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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.

MEDIT CORPORATION
Patent Owner

Case No. IPR2024-01260
Patent 7,912,257

**PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 7,912,257
UNDER 35 U.S.C. §§311–19 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, 3-11, 13-18, and 20-22 of U.S. Patent No. 7,912,257 (“the ’257 Patent”) (EX1001) in accordance with 35 U.S.C. §§311–19 and 37 C.F.R. §42.100 *et seq.*

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

A. Real Parties-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 Germany GmbH, 3Shape France SAS, 3Shape Italy SRL, 3SHAPE UK LIMITED, 3SHAPE DOOEL Skopje, 3Shape S.A.S., 3Shape (Shanghai) Co., Ltd., 3Shape Do Brasil Soluções Tecnológicas Para Saude Ltda, 3Shape Australia Pty Ltd., 3Shape Trios Sociedad Limitada, 3Shape Japan GK, 3Shape Ukraine Ltd., SC Investment Company, LLC, SoundBite Technology, LLC, Shenzhen Full Contour Design Company Ltd., 3Shape Design Services Costa Rica, S.R.L., 3Shape Design Services, LLC, 3Shape A/S Medical Device Manufacturing (Shanghai) Co. Ltd., 3Shape Korea Ltd., 3Shape Manufacturing US LLC, 3Shape India Limited, EQT IX JAWS BIDCO S.A.R.L., Clausen Engineering APS, Tais Clausen, DM Family Office ApS, Deichmann Media APS, and Nikolaj Hoffmann Deichmann 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:

Related District Court Proceedings

3Shape A/S v. Medit Corporation, Civ. Action No. 22-cv-00443 (W.D. Tex.) (“the 443 Litigation”); and

Medit Corporation v. 3Shape A/S, Civ. Action No. 23-cv-00658 (W.D. Tex.) (“Related Litigation”).¹

¹ Medit filed its claim of patent infringement of U.S. Patent Nos. 7,912,257; 9,191,648; 9,245,374; and 9,262,864 as affirmative counterclaims in *3Shape A/S v. Medit Corp.*, Case No. :22-cv-00443 (W.D. Tex.) (the “443 Litigation”) on August 18, 2023. On September 8, 2023, the Court ordered Medit’s four affirmative counterclaims for patent infringement to be severed from the ’443 Litigation and be placed in a separate action. EX1014. Medit’s Answer to 3Shape’s Complaint and Affirmative Counterclaims then became the operative complaint in the Related Litigation. EX1013.

Related Applications

The '257 Patent issued from U.S. Patent Application No. 11/469,870, which claims priority to U.S. Provisional Application No. 60/761,078, filed on January 20, 2006.

PCT International Application No. PCT/US07/01396, filed on January 19, 2007, which published as PCT International Publication No. WO 2007/084647 on July 26, 2007 claims priority from the '870 Application and the '078 Provisional.

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 '257 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 '257 Patent on the grounds identified herein.

This Petition is filed within one year from the date on which Petitioners were served counterclaims by Patent Owner in the 443 Litigation, which asserted infringement of the '257 Patent. EX1013.

Neither Petitioners nor its privies have received a final written decision under 35 U.S.C. §318(a) regarding any claim of the '257 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, 3-11, 13-18, and 20-22 of the '257 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, 3-11, 13-18, and 20-22 are as follows:

Ground	References	Basis	Claims Challenged
1	U.S. Patent Publication 2006/0115793 ("Kopelman") (EX1006)	§103	1, 3-11, 13-18, and 20-22
2	Kopelman in view of U.S. Patent Publication No. 2004/0254476 ("Quadling") (EX1007)	§103	1, 3-11, 13-18, and 20-22

In addition to the above prior art, Petitioners rely upon evidence listed in the Exhibit List, including the Declaration and *Curriculum Vitae* of Eli Saber, Ph.D. (EXs1004-1005). EX1004, ¶¶1-320 supports this Petition, and citations are provided below.

C. Prior Art Qualification of Asserted References

The '257 Patent was filed on September 3, 2006 as U.S. Patent Application No. 11/469,870 ("the '870 Application"). EX1001. The '870 Application claims

priority to U.S. Provisional Application No. 60/761,078, filed on January 20, 2006 (EX1003).

Even if the '257 Patent is deemed entitled to its earliest priority date, all of the applied references in this Petition are prior art.

Kopelman (EX1006), published no later than June 1, 2006, and was filed on November 25, 2005, and thus constitutes prior art under at least under 35 U.S.C. §102(e) (pre-AIA). Additionally, Kopelman claims priority to U.S. Provisional Application Serial No. 60/630,572 (“the '572 Provisional”) (EX1008) filed November 26, 2004, allowing it to separately constitute prior art under 35 U.S.C. §102(e) (pre-AIA) as of November 26, 2004 – support for which is discussed directly below in the section labeled *Dynamic Drinkware Analysis*.

Quadling (EX1007), published no later than December 16, 2004, constitutes prior art at least under 35 U.S.C. §102(b).

D. Dynamic Drinkware Analysis for Kopelman

The '572 Provisional enables and provides written description support for all elements of at least one independent claim of Kopelman. *See Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1382 (Fed. Cir. 2015); *Amgen Inc. v. Sanofi*, 872 F.3d 1367, 1380 (Fed. Cir. 2017); *Ex Parte Ravi Kumar Reddy Kanamatareddy*, No. 2017-006692, 2018 WL 1963956, at *5 (PTAB Apr. 19, 2018) (applying Dynamic Drinkware to published patent applications); EX1004, ¶¶ 50-52.

In fact, the '572 Provisional is nearly verbatim in the relevant respects when compared to Kopelman. *See* EX1016. The following chart shows that the '572 Provisional (EX1008) discloses every limitation of at least claim 1 of Kopelman (EX1006):

Kopelman (EX1006), Claim 1	Support from '572 Provisional (EX1008)
1. A method for providing feedback data useful in at least one prosthodontic procedure associated with the intra oral cavity, comprising:	“1. A method for providing feedback data useful in at least one prosthodontic procedure associated with the intra oral cavity, comprising:” p. 39 (identical) <i>See also</i> Figure 12.
(a) providing at least one numerical entity representative of the three-dimensional surface geometry of at least part of the intra-oral cavity;	“(a) providing at least one numerical entity representative of the three-dimensional surface geometry of at least part of the intra-oral cavity;” p. 39 (identical) <i>See also</i> Figure 12, Step 11’.
(b) manipulating said entity to provide desired data of a type useful in at least a first said procedure;	“(b) manipulating said entity to provide desired data of a type useful in at least a first said procedure;” p. 39 (identical) <i>See also</i> Figure 12, Step 12’.
(c) determining at least one relationship between said desired data and said first procedure; and	“(c) determining at least one relationship between said desired data and said first procedure; and” p. 39 (identical) <i>See also</i> Figure 12, Step 13’.

(d) generating feedback data representative of said at least one relationship.	“(d) generating feedback data representative of said at least one relationship.” p. 39 (identical) <i>See also</i> Figure 12, Step 14’.
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Parallel citations are also provided in the Grounds below to the ’572 Provisional² for each Kopelman citation, confirming written description support for the same material from Kopelman. The ’572 Provisional is also incorporated by reference into Kopelman, and forms part of its disclosure. EX1006, ¶[0001]. Thus, Kopelman is also pre-AIA 102(e) prior art to the ’257 Patent as of November 26, 2004 because the provisional application supports at least one of the claims of Kopelman and provides written description support for the aspects of Kopelman relied upon in the Grounds below.

² The parallel citations are provided directly next to each paragraph number for the Kopelman patent publication EX1006 in parentheses with page and line numbers to EX1008.

V. BACKGROUND

A. The Purported Invention

The '257 Patent relates to a system and method providing real time display of three-dimensional dental data acquired intraorally from a dental patient. EX1001, Abstract. An example rendering of scanned dental data is provided by Figure 5:

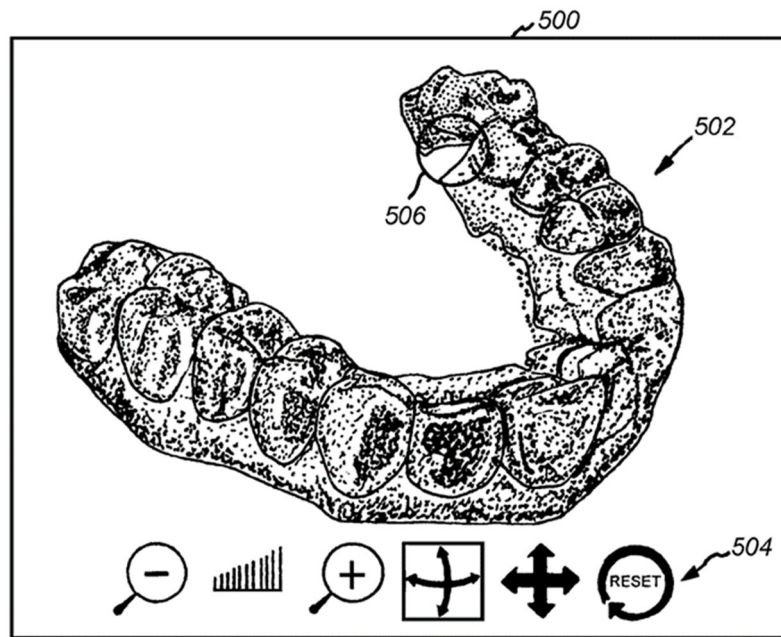


Fig. 5

The '257 Patent explains that at least one problem with the prior art is that “[u]nrecoverable errors or gaps in incremental data cannot be identified and fixed without initiating a new scan, possibly a full scan to completely replace the defective results.” EX1001, 1:42-45. The '257 Patent explains that “[t]here remains a need for real time visual feedback systems to support continuous three-dimensional scanning.” *Id.*, 1:57-58.

Along those lines, the independent claims of the '257 Patent require an inaccurate scan data visualization feature. An embodiment of that feature is identified as region 506 in Figure 5 (reproduced above), and is explained in the '257 Patent as:

“In the window, gross errors in a digital model, such as a region 506 of omitted or missing scan data, may be intrinsically identified by the absence of visible point data. Other errors such as excessive variability of surface data may be intrinsically identified by fuzziness or excessive random texture. Visualization of scan quality may also, or instead, be augmented by explicit indicators, such as coloring, shading, surface texturing, or any of the other visual cues described above, which may visually identify regions of incomplete scan data, inaccurate scan data, insufficient scan detail (such as where a restoration will be affixed) and the like.” EX1001, 13:34-44.

B. The '257 Patent Examination History

A single office action issued rejecting Claims 1-3 and 5-7, 11-13, and 15-17, 18-19, 21-22³ as anticipated by U.S. Pat. Pub. No. 2002/0055800 (“Nikolskiy”) (EX1009), Claims 8-10 as obvious over Nikolskiy in view of U.S. Pat. No. 6,687,393

³ The issued claim numbering is the same as that during prosecution.

(“Skinner”) (EX1010), and 4, 14, and 20 as obvious over Nikolskiy in view of U.S. Pat. No. 4,846,684 (“Oestreich”) (EX1011). EX1002, 215-227. Applicant conducted an Examiner Interview and subsequently filed an Amendment and Reply. *Id.* at 182-194. In that Amendment and Reply, Applicant amended the claims and submitted arguments directed to the incremental nature of the claimed scanning technique. *See e.g.*, EX1002, p. 192.

In doing so, Applicant characterized Nikolskiy as primarily directed to post-processing techniques, with “only cursory descriptions of techniques used to acquire initial three-dimensional tooth models.” *See e.g., id.* (citing Nikolskiy, ¶[0020] (“Fig. 11 is a simplified block diagram of a data processing system 300 that may be used to develop orthodontic treatment plans...”)).

The amendments and accompanying arguments focused on incremental scanning did not directly result in allowance. Instead, the Examiner issued a Notice of Allowance that was premised on an Examiner’s Amendment of independent Claims 1 and 11 to recite “providing a visualization within the visual display, the visualization updated at the video rate to identify ***regions of inaccurate scan data*** within the three-dimensional representation.” *See* EX1002, pp. 164-166 (emphasis added). Additionally, a second Notice of Allowance issued also amending independent Claim 18 to include the same visualization feature that lead to the first Notice of Allowance. *See id.* at pp. 11-20. That Notice specifically stated “claim 1

is considered allowable ... [due to its recitation]” of the inaccurate scan data visualization feature noted above and that “Claim 11 and Claim 18 are considered allowable for similar reasons.” *Id.*

As demonstrated below, the prior art relied upon in this Petition explicitly discloses the inaccurate scan data visualization feature that was absent from the prior art applied by the Examiner.

C. Summary of the Applied Prior Art

1. Kopelman (EX1006)

Kopelman discloses “a system and method for providing feedback information that facilitates and that may provide guidance for prosthodontic procedures in the intra oral cavity, i.e., procedures involving the installation and definition of dental prostheses.” EX1006, ¶[0002] (EX1008, 1:6-9). In Kopelman, “[f]irst, a 3D numerical model [i.e. a virtual model] of the target zone in the intra oral cavity is provided” and then it is “manipulated so as to extract particular data that may be useful in a particular procedure.” *Id.*, Abstract.

Exactly like the '257 Patent, Kopelman recognizes there may be deficiencies with respect to its 3D model/virtual model acquisition, which could result in the need for a complete rescan:

“However, if the model is deficient or undefined in certain areas, or if the preparation is not optimal for receiving the prosthesis, the dental technician has a more difficult job

ahead than otherwise, and may result in less than optimal design for the prosthesis. **In some circumstances, the model is rejected and the dental practitioner must re-scan the dental site**, or must rework the preparation, so that a suitable prosthesis may be produced.” EX1006, ¶[0005] (emphasis added) (EX1008, 2:1-6).

And, just like the '257 Patent, Kopelman solves this problem through an inaccurate scan data visualization feature:

“Thus, in step 13’ the processor 52 determines whether data is missing, or whether the **accuracy** of the data of the numerical entity is **insufficient**.

In step 14’, feedback data is generated to alert the user as to how to correct for the insufficiency of definition.... This information may be provided by display 54, for example by providing a graphical image of the entity, with the deficient areas marked hereon, and then arrows or markers with respect thereto showing the desired position of the scanner 31.” EX1006, ¶¶[0167]-[0168] (emphasis added) (EX1008, 35:23-36:2).

2. Quadling (EX1007)

Quadling discloses a known three-dimensional scanner, specifically designed to scan dentition. *See* EX1007, Abstract (“A intra-oral laser digitizer system

provides a three-dimensional visual image of a real-world object such as a dental item through a laser digitization.”). Quadling explains that its scanner acquires a sequence of images that are stored in memory and from which a three-dimensional model is created with a processor. EX1007, ¶[0012] (“Multiple images of the object may be recorded and processed by the computer to produce a 3D map of the object.”); *see also* Figure 1 and ¶[0067] (illustrating and discussing Quadling’s computer and image processor). Quadling’s images include video images acquired using a video camera as its image sensor. EX1007, ¶[0059].

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 ’257 Patent, a POSITA would have at least (1) a bachelor’s degree in electrical engineering, computer engineering, computer science, or an equivalent field, as well as at least two to three years of industry or research experience with computer vision/graphics making use of three-dimensional virtual models; or (2) a master’s degree in electrical engineering, computer engineering, computer science, or an equivalent field with a focus in making use of three-dimensional virtual models in the area of computer vision/graphics. EX1004, ¶36.

VI. CLAIM CONSTRUCTION

The Board only construes the claims when necessary to resolve the underlying controversy. *Toyota Motor Corp. v. Cellport Systems, Inc.*, IPR2015-00633, Paper 11 at 16 (PTAB Aug. 14, 2015) (citing *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)). Given the Markman Order (EX1015) in the related litigation indicating that the disputed terms from the Related Litigation are to take on their plain and ordinary meaning under the *Phillips* standard, Petitioner believes that no express constructions of the claims are necessary in this Proceeding. Petitioners apply the plain and ordinary *Phillips* meaning in the Grounds below.

The Court did provide some guidance concerning its understating of the plain and ordinary meaning of “video rate” / “at the video rate”, as well as “inaccurate scan data.” That guidance is addressed in the Grounds below.

While the proper metes and bounds of these terms are disputed, the cited prior art falls within these bounds whatever they may be. The prior art meets the language of the claims regardless of whether a plain and ordinary meaning is applied or if Petitioner’s non-adopted litigation construction is adopted. The Challenged Claims are unpatentable under all the potential constructions.

A. Certain Indefinite Terms

Petitioner also note that in the parallel litigation they have asserted that the terms “visualization” (Claims 1, 11, 18), “inaccurate scan data” (Claims 1, 11, 18),

and “visual display signal (of the three-dimensional model)” (Claims 18, 21) are indefinite, and the Court has indicated that these terms should be given their plain and ordinary meaning. EX1015, at 2. While the proper metes and bounds of these terms are disputed, the cited prior art falls within these bounds whatever they may be. And, the Board has consistently held that Petitioners may assert indefiniteness positions in parallel litigation, while simultaneously arguing that the prior art discloses the elements containing those terms. *See Target Corp. v. Proxicom Wireless, Inc.*, IPR2020-00979, Paper 11 at 16-17 (PTAB Dec. 4, 2020); *Sony Interactive Entertainment LLC v. Bot M8, LLC*, IPR2020-00963, Paper 9 at 11 (PTAB Nov. 20, 2020). *See also Intel Corp. v. Qualcomm Inc.*, 21 F.4th 801, 812-814 (Fed. Cir. 2021). The Challenged Claims are unpatentable under all the potential constructions.

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). Further, the purported invention of the ‘257 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 explains why Claims 1, 3-11, 13-18, and 20-22 of the '257 Patent are unpatentable over the prior art asserted in Grounds 1-2.

A. Claims 1, 3-11, 13-18, and 20-22 Would Have Been Obvious Over Kopelman (Ground 1).

The following sections explain where each element of Claims 1, 3-11, 13-18, and 20-22 is found in the prior art of Kopelman.

1. Claim 1 (Preamble): A method comprising:

Kopelman renders obvious a method that includes the steps (among others) of acquiring two dimensional data from intraoral structures at a video rate [1.1], reconstructing a digital surface representation of those intraoral structures [1.2] and displaying them at the video rate [1.3], acquiring additional two dimensional data from the intraoral structures [1.4], reconstructing a subsequent digital surface representation [1.5], combining the two digital surface representations to provide a three-dimensional representation of the intraoral structures [1.6] and providing a visual display of that new three-dimensional representation [1.7], and providing a visualization to identify regions of inaccurate scan data within the three-dimensional representation [1.8]. EX1004, ¶57.

As Kopelman succinctly explains (annotated in **green** for the evaluation and **blue** for the visual feedback):

- “(a) providing at least one numerical entity representative of the three-dimensional surface geometry of at least part of the intra-oral cavity;
- (b) manipulating said entity to provide desired data of a type useful in at least a first said procedure;
- (c) determining at least one relationship between said desired data and said first procedure; and
- (d) generating feedback data representative of said at least one relationship.

Typically, in the said prosthodontic procedure, dental material has been previously removed from said part of the intra-oral cavity by means of a second procedure.

Optionally, step (c) comprises testing an adequacy of said desired data for performing said first procedure according to at least one predetermined parameter, and step (d) comprises generating feedback data representative of said adequacy.” EX1006, ¶¶[0051]-[0054] (emphasis added) (EX1008, 39:2-20 (Claims 1-4)). EX1004, ¶58.

As noted above in Section V.B, the inaccurate scan data visualization feature of the challenged independent claims was the reason for allowance. Here, the '257 Patent explains its understanding of the claimed visualization of inaccurate scan data as:

“Visualization of scan quality may also, or instead, be augmented by explicit indicators, such as coloring, shading, surface texturing, or any of the other visual cues described above, which may visually identify regions of incomplete scan data, inaccurate scan data, insufficient scan detail (such as where a restoration will be affixed) and the like.” EX1001, 13:34-44. EX1004, ¶59.

Kopelman provides precisely the same inaccurate scan data visualization feature:

“Thus, in step 13’ the processor 52 determines whether data is missing, or whether the accuracy of the data of the numerical entity is insufficient.

In step 14’, feedback data is generated to alert the user as to how to correct for the insufficiency of definition.... This information may be provided by display 54, for example by providing a graphical image of the entity, with the deficient areas marked hereon, and then arrows or markers with respect thereto showing the desired position of the scanner 31.” EX1006, ¶¶[0167]-[0168] (emphasis added) (EX1008, 35:23-36:2). EX1004, ¶60.

- a. **[1.1]: acquiring two dimensional data from one or more intraoral structures of a dental patient at a video rate;**

Kopelman is directed to the evaluation of a “numerical entity” of intraoral structures, which is defined as a virtual model (i.e. a three-dimensional / digital surface representation):

“Feedback data useful in prosthodontic procedures associated with the intra oral cavity is provided. First, a 3D numerical model of the target zone in the intra oral cavity is provided, and this is manipulated so as to extract particular data that may be useful in a particular procedure, for example data relating to the finish line or to the shape and size of a preparation.” EX1006, Abstract (EX1008, 3:14-4:17).

“The term ‘numerical entity’ is used herein synonymously with virtual model and other such terms, and relates to a virtual representation of a real object, typically a dentition or at least a part of intraoral cavity, or of a real model thereof, for example.” EX1006, ¶[0011] (EX1008, 3:10-13); *see also* ¶[0082] (discussing numerical entity and stating “the said numerical entity is typically at least ‘three-dimensional’”) (EX1008, 11:22-12:2). EX1004, ¶63.

Kopelman explains its three-dimensional / digital surface representation is acquired by a 3D scanner:

“Any suitable means may be used to provide the numerical entity. FIG. 2 illustrates the main elements of the system 50 according to the present invention, comprising a suitable scanner 31, a microprocessor or computer 52, and a display means 54. According to the invention, digitised three-dimensional (3D) information W (FIG. 3) of the patient's intra-oral cavity, or part thereof, is created by the system 50 using scanner 31. Preferably, the 3D digitized data of the intraoral cavity is obtained, including the dentition and associated anatomical structures of a patient.”

EX1006, ¶[0083] (EX1008, 12:4-11). EX1004, ¶64.

Kopelman explains that confocal scanners are among those applicable to its disclosure, which a POSITA would have appreciated functions by acquiring two dimensional data which is then used to generate a three-dimensional / digital surface representation:

“The scanning means 31 may include, for example, a hand-held scanner that is used by the practitioner or other user to acquire the 3D data. Advantageously, a probe for determining three dimensional structure by confocal focusing of an array of light beams may be used, for example as manufactured under the name of **PROSTHOCAD** or as disclosed in **WO 00/08415**, the

contents of which are incorporated herein in their entirety.” EX1006, ¶[0083] (emphasis added) (EX1008, 12:11-16); ¶[0094] (EX1008, 15:12-15); *see also* WO 00/08415 (EX1012) (incorporated by reference in Kopelman at ¶[0083] (EX1008, 12:11-16)) at 3:3-22 (discussing general function of confocal 3D scanners). EX1004, ¶65.

Kopelman also explains that the display of its scanned “numerical entity” as a digital surface representation is in real time:

“According to the first and second aspects of the invention, the entity obtained by scanning via scanner 31 is displayed in real time via display 54, and when the scanning is complete and acceptable, feedback data is provided alerting the user to this fact.” EX1006, ¶[0173] (EX1008, 37:1-4); *See also* ¶[0081] (discussing real time display) (EX1008, 11:20-21); ¶[0160] (same) (EX1008, 33:12-13). EX1004, ¶66.

Concerning “video” and “video rate,” the ’257 Patent explains that its disclosure and claims cover a wide variety of images displayed in sequence (i.e. frames) as videos at a wide variety of rates. And, in particular that imaging equipment employs a rate adapted to the computation demands of the particular imaging technique employed:

“It will also be understood that terms such as ‘video’ or ‘video rate’ imply a wide range of possible frame rates associated with such video. While most modern video formats employ a frame rate of 25 to 30 frames per second, early video employed frame rates as low as 8 frames per second, and movies of the early 1900's varied from 12 to 18 frames per second. **In addition, it is common for specialized imaging equipment to employ a rate adapted to the computational demands of particular imaging and rendering techniques**, and some video systems operate with frame rates anywhere from 4 frames per second (for computationally extensive imaging systems) to 100 frames per second or higher (for high-speed video systems). **As used herein, the terms video rate and frame rate should be interpreted broadly.** Notwithstanding this broad meaning, it is noted that useful and visually pleasing three-dimensional imaging systems have been constructed according to the foregoing with frame rates of at least ten frames per second, frame rates of at least twenty frames per second, and frame rates between 25 and 30 frames per second.” EX1001, 6:53-7:5 (emphasis added). EX1004, ¶67.

Here, Kopelman does not explicitly disclose that its acquisition and real time display is in the form of “video” at a “video rate.” However, it would have been obvious to a POSITA in view of Kopelman’s disclosure alone to implement

Kopelman's system such that the acquisition of two dimensional data while scanning target intraoral structures would have been acquired at a video rate, and that the display of Kopelman's digital surface representation would be consistent with that data acquisition video rate in order to achieve Kopelman's disclosed real time display so that the "real time" display would continue uninterrupted. EX1004, ¶¶68-69.

A POSITA would have recognized the selection of a consistent acquisition and display video rate was simply a matter of design choice. *In re Kuhle*, 526 F.2d 553 (CCPA 1975) ("Use of such a means of electrical connection in lieu of those used in the references solves no stated problem and would be an obvious matter of design choice within the skill of the art."). And, selection of video rate that is consistent for both acquisition and display would have been one of a finite number of predictable solutions, and one known solution available to a POSITA at that time to achieve real-time acquisition and display. *Perfect Web Tech., Inc. v. InfoUSA, Inc.*, 587 F.3d 1324, 1328 (Fed. Cir. 2009) ("Common sense has long been recognized to inform the analysis of obviousness if explained with sufficient reasoning."). That is, if the rates themselves are selected to be consistent, a POSITA would have recognized less computation would have been necessary to coordinate the acquisition rate with Kopelman's display rate; as compared to inconsistent rates that would have required additional computation and processing to allow for an

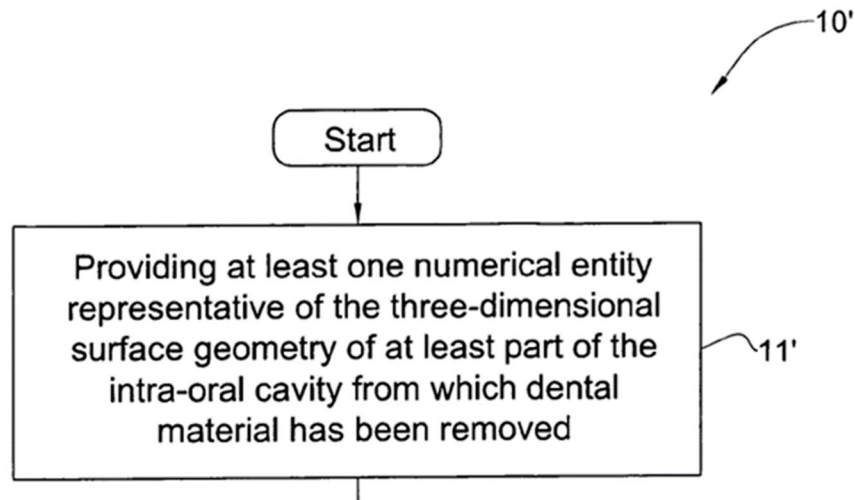
uninterrupted display of the acquired image data. The '257 patent itself recognizes that “it [was] common for specialized imaging equipment to employ a rate adapted to the *computational demands* of particular imaging and rendering techniques.” EX1001, 6:53-7:5 (emphasis added). EX1004, ¶70.

Thus, Kopelman’s disclosure meets the recited “video rate” in this feature as this step relates to that acquisition. EX1004, ¶71.

b. [1.2]: reconstructing a digital surface representation of the one or more intraoral structures;

Kopelman explains that its process of intraoral structure scanning involves reconstructing a “numerical entity” as a digital surface representation of the scanned one or more intraoral structures:

“Thus in step 11’, scanner 32 of system 50 (FIG. 2) scans the area of interest of the intraoral cavity and a numerical entity corresponding to the surface scanned is created by processor 52 and optionally displayed by display 54.” EX1006, ¶[0162] (EX1008, 33:18-20); *see also* ¶[0083] (“According to the invention, digitised three-dimensional (3D) information W (FIG. 3) of the patient's intra-oral cavity, or part thereof, is created by the system 50 using scanner 31.”) (EX1008, 12:7-9).



EX1006, Figure 12 (portion) (EX1008, Figure 12 at Sheet 8/8).

EX1004, ¶¶74-75.

Kopleman discloses its digital surface representation may be obtained through multiple scans resulting in multiple “sub-entities” that are ultimately stitched together to form the overall digital surface representation of the target scanned intraoral structure(s):

“The numerical entity may be obtained in a single scan, or alternatively, the numerical entity is originally created by taking multiple scans of the target area, and stitching the numerical entities thus obtained together.” EX1006, ¶[0163] (EX1008, 33:28-30).

“When multiple scan [sic] are employed, then, in step 11’, the scanner 31 may be used for obtaining high resolution numerical sub-entities representative of the surface

topography within the intra-oral cavity...Nevertheless, by identifying the overlap zone within the entities, the spatial relationship between the entities may be established, and the various entities stitched together or combined to form **a global numerical entity** that comprises the full geometry and color representation of the target zone.” EX1006, ¶[0164] (emphasis added) (EX1008, 34:5-19). EX1004, ¶76.

The multiple scan aspect of Kopelman’s disclosure is more specifically relevant for Elements [1.4]-[1.7], and is introduced here to lay a foundation for Kopelman’s multiple “sub-entities” scanning workflow. EX1004, ¶77.

c. [1.3]: displaying the digital surface representation at the video rate;

Kopelman explains that the display of its scanned “numerical entity” as a digital surface representation is displayed in real time. *See* EX1006, ¶[0173] (EX1008, 37:1-4); *see also* ¶[0081] (discussing real time display) (EX1008, 11:20-21); ¶[0160] (same) (EX1008, 33:12-13). EX1004, ¶80.

As noted above with respect to Element [1.1], Kopelman does not explicitly disclose that its acquisition and real time display is in the form of “video” at a “video rate.” However, it would have been obvious to a POSITA in view of Kopelman’s disclosure alone to implement Kopelman’s system to achieve its “numerical entity” real time display by displaying that “numerical entity” at a video rate consistent with

the video rate of two-dimensional data acquisition during scanning, as also noted above with respect to Element [1.1]. EX1004, ¶¶81-82.

Thus, Kopelman's disclosure relating to real time display is at the "video rate" recited in this feature because it would have been obvious to a POSITA to implement Kopelman's real time display to be coordinated through a common video rate with its two dimensional scanner data acquisition to achieve its disclosed function of "real time" display so that the "real time" display would be uninterrupted. EX1004, ¶83.

d. [1.4]: acquiring additional two-dimensional data from the one or more intraoral structures in a subsequent frame of data at the video rate;

As discussed above with respect to Element [1.2], Kopelman explains that its "numerical entity" acquisition may be obtained through multiple scans (which are stitched together). *See* EX1006, ¶[0163] (EX1008, 33:28-30) and EX1006, ¶[0164] (EX1008, 34:5-7). EX1004, ¶86.

As noted above with respect to Element [1.1], Kopelman does not explicitly disclose that its acquisition and real time display is in the form of "video" at a "video rate." However, it would have been obvious to a POSITA that as Kopelman's overall multiple "sub-entity" scanning process proceeds, additional two dimensional data would be acquired at the same video rate as the data acquired for a preceding "sub-entit[y] representative of the surface topography within the intra-oral cavity" (*i.e.*, the portion scanned as discussed above with reference to Elements [1.1] and [1.2]).

This is because any such scanner would be configured to scan at a constant video rate in this respect, and also to support the obvious implementation of a consistent video rate for Kopelman's disclosed real time display of its "numerical entity" as a digital surface representation (as discussed above with respect to Element [1.3]). EX1004, ¶¶87-88.

Thus, Kopelman's subsequent two-dimensional data acquisition disclosure meets the "video rate" recited in this feature as this step relates to subsequent acquisition and the additional two-dimensional data would be acquired at the same video rate as the data acquired for a preceding "sub-entit[y]." EX1004, ¶89.

e. [1.5]: reconstructing a subsequent digital surface representation from the additional two-dimensional data at the video rate

In view of Kopelman's disclosure of "numerical entity" acquisition through multiple "sub-entities"⁴, and its disclosure of real time display of the same⁵, it would have been obvious to a POSITA that the disclosed stitching process as between "sub-entities representative of the surface topography within the intra-oral cavity" would be at the same video rate as acquisition and previous display. EX1004, ¶92.

⁴ EX1006, ¶[0163] (EX1008, 33:28-30).

⁵ EX1006, ¶[0173] (EX1008, 37:1-4); *See also* ¶[0081] (discussing real time display) (EX1008, 11:20-21); ¶[0160] (same) (EX1008, 33:12-13).

Thus, Kopelman’s disclosure relating to real time display and corresponding subsequent digital surface representation reconstruction meets the “video rate” recited in this feature because it would have been obvious to a POSITA to implement Kopelman’s real time display to be coordinated through a common video rate with its two-dimensional scanner data acquisition to achieve its disclosed function of “real time” display so that the “real time” display would be uninterrupted. EX1004, ¶93.

- f. **[1.6]: combining the digital surface representation and the subsequent digital surface representation at the video rate to provide a three-dimensional representation of the one or more intraoral structures;**

Similarly in view of Kopelman’s disclosure of “numerical entity” acquisition through multiple “sub-entities”⁶, and its disclosure of real time display of the same⁷, it would have been obvious to a POSITA that Kopelman’s digital surface representation (from Element [1.2]) and subsequent digital surface representation (from Element [1.5]) are stitched together into a more complete “numerical entity” at the same video rate as acquisition and previous display. That more complete

⁶ EX1006, ¶[0163] (EX1008, 33:28-30).

⁷ See FN5 for citations.

“numerical entity” as scanning progresses would be the claimed “three-dimensional representation of the one or more intraoral structures.” EX1004, ¶96.

Thus, Kopelman’s disclosure relating to real time display and corresponding stitching together of the digital surface representation (from Element [1.2]) and subsequent digital surface representation (from Element [1.5]) meets the “video rate” recited in this feature because it would have been obvious to a POSITA to implement Kopelman’s real time display to be coordinated through a common video rate with its two-dimensional scanner data acquisition to achieve its disclosed function of “real time” display so that the “real time” display would be uninterrupted. EX1004, ¶97.

g. [1.7]: providing a visual display of the three-dimensional representation at the video rate in real time; and

Likewise in view of Kopelman’s disclosure of “numerical entity” acquisition through multiple “sub-entities”⁸, and its disclosure of real time display of the same⁹, it would have been obvious to a POSITA that the combined “numerical entity” as the claimed “three-dimensional representation of the one or more intraoral

⁸ EX1006, ¶[0163] (EX1008, 33:28-30).

⁹ See FN5 for citations.

structures” would have been displayed at the video rate in real time – again, as Kopelman expressly discloses:

“According to the first and second aspects of the invention, the entity obtained by scanning via scanner 31 is displayed in real time via display 54, and when the scanning is complete and acceptable, feedback data is provided alerting the user to this fact.” EX1006, ¶[0173] (EX1008, 37:1-4); *See also* ¶[0081] (discussing real time display) (EX1008, 11:20-21); ¶[0160] (same) (EX1008, 33:12-13). EX1004, ¶100.

Thus, Kopelman’s disclosure relating to real time display meets the “video rate” recited in this feature because it would have been obvious to a POSITA to implement Kopelman’s real time display to be coordinated through a common video rate with its two-dimensional scanner data acquisition to achieve its disclosed function of “real time” display so that the “real time” display would be uninterrupted. EX1004, ¶101.

- h. [1.8]: providing a visualization within the visual display, the visualization updated at the video rate to identify regions of inaccurate scan data within the three-dimensional representation.**

Kopelman discloses analyzing its scanned “numerical entity” as it is being scanned to identify areas of inaccurate scan data:

“Thus, in step 13’ the processor 52 determines whether data is missing, or whether the accuracy of the data of the numerical entity is insufficient.” EX1006, ¶[0167] (emphasis added) (EX1008, 35:22-24). EX1004, ¶104.

To support its scanning process, Kopelman’s system then provides a visualization within the visual display updated at the video rate to identify regions of inaccurate scan data within its “numerical entity” as the claimed three-dimensional representation:

“In step 14’, feedback data is generated to alert the user as to how to correct for the insufficiency of definition.... This information may be provided by display 54, for example by providing a graphical image of the entity, with the deficient areas marked hereon, and then arrows or markers with respect thereto showing the desired position of the scanner 31.” EX1006, ¶[0168] (EX1008, 35:25-36:2).¹⁰

¹⁰ See also EX1006, ¶[0038] (discussing incomplete definition and feedback concerning the same) (EX1008, 7:3-11); ¶[0163] (discussing analyzing scans for insufficient (*i.e.* inaccurate) data) (EX1008, 33:25-4); ¶[0165] (discussing analyzing scans for insufficient (*i.e.* inaccurate) data) (EX1008, 34:27-35:3); ¶[0166] (discussing analyzing scans for *quantitative* (*i.e.* inaccurate) level of data

“In this context, an image of the numerical entity may be displayed in the display 54, with the finish line 84 and optionally also the shoulder 85 highlighted thereon. Then, the zones of the finish line that require further work may be contrasted with respect to the finish line 84 and/or the shoulder 85, for example by coloring such zones in a different color to the rest of the image.” ¶[0115] (EX1008, 20:9-13). EX1004, ¶105.

Kopelman explains the purpose of such a visualization of inaccurate scan data is to signal to a user that further scanning is required:

“Of course, it may be that more than one scan is required to make up for the missing data, and the processor provides the required feedback data to deal with each scan.” EX1006, ¶[0168] (EX1008, 36:2-5).

“Furthermore, the processor may be programmed to alert the user when the entity is sufficiently well defined for the

available) (EX1008, 35:4-9); ¶[0169] (discussing scans lacking definition and resolution of the same) (EX1008, 36:6-15). Concerning additional visualization disclosure in Kopelman *see* EX1006, ¶¶[0112]-[0116] (EX1008, 19:27-20:20); ¶[0127] (EX1008, 23:15-22).

purpose for which it is needed. In such a case, the feedback data is designed to alert the user that the scan is complete, and may comprise a distinct visual or audio signal, similar but distinguishable from other audio/visual signals provided by display 54, as described herein, *mutatis mutandis*.” EX1006, ¶[0170] (EX1008, 36:16-21).¹¹ EX1004, ¶106.

And, Kopelman’s disclosure explains that all of this, including that the feedback, is provided in real time and a user is alerted when a scan is acceptable:

“Thus, in the second aspect of the invention, the feedback data may essentially be used to facilitate the acquisition of data that may be used to construct the numerical entity for subsequent use, for example according to the first aspect of the invention.

According to the first and second aspects of the invention, the entity obtained by scanning via scanner 31 is displayed **in real time via display 54**, and when the scanning is complete and acceptable, feedback data is provided

¹¹ See also EX1006, ¶¶[0171]-[0172] (discussing feedback to ensure adequacy of acquisition) (EX1008, 36:23-30); ¶[0044] (discussing advising a user to continue scanning until “definition is sufficient”) (EX1008, 44:12-14).

alerting the user to this fact.” EX1006, ¶¶[0172]-[0173]
(emphasis added) (EX1008, 36:27-37:4). EX1004, ¶107.

Including with reference to Figure 12 illustrating the process from acquisition through feedback generation:

“Preferably, steps 11’ to 14’ are carried out in a relatively short space of time, more preferably in **real time** or close thereto.” EX1006, ¶[0160] (emphasis added) (EX1008, 33:12-13).

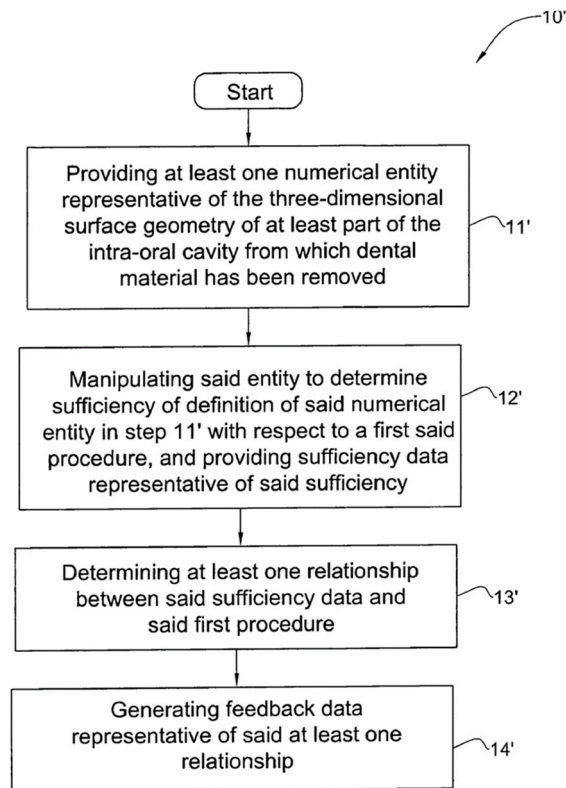


FIG. 12

EX1006, Figure 12 (portion) (EX1008, Figure 12 at Sheet 8/8).

EX1004, ¶¶108-109.

Thus, it would have been obvious to a POSITA that Kopelman's inaccurate scan data visualization would be provided at the video rate of the real time display which meets the "video rate" recited in this feature because it would have been obvious to a POSITA to implement Kopelman's real time display to be coordinated through a common video rate with its two dimensional scanner data acquisition to achieve its disclosed function of "real time" display so that the "real time" display would be uninterrupted. EX1004, ¶110.

Additionally, the foregoing disclosure from Kopelman concerning "inaccurate scan data" is consistent with the guidance from the Court in the Related Litigation which noted that "inaccurate scan data" "includes missing scan data, incomplete scan data, insufficient scan detail (such as where a restoration will be affixed) and the like." *See* EX1015, p. 2. EX1004, ¶111.

2. Claim 3: The method of claim 1 wherein the one or more intraoral structures include at least one tooth.

Kopelman's scanned intraoral structures include at least one tooth associated with a prosthodontic procedure. *See* EX1006, ¶[0155] ("The FIG. 12 illustrates a method 10' for providing feedback data useful in at least one prosthodontic procedure associated with the intra oral cavity, in accordance with a second aspect of the invention.") (EX1008, 32:25-27); ¶[0010] (definition of prosthodontic procedure involving "prosthesis") (EX1008, 3:5-9); ¶[0008] (definition of prosthesis

involving “preparation”) (EX1008, 2:24-26); ¶[0009] (definition of “preparation” meaning remaining portion of a tooth) (EX1008, 2:27-3:4). EX1004, ¶114.

3. Claim 4: The method of claim 1 wherein the one or more intraoral structures include at least one tooth surface prepared for a dental prosthetic.

See Claim 3, above. Kopelman’s scanned site preparations involve at least one tooth surface prepared for a dental prosthetic:

“While the term “preparation” typically refers to the stump (including the finish line and shoulder) that is left of the tooth that is to be replaced by the prosthesis—typically a crown—and on which the crown is to be mounted, the term herein also includes artificial stumps, pivots, cores and posts, or other devices that may be implanted in the intraoral cavity in such a position or in a position that is optimal for implanting the crown.” EX1006, ¶[0009] (EX1008, 2:27-3:4). EX1004, ¶117.

4. Claim 5: The method of claim 1 wherein the one or more intraoral structures include at least one area of soft tissue.

Kopelman discloses scanning soft tissues as part of its scanning process of one or more intraoral structures:

“Optionally, in step (a), said numerical entity further comprises color data of said part of the intra oral cavity, and step (b) comprises differentiating parts of said entity according to whether the said color associated therewith is

correlated with soft tissues or hard tissues of the intra oral cavity.” EX1006, ¶[0047] (EX1008, 44:19-23); *see* also ¶[0025] (“surrounding dental tissues”) (EX1008, 5:1-3); ¶[0105] (color data for soft tissue) (EX1008, 18:26-19:11); ¶[0164] (same) (EX1008, 34:5-26); Claim 44 (same) (EX1008, 44:21-13). EX1004, ¶120.

5. Claim 6 (Preamble): The method of claim 1 further comprising:

a. [6.1] generating user feedback concerning the one or more intraoral structures; and

As discussed above with respect to Element [1.8], Kopelman generates user feedback concerning the scanning of one or more intraoral structures to identify regions of inaccurate scan data in its “numerical entity” as the claimed “three-dimensional representation.” EX1004, ¶124.

b. [6.2] providing a visual display of the user feedback at the video rate.

As discussed above with respect to Element [1.8], it would have been obvious to a POSITA that Kopelman provides a visual display of its user feedback relating to inaccurate scan data in real time at the video rate in various forms, including “by providing a graphical image of the entity, with the deficient areas marked hereon,

and then arrows or markers with respect thereto showing the desired position of the scanner 31.” EX1006, ¶[0168] (EX1008, 35:30-36:2).¹² EX1004, ¶127.

6. Claim 7: The method of claim 6 wherein generating user feedback includes highlighting at least one area in the three-dimensional representation requiring user attention.

As discussed directly above with respect to Element [1.8], Kopelman’s visual user feedback relating to inaccuracy includes “feedback data [that] is generated to alert the user as to how to correct for the insufficiency of definition...[by] providing a graphical image of the entity, with the deficient areas marked hereon, and then arrows or markers with respect thereto showing the desired position of the scanner 31” (EX1006, ¶[0168] (EX1008, 35:25-36:2)) as “highlighting.” Kopelman also specifically uses the term “highlighting” with respect to its visual user feedback options: “In this context, an image of the numerical entity may be displayed in the display 54, with the finish line 84 and optionally also the shoulder 85 highlighted thereon. Then, the zones of the finish line that require further work may be contrasted with respect to the finish line 84 and/or the shoulder 85, for example by coloring such zones in a different color to the rest of the image.” ¶[0115] (emphasis added) (EX1008, 20:9-13). EX1004, ¶130.

¹² See also FN10 listing further visual feedback disclosure of Kopelman.

7. Claim 8: The method of claim 1 wherein the video rate includes a rate of at least eight frames per second.

It would have been obvious to a POSITA that Kopelman's common acquisition and display video rate of its "numerical entity" would have been at a rate of *at least* eight frames per second (as a lower bound) to provide a useable visual interface. A POSITA would have recognized this as a simple matter of design choice, dictated by visual aesthetics of the displaying frame rate as balanced by computation complexity of achieving such a frame rate. *In re Kuhle*, 526 F.2d 553 (CCPA 1975). The '257 Patent itself recognizes such video rates were known in the prior art and does not indicate selection of the video rate is a critical aspect of its alleged invention. *See* EX1001, 6:53-7:5. EX1004, ¶¶133-134.

8. Claim 9: The method of claim 1 wherein the video rate includes a rate of at least twenty frames per second.

See Claim 8, above. Selection of a video rate of at least twenty frames per second by a POSITA would have been a design choice driven by the factors noted above. EX1004, ¶138.

9. Claim 10: The method of claim 1 wherein the video rate includes a rate of between twenty-four and thirty frames per second.

See Claim 8, above. Selection of a video rate of between twenty-four and thirty frames per second by a POSITA would have been a design choice driven by the factors noted above. EX1004, ¶141.

10. Claim 11 (Preamble): A computer program product embodied on a non-transitory computer readable medium that, when executing on one or more computing devices, performs the steps of:

Kopelman's method is computer implemented, which a POSITA would have appreciated includes a non-transitory computer readable medium within computer 52 with instructions that when executed perform the method of Claim 11. *See* Figure 2 and associated disclosure at EX1006, ¶[0083] (EX1008, 12:4-16). EX1004, ¶144.

- a. [11.1]: acquiring two dimensional data from one or more intraoral structures of a dental patient at a video rate;**

See Element [1.1] addressing identical method language.

- b. [11.2]: reconstructing a digital surface representation of the one or more intraoral structures;**

See Element [1.2] addressing identical method language.

- c. [11.3]: displaying the digital Surface representation at the video rate;**

See Element [1.3] addressing identical method language.

- d. [11.4]: acquiring additional two-dimensional data from the one or more intraoral structures in a subsequent frame of data at the video rate;**

See Element [1.4] addressing identical method language.

- e. [11.5]: reconstructing a subsequent digital surface representation from the additional two-dimensional data at the video rate**

See Element [1.5] addressing identical method language.

- f. **[11.6]: combining the digital surface representation and the subsequent digital surface representation at the video rate to provide a three-dimensional representation of the one or more intraoral structures;**

See Element [1.6] addressing identical method language.

- g. **[11.7]: providing a visual display of the three-dimensional representation at the video rate in real time; and**

See Element [1.7] addressing identical method language.

- h. **[11.8] providing a visualization within the visual display, the visualization updated at the video rate to identify regions of inaccurate scan data within the three-dimensional representation.**

See Element [1.8] addressing identical method language.

- 11. **Claim 13: The computer program product of claim 11 wherein the one or more intraoral structures include at least one tooth.**

See Claim 3 addressing identical method language.

- 12. **Claim 14: The computer program product of claim 11 wherein the one or more intraoral structures include at least one tooth surface prepared for a dental prosthetic.**

See Claim 4 addressing identical method language.

- 13. **Claim 15: The computer program product of claim 11 wherein the one or more intraoral structures include at least one area of soft tissue.**

See Claim 5 addressing identical method language.

- 14. **Claim 16: The computer program product of claim 11 further comprising code for performing the steps of**

generating user feedback concerning the one or more intraoral structures; and providing a visual display of the user feedback at the video rate.

See Claim 6 addressing identical method language.

- 15. Claim 17: The computer program product of claim 16 wherein generating user feedback includes highlighting at least one area in the three-dimensional representation requiring user attention.**

See Claim 7 addressing identical method language.

- 16. Claim 18 (Preamble): A system comprising:**

Kopelman's method is disclosed in the context of a computer implemented system. *See* Figure 2 and associated disclosure at EX1006, ¶[0083] (EX1008, 12:4-16). EX1004, ¶173.

- a. [18.1]: a scanner for acquiring a sequence of image sets from one or more intraoral structures of a dental patient at a video rate; and**

Kopelman's method and system includes a scanner 31. *See* Figure 2 and associated disclosure at EX1006, ¶[0083] (EX1008, 12:4-16). Element [1.1]'s discussion above concerning the configuration and function of Kopelman's disclosed scanner is equally applicable to the nearly identical claim language of this element and is incorporated here. EX1004, ¶¶176-177.

- b. [18.2]: a processor configured to:**

Kopelman's method and system is computer implemented, and its method is carried out and executed by the disclosed computer and a processor thereon. *See e.g.*,

EX1006, ¶[0083] (“FIG. 2 illustrates the main elements of the system 50 according to the present invention, comprising a suitable scanner 31, a microprocessor or computer 52, and a display means 54.”) (EX1008, 12:4-16). EX1004, ¶180.

i. [18.2.1]: receive one of the sequence of image sets,

Kopelman’s processor is configured to receive one of the sequence of image sets before creation of the “numerical entity” as a three-dimensional surface representation. EX1006, ¶[0162] (“Thus in step 11’, scanner 32 [sic] of system 50 (FIG. 2) scans the area of interest of the intraoral cavity and a numerical entity corresponding to the surface scanned is created by processor 52 and optionally displayed by display 54.”) (EX1008, 33:18-20). This element is equivalent to Element [1.4] above, which refers to acquiring additional two dimensional data during Kopelman’s multiple “sub-entity” scanning process and is incorporated here. EX1004, ¶¶182-183.

ii. [18.2.2] convert the one of the sequence of image sets into a three-dimensional surface representation of the one or more intraoral structures,

Kopelman’s processor is configured to convert the received one of the sequence of image sets into a “numerical entity” as a three-dimensional surface representation of the one or more intraoral structures that are being scanned. This element is equivalent to Element [1.5] above, which refers to reconstructing a

subsequent digital surface representation during Kopelman's multiple "sub-entity" scanning process and is incorporated here. EX1004, ¶¶184-185.

iii. [18.2.3] combine the three-dimensional surface representation with one or more prior three-dimensional surface representations from one or more prior ones of the sequence of image sets to provide a three-dimensional model of the one or more intraoral structures, and

Kopelman's processor is configured to combine the three-dimensional surface representation (from element [18.2.2]) with one or more prior three-dimensional surface representations from one or more prior ones of the sequence of image sets to provide a three-dimensional model of the one or more intraoral structures. This element is equivalent to Element [1.1] (*prior* acquisition of two dimensional data), Element [1.2] (reconstructing a *prior* digital surface representation), and Element [1.6] (combining digital surface representations together to form a more complete "numerical entity") during Kopelman's multiple "sub-entity" scanning process and are incorporated here. EX1004, ¶¶186-187.

iv. [18.2.4] generate a visual display signal of the three-dimensional model at the video rate in real time,

Kopelman's processor is configured to generate a visual display signal of the three-dimensional model at the video rate in real time. This element is equivalent to Element [1.7] above, which refers to Kopelman's real time display of its "numerical entity" as a three-dimensional model and is incorporated here. EX1004, ¶¶188-189.

- v. [18.2.5] generate a visualization within the visual display signal, the visualization updated at the video rate to identify regions of inaccurate scan data within the three-dimensional representation;**

Kopelman's processor is configured to generate a visualization within the visual display signal, the visualization updated at the video rate to identify regions of inaccurate scan data within the three-dimensional representation. This element is equivalent to Element [1.8] above, which refers to Kopelman's real time display of its "numerical entity" as a three-dimensional model along with an inaccurate data visualization and is incorporated here. EX1004, ¶¶190-192.

- c. [18.3] and a display for displaying the visual display signal.**

Kopelman's system includes a display means 54. *See* Figure 2 and accompanying disclosure at ¶[0083] (EX1008, 12:4-16), and Claim 54 (EX1008, 46:8-9). EX1004, ¶194.

- 17. Claim 20: The system of claim 18 wherein the one or more intraoral structures include at least one of a tooth surface prepared for a dental prosthetic, an area of soft tissue, and a tooth.**

See Claims 3-5 addressing tooth surface (claim 4), soft tissue (claim 5), and tooth (claim 3), but in method form.

- 18. Claim 21: The system of claim 18 wherein the processor generates user feedback concerning the one or more intraoral structures and includes the user feedback in the**

visual display signal at the video rate.

See Claim 6 addressing similar language, but in method form.

19. Claim 22: The system of claim 21 wherein the user feedback includes highlighting at least one area in the three-dimensional Representation requiring user attention.

See Claim 7 addressing similar language, but in method form.

B. Claims 1, 3-11, 13-18, and 20-22 Would Have Been Obvious Over Kopelman in View of Quadling (Ground 2).

The following sections explain where each element of Claims 1, 2 and 15-20 is found in the prior art of Kopelman in view of Quadling.

1. Claim 1 (Preamble): A method comprising:

As discussed above in Ground 1, Kopelman alone discloses or renders obvious all of the limitations of Claim 1, and particularly the inaccurate scan data visualization feature that lead to allowance of the '257 Patent claims. EX1004, ¶203.

However, as also recognized above in Ground 1, Kopelman does not provide an explicit discussion concerning acquisition of two dimensional data at *a video rate* and corresponding reconstruction and display of three-dimensional models at that *video rate*. This Ground 2 is presented as an alternative to address those specific aspects of the claims in view of Quadling. EX1004, ¶204.

a. [1.1]: acquiring two dimensional data from one or more intraoral structures of a dental patient at a video rate;

As discussed above in Ground 1, Kopelman provides a disclosure of acquisition of two dimensional data of intraoral structures for digital surface representation reconstruction, and is incorporated here. And, beyond the scanner expressly discussed in Kopelman, the reference also indicates any scanner is suitable:

“Any suitable means may be used to provide the numerical entity. FIG. 2 illustrates the main elements of the system 50 according to the present invention, comprising a suitable scanner 31, a microprocessor or computer 52, and a display means 54. According to the invention, digitised three-dimensional (3D) information W (FIG. 3) of the patient's intra-oral cavity, or part thereof, is created by the system 50 using scanner 31. Preferably, the 3D digitized data of the intraoral cavity is obtained, including the dentition and associated anatomical structures of a patient. The scanning means 31 may include, for example, a hand-held scanner that is used by the practitioner or other user to acquire the 3D data.” EX1006, ¶[0083] (EX1008, 12:4-12).

“Alternatively, the 3D digitized data may be obtained in any other suitable manner, including other suitable intra oral scanning techniques, based on optical methods, direct

contact or any other means, applied directly to the patient's dentition.” EX1006, ¶[0091] (EX1008, 14:14-17). EX1004, ¶206.

Quadling discloses such a scanner. *See* EX1007, Abstract (“A intra-oral laser digitizer system provides a three-dimensional visual image of a real-world object such as a dental item through a laser digitization.”). Quadling explains that its scanner acquires a sequence of images that are stored in memory and from which a three-dimensional model is created with a processor. EX1007, ¶[0012] (“Multiple images of the object may be recorded and processed by the computer to produce a 3D map of the object.”); *see also* Figure 1 and ¶[0067] (illustrating and discussing Quadling’s computer and image processor). EX1004, ¶¶207-208.

Quadling’s plurality of images also include *video* images acquired using a *video* camera as its image sensor, which are acquired at a “video rate” by that video camera sensor:

“The image sensor 111 captures an image of the scanned surface of the object 108. The image sensor 111 may be a photo-sensitive or light sensitive device or electronic circuit capable of generating signal representative of intensity of a light detected. The image sensor 111 may include an array of photodetectors. The array of photodetectors may be a charge coupled device (“CCD”) or a CMOS imaging device, or other array of light

sensitive sensors capable of generating an electronic signal representative of a detected intensity of the light. The image sensor 111 **may comprise a commercially available CCD or CMOS high resolution video camera** having imaging optics, with exposure, gain and shutter control, such as the Silicon Imaging USB Camera SI-1280F-U.” EX1007, ¶[0059] (emphasis added). EX1004, ¶209.

Also, and significant for further limitations, Quadling also discloses its acquisition, reconstruction, and display of three-dimensional surface representations of intraoral structures occurs in real time for the purpose of ensuring adequate capture. Just like Kopelman, Quadling states:

“Multiple images of the object may be recorded and processed by the computer to produce a 3D map of the object. The multiple images can be captured from multiple positions and orientations with respect to the object. The individual images are merged to create an overall 3D map of the object. The images may be captured and processed **to provide a *real time* image of the surface of the object.** **The real time image may provide an instant feedback mechanism to an operator of the system. The digitizer system may include software that displays the overall 3D image captured in *real time*.** The software also may include feedback and identification provided to the

operator of suggested viewpoints to complete the overall 3D image. The software also may identify crucial features in the scanned data set during a data acquisition process. These features include margins and neighboring dentition. This software also may display highlighted features or possible problem areas, as the operator captures additional viewpoints.” EX1007, ¶[0012] (emphasis added). EX1004, ¶210.

b. [1.2]: reconstructing a digital surface representation of the one or more intraoral structures;

See Ground 1, Element [1.2], concerning Kopelman’s “numerical entity” reconstruction, and also Kopelman’s incremental “sub-entity” based scanning approach and stitching method. Quadling’s scanner, similar to the scanner used with Kopelman, uses an incremental scanning approach; and a POSITA would have appreciated Quadling’s scanner disclosure is directly applicable to Kopelman’s incremental “sub-entity” scanning approach. See e.g., EX1007, ¶[0012] (quoted directly above). EX1004, ¶212.

c. [1.3]: displaying the digital surface representation at the video rate;

Kopelman explains that the display of its scanned “numerical entity” as a digital surface representation is displayed in real time. See EX1006, ¶[0173] (EX1008, 37:1-4); See also ¶[0081] (discussing real time display) (11:20-21); ¶[0160] (same) (EX1008, 33:12-13). Same with Quadling. See ¶[0012]. As noted

above with respect to Elements [1.2] and [1.3] in Ground 1, it would have been obvious to a POSITA to implement Kopelman's real time display to be coordinated through a common video rate with its two dimensional scanner data acquisition to achieve its disclosed function of "real time" display so that the "real time" display would be uninterrupted. EX1004, ¶214.

As explained above with respect to Element [1.1], Quadling discloses its two-dimensional data acquisition is with a video camera as its image sensor at a video rate. Quadling as the scanner used with Kopelman's disclosure directly facilitates a POSITA's obvious implementation of Kopelman to achieve its real time display through a common video rate with its two dimensional scanner data acquisition. This is so because Quadling is expressly capturing video by way of its video sensor at a video rate, and in order to achieve Kopelman's disclosed "real time" display, it would have been obvious to a POSITA to specially choose a corresponding display video rate that was coordinated with the acquisition video rate so the system was useable, and the "real time" display would continue uninterrupted. EX1004, ¶¶214-216.

d. [1.4]: acquiring additional two-dimensional data from the one or more intraoral structures in a subsequent frame of data at the video rate;

As discussed above with respect to Element [1.2] (in this Ground), Kopelman explains that its "numerical entity" acquisition may be obtained through multiple

scans (which are stitched together). *See* EX1006, ¶[0164] (EX1008, 34:5-7). And, Quadling – as the scanner used with Kopelman’s disclosure – uses the same incremental scanning approach, while also using a video camera as its image sensor. *See* EX1007, ¶[0012], ¶[0059]. EX1004, ¶¶218-219.

As such, a POSITA would have appreciated that as Kopelman’s overall multiple “sub-entity” scanning process (using Quadling’s scanner) would have proceeded to acquire additional two-dimensional data at the same video rate as the data acquired for a preceding “sub-entit[y] representative of the surface topography within the intra-oral cavity” (*i.e.*, the portion scanned as discussed above with reference to Elements [1.1] and [1.2]). This is because any such scanner would be configured to scan at a constant video rate in this respect, and also to support the obvious implementation of a consistent video rate for Kopelman’s disclosed real time display of its “numerical entity” as a digital surface representation. EX1004, ¶220.

Thus, Kopelman’s subsequent two dimensional data acquisition disclosure (using Quadling as its scanner) meets the “video rate” recited in this feature as this step relates to acquisition and the additional two dimensional data would be acquired at the same video rate as the data acquired for a preceding “sub-entit[y].” EX1004, ¶221.

e. [1.5]: reconstructing a subsequent digital surface representation from the additional two-dimensional data at the video rate

In view of Kopelman’s disclosure of “numerical entity” acquisition through multiple “sub-entities”¹³, its disclosure of real time display of the same¹⁴, and Quadling’s disclosure of the same incremental scanning with real time display using a video camera as its video sensor¹⁵, a POSITA would have appreciated that Kopelman’s disclosed stitching process as between “sub-entities representative of the surface topography within the intra-oral cavity” would be at the same video rate as acquisition and previous display when using Quadling’s disclosed scanner for its system. EX1004, ¶223.

Thus, Kopelman’s disclosure relating to real time display and corresponding subsequent digital surface representation reconstruction – when used with Quadling’s scanning disclosure – meets the “video rate” recited in this feature. This is so because Quadling is expressly capturing video by way of its video sensor at a video rate, and in order to achieve Kopelman’s disclosed “real time” display, it

¹³ EX1006, ¶[0163] (EX1008, 33:28-30).

¹⁴ EX1006, ¶[0173] (EX1008, 37:1-4); *See also* ¶[0081] (discussing real time display) (EX1008, 11:20-21); ¶[0160] (same) (EX1008, 33:12-13).

¹⁵ EX1007, ¶[0012]; ¶[0059].

would have been obvious to a POSITA to specifically choose a corresponding display video rate (for a reconstructed subsequent digital surface representation) that was coordinated with the acquisition video rate so the system was useable, and the “real time” display would continue uninterrupted. EX1004, ¶224.

f. [1.6]: combining the digital surface representation and the subsequent digital surface representation at the video rate to provide a three-dimensional representation of the one or more intraoral structures;

Similarly in view of Kopelman’s disclosure of “numerical entity” acquisition through multiple “sub-entities”¹⁶, its disclosure of real time display of the same¹⁷, and Quadling’s disclosure of the same incremental scanning with real time display using a video camera as its video sensor¹⁸, a POSITA would have appreciated that Kopelman’s digital surface representation (from Element [1.2]) and subsequent digital surface representation (from Element [1.5]) are stitched together into a more complete “numerical entity” at the same video rate as acquisition and previous display. That more complete “numerical entity” as scanning progresses would be the

¹⁶ EX1006, ¶[0163] (EX1008, 33:28-30).

¹⁷ See FN14 for citations.

¹⁸ EX1007, ¶[0012]; ¶[0059].

claimed “three-dimensional representation of the one or more intraoral structures.” EX1004, ¶226.

Thus, Kopelman’s disclosure relating to real time display and corresponding stitching together of the digital surface representation (from Element [1.2]) and subsequent digital surface representation (from Element [1.5]) – when used with Quadling’s scanning disclosure – meets the “video rate” recited in this feature. This is so because Quadling is expressly capturing video by way of its video sensor at a video rate, and in order to achieve Kopelman’s disclosed “real time” display, it would have been obvious to a POSITA to specifically choose a corresponding display video rate (for a combined digital surface representation) that was coordinated with the acquisition video rate so the system was useable, and the “real time” display would continue uninterrupted. EX1004, ¶227.

g. [1.7]: providing a visual display of the three-dimensional representation at the video rate in real time; and

Likewise in view of Kopelman’s disclosure of “numerical entity” acquisition through multiple “sub-entities”¹⁹, its disclosure of real time display of the same²⁰, along with Quadling’s disclosure of the same incremental scanning with real time

¹⁹ EX1006, ¶[0163] (EX1008, 33:28-30).

²⁰ See FN14 for citations.

display using a video camera as its video sensor²¹, Kopelman’s combined “numerical entity” as the claimed “three-dimensional representation of the one or more intraoral structures” would have been displayed at the video rate in real time – again, as both Kopelman and Quadling expressly disclose:

“According to the first and second aspects of the invention, the entity obtained by scanning via scanner 31 is displayed in real time via display 54, and when the scanning is complete and acceptable, feedback data is provided alerting the user to this fact.” EX1006, ¶[0173] (EX1008, 37:1-4); *see also* ¶[0081] (discussing real time display) (EX1008, 11:20-21); ¶[0160] (same) (EX1008, 33:12-13).

“The images may be captured and processed to provide a **real time** image of the surface of the object. The real time image may provide an instant feedback mechanism to an operator of the system. The digitizer system may include software that displays the overall 3D image captured in **real time**.” EX1007, ¶[0012] (emphasis added). EX1004, ¶229.

Thus, Kopelman’s disclosure relating to real time display – when used with Quadling’s scanning disclosure which expressly relies on a video camera as its

²¹ EX1007, ¶[0012]; ¶[0059].

image sensor – meets the “video rate” recited in this feature. This is so because Quadling is expressly capturing video by way of its video sensor at a video rate, and in order to achieve Kopelman’s disclosed “real time” display, it would have been obvious to a POSITA to specifically choose a corresponding display video rate (for a combined digital surface representation) that was coordinated with the acquisition video rate so the system was useable, and the “real time” display would continue uninterrupted. EX1004, ¶230.

- h. [1.8]: providing a visualization within the visual display, the visualization updated at the video rate to identify regions of inaccurate scan data within the three-dimensional representation.**

The discussion concerning Kopelman’s real time inaccurate scan data visualization disclosure from Element [1.8] in Ground 1 above is equally applicable and is incorporated here. A POSITA would have appreciated that the use of Quadling’s scanner would confirm that such visualization would be at the video rate of the display of the digital surface representation as separately discussed extensively above. EX1004, ¶¶232-233.

- 2. Claim 3: The method of claim 1 wherein the one or more intraoral structures include at least one tooth.**

See Ground 1, Claim 3 for Kopelman’s disclosure.

- 3. Claim 4: The method of claim 1 wherein the one or more intraoral structures include at least one tooth surface prepared for a dental prosthetic.**

See Ground 1, Claim 4 for Kopelman’s disclosure.

4. **Claim 5: The method of claim 1 wherein the one or more intraoral structures include at least one area of soft tissue.**

See Ground 1, Claim 5 for Kopelman's disclosure.

5. **Claim 6 (Preamble): The method of claim 1 further comprising:**

- a. **[6.1] generating user feedback concerning the one or more intraoral structures; and**

The discussion concerning Kopelman's user feedback disclosure from Element [6.1] in Ground 1 above is equally applicable and is incorporated here. EX1004, ¶241.

- b. **[6.2] providing a visual display of the user feedback at the video rate.**

The discussion concerning Kopelman's visual display of the user feedback at the video rate disclosure from Element [6.2] in Ground 1 above is equally applicable and is incorporated here. A POSITA would have appreciated that the use of Quadling's scanner would confirm that such visual display would be at the video rate of the display of the digital surface representation as separately discussed extensively above. EX1004, ¶¶243-244.

6. **Claim 7: The method of claim 6 wherein generating user feedback includes highlighting at least one area in the three-dimensional representation requiring user attention.**

The discussion concerning Kopelman's user feedback that includes highlighting disclosure from Claim 7 in Ground 1 above is equally applicable and is incorporated here. EX1004, ¶¶246-247.

7. **Claim 8: The method of claim 1 wherein the video rate includes a rate of at least eight frames per second.**

See Claim 8, Ground 1 above concerning obviousness of a POSITA's frame selection and disclosure of Kopelman.

8. **Claim 9: The method of claim 1 wherein the video rate includes a rate of at least twenty frames per second.**

See Claim 9, Ground 1 above concerning obviousness of a POSITA's frame selection and disclosure of Kopelman.

9. **Claim 10: The method of claim 1 wherein the video rate includes a rate of between twenty-four and thirty frames per second.**

See Claim 10, Ground 1 above concerning obviousness of a POSITA's frame selection and disclosure of Kopelman.

10. **Claim 11 (Preamble): A computer program product embodied on a non-transitory computer readable medium that, when executing on one or more computing devices, performs the steps of:**

Kopelman's method is computer implemented, which a POSITA would have appreciated includes a non-transitory computer readable medium within computer 52 with instructions that when executed perform the method of Claim 11. *See* Figure 2 and associated disclosure at ¶[0083] (EX1008, 12:4-16). EX1004, ¶¶254-255.

- a. **[11.1]: acquiring two dimensional data from one or more intraoral structures of a dental patient at a video rate;**

See Element [1.1] addressing identical method language.

- b. **[11.2]: reconstructing a digital surface representation of the one or more intraoral structures;**

See Element [1.2] addressing identical method language.

- c. **[11.3]: displaying the digital Surface representation at the video rate;**

See Element [1.3] addressing identical method language.

- d. **[11.4]: acquiring additional two-dimensional data from the one or more intraoral structures in a subsequent frame of data at the video rate;**

See Element [1.4] addressing identical method language.

- e. **[11.5]: reconstructing a subsequent digital surface representation from the additional two-dimensional data at the video rate**

See Element [1.5] addressing identical method language.

- f. **[11.6]: combining the digital surface representation and the subsequent digital surface representation at the video rate to provide a three-dimensional representation of the one or more intraoral structures;**

See Element [1.6] addressing identical method language.

- g. **[11.7]: providing a visual display of the three-dimensional representation at the video rate in real time; and**

See Element [1.7] addressing identical method language.

- h. **[11.8] providing a visualization within the visual display, the visualization updated at the video rate to identify regions of inaccurate scan data within the three-dimensional representation.**

See Element [1.8] addressing identical method language.

- 11. Claim 13: The computer program product of claim 11 wherein the one or more intraoral structures include at least one tooth.**

See Claim 3 addressing identical method language.

- 12. Claim 14: The computer program product of claim 11 wherein the one or more intraoral structures include at least one tooth surface prepared for a dental prosthetic.**

See Claim 4 addressing identical method language.

- 13. Claim 15: The computer program product of claim 11 wherein the one or more intraoral structures include at least one area of soft tissue.**

See Claim 5 addressing identical method language.

- 14. Claim 16: The computer program product of claim 11 further comprising code for performing the steps of generating user feedback concerning the one or more intraoral structures; and providing a visual display of the user feedback at the video rate.**

See Claim 6 addressing identical method language.

- 15. Claim 17: The computer program product of claim 16 wherein generating user feedback includes highlighting at least one area in the three-dimensional representation requiring user attention.**

See Claim 7 addressing identical method language.

- 16. Claim 18 (Preamble): A system comprising:**

Kopelman's method is disclosed in the context of a computer implemented system. *See* Figure 2 and associated disclosure at ¶[0083] (12:4-16). EX1004, ¶282.

a. [18.1]: a scanner for acquiring a sequence of image sets from one or more intraoral structures of a dental patient at a video rate; and

Kopelman's method and system includes a scanner 31. *See* Figure 2 and associated disclosure at EX1006, ¶[0083] (EX1008, 12:4-16). Element [1.1]'s discussion above concerning the configuration and function of Quadling's scanner as used with Kopelman's disclosure is equally applicable to the nearly identical claim language of this element and is incorporated here. EX1004, ¶¶284-286.

b. [18.2]: a processor configured to:

Kopelman's method and system is computer implemented, and its method is carried out and executed by the disclosed computer and a processor thereon. *See e.g.*, EX1006, ¶[0083] ("FIG. 2 illustrates the main elements of the system 50 according to the present invention, comprising a suitable scanner 31, a microprocessor or computer 52, and a display means 54.") (EX1008, 12:4-16). EX1004, ¶¶287-288.

i. [18.2.1]: receive one of the sequence of image sets,

Kopelman's processor is configured to receive one of the sequence of image sets before creation of the "numerical entity" as a three-dimensional surface representation. EX1006, ¶[0162] ("Thus in step 11', scanner 32 [sic] of system 50 (FIG. 2) scans the area of interest of the intraoral cavity and a numerical entity corresponding to the surface scanned is created by processor 52 and optionally displayed by display 54.") (EX1008, 33:18-20). This element is equivalent to Element [1.4] above, which refers to acquiring additional two-dimensional data

during Kopelman's multiple "sub-entity" scanning process and is incorporated here. EX1004, ¶¶289-290.

ii. [18.2.2] convert the one of the sequence of image sets into a three-dimensional surface representation of the one or more intraoral structures,

Kopelman's processor is configured to convert the received one of the sequence of image sets into a "numerical entity" as a three-dimensional surface representation of the one or more intraoral structures that are being scanned. This element is equivalent to Element [1.5] above, which refers to reconstructing a subsequent digital surface representation during Kopelman's multiple "sub-entity" scanning process and is incorporated here. EX1004, ¶¶291-292.

iii. [18.2.3] combine the three-dimensional surface representation with one or more prior three-dimensional surface representations from one or more prior ones of the sequence of image sets to provide a three-dimensional model of the one or more intraoral structures, and

Kopelman's processor is configured to combine the three-dimensional surface representation (from element [18.2.2]) with one or more prior three-dimensional surface representations from one or more prior ones of the sequence of image sets to provide a three-dimensional model of the one or more intraoral structures. This element is equivalent to Element [1.1] (*prior* acquisition of two dimensional data), Element [1.2] (reconstructing a *prior* digital surface representation), and Element

[1.6] (combining digital surface representations together to form a more complete “numerical entity”) during Kopelman’s multiple “sub-entity” scanning process and are incorporated here. EX1004, ¶¶293-294.

iv. [18.2.4] generate a visual display signal of the three-dimensional model at the video rate in real time,

Kopelman’s processor is configured to generate a visual display signal of the three-dimensional model at the video rate in real time. This element is equivalent to Element [1.7] above, which refers to Kopelman’s real time display of its “numerical entity” as a three-dimensional model and is incorporated here. EX1004, ¶¶295-296.

v. [18.2.5] generate a visualization within the visual display signal, the visualization updated at the video rate to identify regions of inaccurate scan data within the three-dimensional representation;

Kopelman’s processor is configured to generate a visualization within the visual display signal, the visualization updated at the video rate to identify regions of inaccurate scan data within the three-dimensional representation. This element is equivalent to Element [1.8] above, which refers to Kopelman’s real time display of its “numerical entity” as a three-dimensional model along with an inaccurate data visualization and is incorporated here. EX1004, ¶¶297-299.

c. [18.3] and a display for displaying the visual display signal.

Kopelman's system includes a display means 54. *See* Figure 2 and accompanying disclosure at EX1006, ¶[0083] (EX1008, 12:4-16), and EX1006, Claim 54 (EX1008, 46:8-9). EX1004, ¶¶300-301.

17. Claim 20: The system of claim 18 wherein the one or more intraoral structures include at least one of a tooth surface prepared for a dental prosthetic, an area of soft tissue, and a tooth.

See Claims 3-5 addressing tooth surface (Claim 4), soft tissue (Claim 5), and tooth (Claim 3), but in method form. EX1004, ¶¶302-303.

18. Claim 21: The system of claim 18 wherein the processor generates user feedback concerning the one or more intraoral structures and includes the user feedback in the visual display signal at the video rate.

See Claim 6 addressing identical language, but in method form. EX1004, ¶¶304-305.

19. Claim 22: The system of claim 21 wherein the user feedback includes highlighting at least one area in the three-dimensional Representation requiring user attention.

See Claim 7 addressing identical language, but in method form.

20. Explanation of Why Claims 1, 3-11, 13-18, and 20-22 Would Have Been Obvious

Claims 1, 3-11, 13-18, and 20-22 would have been obvious over Kopleman in view of Quadling.

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

As discussed in §VII.A, Kopelman discloses all the features of the method and systems of Claims 1, 3-11, 13-18, and 20-22 with the exception of an explicit discussion concerning acquisition of two-dimensional data at *a video rate* and corresponding reconstruction and display of three-dimensional models at that *video rate*. This Ground 2 is presented as an alternative to address those specific aspects of the claims in view of Quadling, which is in the same field as Kopelman. EX1004, ¶309.

b. A POSITA would have had motivation to combine the disclosures of Kopelman and Quadling.

A POSITA would have had express motivation to combine the system of Kopelman with Quadling's known three-dimensional scanner, specifically designed to scan dentition. *See* EX1007, Abstract. EX1004, ¶310.

Beyond the scanner expressly discussed in Kopelman, the reference also indicates any scanner is suitable.

“Any suitable means may be used to provide the numerical entity. FIG. 2 illustrates the main elements of the system 50 according to the present invention, comprising a suitable scanner 31, a microprocessor or computer 52, and a display means 54.” EX1006, ¶[0083] (EX1008, 12:4-16); *see also* EX1006, at ¶[0091] (EX1008, 14:14-17). EX1004, ¶311.

Further, Quadling also discloses its acquisition, reconstruction, and display of three-dimensional surface representations of intraoral structures occurs in real time for the purpose of ensuring adequate capture. Just like Kopelman:

“The images may be captured and processed **to provide a real time image of the surface of the object. The real time image may provide an instant feedback mechanism to an operator of the system. The digitizer system may include software that displays the overall 3D image captured in real time.** The software also may include feedback and identification provided to the operator of suggested viewpoints to complete the overall 3D image.” EX1007, ¶[0012] (emphasis added). EX1004, ¶312.

Thus, Quadling provides readily substitutable scanner elements into Kopelman’s disclosure relating to scanning and reconstructing digital surface representations of intraoral structures. EX1004, ¶313.

- c. **A POSITA would have had a reasonable expectation of success based on the disclosures of Kopelman and Quadling and knowledge generally available in the art.**

A POSITA would have had a reasonable expectation of success in making the combination of Kopelman with Quadling’s scanner disclosure because Kopelman is

agnostic regarding its three-dimensional scanning technique, and expressly motivates a POSITA to look to known methods:

“Alternatively, the 3D digitized data may be obtained in any other suitable manner, including other suitable intraoral scanning techniques, based on optical methods, direct contact or any other means, applied directly to the patient's dentition.” EX1006, ¶[0091] (EX1008, 14:14-17). EX1004, ¶314.

Combining the disclosures of Kopelman with Quadling would only require the use of “known methods”—using each in the same way they were used as disclosed. Specifically, Kopelman alone discloses acquisition, reconstruction, and real time display of digital surface representations of intraoral structures, and Quadling provides a video camera-based three-dimensional scanner used to capture the underlying images of the dentition and create the three-dimensional model of the intraoral structures. None of the components or methods would need to be used in an unexpected or unintended way. Each would be fulfilling its original purpose and used in an expected way. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 416 (2007). EX1004, ¶315.

The combination of Kopelman and Quadling render obvious all the recited features of Claims 1, 3-11, 13-18, and 20-22. EX1004, ¶316.

VIII. OTHER CONSIDERATIONS

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

All elements of Claims 1, 3-11, 13-18, and 20-22 are known in the art, and any differences between the claims of the '257 Patent and Kopelman or Quadling would have been obvious to a POSITA based on the disclosures of the applied references and the knowledge in the art.

Petitioners are not aware of any secondary considerations evidence bearing any nexus to the purported claimed invention. Any purported evidence of secondary considerations that Patent Owner may present in this proceeding would be insufficient to overcome the strong evidence of obviousness of Claims 1, 3-11, 13-18, and 20-22. EX1004, ¶316.

B. The Board Should Not Deny This Petition Under §314(a)

Petitioners hereby stipulate that, should the Petition be granted, Petitioners will not pursue in the Related Litigation the same grounds or any grounds that are raised or could have reasonably been raised in this Petition pursuant to *Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 (PTAB Dec. 1, 2020). The Director has stated that “the PTAB will not discretionarily deny institution of an IPR” in view of such a stipulation. Katherine K. Vidal, Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation (June 21, 2022) at 3 and n.3 (discussing *Sotera*); *see id.* at 7–9.

Accordingly, Petitioners' stipulation is dispositive in establishing that institution should not be discretionarily denied under 35 U.S.C. §314(a).

C. The Board Should Not Deny This Petition Under §325(d)

There is no reason to deny institution under §325(d). The totality of the *Becton, Dickinson* factors favor institution. Specifically, none of the cited references herein is the same or substantially the same art previously addressed by the examiner during prosecution of the application. Further, the prior art relied upon in this Petition discloses an inaccurate scan data visualization feature—a feature absent from the prosecution applied references. *See* Section V.B.

Further, with respect to factor (f), the Petition is supported by an expert declaration by Dr. Eli Saber explaining how a POSITA would have understood the prior art combinations. *See, e.g.*, EX1004, ¶¶1-320. This new evidence also weighs against discretionary denial. *See, e.g., Puma N. Am., Inc. v. Nike, Inc.*, IPR2019-01058, Paper 10, 19 (PTAB Oct. 31, 2019) (instituting where petition presented “new non-cumulative evidence.... probative to issues of patentability and helpful to our consideration of a prior art combination that was not before the Examiner”).

IX. CONCLUSION

For at least the foregoing reasons, Claims 1, 3-11, 13-18, and 20-22 of the '257 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: August 14, 2024

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APPENDIX A—LIST OF EXHIBITS

EXHIBIT	DESCRIPTION
1001	U.S. Patent No. 7,912,257, issued on March 22, 2011 to E. Paley <i>et al.</i> (“the ’257 Patent”)
1002	File History of U.S. Patent Application No. 11/469,870, filed on September 3, 2006
1003	U.S. Provisional Application No. 60/761,078, filed on January 20, 2006
1004	Declaration of Eli Saber
1005	<i>Curriculum Vitae</i> of Eli Saber
1006	U.S. Patent Publication No. 2006/0115793 (“Kopelman”)
1007	U.S. Patent Publication No. 2004/0254476 (“Quadling”)
1008	U.S. Provisional Application Serial No. 60/630,572 (“the ’572 Provisional”)
1009	U.S. Patent Publication No. 2002/0055800 (“Nikolskiy”)
1010	U.S. Patent No. 6,687,393 (“Skinner”)
1011	U.S. Patent No. 4,846,684 (“Oestreich”)
1012	PCT International Publication No. WO 00/08415, published on February 17, 2000
1013	Defendant Medit Corporation’s Answer to Plaintiff’s Complaint and Affirmative Counterclaims filed on August 18, 2023 in <i>3Shape A/S v Medit Corporation</i> , Civ. Action No. 6:22-cv-00443 (WDTX)
1014	Order Severing Claims Related to Counterclaim Patents filed on September 8, 2023 in <i>3Shape A/S v Medit Corporation</i> , Civ. Action No. 6:22-cv-00443 (WDTX)

Petition for *Inter Partes* Review of U.S. Patent No. 7,912,257

EXHIBIT	DESCRIPTION
1015	Claim Construction Order for U.S. Patent Nos. 7,912,257; 9,191,648; 9,245,374; 9,262,864 filed on May 31, 2024 in <i>Medit Corporation v. 3Shape A/S</i> , Civ. Action No. 6:23-cv-00658 (WDTX)
1016	Comparison of U.S. Provisional Application Serial No. 60/630,572 (“the ’572 Provisional”) to U.S. Patent Publication No. 2006/0115793 (“Kopelman”)
1017	Multiple View Geometry in computer vision, Richard Hartley and Andrew Zisserman, Second Edition (2003), Introduction pp. 1-21.

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

I hereby certify that the word count for the foregoing Petition totals 13,870 words, excluding the parts which are exempted by 37 C.F.R. §42.24(a)(1).

Date: August 14, 2024

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CERTIFICATE OF SERVICE

The undersigned hereby certifies that on this 14th day of August, 2024, a true and correct copy of the foregoing **PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 7,912,257 UNDER 35 U.S.C. §§311–19 and 37 C.F.R. §42.100 *et seq.* and EXHIBITS 1001–1017** are being served by USPS Priority Mail Express on the correspondence address of record as follows:

3M Innovative Properties Company
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and a courtesy copy is being served to Patent Owner's litigation counsel as follows:

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