

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

3SHAPE A/S and 3SHAPE INC.
Petitioners

v.

DENTAL IMAGING TECHNOLOGIES CORPORATION
Patent Owner

Case No. IPR2024-00548
Patent 10,076,391

**DECLARATION OF ELI SABER IN SUPPORT OF
PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 10,076,391**

3SHAPE EXHIBIT 1009
3Shape v. DITC
IPR2024-00548

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Petition for *Inter Partes* Review of U.S. Patent No. 10,076,391

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 3. [20.3]: attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface; 80

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4.	[20.4]: displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful;	80
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APPENDIX 1		

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EXHIBIT	DESCRIPTION
1001	U.S. Patent No. 10,076,391, issued on September 18, 2018 to Y. Glinec <i>et al.</i> (“the ’391 Patent”)
1002	File History of U.S. Patent Application No. 14/770,177, filed on August 25, 2015
1005	Veröffentlicht durch SOMMER IP Office “Correlation between upper and lower jaw of digital impressions” (5 pages) (August 2010) (“Sommer”)
1006	U.S. Patent Publication No. 2010/0145898, published June 10, 2010 to K. Malfliet (“Malfliet”)
1007	R. S.J. Estépar <i>et al.</i> , “Robust Generalized Total Least Squares Iterative Closest Point Registration,” Conference Paper: Medical Image Computing and Computer-Assisted Intervention -- MICCAI 2004, 7th International Conference Saint-Malo, France, September 26-29, 2004, Proceedings, Part I, LNCS 3216, pp. 234-241 (2004)
1008	PCT International Publication No. WO 01/80761, published on November 1, 2001 (“Rubbert”)
1013	W. J. van der Meer <i>et al.</i> , “Application of Intra-Oral Dental Scanners in the Digital Workflow of Implantology,” 7(8) PLOS ONE e43312 (6 pages) (August 2012)
1014	Counterclaim Defendant 3Shape A/S’ Opening Brief on Claim Construction, filed on October 27, 2023 in <i>3Shape A/S v. Carestream Dental, LLC et al</i> , Civ. Action No. 1:22-cv-01829
1015	DITC’s Opening Claim Construction Brief Regarding the DITC Asserted Patents, filed on October 27, 2023 in <i>3Shape A/S v. Carestream Dental, LLC et al</i> , Civ. Action No. 1:22-cv-01829

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I, Eli Saber, hereby state as follows:

I. INTRODUCTION

1. I have been retained by Buchanan Ingersoll & Rooney (“Counsel”) on behalf of 3SHAPE A/S (“Petitioner”) as an independent expert consultant in this *inter partes* review (“IPR”) proceeding before the United States Patent and Trademark Office (“PTO”).

2. I have been asked by Counsel to provide opinions regarding Claims 1-21 of U.S. Patent No. 10,076,391 (“the ’391 Patent”). My opinions and the bases for my opinions are set forth below.

3. I am being compensated at my ordinary and customary consulting rate for my work, which is \$450 per hour. My compensation is in no way contingent on the nature of my findings, the presentation of my findings in testimony, or the outcome of this or any other proceeding. I have no other financial interest in this proceeding.

4. This report is based on information currently available to me. I reserve the right to continue my investigation and analysis, which may include a review of documents and information not listed above. I also reserve the right to expand or otherwise modify my opinions and conclusions as my investigation and study

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continues, and to supplement my opinions and conclusions in response to any additional information that becomes available to me.

II. BACKGROUND AND QUALIFICATIONS

5. All my opinions stated in this declaration are based on my own personal knowledge and professional judgment. In forming my opinions, I have relied on my knowledge and experience in designing, developing, researching, and teaching the technology referenced in this declaration.

6. I am over 18 years of age and, if I am called upon to do so, I would be competent to testify as to the matters set forth herein. I understand that a copy of my current curriculum vitae, which details my education and professional and academic experience, is being submitted as EX1004. The following provides a brief overview of some of my experience that is relevant to the matters set forth in this declaration.

7. I am a Professor in the Department of Electrical and Microelectronic Engineering (EME) and the Chester F. Carlson Center for Imaging Science at the Rochester Institute of Technology (RIT) in Rochester, New York. I also serve as the Director of the Image, Video and Computer Vision Laboratory. I joined RIT's full-time faculty in 2004. I have over thirty-four (34) years of industry and academic experience, thirty (30) of which are in the fields of Computer Vision, Digital Image/Video Processing, Pattern Recognition, and Machine Learning.

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8. I received a Ph.D. in Electrical Engineering from the University of Rochester in 1996. My concentration was in Signal/Image/Video Processing, Pattern Recognition, and Computer Vision. I received a Master of Science Degree in Electrical Engineering from the University of Rochester in 1992 in the same concentration as listed above, and I received a Bachelor of Science Degree in Electrical and Computer Engineering, Summa Cum Laude, from the State University of New York at Buffalo in 1988.

9. Before becoming a full-time professor, I worked for Xerox Corporation for 16 years, from 1988 to 2004. During my years at Xerox, I was responsible for delivering color management, image processing innovations, architectures, and algorithms; xerographic sub-systems for a variety of color products; and control systems for toner production facilities. One of several roles I held at Xerox was Advanced Development Scientist and Manager. In that capacity, I established the Advanced Design Laboratory—an Imaging/Xerographics lab—and provided technical and managerial leadership for the Electrical, Imaging and Xerographics Department. In another role, as Product Development Scientist and Manager, I led the research and development of image quality metrics for various product platforms. I also led the Image Science, Analysis, and Evaluation area, with 12 to 15 direct reports and a budget of approximately \$2 million.

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10. From 1997 until 2004, I was an adjunct faculty member at the Electrical Engineering Department of the Rochester Institute of Technology and at the Electrical & Computer Engineering Department of the University of Rochester. I was responsible for teaching undergraduate and graduate coursework such as Digital Signal Processing, Digital Image Processing, Digital Video Processing, Pattern Recognition, Detection and Estimation Theory and Communication Systems; and performing research in multimedia applications, pattern recognition, image understanding and color engineering.

11. Since joining RIT full time, I have been responsible for teaching several undergraduate and graduate courses in Digital Signal Processing, Digital Image Processing, Digital Video Processing, Pattern Recognition, Engineering Analysis, Random Signal & Noise, Advanced Engineering Mathematics, Matrix Methods, Communications, Modern Control Theory, and Linear Systems.

12. I proposed, developed and introduced the Digital Video Processing course and reestablished the Pattern Recognition course at the Electrical Engineering Department at RIT. These graduate courses were instrumental in providing MS/PhD students with the proper foundation and knowledge in all aspects of the subject areas in order to perform in-depth research in the field and continue to advance the state of the art.

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13. The Digital Video Processing course is designed to provide a thorough and comprehensive coverage of the field. Topics covered include the mathematical representation of digital video including motion and time-varying image formation models, spatio-temporal sampling/reconstruction, sampling structure conversions, motion estimation using optical flow, block-based, pel-recursive, Bayesian and point correspondence type methodologies, segmentation, motion tracking, filtering, restoration, super-resolution and compression.

14. The Pattern Recognition course, on the other hand, covers pertinent concepts in Bayes decision theory, linear and nonlinear classifiers, artificial neural networks, feature selection/generation/extraction and various methodologies of clustering.

15. I am currently developing a new graduate course titled: “Advanced Neural Networks and Deep Learning: Theory, Mathematics and Algorithms”. The course is intended to provide an in-depth comprehensive study of the theory, mathematics and algorithms for advanced neural networks and their usage in deep learning. It is primarily targeted for upper graduate students that are planning to pursue advanced studies/research in the field. The course provides a thorough study of shallow and deep neural networks architectures and algorithms, activation functions, backpropagation, initialization, optimization strategies, etc. It then

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progresses to convolutional and recurrent style neural networks and, if time permits, will provide an overview of attention mechanisms/transformers and deep reinforcement learning. The course is being taught for the first time in Spring 2024.

16. My current research focuses on image/video processing for multimedia, military & biomedical applications; computer vision and three-dimensional scene reconstruction; and machine learning for object tracking/remote sensing applications. As a principal investigator (PI) or co-principal investigator, I have acquired research funding in excess of \$5.8 million since joining RIT and have managed multiple government grants from the Department of Defense as well as several corporate grants from Hewlett-Packard, Lenel, and Data Physics. I am currently managing (as PI) a multiyear government grant from the Department of Defense title “Target Detection/Tracking and Activity Recognition from Multimodal Data.” In 2012, I was awarded the Prestigious Trustees Scholarship, the highest award at RIT with regard to research recognition.

17. I am the author or co-author of thirty-eight (38) peer-reviewed journal publications.

18. I have also authored or co-authored one hundred (100) conference and workshop publications and a book entitled Advanced Linear Algebra for Engineers

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with MATLAB, published by CRC Press in February 2009, and am a named inventor on multiple U.S. and foreign patents.

19. I am a senior member of the Institute of Electrical and Electronic Engineers and a member of the IEEE Signal Processing Society, the Electrical Engineering Honor Society, Eta Kappa Nu.

III. INFORMATION CONSIDERED

20. In preparing this declaration, I have reviewed the '391 Patent and the exhibits and documents referenced herein. In addition, my opinions are further based on my education, training, experience, and knowledge in the relevant field.

IV. RELEVANT LEGAL STANDARDS

21. I am not an attorney and offer no legal opinions. For the purposes of this Declaration, I have been informed about certain aspects of the law that are relevant to my analysis, as summarized below.

A. Claim Interpretation

22. I have been informed that during an *inter partes* review proceeding, claims are to be construed in light of the specification as would be read by a person of ordinary skill in the relevant art at the time the application was filed. I have been informed that claim terms are given their ordinary and customary meaning as would be understood by a person of ordinary skill in the relevant art in the context of the entire disclosure. A claim term, however, will not receive its ordinary meaning if the

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patentee acted as his own lexicographer and clearly set forth a definition of the claim term in the specification. In that case, the claim term will receive the definition set forth in the patent.

B. Perspective of One of Ordinary Skill in the Art

23. I have been informed that a patent is to be understood from the perspective of a hypothetical “person of ordinary skill in the art” (“POSITA”). Such an individual is considered to possess normal skills and knowledge in a particular technical field (as opposed to being a genius). I have been informed that in considering what the claims of a patent require, what was known prior to that patent, what a prior art reference discloses, and whether an invention is obvious or not, one must use the perspective of such a POSITA.

C. Anticipation

24. I have been informed that a claim is not patentable if it is anticipated. I have been informed that anticipation of a claim requires that every element of a claim is disclosed expressly or inherently in a prior art reference, arranged as in the claim, when considered from the perspective of a person of ordinary skill in the relevant art. I have been informed that when the structure recited in a reference is substantially identical to that of the claims, claimed properties or functions are presumed to be inherent. I have been informed that extrinsic evidence may be used

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to explain but not expand the meaning of terms and phrases used in the reference relied upon as anticipatory of the claimed subject matter.

D. Obviousness

25. I have been informed that a patent claim is obvious under 35 U.S.C. §103, and therefore invalid, if the claimed subject matter, as a whole, would have been obvious to a POSITA as of the priority date of the patent based on one or more prior art references and/or the knowledge of a POSITA.

26. I have been informed that an obviousness analysis must consider (1) the scope and content of the prior art, (2) the differences between the claims and the prior art, (3) the level of ordinary skill in the pertinent art, and (4) secondary considerations, if any, of non-obviousness (such as unexpected results, commercial success, long- felt but unmet need, failure of others, copying by others, and skepticism of experts).

27. I have been informed that a prior art reference may be combined with other references to disclose each element of the invention under 35 U.S.C. §103. I have been informed that a reference may also be combined with the knowledge of a POSITA, and that this knowledge may be used to combine multiple references. I have been informed that a POSITA is presumed to know the relevant prior art. I have

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been informed that the obviousness analysis may take into account the inferences and creative steps that a POSITA would employ.

28. In determining whether a prior art reference would have been combined with other prior art or other information known to a POSITA, I have been informed that the following principles may be considered:

- whether the references to be combined involve non-analogous art;
- whether the references to be combined are in different fields of endeavor than the alleged invention in the patent;
- whether the references to be combined are reasonably pertinent to the problems to which the inventions of the patent are directed;
- whether the combination is of familiar elements according to known methods that yields predictable results;
- whether a combination involves the substitution of one known element for another that yields predictable results;
- whether the combination involves the use of a known technique to improve similar items or methods in the same way that yields predictable results;

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- whether the combination involves the application of a known technique to a prior art reference that is ready for improvement, to yield predictable results;
 - whether the combination is “obvious to try”;
 - whether the combination involves the known work in one field of endeavor prompting variations of it for use in either the same field or a different one based on design incentives or other market forces, where the variations are predictable to a POSITA;
 - whether there is some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill in the art to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention;
 - whether the combination requires modifications that render the prior art unsatisfactory for its intended use;
 - whether the combination requires modifications that change the principle of operation of the reference;
 - whether the combination is reasonably expected to be a success;
- and

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- whether the combination possesses the requisite degree of predictability at the time the invention was made.

29. I have been informed that in determining whether a combination of prior art references renders a claim obvious, it is helpful to consider whether there is some teaching, suggestion, or motivation to combine the references and a reasonable expectation of success in doing so. I have been informed, however, that a teaching, suggestion, or motivation to combine is not required.

V. SUMMARY OF OPINIONS

30. It is my opinion that Claims 1-21 of the '391 Patent are unpatentable under 35 U.S.C. §103 on the following grounds:

VI. THE CHALLENGED '391 PATENT

31. The '391 Patent contains 21 claims. I have been asked to opine on the validity of Claims 1-21.

Ground	References	Basis	Claims Challenged
1	Sommer (EX1005) in view of Rubbert (EX1008) and Malfliet (EX1006)	35 U.S.C. §103	1, 5-12, 21
2	Sommer in view of Rubbert, Malfliet, and Estépar (EX1007)	35 U.S.C. §103	2-4
3	Sommer in view of Malfliet	35 U.S.C. §103	13, 14, 17-19

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Ground	References	Basis	Claims Challenged
4	Sommer in view of Malfliet, and Estépar	35 U.S.C. §103	15, 16, 20

VII. LEVEL OF ORDINARY SKILL IN THE ART

32. I have been informed that POSITA is presumed to be aware of all pertinent art, thinks along conventional wisdom in the art, and is a person of ordinary creativity.

33. I believe that a POSITA would have at least (1) a bachelor's degree in electrical engineering, computer engineering, or computer science (or equivalent course work) and two to three years of work experience in 3D imaging and modeling of physical structures, or (2) a master's degree in electrical engineering, computer engineering, or computer science (or equivalent course work) with a focus in 3D imaging and modeling of physical structures.

VIII. TECHNICAL BACKGROUND

A. The Purported Invention

34. The '391 Patent relates to a method and system for bite registration. EX1001, Abstract. In this method and system, when the 3D teeth model of both the upper and lower jaws are successfully aligned with the bite surface, the bite surface

with the 3D teeth models is displayed for further evaluation. *Id.* The bite surfaces selected by the user are combined to generate a final bite registration. *Id.*

B. Overview of the Prior Art

1. Sommer (EX1005)

35. Sommer describes methods and systems for correlating the teeth of the upper and lower jaws for the design of a dental restoration or an orthodontic treatment plan. EX1005, 1. Sommer provides a process wherein manual pre-correlation is performed by the user with the final calculation of the correlation done by software. *Id.* The user is able to rotate the upper and lower jaw digital representations at the same time around one axis by clicking on mouse keys. *Id.*, 2. By rotating the models in this way, the user can see the matching parts between the bite surface (e.g., “buccal model”) and the upper and lower jaw models. *Id.*

36. When the bite surface is correlated to the jaws successfully, the user will observe a “leopard” pattern. *Id.* If the correlation is not successful, the bite surface model shakes for a moment and stays between the upper and lower jaw models. *Id.* In this case, the user must redo the pre-correlation step and try to find a better matching area. *Id.* One method disclosed by Sommer for redoing this procedure is to add an additional bite surface scan to enlarge the bite surface model. *Id.*, 3.

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37. Sommer also suggests improving the precision of the correlation between the upper and lower jaws by using more than one bite surface (e.g., one bite surface from each quadrant). *Id.*, 4.

38. While Sommer suggests that its methods and systems are to be used with the CEREC dental product, Sommer states that obtaining digital impressions of the upper and lower jaws the dental scanning systems is typically done separately. *Id.* Further, Sommer acknowledges that such methods for obtaining digital impressions are well-known and technically solved in the art. *Id.*

2. Malfliet (EX1006)

39. Malfliet discloses a method for automatic or semi-automatic planning of dental treatment. EX1006, Abstract. Not only does Malfliet disclose a scanner and a workstation (*id.*, FIG. 1), Malfliet discusses converting the scanned data into a digital model (*id.*, ¶[0035]). Malfliet also discloses methods by which 3D models can be registered onto each other by manually translating and/or rotating one of the 3D models with respect to the other (*id.*, ¶[0036]) as well as by automatic registration algorithms based on feature recognition (*id.*, ¶[0038]). In particular, Malfliet discloses a final mapping of a 3D representation that is performed using an Iterative Closest Point (ICP) registration algorithm which finds the optimal transformation necessary to align sets of data points of scans. *Id.*, ¶[0044]

3. Estépar (EX1007)

40. Estépar is referenced in Paragraph [0038] of Malfliet and details the process of ICP registration. For example, Estépar describes how model shapes are first decomposed from matrix form to point set form. EX1007, 235. Then, ICP finds the rigid body that aligns the model shapes by minimizing the distance between surface points of one model that correspond with the surface points of a second model. *Id.* Once a minimum error threshold is achieved, the model shapes are recomposed for 3D representation purposes. *Id.*

41. Specifically, Estépar investigates the use of a total least squares approach in a generalization of the ICP algorithm for shape registration. *Id.*, Abstract. Estépar's Generalized Total Least Squares (GTLS) formulation of the minimization process is presented opposed to the traditional Least Squares technique. *Id.* Thus, Estépar accounts for uncertainty in both the target and in the source models to lead to a more robust estimation of the transformation. *Id.*

4. Rubbert (EX1008)

42. Rubbert discloses both hardware and software for interactive, computer based orthodontist planning, dental appliance design, and appliance manufacturing that relies on virtual tooth models. EX1008, Abstract.

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43. Not only does Rubbert disclose obtaining dentition scans (*id.*, 85:16-21), Rubbert also discloses methods for determining an entry point for registering such scans into a virtual tooth model (*id.*, 57-58), frame to frame registration of such scans (*id.*, 58-62) and cumulative registration of the entire jaw (*id.*, 63-69). Relevant portions of these methods are described in greater detail below.

IX. CLAIM CONSTRUCTION

44. For purposes of my analysis in this IPR proceeding, I have been informed that terms that appear in the claims of the '391 Patent should be interpreted according to their plain and ordinary meaning under the *Phillips* standard. In determining the ordinary and customary meaning, I have been informed that the words of a claim are first given their plain meaning that those words would have had to a POSITA at the time of the alleged invention. I also have been informed that the claims, specification, and file history may be used to better construe a claim insofar as the plain meaning of the claims cannot be understood. I have been informed that even treatises and dictionaries may be used under limited circumstances to determine the meaning attributed by a POSITA to a claim term at the time of filing.

45. I have reviewed the '391 Patent and its prosecution history as well as additional documents and have used a plain-meaning understanding for each claim term.

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46. I have also been informed that Elements [13.4], [13.5], and [13.6] are subject to 35 U.S.C. §112, ¶6. That is, I understand that these elements must be construed to have a specific function and a specific structure. I understand that the Patent Owner asserted that these terms have the recited function and that specific structure can be found at 5:56-6:24 (Element [13.4]), 6:25-38 (Element [13.5]), and 6:39-7:11 (Element [13.6]). EX1014, EX1015. That is, (i) “means for displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful,” (ii) “means for obtaining at least two successful bite registrations corresponding to different displayed bite surface by repeating,” and (iii) “means for selecting two or more successful bite registrations by evaluating at least two successful bite registrations and selecting said two or more of the displayed successful bite registrations” have the structure of a “computerized workstation and associated software.” EX1015, 27.

X. CLAIMS 1, 5-12 AND 21 WOULD HAVE BEEN OBVIOUS OVER SOMMER IN VIEW OF RUBBERT AND MALFLIET (GROUND 1).

47. In my opinion, Claims 1, 5-12, and 21 are unpatentable over Sommer in view of Rubbert and Malfliet.

48. The following sections explain where each element of these claims is found in this prior art.

A. Claim 1 (Preamble): A method of bite registration, comprising the steps of:

49. As discussed above, Sommer discloses methods and systems for correlating bite surfaces based on data obtained from 3D models of teeth from the upper and lower jaws. And, as discussed above, Rubbert discloses a scanner and a workstation that capture 3D teeth surfaces of the upper and lower jaws and then processes those captured images to generate the 3D teeth models relied on by Sommer.

50. The Preamble of Claim 1 is disclosed in Sommer (EX1005).

51. Sommer describes its “correlation method of bite registration” as a “common technique [that] use[s] a triple-point-matching method.” EX1005, 1.

52. This system and method are described by Sommer for use with the CEREC software produced by SIRONA. *Id.*

53. Sommer further discloses that “[i]n order to correlate both jaws ... information which provides the connection between the upper and lower jaw can be provided by either the digital impression of a bite (patient bites on a silicone-like material that is applied on the preparation) or capturing optical impressions from the buccal view.” *Id.*

54. Thus, by obtaining such a digital impression of a bite, and correlating both jaws for a patient, Sommer discloses a method of bite registration.

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55. In my opinion, Sommer discloses all of the requirements of the Preamble of Claim 1.

1. [1.1]: generating 3-d dimensional (3D) teeth models of the upper jaw and the lower jaw;

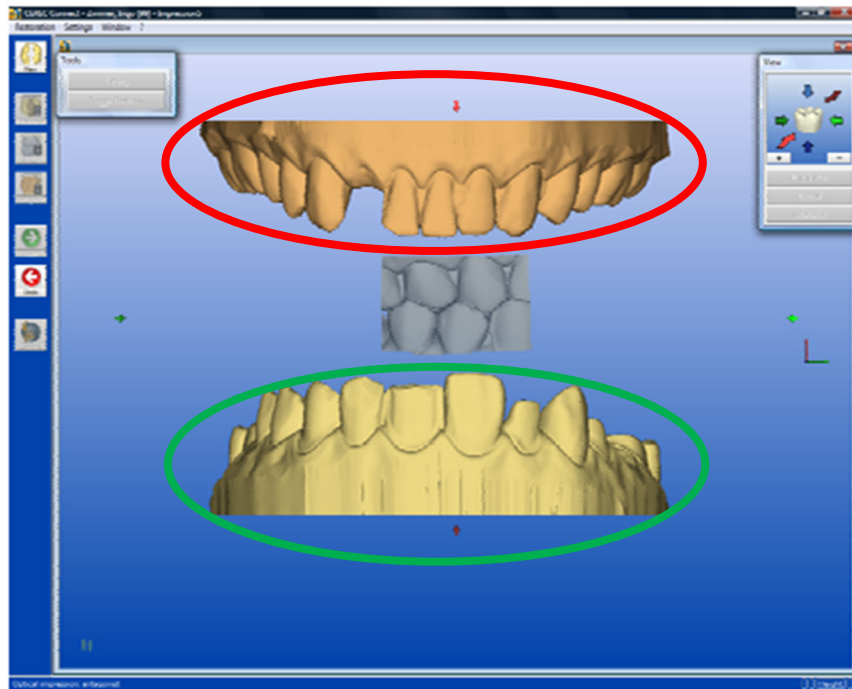
56. Element [1.1] is disclosed in Sommer (EX1005).

57. Sommer describes the “user interaction step in its software where the “user drag&drops the 3D-model of the buccal over the corresponding area of the upper and the lower jaw.” *Id.*

58. According to Sommer, “[i]n the first step the 3D models of the preparation, the antagonist and the buccal are shown.” *Id.*

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59. Sommer provides an illustration, wherein the 3D teeth models of the upper jaw (circled in red) and the lower jaw (circled in green) are generated for user viewing:



Id., 2. Sommer then discloses that the user can “[r]otate both models preparation and the antagonist.” *Id.* Thus, Sommer discloses Element [1.1]: generating 3-d dimensional (3D) teeth models of the upper jaw and the lower jaw.

60. In my opinion, Sommer discloses all of the requirements of Element [1.1].

2. **[1.2]: acquiring a bite surface containing a portion of at least one tooth of the upper jaw and a portion of at least one opposing tooth of the lower jaw simultaneously in a clenched state where the upper jaw is static relative to the lower jaw;**

61. Element [1.2] is disclosed in Sommer (EX1005) in combination with Rubbert (EX1008).

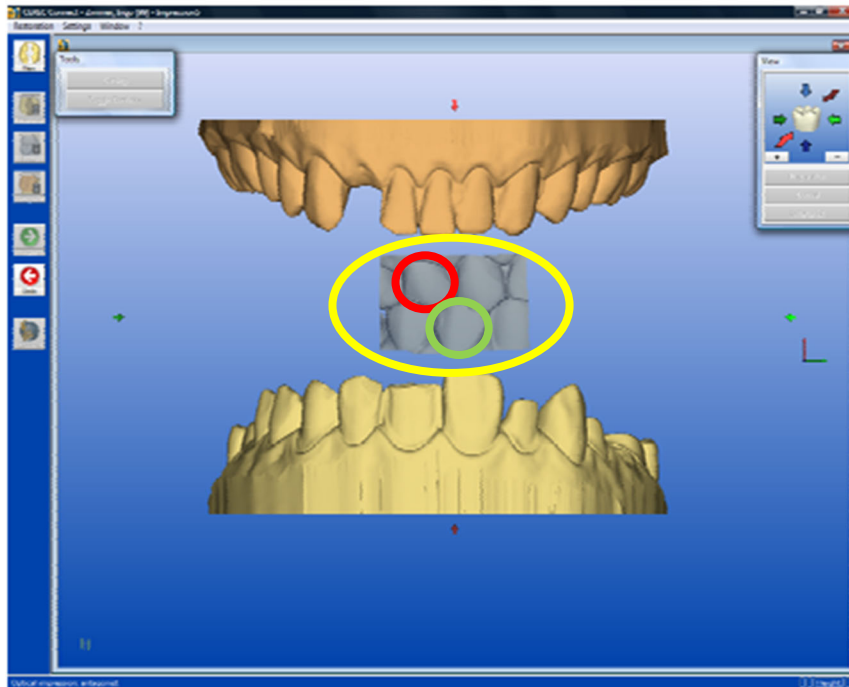
62. Sommer discloses that “[i]n order to correlate both jaws ... information which provides the connection between the upper and lower jaw can be provided by either the digital impression of a bite (patient bites on a silicone-like material that is applied on the preparation) or capturing optical impressions from the buccal view.” EX1005, 1.

63. Sommer states that “[t]he method by taking the optical impressions from the bite is well known and technical solved.” *Id.*

64. Sommer then further describes generating a “buccal model [which] is placed in the middle between preparation and antagonist.” *Id.*

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65. The buccal model illustration displays acquiring a bite surface (circled yellow) containing a portion of at least one tooth of the upper jaw (circled in red) and a portion of at least one opposing tooth of the lower jaw (circled in green) simultaneously in a clenched state:



Id., 2. As shown in the illustration, the teeth are in a clenched state. Thus, it is my opinion that Sommer discloses Element [1.2].

66. Rubbert also explicitly discloses the element. In particular, Rubbert discloses a scanner that is able to acquire bite surface images of the upper and lower jaw. EX1008, Abstract, 18:8-10, 56:5-7, FIG. 36. Rubbert also discloses acquiring

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a bite surface wherein the upper jaw and the lower jaw are in a clenched state where the upper jaw is static relative to the lower jaw:

A bite registration scan is obtained from the patient to spatially correlate the scans of the upper and lower jaws *when the dentition is clenched*. This scan is used to provide a registration of the upper and lower jaw to determine the correct relative position. This bite registration scan is usually needed at the beginning of treatment to set the relation between the upper and lower jaws. [Emphasis added.]

EX1008, 85:17-21.

67. In my opinion, Sommer in combination with Rubbert discloses all of the requirements of Element [1.2].

3. [1.3]: attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface;

68. Element [1.3] is disclosed in Sommer (EX1005).

69. Sommer states that “[t]he buccal model will be correlated to the preparation model automatically.” EX1005, 2.

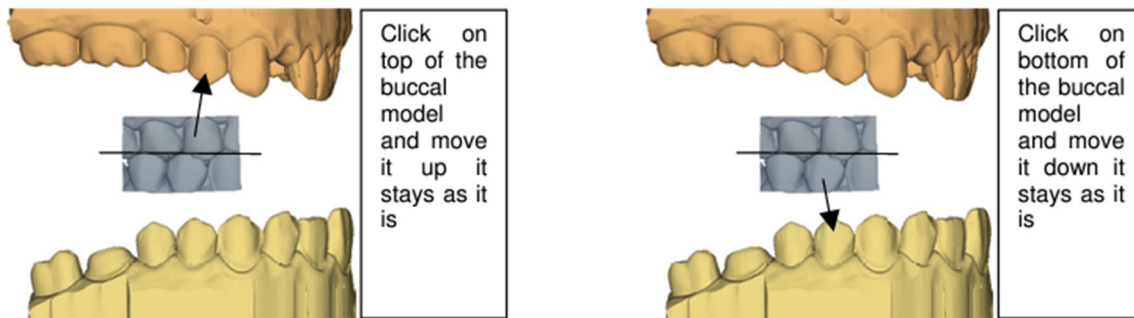
70. If the automatic “correlation was successful the buccal [sic] model matches the regarding position and you see the ‘leopard’ pattern.” *Id.*

71. However, “[i]f the correlation was not successful, the buccal model shakes for a moment and stays in the middle between the models.” *Id.*

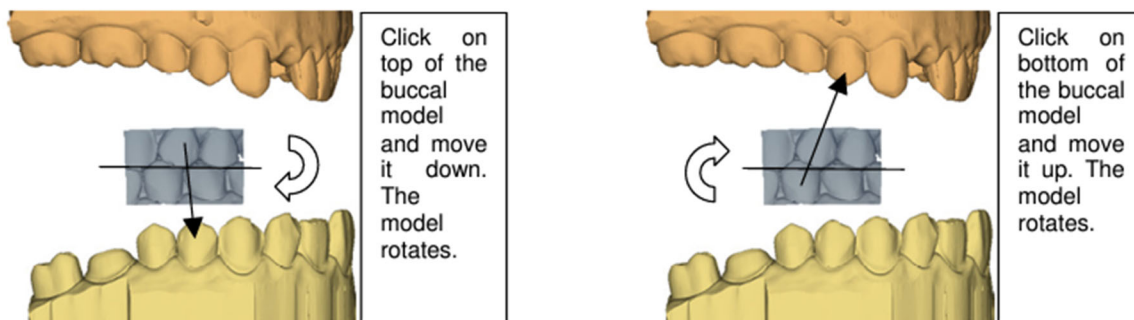
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72. Sommer then counsels the user to “redo this procedure [of rotating both models preparation and antagonist in the way that you can see the matching parts between the buccal model and the preparation/antagonist model] and try to find a better matching area when doing the ‘Drag&Drop’ or add an additional buccal shot to enlarge the buccal model.” *Id.*

73. Sommer provides graphics that show steps of rotating both models preparation and antagonist in the way that you can see the matching parts between the buccal model and the preparation/antagonist model:



In case that the buccal shot was taken in a different quadrant it will be visualized as if it was upside down. The software recognizes how you drag&drop the buccal model and rotates it automatically:



Id., 4.

74. Accordingly, Sommer discloses first an automatic alignment of the 3D teeth models of the upper jaw and the lower jaw with the bite surface [buccal model].

75. If that is not successful, Sommer counsels the user to then attempt to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface [buccal model] by finding a better bite surface.

76. In my opinion, Sommer discloses all of the requirements of Element [1.3].

4. [1.4]: displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful;

77. Element [1.4] is disclosed in Sommer (EX1005).

78. As discussed above with respect to Element [1.3], Sommer discloses that “[t]he buccal model will be correlated to the preparation model automatically.”

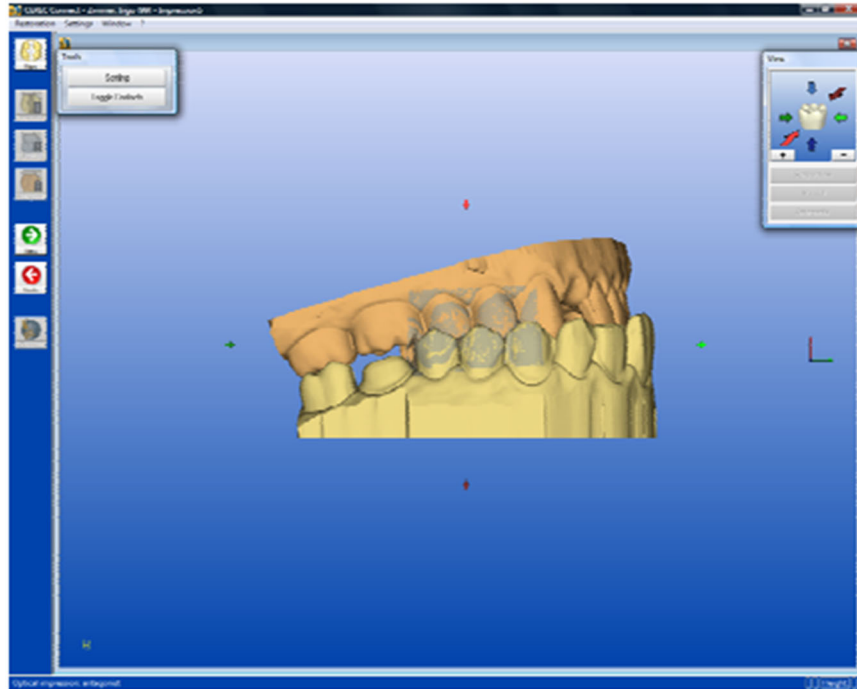
Id.

79. And, “[i]f the correlation was successful, the buccal [sic] model matches and you see the ‘leopard’ pattern.” *Id.*

80. That is, Sommer discloses that the user should expect to see a “leopard” pattern displayed with the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if the alignment is successful.

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Sommer illustrates this “leopard pattern” displayed with the bite surface (grey) together with the 3D teeth models of the upper jaw (orange) and the lower jaw (yellow) aligned with the bite surface (grey) when the alignment is successful:



Id., 3.

81. In my opinion, Sommer discloses all of the requirements of Element [1.4].

5. [1.5]: repeating step b to step d so as to obtain at least two successful bite registrations corresponding to different displayed bite surfaces;

82. Element [1.5] is disclosed in Sommer (EX1005).

83. For example, Sommer states that “the precision of the correlation between upper and lower jaw especially when doing full arches can be possibly

improved by using more than one buccal image (e.g. one buccal image in each quadrant).” *Id.*, 4.

84. That is, Sommer teaches repeating step b (acquiring a bite surface [buccal image] containing a portion of at least one tooth of the upper jaw and a portion of at least one opposing tooth of the lower jaw simultaneously in a clenched state where the upper jaw is static relative to the lower jaw) for each of the quadrants.

85. Sommer also teaches repeating step c (attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface).

86. For example, Sommer notes that

Depending on the quadrant where you have taken the buccal image it can happen that the buccal model seems to be rotated upside down. In this case simply click on the top spot of the buccal model and move it to the model that is underneath. The buccal model automatically rotates and you can use the above described ‘Drag&Drop’ technique.

Id., 3. Thus, the automatic rotation of the buccal model and Drag&Drop technique (rotating both models preparation and antagonist in the way that you can see the matching parts between the buccal model and the preparation/antagonist model) constitute aligning the 3D teeth models of the upper jaw and the lower jaw with the additional bite surface [buccal model]—step c of Claim 1.

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87. Finally, Sommer discloses repeating step d (displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful).

88. As discussed above with respect to Element [1.4], Sommer states that “[i]f the correlation [of the buccal model connected with the preparation model and the antagonist model] was successful the buccal [sic] model matches and you see the ‘leopard’ pattern.” *Id.*

89. Thus, Sommer discloses for each bite surface (i.e., buccal image) of a different quadrant, the user should expect to see a “leopard” pattern displayed with the bite surface aligned together with the 3D teeth models of the upper jaw and the lower jaw if the alignment is successful.

90. In my opinion, Sommer discloses all of the requirements of Element [1.5].

6. [1.6]: selecting two or more successful bite registrations by evaluating the at least two successful bite registrations and selecting said two or more of the displayed successful bite registrations; and

91. Element [1.6] is disclosed in Sommer (EX1005).

92. Sommer states that for prior art products “[a]s far as known all products in this field using the buccal method use an automatic correlation algorithm [and in] case that the software cannot correlate the buccal images with either the upper jaw

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or lower jaw [*i.e.*, produce a successful bite registration], the user has to take additional images or remove not useful images until the software can calculate the correlation.” *Id.*, 1.

93. Sommer also suggests doing the same with its software: “In this case redo this procedure and try to find a better matching area when doing the ‘Drag&Drop’ or add an additional buccal shot to enlarge the buccal model.” *Id.*, 2.

94. In addition to enlarging the buccal model to obtain a successful bite registration, Sommer suggests “improv[ing] the precision of the correlation between upper and lower jaw especially when doing full arches ... by using more than one buccal image [two or more successful bite registrations] (e.g., one buccal image in each quadrant).” *Id.*, 4.

95. As discussed above with respect to Element [1.5], Sommer discloses a process for obtaining and selecting at least two successful bite registrations corresponding to different displayed bite surfaces after evaluating each of the separate alignment/correlations between the upper and lower jaw and the buccal image.

96. In my opinion, Sommer discloses all of the requirements of Element [1.6].

7. **[1.7]: computing a final bite registration between the teeth models of the upper jaw and the lower jaw using the selected two or more displayed successful bite registrations, and wherein in step e, when repeating to perform step b, the location of the acquired bite surface is changed.**

97. Element [1.7] is disclosed in Sommer (EX1005) in combination with Malfliet (EX1006).

98. While Sommer discloses changing the location of the acquired bite surface in step e (when repeating to perform step b) (*id.*, 4 (“using more than one buccal image [two or more successful bite registrations] (e.g., one buccal image in each quadrant).”), and provides a “solution [of] manual pre-correlation by the user combined with the final calculation done by the Software” (*id.*, 1), Sommer is silent with respect to the details of Element [1.7]. That is, Sommer is silent regarding how the final calculation of “computing a final bite registration between the teeth models of the upper jaw and the lower jaw using the selected two or more displayed successful bite registrations” is performed.

99. However, this computation step was well known in the art. For example, Malfliet also teaches the digitization of bite registrations for use in registering the digital 3D models of the patient’s jaws. EX1006, ¶[0045].

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100. Like Sommer, Malfliet discusses registering 3D models by “manually translating and/or rotating one of the 3D models with respect to the other.” *Id.*, ¶[0036].

101. In this manner, “models are displayed on display 10 of the workstation 20 and an operator manipulates the models.” *Id.* Malfliet lists a number of techniques for manually and automatically registering 3D models. *Id.*, ¶¶[0036]-[0038].

102. With regard to the missing step of Element [1.7] that is not taught by Sommer, Malfliet expressly teaches that “[a] final mapping is performed either by: at least-squares algorithm/n-point registration/ICP (Iterative Closest Point) registration, which will find the optimal transformation necessary to align both sets of points; or by an exact matching at the location of the reference points and minimal deformations in between, using an RBF (radial base functions) optimization approach.” *Id.*, ¶[0044].

103. In my opinion, Sommer in combination with Malfliet discloses all of the requirements of Element [1.7].

B. Claim 5 (Preamble): The method of bite registration according to claim 1, wherein step a includes the steps of:

104. Sommer discloses the Preamble of Claim 5. *See* Preamble and Element [1.1] of Claim 1.

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105. Step a of Claim 1 recites “generating 3-d dimensional (3D) teeth models of the upper jaw and the lower jaw.”

106. Claim 5 further characterizes the steps of step a of claim 1.

107. In my opinion, Sommer discloses the requirements of the Claim 5 Preamble.

1. [5.1]: capturing 3D teeth surface on the upper jaw or lower jaw by a scanner;

108. Element [5.1] is disclosed in Rubbert (EX1008).

109. Sommer correlates between upper and lower jaws of digital impressions (EX1005, Title). Sommer states that “[c]apturing digital impressions from the upper jaw and lower jaw with [a] dental scanning system is typically done separately” but such systems are “well known and technically solved.” *Id.*, 1. Rubbert not only discloses such a well-known and technically solved dental scanning system, Rubbert discloses all of Element [5.1].

110. Rubbert discloses that “[a] scanner is described which acquires images of the dentition.” EX1008, Abstract, FIG. 2, 28:14-20.

111. Further, Rubbert provides a “flow chart ... illustrating the steps performed to generate a complete three-dimensional model of a patient from a series of scans of the upper and lower jaws.” *Id.*, 18:9-10 and FIG. 36.

112. Thus, Rubbert discloses using an optical scanner to capture 3D teeth surface on the upper jaw or lower jaw by a scanner.

113. In my opinion, Rubbert discloses all of the requirements of Element [5.1].

2. [5.2]: judging whether the captured 3D teeth surface is the first one or not during the scan;

114. Element [5.2] is disclosed in Rubbert (EX1008).

115. Rubbert discloses a dental scanning system that performs all of the steps required to generate a complete three-dimensional model of the dentition of a patient from a series of scans of the upper and lower jaws. EX1008, 18:9-10, 55:5-7, FIG. 36.

116. Rubbert explains that “[t]he steps include an initial step 190 of determining an entry point into a registration process, a frame to frame registration process 192 of registering one frame to another, a segment registration process 194 to register segments (i.e., portions of a scan where the scan was interrupted for some reason) to one another, and finally a cumulative registration procedure 196 in which the frames are registered to all other frames to obtain a slightly more accurate model of the object than that obtained by frame to frame registration.” *Id.*, 55:7-12.

117. Regarding that initial step 190, *i.e.*, determining an entry point into a registration process, Rubbert states that the process

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require[s] a starting point for fitting one frame, frame i to another frame, $i + 1$. The starting point, in the illustrated embodiment, is rough calculation of the offset between overlapping points in the frames in X, Y and Z directions.... The starting point is the initial assumption of spatial relationship between one frame and the previous frame (and one frame and a set of previous frames).

Id., 57:4-11.

118. Here, Rubbert’s “starting point” is the same as the claimed “first scan” of Element [5.2]. *See also id.*, 34:1-5 (“One of the frames, such as the first frame in the series, is a starting point for registration and no transformation matrix is obtained for that frame.”).

119. Rubbert goes on to describe a “method of calculation” which “is used to find an initial entry point into a registration algorithm between successive frames of data.” *Id.*, 57:12-16.

120. That is, Rubbert describes a process for judging whether that “starting point”/scan of the captured 3D teeth surface is the first one or not during the scan to be able to find an entry point into the registration process of generating a complete three-dimensional model of the dentition of a patient from a series of scans of the upper and lower jaws.

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121. In my opinion, Rubbert discloses all of the requirements of Element [5.2].

3. **[5.3]: if the captured portion is the first one, accepting the captured 3D teeth surface, and if further succeeding to accept, combining the captured 3D teeth surface with the 3D teeth model; and**

122. Element [5.3] is disclosed in Rubbert (EX1008).

123. Because Rubbert discloses a dental scanning system that performs all of the steps required to generate a complete three-dimensional model of a patient from a series of the upper and lower jaws (*id.*, 18:9-10, 55:5-7 and FIG. 36), Rubbert also discloses Element [5.3]. As discussed above, Rubbert discloses a process for determining if the captured portion of the teeth surface is the first one or “starting point.”

124. Once that “starting point” captured 3D teeth surface scan is determined to be the first and accepted, Rubbert discloses a process for adding the “starting point” frame and additional frames to the three-dimensional computer model of the dentition of the upper and lower jaws that had been scanned.

125. For example, Rubbert discloses

Frame to frame registration [as] a process for registering one frame with another frame, that is, finding a best-fit in terms of translation and rotation [to] make overlapping points in the frames agree with each other. If the frames

are generated in sequential order, frame to frame registration refers to registration of the second frame to the first frame, the third frame to the second frame, from the fourth frame to the third frame, etc.... It can be performed in a manner such that the operator of the scanning system sees the results of frame to frame registration on the monitor of the scanning work station while they are still scanning the patient. What they see is *an accurate three-dimensional representation of the dentition* on the monitor, for those portions of the dentition that have been scanned thus far. *As additional frames are obtained, they are registered to the previous frame and added to the computer model.*

Id., 58:14-25 (emphasis added).

126. Thus, Rubbert discloses a process for combining that captured 3D teeth surface with a 3D teeth model.

127. In my opinion, Rubbert discloses all of the requirements of Element [5.3].

4. **[5.4]: if the captured portion is not the first one, attempting to stitch the captured 3D teeth surface onto the existing 3D teeth model; if succeeding to stitch, combining the captured 3D teeth surface with the existing 3D teeth model.**

128. Element [5.4] is disclosed in Rubbert.

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129. Because Rubbert discloses a dental scanning system that performs all of the steps required to generate a complete three-dimensional model of a patient from a series of scans of the upper and lower jaws (*id.*, 18:9-10, 55:5-7 and FIG. 36), Rubbert also discloses Element [5.4]. As discussed above, Rubbert discloses a process for stitching the captured 3D teeth surface onto the existing 3D teeth model if the “starting point” scan is not the first scan: “As additional frames are obtained, they are registered to the previous frame and added to the computer model.” *Id.*, 58:24-25.

130. Here, Rubbert’s description of “frame to frame registration” and the “addition” to the computer model is the same as the claimed “stitching” of Element [5.4].

131. This is done by “finding a best-fit in terms of translation and rotation [to] make overlapping points in the frame agree with each other.” *Id.*, 58:16-17.

132. That is, Rubbert first attempts to stitch the captured 3D teeth surface onto the existing 3D teeth model by ensuring alignment between overlapping points of the “additional frame” and previously registered frame.

133. In my opinion, Rubbert discloses all of the requirements of Element [5.4].

- C. Claim 6: The method of bite registration according to claim 1, wherein step d including step of: if the alignment is not successful, the bite surface is discarded and the user receives a notification of failing to align or to register the bite surface, wherein if the alignment is not successful, automatically returning back to step b until the alignment is successful.**

134. Sommer discloses the additional limitations of Claim 6.

135. Sommer discloses that “[i]n case that the software cannot correlate the buccal images [bite surfaces] with either the upper jaw or lower jaw, the user has to take ... *remove not useful images* until the software can calculate the correlation [emphasis added].” EX1005, 1.

136. Thus, Sommer discloses the module for step d of discarding the bite surface if the alignment is not successful.

137. Sommer also discloses sending a notification of failing to align to the user.

138. For example, Sommer states that “[i]f the correlation was not successful, the buccal model shakes for a moment and stays in the middle between the models.” *Id.*, 2.

139. When the buccal model shakes and stays in the middle between the upper and lower jaw models, the user is notified of an alignment/correlation failure.

140. Sommer also discloses that if the alignment is not successful, the user should automatically return back to step b until the alignment is successful.

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141. That is, the user should acquire a bite surface containing a portion of at least one tooth of the upper jaw and a portion of at least one opposing tooth of the lower jaw simultaneously in a clenched state where the upper jaw is static relative to the lower jaw.

142. As mentioned above, Sommer states that “[i]n case that the software cannot correlate the buccal images [bite surfaces] with either the upper jaw or lower jaw, the user has to *take additional images* ... until the software can calculate the correlation [emphasis added].” *Id.*, 1.

143. In my opinion, Sommer in combination with Rubbert and Malfliet discloses all of the requirements of Claim 6.

D. Claim 7: The method of bite registration according to claim 1, wherein the alignment is completed at least by stitching of a portion of 3D teeth surface of the bite surface with the 3D teeth models of the upper jaw and the lower jaw, where the bite surface includes a tooth of the upper jaw and an opposing tooth of the lower jaw.

144. Rubbert discloses the additional limitation so Claim 7. *See* Claim 5.

145. As discussed above, “stitching” of 3D models can be performed using the “frame to frame registration process” taught by Rubbert. EX1008, 58: 24-25

146. Rubbert also discloses an alignment process prior to stitching the captured portion of the 3D teeth surface of the bite surface with the 3D teeth models of the upper and lower jaw. *Id.*

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147. Rubbert also discloses that alignment can be completed by stitching a portion of 3D teeth surface of the bite surface with the 3D teeth models of the upper jaw and the lower jaw, where the bite surface includes a tooth of the upper jaw and an opposing tooth of the lower jaw.

148. Not only does Rubbert discloses individual “tooth modeling,” Rubbert also directly contemplates the use and registration of the opposing tooth of the other jaw for treatment planning. *Id.*, 10:9-13, 22:30-31, 72:1-5, 78:12-22, 84:1-5, 97:7-10, 98:18-26.

149. Thus, Rubbert discloses an “alignment [that] is completed at least by stitching of a portion of 3D teeth surface of the bite surface with the 3D teeth models of the upper jaw and the lower jaw, where the bite surface includes a tooth of the upper jaw and an opposing tooth of the lower jaw.”

150. In my opinion, Sommer in combination with Rubbert and Malfliet discloses all of the requirements of Claim 7.

E. Claim 8 (Preamble): The method of bite registration according to claim 1, wherein the alignment can be completed at least by stitching of a portion of 3D teeth surface of the acquired bite surface with either the lower or the upper arch, wherein the stitching process includes the steps of:

151. Sommer in combination with Rubbert discloses the Preamble of Claim 8. *See* Claims 5 and 7.

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152. In my opinion, Sommer in combination with Rubbert and Malfliet discloses all of the requirements of Claim 8.

1. [8.1]: generating candidate 3D rigid transformations to place the 3D teeth surface relative to the 3D teeth model;

153. Rubbert discloses Element [8.1].

154. As discussed above, Rubbert discloses frame to frame registrations, *i.e.*, local registration between successive scans.

155. However, Rubbert also describes “cumulative registration [which] is registration of a frame to more than one other frame, such as where one frame is registered to all previously registered frames [which ensures] more accuracy in the resulting three-dimensional model.” EX1008, 64:17-24.

156. Rubbert describes “a few examples” of the “numerous types of cumulative registrations that can be performed” by way of illustration in Figures 47A, 4B, 48A-48C, and 49-52. *Id.*, 64:17-67:25.

157. Cumulative registration includes 3D rigid transformations to place the 3D teeth surface relative to the 3D teeth model that is being generated.

158. For example, one cumulative registration process of Rubbert uses “triangle surfaces [] formed on the points of frame 3 and minimal distance vectors [] calculated for each of the points in frame 1 and frame 2 (after registration to frame 1), and the other steps of Figure 40 are performed.” *Id.*, 64:31-65:2.

159. In one embodiment, Rubbert describes using a "transformation matrix [T]" that is applied to the frames. *Id.*, 63:6-19.

160. The "transformation matrix" of Rubbert is the same as the claimed "rigid transformation" of Element [8.1].

161. Thus, Rubbert discloses generating candidate 3D rigid transformations to place the 3D teeth surface relative to the 3D teeth model.

162. In my opinion, Rubbert discloses all of the requirements of Element [8.1].

2. [8.2] evaluating a metric of the candidate 3D rigid transformations using the relative placement of the 3D teeth surface relative to the 3D teeth model;

163. Rubbert discloses Element [8.2].

164. For example, Rubbert evaluates whether the quality (*i.e.*, metric) of the proposed registration is sufficient after the transformation matrix [T] has been applied to a frame:

At step D, the transformation matrix $[T]_2$ is applied to frame 2.

At step E, a registration is performed of the points of frame 1 to the points of frame 2, after the transformation matrix $[T]_2$ has been applied to frame 2. Basically the steps 1-11 of Figure 40A-40B are performed.

At step F, a check is made as to whether the quality of the registration is less than a threshold.

EX1008, 65:101-5.

165. Thus, Rubbert discloses “evaluating a metric of the candidate 3D rigid transformations using the relative placement of the 3D teeth surface relative to the 3D teeth model.”

166. In my opinion, Rubbert discloses all of the requirements of Element [8.2].

3. **[8.3] choosing the best 3D rigid transformation which corresponds to a best metric; and if the best metric goes below a predetermined threshold, accepting the corresponding 3D rigid transformation; if the best metric exceeds a predetermined threshold, rejecting the stitching.**

167. Rubbert discloses Element [8.3]. Rubbert discloses that

At step F, a check is made as to whether the quality if the registration is less than a threshold. *If not, the registration is performed again* (with the points of frame 2 updated by a new transformation matrix). *Steps 278 and 280 are performed over and over again until either quality threshold is met or a maximum number of iterations has occurred.*

If the index is met or the maximum number of iterations has been reached, *the process proceeds to step G (282).*

The new transformation matrix for frame 2, designated $[T]_2'$ is obtained and stored.

At step H, the new transformation matrix $[T]_2'$ is applied to the points of frame 2.

At step I, *the new transformed points of frame 2 are added to a “global container”*. The global container is merely memory locations containing the points from frame 1 and the points of frame 2 as transformed.

* * *

At Step S, *the global container is displayed to the user.... the global container is a digital representation of the object...*

EX1008, 65-14-66:13 (emphasis added).

168. That is, Rubbert discloses choosing the best 3D rigid transformation which corresponds to a best metric (e.g., transformation matrix $[T]$); and if the best metric goes below a predetermined threshold, accepting the corresponding 3D rigid transformation (e.g., accepting transformation matrix $[T]_2$ in step F and proceeding to step G of the exemplary cumulative registration process illustrated in Figures 40A-40B); if the best metric exceeds a predetermined threshold rejecting the stitching (e.g., rejecting transformation matrix $[T]_2$ and any such proposed stitching of frame 2 to frame 1 and the global container, and performing the registration

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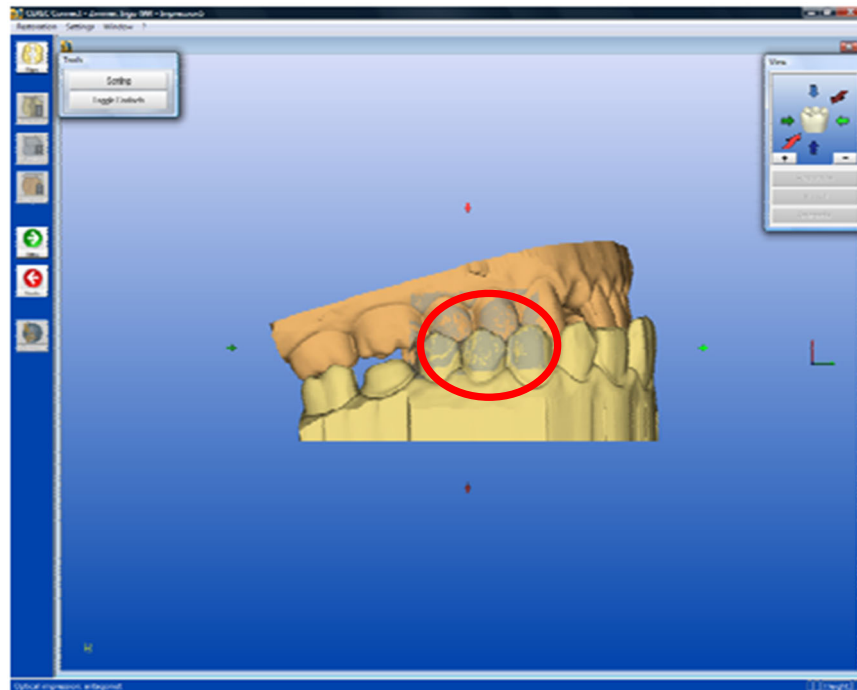
process again until either the index/predetermined threshold is met or a new transformation matrix $[T]_2'$ is applied to frame 2).

169. In my opinion, Rubbert discloses all of the requirements of Element [8.3].

F. Claim 9: The method of bite registration according to claim 1, wherein the teeth contained in the bite surface are selected from incisors, premolar or molars.

170. Sommer discloses the additional limitations of Claim 9.

171. For example, Sommer visually depicts the alignment of premolar teeth (circled in red) in the bite surface of the bite registration that is correlated with the upper and lower jaws:



EX1005, 3.

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172. In my opinion, Sommer in combination with Rubbert and Malfliet discloses all of the requirements of Claim 9.

G. Claim 10: The method of bite registration according to claim 1, wherein the bite surface is acquired based on one or more bite views captured by a scanner.

173. Sommer in combination with Rubbert discloses Claim 10. *See* Element [5.1].

174. In my opinion, Sommer in combination with Rubbert and Malfliet discloses all of the requirements of Claim 10.

H. Claim 11: The method of bite registration according to claim 1, wherein the alignment is completed in a manual way, a semi-automatic way or automatic way.

175. Sommer discloses the additional limitations of Claim 11.

176. For example, Sommer describes both “a manual pre-correlation by the user combined with the final calculation done by the software.” EX1005, 1.

177. Sommer further discloses that “[a]s far as known all products in this field using the buccal method [of correlation] use an automatic correlation algorithm.” *Id.*

178. Thus, Sommer discloses an alignment that is completed in both a manual way and an automatic way.

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179. In my opinion, Sommer in combination with Rubbert and Malfliet discloses all of the requirements of Claim 11.

I. Claim 12: The method of bite registration according to claim 1, wherein the final bite registration is used to construct a global 3D teeth model.

180. Sommer in combination with Malfliet discloses the additional limitations of Claim 12.

181. As discussed above, the combination of Sommer and Malfliet discloses a final bite registration between the teeth models of the upper jaw and the lower jaw using the selected two or more displayed successful bite registrations. *See* Element [1.7].

182. This final bite registration can be used in the construction of a global 3D teeth model as taught by Malfliet. For example, Malfliet discloses that

The image data 30 that has been acquired from the imaging sources 31-34 is used to generate a virtual, three-dimensional model 56 which is a life-like representation of at least the area of the human body to be treated. Typically, this area will be the patient's jaw, teeth (if any are remaining) and soft tissue surrounding these parts, such as the gums, lips and skin on the outer surface of the face. The extent of the 3D model can be restricted just to the area to be treated and the soft tissue immediately

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surrounding this area or it can extend to the entire face and head of the user.

EX1006, ¶[0030].

183. Thus, Malfliet discloses that when the 3D model is extended to the entire face and head of the user, the 3D model is a global 3D model that includes at least the patient's jaws and teeth.

184. Malfliet further discloses that “[t]he composite 3D model created [using the final bite registration] ... should preferably include the face of the patient to allow facial analysis to be based on the model [and that the] 3D model used to plan a modified tooth set-up ... is useful to visualize to the user and patient the effects of the treatment and can be rendered in the final stage 66 of the method when a virtual representation of the tooth set-up following treatment is displayed to the user and a patient.” *Id.*, ¶[0047].

185. In my opinion, Sommer in combination with Rubbert and Malfliet discloses all of the requirements of Claim 12.

J. Claim 21 (Preamble): A method of bite registration, comprising:

186. Sommer discloses the Preamble of Claim 21. *See* Preamble of Claim 1.

187. In my opinion, Sommer discloses all of the requirements of the Preamble of Claim 21.

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1. [21.1]: a. generating 3-dimensional (3D) teeth models of the upper jaw and the lower jaw;

188. Sommer discloses Element [21.1]. *See* Element [1.1].

189. In my opinion, Sommer discloses all of the requirements of Element [21.1].

2. [21.2]: b. acquiring a bite surface containing a portion of the upper jaw and an opposing portion of the lower jaw simultaneously in a clenched state where the upper jaw is static relative to the lower jaw;

190. Sommer in combination with Rubbert discloses Element [21.2]. *See* Element [1.2].

191. In my opinion, Sommer in combination with Rubbert discloses all of the requirements of Element [21.2].

3. [21.3]: c. attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface to achieve successful alignment;

192. Sommer discloses Element [21.3]. *See* Element [1.3].

193. In my opinion, Sommer discloses all of the requirements of Element [21.3].

4. [21.4]: d. displaying the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface where successful alignment is achieved;

194. Sommer discloses Element [21.4]. *See* Element [1.4].

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195. In my opinion, Sommer discloses all of the requirements of Element [21.4].

5. **[21.5]: e. repeating step b to step d so as to obtain at least two successful bite registrations corresponding to different displayed bite surfaces;**

196. Sommer discloses Element [21.5]. *See* Element [1.5].

197. In my opinion, Sommer discloses all of the requirements of Element [21.5].

6. **[21.6]: selecting two or more successful bite registrations by evaluating the at least two successful bite registrations and selecting said two or more of the displayed successful bite registrations; and**

198. Sommer discloses Element [21.6]. *See* Element [1.6].

199. In my opinion, Sommer discloses all of the requirements of Element [21.6].

7. **[21.7]: computing a final bite registration between the teeth models of the upper jaw and the lower jaw using the selected two or more displayed successful bite registrations, and wherein step e, when repeating to perform step b, the location of the acquired bite surface is changed.**

200. Sommer in combination with Malfliet discloses Element [21.7]. *See* Element [1.7].

201. In my opinion, Sommer discloses all of the requirements of Element [21.7].

K. Explanation of Why Claims 1, 5-12, and 21 Would Have Been Obvious (Ground 1)

202. Claims 1, 5-12, and 21 would have been obvious over Sommer, Rubbert, and Malfliet.

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

203. As discussed above in Sections X.A.-J., Sommer, Rubbert, and Malfliet together disclose all of the features of Claims 1, 5-12, and 21.

204. While Sommer does not disclose the details of the hardware or software required to acquire and process images of a dentition for the generation of 3D teeth models, Rubbert discloses these missing limitations (*e.g.*, Elements [5.1]-[5.4], [8.1]-[8.3], and the additional limitations of Claim 7). Similarly, Rubbert expressly discloses acquiring a bite surface containing a portion of at least one tooth of the upper jaw and a portion of at least one opposing tooth of the lower jaw simultaneously in a *clenched state* where the upper jaw is static relative to the lower jaw (*e.g.*, Elements [1.2] and [21.2]).

205. Sommer and Rubbert together disclose all of the features of Claims 1, 5-12, and 21, with the exception of the final computation of bite registration between the teeth models of the upper jaw and the lower jaw using the selected two or more displayed successful bite registrations.

206. In my opinion, Malfliet discloses this missing limitation.

2. A POSITA would have had motivation to combine the disclosures of Sommer, Rubbert, and Malfliet.

207. A POSITA would have had a motivation to modify Sommer to include the clenched dentition state of Rubbert.

208. Further, a POSITA would have had a motivation to (i) use the well-known hardware (*e.g.*, scanner and workstation) and software of Rubbert and (ii) include the clenched dentition state of Rubbert.

209. Further, a POSITA would have had a motivation to use the final computation of bite registration method of Malfliet with Sommer's method of correlating bite surfaces between the upper and lower jaws.

a) A POSITA would have been motivated to use well-known hardware and software of Rubbert.

210. As discussed above, Sommer discloses a correlation method between upper and lower jaw digital impressions. EX1005, Title.

211. Sommer emphasizes that for “the design of a dental restoration or orthodontic treatment planning, [the] upper and lower must be correlated.” *Id.*, 1.

212. According to Sommer, “[c]apturing the digital impressions from the upper jaw and lower jaw with [a] dental scanning system is typically done separately.” *Id.* Sommer also states that the “method by taking the optical impressions from the bite is well known and technically solved.” *Id.*

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213. Rubbert discloses such a well-known and technically solved dental scanning system. EX1008, Abstract. Indeed, Rubbert discloses all of the hardware and software that is required to acquire and process images of a dentition. *Id.*

214. Further, Rubbert describes and provides a flow chart illustrating the steps performed to generate a complete three-dimensional model of a patient's dentition from a series of scans of the upper and lower jaws (*e.g.*, frame registration and stitching). *Id.*, 18:9-10 and FIG. 36. Furthermore, Rubbert discloses a “computer-interactive software program [that] provides for treatment planning, diagnosis and appliance from the [generated] virtual tooth models.” *Id.*, Abstract.

215. Indeed, Rubbert explains that the “virtual model of the desired occlusion and the virtual model of the original dentition provide a base of information for custom manufacture of an orthodontic appliance.” *Id.*

216. Thus, a POSITA would have been motivated to combine Sommer and Rubbert because (i) Rubbert supplies the dental scanning system that Sommer acknowledges is well-known in the art and technically solved and (ii) Rubbert discloses the means for generating high quality virtual 3D teeth models based upon which Sommer performs its correlations.

217. And, once a POSITA had motivation to combine the dental scanning system of Rubbert with the correlation method and system of Sommer, a POSITA

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would have relied on all aspects of Rubbert's disclosure. That is, a POSITA would have had motivation to combine Sommer's correlation process with Rubbert's teachings of (i) scanning 3D teeth surfaces on the upper and lower jaws with a scanner (relates to Element [5.1]) , (ii) determining whether the scanned 3D teeth surface is the first one during the scan (relates to Element [5.2]), (iii) accepting such scans and combining such scans with a 3D teeth model (relates to Element [5.3]), (iv) registering such scan frames of 3D teeth surfaces onto existing 3D teeth models (relates to Element [5.4] and the additional limitations of Claim 7), (v) generating candidate 3D rigid transformations to place the scanned 3D teeth surface relative to the 3D teeth model (related to Element [8.1]), (vi) evaluating a metric of the 3D rigid transformation using the relative placement of the 3D teeth surface relative to the 3D teeth model (related to Element [8.2]), (vii) selecting the best 3D rigid transformation corresponding to the best metric by accepting the 3D rigid transformation if the best metric is below a predetermined threshold value and rejecting the 3D rigid transformation if the best metric is above the predetermined threshold value (related to Element [8.3]) to meet all of the limitations of the independent and dependent claims discussed herein.

218. A POSITA would have also understood that the success of Sommer's correlation method depends on the accuracy of the underlying 3D models that it

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relies upon. Thus, a POSITA would have looked to references like Rubbert which explicitly disclose means for generating accurate 3D models using conventional methods like frame registration and stitching. EX1008, FIGs. 52-53.

219. A POSITA would also have been motivated to combine Sommer and Rubbert because they are in the same field of endeavor—aligning and correlating digital representations of teeth of upper and lower jaws for orthodontic treatment planning.

**b) A POSITA would have been motivated to use the
clenched dentition scan of Rubbert in Sommer’s
correlation method.**

220. To facilitate treatment planning, “[a] bite registration scan is obtained from the patient to spatially correlate the scans of the upper and lower jaws when the *dentition is clenched*.” EX1008, 85:17-18 (emphasis added).

221. Rubbert explains that “[t]his scan is used to provide a registration of the upper and lower jaw to determine the correct relative position.” EX1008, 85:18-19.

222. Rubbert further explains that “[t]his bite registration scan is usually needed at the beginning of a treatment to set the relation between the upper and lower jaws.” *Id.*, 85:19-21.

223. Thus, Rubbert itself provides a POSITA with a motivation to use a clenched dentition scan in Sommer’s correlation method between upper and lower

jaw digital impressions, *i.e.*, to spatially correlate the scans of the upper and lower jaws so as to determine the correct relative position for appropriate treatment purposes.

c) A POSITA would have been motivated to use the final computation step of Malfliet in Sommer's correlation method.

224. While Sommer discloses a “solution [of] manual pre-correlation by the user combined with the final calculation done by the Software” (EX1005, 1), Sommer is silent regarding how the final calculation of “computing a final bite registration between the teeth models of the upper jaw and the lower jaw using the selected two or more displayed successful bite registrations” is performed.

225. Malfliet, much like Sommer, discloses a “method for automatic, or semi-automatic, planning of dental treatment for a patient.” EX1006, Abstract.

226. Malfliet discloses “obtaining data about an area which is to be treated” and “performing a computer-assisted analysis of the data” to “create[e] a modified tooth set-up using a set of stored rules.” *Id.*

227. When combining data into a single virtual model, Malfliet describes “[a] final mapping [that] is performed [] by: a least-squares algorithm/n-point registration/ICP (Iterative Closest Point) registration, which will find the optimal transformation necessary to align both sets of points.” *Id.*, ¶[0044].

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228. Malfliet references a number of journal articles at Paragraph [0038] that describe how “3D models are registered onto each other using a fully automatic registration algorithm based on feature recognition.” The underlying methodologies discuss ICP registration in even greater detail. Because Sommer states that “algorithms correlating the models are well known ICP based algorithms,” a POSITA would have looked to Malfliet for additional details regarding the use of such ICP based algorithms in computation/mapping of a final bite registration between the teeth models of the upper jaw and the lower jaw. EX1005, 1.

229. That is, the combination of Sommer and Malfliet constitutes nothing more than prompting a variation of the Sommer correlation method with the known ICP final computation details of Malfliet and/or combining familiar elements (*e.g.*, using an ICP algorithm) according to known methods (*e.g.*, inserting the algorithm into a correlation process).

230. Finally, a POSITA would have been motivated to combine Sommer and Malfliet because they are in the same field of endeavor—aligning and correlating digital representations of teeth of upper and lower jaws for orthodontic treatment planning.

3. A POSITA would have had a reasonable expectation of success based on the disclosures of Sommer, Rubbert, Malfliet, and knowledge generally available in the art.

231. A POSITA would have had a reasonable expectation of success of making this combination because (i) the hardware and software for acquiring and processing images of a dentition in order to generate 3D models was well-known in the art, (ii) there are only two possible ways to scan the upper and lower jaws, *i.e.*, in the clenched and unclenched states, and (iii) using the ICP algorithm in the correlation process of Sommer was already contemplated.

232. First, as Sommer readily admits, “method[s] by taking the optical impressions from the bite is well known and technically solved.” EX1005, 1. As of the priority date of the ’391 Patent, there were numerous dental scanners with associated software on the commercial market. EX1013, Abstract (listing CEREC AC, Cadent iTero, Lava COS). “Both the CEREC AC and the Cadent iTero capture single 3D frames that are stitched with other frames to compose a complete 3D model in a short registration cycle.” *Id.*, e43313. Sommer also mentions that its software is contemplated for use with the CEREC product. EX1005, 1. As such, a POSITA would have had a reasonable expectation of successfully using not just Rubbert’s scanning hardware and registration software with Sommer’s method of bite surface alignment and registration, but any of the prior art dental scanning

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hardware and registration software. Thus, the combination of Sommer and Rubbert is no more than the application of known techniques to known devices ready for improvement to yield predictable results.

233. Second, because there are only two possible ways to scan the upper and lower jaws, there are a finite number of identified, predictable solutions/orientations for scanning the dentition of a patient.

234. As such, a POSITA would have had a “good reason to pursue the known options within his or her technical grasp.”

235. Third, Sommer had already discussed using “well known ICP based algorithms” as part of its correlation process. EX1005, 1.

236. Malfliet simply placed that ICP based algorithm in its “final mapping” step. EX1006, ¶[0044]. Accordingly, a POSITA would have understood the placement of an ICP based algorithm in the final computation/mapping step of Sommer as simply using a “known method” that would have led to predictable results.

237. For all of the foregoing reasons, Sommer, Rubbert, and Malfliet render obvious all the recited features of Claims 1, 5-12, and 21.

XI. CLAIMS 2-4 WOULD HAVE BEEN OBVIOUS OVER SOMMER IN VIEW OF RUBBERT, MALFLIET, AND ESTÉPAR (GROUND 2).

238. The following sections explain where each element of Claims 2-4 is found in the prior art.

A. Claim 2: The method of bite registration according to claim 1, wherein the computation of the final bite registration involves the optimization of a cost function depending on the selected successful bite registrations.

239. Sommer in combination with Malfliet, and Estépar discloses the additional limitations of Claim 2.

240. Sommer discusses manual pre-correlation of the upper and lower jaw models with a bite registration before a final automatic software calculation:

The correlation between the upper and lower jaw by using buccal images can technically be calculated automatically by correlating corresponding areas on all images. But since the morphology details of the teeth on the buccal surface are very similar among each other, it can be difficult for the software to calculate the correct correlation. Therefore the risk of mismatching models is increased. A solution can be a manual pre-correlation by the user combined with the final calculation done by the software.

EX1005, 1.

241. Sommer further notes that the “algorithms correlating the models are well known ICP based algorithms.” *Id.*, 1.

242. Malfliet also contemplates the use of such ICP algorithms. EX1006, ¶¶[0038], [0044].

243. A POSITA would have known that ICP algorithms involve the optimization of a cost function based on knowledge in the prior art. For example, Estépar is referenced at ¶[0038] of Malfliet and is described as a technique for automatic registering 3D models based on feature recognition. Estépar expressly discusses ICP algorithms and minimizing cost functions:

Iterative Closest Points

Let P be the data shape (source shape) and X the model shape (target shape) to be registered with. The data shape is decomposed in point set form, if not already available in that form. The model shape could originally be given in any representation but for our purpose we will assume that is also decomposed in a point set. Thus, let N_P , N_X be the number of points in the shapes. P and X are respectively defined by the N_P -tuple $\mathcal{P} = \{p_1, p_2, \dots, p_{N_P}\}$ and the N_X -tuple $X = \{x_1, x_2, \dots, x_{N_X}\}$. There is not a preestablished correspondence between the points p_j and x_j .

ICP finds the rigid body transformation, rotation R and translation t that aligns the source with the target by minimizing the distance metric

$$J(R, t) = \sum_{i=1}^{NP} ||y_i - R p_i - t||^2, \text{ where } y_i = C(R p_i + t, X) \quad (1)$$

is a point on the surface of the target model X that corresponds to the point p_i .

EX1007, 235 (emphasis added).

244. Here, “ICP finds the rigid body transformation ... that aligns the source with the target by minimizing the distance metric” of Formula (1), *i.e.*, the cost function. *Id.*

245. “At each iteration a correspondence is established by means of the correspondence operator C .” *Id.*

246. Estépar then states that the “transformation that minimizes a mean square metric is computed,” *i.e.*, computation occurs whereby the cost function is minimized.

247. Thus, Estépar teaches minimizing (*e.g.*, optimizing) a cost function using an ICP algorithm.

248. Thus, Sommer in combination with Malfliet and Estépar discloses a computation of the final bite registration involving the optimization of a cost function depending on the selected successful bite registrations.

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249. In my opinion, Sommer in combination with Rubbert, Malfliet, and Estépar discloses all of the requirements of Claim 2.

B. Claim 3: The method of bite registration according to claim 1, wherein the computation of the final bite registration involves one or more matrix interpolations of the selected successful bite registrations.

250. Sommer in combination with Rubbert, Malfliet, and Estépar discloses Claim 3.

251. As discussed above, Sommer discusses manual pre-correlation of the upper and lower jaw models with a bite registration before a final automatic software calculation. EX1005, 1.

252. Sommer further notes that the “algorithms correlating the models are well known ICP based algorithms.” *Id.*

253. Malfliet also contemplates the use of such ICP based algorithms. EX1006, ¶¶[0038], [0044].

254. A POSITA would have known that ICP algorithms involve interpolations of matrices based on knowledge in the prior art.

255. For example, Estépar is referenced at ¶[0038] of Malfliet and is described as a technique for the automatic registering of 3D models based on feature recognition.

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256. Estépar expressly discloses an ICP protocol that relies on matrix manipulation.

257. For example, Estépar first discloses decomposing matrices associated with the data shape (“[t]he data shape is decomposed in point set form”) and model shape into an equivalent set of values (“The model shape could originally be given in any representation but for our purpose we will assume that is also decomposed in a point set.”). EX1007, 235.

258. Estépar discloses determining corresponding values from each set of values.

259. As discussed above, Estépar discloses a cost function that is sought to be minimized, Formula (1). *Id.*

260. A component of Formula (1) is “*correspondence operator C*,” which is also “typically the closest point operator.” *Id.*

261. Estépar explains that once “the transformation that minimizes a mean square metric is computed [i.e., minimizes the cost function of Formula (1)] ... the data points are transformed using the computed transformation and the process is repeated until a minimum error threshold is achieved or a maximum number of iterations is reached.” *Id.* Once the transformation process is complete, interpolation between the corresponding values from each set of values is performed

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to fill “missing data or gaps.” Rubbert also discloses the need to utilize interpolation to fill in missing data or gaps. EX1008, 76:3-4, FIG. 65. As such, Rubbert discloses such interpolation methods. *Id.*, 21:19-21, 42:20-25, 43:1-2, 53:14-25, and 76:3-15.

262. Thus, the combination of Estépar and Rubbert discloses interpolating corresponding values from each set of values (*e.g.*, point sets from the data shape and the model shape).

263. Thus, Sommer in combination with Rubbert, Malfliet and Estépar discloses a computation of the final bite registration involving one or more matrix interpolations of the selected successful bite registrations.

264. In my opinion, Sommer in combination with Rubbert, Malfliet, and Estépar discloses all of the requirements of Claim 3.

C. Claim 4: The method of bite registration according to claim 3, wherein said one or more interpolations contain steps of: decomposing each matrix into an equivalent set of values; interpolating corresponding values from each set of values; and recomposing a matrix from the interpolated set of values.

265. Sommer in combination with Rubbert, Malfliet, and Estépar discloses Claim 4.

266. As discussed above, the combination of cited references discloses the computation of a final bite registration involving one or more matrix interpolations of the selected successful bite registrations, decomposing each matrix into an

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equivalent set of values, and interpolating corresponding values from each set of values. *See* Claim 3.

267. After interpolating corresponding values from each set of values (*e.g.*, point sets from the data shape and the model shape) based on the teachings of Estépar and Rubbert, the interpolated values of the matrices would need to be recomposed for the aligned bite surface of the 3D teeth models of the upper and lower jaw to be integrated into the 3D model for display purposes.

268. To leave the interpolated corresponding values in point set form would render them useless for 3D model generation which requires x, y, and z coordinates. In one application, Malfliet expressly discloses that the “final step of the method displays a virtual representation of the treatment area, displaying the effect of the optimal tooth (and soft tissue) set-up.” EX1006, ¶[0062].

269. Thus, Sommer in combination with Rubbert, Malfliet, and Estépar discloses a computation of the final bite registration involving one or more matrix interpolations of the selected successful bite registrations, wherein the one or more interpolations contain steps of: decomposing each matrix into an equivalent set of values; interpolating corresponding values from each set of values; and recomposing a matrix from the interpolated set of values.

270. In my opinion, Sommer in combination with Rubbert, Malfliet, and Estépar discloses all of the requirements of Claim 4.

D. Why Claims 2-4 Would Have Been Obvious

271. Claims 2-4 would have been obvious over Sommer, Rubbert, Malfliet, and Estépar.

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

272. Claims 2-4 depend directly or indirectly from Claim 1, and their additional limitations are disclosed by Estépar as discussed in Sections XI.A-C.

2. A POSITA would have had motivation to combine the disclosures of Sommer, Rubbert, Malfliet, and Estépar.

273. As discussed above in Section X.K.2., a POSITA would have had a motivation to combine the disclosures of Sommer, Rubbert, and Malfliet.

274. A POSITA would have had a motivation to additionally combine the disclosure of Estépar with the combination of Sommer, Rubbert, and Malfliet because Malfliet expressly references Estépar for use in its processes and as disclosing an automatic registration algorithm based on feature recognition. EX1006, ¶[0038].

3. A POSITA would have had a reasonable expectation of success based on the disclosures of Sommer, Rubbert, Malfliet, and Estépar and knowledge generally available in the art.

275. As discussed above in Section X.K.3., a POSITA would have had a reasonable expectation of success of making the combination of Sommer, Rubbert, and Malfliet because (i) the hardware and software for acquiring and processing images of a dentition in order to generate 3D models was well-known in the art, (ii) there are only two possible ways to scan the upper and lower jaws, *i.e.*, in the clenched and unclenched states, and (iii) using the ICP algorithm in the correlation process of Sommer was already contemplated.

276. A POSITA would have had a reasonable expectation of making the combination of Sommer, Rubbert, Malfliet, and Estépar because Estépar describes the details of ICP based registration algorithms that were “well known” and “extensively used” in the art (*i.e.*, known methods). EX1005, 1; EX1007, 234 (“The iterative closest point (ICP) algorithm *has been extensively used* as [an] optimization technique for rigid model based registration based on features extracted from medical datasets [Emphasis added].”)

277. For all of the foregoing reasons, Sommer, Rubbert, Malfliet, and Estépar render obvious all the recited features of Claims 2-4.

XII. CLAIMS 13, 14, AND 17-19 WOULD HAVE BEEN OBVIOUS OVER SOMMER IN VIEW OF MALFLIET (GROUND 3).

278. The following sections explain where each element of Claims 13, 14, and 17-19 is found in the prior art.

A. Claim 13 (Preamble): A system for bite registration, comprising:

279. Sommer discloses a method and system for bite registration. *See above* with respect to the Preamble of Claim 1.

1. [13.1]: means for generating 3D teeth models of the upper jaw and the lower jaw;

280. Sommer discloses means for generating 3D teeth models of the upper jaw and the lower jaw. *See Element [1.1].*

2. [13.2]: means for acquiring a bite surface containing a portion of at least one tooth of the upper jaw and a portion of at least one opposing tooth of the lower jaw simultaneously;

281. Sommer discloses means for acquiring a bite surface containing a portion of at least one tooth of the upper jaw and a portion of at least one opposing tooth of the lower jaw simultaneously. *See Element [1.2].*

3. [13.3]: means for attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface;

282. Sommer discloses means for attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface. *See Element [1.3].*

4. **[13.4] means for displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful;**

283. Sommer and Malfliet disclose means for displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful. *See* Element [1.4]. The combination of Sommer and Malfliet also discloses a computerized workstation and associated software as Patent Owner construes this element in Section IX. *See, e.g.*, EX1005, 1 (“CEREC Product name for the software for the dentist by SIRONA”) and EX1006, Abstract, FIG. 1.

5. **[13.5] means for obtaining at least two successful bite registrations corresponding to different displayed bite surface by repeating;**

284. Sommer and Malfliet disclose means for obtaining at least two successful bite registrations corresponding to different displayed bite surface by repeating. *See* Element [1.5]. The combination of Sommer and Malfliet also discloses a computerized workstation and associated software as Patent Owner construes this element in Section IX. *See, e.g.*, EX1005, 1 (“CEREC Product name for the software for the dentist by SIRONA”) and EX1006, Abstract, FIG. 1.

6. **[13.6] means for selecting two or more successful bite registrations by evaluating at least two successful bite registrations and selecting said two or more of the displayed successful bite registrations; and**

285. Sommer and Malfliet disclose means for selecting two or more successful bite registrations by evaluating at least two successful bite registrations and selecting said two or more of the displayed successful bite registrations. *See* Element [1.6]. The combination of Sommer and Malfliet also discloses a computerized workstation and associated software as Patent Owner construes this element in Section IX. *See, e.g.*, EX1005, 1 (“CEREC Product name for the software for the dentist by SIRONA”) and EX1006, Abstract, FIG. 1.

7. **[13.7] means for computing a final bite registration between the teeth models of the upper jaw and the lower jaw using the selected two or more displayed successful bite registrations, and**

286. Sommer in combination with Malfliet discloses means for computing a final bite registration between the teeth models of the upper jaw and the lower jaw using the selected two or more displayed successful bite registrations. *See* Element [1.7].

8. **[13.8] wherein in step e, when repeating to perform step b, the location of the acquired bite surface is changed.**

287. Sommer discloses that the location of the acquired bite surface is changed in step e, when repeating to perform step b. *See* Elements [1.5] and [1.7].

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288. In my opinion, Sommer in combination with Malfliet discloses all of the requirements of Claim 13.

B. Claim 14: The system for bite registration according to claim 13, wherein the computation of the final bite registration involves the optimization of a cost function depending on the selected successful bite registrations.

289. In my opinion, Sommer in combination with Malfliet discloses Claim 14. *See* Claim 2.

C. Claim 17: The system for bite registration according to claim 13, wherein means for attempting to align the 3D teeth models includes: module for, if the alignment is not successful, discarding the bite surface and sending a notification of failing to align to the user.

290. Sommer discloses the additional limitations of Claim 17.

291. Sommer discloses that “[i]n case that the software cannot correlate the buccal images [bite surfaces] with either the upper jaw or lower jaw, the user has to take additional images or *remove not useful images* until the software can calculate the correlation [emphasis added].” EX1005, 1.

292. Thus, Sommer discloses a module for, if the alignment is not successful, discarding the bite surface.

293. Sommer also discloses sending a notification of failing to align to the user.

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294. For example, Sommer states that “[i]f the correlation was not successful, the buccal model shakes for a moment and stays in the middle between the models.” EX1005, 1.

295. When the buccal model shakes and stays in the middle between the upper and lower jaw models, the user is notified of an alignment/correlation failure.

296. In my opinion, Sommer in combination with Malfliet discloses all of the requirements of Claim 17.

D. Claim 18 (Preamble): A system for bite registration, including a scanner and a computerized workstation, wherein the workstation is configured as:

297. Sommer in combination with Malfliet discloses the Preamble of Claim 18. *See* Preambles of Claims 5 and 13 and Element [5.1].

298. Malfliet also discloses a system for bite registration that includes a computerized workstation. EX1006, ¶[0029] and FIG. 1.

1. [18.1]: obtaining 3D teeth models of the upper jaw and the lower jaw, generated respectively, by the scanner;

299. Sommer in combination with Malfliet discloses Element [18.1]. *See* Element [5.1].

2. **[18.2]: acquiring a bite surface containing a portion of at least one tooth of the upper jaw and a portion of at least one opposing tooth of the lower jaw simultaneously in a clenched state where the upper jaw is static relative to the lower jaw;**

300. Sommer in combination with Rubbert discloses Element [18.2]. *See* Element [1.2].

3. **[18.3]: attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface at the workstation;**

301. Sommer discloses Element [18.3]. *See* Element [1.3].

4. **[18.4]: displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful;**

302. Sommer discloses Element [18.4]. *See* Element [1.4].

5. **[18.5]: repeating steps acquiring to step of displaying so as to obtain at least two successful bite registrations corresponding to different displayed bite surfaces;**

303. Sommer discloses Element [18.5]. *See* Element [1.5].

6. **[18.6]: selecting two or more successful bite registrations by evaluating at least two successful bite registrations; and**

304. Sommer discloses Element [18.6]. *See* Element [1.6].

7. **[18.7]: computing a final bite registration using the selected two or more successful bite registrations, and where in the repeating step, when repeating to perform the acquiring step, the location of the acquired bite surface is changed.**

305. Sommer in combination with Malfliet discloses Element [18.7]. *See* Element [1.7].

306. In my opinion, Sommer in combination with Malfliet discloses all of the requirements of Claim 18.

- E. **Claim 19: The system for bite registration according to claim 18, wherein the system is used to construct a global 3D teeth model.**

307. In my opinion, Sommer in combination with Malfliet discloses Claim 19. *See* Claim 12.

- F. **Why Claims 13, 14, and 17-19 Would Have Been Obvious**

308. Claims 1-21 would have been obvious over Sommer and Malfliet.

1. **Difference between the claimed invention and the prior art.**

309. As discussed above in Sections XII.A.-E., Sommer and Malfliet together disclose all of the features of Claims 13, 14, and 17-19. Sommer discloses all of the features of Claims 13, 14, and 17-19, with the exception of the final computation of bite registration between the teeth models of the upper jaw and the lower jaw using the selected two or more displayed successful bite registrations.

310. Malfliet discloses this missing limitation.

2. A POSITA would have had motivation to combine the disclosures of Sommer and Malfliet.

311. A POSITA would have had a motivation to use the computation of a final bite registration method of Malfliet with Sommer's method of correlating bite surfaces between the upper and lower jaws.

312. Malfliet, much like Sommer, discloses a "method for automatic, or semi-automatic, planning of dental treatment for a patient." EX1006, Abstract.

313. Malfliet discloses "obtaining data about an area which is to be treated" and "performing a computer-assisted analysis of the data" to "create[e] a modified tooth set-up using a set of stored rules." *Id.*

314. When combining data into a single virtual model, Malfliet describes "[a] final mapping [that] is performed [] by: a least-squares algorithm/n-point registration/ICP (Iterative Closest Point) registration, which will find the optimal transformation necessary to align both sets of points." *Id.*, ¶[0044].

315. Malfliet references a number of journal articles at Paragraph [0038] that describe how "3D models are registered onto each other using a fully automatic registration algorithm based on feature recognition." The underlying methodologies discuss ICP registration in even greater detail.

316. Because Sommer states that "algorithms correlating the models are well known ICP based algorithms," a POSITA would have looked to Malfliet for

additional details regarding the use of such ICP based algorithms in computation/mapping of a final bite registration between the teeth models of the upper jaw and the lower jaw. EX1005, 1.

317. That is, the combination of Sommer and Malfliet constitutes nothing more than prompting a variation of the Sommer correlation method with the known ICP final computation details of Malfliet and/or combining familiar elements (*e.g.*, using an ICP algorithm) according to known methods (*e.g.*, inserting the algorithm into a correlation process).

318. Finally, a POSITA would have been motivated to combine Sommer and Malfliet because they are in the same field of endeavor—aligning and correlating digital representations of teeth of upper and lower jaws for orthodontic treatment planning.

3. A POSITA would have had a reasonable expectation of success based on the disclosures of Sommer, Malfliet, and knowledge generally available in the art.

319. A POSITA would have had a reasonable expectation of success of making this combination because using the ICP algorithm in the correlation process of Sommer was already contemplated.

320. Sommer had already discussed using “well known ICP based algorithms” as part of its correlation process. EX1005, 1.

321. Malfliet simply placed that ICP based algorithm in its “final mapping” step. EX1006, ¶[0044]. Accordingly, a POSITA would have understood the integration of an ICP based algorithm in the final computation/mapping step of Sommer as simply using a well-“known method” that would have led to predictable results.

322. For all of the foregoing reasons, Sommer and Malfliet render obvious all the recited features of Claims 13, 14, and 17-19.

XIII. CLAIMS 15, 16, AND 20 WOULD HAVE BEEN OBVIOUS OVER SOMMER IN VIEW OF MALFLIET AND ESTÉPAR (GROUND 4).

323. The following sections explain where each element of Claims 15, 16, and 20 is found in the prior art.

A. Claim 15: The system for bite registration according to claim 13, wherein means for computing the final bite registration involves device for one or more matrix interpolations of the selected successful bite registrations.

324. In my opinion, Sommer in combination with Malfliet and Estépar discloses Claim 15. *See* Claim 3.

- B. Claim 16: The system for bite registration according to claim 15, wherein device for one or more matrix interpolations includes: module for decomposing each matrix into an equivalent set of values; module for interpolating corresponding values from each set of values; and module for recomposing a matrix from the interpolated set of values.**

325. In my opinion, Sommer in combination with Malfliet and Estépar discloses Claim 16. *See* Claim 4.

- C. Claim 20 (Preamble): A method of bite registration, characterized by comprising the steps of:**

326. Sommer discloses the Preamble of Claim 20. *See* Preamble of Claim 1.

- 1. [20.1]: generating 3-dimensional (3D) teeth models of the upper jaw and the lower jaw;**

327. Sommer discloses Element [20.1]. *See* Element [1.1].

- 2. [20.2]: acquiring a bite surface containing a part of at least one tooth of the upper jaw and a part of at least one opposing tooth of the lower jaw simultaneously;**

328. Sommer discloses Element [20.2]. *See* Element [1.2].

- 3. [20.3]: attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface;**

329. Sommer discloses Element [20.3]. *See* Element [1.3].

- 4. [20.4]: displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful;**

330. Sommer discloses Element [20.4]. *See* Element [1.4].

5. **[20.5]: repeating step b to step d so as to obtain at least two successful bite registrations corresponding to different displayed bite surfaces;**

331. Sommer discloses Element [20.5]. *See* Element [1.5].

6. **[20.6]: selecting one or more successful bite registrations by evaluating at least two successful bite registrations; and**

332. Sommer discloses Element [20.6]. *See* Element [1.6].

7. **[20.7]: computing a final bite registration using selected one or more successful bite registrations, wherein the computation of the final bite registration involves one or more matrix interpolations of the selected successful bite registrations.**

333. Sommer in combination with Malfliet and Estépar discloses Element [20.7]. *See* Element [1.7] and Claim 3.

334. In my opinion, Sommer in combination with Malfliet and Estépar discloses all of the requirements of Claim 20.

D. Why Claims 15, 16, and 20 Would Have Been Obvious

335. Claims 1-21 would have been obvious over Sommer, Malfliet, and Estépar.

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

336. Claims 15 and 16 depend directly or indirectly from Claim 3, and their additional limitations are disclosed by Estépar as discussed in Sections XIII.A.-C. Regarding Claim 20, Sommer does not expressly disclose computation of a final bite

registration between the teeth models of the upper jaw and the lower jaw using the selected two or more displayed successful bite registrations. Malfliet discloses this missing limitation.

337. The combination of Sommer and Malfliet does not disclose the computation of the final bite registration involving one or more matrix interpolations of the selected successful bite registrations. Estépar discloses this missing limitation.

2. A POSITA would have had motivation to combine the disclosures of Sommer, Malfliet, and Estépar.

338. As discussed above in Section XII.2., a POSITA would have had a motivation to combine the disclosures of Sommer and Malfliet.

339. A POSITA would have had a motivation to additionally combine the disclosure of Estépar with the combination of Sommer and Malfliet because Malfliet expressly references Estépar for use in its processes and as disclosing an automatic registration algorithm based on feature recognition. EX1006, ¶[0038].

3. A POSITA would have had a reasonable expectation of success based on the disclosures of Sommer, Malfliet, and Estépar and knowledge generally available in the art.

340. As discussed above in Section XII.3., a POSITA would have had a reasonable expectation of success of making the combination of Sommer and

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Malfliet because using the ICP algorithm in the correlation process of Sommer was already contemplated.

341. A POSITA would have had a reasonable expectation of making the combination of Sommer, Malfliet, and Estépar because Estépar describes the details of ICP based algorithms that were “well known” and “extensively used” in the art (*i.e.*, known methods). EX1005, 1; EX1007, 234 (“The iterative closest point (ICP) algorithm *has been extensively used* as optimization technique for rigid model based registration based on features extracted from medical datasets [Emphasis added].”).

342. For all of the foregoing reasons, Sommer, Malfliet, and Estépar render obvious all the recited features of Claims 15, 16, and 20.

XIV. ANY PURPORTED SECONDARY CONSIDERATIONS EVIDENCE DOES NOT OVERCOME THE STRONG EVIDENCE OF THE OBVIOUSNESS OF THE CLAIMS

343. I am currently unaware of any secondary considerations evidence that may be commensurate with the challenged claims of the '661 Patent such as commercial products produced by the Patent Owner.

XV. CONCLUSION

344. For the reasons set forth above, it is my opinion that all elements of Claims 1-21 of the '391 Patent are disclosed or suggested by the prior art. In my

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opinion, Claims 1-21 of the '391 Patent would have been anticipated or rendered obvious by the prior art.

345. In signing this Declaration, I understand that the Declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I acknowledge that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

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346. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Date: February 14, 2024



Eli Saber

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APPENDIX 1

I have previously testified and/or been consulted as an expert in the
following matters:

RealD, LLC v. Microsoft Corp., No. 2:22-cv-00942-TL

Feb. 2023 – Present

- Legal Firm: Michelman & Robinson
- Retained as an expert on behalf of RealD, LLC
- Provided expert opinions and a declaration in support of IPR2023-01046. Patent Owner Preliminary Response filed on 10/13/2023.
- Provide expert opinions and additional reports in support of Federal case.
- Provide algorithm support for software review

Autonomous Devices LLC v. Tesla, Inc.

October 2022 - Present

US District Court, District of Delaware

- Legal Firm: McKool-Smith
- Retained as an expert by the Barr Group on behalf of Autonomous Devices.
- Provided declarations in support of legal proceedings.
- Working on multiple IPRs (5X): IPR2023-01054, IPR2023-01055, IPR2023-01169, IPR2023-01172, IPR2023-01173

Medit USA, Crown Jade Co. Ltd. (Petitioner) v. 3Shape A/S (Patent Owner)

Oct. 2023 – Present

US Patent and Trademark Office, Patent Trial and Appeal Board

- Legal Firm: Buchanan, Ingersoll and Rooney PC
- Retained as an expert on behalf of 3Shape A/S to provide expert opinions on proceedings involving U.S. Patent Nos. 9,629,551; 10,064,553; 10,695,151; 11,076,146; 11,368,667; 7,912,257; 9,191,648; 9,245,374 and 9,262,864.
- Provide expert opinions in support of Patent Owner Response proceedings

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Facetec, Inc. v. iProov Ltd., Case No. 2:21-cv-02252-ART-BNW

October 2022 - Present

US District Court, District of Nevada

- Legal Firm: OneLLP
- Retained as an expert by Teklicon on behalf of FaceTec, Inc.
- Provided expert opinions as needed in support of legal proceedings

TVISION INSIGHTS v. The NIELSEN Company (US), LLC

August 2023 - Present

US Patent and Trademark Office, Patent Trial and Appeal Board

- Legal Firm: Erise Intellectual Property Law
- Retained as an expert on behalf of the Nielsen Company (US), LLC
- Provided expert opinions and a declaration in support of patent owner in IPR2023-01014.
- Documents were filed on 10/11/2023.
- PTAB decision to institute/not institute expected in January 2024.

Meta Platforms, Inc. f/k/a Facebook, Inc. v. Angel Technologies Group LLC

May 2023 - Present

US District Court, District of Nevada

- Legal Firm: McKool-Smith
- Retained as an expert by Alliance Technical Staffing on behalf of Angel Technologies Group LLC.
- Provide expert opinions and declarations in support of four IPR proceedings (IPR2023-00057, IPR2023-00058, IPR2023-00059, IPR2023-00060).
- Provided a Deposition on October 20th, 2023 for IPR2023-00057, IPR2023-00058, IPR2023-00059
- Provided a Deposition on October 23rd, 2023 for IPR2023-00060.

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In Re Lyft Rideshare Litigation

Dec. 2021 – Present

Superior Court of the State of California, Case No. CJC-20-005061

- Legal Firm: Williams & Connolly, LLP
- Retained as an expert by WIT Legal, LLC on behalf of Lyft (Defendant)
- Provide reports and consulting services on the challenges of the use of Dashcam solutions in Vehicles
- Provided a Deposition on March 24th, 2023.

The first portion of the Case that requires my expertise has been settled.

Alarm.com Incorporated v. Vivint, Inn, No. 2:23-CV-00004-JRG-RSP

March 2023 – Dec. 2023

- Legal Firm: Cravath, Swaine and Moore, LLP
- Retained as an expert on behalf of Alarm.com, Inc.
- Case has been settled

HL Holdings, Inc. v. LNHL, LLC, et al.

July 2023 – Dec. 2023

- Legal Firm: Nelson, Mullins, Riley and Scarborough LLP
- Retained as an expert by IMS Consulting and Expert Services on behalf of LNHL, LLC and Seek Now Inc. f/k/a Ladder Now LLC.
- Provided expert opinions and a report in support of legal proceedings.
- Provided a Deposition on November 29th, 2023
- Case has been settled.

Angel Group Co. Ltd. V. Sensen Networks Group Pty Ltd

July 2023 – Oct. 2023

- Legal Firm: Norton Rose Fulbright
- Retained as an expert on behalf of Angel Group Co. Ltd.
- Provide expert opinions in support of a potential IPR proceeding.
- Case has been settled.

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United Services Automobile Association v. Truist Bank

March 2023 – Oct. 2023

- Case No. 2-22-CV-00291
- Legal Firm: Cravath, Swaine and Moore, LLP
- Retained as an expert on behalf of Truist Bank.
- Performed review of six patents.
- Case was settled.

Dental Imaging Technologies Corp. (Petitioner) v. 3Shape A/S (Patent Owner)

Feb. 2023 – July 2023

US Patent and Trademark Office, Patent Trial and Appeal Board

- Legal Firm: Buchanan, Ingersoll and Rooney PC
- Retained as an expert on behalf of 3Shape A/S.
- Provided consulting services in support of POPR for IPR2023-00387 (US 11,076,146).
- Provided consulting services in support of POPR for IPR2023-00400 (US 10,695,151).
- Provided consulting services in support of POPR for IPR2023-00411 (US 11,368,667).
- PTAB decision to NOT Institute on all three IPRs.

Nike v. Valmarc

January 2023 – Present

- Legal Firm: Hilgers Graben
- Retained as an expert on behalf of Valmarc Corporation
- Provided expert opinions in support of Patent Owner Preliminary Response on petitions IPR2022-01403 & IPR2022-01404
- PTAB granted institution but client opted not to pursue defending the patents.

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Sensormatic Electronics, LLC v. Genetec, Inc. et al.

Oct. 2021 – Feb. 2023

US District Court, District of Delaware, Case 1:20-cv-00760-MN

- Legal Firm: Fish & Richardson, P.C.
- Retained as an expert by IMS Expert Services on behalf of Genetec, Inc. et al. (Defendant)
- Representing Genetec (USA) Inc. and Genetec Inc. (C. A. No. 20-760)
- Provided Opening, Rebuttal and Reply reports regarding invalidity & Non-infringement with regards to US 7,307,652.
- Sat in on a deposition of Plaintiff expert (April 29th, 2022) per counsel request.
- Provided a deposition on May 3rd, 2022
- Case is completed.

Roku, Inc. v. Flexiworld Technologies, Inc.

June 2022 – October 2022

US Patent and Trademark Office, Patent Trial and Appeal Board, Case No. IPR2022-01112

US Patent and Trademark Office, Patent Trial and Appeal Board, Case No. IPR2022-001269

- Legal Firm: Perkins-Coie, LLP
- Retained as an expert by WIT Legal, LLC on behalf of Roku (Petitioner).
- Provided a declaration in June 2022 in support of the IPR petition for US 10,140,073.
- Provided a declaration in July 2022 in support of the IPR petition for US 7,944,577.
- Case was settled in October 2022.

CareView Communications, Inc. v. Interactive Digital Solutions, Inc.

Jan. 2022 – April 2022

- Legal Firm: Mintz, Levin, Cohn, Ferris, Glovsky & Popeo, P. C.
- Retained as an expert by IMS Expert Services on behalf of Interactive Digital Solutions, LLC (Defendant) to provide declarations in support of 3 IPR proceedings
- Case was settled in April 2022.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 10,076,391

Sovereign Peak Ventures, LLC v. Hisense Co., LTD

Nov. 2021 – Dec. 2021

US District Court, Eastern District of Texas, Case No. 21-cv-00209

- Legal Firm: Perkins-Coie, LLP
- Retained as an expert by WIT Legal, LLC on behalf of Hisense Co. (Defendant).
- Working to provide a declaration in support of the IPR petition for US 8,019,169.
- Case was settled in Early 2022.

Perfect Corporation v. Lennon Image Technologies, LLC

Sept. 2021 – June 2022

US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2021-00124

- Legal Firm: Perkins-Coie, LLP
- Retained as an expert by WIT Legal, LLC on behalf of Perfect Corporation (Petitioner).
- Provided a declaration in support of the IPR petition for US 6,624,843.
- Petitioner filed a motion to dismiss its petition on April 5th, 2022.

Apple Inc. v. Corephotonics, LTD

Jan. 2021 – May 2021

- Legal Firm: Russ, August & Kabat,
- Retained as an expert by WIT Legal, LLC on behalf of Corephotonics in two IPR cases.
- Provided two declarations in support of IPR Petitions IPR2020-00487 & IPR2020-00860.
- Provided a deposition on 04/14/2021.

Davis Polk

Aug. 2020 – Nov. 2021

- Legal Firm: Davis Polk
- Retained as an expert by WIT Legal, LLC
- Provided expert and consulting services for video and point cloud type imagery.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 10,076,391

Cravath, Swaine & Moore, LLP

Feb. 2020 – Mar. 2020 and Jan. 2021

- Legal Firm: Cravath, Swaine & Moore, LLP
- Retained as an expert by WIT Legal, LLC
- Evaluated computer vision technology for various clients.
- No reports, depositions or expert testimonies were provided.

Wells Fargo & Co. v. Lighthouse Consulting Group

Feb. 2020 – Sept. 2020

US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2020-00758 and IPR2020-00759

- Legal Firm: Winston & Strawn LLP
- Retained as an expert by DOAR on behalf of Petitioner Wells Fargo.
- Submitted two declarations in support of IPR Petitions IPR2020-00758 & IPR2020-00759 for US 8,590,940 and US RE44,274.

3Shape A/S v. Align Technology, Inc.

Jan. 2020 – April 2020

US District Court, District of Delaware, Case No. 18-cv-00886 (consolidated with 18-cv-00697)

- Legal Firm: Buchanan, Ingersoll and Rooney, PC
- Retained as an expert by DOAR on behalf of plaintiff for US Patents-in-Suit Nos. 9,962,244 and 9,629,551 with regards to invalidity.
- Case was transferred to Troutman Pepper LLP very shortly after my engagement.

3Shape A/S et al v. Align Technology, Inc.

Oct. 2019 – Oct. 2020

US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2020-00222 and IPR2020-00223

- Legal Firm: Buchanan, Ingersoll and Rooney, PC
- Retained as an expert by DOAR on behalf of Petitioner 3Shape A/S with respect to US 7,156,661
- Provided two declarations in support of IPR petitions (IPR2020-00223 and IPR2020-0222) for US 7,156,661. Both petitions were filed in December 2019.
- Provided a deposition on July 30th, 2020 in support of IPR2020-00223 that was instituted by PTAB and supporting materials for follow on responses.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 10,076,391

Uniloc 2017 LLC v. Netflix, Inc. (Petitioner) (18-cv-2055)

July 2019 – July 2020

US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2020-00044

- Legal Firm: Perkins-Coie, LLP
- Retained as an expert by DOAR on behalf of Petitioner Netflix, Inc.
- Provided an expert declaration in support of IPR2020-00044 for US 6,584,229.
- Case was settled in July 2020.

Align Technology, Inc. v. 3Shape A/S et al

Feb. 2019 – Feb. 2022

US District Court, District of Delaware, Case No. 17-cv-01646 (LPS) (CJB)

- Legal Firm: Troutman Pepper LLP
- Retained as an expert by WIT Legal, LLC on behalf of Defendant 3Shape for US Patent-in-Suit No. 9,510,757 ('757 Patent).
- Served as expert for invalidity and non-Infringement for US 9,510,757
- Provided expert reports regarding Invalidity and non-infringement of '757
- Provided a deposition on 10 January 2020
- Case was settled in February 2022.

Certain Dental and Orthodontic Scanners and Software

Feb. 2019 – Oct. 2019

US International Trade Commission, Investigation No. 337-TA-1144 (3Shape v. Align)

- Legal Firm: Pepper Hamilton, PC
- Retained as an expert by DOAR on behalf of respondent 3Shape A/S with respect to US Patent-in-Suit No. 9,299,192 ('192 Patent).
- Served as expert on invalidity, non-infringement and domestic industry.
- Provided expert opinions and rebuttal reports in support of the above proceedings.
- Provided a deposition (8/13/2019).
- Provided trial testimony on October 30th, 2019 (Trial was held Oct. 24-30, 2019) with regards to Invalidity, Non-infringement and Domestic Industry.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 10,076,391

3Shape A/S et al v. Align Technology, Inc.

Oct. 2018 – Sept. 2019

US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2019-00132 and IPR2019-00134 and IPR2019-00148

- Legal Firm: Buchanan, Ingersoll and Rooney, PC
- Retained as an expert by DOAR on behalf of respondent 3Shape A/S with respect to US 7,112,065, US 9,451,873 and US 9,299,192
- Represented 3Shape (Petitioner) in three IPR Petitions v. Align (Patent Owner).
- Provided three declarations in support of the IPR petitions for US 7,112,065, US 9,299,192 and US 9,451,873. All three petitions were filed in November 2018 and all three were instituted.
- Provided three depositions with regards to US 7,112,065 (8/16/2019), US 9,451,873 (09/18/2019) and US 9,299,192 (09/30/2019).

Blackberry Corp. et al v. Maxell, Ltd

Sept. 2018 – Oct. 2018

US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2019-00087 and IPR2019-00095 and IPR2019-00097

- Legal Firm: Oblon, McClelland, Maier and Neustadt, LLP
- Retained as an expert on behalf of petitioner Blackberry Corp.
- Provided three declarations in support of the IPR petitions for US 9,100, 604 (Joinder), US 6,765, 616 and US 7,995,897.
- Case settled in May 2019.

Exocad GmbH et al v. 3Shape A/S

March 2018 – Sept. 2019

US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2018-00788

- Legal Firm: Buchanan, Ingersoll and Rooney, PC
- Retained as an expert by DOAR on behalf of 3Shape A/S in defending an IPR filings of EXOCAD (Petitioner) v. 3Shape (Patent Owner). Case No. IPR 2018-00788
- Provided a declaration in support of the Patent Owner response for US 9,336,336.
- Provided a deposition on April 1st, 2019.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 10,076,391

Certain Intraoral Scanners and Related Hardware and Software

February 2018 – Sept. 2018

US International Trade Commission, Investigation No. 337-TA-1090 & No. 337-TA-1091 (Align v. 3Shape)

- Legal Firm: Pepper Hamilton, LLP
- Retained as an expert by DOAR on behalf of respondent 3Shape A/S.
- Provided expert opinions regarding claim construction, noninfringement, and the domestic industry analysis.
- Attended a *Markman* hearing and provided a tutorial for the technology in suit.
- Provided a Deposition on July 16, 2018.
- Provided trial testimony as an expert on Sept. 20th, 2018 with regards to Non-infringement and Domestic Industry.

Nikon Corporation et al v. ASML Netherlands BV et al

July 2017 – Nov. 2017

US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2018-00227

- Legal Firm: Morrison & Foerster
- Retained as an expert on behalf of petitioner Nikon Corporation.
- Provided an expert declaration in support of IPR petition for US 7,209,167.

Raster Printing Innovations, LLC v. Hewlett-Packard Company et al

April 2016 – May 2016

US District Court, Northern District of Illinois, Case No. 15-cv-03967

- Legal Firm: Morgan, Lewis & Bockius, LLP
- Retained as an expert by IMS Expert Services on behalf of defendant Hewlett Packard.
- Contributed to the development of initial invalidity contentions charts.
- Case settled very quickly after my engagement in June 2016.

Qomo Hitevission LLC v. Pathway Innovations and Technologies, Inc.

Nov. 2015 – Jan. 2016

US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2016-00661

- Legal Firm: Mei & Mark, LLP
- Retained as an expert on behalf of petitioner Qomo Hitevission.
- Provided an expert declaration in support of petition for inter partes review.

Declaration of Eli Saber in Support of
Petition for *Inter Partes* Review of U.S. Patent No. 10,076,391

Sony Corp of America. v. Image Processing Technologies, LLC

Aug. 2014 – Nov. 2014

US Patent and Trademark Office, Patent Trial and Appeal Board

- Legal Firm: Lerner, David, Littenberg, Krumholz & Mentlik LLP
- Retained as an expert on behalf of Sony.
- Provided an expert declaration in support of petition to institute inter partes review of US Patent No. 6,959,293.

Image Processing Technologies, LLC v. Canon Inc. et al

June 2011 – Dec. 2012

Case: US District Court, Eastern District of New York, Case No. 10-cv-03867

- Legal Firm: Fitzpatrick, Cella, Harper & Scinto
- Retained as an expert on behalf of defendant Canon Inc.
- Traveled to Japan twice to meet with Canon Technical & Engineering Teams
- Provided reports related to Invalidity, Non-Infringement, Rebuttals, and summary judgement.
- Provided a Deposition in April 2012.