VI. HOW THE CHALLENGED CLAIMS ARE TO BE CONSTRUED

Claim terms are interpreted according to their broadest reasonable interpretation (BRI) in light of the specification. 37 C.F.R. § 42.100(b); *Cuozzo Speed Techs., LLC v. Lee*, No. 136 S.Ct. 2131, 2142 (2016). Some of the claim terms of the '228 Patent were disputed in the ITC investigation. Ex. 1051 at 1-4. Any claim terms not addressed below should be interpreted according to their plain and ordinary meaning.

A. "a scanning system configured to provide depth data" (Claims 1-7, 26)

In the ITC investigation, Patent Owner construed this phrase to mean "a 3D scanner that scans in the optical axis (z) direction to provide depth data." Ex. 1051 at 1. However, Petitioners argued in the ITC investigation that the phrase invokes § 112, ¶6. Petitioners believe this is the correct construction. This claimed phrase does not recite the term "means" but nonetheless invokes 35 U.S.C. § 112, ¶6, because the phrase "fails to recite sufficiently definite structure and recites function without reciting structure for performing that function." *Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1349 (Fed. Cir. 2015) (internal citations omitted).

Under a § 112, ¶6 interpretation, the phrase should be construed as requiring a structure of an "illumination source optically coupled to a grating or microlens array and confocal optics to generate an array of light beams that generates illumination spots on the surface of an object, an image sensor optically coupled to receive each of the returned light beams through a pinhole array and a corresponding single pixel in an image sensor, and a processor programmed to measure the maximum intensity of the returned light beams" and a function of "providing depth data separately obtained from two-dimensional color image data." *See* Ex. 1038 at 8-14; Ex. 1048 at 8; Ex. 1051 at 1. Petitioners advocated for this construction in the ITC investigation. *Id.*

In compliance with 37 C.F.R. § 42.104(b)(3), the corresponding structure in the specification of the ’228 Patent is as described at 12:60-13:1, 13:42-45, 13:57-62, 15:63-65, 16:19-27, 24:15-18, Figs. 1 (elements 31, 41, and 60) and 4A (elements 31, 41, and 60) of the ’228 Patent (Ex. 1001). *See also* Ex. 1038 at 8-14; Ex. 1049 at 2-4; Ex. 1051 at 1; Ex. 1024 at ¶¶56-59.

Patent Owner offered a § 112, ¶6 construction for this phrase in the ITC investigation. *See* Ex. 1048 at 20-22; Ex. 1050 at 7-10; Ex. 1051 at 1. The challenged claims would have been obvious over the asserted prior art under all of these constructions, each of which is addressed below.

B. “imaging system configured to provide color image data” (Claims 1-7, 26)

In the ITC investigation, Patent Owner construed this phrase to mean “an image sensor or detector that is configured to provide two-dimensional color image data.” Ex. 1051 at 2. Petitioners argued in the ITC investigation that the phrase invokes § 112, ¶6. Petitioners believe this is the correct construction because the phrase “fails to recite sufficiently definite structure.” *Williamson*, 792 F.3d at 1349 (Fed. Cir. 2015). Under § 112, ¶6, the phrase should be construed as requiring a structure of “an illumination source that generates at least three different colored light sources to illuminate the surface of an object, and an image sensor optically coupled to receive light from the illumination source reflected from the surface of the object” and a function of “providing two-dimensional color image data separately obtained from the depth data." *See* Ex. 1038 at 15-19; Ex. 1048 at 15; Ex. 1051 at 2. Petitioners advocated for this construction in the ITC investigation. *Id.*

In compliance with 37 C.F.R. § 42.104(b)(3), the corresponding structure in the specification of the '228 Patent is as described at 13:8-13 and depicted in Fig. 1 (elements 22, 71, 73, and 74) of the '228 Patent (Ex. 1001). Ex. 1038 at 15-19; Ex. 1049 at 4-6; Ex. 1051 at 2; Ex. 1024 at ¶¶63-66.

Patent Owner offered a § 112, ¶6 construction for this phrase in the ITC investigation. *See* Ex. 1048 at 24-28; Ex. 1050 at 10-11; Ex. 1051 at 2. The challenged claims would have been obvious over the asserted prior art under all of these constructions, each of which is addressed below.

C. "a processor configured to associate the depth data with the color image data" (Claims 1-7, 26)

In the ITC investigation, Patent Owner construed this phrase to mean "one or more electronic circuits which perform operations on data to associate depth data with the color image data." Ex. 1051 at 2. Petitioners argued in the ITC investigation that the phrase invokes § 112, ¶6. Petitioners believe this is the correct construction because the phrase "fails to recite sufficiently definite structure." *Williamson*, 792 F.3d at 1349 (Fed. Cir. 2015). Under § 112, ¶6, the phrase should be construed as requiring a structure of "software, firmware, and/or hardware programmed to map the color image data to the depth data" and a function of "map depth data with the separately obtained color image data." *See* Ex. 1038 at 20-23; Ex. 1048 at 15; Ex. 1051 at 2. Petitioners advocated for this construction in the ITC investigation. *Id.*

In compliance with 37 C.F.R. § 42.104(b)(3), the corresponding structure in the specification of the '228 Patent is an image processor/processor unit 24 as described at 13:20-14:35 and Figs. 1 (image processor 24), 4B (processor unit 24) of the '228 Patent (Ex. 1001). Ex. 1038 at 20-23; Ex. 1049 at 6-7; Ex. 1051 at 2; Ex. 1024 at ¶¶69-71.

Patent Owner offered a § 112, ¶6 construction for this phrase in the ITC investigation. Ex. 1048 at 22-24; Ex. 1050 at 11-12; Ex. 1051 at 2. The challenged claims would have been obvious over the asserted prior art under all of these constructions, each of which is addressed below.

D. "provide the color image data independently from the depth data" (Claim 2)

The specification of the '228 Patent does not define the term "independently." Other than Claim 2, the term "independently" appears only twice in the '228 Patent: first in the context of "independent determination of [spot specific position] for the different light components," and second when describing how "the detector independently detects intensity of each light components." Ex. 1001 at 3:43-48 and 5:62-64. Ex. 1024 at ¶74.

The phrase "provide the color image data independently from the depth data" should be interpreted as the imaging system providing the color image data ***separately*** from the depth data that is provided by the scanning system. This construction is informed by the specification, which discloses that the depth data for the object of interest 26 is obtained separately from the color image data for the object of interest 26. *See, e.g.,* Ex. 1001 at 12:56-13:19. Because depth data and color data are separately obtained, the processor 24 "combines the color data and depth data…thereby providing a three-dimensional color virtual model of the surface of the structure." Ex. 1001 at Abstract, 13:20-25. Ex. 1024 at ¶75.

E. "a handheld device comprising ... (c) a processor configured to associate the depth data with the color image data, wherein the depth data and the color image data represent the surface topology and the color of the portion of the three-dimensional dental structure" (Claims 1-7, 26)

Claim 1 recites the phrase "a handheld device comprising ... (c) a processor configured to associate the depth data with the color image data, wherein the depth data and the color image data represent the surface topology and the color of the portion of the three-dimensional dental structure." Ex. 1001 at 25:41-52.

The '228 Patent specification states that a hand-held device is typically a unitary device. Ex. 1001 at 24:48-54. This phrase should be construed to mean "a unitary device that can be held in a user's hand and includes a processor configured to associate the depth data with the color image data, wherein the depth data and the color image data represent the surface topology and the color of a portion of a three-dimensional dental structure." Along similar lines, this phrase ***does not*** encompass a unitary device that can be held in a user's hand wherein the processor is ***physically separated*** from such unitary device. Ex. 1024 at ¶77.

To the extent that Patent Owner provides a contrary claim construction through expert testimony as opposed to citation to the intrinsic record, the Board should give that testimony little weight as experts "cannot be used to prove the proper or legal construction of any instrument of writing," and "in the actual interpretation of the patent the court proceeds upon its own responsibility, as an arbiter of the law, giving to the patent its true and final character and force." *Teva Pharm. USA, Inc. v. Sandoz, Inc.*, 135 S.Ct. 831, 841 (2015) (internal citations omitted).

F. "confocal imaging techniques" (Claim 4)

The phrase "confocal imaging techniques" should be construed to mean "an imaging technique which generates an array of light beams to illuminate the surface of an object with a corresponding array of illuminated spots, detects a returned light beam for each illuminated spot, each returned light beam passing through a single corresponding pinhole in a pinhole array, and determines the maximum measured intensity of a single pixel of each respective returned light beam." This construction is informed by the specification. *See* Ex. 1001 at 2:61-

3:3; 5:18-44; 9:7-27; 14:59-15:5; 15:51-65; Ex. 1038 at 25-26; Ex. 1048 at 25-26; Ex. 1049 at 9-11; Ex. 1051 at 3. Specifically, the ’228 Patent specifies that “confocal imaging techniques” encompass the techniques described in Babayoff. Ex. 1001 at 1:43-45; Ex. 1024 at ¶78.

Patent Owner construed this term to mean “techniques that utilize confocal imaging.” Ex. 1038 at 25-26; Ex. 1048 at 25-26; Ex. 1050 at 6-7; Ex. 1051 at 3. Claim 4 would have been obvious in view of the asserted prior art under either construction, each of which is addressed below.

VII. PETITIONERS HAVE A REASONABLE LIKELIHOOD OF PREVAILING

Obviousness under 35 U.S.C. § 103 is determined by evaluating several factual inquiries, namely the scope and content of the prior art, ascertaining the differences between the claimed invention and the prior art, and resolving the level of ordinary skill in the relevant art, as well as considering any objective evidence of “secondary considerations” relevant to obviousness. *Graham v. John Deere Co.*, 383 U.S. 1 (1966).

The purported invention of the ’228 Patent is nothing more than the combination of well-known technologies and techniques yielding a predictable outcome. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007).

The following discussion explains why the claims of the ’228 Patent are unpatentable over the prior art asserted in Grounds 1-2. As discussed above, Babayoff, Okamoto, and Engelhardt qualify as prior art under 35 U.S.C. § 102(b) and Sachdeva qualifies as prior art under 35 U.S.C. § 102(e). As discussed below, any difference between Claims 1-7 and 26 and Babayoff can be found in prior art teachings whose combination with Babayoff would have been obvious to a POSITA. Ex. 1024 at ¶4.

A. Claims 1-5, 7, and 26 Would Have Been Obvious Over Babayoff in View of Okamoto and Engelhardt (Ground 1).

Section VII.A.1 explains where each element of claims 1-5, 7, and 26 is found in the prior art. Section VII.A.2 explains why claims 1-5, 7, and 26 would have been obvious.

1. Reference to Where the Elements of Claims 1-5, 7, and 26 Are Found in the Prior Art

The following sections provide reference to where the elements of Claims 1-5, 7, and 26 are found in the prior art, in light of the claim constructions set forth in Section VI above.

a. Claim 1 (Preamble): A system for determining the surface topology and associated color of at least a portion of a three dimensional structure, comprising:

All elements of the preamble of Claim 1 are disclosed in Babayoff and Okamoto. Babayoff teaches "an apparatus for non-contact imaging of three-dimensional structures, particularly useful for direct surveying of teeth." Ex. 1003 at 1:2-4. "A preferred implementation of method and apparatus…are in determining surface topology of a teeth section." *Id*. at 5:22-25. "[T]he Z or depth coordinate can be associated with each spot and thus by knowing the X-Y-Z coordinates of each spot the surface topology can be generated." *Id.* at 5:4-6; *see also id.* at 2:24-4:17, Figs. 1A and 1B; Ex. 1024 at ¶83.

Okamoto discloses a system ("three-dimensional measuring device") for determining the surface topology ("information on the three-dimensional surface shape") and associated color ("color of the measurement target object") of at least a portion of a 3D structure ("measurement target object"). Ex. 1004 at ¶[0001], ¶[0008]; Ex. 1024 at ¶84.

Okamoto states that "confocal microcopy is provided with a confocal optical system 1 to obtain the 3-dimensional surface shape information that includes sample height." Ex.1004 at ¶[0015], ¶[0021]. Okamoto associates surface topology and color of a 3D structure. *Id.*, at ¶[0031] ("Picture elements of the hatched portions are imaged in the XY plane and are ***associated with*** picture elements of the color image [emphasis added]"), Fig. 1. Ex. 1024 at ¶84.

i. [1.1] a hand-held device comprising

All of the features of [1.1] are disclosed in Babayoff and Engelhardt. Babayoff discloses a hand-held device. Ex. 1003 at 4:15-17. Figs. 2A and 2B depict a probing member which can be included in the hand-held device:

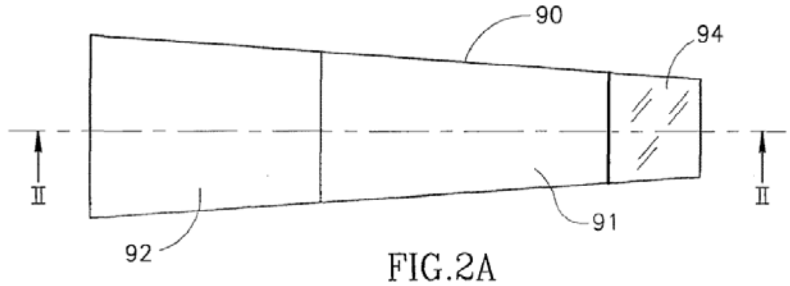


FIG.2A

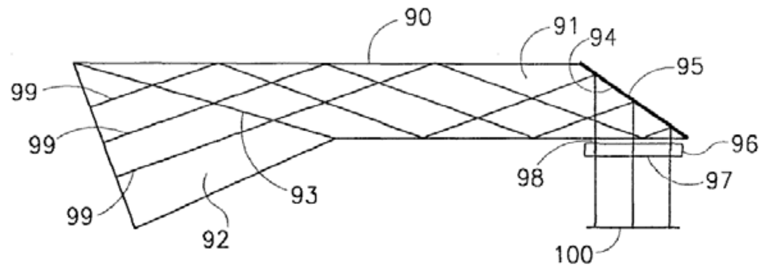


FIG.2B

Babayoff does not disclose, either implicitly or explicitly, that a processor configured to associate depth data with color image data is contained in the hand-held device. Ex. 1024 at ¶¶85-87.

Engelhardt discloses providing a confocal surface-measuring device for measuring the surface profile 1 of one or more teeth 2 in a patient's oral cavity with an intraoral probe 3 (hand-held device) that can be introduced into the patient's oral cavity to obtain 3D data about the surface profile 1 of the patient's teeth 2. Ex. 1005 at 1:5-11, 6:45-62, 7:1-9. The intraoral probe 3 of Engelhardt uses confocal imaging techniques. *Id.* at 6:41-44, Abstract. The probe 3 of Engelhardt is defined by the housing 11. *Id.* at 5:56-57. Engelhardt discloses that various functional units can be incorporated into the hand-held device including the light source, beam splitter, focusing control, detector, and/or processor so that such functional units are part of the hand-held device. *Id*. at 5:62-6:1. Engelhardt also discloses that the processor may take over several other functions "such as control, transformation or geometric correction, and digitizing of the signal, serving to compute the three-dimensional surface profile or for storing the data." Ex. 1005 at 6:8-12; Ex. 1024 at ¶¶88-89.

Thus, Engelhardt discloses "a handheld device comprising ... (c) a processor configured to associate the depth data with the color image data, wherein the depth data and the color image data represent the surface topology and the color of the portion of the three-dimensional dental structure" as this element is construed in Section VI.F.

ii. [1.2]: (a) a scanning system configured to provide depth data of the portion, the depth data corresponding to a plurality of data points defined on a plane substantially orthogonal to a depth direction

All of the features of [1.2] are disclosed in Babayoff and Okamoto. Babayoff discloses a scanning system ("apparatus for non-contact imaging of three-dimensional structures, particularly useful for direct surveying of teeth" and "optical device 22"). Ex. 1003 at 1:2-4, 8:19-12:15, Figs. 1A and 1B; *see also id.* at 2:24-4:17, 3:23-4:9, 5:22-25; Ex. 1024 at ¶91.

Babayoff's scanning system is configured to provide depth data ("the Z or depth coordinate" data) of the portion ("three-dimensional structure"). *Id*. at 1:2-4, 5:1-6, 6:15-18; Ex. 1024 at ¶92.

Thus, Babayoff discloses "a 3D scanner that scans in the optical axis (z) direction to provide depth data," as the first portion of [1.2] is construed under Patent Owner's construction as explained above in Section VI.A.

Regarding Petitioners' construction under 35 U.S.C. § 112, ¶6, the '228 Patent explicitly cites Babayoff. Ex. 1001 at 14:36-42; *see also* Ex. 1003 at Fig. 1A (components 28, 30, 32, 34, and 38 of Babayoff corresponding to illumination source 31 of '228 Patent; components 40, 42, 44, and 46 of Babayoff corresponding to main optics 41 of '228 Patent; component 60 of Babayoff corresponding to detection optics 60 of Babayoff). The '228 Patent explicitly discloses that the scanning system ("system 20 for confocal imaging") of Babayoff can be used in the method described therein. *Id*. Thus, Babayoff discloses the requisite structure and function of the first portion of [1.2] according to Petitioners' construction under 35 U.S.C. §112, ¶6, as explained in Section VI.A. Babayoff discloses the requisite structure and function of the first portion of [1.2] even in view of Patent Owner's § 112, ¶6 construction because Patent Owner's construction includes a mere subset of the structures and functions provided in Petitioners' § 112, ¶6 construction. Ex. 1024 at ¶94.

As seen below, the system depicted in Figs. 1A and 1B of Babayoff is virtually identical to the system depicted in Figs. 4A and 4B of the ’228 Patent:

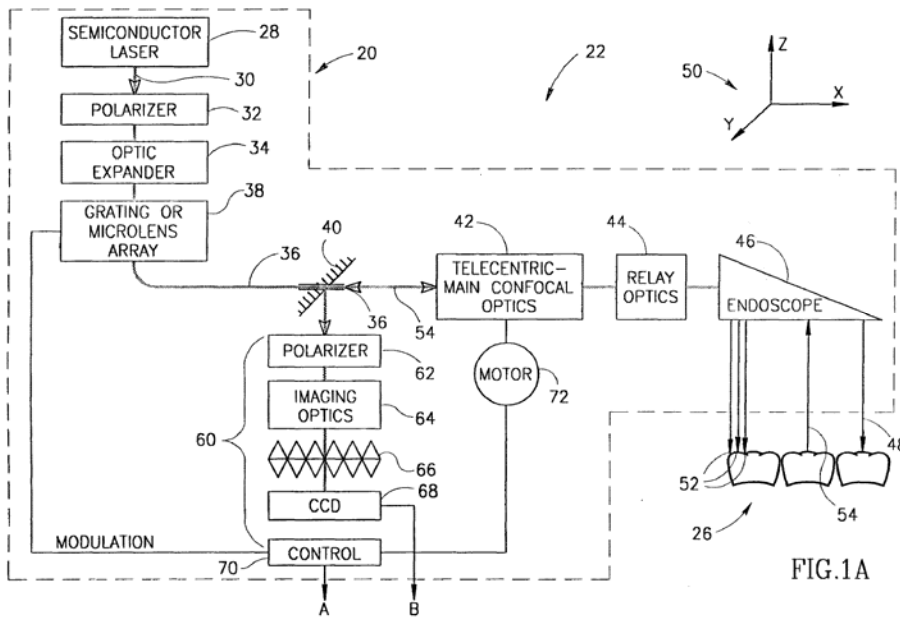


Fig. 1A of Babayoff

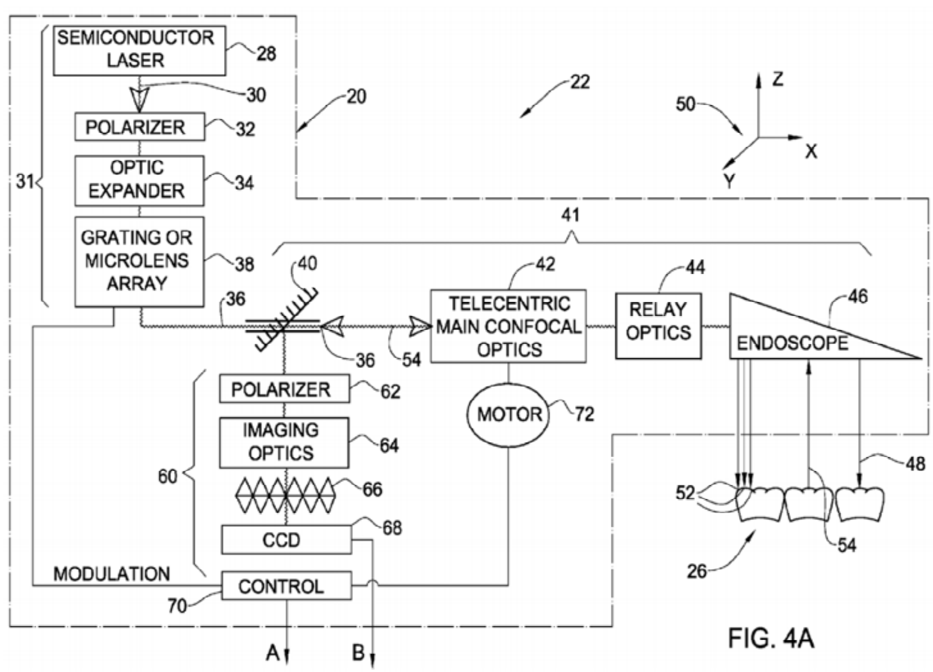


Fig. 4A of the ’228 Patent

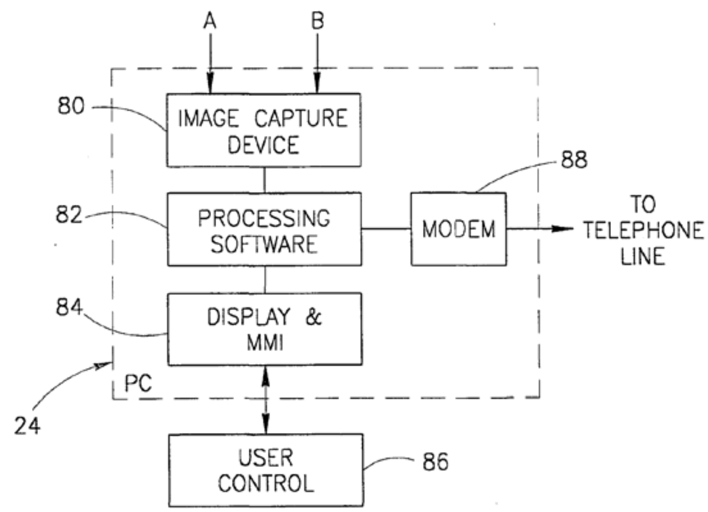


Fig. 1B of Babayoff

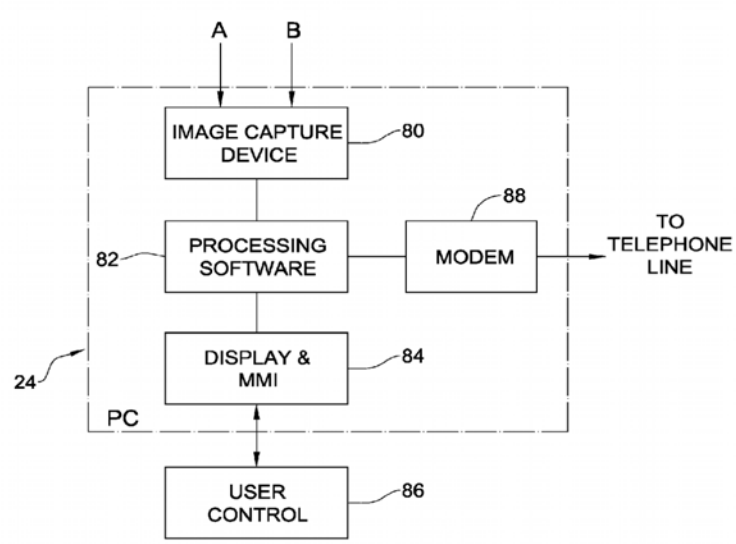


Fig. 4B of the '228 Patent

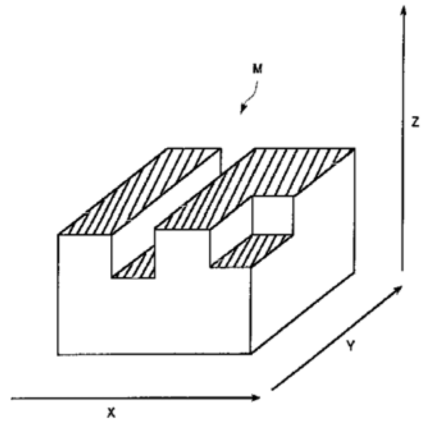
Babayoff also discloses that the depth data ("the Z or depth coordinate" data) corresponds to a plurality of data points defined on a plane substantially orthogonal to a depth direction ("the Z or depth coordinate"). Ex. 1003 at 6:15-18, 5:2-10; Ex. 1024 at ¶¶95-96.

Babayoff discloses that the scanning system is in the hand-held device. Ex. 1003 at 4:15-17; Ex. 1024 at ¶97.

Okamoto also discloses a scanning system (“three-dimensional measuring device” including “confocal optical system 1”) configured to provide depth data (“height information”) of the portion (“information on the three-dimensional surface shape”). Ex. 1004 at ¶[0008], ¶[0015], ¶[0012], ¶¶[0021]-[0024], Figs. 1 and 4; Ex. 1024 at ¶98.

Thus, Okamoto discloses “a 3D scanner that scans in the optical axis (z) direction to provide depth data,” as the first portion of [1.2] is construed under Patent Owner’s construction as explained in Section VI.A.

Okamoto discloses that the depth data (“height” information) corresponds to a plurality of data points defined on a plane (“picture elements of the hatched portions are imaged in the XY plane”) substantially orthogonal to a depth (“height” or Z) direction. Ex. 1004 at ¶[0031, Fig. 3 (showing hatched portions residing in a plane substantially orthogonal to Z axis, below); Ex. 1024 at ¶100.



iii. [1.3]: (b) an imaging system configured to provide two-dimensional color image data of said portion associated with said plurality of data points

All of the features of [1.3] are disclosed in Okamoto and Engelhardt. Okamoto discloses an imaging system ("non-confocal optical system 2" and "color filming means") configured to provide 2D color image data of the portion ("color of the measurement target object") associated with said plurality of data points ("Picture elements of the hatched portions…are associated with picture elements of the color image"). Ex. 1004 at ¶[0008], ¶[0015], ¶[0031]; *see also id.* at ¶[0012], ¶¶[0028]-[0031], Figs. 1 and 4; Ex. 1024 at ¶101.

Okamoto's imaging system is configured to provide color image data of the portion "associated with" said plurality of data points because Okamoto discloses that "[c]olor images obtained with the non-confocal optical system 2 are ***combined*** in a three-dimensional display of the surface profile of the sample obtained by the confocal optical system 1" and "[p]icture elements of the hatched portions are imaged in the XY plane and are ***associated with*** picture elements of the color image." Ex. 1004 at ¶[0008] (emphases added), ¶[0031], Fig. 3; Ex. 1024 at ¶102.

Thus, Okamoto discloses "an image sensor or detector that is configured to provide two-dimensional color image data," as the first portion of [1.3] is construed under Patent Owner's construction as explained in Section VI.B.

Regarding Petitioners' construction under 35 U.S.C. § 112, ¶6, Okamoto discloses components 16, 17, 20-24, and 43 corresponding to the structures disclosed in the '228 Patent. Ex. 1004 at Fig. 1. Thus, Okamoto discloses the requisite structure and function of this claim limitation according to 35 U.S.C. §112, ¶6. Okamoto discloses the requisite structure and function of the first portion of [1.3] even in view of Patent Owner's §112, ¶6 construction because Patent Owner's construction includes a mere subset of the structures and functions provided in Petitioners' § 112, ¶6 construction. Ex. 1024 at ¶104.

Engelhardt discloses that various functional units can be incorporated into the hand-held device including the light source, beam splitter, focusing control, detector, and/or processor so that such functional units are part of the hand-held device. Ex. 1005 at 5:62-6:1; Ex. 1024 at ¶105.

iv. [1.4]: (c) a processor configured to associate the depth data with the color image data

All of the features of [1.4] are disclosed in Babayoff, Okamoto, and Engelhardt. Babayoff discloses a processor configured to generate depth data ("generating data representative of the topology of said portion"). Ex. 1003 at 3:23-4:14, 5:1-6, 1:12-15; Ex. 1024 at ¶106.

Babayoff does not disclose, either implicitly or explicitly, that a processor configured to associate depth data with color image data is contained in the hand-held device. Ex. 1024 at ¶107.

Okamoto discloses a processor ("microprocessor") configured to associate the depth data with the color image data. Ex. 1004 at ¶[0033]; *see also id.* at ¶[0036], ¶[0046], Figs. 1 and 4; Ex. 1024 at ¶108.

Thus, Okamoto discloses "one or more electronic circuits with perform operations on data to associate depth data with the color image data," as this element is construed as explained in Section VI.C.

Regarding Petitioners' construction under 35 U.S.C. § 112, ¶6, Okamoto discloses microprocessor 54 configured to associate the depth data with the color image data corresponding to processor unit 24 of the '228 Patent. Ex. 1004 at Fig. 4. Thus, Okamoto discloses the requisite structure and function of this claim limitation according to 35 U.S.C. §112, ¶6. Okamoto discloses the requisite structure and function of the first portion of [1.4] even in view of Patent Owner's §112, ¶6 construction because Patent Owner's construction includes a mere subset of the structures and functions provided in Petitioners' § 112, ¶6 construction. Ex. 1024 at ¶110.

Engelhardt discloses that various functional units can be incorporated into the hand-held device including the light source, beam splitter, focusing control, detector, and/or processor so that such functional units are part of the hand-held device. Ex. 1005 at 5:62-6:1; Ex. 1024 at ¶111.

b. Claim 2: A system according to claim 1, wherein the imaging system is configured to provide the color image data independently from the depth data.

See Claim 1. All elements of Claim 2 are disclosed in Babayoff, Okamoto, and Engelhardt. Ex. 1024 at ¶112.

Okamoto discloses that the imaging system ("non-confocal optical system 2") is configured to provide the color image data ("color information", "color of the measurement target object", "picture elements of the color image") independently from the depth data ("height information", "3-dimensional surface shape information"). Ex. 1004 at ¶¶[0008], [0012], [0015], [0021], [0031]. Okamoto's imaging system provides the color image data "independently" from the depth data because (1) the imaging system generates color image data that is distinct from (no correlation between the color image data and the depth data, but ultimately associated with) the depth data and (2) Okamoto's imaging system ("non-confocal optical system 2 to obtain the sample color image.") is distinct from Okamoto's scanning system ("confocal optical system 1 to obtain the three-dimensional surface shape information that includes sample height"). *Id.* at ¶[0008]; Ex. 1024 at ¶113.

Thus, Okamoto discloses that the imaging system provides the color image data separately from the depth data that is provided by the scanning system as this portion of the element is construed as explained in Section VI.D.

c. Claim 3: A system according to claim 1, wherein the plurality of data points is associated with a two-dimensional reference array.

See Claim 1. All elements of Claim 3 are disclosed in Babayoff, Okamoto, and Engelhardt. Ex. 1024 at ¶115.

Babayoff discloses that the plurality of data points ("X-Y-Z coordinates of each spot") is associated with a 2D reference array ("focal plane", "X-Y-Z coordinates" are associated with an X-Y array). Ex. 1003 at 5:1-6, 6:15-18; Ex. 1024 at ¶116.

Okamoto discloses that the plurality of data points ("3-dimensional surface shape information that including sample height") is associated with a 2D reference array ("XY plane"). Ex. 1004 at ¶[0015], ¶[0037], ¶[0031] and Fig. 3 (depicting data points ("hatched portions") in an XY plane); Ex. 1024 at ¶117.

d. Claim 4: A system according to claim 1, wherein the operation of the scanning system is based on confocal imaging techniques.

See Claim 1. All elements of Claim 4 are disclosed in Babayoff, Okamoto, and Engelhardt. Ex. 1024 at ¶118.

Babayoff discloses that the operation of the scanning system is based on confocal imaging techniques. Ex. 1003 at Title, 9:18; *see also* Ex. 1001 at 14:44-46; Ex. 1024 at ¶119.

Okamoto also discloses that the operation of the scanning system is based on confocal imaging techniques. Ex. 1004 at ¶[0015]; Ex. 1024 at ¶120.

Thus, both Babayoff and Okamoto disclose "an imaging technique which generates an array of light beams to illuminate the surface of an object with a corresponding array of illuminated spots, detects a returned light beam for each illuminated spot, each returned light beam passing through a single corresponding pinhole in a pinhole array, and determines the maximum measured intensity of a single pixel of each respective returned light beam" as this element is construed as explained in Section VI.G.

e. Claim 5: A system according to claim 1, wherein the depth data and the color image data are associated by aligning the plurality of data points and the color image data in the same frame of reference.

See Claim 1. All elements of Claim 5 are disclosed in Babayoff, Okamoto, and Engelhardt. Ex. 1024 at ¶122.

Babayoff discloses that the plurality of data points ("X-Y-Z coordinates of each spot") is associated with a 2D reference array ("focal plane", "X-Y-Z coordinates" are associated with an X-Y array). Ex. 1003 at 5:1-6, 6:15-18; Ex. 1024 at ¶123.

Okamoto discloses that the depth data ("height information", "3-dimensional surface shape information") and the color image data ("color information", "color of the measurement [of the surface of the] target object", "picture elements of the color image") are associated by aligning the plurality of data points and the color image data in the same frame of reference ("XY plane"). Ex. 1004 at ¶¶[0008], [0012], [0015], [0021], [0031]; ¶[0015], ¶[0037], Fig. 3 (depicting data points ("hatched portions") in an XY plane); Ex. 1024 at ¶124.

f. Claim 7: A system according to claim 1, wherein the associated depth data and the color image data represent the color and surface topology of the portion of the three-dimensional structure.

See Claim 1. All elements of Claim 7 are disclosed in Babayoff, Okamoto, and Engelhardt. Ex. 1024 at ¶125.

Babayoff discloses that the depth data ("the Z or depth coordinate" data) represents the surface topology ("surface topology") of the 3D dental structure. Ex. 1003 at 1:2-4, 5:1-6, 6:15-18; Ex. 1024 at ¶126.

Okamoto discloses that the depth data ("height information") and the color image data ("color information", "color of the measurement target object", "picture elements of the color image") represent the surface topology ("three-dimensional surface shape") and the color of the portion of the three-dimensional dental structure ("measurement target object"). Ex. 1004 at ¶[0008], ¶[0012], ¶[0015], ¶[0021], ¶[0031]; Ex. 1024 at ¶127.

g. Claim 26: A system according to claim 1, wherein the system is configured to determine color and surface topology of a portion of a patient's teeth.

See Claim 1. All elements of Claim 26 are disclosed in Babayoff, Okamoto, and Engelhardt. Ex. 1024 at ¶128.

Babayoff discloses that the depth data ("the Z or depth coordinate" data) represents the surface topology ("surface topology") of a patient's teeth. Ex. 1003 at 1:2-4, 5:1-6, 6:15-18; Ex. 1024 at ¶129.

Okamoto discloses that the depth data ("height information") and the color image data ("color information", "color of the measurement target object", "picture elements of the color image") represent the surface topology ("three-dimensional surface shape") and the color of the portion of the patient's teeth ("measurement target object"). Ex. 1004 at ¶[0008], ¶[0012], ¶[0015], ¶[0021], ¶[0031]; Ex. 1024 at ¶130.

2. Why Claims 1-5, 7, and 26 Would Have Been Obvious

Claims 1-5, 7, and 26 of the '228 Patent would have been obvious over Babayoff in view of Okamoto and Engelhardt. Ex. 1024 at ¶131.

a. Differences between the claimed invention and the prior art.

As discussed in section VII.A.1.a., Babayoff, Okamoto, and Engelhardt together disclose all of the features of Claim 1. While Babayoff does not disclose a system or method for associating color with depth data of a dental structure, Okamoto does disclose a confocal microscope that includes systems for obtaining surface topology and color associated with such surface topology. Babayoff and Okamoto together disclose all of the features of Claim 1 with the exception that the processor responsible for associating depth data and color is physically located in the hand-held device. Engelhardt discloses this missing limitation. Ex. 1024 at ¶132.

b. A POSITA would have had motivation to combine the disclosures of Babayoff, Okamoto, and Engelhardt.

A POSITA would have had a motivation to modify Babayoff to include a color imaging system as described in Okamoto. Ex. 1024 at ¶133. Further, a POSITA would have had a motivation to place the imaging system of Babayoff and Okamoto inside a hand-held device in view of Engelhardt. *Id.*

i. A POSITA would have been motivated to modify Babayoff to associate depth data with color image data as taught by Okamoto.

Babayoff discloses that its confocal depth data acquisition system was used in the preparation of dental prostheses. Ex. 1003 at 2:24-3:2. The desirability of obtaining "the best color match of the dental prosthesis with the patient's teeth" was known in the art. Ex. 1007 at 1:32-38, 2:18-20; Ex. 1055 at 4:26-27; Ex. 1008 at 1:10-19, 2:29-30. In light of the desirability of determining tooth color, a POSITA would have been motivated to modify Babayoff to include a color imaging system and processor for determining the associated color of the dental structure, as taught by Okamoto. This is particularly true given that Okamoto discloses providing accurate color representation. Ex. 1004 at ¶¶[0009], [0046]; Ex. 1024 at ¶134.

Okamoto discloses that the processing device 46 (Figs. 1, 4) receives both the 3D surface information (depth data) and color information for the target object, and associates the 3D information with the color information for each pixel of the 3D data to prepare a "color three-dimensional display data," which is "generated from the height data and color data for each picture element in the XY plane." Ex. 1004 at ¶¶[0031], [0037]. Okamoto discloses that "[b]y coloring the three-dimensional display of the surface profile of a sample [w] in accordance with a two-dimensional color image of the sample in this manner, the correspondence between sample locations and locations in the three-dimensional display will be readily seen." Ex. 1004 at ¶[0033]; *see also id*. at ¶¶[0006], [0007], [0034]-[0037], [0046]. Thus, Okamoto discloses that the color image data is associated with picture elements of the depth data, resulting in an accurate color 3D display image. Ex. 1024 at ¶136.

Accordingly, a POSITA would have been motivated to modify Babayoff in view of Okamoto to include a color imaging system configured to provide color image data of a dental structure and a processor configured to associate the depth data with the color image data because doing so would enable tooth color determination for further orthodontic purposes. Ex. 1024 at ¶137.

ii. A POSITA would have been motivated to place the imaging system and processor inside the hand-held device of Babayoff in view of Engelhardt.

While neither Babayoff nor Okamoto disclose a hand-held device comprising a processor configured to associate depth data with color image data, it would have been obvious to a POSITA to modify the hand-held device of Babayoff to include the imaging system and processor taught by Okamoto in view of Engelhardt. Ex. 1024 at ¶138.

Like Babayoff, Engelhardt discloses a device for determining the surface topology of teeth in a patient's oral cavity with an intraoral probe. Ex. 1005 at 1:5-11, 6:45-62, 7:1-9. Like Okamoto, the intraoral probe 3 of Engelhardt uses confocal imaging techniques. Ex. 1005 at 6:41-44, Abstract; Ex. 1024 at ¶139.

Hand-held devices for intraoral scanning which contain both a 3D scanning system and a color imaging system were well-known, and a POSITA knew how to incorporate both a 3D scanning system and a color imaging system into a single hand-held device. *See, e.g.,* Ex. 1006 at ¶[0053], ¶[0080]; Ex. 1055 at 3:53-54, Fig. 1. A POSITA would have understood that the components of the color imaging system can either be located in a hand-held device or in an off-board location. Ex. 1003 at 4:15-17 (disclosing that the illumination unit, light focusing optics, translation mechanism, and detector are in the hand-held device), Fig. 1B (depicting the image capture device 80 and processing software 82 inside a "PC"). Ex. 1024 at ¶140.

Engelhardt discloses that the processor 6 can be incorporated into the housing 11 of the probe 3 so that the processor 6 is part of the hand-held device (intraoral probe 3). Ex. 1005 at 5:62-6:1. Other prior art taught the desirability of a single hand-held instrument which "combines imaging capture and processing system." Ex. 1035 at 2:19-25. For example, PCT Publ. No. WO 02/056756 teaches the desirability of providing a wireless hand-held instrument. *Id*. at 1:5-6. Thus, a POSITA would have understood that providing a combined image capture and processing system as taught by Ex. 1035 facilitates such wireless communication. *Id.* at 2:12-3:2; Ex. 1024 at ¶141.

Accordingly, a POSITA would have been motivated to modify Babayoff to include the color imaging system and processor that associates the depth data with the color information data in the hand-held device (probe 105) for improved flexibility, portability, and ease of use as taught by Engelhardt. Ex. 1024 at ¶142.

c. A POSITA would have had a reasonable expectation of success based on the disclosures of Babayoff, Okamoto, and Engelhardt, and knowledge generally available in the art.

A POSITA would have had a reasonable expectation of successfully arriving at the claimed invention because (i) Okamoto already disclosed a 3D measurement device that obtains and associates color information with depth data that could be readily deployed in Babayoff's probe; and (ii) Engelhardt discloses the interchangeability of including a processor either inside or outside of Babayoff's probe. Ex. 1005 at 5:62-6:7. Further, combining the disclosures of Babayoff, Okamoto, and Engelhardt would only require the use of "known methods." For example, a POSITA would know to apply, as necessary, techniques appropriate for reducing the size and cost of the resulting device, such that certain components could be shared between the scanning system and the color imaging system. Ex. 1017 at 1:64-67, 2:8-13, 2:20-23, Figs. 1, 2a; Ex. 1024 at ¶143.

i. A POSITA would have had a reasonable expectation of successfully modifying Babayoff to associate depth data with color image data as taught by Okamoto.

Like Babayoff's scanning system, Okamoto obtains depth data using a confocal optical system. In view of the similarities between Babayoff's scanning system and Okamoto's confocal optical system 1, a POSITA would had a reasonable expectation of success in modifying the system of Babayoff to include an imaging system configured to provide color image data of a dental structure and a processor configured to associate the depth data with the color image data, as taught by Okamoto. Knowledge generally available in the art demonstrated that techniques for "combin[ing] 3D scan data with 2D color photographs to create a 3D model of the teeth" were conventional and routine before the priority date. Ex. 1006 at ¶[0080], Fig. 4; Ex. 1024 at ¶145.

Thus, a POSITA would have had a reasonable expectation of successfully modifying the device and methods of Babayoff to include a color imaging system and a processor for associating depth data with color image data, as taught by Okamoto. Ex. 1024 at ¶146.

ii. A POSITA would have had a reasonable expectation of successfully placing the imaging system and processor inside the hand-held device of Babayoff in view of Engelhardt.

A POSITA would have had a reasonable expectation of successfully placing depth and color imaging systems as well as a processor that associates depth and color image data inside a hand-held device because it was well-known how to include a processor in a portable intraoral scanner, as disclosed by Engelhardt. Further, incorporating separate parts into a unitary device would have been within the level of ordinary skill in the art, as evidenced by commercial technology at the time of the purported invention (*e.g.,* handheld bar code scanners). A POSITA would have had a reasonable expectation of success in view of the fact that the prior art teaches that a processor having means for capturing, processing, and transmitting image data, similar to the processors of Babayoff and Okamoto, can be incorporated into a hand-held intraoral imaging instrument. Ex. 1035; Ex. 1024 at ¶147.

Further, a POSITA would have predictably designed the hand-held device with the processor comprised therein to comply with appropriate government regulations concerning power consumption, heat production, etc. to ensure that the intraoral scanner could be sold to dentists, orthodontists, and other practitioners. Furthermore, it was well known that a processor can be incorporated into the housing of a hand-held device. Ex. 1035 at 3:3-10, 5:12-22, 11:12, 11:18. Thus, a POSITA would have had a reasonable expectation of successfully modifying the hand-held device and methods of Babayoff to place the color imaging system and processor of Okamoto inside such device, according to the methods of Engelhardt. Ex. 1024 at ¶148.

For all of the foregoing reasons, the combination of Babayoff, Okamoto and Engelhardt render obvious all the recited features of Claim 1. Ex. 1024 at ¶149. *KSR*, 550 U.S. at 416 (2007).

Claims 2-5, 7, and 26 depend either directly or indirectly from Claim 1, and their additional limitations are also disclosed by Babayoff, Okamoto, and/or Engelhardt as discussed in Sections VII.A.1.b-g. The reasons for motivation to combine the asserted references and expectation of success as discussed for Claim 1 apply equally to Claims 2-5, 7 and 26, which thus would have been equally obvious. Ex. 1024 at ¶150. Further, the imaging system and processor elements of Claims 2, 5, and 7, are features of Okamoto's system, which would have been obvious to combine with Babayoff's scanning system as discussed for Claim 1. The resulting system would include the elements of Claims 2, 5, and 7.

B. Claim 6 Would Have Been Obvious Over Babayoff in View of Okamoto, Engelhardt, and Sachdeva (Ground 2)

Section VII.B.1 explains where each element of Claim 6 is found in the prior art. Section VII.B.2 explains why Claim 6 would have been obvious.

1. Where the Elements of Claim 6 Are Found in the Prior Art

As indicated below, each of the elements of Claim 6 is found in the prior art.

a. Claim 6: A system according to claim 1, wherein the depth data and the color image data are associated by using an alignment procedure comprising an optical character recognition technique.

See Claim 1. All elements of Claim 7 are disclosed in Babayoff, Okamoto, Engelhardt, and Sachdeva. Ex. 1024 at ¶153.

Sachdeva discloses a "hand-held scanner" that obtains "intra-oral 3D scan data." Ex. 1006 at ¶[0053]. The hand-held scanner includes a camera that obtains 2d color dental photographs (color image data) "separate and apart from the acquisition of 3D image data." *Id.* at ¶[0080], Fig. 4. Sachdeva discloses that "each surface is assigned a value associated with a particular color" and "[t]he result is a 3D color model of the teeth." *Id.* at ¶[0081], Fig. 4. Sachdeva discloses that the depth data ("3D image data") and the color image data are associated ("associated with a particular color") by using an alignment procedure ("alignment transformation process 58") comprising an OCR technique ("X, Y and Z translations and rotations to place the data sets into a common coordinate system such that common anatomical structures overlap each other"). *Id.* at ¶¶[0081], [0079], Fig. 3, 4; Ex. 1024 at ¶¶154-155.

2. Explanation of Why Claim 6 Would Have Been Obvious

Claim 6 would have been obvious over Babayoff in view of Okamoto, Engelhardt, and Sachdeva. Ex. 1024 at ¶156.

a. Differences between the claimed invention and the prior art.

Claim 6 depends directly from Claim 1, and its additional limitations are also disclosed by Babayoff and/or Okamoto as discussed in Section VII.B.1.

b. A POSITA would have had motivation to combine the disclosures of Babayoff, Okamoto, Engelhardt, and Sachdeva.

A POSITA would have been motivated to combine Sachdeva with Babayoff, Okamoto, and Engelhardt because Sachdeva is in the same field of endeavor—intraoral dental scanning technology. Ex. 1006 at Abstract. Further, like the combination of Babayoff in view of Okamoto and Engelhardt, Sachdeva discloses a hand-held scanner that obtains 3D scan data and color image data. Ex. 1006 at ¶¶[0053], [0080], Fig. 4. And, like Okamoto, Sachdeva discloses associating 3D scan data with color image data. *Id*. at ¶[0081], Fig. 4. Thus, a POSITA would have been motivated to combine Sachdeva with Babayoff, Okamoto, and Engelhardt because Sachdeva further enables "a complete true color 3D model of the teeth of both arches" for further orthodontic purposes. *Id*. at ¶¶[0014] and [0084]; Ex. 1024 at ¶158.

Regarding Claim 6, Sachdeva teaches that the 3D scan and color image data sets can be aligned through "X, Y and Z translations and rotations to place the data sets into a common coordinate system such that common anatomical structures overlap each other." Ex. 1006 at ¶¶[0081], [0079], Fig. 3, 4. Accordingly, a POSITA would have been motivated to modify the combination of Babayoff in view of Okamoto and Engelhardt, to employ the routine and conventional translation and/or rotation techniques disclosed by Sachdeva to align the 3D scan data with the color image data. Ex. 1024 at ¶159.

Further, Patent Owner admits that using a translation and/or rotation techniques to best fit between two optical shapes is "well known in the art." Ex. 1001 at 14:22-26 ("entity E' is translated or rotated (coplanarly) with respect to entity N' until a best fit between the optical shapes between the two entities is obtained, using OCR techniques that are well known in the art."). In light of this knowledge, a POSITA would have been motivated to employ a translation and/or rotation techniques as an alignment procedure to associate the depth data and the color image data obtained from the system disclosed by the combination of Babayoff, Okamoto, and Engelhardt. Ex. 1024 at ¶160.

c. A POSITA would have had a reasonable expectation of success based on the disclosures of Babayoff, Okamoto, Engelhardt, and Sachdeva, and knowledge generally available in the art.

A POSITA would have had a reasonable expectation of successfully arriving at the purported invention of Claim 6 because Sachdeva already discloses a processor that associates color information with depth data using OCR techniques that could be readily deployed in Babayoff's probe. Thus, combining the disclosures of Babayoff, Okamoto, Engelhardt, and Sachdeva would only require the use of "known methods." Furthermore, the combination of Babayoff, Okamoto, Engelhardt, and Sachdeva as described herein would lead to nothing more than the "predictable result" of a method for determining surface topology and associated color of a 3D dental structure by using a hand-held device capable of obtaining surface topology and associating that depth data with obtained 2D color image data. As such, the combination of Babayoff, Okamoto, Engelhardt, and Sachdeva renders obvious Claim 6. *KSR*, 550 U.S. at 416 (2007). Ex. 1024 at ¶161.

Additionally, the reasons for motivation to combine the asserted references and expectation of success as discussed for Claim 1 apply equally to Claim 6, which thus would have been equally obvious. Ex. 1024 at ¶162.

VIII. OTHER CONSIDERATIONS

A. Any Purported Secondary Considerations Evidence Does Not Overcome the Strong Evidence of the Obviousness

All elements of Claims 1-7 and 26 were known in the art, and any differences between the claims of the '228 Patent and Babayoff would have been obvious to a POSITA based on the disclosures of the applied references and the knowledge in the art. Any purported evidence of secondary considerations Patent Owner may present in this proceeding would be insufficient to overcome the strong evidence of obviousness of Claims 1-7 and 26. Ex. 1024 at ¶163. To the extent that Patent Owner presented any purported evidence of secondary considerations in the ITC investigation, Petitioners are precluded from using or addressing such evidence in this proceeding. Ex. 1052; Ex. 1053 at 25.

B. Discretion to Institute

The PTAB should not deny this Petition under § 314(a) for two reasons. First, Petitioners have not challenged the ’228 Patent in any prior AIA trial proceeding. Based on a review of Docket Navigator® data, the ’228 Patent has not been challenged in *any* prior AIA trial proceeding. This Petition is not a “follow-on” petition as was the case in *General Plastic Co*.

Second, events in the Delaware litigation and ITC investigation do not warrant denial. The statutory framework permits filing within one year of service of a complaint. The Delaware litigation is stayed; discovery and trial have not yet occurred. Exs. 1036, 1068. Further, this Petition presents issues different from those in the Delaware litigation and ITC investigation (*e.g.,* differing claim sets and different claim construction standards). Exs. 1058-1059. Moreover, the Federal Circuit has held that “decisions of the ITC involving patent issues have no preclusive effect in other forums.” *Tex. Instruments Inc. v. Cypress Semiconductor Corp*., 90 F.3d 1558, 1569 (Fed. Cir. 1996). Thus, the outcome of the ITC investigation would have little impact on the Delaware litigation or this proceeding. Denial of institution would require Petitioner to proceed with the Delaware litigation upon the lifting of the stay of that proceeding. For these reasons, denying institution due to the ITC investigation does not promote the efficient administration of justice.

Denial under § 325(d) is not warranted when considering the *Becton, Dickinson* factors. None of the references asserted in Grounds 1-2 were considered during prosecution of the ’228 Patent, let alone applied in a rejection. Further, as noted in Section V.C., during prosecution of the ’112 parent application, Patent Owner argued that Mueller teaches away from a processing means for associating color data with depth data. Ex. 1023 at 109-110. In contrast, the obviousness rationales presented herein rely on Okamoto which explicitly discloses associating color image data with depth data. Such obviousness rationales were not before the Examiner during prosecution of the ’228 family.

Separately, during prosecution of another related application, U.S. Patent No. 6,697,164 (“the ’164 Patent”; Ex. 1056) (which corresponds to Babayoff) was applied in combination with Mueller. Ex. 1021 at 61-62. This prosecution history also does not warrant denial. First, the rejection based on Mueller and the ’164 Patent is not the same or substantially the same as any of the obviousness rationales presented in this Petition (each of which rely on Okamoto for disclosing associating color image data with depth data). Second, Patent Owner amended the claims of the related application to recite allowable subject matter (which is not recited in the claims of the ’228 Patent). Ex. 1021 at 37-51. Patent Owner did not present any argument traversing the rejection based on Mueller in view of the ’164 Patent. *Id*.

IX. CONCLUSION

For at least the foregoing reasons, claims 1-7 and 26 of the ’228 Patent are unpatentable. Since Petitioners have shown the claims to be *prima facie* obvious, Petitioners have also shown a likelihood of success on the merits. Therefore, this Petition should be granted, and the Board should institute trial.

Respectfully submitted,

Date: November 8, 2018

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APPENDIX A - LIST OF EXHIBITS

EXHIBIT	DESCRIPTION
1001	U.S. Patent No. 8,363,228, issued on January 29, 2013 to Noam Babayoff ("the '228 patent")
1002	File History of U.S. Patent Application No. 13/333,351, filed on December 21, 2011 (U.S. Patent No. 8,363,228)
1003	PCT International Publication No. WO 00/08415, published on February 17, 2000 ("Babayoff")
1004	Japanese Patent Publication No. 2001-82935 ("Okamoto"), published on March 30, 2001, with Certified English Translation
1005	U.S. Patent No. 6,263,234, issued on July 17, 2001 to Johann Engelhardt and Thomas Zapf ("the '234 patent" or "Engelhardt")
1006	U.S. Patent Application Publication No. 2004/0197727, published on October 7, 2004 ("Sachdeva")
1007	U.S. Patent No. 6,575,751, issued on June 10, 2003 to Lehmann *et al.* ("Lehmann")
1008	U.S Patent No. 5,766,006, issued on June 16, 1998 to Murljacic ("Murljacic")
1009	U.S. Patent No. 3,013,467, issued on December 19, 1961 to M. Minsky ("Minsky")
1010	Cha, S. *et al.*, *3D profilometry using a dynamically configurable confocal microscope*, 3640 IS&T/SPIE CONFERENCE ON THREE-DIMENSIONAL IMAGE CAPTURE AND APPLICATIONS II 246-253 (Jan. 1999)
1011	U.S. Patent No. 5,754,298, issued on May 19, 1998 to Robert A. Falk ("Falk")
1012	U.S. Patent Application Publication No. 2002/0057438, published on May 16, 2002 ("Decker")

EXHIBIT	DESCRIPTION
1013	Kari Pulli, *Surface Reconstruction and Display from Range and Color Data* (Dec. 2, 1997) available at UMI Microform No. 9819292 (1998)
1014	U.S. Patent No. 5,864,640, issued on January 26, 1999 to John Miramonti and F. Mueller (“Miramonti”)
1015	File History of U.S. Patent Application No. 10/620,231 (U.S. Patent 7,156,655) downloaded on September 27, 2018 (“Sachdeva File History”)
1016	Number not used
1017	U.S. Patent No. 6,525,828, issued on February 25, 2003 to R. Grosskopf (“Grosskopf”)
1018	U.S. Provisional Application No. 60/580,108, filed on June 17, 2004
1019	U.S. Provisional Application No. 60/580,109, filed on June 17, 2004
1020	Number not used
1021	File History of U.S. Patent Application No. 11/154,520, filed on June 17, 2005 (U.S. Patent No. 7,319,529)
1022	U.S. Patent No. 7,511,829, issued on March 31, 2009 to Noam Babayoff (“the ’829 patent”)
1023	File History of U.S. Patent Application No. 11/889,112, filed on August 9, 2007 (U.S. Patent No. 7,511,829)
1024	Declaration of Sohail Dianat
1025	*Curriculum Vitae* of Sohail Dianat
1026-1033	Numbers not used

EXHIBIT	DESCRIPTION
1034	U.S. Patent Publication No. 2006/0001739, published on January 5, 2006
1035	PCT International Publication No. WO 02/056756, published on July 25, 2002 ("Petersen")
1036	Stipulation and [Proposed] Order for Stay [Doc 20] filed on January 23, 2018 in *Align v. 3Shape*, Civ. Action No. 1:17-cv-01649
1037	PCT International Publication No. WO 2010/145669, published on December 23, 2010 ("Fisker")
1038	Respondent 3Shape A/S, 3Shape TRIOS A/S, and 3Shape Inc.'s Opening Claim Construction Brief in ITC Investigation No. 337-TA-1091, filed April 13, 2018
1039-1047	Number not used
1048	Complainant Align Technology, Inc.'s Initial Claim Construction Brief in ITC Investigation No. 337-TA-1091, filed April 13, 2018.
1049	3Shape Respondents' Rebuttal Claim Construction Brief in ITC Investigation No. 337-TA-1091, filed April 27, 2018.
1050	Align Technology, Inc.'s Responsive Claim Construction Brief in ITC Investigation No. 337-TA-1091, filed April 27, 2018.
1051	Joint Agreed and Disputed Claim Constructions in ITC Investigation No. 337-TA-1091, filed May 29, 2018.
1052	Order No. 1: Protective Order in ITC Investigation No. 337-TA-1091, issued December 20, 2017.
1053	Order No. 17: Granting-In-Part Joint Motion to Enter Addendum to the Protective Order in ITC Investigation No. 337-TA-1091, issued April 24, 2018.

EXHIBIT	DESCRIPTION
1054	U.S. Patent No. 7,098,435, issued on August 29, 2006 to F. Mueller *et al.* (“Mueller”)
1055	U.S. Patent No. 7,099,732, issued on August 29, 2006 to Z. Geng (“Geng ’732”)
1056	U.S. Patent No. 6,697,164, issued on February 24, 2004 to N. Babayoff *et al.* (“the ’164 Patent”)
1057	Number not used
1058	Complaint filed on November 14, 2017 in Align v. 3Shape, Civ. Action No. 1:17-cv-01649
1059	Order No. 31: Order Scheduling a Prehearing Conference Regarding the Scope of Asserted Claims and Defenses and Requiring Related Submissions in ITC Investigation No. 337-TA-1091, dated August 30, 2018
1060	Constans, A., *The Confocal Microscope*, 18(22) THE SCIENTIST 32-33 (2004).
1061	Number not used
1062	Hibbs, A.R., *Confocal Microscopy for Biologists*, Appx. 1, 355-443 (2004)
1063	Rajadhyaksha, M., *Confocal Reflectance Microscopy: Diagnosis of Skin Cancer Without Biopsy?*, SYMP. FRONT. OF ENG. (1999).
1064	Paddock, S.W., *Confocal Laser Scanning Microscopy*, 27 BIOTECHNIQUES 992-1004 (1999).
1065	Paddock, S.W., *Confocal Reflection Microscopy: The “Other” Confocal Mode*, 32(2) BIOTECHNIQUES 274-278 (2002).
1066	Cogswell, C.J. *et al., High-resolution, multiple optical mode confocal microscope: I. System design, image acquisition and 3D visualization*, 2184 SPIE 48-54 (1994).

EXHIBIT	DESCRIPTION
1067	Cogswell, C.J. *et al.*, *Colour confocal reflection microscopy using red, green and blue lasers*, 165 J. MICROSCOPY 103-117 (1992).
1068	PACER Docket Sheet, *Align v. 3Shape*, Civ. Action No. 1:17-cv-01649 (downloaded on October 12, 2018)
1069-1072	Numbers not used
1073	U.S. Patent No. 6,263,233, issued on July 17, 2001 to James M. Zavislan and Jay M. Eastman ("Zavislan")

APPENDIX B – ADDITIONAL REAL PARTIES-IN-INTEREST

Allan Junge Hyldal	Lars Henrik Jakobsen
Anders Gaarde	Lars Henriksen
Anders Kjær-Nielsen	Lei Zhang
Anja Engblad	Lene Nørgaard
Birk Plönnings	Lise Thorning Christensen
Bo Esbech	Mads Brøkner Christiansen
Bruce Frederic Mendel	Martin Baltzer
Carsten Nørrevang Mogensen	Michael Bing
Casper Rasmussen	Michael Pedersen
Christian Lysholdt Dünweber	Michael Vinther
Christian Pejrup	Miguel Dovalo
Christophe Barthe	Mikael Toxværd Petersen
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Daniel Grest	Mikkel Ninn-Grønne
David Fischer	Morten Bonding Granlund
Deichmann Media ApS	Morten Nordsted Jacobsen
Dorota Lebiedowicz	Morten Rudkjær Schrøder
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Klaus Rudbæk Høj	Thomas Geoffrey Moon
Konstantinos Zarras	Thomas Højgaard Allin
Kristian Evers Hansen	Thomas Aagaard Jakobsen

Kristian Worziger Nielsen	Tim Trækjær
Kristine Slot	Tommy Sanddal Poulsen
Krzysztof Christopher Adamus	Ye Jin
Lars Christian Lund	Zhengjie Li

CERTIFICATE OF COMPLIANCE WITH 37 C.F.R. § 42.24

I hereby certify that the word count for the foregoing Petition totals 11,398 words, excluding the parts which are exempted by 37 C.F.R. § 42.24(a)(1).

Date: November 8, 2018

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CERTIFICATE OF FILING AND SERVICE

The undersigned hereby certifies that on this 8th day of November, 2018, a true and correct copy of the foregoing **PETITION FOR *INTER PARTES* REVIEW FOR U.S. PATENT NO. 8,363,228 PURSUANT TO 35 U.S.C. §§UNDER 35 U.S.C. §§ 311-319 and 37 C.F.R. § 42.100 *et seq.*** and **EXHIBITS 1001-1015, 1017-1019, 1021-1025, 1034-1038, 1048-1056, 1058-1060, 1062-1068, 1073** were filed via PTAB E2E and served by overnight UPS on the correspondence address of record for **U.S. Patent No. 8,363,228** as follows:

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