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NOTICE OF ALLOWANCE AND FEE(S) DUE

107046 7590 11/27/2019
WSGR / Align Technology , Inc.
650 Page Mill Road
Palo Alto, CA 94304

EXAMINER
MAPAR, BIJAN

ART UNIT	PAPER NUMBER
2128	

DATE MAILED: 11/27/2019

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/176,474	10/31/2018	Avi Kopelman	22773-822.302	3191

TITLE OF INVENTION: METHODS AND SYSTEMS FOR PREPARATION OF ORTHODONTICS AND PROSTODONTICS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1000	$0.00	$0.00	$1000	02/27/2020

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

ALIGN - EXHIBIT 2014
ClearCorrect Operating, LLC. v. Align Technology, Inc.
IPR2025-00817

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

107046 7590 11/27/2019
WSGR / Align Technology , Inc.
650 Page Mill Road
Palo Alto, CA 94304

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/176,474	10/31/2018	Avi Kopelman	22773-822.302	3191

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APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1000	$0.00	$0.00	$1000	02/27/2020

EXAMINER	ART UNIT	CLASS-SUBCLASS
MAPAR, BIJAN	2128	703-001000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑ Issue Fee ❑ Publication Fee (if required) ❑ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

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Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 16/176,474	Applicant(s) Kopelman, Avi	
	Examiner BIJAN MAPAR	Art Unit 2128	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to the amendment dated 8/19/2019 and the IDS dated 10/24/2019.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☑ The allowed claim(s) is/are 1-30 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☑ Notice of References Cited (PTO-892)
2. ☑ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 8/6/2019, 10/24/2019.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☑ Interview Summary (PTO-413), Paper No./Mail Date. 11/23/2019.
5. ☐ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/BIJAN MAPAR/
Primary Examiner, Art Unit 2128

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Allowable Subject Matter

Claims 1-30 are allowed.

The following is an examiner's statement of reasons for allowance:

The claims as amended distinguish over the art of record, and the art as a whole via clarifying the updating scans to be directed to scenarios where the intra-oral cavity (e.g. dentition) is modified in between the scans (e.g. subjected to a surface preparation). This distinguishes over the cited references, which deal only with recapturing scans of a static intra-oral region. The scanning methodology disclosed by the closest prior art, the Kriveshko WIPO reference (WO2007084647A2), does not provide for (or suggest) generating a composite scan after intra-oral modifications are made. Rather, it teaches away from this, teaching that entirely new scans should be made.

In ¶121-122, the Kriveshko WIPO reference (WO2007084647A2) describes an iterative approach to managing a preparation where "a dentist may repeat steps of tooth removal and scanning until a satisfactory surface preparation is achieved." This has an important distinction from the instant applications' claims, which provide a composite scan based on both a first (initial) and second (post-change) scan. In the Kriveshko reference, a new scan is being gathered each time a preparation is made. The user interface allows for rescanning areas that are subject to errors, equivalent to modifying the first scan with data, but does not disclose that this can be done while the intra-oral region is modified (e.g. via a surface preparation). Rather, the rescanning is done to correct errors with the first scan, and the iterative process disclosed by the reference involves complete rescans (generating an entirely new scan rather than generating a composite scan by using a second scan to update the changed region from

the first). See for example the Kriveshko WIPO reference at ¶119, where it discusses the interface used in this process: "The user interface may be adapted for use by a dentist (or dental laboratory) to review a surface preparation ... in this mode, new data is not being acquired. Rather, a stored model may be processed." This explicitly teaches away from the claimed process, which data is newly captured and composited to update for the intra-oral modification.

In view of the above, with the Kriveshko WIPO reference representing the closest prior art, the claims distinguish over the art as a whole. The claims further recite eligible subject matter under 35 USC 101, as under the most recent guidance (2019 PEG) they are not directed to a judicial exception.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BIJAN MAPAR whose telephone number is (571)270-3674. The examiner can normally be reached on Monday - Thursday, 11:00-8:30.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Omar F Fernandez Rivas can be reached on 5712722589. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained

from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/BIJAN MAPAR/
Primary Examiner, Art Unit 2128

Applicant-Initiated Interview Summary	**Application No.** 16/176,474	**Applicant(s)** Kopelman, Avi	
	Examiner BIJAN MAPAR	**Art Unit** 2128	**AIA (FITF) Status** Yes

All participants (applicant, applicants representative, PTO personnel):

(1) BIJAN MAPAR.

(2) CHARLES HAGADORN.

(3) DENNIS CHANG.

(4) _____.

Date of Interview: 19 August 2019.

Type: ☑ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☑ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☑103 ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: 1.

Identification of prior art discussed: Kriveshko, Paley, Rubbert, Babayoff.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Examiner discussed potential avenues for overcoming the current art with applicant, highlighting features discussed in the specification and clarifying the intended focus of the invention. Applicant provided an in depth explanation of the function of the invention, and examiner noted that highlighting the feature of composite scan updates following modification to the dentition, e.g. after a removal operation was done on a tooth, appeared distinct from the noise/error correction rescans disclosed by the prior art. Agreement was reached that equivalent language would distinguish over the current rejection, and likely over the art as a whole. Examiner noted that if further issues were raised, the applicant would be contacted..

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/BIJAN MAPAR/ Primary Examiner, Art Unit 2128	

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) 1.133 Interviews
Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiners responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicants correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:
1) A brief description of the nature of any exhibit shown or any demonstration conducted,-
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
(The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicants record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiners version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, Interview Record OK on the paper recording the substance of the interview along with the date and the examiners initials.

I hereby certify that this correspondence is being filed via EFS-Web with the United States Patent and Trademark Office on August 19, 2019

WILSON SONSINI GOODRICH & ROSATI

By: /Hillary Pratt/

Attorney Docket No.: 22773-822.302
Align Ref. No.: 7034.WO.US.C1.C1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Confirmation No.: 3191
Avi Kopelman	
Application No.: 16/176,474	Examiner: Bijan Mapar
Filed: October 31, 2018	Art Unit: 2128
For: METHODS AND SYSTEMS FOR PREPARATION OF ORTHODONTICS AND PROSTODONTICS	AMENDMENT
Customer No.: 107046	

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

In response to the Non-Final Office Action mailed May 17, 2019, please enter the following amendments and remarks.

Amendments to the Claims are reflected in the listing of claims beginning on page 2.

Remarks begin on page 11.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings of claims in the application:

Listing of Claims:

1. (Currently Amended) A dental system for intraorally scanning a patient's teeth for a dental procedure, the dental system comprising:

a hand-held intraoral scanner; and

a computer readable medium including instructions that when executed by a computer system, causes the computer system to:

receive first 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner;

display, to a display, a first 3D surface model of the patient's teeth, wherein the first 3D surface model of the patient's teeth is based on the received first 3D intraoral scan data of the patient's teeth;

receive user input defining a surface portion of the first 3D surface model to be removed;

after receiving the user input, remove, from the displayed first 3D surface model, the surface portion of the first 3D surface model to be removed according to the user input;

after removing the surface portion of the first 3D surface model, receive second 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner, the second 3D intraoral scan data including surface data of a physically changed portion of the patient's intra-oral cavity;

replace at least a portion of the removed surface portion of the first 3D surface model with at least a surface portion of a second 3D surface model including the physically changed portion based on the received second 3D intraoral scan data of the patient's teeth to produce a composite 3D surface model of the patient's teeth that is based on the first 3D intraoral scan data and the second 3D intraoral scan data; and

output, to the display, the composite 3D surface model of the patient's teeth.

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

3. (Original) The system of claim 2, wherein the system further comprises the computer system and the display; wherein the system further comprises a mouse or wherein the display comprises a touch screen display; and wherein the user input defining portions of the first 3D surface model to be removed is received by from the mouse or the touch screen display.

4. (Original) The system of claim 1, wherein the portion of the removed portion of the first 3D surface model is replaced with at least the portion of the second 3D surface model by registering the second 3D surface model with the first 3D surface model.

5. (Original) The system of claim 4, wherein the second 3D surface model is registered with the first 3D surface model by aligning identifying surface data of the second 3D surface model with corresponding parts of the first 3D surface model.

6. (Original) The system of claim 5, wherein the portion of the removed portion of the first 3D surface model is replaced with at least the portion of the second 3D surface model by further stitching the portion of the second 3D surface model with the first 3D surface model.

7. (Original) The system of claim 6, wherein the portion of the removed portion of the first 3D surface model is replaced with at least the portion of the second 3D surface model by further discarding a remainder of the second 3D surface model, including the identifying surface data, after stitching the portion of the second 3D surface model with the first 3D surface model.

8. (Original) The system of claim 1, wherein the computer readable medium further includes instructions that when executed by the computer system, causes the computer

system to: mark, on the displayed first 3D surface model, the user input defined surface portion, after receiving the user input and before removing the surface portion.

9. (Currently Amended) A dental system for intraorally scanning a patient's teeth for a dental procedure, the dental system comprising:

a hand-held intraoral scanner;

a computer readable medium including instructions that when executed by a computer system, causes the computer system to:

receive first 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner;

display, to the display, a first 3D surface model of the patient's teeth, wherein the first 3D surface model of the patient's teeth is based on the received first 3D intraoral scan data of the patient's teeth;

receive user input via the displayed first 3D surface model demarcating a surface portion of the first 3D surface model to be retained and a surface portion of the first 3D surface model to be replaced;

after receiving the user input, receive second 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner, the second 3D intraoral scan data including surface data of a physically changed portion of the patient's intra-oral cavity;

replace ~~replacing~~ at least a portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least a surface portion of a second 3D surface model based on the received second 3D intraoral scan data of the patient's teeth that includes the physically changed portion while retaining the surface portion of the first 3D surface model to be retained according to the user input to produce a composite 3D surface model of the patient's teeth that is based on the first 3D intraoral scan data and the second 3D intraoral scan data; and

output, to the display, the composite 3D surface model of the patient's teeth.

10. (Original) The system of claim 9, wherein the hand-held intraoral scanner comprises a probing member with a sensing face, an illumination unit, a light focusing optics

defining one or more focal planes forward the sensing face, and a translation mechanism for displacing the focal plane relative to the sensing face.

11. (Original) The system of claim 9, wherein the computer readable medium further includes instructions that when executed by a computer system, causes the computer system to remove, from the displayed first 3D surface model, the surface portion to be replaced according to the user input demarcating the surface portion of the first 3D surface model to be retained and the surface portion of the first 3D surface model to be replaced.

12. (Original) The system of claim 11, wherein the computer readable medium further includes instructions that when executed by the computer system, causes the computer system to: mark, on the displayed first 3D surface model, the user input defined surface portion to be replaced, after receiving the user input and before removing the surface portion to be replaced.

13. (Original) The system of claim 9, wherein the portion of the surface portion of the first 3D surface model to be replaced is replaced with at least the portion of the second 3D surface model by registering the second 3D surface model with the first 3D surface model by aligning identifying surface data of the second 3D surface model with corresponding parts of the first 3D surface model.

14. (Original) The system of claim 13, wherein the portion of the portion of the first 3D surface model to be replaced is replaced with at least the portion of the second 3D surface model by further stitching the portion of the second 3D surface model with the first 3D surface model.

15. (Original) The system of claim 14, wherein the portion of the surface portion of the first 3D surface model to be replaced is replaced with at least the portion of the second 3D surface model by further discarding a remainder of the second 3D surface model, including the identifying surface data, after stitching the portion of the second 3D surface model with the first 3D surface model.

16. (Currently Amended) A dental system for intraorally scanning a patient's teeth for a dental procedure, the dental system comprising:

a hand-held intraoral scanner;

a display; and

a computer system operatively coupled with the display and the hand-held intraoral scanner, the computer system configured to:

receive first 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner;

display, to the display, a first 3D surface model of the patient's teeth, wherein the first 3D surface model of the patient's teeth is based on the received first 3D intraoral scan data of the patient's teeth;

receive user input via the displayed first 3D surface model at least defining a surface portion of the first 3D surface model to be retained;

after receiving the user input, receive second 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner, the second 3D intraoral scan data including surface data of a physically changed portion of the patient's intra-oral cavity;

~~replacing~~ replace at least a portion of the first 3D surface model not part of the surface portion of the first 3D model to be retained according to the user input with at least a surface portion of a second 3D surface model based on the received second 3D intraoral scan data of the patient's teeth that includes the physically changed portion to produce a composite 3D surface model of the patient's teeth that is based on the first 3D intraoral scan data and the second 3D intraoral scan data; and

output, to the display, the composite 3D surface model of the patient's teeth.

17. (Original) The system of claim 16, wherein the hand-held intraoral scanner comprises a probing member with a sensing face, an illumination unit, a light focusing optics defining one or more focal planes forward the sensing face, and a translation mechanism for displacing the focal plane relative to the sensing face.

18. (Original) The system of claim 16, wherein the received user input also defines a surface portion of the first 3D surface model to be replaced by the second 3D surface model.

19. (Original) The system of claim 18, wherein the computer readable medium further includes instructions that when executed by the computer system, causes the computer system to remove, from the displayed first 3D surface model, the surface portion to be replaced according to the user input defining the surface portion of the first 3D surface model to be retained and the surface portion of the first 3D surface model to be replaced.

20. (Currently Amended) The system of claim 16, wherein the portion of the first 3D surface model not part of the surface portion of the first 3D model to be retained according to the user input is replaced with at least the portion of the second 3D surface model by registering the second 3D surface model with the first 3D surface model by aligning identifying surface data of the second 3D surface model with corresponding parts of the first 3D surface model.

21. (Original) The system of claim 20, wherein the portion of the surface portion of the first 3D surface model to be replaced is replaced with at least the surface portion of the second 3D surface model by further stitching the surface portion of the second 3D surface model with the first 3D surface model.

22. (Original) The system of claim 21, wherein the portion of the surface portion of the first 3D surface model to be replaced is replaced with at least the surface portion of the second 3D surface model by further discarding a remainder of the second 3D surface model, including the identifying surface data, after stitching the surface portion of the second 3D surface model with the first 3D surface model.

23. (Currently Amended) A dental method for intraorally scanning a patient's teeth for a dental procedure, the dental method comprising:

receiving first 3D intraoral scan data of the patient's teeth from [[the]] a hand-held intraoral scanner;

displaying, to a display, a first 3D surface model of the patient's teeth, wherein the first 3D surface model of the patient's teeth is based on the received first 3D intraoral scan data of the patient's teeth;

receiving user input via the displayed first 3D surface model demarcating a surface portion of the first 3D surface model to be retained and a surface portion of the first 3D surface model to be replaced;

after receiving the user input, receiving second 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner, the second 3D intraoral scan data including surface data of a physically changed portion of the patient's intra-oral cavity;

replacing at least a portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least a surface portion of a second 3D surface model based on the received second 3D intraoral scan data of the patient's teeth including the physically changed portion to produce a composite 3D surface model of the patient's teeth that is based on the first 3D intraoral scan data and the second 3D intraoral scan data; and

output, to the display, the composite 3D surface model of the patient's teeth.

24. (Original) The method of claim 23, further comprising marking an area, on the displayed first 3D surface model, associated with the received user input.

25. (Original) The method of claim 23, wherein replacing at least the portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least the surface portion of the second 3D surface model comprises registering the second 3D surface model with the first 3D surface model by aligning identifying surface data of the second 3D surface model with corresponding parts of the first 3D surface model.

26. (Original) The method of claim 25, wherein replacing at least the portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least the surface portion of the second 3D surface model further comprises stitching the surface portion of the second 3D surface model with the first 3D surface model.

27. (Original) The method of claim 26, wherein replacing at least the portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least the surface portion of the second 3D surface model further comprises discarding a remainder of the second 3D surface model, including the identifying surface data, after stitching the surface portion of the second 3D surface model with the first 3D surface model.

28. (Currently Amended) The method of claim 23, wherein the first 3D surface model of the patient's teeth comprises a tooth preparation having a finish line, wherein a portion of the finish line is obscured or distorted, and wherein the physical change results in ~~replacing the portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least the surface portion of a second 3D surface model based on the received second 3D intraoral scan data of the patient's teeth comprises replacing a portion of the obscured or distorted portion of the finish line with a portion of the second 3D surface model where~~ the finish line [[is]] not being obscured or distorted.

29. (Currently Amended) The method of claim 23, wherein the first 3D surface model of the patient's teeth comprises a tooth preparation that accurately represents a surface of a physical preparation of the patient, and wherein the method further comprises analyzing the tooth preparation of the first 3D surface model to determine whether the surface of the physical preparation is suitable for a dental prosthesis; and wherein the physical change is a ~~replacing the portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least the surface portion of a second 3D surface model based on the received second 3D intraoral scan data of the patient's teeth comprises replacing a surface of the tooth preparation of the first 3D surface model with a portion of the second 3D surface model where the second 3D surface model is obtained after~~ physical modification of the surface of the physical preparation of the patient.

30. (Original) The method of claim 29, wherein the dental prosthesis comprises a dental crown and wherein the tooth preparation analysis comprises analysis of the first 3D surface model with respect to a virtual model of an opposing dentition of an opposite

jaw to determine whether the tooth preparation would result in an inadequate structure for the dental crown.

REMARKS

Upon entry of this amendment, claims 1-30 will be pending in the present application. Claims 1, 9, 16, 20, 23, 28, and 29 have been amended. Support for the amendments can be found in the specification as originally filed. Accordingly, no new matter has been added. Reconsideration is respectfully requested.

Examiner Interview

Applicant thanks Examiner Mapar for participating in a telephonic interview on August 19, 2019, with Applicant's representatives, Charles Hagadorn and Dennis Chang. The Examiner's rejections of the claims made in a Non-Final Office Action mailed on May 17, 2019, were discussed. During the interview it was agreed that amending the claims to include subject matter directed to the second scan including a data representing a physically changed structure would overcome the current rejection and the art, subject to review of the submitted claim amendments.

Accordingly, claim 1 has been amended to recite, in part, "receive second 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner, the second 3D intraoral scan data including surface data of a physically changed portion of the patient's intra-oral cavity; replace at least a portion of the removed surface portion of the first 3D surface model with at least a surface portion of a second 3D surface model including the physically changed portion." Claims 9, 16, and 23, although different in scope were similarly mended to include subject matter directed to the second scan including a data representing a physically changed structure

Remarks Regarding Information Disclosure Statement

Examiner alleges the IDS filed on 2/28/2019 contains numerous references which do not appear to be related to or material to the examination of the claimed subject matter of the instant application. In accordance with the Examiner's requirement stating:

"One of the following information is required to consider any reference cited by the applicant in the IDS filed on 2/28/2019:

A) Applicants are specifically required to point out which reference or references cited in the IDS filed on 2/28/2019 disclose either the selection of dentition scan areas to be removed,

retained or replaced, or the integration of multiple dentition scans into one unified computer model.

B) Applicants are specifically required to point out which reference or references cited in the IDS filed on 2/28/2019 are most relevant to the examination of the claims of the instant application."

In satisfaction of option B, Applicant points out the following references in the IDS filed on 2/28/2019 in the following tables:

U.S. Patent Documents			
Cite No.	Document Number	Publication Date	Name of Patentee or Applicant
025	US-4575805	03-11-1986	MOERMANN; Werner H [Ch] et al.
028	US-4611288	09-09-1986	DURET; Francois et al.
030	US-4663720	05-05-1987	DURET; Francois et al.
033	US-4742464	05-03-1988	DURET; Francois et al.
039	US-4837732	06-06-1989	BRANDESTINI; Marco et al.
056	US-5027281	06-25-1991	REKOW; Elizabeth D. et al.
061	US-5121333	06-09-1992	RILEY; Donald R. et al.
063	US-5128870	07-07-1992	ERDMAN; Arthur G. et al.
070	US-5184306	02-02-1993	ERDMAN; Arthur G. et al.
074	US-5278756	01-11-1994	LEMCHEN; Marc S [Us] et al.
076	US-5338198	08-16-1994	WU; Chuang-Jy [Ca] et al.
079	US-5368478	11-29-1994	ANDREIKO; Craig A. et al.
082	US-5431562	07-11-1995	ANDREIKO; Craig A. et al.
085	US-5447432	09-05-1995	ANDREIKO; Craig A. et al.
087	US-5454717	10-03-1995	ANDREIKO; Craig A. et al.

095	US-5562448	10-08-1996	MUSHABAC; David R.
098	US-5607305	03-04-1997	ANDERSSON; Matts et al.
100	US-5621648	04-15-1997	CRUMP; Craig D.
106	US-5725376	03-10-1998	POIRIER; Michel
109	US-5740267	04-14-1998	ECHERER; Scott J. et al.
113	US-5823778	10-20-1998	SCHMITT; Stephen M. et al.
114	US-5848115	12-08-1998	LITTLE; Francis H. et al.
119	US-5880962	03-09-1999	ANDERSSON; Matts et al.
120	US-5934288	08-10-1999	AVILA; Ricardo Scott et al.
124	US-5975893	11-02-1999	CHISHTI; Muhammad [Us] et al.
129	US-6068482	05-30-2000	SNOW; Michael Desmond
130	US-6099314	08-08-2000	KOPELMAN; Avi et al.
136	US-6217334	04-17-2001	HULTGREN; Bruce Willard [Us] et al.
137	US-6227850	05-08-2001	CHISHTI; Muhammad Ziaullah Khan [Us] et al.
138	US-6244861	06-12-2001	ANDREIKO; Craig A. et al.
139	US-6309215	10-30-2001	PHAN; Loc X [Us] et al.
140	US-6315553	11-13-2001	SACHDEVA; Rohit et al.
143	US-6350120	02-26-2002	SACHDEVA; Rohit et al.
146	US-6402707	06-11-2002	ERNST; Maurice M.
158	US-9299192	03-29-2016	KOPELMAN; Avi
162	US-20030215764	11-20-2003	KOPELMAN; Avi [Il] et al.
164	US-20030232302	12-18-2003	BABAYOFF; Noam [Il] et al.
174	US-20050283065	12-22-2005	BABAYOFF; Noam [Il] et al.

167	US-20070015111	01-18-2007	KOPELMAN; Avi [Il] et al.
168	US-20070172112	07-26-2007	PALEY; Eric B [Us] et al.
169	US-20070236494	10-11-2007	KRIVESHKO; Ilya A [Us] et al.
170	US-20080206705	08-28-2008	KAZA; Srinivas [Us] et al.
172	US-20130110469	05-02-2013	KOPELMAN; Avi
173	US-20160171128	06-16-2016	KOPELMAN; Avi

Foreign Patent Document			
Cite No.	Document Number	Publication Date	Name of Patentee or Applicant
003	AU-5598894-A	06-08-1994	ORMCO CORP.
007	EP-0091876-A1	10-19-1983	DURET FRANCOIS [FR], et al.
008	EP-0299490-A2	01-18-1989	STEINBICHLER HANS [DE]
009	EP-0376873-A2	07-04-1990	SHAFIR AARON [IL], et al.
010	EP-0490848-A2	06-17-1992	NOBELPHARMA AB [SE]
011	EP-0541500-A1	05-12-1993	NOBELPHARMA AB [SE]
012	EP-0667753-B1	01-19-2000	ORMCO CORP [US]
013	EP-0731673-B1	05-30-2001	NOBEL BIOCARE AB [SE]
025	WO-2004087000-A1	10-14-2004	CADENT LTD [IL], et al.
027	WO-2010001401-A1	01-07-2010	CADENT LTD [IL], et al.
028	WO-2012011101-A2	01-26-2012	CADENT LTD [IL], et al.
031	WO-9410935-A1	05-26-1994	ORMCO CORP [US]
032	WO-9832394-A1	07-30-1998	HULTGREN BRUCE WILLARD [US]
034	WO-9858596-A1	12-30-1998	ALIGN TECHNOLOGY INC [US], et al.

Non-Patent Literature Documents	
Cite No.	Include name of the author(in CAPITAL LETTERS),title of the article(when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s),volume-issue number(s),publisher, city and/or country where published.
002	ALCANIZ, et aL, "An Advanced System for the Simulation and Planning of Orthodontic Treatments," Karl Heinz Hohne and Ron Kikinis (eds.), Visualization in Biomedical Computing, 4th Intl. Conf., VBC '96, Hamburg, Germany, September 22-25, 1996, Springer-Verlag, pp. 511-520.
006	ALTSCHULER et al., "Laser Electro-Optic System for Rapid Three-Dimensional (3D) Topographic Mapping of Surfaces," Optical Engineering, 20(6):953-961 (1981).
007	ALTSCHULER et al., "Measuring Surfaces Space-Coded by a Laser-Projected Dot Matrix," SPIE Imaging Applications for Automated Industrial Inspection and Assembly, Vol. 182, p. 187-191 (1979).
011	BAUMRIND, "A System for Craniofacial Mapping Through the Integration of Data from Stereo X-Ray Films and Stereo Photographs," an invited paper submitted to the 1975 American Society of Photogram Symposium on Close-Range Photogram Systems, University of III., Aug. 26-30, 1975, pp. 142-166.
014	BAUMRIND, "Integrated Three-Dimensional Craniofacial Mapping: Background, Principles, and Perspectives," Semin. in Orthod., 7(4):223-232 (December 2001).
013	BAUMRIND et al., "Mapping the Skull in 3-D," reprinted from J. Calif. Dent. Assoc., 48(2), 11 pages total, (1972 Fall Issue).
015	BEGOLE et al., "A Computer System for the Analysis of Dental Casts," The Angle Orthod., 51(3):253-259 (July 1981).
018	BIGGERSTAFF, "Computerized Diagnostic Setups and Simulations," Angle Orthod., 40(1):28-36 (January 1970).
040	CURRY et al., "Integrated Three-Dimensional Craniofacial Mapping at the Craniofacial Research Instrumentation Laboratory/University of the Pacific," Semin. Orthod., 7(4):258-265 (December 2001).
046	DENTRAC CORPORATION, Dentrac document, pp. 4-13 (1992).
051	DURET et al, "CAD-CAM in Dentistry," J. Am. Dent. Assoc. 117:715-720 (November 1988).

086	KURODA et al., Three-Dimensional Dental Cast Analyzing System Using Laser Scanning, Am. J. Orthod. Dentofac. Orthop. (1996) 110:365-369.
087	LAURENDEAU, et al., "A Computer-Vision Technique for the Acquisition and Processing of 3-D Profiles of 7 KR Dental Imprints: An Application in Orthodontics," IEEE Transactions on Medical Imaging, 10(3):453-461 (September 1991.
099	PAUL et al., "Digital Documentation of Individual Human Jaw and Tooth Forms for Applications in Orthodontics, Oral Surgery and Forensic Medicine" Proc. of the 24th Annual Conf. of the IEEE Industrial Electronics Society (IECON '98), Sept. 4, 1998, pp. 2415-2418.
112	REKOW et al., "Comparison of Three Data Acquisition Techniques for 3-D Tooth Surface Mapping," Annual International Conference of the IEEE Engineering in Medicine and Biology Society, 13(1):344-345 1991.
116	RICHMOND, "Recording The Dental Cast In Three Dimensions," Am. J. Orthod. Dentofacial Orthop., 92(3):199-206 (September 1987).
120	SCHROEDER et al., Eds. The Visual Toolkit, Prentice Hall PTR, New Jersey (1998) Chapters 6, 8 & 9, (pages 153-210,309-354, and 355-428, respectively.
140	VERSTREKEN et al., "An Image-Guided Planning System for Endosseous Oral Implants," IEEE Trans. Med. Imaging, 17(5):842-852 (October 1998).
149	YAMAMOTO et al., "Optical Measurement of Dental Cast Profile and Application to Analysis of Three-Dimensional Tooth Movement in Orthodontics," Front. Med. Biol. Eng., 1(2):119-130 (1988).
150	YAMAMOTO et al., "Three-Dimensional Measurement of Dental Cast Profiles and Its Applications to Orthodontics," Conf. Proc. IEEE Eng. Med. Biol. Soc., 12(5):2051-2053 (1990).
151	YAMANY et al., "A System for Human Jaw Modeling Using Intra-Oral Images," Proc. of the 20th Annual Conf. of the IEEE Engineering in Medicine and Biology Society, November 1, 1998, Vol. 2, pp. 563-566.

In view of the above, Applicant respectfully submits that the requirement under 37 CFR § 1.105, issued in the Office Action regarding the IDS filed on 2/28/2019, has been fulfilled.

Claim Rejections – 35 USC § 112

Claims 16-30 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. § 112 (pre-AIA), second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the Applicant regards as the invention.

Applicant has amended claims 16 and 23 as helpfully suggested by the Examiner.

Accordingly, for the reasons set forth above, withdrawal of the rejection of claims 16-30 under 35 U.S.C. § 112 is respectfully requested.

Claim Rejections – 35 USC § 103

Claims 1, 4-9, 11-16, 18-27, and 29-30 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Paley et al. (U.S. Pub. No. 2007/0172112, hereinafter "Paley") in view of Rubbert et al. (U.S. Pub. No. 2002/0006217, hereinafter "Rubbert") and Kriveshko (U.S. Pub. No. 2007/0236494, hereinafter "Kriveshko").

Without conceding the merits of the rejection and solely to expedite prosecution, Applicant has amended claim 1 to recite, in part, "receive second 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner, the second 3D intraoral scan data including surface data of a physically changed portion of the patient's intra-oral cavity; replace at least a portion of the removed surface portion of the first 3D surface model with at least a surface portion of a second 3D surface model including the physically changed portion."

Similarly claim 9 has been amended to recite, in part, "receive second 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner, the second 3D intraoral scan data including surface data of a physically changed portion of the patient's intra-oral cavity."

Similarly claim 16 has been amended to recite, in part, "receive second 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner, the second 3D intraoral scan data including surface data of a physically changed portion of the patient's intra-oral cavity."

Similarly claim 23 has been amended to recite, in part, "receiving second 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner, the second 3D intraoral scan data including surface data of a physically changed portion of the patient's intra-oral cavity."

As agreed during the interview, amending the claims to include subject matter directed to the second scan including a data representing a physically changed structure would overcome the current rejection and the art, subject to review of the submitted claim amendments. As indicated, above, Applicant has amended the claims to include such subject matter. Applicant respectfully submits that claims 1, 9, 16, and 23 are allowable over the Paley in view of Rubbert and Kriveshko.

Claims 4-8, 11-15, 18-22, 24-27, and 29-30 depend from one of allowable claims 1, 9, 16, and 23, respectively, and are therefore allowable at least for their dependence on one of claims 1, 9, 16, and 23, and on their own merits.

Accordingly, for the reasons set forth above, withdrawal of the rejection of claims 1, 4-9, 11-16, 18-27, and 29-30 under 35 U.S.C. § 103(a) is respectfully requested.

Claims 2, 3, 10, and 17 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Paley, in view of Rubbert and Kriveshko, and further in view of Hart et al. (U.S. Pub. No. 2004/0155975, hereinafter "Hart").

Claims 2, 3, 10, and 17 are allowable over Paley, Rubbert, and Kriveshko for at least the same reasons as discussed above with respect to the rejection of independent claims 1, 9, and 16. Hart cited for purportedly teaching light focusing optics and translation mechanisms does not cure the deficiencies of Paley, Rubbert, and Kriveshko, as described above. Accordingly, claims 2, 3, 10, and 17 are allowable over Paley, Rubbert, Kriveshko, and Hart.

Accordingly, for the reasons set forth above, withdrawal of the rejection of claims 2, 3, 10, and 17 under 35 U.S.C. § 103(a) is respectfully requested.

Claim 28 is rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Paley, in view of Rubbert and Kriveshko, and further in view of Babayoff (U.S. Pub. No. 2005/0283065, hereinafter "Babayoff").

Claim 28 depends from allowable claim 23 and is therefore allowable at least for its dependence on claim 23, and on its own merits.

Claim 28 is allowable over Paley, Rubbert, and Kriveshko for at least the same reasons as discussed above, with respect to the rejection of independent claim 23. Babayoff cited for

purportedly teaching a preparation having a finish line does not cure the deficiencies of Paley, Rubbert, and Kriveshko, as described above. Accordingly, claim 28 is allowable over Paley, Rubbert, Kriveshko, and Babayoff.

Accordingly, for the reasons set forth above, withdrawal of the rejection of claim 28 under 35 U.S.C. § 103(a) is respectfully requested.

CONCLUSION

In view of the foregoing, Applicant believes all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

Further, the Commissioner is hereby authorized to charge any additional fees or credit any overpayment in connection with this paper to Deposit Account No. 23-2415.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 206-883-2500.

Respectfully submitted,

Dated: August 19, 2019

/Charles Hagadorn, III/

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16/176,474	10/31/2018	Avi Kopelman	22773-822.302	3191

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WSGR / Align Technology , Inc.
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EXAMINER	
MAPAR, BIJAN	

ART UNIT	PAPER NUMBER
2128	

NOTIFICATION DATE	DELIVERY MODE
05/17/2019	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patentdocket@wsgr.com

Office Action Summary	Application No. 16/176,474	Applicant(s) Kopelman, Avi	
	Examiner BIJAN MAPAR	Art Unit 2128	AIA (FITF) Status Yes

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☑ Responsive to communication(s) filed on 2/28/2019.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL.** 2b) ☑ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5) ☑ Claim(s) 1-30 is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6) ☐ Claim(s) _____ is/are allowed.

7) ☑ Claim(s) 1-30 is/are rejected.

8) ☐ Claim(s) _____ is/are objected to.

9) ☐ Claim(s) _____ are subject to restriction and/or election requirement

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☑ The drawing(s) filed on 10/31/2018 is/are: a)☑ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☑ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date 2/28/2019.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

The present application, filed on or after March 16, 2013, is being examined under the first inventor to file provisions of the AIA.

Information Disclosure Statement

Applicant and the assignee of this application are required under 37 CFR 1.105 to provide the following information that the examiner has determined is reasonably necessary to the examination of this application.

In the IDS filed on 2/28/2019, applicants submitted 31 pages of citations. In total, the IDS cited approximately 364 references. The extraordinary large number of references pose a serious burden on the Office.

The instant claims are drawn to an apparatus [and/or method and/or medium] including scanning dentition, identifying areas of the scan that should be removed, retained, or replaced, and then providing an additional scan that is integrated with the first scan to accomplish the removal, retaining, or replacement of the identified areas.

The IDS contains numerous references which do not appear to be related to or material to the examination of the claimed subject matter of the instant application.

The following references discuss mechanical facets of dental operations, or of jaw wire procedures, and are wholly or mostly irrelevant: US 20030232302 A1, US 20030224311 A1, US 20030215764 A1, US 5683243 A, US 7536234 B2, US 7476100 B2, US 7347686 B2, US 6554611 B2, US 6705863 B2.

One of the following information is required to consider any reference cited by the applicant in the IDS filed on 2/28/2019:

A) Applicants are specifically required to point out which reference or references cited in the IDS filed on 2/28/2019 disclose either the selection of dentition scan areas to be removed, retained or replaced, or the integration of multiple dentition scans into one unified computer model.

B) Applicants are specifically required to point out which reference or references cited in the IDS filed on 2/28/2019 are most relevant to the examination of the claims of the instant application.

This requirement is an attachment of the enclosed Office action. A complete reply to the enclosed Office action must include a complete reply to this requirement. The time period for reply to this requirement coincides with the time period for reply to the enclosed Office action.

Claim Rejections - 35 USC § 112

The following is a quotation of 35 U.S.C. 112(b):
(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 16-30 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

Claim 16 recites the limitation "replacing at least a portion of the first 3D surface model not to be retained according to the user input ". There is insufficient antecedent basis for this limitation in the claim, as the user input has previously been described in the claim as “defining a surface portion of the first 3D surface model to be retained”, as opposed to input for a portion “not to be retained”. One of the two phrases should be amended to match the other such that both either recite “to be retained” or alternatively “not to be retained”.

The dependent claims of claim 16 inherit this issue and do not correct it.

Claim 23 recites the limitation " receiving first 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner;". There is insufficient antecedent basis for this limitation in the claim, as no hand-held intraoral scanner is previously recited. It seems likely that limitations equivalent to those recited at the beginning of the other independent claims (e.g. "a hand-held intraoral scanner;") were intended to be present here, but are inadvertently not recited. Correction is required.

The dependent claims of claim 23 inherit this issue and do not correct it.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 4-9, 11-16, 18-27 and 29-30 are rejected under 35 U.S.C. 103 as being unpatentable over Paley (US 2007/0172112 A1) in view of Rubbert (US 2002/0006217 A1) and Kriveshko (US 2007/0236494 A1).

Regarding claim 1:

Paley teaches:

a hand-held intraoral scanner; and (¶30 More particularly, the scanner may be shaped and sized for intraoral scanning and data capture, such as by insertion into a mouth of an imaging subject and passing the imaging plane 106 over one or more intraoral structures at a suitable distance to acquire surface data from teeth, gums, and so forth.)

a computer readable medium including instructions that when executed by a computer system, causes the computer system to: (¶34 The computer 108 may be, for example, a personal computer or other processing device. In one embodiment, the computer 108 includes a personal computer … hard drive)

receive first 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner; (¶28 the system 100 may include a scanner 102 that captures images of a subject 104 within an image plane 106, and forwards the images to a computer 108, which may include a display 110 and one or more user input devices such as a mouse 112 or a keyboard 114; ¶29 each two-dimensional image set may be transmitted to an external processor such as contained in the computer 108 described below.)

display, to a display, a first 3D surface model of the patient's teeth, (¶54 FIG. 4 depicts a view of a user interface for an image capture system during an acquisition of three-dimensional data … As depicted, the video image may include a plurality of teeth 410 and other intraoral structures visible during an intraoral scan.; ¶58 FIG. 5 depicts a view of a user interface for an image capture system during an evaluation. The window 500 may include a two-dimensionally rendered perspective view 502 of a stored digital surface representation)

wherein the first 3D surface model of the patient's teeth is based on the received first 3D intraoral scan data of the patient's teeth; (¶28 the system 100 may include a scanner 102 that captures images of a subject 104 within an image plane 106, and forwards the images to a computer 108, which may include a display 110)

receive user input defining a surface portion of the first 3D surface model to be removed; (¶60 One user control (not shown) may permit a user to return to data acquisition, e.g., the scanning mode of FIG. 4, to acquire additional data where a void or deviation is detected (either automatically or through human visual inspection). This control, or another control, may permit a user to select a specific point on

the surface of the digital model (or the scan subject, although the distinction becomes trivial for highly detailed and accurate digital models) where the continuous scan is to be reacquired from the subject)

after removing the surface portion of the first 3D surface model, receive second 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner; (¶38 In a related landing mode, a user may attempt to initiate a new scan registered or connected to an existing three-dimensional model. Similar visual feedback tools may be provided to guide a user to an appropriate scan location, and notify a user when the scan has been reacquired; ¶60 may permit a user to select a specific point on the surface of the digital model (or the scan subject, although the distinction becomes trivial for highly detailed and accurate digital models) where the continuous scan is to be reacquired from the subject)

Paley does not teach in particular:

after receiving the user input, remove, from the displayed first 3D surface model, the surface portion of the first 3D surface model to be removed according to the user input;

replace at least a portion of the removed surface portion of the first 3D surface model with at least a surface portion of a second 3D surface model based on the received second 3D intraoral scan data of the patient's teeth to produce a composite 3D surface model of the patient's teeth that is based on the first 3D intraoral scan data and the second 3D intraoral scan data; and

output, to the display, the composite 3D surface model of the patient's teeth.

Rubbert teaches:

after receiving the user input, remove, from the displayed first 3D surface model, the surface portion of the first 3D surface model to be removed according to the user input; (¶324 We address the first problem by providing an erase mode on the workstation software that is performing the modeling process. In this mode, the user is provided with a tool that erases triangle surfaces from the 3-D data, e.g., by highlighting unwanted areas with a mouse and clicking an erase icon or other similar technique. As each tooth is modeled individually, parts of the data that represent the unwanted data, e.g., data

belonging to other teeth or gingival tissue, are eliminated from the tooth; ¶325-326; examiner notes that Rubbert further discloses user input to define regions to be removed and regions to be kept in ¶326, e.g. "The planes serve as boundaries for the selection of tooth scan data as an individual virtual tooth object, or as part of the iterative procedure of FIG. 58. All 3-D data that is outside of the planes 1000 and 1002 is ignored.")

It would have been obvious to one of ordinary skill in the art to apply the data editing and filtering tools of Rubbert to the scanning system of Paley, in order to address the problem of spurious data by enabling it to be removed (Rubbert ¶323-324).

Kriveshko teaches:

replace at least a portion of the removed surface portion of the first 3D surface model with at least a surface portion of a second 3D surface model based on the received second 3D intraoral scan data of the patient's teeth to produce a composite 3D surface model of the patient's teeth that is based on the first 3D intraoral scan data and the second 3D intraoral scan data; and (¶11 the method may enter a landing mode which may include superimposing a current two-dimensional image of the subject onto a previous two-dimensional image of the subject in the display, the current two-dimensional image representing a view of the subject from a position from which the image set was acquired, and the previous two-dimensional image representing a view of the subject from which at least a portion of the three-dimensional surface data was acquired; acquiring at least one subsequent three-dimensional image; fitting the at least one subsequent three-dimensional image to a second three-dimensional surface reconstruction; and test fitting the at least one subsequent three-dimensional image to the three-dimensional surface data. When the image set can be fitted to the three-dimensional surface data, the method superimposes the three-dimensional surface data and the next three-dimensional image onto a two-dimensional image of the subject in a display and adds the second three-dimensional surface reconstruction to the three-dimensional surface data.)

output, to the display, the composite 3D surface model of the patient's teeth. (¶11 superimposes the three-dimensional surface data and the next three-dimensional image onto a two-dimensional image of the subject in a display and adds the second three-dimensional surface reconstruction to the three-dimensional surface data.)

It would have been obvious to one of ordinary skill in the art to use the landing mode of Kriveshko when implementing the system of Paley as modified by Rubbert, because Paley explicitly discloses a landing mode, and notes that the landing mode disclosed in Kriveshko is how this should be implemented (Paley, ¶60).

Regarding claim 4:

Paley does not teach in particular:

wherein the portion of the removed portion of the first 3D surface model is replaced with at least the portion of the second 3D surface model by registering the second 3D surface model with the first 3D surface model.

Kriveshko teaches:

wherein the portion of the removed portion of the first 3D surface model is replaced with at least the portion of the second 3D surface model by registering the second 3D surface model with the first 3D surface model. (¶59 a user may attempt to initiate a new scan registered or connected to an existing three-dimensional model; ¶70 any suitable technique for registering new three-dimensional data to existing three-dimensional data may be usefully employed in step 216; ¶74 all of the three-dimensional data acquired during the recover mode may be immediately registered to the original three-dimensional model; ¶86 the entire new three-dimensional model, or a selected portion thereof, may be registered to the original three-dimensional model using a transformation based upon the successfully fitted frames or three-dimensional images.)

It would have been obvious to one of ordinary skill in the art to use the landing mode of Kriveshko when implementing the system of Paley as modified by Rubbert, because Paley explicitly discloses a landing mode, and notes that the landing mode disclosed in Kriveshko is how this should be implemented (Paley, ¶60).

Regarding claim 5:

Paley does not teach in particular:

wherein the second 3D surface model is registered with the first 3D surface model by aligning identifying surface data of the second 3D surface model with corresponding parts of the first 3D surface model.

Kriveshko teaches:

wherein the second 3D surface model is registered with the first 3D surface model by aligning identifying surface data of the second 3D surface model with corresponding parts of the first 3D surface model. (¶83-85; ¶86 When a successful test fit is made to the original (acquisition mode) three-dimensional model, the entire new three-dimensional model, or a selected portion thereof, may be registered to the original three-dimensional model using a transformation based upon the successfully fitted frames or three-dimensional images.)

It would have been obvious to one of ordinary skill in the art to use the landing mode of Kriveshko when implementing the system of Paley as modified by Rubbert, because Paley explicitly discloses a landing mode, and notes that the landing mode disclosed in Kriveshko is how this should be implemented (Paley, ¶60).

Regarding claim 6:

Paley does not teach in particular:

wherein the portion of the removed portion of the first 3D surface model is replaced with at least the portion of the second 3D surface model by further stitching the portion of the second 3D surface model with the first 3D surface model.

Kriveshko teaches:

wherein the portion of the removed portion of the first 3D surface model is replaced with at least the portion of the second 3D surface model by further stitching the portion of the second 3D surface model with the first 3D surface model. (¶66 the incremental three-dimensional image data may be fitted or stitched to the existing three-dimensional model. In one embodiment, this process is performed by deriving scanner motion between positions or points of view for successive image captures; ¶74 In the stitch recover mode 226 the process 200 may attempt to reacquire or resume a scan by test fitting each newly acquired data set to some portion of the three-dimensional model. During this phase, the process may optionally begin assembling a new three-dimensional model from sequential, incremental three-dimensional data sets. In this manner, once the original scan is reacquired with a successful fit to the original three-dimensional model, all of the three-dimensional data acquired during the recover mode may be immediately registered to the original three-dimensional model.)

It would have been obvious to one of ordinary skill in the art to use the landing mode of Kriveshko when implementing the system of Paley as modified by Rubbert, because Paley explicitly discloses a landing mode, and notes that the landing mode disclosed in Kriveshko is how this should be implemented (Paley, ¶60).

Regarding claim 7:

Paley does not teach in particular:

wherein the portion of the removed portion of the first 3D surface model is replaced with at least the portion of the second 3D surface model by further discarding a remainder of the second 3D

surface model, including the identifying surface data, after stitching the portion of the second 3D surface model with the first 3D surface model.

Rubbert teaches:

wherein the portion of the removed portion of the first 3D surface model is replaced with at least the portion of the second 3D surface model by further discarding a remainder of the second 3D surface model, including the identifying surface data, after stitching the portion of the second 3D surface model with the first 3D surface model. (¶92 FIG. 45 illustrates the parameter R, which is used in the frame registration process to discard or filter out points which are greater than a distance R from the triangle surfaces; ¶270 The purpose of the range variable R is to screen out stray data points far from the triangle surface of the previous frame; ¶300 The maximum triangle size is a filter to filter out triangle sizes where the size of the triangle is too large, indicating a stray data point; ¶318; ¶326 The planes serve as boundaries for the selection of tooth scan data as an individual virtual tooth object, or as part of the iterative procedure of FIG. 58. All 3-D data that is outside of the planes 1000 and 1002 is ignored.)

It would have been obvious to one of ordinary skill in the art to apply the data editing and filtering tools of Rubbert to the scanning system of Paley, in order to address the problem of spurious data by enabling it to be removed (Rubbert ¶323-324).

Regarding claim 8:

Paley does not teach in particular:

mark, on the displayed first 3D surface model, the user input defined surface portion, after receiving the user input and before removing the surface portion.

Kriveshko teaches:

mark, on the displayed first 3D surface model, the user input defined surface portion, after receiving the user input and before removing the surface portion. (¶12 the method may include highlighting a region on the subject for attempting a landing. The highlighted region may include a portion of the three-dimensional surface data.)

It would have been obvious to one of ordinary skill in the art to use the landing mode of Kriveshko when implementing the system of Paley as modified by Rubbert, because Paley explicitly discloses a landing mode, and notes that the landing mode disclosed in Kriveshko is how this should be implemented (Paley, ¶60).

Regarding claim 9:

Paley teaches:

a hand-held intraoral scanner; (¶30 More particularly, the scanner may be shaped and sized for intraoral scanning and data capture, such as by insertion into a mouth of an imaging subject and passing the imaging plane 106 over one or more intraoral structures at a suitable distance to acquire surface data from teeth, gums, and so forth.)

a computer readable medium including instructions that when executed by a computer system, causes the computer system to: (¶34 The computer 108 may be, for example, a personal computer or other processing device. In one embodiment, the computer 108 includes a personal computer … hard drive)

receive first 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner; (¶28 the system 100 may include a scanner 102 that captures images of a subject 104 within an image plane 106, and forwards the images to a computer 108, which may include a display 110 and one or more user input devices such as a mouse 112 or a keyboard 114; ¶29 each two-dimensional image set may be transmitted to an external processor such as contained in the computer 108 described below.)

display, to the display, a first 3D surface model of the patient's teeth, (¶54 FIG. 4 depicts a view of a user interface for an image capture system during an acquisition of three-dimensional data … As depicted, the video image may include a plurality of teeth 410 and other intraoral structures visible during an intraoral scan.; ¶58 FIG. 5 depicts a view of a user interface for an image capture system during an evaluation. The window 500 may include a two-dimensionally rendered perspective view 502 of a stored digital surface representation)

wherein the first 3D surface model of the patient's teeth is based on the received first 3D intraoral scan data of the patient's teeth; (¶28 the system 100 may include a scanner 102 that captures images of a subject 104 within an image plane 106, and forwards the images to a computer 108, which may include a display 110)

receive user input via the displayed first 3D surface model demarcating [[...]] a surface portion of the first 3D surface model to be replaced; (¶60 One user control (not shown) may permit a user to return to data acquisition, e.g., the scanning mode of FIG. 4, to acquire additional data where a void or deviation is detected (either automatically or through human visual inspection). This control, or another control, may permit a user to select a specific point on the surface of the digital model (or the scan subject, although the distinction becomes trivial for highly detailed and accurate digital models) where the continuous scan is to be reacquired from the subject)

after receiving the user input, receive second 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner; (¶38 In a related landing mode, a user may attempt to initiate a new scan registered or connected to an existing three-dimensional model. Similar visual feedback tools may be provided to guide a user to an appropriate scan location, and notify a user when the scan has been reacquired; ¶60 may permit a user to select a specific point on the surface of the digital model (or the scan subject, although the distinction becomes trivial for highly detailed and accurate digital models) where the continuous scan is to be reacquired from the subject)

Paley does not teach in particular:

receive user input via the displayed first 3D surface model demarcating a surface portion of the first 3D surface model to be retained and a surface portion of the first 3D surface model to be replaced;

replacing at least a portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least a surface portion of a second 3D surface model based on the received second 3D intraoral scan data of the patient's teeth while retaining the surface portion of the first 3D surface model to be retained according to the user input to produce a composite 3D surface model of the patient's teeth that is based on the first 3D intraoral scan data and the second 3D intraoral scan data; and

output, to the display, the composite 3D surface model of the patient's teeth.

Rubbert teaches:

receive user input via the displayed first 3D surface model demarcating a surface portion of the first 3D surface model to be retained and a surface portion of the first 3D surface model to be replaced; (¶324-326; ¶326, The planes serve as boundaries for the selection of tooth scan data as an individual virtual tooth object, or as part of the iterative procedure of FIG. 58. All 3-D data that is outside of the planes 1000 and 1002 is ignored.)

It would have been obvious to one of ordinary skill in the art to apply the data editing and filtering tools of Rubbert to the scanning system of Paley, in order to address the problem of spurious data by enabling it to be removed (Rubbert ¶323-324).

Kriveshko teaches:

replacing at least a portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least a surface portion of a second 3D surface model based on the received second 3D intraoral scan data of the patient's teeth while retaining the surface portion of the first 3D surface model to be retained according to the user input to produce a composite 3D surface

model of the patient's teeth that is based on the first 3D intraoral scan data and the second 3D intraoral scan data; and (¶11 the method may enter a landing mode which may include superimposing a current two-dimensional image of the subject onto a previous two-dimensional image of the subject in the display, the current two-dimensional image representing a view of the subject from a position from which the image set was acquired, and the previous two-dimensional image representing a view of the subject from which at least a portion of the three-dimensional surface data was acquired; acquiring at least one subsequent three-dimensional image; fitting the at least one subsequent three-dimensional image to a second three-dimensional surface reconstruction; and test fitting the at least one subsequent three-dimensional image to the three-dimensional surface data. When the image set can be fitted to the three-dimensional surface data, the method superimposes the three-dimensional surface data and the next three-dimensional image onto a two-dimensional image of the subject in a display and adds the second three-dimensional surface reconstruction to the three-dimensional surface data.)

output, to the display, the composite 3D surface model of the patient's teeth. (¶11 superimposes the three-dimensional surface data and the next three-dimensional image onto a two-dimensional image of the subject in a display and adds the second three-dimensional surface reconstruction to the three-dimensional surface data.)

It would have been obvious to one of ordinary skill in the art to use the landing mode of Kriveshko when implementing the system of Paley as modified by Rubbert, because Paley explicitly discloses a landing mode, and notes that the landing mode disclosed in Kriveshko is how this should be implemented (Paley, ¶60).

Regarding claim 11:

Paley does not teach in particular:

remove, from the displayed first 3D surface model, the surface portion to be replaced according to the user input demarcating the surface portion of the first 3D surface model to be retained and the surface portion of the first 3D surface model to be replaced.

Rubbert teaches:

remove, from the displayed first 3D surface model, the surface portion to be replaced according to the user input demarcating the surface portion of the first 3D surface model to be retained and the surface portion of the first 3D surface model to be replaced. (¶324-326; ¶326, The planes serve as boundaries for the selection of tooth scan data as an individual virtual tooth object, or as part of the iterative procedure of FIG. 58. All 3-D data that is outside of the planes 1000 and 1002 is ignored.)

It would have been obvious to one of ordinary skill in the art to apply the data editing and filtering tools of Rubbert to the scanning system of Paley, in order to address the problem of spurious data by enabling it to be removed (Rubbert ¶323-324).

Regarding claim 12:

Paley does not teach in particular:

mark, on the displayed first 3D surface model, the user input defined surface portion to be replaced, after receiving the user input and before removing the surface portion to be replaced.

Kriveshko teaches:

mark, on the displayed first 3D surface model, the user input defined surface portion to be replaced, after receiving the user input and before removing the surface portion to be replaced. (¶12 the method may include highlighting a region on the subject for attempting a landing. The highlighted region may include a portion of the three-dimensional surface data.)

It would have been obvious to one of ordinary skill in the art to use the landing mode of Kriveshko when implementing the system of Paley as modified by Rubbert, because Paley explicitly

discloses a landing mode, and notes that the landing mode disclosed in Kriveshko is how this should be implemented (Paley, ¶60).

Regarding claim 13:

Paley does not teach in particular:

wherein the portion of the surface portion of the first 3D surface model to be replaced is replaced with at least the portion of the second 3D surface model by registering the second 3D surface model with the first 3D surface model by aligning identifying surface data of the second 3D surface model with corresponding parts of the first 3D surface model.

Kriveshko teaches:

wherein the portion of the surface portion of the first 3D surface model to be replaced is replaced with at least the portion of the second 3D surface model by registering the second 3D surface model with the first 3D surface model by aligning identifying surface data of the second 3D surface model with corresponding parts of the first 3D surface model. (¶59 a user may attempt to initiate a new scan registered or connected to an existing three-dimensional model; ¶70 any suitable technique for registering new three-dimensional data to existing three-dimensional data may be usefully employed in step 216; ¶74 all of the three-dimensional data acquired during the recover mode may be immediately registered to the original three-dimensional model; ¶83-85; ¶86 When a successful test fit is made to the original (acquisition mode) three-dimensional model, the entire new three-dimensional model, or a selected portion thereof, may be registered to the original three-dimensional model using a transformation based upon the successfully fitted frames or three-dimensional images.)

It would have been obvious to one of ordinary skill in the art to use the landing mode of Kriveshko when implementing the system of Paley as modified by Rubbert, because Paley explicitly

discloses a landing mode, and notes that the landing mode disclosed in Kriveshko is how this should be implemented (Paley, ¶60).

Regarding claim 14:

Paley does not teach in particular:

wherein the portion of the portion of the first 3D surface model to be replaced is replaced with at least the portion of the second 3D surface model by further stitching the portion of the second 3D surface model with the first 3D surface model.

Kriveshko teaches:

wherein the portion of the portion of the first 3D surface model to be replaced is replaced with at least the portion of the second 3D surface model by further stitching the portion of the second 3D surface model with the first 3D surface model. (¶66 the incremental three-dimensional image data may be fitted or stitched to the existing three-dimensional model. In one embodiment, this process is performed by deriving scanner motion between positions or points of view for successive image captures; ¶74 In the stitch recover mode 226 the process 200 may attempt to reacquire or resume a scan by test fitting each newly acquired data set to some portion of the three-dimensional model. During this phase, the process may optionally begin assembling a new three-dimensional model from sequential, incremental three-dimensional data sets. In this manner, once the original scan is reacquired with a successful fit to the original three-dimensional model, all of the three-dimensional data acquired during the recover mode may be immediately registered to the original three-dimensional model.)

It would have been obvious to one of ordinary skill in the art to use the landing mode of Kriveshko when implementing the system of Paley as modified by Rubbert, because Paley explicitly discloses a landing mode, and notes that the landing mode disclosed in Kriveshko is how this should be implemented (Paley, ¶60).

Regarding claim 15:

Paley does not teach in particular:

wherein the portion of the surface portion of the first 3D surface model to be replaced is replaced with at least the portion of the second 3D surface model by further discarding a remainder of the second 3D surface model, including the identifying surface data, after stitching the portion of the second 3D surface model with the first 3D surface model.

Rubbert teaches:

wherein the portion of the surface portion of the first 3D surface model to be replaced is replaced with at least the portion of the second 3D surface model by further discarding a remainder of the second 3D surface model, including the identifying surface data, after stitching the portion of the second 3D surface model with the first 3D surface model. (¶92 FIG. 45 illustrates the parameter R, which is used in the frame registration process to discard or filter out points which are greater than a distance R from the triangle surfaces; ¶270 The purpose of the range variable R is to screen out stray data points far from the triangle surface of the previous frame; ¶300 The maximum triangle size is a filter to filter out triangle sizes where the size of the triangle is too large, indicating a stray data point; ¶318; ¶326 The planes serve as boundaries for the selection of tooth scan data as an individual virtual tooth object, or as part of the iterative procedure of FIG. 58. All 3-D data that is outside of the planes 1000 and 1002 is ignored.)

It would have been obvious to one of ordinary skill in the art to apply the data editing and filtering tools of Rubbert to the scanning system of Paley, in order to address the problem of spurious data by enabling it to be removed (Rubbert ¶323-324).

Regarding claim 16:

Paley teaches:

a hand-held intraoral scanner; (¶30 More particularly, the scanner may be shaped and sized for intraoral scanning and data capture, such as by insertion into a mouth of an imaging subject and passing the imaging plane 106 over one or more intraoral structures at a suitable distance to acquire surface data from teeth, gums, and so forth.)

a display; and a computer system operatively coupled with the display and the hand-held intraoral scanner, the computer system configured to: (¶34 The computer 108 may be, for example, a personal computer or other processing device. In one embodiment, the computer 108 includes a personal computer … display 110)

receive first 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner; (¶28 the system 100 may include a scanner 102 that captures images of a subject 104 within an image plane 106, and forwards the images to a computer 108, which may include a display 110 and one or more user input devices such as a mouse 112 or a keyboard 114; ¶29 each two-dimensional image set may be transmitted to an external processor such as contained in the computer 108 described below.)

display, to the display, a first 3D surface model of the patient's teeth, (¶54 FIG. 4 depicts a view of a user interface for an image capture system during an acquisition of three-dimensional data … As depicted, the video image may include a plurality of teeth 410 and other intraoral structures visible during an intraoral scan.; ¶58 FIG. 5 depicts a view of a user interface for an image capture system during an evaluation. The window 500 may include a two-dimensionally rendered perspective view 502 of a stored digital surface representation)

wherein the first 3D surface model of the patient's teeth is based on the received first 3D intraoral scan data of the patient's teeth; (¶28 the system 100 may include a scanner 102 that captures images of a subject 104 within an image plane 106, and forwards the images to a computer 108, which may include a display 110)

after receiving the user input, receive second 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner; (¶38 In a related landing mode, a user may attempt to initiate a new scan registered or connected to an existing three-dimensional model. Similar visual feedback tools may be provided to guide a user to an appropriate scan location, and notify a user when the scan has been reacquired; ¶60 may permit a user to select a specific point on the surface of the digital model (or the scan subject, although the distinction becomes trivial for highly detailed and accurate digital models) where the continuous scan is to be reacquired from the subject)

Paley does not teach in particular:

receive user input via the displayed first 3D surface model at least defining a surface portion of the first 3D surface model to be retained;

replacing at least a portion of the first 3D surface model not to be retained according to the user input with at least a surface portion of a second 3D surface model based on the received second 3D intraoral scan data of the patient's teeth to produce a composite 3D surface model of the patient's teeth that is based on the first 3D intraoral scan data and the second 3D intraoral scan data; and

output, to the display, the composite 3D surface model of the patient's teeth.

Rubbert teaches:

receive user input via the displayed first 3D surface model at least defining a surface portion of the first 3D surface model to be retained; (¶324-326; ¶326, The planes serve as boundaries for the selection of tooth scan data as an individual virtual tooth object, or as part of the iterative procedure of FIG. 58. All 3-D data that is outside of the planes 1000 and 1002 is ignored; see also Paley ¶60)

It would have been obvious to one of ordinary skill in the art to apply the data editing and filtering tools of Rubbert to the scanning system of Paley, in order to address the problem of spurious data by enabling it to be removed (Rubbert ¶323-324).

Kriveshko teaches:

replacing at least a portion of the first 3D surface model not to be retained according to the user input with at least a surface portion of a second 3D surface model based on the received second 3D intraoral scan data of the patient's teeth to produce a composite 3D surface model of the patient's teeth that is based on the first 3D intraoral scan data and the second 3D intraoral scan data; and (¶11 the method may enter a landing mode which may include superimposing a current two-dimensional image of the subject onto a previous two-dimensional image of the subject in the display, the current two-dimensional image representing a view of the subject from a position from which the image set was acquired, and the previous two-dimensional image representing a view of the subject from which at least a portion of the three-dimensional surface data was acquired; acquiring at least one subsequent three-dimensional image; fitting the at least one subsequent three-dimensional image to a second three-dimensional surface reconstruction; and test fitting the at least one subsequent three-dimensional image to the three-dimensional surface data. When the image set can be fitted to the three-dimensional surface data, the method superimposes the three-dimensional surface data and the next three-dimensional image onto a two-dimensional image of the subject in a display and adds the second three-dimensional surface reconstruction to the three-dimensional surface data.)

output, to the display, the composite 3D surface model of the patient's teeth. (¶11 superimposes the three-dimensional surface data and the next three-dimensional image onto a two-dimensional image of the subject in a display and adds the second three-dimensional surface reconstruction to the three-dimensional surface data.)

It would have been obvious to one of ordinary skill in the art to use the landing mode of Kriveshko when implementing the system of Paley as modified by Rubbert, because Paley explicitly discloses a landing mode, and notes that the landing mode disclosed in Kriveshko is how this should be implemented (Paley, ¶60).

Regarding claim 18:

Paley teaches:

wherein the received user input also defines a surface portion of the first 3D surface model to be replaced by the second 3D surface model. (¶60 One user control (not shown) may permit a user to return to data acquisition, e.g., the scanning mode of FIG. 4, to acquire additional data where a void or deviation is detected (either automatically or through human visual inspection). This control, or another control, may permit a user to select a specific point on the surface of the digital model (or the scan subject, although the distinction becomes trivial for highly detailed and accurate digital models) where the continuous scan is to be reacquired from the subject)

Regarding claim 19:

Paley does not teach in particular:

remove, from the displayed first 3D surface model, the surface portion to be replaced according to the user input defining the surface portion of the first 3D surface model to be retained and the surface portion of the first 3D surface model to be replaced.

Rubbert teaches:

remove, from the displayed first 3D surface model, the surface portion to be replaced according to the user input defining the surface portion of the first 3D surface model to be retained and the surface portion of the first 3D surface model to be replaced. (¶324 We address the first problem by providing an erase mode on the workstation software that is performing the modeling process. In this mode, the user is provided with a tool that erases triangle surfaces from the 3-D data, e.g., by highlighting unwanted areas with a mouse and clicking an erase icon or other similar technique. As each tooth is modeled individually, parts of the data that represent the unwanted data, e.g., data belonging

to other teeth or gingival tissue, are eliminated from the tooth; ¶325-326; examiner notes that Rubbert further discloses user input to define regions to be removed and regions to be kept in ¶326, e.g. "The planes serve as boundaries for the selection of tooth scan data as an individual virtual tooth object, or as part of the iterative procedure of FIG. 58. All 3-D data that is outside of the planes 1000 and 1002 is ignored.")

It would have been obvious to one of ordinary skill in the art to apply the data editing and filtering tools of Rubbert to the scanning system of Paley, in order to address the problem of spurious data by enabling it to be removed (Rubbert ¶323-324).

Regarding claim 20:

Paley does not teach in particular:

wherein the portion of the first 3D surface model not to be retained according to the user input is replaced with at least the portion of the second 3D surface model by registering the second 3D surface model with the first 3D surface model by aligning identifying surface data of the second 3D surface model with corresponding parts of the first 3D surface model.

Kriveshko teaches:

wherein the portion of the first 3D surface model not to be retained according to the user input is replaced with at least the portion of the second 3D surface model by registering the second 3D surface model with the first 3D surface model by aligning identifying surface data of the second 3D surface model with corresponding parts of the first 3D surface model. (¶59 a user may attempt to initiate a new scan registered or connected to an existing three-dimensional model; ¶70 any suitable technique for registering new three-dimensional data to existing three-dimensional data may be usefully employed in step 216; ¶74 all of the three-dimensional data acquired during the recover mode may be immediately registered to the original three-dimensional model; ¶83-85; ¶86 When a successful test fit

is made to the original (acquisition mode) three-dimensional model, the entire new three-dimensional model, or a selected portion thereof, may be registered to the original three-dimensional model using a transformation based upon the successfully fitted frames or three-dimensional images.)

It would have been obvious to one of ordinary skill in the art to use the landing mode of Kriveshko when implementing the system of Paley as modified by Rubbert, because Paley explicitly discloses a landing mode, and notes that the landing mode disclosed in Kriveshko is how this should be implemented (Paley, ¶60).

Regarding claim 21:

Paley does not teach in particular:

wherein the portion of the surface portion of the first 3D surface model to be replaced is replaced with at least the surface portion of the second 3D surface model by further stitching the surface portion of the second 3D surface model with the first 3D surface model.

Kriveshko teaches:

wherein the portion of the surface portion of the first 3D surface model to be replaced is replaced with at least the surface portion of the second 3D surface model by further stitching the surface portion of the second 3D surface model with the first 3D surface model. (¶66 the incremental three-dimensional image data may be fitted or stitched to the existing three-dimensional model. In one embodiment, this process is performed by deriving scanner motion between positions or points of view for successive image captures; ¶74 In the stitch recover mode 226 the process 200 may attempt to reacquire or resume a scan by test fitting each newly acquired data set to some portion of the three-dimensional model. During this phase, the process may optionally begin assembling a new three-dimensional model from sequential, incremental three-dimensional data sets. In this manner, once the original scan is reacquired with a successful fit to the original three-dimensional model, all of the three-

dimensional data acquired during the recover mode may be immediately registered to the original three-dimensional model.)

It would have been obvious to one of ordinary skill in the art to use the landing mode of Kriveshko when implementing the system of Paley as modified by Rubbert, because Paley explicitly discloses a landing mode, and notes that the landing mode disclosed in Kriveshko is how this should be implemented (Paley, ¶60).

Regarding claim 22:

Paley does not teach in particular:

wherein the portion of the surface portion of the first 3D surface model to be replaced is replaced with at least the surface portion of the second 3D surface model by further discarding a remainder of the second 3D surface model, including the identifying surface data, after stitching the surface portion of the second 3D surface model with the first 3D surface model.

Rubbert teaches:

wherein the portion of the surface portion of the first 3D surface model to be replaced is replaced with at least the surface portion of the second 3D surface model by further discarding a remainder of the second 3D surface model, including the identifying surface data, after stitching the surface portion of the second 3D surface model with the first 3D surface model. (¶92 FIG. 45 illustrates the parameter R, which is used in the frame registration process to discard or filter out points which are greater than a distance R from the triangle surfaces; ¶270 The purpose of the range variable R is to screen out stray data points far from the triangle surface of the previous frame; ¶300 The maximum triangle size is a filter to filter out triangle sizes where the size of the triangle is too large, indicating a stray data point; ¶318; ¶326 The planes serve as boundaries for the selection of tooth scan data as an

individual virtual tooth object, or as part of the iterative procedure of FIG. 58. All 3-D data that is outside of the planes 1000 and 1002 is ignored.)

It would have been obvious to one of ordinary skill in the art to apply the data editing and filtering tools of Rubbert to the scanning system of Paley, in order to address the problem of spurious data by enabling it to be removed (Rubbert ¶323-324).

Regarding claim 23:

Paley teaches:

receiving first 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner; (¶30 More particularly, the scanner may be shaped and sized for intraoral scanning and data capture, such as by insertion into a mouth of an imaging subject and passing the imaging plane 106 over one or more intraoral structures at a suitable distance to acquire surface data from teeth, gums, and so forth.)

displaying, to a display, a first 3D surface model of the patient's teeth, (¶54 FIG. 4 depicts a view of a user interface for an image capture system during an acquisition of three-dimensional data … As depicted, the video image may include a plurality of teeth 410 and other intraoral structures visible during an intraoral scan.; ¶58 FIG. 5 depicts a view of a user interface for an image capture system during an evaluation. The window 500 may include a two-dimensionally rendered perspective view 502 of a stored digital surface representation)

wherein the first 3D surface model of the patient's teeth is based on the received first 3D intraoral scan data of the patient's teeth; (¶28 the system 100 may include a scanner 102 that captures images of a subject 104 within an image plane 106, and forwards the images to a computer 108, which may include a display 110)

receiving user input via the displayed first 3D surface model demarcating [[…]] a surface portion of the first 3D surface model to be replaced; (¶60 One user control (not shown) may permit a user to

return to data acquisition, e.g., the scanning mode of FIG. 4, to acquire additional data where a void or deviation is detected (either automatically or through human visual inspection). This control, or another control, may permit a user to select a specific point on the surface of the digital model (or the scan subject, although the distinction becomes trivial for highly detailed and accurate digital models) where the continuous scan is to be reacquired from the subject)

after receiving the user input, receiving second 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner; (¶38 In a related landing mode, a user may attempt to initiate a new scan registered or connected to an existing three-dimensional model. Similar visual feedback tools may be provided to guide a user to an appropriate scan location, and notify a user when the scan has been reacquired; ¶60 may permit a user to select a specific point on the surface of the digital model (or the scan subject, although the distinction becomes trivial for highly detailed and accurate digital models) where the continuous scan is to be reacquired from the subject)

Paley does not teach in particular:

receiving user input via the displayed first 3D surface model demarcating a surface portion of the first 3D surface model to be retained and a surface portion of the first 3D surface model to be replaced;

replacing at least a portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least a surface portion of a second 3D surface model based on the received second 3D intraoral scan data of the patient's teeth to produce a composite 3D surface model of the patient's teeth that is based on the first 3D intraoral scan data and the second 3D intraoral scan data; and

output, to the display, the composite 3D surface model of the patient's teeth.

Rubbert teaches:

receiving user input via the displayed first 3D surface model demarcating a surface portion of the first 3D surface model to be retained and a surface portion of the first 3D surface model to be replaced; (¶324-326; ¶326, The planes serve as boundaries for the selection of tooth scan data as an individual virtual tooth object, or as part of the iterative procedure of FIG. 58. All 3-D data that is outside of the planes 1000 and 1002 is ignored.)

It would have been obvious to one of ordinary skill in the art to apply the data editing and filtering tools of Rubbert to the scanning system of Paley, in order to address the problem of spurious data by enabling it to be removed (Rubbert ¶323-324).

Kriveshko teaches:

replacing at least a portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least a surface portion of a second 3D surface model based on the received second 3D intraoral scan data of the patient's teeth to produce a composite 3D surface model of the patient's teeth that is based on the first 3D intraoral scan data and the second 3D intraoral scan data; and (¶11 the method may enter a landing mode which may include superimposing a current two-dimensional image of the subject onto a previous two-dimensional image of the subject in the display, the current two-dimensional image representing a view of the subject from a position from which the image set was acquired, and the previous two-dimensional image representing a view of the subject from which at least a portion of the three-dimensional surface data was acquired; acquiring at least one subsequent three-dimensional image; fitting the at least one subsequent three-dimensional image to a second three-dimensional surface reconstruction; and test fitting the at least one subsequent three-dimensional image to the three-dimensional surface data. When the image set can be fitted to the three-dimensional surface data, the method superimposes the three-dimensional surface data and the next three-dimensional image onto a two-dimensional image of the subject in a display and adds the second three-dimensional surface reconstruction to the three-dimensional surface data.)

output, to the display, the composite 3D surface model of the patient's teeth. (¶11 superimposes the three-dimensional surface data and the next three-dimensional image onto a two-dimensional image of the subject in a display and adds the second three-dimensional surface reconstruction to the three-dimensional surface data.)

It would have been obvious to one of ordinary skill in the art to use the landing mode of Kriveshko when implementing the system of Paley as modified by Rubbert, because Paley explicitly discloses a landing mode, and notes that the landing mode disclosed in Kriveshko is how this should be implemented (Paley, ¶60).

Regarding claim 24:

Paley does not teach in particular:

further comprising marking an area, on the displayed first 3D surface model, associated with the received user input.

Kriveshko teaches:

further comprising marking an area, on the displayed first 3D surface model, associated with the received user input. (¶12 the method may include highlighting a region on the subject for attempting a landing. The highlighted region may include a portion of the three-dimensional surface data.)

It would have been obvious to one of ordinary skill in the art to use the landing mode of Kriveshko when implementing the system of Paley as modified by Rubbert, because Paley explicitly discloses a landing mode, and notes that the landing mode disclosed in Kriveshko is how this should be implemented (Paley, ¶60).

Regarding claim 25:

Paley does not teach in particular:

wherein replacing at least the portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least the surface portion of the second 3D surface model comprises registering the second 3D surface model with the first 3D surface model by aligning identifying surface data of the second 3D surface model with corresponding parts of the first 3D surface model.

Kriveshko teaches:

wherein replacing at least the portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least the surface portion of the second 3D surface model comprises registering the second 3D surface model with the first 3D surface model by aligning identifying surface data of the second 3D surface model with corresponding parts of the first 3D surface model. (¶59 a user may attempt to initiate a new scan registered or connected to an existing three-dimensional model; ¶70 any suitable technique for registering new three-dimensional data to existing three-dimensional data may be usefully employed in step 216; ¶74 all of the three-dimensional data acquired during the recover mode may be immediately registered to the original three-dimensional model; ¶83-85; ¶86 When a successful test fit is made to the original (acquisition mode) three-dimensional model, the entire new three-dimensional model, or a selected portion thereof, may be registered to the original three-dimensional model using a transformation based upon the successfully fitted frames or three-dimensional images.)

It would have been obvious to one of ordinary skill in the art to use the landing mode of Kriveshko when implementing the system of Paley as modified by Rubbert, because Paley explicitly discloses a landing mode, and notes that the landing mode disclosed in Kriveshko is how this should be implemented (Paley, ¶60).

Regarding claim 26:

Paley does not teach in particular:

wherein replacing at least the portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least the surface portion of the second 3D surface model further comprises stitching the surface portion of the second 3D surface model with the first 3D surface model.

Kriveshko teaches:

wherein replacing at least the portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least the surface portion of the second 3D surface model further comprises stitching the surface portion of the second 3D surface model with the first 3D surface model. (¶66 the incremental three-dimensional image data may be fitted or stitched to the existing three-dimensional model. In one embodiment, this process is performed by deriving scanner motion between positions or points of view for successive image captures; ¶74 In the stitch recover mode 226 the process 200 may attempt to reacquire or resume a scan by test fitting each newly acquired data set to some portion of the three-dimensional model. During this phase, the process may optionally begin assembling a new three-dimensional model from sequential, incremental three-dimensional data sets. In this manner, once the original scan is reacquired with a successful fit to the original three-dimensional model, all of the three-dimensional data acquired during the recover mode may be immediately registered to the original three-dimensional model.)

It would have been obvious to one of ordinary skill in the art to use the landing mode of Kriveshko when implementing the system of Paley as modified by Rubbert, because Paley explicitly discloses a landing mode, and notes that the landing mode disclosed in Kriveshko is how this should be implemented (Paley, ¶60).

Regarding claim 27:

Paley does not teach in particular:

wherein replacing at least the portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least the surface portion of the second 3D surface model further comprises discarding a remainder of the second 3D surface model, including the identifying surface data, after stitching the surface portion of the second 3D surface model with the first 3D surface model.

Rubbert teaches:

wherein replacing at least the portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least the surface portion of the second 3D surface model further comprises discarding a remainder of the second 3D surface model, including the identifying surface data, after stitching the surface portion of the second 3D surface model with the first 3D surface model. (¶92 FIG. 45 illustrates the parameter R, which is used in the frame registration process to discard or filter out points which are greater than a distance R from the triangle surfaces; ¶270 The purpose of the range variable R is to screen out stray data points far from the triangle surface of the previous frame; ¶300 The maximum triangle size is a filter to filter out triangle sizes where the size of the triangle is too large, indicating a stray data point; ¶318; ¶326 The planes serve as boundaries for the selection of tooth scan data as an individual virtual tooth object, or as part of the iterative procedure of FIG. 58. All 3-D data that is outside of the planes 1000 and 1002 is ignored.)

It would have been obvious to one of ordinary skill in the art to apply the data editing and filtering tools of Rubbert to the scanning system of Paley, in order to address the problem of spurious data by enabling it to be removed (Rubbert ¶323-324).

Regarding claim 29:

Paley teaches:

wherein the first 3D surface model of the patient's teeth comprises a tooth preparation that accurately represents a surface of a physical preparation of the patient, and (¶67 can be tested for against an accurate three-dimensional representation of an actual surface preparation, with suitable visualizations generated to guide a dentist in improving or accepting a preparation.)

wherein the method further comprises analyzing the tooth preparation of the first 3D surface model to determine whether the surface of the physical preparation is suitable for a dental prosthesis; and (¶67 The analysis described herein may include an analysis of draw path for the multi-tooth preparation that ensures a fit is physically possible.)

wherein replacing the portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least the surface portion of a second 3D surface model based on the received second 3D intraoral scan data of the patient's teeth comprises replacing a surface of the tooth preparation of the first 3D surface model with a portion of the second 3D surface model (¶64-65 Where physical specifications for a particular restoration require additional removal, the regions to be removed may be depicted within the three-dimensional model using one or more visual cues for identification by the dentist. In certain embodiments, regions recommended for removal may include a number of different possible regions for removal, such as the surface preparation and/or an opposing tooth surface ... A process of preparing a tooth surface, scanning the tooth surface, and analyzing the tooth surface may be applied iteratively to refine a surface preparation.)

where the second 3D surface model is obtained after physical modification of the surface of the physical preparation of the patient. (¶65 In an iterative process, a dentist may repeat steps of tooth removal and scanning until a satisfactory surface preparation is achieved.)

Regarding claim 30:

Paley teaches:

wherein the dental prosthesis comprises a dental crown and (¶68 While reviewing a crown surface preparation is one useful application of the analysis and visualization tool)

wherein the tooth preparation analysis comprises analysis of the first 3D surface model with respect to a virtual model of an opposing dentition of an opposite jaw to determine whether the tooth preparation would result in an inadequate structure for the dental crown. (¶64 In certain embodiments, regions recommended for removal may include a number of different possible regions for removal, such as the surface preparation and/or an opposing tooth surface; examiner notes the claim language would include the "opposing tooth surface" discussed here by the reference.)

Claims 2, 3, 10, and 17 are rejected under 35 U.S.C. 103 as being unpatentable over Paley (US 2007/0172112 A1) in view of Rubbert (US 2002/0006217 A1) and Kriveshko (US 2007/0236494 A1), and further in view of Hart (US 2004/0155975 A1).

Regarding claim 2:

Paley teaches:

wherein the hand-held intraoral scanner comprises a probing member with a sensing face, (¶29 For example, the scanner 102 may employ a multi-aperture system; Fig. 1 illustrating a scanner with a sensor face)

an illumination unit, (¶31 The scanner 102 may also, or instead, include a strobe, flash, or other light source to supplement illumination of the subject 104 during image acquisition.)

Paley does not teach in particular:

a light focusing optics defining one or more focal planes forward the sensing face, and

a translation mechanism for displacing the focal plane relative to the sensing face.

Hart teaches:

a light focusing optics defining one or more focal planes forward the sensing face, and (¶33 at least two image recordings on the image plane 18A at different angles of rotation of the aperture 160 are used to generate the measured displacement for target object 8A. The separate images are captured successively as the aperture rotates to position #1 at time t and position #2 at time t+Δt; ¶35 f is the focal length of the lens objective, L is the depth of in-focus object points (focal plane), R is the radius of the circle along which the off-axis pupil is rotating, and d is the diameter of a circle along which the relevant out-of-focus point is moving on the image plane 18A as the aperture is rotated)

a translation mechanism for displacing the focal plane relative to the sensing face. (¶33 at least two image recordings on the image plane 18A at different angles of rotation of the aperture 160 are used to generate the measured displacement for target object 8A. The separate images are captured successively as the aperture rotates to position #1 at time t and position #2 at time t+Δt; ¶35 f is the focal length of the lens objective, L is the depth of in-focus object points (focal plane), R is the radius of the circle along which the off-axis pupil is rotating, and d is the diameter of a circle along which the relevant out-of-focus point is moving on the image plane 18A as the aperture is rotated)

It would have been obvious to one of ordinary skill in the art to use the imaging sensor of Hart when implementing the system of Paley as modified by Rubbert and Kriveshko, because Paley explicitly discloses that Hart's sensor can be used to successfully implement the system (Paley, ¶29).

Regarding claim 3:

Paley teaches:

wherein the system further comprises the computer system and the display; (¶34 The computer 108 may be, for example, a personal computer or other processing device. In one embodiment, the computer 108 includes a personal computer … display 110)

wherein the system further comprises a mouse or wherein the display comprises a touch screen display; and (¶34 peripheral devices such as a keyboard 114, display 110, and mouse 112 for user interaction with the camera system 100 ...The display 110 may be a touch screen display capable of receiving user input through direct, physical interaction with the display 110.)

wherein the user input defining portions of the first 3D surface model to be removed is received by from the mouse or the touch screen display. (¶34 mouse 112 for user interaction with the camera system 100 … touch screen display capable of receiving user input; ¶60 permit a user to select a specific point on the surface of the digital model (or the scan subject, although the distinction becomes trivial for highly detailed and accurate digital models) where the continuous scan is to be reacquired from the subject)

Regarding claim 10:

Paley teaches:

wherein the hand-held intraoral scanner comprises a probing member with a sensing face, (¶29 For example, the scanner 102 may employ a multi-aperture system; Fig. 1 illustrating a scanner with a sensor face)

an illumination unit, (¶31 The scanner 102 may also, or instead, include a strobe, flash, or other light source to supplement illumination of the subject 104 during image acquisition.)

Paley does not teach in particular:

a light focusing optics defining one or more focal planes forward the sensing face, and

a translation mechanism for displacing the focal plane relative to the sensing face.

Hart teaches:

a light focusing optics defining one or more focal planes forward the sensing face, and (¶33 at least two image recordings on the image plane 18A at different angles of rotation of the aperture 160

are used to generate the measured displacement for target object 8A. The separate images are captured successively as the aperture rotates to position #1 at time t and position #2 at time t+Δt; ¶35 f is the focal length of the lens objective, L is the depth of in-focus object points (focal plane), R is the radius of the circle along which the off-axis pupil is rotating, and d is the diameter of a circle along which the relevant out-of-focus point is moving on the image plane 18A as the aperture is rotated)

a translation mechanism for displacing the focal plane relative to the sensing face. (¶33 at least two image recordings on the image plane 18A at different angles of rotation of the aperture 160 are used to generate the measured displacement for target object 8A. The separate images are captured successively as the aperture rotates to position #1 at time t and position #2 at time t+Δt; ¶35 f is the focal length of the lens objective, L is the depth of in-focus object points (focal plane), R is the radius of the circle along which the off-axis pupil is rotating, and d is the diameter of a circle along which the relevant out-of-focus point is moving on the image plane 18A as the aperture is rotated)

It would have been obvious to one of ordinary skill in the art to use the imaging sensor of Hart when implementing the system of Paley as modified by Rubbert and Kriveshko, because Paley explicitly discloses that Hart's sensor can be used to successfully implement the system (Paley, ¶29).

Regarding claim 17:

Paley teaches:

wherein the hand-held intraoral scanner comprises a probing member with a sensing face, (¶29 For example, the scanner 102 may employ a multi-aperture system; Fig. 1 illustrating a scanner with a sensor face)

an illumination unit, (¶31 The scanner 102 may also, or instead, include a strobe, flash, or other light source to supplement illumination of the subject 104 during image acquisition.)

Paley does not teach in particular:

a light focusing optics defining one or more focal planes forward the sensing face, and

a translation mechanism for displacing the focal plane relative to the sensing face.

Hart teaches:

a light focusing optics defining one or more focal planes forward the sensing face, and (¶33 at least two image recordings on the image plane 18A at different angles of rotation of the aperture 160 are used to generate the measured displacement for target object 8A. The separate images are captured successively as the aperture rotates to position #1 at time t and position #2 at time t+Δt; ¶35 f is the focal length of the lens objective, L is the depth of in-focus object points (focal plane), R is the radius of the circle along which the off-axis pupil is rotating, and d is the diameter of a circle along which the relevant out-of-focus point is moving on the image plane 18A as the aperture is rotated)

a translation mechanism for displacing the focal plane relative to the sensing face. (¶33 at least two image recordings on the image plane 18A at different angles of rotation of the aperture 160 are used to generate the measured displacement for target object 8A. The separate images are captured successively as the aperture rotates to position #1 at time t and position #2 at time t+Δt; ¶35 f is the focal length of the lens objective, L is the depth of in-focus object points (focal plane), R is the radius of the circle along which the off-axis pupil is rotating, and d is the diameter of a circle along which the relevant out-of-focus point is moving on the image plane 18A as the aperture is rotated)

It would have been obvious to one of ordinary skill in the art to use the imaging sensor of Hart when implementing the system of Paley as modified by Rubbert and Kriveshko, because Paley explicitly discloses that Hart's sensor can be used to successfully implement the system (Paley, ¶29).

Claim 28 is rejected under 35 U.S.C. 103 as being unpatentable over Paley (US 2007/0172112 A1) in view of Rubbert (US 2002/0006217 A1) and Kriveshko (US 2007/0236494 A1), and further in view of Babayoff (US 2005/0283065A1).

Regarding claim 28:

Paley teaches:

wherein a portion of the finish line is obscured or distorted, and (¶60 One user control (not shown) may permit a user to return to data acquisition, e.g., the scanning mode of FIG. 4, to acquire additional data where a void or deviation is detected (either automatically or through human visual inspection). This control, or another control, may permit a user to select a specific point on the surface of the digital model (or the scan subject, although the distinction becomes trivial for highly detailed and accurate digital models) where the continuous scan is to be reacquired from the subject; examiner notes that taken in context with the modification of Babayoff, this would apply to a finish line with a "void or deviation")

Paley does not teach in particular:

wherein the first 3D surface model of the patient's teeth comprises a tooth preparation having a finish line,

wherein replacing the portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least the surface portion of a second 3D surface model based on the received second 3D intraoral scan data of the patient's teeth comprises replacing a portion of the obscured or distorted portion of the finish line with a portion of the second 3D surface model where the finish line is not obscured or distorted.

Kriveshko teaches:

wherein replacing the portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least the surface portion of a second 3D surface model based on the received second 3D intraoral scan data of the patient's teeth comprises replacing a portion of the obscured or distorted portion of the finish line with a portion of the second 3D surface model where the finish line is not obscured or distorted. (¶11 the method may enter a landing mode which may include

superimposing a current two-dimensional image of the subject onto a previous two-dimensional image of the subject in the display, the current two-dimensional image representing a view of the subject from a position from which the image set was acquired, and the previous two-dimensional image representing a view of the subject from which at least a portion of the three-dimensional surface data was acquired; acquiring at least one subsequent three-dimensional image; fitting the at least one subsequent three-dimensional image to a second three-dimensional surface reconstruction; and test fitting the at least one subsequent three-dimensional image to the three-dimensional surface data. When the image set can be fitted to the three-dimensional surface data, the method superimposes the three-dimensional surface data and the next three-dimensional image onto a two-dimensional image of the subject in a display and adds the second three-dimensional surface reconstruction to the three-dimensional surface data.)

It would have been obvious to one of ordinary skill in the art to use the landing mode of Kriveshko when implementing the system of Paley as modified by Rubbert, because Paley explicitly discloses a landing mode, and notes that the landing mode disclosed in Kriveshko is how this should be implemented (Paley, ¶60).

Babayoff teaches:

wherein the first 3D surface model of the patient's teeth comprises a tooth preparation having a finish line, (examiner notes that when the finish line detection and definition methods of Babayoff are applied to the image registration system of Paley as modified by Rubbert and Kriveshko, the finish line would be subject to the registration procedures - the data set being separated into entities being applied as frames being registered to each other, resulting in a system that registers the finish line information from the "specific data entity" (as discussed in ¶174) to the remaining frames/data entities that do not have such data (the other entities from ¶174); ¶104 Any suitable means may be used to provide the numerical entity. For example, a three-dimensional surface scanner with color capabilities

may be used; ¶172 may also be applied to the identification of a finish line profile for a crown or bridge prosthesis; ¶174 The ring thus adopts a profile which may often be substantially similar to that of the finish line. By having the ring colored sufficiently differently to the color of the teeth or soft tissues, say in blue, it is relatively straightforward to separate out from the entity I all data points having a color component with a value in a specific range corresponding to the color of the ring. Identification of the ring itself provides a useful starting point for suitable algorithms that are then applied to determine the location and geometry of the finish line. Such algorithms are known and typically attempt to identify features commonly found with finish lines such as for example, a discontinuity in the slope of the tooth surface, or a mound-shaped projection corresponding to the preparation ... In particular, when the data set has been separated into entities I.sub.1, then only the specific entity I.sub.1 corresponding to the ring needs to the analysed for the finish line, as this entity corresponds to the preparation; see also ¶182-186 which discusses "automatically defining the finish line of a preparation.")

It would have been obvious to one having ordinary skill in the art at the time the invention was filed to apply the finish line modeling and identification of Babayoff to the image registration of Paley as modified by Rubbert and Kriveshko, in order to provide data that is useful in procedures associated with the oral cavity, specially dental surfaces thereof (Babayoff ¶1).

Conclusion

This Office action has an attached requirement for information under 37 CFR 1.105. A complete reply to this Office action must include a complete reply to the attached requirement for information. The time period for reply to the attached requirement coincides with the time period for reply to this Office action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BIJAN MAPAR whose telephone number is (571)270-3674. The examiner can normally be reached on Monday - Thursday, 11:00-8:30.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Omar F Fernandez Rivas can be reached on 5712722589. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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CLAIMS

WHAT IS CLAIMED IS:

1. A dental system for intraorally scanning a patient's teeth for a dental procedure, the dental system comprising:

a hand-held intraoral scanner; and

a computer readable medium including instructions that when executed by a computer system, causes the computer system to:

receive first 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner;

display, to a display, a first 3D surface model of the patient's teeth, wherein the first 3D surface model of the patient's teeth is based on the received first 3D intraoral scan data of the patient's teeth;

receive user input defining a surface portion of the first 3D surface model to be removed;

after receiving the user input, remove, from the displayed first 3D surface model, the surface portion of the first 3D surface model to be removed according to the user input;

after removing the surface portion of the first 3D surface model, receive second 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner;

replace at least a portion of the removed surface portion of the first 3D surface model with at least a surface portion of a second 3D surface model based on the received second 3D intraoral scan data of the patient's teeth to produce a composite 3D surface model of the patient's teeth that is based on the first 3D intraoral scan data and the second 3D intraoral scan data; and

output, to the display, the composite 3D surface model of the patient's teeth.

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

3. The system of claim 2, wherein the system further comprises the computer system and the display; wherein the system further comprises a mouse or wherein the display

comprises a touch screen display; and wherein the user input defining portions of the first 3D surface model to be removed is received by from the mouse or the touch screen display.

4. The system of claim 1, wherein the portion of the removed portion of the first 3D surface model is replaced with at least the portion of the second 3D surface model by registering the second 3D surface model with the first 3D surface model.

5. The system of claim 4, wherein the second 3D surface model is registered with the first 3D surface model by aligning identifying surface data of the second 3D surface model with corresponding parts of the first 3D surface model.

6. The system of claim 5, wherein the portion of the removed portion of the first 3D surface model is replaced with at least the portion of the second 3D surface model by further stitching the portion of the second 3D surface model with the first 3D surface model.

7. The system of claim 6, wherein the portion of the removed portion of the first 3D surface model is replaced with at least the portion of the second 3D surface model by further discarding a remainder of the second 3D surface model, including the identifying surface data, after stitching the portion of the second 3D surface model with the first 3D surface model.

8. The system of claim 1, wherein the computer readable medium further includes instructions that when executed by the computer system, causes the computer system to: mark, on the displayed first 3D surface model, the user input defined surface portion, after receiving the user input and before removing the surface portion.

9. A dental system for intraorally scanning a patient's teeth for a dental procedure, the dental system comprising:

a hand-held intraoral scanner;

a computer readable medium including instructions that when executed by a computer system, causes the computer system to:

receive first 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner;

display, to the display, a first 3D surface model of the patient's teeth, wherein the first 3D surface model of the patient's teeth is based on the received first 3D intraoral scan data of the patient's teeth;

receive user input via the displayed first 3D surface model demarcating a surface portion of the first 3D surface model to be retained and a surface portion of the first 3D surface model to be replaced;

after receiving the user input, receive second 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner;

replacing at least a portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least a surface portion of a second 3D surface model based on the received second 3D intraoral scan data of the patient's teeth while retaining the surface portion of the first 3D surface model to be retained according to the user input to produce a composite 3D surface model of the patient's teeth that is based on the first 3D intraoral scan data and the second 3D intraoral scan data; and

output, to the display, the composite 3D surface model of the patient's teeth.

10. The system of claim 9, wherein the hand-held intraoral scanner comprises a probing member with a sensing face, an illumination unit, a light focusing optics defining one or more focal planes forward the sensing face, and a translation mechanism for displacing the focal plane relative to the sensing face.

11. The system of claim 9, wherein the computer readable medium further includes instructions that when executed by a computer system, causes the computer system to remove, from the displayed first 3D surface model, the surface portion to be replaced according to the user input demarcating the surface portion of the first 3D surface model to be retained and the surface portion of the first 3D surface model to be replaced.

12. The system of claim 11, wherein the computer readable medium further includes instructions that when executed by the computer system, causes the computer system to: mark, on the displayed first 3D surface model, the user input defined surface portion to be replaced, after receiving the user input and before removing the surface portion to be replaced.

13. The system of claim 9, wherein the portion of the surface portion of the first 3D surface model to be replaced is replaced with at least the portion of the second 3D surface model

by registering the second 3D surface model with the first 3D surface model by aligning identifying surface data of the second 3D surface model with corresponding parts of the first 3D surface model.

14. The system of claim 13, wherein the portion of the portion of the first 3D surface model to be replaced is replaced with at least the portion of the second 3D surface model by further stitching the portion of the second 3D surface model with the first 3D surface model.

15. The system of claim 14, wherein the portion of the surface portion of the first 3D surface model to be replaced is replaced with at least the portion of the second 3D surface model by further discarding a remainder of the second 3D surface model, including the identifying surface data, after stitching the portion of the second 3D surface model with the first 3D surface model.

16. A dental system for intraorally scanning a patient's teeth for a dental procedure, the dental system comprising:

a hand-held intraoral scanner;

a display; and

a computer system operatively coupled with the display and the hand-held intraoral scanner, the computer system configured to:

receive first 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner;

display, to the display, a first 3D surface model of the patient's teeth, wherein the first 3D surface model of the patient's teeth is based on the received first 3D intraoral scan data of the patient's teeth;

receive user input via the displayed first 3D surface model at least defining a surface portion of the first 3D surface model to be retained;

after receiving the user input, receive second 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner;

replacing at least a portion of the first 3D surface model not to be retained according to the user input with at least a surface portion of a second 3D surface model based on the received second 3D intraoral scan data of the patient's teeth to produce a composite 3D surface model of the patient's teeth that is based on the first 3D intraoral scan data and the second 3D intraoral scan data; and

output, to the display, the composite 3D surface model of the patient's teeth.

17. The system of claim 16, wherein the hand-held intraoral scanner comprises a probing member with a sensing face, an illumination unit, a light focusing optics defining one or more focal planes forward the sensing face, and a translation mechanism for displacing the focal plane relative to the sensing face.

18. The system of claim 16, wherein the received user input also defines a surface portion of the first 3D surface model to be replaced by the second 3D surface model.

19. The system of claim 18, wherein the computer readable medium further includes instructions that when executed by the computer system, causes the computer system to remove, from the displayed first 3D surface model, the surface portion to be replaced according to the user input defining the surface portion of the first 3D surface model to be retained and the surface portion of the first 3D surface model to be replaced.

20. The system of claim 16, wherein the portion of the first 3D surface model not to be retained according to the user input is replaced with at least the portion of the second 3D surface model by registering the second 3D surface model with the first 3D surface model by aligning identifying surface data of the second 3D surface model with corresponding parts of the first 3D surface model.

21. The system of claim 20, wherein the portion of the surface portion of the first 3D surface model to be replaced is replaced with at least the surface portion of the second 3D surface model by further stitching the surface portion of the second 3D surface model with the first 3D surface model.

22. The system of claim 21, wherein the portion of the surface portion of the first 3D surface model to be replaced is replaced with at least the surface portion of the second 3D surface model by further discarding a remainder of the second 3D surface model, including the identifying surface data, after stitching the surface portion of the second 3D surface model with the first 3D surface model.

23. A dental method for intraorally scanning a patient's teeth for a dental procedure, the dental method comprising:

receiving first 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner;

displaying, to a display, a first 3D surface model of the patient's teeth, wherein the first 3D surface model of the patient's teeth is based on the received first 3D intraoral scan data of the patient's teeth;

receiving user input via the displayed first 3D surface model demarcating a surface portion of the first 3D surface model to be retained and a surface portion of the first 3D surface model to be replaced;

after receiving the user input, receiving second 3D intraoral scan data of the patient's teeth from the hand-held intraoral scanner;

replacing at least a portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least a surface portion of a second 3D surface model based on the received second 3D intraoral scan data of the patient's teeth to produce a composite 3D surface model of the patient's teeth that is based on the first 3D intraoral scan data and the second 3D intraoral scan data; and

output, to the display, the composite 3D surface model of the patient's teeth.

24. The method of claim 23, further comprising marking an area, on the displayed first 3D surface model, associated with the received user input.

25. The method of claim 23, wherein replacing at least the portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least the surface portion of the second 3D surface model comprises registering the second 3D surface model with the first 3D surface model by aligning identifying surface data of the second 3D surface model with corresponding parts of the first 3D surface model.

26. The method of claim 25, wherein replacing at least the portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least the surface portion of the second 3D surface model further comprises stitching the surface portion of the second 3D surface model with the first 3D surface model.

27. The method of claim 26, wherein replacing at least the portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least the surface portion of the second 3D surface model further comprises discarding a remainder of the second 3D surface model, including the identifying surface data, after stitching the surface portion of the second 3D surface model with the first 3D surface model.

28. The method of claim 23, wherein the first 3D surface model of the patient's teeth comprises a tooth preparation having a finish line, wherein a portion of the finish line is obscured or distorted, and wherein replacing the portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least the surface portion of a second 3D surface model based on the received second 3D intraoral scan data of the patient's teeth comprises replacing a portion of the obscured or distorted portion of the finish line with a portion of the second 3D surface model where the finish line is not obscured or distorted.

29. The method of claim 23, wherein the first 3D surface model of the patient's teeth comprises a tooth preparation that accurately represents a surface of a physical preparation of the patient, and wherein the method further comprises analyzing the tooth preparation of the first 3D surface model to determine whether the surface of the physical preparation is suitable for a dental prosthesis; and wherein replacing the portion of the surface portion of the first 3D surface model to be replaced according to the user input with at least the surface portion of a second 3D surface model based on the received second 3D intraoral scan data of the patient's teeth comprises replacing a surface of the tooth preparation of the first 3D surface model with a portion of the second 3D surface model where the second 3D surface model is obtained after physical modification of the surface of the physical preparation of the patient.

30. The method of claim 29, wherein the dental prosthesis comprises a dental crown and wherein the tooth preparation analysis comprises analysis of the first 3D surface model with respect to a virtual model of an opposing dentition of an opposite jaw to determine whether the tooth preparation would result in an inadequate structure for the dental crown.