

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 IPR2024-00548
Patent No. 10,076,391

PATENT OWNER'S PRELIMINARY RESPONSE

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I. INTRODUCTION

Patent Owner Dental Imaging Technologies Corp. (“DITC”) designs and manufactures highly-successful intraoral scanner systems, which are used to create 3D models of patients’ teeth. U.S. Patent No. 10,076,391 (the “’391 Patent”) discloses and claims novel methods and systems for accurately registering 3D models of patients’ upper and lower jaws with one another. Bite registration refers to the process of registering or aligning the 3D models of the patient’s upper and lower jaw using a “bite surface,” *e.g.*, a model of the cheek-side surface of a patient’s teeth in a clenched position. Petitioners 3Shape A/S and 3Shape Inc. are competitors of DITC accused of infringing the ’391 Patent.

Petitioners fail to establish a reasonable likelihood that they would prevail with respect to any challenged claim of the ’391 Patent. All four grounds fail for at least the same three reasons. First, none of the references, alone or in combination, disclose or suggest the elements of the independent claims. For example, the ’391 Patent requires, *inter alia*, obtaining and displaying ***multiple successful bite registrations***, which are then used to create a final bite registration. By using multiple successful bite registrations, the ’391 Patent reduces “mismatch” caused by, for example, trying to align the entire jaw based on a bite surface from only one side of the jaw. Unlike the ’391 Patent, the asserted references concern conventional systems expressly, which disclose obtaining only one successful bite registration.

Second, all grounds require modifying Sommer with Malfliet. But there is no motivation to combine these references. A POSITA would not look to Malfliet in the first instance. Malfliet is not about bite registration—much less cutting-edge improvements to camera-based bite registration. Rather, Malfliet is about showing a simulated image of a proposed treatment (*e.g.*, tooth set-up) with a picture of a patient's face so the patient can visualize it for aesthetic purposes. It only mentions bite registration once, and that reference is to an old mechanical device used to calculate alignment of the jaws of people without teeth. Moreover, the techniques by which Malfliet proposes combining models of a face and teeth model (based on a few selected points) are disparaged by Sommer. Thus, there is no motivation to combine Sommer and Malfliet in the manner asserted by Petitioners.

Third, even if one were to overlook the absence of motivation and the distinct result from combination, there would not have been a reasonable expectation of success. The “mapping” suggested by Malfliet uses an approach similar to one that was disparaged by Sommer. Petitioners fail to explain how a POSITA reasonably would expect to succeed in combining those approaches to achieve the claimed invention.

II. THE '391 PATENT

The '391 Patent issued from U.S. Application No. 14/770,177, a National Stage of PCT Application No. PCT/CN2013/72420, filed on March 11, 2013. Titled

“Method And System For Bite Registration,” the ’391 Patent relates to methods and systems for bite registration using multiple registrations. EX1001, Abstract. The inventions “relate 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.” *Id.*, 1:15-18.

The ’391 Patent explains that, in the dental field, it can be necessary to obtain a 3D teeth model corresponding to the patient’s clenched state. EX1001, 1:22-24. Instead of conventional cast impressions, a 3D camera system may be used to create a 3D model of the teeth. *Id.*, 1:24-27. To create a global 3D teeth model, the step of bite registration is critical. *Id.*, 1:29-30. Bite registration refers to the process of registering the upper jaw with the lower jaw to establish a 3D spatial positioning relationship in a clenched state. *Id.*, 1:31-34.

Conventional dental camera systems for capturing a dental patient’s upper and lower jaws used a *single* bite registration. Such systems used one bite surface captured from one location (such as the right side of molars). *Id.*, 1:35-39. The 3D teeth models of the upper and lower jaw would then be “stitched” onto that bite surface. *Id.*, 1:39-42. However, as the ’391 Patent recognized, that prior approach could lead to a significant mismatch in another location of the overall model. *Id.*, 1:42-46. If, for example, a bite surface corresponding to the right-side molars is

used, there may be several hundred microns of mismatch in the bite registration on the left side. *Id.*, 1:46-50.

The '391 Patent improved upon the accuracy of bite registration, including through its disclosure of methods and computerized systems for bite registration that use multiple successful bite registrations to calculate a final bite registration. *E.g.*, *id.*, 1:15-18, 2:3-5, claim 1. Instead of simply accepting a single successful bite registration, the '391 Patent recites obtaining and displaying multiple successful bite registrations, selecting from them, and computing a final bite registration. By way of example, the computation of the final bite registration may be carried out using “multiple matrix interpolation of the selected successful bite registrations.” *Id.*, 7:15-38. For example, “a 4x4 matrix interpolation may contain the steps of decomposing each matrix into an equivalent set of values (S211), interpolating corresponding values from each set of values (S212) and recomposing a matrix from the interpolated set of values (S213).” *Id.* Thus, “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.* As set forth below, none of 3Shape's purported prior art remotely suggests the novel teachings of the '391 Patent.

III. LEVEL OF ORDINARY SKILL IN THE ART

Petitioners define a person of ordinary skill in the art (“POSITA”) with respect to the ’391 Patent as having “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.

Patent Owner proposes that a POSITA as of the effective filing date of the ’391 patent 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. Additional education reduces the threshold for years of experience in the field, and vice versa.

Patent Owner’s arguments herein apply regardless of which definition of a POSITA is adopted.

IV. CLAIM CONSTRUCTION

The claims in an *inter partes* review are construed using the “plain and ordinary meaning” standard applied in district court proceedings set forth in *Phillips*

v. AWH Corp., 415 F.3d 1303 (Fed. Circ. 2005) (en banc). Petitioners contend that “no express constructions of the claims are necessary.” Pet. 10.

The Petition’s “claim construction” section is deficient and alone warrants denial of institution. The rules governing *inter partes* review require that “[w]here the claim to be construed contains a means-plus-function or step-plus-function limitation” the Petition must “identify the specific portions of the specification that describe the structure, material, or acts corresponding to each claimed function.” *Samsung Elec. Co., Ltd. v. Power2B*, IPR2022-01378, Paper 12 at 11. This is not optional. *Id.* This situation is analogous to *Samsung*. Independent claim 13 is drafted in means-plus-function format. Limitations [13.1] through [13.7] begin with the phrase “means for.” Petitioners do not argue against the presumption that § 112, ¶ 6 applies. *Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1348 (Fed. Cir. 2015) (en banc in relevant part). Moreover, Petitioners acknowledge they asserted in the district court that limitations [13.4], [13.5], and [13.6] are subject to 35 U.S.C. § 112, ¶ 6. Pet. 10. Nor do they propose structure for the claimed functions. Thus, as in *Samsung*, the Petition is deficient. *See Samsung*, Paper 12 at 11-13.

V. ARGUMENT

The Board should deny institution because Petitioners fail to demonstrate a reasonable likelihood that they would prevail as to any ground for any challenged claim. There are several independent reasons for denial on each ground.

Notably, all grounds require at least a combination of Sommer and Malfliet. But this combination does not render the claims obvious. First, Petitioners fail to establish a motivation to combine or a reasonable expectation of success in combining Sommer and Malfliet, including because Malfliet relates to a different concept with a materially different purpose, embraces only a conventional bite registration, and teaches a computation method that conflicts with the intended purpose and touted benefits of Sommer. Ultimately, Petitioners attempt to fill the numerous gaps with hindsight and conjecture, including an expert declaration that generally parrots the Petition. But a conclusory expert opinion is not enough to carry Petitioners' burden.

Second, even if Sommer and Malfliet could be combined, the result is patentably distinct from the challenged claims. The primary reference, Sommer, does not disclose multiple elements of the independent claims, including obtaining and displaying *multiple* successful bite registrations, selecting from displayed bite registrations, and using the selected bite registrations to compute a final bite registration. Petitioners concede that Sommer does not disclose the claimed computation using multiple bite registrations and attempt to fill the gap with Malfliet. But Malfliet is insufficient because it does not teach computing a final bite registration from multiple successful bite registrations. Malfliet is instead directed

to showing a dental model with a picture of a patient's face to simulate the appearance of a proposed treatment (*e.g.*, modified tooth set-up) and the patient's face surrounding the treatment area to permit aesthetic evaluation of proposed treatments—a different concept entirely from Sommer—and only mentions a bite registration in passing. Even then, the bite registration mentioned in Malfliet is the conventional mechanical method that is distinguished by both the '391 Patent and Sommer. A POSITA seeking to modify Sommer's bite registration technique would not use the very method it distinguishes as conventional. The combination, therefore, fails.

A. Ground 1 Fails For Several Independent Reasons.

Asserted References	Alleged Basis	Claims Challenged
Sommer (EX1005) in view of Rubbert (EX1008) and Malfliet (EX1006)	35 U.S.C. § 103	1, 5-12, 21

Ground 1 fails for multiple independent reasons. First, there is no motivation to combine Sommer with Malfliet and Rubbert. Second, a POSITA also would not have a reasonable expectation of success in combining Sommer with Malfliet and Rubbert. Third, even if the references were suitable for combination, the result would be patentably distinct from the challenged claims.

1. Petitioners' Cursory Motivation to Combine Analysis for Sommer and Malfliet Fails to Account For Significant Technical Differences Between the References.

Ground 1 depends on the combination of Sommer and Malfliet, but Petitioners have failed to establish a motivation to combine Sommer and Malfliet.¹ Sommer is directed to correlating digital impressions of a patient's upper and lower jaw. EX1005 at 1. Like the conventional prior art systems described in the '391 Patent specification (EX1001, 1:35-54) and unlike the claimed inventions of the '391 Patent, Sommer obtains *one* successful bite registration; it does not obtain or display multiple successful bite registrations, much less compute a final bite registration based on multiple successful bite registrations. *Infra* pp. 20-22.

3Shape concedes at least that Sommer does not teach how to compute a final bite registration based on multiple bite registrations (Pet. 42), and attempts to fill that gap with Malfliet. Unlike the '391 Patent and Sommer, however, Malfliet is not directed to correlation of digital impressions of a patient's upper and lower jaw. Rather, Malfliet is directed to methods of dental treatment in which a three-dimensional model of simulated treatment (*e.g.*, a modified tooth set-up) is shown with a picture of the patient's face surrounding the treatment area. EX1006,

¹ There are additional problems with Petitioners' arguments to combine Sommer and Rubbert, which DITC may raise if institution is granted. The reasons identified herein, however, are independently sufficient to deny institution.

Abstract. Malfliet does not disclose obtaining multiple successful bite registrations, much less using multiple successful bite registrations to compute a final bite registration. *Infra* pp. 26-29. In fact, it only once mentions bite registration in passing, in the context of using a mechanical device called a “bite fork” to register the upper and lower jaws of an “edentulous patient” (*i.e.*, a patient lacking teeth). EX1006, ¶[0045]; *see also infra* pp. 28-29.

Despite the stark differences between Malfliet and Sommer, Petitioners motivation argument is remarkably cursory. Pet. 42-43. Petitioners state that both references are related to dental treatment. Pet. 43. Next, Petitioners state that “Malfliet discloses ‘obtaining data about an area which is to be treated’ and ‘performing a computer-assisted analysis of the data’ to ‘create a modified tooth set-up using a set of stored rules.’” Pet. 43. Petitioners assert that “[w]hen 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’” Pet. 43 (quoting EX1006, ¶[0044]).

Without explanation, Petitioners then assert in conclusory fashion: “[b]ecause 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.” Pet. 43 (emphasis added).

Petitioners argument is not only unsubstantiated, but also contradicted by the references themselves. As an initial matter, when Sommer says “algorithms correlating the *models*,” it is not referring to multiple successful bite registrations but rather, it refers to correlating models of the upper and lower jaw to the “buccal”² model (*i.e.*, a single bite registration). *See, e.g.*, EX1005 at 1-2 (discussing and depicting steps for correlating “3D models of the preparation, antagonist, and the buccal”). Thus, neither Sommer nor Malfliet suggests obtaining multiple successful bite registrations.

Moreover, Petitioners fail to articulate a reason with rational underpinning that a POSITA would look to Malfliet. Malfliet is not related, in any way, to computing a final bite registration based on multiple successful bite registrations. The only bite registration even mentioned in Malfliet is the use of a conventional, mechanical device—a “face bow” with a “bite fork”—in patients who have no teeth or are missing many teeth. *Infra* pp. 28-29; EX1006, ¶[0045]. This mechanical device is depicted in Figure 3 of Malfliet, reproduced below.

² “Buccal” refers to the surface of teeth that predominantly face the cheek.

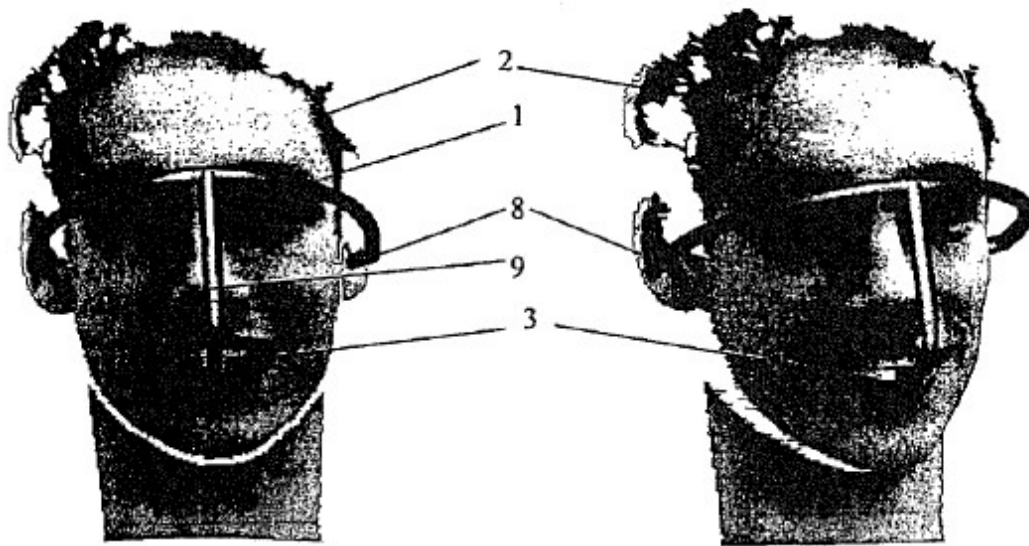


Fig. 3

A “face bow is a mechanical device used in dentistry to record the positional relations of the maxillary arch to the temporomandibular joints, and to orient dental casts in this same relationship to the opening axis of the mechanical articulator.” *Id.*, ¶[0045]. A face bow has two parts. “The first part 3, called the bite fork, is shaped like a horseshoe and is inserted into the mouth of the patient and claimed between upper and lower jaws.” *Id.* “The second part comprises two curved elements 1, 9.” *Id.* The position of the bite fork relative to the other elements is “used to transfer the plaster cast into the corresponding mechanical articulator.” *Id.*

The description of this mechanical device does not suggest obtaining multiple successful bite registrations. The horseshoe-shaped bite fork gathers information

from both sides of the jaws at once, making it unlike the camera-based systems, which cannot image both sides of the jaw at once. Simply put, Malfliet's mechanical device has no connection to the problem that the '391 Patent sought to solve or to the use of multiple bite registrations.³

Instead of addressing camera-based bite registration, Malfliet is focused on something entirely different: *correlating teeth models with a patient's face* because “dental treatment needs to be planned in the context of a patient's face, to provide a result which is aesthetically pleasing as well as being clinically correct.” *E.g.*, EX1006, ¶[0011]. Malfliet's disclosures allow a patient to visualize proposed treatment options, so that the patient is “better informed about the aesthetical implications of the different alternatives” *Id.*, ¶[0012]. This is a wholly different technique from the one taught in Sommer, as well as the one claimed in the '391 Patent.

Petitioners rely heavily (if not exclusively) on Malfliet's mention of “final mapping” in paragraph [0044] to attempt to tie together the references. Pet. 43. But,

³ According to Sommer, information to register a bite “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 at 1. Petitioners fail to explain why a POSITA would look to improve a reference focused on optical impressions with teachings from a reference that only mentions a conventional, mechanical approach.

consistent with the rest of Malfliet's disclosure, this paragraph refers to the mapping of a 2D or 3D photograph of the patient's face onto a digital model (as opposed to a bite registration). *See* EX1006, ¶¶[0043]-[0044] ("For the mapping of the 2D or 3D photographs onto the digital model one of several techniques may be used when photographs and digital models contain identical surfaces (e.g. teeth visible in photograph, facial skin): Semi-automatic registration: Photograph and 3D representation are shown side-by-side. Reference points are indicated on both to mark corresponding features. A final mapping is performed by: a least-squares algorithm/n-point registration/ICP"). Petitioners fail to explain why a POSITA would have been motivated to combine Malfliet's teaching about mapping a teeth model to a facial picture with Sommer's system, which is focused on bite registration.

The specific examples provided by Malfliet further confirm that Malfliet is focused on combining conventional models with images of the patient's face for aesthetics. "Example 1" involves combining information from a "photograph" "of the face while smiling" with information from "impressions of the patient's dentition . . . taken in alginate or silicon[e] material." *Id.*, ¶[0064]. "The plaster models are subsequently digitized using an optical scanner in order to yield a virtual 3D model that represents the dentition of the patient prior to treatment." *Id.* In other words,

Malfliet teaches capturing a single model by conventional plaster models, digitizing it, and *combining with a picture of a patient's face* to visualize potential treatment.

Similarly, “Example 2” describes the combination of a “2D photograph” with “a CT scan and impressions . . . of a partially edentulous patient needing a prosthetic reconstruction.” *Id.*, ¶[0065]. In this example, a “representation of the patient is created by mapping the 2D photograph onto the 3D soft tissue model of the patient’s face generated from the CT images and registering the 3D models of the patient’s dentition generated from μ CT images of the impressions with the CT images of the patient’s face.” *Id.* Likewise, the third and final example (“Example 3”) involves a “3D photograph” and “impressions . . . of a fully edentulous patient.” *Id.*, ¶[0066]. The impressions are scanned “via μ CT.” *Id.* Malfliet then teaches “[p]ositioning the virtual 3D models of the patient’s edentulous jaws relative to the 3D photograph using face bow measurements” to create a “virtual, life-like, representation.” *Id.*

In sum, Malfliet is focused on combining models of the jaws with an image of a patient’s face to visualize proposed treatment options, using, at most, conventional (*e.g.*, plaster) models of a patient’s bite registration. But Sommer is directed to *alternatives* to such conventional models. EX1005 at 1 (recognizing that bite registration “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” and proceeding to discuss optical impressions); EX1001, 1:22-28 (recognizing that use of 3D camera system “to create a 3D model of teeth directly with the patient . . . avoids the need to cast impressions and send them to the lab for restoration” and thus “reduces cost and simplifies the workflow of dental restoration”). In failing to explain why a POSITA would look to the disparate teachings of Malfliet to improve Sommer, Petitioners fail to provide “articulated reasoning with some rational underpinning” to support their obviousness assertion. *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006).

Moreover, to obtain a bite registration, Sommer attempts to correlate a ***buccal model*** (*i.e.*, a model of the teeth surface that predominantly faces the cheeks) with models of the upper and lower jaw. *E.g.*, EX1005 at 1. Malfliet does not. Its only reference to a bite registration is the use of the mechanical device, which is clamped between the jaws and thus uses the occlusal (not buccal) surface for registration. *Id.* Petitioners provide no explanation why someone seeking to improve Sommer’s buccal-based bite registration would look to a reference (*i.e.*, Malfliet) that describes an occlusal-based approach with a mechanical device.

Finally, Sommer teaches away from combination with Malfliet. In particular, Sommer suggests that it improved upon prior art systems by using data clouds to select high quality pixels for correlation, rather than “just defining single dots on

the tooth surface.” EX1005 at 1, 5. Yet, Malfliet’s “final mapping” step applies what Sommer recognized as an inferior approach, simply defining and matching dots on a tooth surface. Namely, in Malfliet, reference points are indicated on the 3D model and the scaled photograph, followed by either: (a) finding the optimal transformation necessary to align both sets of points; or (b) an exact matching at the location of the reference points and minimal deformations [of the photograph or 3D model] in between. *Id.*, ¶[0044].

Thus, modifying Sommer with Malfliet’s “final mapping” step would require eliminating Sommer’s touted improvement by reverting to the methods over which Sommer purported to improve. *See, e.g., Tec Air, Inc. v. Denso Mfg. Michigan Inc.*, 192 F.3d 1353, 1360 (Fed. Cir. 1999) (reference teaches away when a POSITA, “upon reading the reference, . . . would be led in a direction divergent from the path that was taken by the applicant” or if the combination would “render the device inoperable for its intended purpose”).

2. Petitioners Fail To Establish A Reasonable Expectation of Success In Combining The Asserted References To Achieve The Claimed Inventions And Fails To Account For Significant Technical Differences Between The References.

Relatedly, Petitioners fail to establish a reasonable expectation of success in combining the disclosures of Sommer and Malfliet.⁴ Petitioners' argument that a POSITA would have had a reasonable expectation of success in combining Sommer and Malfliet is a single, conclusory paragraph, which asserts that Sommer used ICP based algorithms in its correlation process and "Malfliet simply placed that ICP based algorithm in its 'final mapping' step." Pet. 45. Petitioners' expert testimony simply mirrors the Petition and adds no additional explanation. These conclusory assertions are inadequate. *Magnum Oil*, 829 F.3d at 1380.

Moreover, there are numerous and fundamental differences between Sommer and Malfliet that undermine a reasonable expectation of success, which Petitioners fail to address. First, the "final mapping" step in paragraph 44 of Malfliet refers to "mapping of the 2D or 3D photographs onto the digital model." *See* EX1006, ¶¶[0043]-[0044]; *id.*, ¶[0044] ("Photograph and 3D representation are shown side-by-side. Reference points are indicated on both to mark corresponding features. A

⁴ There are additional problems with Petitioners' arguments that a POSITA would have a reasonable expectation of success in combining Sommer and Rubbert, which DITC may raise if institution is granted. The reasons identified herein, however, are independently sufficient to deny institution.

final mapping is performed by . . .”). There is no indication that the final mapping step relates to aligning multiple 3D dental models, much less successful bite registrations.

Second, Malfliet's “final mapping” step cannot be incorporated into Sommer in view of Sommer's stated purpose. Malfliet's “final mapping” involves a user indicating reference points on the 3D model and scaled photograph followed by one of: (a) finding the optimal transformation necessary to align both sets of points; or (b) an exact matching at the location of the reference points and minimal deformations [of the photograph or 3D model] in between. *Id.*, ¶[0044]. That is the approach Sommer purports to improve upon. Instead of “just defining single dots on the tooth surface,” EX1005 at 1, Sommer uses data clouds of the images to use only high quality data for the alignment, *id.* at 5. Moreover, Petitioners fail to explain how the “deformations” created by Malfliet's option (b) would have been acceptable to a POSITA, who they assume was looking to improve upon the accuracy of Sommer. The inclusion of deformations and using only user-defined points conflicts with Sommer's use of data clouds of the images to automatically select high quality pixels and exclude “bad pixels” from correlation. *See* EX1005 at 5.

3. The Combination of Sommer and Malfliet Does Not Render Obvious The Challenged Claims.

Petitioners fail to show that the cited references, alone or in combination, disclose at least three limitations of claim 1, *i.e.*, [1.5], [1.6], or [1.7].⁵ Even if the references were combined, the resulting combination would be patentably distinct from the challenged claims. Like the conventional systems distinguished in the '391 specification and prosecution history, the resulting combination would obtain a *single* successful bite registration and, therefore, would not meet or suggest several limitations of the independent claims, which require, *inter alia*, obtaining and displaying *multiple* successful bite registrations, selecting among them, and computing a final bite registration using two or more selected bite registrations.

a. limitation [1.5]: “repeating step b to step d so as to obtain at least two successful bite registrations corresponding to different displayed bite surfaces”

Limitation [1.5] requires “repeating step b to step d so as to obtain *at least two successful bite registrations* corresponding to different displayed bite surfaces.” EX1001, claim 1 (emphasis added). By its plain language, this limitation requires obtaining *multiple* successful bite registrations—not just repeating steps b to step d

⁵ The same is true for independent claim 21. As noted below, Petitioners rely on their discussion of independent claim 1 for claim 21 and do not advance any additional argument.

to obtain one successful bite registration. Furthermore, it requires that the successful bite registrations correspond to different displayed bite surfaces.

For limitation [1.5], Petitioners rely *only* on Sommer, which does not disclose obtaining at least two successful bite registrations. Petitioners cite a 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. buccal image in each quadrant).” Pet. 19. From that statement, Petitioners apparently infer that Sommer teaches obtaining multiple successful bite registrations. But this is baseless—Sommer does not mention or suggest obtaining multiple successful bite registrations. Petitioners even *concede* Sommer does not say anything about what one would do with multiple successful bite registrations. Pet. 21-22 (“Sommer is silent regarding how the final calculation of ‘computing a final bite registration between the teeth models of the upper jaw and lower jaw using the selected two or more displayed successful bite registrations’ is performed.”). That is because Sommer *does not teach* obtaining multiple successful bite registrations.

Rather, Sommer simply discloses using “more than one buccal image” in obtaining *one* bite registration. As Sommer itself explains, the idea behind using two buccal images is “to enlarge the buccal model” and create a larger area for

matching the jaw models. EX1005 at 2. Using a larger buccal model to obtain *one* successful bite registration, however, is a different concept from obtaining *multiple* successful bite registrations and using them to compute a final registration.

This understanding of Sommer is consistent with the teachings of the '391 Patent. With reference to step S120 (*i.e.*, “acquiring a bite surface”), the '391 Patent teaches that the intraoral scanner can be set to obtain multiple bite views. EX1001, 4:48-5:10. Multiple bite views can be used to increase the size of the bite surface used to obtain a single bite registration. *Id.*, 4:57-61. What Sommer actually teaches is using multiple bite views for a single bite registration. But, as the '391 Patent specification makes clear, using multiple bite views for a single bite registration is a different concept altogether from obtaining multiple successful bite registrations and using them to compute a final bite registration.

Petitioners attempt to fill the gap in Sommer with expert testimony (Pet. 20, citing EX1009, ¶¶87-90), but that testimony is conclusory and unsupported. Dr. Saber fails to explain what disclosure in Sommer amounts to obtaining two successful bite registrations. Paragraphs 87 and 90 only state the ultimate conclusion, while paragraph 88 quotes Sommer's statement that the user sees a particular pattern on the screen if correlation was successful. In paragraph 89, Dr. Saber concludes, *without citation or explanation*, “[t]hus, Sommer discloses for

each bite surface (i.e., buccal image)⁶ 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.”

Dr. Saber's conclusion is unsupported and conclusory. He provides no supporting citation or explanation why a POSITA would have understood Sommer to disclose obtaining a successful bite registration for each quadrant. Not only is his testimony conclusory, but it also fails to acknowledge that Sommer presents multiple buccal images as something to do when the registration is *unsuccessful*. See EX1005 at 2 (“If 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.”). At bottom, the say-so of an expert, particularly where it ignores the totality of the evidence, is insufficient to establish obviousness. See *In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016) (“To satisfy its burden of proving obviousness, a petitioner cannot employ mere conclusory statements. The petitioner must instead articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness.”).

⁶ Dr. Saber incorrectly equates bite surface to buccal image. In fact, the bite surface can be comprised of many buccal images.

Accordingly, Petitioners have not identified any reference that teaches or suggests limitation [1.5]. For that reason alone, Ground 1 fails.

- b. limitation [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”**

Limitation [1.6] requires “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.” EX1001, claim 1 (emphasis added). By its plain language, this limitation requires selecting at least two successful bite registrations from two or more successful bite registrations that are obtained and displayed in steps 1(a) through 1(e).

For limitation [1.6], Petitioners again rely *only* on Sommer. Pet. 20-21. As discussed above, Sommer does not disclose or suggest obtaining at least two successful bite registrations, let alone displaying at least two successful bite registrations. Sommer likewise does not teach selecting two or more successful bite registrations from multiple displayed successful bite registrations. Sommer merely teaches to repeat certain steps in order to obtain *one* successful bite registration. *Supra* pp. 20-22.

Petitioners point to Sommer's disclosure that “[i]n case [] the software *cannot correlate* the buccal images with either the upper or lower jaw, the user has to take

additional images or remove not useful images until the software can calculate the correlation.” Pet. 21 (citing EX1005 at 1 (emphasis added)). But this is not a teaching to obtain or select multiple successful bite registrations. Rather, it is simply a teaching that if a bite registration is not successful, a user should take additional images or remove non-useful images until the software can perform a successful *single* bite registration.

Petitioners also cite Sommer's statement: “In this case redo the 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.” Pet. 21 (citing EX1005 at 2). This sentence, however, makes clear that the “redo” is called for only if the attempted registration was *not* successful. EX1005 at 2 (“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 the procedure”) (emphasis added). There is no suggestion to repeat in order to obtain multiple successful bite registrations.

Petitioners again attempt to fill the gap with expert testimony (Pet. 21, citing EX1009, ¶¶91-96), but the testimony is again conclusory and unsupported. Dr. Saber asserts that “Sommer discloses a process for obtaining and selecting at least two successful bite registrations” EX1009, ¶95. But he identifies no provision of Sommer that teaches selecting multiple successful bite registrations, simply

quoting the same provisions from Sommer that teach redoing a procedure to obtain *one* successful bite registration, with a conclusory assertion that they somehow teach obtaining multiple successful bite registrations. EX1009, ¶¶92-94. Again, the say-so of an expert is not enough. *Magnum Oil Tools*, 829 F.3d at 1380.

Accordingly, Petitioners have not identified any reference that teaches or suggests limitation [1.6]. For that reason alone, Ground 1 fails.

- c. **limitation [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.”**

Limitation [1.7] requires, *inter alia*, “computing a final bite registration . . . using the selected two or more displayed successful bite registrations.” Petitioners concede at least that Sommer “is silent regarding how the final calculation . . . is performed.” Pet. 22. To be sure, Sommer says nothing at all about a computing a final bite registration from multiple successful bite registrations. It also does not suggest obtaining, displaying, or selecting from multiple successful bite registrations. *Supra* pp. 24-26.

Petitioners contend that Malfliet teaches the “computation step” in paragraphs [0036]-[0038] and [0044]-[0045]. Pet. 22. But there is nothing in Malfliet that suggests or teaches obtaining and displaying multiple successful bite registrations,

much less computing a final bite registration based on multiple bite registrations. For background, and as discussed in greater detail above, Malfliet has an entirely different focus from the '391 Patent. Rather than improving accuracy of bite registrations, it is focused on combining an image of a patient's face with a dental model, so that a patient can visualize potential treatment options from an aesthetic perspective. Nothing in Malfliet teaches the computation of a final bite registration using multiple successful bite registrations, or even obtaining multiple successful bite registrations.

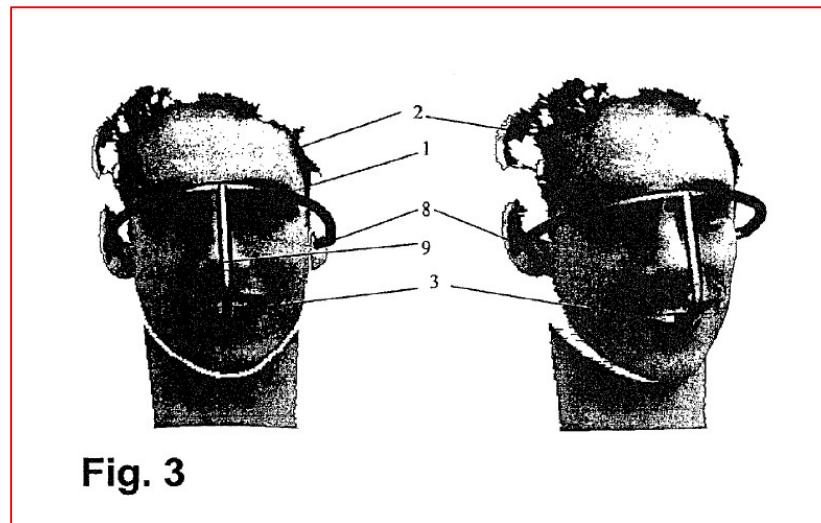
Petitioners rely on paragraphs [0036]-[0038], which refer to techniques for registering "3D models," but Malfliet does not suggest that these 3D models refer to bite registrations. Rather, these paragraphs refer back to the discussion in paragraph [0035], which indicates that "[d]ata derived from imaging sources (e.g. CT, optical scan) needs to be combined into a single model. Initially, a separate model is constructed from each image data source (e.g. a model for CT scan data, a model for optical scan data) and the set of individual models is then combined into a single model." EX1006, ¶[0035]. Thus, Malfliet addresses combining models generated from different data sources, *none of which are bite registrations*.

Paragraph [0044], which Petitioners cite, likewise does not apply to bite registrations. It refers to the "mapping of the 2D or 3D photographs onto the digital

model.” EX1006, ¶¶[0042]-[0043]. This concerns mapping of the 3D models of the patient's dental anatomy to a 2D or 3D *photograph of the patient's face*. *Id.*, ¶[0045] (noting that this approach does not work with edentulous patients without teeth). It does not disclose or suggest to obtain, display, and select multiple successful bite registrations, much less use multiple successful bite registrations to compute a final bite registration.

In fact, Paragraph [0045] is the only mention of bite registrations in Malfliet at all. But this paragraph, with its passing mention of bite registrations, does not suggest obtaining multiple different bite registrations based on bite surfaces from different locations. Rather, paragraph [0045] is focused specifically on *edentulous* patients who have *no teeth*. EX1006, ¶[0045] (“In a case where no identical surfaces are available (e.g. mapping of 2D or 3D photograph of *edentulous* patient onto digitized 3D models of the maxillar and mandibular plaster casts)) (emphasis added). For such cases, Paragraph [0045] discusses the use of a mechanical device (bite fork of a face bow) to gather an impression of the occluding surfaces of the (edentulous) jaws. The mechanical device is depicted in Figure 3 of Malfliet, and represents a different and more cumbersome approach to bite registration. Moreover, the bite fork of a face bow, being positioned in between the upper and

lower jaw when the patient bites down, plainly does not permit obtaining a bite registration of teeth in a clenched state as required by '391 Patent and Sommer.



EX1006, Fig. 3. Neither Petitioners nor Dr. Saber explains how disclosures related to this mechanical device (the bite fork) suggest obtaining multiple successful bite registrations corresponding to different displayed bite surfaces, much less using multiple bite registrations to compute a final bite registration. This failure to explain how the references even arguably disclose the limitations of the claims of the '391 Patent is fatal to the Petition. *In re Kahn*, 441 F.3d at 988 (“there must be some rational underpinning to support the legal conclusion of obviousness”); *Univ. of Strathclyde v. Clear-Vu Lighting LLC*, 17 F.4th 155, 160-62 (Fed. Cir. 2021) (reversing obviousness decision in IPR where substantial evidence did not support finding that prior art taught all of the claim limitations).

Further, there is no apparent reason—and Petitioners have not identified one—why a user would want to capture, much less combine, two registrations using a bite fork. In the case of 3D camera systems that use a bite surface, the bite surface may be captured on only one side, leading to a registration with potential mismatch on the opposite side. EX1001, 1:42-50. The mechanical bite fork, by contrast, is on both sides of the patient's jaws at once. EX1006, ¶[0045] (bite fork is “shaped like a horseshoe and is inserted in the mouth of the patient and claimed between upper and lower jaw”).

Petitioners' expert testimony is also unpersuasive. Dr. Saber concedes that “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.” EX1009, ¶98. He nevertheless asserts that “this computation step was well known in the art,” citing only paragraphs [0044]-[0045] of Malfliet in support of that assertion without explanation. As discussed above, those paragraphs do not teach limitation [1.7] and do not fill in the numerous gaps in Sommer as to the preceding limitations. *See Magnum Oil Tools*, 829 F.3d at 1380.

Accordingly, Petitioners have not identified any reference that teaches or suggests limitation [1.7]. For that reason alone, Ground 1 fails.

d. Claims 5-12

Claims 5-12 depend from independent claim 1, and therefore have at least the same limitations. For at least the reasons discussed with respect to claim 1, none of the asserted references disclose or suggest the limitations of claims 5-12. Thus, even if a POSITA were motivated to combine the asserted references, the resulting combination would not render claims 5-12 obvious.

e. Claim 21

Petitioners do not raise any additional arguments with respect to claim 21. Their challenge of claim 21 relies entirely on the discussion of claim 1. Pet. 36-37. For the reasons discussed as to limitations [1.5], [1.6], and [1.7], none of the asserted references disclose or suggest limitations [21.5], [21.6], or [21.7]. Thus, even if a POSITA would have been motivated to combine the asserted references, the resulting combination would not render claim 21 obvious.

B. Ground 2 Fails For All The Reasons Of Ground 1.

Asserted References	Alleged Basis	Claims Challenged
Sommer (EX1005) in view of Rubbert (EX1008), Malfliet (EX1006), and Estépar (EX1007)	35 U.S.C. § 103	2-4

Ground 2 challenges claims 2-4 based on the same prior art of Ground 1, plus an additional reference: Estépar (EX1007). Claims 2 and 3 depend from claim 1,

and claim 4 depends from claim 3. Thus, claims 2-4 have at least the same limitations as claim 1. Although Ground 2 adds a fourth reference, Estépar (EX1007), it does so only for the additional limitations of the dependent claims. Ground 2, therefore, fails for at least the same reasons that Ground 1 fails.

C. Ground 3 Fails For Several Independent Reasons, Including Many Of The Same Reasons As Ground 1.

Asserted References	Alleged Basis	Claims Challenged
Sommer (EX1005) in view of Malfliet (EX1006)	35 U.S.C. § 103	13, 14, 17-19

Ground 3 fails for multiple independent reasons. First, there is no motivation to combine Sommer and Malfliet. Second, even if combined, these references do not disclose or suggest every limitation of the challenged claims. Third, a POSITA would not have had a reasonable expectation of success in combining Sommer and Malfliet to achieve the inventions of the challenged claims.

1. There Is No Motivation To Combine, Or Reasonable Expectation of Success In Combining, Sommer And Malfliet.

As discussed with respect to Ground 1, Petitioners fail to show why a POSITA would have been motivated to combine Sommer and Malfliet and further fail to show a reasonable expectation of success. *Supra* pp. 9-19. Likewise, this ground fails because the Petition did not propose a construction for what Petitioners contend are means-plus-function limitations. For those reasons alone, Ground 3 fails.

2. The Asserted References, Alone Or In Combination, Do Not Suggest Every Limitation Of The Challenged Claims.

Ground 3 challenges two independent claims and several dependent claims. First, as for independent claim 13 (and claims 14 and 17, which depend therefrom), Petitioners fail to show that the cited references, alone or in combination, disclose at least the following limitations: [13.2], [13.5], [13.6], and [13.7]. Second, as for independent claim 18 (and claim 19, which depends therefrom), Petitioners fail to show the cited references, alone or in combination, disclose at least the following limitations: [18.5], [18.6], and [18.7].

- a. limitation [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;”**

Petitioners assert that Sommer teaches this limitation and references their prior discussion of limitation [1.2]. Pet. 54 (citing §VII.A.1.b). Petitioners include no other analysis or discussion. This is insufficient. Specifically, nowhere in their discussion of limitation [1.2] do Petitioners identify a “means for acquiring a bite surface” in Sommer. As explained by the '391 Patent, a bite surface is acquired by a scanner and its associated software. *See, e.g., '391 Patent at 4:48-62.* Petitioners do not identify a disclosure in Sommer of such a scanner. In fact, Petitioners concede elsewhere that 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” and rely instead on Rubbert for disclosing the acquisition step of limitation [1.2]. Pet. 38; *see also* Pet. 15. Rubbert, however, is not one of the references asserted in Ground 3. Thus, Rubbert cannot supply all or part of limitation [13.2] in a combination in which it is not present. Accordingly, this limitation is not suggested by the asserted references in Ground 3.

b. limitation [13.5]: “means for obtaining at least two successful bite registrations corresponding to different displayed bite surface by repeating;”

For this limitation, the Petition relies entirely on the discussion of limitation [1.5]. Pet. 55 (citing §VII.A.1.e). For the reasons discussed as to limitation [1.5], none of the asserted references disclose or suggest limitation [13.5].

c. limitation [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”

For this limitation, the Petition relies entirely on the discussion of limitation [1.6]. Pet. 55 (citing §VII.A.1.f). For the reasons discussed as to limitation [1.6], none of the asserted references disclose or suggest limitation [13.6].

d. limitation [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”

For this limitation, the Petition relies entirely on the discussion of limitation [1.7]. Pet. 56 (citing §VII.A.1.g). For the reasons discussed as to limitation [1.7], none of the asserted references disclose or suggest limitation [13.7].

e. Claims 14 and 17

Claims 14 and 17 depend from claim 13, and thus have at least the same limitations. For at least the reasons discussed with respect to claim 13, none of the asserted references suggest all the limitations of claims 14 and 17. Thus, even if a POSITA were motivated to combine the asserted references, the resulting combination would not render claims 14 and 17 obvious.

f. limitation [18.5]

For this limitation, the Petition relies entirely on its discussion of limitation [1.5]. Pet. 58 (citing §VII.A.1.e). For the reasons discussed as to limitation [1.5], none of the asserted references disclose or suggest limitation [18.5].

g. limitation [18.6]

For this limitation, the Petition relies entirely on its discussion of limitation [1.6]. Pet. 58 (citing §VII.A.1.f). For the reasons discussed as to limitation [1.6], none of the asserted references disclose or suggest limitation [18.6].

h. limitation [18.7]

For this limitation, the Petition relies entirely on its discussion of limitation [1.7]. Pet. 59 (citing §VII.A.1.g). For the reasons discussed as to limitation [1.7], none of the asserted references disclose or suggest limitation [18.7].

i. Claim 19

Claim 19 depends from claim 18, and thus has at least the same limitations. For at least the reasons discussed with respect to claim 18, none of the asserted references suggest all the limitations of claim 19. Thus, even if a POSITA would have been motivated to combine the asserted references, the resulting combination would not render claim 19 obvious.

D. Ground 4 Fails For The Same Reasons As Ground 3.

Asserted References	Alleged Basis	Claims Challenged
Sommer (EX1005) in view of Malfliet (EX1006) and Estépar (EX1007)	35 U.S.C. § 103	15, 16, 20

Ground 4 fails for at least the same reasons as Ground 3. First, there is no motivation to combine Sommer and Malfliet. Second, even if combined, these references do not disclose or suggest every limitation of the challenged claims. Third, a POSITA would not have had a reasonable expectation of success in combining Sommer and Malfliet to achieve the inventions of the challenged claims.

1. There Is No Motivation To Combine, Or Reasonable Expectation of Success In Combining, Sommer And Malfliet.

As discussed with respect to Ground 1, Petitioners fail to show why a POSITA would have been motivated to combine Sommer and Malfliet and further fail to show a reasonable expectation of success. *Supra* pp. 9-19. For those reasons alone, Ground 4 fails.

2. None of the asserted references, alone or in combination, disclose or suggest every limitation of the challenged claims.

a. Claims 15-16

Claims 15 and 16 have at least the same limitations as claim 13, because claim 16 depends from claim 15 which depends from claim 13. Although Ground 4 adds a third reference (EX1007), it does so only for the additional limitations of the dependent claims. Thus, for at least the reasons discussed with respect to claim 13 in Ground 13, none of the asserted references disclose or suggest all limitations of claims 15-16. Thus, even if a POSITA would have been motivated to combine the asserted references, the resulting combination would not render claims 15-16 obvious.

b. Claim 20

Petitioners' challenge of claim 20 relies entirely on their discussion of claim 1 and claim 3. For limitation [20.5], Petitioners rely on their discussion of limitation [1.5]. Pet. 63 (citing §VII.A.1.e). For limitation [20.6], Petitioners rely

on their discussion of limitation [1.6]. Pet. 63 (citing §VII.A.1.f). For limitation [20.7], Petitioners relies on their discussion of limitation [1.7]. Pet. 64 (citing §VII.A.1.g). As discussed above, limitations [1.5], [1.6], [1.7] are not disclosed and would not have been rendered obvious by the asserted combination. For at least the same reasons, Petitioners' challenge to claim 20 should be rejected.

VI. CONCLUSION

For the foregoing reasons, Patent Owner respectfully requests that the Board deny institution.

Respectfully Submitted,

Dated: May 21, 2024

/s/ John T. McKee

John T. McKee
Registration No. 65,926
Quinn Emanuel Urquhart & Sullivan LLP
51 Madison Ave, 22nd Floor
New York, New York 10010
Tel: (212) 849-7219
Fax (212) 849-7100

CERTIFICATE OF COMPLIANCE

I hereby certify that the word count for the foregoing Patent Owner's Preliminary Response totals 8,166, excluding the parts which are exempted by 37 C.F.R. § 42.24. Patent Owner has relied on the word count feature of the word processing system used to create this paper in making this certification.

Dated: May 21, 2024

/s/ John T. McKee

John T. McKee

Registration No. 65,926

Quinn Emanuel Urquhart & Sullivan LLP

51 Madison Ave, 22nd Floor

New York, New York 10010

Tel: (212) 849-7219

Fax (212) 849-7100

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6, I hereby certify that on May 21, 2024, the foregoing Patent Owner's Preliminary Response was served via email on the following counsel of record for the Petitioner:

todd.walters@bipc.com
roger.lee@bipc.com
andrew.cheslock@bipc.com
mythili.markowski@bipc.com
robert.wagner@bipc.com

Dated: May 21, 2024

/s/ John T. McKee

John T. McKee
Registration No. 65,926
Quinn Emanuel Urquhart & Sullivan LLP
51 Madison Ave, 22nd Floor
New York, New York 10010
Tel: (212) 849-7219
Fax (212) 849-7100