

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

3SHAPE A/S and 3SHAPE INC.,
Petitioner,

v.

DENTAL IMAGING TECHNOLOGIES CORPORATION,
Patent Owner.

IPR2024-00548
Patent 10,076,391 B2

Before HUBERT C. LORIN, STACEY G. WHITE, and
FRANCES L. IPPOLITO, *Administrative Patent Judges*.

WHITE, *Administrative Patent Judge*.

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

I. INTRODUCTION

3Shape A/S and 3Shape Inc. (collectively “Petitioner”) filed a Petition requesting *inter partes* review of claims 1–21 of U.S. Patent No. 10,076,391 B2 (Ex. 1001, “the ’391 patent”). Paper 3 (“Pet.”). Dental Imaging Technologies Corporation (“Patent Owner”) filed a Preliminary Response. Paper 7 (“Prelim. Resp.”).

Under 35 U.S.C. § 314(a), an *inter partes* review may not be instituted unless the information presented in the petition “shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” For the reasons stated below, we determine that Petitioner has not established a reasonable likelihood that it would prevail with respect to at least one claim. We, therefore, deny Petitioner’s request to institute *inter partes* review of the challenged claims on the asserted grounds.

A. Related Matters

The parties identify *3Shape A/S v. Carestream Dental, LLC*, No. 1:22-cv-01829 (N.D. Ga.), as a related district court case. Pet. 2; Paper 5, 2.

Petitioner further indicates that “The ’391 Patent issued from U.S. Patent Application No. 14/770,177, which is a National Stage of PCT International Application No. PCT/CN2013/72420, filed on March 11, 2013, which published as PCT International Publication No. WO 2014/139078 on September 18, 2014.” Pet. 2.

B. The ’391 Patent

The ’391 patent is titled “Method And System For Bite Registration,” and relates to “the technical field of dental 3-dimensional (3D) imaging, and in particular to a method and computerized system for bite registration using

at least two bite surfaces.” Ex. 1001, code (54), 1:16–18. According to the ’391 patent, it is important to obtain an accurate 3D teeth model corresponding to a patient’s clenched state. *Id.* at 1:22–24. A 3D camera system may be used to create a 3D model of the teeth directly, which avoids the need to cast impressions and send them to a lab for restoration. *Id.* at 1:24–28. Creating the 3D model in this way “reduces cost and simplifies the workflow of dental restoration.” *Id.* at 1:27–28.

Bite registration is a crucial step in the process of constructing a global 3D teeth model. *Id.* at 1:29–30. The ’391 patent teaches that “[b]ite registration is the process of registering the upper jaw with the lower jaw to establish a 3D spatial positioning relationship between an upper jaw and its corresponding lower jaw in a clenched state.” *Id.* at 1:30–34. Further, “[i]n an existing 3D camera system, during bite registration, only one bite surface is required for constructing a global 3D teeth model.” *Id.* at 1:35–37. The ’391 patent states that “[i]n this method, the single bite surface is captured from one certain location (such as right side of molars) of the clenched teeth by a scanner, then the 3D teeth models of the upper jaw and the lower jaw captured independently are stitched onto the bite surface in a semiautomatic way so as to complete bite registering. *Id.* at 1:37–42.

It is noted that “the bite registration obtained from only one location of the bite surface may lead to significant mismatch in another location.” *Id.* at 1:44–46. As an example, the ’391 patent states that “when only one bite surface corresponding to right side of molars is used, there are several hundreds microns of mismatch in the bite registration corresponding to the distant end (such as incisors or left side of molars).” *Id.* at 1:46–50.

The '391 patent seeks to “improve the accuracy of bite registration” by employing “registration using at least two bite surfaces.” *Id.* at 1:15–18, 2:3–5. In one embodiment, “the computation of the final bite registration employs multiple matrix interpolation of . . . selected successful bite registrations.” *Id.* at 7:15–17. More specifically, the '391 patent teaches “a 4x4 matrix interpolation may contain the 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.” *Id.* at 7:21–25. According to the '391 patent, “multiple matrix interpolation . . . provides the user with a way to merge information from all selected bite registration[s] together, and it can be seen as a process of averaging transformations (i.e. averaging the stitching noise) while keeping the upper and lower arches rigid.” *Id.* at 7:33–38.

C. Illustrative Claim

Claims 1–21 are challenged, and claims 1, 13, 18, 20, and 21 are independent claims. Claim 1 is illustrative of the subject matter at issue and reproduced below.

1. [1(preamble)] A method of bite registration, comprising the steps of:
 - [1.1] a. generating 3-dimensional (3D) teeth models of the upper jaw and the lower jaw;
 - [1.2] b. 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;
 - [1.3] c. attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface;
 - [1.4] 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;

- [1.5] e. repeating step b to step d so as to obtain at least two successful bite registrations corresponding to different displayed bite surfaces;
- [1.6] f. 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
- [1.7] g. 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.

Ex. 1001, 9:37–62 (bracketed designations added by Petitioner (*see* Pet. ii–iii)).

D. Asserted Grounds of Unpatentability

Petitioner, supported by the declaration of Dr. Eli Saber (Ex. 1009), asserts the following grounds of unpatentability (Pet. 4–5)¹:

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1, 5–12, 21	§ 103	Sommer ² , Rubbert ³ , Malfliet ⁴

¹ We apply the pre-AIA version of 35 U.S.C. § 103 because the claims at issue have an effective filing date prior to March 16, 2013, the effective date of the Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”). *See* Ex. 1001, code (22).

² Veröffentlicht durch SOMMER IP Office “Correlation between upper and lower jaw of digital impressions” (Aug. 2010) (Ex. 1005, “Sommer”)

³ Rubbert et al., PCT Pub. No. WO 01/80761 A2, published Nov. 1, 2001 (Ex. 1008, “Rubbert”)

⁴ Malfliet et al., U.S. Pat. Appl. Pub. 2010/0145898 A1, published Jun. 10, 2010 (Ex. 1006, “Malfliet”).

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
2–4	§ 103	Sommer, Rubbert, Malfliet, Estépar ⁵
13, 14, 17–19	§ 103	Sommer, Malfliet
15, 16, 20	§ 103	Sommer, Malfliet, Estépar

II. ANALYSIS⁶

A. *Level of Ordinary Skill in the Art*

In order to determine whether an invention would have been obvious at the time the application was filed, we consider the level of ordinary skill in the pertinent art at critical time. *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966). The resolution of this question is important because it allows us to “maintain[] objectivity in the obviousness inquiry.” *Ryko Mfg. Co. v. Nu-Star, Inc.*, 950 F.2d 714, 718 (Fed. Cir. 1991). In assessing the level of ordinary skill in the art, various factors may be considered, including the “type of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field.” *In re GPAC, Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (quotation omitted). Generally, it is easier to establish obviousness under a higher level of

⁵ R. S.J. Estépar *et al.*, “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) (Ex. 1007, “Estépar”)

⁶ Petitioner argues that discretionary denial is not warranted under 35 U.S.C. §§ 314(a) or 325(d). Pet. 66–67. Because Patent Owner does not argue for discretionary denial, we see no need to consider the issue further.

ordinary skill in the art. *Innovation Toys, LLC v. MGA Entm't, Inc.*, 637 F.3d 1314, 1323 (Fed. Cir. 2011) (“A less sophisticated level of skill generally favors a determination of nonobviousness . . . while a higher level of skill favors the reverse.”).

Petitioner asserts that a person of ordinary skill in the art 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. Pet. 9 (citing Ex. 1009 ¶¶ 32–33).

Patent Owner asserts that a person of ordinary skill in the art would have had a bachelor’s degree in Computer Engineering, Computer Science, Electrical Engineering, Physics, or an equivalent field, as well as at least two years of work experience, or alternatively, at least five years of comparable industry experience in the field of imaging and/or image scanning, including 3D imaging systems and 3D modeling techniques.” Prelim. Resp. 5. Patent Owner adds that “[a]dditional education reduces the threshold for years of experience in the field, and vice versa.” *Id.*

For purposes of this Decision, the level of ordinary skill in the art is not dispositive and our determination would be the same under either party’s proposal. *See* Prelim. Resp. 5 (“Patent Owner’s arguments herein apply regardless of which definition of a POSITA is adopted.”). Nonetheless, we note that Petitioner’s proposal is reasonable and consistent with the prior art, and is further supported by Dr. Saber’s testimony. Ex. 1003 ¶ 33; *see Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (the prior art may reflect an appropriate level of skill in the art).

B. Claim Construction

In an *inter partes* review proceeding, a patent claim shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b). 37 C.F.R. § 42.100(b) (as amended Oct. 11, 2018). Our rule adopts the same claim construction standard used by Article III federal courts, which follow *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc), and its progeny. Under this standard, the words of a claim are generally given their “ordinary and customary meaning,” which is the meaning the term would have to a person of ordinary skill at the time of the invention, in the context of the entire patent including the specification. *See Phillips*, 415 F.3d at 1312–13.

Petitioner states that it “believe[s] that no express constructions of the claims are necessary. Pet 10. Patent Owner argues that “[t]he Petition’s ‘claim construction’ section is deficient and alone warrants denial of institution.” Prelim. Resp. 6. Specifically, Patent Owner asserts that the Petition is deficient because there are certain terms in claim 13 that are “drafted in means-plus-function format” in which “Petitioner[] do[es] not argue against the presumption that § 112 ¶ 6 applies” and yet, Petitioner failed to propose structure for the claim functions. *Id.*

Petitioner, however, notes in the Petition that there are several claim terms in dispute in the related district court case, but asserts that “while the proper metes and bounds of these terms are disputed, the cited prior art falls within these bounds whatever they may be.” Pet. 10. As to the purported means-plus-function terms, Petitioner contends (in the district court proceeding) that these terms lack corresponding structure, but maintains

“that resolution of this Petition does not depend on which constructions are used because these features of the claims are disclosed by the prior art regardless of the construction.” *Id.* at 11.

As the Federal Circuit has noted, it is not within our statutory authority to determine questions of indefiniteness of issued claims within a *inter partes* review proceeding. *Samsung Elecs. Am., Inc. v. Prisia Eng'g Corp.*, 948 F.3d 1342, 1350 (Fed. Cir. 2020). As such, we make no findings as to any alleged indefiniteness. The Federal Circuit, however, also has stated that “[t]he indefiniteness of a limitation (here, a means-plus-function limitation) precludes a patentability determination **only** when the indefiniteness renders it logically impossible for the Board to reach such a decision.” *Intel Corp. v. Qualcomm Inc.*, 21 F.4th 801, 813 (Fed. Cir. 2021) (emphasis added). Here, we are presented with a circumstance in which our determinations in this proceeding are not precluded by the allegations of indefiniteness. Thus, we will not deny the Petition based on Petitioner’s failure to identify corresponding structure for the purported means-plus-function terms of claim 13.

Further, based on the record before us, we see no need for express construction of any term at this stage of the proceeding. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“we need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

C. Overview of the Asserted Prior Art

1. Sommer (Ex. 1005)

Sommer is titled “Correlation between upper and lower jaw of digital impressions,” and relates to the information which provides the connection between upper and lower jaw when digital impressions from the upper jaw and lower jaw are captured separately. Ex. 1005, 1.

Sommer teaches that “[c]apturing digital impressions from the upper jaw and lower jaw with dental scanning system is typically done separately,” but that “[i]n order to correlate both jaws additional information is necessary.” *Id.* Sommer states that because “the morphology details of teeth on the buccal surface are very similar among each other, it can be difficult for the software to calculate the correct correlation” between impressions of the upper and lower jaw. *Id.* According to Sommer, “[a] solution can be a manual pre-correlation by the user combined with the final calculation done by the software.” *Id.*

Sommer teaches:

Rotate both models preparation and antagonist in the way that you can see the matching parts between the buccal model and the preparation/antagonist model. Click and hold the buccal model and move it over the corresponding area on the preparation and drop it. The buccal model will be correlated to the preparation model automatically. If the correlation was successful the [buccal] model matches at the regarding position and you see the “leopard” pattern. If the correlation was not successful, the buccal model shakes for a moment and stays in the middle between the models. 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. at 2.

Sommer further states that “improv[ing] the precision of the correlation between upper and lower jaw . . . can be possibly improved by using more than one buccal image.” *Id.* at 4.

2. *Rubbert (Ex. 1008)*

Rubbert is titled “Interactive Orthodontic Care System Based on Intra-Oral Scanning of Teeth.” Ex. 1008, code (54). Rubbert relates to “[i]nteractive, computer based orthodontist treatment planning, appliance design and appliance manufacturing.” *Id.*, code (57). Rubbert purports to address the need for “a reliable, accurate, low-cost, and easily used scanning system that can quickly and automatically acquire three-dimensional information of an object, without requiring substantial operator input, and in particular one that can be held in the hand and used for in vivo scanning or scanning a model.” *Id.* at 7:7–10.

Rubbert teaches “[a] bite registration scan . . . obtained from the patient to spatially correlate . . . scans of the upper and lower jaws when the dentition is clenched.” *Id.* at 85:17–18. According to Rubbert, “[t]his scan is used to provide a registration of the upper and lower jaw to determine the correct relative position.” *Id.* at 85:18–19. Rubbert further discloses determining an entry point into registration, frame to frame registration of scans and cumulative registration of the entire jaw. *Id.* at 57:4–69:10.

3. *Malfliet (Ex. 1006)*

Malfliet is titled Computer-Assisted Creation of a Custom Tooth Set-Up Using Facial Analysis.” Ex. 1006, code (54). Malfliet relates to “a method for automatic or semi-automatic planning of dental treatment.” *Id.*, code (57). Malfliet teaches creating a 3D model “by making 3D measurements of the area to be treated and by converting the measurement

data into a digital solid or surface model.” *Id.* at ¶ 32. Malfliet states that “[i]mages from digital 2D or 3D photographs, or from scanned printed photographs, of the same area are then mapped onto this model.” *Id.* According to Malfliet, “[a] 3D photograph is taken by an optical device that allows capturing the 3D geometry/shape of the object as well as its texture.” *Id.* Malfliet notes that “[i]n general the device comprises a laser scanner to measure the 3D geometry/shape and a camera for imaging the texture.” *Id.* at ¶ 32.

Malfliet teaches that “[d]ata derived from different imaging sources . . . needs to be combined into a single model.” Ex. 1006 ¶ 35. Malfliet teaches multiple techniques to combine the models, including “3D models can be registered onto each other by manually translating and/or rotating one of the 3D models with respect to the other” and “3D models . . . registered onto each other using a fully automatic registration algorithm based on feature recognition.” *Id.* ¶¶ 35–38.

Malfliet also teaches techniques for mapping 2D or 3D photographs onto a digital model, including a final mapping performed by an “ICP (Iterative Closest Point) registration, which will find the optimal transformation necessary to align both sets of points.” *Id.* ¶¶ 42–44.

4. *Estépar (Ex. 1007)*

Estépar is titled “Robust Generalized Total Least Squares Iterative Closest Point Registration.” Ex. 1007, 234. Estépar “introduces a novel total least squares generalization of ICP.” *Id.* According to Estépar, “ICP finds the rigid body transformation, rotation R and translation t that aligns the source with the target by minimizing the distance metric

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

is a point on the surface of the target model X that corresponds to the point p_i .” *Id.* at 235.

D. Asserted Obviousness

Each of the independent claims, 1, 13, 18, 20, and 21, recite, in relevant part, obtaining at least two successful bite registrations corresponding to different displayed bite surfaces. Ex. 1001, 9:50–52 (claim 1), 11:13–15 (claim 13), 12:5–6 (claim 18), 12:31–32 (claim 20), 12:53–55 (claim 21). Patent Owner argues, and we agree, that “[b]y its plain language, this limitation requires obtaining multiple successful bite registrations.” Prelim. Resp. 20. In each of the asserted grounds, Petitioner relies on Sommer alone or with Malfliet to teach this limitation in each of the independent claims. Pet. 19–20 (claim 1), 55 (claim 13), 58 (claim 18), 63 (claim 20), 37 (claim 21). We are not persuaded that Petitioner has shown sufficiently that the art teaches this limitation.

Petitioner directs us to Sommer’s statement 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)” in order to teach repeating the image acquisition process in order to obtain more than one bite registration. Pet. 19. Dr. Saber supports Petitioner’s argument by opining that Sommer teaches repeating the process of acquiring images and aligning those images and thus, Dr. Saber concludes that Sommer teaches the recited obtaining of multiple bite registrations. Ex. 1009 ¶¶ 82–90.

Patent Owner contends that these disclosures are insufficient to teach the disputed limitation. Prelim. Resp. 21. According to Patent Owner, “Sommer does not mention or suggest obtaining multiple successful bite

registrations.” *Id.* Patent Owner asserts that “Sommer simply discloses using ‘more than *one* buccal image’ in obtaining one bite registration.” *Id.* Patent Owner points out that the ’391 patent also teaches the use of multiple bite views to improve a single bite registration, but asserts that this is distinct from obtaining multiple bite registrations. *Id.* at 22 (citing Ex. 1001, 4:57–61 (“several bite views corresponding to different teeth respectively can be combined into one view so as to form a bigger bite surface”). Petitioner criticizes Dr. Saber’s testimony as conclusory and points out that “it also fails to acknowledge that Sommer presents multiple buccal images as something to do when the registration is unsuccessful.” *Id.* at 23.

We are persuaded by Patent Owner’s arguments. As Patent Owner points out, Sommer states that “[i]f the correlation was successful . . . you see the ‘leopard’ pattern. If the correlation was not successful, . . . try to find a better matching area . . . or add an additional buccal shot to enlarge the buccal model.” Ex. 1005, 2. As described in the ’391 patent, “[b]ite registration is the process of registering the upper jaw with the lower jaw to establish a 3D spatial positioning relationship between an upper jaw and its corresponding lower jaw in a clenched state.” *Id.* at 1:30–34. Thus, a bite registration is not just an image, but rather it requires the successful correlation of images of the upper and lower jaws. As stated in Sommer, additional images are obtained if the correlation is unsuccessful. In our view, this does not indicate a need for obtaining multiple successful correlations, but only multiple images in order to obtain *a* successful correlation.

To the extent Petitioner relies on Malfliet’s teachings, this reference also fails to teach obtaining multiple bite registrations. Petitioner asserts that

Malfliet teaches a “computerized workstation and associated software” that would be used to obtain the multiple bite registrations. Pet. 55. Petitioner also directs us to Malfliet’s “digitization of bite registrations for use in registering the digital 3D models of the patient’s jaws” and Malfliet’s discussion of “manually translating and/or rotating one of the 3D models with respect to the other.” *Id.* at 22 (citing Ex. 1006 ¶¶ 36, 45).

Patent Owner contends and we agree that “there is nothing in Malfliet that suggests or teaches obtaining and displaying multiple successful bite registrations.” Prelim. Resp. 26. Patent Owner argues that Petitioner relies on Malfliet’s disclosures regarding the registration of 3D models, however “there is nothing in Malfliet that suggests or teaches obtaining and displaying multiple successful bite registrations.” *Id.* at 27. The data models discussed in Malfliet are models constructed from various data sources including CT scans, and optical scans and not bite registrations. *Id.* (citing Ex. 1006 ¶ 35). Patent Owner also argues that the other portion of Malfliet relied upon by Petitioner “concerns mapping of the 3D models of the patient’s dental anatomy to a 2D or 3D *photograph of the patient’s face.*” *Id.* at 28 (citing Ex. 1006 ¶ 45). Further Patent Owner asserts that the only mention of bite registrations in Malfliet is focused on a mechanical device for obtaining a bite registration for a patient with no teeth. *Id.* (citing Ex. 1006 ¶ 45).

We agree with Patent Owner that the disclosures of Sommer alone or combined with Malfliet would not have taught one of ordinary skill in the art to obtain multiple bite registrations. As such, Petitioner has not met its burden to demonstrate that the cited art would have rendered independent claims, 1, 13, 18, 20, or 21 obvious. As to the dependent claims 2–12, 14–

17, and 19, Petitioner makes no further allegations that would remedy the deficiency discussed above in regards to the independent claims. As such, Petitioner has not met its burden to show that any of claims 1–21 would have been obvious over the assert art.

III. CONCLUSION

For the foregoing reasons, we determine that the information presented in the Petition does not establish that there is a reasonable likelihood that Petitioner would prevail with respect to at least one of challenged claims 1–21 of the '391 patent. We, therefore, deny Petitioner's request to institute an *inter partes* review.

IV. ORDER

For the foregoing reasons, it is
ORDERED that the Petition is denied, and no trial is instituted.

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