

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CLEARCORRECT OPERATING LLC,
Petitioner,

v.

ALIGN TECHNOLOGY INC.,
Patent Owner.

Case IPR2025-00817
Patent No. 10,791,936

PETITION FOR *INTER PARTES* REVIEW

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LIST OF EXHIBITS

<u>Exhibit No.</u>	<u>Description</u>
Ex-1001	U.S. Patent No. 10,791,936 B2 (“the ’936 patent”)
Ex-1002	Prosecution History of U.S. Patent No. 10,791,936
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Ex-1005	U.S. Patent No. 7,474,932 B2 to Geng (“Geng”)
Ex-1006	U.S. Patent Application Publication No. US 2005/0283065 A1 to Babayoff (“Babayoff”)
Ex-1007	U.S. Patent Application Publication No. US 2007/0236494 A1 to Kriveshko (“Kriveshko”)
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Ex-1010	International Application Publication No. WO 2007/084768 A1 to Dunne et al. (“Dunne”)
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Ex-1012	U.S. Patent Application Publication No. US 2008/0131841 A1 to Taub et al. (“Taub-841”)
Ex-1013	U.S. Patent No. 7,112,065 B2 to Kopelman et al. (“Kopelman-065”)
Ex-1014	U.S. Patent Application Publication No. US 2007/0015111 A1 to Kopelman et al. (“Kopelman-111”)

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Ex-1015	U.S. Patent Application Publication No. US 2009/0316966 A1 to Marshall et al. (“Marshall”)
Ex-1016	U.S. Patent Application Publication No. US 2005/0250075 A1 to Taub et al. (“Taub-075”)
Ex-1017	U.S. Patent Application Publication No. US 2005/0153255 A1 to Sporbert et al. (“Sporbert”)
Ex-1018	International Application Publication No. WO 2009/085752 A2 to Cinader (“Cinader”)
Ex-1019	International Application Publication No. WO 2003/094102 A1 to Rubbert et al. (“Rubbert-102”)
Ex-1020	U.S. Patent No. 6,227,850 B1 to Chishti et al. (“Chishti”)
Ex-1021	U.S. Patent Application Publication No. US 2010/0281370 A1 to Rohaly et al. (“Rohaly”)
Ex-1022	U.S. Patent Application Publication No. US 2003/0232302 A1 to Babayoff et al. (“Babayoff-302”).
Ex-1023	Preliminary Claim Constructions in <i>Align Technology Inc. v. ClearCorrect Operating LLC, et al.</i> , No. 24-cv-00187-ADA-DTG (W.D. Tex. Jan. 21, 2025)
Ex-1024	U.S. Patent No. 7,382,897 B2 to Brown et al.
Ex-1025	U.S. Patent No. 9,299,192 B2 (“the ’192 patent”)
Ex-1026	<i>3Shape A/S v. Align Tech., Inc.</i> , IPR2019-00134, Paper 29 (P.T.A.B. July 20, 2020)
Ex-1027	Align Technology Inc.’s Preliminary Infringement Contention Charts and Identification of Priority Dates in <i>Align Technology Inc. v. ClearCorrect Operating LLC, et al.</i> , No. 24-cv-00187-ADA-DTG (W.D. Tex. July 18, 2024)

LIST OF CHALLENGED CLAIMS

Claim 1	
1[pre]	A system for scanning a patient's teeth for a dental procedure, the system comprising:
1[a]	a hand-held intraoral scanner; and
1[b]	a computer readable medium including instructions that when executed by a computer system, cause the computer system to:
1[c]	receive first scan data of the patient's teeth from the hand-held intraoral scanner;
1[d]	display, to a display, a model of the patient's teeth, wherein the model of the patient's teeth is based on the received first scan data of the patient's teeth;
1[e]	receive user input defining a portion of the model to be removed;
1[f]	remove, from the displayed model, a removed surface portion of the model to be removed according to the user input;
1[g]	receive second scan data of the patient's teeth from the hand-held intraoral scanner, the second scan data including surface data of a physically changed portion of the patient's intraoral cavity;
1[h]	replace at least a portion of the removed surface portion of the model using the received second scan data of the patient's teeth including surface data of a physically changed portion of the patient's intraoral cavity; and
1[i]	output, to the display, the model of the patient's teeth with the portion of the removed surface portion replaced using the received second scan data.

Claim 2	
2	The system of claim 1, wherein the hand-held intraoral scanner comprises a probing member with a sensing face, an illumination unit, a light focusing optics defining one or more focal planes forward the sensing face, and a translation mechanism for displacing the one or more focal planes relative to the sensing face.
Claim 3	
3	The system of claim 2, wherein the system further comprises the computer system and the display; wherein the system further comprises a mouse or wherein the display comprises a touch screen display; and wherein the user input defining portion of the model to be removed is received by the mouse or the touch screen display.
Claim 4	
4	The system of claim 1, wherein the instructions to replace the at least the portion of the removed surface portion of the model using the received second scan data comprise instructions to register the received second scan data with the model.
Claim 5	
5	The system of claim 4, wherein the received second scan data is registered with the model by aligning identifying data of the received second scan data with corresponding parts of the model.

Claim 6	
6	The system of claim 5, wherein the instructions to replace the at least the portion of the removed surface portion of the model using the received second scan data comprise instructions to further stitch a portion of the received second scan data with the model.
Claim 7	
7	The system of claim 6, wherein the instructions to replace the at least the portion of the removed surface portion of the model using the received second scan data comprise instructions to further discard a remainder of the received second scan data, the remainder including the identifying surface data, after stitching the portion of the received second scan data with the model.
Claim 8	
8	The system of claim 1, wherein the computer readable medium further includes instructions that when executed by the computer system, cause the computer system to: mark, on the displayed model, the user input defined portion, after receiving the user input and before removing the removed surface portion of the model.
Claim 9	
9[pre]	A method for scanning a patient's teeth for a dental procedure, the method comprising:
9[a]	receiving first scan data of the patient's teeth from a hand-held intraoral scanner;
9[b]	displaying, to a display, a model of the patient's teeth, wherein the model of the patient's teeth is based on the received first scan data of the patient's teeth;

9[c]	receiving user input via the displayed model demarcating a portion of the model to be retained and a surface portion of the model to be replaced;
9[d]	receiving second scan data of the patient's teeth from the hand-held intraoral scanner, the second scan data including surface data of a physically changed portion of the patient's intraoral cavity;
9[e]	replacing at least a portion of the surface portion of the model to be replaced according to the user input using at least a portion of the second scan data of the patient's teeth including the physically changed portion; and
9[f]	outputting, to the display, the model of the patient's teeth with the at least the portion of the surface portion replaced using the second scan data.
Claim 10	
10	The method of claim 9, further comprising marking an area on the displayed model associated with the received user input.
Claim 11	
11	The method of claim 9, wherein replacing the at least the portion of the surface portion of the model to be replaced according to the user input using at least the portion of the second scan data comprises registering the second scan data with the model by aligning identifying data of the second scan data with corresponding parts of the model.
Claim 12	
12	The method of claim 11, wherein replacing the at least the portion of the surface portion of the model to be replaced according to the user input using at least the portion of the second scan data further comprises stitching the at least the portion of the second scan data with the model.
Claim 13	

13	The method of claim 12, wherein replacing the at least the portion of the surface portion of the model to be replaced according to the user input using the at least the portion of the second scan data further comprises discarding a remainder of the second scan data, including the identifying surface data, after stitching the at least the portion of the second scan data with the model.
Claim 14	
14[a]	The method of claim 9, wherein the model of the patient's teeth comprises a tooth preparation having a finish line,
14[b]	wherein a portion of the finish line is obscured or distorted, and
14[c]	wherein the physical change results in the finish line not being obscured or distorted.
Claim 15	
15[a]	The method of claim 9, wherein the model of the patient's teeth comprises a tooth preparation that accurately represents a surface of a physical preparation of the patient, and
15[b]	wherein the method further comprises analyzing the tooth preparation of the model to determine whether the surface of the physical preparation is suitable for a dental prosthesis; and
15[c]	wherein the physical change is a physical modification of the surface of the physical preparation of the patient.
Claim 16	
16[a]	The method of claim 15, wherein the dental prosthesis comprises a dental crown and
16[b]	wherein the tooth preparation analysis comprises analysis of the model with respect to a virtual model of an opposing dentition of an opposite jaw to determine whether the tooth preparation would result in an inadequate structure for the dental crown.

Claim 17	
17[pre]	A system for intraorally scanning a patient's teeth for a dental procedure, the system comprising:
17[a]	a hand-held intraoral scanner; and
17[b]	a computer readable medium including instructions that when executed by a computer system, cause the computer system to:
17[c]	receive first scan data of the patient's teeth from the hand-held intraoral scanner;
17[d]	display, to a display, a model of the patient's teeth, wherein the model of the patient's teeth is based on the received first scan data of the patient's teeth;
17[e]	receive user input defining a portion of the model to be removed;
17[f]	after receiving the user input, remove, from the displayed model, a removed surface portion of the model to be removed according to the user input;
17[g]	after removing the portion of the model, receive second scan data of the patient's teeth from the hand-held intraoral scanner;
17[h]	register the second scan data with the model by aligning identifying data of the second scan data with corresponding parts of the model;
17[i]	replace at least a portion of the removed surface portion of the model using at least a portion of the received second scan data of the patient's teeth;
17[j]	discarding a remainder of the second scan data, including the identifying data, after registering the second scan data with the model; and
17[k]	output, to the display, the model of the patient's teeth with the portion of the removed surface portion replaced using the received scan data.

Claim 18	
18	The system of claim 17, wherein the hand-held intraoral scanner comprises a probing member with a sensing face, an illumination unit, a light focusing optics defining one or more focal planes forward the sensing face, and a translation mechanism for displacing the one or more focal planes relative to the sensing face.
Claim 19	
19	The system of claim 18, wherein the system further comprises the computer system and the display; wherein the system further comprises a mouse or wherein the display comprises a touch screen display; and wherein the user input defining portion of the model to be removed is received by the mouse or the touch screen display.
Claim 20	
20	The system of claim 17, wherein the portion of the removed surface portion of the model is replaced using at least the portion of the received second scan data by registering the second scan data with the model.

I. INTRODUCTION

The claims of U.S. Patent No. 10,791,936 (“’936 patent”) are directed to systems and methods for scanning a patient’s teeth to create 3D models for preparing orthodontics and prosthodontics. Ex-1001, Abstract. Patent Owner Align Technology Inc. (“Align”) has described the ’936 patent as relating to updating an initial scan of a patient’s intraoral cavity with a new scan obtained *after* the patient’s intraoral cavity has been *physically changed*—such as by a dental procedure—to create a new composite image.

The ’936 patent does not disclose or claim anything new or nonobvious. It merely claims standard, well-known components present in many prior-art dental scanning systems, including: an intraoral scanner; a computer; and an interactive display for displaying a model of a patient’s intraoral cavity. The claims require receiving user input identifying portions of the model to be removed and replaced with new scan data. *See* Ex-1001, claim 1. All these features were well known before the earliest possible priority date of the ’936 patent, as shown both by the art cited in this Petition and by the Board’s invalidation of a parent patent to the ’936 patent—U.S. Patent No. 9,299,192 (“’192 patent”)—which, as described below, had similar claims to those of the ’936 patent. *See 3Shape A/S v. Align Tech., Inc.*, IPR2019-00134, Paper 29 (P.T.A.B. July 20, 2020); *see also infra* Section IV.

During prosecution, the '936 patent claims were allowed based on one claim requirement—that “the intra-oral cavity (e.g.,] dentition) *is modified in between the scans.*” Ex-1002, 238-39 (emphasis added). The '936 patent thus describes at most an intended use for an old product, which cannot make that product patentable absent any structural modification to, or change in the operation of, the old product. *In re Schreiber*, 128 F.3d 1473, 1477 (Fed. Cir. 1997) (finding “a new intended use for an old product does not make a claim to that old product patentable”).

Regardless, this feature was also well known and squarely disclosed by prior art such as Boerjes, which was not before the Office during prosecution or prior IPR proceedings. Accordingly, the claims of the '936 patent would have been obvious based on Boerjes alone or in combination with additional references discussed below.

II. RELIEF REQUESTED

Petitioner ClearCorrect Operating LLC requests review and cancellation of claims 1-20 of the '936 patent based on the following prior art and grounds (Ex-1003, ¶¶ 72-73):

<u>Exhibit</u>	<u>Reference</u>	<u>Prior-Art Status¹</u>
Ex-1004	International Application Publication No. WO 2007/084727 A1 to Boerjes et al. (“Boerjes”), published July 26, 2007	§ 102(b)
Ex-1005	U.S. Patent No. 7,474,932 B2 to Geng (“Geng”), filed October 25, 2004, and issued January 6, 2009	§ 102(a)/(e)
Ex-1006	U.S. Patent Application Publication No. US 2005/0283065 A1 to Babayoff (“Babayoff”), published December 22, 2005	§ 102(b)

Ground	Claim(s) Challenged	35 U.S.C.	Reference(s)
1	1, 4-6, 8-12, 14-16	§ 103	Boerjes
2	1, 4-6, 8-12, 14-16	§ 103	Boerjes and Geng
3	2-3, 7, 13, 17-20	§ 103	Boerjes and Babayoff
4	2-3, 7, 13, 17-20	§ 103	Boerjes, Geng, and Babayoff

¹ Prior-art status has been assessed under pre-AIA 35 U.S.C. § 102. The ’936 patent claims priority to a provisional application filed July 19, 2010. Without conceding that date, each asserted reference qualifies as prior art under it.

Computer 32 includes display 33 and input device 40, such as mouse 35 or a touch screen, to allow the user to visually check and interact with the model. Ex-1001, 19:14-26, 20:30-58, Figs. 1, 3, 9; Ex-1003, ¶¶ 50-51.

The '936 patent generally discloses modifying the model, such as by allowing a user to interface with the model to identify a portion to be modified and modifying that portion with new scan data obtained from the intraoral cavity. Ex-1001, 4:6-14, 21:18-59, 27:17-22, Figs. 1-3. For example, the '936 patent describes rescanning a portion of the intraoral cavity where the first scan was distorted or obscured (e.g., by a dental instrument), and then “stitch[ing]” the new rescan data into the original model. *See* Ex-1001, 14:43-15:36, 20:64-21:17, 22:16-23:15, 27:29-34, Figs. 1, 5. The virtual model may then be updated by replacing the removed or deleted area with a corresponding part of the new scan data. *Id.*, 22:61-23:15, 27:35-39, Figs. 1, 6. The '936 patent states that replacement can occur after or concurrently with removing the inadequate portion. *Id.*, 22:61-23:15, 27:17-39, Fig. 9; *see also id.*, 25:2-4 (describing “a unified replacement function” in which part of a model is replaced “in one operation”); Ex-1003, ¶¶ 52-55.

The '936 patent also describes a particular use case in which a portion of a patient's mouth is rescanned after that portion has been physically changed (e.g., after saliva, blood, or tissue has been removed or after a dental procedure such as an implant). *See, e.g.*, Ex-1001, 15:38-17:3, 27:17-34, Figs. 3-6, 8. The '936 patent

does not suggest that this use case requires any different technical capabilities or methods compared to the patent's general disclosures regarding how to modify a virtual model of a patient's intraoral cavity. Ex-1003, ¶¶ 53-55.

B. Prosecution History

U.S. Application No. 16/586,528 issued as the '936 patent after one double-patenting rejection. Ex-1002, 88-96. The Office allowed the claims based on one feature, finding that the “claims as recited distinguish over the art of record ... via reciting the updating scans to be directed to *scenarios where the intra-oral cavity (e.g.,] dentition) is modified in between the scans* (e.g.,] subjected to a surface preparation).” *Id.*, 238-39 (emphasis added). The Office explained that the prior art of record “deal[t] only with recapturing scans of a static intra-oral region” and thus did not generate a composite scan using a scan taken after intra-oral modifications had been made. *Id.* But these exact features are disclosed by the prior art, such as Boerjes (Ex-1004), which was not considered by the Examiner. Ex-1003, ¶ 56.

A parent patent to the '936 patent—the '192 patent, which shares the same specification and figures—was addressed by the Board in an IPR Final Written Decision where all challenged claims were held unpatentable. *See 3Shape A/S v. Align Tech., Inc.*, IPR2019-00134, Paper 29, 59-60 (P.T.A.B. July 20, 2020). The '192 patent claims were very similar to the claims here: they required generating a first virtual model from 3D scan data, receiving user input identifying at least a

portion of the first virtual model desired to be modified, receiving a second virtual model generated from a rescan (“second 3D scan data”), and replacing the identified portion of the first virtual model with a corresponding portion of the second virtual model. *See, e.g.*, Ex-1025, claim 1.

The Board found all ’192 patent claims invalid over Paley (Ex-1008) and Kriveshko (Ex-1007). The Board found that the prior art taught both (1) “visual aids that assist the user in specifying the location on the model where errors in the model require the data be replaced,” and (2) “reacquiring a scan at a point on a model, obtaining new scan data, creating a supplemental 3D model and subsequently fitting the supplemental model data into the original model, i.e., substituting the supplemental model for the defective portion of the first model.” *3Shape A/S*, IPR2019-00134, Paper 29, at 32.

Moreover, like the ’936 patent claims challenged here, several of the invalidated claims of the ’192 patent involved rescanning a patient’s intraoral cavity *after it was physically changed*. For example, claim 18 involved a surface in the intraoral cavity that was “inadequate for enabling a prosthesis [e.g., a dental crown] to be mounted” at the time of the first scan but that became adequate at the time of the second scan after the surface “has been physically altered,” such as by reshaping, cleaning, or refining the surface. Ex-1025, 31:63-32:3. Claim 13

involved rescanning when a portion of the intraoral cavity was “obscured” initially but became “unobscured” at the time of the second scan. *Id.*, 31:34-40.

The Board found claims 13 and 18—as well as similar claims 15, 16, and 17—invalid over Paley and Kriveshko. Moreover, as explained below, Boerjes cited in this Petition is even more clear in disclosing the feature for which the ’936 patent claims were allowed—i.e., generating a composite scan using a scan taken after the intraoral cavity has been physically changed.

3Shape also filed a petition on the ’936 patent relying on a different combination of art—Rubbert (Ex-1019), Babayoff (WO 00/08415), and a dental textbook (Rosenstiel). *3Shape A/S v. Align Tech., Inc.*, IPR2021-01241, Paper 16, 2 (P.T.A.B. Jan. 26, 2022). Institution was denied because the Board found that what 3Shape was calling “first scan data” came temporally later than the alleged “second scan data.” *Id.*, 14-15. The Board also found that 3Shape had not shown that the prior art disclosed “surface data of a physically changed portion of the patient’s intra-oral cavity.” *Id.*, 15. By contrast, the prior art here discloses first scan data that is temporally earlier than second scan data, and surface data of a physically changed portion of the intraoral cavity.

IV. STATE OF THE ART

A. Three-Dimensional Virtual Models of the Intraoral Cavity Were Known and Conventional in Dentistry

Before the '936 patent's priority date—as the '936 patent concedes—3D virtual models of the intraoral cavity were frequently used in dentistry. Ex-1001, 1:26-59. 3D virtual models provide accurate representations of a patient's dentition (e.g., the number, kind, and arrangement of the patient's teeth), allowing for precise planning and execution of dental procedures. *See* Ex-1009, [0010], [0013], [0021], [0225]-[0226], Figs. 1-4; Ex-1001, 1:26-49; Ex-1010, [0006]-[0008]; Ex-1003, ¶¶ 36-37. An example is below from Paley, the reference that the PTAB agreed invalidated the claims of the '192 patent:

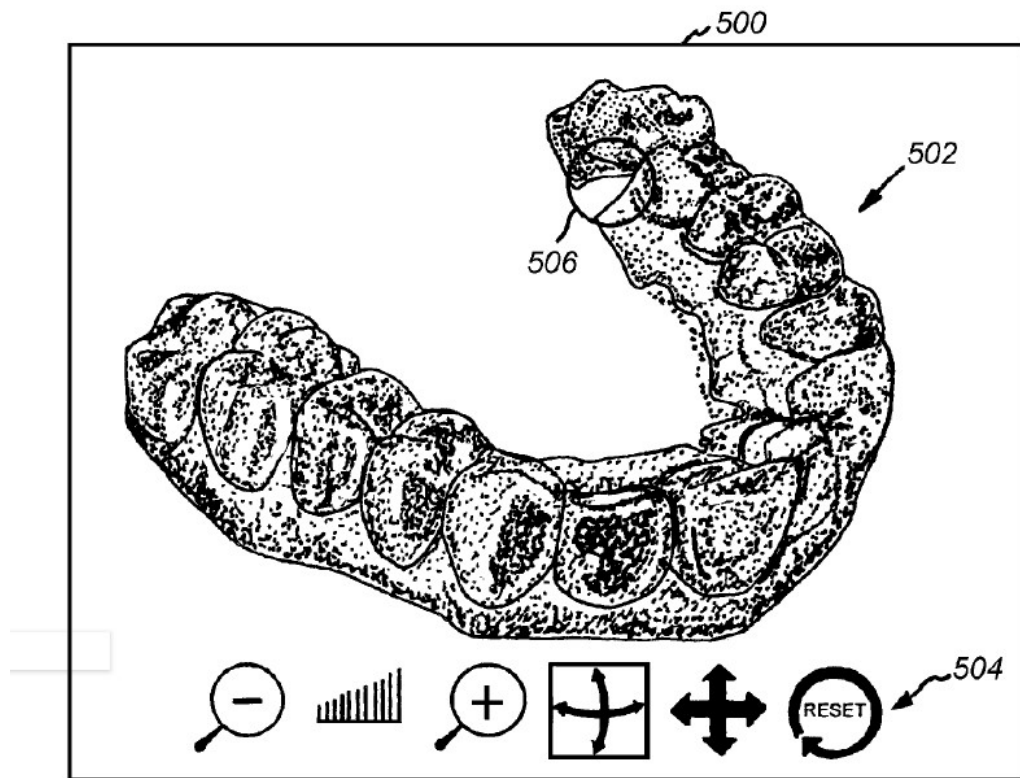


Fig. 5

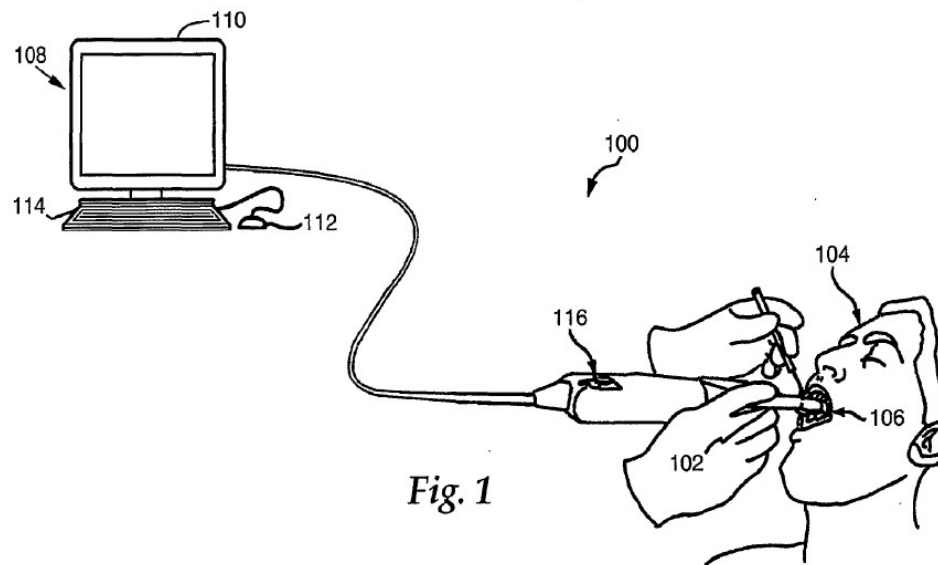
Ex-1008, Fig. 5 (showing a 3D model of teeth displayed on a user interface).

Three-dimensional models were also frequently used in prosthodontics, which is the dental specialty concerned with artificial replacements of parts of the mouth and jaw, such as a tooth. Ex-1011, [0003]; Ex-1005, 3:61-4:2; Ex-1012, [0002]-[0004], [0007]; Ex-1003, ¶ 38. To implant a dental prosthesis, such as a crown, the site for implantation needs to be accurately prepared so that the crown can be dimensioned to fit in place. Ex-1011, [0004], [0097]; Ex-1001, 1:50-59. In dentistry, a “preparation” or “surface preparation” refers to the process of shaping and treating a tooth structure before placing a prosthesis, such as a crown, to

ensure proper retention and fit of the prosthesis. Ex-1008, [0062]-[0068]; Ex-1011, [0009]-[0010]; Ex-1014, [0012]. It was well known that computers or dental professionals could analyze 3D virtual models to determine whether the surface preparation or the prosthesis is acceptable or whether further work at the site is necessary. *See, e.g.*, Ex-1011, Abstract, [0002], [0004]-[0005], [0011], [0097], [0106]-[0112]; Ex-1017, [0087]-[0088]; Ex-1003, ¶¶ 38-39.

B. Hand-Held Intraoral Scanners, Displays, and Input Devices for Obtaining and Displaying a 3D Virtual Model of the Intraoral Cavity Were Known and Conventional

Using hand-held intraoral scanners to obtain 3D virtual models was well known before the '936 patent. *See, e.g.*, Ex-1009, [0025]-[0042], [0119]-[0125], Figs. 1-5; Ex-1004, [0065]-[0066]; Ex-1019, 2:8-15; Ex-1014, [0003]-[0006], Fig. 2; Ex-1011, [0083]; Ex-1006, [0113]-[0137]; Ex-1017, [0039], [0058], [0061], [0067], Fig. 10; Ex-1007, [0052], Fig. 1; Ex-1003, ¶¶ 40-42.



Ex-1004, Fig. 1 (showing a hand-held intraoral scanner).

Hand-held scanners typically send scan data to a computer, which displays a 3D model in real time. *See, e.g.*, Ex-1004, [0040], [00131]-[00133], [00145], [00150]; Ex-1007, [0051]-[0052], [0058], Fig. 1; Ex-1009, [0114], [0122], Figs. 1-2; Ex-1015, [0057]-[0064]; Ex-1003, ¶ 41. Figs. 1-2; Ex-1015, [0057]-[0064]; Ex-1003, ¶ 41. It was well known before the '936 patent that users could communicate with the computer through input devices and interact with the model, including marking areas on the model to be removed and replaced. Ex-1004, [00196]-[00199]; *see also* Ex-1005, 2:21-31; Ex-1020, 2:4-7, 3:15-23, 9:3-40; Ex-1003, ¶¶ 41-42.

C. Performing Additional Scans to Supplement or Correct an Existing 3D Virtual Model Was Known and Conventional

It was well known before the '936 patent that a 3D model derived from scan data could have defects, such as missing or inaccurate areas, physical obstacles, or poor margin lines. *See, e.g.*, Ex-1021, [0005], [0102], [0111] (3D models can have errors resulting from physical obstacles that obscure portions of the margin of a prepared tooth, such as collapsed tissue around the prepared tooth, blood, and saliva); Ex-1007, [0005]-[0006]; Ex-1008, [0059]; Ex-1011, [0165]-[0168]; Ex-1014, [0007], [0023], [0078]; Ex-1004, [00189]-[00198]; Ex-1003, ¶¶ 43-47. For example, Paley's Figure 5 below shows region 506, which is inadequate because of missing data.

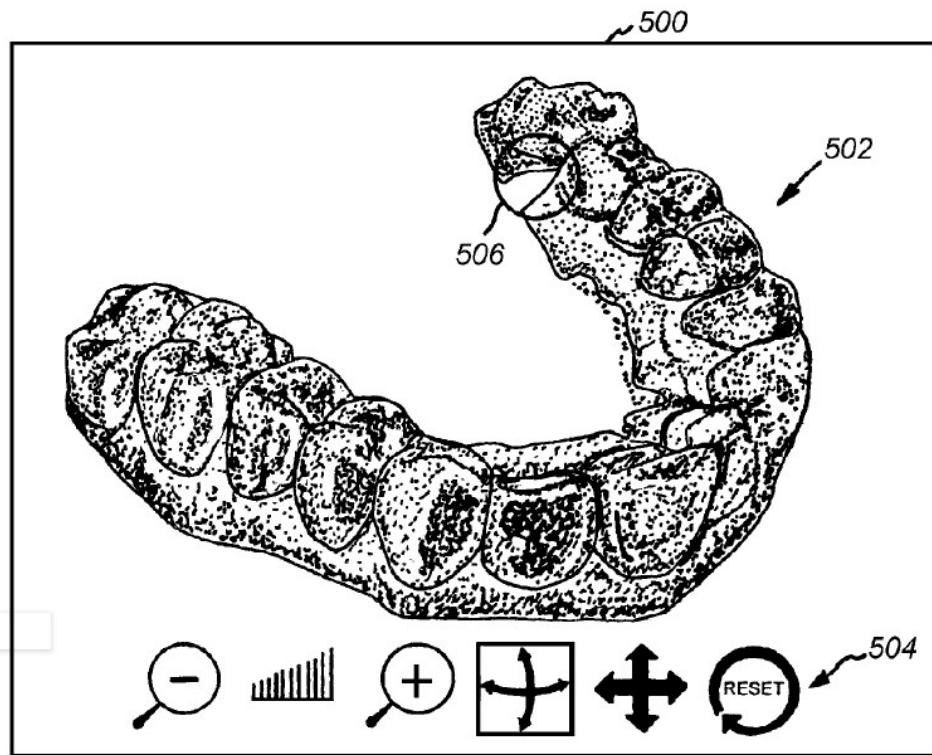


Fig. 5

Ex-1008, Fig. 5; *see also id.* [0059]-[0060].

It was well known to take an additional scan or scans to supplement or replace areas in a 3D model. *See, e.g.,* Ex-1004, [00189]-[00199]; Ex-1007, [0005]; Ex-1015, [0010]-[0014]; Ex-1003, ¶¶ 44-45.

And it was well known to use image registration and stitching to replace portions of models with additional scan data. Ex-1003, ¶¶ 46-47; Ex-1007, [0058], [0065]-[0066], [0074], [0086], [0099], [0097]-[0101]; Ex-1004, [00144]; Ex-1008, [0036]; Ex-1006, [0037]-[0039], [0044]-[0047], [0176]-[0180]. Image registration is a process that aligns multiple images into a single coordinate system based on

corresponding data or features between the images. Ex-1003, ¶ 47. Image registration is typically used in conjunction with image stitching, where multiple images are aligned and combined into a single image. *Id.* Image registration and stitching were commonly known and used in computer vision, image processing, and medical imaging. *Id.*

It was also known to perform registration to replace defective areas after the defective areas were removed from a virtual model. *See, e.g.*, Ex-1015, [0048], [0118]-[0119]; Ex-1003, ¶ 46. Kriveshko, which the Board relied on in the '192 patent IPR, for example, describes the user's "ability to select a point on the original three-dimensional model for re-acquisition of a scan" and then "create a supplemental three-dimensional model by fitting sequential frames to one another before a successful fit to the original three-dimensional model"—including when the intraoral cavity has been physically changed between the two scans. Ex-1007, [0097]; *see also id.*, [0058], [0065]-[0066], [0074], [0086], [0098]-[0099] (“[M]ultiple scans of an object, including scans taken at different times, may be interpreted as a single scan. For example, in a dental application, a tooth surface may be scanned before and after a surface preparation for dental prosthetic. By starting the second, post-preparation scan, by reacquiring a scan of an unprepared tooth surface, the pre-scan and post-scan structure of the prepared surface may be combined into a single surface representation ...”), [0100]-[0101].

V. LEVEL OF ORDINARY SKILL

A person of ordinary skill in the art (“POSITA”) as of July 19, 2010 (the earliest possible priority date of the ’936 patent), would have been a person having at least a bachelor’s degree in electrical engineering, computer engineering, or a closely related field such as computer science, and two years of work experience in 3D imaging, including the generation of 3D models of physical structures and image processing. Additional education might substitute for less work experience, or vice versa. Ex-1003, ¶¶ 27-30.

VI. CLAIM CONSTRUCTION

The Board construes claims according to *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc); 37 C.F.R. § 42.200(b). Here, no claim construction is needed. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017). The Court in a parallel district-court proceeding provided preliminary constructions on January 21, 2025:

Claim Term	<u>Court’s Preliminary Constructions</u>
“replace [replacing] at least a portion of the [removed] surface portion of the model [...] using the received second scan data [at least a portion of the second scan data]” Ex-1001, cls. 1, 9, 17	[register]/[registering] the [received] second scan data with a retained portion of the model after removing the scan data of the removed surface portion

Claim Term	<u>Court's Preliminary Constructions</u>
“second scan data of the patient's teeth” Ex-1001, cl. 17	Plain and Ordinary Meaning

Ex-1023.

The claims are unpatentable on the proposed grounds under the Court's preliminary constructions, which Petitioner adopts here for purposes of this IPR, or any other reasonable construction under *Phillips*. *Infra* VIII.A.1.h, VIII.A.1.g, VIII.A.6.e, VIII.A.6.f, VIII.B.5.d. Because the prior art shows the claims under plain and ordinary meaning or the Court's preliminary constructions, the Board need not construe either term.² *Nidec*, 868 F.3d at 1017; Ex-1003, ¶¶ 31-35.

VII. OVERVIEW OF THE PRIOR ART

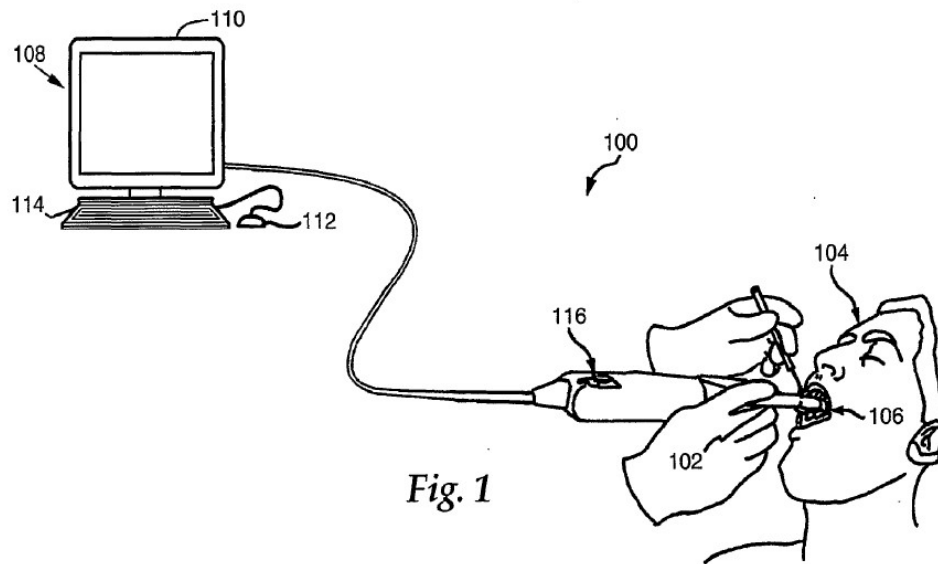
A. Boerjes (Ex-1004)

Boerjes discloses scanning systems and methods for capturing detailed digital 3D dental models of a patient's intraoral cavity for dental procedures, such as preparing a surface for a dental prosthesis. Boerjes also discloses updating an initial scan of the patient's tooth with new scan data after the intraoral cavity has

² Petitioner does not concede that any claim term meets the statutory requirements of 35 U.S.C. §§ 101, 112.

been changed. Ex-1004, Abstract, [0006]-[0007], [00107], [00169], [00185]-[00189], [00199], Fig. 1; Ex-1003, ¶¶ 57-58, 60-61.

Boerjes's system includes a hand-held intraoral scanner for acquiring surface scan data of a patient's tooth.



Ex-1004, Fig. 1; *see also id.*, [0012], [0040], [00132]-[00135], [00144]. The scanned area can include a tooth surface prepared for a dental restoration, such as a crown. *Id.*, [0016], [00162]-[00163]. A computer acquires data from the scanner, converts it into a 3D digital model of a tooth or teeth, and displays the model, such as in Figure 7A:

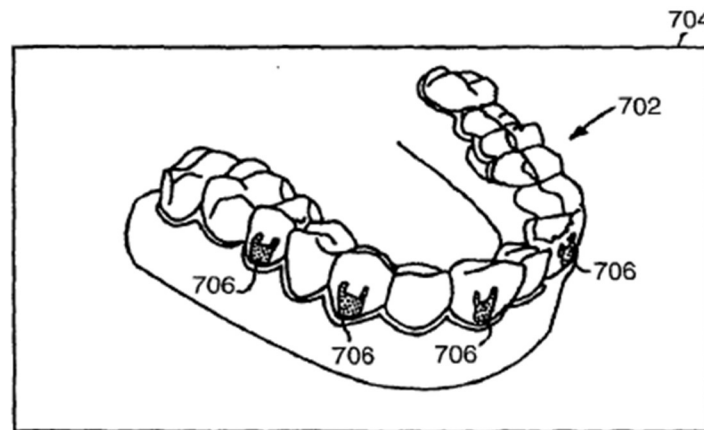


Fig. 7A

Id., Fig. 7A; *see also id.*, [0010], [0016], [00132], [00141], Fig. 1; Ex-1003, ¶ 58.

Boerjes further teaches using a user interface to mark, annotate, or otherwise manipulate the displayed model. Ex-1004, [00120], [00142], [00146]-[00148], [00182], [00192], [00196], Fig. 3. Boerjes discloses that the model can be evaluated to determine the adequacy of a surface prepared for receiving a dental restoration. *Id.*, [0042], [0083], [00162], [00188]-[00196], [00199]-[00200], Fig. 4. For example, the user can identify on the display regions of the model requiring additional scanning. *Id.*, [00196]. The user can also remove unwanted areas. *Id.*, [0043]-[0044], [00208]; Ex-1003, ¶ 59.

As shown below, the user can perform a quality check of the model (step 408), and if the scan and/or surface preparations are not satisfactory (step 412)—such as because “additional surface preparation” is required—the process may

“proceed to step 414 where the digital model may be supplemented or replaced with new scan data.” Ex-1004, [00199].

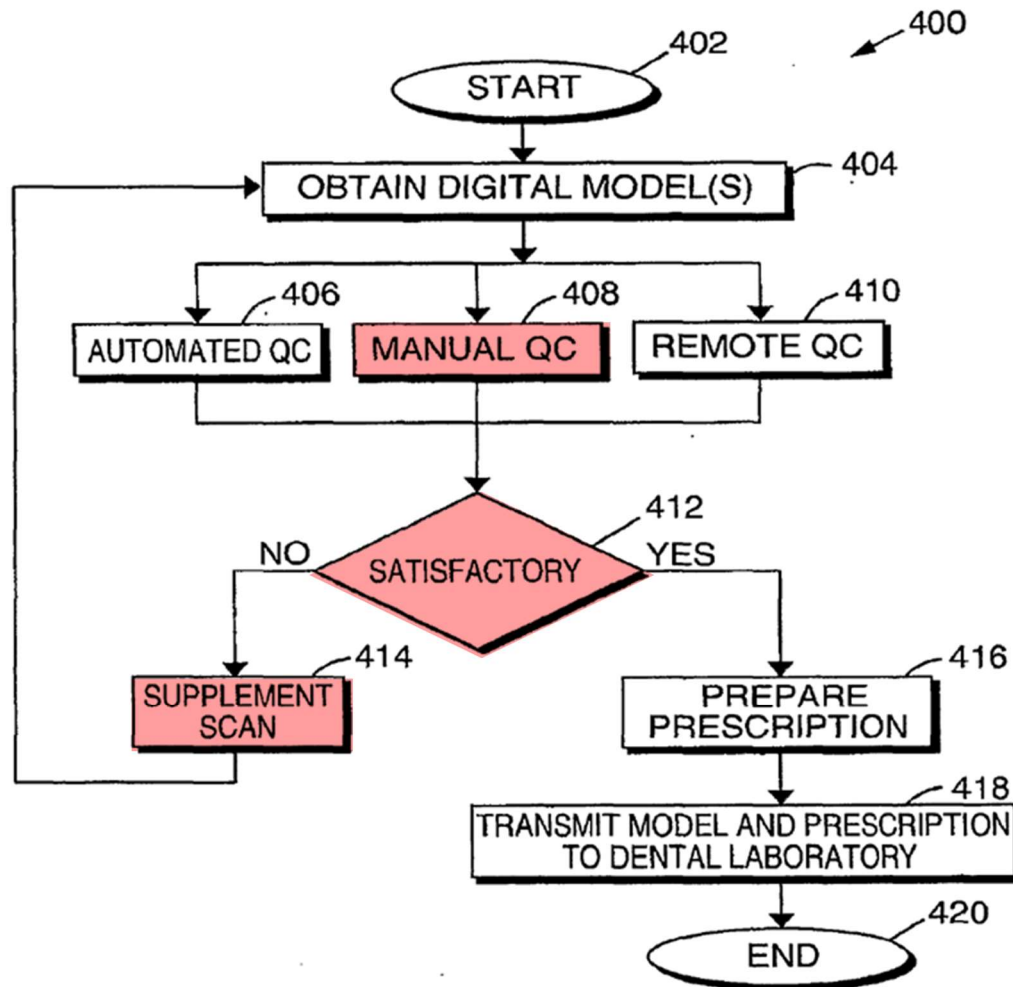


Fig. 4

Id., Fig. 4 (annotated); *see also id.*, [0037], [00196]. The new scan data may consist, for example, of “scanning to replace apparently erroneous or inadequate scan data, or a new scan of the dental subject matter following, e.g., additional surface preparation consistent with errors identified during quality control.” *Id.*, [00199]; *see also id.* [00163] (“[A] scan may be obtained of a prepared surface”

followed by “combining historical three-dimensional data with a three-dimensional representation of the prepared surface.”). The new scan data is “stitched” with the prior scan data to create an updated digital model that is displayed. *Id.*, [00144] (“The three-dimensional data for each newly acquired two-dimensional image set may be derived and fitted or ‘stitched’ to existing three-dimensional data using a number of different techniques.”), [00145], [00162], [00169], [00190]-[00193], [00199]-[00200], Fig. 4; Ex-1003, ¶ 59.

B. Geng (Ex-1005)

Geng discloses systems and methods for interactive 3D dental imaging for dental prostheses. Ex-1005, Abstract, 2:61-3:13, 3:48-4:2, 12:38-56, Fig. 1. Geng’s system includes camera 104 to acquire image data of a patient’s dentition and send it to computer 112, as illustrated in Fig. 1.

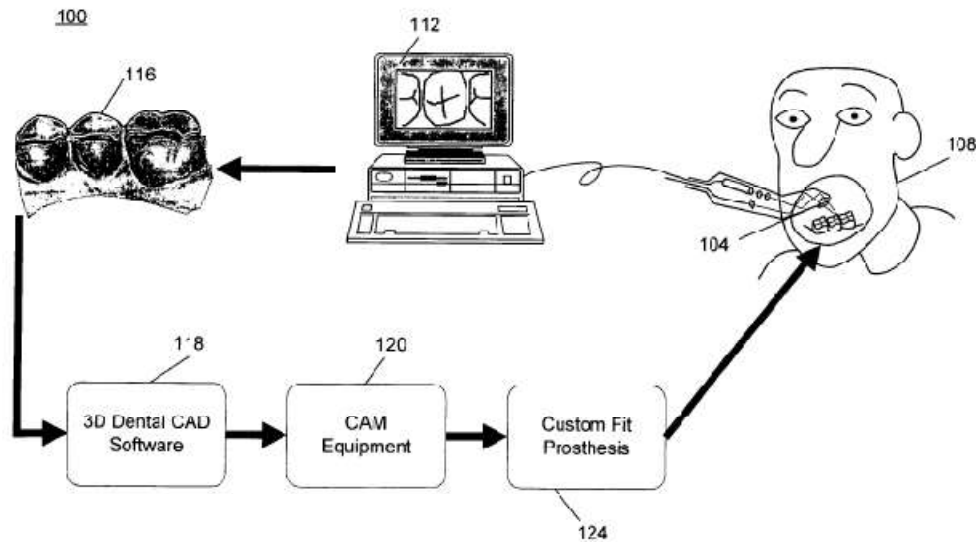


Fig. 1

Id., Fig. 1, 3:48-4:30. The computer processes the data to form a 3D image. *Id.*, 3:48-4:36, Fig. 1; Ex-1003, ¶¶ 62-64.

The computer also includes a graphical user interface for displaying and manipulating the 3D image. Ex-1005, 2:21-31, 3:14-34, 4:37-5:21, 6:15-53, 7:12-51, Figs. 2-3. The interface can include a touch screen, and an editor tool can manipulate or edit the 3D image model, such as by modifying and/or eliminating undesirable areas on the original 3D image. *Id.*; Ex-1003, ¶¶ 64-65.

Geng also discloses a merger function that integrates multiple 3D images into a single 3D image via registration using common points between the images. Ex-1005, 7:57-8:3, Fig. 3; Ex-1003, ¶ 64.

Geng teaches that its system and methods allow for interactive design and fabrication of dental prostheses using 3D models, which advantageously allows dental restorations to be performed in a patient's single visit, improves accuracy and quality of care, and reduces dental costs and time. Ex-1005, 1:22-32, 15:41-57; Ex-1003, ¶¶ 64-66.

C. Babayoff (Ex-1006)

Babayoff discloses systems and methods for providing a 3D surface representation of the oral cavity for various procedures, such as dental restoration. Ex-1006, Abstract, [0001], [0005]-[0007], [0101], [0171]-[0172], Fig. 1; Ex-1003, ¶¶ 67-68.

Babayoff's system includes a hand-held 3D surface scanner for acquiring image data. Ex-1006, [0104], [0113]-[0136], [0156], Figs. 4A, 5A-8. As shown in Figure 4A, the scanner includes probe 46 with an illumination source 31, optical sensor 68, light-focusing optics 41 defining focal planes, and motor 72 for changing the focal-plane location. *Id.*, [0104], [0113]-[0136], [0156], Figs. 4A, 5A-8; Ex-1003, ¶ 69.

VIII. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. **Grounds 1-2: Claims 1, 4-6, 8-12, and 14-16 Would Have Been Obvious Based on Boerjes (Ground 1) or Boerjes and Geng (Ground 2)**

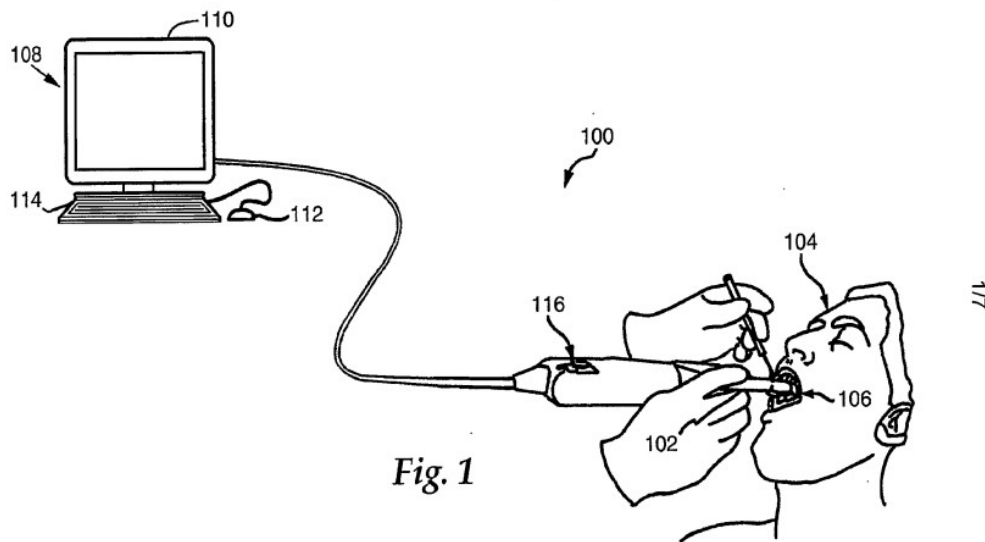
Boerjes renders obvious claims 1, 4-6, 8-12, and 14-16 of the '936 patent.

Boerjes in view of Geng also renders these claims obvious. Geng discloses eliminating undesirable areas of a 3D model of the intraoral cavity, including deleting and removing data points, such as in limitations 1[e] and 1[f]. Geng also provides additional implementation details on replacing an image with another image, such as in limitation 1[h], claims 4-5 and 11. While these claim elements are disclosed and/or rendered obvious by Boerjes alone, Geng provides additional details regarding how to implement those features. Ex-1003, ¶¶ 74-76.

1. **Independent Claim 1**

a. **1[pre] A system for scanning a patient's teeth for a dental procedure, the system comprising:**

Boerjes describes “systems and methods” that employ “a scanning system for capturing highly detailed digital dental models” of a patient's teeth for a dental procedure. Ex-1004, [0006]-[0007], Fig. 1; *supra* VII.A; Ex-1003, ¶¶ 77-78.

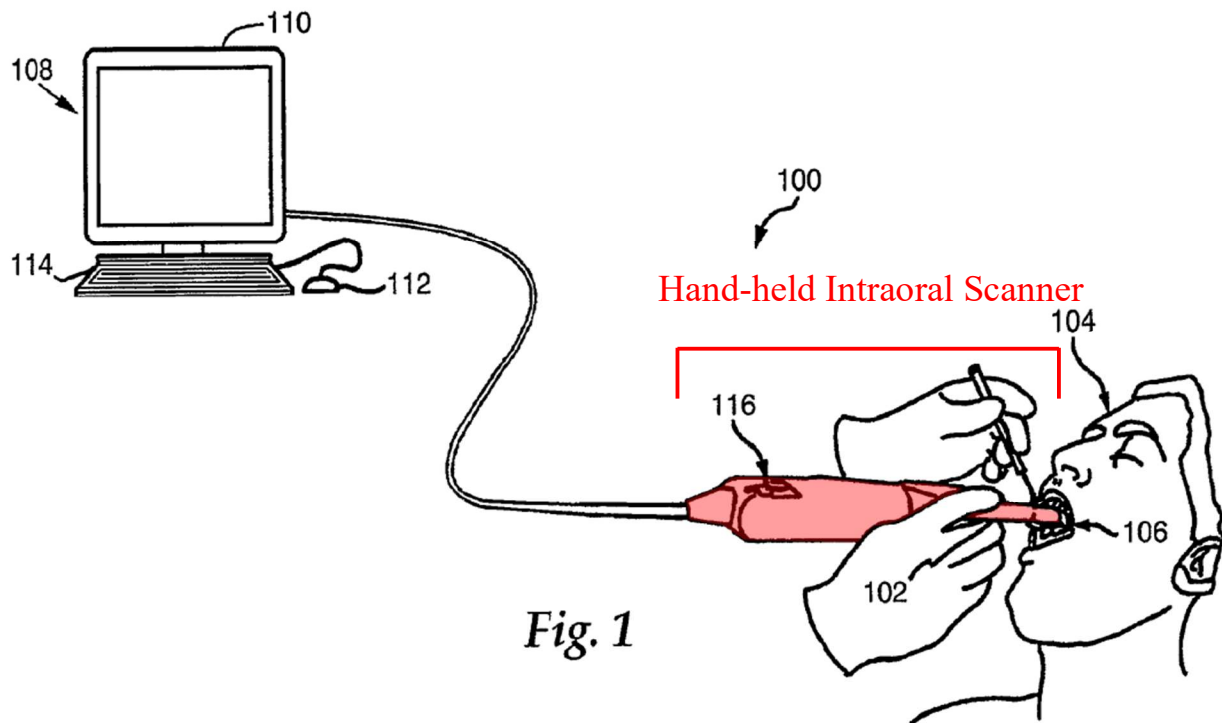


Ex-1004, Fig. 1, [00118] (“dental image capture system”). Boerjes’s system “captures images from a surface 106 of a subject 104,” such as a dental patient’s teeth, and “forwards the images to a computer 108, which may include a display 110” and user input devices. Ex-1004, [00132]; Ex-1003, ¶ 78.

b. 1[a] a hand-held intraoral scanner; and

Boerjes’s “scanner 102 is a handheld, freely positionable probe.” Ex-1004, [00135], Fig. 1. The scanner is used “for acquiring a three-dimensional representation of one or more intraoral structures of a dental patient.” *Id.*, [0012];

see also *id.*, [0007], [0016]; *supra* VII.A.



Ex-1004, Fig. 1 (annotated). The scanner is “shaped and sized for intraoral scanning and data capture, such as by insertion into a mouth of an imaging subject and passing over an intraoral surface.” *Id.*, [00135]. As scanner 102 passes over the imaging surface, it “acquire[s] surface data from teeth, gums, and so forth.” *Id.*; Ex-1003, ¶¶ 79-80.

- c. **1[b] a computer readable medium including instructions that when executed by a computer system, cause the computer system to:**

Boerjes’s system performs certain functions, such as image acquisition, processing, display, and manipulation according to the instructions stored on its computer-readable medium. Ex-1004, [0010], [0038], [0061], [00146]-[00148],

Fig. 1. For example, Boerjes “includes computer executable *code* embodied in a *computer readable medium that, when executed on one or more computer devices, may perform the steps* of: acquiring one or more images of one or more intraoral structures of a dental patient from an intraoral scanner; converting the one or more images into a three-dimensional representation of the one or more intraoral structures.” Ex-1004, [0010] (emphasis added); Ex-1003, ¶ 81-82.

d. 1[c] receive first scan data of the patient’s teeth from the hand-held intraoral scanner;

Boerjes’s scanner 102 “acquire[s] surface data.” *Supra* VIII.A.1.b. The computer system receives this surface data—first scan data of the patient’s teeth—from the hand-held intraoral scanner. Ex-1004, [00130], [00144]; Ex-1003, ¶¶ 83-84.

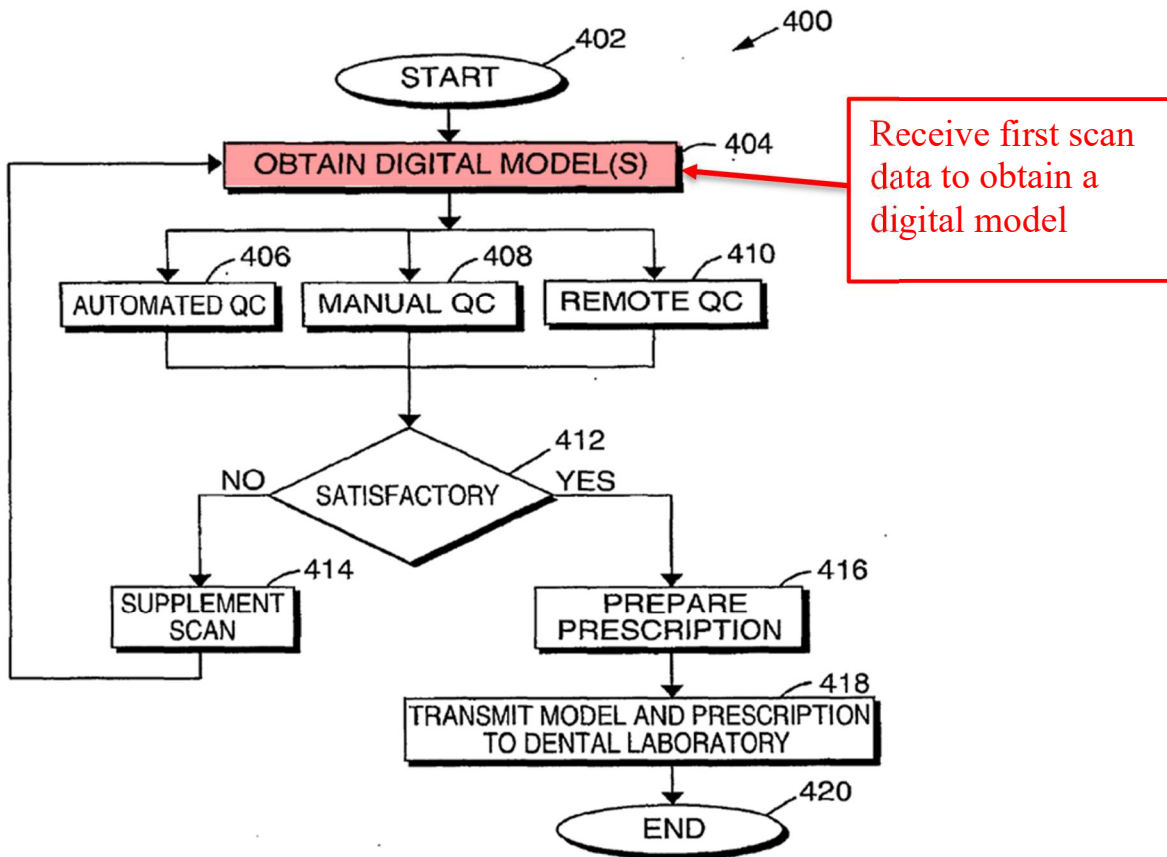
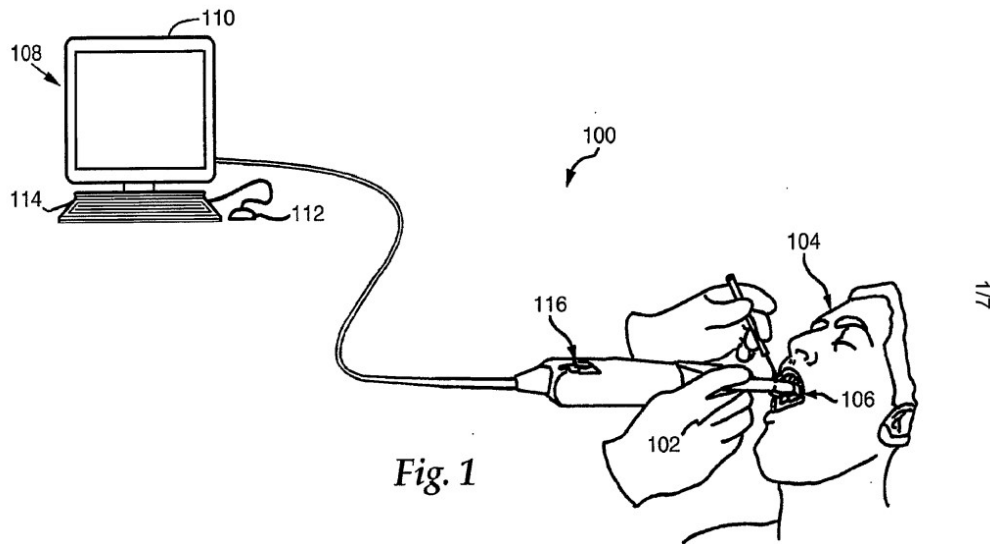


Fig. 4

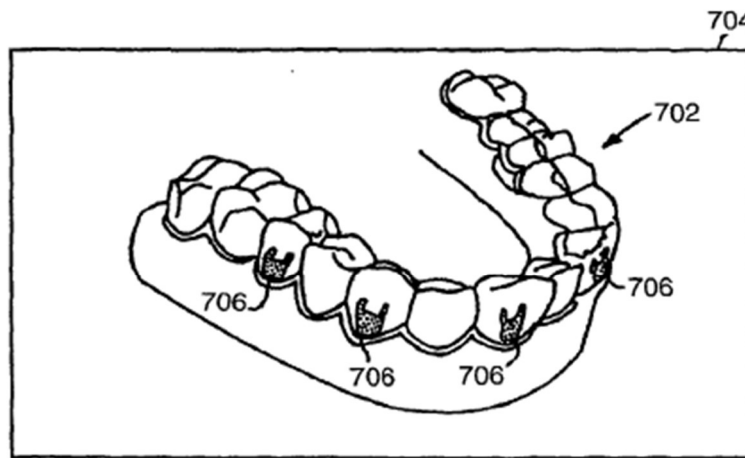
Ex-1004, Fig. 4 (annotated).

- e. 1[d] display, to a display, a model of the patient's teeth, wherein the model of the patient's teeth is based on the received first scan data of the patient's teeth;

Boerjes's computer 108 creates a digital model of a patient's teeth based on the received first scan data and displays the model on display 110. Ex-1004, [0040], [0061], [00129], [00132], [00139], Fig. 1; Ex-1003, ¶¶ 85-86.



Ex-1004, Fig. 1. The computer “generate[s] a visualization of the three-dimensional representation” and “provide[s] the visualization as a display signal” to be sent to a display and “convert[ed] ... into a viewable image.” *Id.*, [0076], [0145]. The model displayed may be dentition model 702, such as in Figure 7A:



Id., Fig. 7A, [00221]-[00222]; Ex-1003, ¶ 86.

- f. 1[e] receive user input defining a portion of the model to be removed; 1[f] remove, from the displayed model, a removed surface portion of the model to be removed according to the user input;**

Boerjes alone discloses and renders obvious these limitations (**Ground 1**) and Boerjes in view of Geng (**Ground 2**) also renders obvious these limitations.

Ex-1003, ¶¶ 87-105.

- i. Boerjes renders obvious 1[e]-1[f] (Ground 1)**

Boerjes's system receives user input defining a portion of the model to be replaced with new scan data following physical changes to the intraoral cavity. Ex-1004, [00196], [00199]. After a model is obtained from a first scan (step 404), Boerjes's process proceeds to quality control steps (e.g., steps 406-410). *Id.*, [00188]-[00197]; Ex-1003, ¶ 88.

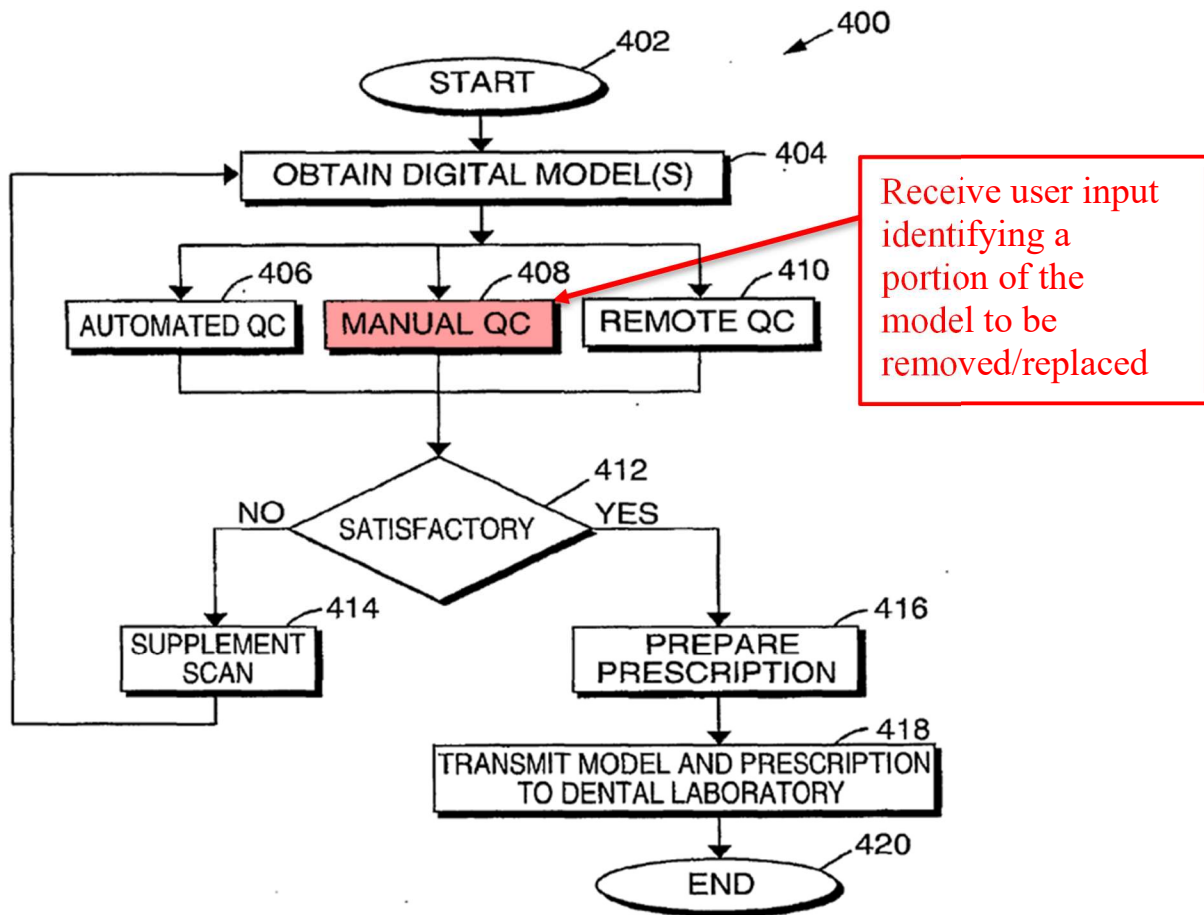


Fig. 4

Ex-1004, Fig. 4 (annotated). These steps include displaying the model and allowing the user to manually locate potential defects. *Id.*, [00188]-[00196]; *see also id.*, [0043]. For instance, a user may identify areas that need replacing, such as “a margin line” to be removed, “areas of poor margin preparation,” and “holes or areas of incomplete scan[s].” *Id.*, [00189], [00193]. Boerjes also specifically describes a user “identif[ying] ...regions of a prepared tooth surface requiring additional preparation[s]” and “supplemental scanning.” *Id.*, [00196]; Ex-1003, ¶ 88.

Boerjes provides “a number [of] interactive, three-dimensional tools such as markup tools” that “a dentist or other dental professional” could use to identify areas to be replaced with additional scan data. Ex-1004, [00192]. Boerjes’s user interface, e.g., a touch-screen display, is “capable of receiving user input.” *Id.*, [00142], [00148], [00192]. A POSITA would have understood that the user would mark on the model “regions of a digital model requiring additional or supplemental scanning” via the user interface, such as by providing “graphical feedback ... highlighting questionable or erroneous areas of a preparation within a rendered display of scan data” (*id.*, [00196]) to indicate areas of the model to be “replaced.” *Id.*, [00196]-[00197], [00199]. Boerjes thus discloses identifying a surface portion of the model to be replaced. Ex-1003, ¶ 89.

Identifying areas to be replaced also would have been obvious to a POSITA in view of the well-known capabilities (discussed above *supra* IV.C) to identify defects and replace them, e.g., using image registration. *See, e.g.*, Ex-1008, [0059]-[0060]. For example, Kriveshko—relied on by the Board in the ’192 patent IPR—avoids “initiating a [full] new scan” to “replace the defective results” by allowing a user to “continue a previous scan.” Ex-1008, [0005]-[0006]. Kriveshko therefore describes “a user’s ability to select a point on the original three-dimensional model for re-acquisition of a scan,” and that the system then “create[s] a supplemental three-dimensional model by fitting sequential frames to one another before a

successful fit to the original three-dimensional model.” Ex-1007, [0097]; *see also id.*, [0074], [0086], [0098]-[0101]; *see also* Ex-1008, Fig. 5, ¶¶ 38, 53, 60, 73, 77; *3Shape A/S*, IPR2019-00134, Paper 29, at 20-23.

Boerjes also suggests removing the user-identified surface portion from the model, and a POSITA would have been motivated to remove the user-identified surface portion before replacing it with new scan data. Ex-1004, [00196]-[00199]; Ex-1003, ¶ 90. For instance, a POSITA would have understood that *removing* the identified portion would have been a suitable way to allow new scan data to replace the identified, unwanted portion. Ex-1003, ¶¶ 90-91. A POSITA would have understood that keeping the unwanted old data could result in confusing and incoherent data. *Id.* Additionally, when addressing a similar limitation in the IPR of the ’192 patent, the Board concluded that, “even if the replacing step is construed to require deleting the inaccurate data, Petitioner has shown that such deleting was well known and would have been obvious to a [POSITA].” *See 3Shape*, IPR2019-00134, Paper 29, 32-33, 37-38.

Also, a POSITA implementing Boerjes would have found it preferable to remove the user-identified portion from the model *before* replacing it with new scan data. Ex-1003, ¶ 92. This is because removing the unwanted data would improve the accuracy and efficiency of replacing the user-identified surface portion with new scan data, reduce time for the dental procedure, and improve patients’

comfort. Ex-1003, ¶¶ 92-94; Ex-1005, 3:23-34. A POSITA also would have had a reasonable expectation of success in including the function to remove the identified portion from the model before replacing it with new scan data in Boerjes's system. Ex-1003, ¶¶ 95-96. As explained above, removing portions of a virtual model has been a well-known and routine technique in 3D modeling. *Id.*; Ex-1005, 7:38-51; Ex-1009, [0324]-[0328]; Ex-1015, [0068]-[0069], [0088]-[0089], [0117]-[0119]; Ex-1020, 9:3-40; *supra* IV.B. Boerjes's system is equipped with a tool to remove an unwanted portion from the model. Ex-1004, [0043]-[0044], [00208]. Implementing the function of removing the user-identified portion in Boerjes's process of replacing a user-identified portion would have been well within the skills of a POSITA. Ex-1003, ¶ 95.

ii. Boerjes in view of Geng renders obvious 1[e]-1[f] (Ground 2)

Geng discloses receiving user input defining a surface portion of the model to be removed and removing the portion. Ex-1005, 7:40-44. A POSITA would have been motivated to combine Geng's teachings regarding a functionality for identifying and removing the identified surface portion with the teachings of Boerjes. Ex-1003, ¶¶ 97-105.

Like Boerjes, Geng discloses a system for scanning a patient's teeth with a hand-held intraoral scanner. Geng's system (1) receives first image data of a

patient's teeth from a scanner, (2) displays a model of the patient's teeth created from the first scan data, (3) receives user input defining a portion of the model to be removed, and (4) removes that portion. Ex-1005, 2:21-3:34, 3:48-5:21, 6:15-53, 7:12-51, Figs. 1-3; Ex-1003, ¶¶ 97-98.

Geng's system includes a user interface for evaluating a 3D image of prepared teeth to ensure that the image is accurate and suitable for fabricating dental prostheses. Ex-1005, 2:21-31, 3:14-4:53, 7:12-51, 15:41-57, Figs. 1-2. Geng's user interface allows the user to manipulate or edit the 3D image model, such as by modifying and/or *removing* undesirable areas on the model. *Id.*, 6:15-41, 7:38-51, Figs. 1-3, 5. Geng explains that “[k]nown editing functions can be employed, including typical editing functions that provide for *deleting*, creating, and modifying objects.” Ex-1005, 7:46-48 (emphasis added); Ex-1003, ¶ 99. Geng also discloses removing undesirable data points to reduce the size of image files. Ex-1005, 7:40-44 (“The editor (312) allows operators to modify and/or eliminate any undesirable area(s) on the original 3D image obtained from the camera (104; FIG. 1), remove abnormal data point(s), and clean up the acquired image data to reduce the sizes of image data files.”); Ex-1003, ¶ 100.

Geng's system “can dramatically reduce dental costs, eliminate unnecessary time waste for both dentists and patients, and create new business opportunities in dentistry.” Ex-1005, 15:53-57.

(a) Rationale to Combine

Boerjes and Geng are both analogous art to the '936 patent and to each other, each disclosing systems that allow for interactive 3D imaging of teeth. *Supra* VII.A-VII.B; Ex-1003, ¶¶ 61, 66, 97-101.

A POSITA would have been motivated to look to Geng, when implementing Boerjes's quality control process, and use Geng's editing function to remove the undesirable portions on the model to improve the efficiency and accuracy of Boerjes's replacement process and improve patient comfort. *Supra* VIII.A.1.f.i; Ex-1003, ¶¶ 100-101.

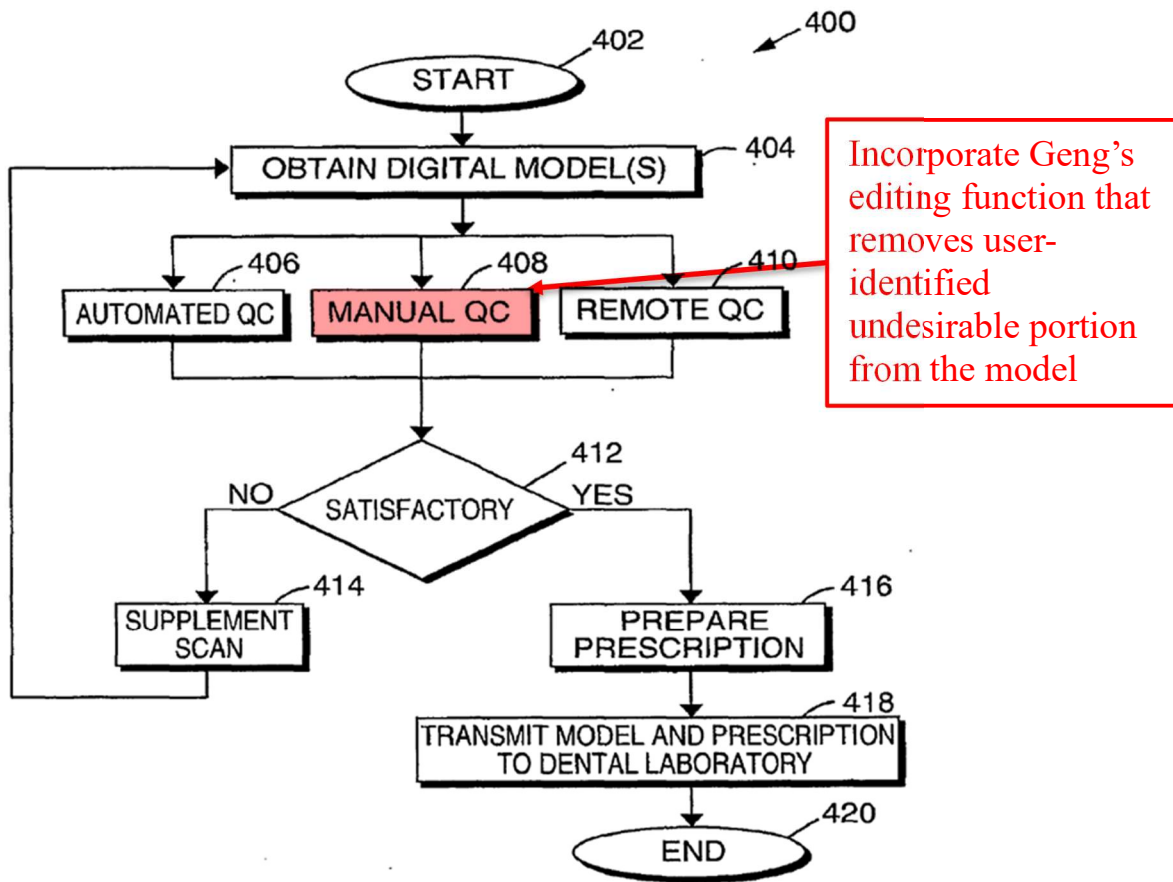


Fig. 4

Ex-1004, Fig. 4 (annotated).

A POSITA would have understood that *removing* the undesirable portion to allow for the new scan data to take its place is a suitable option for implementing Boerjes's replacement process. A POSITA would have also understood that *removing* the user-identified portion from the model would improve the accuracy and efficiency for replacing the identified portion with newly scanned data. *Supra* VIII.A.1.f.i; Ex-1003, ¶ 102.

And a POSITA would have understood that by removing undesired portions, and thus removing unused data, this system would conserve computer resources and provide faster processing because the computer has less data to sift through. Ex-1003, ¶ 103. Likewise, data-transfer times would be similarly reduced with less image data to transfer. Ex-1004, [00194]. This would lead to faster model generation and a less time-consuming procedure for patients, thereby improving comfort and costs. Ex-1003, ¶ 103.

In addition, a POSITA would have had a reasonable expectation of success in combining Boerjes's system with Geng's teachings to interactively remove undesirable portions from the model. Both references disclose scanning systems, and a POSITA could have readily incorporated Geng's editing functionality into Boerjes's similar user interface. A POSITA would have known how to program Boerjes's system to implement Geng's functions using ordinary computer-programming skills. Ex-1003, ¶ 104. As discussed above, it was well known to equip dental scanning systems with software tools that allow the user to manipulate and edit the model, including removing undesirable areas. *See supra* IV.A-IV.B; *see also* Ex-1020, 2:4-7, 3:15-23, 9:3-40; Ex-1009, [0116], [0128], [0324]-[0328]. Indeed, removing a defective area before replacing that area was known and performed in dental scanning systems. *See, e.g.*, Ex-1015, [0118]-[0119] (removing

and replacing scan data with data from a different scan that represents the same area); *see also* Ex-1003, ¶ 104.

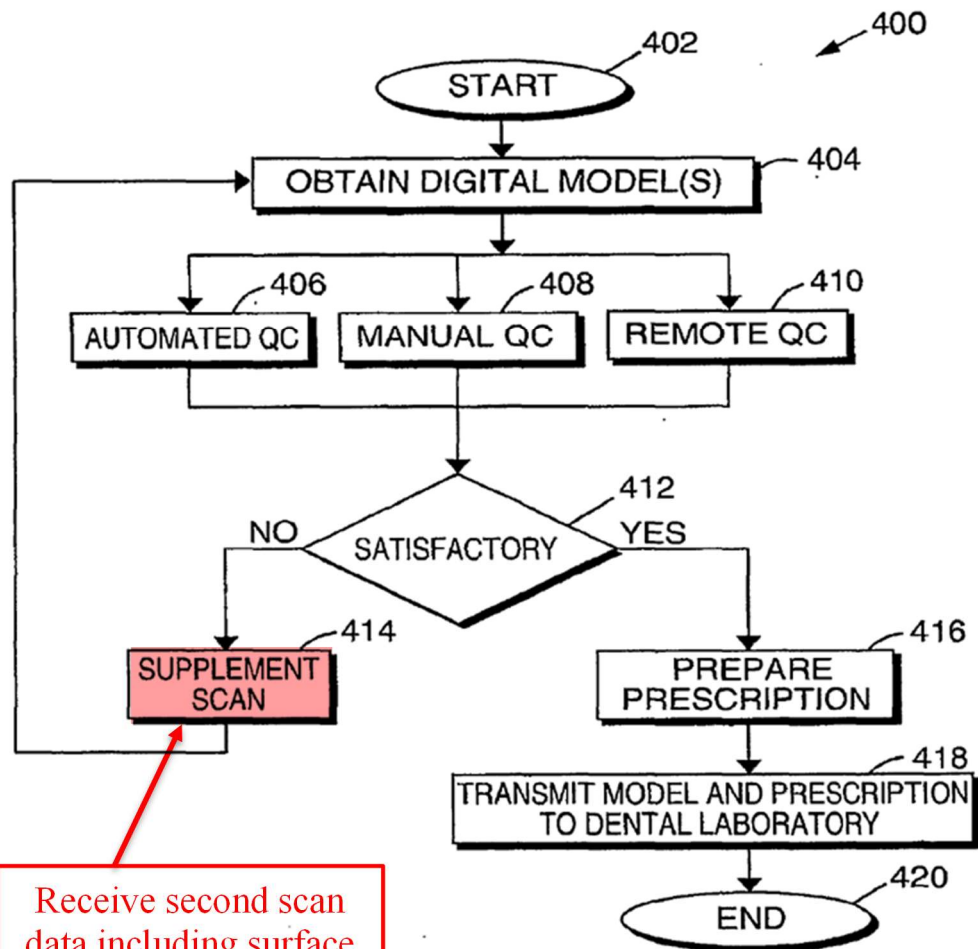
Finally, implementing Geng’s function in Boerjes’s system would have involved merely applying known techniques—Geng’s editing function—to improve Boerjes’s known and similar system in the same way. Ex-1003, ¶ 105. This implementation also would have involved simply combining known techniques—Boerjes’s system and Geng’s function—to yield predictable results of removing and replacing an undesirable portion from Boerjes’s model. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007) (“[W]hen a patent simply arranges old elements with each performing the same function it had been known to perform and yields no more than one would expect from such an arrangement, the combination is obvious.” (quotation omitted)).

- g. 1[g] receive second scan data of the patient’s teeth from the hand-held intraoral scanner, the second scan data including surface data of a physically changed portion of the patient’s intraoral cavity;**

Boerjes’s scanner captures surface data of an intraoral cavity and displays a digital model of the patient’s teeth. Ex-1004, [0041], Figs. 1, 4; *supra* VII.A, VIII.A.1.d. During quality-control steps, a user can identify regions of the model that require “additional or supplemental scanning,” such as regions that require “additional surface preparation or reduction.” *Id.*, [00189]-[00196]; Ex-1003,

¶ 107; *supra* VII.A, VIII.A.1.f. For example, a dentist can identify areas that require additional preparations, complete the preparations, and then rescan these areas. Ex-1004, [00193], [00196], [00199]. Thus, Boerjes discloses acquiring “new scan data” (i.e., second scan data) “following, e.g., additional surface preparation consistent with errors identified during quality control” and allowing “the digital model [to] be supplemented or replaced with new scan data.” *Id.*, 1004, [00199]. A POSITA would have understood that, like the first scan data, the “new scan data” would include surface data of a tooth or preparation captured by Boerjes’s scanner after additional surface preparation (“a physically changed portion of the patient’s intraoral cavity”). *Id.*, [0059]-[0064], [00127]-[00128], [00135].³

³ The ’936 patent does not disclose any mechanism for handling a physically changed portion of a patient’s intraoral cavity (i.e., “instructions that when executed ... cause the computer system to: ... receive ... surface data of a physically changed portion”), and Boerjes discloses at least as much as the patent.



Receive second scan
data including surface
data of physically
changed portion

Fig. 4

Ex-1004, Fig. 4 (annotated), [00199] (“This may include, for example, new scanning to replace apparently erroneous or inadequate scan data, or a new scan of the dental subject matter following, e.g., additional surface preparation ...”). Thus, Boerjes receives second scan data including the surface data of the physically changed portion of the patient’s intraoral cavity, e.g., after an additional surface preparation is performed. Ex-1003, ¶¶ 106-107.

- h. 1[h] replace at least a portion of the removed surface portion of the model using the received second scan data of the patient's teeth including surface data of a physically changed portion of the patient's intraoral cavity; and**

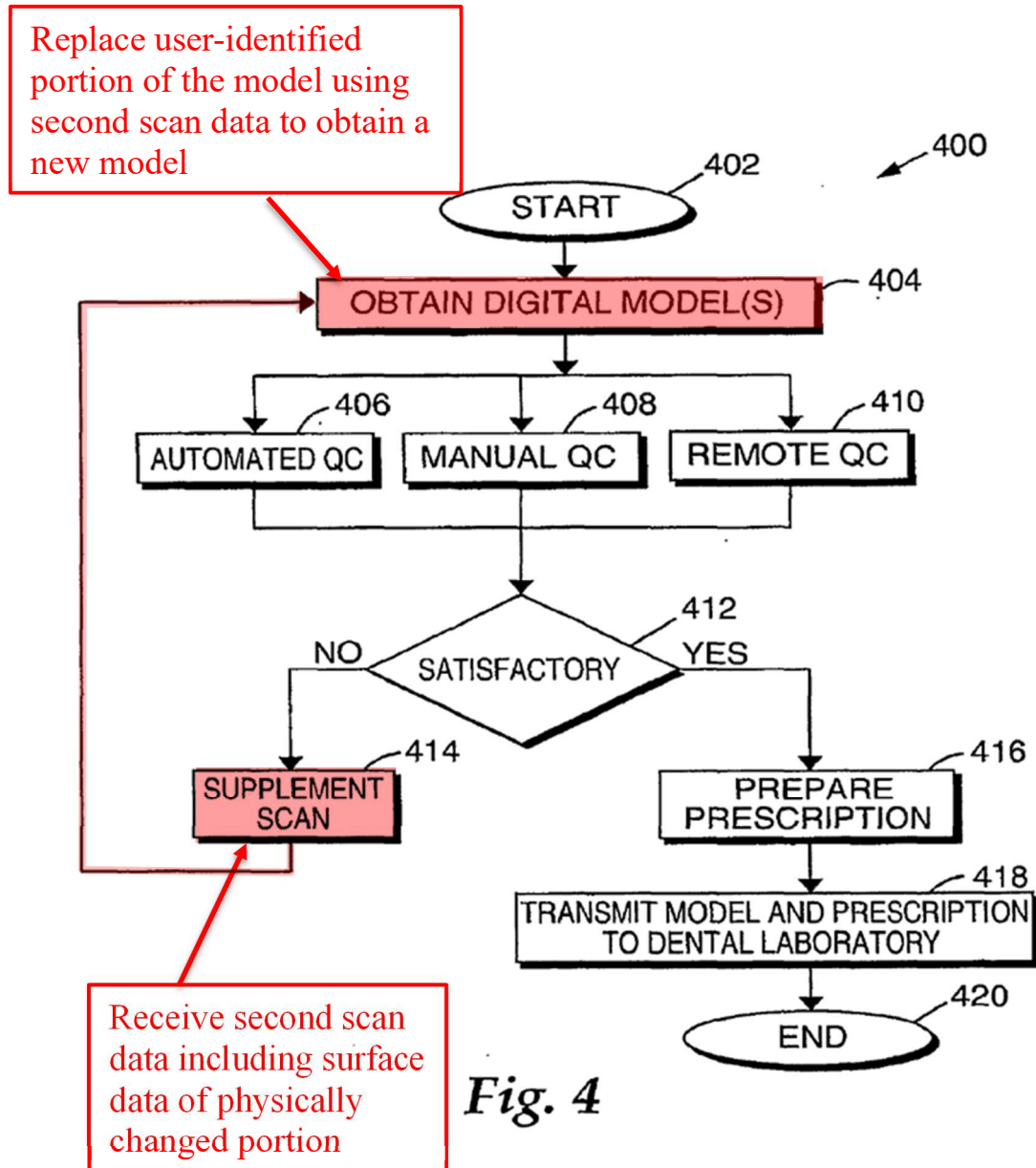
Under either the district court's preliminary construction or the plain and ordinary meaning as proposed by Patent Owner (*see* Section VI), Boerjes discloses and renders obvious this limitation (**Ground 1**), and Boerjes in view of Geng (**Ground 2**) also renders obvious this limitation. Ex-1003, ¶¶ 108-123.

- i. Boerjes discloses and renders obvious 1[h] (**Ground 1**)**

Boerjes discloses, or at least renders obvious, obtaining new (second) scan data to “*replace[]*” at least a portion of the removed surface portion of the model following additional surface preparations of teeth—i.e., after a portion of the patient's intraoral cavity has been “physically changed.” Ex-1004, [00199] (emphasis added); *supra* VIII.A.1.g. Boerjes discloses (i) identifying regions of the first scan data that “requir[e] additional preparation[s],” (ii) correcting the inadequacies with additional preparations, and (iii) subsequently conducting “additional or supplemental scanning” to *replace* the inadequate regions. *Id.*, [00189]-[00199]. After Boerjes determines “whether a scan and/or surface preparations are satisfactory,” in step 412, the process proceeds to step 414, “where

the digital model may be supplemented or replaced with new scan data.” *Id.*,

[00199], Fig. 4; Ex-1003, ¶¶ 109-110.



Ex-1004, Fig. 4 (annotated), [00199]. Boerjes describes, for example, “new scanning to replace apparently erroneous or inadequate scan data,” or a “new scan of the dental subject matter following, e.g., additional surface preparation

consistent with errors identified during quality control.” *Id.*, [00199]; *see also id.* [00139] (“A scan may capture a three-dimensional representation of some or all of the dentition according to particular purpose of the scan.”); [00144] (“The three-dimensional data for each newly acquired two-dimensional image set may be derived and fitted or ‘stitched’ to existing three-dimensional data using a number of different techniques.”); [00163] (“[A] scan may be obtained of a prepared surface” followed by “combining historical three-dimensional data with a three-dimensional representation of the prepared surface.”); Ex-1003, ¶¶ 109-110.

A POSITA would have understood that in Boerjes, the second scan data would be used to replace at least a portion of the removed surface of the model, including the surface data of the physically changed portion. *Id.*, [00196]-[00199]; *supra* VIII.A.1.f.i; Ex-1003, ¶¶ 109-111.

A POSITA would have understood that well-known image registration and stitching techniques as in Boerjes would be used to replace at least a portion of the model with the new scan data. Ex-1003, ¶ 112. As explained above, Boerjes discloses registering and combining or stitching 3D data into an aggregate 3D model. Ex-1004, [00126], [0144], [00218]. This is also true under the district court’s construction, requiring registering the second scan data with a retained portion of the model after removing the portion of the first scan data. *Supra* VI.

Replacing a portion of the model using new scan data of a physically changed portion would have been obvious to a POSITA based on Boerjes and a POSITA's knowledge. Updating a model by removing and replacing portions that are inadequate or have been physically changed was well-known in the art. *Supra* IV.C; Ex-1008, [0059]-[0060]; Ex-1007, [0074], [0086], [0097]-[0101]; Ex-1015, [0010]-[0014], [0048], [0118]-[0119]. Applying that technique in situations described by Boerjes (e.g., after additional surface preparation) would have been a well-known and efficient way to update a model based on new scan data.

Indeed, a POSITA would have known and been motivated to use known methods, such as “register[ing]” and “stitch[ing],” as recognized by Boerjes, as part of Boerjes's replacement of undesirable areas. Ex-1004, [00126], [00218], [00144]; Ex-1007, [0058], [0065]-[0066], [0074], [0086], [0097]; Ex-1008, [0006], [0036]. Both image registration and stitching were commonly known and used in computer-vision and image-processing applications, and a POSITA would have known that image stitching is often performed with image registration to align multiple images based on common features or data and further combines the aligned images into a single image. Ex-1003, ¶ 112; *supra* IV.C.

A POSITA therefore would have been motivated to register the new scan data with the model after the undesirable portion is removed such that the new scan data would be properly aligned with and stitched into the model because doing so

would (1) reduce the risk of improper or failed registration of the new scan data to the model, and (2) prevent inefficiencies in registering new scan data with the model. Ex-1003, ¶¶ 113-115.

Finally, a POSITA would have had a reasonable expectation of success in applying these techniques to update a model to include new scan data for a physically changed portion of the patient's intraoral cavity. The '936 patent does not propose any special method for updating a model for this particular use case (where the patient's intraoral cavity has been physically changed), nor does it require any particular technical capability. A POSITA therefore could have applied conventional image-registration and stitching techniques to replace a removed portion of the model using second scan data, which includes surface data for a portion of the intraoral cavity that has physically changed. Ex-1003, ¶¶ 116-117.

**ii. Boerjes in view of Geng renders obvious 1[h]
(Ground 2)**

Geng's system is equipped with merger tool (320) "that enable[s] operators to integrate multiple uncalibrated 3D images into a single 3D digital impression (116; FIG. 1)." *See, e.g.*, Ex-1005, 7:57-8:3, FIG. 3.

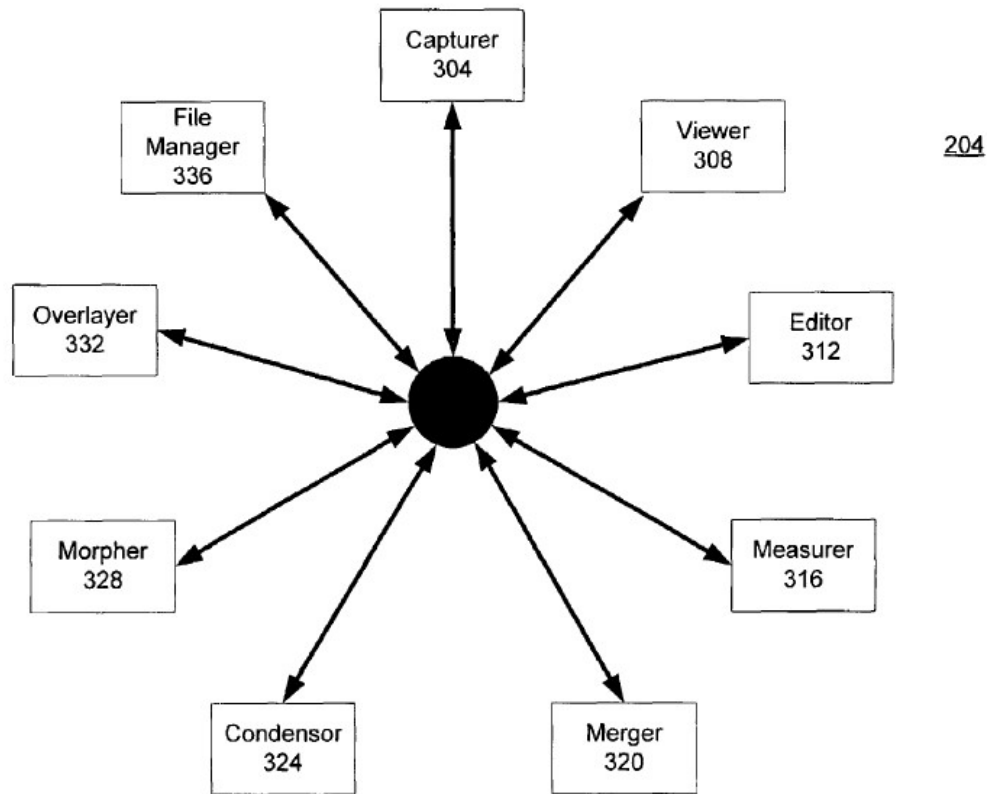


Fig. 3

Id., Fig. 3; Ex-1003, ¶ 119.

(a) Rationale to Combine

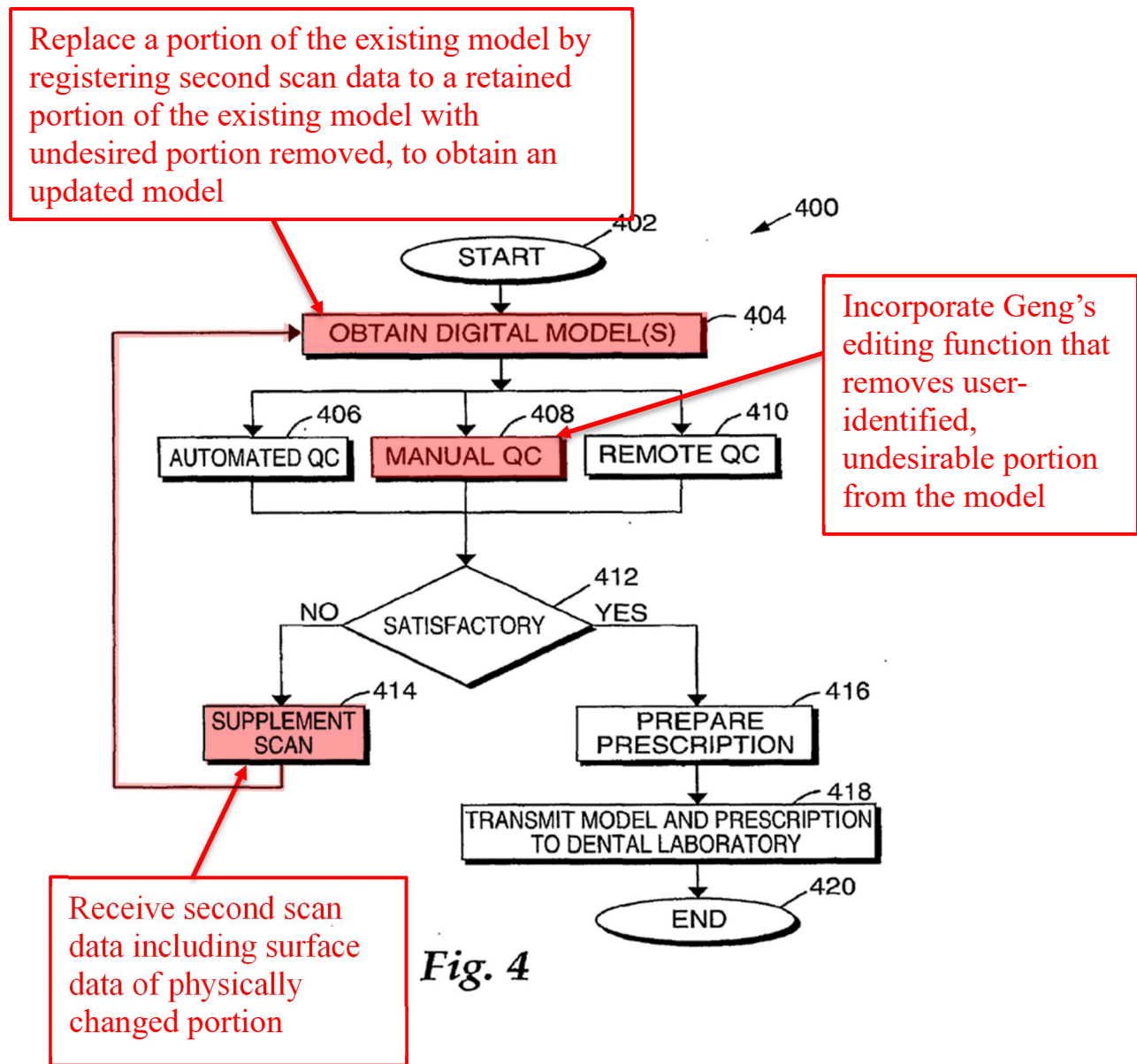
A POSITA would have been motivated to use Geng’s merger function to replace the first scan’s undesired portion with the second scan data in Boerjes.

Supra VIII.A.1.f.ii; Ex-1003, ¶¶ 118-123. Boerjes and Geng are analogous art to the claimed invention and to each other. *Supra* VII.A, VII.B; Ex-1003, ¶ 120.

Geng discloses that the system “is able to bring the 3D images together and optimize the geometric registration of these images.” Ex-1005, 7:57-8:3.

(explaining that “*image registration* techniques known to those skilled in the art

can be used to merge the acquired images together to form the 3D digital impression.” (emphasis added)). A POSITA would have known to use conventional image-registration methods to replace Boerjes’s undesired portion of the model with second scan data. *Supra* V.III.A.1.f. And Geng’s merger function would have been a suitable option because it allows for aligning and integrating the second scan data to the existing model in Boerjes. Ex-1003, ¶¶ 120-123. The combined system would have registered the second scan data to the existing model to replace the undesired, removed portion, thereby obtaining an updated digital model of the teeth (e.g., after additional surface preparation, as described by Boerjes). *Supra* VIII.A.1.f.



Ex-1004, Fig. 4 (annotated to show the combination).

A POSITA would have had a reasonable expectation of success in implementing Geng's merging function in Boerjes's system because such modification requires nothing more than ordinary computer-programming skill.

Ex-1003, ¶ 123; *supra* VIII.A.1.f.ii. Implementing Geng's merger function in

Boerjes's system would have only involved applying known techniques—Geng's merger function—to improve a known and similar system—Boerjes's system, and it would also have been combining known techniques, Boerjes's system and Geng's merger function, with each performing the same function it had been known to perform, and would have yielded predictable results of replacing the user-identified portion with new scan data in Boerjes. Ex-1003, ¶ 123.

- i. **1[i] output, to the display, the model of the patient's teeth with the portion of the removed surface portion replaced using the received second scan data.**

Boerjes or Boerjes combined with Geng's editing function renders obvious removing the user-identified portion of the model of the patient's teeth before replacing that portion. *Supra* VIII.A.1.f, VIII.A.1.g. Boerjes discloses that once the new scan data ("second scan data") replaces the identified portion of the model, the process 400 returns to step 404 and the digital model is updated and then displayed. Ex-1004, [00193]-[00199], Fig. 4. Thus, Boerjes or Boerjes in view of Geng renders obvious outputting, to the display, the model with the removed surface portion replaced using the received second scan data. Ex-1003, ¶¶ 124-125.

2. **Claim 4: The system of claim 1, wherein the instructions to replace the at least the portion of the removed surface portion of the model using the received second scan data comprise instructions to register the received second scan data with the model.**

a. Boerjes alone renders obvious claim 4 (Ground 1)

Boerjes alone renders obvious this limitation for the reasons disclosed above for limitations 1[b], 1[e]-1[h]. Ex-1003, ¶ 126; *supra* VIII.A.1.c, VIII.A.1.f-h. Boerjes renders obvious instructions that cause the computer system to replace the removed surface portion according to user input because a POSITA would have found removing the user-identified portion would improve the accuracy and efficiency of replacing the user-identified portion and improve patients' comfort. *Supra* VIII.A.1.c, VIII.A.1.f.i, VIII.A.1.g, VIII.A.1.h.i; Ex-1003, ¶¶ 90-96, 126. And Boerjes renders obvious registering the second scan data with the retained portion of the model after the undesirable portion is removed because a POSITA would have found it obvious to use well-known image registration and stitching techniques disclosed in Boerjes in the replacement process. *Supra* VIII.A.1.h.i; Ex-1003, ¶¶ 112-117, 126.

b. Boerjes in view of Geng renders obvious claim 4 (Ground 2)

Boerjes in view of Geng renders obvious this limitation, including for the reasons disclosed above for limitations 1[b], 1[e]-1[h]. Ex-1003, ¶ 127; *supra* VIII.A.1.c, VIII.A.1.f.ii, VIII.A.1.h.ii. Boerjes in view of Geng renders obvious

instructions to replace the removed surface portion using second scan data because a POSITA would also have found it obvious to implement Geng's editing functionality in Boerjes's system. *Supra* VIII.A.1.c, VIII.A.1.g, VIII.A.1.f.ii, VIII.A.1.h.ii; Ex-1003, ¶¶ 97-105, 127. And Boerjes in view of Geng renders obvious registering the second scan data with the retained portion of the model after the undesirable portion is removed because a POSITA would have found it obvious to implement, in Boerjes's system, Geng's merger functionality in Boerjes's system. *Supra* VIII.A.1.h.ii; Ex-1003, ¶¶ 118-123, 127.

3. Claim 5: The system of claim 4, wherein the received second scan data is registered with the model by aligning identifying data of the received second scan data with corresponding parts of the model.

a. Boerjes alone renders obvious claim 5 (Ground 1)

Boerjes alone renders obvious this limitation, for the reasons below and discussed above for limitation 1[h] and claim 4. *Supra* VIII.A.1.h.i, VIII.A.2.a. A POSITA would have understood that alignment of the corresponding data points or features ("identifying data") (as discussed in Section IV.C) in overlapping areas between two datasets would be required to ensure proper alignment of the full data sets during registration. Ex-1003, ¶ 129. Indeed, Boerjes suggests aligning identifying data of the second scan data with corresponding parts of the model because Boerjes discloses using a stitching process for combining data sets into a

single model. Ex-1004, [00144]. A POSITA would have understood that to stitch the new scan data to the existing model, Boerjes's system would first identify corresponding points or features between the new data set and the retained portion of the model and align the corresponding points or features, thereby registering the new scan data with the model. Ex-1003, ¶¶ 128-130.

b. Boerjes in view of Geng renders obvious claim 5 (Ground 2)

Boerjes in view of Geng renders obvious this limitation for the reasons below and for similar reasons discussed for limitation 1[h] and claim 4. *Supra* VIII.A.1.h.ii, VIII.A.2.b; Ex-1003, ¶¶ 131-133. A POSITA would have found it obvious to implement Geng's merger functionality in replacing the removed portion of the model using new scan data in Boerjes's system. *See supra* VIII.A.1.h.ii. Geng's merger function performs registration by searching for common points based ("identifying data") among multiple images or scans. Ex-1005, 7:57-8:3, Fig. 3. Based on these common points, the multiple images and scans can later be merged together to form one 3D digital representation. *Id.*; Ex-1003, ¶ 132.

A POSITA would have understood that Geng's use of common points for registering images would ensure proper alignment of the 3D images. Ex-1003, ¶ 133. Thus, in Boerjes combined with Geng's merger function, the common points

and their geometric features (“identifying data”) of the second scan data would be aligned with the corresponding parts of the retained portion of the model such that the removed portion would be replaced with the second scan data at the correct locations and pixels. *Id.*

4. **Claim 6: The system of claim 5, wherein the instructions to replace the at least the portion of the removed surface portion of the model using the received second scan data comprise instructions to further stitch a portion of the received second scan data with the model.**

- a. **Boerjes alone renders obvious claim 6 (Ground 1)**

Boerjes renders obvious this limitation for the reasons below and those disclosed above for limitation 1[h] and claims 4-5. *Supra* VIII.A.1.h.i, VIII.A.2.a-VIII.A.3.a. Boerjes discloses that new 3D data can be fitted or “stitched” to existing 3D data. Ex-1004, [00144]. A POSITA would have found it obvious to use conventional methods, such as “stitch[ing],” in Boerjes’s replacement of the undesired area in the model. *Id.*; Ex-1003, ¶ 135. A POSITA would have known that image registration is commonly performed before image stitching, and both techniques were conventional and well-known. Ex-1003, ¶¶ 134-135; *see also supra* IV.C. Thus, a POSITA would have applied ordinary skill to include computer instructions in Boerjes’s system to stitch the second scan data with the model such that the undesired surface portion would be replaced with the second scan data. Ex-1003, ¶¶ 134-135; *see also supra* IV.C.

**b. Boerjes in view of Geng renders obvious claim 6
(Ground 2)**

Boerjes in view of Geng renders obvious this limitation for the reasons disclosed above for limitation 1[h] and claims 4-5. *Supra* VIII.A.1.h.ii, VIII.A.2.b, VIII.A.3.b. Boerjes discloses stitching new 3D data to existing 3D data (Ex-1004, [00144]), and a POSITA would have found it obvious to implement Geng's merger function in Boerjes's system when replacing the removed portion of the model using new scan data. *Supra* VIII.A.1.h.i-h.ii. Geng also explains that "[k]nown techniques for merging or overlaying images" can be implemented to form an integrated 3D model. Ex-1003, ¶ 136; Ex-1005, 5:28-40. A POSITA would have found it obvious to use Geng's merger function with Boerjes's conventional stitching technique in the Boerjes-Geng system. Ex-1003, ¶ 136; *supra* IV.C.

5. Claim 8: The system of claim 1, wherein the computer readable medium further includes instructions that when executed by the computer system, cause the computer system to: mark, on the displayed model, the user input defined portion, after receiving the user input and before removing the removed surface portion of the model.

Boerjes discloses and renders obvious claim 8, alone and with Geng. Ex-1004, [00188]-[00196]; Ex-1003, ¶¶ 137-141. Once Boerjes's system displays the digital model, the user can identify, such as through interaction with a touch-screen display, portions of a tooth requiring further preparation (physical changes) and/or additional scanning. Ex-[1004], [00188], [00196]. This allows a user to "measure,

mark, annotate, or otherwise manipulate” the digital model of the patient’s teeth on the display. *Id.*, [00192] (emphasis added); Ex-1003, ¶ 138.

Boerjes’s computer displays this feedback concerning the areas for additional scanning and/or surface preparation. Ex-1004, [0060]-[0061], [00196]. For instance, Boerjes’s computer can highlight these areas using “color, texture, or explicit annotations, arrows, callouts, or the like” on the displayed model. *Id.*, [00196]. This marking occurs after receiving the user input because Boerjes’s display provides for real-time updates, “generally with no observable latency between processing and display.” *Id.*, [00141], [00190]. Thus, a POSITA would have understood that Boerjes updates the displayed model according to the user input after it is received. Ex-1003, ¶¶ 139-140.

A POSITA would also have understood that Boerjes’s marking the display would be before removing and replacing the user-identified portion based on a POSITA’s general knowledge. Moreover, a POSITA would have understood it as a suitable option to remove and replace the user-identified portion of the model after marking it on the display because it would allow the user to visualize and confirm the marked portion was correctly identified. Ex-1003, ¶ 141. Thus, Boerjes discloses or at least renders obvious marking, on the displayed model, the user input defined portion before removing and replacing that portion of the model. *Id.*, ¶ 141; *supra* VIII.A.1.f.ii.

6. Independent Claim 9

- a. 9[pre] A method for scanning a patient's teeth for a dental procedure, the method comprising:**

Boerjes discloses this limitation for the reasons discussed in 1[pre]. *Supra* VII.A, VIII.A.1.a; Ex-1003, ¶ 142.

- b. 9[a] receiving first scan data of the patient's teeth from a hand-held intraoral scanner;**

Boerjes discloses this limitation for the reasons discussed for 1[a] and 1[c]. *Supra* VIII.A.1.b, VIII.A.1.d. Ex-1003, ¶ 143.

- c. 9[b] displaying, to a display, a model of the patient's teeth, wherein the model of the patient's teeth is based on the received first scan data of the patient's teeth;**

Boerjes discloses this limitation for the reasons discussed for 1[d]. *Supra* VIII.A.1.e. Ex-1003, ¶ 144.

- d. 9[c] receiving user input via the displayed model demarcating a portion of the model to be retained and a surface portion of the model to be replaced;**

Boerjes discloses or at least renders obvious this limitation. As discussed for limitation 1[e], Boerjes discloses receiving user input identifying a portion of the displayed model to be replaced with new scan data. Ex-1004, [00142], [00148], [00192], [00196]-[00197]; *supra* VIII.A.1.f.i. This user input would include demarcating portions and, more specifically, marking, circling, outlining, annotating, highlighting, or otherwise identifying portions of the model, such as

those in need of replacement with additional scan data. Ex-1004, [00192]-[00194], [00196]; Ex-1003, ¶¶ 146-147.⁴

A POSITA also would have understood that it was well known to receive user input demarcating a portion of the model to be retained and a portion of the model to be replaced. Ex-1014, [0078], [0083], Figs. 1, 5, 7. For example, Kriveshko describes a “visualization [that] lets the user know where scanning has been performed and where additional scanning may be appropriate.” Ex-1007, [0096]. Kriveshko also explains that the user interface may “permit selection of a point or region of a subject where reacquisition is to be attempted.” Ex-1007, [0101].

Moreover, it would have been obvious to a POSITA to modify a system to identify on the display a portion of the model to be retained as well as the portion to be replaced. As explained by Dr. Karam, such a system would provide useful graphics for complex situations where additional information is needed to identify which portions of the model will be replaced and which will be retained. Ex-103, ¶ 148. A POSITA would have known how to incorporate this change into Boerjes’s

⁴ Patent Owner’s interpretation of this limitation in its infringement contentions is that this limitation is satisfied whenever a portion of the model to be replaced is demarcated. Ex-1027, 139-40, 150.

system because doing so would have required no more than ordinary computer-programming skills—updating software to expand Boerjes’s graphical feedback tools. Ex-1014, [0078], Figs. 1, 4-5. Accordingly, a POSITA would have had a reasonable expectation of success in such ordinary improvement of Boerjes, and this improvement would have yielded predictable results. Ex-1003, ¶ 148; *supra* VIII.A.1.f.ii.

- e. **9[d] receiving second scan data of the patient’s teeth from the hand-held intraoral scanner, the second scan data including surface data of a physically changed portion of the patient’s intraoral cavity;**

Boerjes discloses or renders obvious this limitation for the reasons discussed for limitation 1[g]. *Supra* VIII.A.1.g. Ex-1003, ¶ 149.

- f. **9[e] replacing at least a portion of the surface portion of the model to be replaced according to the user input using at least a portion of the second scan data of the patient’s teeth including the physically changed portion; and**

Limitation 9[e] is substantially similar to limitation 1[h]. Boerjes discloses and renders obvious this limitation alone (**Ground 1**) and in view of Geng (**Ground 2**) for the reasons discussed for limitation 1[h]. *Supra* VIII.A.1.h; Ex-1003, ¶ 150.

- g. 9[f] outputting, to the display, the model of the patient's teeth with the at least the portion of the surface portion replaced using the second scan data.**

Limitation 9[f] is substantially similar to limitation 1[i]. Boerjes discloses and renders obvious this limitation alone (**Ground 1**) and in view of Geng (**Ground 2**) for the reasons discussed for limitation 1[i]. *Supra* VII.A.1.i; Ex-1003, ¶ 151.

- 7. Claim 10: The method of claim 9, further comprising marking an area on the displayed model associated with the received user input.**

For the reasons discussed for claim 8, Boerjes discloses and renders obvious claim 10. *Supra* VIII.A.5; Ex-1003, ¶ 152.

- 8. Claim 11: The method of claim 9, wherein replacing the at least the portion of the surface portion of the model to be replaced according to the user input using at least the portion of the second scan data comprises registering the second scan data with the model by aligning identifying data of the second scan data with corresponding parts of the model.**

For the reasons discussed for limitation 1[h] and claims 4 and 5, Boerjes alone (**Ground 1**) or in view of Geng (**Ground 2**) renders obvious claim 11. *Supra* VIII.A.1.h, VIII.A.2-VIII.A.3. Ex-1003, ¶ 153.

9. **Claim 12: The method of claim 11, wherein replacing the at least the portion of the surface portion of the model to be replaced according to the user input using at least the portion of the second scan data further comprises stitching the at least the portion of the second scan data with the model.**

For the reasons discussed for limitation 1[h] and claims 4-6, Boerjes alone (**Ground 1**) or in view of Geng (**Ground 2**) renders obvious claim 12. *Supra* VIII.A.1.h, VIII.A.2-VIII.A.4; Ex-1003, ¶ 154.

10. **Claim 14: depends from claim 9**

- a. **14[a] wherein the model of the patient's teeth comprises a tooth preparation having a finish line,**

Boerjes discloses and renders obvious this limitation. Boerjes discloses that the model of the patient's teeth can comprise a tooth preparation having a margin line. Ex-1004, [0037], [0078], [00148], [00189], [00195]-[00196]. Once Boerjes displays the model, the system may identify a "margin line" and allow a visual inspection "to ensure that a margin line is present all the way around a preparation." *Id.*; *see also id.*, [0043]-[0046], [00189]-[00194]; Ex-1021, [0005]; Ex-1014, [0007], [0023], [0078], [0081]; Ex-1003, ¶¶ 155-158. A POSITA would have understood that Boerjes's "margin line" is a boundary of the contact area between a prepared tooth and a dental restoration (Ex-1004, [00189]), and thus fundamentally the same as the '936 patent's "finish line," which represents the "transition boundary between the prosthesis and the dental preparation." Ex-1001,

1:50-54; Ex-1014, [0005], [0066] (a “finish line” is also referred to as a “margin line”); Ex-1012, [0016], [0054] (using “finish line” and “margin line” interchangeably); Ex-1003, ¶¶ 155-158.

b. 14[b] wherein a portion of the finish line is obscured or distorted, and

Boerjes further discloses and renders obvious that the finish line can be obscured or distorted. Boerjes explains that in addition to ensuring that a margin/finish line is present all the way around the preparation, the quality control process may also “locate areas of potential problems, such as occlusal high spots, occlusal clearance, occlusal irregularities, *areas of poor margin preparation*, ... and so forth.” Ex-1004, [00189] (emphasis added), [00194]-[00196] (“manual marking of a margin by a dentist where the margin is not visible on a prepared tooth surface”). Ex-1003, ¶¶ 159-160.

A POSITA would have understood that these areas could include portions of the margin/finish line that are obscured or distorted. Ex-1003, ¶ 161. For instance, Boerjes explains that a user may “visually confirm [the] accuracy of a scan by inspection for gross errors or omissions such as holes, gaps, *distortions*, [etc.].” Ex-1004, [00195] (emphasis added). A distorted or obscured margin/finish line could render the scan incomplete and unusable. Ex-1003, ¶ 161. To correct such a deficiency, a user may “requir[e] additional preparation” of “a prepared tooth

surface” before completing “additional or supplemental scanning.” Ex-1004, [00196]; Ex-1021, [0005] (tissue, blood, saliva, and the like may accumulate and obscure portions of the margin); Ex-1014, [0007], [0023], [0078], [0081] (same); Ex-1003, ¶ 161.

c. 14[c] wherein the physical change results in the finish line not being obscured or distorted.

Boerjes discloses and renders obvious this limitation. Ex-1003, ¶ 162.

Boerjes corrects an inadequate margin/finish line with a physical change. Ex-1004, [00189], [00194]-[00199]. Boerjes teaches that after a first scan is complete, some corrective action may be required to correct deficiencies with the model, such as “additional surface preparation.” *Id.*, [0037], [00199]; Ex-1003, ¶ 163; *supra* VIII.A.1.h.i. This includes when the initial scan is deficient due to “areas of poor margin preparation.” Ex-1004, [00189]. In such cases a user may complete additional preparations of the tooth surface, correcting the deficiencies, before rescanning. Ex-1004, [00189]-[00196], [00199]. A POSITA would have understood from Boerjes (and common sense) that the obscuring or distorting physical materials should be removed. Ex-1022, Abstract, [0009], [0012], [0023], [0032] (teaching removal of the saliva, mucous, or blood to obtain clear images for rendering a 3D model); Ex-1003, ¶¶ 164-165; *see also 3Shape*, IPR2021-01241,

Paper 16, 9 & n.5 (finding that a physical change includes removing saliva, as well as blood and debris, from teeth).

11. Claim 15: The method of claim 9,

- a. 15[a] wherein the model of the patient's teeth comprises a tooth preparation that accurately represents a surface of a physical preparation of the patient, and**

Boerjes discloses and renders obvious this limitation. Ex-1003, ¶¶ 166-167.

Boerjes uses a quality control procedure where a scan is taken following tooth preparation and is analyzed. Ex-1004, [00188]-[00200]. If the preparation is inadequate, additional preparation is performed followed by additional scanning used to replace or supplement the prior scan. *Id.*, [00196], [00199]. Boerjes teaches repeating these steps until the model shows that the “surface preparations are satisfactory.” *Id.*, [00199]-[00200]; Ex-1003, ¶ 167.

Boerjes's model depicts an accurate representation of a surface of a physical preparation of the patient because Boerjes explains that for “a surface preparation or other area of diagnostic or treatment significance,” the dentist can “scan[] at a relatively higher accuracy” with the intraoral scanner. Ex-1004, [00151]; *see also id.*, [00137], [00150], [00169], [00195]. The digital model would thus accurately represent the “one or more prepared surfaces, such as a single tooth surface

prepared for a crown, or a number of tooth surfaces prepared for a multi-unit bridge.” *Id.*, [00185]; Ex-1003, ¶¶ 168-169.

b. 15[b] wherein the method further comprises analyzing the tooth preparation of the model to determine whether the surface of the physical preparation is suitable for a dental prosthesis; and

Boerjes disclose and renders obvious this limitation. Boerjes’s scanning and depicting of a patient’s tooth surface (*supra* VII.A) covers an array of dental procedures, including preparation for “a dental prosthesis, a dental implant, a dental appliance, a dental restoration, a restorative component, or an abutment.” Ex-1004, [0022] (emphasis added); Ex-1003, ¶¶ 170-171.

Once the scan of the patient’s teeth is complete and displayed as a 3D model, Boerjes describes subsequent quality control steps, used to ensure that the surface of the physical preparation is suitable for a dental prosthesis by requiring corrective action. Ex-1004, [0037], [00195]-[00196]. If corrective action is required, the user may undertake “additional surface preparations of the at least one tooth” to correct the deficiency and make the surface suitable for a dental prosthesis. *Id.*, [0037]. Once the additional surface preparations are complete, Boerjes explains that the user can complete supplemental or replacement scanning and obtain an updated model of the patient’s tooth. *Id.*, [00199], Fig. 4. If no corrective action is required, then the physical preparation is suitable for

completion of the dental procedure. Ex-1004, [00103], [00199], Fig. 4; Ex-1003, ¶ 172.

c. [15(c) wherein the physical change is a physical modification of the surface of the physical preparation of the patient.

Boerjes discloses and renders obvious this limitation. As explained above, some corrective action may be required to correct deficiencies with the surface preparation of the patient's tooth. *Supra* VIII.A.1.f, VIII.A.1.g, VIII.A.1.h.i, VIII.A.11.b; Ex-1003, ¶¶ 173-174. A POSITA would have understood that the physical change is a physical modification of the surface. Ex-1003, ¶ 175. For instance, the initial surface preparation described in Boerjes includes a physical change of the surface of a tooth to prepare it for the dental prosthesis. Ex-1004, [00185]. Thus, additional surface preparations would be further physical changes to the surface of the initial preparation to correct deficiencies and ensure that the physical preparation is suitable for the dental prosthesis. *Id.*, [00189], [00196]; Ex-1003, ¶ 175.

12. Claim 16: depends from claim 15

a. 16(a) wherein the dental prosthesis comprises a dental crown and

Boerjes discloses that the dental prosthesis can be a dental crown. Ex-1004, [00101] (“[t]he artificial dental object may include ... a crown”); *see also id.*, [00102]-[00111], [00130]; Ex-1003, ¶ 176.

- b. 16[b] wherein the tooth preparation analysis comprises analysis of the model with respect to a virtual model of an opposing dentition of an opposite jaw to determine whether the tooth preparation would result in an inadequate structure for the dental crown.**

Boerjes discloses and renders obvious this limitation. Boerjes describes scanning a crown using “image capture system 100,” such that the crown “may be test fit to the digital model.” Ex-1004, [00209]-[00211]. The “test fitting may include measuring dimensional accuracy of the [crown],” the “fit between adjacent teeth,” or “contact points with teeth of an opposing arch when the [crown] is fitted.” *Id.*, [00212]. A POSITA would have understood that Boerjes’s system includes an analysis of the model of a crown with respect to the model of the patient’s surrounding and opposing dentitions to ensure that the dental crown and opposing dentition do not improperly contact or interfere. Ex-1003, ¶ 177. Indeed, Boerjes’s system uses the models to evaluate the patient’s bite with the crown in place to ensure appropriate “mating of lower and upper arches.” Ex-1004, [00211]. A POSITA would have understood that this would at least prevent costly errors from unforeseen collisions or interference between the dental crown and opposing dentitions. Ex-1003, ¶¶ 177-178.

B. Grounds 3-4: Claims 2-3, 7, 13, and 17-20 Would Have Been Obvious Based on Boerjes and Babayoff (Ground 3) or Boerjes, Geng, and Babayoff (Ground 4)

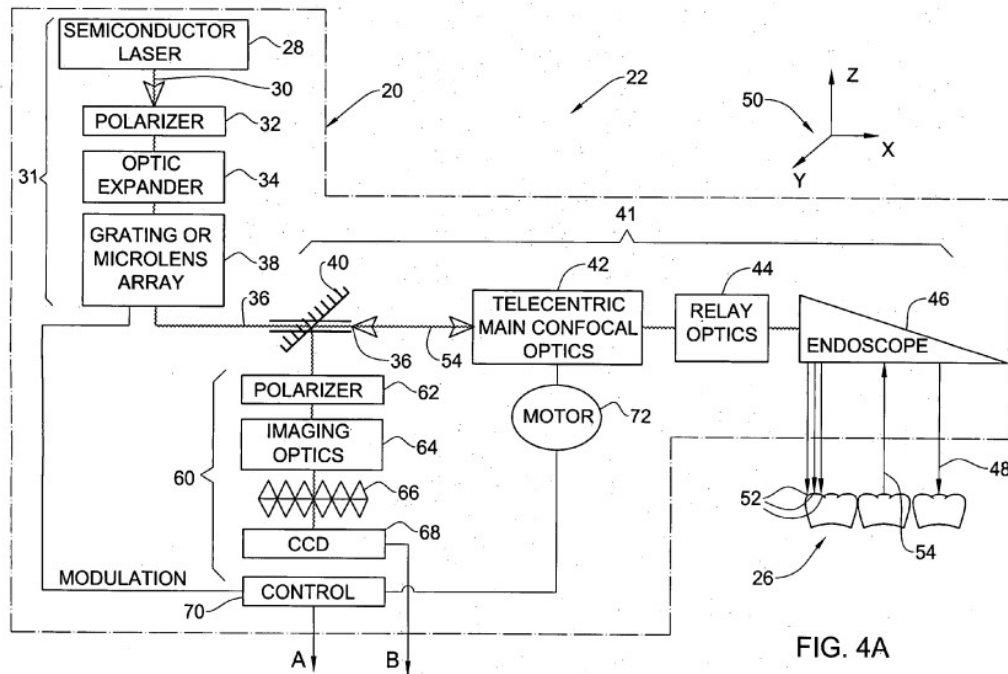
Boerjes and Babayoff (**Ground 3**) and Boerjes, Geng, and Babayoff (**Ground 4**) render obvious claims 2-3, 7, 13, and 17-20. Ex-1003, ¶¶ 179-219.

Babayoff discloses a hand-held intraoral scanner as disclosed in claims 2 and 18, and discloses discarding the remainder of second scan data as recited in claim 7, claim 13, and limitation 17[j]. A POSITA would have found it obvious to use Babayoff's hand-held intraoral scanner in Boerjes's system or the Boerjes-Geng system (*infra* VIII.B.1) and to modify the Boerjes system or the Boerjes-Geng system to further discard the remainder of the second scan data after registering and stitching the second scan data to the model (*infra* VIII.B.3-4); Ex-1003, ¶ 180.

1. **Claim 2: The system of claim 1, wherein the hand-held intraoral scanner comprises a probing member with a sensing face, an illumination unit, a light focusing optics defining one or more focal planes forward the sensing face, and a translation mechanism for displacing the one or more focal planes relative to the sensing face.**

a. Babayoff discloses claim 2

Babayoff discloses a hand-held intraoral scanner because Babayoff's "hand-held device" includes an endoscope 46, illumination unit 31, main optics 41, color illumination 71, and tri-color sequence generator 74 used to illuminate and scan objects 26 of the intraoral cavity. Ex-1006, [0107], [0156], Figs. 1, 4A; Ex-1003, ¶¶ 181-182.



Ex-1006, Figs. 4A.

Babayoff's endoscope is in the form of a “**probing member 90**,” which “is made of a light transmissive material,” and includes a “[g]lass disk 96 defining a **sensing surface 97**” (i.e., sensing face). Ex-1006, [0124]; Ex-1003, ¶ 183.

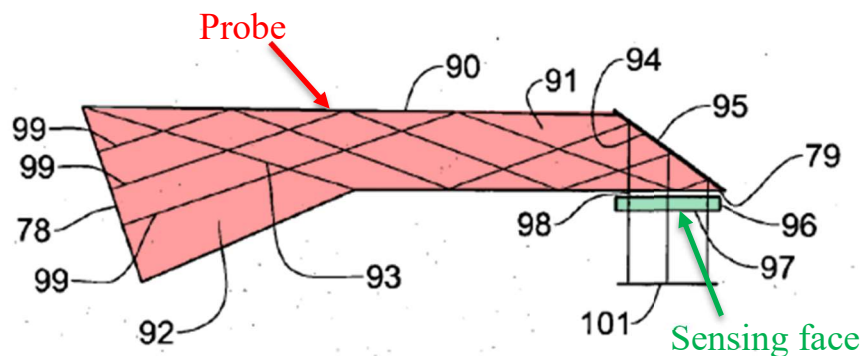


FIG. 5B

Ex-1006, Fig. 5B (annotated).

Babayoff's endoscope probe includes "a main illumination source 31 [i.e., illumination unit] for illuminating the object of interest 26, typically a part of the intraoral cavity," Ex-1006, [0107], Fig. 4A; Ex-1003, ¶ 184.

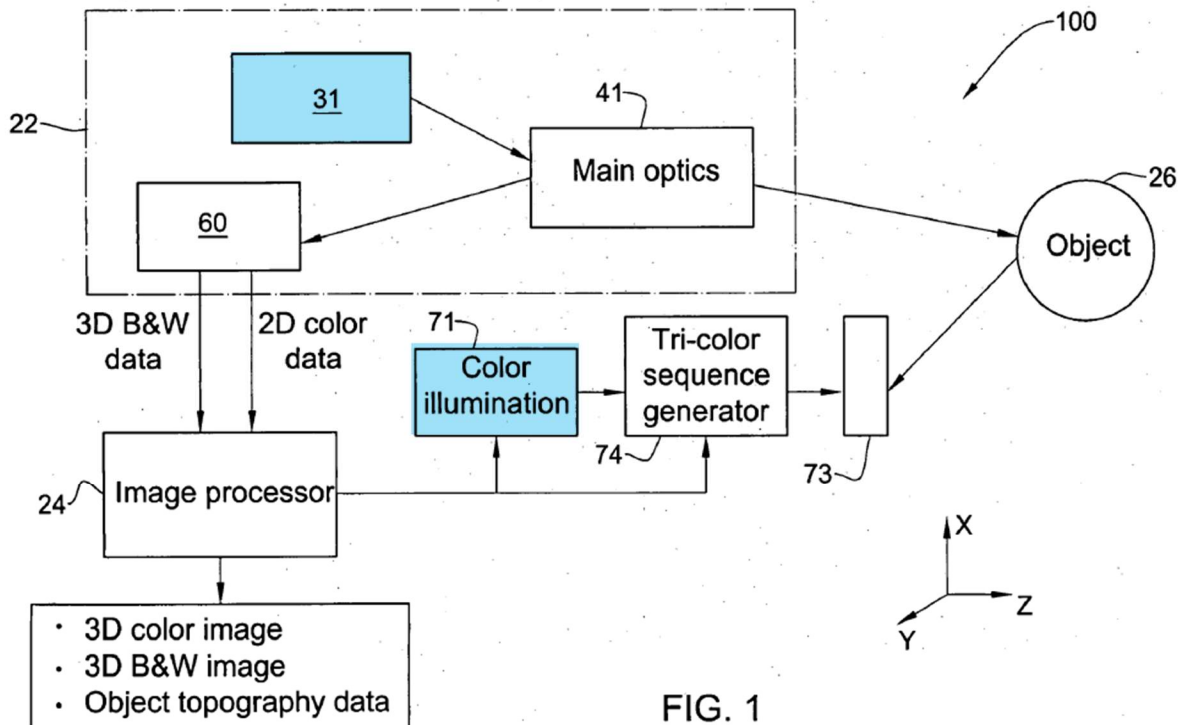


FIG. 1

Ex-1006, Fig. 1 (annotated).

The endoscope probe "further comprises a plurality of tri-color LED's [sic] 77[] for providing the colored illumination to the object 26." Ex-1006, [0124]; Ex-1003, ¶ 184.

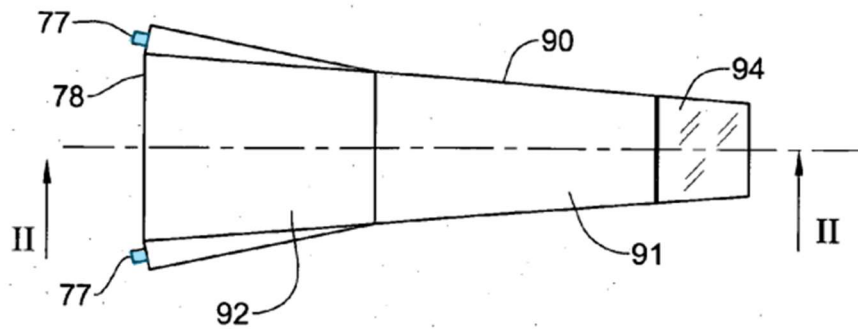


FIG. 5A

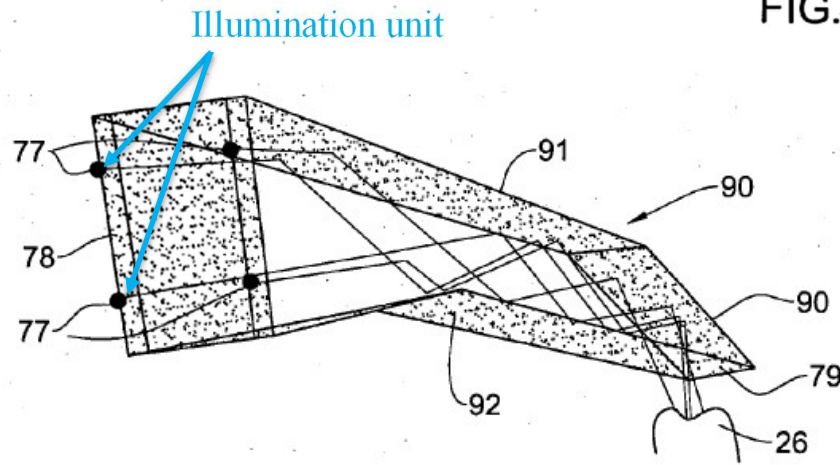
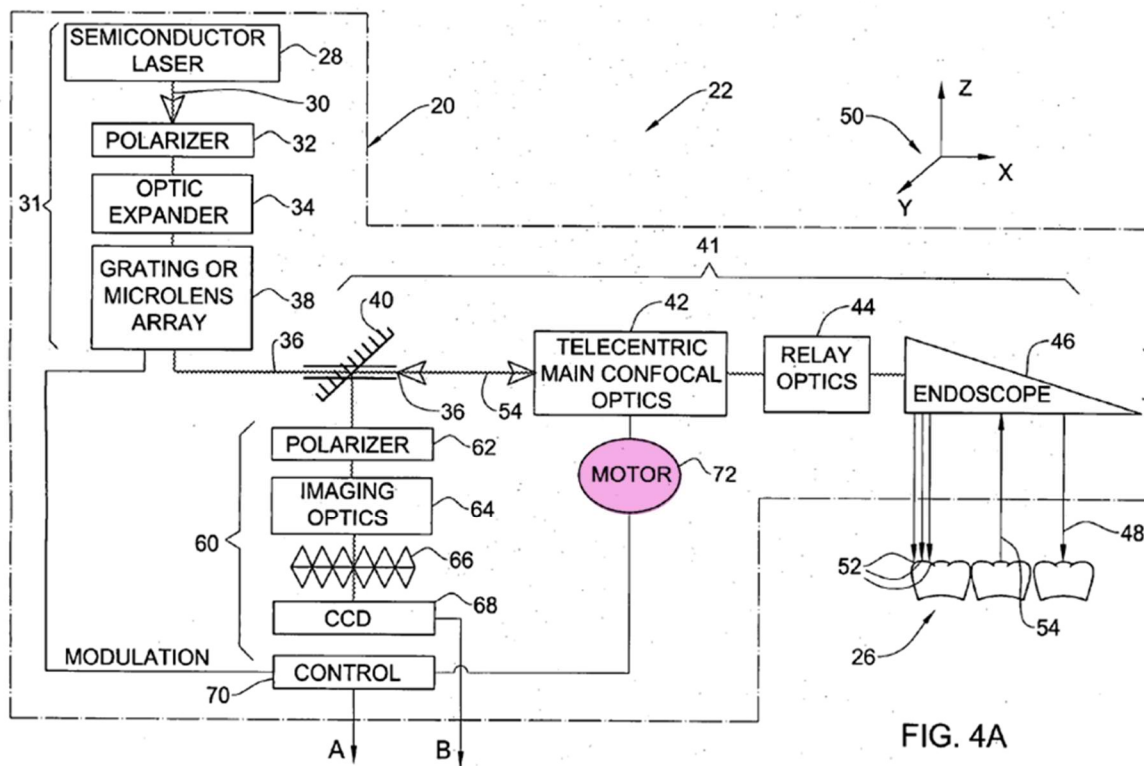


FIG. 5C

Ex-1006, Figs. 1, 4A, 5A, 5C (annotated). Each LED is an illumination unit because “each [is] capable of providing an illumination radiation” in a desired color. Ex-1006, [0126]; *see also id.*, [0108], [0123]; Ex-1003, ¶ 184.

Babayoff’s endoscope probe further comprises light-focusing optics defining one or more focal planes forward of the sensing face. Babayoff explains that light rays are reflected through sensing face 97 and focus on **focusing plane 101**, which is positioned forward of **sensing face 97**, closer to the dental objects 26. Ex-1006, [0124]; Ex-1003, ¶ 185.

Babayoff's scanner further comprises a translation mechanism for displacing the one or more focal planes relative to the sensing face because it describes a motor 72, which "is linked to telecentric confocal optics 42 for changing the relative location of the focal plane of the optics 42 along the Z-axis." *Id.*, [0120]. Babayoff's control unit 70 will cause "motor 72 to displace the optical element 42 to change the focal plane location" along the Z-axis, displacing it relative to the device's sensing face 97. *Id.*, [0120]; Ex-1003, ¶ 187.



Ex-1006, Fig. 4A (annotated).

b. A POSITA would have been motivated to use Babayoff's intraoral scanner in Boerjes or Boerjes-Geng

A POSITA would have been motivated to use Babayoff's intraoral scanner in Boerjes (**Ground 3**) or Boerjes as modified by Geng (**Ground 4**). Ex-1003, ¶¶ 188-194.

A POSITA would have understood that Babayoff's intraoral scanner would improve the dental restoration procedure of Boerjes or Boerjes as modified by Geng by providing color data for presenting an accurate 3D color model. Ex-1006, [0001], [0007], [0101]; Ex-1003, ¶¶ 189-191. Babayoff explains that it is important to match the color and texture of the prosthesis with the surrounding teeth to give the prosthesis a natural appearance. Ex-1006, [0007]-[0014]. A POSITA would have understood that the color scan data or 3D color model would allow the dentist to more accurately match the color and shade of a prosthesis, such as a crown, by performing digital colorimetric measurements in addition to or instead of only visual comparison. *Id.*, [0190]-[0198]. Indeed, Boerjes suggests evaluating color and shade matching. Ex-1004, [00194]; Ex-1003, ¶ 191.

In addition, a POSITA would have understood that Babayoff's intraoral scanner with color scan data would improve Boerjes's automatic identification of the margin line. Babayoff's scanner provides color data of the surrounding soft tissue, such as gums, cheeks, and tongue. Ex-1006, [0001], [0028]-[0033], [0036]

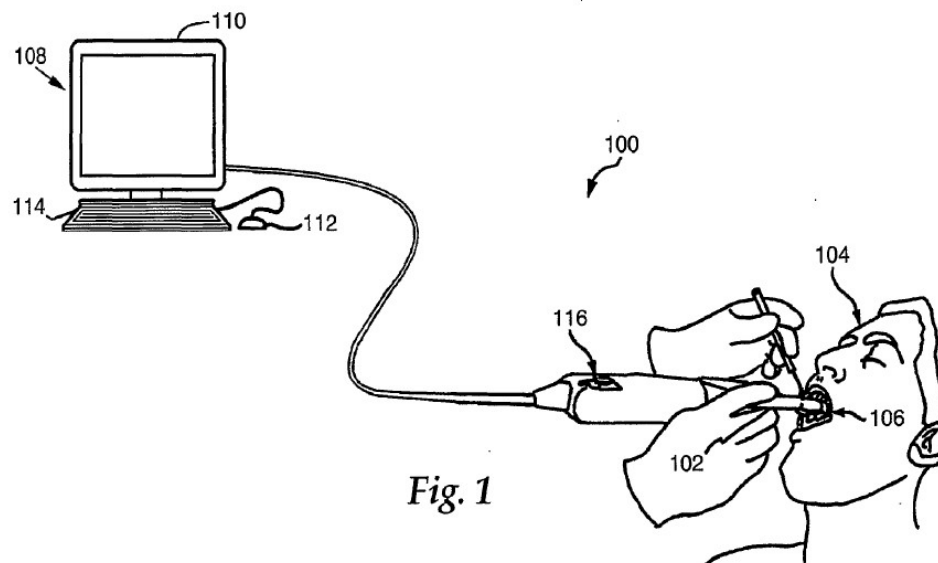
[0064]-[0069], [0161]. This allows differentiating between hard and soft tissues (*id.*, [0161]-[0171]), and identifying a finish line for a prosthesis (*id.*, [0036], [0172]-[0175], [0182]-[0187]), even when the finish line is below the gum line (Ex-1006, [0185]). Ex-1003, ¶ 192.

Boerjes notes that manual marking of the finish line may be needed when the margin is not visible on a prepared tooth surface. Ex-1004, [00194]. A POSITA would have understood that using Babayoff's scanner with color data would facilitate the identification of a finish line, such as when the finish line is below the gum line, in Boerjes or Boerjes modified by Geng, such as by omitting the need of manual marking for at least some cases, thereby improving the efficiency of the dental procedure, as desired by Boerjes. Ex-1003, ¶ 193.

A POSITA would have had a reasonable expectation of success in using Babayoff's scanner in Boerjes's or Boerjes-Geng's system. Boerjes teaches its scanner can use any camera system suitable for acquiring two-dimensional data of a three-dimensional object or from which a three-dimensional point cloud may be obtained. Ex-1004, [00133]. Babayoff's intraoral scanner would be a suitable option for acquiring such scan data while providing the benefit of precise color matching and margin-line identification. Using Babayoff's intraoral scanner would be using a known device in a known, similar system ready for improvement to yield predictable results. Ex-1003, ¶ 194.

2. **Claim 3: The system of claim 2, wherein the system further comprises the computer system and the display; wherein the system further comprises a mouse or wherein the display comprises a touch screen display; and wherein the user input defining portion of the model to be removed is received by the mouse or the touch screen display.**

Boerjes's system includes touchscreen display 110 and mouse 112 for receiving user input for manipulating the model. Ex-1004, [0065], [0076], [00142], Fig. 1.



Ex-1004, Fig. 1. A POSITA would have understood that Boerjes's mouse or touchscreen display could be used to receive the user input identifying a portion of the model to be removed, and, in any event, such a use would have been obvious to a POSITA. *Supra* VIII.A.1.f; Ex-1003, ¶¶ 195-196.

3. **Claim 7: The system of claim 6, wherein the instructions to replace the at least the portion of the removed surface portion of the model using the received second scan data comprise instructions to further discard a remainder of the received second scan data, the remainder including the identifying surface data, after stitching the portion of the received second scan data with the model.**

Boerjes in view of Babayoff (**Ground 3**) or Boerjes in view of Geng and Babayoff (**Ground 4**) renders obvious this claim. Ex-1003, ¶¶ 197-203.

Babayoff discloses a system “for accurately stitching data sets of overlapping areas scanned within the intra-oral cavity.” Ex-1006, [0176]. When the system receives first and second scan data, the system will identify overlapping zones, establish the spatial relationship between the scans, and stitch together or combine the scans to form a scan “that comprises the full geometry and color representation of the target zone.” *Id.*, [0176]; *see id.*, [0037]-[0039], [0177], [0179]. Babayoff further teaches that it was well known to discard a remainder of received second data. *Id.*, [0177]; Ex-1003, ¶ 199.

A POSITA would have understood that the portion of the second scan data that includes the corresponding points or features (“identifying surface data”/“identifying data”) as “a remainder of the received second scan data,” i.e., a left-over portion to be disposed of after stitching is completed. Ex-1003, ¶ 200. A POSITA would have been motivated to modify Boerjes or Boerjes-Geng to discard the corresponding points (“identifying surface data”/“identifying data”) of the

second scan data after registration and stitching, as taught in Babayoff, because they would be repetitive. Ex-1003, ¶ 201. Discarding the repeated data after the stitching would have improved the smoothness in the stitched boundary and would have reduced artifacts, ghosting, or blurring in the overlapping areas due to differences between the two scans, such as different light exposure or small misalignment from the registration. A POSITA also would have likewise understood that this discarding would have reduced data redundancy, and thus reduce data size, the required memory space, and processing power for storing and further manipulating the stitched model. *Id.*; Ex-1003, ¶¶ 200-201.

A POSITA would have had a reasonable expectation of success in modifying the Boerjes or Boerjes-Geng system to include discarding repeated data after registration and stitching, as taught in Babayoff, because such modification would merely involve using a known technique to improve similar systems in the same way taught. Boerjes, Geng, and Babayoff each include software to process to scan data and render a 3D model. Ex-1004, [0010], [0040], [0061], [00130]-[00132]; Ex-1005, 3:48-5:40, 7:12-37; Ex-1006, [0070]-[0072]. A POSITA would have known how to update Boerjes's software to discard repeated data after registering and stitching the 3D models, as taught in Babayoff, using ordinary computer-programming skills. Ex-1003, ¶¶ 202-203. Incorporating Babayoff's discarding step in Boerjes or Boerjes-Geng would have been applying a known technique to

improve a known, similar system ready for improvement to yield predictable results. *Id.* A POSITA also would have known that Babayoff's discarding repeated data after image registration and stitching would have been a suitable option for obtaining a final stitched model in Boerjes or Boerjes-Geng. *Id.*

4. **Claim 13: The method of claim 12, wherein replacing the at least the portion of the surface portion of the model to be replaced according to the user input using the at least the portion of the second scan data further comprises discarding a remainder of the second scan data, including the identifying surface data, after stitching the at least the portion of the second scan data with the model.**

Boerjes and Babayoff (**Ground 3**) or Boerjes, Geng, and Babayoff (**Ground 4**) render obvious this claim for the reasons discussed for claim 7. *Supra* VIII.B.3; Ex-1006, [0176]-[0177]; Ex-1003, ¶ 204.

5. **Independent Claim 17**

- a. 17[pre], 17[a], 17[b], 17[c], 17[d], 17[e]

Boerjes discloses or renders obvious 17[pre], 17[a], 17[b], 17[c], 17[d], for reasons discussed for 1[pre], 1[a], 1[b], 1[c], 1[d], respectively. *Supra* VIII.A.1.a-VIII.A.1.e. Boerjes alone (**Ground 3**) or in view of Geng (**Ground 4**) renders obvious 17[e] for the reasons discussed for 1[e]. *Supra* VIII.A.1.f; Ex-1003, ¶¶ 205-210.

- b. 17[f] after receiving the user input, remove, from the displayed model, a removed surface portion of the model to be removed according to the user input;**

Boerjes alone (**Ground 3**) or in view of Geng (**Ground 4**) renders obvious this limitation for the reasons discussed for limitations 1[e] and 1[f]. *Supra* VIII.A.1.f. As explained above, a POSITA would have understood that in Boerjes or Boerjes combined with Geng, the removal step would occur “after receiving the user input.” *Id.*; Ex-1003, ¶ 211.

- c. 17[g] after removing the portion of the model, receive second scan data of the patient’s teeth from the hand-held intraoral scanner;**

Boerjes discloses receiving the new scan data after identifying a portion to be replaced (Ex-1004, [00199], Fig. 4), and Boerjes alone (**Ground 3**) or in view of Geng (**Ground 4**) renders obvious removing the identified portion. *Supra* VIII.A.1.f, VIII.A.1.g. Thus, this limitation is obvious over Boerjes alone or in view of Geng for the same reasons discussed for limitations 1[e]-1[g]. Ex-1003, ¶ 212; *supra* VIII.A.1.f, VIII.A.1.g.⁵

⁵ In the district court, Petitioner asserted that “second scan data of the patient’s teeth” should be construed as “new scan data of the patient’s teeth after the patient’s intraoral cavity itself has been physically changed,” while Patent

d. 17[h], 17[i], 17[k]

Boerjes alone (**Ground 3**) or in view of Geng (**Ground 4**) renders obvious 17[h], 17[i], and 17[k] for the reasons discussed for claims 4-5, 1[h], and 1[i], respectively. *Supra* VIII.A.2, VIII.A.3, VIII.A.1.h, VIII.A.1.i; Ex-1003, ¶¶ 213-214, 216.

e. 17[j]: discarding a remainder of the second scan data, ... after registering the second scan data with the model

Boerjes and Babayoff (**Ground 3**) or Boerjes, Geng, and Babayoff (**Ground 4**) render obvious 17[j] for the reasons discussed for claim 7. *Supra* VIII.B.3. Ex-1003, ¶ 215.

Owner argued it should be given its plain and ordinary meaning. *See supra* VI. The district court indicated the term should be given its plain and ordinary meaning. The limitation would have been obvious under either construction. Boerjes teaches receiving second scan data after the intraoral cavity has been changed, which discloses the limitation under either construction. Ex-1009, [0059]-[0060], [0127]-[0128], [0135], [0199]; Ex-1003, ¶¶ 106-107.

6. **Claim 18: The system of claim 17, wherein the hand-held intraoral scanner comprises a probing member with a sensing face, an illumination unit, a light focusing optics defining one or more focal planes forward the sensing face, and a translation mechanism for displacing the one or more focal planes relative to the sensing face.**

Babayoff discloses these limitations, and Boerjes and Babayoff (**Ground 3**) or Boerjes, Geng, and Babayoff (**Ground 4**) render obvious this claim for the reasons discussed for claim 2. *Supra* VIII.B.1; Ex-1003, ¶ 217.

7. **Claim 19: The system of claim 18, wherein the system further comprises the computer system and the display; wherein the system further comprises a mouse or wherein the display comprises a touch screen display; and wherein the user input defining portion of the model to be removed is received by the mouse or the touch screen display.**

Boerjes discloses this limitation for the reasons discussed for claim 3. *Supra* VIII.B.2; Ex-1003, ¶ 218.

8. **Claim 20: The system of claim 17, wherein the portion of the removed surface portion of the model is replaced using at least the portion of the received second scan data by registering the second scan data with the model.**

Boerjes or Boerjes-Geng renders obvious this limitation for the reasons discussed for limitation 1[h] and claim 4. *Supra* VIII.A.1.h, VIII.A.2; Ex-1003, ¶ 219.

IX. THE BOARD SHOULD NOT EXERCISE DISCRETION TO DENY INSTITUTION

Petitioner stipulates that if IPR is instituted for the '936 patent, it will not pursue in the parallel district court case for the '936 patent any ground raised or that could have been reasonably raised in this Petition, and all defendants to the litigation have agreed to be bound by this stipulation. *See Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 at 19 (Dec. 1, 2020). Petitioner reserves its rights to oppose any discretionary denial arguments Patent Owner may make pursuant to the procedures detailed in the Office's March 26, 2025 Memorandum ("Interim Processes for PTAB Workload Management").

X. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8

A. Real Parties-in-Interest

The real parties-in-interest are ClearCorrect Operating LLC, ClearCorrect Holdings, Inc., Straumann USA, LLC, and Institut Straumann AG.

B. Related Matters

To the best of Petitioner's knowledge, the '936 patent is involved in:

Align Technology, Inc. v. ClearCorrect Operating, LLC, No. 6:24-cv-00187-ADA-DTG (W.D. Tex. Apr. 11, 2024).

And to the best of Petitioner's knowledge, the '936 patent was previously involved in:

Align Technology, Inc. v. 3Shape A/S and 3Shape Inc., No. 6:20-cv-00979-ADA (W.D. Tex.); *3Shape A/S et al. v. Align Technology, Inc.*, No. 1-20-cv-01492 (D. Del.); and *3Shape A/S and 3Shape Inc. v. Align Technology, Inc.*, IPR2021-01241 (P.T.A.B.).

C. Lead and Back-Up Counsel, and Service Information

Lead Counsel	Back-Up Counsel
Kathleen A. Daley (Reg. No. 36,116) Kathleen.Daley@finnegan.com Finnegan, Henderson, Farabow, Garrett & Dunner, LLP 901 New York Avenue, NW Washington, DC 20001-4413 Tel: 202-408-4000 Fax: 202-408-4400	Anthony J. Berlenbach (Reg. No. 77,963) Anthony.Berlenbach@finnegan.com Charles Collins-Chase (Reg. No. 78,019) Charles.Collins-Chase@finnegan.com Finnegan, Henderson, Farabow, Garrett & Dunner, LLP 901 New York Avenue, NW Washington, DC 20001-4413 Tel: 202-408-4000 Fax: 202-408-4400 Xirui Zhang (Reg. No. 78,809) Xirui.Zhang@finnegan.com Finnegan, Henderson, Farabow, Garrett & Dunner, LLP 2 Seaport Lane, 6th Floor Boston, MA 02210-2001 Tel: 617-646-1626 Fax: 202-408-4400

Petitioner consents to electronic service at the email addresses shown above and ClearCorrect-IPR-Attorneys@finnegan.com.

XI. GROUNDS FOR STANDING

The '936 patent is available for *inter partes* review. Petitioner is not barred or estopped from requesting such review.

XII. CONCLUSION

For the reasons above, Petitioner requests the Board institute *inter partes* review and find each challenged claim unpatentable.

Respectfully submitted,

Dated: April 10, 2025

By: /Kathleen A. Daley/
Kathleen A. Daley, Lead Counsel
Reg. No. 36,116

CERTIFICATION UNDER 37 C.F.R. § 42.24(D)

Pursuant to 37 C.F.R. § 42.24(d), the undersigned hereby certifies that the foregoing Petition contains 13,873 words, excluding those portions identified in 37 C.F.R. § 42.24(a), as measured by the word-processing system used to prepare this paper.

Respectfully submitted,

Dated: April 10, 2025

By: /Kathleen A. Daley/
Kathleen A. Daley, Lead Counsel
Reg. No. 36,116

CERTIFICATE OF SERVICE

The undersigned certifies that, in accordance with 37 C.F.R. §§ 42.6(e) and 42.105(a), the **Petition for *Inter Partes* Review of U.S. Patent No. 10,791,936, the associated Power of Attorney, and Exhibits 1001-1027** were served via FedEx Priority Overnight delivery on April 10, 2025, on the correspondence address of record below indicated in the U.S. Patent Office's Patent Center for U.S. Patent No. 10,791,936:

Kevin Broyles
FISHERBROYLES, LLP - Align Technology, Inc.
3340 Peachtree Road NE, Suite 1800
Atlanta, GA 30326

A courtesy copy has been concurrently served by the same means on Patent Owner's litigation counsel at:

Brian C. Nash
MORRISON & FOERSTER LLP
300 Colorado Street, Suite 1800
Austin, TX 78701

Dated: April 10, 2025

By: /William Esper/
William Esper
Legal Assistant and PTAB Coordinator
Finnegan, Henderson, Farabow,
Garrett & Dunner, LLP