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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/770,177	09/18/2018	10076391	95480	8357

151459 7590 08/29/2018

Carestream Dental LLC
1765 The Exchange SE
Atlanta, GA 30339

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

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

The Patent Term Adjustment is 143 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

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 Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Yannick Glinec, Montevrain, FRANCE;
Carestream Dental Technology Topco Limited, London, UNITED KINGDOM;
Qinran Chen, Shanghai, CHINA;
Mo Yufeng, Shanghai, CHINA;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

3SHAPE EXHIBIT 1002
3Shape v. DITC
IPR2024-00548

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
14/770,177	08/25/2015	2665	2600	95480	20	3

CONFIRMATION NO. 8357

CORRECTED FILING RECEIPT

151459
Carestream Dental LLC
1765 The Exchange SE
Atlanta, GA 30339

OC000000101626491

Date Mailed: 08/10/2018

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Yannick Glinec, Shanghai, CHINA;
Qinran Chen, Shanghai, CHINA;
Mo Yufeng, Shanghai, CHINA;

Applicant(s)

Carestream Dental Technology Topco Limited, London,;

Power of Attorney: The patent practitioners associated with Customer Number 151459

Domestic Priority data as claimed by applicant

This application is a 371 of PCT/CN13/72420 03/11/2013

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: No

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 10/05/2015

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/770,177**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No

Title

METHOD AND SYSTEM FOR BITE REGISTRATION

Preliminary Class

382

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/770,177	08/25/2015	Yannick Glinec	95480

CONFIRMATION NO. 8357

151459
Carestream Dental LLC
1765 The Exchange SE
Atlanta, GA 30339

POA ACCEPTANCE LETTER

OC000000101626481

Date Mailed: 08/10/2018

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/08/2018.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/tcouch/

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/770,177	08/25/2015	Yannick Glinec	95480

CONFIRMATION NO. 8357

POWER OF ATTORNEY NOTICE

70523
Carestream Health, Inc.
ATTN: Patent Legal Staff
150 Verona Street
Rochester, NY 14608

OC000000101626473

Date Mailed: 08/10/2018

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 08/08/2018.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/tcouch/

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
14/770,177	08/25/2015	2665	2600	95480	20	3

CONFIRMATION NO. 8357

CORRECTED FILING RECEIPT

151459
Carestream Dental LLC
1765 The Exchange SE
Atlanta, GA 30339

OC000000101640393

Date Mailed: 08/10/2018

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Inventor(s)

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Qinran Chen, Shanghai, CHINA;
Mo Yufeng, Shanghai, CHINA;

Applicant(s)

Carestream Dental Technology Topco Limited, London, UNITED KINGDOM;

Power of Attorney: The patent practitioners associated with Customer Number 151459

Domestic Priority data as claimed by applicant

This application is a 371 of PCT/CN13/72420 03/11/2013

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Permission to Access Application via Priority Document Exchange: Yes

Permission to Access Search Results: No

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Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No

Title

METHOD AND SYSTEM FOR BITE REGISTRATION

Preliminary Class

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PTO/AIA/82A (07-13)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	14/770,177
Filing Date	August 25, 2015
First Named Inventor	GLINEC, Yannick
Title	Method and System for Bite Registration
Art Unit	2665
Examiner Name	PATEL, Nirav G.
Attorney Docket Number	95480

SIGNATURE of Applicant or Patent Practitioner

Signature	/R. Stevan Coursey/	Date (Optional)	August 8, 2018
Name	R. Stevan Coursey	Registration Number	39,949
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ *Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. 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 1.11 and 1.14. This collection is estimated to take 3 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, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82B (07-13)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 151459

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☑ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

Carestream Dental Technology Topco Limited

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature		Date (Optional)	
Name	Philippe Maillet		
Title	Managing Director		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. 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 1.11 and 1.14. This collection is estimated to take 3 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, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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PTO/AIA/82C (07-13)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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POWER OF ATTORNEY BY APPLICANT

No more than ten (10) patent practitioners total may be appointed as set forth below by name and registration number. This page need not be submitted if appointing the Patent Practitioner(s) associated with a Customer Number (see form PTO/AIA/82B):

Name	Registration 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 the Freedom of Information Act requires disclosure of these records.
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 inspections 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.

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
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.

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Carestream Dental Technology Topco Limited

Application No./Patent No.: 14/770,177 Filed/Issue Date: August 25, 2015

Titled: Method and System for Bite Registration

Carestream Dental Technology Topco Limited, a corporation

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☑ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

B. ☑ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: Yannick Glinec To: Carestream Health, Inc

The document was recorded in the United States Patent and Trademark Office at
Reel 036463, Frame 0651, or for which a copy thereof is attached.

2. From: Qinran Chen To: Carestream Health, Inc.

The document was recorded in the United States Patent and Trademark Office at
Reel 036463, Frame 0651, or for which a copy thereof is attached.

This collection of information is required by 37 CFR 3.73(b). 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 1.11 and 1.14. This collection is estimated to take 12 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, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: Yufeng Mo To: Carestream Health, Inc.

The document was recorded in the United States Patent and Trademark Office at
Reel 036463, Frame 0651, or for which a copy thereof is attached.

4. From: Carestream Health, Inc. To: Carestream Dental Technology Topco Limited

The document was recorded in the United States Patent and Trademark Office at
Reel 044873, Frame 0520, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☑ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/R. Stevan Coursey/	August 8, 2018
Signature	Date
R. Stevan Coursey	39,949
Printed or Typed Name	Title or Registration Number

[Page 2 of 2]

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.

Doc Code: R46C.REQ
Document Description: Request under 37 CFR 1.46(c) to correct, update or change the applicant.

PTO/AIA/41 (04-15)
Approved for use through 11/30/2020. OMB 0651-0031
U.S. Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE
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.

REQUEST TO CORRECT OR UPDATE THE NAME OF THE APPLICANT UNDER 37 CFR 1.46(c)(1), OR CHANGE THE APPLICANT UNDER 37 CFR 1.46(c)(2)
(FOR USE ONLY IN APPLICATIONS FILED ON OR AFTER SEPTEMBER 16, 2012)

Application Number	14/770,177
Filing Date	August 25, 2015
First Named Inventor	GLINEC, Yannick
Art Unit	2665
Examiner Name	PATEL, Nirav G.
Practitioner Docket Number	95480

To: Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Applicant hereby **requests that the name of the applicant be corrected or updated under 37 CFR 1.46(c)(1), or that the applicant be changed under 37 CFR 1.46(c)(2),** in the above-identified application. **Requests under 37 CFR 1.46(c)(1) or (c)(2) cannot be submitted after payment of the issue fee or if the application has been patented.**

Please check the applicable box(es) below.

☐ 1. This request is to **correct or update the name of the applicant (under 37 CFR 1.46(c)(1))** and includes:

☐ An application data sheet (ADS) in accordance with 37 CFR 1.76(c) with the corrected or updated information shown with markings (*e.g.*, underlining for insertions, strikethrough for deletions). A Corrected Web-based ADS may be used.

Note: Requests under 37 CFR 1.46(c)(1) may be filed to correct typographical errors in the name of the § 1.46 applicant, or for updating the name of the § 1.46 applicant (*i.e.*, where there is no change in the applicant itself but just in the applicant's name). See the Manual of Patent Examining Procedure (MPEP) section 605.01.

☒ 2. This request is to **change the applicant (under 37 CFR 1.46(c)(2))** and includes:

☒ An application data sheet (ADS) in accordance with 37 CFR 1.76(c) that identifies the changes with proper markings (underlining for insertions and strikethrough for deletions). A Corrected Web-based ADS may be used.

☒ A Statement Under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent). See MPEP 325.

I am the

☐ applicant* ☐ attorney or agent of record Registration number _____ ☒ attorney or agent acting under 37 CFR 1.34 Registration number 39,949

Signature /R. Stevan Coursey/
Typed or printed name R. Stevan Coursey
Date August 8, 2018

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. *Juristic entities must be represented by a patent practitioner (See 37 CFR 1.31, applicable to any paper filed on or after September 16, 2012 that is presented on behalf of a juristic entity, regardless of application filing date). Submit multiple forms if more than one signature is required, see below**.

☒ ** Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.36. 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 1.11 and 1.14. This collection is estimated to take 12 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, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	95480
	Application Number	14/770,177
Title of Invention	METHOD AND SYSTEM FOR BITE REGISTRATION	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2:

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Yannick		Glinec	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	~~Shanghai~~ Montevrain	Country of Residence i	~~CN~~ FR

Mailing Address of Inventor:

Address 1	~~Carestream Health, Inc.~~ Carestream Dental LLC – c/o ~~Patent~~ Legal ~~Staff~~ Dept.
Address 2	~~150 Verona Street~~ 1765 The Exchange SE

City	~~Rochester~~ Atlanta	State/Province	~~NY~~ GA
Postal Code	~~14608~~ 30339	Country i	US

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Qinran		Chen	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Shanghai	Country of Residence i	CN

Mailing Address of Inventor:

Address 1	~~Carestream Health, Inc.~~ Carestream Dental LLC – c/o ~~Patent~~ Legal ~~Staff~~ Dept.
Address 2	~~150 Verona Street~~ 1765 The Exchange SE

City	~~Rochester~~ Atlanta	State/Province	~~NY~~ GA
Postal Code	~~14608~~ 30339	Country i	US

Inventor 3 Remove

Legal Name

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	95480
	Application Number	14/770,177
Title of Invention	METHOD AND SYSTEM FOR BITE REGISTRATION	

Prefix	Given Name	Middle Name	Family Name	Suffix
	Mo		Yufeng	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Shanghai	Country of Residence [i]	CN

Mailing Address of Inventor:

Address 1	~~Carestream Health, Inc.~~ Carestream Dental LLC – c/o ~~Patent~~ Legal ~~Staff~~ Dept.		
Address 2	~~150 Verona Street~~ 1765 The Exchange SE		
City	~~Rochester~~ Atlanta	**State/Province**	~~NY~~ GA
Postal Code	~~14608~~ 30339	**Country** [i]	US

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	~~70523~~ 151459			
Email Address	~~patent@carestream.com~~ patent@csdental.com	Add Email	Remove Email	

Application Information:

Title of the Invention	METHOD AND SYSTEM FOR BITE REGISTRATION		
Attorney Docket Number	95480	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	8	**Suggested Figure for Publication (if any)**	

Filing By Reference:

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	95480
	Application Number	14/770,177
Title of Invention	METHOD AND SYSTEM FOR BITE REGISTRATION	

Publication Information:

☐	Request Early Publication (Fee required at time of Request 37 CFR 1.219)
☐	**Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32). Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	~~70523~~ 151459		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing benefit claim information in the Application Data Sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the "Application Number" field blank.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing or 371(c) Date (YYYY-MM-DD)
	a 371 of international	PCT/CN13/072420	2013-03-11

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX)[i] the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	95480
	Application Number	14/770,177
Title of Invention	METHOD AND SYSTEM FOR BITE REGISTRATION	

Application Number	Country[i]	Filing Date (YYYY-MM-DD)	Access Code[i] (if applicable)

Remove

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button. Add

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	95480
	Application Number	14/770,177
Title of Invention	METHOD AND SYSTEM FOR BITE REGISTRATION	

Authorization or Opt-Out of Authorization to Permit Access:

When this Application Data Sheet is properly signed and filed with the application, applicant has provided written authority to permit a participating foreign intellectual property (IP) office access to the instant application-as-filed (see paragraph A in subsection 1 below) and the European Patent Office (EPO) access to any search results from the instant application (see paragraph B in subsection 1 below).

Should applicant choose not to provide an authorization identified in subsection 1 below, applicant **must opt-out** of the authorization by checking the corresponding box A or B or both in subsection 2 below.

NOTE: This section of the Application Data Sheet is **ONLY** reviewed and processed with the **INITIAL** filing of an application. After the initial filing of an application, an Application Data Sheet cannot be used to provide or rescind authorization for access by a foreign IP office(s). Instead, Form PTO/SB/39 or PTO/SB/69 must be used as appropriate.

1. Authorization to Permit Access by a Foreign Intellectual Property Office(s)

A. Priority Document Exchange (PDX) - Unless box A in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the State Intellectual Property Office of the People's Republic of China (SIPO), the World Intellectual Property Organization (WIPO), and any other foreign intellectual property office participating with the USPTO in a bilateral or multilateral priority document exchange agreement in which a foreign application claiming priority to the instant patent application is filed, access to: (1) the instant patent application-as-filed and its related bibliographic data, (2) any foreign or domestic application to which priority or benefit is claimed by the instant application and its related bibliographic data, and (3) the date of filing of this Authorization. See 37 CFR 1.14(h)(1).

B. Search Results from U.S. Application to EPO - Unless box B in subsection 2 (opt-out of authorization) is checked, the undersigned hereby **grants the USPTO authority** to provide the EPO access to the bibliographic data and search results from the instant patent application when a European patent application claiming priority to the instant patent application is filed. See 37 CFR 1.14(h)(2).

The applicant is reminded that the EPO's Rule 141(1) EPC (European Patent Convention) requires applicants to submit a copy of search results from the instant application without delay in a European patent application that claims priority to the instant application.

2. Opt-Out of Authorizations to Permit Access by a Foreign Intellectual Property Office(s)

☐ A. Applicant **DOES NOT** authorize the USPTO to permit a participating foreign IP office access to the instant application-as-filed. If this box is checked, the USPTO will not be providing a participating foreign IP office with any documents and information identified in subsection 1A above.

☐ B. Applicant **DOES NOT** authorize the USPTO to transmit to the EPO any search results from the instant patent application. If this box is checked, the USPTO will not be providing the EPO with search results from the instant application.

NOTE: Once the application has published or is otherwise publicly available, the USPTO may provide access to the application in accordance with 37 CFR 1.14.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	95480
	Application Number	14/770,177
Title of Invention	METHOD AND SYSTEM FOR BITE REGISTRATION	

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1 Remove

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

◉ Assignee	○ Legal Representative under 35 U.S.C. 117	○ Joint Inventor
~~◉ Person to whom the inventor is obligated to assign.~~	○ Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor:

If the Applicant is an Organization check here. ☒

Organization Name	~~Carestream Health, Inc.~~ Carestream Dental Technology Topco Limited		
Mailing Address Information For Applicant:			
Address 1	~~Carestream Health, Inc. -- c/o Patent Legal Staff~~ Cleveland House		
Address 2	~~150 Verona Street~~ 33 King Street		
City	~~Rochester~~ London	**State/Province**	~~NY~~
Country[i]	~~US~~ UK	Postal Code	~~14608~~ SW1Y6RJ
Phone Number		Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button. Add

Assignee Information including Non-Applicant Assignee Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	95480
	Application Number	14/770,177
Title of Invention	METHOD AND SYSTEM FOR BITE REGISTRATION	

Assignee 1

Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication. An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

Remove

If the Assignee or Non-Applicant Assignee is an Organization check here. ☐

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		**State/Province**	
Country i		Postal Code	
Phone Number		Fax Number	
Email Address			

Additional Assignee or Non-Applicant Assignee Data may be generated within this form by selecting the Add button. Add

Remove

Signature:

NOTE: This Application Data Sheet must be signed in accordance with 37 CFR 1.33(b). **However, if this Application Data Sheet is submitted with the INITIAL filing of the application and either box A or B is not checked in subsection 2 of the "Authorization or Opt-Out of Authorization to Permit Access" section, then this form must also be signed in accordance with 37 CFR 1.14(c).**

This Application Data Sheet **must** be signed by a patent practitioner if one or more of the applicants is a **juristic entity** (e.g., corporation or association). If the applicant is two or more joint inventors, this form must be signed by a patent practitioner, **all** joint inventors who are the applicant, or one or more joint inventor-applicants who have been given power of attorney (e.g., see USPTO Form PTO/AIA/81) on behalf of **all** joint inventor-applicants.

See 37 CFR 1.4(d) for the manner of making signatures and certifications.

Signature	/R. Stevan Coursey/			Date (YYYY-MM-DD)	2018-08-08
First Name	R. Stevan	Last Name	Coursey	Registration Number	39,949

Additional Signature may be generated within this form by selecting the Add button. Add

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	95480
	Application Number	14/770,177
Title of Invention	METHOD AND SYSTEM FOR BITE REGISTRATION	

This collection of information is required by 37 CFR 1.76. 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 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet 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, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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 the Freedom of Information Act requires disclosure of these records.

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 CooperationTreaty.

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 inspections 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.

PART B--FEE(S) TRANSMITTAL

Complete and send this form, together with the applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22314-1450
or Fax **(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)

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, EFS-Web transmitted, or facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

R. Stevan Coursey	(Depositor's Name)
/R. Stevan Coursey/	(S-signature)
August 8, 2018	(Date)

APPLICATION NO	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO	CONFIRMATION NO
14/770,177	08/25/2015	Yannick Glinec	95480	8357

TITLE OF INVENTION: METHOD AND SYSTEM FOR BITE REGISTRATION

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1000	$0	$0	$1000	08/09/2018

EXAMINER	ART UNIT	CLASS-SUBCLASS
PATEL, Nirav G.	2665	382-154000

1. Change of correspondence address or indication of "Fee Address" (37CFR 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 03-02 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 attorney or agent. 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 has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

1a. NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Carestream Dental Technology Topco Limited London, United Kingdom

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

4a. The following fee(s) are submitted:
☑ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies

4b. Payment of Fees(s): **(Please first reapply and previously paid fee shown above)**
☐ A check is enclosed
☐ Payment be credit card. Form PTO-2038 is attached
☐ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number (enclose an extra copy of this form)

5. Change of Entity Status (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29 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.

☐ Applicant asserting small entity status. See 37 CFR 1.27 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.

☐ Applicant changing to regular undiscounted fee status. NOTE: Checking this box will be taken to be 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 /R. Stevan Coursey/ Date August 8, 2018

Typed or printed name R. Stevan Coursey Registration No. 39,949

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.

Electronic Patent Application Fee Transmittal

Application Number:	14770177
Filing Date:	25-Aug-2015
Title of Invention:	METHOD AND SYSTEM FOR BITE REGISTRATION
First Named Inventor/Applicant Name:	Yannick Glinec
Filer:	Robert Stevan Coursey.
Attorney Docket Number:	95480

Filed as Large Entity

Filing Fees for U.S. National Stage under 35 USC 371

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
UTILITY APPL ISSUE FEE	1501	1	1000	1000

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1000**

Electronic Acknowledgement Receipt

EFS ID:	33411555
Application Number:	14770177
International Application Number:	
Confirmation Number:	8357
Title of Invention:	METHOD AND SYSTEM FOR BITE REGISTRATION
First Named Inventor/Applicant Name:	Yannick Glinec
Customer Number:	70523
Filer:	Robert Stevan Coursey.
Filer Authorized By:	
Attorney Docket Number:	95480
Receipt Date:	08-AUG-2018
Filing Date:	25-AUG-2015
Time Stamp:	15:16:22
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1000
RAM confirmation Number	080918INTEFSW15190500
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	POA.pdf	1859484 c8a11862eee619198a0a6843a5921426b7c53dcb	no	4
Warnings:					
Information:					
2	Assignee showing of ownership per 37 CFR 3.73	STMT.pdf	90736 4912fe96bb83e22ade8fb987d20f4b1afaefe136	no	3
Warnings:					
Information:					
3	Req to correct/update/change appl name until pay issue fee	CHG_APPLICANT.pdf	147086 aefc53e6e25d89291c2d881408568e6baa7a8234	no	2
Warnings:					
Information:					
4	Application Data Sheet	ADS.pdf	1028764 ef2c8215792aa4c5cca7ddfc8e0d663e8ecc1d8f	no	9
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
5	Issue Fee Payment (PTO-85B)	PART_B_FEES_TRANSMITTAL.pdf	124172 bff13c42aceccea04b35869214db90d004ef8f68	no	2
Warnings:					
Information:					
6	Fee Worksheet (SB06)	fee-info.pdf	30265 632072eb61212da8f3e8421559904991 96fc3092	no	2
Warnings:					

Information:	
Total Files Size (in bytes):	3280507

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

70523 7590 05/09/2018

Carestream Health, Inc.
ATTN: Patent Legal Staff
150 Verona Street
Rochester, NEW YORK 14608
UNITED STATES OF AMERICA

EXAMINER
PATEL, NIRAV G

ART UNIT	PAPER NUMBER
2665	

DATE MAILED: 05/09/2018

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/770,177	08/25/2015	Yannick Glinec	95480	8357

TITLE OF INVENTION: METHOD AND SYSTEM FOR BITE REGISTRATION

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	08/09/2018

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: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (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)

70523 7590 05/09/2018

Carestream Health, Inc.
ATTN: Patent Legal Staff
150 Verona Street
Rochester, NEW YORK 14608
UNITED STATES OF AMERICA

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 facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/770,177	08/25/2015	Yannick Glinec	95480	8357

TITLE OF INVENTION: METHOD AND SYSTEM FOR BITE REGISTRATION

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	08/09/2018

EXAMINER	ART UNIT	CLASS-SUBCLASS
PATEL, NIRAV G	2665	382-154000

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 03-02 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 has been filed for recordation as set forth in 37 CFR 3.11. 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. The following fee(s) are submitted:

❑ Issue Fee

❑ Publication Fee (No small entity discount permitted)

❑ Advance Order - # of Copies _____

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

❑ A check is enclosed.

❑ Payment by credit card. Form PTO-2038 is attached.

❑ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

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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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/770,177	08/25/2015	Yannick Glinec	95480	8357

70523 7590 05/09/2018

Carestream Health, Inc.
ATTN: Patent Legal Staff
150 Verona Street
Rochester, NEW YORK 14608
UNITED STATES OF AMERICA

EXAMINER	
PATEL, NIRAV G	
ART UNIT	PAPER NUMBER
2665	

DATE MAILED: 05/09/2018

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 12 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. 14/770,177	Applicant(s) Glinec et al.	
	Examiner NIRAV G PATEL	Art Unit 2665	AIA Status No

-- 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 RCE filed 3/15/2018.
   ☐ 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 1-6,8-9 and 12-24 . 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 areply 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 _____.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☑ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/NIRAV G PATEL/
Primary Examiner, Art Unit 2665

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

Continued Examination Under 37 CFR 1.114

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 3/15/2018 has been entered.

Response to Arguments

3. Applicant's arguments, see pages 2-3, filed 3/15/2018, with respect to rejection of claims under 35 U.S.C. 112(b) have been fully considered and are persuasive. The rejection of claims 1-6, 8, 9 and 11-23 under 35 U.S.C. 112(b) has been withdrawn.

Conclusion

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to NIRAV G PATEL whose telephone number is 5712705812. The examiner can normally be reached on 9am - 5pm.

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, Bhavesh Mehta can be reached on 571-272-7453. 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.

/NIRAV G PATEL/
Primary Examiner, Art Unit 2665

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14/770,177	Glinec et al.
	Examiner	**Art Unit**
	NIRAV G PATEL	2665

CPC							
Symbol						**Type**	**Version**
A61C	/	19	/	05		F	2013-01-01
G06T	/	19	/	20		I	2013-01-01
A61C	/	9	/	0053		I	2013-01-01
A61C	/	7	/	002		I	2013-01-01
G06T	/	2219	/	2004		A	2013-01-01

CPC Combination Sets								
Symbol						**Type**	**Set**	**Ranking**	**Version**
	/		/						

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	21	
/NIRAV G PATEL/ Primary Examiner, Art Unit 2665	27 March 2018	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	2

U.S. Patent and Trademark Office — Part of Paper No.: 20180327

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14/770,177	Glinec et al.
	Examiner	**Art Unit**
	NIRAV G PATEL	2665

INTERNATIONAL CLASSIFICATION					
CLAIMED					
G06K	/	9	/	00	

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

NONE (Assistant Examiner) (Date)	**Total Claims Allowed:** 21	
/NIRAV G PATEL/ Primary Examiner, Art Unit 2665 (Primary Examiner) 27 March 2018 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 2

U.S. Patent and Trademark Office Part of Paper No.: 20180327

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14/770,177	Glinec et al.
	Examiner	**Art Unit**
	NIRAV G PATEL	2665

☑ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1		10		19										
	2		11		20										
	3		12		21										
	4		13		22										
	5		14		23										
	6		15		24										
	7		16												
	8		17												
	9		18												

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	21	
/NIRAV G PATEL/ Primary Examiner, Art Unit 2665	27 March 2018	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	2

U.S. Patent and Trademark Office — Part of Paper No.: 20180327

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14/770,177	Glinec et al.
	Examiner	**Art Unit**
	NIRAV G PATEL	2665

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	06/12/2017	12/15/2017	03/27/2018						
	1	✓	✓	=						
	2	✓	✓	=						
	3	✓	✓	=						
	4	✓	✓	=						
	5	✓	✓	=						
	6	✓	✓	=						
	7	-	-	-						
	8	✓	✓	=						
	9	✓	✓	=						
	10	-	-	-						
	11	✓	-	-						
	12	✓	✓	=						
	13	✓	✓	=						
	14	✓	✓	=						
	15	✓	✓	=						
	16	✓	✓	=						
	17	✓	✓	=						
	18	✓	✓	=						
	19	✓	✓	=						
	20	✓	✓	=						
	21	✓	✓	=						
	22	✓	✓	=						
	23		✓	=						
	24			=						

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14/770,177	Glinec et al.
	Examiner	Art Unit
	NIRAV G PATEL	2665

CPC - Searched*		
Symbol	Date	Examiner
A61C19/05, A61C7/002, A61C9/0053, G06T19/20, G06T2219/2004	6/12/2017	/NGP/

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
A61C19/05, A61C7/002, A61C9/0053, G06T19/20, G06T2219/2004 limited with keywords	6/12/2017	/NGP/
Google Search	6/12/2017	/NGP/
EAST Inventor Name & Assignee Search	03/27/2018	/NGP/

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
	Multiple symbol/group search limited with keywords. See attached printout.	03/27/2018	/NGP/

EAST Search History

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	7	(Glinec-Yannick|Chen-QinranYufeng-Mo).in.	US-PGPUB; USPAT	ADJ	ON	2018/03/27 10:45
L2	593	carestream health.as.	US-PGPUB; USPAT	ADJ	ON	2018/03/27 10:45
L3	6493	(A61C19/05 OR A61C7/002 OR A61C9/0053 OR G06T19/20 OR G06T2219/2004).CPC.	US-PGPUB; USPAT	ADJ	ON	2018/03/27 10:45
L4	7085	(1 or 2 or 3)	US-PGPUB; USPAT	ADJ	ON	2018/03/27 10:45
L5	204	upper jaw same lower jaw same model same (3d or three$dimension$4)	US-PGPUB; USPAT	ADJ	ON	2018/03/27 10:45
L6	116	4 and 5	US-PGPUB; USPAT	ADJ	ON	2018/03/27 10:45
L7	1	upper jaw same lower jaw same model same (3d or three$dimension$4) same (clench or closed) and (bite or occlusal) with surface and (align or level)	US-PGPUB; USPAT	ADJ	ON	2018/03/27 10:45
L8	12	upper jaw same lower jaw same model and (3d or three$dimension$4) same (clench or closed) same (bite or occlusal)	US-PGPUB; USPAT	ADJ	ON	2018/03/27 10:46
L9	10	4 and 8	US-PGPUB; USPAT	ADJ	ON	2018/03/27 10:46
L10	8	upper jaw same lower jaw same model and (3d or three$dimension$4) same (clench or closed) same (bite or occlusal) and (align or level) and display	US-PGPUB; USPAT	ADJ	ON	2018/03/27 10:46
L11	8	4 and 10	US-PGPUB; USPAT	ADJ	ON	2018/03/27 10:46
L12	0	(upper jaw same lower jaw same model and (3d or three$dimension$4) same (clench or closed) same (bite or occlusal) and (align or level) and display).clm.	US-PGPUB; USPAT	ADJ	ON	2018/03/27 10:46

3/ 27/ 2018 10:53:11 AM
C:\ Users\ npatel9\ Documents\ EAST\ Workspaces\ 14770177.wsp

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 14/770,177	Filing Date 08/25/2015	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $80 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $420 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	03/15/2018	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 21	Minus	** 20	= 1		x $100 =	100
	Independent (37 CFR 1.16(h))	* 5	Minus	*** 4	= 1		x $460 =	460
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	560

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $ 0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $ 0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	SLIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	juliet mcmillan
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

This collection of information is required by 37 CFR 1.16. 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 12 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, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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 method of bite registration, comprising the steps of:

a. generating 3-dimensional (3D) teeth models of the upper jaw and the lower jaw;

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

c. attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface;

d. displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful;

e. repeating step b to step d so as to obtain at least two successful bite registrations corresponding to different displayed bite surfaces;

f. selecting two or more successful bite registrations by evaluating the at least two successful bite registrations and selecting said two or more of the displayed successful bite registrations; and

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

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

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

4. (Original) The method of bite registration according to claim 3, wherein said one or more interpolations contain steps of:

decomposing each matrix into an equivalent set of values;

interpolating corresponding values from each set of values; and

recomposing a matrix from the interpolated set of values.

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

a1) capturing 3D teeth surface on the upper jaw or lower jaw by a scanner;

a2) judging whether the captured 3D teeth surface is the first one or not during the scan;

a3) if the captured portion is the first one, accepting the captured 3D teeth surface; and if further succeeding to accept, combining the captured 3D teeth surface with the 3D teeth model; and

a4) if the captured portion is not the first one, attempting to stitch the captured 3D teeth surface onto the existing 3D teeth model; if succeeding to stitch, combining the captured 3D teeth surface with the existing 3D teeth model.

6. (Previously Presented) The method of bite registration according to claim 1, wherein step d including step of:

if the alignment is not successful, the bite surface is discarded and the user receives a notification of failing to align or to register the bite surface, wherein if the alignment is not successful, automatically returning back to step b until the alignment is successful

7. Canceled

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

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

generating candidate 3D rigid transformations to place the 3D teeth surface relative to the 3D teeth model;

evaluating a metric of the candidate 3D rigid transformations using the relative placement of the 3D teeth surface relative to the 3D teeth model;

choosing the best 3D rigid transformation which corresponds to a best metric; and

if the best metric goes below a predetermined threshold, accepting the corresponding 3D rigid transformation; if the best metric exceeds a predetermined threshold, rejecting the stitching.

10. Canceled

11. Canceled

12. (Previously Presented) The method of bite registration according to claim 1, wherein the teeth contained in the bite surface are selected from incisors, premolar or molars.

13. (Original) The method of bite registration according to claim 1, wherein the bite surface is acquired based on one or more bite views captured by a scanner.

14. (Original) The method of bite registration according to claim 1, wherein the alignment is completed in a manual way, a semi-automatic way or automatic way.

15. (Original) The method of bite registration according to claim 1, wherein the final bite registration is used to construct a global 3D teeth model.

16. (Currently Amended) A system for bite registration, comprising:

means for generating 3D teeth models of the upper jaw and the lower jaw;

means for acquiring a bite surface containing a portion of at least one tooth of the upper jaw and a portion of at least one opposing tooth of the lower jaw simultaneously;

means for attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface;

means for displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful;

means for obtaining at least two successful bite registrations corresponding to different displayed bite surface by repeating;

means for selecting two or more successful bite registrations by evaluating at least two successful bite registrations and selecting said two or more of the displayed successful bite registrations; and

means for computing a final bite registration between the teeth models of the upper jaw and the lower jaw using the selected two or more displayed successful bite registrations, and wherein in the means for obtaining, the location of the acquired bite surface is changed.

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

17. (Original) The system for bite registration according to claim 16, wherein the computation of the final bite registration involves the optimization of a cost function depending on the selected successful bite registrations.

18. (Original) The system for bite registration according to claim 16, wherein means for computing the final bite registration involves device for one or more matrix interpolations of the selected successful bite registrations.

19. (Original) The system for bite registration according to claim 18, wherein device for one or more matrix interpolations includes:

module for decomposing each matrix into an equivalent set of values;

module for interpolating corresponding values from each set of values; and

module for recomposing a matrix from the interpolated set of values.

20. (Original) The system for bite registration according to claim 16, wherein means for attempting to align the 3D teeth models includes:

module for, if the alignment is not successful, discarding the bite surface and sending a notification of failing to align to the user.

21. (Currently Amended) A system for bite registration, including a scanner and a computerized workstation, wherein the workstation is configured as:

obtaining 3D teeth models of the upper jaw and the lower jaw, generated respectively, by the scanner;

acquiring a bite surface containing a portion of at least one tooth of the upper jaw and a portion of at least one opposing tooth of the lower jaw simultaneously in a clenched state where the upper jaw is static relative to the lower jaw;

attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface at the workstation;

displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful;

repeating steps acquiring to step of displaying so as to obtain at least two

successful bite registrations corresponding to different displayed bite surfaces;

selecting two or more successful bite registrations by evaluating at least two successful bite registrations; and

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

22. (Original) The system for bite registration according to claim 21, wherein the system is used to construct a global 3D teeth model.

23. (Currently Amended) A method of bite registration, characterized by comprising the steps of:

a. generating 3-dimensional (3D) teeth models of the upper jaw and the lower jaw;

b. acquiring a bite surface containing a part of at least one tooth of the upper jaw and a part of at least one opposing tooth of the lower jaws, simultaneously;

c. attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface;

d. displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful;

e. repeating step b to step d so as to obtain at least two successful bite registrations corresponding to different displayed bite surfaces;

f. selecting one or more successful bite registrations by evaluating at least two successful bite registrations; and

g. computing a final bite registration using selected one or more successful bite registrations, wherein the computation of the final bite registration involves one or more matrix interpolations of the selected successful bite registrations.

24. (New) A method of bite registration, comprising:

a. generating 3-dimensional (3D) teeth models of the upper jaw and the lower jaw;

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

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

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

e. repeating step b to step d so as to obtain at least two successful bite registrations corresponding to different displayed bite surfaces;

f. selecting two or more successful bite registrations by evaluating the at least two successful bite registrations and selecting said two or more of the displayed successful bite registrations; and

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

PTO/SB/30EFS (07-14)
Approved for use through 07/31/2016. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	14770177	Filing Date	2015-08-25	Docket Number (if applicable)	097478-00018USe	Art Unit	2665
First Named Inventor	Yannick Glinec			Examiner Name	Patel, Nirav G.		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, to any international application that does not comply with the requirements of 35 U.S.C. 371, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV.

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

- ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
- ☐ Other _____

☒ Enclosed

- ☒ Amendment/Reply
- ☐ Information Disclosure Statement (IDS)
- ☐ Affidavit(s)/ Declaration(s)
- ☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____
(Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

☒ The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 200809

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

☐ Applicant Signature

PTO/SB/30EFS (07-14)
Approved for use through 07/31/2016. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Signature of Registered U.S. Patent Practitioner			
Signature	/Carl R. WESOLOWSKI/	Date (YYYY-MM-DD)	2018-03-15
Name	Carl R. Wesolowski	Registration Number	40372

This collection of information is required by 37 CFR 1.114. 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 1.11 and 1.14. This collection is estimated to take 12 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, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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 the Freedom of Information Act requires disclosure of these records.

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 inspections 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.

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Customer No. **27805**
Confirmation No. **8357**

First Named Inventor	:	Yannick GLINEC, et al.
Application No.	:	14/770,177
Filed	:	August 25, 2015
Title	:	METHOD AND SYSTEM FOR BITE REGISTRATION
Docket No.	:	097478-00018USe
Art Unit	:	2665
Examiner	:	PATEL, Nirav G.

Filed Via EFS-Web

AMENDMENT

In response to the Office Action dated December 18, 2017, consideration of the following amendments and/or remarks are respectfully requested:

The Commissioner is hereby authorized to charge any additional fees required, including the fee for an extension of time, or to credit any overpayment to Deposit Account 20-0809. The Applicants hereby authorize the Commissioner under 37 C.F.R. §1.136(a)(3) to treat any paper that is filed in this application which requires an extension of time as incorporating a request for such an extension.

Amendments to the Claims are reflected in the listing of claims, which begins on page 2 of this paper.

Remarks/Arguments begin on page 8 of this paper.

REMARKS

Status

This Reply is responsive to the Office Action dated December 18, 2017, in which Claims 1-6, 8-9, and 12-23 are rejected. Claims 1, 16, 21, and 23-24 are the independent claims.

Claims 1, 8, 16, 21, and 23 have been amended. Claim 24 is newly added by this amendment.

No new matter has been added. Support for the amendments can be found is at least Figure 2 and its corresponding description. Accordingly, Claims 1-6, 8-9, and 12-24 are pending in the application, and are presented for reconsideration and allowance.

Allowable subject matter

Applicants acknowledge the Office Action's indication that claims 1-6, 8-9, and 12-23 define patentable subject matter. However, based on the above amendments or the following remarks, Applicants respectfully submit that all pending claims are in condition for allowance.

Statement of the Substance of the Interview

Applicants gratefully acknowledge the courtesies extended by Examiner Patel to Applicants' representative, Carl Wesolowski, during a February 9, 2018 telephonic interview. The substance of the interview is incorporated in the following remarks. During the interview, the pending claims including independent claims 1, 16, 21, and 23 were argued to be definite despite using the terms "portion" and "part". The outstanding rejection was argued to be in error on at least these grounds. Also discussed was adding "corresponding" to "at least one tooth of the lower jaw" in the independent claims to indicate such relationship is captured in the bite surface. However, no agreement was reached. Examiner Patel indicated a determination would be made upon receipt of a written response.

No exhibit was presented or demonstration conducted during the interview.

Applicants respectfully submit that this paper be included in the record for purposes of satisfying the requirements under MPEP § 713.04.

Claim Rejection - 35 U.S.C. § 112

Claims 1-6, 8, 9, and 11-23 are rejected to under 35 U.S.C. § 112, second paragraph, for being indefinite. Applicants respectfully submit that the above amendments or following remarks obviate the grounds for the rejection. Support for the amendments can be found is at least Figure 2 and its corresponding description including paragraph [0055] and Figure 5 of the corresponding patent application publication, US 20160008116.

Applicants respectfully submit that the relative term "portion" as recited in the pending claims including independent claims 1, 16 and 21 and the term "part" as recited in pending independent claim 23 are definite.

For example, in pending independent claim 1, when the "portion" is insufficient, the bite registration fails and step e (in claim 1), repeats steps b through d (in claim 1) until two successful registrations are made. The claim is definite because when the "portion" is enough, a successful bite registration is made. When the "portion" is not enough, a successful bite registration is not made in step e.

Further, for example, Applicants respectfully submit that the relative term "portion" as recited in pending independent claim 1 is definite because it is based on the stitching threshold process. The process of capturing a 3D tooth surface is described in paragraph [0051] where a captured portion is described as a 3D view coming from the scanner. In paragraph [0051], a portion can be described by the field of view of the scanner, which can be $1cm^2$ for some commercial scanner products. The 3D teeth surface is the result of the stitching of all the captured portions.

[0051] In a preferred embodiment, as shown in FIG. **3**, S**110** includes the following steps: S**111**, 3D teeth surface on the upper jaw or lower jaw is captured by the handheld scanner **13**; S**112**, judging whether the captured portion is the first one or not for a certain patient in the workstation **91**; S**114**, if the captured portion is the first one during the scan, the captured portion is accepted; if succeeding to be accepted in S**116**, entering into S**117** of combining the captured 3D teeth surface with the 3D teeth model; S**113**, if the captured portion is not the first one, attempting to stitch the captured portion onto the existing 3D teeth model; S**115** judging whether the captured portion is successfully stitched not if succeeding to stitch in S**115**, entering into S**117** of combining the captured portion with the existing 3D teeth model. Thus, the captured portion combine with the existing 3D teeth model would make the ultimately formed 3D teeth model of the upper or lower jaw more accurate.

Paragraph [0054] describes that the bite surface may be obtained from the process of Step 110. Thus, a bite surface may be a combination of captured portions, assembled using a stitching algorithm (e.g., where again successfully stitching references to a logic decision from a stitching algorithm).

[0054] It can be understood that the bite surface **191** is a 3D surface, and can be obtained by a method of image processing applied to one or more bite views. In an embodiment, this method is similar with that used in steps of S**110**. It can also

Paragraph [0057] describes that bite surface may be aligned with the upper and lower jaw using the same stitching algorithm.

embodiment of the invention. The stitching of a portion of 3D teeth surface of the bite surface with the 3D teeth models includes steps of S**131** to S**136**. In S**131**, generating candidate 3D rigid transformations to place the 3D teeth surface of the bite surface relative to the 3D teeth model. In S**132**, evaluating a metric of the candidate 3D rigid transformations using the relative placement of the 3D teeth surface relative to the 3D teeth model. In S**133**, choosing the best 3D rigid transformation which corresponds to a best metric. In S**134**, judging whether the best metric exceeds a predetermined threshold or not: if the best metric goes below a predetermined threshold, entering into S**136** of accepting the corresponding 3D rigid transformation; if the best metric exceeds a predetermined threshold, entering into S**137** of rejecting the stitching, which means a failure of stitching.

Thus, the definition of a portion of upper and lower jaw is related to the stitching success of the bite surface onto the upper and lower 3D teeth models.

Accordingly, for at least one of the reasons herein, Applicants respectfully submit that the relative term "portion" as recited in the pending claims including independent claims 1, 16 and 23 is definite, and the term "part" as recited in pending independent claim 23 is definite.

Withdrawal of the rejection under 35 U.S.C. § 112, second paragraph, of Claims 1-6, 8, 9, and 11-22 is respectfully requested.

Newly added claims

Claim 24 is newly added by this amendment and believed to be in condition for allowance.

Summary

For the reasons set forth above, it is believed that the application is in condition for allowance. Accordingly, reconsideration and favorable action are respectfully solicited.

It is believed that all of the pending claims have been addressed. However, failure to address a specific rejection, issue, or comment in the present file history does not signify agreement with or concession of that rejection, issue, or comment. In addition, because the arguments made in the present file history are not intended to be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in the present file history should be construed as intent to concede any issue with regard to any claim, except as specifically stated, and the amendment of any claim does not necessarily signify concession of patentability of the claim prior to its amendment.

Should the Examiner consider that additional amendments are necessary to place the application in condition for allowance, the favor is requested of a telephone call to the undersigned counsel for the purpose of discussing such amendments.

Respectfully submitted,

March 15, 2018

By: /Carl R. WESOLOWSKI/
Carl R. Wesolowski
Reg. No. 40,372

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Electronic Patent Application Fee Transmittal

Application Number:	14770177
Filing Date:	25-Aug-2015
Title of Invention:	METHOD AND SYSTEM FOR BITE REGISTRATION
First Named Inventor/Applicant Name:	Yannick Glinec
Filer:	Carl R. Wesolowski/Marge Timoldi
Attorney Docket Number:	95480

Filed as Large Entity

Filing Fees for U.S. National Stage under 35 USC 371

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
CLAIMS IN EXCESS OF 20	1615	1	100	100
INDEPENDENT CLAIMS IN EXCESS OF 3	1614	1	460	460
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
RCE- 1st Request	1801	1	1300	1300
		Total in USD ($)		**1860**

Electronic Acknowledgement Receipt

EFS ID:	32063633
Application Number:	14770177
International Application Number:	
Confirmation Number:	8357
Title of Invention:	METHOD AND SYSTEM FOR BITE REGISTRATION
First Named Inventor/Applicant Name:	Yannick Glinec
Customer Number:	70523
Filer:	Carl R. Wesolowski/Marge Timoldi
Filer Authorized By:	Carl R. Wesolowski
Attorney Docket Number:	95480
Receipt Date:	15-MAR-2018
Filing Date:	25-AUG-2015
Time Stamp:	15:40:52
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$1860
RAM confirmation Number	031618INTEFSW15421800
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Continued Examination (RCE)	097478-00018USe_D-95480_PO-T_RCE_2018-03-15.pdf	42127 80bec7bf4bb23dbf861a7b660e54c6c02cba7c34	no	3
Warnings:					
This is not a USPTO supplied RCE SB30 form.					
Information:					
2		097478-00018USe_D-95480_PO-T_Amendment_2018-03-15.pdf	174134 d7978f9ed5dce3819e7202c25cfa30043dfa1e8f	yes	13

Multipart Description/PDF files in .zip description

Document Description	Start	End
Amendment Submitted/Entered with Filing of CPA/RCE	1	1
Claims	2	7
Applicant Arguments/Remarks Made in an Amendment	8	13

Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	34093 38b95e44c1382eca7f3a2b38fb66b6758f728a86	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	250354	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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

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

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

e. repeating step b to step d so as to obtain at least two successful bite registrations corresponding to different displayed bite surfaces;

f. selecting two or more successful bite registrations by evaluating the at least two successful bite registrations and selecting said two or more of the displayed successful bite registrations; and

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

REMARKS

Status

This Reply is responsive to the Office Action dated December 18, 2017, in which Claims 1-6, 8-9, and 12-23 are rejected. Claims 1, 16, 21, and 23-24 are the independent claims.

Claims 1, 8, 16, 21, and 23 have been amended. Claim 24 is newly added by this amendment.

No new matter has been added. Support for the amendments can be found is at least Figure 2 and its corresponding description. Accordingly, Claims 1-6, 8-9, and 12-24 are pending in the application, and are presented for reconsideration and allowance.

Allowable subject matter

Applicants acknowledge the Office Action's indication that claims 1-6, 8-9, and 12-23 define patentable subject matter. However, based on the above amendments or the following remarks, Applicants respectfully submit that all pending claims are in condition for allowance.

Statement of the Substance of the Interview

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No exhibit was presented or demonstration conducted during the interview.

Applicants respectfully submit that this paper be included in the record for purposes of satisfying the requirements under MPEP § 713.04.

Claim Rejection - 35 U.S.C. § 112

Claims 1-6, 8, 9, and 11-23 are rejected to under 35 U.S.C. § 112, second paragraph, for being indefinite. Applicants respectfully submit that the above amendments or following remarks obviate the grounds for the rejection. Support for the amendments can be found is at least Figure 2 and its corresponding description including paragraph [0055] and Figure 5 of the corresponding patent application publication, US 20160008116.

Applicants respectfully submit that the relative term "portion" as recited in the pending claims including independent claims 1, 16 and 21 and the term "part" as recited in pending independent claim 23 are definite.

For example, in pending independent claim 1, when the "portion" is insufficient, the bite registration fails and step e (in claim 1), repeats steps b through d (in claim 1) until two successful registrations are made. The claim is definite because when the "portion" is enough, a successful bite registration is made. When the "portion" is not enough, a successful bite registration is not made in step e.

Further, for example, Applicants respectfully submit that the relative term "portion" as recited in pending independent claim 1 is definite because it is based on the stitching threshold process. The process of capturing a 3D tooth surface is described in paragraph [0051] where a captured portion is described as a 3D view coming from the scanner. In paragraph [0051], a portion can be described by the field of view of the scanner, which can be $1cm^2$ for some commercial scanner products. The 3D teeth surface is the result of the stitching of all the captured portions.

[0051] In a preferred embodiment, as shown in FIG. **3**, S**110** includes the following steps: S**111**, 3D teeth surface on the upper jaw or lower jaw is captured by the handheld scanner **13**; S**112**, judging whether the captured portion is the first one or not for a certain patient in the workstation **91**; S**114**, if the captured portion is the first one during the scan, the captured portion is accepted; if succeeding to be accepted in S**116**, entering into S**117** of combining the captured 3D teeth surface with the 3D teeth model; S**113**, if the captured portion is not the first one, attempting to stitch the captured portion onto the existing 3D teeth model; S**115** judging whether the captured portion is successfully stitched not if succeeding to stitch in S**115**, entering into S**117** of combining the captured portion with the existing 3D teeth model. Thus, the captured portion combine with the existing 3D teeth model would make the ultimately formed 3D teeth model of the upper or lower jaw more accurate.

Paragraph [0054] describes that the bite surface may be obtained from the process of Step 110. Thus, a bite surface may be a combination of captured portions, assembled using a stitching algorithm (e.g., where again successfully stitching references to a logic decision from a stitching algorithm).

[0054] It can be understood that the bite surface **191** is a 3D surface, and can be obtained by a method of image processing applied to one or more bite views. In an embodiment, this method is similar with that used in steps of S**110**. It can also

Paragraph [0057] describes that bite surface may be aligned with the upper and lower jaw using the same stitching algorithm.

embodiment of the invention. The stitching of a portion of 3D teeth surface of the bite surface with the 3D teeth models includes steps of S**131** to S**136**. In S**131**, generating candidate 3D rigid transformations to place the 3D teeth surface of the bite surface relative to the 3D teeth model. In S**132**, evaluating a metric of the candidate 3D rigid transformations using the relative placement of the 3D teeth surface relative to the 3D teeth model. In S**133**, choosing the best 3D rigid transformation which corresponds to a best metric. In S**134**, judging whether the best metric exceeds a predetermined threshold or not: if the best metric goes below a predetermined threshold, entering into S**136** of accepting the corresponding 3D rigid transformation; if the best metric exceeds a predetermined threshold, entering into S**137** of rejecting the stitching, which means a failure of stitching.

Thus, the definition of a portion of upper and lower jaw is related to the stitching success of the bite surface onto the upper and lower 3D teeth models.

Accordingly, for at least one of the reasons herein, Applicants respectfully submit that the relative term "portion" as recited in the pending claims including independent claims 1, 16 and 23 is definite, and the term "part" as recited in pending independent claim 23 is definite.

Withdrawal of the rejection under 35 U.S.C. § 112, second paragraph, of Claims 1-6, 8, 9, and 11-22 is respectfully requested.

Newly added claims

Claim 24 is newly added by this amendment and believed to be in condition for allowance.

Summary

For the reasons set forth above, it is believed that the application is in condition for allowance. Accordingly, reconsideration and favorable action are respectfully solicited.

It is believed that all of the pending claims have been addressed. However, failure to address a specific rejection, issue, or comment in the present file history does not signify agreement with or concession of that rejection, issue, or comment. In addition, because the arguments made in the present file history are not intended to be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in the present file history should be construed as intent to concede any issue with regard to any claim, except as specifically stated, and the amendment of any claim does not necessarily signify concession of patentability of the claim prior to its amendment.

Should the Examiner consider that additional amendments are necessary to place the application in condition for allowance, the favor is requested of a telephone call to the undersigned counsel for the purpose of discussing such amendments.

Respectfully submitted,

March 15, 2018

By: /Carl R. WESOLOWSKI/
Carl R. Wesolowski
Reg. No. 40,372

THOMPSON HINE LLP
Intellectual Property Group
10050 Innovation Drive
Suite 400
Dayton, Ohio 45342-4934
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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/770,177	08/25/2015	Yannick Glinec	95480	8357

70523 7590 02/28/2018

Carestream Health, Inc.
ATTN: Patent Legal Staff
150 Verona Street
Rochester, NEW YORK 14608

EXAMINER	
PATEL, NIRAV G	

ART UNIT	PAPER NUMBER
2665	

MAIL DATE	DELIVERY MODE
02/28/2018	PAPER

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.

Applicant-Initiated Interview Summary	**Application No.** 14/770,177	**Applicant(s)** Glinec et al.	
	Examiner NIRAV G PATEL	**Art Unit** 2665	**AIA Status** No

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

(1) NIRAV G. PATEL. (3) _____.

(2) Carl Wesolowski (Reg. No.: 40,372). (4) _____.

Date of Interview: 09 February 2018.

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: _____.

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...)

The examiner and representative discussed how to possibly overcome the 112 rejection. The examiner provided the interpretation and how the claims were indefinite. The representative indicated that an appropriate response would be filed.

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

/NIRAV G PATEL/ Primary Examiner, Art Unit 2665	

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.

Doc Code: M865 or FAI.REQ.INTV

PTOL-413A (07-16)
Approved for use through 08/31/2016. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Applicant Initiated Interview Request Form

Application No.: 14/770, 177 First Named Applicant: Yannick GLINEC,
Examiner: N Patel Art Unit: 2665 Status of Application: Final Office Action issued

Tentative Participants:
(1) Carl R Wesolowski (2) Examiner N Patel
(3) _____ (4) _____

Proposed Date of Interview: February 9, 2018 **Proposed Time:** 1PM (○AM⊙PM)

Type of Interview Requested:
(1) ☑ Telephonic (2) ☐ Personal (3) ☐ Video Conference

Exhibit To Be Shown or Demonstrated: ☐ YES ☐ NO
If yes, provide brief description: _____

Issues To Be Discussed

Issues (Rej., Obj., etc)	Claims/ Fig. #s	Prior Art	Discussed	Agreed	Not Agreed
(1) 112, 2nd para	1-6, 8, 9, 11-23		☐	☐	☐
(2)			☐	☐	☐
(3)			☐	☐	☐
(4)			☐	☐	☐

☐ Continuation Sheet Attached ☐ Proposed Amendment or Arguments Attached
Brief Description of Arguments to be Presented: discussion of paragraphs 51, 54, 57 and 58
(e.g., 8121718) of corresponding USP Publn. No. 2016/008116
An interview was conducted on the above-identified application on _____

NOTE: This form should be completed and filed by applicant in advance of the interview (see MPEP § 713.01). If this form is signed by a registered practitioner not of record, the Office will accept this as an indication that he or she is authorized to conduct an interview on behalf of the principal (37 CFR 1.32(a)(3)) pursuant to 37 CFR 1.34. This is not a power of attorney to any above named practitioner. See the Instruction Sheet for this form, which is incorporated by reference. By signing this form, applicant or practitioner is certifying that he or she has read the Instruction Sheet. After the interview is conducted, applicant is advised to file a statement of the substance of this interview (37 CFR 1.133(b)) as soon as possible. This application will not be delayed from issue because of applicant's failure to submit a written record of this interview.

/Carl R. WESOLOWSKI/
Applicant/Applicant's Representative Signature

_____
Examiner/SPE Signature

Carl R. Wesolowski
Typed/Printed Name of Applicant or Representative

404.541.2974
Applicant's/Applicant's Representative's Telephone Number

40372
Registration Number, if applicable

This collection of information is required by 37 CFR 1.133. 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 1.11 and 1.14. This collection is estimated to take 24 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, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS.
If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Electronic Acknowledgement Receipt

EFS ID:	31722987
Application Number:	14770177
International Application Number:	
Confirmation Number:	8357
Title of Invention:	METHOD AND SYSTEM FOR BITE REGISTRATION
First Named Inventor/Applicant Name:	Yannick Glinec
Customer Number:	70523
Filer:	Carl R. Wesolowski/Marge Timoldi
Filer Authorized By:	Carl R. Wesolowski
Attorney Docket Number:	95480
Receipt Date:	07-FEB-2018
Filing Date:	25-AUG-2015
Time Stamp:	11:05:52
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Letter Requesting Interview with Examiner	097478-00018USe_Applicant_Initiated_Interview_Request_Form_2018-02-07.pdf	78182 2e28cf39d42e9cd9d0dac589d5f406726248ecfb	no	1

Warnings:

Information:	
Total Files Size (in bytes):	78182

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/770,177	08/25/2015	Yannick Glinec	95480	8357

70523 7590 12/18/2017

Carestream Health, Inc.
ATTN: Patent Legal Staff
150 Verona Street
Rochester, NY 14608

EXAMINER	
PATEL, NIRAV G	

ART UNIT	PAPER NUMBER
2665	

MAIL DATE	DELIVERY MODE
12/18/2017	PAPER

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.

Office Action Summary	Application No. 14/770,177	Applicant(s) Glinec et al.	
	Examiner NIRAV G PATEL	Art Unit 2665	AIA Status No

-- 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 2 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 10/16/2017 .

☐ 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) 1-6,8-9 and 12-23 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) 1-6,8-9 and 12-23 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 _____ 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 _____.

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

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

Response to Arguments

2. Applicant's arguments filed 10/16/2017 have been fully considered but they are not persuasive.

a. Regarding Claims 1 through 6, 8, 9 and 11 through 22 rejected under 35 U.S.C. § 112, the claim amendments do not overcome the rejection as the same questions are posed by the amendment. See the rejection set forth below.

Claim Rejections - 35 USC § 112

3. 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.

4. Claims 1 through 6, 8, 9 and 11 through 23 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.

5. The term "portion" in claims 1, 16 and 21 is a relative term which renders the claim indefinite. The term "portion" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. The claim amendment requires a portion of at least one tooth, which begs the question of whether 10% of the tooth has to be contained, or does 50% in order to meet the claim limitation?

6. The term "part" in claim 23 is a relative term which renders the claim indefinite. The term "portion" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. The claim amendment requires a portion of at least one tooth, which begs the question of whether 10% of the tooth has to be contained, or does 50% in order to meet the claim limitation?

Conclusion

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to NIRAV G PATEL whose telephone number is 571-270-5812. The examiner can normally be reached on 9am - 5pm.

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, Bhavesh Mehta can be reached on 571-272-7453. 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.

/NIRAV G PATEL/
Primary Examiner, Art Unit 2665

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14/770,177	Glinec et al.
	Examiner	Art Unit
	NIRAV G PATEL	2665

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

CLAIMS

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	06/12/2017	12/15/2017							
	1	✓	✓							
	2	✓	✓							
	3	✓	✓							
	4	✓	✓							
	5	✓	✓							
	6	✓	✓							
	7	-	-							
	8	✓	✓							
	9	✓	✓							
	10	-	-							
	11	✓	-							
	12	✓	✓							
	13	✓	✓							
	14	✓	✓							
	15	✓	✓							
	16	✓	✓							
	17	✓	✓							
	18	✓	✓							
	19	✓	✓							
	20	✓	✓							
	21	✓	✓							
	22	✓	✓							
	23		✓							

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Customer No. **27805**
Confirmation No. **8357**

First Named Inventor	:	Yannick GLINEC, et al.
Application No.	:	14/770,177
Filed	:	August 25, 2015
Title	:	METHOD AND SYSTEM FOR BITE REGISTRATION
Docket No.	:	097478-00018USe
Art Unit	:	2665
Examiner	:	PATEL, Nirav G.

Filed Via EFS-Web

AMENDMENT

In response to the Office Action dated June 15, 2017, consideration of the following amendments and/or remarks are respectfully requested:

Amendments to the Claims are reflected in the listing of claims, which begins on page 2 of this paper.

Remarks/Arguments begin on page 8 of this paper.

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 method of bite registration, ~~characterized by~~ comprising the steps of:

a. generating 3-dimensional (3D) teeth models of the upper jaw and the lower jaw;

b. acquiring a bite surface containing a portion of at least one tooth of the upper jaw and a portion of at least one tooth of the lower jaw~~s~~ simultaneously in a clenched state where the upper jaw is static relative to the lower jaw;

c. attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface;

d. displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful;

e. repeating step b to step d so as to obtain at least two successful bite registrations corresponding to different displayed bite surfaces;

f. selecting ~~one~~two or more successful bite registrations by evaluating the at least two successful bite registrations and selecting said two or more of the displayed successful bite registrations; and

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

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

3. (Original) The method of bite registration according to claim 1, wherein

the computation of the final bite registration involves one or more matrix interpolations of the selected successful bite registrations.

4. (Original) The method of bite registration according to claim 3, wherein said one or more interpolations contain steps of:

decomposing each matrix into an equivalent set of values;

interpolating corresponding values from each set of values; and

recomposing a matrix from the interpolated set of values.

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

a1) capturing 3D teeth surface on the upper jaw or lower jaw by a scanner;

a2) judging whether the captured 3D teeth surface is the first one or not during the scan;

a3) if the captured portion is the first one, accepting the captured 3D teeth surface; and if further succeeding to accept, combining the captured 3D teeth surface with the 3D teeth model; and

a4) if the captured portion is not the first one, attempting to stitch the captured 3D teeth surface onto the existing 3D teeth model; if succeeding to stitch, combining the captured 3D teeth surface with the existing 3D teeth model.

6. (Previously Presented) The method of bite registration according to claim 1, wherein step d including step of:

if the alignment is not successful, the bite surface is discarded and the user receives a notification of failing to align or to register the bite surface, wherein if the alignment is not successful, automatically returning back to step b until the alignment is successful.

7. Canceled

8. (Original) The method of bite registration according to claim 1, wherein the alignment is completed at least by stitching of a portion of 3D teeth surface of the bite surface with the 3D teeth models of the upper jaw and the lower jaw.

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

generating candidate 3D rigid transformations to place the 3D teeth surface relative to the 3D teeth model;

evaluating a metric of the candidate 3D rigid transformations using the relative placement of the 3D teeth surface relative to the 3D teeth model;

choosing the best 3D rigid transformation which corresponds to a best metric; and

if the best metric goes below a predetermined threshold, accepting the corresponding 3D rigid transformation; if the best metric exceeds a predetermined threshold, rejecting the stitching.

10. Canceled

11. Canceled

12. (Currently Amended) The method of bite registration according to claim ~~11~~, wherein the teeth contained in the bite surface are selected from incisors, premolar or molars.

13. (Original) The method of bite registration according to claim 1, wherein the bite surface is acquired based on one or more bite views captured by a scanner.

14. (Original) The method of bite registration according to claim 1, wherein the alignment is completed in a manual way, a semi-automatic way or automatic way.

15. (Original) The method of bite registration according to claim 1, wherein the final bite registration is used to construct a global 3D teeth model.

16. (Currently Amended) A system for bite registration, ~~characterized by~~ ~~includingcomprising~~:

means for generating 3D teeth models of the upper jaw and the lower jaw;

means for acquiring a bite surface containing a portion of at least one tooth of the upper jaw and a portion of at least one tooth of the lower jaw~~s~~ simultaneously;

means for attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface;

means for displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful;

means for obtaining at least two successful bite registrations corresponding to different displayed bite surface by repeating;

means for selecting ~~one~~two or more successful bite registrations by evaluating at least two successful bite registrations and selecting said two or more of the displayed successful bite registrations; and

means for computing a final bite registration between the teeth models of the upper jaw and the lower jaw using the selected ~~one~~two or more displayed successful bite registrations, and wherein in the means for obtaining, the location of the acquired bite surface is changed.

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

17. (Original) The system for bite registration according to claim 16, wherein the computation of the final bite registration involves the optimization of a cost function depending on the selected successful bite registrations.

18. (Original) The system for bite registration according to claim 16, wherein means for computing the final bite registration involves device for one or more matrix interpolations of the selected successful bite registrations.

19. (Original) The system for bite registration according to claim 18, wherein device for one or more matrix interpolations includes:

module for decomposing each matrix into an equivalent set of values;

module for interpolating corresponding values from each set of values; and

module for recomposing a matrix from the interpolated set of values.

20. (Original) The system for bite registration according to claim 16, wherein means for attempting to align the 3D teeth models includes:

module for, if the alignment is not successful, discarding the bite surface and sending a notification of failing to align to the user.

21. (Currently Amended) A system for bite registration, including a scanner and a computerized workstation, wherein the workstation is configured as:

~~generating~~ obtaining 3D teeth models of the upper jaw and the lower jaw, generated respectively, by the scanner;

acquiring a bite surface containing a portion of at least one tooth of the upper jaw and a portion of at least one tooth of the lower jaw~~s~~ simultaneously in a clenched state where the upper jaw is static relative to the lower jaw;

attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surfaceat the workstation;

displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful;

repeating steps acquiring to step of displaying so as to obtain at least two

successful bite registrations corresponding to different displayed bite surfaces;

selecting ~~one~~two or more successful bite registrations by evaluating at least two successful bite registrations; and

computing a final bite registration using the selected ~~one~~two or more successful bite registrations, and where in the repeating step, when repeating to perform the acquiring step, the location of the acquired bite surface is changed.

22. (Original) The system for bite registration according to claim 21, wherein the system is used to construct a global 3D teeth model.

23. (New) A method of bite registration, characterized by comprising the steps of:

a. generating 3-dimensional (3D) teeth models of the upper jaw and the lower jaw;

b. acquiring a bite surface containing a part of at least one tooth of the upper and lower jaws, simultaneously;

c. attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface;

d. displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful;

e. repeating step b to step d so as to obtain at least two successful bite registrations corresponding to different displayed bite surfaces;

f. selecting one or more successful bite registrations by evaluating at least two successful bite registrations; and

g. computing a final bite registration using selected one or more successful bite registrations, wherein the computation of the final bite registration involves one or more matrix interpolations of the selected successful bite registrations.

REMARKS

Status

This Reply is responsive to the Office Action dated June 15, 2017, in which Claims 1-6, 8, 9, and 11-22 are rejected. Claims 1, 16, and 21 are the independent claims. Claims 1, 12, 16, and 21 have been amended. Claim 11 is canceled without prejudice or disclaimer, and claim 23 is newly added.

No new matter has been added. Support for the amendments can be found is at least Figure 2 and its corresponding description. Accordingly, Claims 1-6, 8, 9, and 11-23 are pending in the application, and are presented for reconsideration and allowance.

Allowable subject matter

Applicants acknowledge the Office Action's indication that claims 3, 4, 9, 11, 12, 18 and 19 define patentable subject matter. However, based on the above amendments or the following remarks, Applicants respectfully submit that all pending claims are in condition for allowance.

Claim Interpretation

Applicants respectfully submit that at least Figure 1 and its corresponding description in the corresponding patent application publication, US 20160008116, provides corresponding structure for Claims 16-20 with respect to 35 U.S.C. § 112, sixth paragraph.

Claim Rejection - 35 U.S.C. § 112

Claims 1-6, 8, 9, and 11-22 are rejected to under 35 U.S.C. § 112 for being indefinite. Applicants respectfully submit that the above amendments or following remarks obviate the grounds for the rejection. Support for the amendments can be found is at least Figure 2 and its corresponding description including paragraph [0055] and Figure 5 of the corresponding patent application publication, US

20160008116. Withdrawal of the rejection to Claims 1-6, 8, 9, and 11-22 is respectfully requested.

Claim Rejection - 35 U.S.C. § 102 and § 103

Claims 1, 6, 8, 13-16, and 20-22 stand rejected under 35 U.S.C. § 102(e) as being unpatentable over Sirona (CEREC SW Operator's Manual, pages 1-82, dated August 2012, (hereafter *Sirona*). Claims 2 and 17 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Sirona*. The rejections are respectfully traversed.

Without acquiescing to the rejections, Applicants have amended Claims 1, 16 and 21.

Amended claim 1 recites features including a method of bite registration including computing a final bite registration between the teeth models of the upper jaw and the lower jaw using the selected two or more displayed successful bite registrations, and wherein in step e, when repeating to perform step b, the location of the acquired bite surface is changed and combinations thereof as recited.

The Office Action asserts that *Sirona* discloses computing a final bite registration using selected one or more successful bite registrations, citing page 78 of *Sirona*, which is asserted to disclose "the (model) phase is finished after successful bite registration". with respect to forming the hole patter with two or more positioning holes in the first planar surface…". See Item 9, page 6-7, of the Office Action. Applicants respectfully submit that *Sirona* discloses generating a single bite registration of the upper and lower jaw models. Thus, Applicants respectfully submit that *Sirona* does not disclose at least features of a method of bite registration including e. repeating step b to step d so as to obtain at least two successful bite registrations corresponding to different displayed bite surfaces; f. selecting two or more successful bite registrations by evaluating the at least two successful bite registrations and selecting said two or more of the displayed successful bite registrations; and g. computing a final bite registration between the teeth models of the upper jaw and the lower jaw using the selected two or more displayed successful bite registrations, and wherein in step e, when repeating to perform step b, the location of the acquired bite surface is changed and combinations thereof as recited.

See at least pages 66, 71, 72 and 78 of *Sirona*.

Applicants respectfully submit that ***Sirona*** does not suggest any modification to its disclosure that would result in at least features of a method of bite registration including computing a final bite registration between the teeth models of the upper jaw and the lower jaw using the selected two or more displayed successful bite registrations, and wherein in step e, when repeating to perform step b, the location of the acquired bite surface is changed and combinations thereof as recited in claim 1.

For at least one of the foregoing reasons, Applicants respectfully submit that independent claim 1 defines patentable subject matter. Applicants respectfully submit that independent claims 16 and 21, define patentable subject matter for at least reasons similar to claim 1. Claims 6, 8, 13-15, 20, and 22 depend from claims 1, 16 and 21, respectively, and therefore also define patentable subject matter for at least that reason as well as their additionally recited features.

Reconsideration and withdrawal of the rejection of claims 1, 6, 8, 13-16, and 20-22 under § 102 and claims 2 and 17 under § 103 is respectfully requested.

Newly added claims

Claim 23 is newly added by this amendment and believed to be in condition for allowance. Support for these claims can be found in at least original claim 3 of the application.

Summary

For the reasons set forth above, it is believed that the application is in condition for allowance. Accordingly, reconsideration and favorable action are respectfully solicited.

It is believed that all of the pending claims have been addressed. However, failure to address a specific rejection, issue, or comment in the present file history does not signify agreement with or concession of that rejection, issue, or comment. In addition, because the arguments made in the present file history are not intended to be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in the present file history

should be construed as intent to concede any issue with regard to any claim, except as specifically stated, and the amendment of any claim does not necessarily signify concession of patentability of the claim prior to its amendment.

Should the Examiner consider that additional amendments are necessary to place the application in condition for allowance, the favor is requested of a telephone call to the undersigned counsel for the purpose of discussing such amendments.

Respectfully submitted,

October 16, 2017

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Electronic Patent Application Fee Transmittal

Application Number:	14770177
Filing Date:	25-Aug-2015
Title of Invention:	METHOD AND SYSTEM FOR BITE REGISTRATION
First Named Inventor/Applicant Name:	Yannick Glinec
Filer:	Carl R. Wesolowski/Ann Girardot
Attorney Docket Number:	95480

Filed as Large Entity

Filing Fees for U.S. National Stage under 35 USC 371

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
INDEPENDENT CLAIMS IN EXCESS OF 3	1614	1	420	420
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Extension - 1 month with $0 paid	1251	1	200	200
Miscellaneous:				
			Total in USD ($)	**620**

Electronic Acknowledgement Receipt

EFS ID:	30666314
Application Number:	14770177
International Application Number:	
Confirmation Number:	8357
Title of Invention:	METHOD AND SYSTEM FOR BITE REGISTRATION
First Named Inventor/Applicant Name:	Yannick Glinec
Customer Number:	70523
Filer:	Carl R. Wesolowski/Ann Girardot
Filer Authorized By:	Carl R. Wesolowski
Attorney Docket Number:	95480
Receipt Date:	16-OCT-2017
Filing Date:	25-AUG-2015
Time Stamp:	15:34:11
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	CARD
Payment was successfully received in RAM	$620
RAM confirmation Number	101717INTEFSW15351100
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		097478-00018USe_PO-T_Amend1_2017-10-16.pdf	504541 983e8be202cf84601a27c56a29574c62d120e3ea	yes	11
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Amendment/Req. Reconsideration-After Non-Final Reject		1	1	
	Claims		2	7	
	Applicant Arguments/Remarks Made in an Amendment		8	11	
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	32847 747437c4ad18d2ad2bfb6b3e8f7aabab2764dccf	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	537388		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (09-11)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 14/770,177	Filing Date 08/25/2015	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT **10/16/2017**

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	X $80 =	0
Independent (37 CFR 1.16(h))	* 4	Minus	***3	= 1	X $420 =	420
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	**420**

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
EVELYN NIMMONS

This collection of information is required by 37 CFR 1.16. 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 12 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, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/770,177	08/25/2015	Yannick Glinec	95480	8357

70523 7590 06/15/2017

Carestream Health, Inc.
ATTN: Patent Legal Staff
150 Verona Street
Rochester, NY 14608

EXAMINER
PATEL, NIRAV G

ART UNIT	PAPER NUMBER
2665	

MAIL DATE	DELIVERY MODE
06/15/2017	PAPER

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.

Office Action Summary	Application No. 14/770,177	Applicant(s) GLINEC ET AL.	
	Examiner Nirav G. Patel	Art Unit 2665	AIA (First Inventor to File) Status No

-- 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 *8/25/2015*.

☐ 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) *1-6,8,9 and 11-22* 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) *1-6,8,9 and 11-22* 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 *8/25/2015* 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 _____.

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

4) ☐ Other: _____.

DETAILED ACTION

Notice of Pre-AIA or AIA Status

1. The present application is being examined under the pre-AIA first to invent provisions.

Information Disclosure Statement

2. The information disclosure statement (IDS) submitted on 8/25/2015, 11/29/2016, 2/7/2017 are in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Claim Interpretations - 35 USC § 112

The following is a quotation of 35 U.S.C. 112(f):

> (f) Element in Claim for a Combination. – An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

The following is a quotation of pre-AIA 35 U.S.C. 112, sixth paragraph:

> An element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

Use of the word "means" (or "step for") in a claim with functional language creates a rebuttable presumption that the claim element is to be treated in accordance with 35 U.S.C. 112(f) (pre-AIA 35 U.S.C. 112, sixth paragraph). The presumption that 35 U.S.C. 112(f) (pre-AIA 35 U.S.C. 112, sixth paragraph) is invoked is rebutted when the function is recited with

sufficient structure, material, or acts within the claim itself to entirely perform the recited function.

Absence of the word “means” (or “step for”) in a claim creates a rebuttable presumption that the claim element is not to be treated in accordance with 35 U.S.C. 112(f) (pre-AIA 35 U.S.C. 112, sixth paragraph). The presumption that 35 U.S.C. 112(f) (pre-AIA 35 U.S.C. 112, sixth paragraph) is not invoked is rebutted when the claim element recites function but fails to recite sufficiently definite structure, material or acts to perform that function.

Claim elements in this application that use the word “means” (or “step for”) are presumed to invoke 35 U.S.C. 112(f) except as otherwise indicated in an Office action. Similarly, claim elements that do not use the word “means” (or “step for”) are presumed not to invoke 35 U.S.C. 112(f) except as otherwise indicated in an Office action.

3. Claim limitation “means” have been interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, because it uses/they use a generic placeholder “means” coupled with functional language “generating 3D teeth models,” “acquiring a bite surface,” “attempting to align,” “displaying the bite surface,” “obtaining at least two successful bite registrations," "selecting one or more successful bite registrations" and "means for computing a final bite registration" without reciting sufficient structure to achieve the function. Furthermore, the generic placeholder is not preceded by a structural modifier.

Since the claim limitation(s) invokes 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, claims 16 through 20 have been interpreted to cover the corresponding structure described in the specification that achieves the claimed function, and equivalents thereof.

A review of the specification shows that the following appears to be the corresponding structure described in the specification for the 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph limitation: Figure 1.

If applicant wishes to provide further explanation or dispute the examiner's interpretation of the corresponding structure, applicant must identify the corresponding structure with reference to the specification by page and line number, and to the drawing, if any, by reference characters in response to this Office action.

If applicant does not intend to have the claim limitation(s) treated under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112 , sixth paragraph, applicant may amend the claim(s) so that it/they will clearly not invoke 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, or present a sufficient showing that the claim recites/recite sufficient structure, material, or acts for performing the claimed function to preclude application of 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph.

For more information, see MPEP § 2173 *et seq.* and *Supplementary Examination Guidelines for Determining Compliance With 35 U.S.C. 112 and for Treatment of Related Issues in Patent Applications*, 76 FR 7162, 7167 (Feb. 9, 2011).

Claim Rejections - 35 USC § 112

4. 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.

5. Claims 1 through 6, 8, 9 and 11 through 22 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.

6. The term "portion" in claim claims 1, 16 and 21 is a relative term which renders the claim indefinite. The term "portion" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. It is unclear what amount of the model data is required to meet the "portion" claim limitation. Is one tooth sufficient, or are two teeth sufficient?

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of pre-AIA 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

8. Claims 1, 6, 8, 13 through 16 and 20 through 22 are rejected under pre-AIA 35 U.S.C. 102(e) as being anticipated by Sirona ("CEREC SW Operator's Manual, "Sirona").

9. **Regarding Claims 1**, Sirona teaches a method of bite registration, characterized by comprising the steps of:

a. generating 3-dimensional (3D) teeth models of the upper jaw and the lower jaw (Page 53: The lower jaw and upper jaw models are generated);

b. acquiring a bite surface containing a portion of upper and lower jaws simultaneously (Page 71: Figure shows the acquired bite surface containing the upper and lower jaws in the center of the image);

c. attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface (Page 71: The buccal registration attempts to align the models);

d. displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful (Page 72: Second figure shows the upper and lower jaws aligned);

e. repeating step b to step d so as to obtain at least two successful bite registrations

corresponding to different displayed bite surfaces (Page 66: The acquisition is performed on 4 different surfaces, which performs the registrations which performing the acquisitions);

f. selecting one or more successful bite registrations by evaluating at least two successful bite registrations (Page 66: If there is a registration error, the scan is repeated until it is successful for each surface scanned); and

g. computing a final bite registration using selected one or more successful bite registrations (Page 78: The (model) phase is finished after successful bite registration).

10. **Regarding Claim 16**, the limitations of claim 16 are similar to those of claim 1, where Sirona teaches the system includes the means (Page 61: The 3D camera acquires image data. Page 7: The CEREC SW system performs the steps described) to perform the steps. Therefore, claim 16 is rejected under the same rationale as claim 1.

11. **Regarding Claim 21**, the limitations of claim 21 are similar to those of claim 1, where Sirona teaches the system includes the scanner (Page 61: The 3D camera acquires image data) and a computerized workstation (Page 7: The CEREC SW (software installed on a computer) system performs the steps described) to perform the steps. Therefore, claim 21 is rejected under the same rationale as claim 1.

12. **Regarding Claims 6 and 20**, Sirona teaches in addition to the method of bite registration according to claim 1, wherein step d including step of: if the alignment is not successful, the bite surface is discarded and the user receives a notification of failing to align or to register the bite surface, wherein if the alignment is not successful, automatically returning back to step b

until the alignment is successful (Page 66: The user is notified if there is a registration error and requires a user to start over).

13. **Regarding Claim 8**, Sirona teaches in addition to the method of bite registration according to claim 1, wherein the alignment is completed at least by stitching of a portion of 3D teeth surface of the bite surface with the 3D teeth models of the upper jaw and the lower jaw (Pages 71-72: The acquired image is combined with the model to perform registration).

14. **Regarding Claim 13**, Sirona teaches in addition to the method of bite registration according to claim 1, wherein the bite surface is acquired based on one or more bite views captured by a scanner (Page 67: The captured images are used to generate models).

15. **Regarding Claim 14**, Sirona teaches in addition to the method of bite registration according to claim 1, wherein the alignment is completed in a manual way, a semi-automatic way or automatic way (Pages 71-73: Section 11: The registration is performed in a semi-automatic way).

16. **Regarding Claims 15 and 22**, Sirona teaches in addition to the limitations of claims 1 and 22, wherein the final bite registration is used to construct a global 3D teeth model (Page 80: The MILL phase uses the final registration as the 3D teeth model to be used for further processing).

Claim Rejections - 35 USC § 103

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

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

18. Claims 2 and 17 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Sirona in view of Wu et al. (U.S. Pub. No.: 2010/0151404, "Wu").

19. **Regarding Claims 2 and 17**, while Sirona teaches the limitations of claims 1 and 16, they fail to explicitly teach wherein the computation of the final bite registration involves the optimization of a cost function depending on the selected successful bite registrations.
Wu, in the same field of 3D dental imaging teaches wherein the computation of the final bite registration involves the optimization of a cost function depending on the selected successful bite registrations (Paragraph 171: The alignment of models is performed by minimizing a cost function).
It would have been obvious at the time the invention was made to one of ordinary skill in the art to add the teachings of Wu to Sirona such that the final registration is performed as suggested by Wu. The determination of obviousness is based upon the following findings: one skilled in the art would have been motivated to modify Sirona in this manner in order to generate accurate models. Furthermore, the prior art collectively includes each element claimed (though not all in the same reference), and one of ordinary skill in the art could have combined the elements using known engineering design, interface and/or programming techniques, without changing a fundamental operating principle of Sirona, while the teaching of Wu continues to perform the same function as originally taught prior to being combined, in order to produce repeatable and predictable results. It is for at least the aforementioned

reasons that the examiner has reached a conclusion of obviousness with respect to the claim in question.

Allowable Subject Matter

20. Claims 3, 4, 5, 9, 11, 12, 18 and 19 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nirav G. Patel whose telephone number is (571)270-5812. The examiner can normally be reached on Monday - Friday 8 am - 5 pm EST.

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, Bhavesh Mehta can be reached on 571-272-7453. 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.

/Nirav G Patel/
Primary Examiner, Art Unit 2665

Notice of References Cited	Application/Control No. 14/770,177	Applicant(s)/Patent Under Reexamination GLINEC ET AL.	
	Examiner Nirav G. Patel	Art Unit 2665	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
*	A	US-2010/0151404 A1	06-2010	Wu; Fuming	A61C7/00	433/24
	B	US-				
	C	US-				
	D	US-				
	E	US-				
	F	US-				
	G	US-				
	H	US-				
	I	US-				
	J	US-				
	K	US-				
	L	US-				
	M	US-				

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	CPC Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	Sirona. "CEREC SW Operator's Manual Software Version 4.0." August 2012
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

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BIB DATA SHEET

CONFIRMATION NO. 8357

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
14/770,177	08/25/2015	382	2665	95480

APPLICANTS

CARESTREAM HEALTH, INC., Rochester, NY

INVENTORS

Yannick Glinec, Shanghai, CHINA;
Qinran Chen, Shanghai, CHINA;
Mo Yufeng, Shanghai, CHINA;

**** CONTINUING DATA ***************************

This application is a 371 of PCT/CN13/72420 03/11/2013

**** FOREIGN APPLICATIONS ***************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****

10/05/2015

Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☐ No Verified and Acknowledged /NIRAV G PATEL/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		CHINA	8	20	3

ADDRESS

Carestream Health, Inc.
ATTN: Patent Legal Staff
150 Verona Street
Rochester, NY 14608
UNITED STATES

TITLE

METHOD AND SYSTEM FOR BITE REGISTRATION

FILING FEE RECEIVED		
1620	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

BIB (Rev. 05/07).

Docket No.: 95480
Customer No. 70523
Confirmation No. 8357

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of
Yannick GLINEC, et al.

METHOD AND SYSTEM FOR BITE REGISTRATION

Serial No. 14/770,177

Filed: 03/11/2013

Group Art: Unknown

Examiner: Unknown

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Signature Laurie Wurtz

Name: Laurie Wurtz

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

Sir/Madam:

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II. [ ] This Statement is being filed under §1.97(c), with fee, **prior** to either a final action, a notice of allowance or an action that otherwise closes prosecution in the application. Please charge any additional fees required by §1.17(p) to Carestream Health, Inc. Deposit Order Account Number 50-4233.

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Respectfully submitted,

Carl R. Wesolowski/law
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Facsimile (585) 627-8919
Enclosures

Attorney for Applicants
Registration No. 40372

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FORM CSH-1449 US DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	Atty. Docket No. 95480 Customer No. 70523	Serial No. 14/770,177
If AFTER the later date of the first Office Action or 3 months from filing, use only with Rule 97(E) Certificate or Fee	Applicant: Yannick GLINEC, et al.	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date 03/11/2013	Group Unknown

U.S. PATENT DOCUMENTS

Examiner Initial*	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE

FOREIGN PATENT DOCUMENTS

Examiner Initial*	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES | NO
	5017487B	Sep 5, 2012	JP			machine translation

OTHER ART *(Including Author, Title, Date, Pertinent Pages, Etc.)*

EXAMINER	/NIRAV G PATEL/	DATE CONSIDERED	06/12/2017

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

CSH-1449

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Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14770177	GLINEC ET AL.
	Examiner	Art Unit
	NIRAV G PATEL	2665

CPC- SEARCHED		
Symbol	Date	Examiner
A61C19/05, A61C7/002, A61C9/0053, G06T19/20, G06T2219/2004	6/12/2017	/NGP/

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
A61C19/05, A61C7/002, A61C9/0053, G06T19/20, G06T2219/2004 limited with keywords	6/12/2017	/NGP/
Google Search	6/12/2017	/NGP/

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14770177	GLINEC ET AL.
	Examiner	Art Unit
	NIRAV G PATEL	2665

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	06/12/2017								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
	7	-								
	8	✓								
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	20	✓								
	21	✓								
	22	✓								

Docket No.: 95480
Customer No. 70523
Confirmation No.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of
Yannick GLINEC, et al.

METHOD AND SYSTEM FOR BITE REGISTRATION

Serial No. UNKNOWN

Filed: HEREWITH

Group Art: Unknown

Examiner: Unknown

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Signature Karen J Tyler

Name: Karen Tyler

Commissioner for Patents
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Respectfully submitted,

Carl R. Wesolowski/kjt
Telephone (770) 226-3287
Facsimile (585) 627-8919
Enclosures

Attorney for Applicants
Registration No. 40372

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FORM CSH-1449 US DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	Atty. Docket No. 95480 Customer No. 70523	Serial No. UNKNOWN
If AFTER the later date of the first Office Action or 3 months from filing, use only with Rule 97(E) Certificate or Fee	Applicant: Yannick GLINEC, et al.	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date HEREWITH	Group Unknown

U.S. PATENT DOCUMENTS

Examiner Initial*	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	2002/0094509	07/08/2002	Durbin et al.			11/30/2000
	7,118,375	10/10/2006	Durbin et al.			01/08/2004

FOREIGN PATENT DOCUMENTS

Examiner Initial*	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES | NO
	101228556	07/23/2008	CN			Yes

OTHER ART *(Including Author, Title, Date, Pertinent Pages, Etc.)*

	International Search Report, dated December 19, 2013 International Application No. PCT/CN2013/;072420, 5 pages.

EXAMINER	DATE CONSIDERED
/NIRAV G PATEL/	06/12/2017

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Docket No.: 95480
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of
Yannick GLINEC, et al.

METHOD AND SYSTEM FOR BITE REGISTRATION

Serial No. 14/770,177

Filed: 03/11/2013

Group Art: Unknown

Examiner: Unknown

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on this 29 day of November 2016.
Signature Karen J. Tyler
Name: Karen Tyler

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

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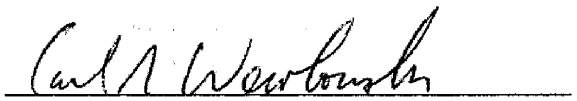
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FORM CSH-1449 US DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	Atty. Docket No. 95480 Customer No. 70523	Serial No. 14/770,177
If AFTER the later date of the first Office Action or 3 months from filing, use only with Rule 97(E) Certificate or Fee	Applicant: Yannick GLINEC, et al.	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date 03/11/2013	Group Unknown

U.S. PATENT DOCUMENTS

Examiner Initial*	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	2002/0015934	02/07/2002	Rubbert et al.			04/13/2001

FOREIGN PATENT DOCUMENTS

Examiner Initial*	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES | NO
	2428764	03/14/2012	EP			**no**
	102010040096	03/01/2012	DE			**machine**
	2012096312	07/19/2012	WO			**machine**

OTHER ART *(Including Author, Title, Date, Pertinent Pages, Etc.)*

	EP Search Report, dated October 27, 2016, EP Application Number 13878438, 3 pages.

EXAMINER	/NIRAV G PATEL/	DATE CONSIDERED	06/12/2017

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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Docket No.: 95480
Customer No. 70523
Confirmation No. 8357

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of
Yannick GLINEC, et al.

METHOD AND SYSTEM FOR BITE REGISTRATION

Serial No. 14/770,177

Filed: 03/11/2013

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CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being filed using the USPTO's electronic filing system EFS-Web, and is addressed to: Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on this 7 day of February 2017.

Signature Laurie Wurtz

Name: Laurie Wurtz

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Sir/Madam:

INFORMATION DISCLOSURE STATEMENT FOR CONSIDERATION BY THE OFFICE UNDER 37 C.F.R. 1.97-1.99

Enclosed herewith are patents and/or publications for consideration by the Patent and Trademark Office in regard to the invention claimed in the above-described application. In compliance with §1.56, such documents are listed in the enclosed Form CSH-1449.

Applicants request that the Patent and Trademark Office make of record the above-identified documents. A full text copy of each document is attached, except for copies of U.S. patents and U.S. patent application publications. For documents not in English, an English translation or an equivalent English language patent or publication may be attached. Where a translation is not available, a concise explanation of the relevance of each document not in English is included either here or in the specification.

This Information Disclosure Statement is submitted according to the following selected paragraph:

I. [X] This Statement is being filed under §1.97(b) within three months of the filing date of the application (other than a CPA), or before the first Office action on the merits or before mailing of a first Office action after the filing of a request for continued examination.

II. [ ] This Statement is being filed under §1.97(c), with fee, **prior** to either a final action, a notice of allowance or an action that otherwise closes prosecution in the application. Please charge any additional fees required by §1.17(p) to Carestream Health, Inc. Deposit Order Account Number 50-4233.

III. ☐ This Statement is being filed under §1.97(c), with a statement under, §1.97(e) **prior** to either a final action, a notice of allowance or an action that otherwise closes prosecution in the application. The undersigned hereby states that (check one):

☐ each item of information contained in this Statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this Statement.

☐ no item of information in this Statement was cited in a communication from a foreign patent office in a counterpart foreign application and, to the knowledge of the person signing this certification statement under §1.97(e) after making reasonable inquiry, no item of information contained in this Statement was known to any individual designated in §1.56(c) more than three months prior to the filing of this Statement.

IV. ☐ This Statement is being filed under §1.97(d), with fee and statement under §1.97(e), on or after the mailing date of either a final action, a notice of allowance (but prior to payment of the issue fee) or an action that otherwise closes prosecution in the application. Please charge the fee required by §1.17(p) to Carestream Health, Inc. Deposit Order Account No. 50-4233. A duplicate copy of this Statement is enclosed. The undersigned hereby states that (check one):

☐ each item of information in this Statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this Statement.

☐ no item of information in this Statement was cited in a communication from a foreign patent office in a counterpart foreign application and, to the knowledge of the person signing this certification Statement under §1.97(e) after making reasonable inquiry, no item of information contained in this Statement was known to any individual designated in §1.56(c) more than three months prior to the filing of this Statement.

Respectfully submitted,

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FOREIGN PATENT DOCUMENTS

Examiner Initial*	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES | NO
	5017487B	Sep 5, 2012	JP			machine translation

OTHER ART *(Including Author, Title, Date, Pertinent Pages, Etc.)*

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JP5017487

Machine translation

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
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CLAIMS

[Claim(s)]
[Claim 1]
Three dimensional data of form of a maxilla molar and a mandible molar is read, An occlusion evaluation system computing and displaying form of drift space formed between occlusal surface of the aforementioned maxilla molar, and occlusal surface of the aforementioned mandible molar when the aforementioned maxilla molar and the aforementioned mandible molar are engaged.
[Claim 2]
Three dimensional data of form of a maxilla molar and a mandible molar is read, An occlusion evaluation system computing and displaying volume of drift space formed between occlusal surface of the aforementioned maxilla molar, and occlusal surface of the aforementioned mandible molar when the aforementioned maxilla molar and the aforementioned mandible molar are engaged.
[Claim 3]
The occlusion evaluation system according to claim 2 reading three dimensional data of form of a plurality of maxilla molars and a mandible molar, and carrying out the comparison display of the volume of the aforementioned drift space.
[Claim 4]
The aforementioned drift space,
Space demarcated in a plane vertical to a plane of occlusion containing two points of contact which are points of contact of the aforementioned maxilla molar and the aforementioned mandible molar, and adjoin each other, occlusal surface of the aforementioned maxilla molar, and occlusal surface of the aforementioned mandible molar,
space demarcated in a plane vertical to a plane of occlusion containing two cusps which the aforementioned maxilla molar adjoins, a plane vertical to a plane of occlusion containing two cusps which the aforementioned mandible molar adjoins, occlusal surface of the aforementioned maxilla molar, and occlusal surface of the aforementioned mandible molar -- or
A plane vertical to a plane of occlusion containing the two maximum Toyotaka parts which the aforementioned maxilla molar adjoins for each other, Space demarcated in a plane vertical to a plane of occlusion containing the two maximum Toyotaka parts in which the aforementioned mandible molar adjoins a predetermined maxilla base plane which is placed above socket of the

aforementioned maxilla molar for each other, a predetermined mandible base plane which is placed below socket of the aforementioned mandible molar, occlusal surface of the aforementioned maxilla molar, and occlusal surface of the aforementioned mandible molar,
The occlusion evaluation system according to any one of claims 1 to 3 which comes out and is characterized by a certain thing.
[Claim 5]
The occlusion evaluation system according to any one of claims 1 to 4 specifying and displaying a section of the aforementioned drift space whose cross-sectional area becomes small most.
[Claim 6]
The occlusion display device according to any one of claims 1 to 5 being able to correct the aforementioned three dimensional data of form of the aforementioned maxilla molar and the aforementioned mandible molar.
[Claim 7]
The occlusion evaluation system according to any one of claims 1 to 6 by which it is occlusion evaluation system characterized [being able to change arbitrarily an occluded condition of the aforementioned maxilla molar and the aforementioned mandible molar / according to claim 1].
[Claim 8]
The occlusion evaluation system according to claim 7 computing and displaying variation of volume of the aforementioned drift space to relative displacement of the aforementioned maxilla molar and the aforementioned mandible molar when changing an occluded condition of the aforementioned maxilla molar and the aforementioned mandible molar.
[Claim 9]
When changing an occluded condition of the aforementioned maxilla molar and the aforementioned mandible molar, variation of a cross-sectional area in a section vertical to a plane of occlusion of the aforementioned drift space to relative displacement of the aforementioned maxilla molar and the aforementioned mandible molar is computed, The occlusion evaluation system according to claim 7 differentiating and displaying relative displacement.
[Claim 10]
Three dimensional data of form of a maxilla molar and a mandible molar is made to read into a computer.
An occlusion valuation method computing and displaying form of drift space formed between the aforementioned maxilla molar and the aforementioned mandible molar when the aforementioned maxilla molar and the aforementioned mandible molar are engaged by aforementioned computer.
[Claim 11]
Three dimensional data of form of a maxilla molar and a mandible molar is made to read into a computer.
An occlusion valuation method computing and displaying volume of drift space formed between the aforementioned maxilla molar and the aforementioned mandible molar when the aforementioned maxilla molar and the aforementioned mandible molar are engaged by aforementioned computer.
[Claim 12]

Three dimensional data of form of a maxilla molar and a mandible molar is read into a computer,
An occlusion evaluation program computing and displaying form of drift space formed between the aforementioned maxilla molar and the aforementioned mandible molar when the aforementioned maxilla molar and the aforementioned mandible molar are engaged by aforementioned computer.
[Claim 13]
Three dimensional data of form of a maxilla molar and a mandible molar is read into a computer,
An occlusion evaluation program computing and displaying volume of drift space formed between the aforementioned maxilla molar and the aforementioned mandible molar when the aforementioned maxilla molar and the aforementioned mandible molar are engaged by aforementioned computer.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[Field of the Invention]
[0001]
The present invention relates to an occlusion evaluation system, an occlusion valuation method, and an occlusion evaluation program.
[Background of the Invention]
[0002]
As a method of measuring dental (a natural tooth and artificial tooth) digestion capability, when people actually digest something, the method of judging digestion capability is advocated, as it describes in a Patent document 1, 2, and the nonpatent literature 1.
[0003]
In such a method, the influence by a test subject's muscular power, a habit of biting, etc. and influence by dental (a prosthesis is included) occlusion form cannot be distinguished and measured. It is desirable that only the digestion capability to originate in the occlusion form of a prosthesis can be especially evaluated on the occasion of manufacture and adjustment of a prosthesis.
[0004]
In the natural tooth, wear of the tooth by the occluded condition and aging of the up-and-down jaw by a crowding-teeth situation influences the biting strength of food largely, and the equipment and the method of measuring the biting strength resulting from the arrangement occluded condition of a tooth are not known.
[0005]
In the prosthesis, the wear after using the occluded condition of an up-and-down jaw and the grinding of a prosthesis by a tooth arrangement situation, and a prosthesis for a fixed time influences the biting strength of food largely, and the equipment and the method of measuring the biting strength resulting from the arrangement occluded condition of a tooth are not known.

[0006]
The thing in particular for which it is before and after use of prostheses and a prosthesis, and measures biting strength was not performed, and was not able to evaluate digestion capability of the replacement timing of a prosthesis, or a prosthesis. Since the biting strength of the prosthesis itself was also what is largely influenced by a patient's stress, a habit of biting, eating habits, etc., and has a suitable prosthesis for every patient, a method of evaluating whether the biting strength of a prosthesis is suitable was preliminarily desired at the time of creation of a prosthesis.
[0007]
it being possible to get to know, before equipping with the biting strength of a prosthesis, being able to use as information on a patient's therapy or diagnosis, and also using for the next therapy -- although -- it can do.
[0008]
If digestion capability can be evaluated, it can use also for evaluation of the prosthesis created by providing a threshold value, and it can be evaluated whether the prosthesis created especially is what has what biting strength.
[Citation list]
[Patent literature]
[0009]
[Patent document 1] Japanese Published Patent Application No. 2005-237710 (JP2005-237710A)
[Patent document 2] Japanese Published Patent Application No. 2008-220600 (JP2008-220600A)
[Nonpatent literature]
[0010]
[Nonpatent literature 1] "It is the digestion ability test method - as the guideline Lord of a dysfunction-of-masticatory appraisal method", a prosthetic dentistry magazine, 2002, volume [46th] No. 4, p.619-625
[Summary of Invention]
[Problem to be solved by the invention]
[0011]
In view of the aforementioned problem, the present invention makes it problem to provide the occlusion evaluation system, occlusion valuation method, and occlusion evaluation program which can evaluate the digestion capability by dental occlusion form, without being dependent on a test subject.
[Means for solving problem]
[0012]
In order to solve the aforementioned problem, the first modes of the occlusion evaluation system by the present invention, When the three dimensional data of the form of a maxilla molar and a mandible molar is read and the aforementioned maxilla molar and the aforementioned mandible molar are engaged, the form of the drift space formed between the occlusal surface of the aforementioned maxilla molar and the

occlusal surface of the aforementioned mandible molar shall be computed, and a display, preferably any section shall be displayed.

[0013]

The second modes of the occlusion evaluation system by the present invention, When the three dimensional data of the form of a maxilla molar and a mandible molar is read and the aforementioned maxilla molar and the aforementioned mandible molar are engaged, the volume of the drift space formed between the occlusal surface of the aforementioned maxilla molar and the occlusal surface of the aforementioned mandible molar shall be computed and displayed.

[0014]

According to these composition, the size of the effect discharged from between gear teeth can grasp easily the food printed and crushed with the molar with the size and form of food drift space, and it can evaluate the digestion capability of a molar, without being dependent on the muscular power and the habit of biting of a patient or a test subject.

[0015]

The place where food is crushed, and the place where food escapes are observable by displaying a section especially.

[0016]

Tabling with the maxilla molar and mandible molar in the occlusion evaluation system of the present invention, It may carry out by reproducing a patient's actual jaw movement measured with the jaw movement measuring device, and may simulate on data the regulatory mechanism of the occlusion conditions of inclination of sagittal condyle path reproduced by the articulator, for example, the degree, a balancing-side lateral condyle path, and an immediate side shifter, a working-side lateral condyle path angle regulatory mechanism, etc.

[0017]

The occlusion evaluation system of the second modes of the present invention may read the three dimensional data of the form of a plurality of maxilla molars and a mandible molar, and may carry out the comparison display of the volume of the aforementioned drift space.

[0018]

According to this composition, it turns and can check a fixed quantity of deterioration of digestion capability by wear of a prosthesis, and change of the digestion capability by the grinding. Comparison of digestion capability with the present prosthesis and the prosthesis manufactured newly can also be performed. In particular, a fixed quantity of deterioration of the digestion capability by wear of a prosthesis is turned, the information of a patient possible [a display of the graph which can compare the data for every prosthesis], then specific is accumulated, and it becomes easy to create a more suitable prosthesis to the patient.

[0019]

In the occlusion evaluation system of the present invention, the aforementioned drift

space, A plane vertical to the plane of occlusion containing two points of contact which are points of contact of the aforementioned maxilla molar and the aforementioned mandible molar, and adjoin each other, A plane vertical to space demarcated in the occlusal surface of the aforementioned maxilla molar, and the occlusal surface of the aforementioned mandible molar, and the plane of occlusion containing two cusps which the aforementioned maxilla molar adjoins, space demarcated in a plane vertical to the plane of occlusion containing two cusps which the aforementioned mandible molar adjoins, the occlusal surface of the aforementioned maxilla molar, and the occlusal surface of the aforementioned mandible molar -- or, A plane vertical to the plane of occlusion containing the two maximum Toyotaka parts which the aforementioned maxilla molar adjoins for each other, The predetermined maxilla base plane which is placed above the socket of the aforementioned maxilla molar, and a plane vertical to the plane of occlusion containing the two maximum Toyotaka parts which the aforementioned mandible molar adjoins for each other, It may be space demarcated in the predetermined mandible base plane which is placed below the socket of the aforementioned mandible molar, the occlusal surface of the aforementioned maxilla molar, and the occlusal surface of the aforementioned mandible molar.

[0020]

According to this composition, the range which should be compared can be specified easily.

[0021]

The occlusion evaluation system of the present invention may display the volume of the aforementioned drift space.

[0022]

According to this composition, digestion capability can be quantitatively grasped as a numerical value.

[0023]

The occlusion evaluation system of the present invention may specify and display the section of the aforementioned drift space where a cross-sectional area becomes small most.

[0024]

According to this composition, the degree of wear by **** or the grinding is most directly shown by the smallest section.

[0025]

The occlusion evaluation system of the present invention corrects the aforementioned three dimensional data of the form of the aforementioned maxilla molar and the aforementioned mandible molar.

[0026]

According to this composition, change of the digestion capability by the grinding of a prosthesis can be simulated, and the optimal grinding can be found.

[0027]

The occlusion evaluation system of the present invention changes arbitrarily the

occluded condition of the aforementioned maxilla molar and the aforementioned mandible molar.

[0028]

According to this composition, the shape change of the drift space by chewing motion is checked, and digestion capability can be judged.

[0029]

When the occlusion evaluation system of the present invention changes the occluded condition of a note maxilla molar and the aforementioned mandible molar, it may compute and display the variation of the volume of the aforementioned drift space to the relative displacement of the aforementioned maxilla molar and the aforementioned mandible molar.

[0030]

According to this composition, change of the digestion capability in the process of chewing motion can be checked.

[0031]

When the occlusion evaluation system of the present invention changes the occluded condition of the aforementioned maxilla molar and the aforementioned mandible molar, it may compute the variation of the cross-sectional area in a section vertical to the plane of occlusion of the aforementioned drift space to the relative displacement of the aforementioned maxilla molar and the aforementioned mandible molar, and may differentiate and display it about relative displacement.

[0032]

Also by this composition, change of the digestion capability in the process of chewing motion can be checked.

[0033]

The occlusion valuation method by the present invention makes the three dimensional data of the form of a maxilla molar and a mandible molar read into a computer. When the aforementioned maxilla molar and the aforementioned mandible molar are engaged, it is considered as the method of computing and displaying the form of the drift space formed between the aforementioned maxilla molar and the aforementioned mandible molar by aforementioned computer.

[0034]

The occlusion evaluation program by the present invention reads the three dimensional data of the form of a maxilla molar and a mandible molar into a computer, When the aforementioned maxilla molar and the aforementioned mandible molar are engaged, the form of the drift space formed between the aforementioned maxilla molar and the aforementioned mandible molar shall be computed and displayed by aforementioned computer.

[Effect of the Invention]

[0035]

According to the present invention, it can evaluate by grasping the size and form of food drift space, without depending for the digestion capability of a molar on the muscular

power and the habit of biting of a patient or a test subject.
[0036]
According to the present invention, by storing the data of a plurality of prostheses, the digestion capability to have included the patient's habit of biting can be visualized and quantified, and exact diagnosis and creation of a more suitable prosthesis are also attained.
[Brief Description of the Drawings]
[0037]
[Drawing 1]It is a block diagram showing the composition of the occlusion evaluation system of the embodiment of the one present invention.
[Drawing 2]It is a cross sectional view of the first modes of the drift space of the present invention.
[Drawing 3]It is a plan view of the drift space of Fig.2.
[Drawing 4]It is a cross sectional view of the second modes of the drift space of the present invention.
[Drawing 5]It is a plan view of the drift space of Fig.4.
[Drawing 6]It is a cross sectional view of the 3rd modes of the drift space of the present invention.
[Drawing 7]It is a plan view of the drift space of Fig.6.
[Drawing 8]It is a plan view of the drift space of the alternative plan of Fig.7.
[Drawing 9]It is an A-A line cross sectional view of Fig.5.
[Description of Embodiments]
[0038]
From this, about the embodiment of the present invention, while referring to Drawings, it describes. The occlusion evaluation system by the present invention may be realized using a computer provided with an arithmetic unit, a data input unit, a display device, and user input equipment etc., as shown in Fig.1.
[0039]
An arithmetic unit may be designed for exclusive use, although it is realizable using a personal computer and a software program. A data input unit not only in apparatus, such as a three dimensional scanner which reads three-dimensional form directly, It may be equipment for making the three dimensional shape data read with the external three dimensional scanner etc. like media readers, such as a memory device and a disk unit, or a data communication unit read into an arithmetic unit. A common display may be sufficient as a display device. General-purpose input devices, such as a keyboard and a mouse, can be used for user input equipment.
[0040]
The occlusion evaluation system of the present invention reads the three dimensional shape data of a maxilla molar and a mandible molar with a data input unit, A maxilla molar and a mandible molar are engaged in an arithmetic unit, the three-dimensional form of the drift space formed between the occlusal surface of a maxilla molar and the occlusal surface of a mandible molar is computed, and it displays on a display device.

Techniques used in computer graphics, such as a wire frame and ray tracing, are applicable to the display of drift space.

[0041]

Vw of the drift space of the 3rd modes that starts Fig.6 and 7 at the embodiment of the present invention in Vc of the drift space of the second modes which starts Fig.4 and 5 at the embodiment of the present invention in Va of the drift space of the first modes that starts Fig.2 and 3 at the embodiment of the present invention is shown, respectively.

[0042]

The drift space Va of a first modes, The plane Sa vertical to the plane of occlusion containing two point-of-contact Pa which is point-of-contact Pa of a maxilla molar (the first premolars 1, the second premolars 2, the first molar 3, second molars 4) and a mandible molar (the first premolars 5, the second premolars 6, the first molar 7, second molars 8), and adjoins each other, It is space demarcated in the occlusal surface 1a, 2a, 3a, and 4a of the maxilla molars 1, 2, 3, and 4, and the mandible molars 5, 6, and 7 and the occlusal surface 5a, 6a, 7a, and 8a of 8.

[0043]

Plane Sc with the drift space Vc of a second modes vertical to the plane of occlusion containing the two cusps Pc which the maxilla molars 1, 2, 3, and 4 adjoin for each other, It is space demarcated in plane Sc vertical to the plane of occlusion containing the two cusps Pc which the mandible molars 5, 6, 7, and 8 adjoin for each other, the occlusal surface 1a, 2a, 3a, and 4a of the maxilla molars 1, 2, 3, and 4, and the mandible molars 5, 6, and 7 and the occlusal surface 5a, 6a, 7a, and 8a of 8.

[0044]

The plane Sw where the drift space Vw of the 3rd modes is vertical to the plane of occlusion containing the maximum Toyotaka part Pw of the two maxilla molars 1, 2, 3, and 4 which adjoin each other, The plane Sw vertical to the plane of occlusion containing the maximum Toyotaka part Pw of the two mandible molars 5, 6, 7, and 8 which adjoin each other, It is space demarcated in the maxilla base level Su which is placed above the occlusal surface 1a, 2a, 3a, and 4a of the maxilla molars 1, 2, 3, and 4, and the mandible base level Sl which is placed below the occlusal surface 5a, 6a, 7a, and 8a of the mandible molars 5, 6, 7, and 8.

[0045]

Although a plane of occlusion means strictly the plane determined by three points of the point of contact of the margo incisalis of a lower central incisor, and a right and left lower second molar distal buccal cusp, it may be what kind of plane according to this in the present invention. For example, the plane etc. which are determined by three points of the mandible first-premolars mesial buccal cusp of either right or left, and a right-and-left lower second molar distal buccal cusp when there is no data of an anterior tooth, When there is only data of the molar of either right or left, the plane etc. which are determined by three points of a mandible first-premolars mesial buccal cusp, a lower second molar distal buccal cusp, and a mandible first-molar mesial lingual cusp may be treated as a plane of occlusion, respectively. It does not interfere, even if it treats the

basolateral of the base level at the time of reading mandible molar form (plane where the position of the axial direction of the upper and lower sides of a rectangular coordinate system is equal), i.e., the mandible molar in data, and its gum as a plane of occlusion as further alternative plan. In the present invention, the occlusal surface is a term which points out a surface with unevenness of the surface of a molar, and a plane of occlusion is distinguished clearly.

[0046]

In the present invention, although calculated at a time by one right and left, when there is a deficit of a molar, the drift space Va, Vc, and Vw may be divided and computed by the **** and centrifugality side rather than anodontia, and may usually be computed for every antagonistic-tooth pair. When it has the third molar, the drift space Va, Vc, and Vw may be computed by extending to the third molar.

[0047]

the case where the maximum Toyotaka part Pw can demarcate a dental arch in calculation of the drift space Vw of the 3rd modes -- ****** -- although it wears and is good also as a maximum Toyotaka part of a lingual side, as shown in Fig.7, the point used as the maximum and the point which becomes minimum may be used for the right and left axial direction of rectangular-coordinate-system three dimensional data.

[0048]

Fig.3, the drift space Va shown in 5 and 7, Vc, and Vw, plane Sc containing the two cusps Pc which the plane Sa containing two contact Pa which first premolars and second molars adjoin, first premolars, and second molars adjoin -- or, It is demarcated as space closed to the **** centrifugal direction by the plane Sw containing the maximum Toyotaka part Pw of the right-and-left-directions (**** direction) both sides of first premolars and second molars. However, in the alternative plan of the drift space Vw of the 3rd modes shown in Fig.8, The end face of the **** centrifugal direction of the drift space Vw is demarcated according to the plane of composition Sd in maximum Toyotaka part Pd of plane-of-composition Sm in maximum Toyotaka part Pm of the **** direction of first premolars, or the direction of an axis of coordinates and the centrifugal direction of second molars, or the direction of an axis of coordinates. Similarly, the end face of the **** centrifugal direction of the drift space Va of a first modes and the drift space Vc of a second modes may be demarcated according to the plane defined by other standards.

[0049]

In calculation of the drift space Vw shown in Fig.6, the maxilla base level Su and the mandible base level Sl are made into the maximum Toyotaka part Pw of three points, for example, the cheek side maximum Toyotaka part of the first premolars 1 and 5, defined preliminarily, and the cheek side of the second molars 4 and 8 and the plane which the bottom maximum Toyotaka part includes, respectively. However, the maxilla base level Su should just be a plane which is placed above all the socket of the maxilla molars 1, 2, 3, and 4, and the mandible base level Sl should just be a plane which is placed below all the socket of the mandible molars 5, 6, 7, and 8. For example, the maxilla base level Su and the mandible base level Sl are good also as a plane parallel to the plane of occlusion

which contained the specific maximum Toyotaka part of the molar defined preliminarily, respectively.

[0050]

In the interdentium etc., the boundary in direction vertical to a plane of occlusion may be unable to be demarcated according to the occlusal surface when computing the drift space Va of a first modes, and the drift space Vc of a second modes. For this reason, also in calculation of the drift space Va of a first modes, and the drift space Vc of a second modes, the maxilla base level Su and the mandible base level Sl may be set up like demarcation of the drift space Vw of the 3rd modes.

[0051]

As for the occlusion evaluation system of the present invention, it is desirable for a user (a medical practitioner and an engineer) to choose either the drift space Va, the drift space Vc and the drift space Vw via user input equipment, and to enable it to display the selected form.

[0052]

With the display of the drift space Va, Vc, and Vw, by enabling it to display the volume, it turns and can grasp now a fixed quantity of digestion capability.

[0053]

The occlusion evaluation system of the present invention is the centric occlusion of the maxilla molars 1, 2, 3, and 4 and the mandible molars 5, 6, 7, and 8. It is preferable for about the occlusion and main fitting, the drift space Va, Vc, or Vw to compute the initial-contact position used as the maximum, etc. automatically, and for a user to choose from those occluded conditions, and to enable it to display.

[0054]

As for the occlusion criticism equipment of the present invention, it is desirable to enable it to change arbitrarily the occluded condition of the maxilla molars 1, 2, 3, and 4 and the mandible molars 5, 6, 7, and 8. For example, by inputting any direction to which a user moves the maxilla molars 1, 2, 3, and 4 to the mandible molars 5, 6, 7, and 8, If a computer calculates **** of the maxilla molars 1, 2, 3, and 4 and the mandible molars 5, 6, 7, and 8 and displays the shape change of the drift space Va, Vc, and Vw in real time, change of the drift space Va by chewing motion, Vc, and Vw can be grasped visually.

[0055]

As for the occlusion evaluation system of the present invention, it is desirable that the form of any section of the drift space Va, Vc, and Vw and its cross-sectional area can be displayed. As an example, the A-A section of the drift space Vc of Fig.5 is shown in Fig.9. If an occlusion evaluation system calculates the cross section position where a cross-sectional area becomes minimum and is made to carry out a screen display, in digestion, a user can be told about the most significant section in the drift space Va, Vc, and Vw.

[0056]

In addition, the occlusion evaluation system of the present invention, The relative displacement of the maxilla molars 1, 2, 3, and 4 and the mandible molars 5, 6, 7, and 8 is received in change of the cross-sectional area of the specified position of the volume

of the drift space Va in any **** of the maxilla molars 1, 2, 3, and 4 and the mandible molars 5, 6, 7, and 8, Vc, and Vw, the drift space Va, Vc, and Vw. It is preferable that it graph-izes and can display. Still more preferably, it is differentiating and double differentiating variation and graph-izing it with amount of motion, and the rate of change of the drift space Va, Vc, and Vw is searched for, and the smoothness of chewing motion can be checked.

[0057]

The simulation of the design of the prosthesis optimal by this or a grinding state with the ability of the occlusion evaluation system of the present invention to correct [preferable] the three dimensional data of the maxilla molars 1, 2, 3, and 4 and the mandible molars 5, 6, 7, and 8 is attained.

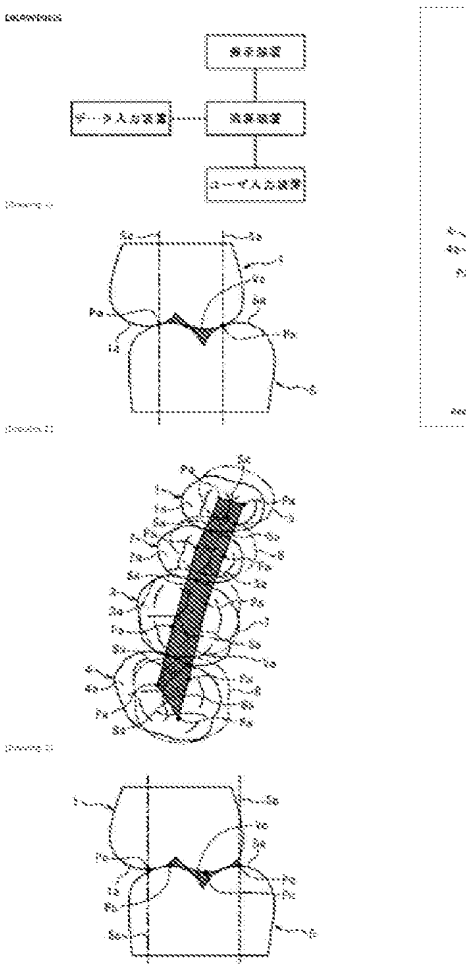
[0058]

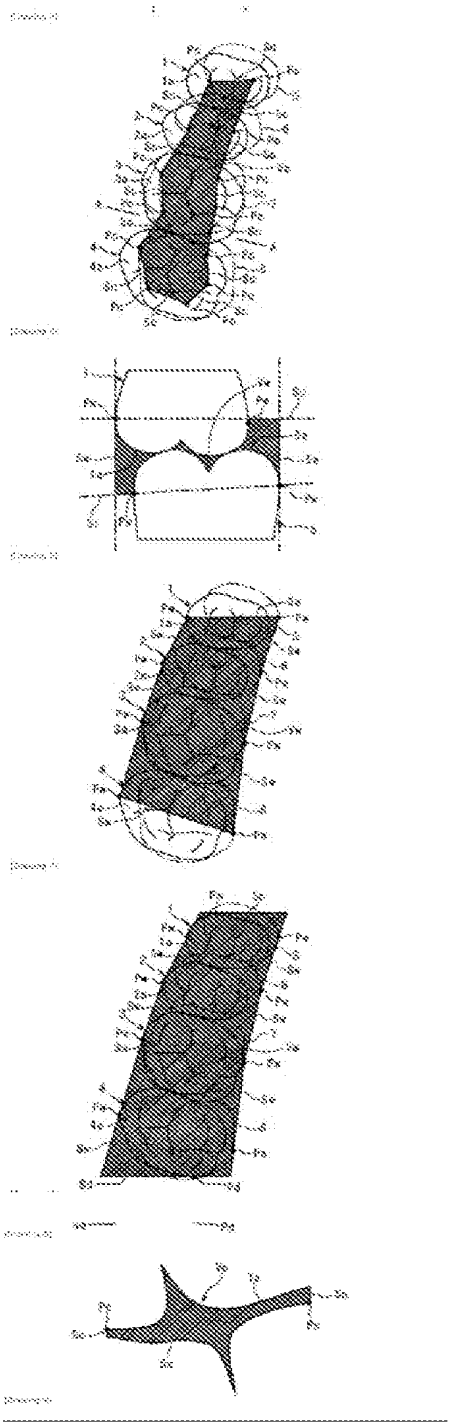
It is possible it not only to to determine the form of the optimal prosthesis by the drift space Va, Vc, and Vw, but to evaluate the digestion capability of a prosthesis including a patient's habit of biting etc. by the occlusion evaluation system of the present invention by evaluating the difference of digestion capability between the prosthesis at the time of a new article and the worn-out prosthesis after use.

[Explanations of letters or numerals]

[0059]

1 -- Maxilla first premolars
2 -- Maxilla second premolars
3 -- Maxilla first molar
4 -- Maxilla second molars
5 -- Mandible first premolars
6 -- Mandible second premolars
7 -- Mandible first molar
8 -- Lower second molar
Pa -- Point of contact
Pc -- Cusp
Pw -- The maximum Toyotaka part
Sa -- Plane containing a point of contact
Sc -- Plane containing a cusp
Sw -- Plane containing the maximum Toyotaka part
Su -- Maxilla base plane
Sl -- Mandible base plane





WRITTEN AMENDMENT

[Written Amendment]
[Filing date]Heisei 23(2011) October 31 (2011.10.31)
[Amendment 1]

[Document to be Amended]Scope of the claim
[Item(s) to be Amended]Full text
[Method of Amendment]Change
[The contents of correction]
[Claim(s)]
[Claim 1]
Three dimensional data of form of a maxilla molar and a mandible molar is read,
An occlusion evaluation system characterized by what is displayed so that form of drift space formed between occlusal surface of the aforementioned maxilla molar and occlusal surface of the aforementioned mandible molar may be specified when the aforementioned maxilla molar and the aforementioned mandible molar are engaged, and form of the aforementioned drift space can be checked.
[Claim 2]
Three dimensional data of form of a maxilla molar and a mandible molar is read,
An occlusion evaluation system specifying form of drift space formed between occlusal surface of the aforementioned maxilla molar, and occlusal surface of the aforementioned mandible molar when the aforementioned maxilla molar and the aforementioned mandible molar are engaged, and computing and displaying volume of the aforementioned drift space.
[Claim 3]
The occlusion evaluation system according to claim 2 reading three dimensional data of form of a plurality of maxilla molars and a mandible molar, and carrying out the comparison display of the volume of the aforementioned drift space.
[Claim 4]
The aforementioned drift space,
Space demarcated in a plane vertical to a plane of occlusion containing two points of contact which are points of contact of the aforementioned maxilla molar and the aforementioned mandible molar, and adjoin each other, occlusal surface of the aforementioned maxilla molar, and occlusal surface of the aforementioned mandible molar,
space demarcated in a plane vertical to a plane of occlusion containing two cusps which the aforementioned maxilla molar adjoins, a plane vertical to a plane of occlusion containing two cusps which the aforementioned mandible molar adjoins, occlusal surface of the aforementioned maxilla molar, and occlusal surface of the aforementioned mandible molar -- or
A plane vertical to a plane of occlusion containing the two maximum Toyotaka parts which the aforementioned maxilla molar adjoins for each other, Space demarcated in a plane vertical to a plane of occlusion containing the two maximum Toyotaka parts in which the aforementioned mandible molar adjoins a predetermined maxilla base plane which is placed above socket of the aforementioned maxilla molar for each other, a predetermined mandible base plane which is placed below socket of the aforementioned mandible molar, occlusal surface of the aforementioned maxilla molar, and occlusal surface of the aforementioned mandible molar,
The occlusion evaluation system according to any one of claims 1 to 3 which comes out and is characterized by a certain thing.
[Claim 5]

The occlusion evaluation system according to any one of claims 1 to 4 specifying and displaying a section of the aforementioned drift space whose cross-sectional area becomes small most.
[Claim 6]
The occlusion display device according to any one of claims 1 to 5 being able to correct the aforementioned three dimensional data of form of the aforementioned maxilla molar and the aforementioned mandible molar.
[Claim 7]
The occlusion evaluation system according to any one of claims 1 to 6 by which it is occlusion evaluation system characterized [being able to change arbitrarily an occluded condition of the aforementioned maxilla molar and the aforementioned mandible molar / according to claim 1].
[Claim 8]
The occlusion evaluation system according to claim 7 computing and displaying variation of volume of the aforementioned drift space to relative displacement of the aforementioned maxilla molar and the aforementioned mandible molar when changing an occluded condition of the aforementioned maxilla molar and the aforementioned mandible molar.
[Claim 9]
When changing an occluded condition of the aforementioned maxilla molar and the aforementioned mandible molar, they are the aforementioned maxilla molar and the aforementioned mandible.
The occlusion evaluation system according to claim 7 computing variation of a cross-sectional area in a section vertical to a plane of occlusion of the aforementioned drift space to relative displacement with a molar, and differentiating and displaying relative displacement.
[Claim 10]
Three dimensional data of form of a maxilla molar and a mandible molar is made to read into a computer.
Form of drift space formed between occlusal surface of the aforementioned maxilla molar and occlusal surface of the aforementioned mandible molar when the aforementioned maxilla molar and the aforementioned mandible molar are engaged is specified by aforementioned computer, An occlusion valuation method making it display so that form of the aforementioned drift space can be checked with a display device of the aforementioned computer.
[Claim 11]
Three dimensional data of form of a maxilla molar and a mandible molar is made to read into a computer.
By aforementioned computer, when the aforementioned maxilla molar and the aforementioned mandible molar are engaged, specify form of drift space formed between occlusal surface of the aforementioned maxilla molar, and occlusal surface of the aforementioned mandible molar, and volume of the aforementioned drift space is computed, An occlusion valuation method displaying volume of the aforementioned drift space on a display device of the aforementioned computer.
[Claim 12]
Three dimensional data of form of a maxilla molar and a mandible molar is read into a computer,

Form of drift space formed between occlusal surface of the aforementioned maxilla molar, and occlusal surface of the aforementioned mandible molar when the aforementioned maxilla molar and the aforementioned mandible molar are engaged, An occlusion evaluation program making it display so that it may specify by aforementioned computer and form of the aforementioned drift space can be checked with a display device of the aforementioned computer.
[Claim 13]
Three dimensional data of form of a maxilla molar and a mandible molar is read into a computer,
By aforementioned computer, when the aforementioned maxilla molar and the aforementioned mandible molar are engaged, specify form of drift space formed between occlusal surface of the aforementioned maxilla molar, and occlusal surface of the aforementioned mandible molar, and volume of the aforementioned drift space is computed, An occlusion evaluation program displaying volume of the aforementioned drift space on a display device of the aforementioned computer.
[Amendment 2]
[Document to be Amended]Description
[Item(s) to be Amended]0012
[Method of Amendment]Change
[The contents of correction]
[0012]
In order to solve the aforementioned problem, the first modes of the occlusion evaluation system by the present invention, The form of the drift space formed between the occlusal surface of the aforementioned maxilla molar and the occlusal surface of the aforementioned mandible molar when the three dimensional data of the form of a maxilla molar and a mandible molar is read and the aforementioned maxilla molar and the aforementioned mandible molar are engaged is specified, A display, preferably any section shall be displayed so that the form of the aforementioned drift space can be checked.
[Amendment 3]
[Document to be Amended]Description
[Item(s) to be Amended]0013
[Method of Amendment]Change
[The contents of correction]
[0013]
The second modes of the occlusion evaluation system by the present invention, The three dimensional data of the form of a maxilla molar and a mandible molar is read, when the aforementioned maxilla molar and the aforementioned mandible molar are engaged, the drift space formed between the occlusal surface of the aforementioned maxilla molar and the occlusal surface of the aforementioned mandible molar shall be specified, and the volume of the aforementioned drift space shall be computed and displayed.
[Amendment 4]
[Document to be Amended]Description
[Item(s) to be Amended]0033
[Method of Amendment]Change

[The contents of correction]
[0033]
The occlusion valuation method by the present invention makes the three dimensional data of the form of a maxilla molar and a mandible molar read into a computer. The form of the drift space formed between the occlusal surface of the aforementioned maxilla molar, and the occlusal surface of the aforementioned mandible molar when the aforementioned maxilla molar and the aforementioned mandible molar are engaged, It specifies by aforementioned computer and considers it as the method of displaying so that the form or volume of the aforementioned drift space can be checked with the display device of the aforementioned computer.
[Amendment 5]
[Document to be Amended]Description
[Item(s) to be Amended]0034
[Method of Amendment]Change
[The contents of correction]
[0034]
The occlusion evaluation program by the present invention reads the three dimensional data of the form of a maxilla molar and a mandible molar into a computer, The form of the drift space formed between the occlusal surface of the aforementioned maxilla molar, and the occlusal surface of the aforementioned mandible molar when the aforementioned maxilla molar and the aforementioned mandible molar are engaged, It specifies by aforementioned computer and makes it display so that the form or volume of the aforementioned drift space can be checked with the display device of the aforementioned computer.
[Written Amendment]
[Filing date]Heisei 24(2012) March 5 (2012.3.5)
[Amendment 1]
[Document to be Amended]Scope of the claim
[Item(s) to be Amended]Full text
[Method of Amendment]Change
[The contents of correction]
[Claim(s)]
[Claim 1]
Three dimensional data of form of a maxilla molar and a mandible molar is read, When the aforementioned maxilla molar and the aforementioned mandible molar are engaged, form of drift space formed between occlusal surface of the aforementioned maxilla molar and occlusal surface of the aforementioned mandible molar is specified, and it displays so that form of the aforementioned drift space can be checked,
An occlusion evaluation system which making the aforementioned maxilla molar and the aforementioned mandible molar ****, changing an occluded condition arbitrarily, and changing according to an occluded condition in form of drift space which displayed [aforementioned].
[Claim 2]
Three dimensional data of form of a maxilla molar and a mandible molar is read, When the aforementioned maxilla molar and the aforementioned mandible molar

are engaged, form of drift space formed between occlusal surface of the aforementioned maxilla molar and occlusal surface of the aforementioned mandible molar is specified, and volume of the aforementioned drift space is computed and displayed,
An occlusion evaluation system being able to compute and display variation of volume of the aforementioned drift space to relative displacement of the aforementioned maxilla molar and the aforementioned mandible molar while making the aforementioned maxilla molar and the aforementioned mandible molar ****, changing an occluded condition arbitrarily and changing volume of drift space which displayed [aforementioned].
[Claim 3]
The occlusion evaluation system according to claim 2 reading three dimensional data of form of a plurality of maxilla molars and a mandible molar, and carrying out the comparison display of the volume of the aforementioned drift space.
[Claim 4]
The aforementioned drift space,
a plane vertical to a plane of occlusion containing two points of contact which are points of contact of the aforementioned maxilla molar and the aforementioned mandible molar, and adjoin each other, occlusal surface of the aforementioned maxilla molar, and occlusal surface of the aforementioned mandible molar -- demarcation
**** space,
space demarcated in a plane vertical to a plane of occlusion containing two cusps which the aforementioned maxilla molar adjoins, a plane vertical to a plane of occlusion containing two cusps which the aforementioned mandible molar adjoins, occlusal surface of the aforementioned maxilla molar, and occlusal surface of the aforementioned mandible molar -- or
A plane vertical to a plane of occlusion containing the two maximum Toyotaka parts which the aforementioned maxilla molar adjoins for each other, Space demarcated in a plane vertical to a plane of occlusion containing the two maximum Toyotaka parts in which the aforementioned mandible molar adjoins a predetermined maxilla base plane which is placed above socket of the aforementioned maxilla molar for each other, a predetermined mandible base plane which is placed below socket of the aforementioned mandible molar, occlusal surface of the aforementioned maxilla molar, and occlusal surface of the aforementioned mandible molar,
The occlusion evaluation system according to any one of claims 1 to 3 which comes out and is characterized by a certain thing.
[Claim 5]
The occlusion evaluation system according to any one of claims 1 to 4 specifying and displaying a section of the aforementioned drift space whose cross-sectional area becomes small most.
[Claim 6]
The occlusion evaluation system according to any one of claims 1 to 5 being able to correct the aforementioned three dimensional data of form of the aforementioned maxilla molar and the aforementioned mandible molar.
[Claim 7]

When changing an occluded condition of the aforementioned maxilla molar and the aforementioned mandible molar, variation of a cross-sectional area in a section vertical to a plane of occlusion of the aforementioned drift space to relative displacement of the aforementioned maxilla molar and the aforementioned mandible molar is computed, The occlusion evaluation system according to any one of claims 1 to 6 differentiating and displaying relative displacement.
[Claim 8]
Three dimensional data of form of a maxilla molar and a mandible molar is made to read into a computer.
When the aforementioned maxilla molar and the aforementioned mandible molar are engaged, form of drift space formed between occlusal surface of the aforementioned maxilla molar and occlusal surface of the aforementioned mandible molar is specified by aforementioned computer, and it is made to display so that form of the aforementioned drift space can be checked with a display device of the aforementioned computer.
An occlusion valuation method changing form of the aforementioned drift space which made the aforementioned maxilla molar and the aforementioned mandible molar **** in the aforementioned computer, changed an occluded condition arbitrarily, and was displayed on the aforementioned display device according to an occluded condition.
[Claim 9]
Three dimensional data of form of a maxilla molar and a mandible molar is made to read into a computer.
By aforementioned computer, when the aforementioned maxilla molar and the aforementioned mandible molar are engaged, form of drift space formed between occlusal surface of the aforementioned maxilla molar and occlusal surface of the aforementioned mandible molar is specified, volume of the aforementioned drift space is computed, and volume of the aforementioned drift space is displayed on a display device of the aforementioned computer,
While changing volume of the aforementioned drift space which made the aforementioned maxilla molar and the aforementioned mandible molar **** in the aforementioned computer, changed an occluded condition arbitrarily, and was displayed on the aforementioned display device, An occlusion valuation method computing variation of volume of the aforementioned drift space to relative displacement of the aforementioned maxilla molar and the aforementioned mandible molar, and making it display on the aforementioned display device.
[Claim 10]
Three dimensional data of form of a maxilla molar and a mandible molar is read into a computer,
When the aforementioned maxilla molar and the aforementioned mandible molar are engaged, form of drift space formed between occlusal surface of the aforementioned maxilla molar and occlusal surface of the aforementioned mandible molar is specified by aforementioned computer, and it is made to display so that form of the aforementioned drift space can be checked with a display device of the aforementioned computer.
An occlusion evaluation program changing form of the aforementioned drift space which made the aforementioned maxilla molar and the aforementioned mandible

molar **** in the aforementioned computer, could change an occluded condition arbitrarily, and was displayed on the aforementioned display device according to an occluded condition.
[Claim 11]
Three dimensional data of form of a maxilla molar and a mandible molar is read into a computer,
By aforementioned computer, when the aforementioned maxilla molar and the aforementioned mandible molar are engaged, it describes above.
Form of drift space formed between occlusal surface of a maxilla molar and occlusal surface of the aforementioned mandible molar is specified, volume of the aforementioned drift space is computed, and volume of the aforementioned drift space is displayed on a display device of the aforementioned computer,
While changing volume of the aforementioned drift space which made the aforementioned maxilla molar and the aforementioned mandible molar **** in the aforementioned computer, could change an occluded condition arbitrarily, and was displayed on the aforementioned display device, An occlusion evaluation program computing variation of volume of the aforementioned drift space to relative displacement of the aforementioned maxilla molar and the aforementioned mandible molar, and making it display on the aforementioned display device.
[Amendment 2]
[Document to be Amended]Description
[Item(s) to be Amended]0012
[Method of Amendment]Change
[The contents of correction]
[0012]
In order to solve the aforementioned problem, the first modes of the occlusion evaluation system by the present invention, The form of the drift space formed between the occlusal surface of the aforementioned maxilla molar and the occlusal surface of the aforementioned mandible molar when the three dimensional data of the form of a maxilla molar and a mandible molar is read and the aforementioned maxilla molar and the aforementioned mandible molar are engaged is specified, Shall display a display, preferably any section so that the form of the aforementioned drift space can be checked, and the aforementioned maxilla molar and the aforementioned mandible molar shall be made to ****, an occluded condition shall be changed arbitrarily, and the form of the drift space which displayed [aforementioned] shall be changed according to an occluded condition.
[Amendment 3]
[Document to be Amended]Description
[Item(s) to be Amended]0013
[Method of Amendment]Change
[The contents of correction]
[0013]
The second modes of the occlusion evaluation system by the present invention, The drift space formed between the occlusal surface of the aforementioned maxilla molar and the occlusal surface of the aforementioned mandible molar when the three dimensional data of the form of a maxilla molar and a mandible

molar is read and the aforementioned maxilla molar and the aforementioned mandible molar are engaged is specified, The volume of the aforementioned drift space is computed and displayed, the aforementioned maxilla molar and the aforementioned mandible molar shall be made to ****, an occluded condition shall be changed arbitrarily, and the variation of the volume of the aforementioned drift space to the relative displacement of the aforementioned maxilla molar and the aforementioned mandible molar shall be computed and displayed.
[Amendment 4]
[Document to be Amended]Description
[Item(s) to be Amended]0014
[Method of Amendment]Change
[The contents of correction]
[0014]
According to these composition, by change of the size of food drift space, or form, The shape change of the drift space by chewing motion can be checked, the size of the effect discharged from between gear teeth can grasp easily the food printed and crushed with the molar, and it can evaluate the digestion capability of a molar, without being dependent on the muscular power and the habit of biting of a patient or a test subject.
[Amendment 5]
[Document to be Amended]Description
[Item(s) to be Amended]0027
[Method of Amendment]Deletion
[The contents of correction]
[Amendment 6]
[Document to be Amended]Description
[Item(s) to be Amended]0028
[Method of Amendment]Deletion
[The contents of correction]
[Amendment 7]
[Document to be Amended]Description
[Item(s) to be Amended]0029
[Method of Amendment]Deletion
[The contents of correction]
[Amendment 8]
[Document to be Amended]Description
[Item(s) to be Amended]0030
[Method of Amendment]Deletion
[The contents of correction]
[Amendment 9]
[Document to be Amended]Description
[Item(s) to be Amended]0033
[Method of Amendment]Change
[The contents of correction]
[0033]
The occlusion valuation method by the present invention makes the three dimensional data of the form of a maxilla molar and a mandible molar read into a

computer. The form of the drift space formed between the occlusal surface of the aforementioned maxilla molar, and the occlusal surface of the aforementioned mandible molar when the aforementioned maxilla molar and the aforementioned mandible molar are engaged, Specify by aforementioned computer and it makes it display so that the form or volume of the aforementioned drift space can be checked with the display device of the aforementioned computer. Make it **** with the aforementioned maxilla molar and the aforementioned mandible molar in the aforementioned computer, and it changes an occluded condition arbitrarily, It is considered as the method of displaying the variation of the volume of the aforementioned drift space [as opposed to the relative displacement of change or the aforementioned maxilla molar, and the aforementioned mandible molar for the form of the aforementioned drift space displayed on the aforementioned display device according to the occluded condition].

[Amendment 10]

[Document to be Amended]Description

[Item(s) to be Amended]0034

[Method of Amendment]Change

[The contents of correction]

[0034]

The occlusion evaluation program by the present invention reads the three dimensional data of the form of a maxilla molar and a mandible molar into a computer, The form of the drift space formed between the occlusal surface of the aforementioned maxilla molar, and the occlusal surface of the aforementioned mandible molar when the aforementioned maxilla molar and the aforementioned mandible molar are engaged, Specify by aforementioned computer and it makes it display so that the form or volume of the aforementioned drift space can be checked with the display device of the aforementioned computer. It is made to **** with the aforementioned maxilla molar and the aforementioned mandible molar in the aforementioned computer, and an occluded condition can be changed arbitrarily, The variation of the volume of the aforementioned drift space [as opposed to the relative displacement of change or the aforementioned maxilla molar, and the aforementioned mandible molar for the form of the aforementioned drift space displayed on the aforementioned display device according to the occluded condition] shall be displayed.

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最終頁に続く

(54)【発明の名称】咬合評価装置、咬合評価方法および咬合評価プログラム

(57)【特許請求の範囲】

【請求項１】

上顎臼歯および下顎臼歯の形状の三次元データを読み込み、

前記上顎臼歯と前記下顎臼歯とを噛み合わせたときに前記上顎臼歯の咬合面と前記下顎臼歯の咬合面との間に形成される流動空間の形状を特定し、前記流動空間の形状を確認できるように表示し、

前記上顎臼歯と前記下顎臼歯とを擦動させて咬合状態を任意に変更し、前記表示した流動空間の形状を咬合状態に応じて変化させられることを特徴とする咬合評価装置。

【請求項２】

上顎臼歯および下顎臼歯の形状の三次元データを読み込み、

前記上顎臼歯と前記下顎臼歯とを噛み合わせたときに前記上顎臼歯の咬合面と前記下顎臼歯の咬合面との間に形成される流動空間の形状を特定し、前記流動空間の体積を算出して表示し、

前記上顎臼歯と前記下顎臼歯とを擦動させて咬合状態を任意に変更し、前記表示した流動空間の体積を変化させるとともに、前記上顎臼歯と前記下顎臼歯との相対移動量に対する前記流動空間の体積の変化量を算出して表示できることを特徴とする咬合評価装置。

【請求項３】

複数の上顎臼歯および下顎臼歯の形状の三次元データを読み込み、前記流動空間の体積を比較表示することを特徴とする請求項２に記載の咬合評価装置。

【請求項４】

前記流動空間は、

前記上顎臼歯と前記下顎臼歯との接触点であって互いに隣接する２つの接触点を含んだ咬合平面に垂直な平面と、前記上顎臼歯の咬合面と、前記下顎臼歯の咬合面とで画定される空間、

前記上顎臼歯の隣接する２つの咬頭を含んだ咬合平面に垂直な平面と、前記下顎臼歯の隣接する２つの咬頭を含んだ咬合平面に垂直な平面と、前記上顎臼歯の咬合面と、前記下顎臼歯の咬合面とで画定される空間、或いは、

前記上顎臼歯の隣接し合う２つの最大豊隆部を含んだ咬合平面に垂直な平面と、前記上顎臼歯の窩よりも上に位置する所定の上顎基準平面と前記下顎臼歯の、隣接し合う２つの最大豊隆部を含んだ咬合平面に垂直な平面と、前記下顎臼歯の窩よりも下に位置する所定の下顎基準平面と、前記上顎臼歯の咬合面と、前記下顎臼歯の咬合面とで画定される空間、

であることを特徴とする請求項１から３のいずれかに記載の咬合評価装置。

【請求項５】

前記流動空間の最も断面積が小さくなる断面を特定して表示することを特徴とする請求項１から４のいずれかに記載の咬合評価装置。

【請求項６】

前記上顎臼歯および前記下顎臼歯の形状の前記三次元データを修正可能であることを特徴とする請求項１から５のいずれかに記載の咬合評価装置。

【請求項７】

前記上顎臼歯および前記下顎臼歯の咬合状態を変更する際に、前記上顎臼歯と前記下顎臼歯との相対移動量に対する前記流動空間の咬合平面に垂直な断面における断面積の変化量を算出し、相対移動量について微分して表示することを特徴とする請求項１から６のいずれかに記載の咬合評価装置。

【請求項８】

上顎臼歯および下顎臼歯の形状の三次元データをコンピュータに読み込ませ、

前記上顎臼歯と前記下顎臼歯とを噛み合わせたときに前記上顎臼歯の咬合面と前記下顎臼歯の咬合面との間に形成される流動空間の形状を前記コンピュータによって特定し、前記コンピュータの表示装置に前記流動空間の形状を確認できるように表示させ、

前記コンピュータにおいて前記上顎臼歯と前記下顎臼歯とを擦動させて咬合状態を任意に変更し、咬合状態に応じて前記表示装置に表示した前記流動空間の形状を変化させることを特徴とする咬合評価方法。

【請求項９】

上顎臼歯および下顎臼歯の形状の三次元データをコンピュータに読み込ませ、

前記コンピュータによって、前記上顎臼歯と前記下顎臼歯とを噛み合わせたときに前記上顎臼歯の咬合面と前記下顎臼歯の咬合面との間に形成される流動空間の形状を特定し、前記流動空間の体積を算出して、前記コンピュータの表示装置に前記流動空間の体積を表示させ、

前記コンピュータにおいて前記上顎臼歯と前記下顎臼歯とを擦動させて咬合状態を任意に変更し、前記表示装置に表示した前記流動空間の体積を変化させるとともに、前記上顎臼歯と前記下顎臼歯との相対移動量に対する前記流動空間の体積の変化量を算出して前記表示装置に表示させることを特徴とする咬合評価方法。

【請求項１０】

上顎臼歯および下顎臼歯の形状の三次元データをコンピュータに読み込み、

前記上顎臼歯と前記下顎臼歯とを噛み合わせたときに前記上顎臼歯の咬合面と前記下顎臼歯の咬合面との間に形成される流動空間の形状を、前記コンピュータによって特定し、前記コンピュータの表示装置に前記流動空間の形状を確認できるように表示させ、

前記コンピュータにおいて前記上顎臼歯と前記下顎臼歯とを擦動させて咬合状態を任意に変更でき、咬合状態に応じて前記表示装置に表示した前記流動空間の形状を変化させることを特徴とする咬合評価プログラム。

【請求項１１】
上顎臼歯および下顎臼歯の形状の三次元データをコンピュータに読み込み、
前記コンピュータによって、前記上顎臼歯と前記下顎臼歯とを噛み合わせたときに前記上顎臼歯の咬合面と前記下顎臼歯の咬合面との間に形成される流動空間の形状を特定し、前記流動空間の体積を算出して、前記コンピュータの表示装置に前記流動空間の体積を表示させ、
前記コンピュータにおいて前記上顎臼歯と前記下顎臼歯とを擦動させて咬合状態を任意に変更でき、前記表示装置に表示した前記流動空間の体積を変化させるとともに、前記上顎臼歯と前記下顎臼歯との相対移動量に対する前記流動空間の体積の変化量を算出して前記表示装置に表示させることを特徴とする咬合評価プログラム。
【発明の詳細な説明】
【技術分野】
【０００１】
本発明は、咬合評価装置、咬合評価方法および咬合評価プログラムに関する。
【背景技術】
【０００２】
歯（天然歯および人工歯）の咀嚼能力を測定する方法として、特許文献１，２および非特許文献１に記載されているように、実際に人が何かを咀嚼することによって、咀嚼能力を判断する方法が提唱されている。
【０００３】
このような方法では、被験者の筋力や噛み癖等による影響と、歯（義歯を含む）の咬合形状による影響とを区別して測定できない。特に、義歯の製作や調整に際しては、義歯の咬合形状に起因する咀嚼能力だけを評価できることが望ましい。
【０００４】
天然歯においては、歯牙叢生状況による上下顎の咬合状態や加齢による歯牙の摩耗は食物の咀嚼力に大きく影響し、歯牙の排列咬合状態に起因する咀嚼力を測定する装置、方法は知られていない。
【０００５】
また、義歯においても、歯牙排列状況による上下顎の咬合状態や義歯の削合や義歯を一定期間使用した後の摩耗は食物の咀嚼力に大きく影響し、歯牙の排列咬合状態に起因する咀嚼力を測定する装置、方法は知られていない。
【０００６】
特に、義歯同士や義歯の使用前後で咀嚼力を比べることは行なわれておらず、義歯の交換時期や義歯の咀嚼能力を評価することはできなかった。義歯そのものの咀嚼力は患者の咬合力、噛み癖、食習慣などに大きく影響されるものであり、患者ごとに適切な義歯を有するものでもあるため、義歯の作成時に予め義歯の咀嚼力が適切であるかどうかを評価する方法が望まれていた。
【０００７】
義歯の咀嚼力を装着前に知ることが可能であり、患者の治療や診断の情報として用いることができ、次の治療に役立てることもができる。
【０００８】
また、咀嚼能力を数値化できれば、閾値を設けることで作成された義歯の評価にも用いることができ、特に作成された義歯がどの程度の咀嚼力を有するものであるかを評価することができる。
【先行技術文献】
【特許文献】
【０００９】
【特許文献１】特開２００５－２３７７１０号公報
【特許文献２】特開２００８－２２０６００号公報
【非特許文献】

【００１０】
【非特許文献１】「咀嚼障害評価法のガイドライン―主として咀嚼能力検査法―」、補綴誌、２００２年、第４６巻第４号、ｐ．６１９－６２５
【発明の概要】
【発明が解決しようとする課題】
【００１１】
前記問題点に鑑みて、本発明は、被験者に依存せずに、歯の咬合形状による咀嚼能力を評価できる咬合評価装置、咬合評価方法および咬合評価プログラムを提供することを課題とする。
【課題を解決するための手段】
【００１２】
前記課題を解決するために、本発明による咬合評価装置の第１の態様は、上顎臼歯および下顎臼歯の形状の三次元データを読み込み、前記上顎臼歯と前記下顎臼歯とを噛み合わせたときに前記上顎臼歯の咬合面と前記下顎臼歯の咬合面との間に形成される流動空間の形状を特定し、前記流動空間の形状を確認できるように表示、好ましくは、任意の断面を表示し、前記上顎臼歯と前記下顎臼歯とを擦動させて咬合状態を任意に変更し、前記表示した流動空間の形状を咬合状態に応じて変化させられるものとする。
【００１３】
また、本発明による咬合評価装置の第２の態様は、上顎臼歯および下顎臼歯の形状の三次元データを読み込み、前記上顎臼歯と前記下顎臼歯とを噛み合わせたときに前記上顎臼歯の咬合面と前記下顎臼歯の咬合面との間に形成される流動空間を特定し、前記流動空間の体積を算出して表示し、前記上顎臼歯と前記下顎臼歯とを擦動させて咬合状態を任意に変更し、前記上顎臼歯と前記下顎臼歯との相対移動量に対する前記流動空間の体積の変化量を算出して表示できるものとする。
【００１４】
これらの構成によれば、食物流動空間の大きさや形状の変化により、咀嚼運動による流動空間の形状変化を確認して、臼歯で摺り潰した食物を歯の間から排出する効果の大きさが容易に把握でき、臼歯の咀嚼能力を患者または被験者の筋力や噛み癖に依存せずに評価することができる。
【００１５】
特に、断面を表示することにより、食物が潰される場所や食物が逃げ出す場所を観察できる。
【００１６】
尚、本発明の咬合評価装置における上顎臼歯と下顎臼歯との噛み合わせは、顎運動測定装置によって測定した患者の実際の顎運動を再現して行ってもよく、咬合器によって再現される咬合条件、例えば、矢状顆路傾斜度、平衡側側方顆路、イミディエイト・サイドシフトの調節機構、作業側側方顆路角調節機構等をデータ上でシミュレートしてもよい。
【００１７】
また、本発明の第２の態様の咬合評価装置は、複数の上顎臼歯および下顎臼歯の形状の三次元データを読み込み、前記流動空間の体積を比較表示してもよい。
【００１８】
この構成によれば、義歯の摩耗による咀嚼能力の低下や削合による咀嚼能力の変化を定量化して確認できる。また、現在の義歯と新しく製作する義歯との咀嚼能力の比較もできる。特に、義歯の摩耗による咀嚼能力の低下を定量化し、義歯ごとのデータを比較できるようなグラフを表示可能とすれば、特定の患者の情報を蓄積し、その患者に対してより適切な義歯を作成することが容易になる。
【００１９】
本発明の咬合評価装置において、前記流動空間は、前記上顎臼歯と前記下顎臼歯との接触点であって互いに隣接する２つの接触点を含んだ咬合平面に垂直な平面と、前記上顎臼歯の咬合面と、前記下顎臼歯の咬合面とで画定される空間、前記上顎臼歯の隣接する２つ

の咬頭を含んだ咬合平面に垂直な平面と、前記下顎臼歯の隣接する２つの咬頭を含んだ咬合平面に垂直な平面と、前記上顎臼歯の咬合面と、前記下顎臼歯の咬合面とで画定される空間、或いは、前記上顎臼歯の隣接し合う２つの最大豊隆部を含んだ咬合平面に垂直な平面と、前記上顎臼歯の窩よりも上に位置する所定の上顎基準平面と、前記下顎臼歯の隣接し合う２つの最大豊隆部を含んだ咬合平面に垂直な平面と、前記下顎臼歯の窩よりも下に位置する所定の下顎基準平面と、前記上顎臼歯の咬合面と、前記下顎臼歯の咬合面とで画定される空間であってもよい。

【００２０】

この構成によれば、比較すべき範囲を容易に特定できる。

【００２１】

また、本発明の咬合評価装置は、前記流動空間の体積を表示してもよい。

【００２２】

この構成によれば、咀嚼能力を数値として定量的に把握できる。

【００２３】

また、本発明の咬合評価装置は、前記流動空間の最も断面積が小さくなる断面を特定して表示してもよい。

【００２４】

この構成によれば、最も小さい断面によって、擦動による摩滅や削合の程度が最も端的に示される。

【００２５】

また、本発明の咬合評価装置は、前記上顎臼歯および前記下顎臼歯の形状の前記三次元データを修正可能であってもよい。

【００２６】

この構成によれば、義歯の削合による咀嚼能力の変化をシミュレートでき、最適な削合を見つけることができる。

【００３１】

また、本発明の咬合評価装置は、前記上顎臼歯および前記下顎臼歯の咬合状態を変更する際に、前記上顎臼歯と前記下顎臼歯との相対移動量に対する前記流動空間の咬合平面に垂直な断面における断面積の変化量を算出し、相対移動量について微分して表示してもよい。

【００３２】

この構成によっても、咀嚼運動の過程における咀嚼能力の変化を確認できる。

【００３３】

また、本発明による咬合評価方法は、上顎臼歯および下顎臼歯の形状の三次元データをコンピュータに読み込ませ、前記上顎臼歯と前記下顎臼歯とを噛み合わせたときに前記上顎臼歯の咬合面と前記下顎臼歯の咬合面との間に形成される流動空間の形状を、前記コンピュータによって特定し、前記コンピュータの表示装置に前記流動空間の形状または体積を確認できるように表示させ、前記コンピュータにおいて前記上顎臼歯と前記下顎臼歯と擦動させて咬合状態を任意に変更し、咬合状態に応じて前記表示装置に表示した前記流動空間の形状を変化または前記上顎臼歯と前記下顎臼歯との相対移動量に対する前記流動空間の体積の変化量を表示する方法とする。

【００３４】

また、本発明による咬合評価プログラムは、上顎臼歯および下顎臼歯の形状の三次元データをコンピュータに読み込み、前記上顎臼歯と前記下顎臼歯とを噛み合わせたときに前記上顎臼歯の咬合面と前記下顎臼歯の咬合面との間に形成される流動空間の形状を、前記コンピュータによって特定し、前記コンピュータの表示装置に前記流動空間の形状または体積を確認できるように表示させ、前記コンピュータにおいて前記上顎臼歯と前記下顎臼歯と擦動させて咬合状態を任意に変更でき、咬合状態に応じて前記表示装置に表示した前記流動空間の形状を変化または前記上顎臼歯と前記下顎臼歯との相対移動量に対する前記流動空間の体積の変化量を表示するものとする。

【発明の効果】
【００３５】
本発明によれば、食物流動空間の大きさや形状を把握することによって、臼歯の咀嚼能力を患者または被験者の筋力や噛み癖に依存せずに評価することができる。
【００３６】
また、本発明によれば、複数の義歯のデータを蓄積することによって、患者の噛み癖を含めた咀嚼能力を視覚化および定量化でき、正確な診断や、より適切な義歯の作成も可能になる。
【図面の簡単な説明】
【００３７】
【図１】本発明１つの実施形態の咬合評価装置の構成を示すブロック図である。
【図２】本発明の流動空間の第１の態様の断面図である。
【図３】図２の流動空間の平面図である。
【図４】本発明の流動空間の第２の態様の断面図である。
【図５】図４の流動空間の平面図である。
【図６】本発明の流動空間の第３の態様の断面図である。
【図７】図６の流動空間の平面図である。
【図８】図７の代案の流動空間の平面図である。
【図９】図５のＡ－Ａ線断面図である。
【発明を実施するための形態】
【００３８】
これより、本発明の実施形態について、図面を参照しながら説明する。本発明による咬合評価装置は、図１に示すように、演算装置と、データ入力装置と、表示装置と、ユーザ入力装置とを備えるコンピュータ等を用いて実現され得るものである。
【００３９】
演算装置は、パーソナルコンピュータとソフトウェア・プログラムとを用いて実現することができるが、専用に設計したものであってもよい。データ入力装置は、直接三次元形状を読み取る三次元スキャナ等の機器だけでなく、メモリデバイスやディスク装置などのメディア読み取り装置またはデータ通信装置のように外部の三次元スキャナ等で読み取った三次元形状データを演算装置に読み込ませるための装置であってもよい。表示装置は、一般的なディスプレイでよい。ユーザ入力装置は、キーボードやマウス等の汎用の入力装置が利用できる。
【００４０】
本発明の咬合評価装置は、データ入力装置によって上顎臼歯および下顎臼歯の三次元形状データを読み込んで、演算装置において上顎臼歯と下顎臼歯とを噛み合わせ、上顎臼歯の咬合面と下顎臼歯の咬合面との間に形成される流動空間の三次元形状を算出し、表示装置上に表示するものである。流動空間の表示には、コンピュータグラフィックスにおいて使用されるワイヤフレームやレイトレーシング等の手法を適用できる。
【００４１】
図２および３に本発明の実施形態に係る第１の態様の流動空間のＶａを、図４および５に本発明の実施形態に係る第２の態様の流動空間のＶｃを、図６および７に本発明の実施形態に係る第３の態様の流動空間のＶｗを、それぞれ示す。
【００４２】
第１の態様の流動空間Ｖａは、上顎臼歯（第一小臼歯１、第二小臼歯２、第一大臼歯３、第二大臼歯４）と下顎臼歯（第一小臼歯５、第二小臼歯６、第一大臼歯７、第二大臼歯８）との接触点Ｐａであって互いに隣接する２つの接触点Ｐａを含んだ咬合平面に垂直な平面Ｓａと、上顎臼歯１，２，３，４の咬合面１ａ，２ａ，３ａ，４ａと、下顎臼歯５，６，７，８，の咬合面５ａ，６ａ，７ａ，８ａとで画定される空間である。
【００４３】
第２の態様の流動空間Ｖｃは、上顎臼歯１，２，３，４の隣接し合う２つの咬頭Ｐｃを

含んだ咬合平面に垂直な平面Ｓｃと、下顎臼歯５，６，７，８の隣接し合う２つの咬頭Ｐｃを含んだ咬合平面に垂直な平面Ｓｃと、上顎臼歯１，２，３，４の咬合面１ａ，２ａ，３ａ，４ａと、下顎臼歯５，６，７，８，の咬合面５ａ，６ａ，７ａ，８ａとで画定される空間である。

【００４４】

第３の態様の流動空間Ｖｗは、隣接し合う２つの上顎臼歯１，２，３，４の最大豊隆部Ｐｗを含んだ咬合平面に垂直な平面Ｓｗと、隣接し合う２つの下顎臼歯５，６，７，８の最大豊隆部Ｐｗを含んだ咬合平面に垂直な平面Ｓｗと、上顎臼歯１，２，３，４の咬合面１ａ，２ａ，３ａ，４ａよりも上に位置する上顎基準面Ｓｕと、下顎臼歯５，６，７，８の咬合面５ａ，６ａ，７ａ，８ａよりも下に位置する下顎基準面Ｓｌとで画定される空間である。

【００４５】

咬合平面とは、厳密には、下顎中切歯の切縁の接触点と左右の下顎第二大臼歯遠心頬側咬頭との３点によって決定される平面をいうが、本発明では、これに準ずるいかなる平面であってもよい。例えば、前歯のデータがない場合には、左右いずれかの下顎第一小臼歯近心頬側咬頭と左右下顎第二大臼歯遠心頬側咬頭との３点によって決定される平面等、左右いずれかの臼歯のデータしかない場合には、下顎第一小臼歯近心頬側咬頭と下顎第二大臼歯遠心頬側咬頭と下顎第一大臼歯近心舌側咬頭との３点によって決定される平面等を、それぞれ咬合平面として取り扱ってもよい。さらなる代案として、下顎臼歯形状を読み込む際の基準面（直交座標系の上下の軸方向の位置が等しい平面）、つまり、データにおける下顎臼歯またはその歯茎の基底面を咬合平面として取り扱っても差し支えない。尚、本発明において咬合面とは、臼歯の表面の凹凸のある面を指す用語であって咬合平面とは明確に区別されるものである。

【００４６】

本発明において、流動空間Ｖａ，Ｖｃ，Ｖｗは、通常、左右に１つずつ算定されるが、臼歯の欠損がある場合には、欠損歯よりも近心側と遠心側とで分割して算出してもよく、各対合歯対ごとに算出してもよい。また、第三大臼歯を有する場合には、第三大臼歯まで拡張して流動空間Ｖａ，Ｖｃ，Ｖｗを算出してもよい。

【００４７】

第３の態様の流動空間Ｖｗの算出において、最大豊隆部Ｐｗは、歯列弓を画定できる場合には、頬側おおび舌側の最大豊隆部としてもよいが、図７に示すように、直交座標系三次元データの左右の軸方向に最大となる点および最小となる点を用いてもよい。

【００４８】

また、図３，５，７に示した流動空間Ｖａ，Ｖｃ，Ｖｗは、第一小臼歯および第二大臼歯の隣接する２つの接点Ｐａを含む平面Ｓａ、第一小臼歯および第二大臼歯の隣接する２つの咬頭Ｐｃを含む平面Ｓｃ、或いは、第一小臼歯および第二大臼歯の左右方向（頬舌方向）両側の最大豊隆部Ｐｗを含んだ平面Ｓｗによって、近心遠心方向に閉じた空間として画定されている。しかしながら、図８に示す第３の態様の流動空間Ｖｗの代案では、第一小臼歯の近心方向または座標軸方向の最大豊隆部Ｐｍにおける接面Ｓｍ、および、第二大臼歯の遠心方向または座標軸方向の最大豊隆部Ｐｄにおける接面Ｓｄによって、流動空間Ｖｗの近心遠心方向の端面を画定している。同様に、第１の態様の流動空間Ｖａおよび第２の態様の流動空間Ｖｃの近心遠心方向の端面を、他の基準によって定めた平面によって画定してもよい。

【００４９】

また、図６に示した流動空間Ｖｗの計算において、上顎基準面Ｓｕおよび下顎基準面Ｓｌは、それぞれ、予め定めた３点の最大豊隆部Ｐｗ例えば、第一小臼歯１，５の頬側最大豊隆部と、第二大臼歯４，８の頬側および下側最大豊隆部）含む平面としている。しかしながら、上顎基準面Ｓｕは、上顎臼歯１，２，３，４のすべての窩よりも上に位置する平面であればよく、下顎基準面Ｓｌは、下顎臼歯５，６，７，８のすべての窩よりも下に位置する平面であればよい。例えば、上顎基準面Ｓｕおよび下顎基準面Ｓｌは、それぞれ、

予め定めた臼歯の特定の最大豊隆部を含んだ咬合平面に平行な平面としてもよい。

【００５０】

また、第１の態様の流動空間Ｖａおよび第２の態様の流動空間Ｖｃの算出に際し、歯間等においては、咬合面によって咬合平面に垂直な方向の境界が画定できない場合がある。このため、第１の態様の流動空間Ｖａおよび第２の態様の流動空間Ｖｃの算出においても、第３の態様の流動空間Ｖｗの画定と同様に、上顎基準面Ｓｕおよび下顎基準面Ｓｌを設定してもよい。

【００５１】

本発明の咬合評価装置は、流動空間Ｖａ、流動空間Ｖｃおよび流動空間Ｖｗのいずれかをユーザ入力装置を介してユーザ（医師や技師）が選択し、選択された形状を表示できるようにすることが望ましい。

【００５２】

また、流動空間Ｖａ，Ｖｃ，Ｖｗの表示とともに、その体積を表示できるようにすることで、咀嚼能力を定量化して把握できるようになる。

【００５３】

また、本発明の咬合評価装置は、上顎臼歯１，２，３，４と下顎臼歯５，６，７，８との咬頭嵌合位、咬合位、中心嵌合位、および、流動空間Ｖａ，ＶｃまたはＶｗが最大となる初期接触位置等を自動的に算出し、それらの咬合状態の中からユーザが選択して表示することができるようにすることが好ましい。

【００５４】

さらに、本発明の咬合評装置は、上顎臼歯１，２，３，４と下顎臼歯５，６，７，８との咬合状態を任意に変更できるようにすることが望ましい。例えば、ユーザが下顎臼歯５，６，７，８に対して上顎臼歯１，２，３，４を移動させる任意の方向を入力することによって、コンピュータが上顎臼歯１，２，３，４と下顎臼歯５，６，７，８との擦動を計算して、リアルタイムに流動空間Ｖａ，Ｖｃ，Ｖｗの形状変化を表示するようにすれば、咀嚼運動による流動空間Ｖａ，Ｖｃ，Ｖｗの変化を視覚的に把握できる。

【００５５】

また、本発明の咬合評価装置は、流動空間Ｖａ，Ｖｃ，Ｖｗの任意の断面の形状およびその断面積を表示できることが望ましい。例として、図９に、図５の流動空間ＶｃのＡ－Ａ断面を示す。さらに、咬合評価装置が、断面積が最小となる断面位置を算定して、画面表示するようにすれば、流動空間Ｖａ，Ｖｃ，Ｖｗの中で咀嚼において最も有意な断面をユーザに知らせることができる。

【００５６】

加えて、本発明の咬合評価装置は、上顎臼歯１，２，３，４と下顎臼歯５，６，７，８との任意の擦動における流動空間Ｖａ，Ｖｃ，Ｖｗの体積や流動空間Ｖａ，Ｖｃ，Ｖｗの特定位置の断面積の変化を上顎臼歯１，２，３，４と下顎臼歯５，６，７，８との相対移動量に対してグラフ化して表示できることが好ましい。さらに好ましくは、変化量を運動量で微分および２重微分してグラフ化することで、流動空間Ｖａ，Ｖｃ，Ｖｗの変化率を求め、咀嚼運動のスムーズさを確認できる。

【００５７】

また、本発明の咬合評価装置は、上顎臼歯１，２，３，４および下顎臼歯５，６，７，８の三次元データを修正可能であることが好ましい、これにより、最適な義歯の設計または削合状態のシミュレートが可能になる。

【００５８】

本発明の咬合評価装置では、流動空間Ｖａ，Ｖｃ，Ｖｗによって、最適な義歯の形状を決定するだけでなく、新品時の義歯と、使用後の摩耗した義歯との咀嚼能力の違いを評価することで、患者の噛み癖等も含めて、義歯の咀嚼能力を評価することも可能である。

【符号の説明】

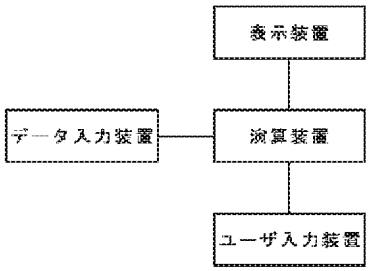
【００５９】

１…上顎第一小臼歯

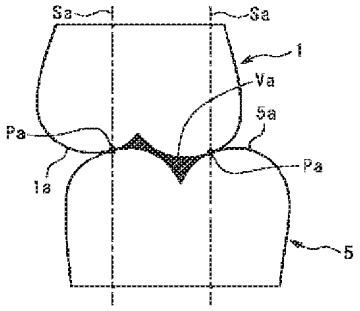
２…上顎第二小臼歯
３…上顎第一大臼歯
４…上顎第二大臼歯
５…下顎第一小臼歯
６…下顎第二小臼歯
７…下顎第一大臼歯
８…下顎第二大臼歯
Ｐａ…接触点
Ｐｃ…咬頭
Ｐｗ…最大豊隆部
Ｓａ…接触点を含んだ平面
Ｓｃ…咬頭を含んだ平面
Ｓｗ…最大豊隆部を含んだ平面
Ｓｕ…上顎基準平面
Ｓｌ…下顎基準平面

【要約】
【課題】被験者に依存せずに、歯の咬合形状による咀嚼能力を評価できる咬合評価装置を提供する。
【解決手段】上顎臼歯１，２，３，４および下顎臼歯５，６，７，８の形状の三次元データを読み込み、上顎臼歯と下顎臼歯とを噛み合わせたときに上顎臼歯の咬合面と下顎臼歯の咬合面との間に形成される流動空間Ｖａであって、上顎臼歯と下顎臼歯との接触点Ｐａであって互いに隣接する２つの接触点Ｐａを含んだ咬合平面に垂直な平面Ｓａと、上顎臼歯１，２，３，４の咬合面１ａ，２ａ，３ａ，４ａと、下顎臼歯５，６，７，８の咬合面５ａ，６ａ，７ａ，８ａとで画定される流動空間Ｖａの形状を算出して表示する。
【選択図】図３

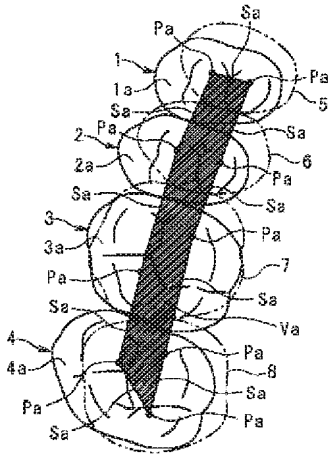
【図１】



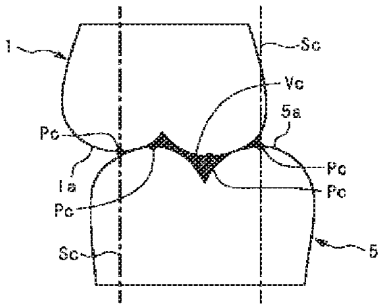
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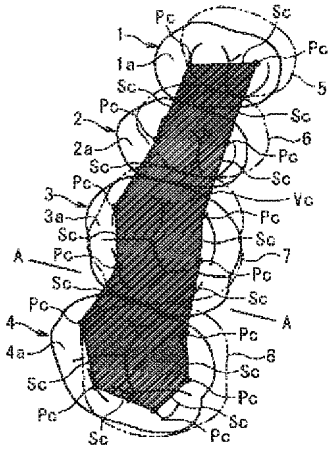
【図３】



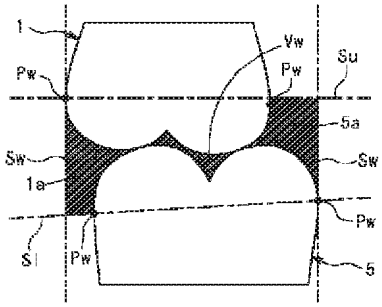
【図４】



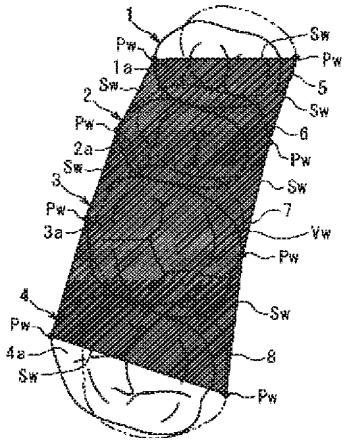
【図５】


Pc
Sc
1
1a
Sc
Pc
2
2a
Sc
Pc
3
3a
Sc
A
Pc
Sc
Pc
4
4a
5c
Pc
Sc
Pc
Sc
Pc
Sc
Pc
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Pc
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Vc
Pc
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7
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Sc
Pc
Sc
Pc
5

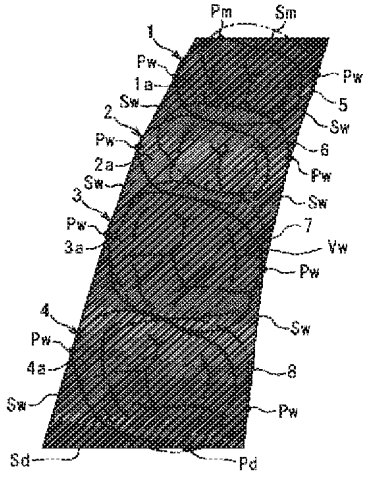
【図６】


1
Pw
Vw
Pw
Su
5a
Sw
Sw
1a
Pw
Sl
Pw
5

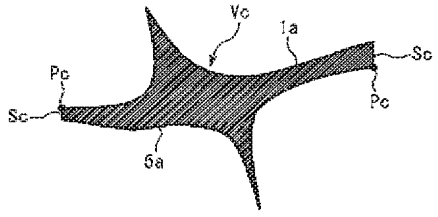
【図７】


1
Pw
Sw
1a
Pw
Sw
5
2
Sw
Pw
6
2a
Pw
Sw
3
Sw
7
Pw
3a
Vw
Pw
4
Sw
Pw
4a
8
Sw
Pw

【図８】


Pm
Sm
1
Pw
Pw
1a
Sw
5
2
Sw
Pw
6
2a
Pw
Sw
3
Sw
7
Pw
Vw
3a
Pw
4
Sw
Pw
4a
8
Sw
Pw
Sd
Pd

【図９】


Vc
1a
Sc
Pc
Pc
Sc
5a

フロントページの続き

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審査官　胡谷　佳津志

(56)参考文献　特開２００５－１９３０２８（ＪＰ，Ａ）
特開２０１０－１８７７１０（ＪＰ，Ａ）
特開２００９－２３３３４９（ＪＰ，Ａ）
三谷 章、外２名，新しい咀嚼機能評価システムを用いたブリッジ装着前後の咀嚼機能の変化に関する研究，口腔衛生学会雑誌，日本，１９９９年，第49巻，第3号，p. 270-285
Ralph DeLong, Intra-oral restorative materials wear: Rethinking the current approaches : How to measure wear, Dental Materials, ２００６年, Vol. 22, p. 702-711

(58)調査した分野(Int.Cl., ＤＢ名)
Ａ６１Ｃ　１９／０４
Ａ６１Ｃ　１１／００
ＰｕｂＭｅｄ
医学中央雑誌ＷＥＢ

Electronic Acknowledgement Receipt

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Application Number:	14770177
International Application Number:	
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Title of Invention:	METHOD AND SYSTEM FOR BITE REGISTRATION
First Named Inventor/Applicant Name:	Yannick Glinec
Customer Number:	70523
Filer:	Carl R. Wesolowski/Laurie Wurtz
Filer Authorized By:	Carl R. Wesolowski
Attorney Docket Number:	95480
Receipt Date:	07-FEB-2017
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Application Type:	U.S. National Stage under 35 USC 371

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Submitted with Payment	no

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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Docket No.: 95480
Customer No. 70523
Confirmation No. 8357

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of
Yannick GLINEC, et al.

METHOD AND SYSTEM FOR BITE REGISTRATION

Serial No. 14/770,177

Filed: 03/11/2013

Group Art: Unknown

Examiner: Unknown

CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being filed using the USPTO's electronic filing system EFS-Web, and is addressed to: Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450
on this 29 day of November 2016.
Signature Karen J. Tyler
Name: Karen Tyler

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

Sir/Madam:

SUPPLEMENTARY INFORMATION DISCLOSURE STATEMENT FOR CONSIDERATION BY THE OFFICE UNDER 37 C.F.R. 1.97-1.99

Enclosed herewith are patents and/or publications for consideration by the Patent and Trademark Office in regard to the invention claimed in the above-described application. In compliance with §1.56, such documents are listed in the enclosed Form CSH-1449.

Applicants request that the Patent and Trademark Office make of record the above-identified documents. A full text copy of each document is attached, except for copies of U.S. patents and U.S. patent application publications. For documents not in English, an English translation or an equivalent English language patent or publication may be attached. Where a translation is not available, a concise explanation of the relevance of each document not in English is included either here or in the specification.

This Information Disclosure Statement is submitted according to the following selected paragraph:

I. [X] This Statement is being filed under §1.97(b) within three months of the filing date of the application (other than a CPA), or before the first Office action on the merits or before mailing of a first Office action after the filing of a request for continued examination.

II. [ ] This Statement is being filed under §1.97(c), with fee, **prior** to either a final action, a notice of allowance or an action that otherwise closes prosecution in the application. Please charge any additional fees required by §1.17(p) to Carestream Health, Inc. Deposit Order Account Number 50-4233.

III. ☐ This Statement is being filed under §1.97(c), with a statement under, §1.97(e) **prior** to either a final action, a notice of allowance or an action that otherwise closes prosecution in the application. The undersigned hereby states that (check one):

☐ each item of information contained in this Statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this Statement.

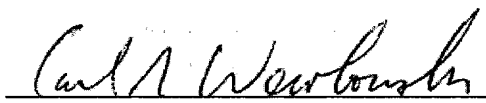
☐ no item of information in this Statement was cited in a communication from a foreign patent office in a counterpart foreign application and, to the knowledge of the person signing this certification statement under §1.97(e) after making reasonable inquiry, no item of information contained in this Statement was known to any individual designated in §1.56(c) more than three months prior to the filing of this Statement.

IV. ☐ This Statement is being filed under §1.97(d), with fee and statement under §1.97(e), on or after the mailing date of either a final action, a notice of allowance (but prior to payment of the issue fee) or an action that otherwise closes prosecution in the application. Please charge the fee required by §1.17(p) to Carestream Health, Inc. Deposit Order Account No. 50-4233. A duplicate copy of this Statement is enclosed. The undersigned hereby states that (check one):

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Respectfully submitted,



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Enclosures

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U.S. PATENT DOCUMENTS

Examiner Initial*	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	2002/0015934	02/07/2002	Rubbert et al.			04/13/2001

FOREIGN PATENT DOCUMENTS

Examiner Initial*	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES | NO
	2428764	03/14/2012	EP			**no**
	102010040096	03/01/2012	DE			**machine**
	2012096312	07/19/2012	WO			**machine**

OTHER ART *(Including Author, Title, Date, Pertinent Pages, Etc.)*

	EP Search Report, dated October 27, 2016, EP Application Number 13878438, 3 pages.

EXAMINER	DATE CONSIDERED

***EXAMINER:** *Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.*

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(54) System and method for processing and displaying intra-oral measurement data

(57) Provided are a system and method for generating and displaying intra-oral measurement data. A measurement field of view of an intra-oral scanning device (12) is directed at a first region of an object scene (20) to acquire image data related to the first region. The intra-oral scanning device is moved from the first region along a path proximal to one or more surfaces of the object scene to a second region of the object scene. The intra-oral scanning device acquires image data corresponding to the object scene along the path. A set of 3D data is presented in a display (16). 3D data are generated from the image data acquired for the first region of the object scene to the second region of the object scene. Presented in a window of the display is a current video image of acquired image data of the object scene in the measurement field of view. The current video image overlays a respective portion of a graphical representation of accumulated data of the set of 3D data.

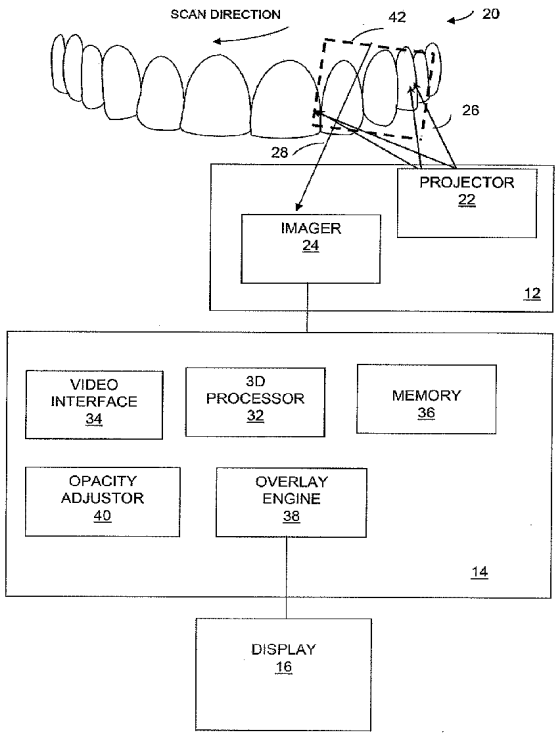


FIG. 2

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Description

RELATED APPLICATIONS

[0001] This application claims the benefit of the earlier filing date of U.S. Provisional Patent Application Serial No. 61/381,731, filed September 10, 2010 and titled "Method of Data Processing and Display for a Three-Dimensional Intra-Oral Scanner," the contents of which are incorporated herein by reference in their entirety.

FIELD OF THE INVENTION

[0002] The invention relates generally to three-dimensional imaging (3D) of an object surface. More particularly, the invention relates to an apparatus and a method for generating and displaying a graphical representation of a set of 3D data acquired during a scanning operation of an intra-oral cavity and overlaying the displayed graphical representation with a two-dimensional (2D) video image of the intra-oral cavity.

BACKGROUND

[0003] A dental or medical 3D camera or scanner, when part of an imaging system, can capture a series of 2D intensity images of one or more object surfaces in an object scene. In some systems, this is achieved by projecting structured light patterns onto the surface. A light pattern can be generated by projecting a pair of coherent optical beams onto the object surface and the resulting fringe pattern varied between successive 2D images. Alternatively, the projected light pattern may be a series of projected parallel lines generated using an intensity mask and the projected pattern shifted in position between successive 2D images. In still other types of 3D imaging systems, confocal imaging techniques and the like are employed.

[0004] A typical imaging system includes a wand or other handheld scanning device that a user manually directs at the object scene. During measurement of the object scene, the wand can be used to acquire a set of 3D data related to the object scene while the wand is in motion. In some applications, multiple object surfaces are measured by positioning the wand to be in close proximity to the object surfaces. However, when the wand is positioned at one location of the object scene, some sections of the object scene may be obscured from view of the wand. For example, in dental applications, the presence of teeth, gingiva, or other dental features in a particular static view can obscure the view of other teeth. Accordingly, a clinician may acquire 3D data sets from various scans of a dental arch. A processing unit can register the overlapped regions of all 3D data sets acquired from the various scans to obtain a full 3D data set representation of all surfaces observed during the measurement procedure.

[0005] The present invention is as claimed in the claims.

BRIEF SUMMARY

[0006] In one aspect, a computer-implemented method is provided for displaying intra-oral measurement data. A measurement field of view of an intra-oral scanning device is directed at a first region of an object scene to acquire image data related to the first region. The intra-oral scanning device is moved from the first region along a path proximal to one or more surfaces of the obj ect scene to a second region of the obj ect scene. The intra-oral scanning device acquires image data corresponding to the object scene along the path. A set of 3D data is presented in a display. 3D data are generated from the image data acquired for the first region of the object scene to the second region of the object scene. Presented in a window of the display is a current video image of acquired image data of the object scene in the measurement field of view. The current video image overlays a respective portion of a graphical representation of accumulated data of the set of 3D data.

[0007] In another aspect, a method is provided for displaying intra-oral measurement data related to a dental arch. An intra-oral measurement device is positioned at a first scan starting point proximal to a first region of a dental arch. A measurement field of view of the intra-oral measurement device is directed at the first region of the dental arch. The intra-oral measurement device is moved from the first region along a path proximal to a surface of the dental arch to a first scan end point proximal to a second region of the dental arch to acquire image data from the first scan starting point to the first scan end point. A set of 3D data generated from the acquired image data is displayed at a display. A video image of the acquired image data is overlaid on a respective portion of a graphical representation of accumulated data of the set of 3D data. The 3D data is displayed in the window by adjusting an opacity level of the current video image.

[0008] In another aspect, an image overlay system comprises a 3D processor, a video interface, and an overlay engine. The 3D processor generates three-dimensional (3D) data from image data acquired in an intra-oral scan procedure. The video interface outputs a current video image in response to receiving the image data. The overlay engine generates a graphical representation of accumulated data of the 3D data and that overlays a respective portion of the graphical representation in a display window.

[0009] In another aspect, an orthodontic analysis system comprises a scanning device, an image overlay processor, and a display device. The scanning device acquires image data related to an object scene of an intra-oral cavity. The image overlay processor generates at least one of a current video image and 3D data from the acquired image data, and configures the current video image for overlay on a graphical representation of accumulated data of the 3D data. The display device includes

a window for displaying the video image on a respective portion of the graphical representation of the 3D data.

[0010] In another aspect, a computer program product is provided for displaying intra-oral measurement data. The computer program product comprises a computer readable storage medium having computer readable program code embodied therewith. The computer readable program code comprises computer readable program code configured to direct a measurement field of view of an intra-oral scanning device at a first region of an object scene to acquire image data related to the first region. The computer readable program code further comprises computer readable program code configured to acquire image data corresponding to the object scene along a path between the first region and a second region of the obj ect scene. The computer readable program code further comprises computer readable program code configured to present a graphical representation of a set of three-dimensional (3D) data generated from the image data acquired for the first region of the object scene to the second region of the object scene. The computer readable program code further comprises computer readable program code configured to present a current video image of the object scene in the measurement field of view, wherein the current video image overlays a respective portion of the graphical representation of accumulated data of the set of 3D data.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0011] [0010] The above and further advantages of this invention may be better understood by referring to the following description in conjunction with the accompanying drawings, in which like numerals indicate like structural elements and features in various figures. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention.

[0012] FIG. 1 is a schematic diagram of an environment for acquiring image data related to dental structures during an intra-oral scanning operation and displaying images from the acquired image data, in accordance with an embodiment;

[0013] FIG. 2 is a block diagram of the scanning device and the image overlay system of FIG. 1, in accordance with an embodiment;

[0014] FIG. 3 is a flowchart of a method for presenting dental structure image data acquired during a scanning operation, in accordance with an embodiment;

[0015] FIGs. 4A-4C show a measurement field of view at various positions along an upper dental arch during a measurement scan of a dental arch and also show displayed results from the measurement scan, in accordance with an embodiment;

[0016] FIG. 5 is a flowchart of a method for displaying intra-oral measurement data related to a dental arch, in accordance with an embodiment;

[0017] FIG. 6 is a flowchart of a method for obtaining three-dimensional (3D) surface data of a dental arch, in accordance with an embodiment; and

[0018] FIG. 7 shows a set of intra-oral measurement data displayed in a window, in accordance with an embodiment.

DETAILED DESCRIPTION

[0019] The present teaching will now be described in more detail with reference to exemplary embodiments thereof as shown in the accompanying drawings. While the present teaching is described in conjunction with various embodiments and examples, it is not intended that the present teaching be limited to such embodiments. On the contrary, the present teaching encompasses various alternatives, modifications and equivalents, as will be appreciated by those of skill in the art. Those of ordinary skill in the art having access to the teaching herein will recognize additional implementations, modifications and embodiments, as well as other fields of use, which are within the scope of the present disclosure as described herein.

[0020] The methods of the present invention may include any of the described embodiments or combinations of the described embodiments in an operable manner. In brief overview, systems and methods of the present inventive concepts produce a display of a graphical representation of 3D data as well as a video image overlaid on a portion of the graphical representation. The video image can be a real-time or near-real time 2D video stream that can correspond to a measurement field of view of the clinician. The 3D data and the video image are generated from a set of 2D image data taken during a measurement scan of an object scene, for example, a dental arch in an intra-oral cavity. A graphical representation of the acquired 3D data is generated during a 3D measurement scan of the object scene. As additional 3D data is acquired and displayed during the measurement scan, the graphical representation can grow. The video image is displayed in a window at a portion of the display and is overlaid on a portion of the graphical representation of the 3D data.

[0021] As described above, a clinician such as a dentist typically performs different scans of a set of teeth in order to obtain a full and "final" 3D data set representation of all surfaces observed during the measurement procedure. To achieve this, the clinician maneuvers a scanner wand in the patient's mouth and acquires the 3D data in a preferred sequence so that the final 3D data set resulting from all the 3D data more accurately represents the dental arch. In particular, a first 3D data set is generated and additional sequences of second 3D data are subsequently joined to the first 3D data set. Individual scan segments are used to acquire subsets of 3D data for the final 3D data set, which can include a point cloud, a wireframe representation, or other 3D surface representations. For example, data acquisition starts by acquiring data from a measurement field of view at the patient's

left back molar of the upper dental arch. The wand is then moved along the arch to the right back molar. The clinician can then position the wand so that the measurement field of view includes a portion of the first 3D data set, and new 3D data are acquired that overlap a portion of the first 3D data set. Preferably, the 3D measurement system provides an affirmative visual or audible indication to the clinician when the new 3D data for the real-time position of the measurement field of view "locks on" to the display of the surface for the first 3D data set. The newly-acquired 3D data are then registered or joined to the first 3D data and serve as the start of a different scan segment for the arch. The wand is then rotated about its primary axis and moved so that a new portion of the surface of the arch is within the measurement field of view and 3D data are acquired. The wand is then maneuvered by the clinician so that the measurement field of view moves along a new segment of the arch surface.

[0022] A clinician can have difficulty locking the measurement field of view to the display of the surface for the first 3D data set due to difficulty interpreting a graphical display of 3D data, for example, due to a lack of shading, color, and other viewing characteristics. Thus, 3D data for the subsequent scan segment may not properly "register" to the existing 3D data in the common coordinate reference system. The acquisition of additional 3D data can be interrupted, for example, when switching between different scans, where the additional 3D points cannot be joined.

[0023] The present invention permits the scanning wand to be repositioned by the clinician to a position such that the current video image substantially matches a portion of the 3D data displayed in the same display window as the video image. Once 3D data represented in the displays are determined to be similar in their region of overlap, the acquisition of 3D measurement data resumes and subsequently determined 3D data are joined to the previously acquired 3D data. Providing a live video image for a current measurement field of view can therefore facilitate the interpretation of the previously acquired and displayed 3D data. Thus, an intra-oral measurement procedure can be performed more efficiently, resulting in less discomfort to the patient and shorter acquisition times.

[0024] FIG. 1 is a schematic diagram of an environment 10 for acquiring image data related to dental structures during an intra-oral scanning operation and displaying images from the acquired image data, in accordance with an embodiment. The environment 10 includes a scanning device 12, an image overlay system 14, and a display 16. The scanning device 12, the image overlay system 14, and the display 16 can each include a processor, a memory, and an I/O interface. The memory can include removable and/or non-removable storage media implemented in accordance with methods and technologies known to those of ordinary skill in the art for storing data. Program code, such as program code of an operating system, graphics, applications, and the like for execution by the processor is stored in a memory. Data related to 2D and/or 3D images can likewise be stored in a memory.

[0025] The scanning device 12 is constructed to measure one or more object surfaces by scanning an object scene. In doing so, the scanning device 12 captures 2D image data that is used to generate 2D and/or 3D images for display. The scanning device 12 can be an intra-oral scanner such as a wand. When the scanning device 12 is inserted in the intra-oral cavity 20 of a patient 18, a dentist, a hygienist, or other clinician can conduct a 3D scan of a dental arch or other intra-oral structures.

[0026] The acquired image data is output to the image overlay system 14, which converts the image data into a set of 3D data. The image overlay system 14 processes the 3D data to generate one or more wireframe representations, point clouds, or other 3D object surface representations.

[0027] The image overlay system 14 overlays a portion of the graphical representation of the 3D data with a real-time or near-real time 2D video image of a section of a current object scene in the measurement field of view for a current position of the scanning device 12. The video image is presented in a window of the display 16. At any time during active scanning, the video image can show a true grayscale or color image of the oral cavity within the field of view of the scanning device 12, while the 3D display shows accumulated surface data of the scanning operation. During operation, the point cloud or object surface representation appears to grow within the display 16 while the live video image allows the clinician to see the portion of the oral cavity currently being measured.

[0028] The display 16 preferably includes its own processor and memory for providing a graphical user interface to display the graphical representation of the 3D data generated from the acquired image data. The display 16 can include a touchscreen or a monitor coupled to the image overlay system 14 for receiving 2D and/or 3D image feeds from the image overlay system 14. The display 16 includes a window for displaying 2D video of an object scene overlaid on the 3D representation of the object scene.

[0029] FIG. 2 is a block diagram of the scanning device 12 and the image overlay system 14 of FIG. 1, in accordance with an embodiment. The scanning device 12 includes a projector 22 and an imager 24. The projector 22 includes a radiation source, for example, a light or laser source, for projecting an optical radiation pattern 26, for example, light, onto a-dental arch in a patient's mouth, which includes a set of teeth, gums, and the like. In an embodiment, the projector 18 is a fringe projector that emits optical radiation, for example, two divergent optical beams generated from a coherent light source (e.g. a laser diode), where they generate a fringe pattern. A surface of the dental arch is illuminated with the fringe pattern. A related approach is described in U.S. Patent No. 5,870,191, incorporated herein by reference in its entirety, where a technique referred to as Accordion

Fringe Interferometry (AFI) can be used for high precision 3D measurements based on interferometric fringe projection.

[0030] The imager 24 can include a charge-coupled device (CCD) camera or other imaging device that includes one or more image sensors, a photodetector array, or related electronic components (not shown) that receive one or more beams 28 of optical radiation reflected or otherwise received from the surface of the illuminated dental arch 20. As is well-known to those of ordinary skill in the art, electrical signals can be generated by the imager 24, for example, an array of photodetectors or CCD readers (not shown), in response to the received radiation. The imager 24 can capture the signals used to process a two dimensional image of the dental arch 20, and generate an image of the projection pattern after reflection of the pattern off the surface of the dental arch 20.

[0031] The images acquired by the imager 24 include 3D information related to the surface of the object 20. The images, more specifically, 2D image data including this information, are output to a 3D processor 32. The 3D processor can generate 3D data from the received image data.

[0032] The image overlay system 14 can include the 3D processor 32, a video interface 34, a memory 36, an overlay engine 38, and an opacity adjuster 40. All of these elements can execute entirely on the image overlay system 14. Alternatively, some elements can execute on the image overlay system 14 or other computer platform, while other elements execute on the scanning device 12, the display 16, or a remote computer. For example, the 3D processor 32 can be part of the image overlay system 14 as shown in FIG. 2. Alternatively, the 3D processor 32 can be part of the scanning device 12. In another example, the overlay engine 38 can be part of the image overlay system 14 as shown in FIG. 2, or can alternatively be part of the display 16.

[0033] The 3D processor 32 can receive signals related to one or more 2D images from the imager 24. For example, the signals can includes information on the intensity of the light received at each photodetector in the imager 24. In response, the 3D processor 32 can calculate the distance from the imager 24, for example, a detector array, of the scanning device 12 to the surface of the dental arch 20 for each pixel based on the intensity values for the pixel in the series of generated 2D images. Thus, the 3D processor 32 creates a set of 3D coordinates that can be displayed as a point cloud or a surface map that represents the object surface. The 3D processor 32 communicates with the memory 36 for storage of 3D data generated during a measurement procedure. A user interface (not shown) allows an operator such as a clinician to provide operator commands and to observe the acquired 3D information in a near-real time manner. For example, the operator can observe a display of the growth of a graphical representation of the point cloud as different regions of the surface of the dental arch 20 are measured and additional 3D measurement data are acquired.

[0034] The video interface 34 can likewise receive 2D image data from the scanning device 12. The 2D image data can be the same data as that received by the 3D processor 32, for example, from the imager 24. Optionally, the video interface 34 can receive 2D image data from a different source, for example, a video camera instead of the scanning device 12. The video interface 24 processes and outputs from the received 2D image data a real-time or "live" video image of the surfaces being measured to the overlay engine 38. In particular, the image data received by the video interface 34 corresponds to a portion of the dental arch in the measurement field of view 42 of the scanning device 12.

[0035] As described above, the memory 36 can store the 3D data and/or 2D data. The memory 36 can also include machine executable instructions enabling the 3D processor 32 to process the points in a point cloud and/or generate a single mesh surface configuration representing the scanned object, i.e., the dental arch 20 for the display 16. The memory 36 can include volatile memory, for example, RAM and the like, and/or non-volatile memory, for example, ROM, flash memory, and the like. The memory can include removable and/or non-removable storage media implemented in accordance with methods and technologies known to those of ordinary skill in the art for storing data. Stored in the memory can include program code, such as program code of an operating system executed by the image generator 34, the 3D processor 32, or other processors of the image overlay system 14.

[0036] The overlay engine 38 can be part of a display processor or graphical user interface for displaying the 3D data as a graphical representation on the display 16. The overlay engine 38 includes a first input that receives a 2D video feed from the video interface 34 and a second input that receives 3D data from the 3D processor. The overlay engine 38-can overlay or superimpose real-time or near-real time video images of the 2D feed corresponding to the dentition within the field of view of the imager 24 overlaid on at least a portion of the graphical representation of the 3D data, for example, one or more point clouds or object surface representation.

[0037] During an operation, the 3D data and video images can be output from the overlay engine 38 to the display 16, and can be configured by the overlay engine 38 such that the 3D data is displayed as a point cloud, object surface representation on the display, and the video images are displayed in a window on the display. In a preferred embodiment, the video image is displayed in a window centered in the viewing area of the display 16. The window in which the video image is displayed can have a rectangular or square shape that is substantially smaller than the rectangular shape of the viewing area of the display 16. The display 16 can include a user interface (not shown) for presenting the received images in grayscale, color, or other user-defined format, and for

permitting a user to enter commands, view images, or other well-known functions for performing a scanning and/or display operation.

[0038] A portion of the 3D data can also be available for presentation in the window. The opacity adjuster 40 can be configured to change the opacity level of the 3D data and/or the video image in the window. For example, the video image can be presented as being substantially opaque and the portion of the graphical representation of the 3D data in the window can be transparent to prevent a display of the graphical representation of the 3D data in a region of overlay identified by the window. The opacity adjuster 40 can reduce the opacity of the video image and/or reduce the transparency of the graphical representation of the set of 3D data in the region of overlay identified by the window. In this manner, the video image and the graphical representation of the set of 3D data in the region of overlay can be simultaneously viewed in the window. This feature can be beneficial when a clinician attempts to "stitch" or join a 3D point cloud or surface map to a previously acquired 3D point cloud or surface map. In particular, a change in transparencies of the video image and 3D data allows the clinician to maneuver the scanning device to substantially match a live video image with a portion of the displayed, previously generated 3D data. Once the two displays are determined to be substantially similar in their region of overlap, the acquisition of a 3D measurement scan can resume, and subsequently determined 3D data sets, e.g. point clouds or surface maps, can be stitched to an existing 3D data set.

[0039] FIG. 3 is a flowchart of a method 100 for presenting dental structure image data acquired during a scanning operation. In describing the method 100, reference is also made to FIGs. 1 and 2. The method 100 can be governed by instructions that are stored in a memory and executed by a processor of the scanning device 12, the image overlay system 14, and/or the display 16. The method 100 is described herein as being performed on a dental arch. In other embodiments, the method 100 can be performed on virtually any object.

[0040] A clinician such as a dentist initiates the method 100 by positioning (step 105) the scanning device 12 at a starting point of the dental arch so that a structured light pattern generated from the scanning device 12 illuminates a first region of the dental arch, for example, a back portion of an occlusal surface of the dental arch at one end of the arch. Image data for providing 2D and/or 3D images can be acquired for the illuminated portion of the surface of the dental arch at the first region. The scanning device can include a 2D imager 24 with a small measurement field of view (FOV) (e.g., 13 mm x 10 mm) relative to the full arch. The imager 24 can include a camera that captures 2D images of the surface and displays them on the display 16. The camera can be a video camera and present the 2D images as a real time or near real time video stream.

[0041] The clinician can move (step 110) the scanning device 12 along a path proximal to a surface of the dental arch to a second region of the dental arch. Here, the structured light pattern generated from the scanning device 12 can illuminate a remainder of the surface of the dental arch along the path, for example, the occlusal surface. Image data can therefore be acquired (step 115) for the remainder of the occlusal surface from the first region to the second region. A set of 3D data can be generated (step 120) from the acquired image data. A graphical representation of the 3D data can be displayed (step 125) as a wireframe representation, an object map, and the like.

[0042] The 2D video can be overlaid (step 130) on the graphical representation of 3D data. The 2D video can be provided from the acquired image data, or other 2D image data, for example, acquired from a CCD camera. The video image can corresponds to a current measurement field of view directed at a region of object scene for receiving image data related to that region.

[0043] FIGs. 4A-4C show a measurement field of view at various positions along an upper dental arch during a measurement scan of a dental arch and also show displayed results from the measurement scan according to the method of FIG. 3, in accordance with an embodiment. The measurement scan can be performed using a handheld image-capturing device such as the scanning device 12 of FIGs. 1 and 2. During the measurement scan, a set of 2-D images of the dental arch 20 can be acquired. In FIG. 4A, a measurement scan can be initiated by acquiring image data from within a measurement field of view 42A at the patient's right back region of the upper dental arch 20, for example, starting with the back molar 46. The image data can be acquired according to acquisition techniques related to AFI measurements, or other techniques involving the projection of structured light patterns projected onto the surface to be measured.

[0044] A substantially real-time 2D video image can be displayed of the surface being measured. For example, an image 52 of the back molar 46 within the field of view 42A of the scanning device 12 can be displayed in a display window 50. In addition, 3D data is generated from the image data acquired at the region of the dental arch 20 in the field of view 42A. The 3D data can be generated from image data acquired by the imager 24 of the scanning device 12, or from another source, for example, a different CCD camera. As shown in FIG. 4B, the 3D data can be displayed as a 3D point cloud 54. Alternatively, as shown in Fig. 4C, the 3D data can be displayed as a 3D surface map 56 that represents the object surface.

[0045] FIG. 5 is a flowchart of a method 200 for displaying intra-oral measurement data related to a dental arch, in accordance with an embodiment. In describing the method 200, reference is also made to FIGs. 1-4. The method 200 can be governed by instructions that are stored in a memory and executed by a processor of the scanning device 12, the image overlay system 14, and/or the display 16. The method 200 is described here-

in as being performed on a dental arch; however, in other embodiments the method 200 can be performed on virtually any object.

[0046] The method 200 can be initiated by a clinician positioning the scanning device 12 at a starting point of the dental arch and generating 2D and/or 3D image data for example described above.

[0047] 3D data generated from the measurement scan can be displayed (step 205) on the display 16. The 3D data can be displayed as a 3D point cloud, a 3D object surface representation, or related graphical representation. The display 16 can include a window that presents a 2D video image of acquired image data of an object scene in a measurement field of view. The video image displayed in the window overlays (step 210) a portion of the graphical representation of the 3D data.

[0048] Some of the previously acquired 3D points can be present in a display window allocated for the live 2D video image. The transparency of the 3D display within the region of the display monitor shared with the 2D video image can be set for full transparency, for example, 100% transparency, while the transparency for the 2D video image can be set for a low transparency or no transparency, for example, 0% transparency, or opaque. Consequently, only the 2D video image is visible in the smaller region of overlapped displays.

[0049] The opacity of at least one of the first 3D data and the video image in the display window is adjusted (step 215). In this manner, a clinician can view (step 220) both 3D and the current video image in the display window, for example, when joining new 3D data to a current set of 3D data.

[0050] FIG. 6 is a flowchart of a method 300 obtaining three-dimensional (3D) surface data of a dental arch, in accordance with an embodiment.

[0051] The method 300 can begin with a clinician positioning (step 305) an intra-oral measurement device 12 at a first starting point proximal to a first region of the dental arch 20, for example, a region include a back molar 46 shown in FIG. 4A. Image data can be acquired from the first region of the dental arch 20 by directing a measurement field of view 42A of the intra-oral measurement device 12 at the first region and performing a scan of the first region.

[0052] The clinician can perform the first scan by moving (step 310) the measurement device 12 along a path proximal to the surface of the dental arch 20 to a first end point of the dental arch 20, for example, at region 48 shown in FIG. 4B. Image data can be acquired from the surface of the dental arch 20 during the first scan from the first starting end point to the first end point of the dental arch 20.

[0053] A first 3D data set can be generated from the acquired image data, and displayed (step 315) at the display 16. The 3D data can be displayed as a point cloud 54 as shown in FIG. 4B, or displayed as a wireframe or 3D object surface representation 56 shown in FIG. 4C.

[0054] A current field of view of the video image is overlaid (step 320) on the graphical representation of the 3D data.

[0055] The opacity of the video image is adjusted (step 325), for example, reduced, so that the underlying 3D data is more visible to the user.

[0056] The FOV of the measurement device 12 is moved (step 330) to a second scan starting location. For example, a first scan such as an occlusal scan can be temporarily stopped or interrupted, whereby the clinician can move the measurement device 12 back to a region proximal to the starting location of the occlusal scan in order to perform a different scan.

[0057] The FOV of the measurement device 12 registers (step 335) to the graphical representation of the 3D data in the overlap region in the display window. This can be achieved by moving the measurement device 12 until a substantial match is determined between the opacity-adjusted video image and the set of 3D data in the region of overlay viewable in the window.

[0058] Subsequent 3D data, for example, new wireframe representations of the dental arch, is joined (step 340) to the 3D data. When new 3D data is obtained after registration, the video image can be automatically changed to full opacity, whereby the 3D data is hidden from view in the display window so that the live video corresponding with a current measurement field of view is prominently displayed in the window.

[0059] FIG. 7 shows a set of intra-oral measurement data 64, 66 displayed in a window 50 of the display 16, in accordance with an embodiment. The measurement data includes a video image 64 (dotted line) having a reduced opacity relative to a graphical representation of 3D data 66 displayed in the window 50, which is part of a set of a graphical representation of 3D data 62 presented in the display 16 outside the window 50. The methods described in FIGs. 5 and 6 can be applied to display the measurement data as shown in FIG. 7.

[0060] It should be also understood that many of the functional units described in this specification have been labeled as modules or systems, in order to more particularly emphasize their implementation independence. For example, a module may be implemented as a hardware circuit comprising custom VLSI circuits or gate arrays, off-the-shelf semiconductors such as logic chips, transistors, or other discrete components. A module may also be implemented in programmable hardware devices such as field programmable gate arrays, programmable array logic, programmable logic devices or the like.

[0061] Modules may also be implemented in software for execution by various types of processors. An identified module of executable code may, for instance, comprise one or more physical or logical blocks of computer instructions, which may, for instance, be organized as an object, procedure, or function. Nevertheless, the executables of an identified module need not be physically located together, but may comprise disparate instructions stored in different locations which, when joined logically together, comprise the module and achieve the stated

purpose for the module.

[0062] Indeed, a module of executable code may be a single instruction, or many instructions, and may even be distributed over several different code segments, among different programs, and across several memory devices. Similarly, operational data may be identified and illustrated herein within modules, and may be embodied in any suitable form and organized within any suitable type of data structure. The operational data may be collected as a single data set, or may be distributed over different locations including over different storage devices, and may exist, at least partially, merely as electronic signals on a system or network. The modules may be passive or active, including agents operable to perform desired functions.

[0063] A storage device can include a computer readable storage medium, which may be, for example, but not limited to, an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system, apparatus, or device, or any suitable combination of the foregoing. More specific examples (a non-exhaustive list) of the computer readable storage medium include the following: an electrical connection having one or more wires, a portable computer diskette, a hard disk, a random access memory (RAM), a read-only memory (ROM), an erasable programmable read-only memory (EPROM or Flash memory), an optical fiber, a portable compact disc read-only memory (CD-ROM), an optical storage device, a magnetic storage device, or any suitable combination of the foregoing.

[0064] While the invention has been shown and described with reference to specific embodiments, it should be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the scope of the invention which is as claimed in the appended claims.

Claims

1. A method for displaying intra-oral measurement data, comprising:

   directing a measurement field of view of an intra-oral scanning device at a first region of an object scene to acquire image data related to the first region;
   moving the intra-oral scanning device from the first region along a path proximal to one or more surfaces of the object scene to a second region of the object scene;
   acquiring, by the intra-oral scanning device, image data corresponding to the object scene along the path;
   presenting in a display a set of three-dimensional (3D) data generated from the image data acquired for the first region of the object scene to the second region of the object scene; and
   presenting in a window of the display a current video image of the object scene in the measurement field of view, wherein the current video image overlays a respective portion of a graphical representation of accumulated data of the set of 3D data.

2. The method of claim 1, further comprising:

   configuring the window of the display to present the current video image as a substantially opaque video image to prevent a display of the graphical representation in a region of overlay identified by the window;
   reducing the opacity of the current video image in the region of overlay identified by the window to display the 3D in the window; and
   simultaneously viewing the current video image and the graphical representation in the region of overlay identified by the window.

3. The method of claim 2, further comprising:

   temporarily interrupting an acquisition of image data;
   moving the intra-oral scanning device to a third region proximal to the first region;
   moving the intra-oral measurement device until a substantial match is determined between the opacity-adjusted video image and the opacity-adjusted portion of the set of 3D data in the region of overlay viewable in the window;
   resuming the acquisition of image data; and
   joining a new set of 3D data generated from the resumed acquisition of image data to the graphical representation.

4. The method of claim 1, further comprising:

   generating at least one wireframe representation, 3D surface map, or point cloud from the set of 3D data; and
   presenting the at least one wireframe representation, 3D surface map, or point cloud as the graphical representation.

5. The method of claim 1, wherein the object scene includes a dental arch, and wherein the method further comprises:

   positioning the intra-oral scanning device at a first scan starting point proximal to a first region of the dental arch;
   directing the measurement field of view of the intra-oral scanning device at the first region of the dental arch; and
   moving the intra-oral scanning device from the first scan starting point along a path proximal to

a surface of the dental arch to a first scan end point proximal to a second region of the dental arch to acquire image data from the first scan starting point to the first scan end point;
displaying a set of 3D data generated from the image data acquired from the first scan starting point to the first scan end point at a display; and
overlaying a video image of the dental arch on a respective portion of a graphical representation of accumulated data of the set of 3D data generated from the image data acquired from the first scan starting point to the first scan end point.

6. The method of claim 5 further comprising displaying the 3D data generated from the image data acquired from the first scan starting point to the first scan end point in the window of the display by adjusting an opacity level of the video image of the dental arch.

7. The method of claim 5, further comprising:

moving the intra-oral measurement device to a second starting point proximal to the first region of the dental arch until a substantial match is determined in a region of overlap between the current video image and the portion of the set of 3D data in the window of the display;
resuming the acquisition of image data; and
joining a new 3D data set generated from the resumed acquisition of image data to the 3D data of the acquired image data, the new 3D data set overlapping a portion of the set of 3D data.

8. An image overlay system, comprising:

a 3D processor that generates three-dimensional (3D) data from image data acquired in an intra-oral scan procedure;
a video interface that outputs a current video image in response to receiving the image data; and
an overlay engine that generates a graphical representation of accumulated data of the 3D data and that overlays a respective portion of the graphical representation in a display window.

9. The image overlay system of claim 8 further comprising an opacity adjuster that adjusts an opacity level of the current video image such that a portion of the set of 3D data is viewed in the display window in relation to the current video image.

10. The image overlay system of claim 8, wherein the overlay engine includes a processor that generates at least one of a 3D surface map, a wireframe representation, and a point cloud from the set of 3D data.

11. The image overlay system of claim 8, wherein the image overlay system is arranged in an orthodontic analysis system, the orthodontic analysis system further comprising:

a scanning device that acquires the image data related to an object scene of an intra-oral cavity in the intra-oral scan procedure; and
a display device that includes the display window for displaying the current video image on a respective portion of the graphical representation of the accumulated data of the 3D data.

12. A computer program product for displaying intra-oral measurement data, the computer program product comprising:

a computer readable storage medium having computer readable program code embodied therewith, the computer readable program code comprising;
computer readable program code configured to direct a measurement field of view of an intra-oral scanning device at a first region of an object scene to acquire image data related to the first region;
computer readable program code configured to acquire image data corresponding to the object scene along a path between the first region and a second region of the object scene;
computer readable program code configured to present a graphical representation of a set of three-dimensional (3D) data generated from the image data acquired for the first region of the object scene to the second region of the object scene; and
computer readable program code configured to present a current video image of the object scene in the measurement field of view, wherein the current video image overlays a respective portion of the graphical representation of accumulated data of the set of 3D data.

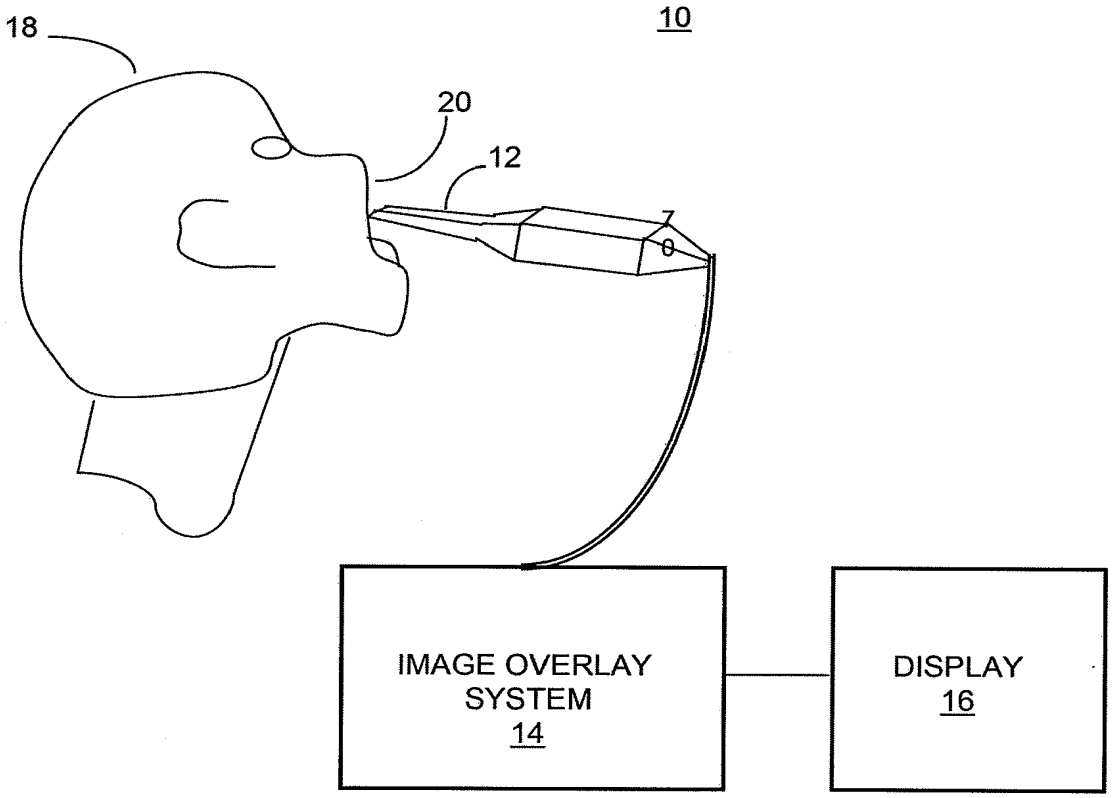


FIG. 1

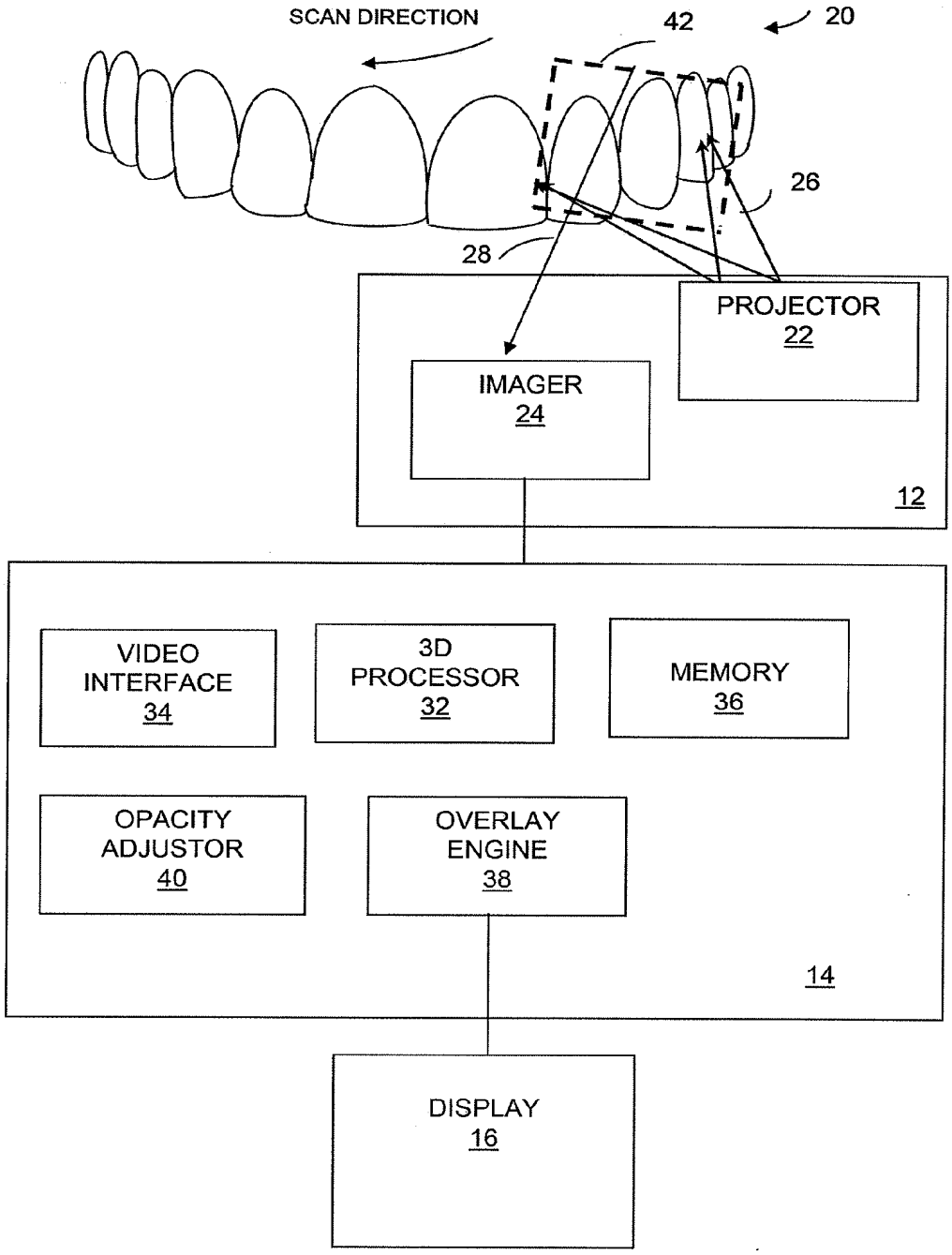

SCAN DIRECTION
42
20
26
28
PROJECTOR
22
IMAGER
24
12
VIDEO
INTERFACE
34
3D
PROCESSOR
32
MEMORY
36
OPACITY
ADJUSTOR
40
OVERLAY
ENGINE
38
14
DISPLAY
16

FIG. 2

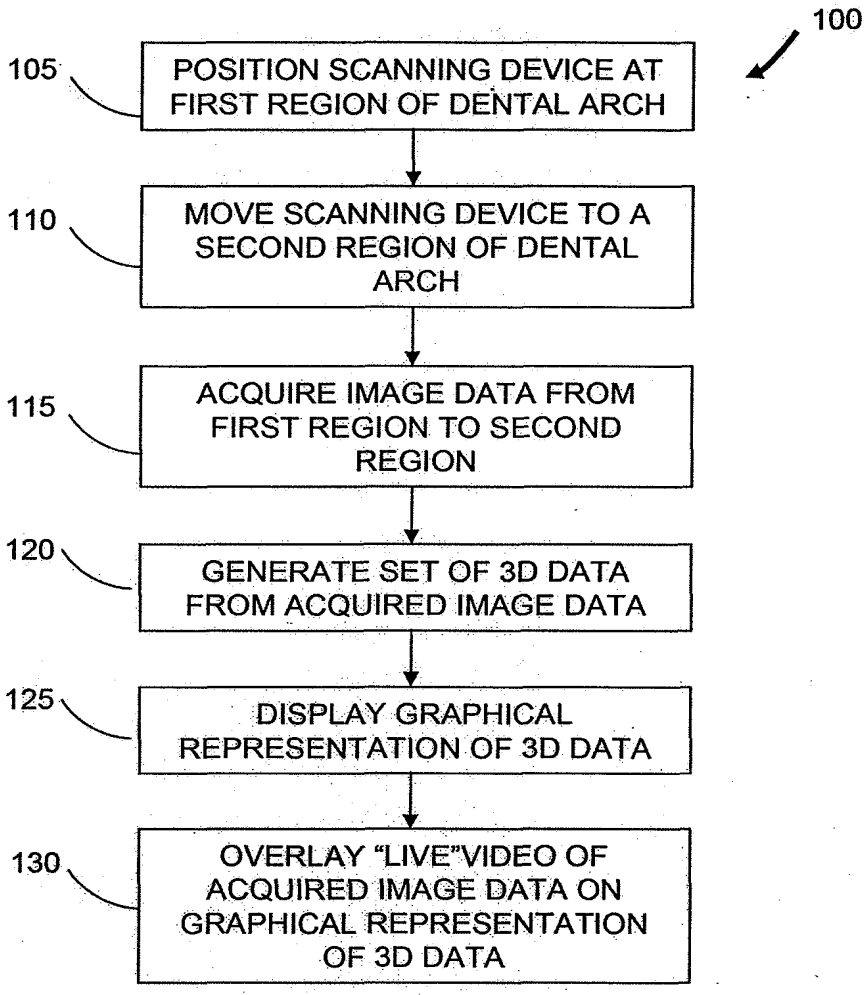

100
105
POSITION SCANNING DEVICE AT FIRST REGION OF DENTAL ARCH
110
MOVE SCANNING DEVICE TO A SECOND REGION OF DENTAL ARCH
115
ACQUIRE IMAGE DATA FROM FIRST REGION TO SECOND REGION
120
GENERATE SET OF 3D DATA FROM ACQUIRED IMAGE DATA
125
DISPLAY GRAPHICAL REPRESENTATION OF 3D DATA
130
OVERLAY "LIVE"VIDEO OF ACQUIRED IMAGE DATA ON GRAPHICAL REPRESENTATION OF 3D DATA

FIG. 3

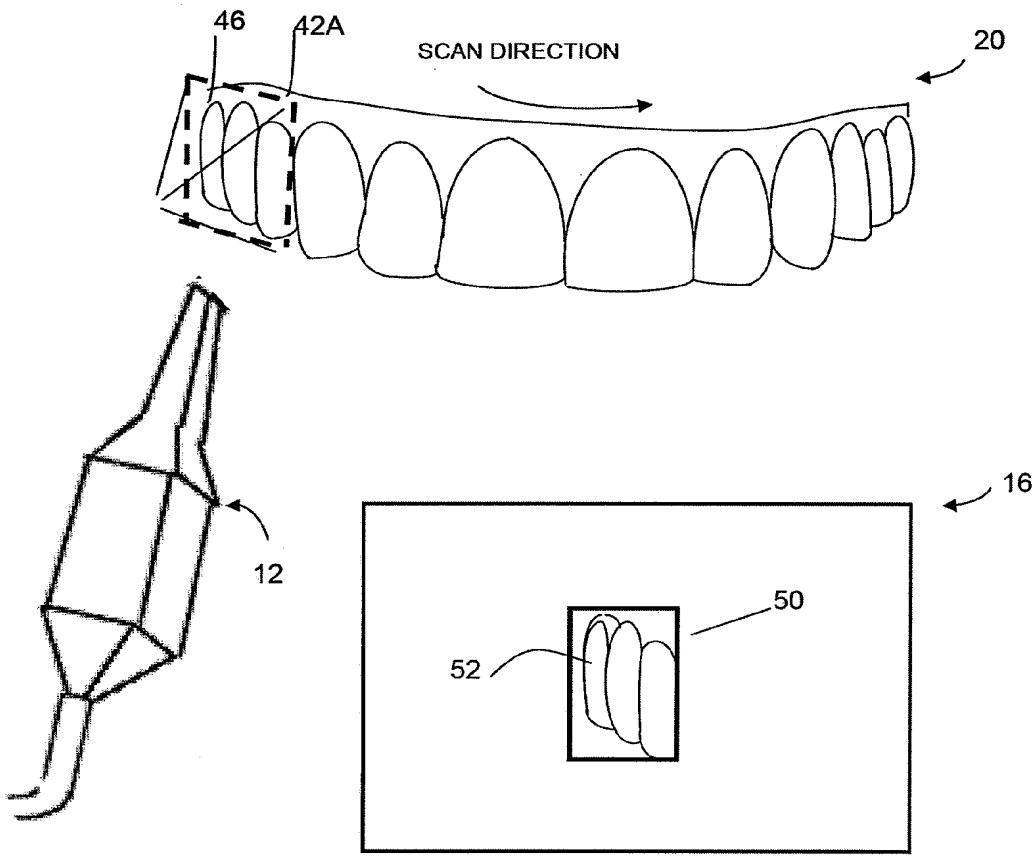


FIG. 4A

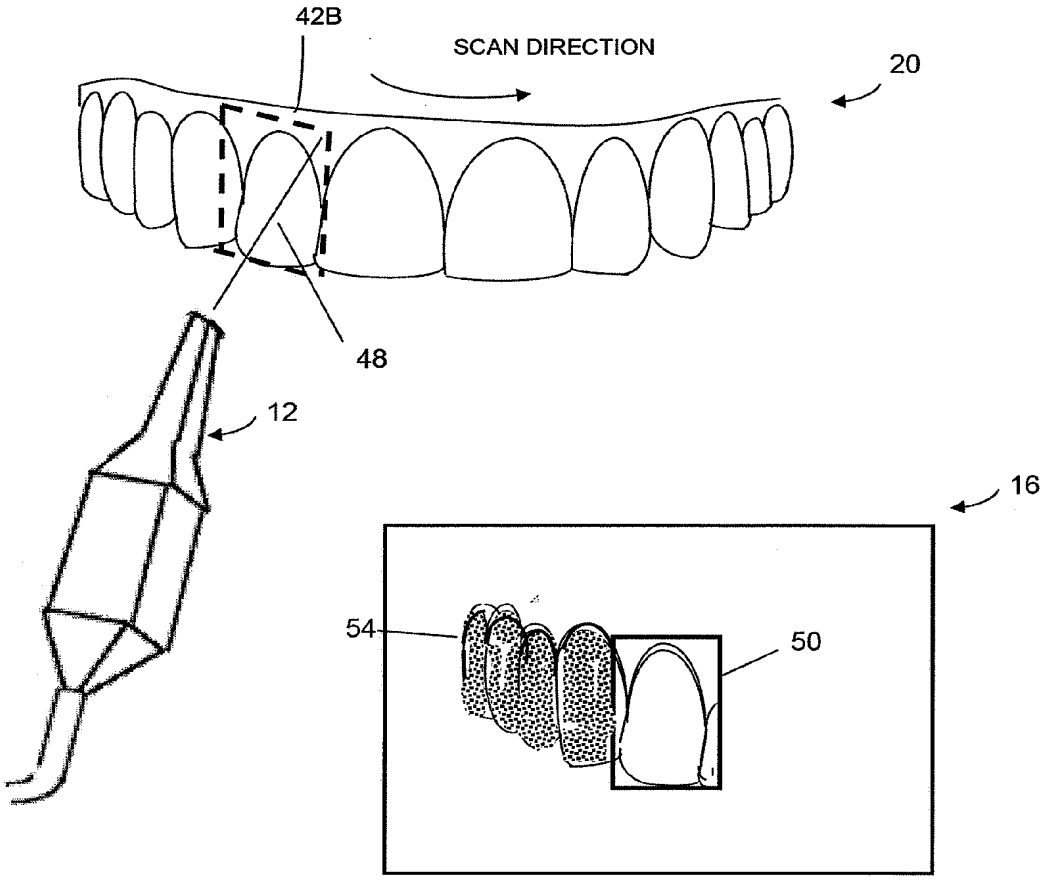


FIG. 4B

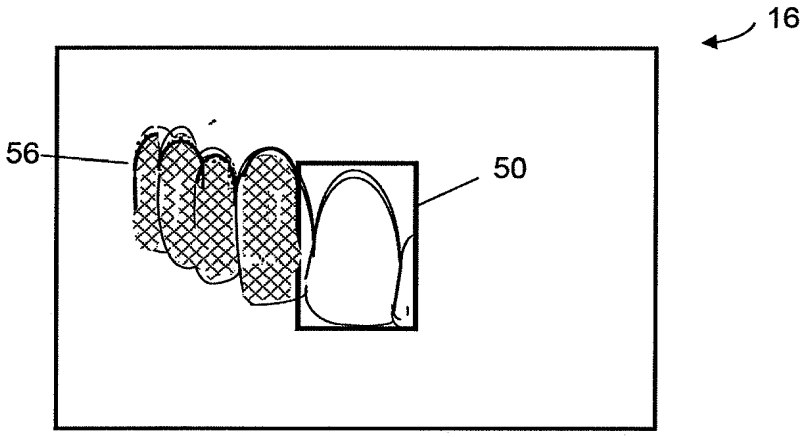


FIG. 4C

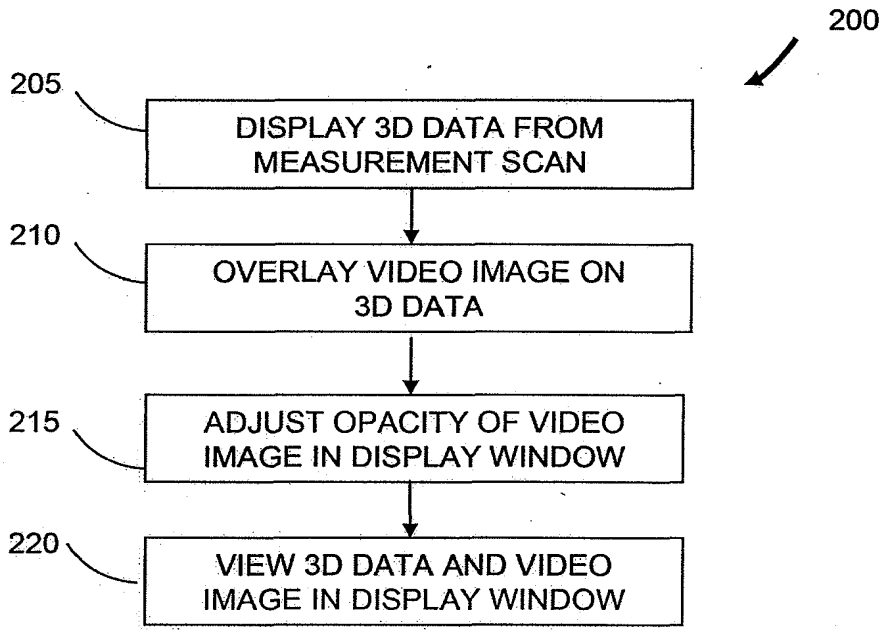

200
205
DISPLAY 3D DATA FROM MEASUREMENT SCAN
210
OVERLAY VIDEO IMAGE ON 3D DATA
215
ADJUST OPACITY OF VIDEO IMAGE IN DISPLAY WINDOW
220
VIEW 3D DATA AND VIDEO IMAGE IN DISPLAY WINDOW

FIG. 5

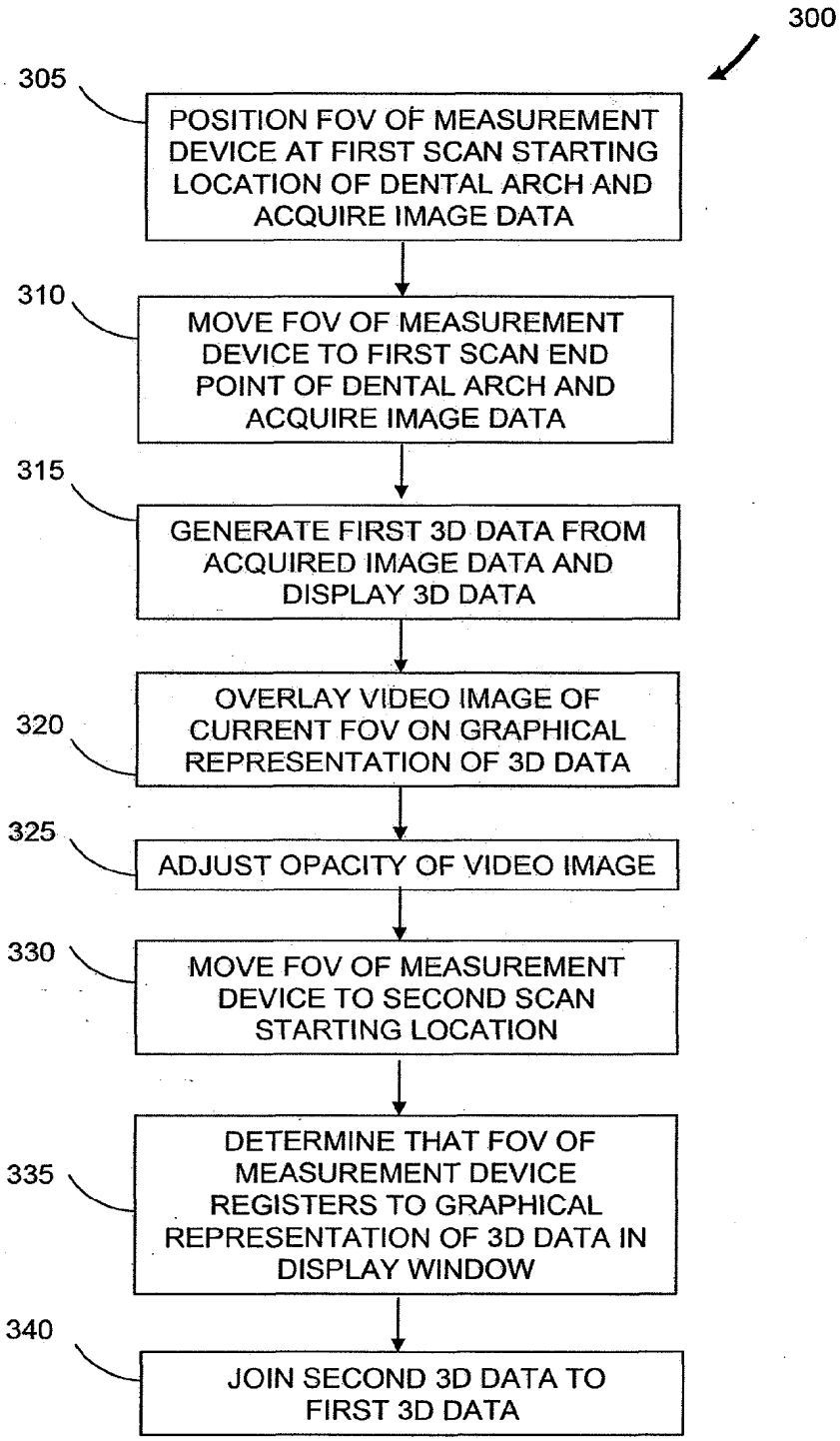

300
305
POSITION FOV OF MEASUREMENT DEVICE AT FIRST SCAN STARTING LOCATION OF DENTAL ARCH AND ACQUIRE IMAGE DATA
310
MOVE FOV OF MEASUREMENT DEVICE TO FIRST SCAN END POINT OF DENTAL ARCH AND ACQUIRE IMAGE DATA
315
GENERATE FIRST 3D DATA FROM ACQUIRED IMAGE DATA AND DISPLAY 3D DATA
320
OVERLAY VIDEO IMAGE OF CURRENT FOV ON GRAPHICAL REPRESENTATION OF 3D DATA
325
ADJUST OPACITY OF VIDEO IMAGE
330
MOVE FOV OF MEASUREMENT DEVICE TO SECOND SCAN STARTING LOCATION
335
DETERMINE THAT FOV OF MEASUREMENT DEVICE REGISTERS TO GRAPHICAL REPRESENTATION OF 3D DATA IN DISPLAY WINDOW
340
JOIN SECOND 3D DATA TO FIRST 3D DATA

FIG. 6

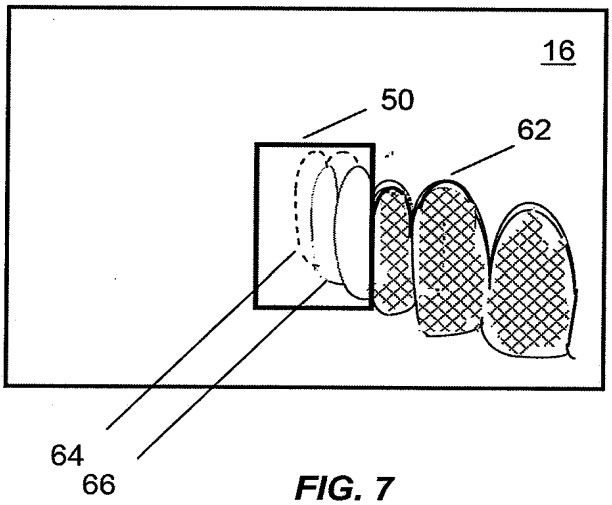


FIG. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 11 17 9801

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2007/084589 A2 (3M INNOVATIVE PROPERTIES CO [US]) 26 July 2007 (2007-07-26) * paragraphs [0049] - [0054], [0075], [0089] - [0092], [0101] - [0104] * * abstract; claims 82,89,96; figures 1,4-6,10-12 *	1-12	INV. G01B11/24 G01B21/20 A61C13/00
X	US 2008/280247 A1 (SACHDEVA ROHIT [US] ET AL) 13 November 2008 (2008-11-13) * paragraphs [0056] - [0061], [0084] - [0089], [0155] * * figures 1,3,4-4E,28 *	1-12	
A	DE 199 25 462 C1 (DAIMLER CHRYSLER AG [DE]) 15 February 2001 (2001-02-15) * column 8, lines 42-55 * * abstract; figure 1 *	1-12	

TECHNICAL FIELDS SEARCHED (IPC)

G01B
A61C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	12 January 2012	Passier, Martinus

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 17 9801

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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12-01-2012

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2007084589 A2	26-07-2007	EP 1974325 A2	01-10-2008
		JP 2009523547 A	25-06-2009
		US 2007171220 A1	26-07-2007
		US 2007236494 A1	11-10-2007
		WO 2007084589 A2	26-07-2007
US 2008280247 A1	13-11-2008	US 2004197727 A1	07-10-2004
		US 2008280247 A1	13-11-2008
DE 19925462 C1	15-02-2001	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 61381731 A **[0001]**
- US 5870191 A **[0029]**

Patent Record Full View Wednesday, November 23 2016 THOMSON INNOVATION

Patent/Publication: DE102010040096A1

Bibliography

DWPI Title

Method for preparing virtual dental retainer, involves determining three dimensional volume and partial volume, where partial volume is generated by computer-assisted transfer of volumetric image data

Original Title

Verfahren zur Erstellung einer Aufnahme aus einem 3D-Volumen

Assignee/Applicant

Standardized: **SIRONA DENTAL SYSTEMS GMBH**

Original: Sirona Dental Systems GmbH, Bensheim, DE

DWPI Assignee/Applicant

SIRONA DENTAL SYSTEMS GMBH (SIRO-C); SIRONA DENTAL SYSTEMS GMBH & CO KG (SIRO-C)

Inventor

Ulrici Johannes, Darmstadt, DE

DWPI Inventor

ULRICI J

Publication Date (Kind Code)

2012-03-01 (A1)

DWPI Accession / Update

2012-C69221 / 201219

Application Number / Date

DE102010040096A / 2010-09-01

Priority Number / Date / Country

DE102010040096A / 2010-09-01 / DE

Abstract

DWPI Abstract

(DE102010040096A1)

Novelty

The method involves determining three dimensional volume (1) and a partial volume (8, 12, 15, 18) a dental arch and teeth, where the partial volume is generated by computer-assisted transfer of volumetric image data through a certain beam direction (11).

Use

Method for preparing virtual dental retainer.

Advantage

The method involves determining three dimensional volumes and a partial volume, and hence ensures that the method produces a two-dimensional projection image at a defined feeding capacity.

Drawing Description

The drawing shows a schematic sketch of a three dimensional volume with selected partial volumes.

1 - Three dimensional volume.

2 - Teeth.

4 - Upper jaw arc.

8, 12, 15, 18 - Partial volume.

11 - Certain beam direction.

German Abstract

Die Erfindung betrifft ein Verfahren zur Erstellung einer virtuellen dentalen Aufnahme aus einem 3D-Volumen (1) mit volumetrischen Bilddaten. Aus dem 3D-Volumen (1) wird zunächst ein Teilvolumen (8, 12, 15, 18) festgelegt und anschließend für dieses Teilvolumen (8, 12, 15, 18) eine virtuelle Projektionsaufnahme (30, 41) aus einer bestimmten Durchstrahlrichtung (11) durch computergestützte Verrechnung der volumetrischen Bilddaten in dieser Durchstrahlrichtung (11) erzeugt.

Classes/Indexing

IPC

Current IPC	Invention	Version	Additional	Version
Full	A61B 6/03 A61B 6/14 G06T 15/00	20060101 20060101 20110101	-	-
Main Group	-	-	-	-
Subclass	-	-	-	-

Original IPC	Invention	Version	Additional	Version
Advanced/Full	A61B 6/03 A61B 6/14 G06T 15/00	20060101 20060101 20060101	-	-
Core/Main Group	-	-	-	-
Subclass	-	-	-	-

ECLA

G06T 11/00T5 G06T 15/08 K61B 6/03B K61B 6/14 K61B 6/46B10 S06T 210/41

DWPI Class

S05 T01 P31

DWPI Manual Codes

Expand DWPI Manual Codes

DWPI Chemistry Resource Numbers

Expand DWPI Chemistry Resource Numbers

DWPI Registry Numbers

Expand DWPI Registry Numbers

Plasdoc Punch Codes

Expand Plasdoc Punch Codes

Plasdoc Key Serial Codes

Expand Plasdoc Key Serial Codes

Enhanced Polymer Indexing

Expand Enhanced Polymer Indexing

Chemical Fragment Codes

Expand Chemical Fragment Codes

Legal Status

INPADOC Legal Status

Gazette Date	Code	Description
2015-10-15	R120 -	APPLICATION WITHDRAWN OR IP RIGHT ABANDONED
2011-08-05	R016	RESPONSE TO EXAMINATION COMMUNICATION

Get Family Legal Status

Family

Family

Expand INPADOC Family (10)

Expand DWPI Family (10); Countries (127)

Claims

Claims

All Claims (21)

Claims (German)

1. Verfahren zur Erstellung einer virtuellen dentalen Aufnahme (30, 41) aus einem 3D-Volumen (1) mit volumetrischen Bilddaten, **dadurch gekennzeichnet**, dass aus dem 3D-Volumen (1) ein Teilvolumen (8, 12, 15, 18) festgelegt wird und dass für dieses Teilvolumen (8, 12, 15, 18) eine virtuelle Projektionsaufnahme (30, 41) aus einer bestimmten Durchstrahlrichtung (11) durch computergestützte Verrechnung der volumetrischen Bilddaten in dieser Durchstrahlrichtung (11) erzeugt wird.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, dass das 3D-Volumen (1) mit volumetrischen Bilddaten eine dreidimensionale Röntgenaufnahme (1) mit Röntgenabsorptionswerten ist.

3. Verfahren nach Anspruch 1 oder 2, dadurch gekennzeichnet, dass die Verrechnung der volumetrischen Bilddaten durch Summation der hintereinander angeordneten Elemente der volumetrischen Bilddaten entlang der Durchstrahlrichtung (11) erfolgt.

4. Verfahren nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, dass vor der Verrechnung der volumetrischen Bilddaten eine bestimmte Funktion auf die volumetrischen Bilddaten in Durchstrahlrichtung angewendet wird, wobei diese Funktion so gestaltet ist, dass bestimmte für die Auswertung wesentlichen Bereiche hervorgehoben werden und andere für die Auswertung unwesentlichen Bereiche weniger gewichtet werden.

5. Verfahren nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, dass die Festlegung des Teilvolumens (8, 12, 15, 18) manuell oder computergestützt automatisch erfolgt.

6. Verfahren nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, dass das Teilvolumen automatisch anhand eines segmentierten Teilobjekts (2, 3) festgelegt wird, wobei die Außenkontur des Teilvolumens entsprechend einer Außenkontur des segmentierten Teilobjekts festgelegt wird.

7. Verfahren nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, dass das Teilvolumen manuell in seiner Außenkontur so festgelegt wird, dass es der Außenkontur eines charakteristischen Teilobjekts entspricht.

8. Verfahren nach einem der Ansprüche 1 bis 7, dadurch gekennzeichnet, dass aus dem 3D-Volumen (1) zunächst die Zähne (2, 3) und/oder der Kieferbogen (6, 7) identifiziert werden, wobei die Lage und die Orientierung der Zähne (2, 3) und/oder des Kieferbogens (6, 7) im 3D-Volumen (1) bestimmt wird, um das Teilvolumen (8, 12, 15, 18) und die Durchstrahlrichtung (11) zur Erzeugung der virtuellen Projektionsaufnahme (30, 41) festzulegen.

9. Verfahren nach einem der Ansprüche 1 bis 8, dadurch gekennzeichnet, dass das Teilvolumen (8, 12, 15, 18) mit einer beliebig festgelegten Grundfläche (9, 13, 16, 19) und einer bestimmten Dicke (10, 13, 17, 19) in Durchstrahlrichtung (11) festgelegt wird.

10. Verfahren nach einem der Ansprüche 1 bis 9, dadurch gekennzeichnet, dass die virtuelle Projektionsaufnahme (30, 41) in einer Benutzersoftware für die Verwaltung von dentalen Röntgenbildern als eine Intraoralaufnahme abgelegt wird.

11. Verfahren nach einem der Ansprüche 1 bis 10, dadurch gekennzeichnet, dass die virtuelle Projektionsaufnahme (30, 41) mittels einer Anzeigevorrichtung als eine Intraoralaufnahme dargestellt wird.

12. Verfahren nach einem der Ansprüche 1 bis 11, dadurch gekennzeichnet, dass mehrere Projektionsaufnahmen (30, 41) aus unterschiedlichen Teilvolumina (8, 12, 15, 18) mit unterschiedlichen Durchstrahlrichtungen (11) nach einem vorgegebenen Schema erzeugt werden.

13. Verfahren nach Anspruch 12, dadurch gekennzeichnet, dass jedes Teilvolumen (8, 12, 15, 18) Bilddaten mit volumetrischen Bilddaten eines einzelnen Zahns oder einer Zahngruppe des Kieferbogens (6, 7) umfasst, um separate Projektionsaufnahmen (30, 41) der einzelnen Zähne (2, 3) oder von einzelnen Zahngruppen zu erzeugen.

14. Verfahren nach Anspruch 12, dadurch gekennzeichnet, dass für jedes Teilvolumen (8, 12, 15, 18) eine Durchstrahlrichtung (11) in palatinaler Richtung zum Gaumen hin beziehungsweise in lingualer Richtung zur Zunge hin festgelegt wird, wobei die einzelnen Teilvolumina (8, 12, 15, 18) aneinander lückenlos anschließen oder sich teilweise überlappen, so dass eine Serie von Projektionsaufnahmen (30, 41) des gesamten Kieferbogens (6, 7) erzeugt wird.

15. Verfahren nach Anspruch 12, dadurch gekennzeichnet, dass für jedes Teilvolumen eine Durchstrahlrichtung (11) in okklusaler Richtung entlang einer Zahnachse (78) festgelegt wird, wobei die einzelnen Teilvolumina (8, 12, 15, 18) aneinander lückenlos anschließen oder sich teilweise überlappen, so dass eine Serie von okklusalen Projektionsaufnahmen des gesamten Kieferbogens (6, 7) erzeugt wird.

16. Verfahren nach einem der Ansprüche 12 bis 15, dadurch gekennzeichnet, dass eine automatische Anordnung der aus dem 3D-Volumen (1) erzeugten virtuellen Projektionsaufnahmen (30, 41) als eine vollständige Erfassung der in der Mundhöhle angeordneten Zähne (2, 3) erfolgt.

17. Verfahren nach einem der Ansprüche 1 bis 16, dadurch gekennzeichnet, dass die virtuelle Projektionsaufnahme (30, 41) einer herkömmlichen mit einer intraoralen Aufnahmevorrichtung bestehend aus einem Röntgenstrahler und einem Bildempfänger, wie einem Intraoralsensor, erzeugten Intraoralaufnahme entspricht.

18. Verfahren nach einem der Ansprüche 1 bis 17, dadurch gekennzeichnet, dass das 3D-Volumen (1) mittels der digitalen Volumentomographie (DVT), mittels der Computertomographie (CT), mittels eines dreidimensionalen Ultraschallverfahrens oder mittels Magnetresonanztomographie (MRT) aufgenommen ist.

19. Verfahren nach einem der Ansprüche 1 bis 18, dadurch gekennzeichnet, dass in die Erzeugung der virtuellen Projektionsaufnahme (30, 41) für das festgelegte Teilvolumen bestimmte physikalische Bedingungen einer herkömmlichen Intraoralaufnahme, wie Streuung, Strahlereigenschaften, oder eine relative Anordnung des Detektors zum Strahler, einfließen.

20. Verfahren nach einem der Ansprüche 1 bis 19, dadurch gekennzeichnet, dass bei der Festlegung des Teilvolumens (77) bestimmte störende Teilobjekte, wie Füllungen (72) oder Kieferknochen (73), aus dem Teilvolumen (77) herausgeschnitten werden oder mit einer geringeren Gewichtung bei der Verrechnung der volumetrischen Bilddaten berücksichtigt werden, um die Untersuchung der vom Teilvolumen (77) umfassten Teilobjekte, wie Zähne (3), beispielsweise auf Sekundärkaries (78) hin zu verbessern.

21. Verfahren nach einem der Ansprüche 1 bis 20, dadurch gekennzeichnet, dass bei der Erzeugung der virtuellen Projektionsaufnahme (30, 41) für das festgelegte Teilvolumen (8, 12, 15, 18) bestimmte Systemcharakteristika einer herkömmlichen Intraoralaufnahme, wie eine Detektoreffizienz, eine Detektorkennlinie und/oder eine Detektorempfindlichkeit bei unterschiedlichen Detektoren, simuliert werden, wobei die Art des Detektors, wie ein Speicherfoliensystem, Zahnfilme unterschiedlicher Empfindlichkeit oder ein digitaler Intraoralsensor, virtuell ausgewählt werden kann.

Description

Background/ Summary

Background/Summary

-

DWPI Drawing Description

The drawing shows a schematic sketch of a three dimensional volume with selected partial volumes.

1 - Three dimensional volume.

2 - Teeth.

4 - Upper jaw arc.

8, 12, 15, 18 - Partial volume.

11 - Certain beam direction.

Drawing Description

Expand Drawing Description

Description

Description

Technisches Gebiet

Die Erfindung betrifft ein Verfahren zur Erstellung einer Aufnahme aus einem 3D-Volumen mit volumetrischen Bilddaten von einem Kieferbogen und von Zähnen.

Stand der Technik

Aus dem Stand der Technik sind mehrere Verfahren zur Erstellung einer virtuellen dreidimensionalen Röntgenaufnahme bekannt. Bei der so genannten digitalen Volumentomographie (DVT) werden ein Strahler und ein Sensor, die durch eine Achse miteinander verbunden sind, in einer definierten Ebene um den Kopf des Patienten bewegt. Aus verschiedenen Positionen in dieser Umlaufbahn werden Projektionsaufnahmen erzeugt und im nächsten Schritt aus diesen Projektionsaufnahmen anschließend ein dreidimensionales Volumen berechnet. Das 3D-Volumen kann dann in einer Benutzersoftware auf einem Bildschirm dargestellt werden. Bei einer so genannten Computertomografie (CT) beruht die Bildgebung auf einer kontinuierlichen Aufnahme der Projektion aus unterschiedlichen Richtungen. In der Regel setzen sich die berechneten 3D-Rekonstruktionen aus Einzelschnitten nach dem Schnittbildverfahren zusammen, die quer durch das Objekt verlaufen. Auf diese Weise kann für jedes Volumenelement des Objekts, so genannte Voxel, der Röntgenabsorptionswert ermittelt werden.

In der ist ein Verfahren und eine Anordnung zur Identifikation von Objekten, insbesondere von Zähnen, offenbart, basierend auf einer digitalisierten Röntgenaufnahme, bei unter Verwendung von Bildverarbeitungsalgorithmen durch Segmentierung und/oder Kantendetektion im Objekt enthaltene Bereiche eingegrenzt und mit Parametern des Röntgengeräts sowie ggf. der Patienten zu spezifischen Parametern rechnerisch verknüpft werden. Darüber hinaus ist ein Verfahren offenbart, bei dem die Bestimmung der Objekte manuell oder automatisch erfolgt, wobei in einem Schritt das Objekt ausgewählt wird, für das weitere Informationen gespeichert, abgerufen oder gelöscht werden sollen, und in einem weiteren Schritt eine Referenz in Relation zum Objekt abgelegt wird, um anhand dieser Referenz die Informationen zu bestimmen, die dargestellt werden.

Auf die Bilddaten der digitalisierten Röntgenaufnahme werden computergestützt die Verfahren der Kantenfindung und der Segmentierung angewendet und die ermittelten Kanten und Segmente mittels der so genannten Cluster-Bildung gruppiert.

Das Patent offenbart ein Verfahren zur Darstellung von intraoralen Röntgenaufnahmen. Die intraoralen Röntgenaufnahmen werden erfasst, digitalisiert und zusammen mit einem Symbol eines Teils der Anatomie, von der die Röntgenaufnahme aufgenommen wird, angezeigt. Die Aufnahmen der anatomischen Bereiche werden mit dem jeweiligen Symbol nach ihrer normalen anatomischen Anordnung auf einem Bildschirm angezeigt. Das Symbol wird durch den Benutzer verwendet, um die jeweilige Röntgenaufnahme eines Bereiches der Anatomie auszuwählen. Als Symbol kann auch ein verkleinertes Bild des Gebisses, einer Zahnreihe oder der einzelnen Zähne verwendet werden.

In der ist eine Vorrichtung für verbesserte intraorale Röntgenaufnahmen offenbart. Die Vorrichtung beinhaltet einen Aufbissblock, eine Führungsstange, einen Zielring und einen zusätzlichen Ring. Der Aufbissblock enthält einen Filmhalter, der senkrecht zu der Oberseite des Aufbissblocks angeordnet ist. Die Führungsstange ist dabei mit dem Aufbissblock verbunden. Mittels der Vorrichtung wird ein vorgegebener Abstand zwischen dem Film im Filmhalter und dem äußeren Ring gewährleistet.

Ein Nachteil der genannten Vorrichtungen und Verfahren aus dem Stand der Technik ist, dass zur Erstellung der intraoralen Aufnahme eine aufwändige Vorrichtung im Mund des Patienten positioniert und fixiert werden muss, wobei diese Vorrichtung zur Fixierung meist einen Aufbissblock aufweist, und als Aufnahmemittel ein Röntgenfilm oder ein digitaler Röntgensensor an dieser Vorrichtung im Mundraum des Patienten angeordnet ist. Die Positionierung dieser Vorrichtung wird dadurch erschwert, dass der Patient beim Aufbeißen die relative Position der Vorrichtung zum Oberkiefer verändert und dass der Abstand des Aufnahmeelements von den Zähnen unbekannt ist.

Bei einer Serie von mehreren intraoralen Aufnahmen kann es vorkommen, dass durch die ungenaue Positionierung Lücken zwischen den einzelnen Aufnahmen entstehen und dadurch der Mundraum des Patienten nicht vollständig aufgenommen wird.

Darüber hinaus ist das Aufnahmevolumen der intraoralen Aufnahmen bezogen auf die Zähne in der Aufnahmerichtung nicht bekannt.

In der ist ein Verfahren zur Erstellung einer Schichtaufnahme offenbart, wobei aus einem digitalen 3D-Volumen, das Röntgenstrahlenabsorptionswerte aufweist, insbesondere eine dentale Röntgen-Panoramaschichtaufnahme erzeugt wird, wobei das 3D-Volumen als aufzunehmendes Objekt mit einer virtuellen Röntgenquelle virtuell durchstrahlt und das virtuelle entstehende Bild mit einem virtuellen Detektor aufgenommen wird. Die virtuelle Röntgenquelle und der virtuelle Detektor werden unter Ausbildung einer scharfen Schicht mit einem Verwischungsanteil an dem aufzunehmenden Objekt virtuell vorbeibewegt. Die Breite des virtuellen Detektors, die Auffächerung des virtuellen Strahlenfächers und die simulierte Umlaufgeschwindigkeit der virtuellen Röntgenquelle und des virtuellen Detektors ist veränderbar, um die Dicke sowie die Position der aufgenommen scharfen Schicht zu beeinflussen. In einer Ausführungsform wird aus dem 3D-Volumen ein festgelegter Teilbereich ausgewählt, dessen Ausdehnung der scharfen Schicht entspricht, wobei bei einer virtuellen Durchstrahlung des Teilbereichs senkrecht zum Verlauf des Teilbereichs eine Panoramaaufnahme erzeugt wird.

Ein Nachteil dieses Verfahrens besteht darin, dass die virtuell erzeugte Panoramaaufnahme im Gegensatz zu intraoralen Projektionsaufnahmen ein verzerrtes Bild des gesamten Kieferbogens darstellt und dadurch die Diagnose bestimmter Befunde erschwert wird.

Die Aufgabe dieser Erfindung besteht daher darin, eine zweidimensionale Projektionsaufnahme bei einem definierten Aufnahmevolumen zu erzeugen.

Darstellung der Erfindung

Ein Gegenstand der vorliegenden Erfindung ist ein Verfahren zur Erstellung einer virtuellen dentalen Aufnahme aus einem 3D-Volumen mit volumetrischen Bilddaten. Aus dem 3D-Volumen wird zunächst ein Teilvolumen festgelegt. Für dieses Teilvolumen wird eine virtuelle Projektionsaufnahme aus einer bestimmten Durchstrahlrichtung durch computergestützte Verrechnung der volumetrischen Bilddaten in dieser Durchstrahlrichtung erzeugt.

Das 3D-Volumen kann eine dreidimensionale Röntgenaufnahme sein, die mittels eines beliebigen dreidimensionalen Röntgenaufnahmeverfahrens, wie DVT oder CT, erzeugt worden ist und wobei die volumetrischen Bilddaten aus Voxeln mit Röntgenabsorptionswerten bestehen können. Das 3D-Volumen kann auch mittels anderer bildgebender Verfahren, wie MRT, aufgenommen sein. Das 3D-Volumen kann vom gesamten Kieferbogen mit Zähnen oder von einem Teil davon vorliegen. Die volumetrischen Bilddaten des 3D-Volumens können aus Voxeln, Vektorelementen oder aus einer Kombination von Voxeln und Vektorelementen aufgebaut sein. Die volumetrischen Bilddaten können auch aus Punktwolken bestehen, die Vektorelemente enthalten. Aus diesem 3D-Volumen wird ein bestimmtes Teilvolumen mit einer beliebigen Grundfläche und einer bestimmten Tiefe in der Durchstrahlrichtung ausgewählt. In einem weiteren Schritt wird für dieses ausgewählte Teilvolumen eine virtuelle Projektionsaufnahme durch Verrechnung der volumetrischen Bilddaten, wie Voxel oder Vektorelemente, in Durchstrahlrichtung erzeugt. Dadurch entsteht eine virtuelle Projektionsaufnahme des ausgewählten Teilvolumens, die einer intraoralen Röntgenaufnahme eines bestimmten Bereichs des Kieferbogens entspricht. Die Verrechnung der Volumetrischen Bilddaten in Durchstrahlrichtung kann beispielsweise durch Summation der einzelnen hintereinander angeordneten volumetrischen Bilddaten, wie Voxel oder

Vektorelemente, in Durchstrahlrichtung erfolgen. Die Verrechnung der volumetrischen Bilddaten kann auch durch Integration nach der Anwendung einer bestimmten Funktion auf die in Durchstrahlrichtung angeordneten Voxel erfolgen.

Vor der Verrechnung der volumetrischen Bilddaten kann eine bestimmte Funktion auf die volumetrischen Bilddaten angewendet werden, um die volumetrischen Bilddaten in Durchstrahlrichtung so zu gewichten, dass bestimmte für die Auswertung wesentliche Bereiche, wie beispielsweise mit Karies befallene Bereiche, hervorgehoben werden und andere für die Auswertung unwesentliche Bereiche, wie beispielsweise eine Füllung, weniger gewichtet werden. Eine solche Funktion kann beispielsweise auf die Grauwerte der einzelnen Elemente der volumetrischen Bilddaten angewendet werden.

Das 3D-Volumen kann aus Voxeln bestehen, die Volumenelemente des aufgenommenen Objekts repräsentieren. Als 3D-Volumen kann dabei jede beliebige dreidimensionale dentale Aufnahme verwendet werden, wie eine dreidimensionale Röntgenaufnahme, nämlich eine DVT-Aufnahme oder eine CT-Aufnahme mit Voxeln, die Röntgenabsorptionswerte in Form von Grauwerten enthalten, oder eine MRT-Aufnahme mit Voxeln, die Volumenelemente des aufgenommenen Gewebes repräsentieren. Das 3D-Volumen kann auch eine dreidimensionale Ultraschallaufnahme sein.

Bei der Erzeugung der Projektionsaufnahme können die volumetrischen Bilddaten durch Summation in der Durchstrahlrichtung erfolgen, wobei die virtuelle Durchstrahlrichtung über die gesamte Grundfläche parallel ist oder in Form eines konischen Fächers als Verlängerung von virtuellen Röntgenstrahlen einer virtuellen Röntgenquelle gebildet ist. Die Grundfläche kann dabei beliebig gestaltet sein, beispielsweise in Form eines Kreises, eines Rechtecks oder eines festgelegten Umrisses des aufzunehmenden Objekts.

Das Teilvolumen kann auch eine andere beliebige geometrische Grundform, wie einen Tetraeder, oder die Form eines segmentierten Teilvolumens haben.

Eine optimale Projektionsaufnahme wird mit einer Grundfläche in Form eines Rechtecks in einer parallelen Durchstrahlrichtung erzeugt, so dass das ausgewählte Teilvolumen die Form eines Quaders hat.

Die Projektionsaufnahme sollte in ihren Abmessungen der Größe einer herkömmlichen Intraoralaufnahme mit Zahnfilmen entsprechen, nämlich mit einer Breite zwischen 15 mm und 30 mm und einer Höhe zwischen 25 mm und 40 mm.

Ein Vorteil ist, dass zur Erzeugung der Projektionsaufnahmen der Patient nicht nochmals bestrahlt werden muss. Die Projektionsaufnahmen, wie intraorale Röntgenaufnahmen bestimmter Bereiche, können aus den bereits vorhandenen dreidimensionalen Bilddaten des 3D-Volumens erzeugt werden.

Ein weiterer Vorteil ist, dass das Teilvolumen computergestützt durch den Benutzer genau festgelegt werden kann und beispielsweise intraorale Röntgenaufnahmen einzelner Zähne erzeugt werden können.

Ein weiterer Vorteil liegt darin, dass das Teilvolumen so gewählt werden kann, dass ein Gebiet des 3D-Volumens von Interesse, wie eine Füllung, virtuell ausgeschnitten wird, um eine Projektionsaufnahme ohne den ausgeschnittenen Bereich zu berechnen. Dadurch kann beispielsweise eine Sekundärkaries, die unter der Füllung liegt, diagnostiziert werden. Dieses Herausschneiden spezieller Strukturen lässt sich bei Füllungen, Dentinschichten, Zahnschmelzstrukturen etc. durchführen, die nach einer entsprechenden Segmentierung virtuell ausgeschnitten werden können.

Vorteilhafterweise kann das 3D-Volumen mit volumetrischen Bilddaten eine dreidimensionale Röntgenaufnahme mit Röntgenabsorptionswerten sein.

Dadurch entspricht die virtuelle Projektionsaufnahme einer zweidimensionalen Röntgenaufnahme in einer bestimmten Durchstrahlrichtung.

Vorteilhafterweise kann die Verrechnung der volumetrischen Bilddaten durch Summation der hintereinander angeordneten volumetrischen Bilddaten, wie Voxel oder Vektorelemente, entlang der Durchstrahlrichtung erfolgen.

Dadurch kann beispielsweise jedes Pixel der Projektionsaufnahme durch Summation der Voxel in Durchstrahlrichtung bezüglich der Grauwerte berechnet werden.

Vorteilhafterweise kann die Verrechnung der volumetrischen Bilddaten durch Integration nach der Anwendung einer bestimmten Funktion auf die in Durchstrahlrichtung angeordneten Elemente der volumetrischen Bilddaten erfolgen.

Dies eine weitere Alternative zur Verrechnung der volumetrischen Bilddaten und erlaubt eine unterschiedliche Gewichtung der Elemente nach einer bestimmten Funktion. Diese Funktion kann so gestaltet sein, dass bestimmte Bereiche ausgeblendet beziehungsweise abgeschwächt werden und für die Diagnose wesentlichen Bereiche stärker gewichtet werden.

Vorteilhafterweise kann die Festlegung des Teilvolumens manuell oder computergestützt automatisch erfolgen.

Das Teilvolumen kann manuell durch einen Benutzer unter Verwendung von Eingabemitteln bestimmt werden. Die Festlegung des Teilvolumens kann auch computergestützt automatisch mittels eines Computers und einer Software zur Verarbeitung von Bilddaten unter Verwendung herkömmlicher Bildbearbeitungsverfahren, wie Identifizierung beziehungsweise Segmentierung bestimmter Teilobjekte, wie Zähne oder Kieferknochen, erfolgen.

Vorteilhafterweise kann das Teilvolumen automatisch anhand eines segmentierten Teilobjekts festgelegt werden, wobei die Außenkontur des Teilvolumens entsprechend einer Außenkontur des segmentierten Teilobjekts festgelegt wird.

Zur Segmentierung kann ein herkömmliches Verfahren zur Mustererkennung verwendet werden. Dadurch umfasst ein Volumen nur das Teilobjekt, das diagnostiziert werden soll, so dass das benachbarte Gewebe, wie das Zahnfleisch und der Kieferknochen, unberücksichtigt bleibt und dadurch die Diagnose erleichtert wird.

Vorteilhafterweise kann das Teilvolumen in seiner Außenkontur manuell so festgelegt werden, dass es der Außenkontur eines charakteristischen Teilobjekts entspricht.

Dadurch kann der Benutzer unter Verwendung von Eingabemitteln die Außenkontur des Teilvolumens manuell entsprechend der Außenform des zu diagnostizierenden Teilobjekts, wie eines Zahns oder einer Zahngruppe, festlegen.

Vorteilhafterweise können aus dem 3D-Volumen zunächst die Zähne und/oder der Kieferbogen identifiziert werden. Anschließend wird die Lage und die Orientierung der Zähne und/oder des Kieferbogens im 3D-Volumen bestimmt, um das Teilvolumen und die Durchstrahlrichtung zur Erzeugung der virtuellen Projektionsaufnahme festzulegen.

Die Identifizierung der Zähne und des Kieferbogens aus dem 3D-Volumen kann entweder automatisch computergestützt oder manuell durch einen Benutzer unter Verwendung von Eingabemitteln, wie einer Maus und Tastatur, und unter Verwendung eines Anzeigemittels, wie eines Monitors, erfolgen. Bei der automatischen Identifizierung beziehungsweise Segmentierung werden übliche Verfahren zur Mustererkennung verwendet, bei denen Objekte segmentiert werden, und nach Zusammenhängen zwischen den Objekten gesucht wird. Die Mustererkennung kann die folgenden Schritte umfassen, nämlich die Vorverarbeitung, die Merkmalsgewinnung, die Merkmalsreduktion, und die Klassifizierung der Merkmale. Bei der Vorverarbeitung werden unerwünschte oder irrelevante Bestandteile der Bilddaten entfernt. Bei der Merkmalsgewinnung werden bestimmte Merkmale aus den Bilddaten durch Vergleich mit bekannten Mustern einer Datenbank, wie einer Datenbank von charakteristischen Zähnen, gewonnen. Der automatische Vergleich erfolgt unter Anwendung von Transformationsfunktionen und Skalierung, wobei durch Berechnung einer Varianz zwischen einem Muster aus den Bilddaten und einem erwarteten Muster aus der Datenbank ein Vergleichsfaktor berechnet wird. Bei der Merkmalsreduktion wird geprüft, welche Merkmale für die Klassentrennung relevant sind und welche weggelassen werden können. Insbesondere die gewonnenen Muster von Zähnen und des Kieferbogens sind für dieses Verfahren relevant, wobei die übrigen gewonnenen Merkmale unbeachtet bleiben können. Im letzten Schritt der Klassifizierung werden die wesentlichen erkannten Merkmale, wie Zähne und charakteristische Formgestaltungen des Kieferbogens, in zusammengehörige Klassen, wie Schneidezähne, Backenzähne, Zahnwurzeln und Kieferknochen, unterteilt.

Bei der Merkmalsgewinnung kommen bekannte Verfahren, wie die Rasteranalyse, Cluster-Analyse und Pattern-Matching zur Anwendung.

Vorteilhafterweise kann das Teilvolumen in Form eines Prismas mit einer beliebigen Grundfläche und einer bestimmten Dicke in Durchstrahlrichtung festgelegt werden.

Das Teilvolumen kann computergestützt automatisch anhand bestimmter erkannter Objekte, wie Zähne oder Zähnegruppen, festgelegt werden oder manuell durch den Benutzer eingegeben werden. Zunächst wird eine Grundfläche definiert und anschließend die Dicke in Durchstrahlrichtung bestimmt. Dadurch

wird ein geometrisches Prisma gebildet, wobei die Durchstrahlrichtung senkrecht auf der Grundfläche angeordnet sein kann.

Dadurch kann das Teilvolumen so festgelegt werden, dass bestimmte Objekte, wie Zähne oder Zähnegruppen bzw. bestimmte Teile des Kieferknochens, im Teilvolumen angeordnet sind. Durch das Festlegen der Dicke kann das Teilvolumen nur auf das aufzunehmende Objekt begrenzt werden, so dass andere Objekte, wie eine Wange eines Patienten, die vor oder hinter dem aufzunehmenden Objekt in Durchstrahlrichtung angeordnet sind, nicht im Teilvolumen enthalten sind und damit nicht als störende Artefakte in der berechneten Projektionsaufnahme auftauchen.

Vorteilhafterweise kann die virtuelle Projektionsaufnahme in einer Benutzersoftware für die Verwaltung von dentalen Röntgenbildern als eine Intraoralaufnahme abgelegt werden.

Eine virtuelle Projektionsaufnahme in einer Durchstrahlrichtung, die senkrecht zum Verlauf des Kieferbogens lingual bzw. palatinal ausgerichtet ist und dessen Teilvolumen bestimmte Zähne umfasst, entspricht einer Intraoralaufnahme und kann als solche in einer vorhandenen Benutzersoftware abgelegt werden.

Dadurch kann die berechnete Projektionsaufnahme, wie eine herkömmliche Intraoralaufnahme, zur Diagnose verwendet werden.

Vorteilhafterweise kann die virtuelle Projektionsaufnahme mittels einer Anzeigevorrichtung als eine virtuelle Intraoralaufnahme dargestellt werden.

Dadurch kann die virtuelle Projektionsaufnahme mittels einer Anzeigevorrichtung, wie eines Computerbildschirms, in einer vorhandenen Benutzersoftware, wie eine herkömmliche Intraoralaufnahme, dargestellt werden.

Vorteilhafterweise können mehrere Projektionsaufnahmen aus unterschiedlichen Teilvolumina mit unterschiedlichen Durchstrahlrichtungen nach einem vorgegebenen Schema erzeugt werden.

Diese Teilvolumina können beliebig gestaltet sein. Sie können unterschiedliche Dicken mit einer ausgewählten Grundfläche aufweisen oder in ihrer Außenkontur entsprechend einem segmentierten Teilobjekt, wie einem Zahn oder einer Zahngruppe, festgelegt sein. Die erzeugten Projektionsaufnahmen können auch in einer bestimmten Anordnung zueinander mittels der Anzeigevorrichtung dargestellt werden.

Dadurch kann eine Serie von mehreren virtuellen Intraoralaufnahmen vom ganzen Mundraum des Patienten erzeugt werden.

Die Serie der virtuellen Intraoralaufnahmen kann nach einem herkömmlichen Schema erzeugt werden, wie sie im Patent in Fig. 5A bis Fig. 5S gezeigt ist und in den dazugehörigen Teilen der Beschreibung offenbart ist.

Die einzelnen virtuellen Intraoralaufnahmen der Serie können einzelne oder mehrere Zähne umfassen. Eine virtuelle Intraoralaufnahme von mehreren Zähnen ermöglicht die Diagnose auch von Bereichen zwischen den Zähnen.

Dadurch können Intraoralaufnahmen der einzelnen Zähne oder von Zahngruppen erzeugt werden, um eine verbesserte Diagnose zu ermöglichen. Dadurch wird eine Serie von Intraoralaufnahmen des ganzen Mundraums des Patienten (vollständiger Zahnstatus) erzeugt. Im Gegensatz zu den herkömmlichen Intraoralaufnahmen, die mittels eines Films oder eines Intraoralsensors durchgeführt werden, ist eine exakte Anordnung der virtuellen Teilvolumina möglich, so dass bei einer Serie von Aufnahmen die Teilvolumina lückenlos zueinander angeordnet werden können und damit die Diagnosemöglichkeiten verbessert werden.

Vorteilhafterweise kann jedes Teilvolumen Bilddaten mit volumetrischen Bilddaten eines einzelnen Zahns oder einer Zahngruppe des Kieferbogens umfassen, um separate Projektionsaufnahmen der einzelnen Zähne oder von einzelnen Zahngruppen zu erzeugen.

Dadurch kann eine Serie von Projektionsaufnahmen der einzelnen Zähne beider Kieferbögen erzeugt werden.

Das Teilvolumen kann auch nur Teilbereiche von Zähnen, wie einem halben Zahn umfassen. Das Teilvolumen kann auch einen Zahn und zwei Zahnlücken umfassen.

Vorteilhafterweise kann für jedes Teilvolumen eine Durchstrahlrichtung in palatinaler Richtung zum Gaumen hin beziehungsweise in lingualer Richtung zur Zunge hin festgelegt werden, wobei die einzelnen Teilvolumina aneinander lückenlos anschließen oder sich teilweise überlappen, so dass eine Serie von Projektionsaufnahmen des gesamten Kieferbogens erzeugt wird.

Dadurch entspricht die Durchstrahlrichtung der erzeugten Projektionsaufnahmen der üblichen Orientierung von intraoralen Aufnahmen, so dass die erzeugte Serie, wie eine Serie von herkömmlichen intraoralen Aufnahmen, zur Diagnose verwendet werden kann.

Vorteilhafterweise kann für jedes Teilvolumen eine Durchstrahlrichtung in okklusaler Richtung entlang einer Zahnachse festgelegt werden, wobei die einzelnen Teilvolumina aneinander lückenlos anschließen oder sich teilweise überlappen, so dass eine Serie von okklusalen Projektionsaufnahmen des gesamten Kieferbogens erzeugt wird.

Dadurch wird die Diagnose aus okklusaler Richtung der Zähne des gesamten Kieferbogens ermöglicht.

Vorteilhafterweise kann eine automatische Anordnung der aus dem 3D-Volumen erzeugten virtuellen Projektionsaufnahmen als eine vollständige Erfassung der in der Mundhöhle angeordneten Zähne erfolgen.

Dadurch kann eine Serie von Intraoralaufnahmen (vollständiger Zahnstatus; full mouth series) zur vollständigen Erfassung der Mundhöhle des Patienten erzeugt werden.

Vorteilhafterweise kann die virtuelle Projektionsaufnahme einer mit einer intraoralen Aufnahmevorrichtung bestehend aus einem Röntgenstrahler und einem Bildempfänger, wie einem Intraoralsensor, erzeugten Intraoralaufnahme entsprechen.

Bei einer Durchstrahlrichtung senkrecht zur Ausrichtung des Kieferbogens entspricht die Projektionsaufnahme einer herkömmlichen Intraoralaufnahme eines Abschnitts des Kieferbogens. Die virtuelle Projektionsaufnahme kann auch mit der Durchstrahlrichtung entlang des Kieferbogens für einzelne Zähne erzeugt werden. Solche Projektionsaufnahmen können für die Diagnose bestimmter Befunde im Zwischenraum der Zähne an den approximalen Flächen vorteilhaft sein.

Vorteilhafterweise kann das 3D-Volumen mittels der digitalen Volumentomographie (DVT), mittels der Computertomographie (CT), mittels eines dreidimensionalen Ultraschallverfahrens oder mittels Magnetresonanztomographie (MRT) aufgenommen sein.

Dadurch wird ein 3D-Volumen mit einer hohen Auflösung bei hoher Aufnahmequalität erzeugt.

Vorteilhafterweise können in die Erzeugung der virtuellen Projektionsaufnahme für das festgelegte Teilvolumen bestimmte physikalische Bedingungen einer herkömmlichen Intraoralaufnahme, wie Streuung, Strahlereigenschaften, Röntgenspektrum oder die relative Anordnung des Detektors zum Strahler, einfließen.

Diese Faktoren können beispielsweise, computergestützt simuliert werden oder aus einer Datenbank mit Faktoren für unterschiedliche Anordnungen unter Berücksichtigung unterschiedlicher physikalischer Bedingungen abgerufen werden.

Dadurch wird eine herkömmliche Intraoralaufnahme bezüglich der physikalischen Bedingungen nachgebildet, um eine Diagnose auf herkömmliche Art und Weise zu ermöglichen.

Vorteilhafterweise können bei der Festlegung des Teilvolumens bestimmte störende Teilobjekte, wie beispielsweise Füllungen oder Kieferknochen, aus dem Teilvolumen herausgeschnitten werden oder mit einer geringeren Gewichtung bei der Verrechnung der volumetrischen Bilddaten berücksichtigt werden, um die Untersuchung der vom Teilvolumen umfassten Teilobjekte, wie Zähnen, beispielsweise auf Sekundärkaries hin zu verbessern.

Dadurch kann insbesondere Sekundärkaries, der meist zwischen der Füllung und der Zahnsubstanz angeordnet ist, besser diagnostiziert werden.

Vorteilhafterweise können bei der Erzeugung der virtuellen Projektionsaufnahme für das festgelegte Teilvolumen bestimmte Systemcharakteristika einer herkömmlichen Intraoralaufnahme, wie eine Detektoreffizienz, eine Detektorkennlinie beziehungsweise mehrere Detektorkennlinien und/oder eine Detektorempfindlichkeit bei unterschiedlichen Detektoren, simuliert werden, wobei die Art des Detektors,

wie ein Speicherfoliensystem, Zahnfilme unterschiedlicher Empfindlichkeit oder ein digitaler Intraoralsensor, virtuell ausgewählt werden können.

Diese Systemcharakteristika können auch aus einer Datenbank für unterschiedliche Bilddaten abgerufen werden.

Dadurch können Systemcharakteristika bestimmter Detektorarten simuliert werden, um eine herkömmliche Intraoralaufnahme mit dieser Detektorart möglichst genau nachzuahmen. Die Auswahl der Detektorart kann virtuell durch den Benutzer unter Verwendung von Eingabemitteln erfolgen.

Kurzbeschreibung der Zeichnungen

Ausführungsbeispiele der Erfindung sind in der Zeichnung dargestellt. Es zeigt die

Fig. 1 eine Skizze eines 3D-Volumens mit ausgewählten Teilvolumina;

Fig. 2 eine Skizze einer erzeugten Projektionsaufnahme aus einem Teilvolumen;

Fig. 3 eine Skizze einer Anordnung von mehreren Projektionsaufnahmen des gesamten Mundraums eines Patienten;

Fig. 4A eine Skizze eines Teilvolumens mit parallelen Strahlen;

Fig. 4B eine Skizze eines alternativen Teilvolumens in Form eines kegelförmigen Fächers;

Fig. 4C eine Skizze eines alternativen Teilvolumens mit einer trapezförmigen Grundfläche;

Fig. 5 eine Skizze eines Schemas mit mehreren ausgewählten Teilvolumina;

Fig. 6 eine Skizze eines Ausschnitts des 3D-Volumens, das einen einzelnen Backenzahn umfasst;

Fig. 7 eine Skizze eines alternativen Ausschnitts, das eine Füllung zwischen zwei Backenzähnen umfasst.

Ausführungsbeispiele

Die Fig. 1 zeigt eine Skizze eines 3D-Volumens 1, das mittels der digitalen Volumentomografie, abgekürzt DVT, oder mittels der Computertomografie, abgekürzt CT, aufgenommen wurde. Das 3D-Volumen 1 besteht aus Voxeln mit bestimmten Röntgenabsorptionswerten. Das 3D-Volumen umfasst mehrere Strukturen, wie die vorderen Schneidezähne 2, die seitlichen Backenzähne 3 und den oberen Kieferbogen 4, den unteren Kieferbogen 5, den oberen Kieferknochen 6 sowie den unteren Kieferknochen 7. Das 3D-Volumen 1 ist in einer Benutzersoftware auf einem nicht gezeigten Computerbildschirm dargestellt. Das 3D-Volumen lässt sich beliebig verschieben und drehen, um die Blickrichtung der Anzeige zu verändern. Im ersten Schritt des Verfahrens wird ein virtuelles Teilvolumen 8 mit einer bestimmten Grundfläche 9 und einer bestimmten Dicke 10 in einer Durchstrahlrichtung 11 festgelegt. Die Festlegung des Teilvolumens kann automatisch computergestützt oder manuell durch einen Benutzer festgelegt werden. Bei der automatischen Festlegung werden mittels eines herkömmlichen Verfahrens zur Mustererkennung die einzelnen Zähne erkannt und klassifiziert, wobei das Teilvolumen so festgelegt wird, dass bestimmte Bereiche des Kieferbogens von diesem Teilvolumen umfasst sind. Bei der manuellen Festlegung kann der Benutzer zunächst mittels Eingabemitteln die Grundfläche 9 definieren und anschließend die Dicke des Teilvolumens bestimmen. Das festgelegte Teilvolumen 8 wird in der Benutzersoftware besonders markiert in Relation zum 3D-Volumen 1 dargestellt. Das zweite Teilvolumen 12 mit der Grundfläche 13 und der Dicke 14, das dritte Teilvolumen 15 mit der Grundfläche 16 und der Dicke 17 sowie das vierte Teilvolumen 18 mit der Grundfläche 19 und der Dicke 20 werden entsprechend festgelegt. Bei der Festlegung der Teilvolumina 8, 12, 15 und 18 ist die Dicke 10, 14, 17, 20 in eine Durchstrahlrichtung ausgerichtet, die senkrecht zum Verlauf 21 der unteren Zahnreihe in palatinaler Richtung zum Gaumen hin bzw. in lingualer Richtung zur Zunge hin angeordnet ist. Die einzelnen Teilvolumina 8, 12, 15 und 18 schließen sich lückenlos aneinander an. Im zweiten Schritt des erfinderischen Verfahrens wird computergestützt unter Verwendung eines Algorithmus aus dem ausgewählten Teilvolumen durch Summation der Röntgenabsorptionswerte in der Durchstrahlrichtung eine zweidimensionale virtuelle Projektionsaufnahme erzeugt, die einer herkömmlichen Intraoralaufnahme des jeweiligen Bereichs des Kieferbogens innerhalb des Teilvolumens entspricht. Die Form der Teilvolumina 8, 12, 15 und 18 entspricht einem Prisma mit einer Grundfläche 9, 13, 16, 19 und der Dicke 10, 14, 17 und 20. Die erzeugte Projektionsaufnahme wird als eine virtuelle Intraoralaufnahme in einer Datenbank einer herkömmlichen Benutzersoftware abgelegt.

Die Fig. 2 zeigt eine Skizze einer erzeugten Projektionsaufnahme 30 aus dem vierten Teilvolumen 18 der hinteren Backenzähne des unteren Kieferbogens 5. Die virtuelle Projektionsaufnahme 30 entspricht einer herkömmlichen Intraoralaufnahme und wird in der Benutzersoftware mittels eines Computerbildschirms angezeigt und entsprechend in einer dafür vorgesehenen Datenbank abgelegt.

Die Fig. 3 zeigt eine Skizze einer Anordnung 40 von mehreren Projektionsaufnahmen des gesamten Mundraums des Patienten vom unteren Kieferbogen 5 und vom oberen Kieferbogen 6 aus Fig. 1. Unten links ist die erzeugte Projektionsaufnahme 30 aus Fig. 2 zu sehen. Die übrigen Projektionsaufnahmen 41 wurden entsprechend aus den weiteren Teilvolumina 8, 12, 15, die in Fig. 1 dargestellt sind, sowie aus weiteren Teilvolumina des oberen Kieferbogens 6 erzeugt, die in Fig. 1 nicht dargestellt sind. Die Teilvolumina zur Erzeugung der Projektionsaufnahmen 30, 41 aus Fig. 3 sind teilweise überlappend. Die in Fig. 3 gezeigte Anordnung 40 von erzeugten Intraoralaufnahmen 30, 41 wurden nach einem vorgegebenen Schema erzeugt, nämlich nach dem so genannten „full mouth series", auf Deutsch „vollständiger Zahnstatus". Die Projektionsaufnahmen 30, 41 können auch nach einem anderen beliebigen Schema erzeugt werden. Die Erzeugung von Projektionsaufnahmen in Richtung des Verlaufs 21 des unteren Kieferbogens bzw. des oberen Kieferbogens 6 ist ebenfalls möglich, so dass die Bereiche zwischen den Zähnen auf einer solchen Projektionsaufnahme abgebildet werden.

Die Fig. 4A zeigt ein Teilvolumen 18, das einen Backenzahn 3 vollständig und zwei Nachbarzähne zum Teil umfasst, wobei die Grundfläche 19 in Form eines Kreises ausgebildet ist und die Dicke 20 so festgelegt ist, dass die Backenzähne 3 vollständig vom Teilvolumen 18 erfasst sind. Bei der Erzeugung der Projektionsaufnahme aus dem Teilvolumen 18 erfolgt eine Summation entlang der virtuellen Durchstrahlrichtung, die durch virtuelle parallele Strahlen 50 dargestellt ist.

Die Fig. 4B zeigt das Teilvolumen 18, wie in Fig. 4A, mit dem Unterschied, dass die Strahlen 50 in Form eines kegelförmigen Fächers ausgehend von einer virtuellen Röntgenquelle 51 angeordnet sind, wobei die festgelegte Grundfläche 19 ein Rechteck ist.

Die Fig. 4C zeigt eine weitere alternative Ausführungsform des Teilvolumens 18 mit einer trapezförmigen Grundfläche 19, wobei die Durchstrahlrichtung durch parallele Strahlen 50 dargestellt ist.

Die Fig. 5 zeigt ein Schema eines unteren Kieferbogens 5 aus der Sicht von oben mit den ausgewählten Teilvolumina 18, 15, 12, 8 aus Fig. 1 und weiterer Teilvolumina 60, die in die Durchstrahlrichtung 11 angeordnet sind, die senkrecht zum Verlauf 21 des Unterkieferbogens 5 ausgerichtet ist. Bei der Erzeugung der einzelnen Projektionsaufnahmen erfolgt die Summation wie in Fig. 4A oder Fig. 4C dargestellt entlang der parallelen virtuellen Strahlen. Im Unterschied zu Fig. 1 sind die einzelnen Teilvolumina 18, 15, 12, 8 überlappend ausgewählt, so dass Teile des Kieferbogens 5 sowohl von einem Teilvolumen als auch von seinem benachbarten Teilvolumen umfasst sind und damit in den aus diesen benachbarten Teilvolumina erzeugten Projektionsaufnahmen derselbe Teil des Kieferbogens 5 zu sehen ist.

Die Fig. 6 zeigt ein Schema eines Ausschnitts des 3D-Volumens 1, das einen einzelnen Backenzahn 3 des unteren Kieferbogens 5 umfasst. Der Backenzahn 3 besteht aus einer Zahnwurzel 70 und eine Zahnkrone 71, die mit einer Füllung 72 versehen ist. Die Zahnwurzel 70 ist im Kieferknochen 73 angeordnet. Auf dem Kieferknochen 73 liegt die Gingiva 74 auf. Auf der Rückseite 75 der Füllung 72 ist eine Sekundärkaries 76 entstanden, die zu diagnostizieren ist. Ein Teilvolumen 77 ist durch den Benutzer oder computergestützt automatisch festgelegt, wobei das Teilvolumen 77 die Zahnkrone 71 umfasst und das störende Teilobjekt, nämlich die Füllung 72, virtuell herausgeschnitten ist. Die übrigen für die Diagnose unwichtigen Teilobjekte, wie die Zahnwurzel 70, die Gingiva 74, der Kieferknochen 73, wurden ebenfalls bei der Festlegung des Teilvolumens 77 weggelassen. Die virtuelle Durchstrahlrichtung 11 des Volumens 77 verläuft entlang einer Zahnachse 78 in okklusaler Richtung senkrecht zur Okklusalfläche 79. Dadurch dass die Füllung 72 virtuell herausgeschnitten wurde lässt sich anhand der Projektionsaufnahme, die aus dem Teilvolumen 77 in Durchstrahlrichtung 11 erzeugt wird, die Sekundärkaries 76 besser diagnostizieren. Das Ausscheiden der Füllung kann auch mittels einer bestimmten Funktion erfolgen. Eine solche Funktion so gestaltet, dass die für eine Auswertung unwesentliche Bereiche, wie eine Füllung, ausblendet beziehungsweise abschwächt und für eine Auswertung wesentliche Bereiche, wie mit Karies befallen Bereiche, verstärkt dargestellt werden.

Die Fig. 7 zeigt ein Schema eines Ausschnitts des 3D-Volumens 1 wie in Fig. 6 mit dem Unterschied, dass die Füllung 72 zwischen zwei Backenzähnen 3 angeordnet ist und dass die Durchstrahlrichtung 11 in lingualer Richtung senkrecht zum Verlauf 21 des Kieferbogens 5 ausgerichtet ist. In Fig. 7 ist eine Schnittebene 80 dargestellt, die mittig die beiden Backenzähne 3 teilt. Das Teilvolumen 81 ist durch Schnittebene 80 und die Außenkontur 82 der hinteren Seite der Backenzähne 3 gebildet. Dadurch wird

die Diagnose von Sekundärkaries 78 auf der Rückseite der Füllung 72 anhand der aus dem Teilvolumen 81 in Durchstahlrichtung 11 erzeugten Projektionsaufnahme verbessert.

Bezugszeichenliste

1 3D-Volumen
2 vordere Schneidezähne
3 seitliche Backenzähne
4 oberer Kieferbogen
5 unterer Kieferbogen
6 oberer Kieferknochen
7 unterer Kieferknochen
8 virtuelles Teilvolumen
9 Grundfläche
10 Dicke
11 Durchstrahlrichtung
12 zweites Teilvolumen
13 Grundfläche
14 Dicke
15 drittes Teilvolumen
16 Grundfläche
17 Dicke
18 viertes Teilvolumen
19 Grundfläche
20 Dicke
21 Verlauf
30 Projektionsaufnahme
40 Anordnung
41 Projektionsaufnahme
50 Strahlen
60 weitere Teilvolumina

ZITATE ENTHALTEN IN DER BESCHREIBUNG

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Zitierte Patentliteratur

- DE 10108295 A1 **[0003]**
- US 5179579 **[0005, 0050]**
- US 6190042 B1 **[0006]**
- DE 102008008733 A1 **[0010]**

Citations

Citation *Record level*

Expand Citing Patents (6)

Expand Cited Patents (7)

Cited Non-patents (0)

DPCI Citation *Patent family level*

Expand DPCI Citing Patents (10)

Expand DPCI Cited Patents (18)

Expand DPCI Cited Non-patents (3)

Expand DPCI Citation Counts

DPCI Field of Search

-

DPCI Citing Patents Country

JP; EP; US; KR; DE; CN

DPCI Cited Patents Country

JP; WO; US; DE; CN

Other

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DWPI Title Terms

METHOD PREPARATION VIRTUAL DENTAL RETAIN DETERMINE THREE DIMENSION VOLUME GENERATE COMPUTER ASSIST TRANSFER IMAGE DATA

Custom Fields

Class

-

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Bibliography

DWPI Title

Intraoral imaging display system for dentistry field, has side surface dentition image combination unit that combines several partial dentition images formed by side surface dentition image formation unit to obtain dentition arch

Original Title

ORAL IMAGING AND DISPLAY SYSTEM

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JP201120197A / 2011-01-13 / JP

JP2011134633A / 2011-06-16 / JP

Abstract

DWPI Abstract

(WO2012096312A1)

Novelty

The system has a continuous shooting image rows formation unit that performs continuous shooting photography of the side surface of a dentition to form image rows. A side surface dentition image formation unit combines image rows formed by the continuous shooting image-rows formation unit. A side surface dentition image combination unit combines the several partial dentition images formed by the side surface dentition image formation unit to obtain dentition arch.

Use

Intraoral imaging display system for dentistry field, used during treatment of dental caries.

Advantage

Accurate medical-examination and explanation can be given to a patient using the display. Intraoral health can be examined effectively. The system is simple in structure so that the cost can be reduced.

Drawing Description

The drawing shows a block diagram of the intraoral imaging display system. (Drawing includes non-English language text)

11 - Intraoral image input unit.

12 - Medical-examination site detection unit.

13 - Unit picture formation unit.

14 - Medical-examination order setting unit.

15 - Medical-examination description formation unit.

Abstract

The system is configured so as to be provided with: a continuous image sequence-forming means for forming an image sequence by continuous imaging of the surfaces of the dental arch; a lateral dentition image-forming means for forming multiple partial dentition images with the image sequence formed by the continuous image sequence-forming means as partial dentition images and combining, starting with the image that is to become the center of the overall combined image; and a lateral dentition image-combining means for radially combining the multiple partial dentition images formed by the lateral dentition image-forming means, starting with the image that is to become the center of the overall combined image, to form the entire dental arch. Such a configuration allows the formation and display on a computer monitor of lateral panoramic dentition images using a hand-held intraoral camera, making it possible to suggest a broad range of dental treatments to patients as well as to promote active patient participation in dental treatment.

French Abstract

Le système est conçu de façon à comprendre : un moyen de formation de séquence continue d'images permettant de former une séquence d'images par imagerie continue des surfaces de l'arc dentaire; un moyen de formation d'images de la dentition latérale permettant de former plusieurs images partielles de la dentition avec la séquence d'images obtenue par les moyens de formation de séquence continue d'images comme image partielles de la dentition, et de les combiner, en commençant par l'image qui doit devenir le centre de l'image combinée globale; et un moyen de combinaison d'images de la dentition latérale permettant de combiner radialement les multiples images partielles de la dentition obtenues par le moyen de formation d'images de la dentition latérale, en commençant par l'image qui doit devenir le centre de l'image combinée globale, de façon à former la totalité de l'arc dentaire. Une telle configuration permet la formation et l'affichage sur un écran d'ordinateur d'images panoramiques de la dentition latérale au moyen d'une caméra intrabuccale portative, ce qui permet de proposer aux patients une large plage de traitements dentaires, et de favoriser la participation active des patients au traitement dentaire.

Classes/Indexing

IPC

Current IPC	Invention	Version	Additional	Version
Full	A61B 1/24 G02B 23/24	20060101 20060101	-	-
Main Group	-	-	-	-
Subclass	-	-	-	-

Original IPC	Invention	Version	Additional	Version
Advanced/Full	A61B 1/24 G02B 23/24	20060101 20060101	-	-
Core/Main Group	-	-	-	-
Subclass	-	-	-	-

ECLA

A61B 1/00C7B4 A61B 1/00C1D A61B 1/04 A61B 1/247

DWPI Class

P31 P81

DWPI Manual Codes

Expand DWPI Manual Codes

DWPI Chemistry Resource Numbers

Expand DWPI Chemistry Resource Numbers

DWPI Registry Numbers

Expand DWPI Registry Numbers

Plasdoc Punch Codes

Expand Plasdoc Punch Codes

Plasdoc Key Serial Codes

Expand Plasdoc Key Serial Codes

Enhanced Polymer Indexing

Expand Enhanced Polymer Indexing

Chemical Fragment Codes

Expand Chemical Fragment Codes

Legal Status

INPADOC Legal Status

Gazette Date	Code	Description
2013-08-15	ENP	ENTRY INTO THE NATIONAL PHASE IN: AU 2012206109 A 2012-01-11
2013-07-11	NENP	NON-ENTRY INTO THE NATIONAL PHASE IN: DE
2013-07-11	ENP	ENTRY INTO THE NATIONAL PHASE IN: CA 2824665
2013-07-10	WWE +	WIPO INFORMATION: ENTRY INTO NATIONAL PHASE US 13978939
2012-09-05	121	EP: THE EPO HAS BEEN INFORMED BY WIPO THAT EP WAS DESIGNATED IN THIS APPLICATION EP 12734447 A1

Get Family Legal Status

Family

Family

Expand INPADOC Family (19)

Expand DWPI Family (17); Countries (128)

Claims

Claims

All Claims (7)

Claims (English)

1. A continuous shooting image-rows formation means to carry out continuous shooting imaging|photography of the side surface of a dentition|gear_row, and to form image rows,
A side surface dentition|gear_row image formation means to synthesize|combine the image rows formed by the said continuous shooting image-rows formation means from the image which becomes the center in a whole synthesis|combination as a partial dentition|gear_row image, and to form a several partial dentition|gear_row image,
The side surface dentition|gear_row image combination means which carries out a connection synthesis|combination based on the image which becomes the center in a whole synthesis|combination between the several partial dentition|gear_row images formed by the said side surface dentition|gear_row image formation means, and forms the whole dentition|gear_row,
The intraoral imaging|photography display system which comprises these.

2. The mark setting means which sets the mark in which recognition on a picked-up image is possible to the predetermined position on a dentition|gear_row,
A continuous shooting image-rows formation means to form continuous shooting image rows about one side surface and the other side surface of a dentition|gear_row,
A side surface dentition|gear_row image formation means to form one side surface dentition|gear_row image and the other side surface dentition|gear_row image, respectively by synthesize|combining from the image for which a mark comes to a predetermined position about each of the continuous shooting image rows of said one side surface, and the continuous shooting image rows of said other side surface,
The side surface dentition|gear_row image combination means which carries out the connection synthesis|combination of said one side surface dentition|gear_row image and said other side surface dentition|gear_row image based on the characteristic part on the dentition|gear_row in the still image which has the said mark in a predetermined position
The intraoral imaging|photography display system of Claim 1 which comprises these.

3. The X-ray-image display means which displays the tooth|gear X-ray image corresponding to the said side surface dentition|gear_row image,
The virtual dentition|gear_row display means which displays the dentition|gear_row in which the tooth|gear corresponding to the said side surface dentition|gear_row image carried out imagination correction or virtual aesthetic appreciation coloring
The intraoral imaging|photography display system of Claim 1 which has these.

4. The dentition|gear_row display means which displays the dentition|gear_row image acquired by the said side surface dentition|gear_row image combination means,
An unit picture-ized means to image-form an intraoral area for every medical-examination improvement unit,
The setting means which sets medical-examination improvement order information with respect to the image unit-picture-ized by the said unit picture-ized means,
The display means which displays the image to which the said medical-examination improvement order information was attached based on medical-examination improvement order information so that a display is possible in list,
The intraoral imaging|photography display system of Claim 1 consisting of the display medium which carried out indicating record of the display information obtained by the said display means.

5. The input part which can input adjust the data relevant to dentist business, and the server which performs an external data process terminal and attendance management, or dentistry medical-examination management and the communication means in which a data communication is possible,
The display means which displays the data relevant to the dentition|gear_row image combined by the said side surface dentition|gear_row image combination means, and the said dentist business
The intraoral imaging|photography display system of Claim 1 which comprises the small and portable data processing terminal which has these.

6. The subdivision dynamic image data formed as a moving image which subdivided the dental treatment created previously is accumulate|stored, and it memorize|stores in a memory|storage means,
The intraoral imaging|photography display system of Claim 1 which has a data formation means for dental treatment description to form the data for dental treatment description and to display by the said display means, by selecting and connecting the said subdivision dynamic image data from the said memory|storage means.

7. An imaging|photography means of a hand-held type|mold to image-form the said intraoral area,
An irradiation means comprised for the said imaging|photography means to irradiate the illumination

light which instruct|indicates an imaging|photography site|part
The intraoral imaging|photography display system of Claim 1 which has these.

(Translation from Thomson Reuters)

Description

DWPI Drawing Description

The drawing shows a block diagram of the intraoral imaging display system. (Drawing includes non-English language text)

11 - Intraoral image input unit.

12 - Medical-examination site detection unit.

13 - Unit picture formation unit.

14 - Medical-examination order setting unit.

15 - Medical-examination description formation unit.

Description

Description

Intraoral imaging|photography display system

SUMMARY

TECHNICAL FIELD

This invention relates to the system which image|photographs intraoral [at large] and indicates by a panorama.

DESCRIPTION OF RELATED ART

The treatment of intraoral diseases, such as a dental caries, also complete|finishes hospital visit in many cases, after the target treatment finishes.
After a patient is aware of symptom, such as a tooth|gear pain and discomfort, the treatment of a dental caries starts in many cases and a treatment is complete|finished, there are many patterns which also complete|finish hospital visit,
It is said that it goes to hospital from this only after it is left to stand as it is and a dental caries advances when there is no subjective symptom, even if there exists a dental caries in addition to this in many cases.
Moreover, in such transient hospital visit, improvement in health intraoral [at large] cannot be attained, either, and there are no subjective symptoms, such as stain|pollution|contamination, a swelling, a defect|deletion, a dental calculus, abrasion, sialolith, and a malfunction,
However,
From the outside, an individual|principal does not know the symptom which can be seen in many cases, and there exists.

Although it cannot say that treating in single shot also for the management of dentist business has by no means good profitability, a suitable means to solve was not found.
For example, all the dentition|gear_rows are displayed by patent document 1 on a computer monitor, and the structure of the clear electronic medical chart is shown also from the patient side by coloring being attached|subjected to each tooth|gear.
The conspicuousness of a dentition|gear_row is requirements calculated|required also in informed consent,
However,
Even if it is a state with a part of all the clear dentition|gear_rows, in order to use for description of a

treatment, it expands more,
A structure which understands the treatment purpose is required.

Moreover, the structure which displays several sheets the intraoral image data image|photographed previously on the monitoring screen of a computer is described in patent document 2.
Furthermore, in patent document 3, tools for informed consent, such as an improvement of an understanding of technical terms, are indicated by the moving image which used the computer, and the presentation method by still image display.
Moreover, enabling such a presentation method to use for an education in an elementary school, a junior high school, each office, an institution for the aged, etc. is also described.
Furthermore, the fluorescence film which visualizes X-ray image, and the structure which makes it reflect by prism and image|photographs the visualized image with a camera are indicated by patent document 4.

As another dentistry-related patent document,
For example, the following literature can be mentioned.:
Patent document 5: Oral irrigating device with a video scope;
Patent document 6: The camera apparatus and method in an opening|mouth;
Patent document 7: Handpiece for a dentistry observation diagnosis;
Patent document 8: Hand switch of an intraoral camera;
Patent document 9: Display integrated oral-cavity camera;
Patent document 10: An intraoral imaging device and dental mirror;
Patent document 11: Dental imaging device;
Patent document 12: Assistance tool for a periodontal test|inspection;
Patent document 13: Scheduled inspection method and apparatus;
Patent document 14: Apparatus used in a dental environment;
And patent document 15: Medical X-ray-image detection apparatus.
[Prior Art Literature]
[PATENT DOCUMENTS]

SUMMARY of the Invention

PROBLEM to be solved by the Invention

Many intraoral observation by an image display is proposed,
However,
It is single shot-like [the former] eventually and remains in information provision to the patient on a local treatment system,
A system which attains improvement in health tooth|gear [at large / intraoral] is not reached|attained.

Moreover, when a dentist demonstrates a treatment to a patient, their intraoral image and X-ray image may be used with a dental camera, but image itself is difficult.

Furthermore, while an image intelligible for a patient and data make medical examination easy to demonstrate to a patient for a dentist, the interest in a patient's intraoral area and the increase in self-management volition are expectable,
However,
An apparatus, an image display, etc. which reply to such [still] anticipation are not proposed.

In order the dentist business must be conscious of the management with the increase in a dentistry clinic and to stabilize the management, the advance to a new dentistry medical examination, suppression of cost, a patient's acquisition gone to hospital continuously, and rationalization of dentist business are needed.
For example, there also exists a proposal of a portable terminal like the utility model registration 3131408 referred previously.

MEANS to solve the Problem

In view of the above, this invention is a continuous shooting image-rows formation means to carry out continuous shooting imaging|photography of the side surface of a dentition|gear_row, and to form image rows,
A side surface dentition|gear_row image formation means to synthesize|combine from the image which becomes the center in a whole synthesis|combination by making into a partial dentition|gear_row image the image rows formed by the said continuous shooting image-rows formation means, and to form a

several partial dentition|gear_row image,
It proposes comprising the side surface dentition|gear_row image combination means which carries out a connection synthesis|combination based on the image which becomes the center in a whole synthesis|combination between the several partial dentition|gear_row images formed by the said side surface dentition|gear_row image formation means, and forms the whole dentition|gear_row.
According to this invention, by comprising in this way, a clear panorama dentition|gear_row can be formed using the intraoral camera of a hand-held type|mold,
Furthermore, it becomes possible to extend the medical-examination range in dentistry by putting side by side and displaying a X-ray panorama dentition|gear_row image and the panorama dentition|gear_row which corrected [imagination-] or colored [virtual-aesthetic-appreciation-], or overlap|superposing and displaying it.

Furthermore, this invention is an unit picture-ized means to image-form an intraoral area for every medical-examination improvement unit,
The setting means which sets medical-examination improvement order information with respect to the unit-picture-ized image by the said unit picture-ized means,
The display means which displays the image to which the said medical-examination improvement order information was attached based on medical-examination improvement order information so that a display is possible in list,
The combination which consists of a display medium which carried out indicating record of the display information obtained by the said display means is proposed.
While raising the consciousness to a patient's treatment and attaining intraoral improvement in health by comprising in this way according to this invention, a patient's continuous acquisition are enabled and the improvement of the operating efficiency of dentist business is implement|achieved.

Furthermore, in addition, this invention are a processor, memory, and a communication means about the data processing performed using computers, such as data creation for dental personnel to demonstrate the content of a treatment using the method etc. which were mentioned above to the patient using the monitor of a computer etc., an attendance process of dental personnel, a medical treatment fee process,
It proposes carrying out with the small portable terminal provided with the input means and the display means.
By using this small portable terminal, it implement|achieves attaining rationalization of dentist business at this invention.

Finally the image shown by this invention shows a digital image,
Comprising:
You may use any of a moving image and a still image.
Moreover, "the image which becomes the center in a whole synthesis|combination" in this invention shows the image common to both in the case of combining two partial panorama images, for example.
It is a case where did not show only a final whole panorama dentition|gear_row image in the "whole", but three or more partial dentition|gear_row images are formed in it, for example,
Comprising:
The panorama dentition|gear_row image in the middle of the synthesis|combination obtained by combining two partial panorama dentition|gear_row images initially is also included.
"Synthesize|combining from the image which becomes the center in a whole synthesis|combination" means synthesize|combining the several still image obtained by continuously shooting the dentition|gear_row of a molar direction, and, forming a left part dentition|gear_row panorama image and a right part dentition|gear_row panorama image for example, from the image for which a part of one tooth|gear of the center of the surface of the anterior teeth comes in the center.
A "connection synthesis|combination" is with a left part dentition|gear_row panorama image and a right part dentition|gear_row panorama image, and means synthesize|combining by the site|part common to both, or connecting based on the site|part which can be connected, and synthesize|combining, for example.

This invention may set a mark to the image containing the part which becomes the center in synthetic|combination.
However,
With this mark, for example, it does not melt|dissolve easily with a saliva, water, etc., but has an elongate rectangular-shaped thing and short rectangular shape,
For example, it is the seal|sticker in which an adhesive agent, an adhesive, etc. were apply|coated to the back surface,
Comprising:

The deposit|attachment which can be peeled off is shown.
Moreover, it is possible to drop|remove not only a deposit|attachment but a color, and it may draw a mark on a tooth|gear with colored pens which are easy to image|photograph clearly, such as green and red.

Although it is preferable to arrange|position so that upper teeth and lower teeth may be started, the site|part which arrange|positions a mark may arrange|position only the direction to image|photograph, for example, when image|photographing only either one of the upper jaw or the lower jaw.
Moreover, the predetermined positions on the dentition|gear_row which arrange|positions a mark are an imaging|photography direction of a camera, and a position where it is changing holding method etc., and imaging|photography is interrupted or a motion rests still, for example,
Comprising:
The image which becomes the center in synthetic|combination is shown.

A mark should just be formed in the colors (green, blue, etc.) and shape which are easy to recognize on a picked-up image, and a material and a color are selected suitably.
Moreover, when acquiring a three-dimensional image, you may use the thing provided with characteristic third dimension.
A mark is displayed on the surface of a tooth|gear, and position display should just be clearly carried out to the image|photographed image,
From an intraoral camera, toward a tooth|gear, you may arrange|position the case where an irradiation means to irradiate the laser aim|sight light in which the dimension projected on the tooth|gear surface has a known shape from this, for example is provided, and the irradiation means which has an area of the light irradiated with illumination distance like a spotlight in correspondence so that irradiation is possible.

The synthesis|combination of a mark just begins from the image by which the mark was image|photographed by the predetermined position at least, and the imaging|photography direction may not need to be from a molar.
An imaging|photography direction and a synthetic|combination direction may not necessarily be reverse,
A mark carries out a partial synthesis|combination to right and left from the image displayed on the predetermined position at the time of a synthesis|combination,
A whole synthesis|combination is just performed based on the image as which the mark was finally displayed on the predetermined position.
The predetermined positions of the mark which starts a synthesis|combination are not only this but a partial synthesis|combination, and a whole synthesis|combination, although the case where a mark comes to the center of a picked-up image is illustrated for example.
WHEREIN:
A synthesis|combination should just be an easy site|part.

When, carrying out the partial synthesis|combination of the mark for example, about three side surfaces, the right of a dentition|gear_row, the center, and the left, such as a tooth|gear back side side surface, the intermediate|middle tooth|gear of right side and a center side surface and two teeth|gears of a center side surface and right side may be needed.
A several mark may be attached|subjected.
With "the side surface of a dentition|gear_row" as used in the field of this invention, not only front side but a back side and the occlusal surface may be included.
Continuous shooting shows image|photographing per second 30 or less sheets automatically.

A "synthesis|combination" is the panorama synthetic|combination method,
The existing method should just selectively be used for the method at the time of synthesize|combining,
Automatic or manual synthesis|combining methods, such as optical flow estimation methods, such as a simple synthesis method, simple enumeration-method, and block matching method and Lucas-Kanade method, can be utilized,
However,
It is preferable to incline and to adjust a magnification|multiplying_factor etc. by image adjustment means, such as an affine transformation, based on the common part between images, in advance.

The characteristic part in this invention is a thing of linear, dotted|punctate form, the shape of a figure, or three-dimensional shape which shows the coupling|bonding position at the time of couple|bonding a partial dentition|gear_row panorama image,
Comprising:
For example, when combining two side surface panorama images, the boundary line of the center

anterior teeth and the anterior teeth is shown, but not only this but site|parts in which even the anterior teeth has the characteristics, such as a tooth|gear and a front-end|tip of a gum, are contained.

The intraoral area in an unit picture-ized means to image-form an intraoral area for every medical-examination improvement unit shows area|regions, such as a tooth|gear, a dentition|gear_row, a gum, an alveolar bone, lips, palatum durum, soft palate, and uvula palatina.

A medical examination and a treatment are included, and at dentist, it may examine on "medical examination" and may perform a treatment on it in a special medical institution.

They are a dental caries, a periodontal disease, cancer of the tongue, cancer of the gum, etc. as a "medical-examination improvement unit",
Preferably, the range of one medical examination and a treatment is shown, and also improvement of stain|pollution|contamination, correction, etc., a prevention process, and semi- medical examination may be shown.

Application|coating etc. of preventive agents, such as a thing of a grade conquerable by application|coating of brushing, a fluorine, and a prevention-of-mouth-odor agent, etc. with "improvement", a preventative action which apply|coats a fluorine to a tooth|gear, a cleaning, a periodontal disease,
These action is shown.

"Imaging" shows the state by which the 2-dimensional or 3-dimensional display of the state etc. which were printed and printed was given to the paper other than converting into the image data in which the output display to the monitor (display) apparatus of a computer and a mobile telephone display part is possible.

By an unit picture-ized means, the medical-examination improvement order information of the setting means which sets medical-examination improvement order information shows a symbol, agreement, a numerical value, etc. which show the order|rank of medical examination, prevention, and improvement with respect to the unit-picture-ized image,
Comprising:
In addition, the data of medical-examination date-time, the advancing condition of a disease, an estimation of disease advancing, etc. are shown,
What is necessary is just to be able to determine the order of medical-examination improvement with respect to an at least some unit picture.
It is a parameter for a calculation other than the content which can carry out visual confirmation directly,
Comprising:
It confirms by computer arithmetic processing.

"It displays so that a display is possible in list", a medical-examination improvement order is a list at least,
Comprising:
As long as it is a state which can recognize the whole easily, you may be comprised in what was printed on a plurality of paper, the state which replaced and displayed two or more images by the scroll, etc.

The display medium which carried out indicating record of the display information obtained by the display means shows the state which printed and printed on 1 or more sheets of paper, and a booklet, and was displayed on them, and the state which displays the image data based on patterns, such as JPEG, GIF, and BMP, so that a carrying|mobile_telephone is possible,
A display medium may show the shape of a paper, a booklet-like paper medium, a USB memory, an SD card, a display apparatus, a mobile telephone equipped with recording elements, such as a memory, etc.
However,
A patient carries at least,
Printing, a printing matter, an electronic image, etc. which can see an intraoral area are shown.
Moreover, it is on the homepage|website display on the internet, and it is contained also when browsing its intraoral data,
From this, the personal computer of a desk-top type|mold or notebook type is also contained in a display medium.

The optical path of this invention of irradiated light is comparatively long in order to utilize a reflective mirror, and an imaging|photography position and an imaging|photography range can be clarified by using aim|sight light sources, such as LED equipped with the breadth based on an angle of beam spread.

Moreover, in the intraoral camera using a reflective mirror, this invention enables dentist etc. to understand an imaging|photography position clearly also by the image image|photographed through this reflective mirror.

Furthermore, this invention measures the angle information of a main body for the attitude|position of the intraoral camera which moves in every direction by a gyro sensor, derives the angle of a mirror from the angle of this main body, and grasps|ascertains in what kind of state it exists.
By adjusting the attitude|position of an image from an imaging|photography state, it is realizable that the image of an always clear state is displayed irrespective of the state of the camera which moves in every direction.

In this invention, position sensors, such as an angular velocity sensor (gyro sensor) and an acceleration sensor, are used.
Specifically, acceleration sensors, such as a MEMS sensor angular velocity sensors, such as the rate gyro which outputs an angular velocity, the rate integral gyro which outputs an angle, an attitude gyro, a MEMS(micro electro mechanical systems) type, other machine types, an optical type, a piezoresistance type, an electrostatic capacitance type, and heat|fever detection type, are illustrated.

The color of the aim|sight light in this invention should just be a color discriminable from the color of illumination light, and as for aim|sight light, red, green, etc. will be illustrated if illumination light is white.
Moreover, although a timing just before a user starts imaging|photography is preferable, short-time irradiation is sufficient as the timing of irradiation of aim|sight light during imaging|photography.

Furthermore, this invention is a portable terminal with which a body can be mounted|worn,
Comprising:
It is a memory|storage means to an inside,
A computer, and the modulation-demodulation means for communication and a display means with the exterior are arrange|positioned,
Enabling the input-output of dentist business at large can perform a dentistry worker at large, an electronic medical chart, medical treatment fee calculation, etc. by a hand,
And it is enabled for the number of persons restricted by synchronizing sharing, a display, etc. in such information to also disperse|distribute the office work of dentistry office work and medical-examination relation, and to perform it,
Rationalization of dentist business is implement|achieved from this.

It is preferable that the interface for operation is arrange|positioned in the position which can be operated in the case of a treatment as for this invention,
However,
By the physical requirements that the method of operation does not change with operators or a finger|toe does not reach an interface,
According to an inoperable condition and the condition (For example, it is when between is required etc. to an oral presentation and a screen display.) of demonstrating to a patient, an adjustment means by which the method of the operation of operation of the interface for operation and actual execution operation|movement of an interface performs time-delay is provided.

This will also enable GUI operation adjusted in the frequency|count of adjusting delay time with the frequency|count of pushing so that it may perform in 2 second, or pushing the timing of a display of a display means, time to push, etc., when a switch will be pushed twice continuously, if it is [for example, the interface for operation] switches.

Furthermore, this invention takes in X-ray image, overlap|superposes with an actual image, or connects the X-ray image for every tooth|gear, for example, and forms a panoptic image,
It overlap|superposes with the actual image by which the imaging|photography coupling|bonding was carried out similarly, and provides the means which enables the panoptic comparison from the side surface of a dentition|gear_row.
The much more understanding with respect to a patient's treatment is implement|achieved by performing the stacking|superposition of this actual image and X-ray image, juxtaposition, etc. on a display means.

Furthermore, this invention is connected with a computer terminal with a radio|wireless or a wire communication,
A liquid-crystal-display part, a ten-key pad, etc. are equipped depending on the case, and a user's arm,

a leg|foot, and the terminal with which another site|part can be mounted|worn are formed,
It is possible to make it possible to perform an input-output with computer terminals, such as patient information, by a hand, and to perform the acknowledgement at the time of giving treatment explanation for every past data which a dentist needs for a treatment, or patient in the state which is not in sight from a patient,
Exact medical examination to a patient, treatment description, etc. are enabled.

Namely, the portable terminal equipped with the input part which inputs a dentistry relevant information, and the display part which displays a dentistry relevant information, a recording means to record a dentistry relevant information temporarily or continuously,
You may be together put with the dentistry medical-examination system which consists between a host terminal and a portable terminal equipped with a process means to process a dentistry relevant information based on a predetermined algorithm, and a center terminal of an information transmission means to perform information transmission with a radio|wireless or a wire communication,
In this case, each dental personnel may mount|wear bodies, such as an arm, a leg|foot, upper half body, and lower body, with a portable terminal, and may carry it,
It is good also as sharing of the information in which all dental personnel or one part of those is displayed being possible.

centralized management set it as the structure which can be carried so that it may come out and show, and also may use it as a personal computer of a tablet type or a desk-top type|mold, and concerning [this system / said] dentistry also in that case may be performed.

This portable terminal can be input-output, and since it is a terminal which can process information, dentist business relevant informations, such as intraoral information, dentistry medical-examination information, dentistry office information, and dental-personnel information, are manageable across the board.
Specifically display the corresponding information from peripheral devices, such as software and an intraoral camera, etc., or,
Although what shows the state which shares the data of the state which can perform the memory|storage of input processing, such as addition of novel data, correction, and deletion, and data, another portable terminal, and a host terminal, synchronizes them, and can perform display and input processing is illustrated, it is not restricted to this,
A display, recording, and input processing of the dentistry information to require can be performed from a portable terminal at least.

On the monitoring screen of a computer, it is indicated to the screen of a portable terminal by a menu, for example,
In addition, whenever a user selects each information in a mouse|mouth etc., all the information of a specific patient is separately made for a display as a window screen on the display and one screen on which a screen switches.

A user inputs selection, the novel|new, correction, deletion, etc. according to the display content of a screen.
Input may be performed using a built-in ten-key pad and virtual ten-key pad, or you may be performed by the selection in a mouse|mouth, a ten-key pad, etc. of an input character which were preset.

Moreover, each employee may perform input of a dentistry employee's attendance using his own portable terminal and a host terminal, for example, or an attendance person in charge may input the novel|new, correction, deletion, etc. from his own portable terminal or host terminal.
When dental personnel have a portable terminal, respectively and only the person in charge makes the process possible, respectively, you may set a password to a person in charge.

Centralized management is one terminal, for example, and it shows the case where input-output presenting of dentist business relevant informations, such as intraoral information, dentistry medical-examination information, dentistry office information, and dental-personnel information, can be performed,
Even if it is not only this but some [the] information, it is contained if it responds to the target management object.

This invention is formed by combining further the subdivision image like parts previously subdivided in the menu of the dental treatment,

It makes it possible to form images for description, such as a still image according to the treatment for every patient, sliding motion drawing, or a moving image.

It is preferable that the subdivision image is previously created by CG image and the moving image by a tooth-extraction image, an antagonistic-tooth extension image, the illustration image of a processed material etc., for example.
A dentist, dental hygienist, etc. select these from the treatment menu display of an implant treatment, a prosthesis treatment, etc. based on a patient, it couple|bonds together, or a patient selects and couple|bonds together.

Selection selects each subdivision image, and if it is made to perform continuously on a computer, it is sufficient for it.
Moreover, two or more preselected existing moving images are prepared, and a dentistry worker or a patient may see during a treatment before a treatment and after a treatment as a combination moving image for treatment description depending on the case.

Since this connected image can form the content adapted to a patient's own treatment condition, it can anticipate the effect to much more understanding and educational campaigns, such as dental-caries prevention.
You may use what image|photographed the patient's image for the same image-like type|formula by the moving image of the shape of these parts, and an imaging|photography means, converting it,
It is intelligible for a patient, and also proposes the treatment system which is easy to use it for users, such as a dentist.

ADVANTAGE of the Invention

This invention enables the clear panoptic display by an actual image about a one part or all part of dentition|gear_row,
Furthermore, X-ray image can be accumulated, or written together and displayed depending on the case,
From this, intelligible medical-examination explanation can be given with respect to a patient using the said display.

Moreover, while enabling this invention to display correctly the imaging|photography position of the intraoral camera which used the reflective mirror, the imaging|photography attitude|position of the imaging|photography unit which moves an intraoral area in every direction is grasped|ascertained,
Adjustment of a picked-up image in a clear state is enabled.

A patient is always recognizing one's intraoral condition and the necessity for medical examination by the display means displayed as a list by the paper or the recording medium so that carrying was possible, possibility of performing continuously the medical examination and improvement for the improvement in intraoral health becomes high, and improved management of him, such as an improvement of the profit in dentist business, also becomes possible.

This invention is processing the process of dentist business at large using the portable terminal in which digital data processing is possible, and also makes rationalization and cost reduction possible.

BRIEF DESCRIPTION OF THE DRAWINGS

[FIG. 1]
FIG. 1 is a block diagram which shows one Example of this invention.
[FIG. 2]
FIG. 2 is a schematic diagram for describing an Example.
[FIG. 3]
FIG. 3 is a schematic diagram for describing an Example.
[FIG. 4]
FIG. 4 is a schematic diagram for describing an Example.
[FIG. 5]
FIG. 5 is a block diagram which shows the other Example of this invention.
[FIG. 6]
FIG. 6 is a schematic diagram for describing an Example.
[FIG. 7]
FIG. 7 is a schematic diagram for describing an Example.
[FIG. 8]

FIG. 8 is a schematic diagram for describing an Example.
[FIG. 9]
FIG. 9 is a schematic diagram which shows one Example of this invention.
[FIG. 10]
FIG. 10 is a schematic diagram for describing an Example.
[FIG. 11]
FIG. 11 is a schematic diagram for describing an Example.
[FIG. 12]
FIG. 12 is a schematic diagram for describing an Example.
[FIG. 13]
FIG. 13 is a block diagram which shows the other Example of this invention.
[FIG. 14]
FIG. 14 is a schematic diagram for describing an Example.
[FIG. 15]
FIG. 15 is a schematic diagram for describing an Example.
[FIG. 16]
FIG. 16 is a schematic diagram for describing an Example.
[FIG. 17]
FIG. 17 is a schematic diagram for describing an Example.
[FIG. 18]
FIG. 18 is a block diagram which shows one Example of this invention.
[FIG. 19]
FIG. 19 is a schematic diagram for describing the Example of this invention.
[FIG. 20]
FIG. 20 is a block diagram for describing the Example of this invention.
[FIG. 21]
FIG. 21 is a block diagram for describing the Example of this invention.
[FIG. 22]
FIG. 22 is a schematic diagram for describing the Example of this invention.
[FIG. 23]
FIG. 23 is a schematic diagram for describing the Example of this invention.
[FIG. 24]
FIG. 24 is a block diagram for describing the Example of this invention.
[FIG. 25]
FIG. 25 is a block diagram for describing the Example of this invention.
[FIG. 26]
FIG. 26 is a block diagram for describing the Example of this invention.
[FIG. 27]
FIG. 27 is a schematic diagram for describing the Example of this invention.
[FIG. 28]
FIG. 28 is a schematic diagram for describing the Example of this invention.
[FIG. 29]
FIG. 29 is a block diagram for describing the Example of this invention.

EMBODIMENT of the Invention

Then, the various forms and Examples for implementing this invention are described in detail, referring drawings.
However, this invention is not limited only to the following form,
Please understand that a various change and improvement are possible in the scope of the present invention.

It is the method of this invention carrying out continuous shooting imaging|photography of the dentition|gear_row, combining the partial panorama image by a panorama synthesis|combination, and these partial panorama images, and forming the whole panorama dentition|gear_row,
Comprising:
By the structure which preferably arrange|positions a mark in a synthetic|combination part, it makes it possible to form easily a dentition|gear_row panorama image with a hand-held camera.

This invention acquires the unit picture corresponding to medical examination and improvement from a medical checkup in the case of dentistry medical examination, and the other oral-cavity images image|photographed at home using an intraoral camera and an X-ray imaging apparatus.
This unit picture is projected on the monitor (display) apparatus for computers which can be seen, for

example together with a patient,
While a patient recognizes an intraoral condition, with a dentist The order|rank of medical examination, the start period of medical examination,
While printing or making a printing|printed_character and the mobile telephone equipped with the storage medium memorize|store the medical-examination improvement order information obtained by filling in the degree of the necessity for medical examination, etc., and an unit picture in 1 sheet of paper, it is a homepage|website which he displays on the monitor of a mobile telephone, or a dentist opens otherwise,
Comprising:
It displays on the screen only for an individual.

This invention is a portable terminal with which a body can be mounted|worn,
Comprising:
It is a memory|storage means to an inside,
A computer, and the modulation-demodulation means for communication and a display means with the exterior are arrange|positioned,
By making possible an input-output and data processing of dentist business at large, dental personnel can perform a dentistry worker's attendance management, electronic medical chart entry, medical treatment fee calculation, etc. by each hand,
And such information is shared.
A portable terminal is wirelessly connected through media, such as infrared rays and light, or is connected with a host terminal with a wire communication.
Or a portable terminal may have a computer specification linked to the cloud-computing-ized computer network through wireless LAN, wired LAN, etc.

(1st Embodiment)
Fig.1 (a) is a figure which shows one Example of this invention.
In the figure, the reference number 11 is an intraoral image input means, for example, is an apparatus which image|photographs and obtains digital image data using the camera for image|photographing all the teeth|gears of the upper jaw and the lower jaw.

The intraoral image input means 11 are a reflection type dental camera using a convex mirror as shown in FIG.3(c), and the other cameras for intraoral imaging|photography using a fish-eye lens, for example,
Comprising:
The digital image of all the teeth|gears is output.
Or as shown in FIG. 6, each tooth|gear is image|photographed with a normal intraoral camera, an outline is extracted from each picked-up image, and it connects and synthesize|combines in the common part of the outline, and may use the method of acquiring all the tooth|gear images, etc.

12 is a medical-examination site|part detection means,
For example, it is a thing for setting the tooth|gear for medical examination or improvement, and its tooth|gear predetermined range,
Graphics software is used by an extensive intraoral image to visual observation input by the intraoral image input means 11,
It cuts out and extracts.
Or that center is calculated|required assuming the outline which extracted the tooth|gear outline by the process of software, was calculated|required, and was extracted to be a circle|round|yen, and the process etc. at which a radius extracts the image of a radius longer 10 % - 20% than an outline from this center are shown.

13 is an unit picture formation means,
Forming of the image for the medical examination obtained by the medical-examination site|part detection means 12 is carried out to a display,
It is a thing for forming the image which added the medical-examination order|rank and the area|region as which a comment is filled in.
The creation display of the form is automatically given because the unit picture formation means 13 designates a medical-examination site|part by icon operation by software by the medical-examination site|part detection means 12 mentioned above.

A user may designate himself the form of the unit picture display created separately when an image project|reflects only a designated range from the image input by the intraoral image input means 11.
When an unit picture is displayed, you may also image|photograph and display an image with the camera using the suitable reflective mirror shown in FIG. 3.

The display is displayed in moving image at first in an unit picture area, and it is pushing a determination button after that, it may decide, and may display it as a still image.

14 is a medical-examination order|rank setting means,
For example, according to the advancing condition of a dental caries, and the grade of medical-examination improvement, while a dentist does a consultation with a patient arbitrarily, the advancing condition of a dental caries and deformation degree of a shape are measured automatically,
You may determine an order|rank.
The determination of an automatic order|rank expresses the difference in a tooth|gear color numerically, and compares with a fixed threshold value, or,
From a tooth|gear unit form, if [fixed] there exists the deformation degree at all, it has exceeded, or when the magnitude|size of the spectral content based on the wavelength with respect to the illumination light source of a dental-caries detection wavelength is more than predetermined value, referring the order|rank is performed, and you may change the order|rank of the image on the screen of a monitor (display) apparatus.

The above-mentioned change determines the order|rank of a treatment and a medical examination, after talking with a patient,
Rationality of consultation hours can be intended because the order|rank of the unit picture arrange|positioned on a screen is changed automatically and performs printing for patients by pushing a determination button from this, after deciding.

15 is a medical-examination description formation means,
It is a means by which a dentist fills in as data the content which thinks that a patient needs entry of the medical-examination start stage, the urgency of medical examination, or the medical-examination method like the medical-examination order|rank setting means 14.
This entry The input from the keyboard (for example, 315 of FIG. 3) of a computer,
The input by operating the button|peony which accompanies a camera main body in the state which selection of the existing established theory bright|clear by operation using a mouse|mouth (for example, 316 of FIG. 3) and the operation button of the intraoral camera shown in FIG. 3 connected to the input interface of a computer may be used.

Although a medical-examination start date or the date of a scheduled medical-examination start is entered in 23b from the cell 21b which the medical-examination description formation means 15 shows in FIG.2(e) from FIG.2(c), as for this date, the medical-examination possible shortest day may be displayed automatically.

It is a day as which the shortest day which can be medical-examination started calls the date entry_column of a scheduled medical-examination start in the database of each patient recorded and accumulate|stored by the recording means 17, and it is not entered in it,
Comprising:
You may have a function set so that the shortest day may be displayed.

A concrete structure is shown in FIG.1(b).
This is the structure of a part of medical-examination description formation means,
Comprising:
The state which abbreviate|omitted others is shown.
151 is patient database calling means,
Comprising:
It is the database with which the image data, order|rank data and treatment start date (time is included) data which are shown in FIG. 2, and description data were recorded,
From what general management is made, related data are recorded on a temporary recording area.
When this has many stored data, the structure which goes data to a database for call|nominal every time it test|inspects may be sufficient.

The shortest medical-examination day search means 152 outputs this as a shortest medical-examination day, when the date in which medical-examination start date data are called, and the medical-examination start date is not entered from this inside is searched from the search start date and there exist data not corresponding.

153 is the shortest medical-examination day display means, and is a means to display date-time searched and detected by the shortest medical-examination day search means 152 on the display part on an unit picture.

154 is an empty medical-examination day display means,
Open medical-examination date-time is displayed intelligibly,
For example, you may perform the display of a unit, several month unit, or an one-year unit for one month on computer monitors, such as an informality display of an analog timepiece and a calendar|calender.

155 is a determination input means and is an input part for starting recording in a database with a patient's consent.

156 is a recording means,
It is a means to perform recording in a database,
However,
This recording means 156 is the same as the recording means 17,
Definite recording may be carried out by the recording means 17,
However,
Medical-examination date-time has possibility that the other doctor has stood the schedule similar to a patient simultaneously,
From this, a rapid ⊡G-⊡^ base needs to be recorded,
It is preferable that recording in a database is performed from this immediately after determining.

When returning it to Fig.1 (a) again, 16 is the display output means,
Edit the image which consists of an unit picture, a medical-examination order|rank, and medical-examination description on the screen of the monitor (display) apparatus of a computer, and it displays, or prints and prints the image edited on the paper using the printer (for example, 317 of FIG. 3).

17 is a recording means and it is for recording the edited image data,
Comprising:
It is a means for recording as some electronic medical charts which dentist equipped, or recording on a patient's mobile telephone and a computer through a storage medium.
The recording means 17 contains the database which stored the whole patient's data from the data of patient each.

Next, FIG. 3 shows and demonstrates an example of an intraoral camera.

That the reference number 301 is a housing|casing for a holding|grip, and should form a pencil-shaped intraoral camera, it forms by a cylindrical form and internally_contacts|inscribes in the USB connection circuit for connection to a circuit board and the exterior, and the USB socket inside.

The camera unit 309 is integrally connected at the front-end|tip,
For example, as shown in FIG.3(e), the camera unit 309 arrange|positions a CCD camera at the center,
The structure which, and is arrange|positioned at equal intervals around it is shown. [white LED, LED of another color, and the element 312 for other illumination]

302 is a reflective-mirror unit,
The plane mirror 303 arrange|positioned at an angle 45 degree|times, for example connects at a front-end|tip,
A rear end is inserted-connected on the outer periphery of the camera unit 309, and the cylindrical part 305 is formed in the exchangeable state.
It is preferable that a setting which the external shape of the camera unit 309 and the internal shape of the cylindrical part 305 of the reflective-mirror unit 302 are formed by ellipse shape, and does not rotate at the time of insertion mounting|wearing is made|formed.

The reflective-mirror unit 302 is exchangeable timely,
The state equipped with the reflective-mirror unit which FIG.3(b) equipped with the plane mirror 303, and FIG.3(c) are the state in which the reflective-mirror unit 310 to which the spherically-shaped convex mirror 308 was set carried out the insertion coupling|bonding with the camera unit 309.

Thus, when image|photographing all the teeth|gears, the reflective-mirror unit 310 which connected the convex mirror 308 of FIG.3(c) is used,
The convex surface reflective image|video of the convex mirror 308 is image|photographed with the camera 313 of the camera unit 309,
The output light of the element 312 for illumination reflects the convex mirror 308,
An intraoral observation part is irradiated.
As for the camera 313, a CCD pattern, a C-MOS pattern, etc. are illustrated, and although high quality is

more preferable, it may be used for resolution|decomposability for an image quality by the case constituted mainly of a moving image, making it low.

In normal imaging|photography, insert in the outer periphery of the camera unit 309 the cylindrical part 305 of the reflective-mirror unit equipped with the plane mirror 303 shown in FIG.3(b), and it is made to couple|bond together, and uses.

304 is a lead wire and can utilize the exclusive electricity lead wire, a general purpose USB cable, etc.

306 and 307 are operation buttons, and are button|peonies, such as 1 or several press-type, rotary types, these combination-types,, and it showed them two by the present Example.
The selection which cameras, such as on-off of a power supply, were operated, and also was displayed on the monitor monitor 314A of the computer 314 connected through the lead wire 304,
The GUI (graphical, user interface) function which pushes this operation button 307 and operates the display window for operation may be provided.
For example, when rearranging in order of an order|rank automatically after the order|rank of an unit picture is decided, these operation buttons 306 and 307 are operated, and execution is made possible.

For example, it is good also as the button|peony which corresponds 306 to the left-click function of a mouse|mouth, and a button|peony which corresponds 307 to a right-click function.

314 is a computer and illustrates the thing in which the monitor (display) 314A and the integrated type were formed.
In addition, the combination as a dedicated device may be sufficient.

315 is a keyboard and 316 is a mouse|mouth for computers.
It serves also as all and the switch for being used as an object for computer operation, and also operating an intraoral camera.

It is a printer, 317 is formed with the color printer of an inkjet system and a laser system, etc., and when a patient is printed and provided with his intraoral image, it is used.

FIG.3(d) shows the reflective-mirror unit 318 which used the concave mirror 311 as a reflective mirror,
Comprising:
For example, when you require an extensive image, it uses.
Moreover, when image|photographing only inner side extensively from a dentition|gear_row in an intraoral case, the curvature of the concave mirror 311 is adjusted in the direction close|similar to a plane mirror,
By image|photographing from the place from which some were left|separated, the wide range image shown by this invention may be acquired from a dentition|gear_row.

In this invention, not only a dentition|gear_row but ����, a lip, a gum, etc. may be handled as a wide range image and an unit picture.
For example, expression of tongue cancer can display a polyp as an unit picture, and it can utilize suitably this invention in the case of demonstrating medical examination, etc.

Next, this invention is demonstrated with reference to FIG. 6 which showed an example for forming all the tooth|gear images.
The reflective-mirror unit 302 using the plane mirror 303 as shown in FIG.3(b) is used for the camera to be used.
Moreover, rest digital drawing imaging|photography may be sufficient as an image, and digital video recording may be sufficient as it.
In addition, since it is an object for video recording when obtaining a several still image from a moving image digital image and a pixel count becomes comparatively small, it is preferable to image|photograph moving a still image with an auto shutter.

It image|photographs moving the plane mirror 303 of the reflective-mirror unit 302 to 612 directions from the photographing face 601 with respect to all the teeth|gears of the lower jaw 600 shown by Fig.6 (a).
In digital video recording, it is the same as that of the case where a still image is input by a 30 sheet / second grade,
From this, if the reflective-mirror part of the intraoral camera for digital video recording is moved along the locus|trajectory of the photographing faces 601-612 of Fig.6 (a), many still images will be calculated|required.

In addition, since there are many pixel counts and resolution|decomposability is higher than still image acquisition according [the direction of still image continuous shooting|imaging] to video recording, it becomes a preferable aspect when acquiring each tooth|gear image from these tooth|gear images of all the.

FIG.6(b) has shown a part of each image at the time of performing imaging|photography shown by Fig.6 (a).
613 is a common partial image of the images 601 and 602, 614 is a common partial image of the images 602 and 603, and 615 is a common partial image of the images 603 and 604.
In addition, it image|photographs so that a common partial image may be acquired by each of 604, 605, 605, 606 and 606, 607 and 607, 608 and 608, 609 and 609, 610 and 610, 611 and 611, and 612.

For example, these images are binarized, and in the state which acquired the outline, the outline of the common part is overlap|superposed so that it may correspond between images.
Furthermore, it image|photographs and image-forms in image 605, 606, 607, 608, 609, 610, 611, 612 and order, each image is connected based on a mutual common part, and all the tooth|gear images are acquired.
A panorama-like occlusal-surface image can be formed with a well-known panorama synthetic|combination software,
However,
Since an image is correct|amended before a synthesis|combination when rocking|fluctuation by hand-holding influences, it may be preferable to perform an affine transformation process.

Next, operation|movement of the said Example is demonstrated in detail with reference to FIG. 2.

For example, all the intraoral upper-jaw teeth|gears are image|photographed by the intraoral image input means 11.
The position of the image|photographed image is shown to Fig.2 (a).
The intraoral image input means 11 should just be an image which the tooth|gear which the dentist made medical-examination object at least is contained, and is understood into which intraoral part it corresponds.

The image shown by Fig.2 (a) may be image|photographed by the intraoral imaging|photography unit shown, for example in FIG.3(c), and also may calibrate, and may correct|amend distortion.
Moreover, the intraoral image input means 11 may always be all the teeth|gears, and may be a case where it is a partial tooth|gear, and one tooth|gear.
Fig.2 (a) shows the upper jaw 20 and all the teeth|gears and a palatum-durum part are also image|photographed,
It may carry out by combining the medical examination of this site|part.

Next, the medical-examination site|part detection means 12 extracts the site|part which requires medical examination and improvement automatically or manually.
When extracting manually, similarly to graphics software, it designates with a tablet|circle or a square|rectangle|intersection using a mouse|mouth, and a copy, cutoff, etc. are carried out, and also this is affixed by an affixing operation|work.
20a, 20b of Fig.2 (a) and 20c show the state which indicated the circle|round|yen of the color which is conspicuous by graphics software for the tooth|gear made into object by the instruction|indication manually or automatically.

Indicating by an instruction|indication manually is the mouse|mouth and keyboard attached to a computer are operated and they are a circle|round|yen, a square|rectangle|intersection, and another outline figure etc.,
Comprising:
An inside is drawing that by which the permeation|transmission process was carried out,
Indicating by an instruction|indication automatically are a circle|round|yen of a predetermined radius, a square|rectangle|intersection of a predetermined area, etc., when it has a pointer in a designation|designated site|part and a button|peony is pushed with a mouse|mouth for example, on a screen,
Comprising:
That by which the permeation|transmission process of the inside was carried out is displayed.

Next, the designated tooth|gear 20a which is shown in FIG.2(c) is adjusted to the unit picture 21 by the unit picture formation means 13.

In that case, the addition setting of the medical-examination start date column 21b filled in after determining the order|rank column 21a which fills in an order|rank after determining the order|rank of a treatment, for example, for example, a treatment start, and the description column 21c which fills in what kind of medical examination is carried out is carried out.
The order|rank of FIG. 2 displays this shortest medical-examination day on the medical-examination start date column 21b of an earliest unit picture, for example.
When a patient agrees with respect to this day, it moves to the determination input means 155, this day is determined, and it records on a patient's database by the recording means 156.

When a patient does not agree, an empty medical-examination day is displayed in a two-dimensional format like a calendar|calender format by the empty medical-examination day display means 154.
This display should just be a display with a patient intelligible at least, although the method of schedule displays, such as a looked-through type and hand turning-over type, is employ|adopted.

In addition, since not only the date but time is required, it is preferable to be carried out by combining a timepiece display.
When there exists consent of a medical-examination start date based on this display, that date-time will be input by the determination input means 155, and it will record on a database by the recording means 156.

It moves to the unit picture of the following order|rank, and determination entry of the same medical-examination start date is carried out.

Since such schedule operation of a medical-examination day needs to avoid confusion with a schedule with the other patient who did not arise with a transient medical examination when this invention sets the several date of a scheduled medical examination, it is effective in schedule clarification.

In addition, what entered the ID number in one of columns for every tooth|gear may be used.
The box display for input etc. for which this column is used in a database are shown, and the medical-examination day can determine automatically the day open from the other patient's medical-examination schedule,
When an unit picture is displayed from this, you may display the vacant time from another patient's data.
The image before a treatment should just have a column as which a treatment order|rank is displayed at least, or the display content in these frames may attach|subject identification agreement to each, and may display it.

FIG.2(d) is the unit picture 22 which shows the tooth|gear 20b for the medical examination of Fig.2 (a), and FIG.2(e) is the unit picture 23 which shows the tooth|gear 20c for the medical examination of Fig.2 (a).

Order|rank column 22a, medical-examination start date column 22b, and the description column 22c are integrally displayed on the unit picture 22, and, as for FIG.2(e), the order|rank column 23a, the medical-examination start date column 23b, and the description column 23c are similarly displayed on it integrally in the unit picture 23.
In addition, when deciding, a determination button (the virtual button|peony displayed on the screen is included) is pushed.
By pushing a determination button, you may rearrange and display along the number of an order|rank entry_column, and creation time of the paper finally passed to a patient can be shortened by automating this operation|work.

The figure shown in FIG. 2 may show the state as which the whole is displayed on the monitor monitor of one computer.
In this case, it may already serve as the operating range in the display output means 16.

By the medical-examination order|rank setting means 14, while a patient talks with dentist itself or dentist, it determines and fills in the order|rank of order|rank column 22a.
Medical-examination start date column 22b and the description column 22c are similarly filled in by the medical-examination description formation means 15.
Since this entry includes many special content, dentist may perform it independently previously.

The display output means 16 forms and displays the several unit picture settled on the computer screen, and the state by which all the tooth|gear images are published.

When the display output means 16 is performed at the time of dentistry medical examination, etc., displaying on one screen is preferable.

However, when there are many unit pictures, it may shrink|reduce in that a scroll is also performed ���� if needed, or you may display on a thumbnail form.
Furthermore, with a printer, the image in the settled display output means 16 may be printed on a paper, and may be distributed to a patient.
A patient is possessing one's intraoral area by an image, and going to hospital in order to attain intraoral improvement in health is anticipated.
And after the completion of medical examination, as again shown in FIG. 1, intraoral imaging|photography is performed.

An image display as shown in FIG.2(b) by using the tooth|gear 20a of the same site|part as the unit picture 24 is performed.
24 d is a medical-examination site|part and the order|rank display as which 24a searched the image data same from the image data to which it is the medical-examination order|rank setting means 14 for example, and the medical-examination order|rank was set previously, and was displayed at that time is performed.
The matter of record at the time of treating 24b, for example by the medical-examination description formation means 15, etc. are described previously.

And the unit picture after the medical examination shown by Fig.2 (a) is an unit picture before medical examination,
Comprising:
It displays in the location adjacent to the same thing, and the reliance for dentist and the timing of hospital visit for the maintenance of the treated tooth|gear can be recognized.
24c is the description column after medical examination, for example, and its description column for consulting the start of the next medical examination with a patient is more preferable.

And by the display output means 16, the image of 4 sheets as shown, for example by 400 of FIG. 4 in 1 sheet of paper with a printer is printed, a patient is passed, and the necessity for continuous medical examination is given to a patient.
In addition, 400 is although the intraoral wide range image shown by Fig.2 (a) is not published,
Preferably a wide range image is published, it is clarifying a medical-examination site|part and a patient's much more understanding is obtained.

Each display column of FIG.2 and FIG.4 is an example, and the number of the display columns per unit picture and a display content are also suitably selected according to the objective of a treatment, a schedule, etc.

(2nd Embodiment)
Next, another Example is shown and described to FIG. 5.
The reference number 51 is a wide range image input means in the figure,
It is a means for image|photographing all the teeth|gears of the intraoral upper jaw, and all the teeth|gears of the lower jaw,
For example, a wide range image is acquired by image|photographing with a camera all the teeth|gears projected on the convex mirror shown in FIG.3(c), or a common part is synthesize|combined from continuous shooting|imaging as shown in FIG. 6, and the still image which comprises a digital moving image,
You may form all the tooth|gear images.

52 is a tooth|gear detection means and is a means to extract each tooth|gear image data from the dentition|gear_row obtained by the wide range image input means 51.
Extraction is very good in a means to image|photograph and one-image-ize each tooth|gear using the plane mirror shown in FIG.3(b) other than a means only for a predetermined range to extract the periphery further by an outline extraction program, and to form the image of one tooth|gear for example,
However,
A means to cut out an unit picture from all the tooth|gear images or an intraoral wide range image, and to form the image of one tooth|gear may be rational and more preferable.

53 is an unit picture formation means and is for respectively adding an order|rank entry_column, a medical-examination description entry_column, etc. to each image acquired by the tooth|gear detection

means 52, and forming the image for a display.
Furthermore, it is preferable to form the database for teeth|gears, and to attach|subject and manage an intrinsic|native symbol.

54 is a medical-examination image selection means,
It is a means for selecting the tooth|gear used as medical-examination object, such as a dental caries and a defect|deletion, from an image,
A dentist may read and compare visual observation or the data registered previously, and may select as a tooth|gear of medical-examination object by the difference of a color, a shape, etc.

55 is a medical-examination order|rank setting means,
A dentist determines the tooth|gear order to treat independently, and also while a patient talks with a dentist based on the image by which project|reflected on the monitor (For example, the monitor 314A of Fig.3 (a)) of a computer or printing|printed_character printing was carried out, you may determine.

56 is a medical-examination description formation means,
The arrangement with dentist itself or a patient may fill in the period of medical examination, a start date, the content of medical examination, the necessity for improvement, etc., or it may display the description previously recorded by the magnitude|size of the difference by the comparison with previous data.

57 is the display output means,
The display image used as medical-examination object is displayed on 1 sheet of paper, or is displayed on the monitor (for example, 314A of Fig.3 (a)) of a computer,
You may be provided to a patient's consent and the description for obtaining an understanding.
Moreover, the image printed on the paper is provided to a patient, and continuous dentistry medical examination is implement|achieved as a future medical-examination schedule.

58 is a recording means,
It records as a patient medical sheet or a database, or it may upload to the storage area only for a patient of a server, or may record tooth|gear image data on the recording part of a patient's mobile telephone.

Next, operation|movement of the Example shown in FIG. 5 is demonstrated with reference to FIG. 7.
In a present Example, all the teeth|gears are image|photographed by the wide range image input means 51 from a patient's intraoral area, and the image data 700 of all the teeth|gears which consists of 1 sheet or several sheets is formed (refer Fig.7 (a)).
The image data 700 which shows all the teeth|gears can make an example what connected and formed the still image shown in FIG. 6.
From the obtained wide range image data 700, by the tooth|gear detection means 52, it is manual or forms a tooth|gear image automatically.

As the method of detecting a tooth|gear automatically, outline extraction of the intraoral image data is carried out by an outline extraction program, and a tooth|gear outline is detected, respectively.
In this case, when an outline is incomplete, several of those points|pieces are detected and the virtual circle which passes several of these points|pieces is formed.
Since it can consider that this virtual circle is a position of one tooth|gear, only predetermined value extends a radius further from the assumed center, and it extracts that range as an image of one tooth|gear as a square|rectangle|intersection surface.

It comes to show the extracted image, for example in FIG.7(b).
It is the tooth|gear image 701 with respect to the tooth|gear 71, is the tooth|gear image 702 with respect to the tooth|gear 72, and is the tooth|gear image 703 with respect to the tooth|gear 73.

Next, by the unit picture formation means 53, in these tooth|gear images, an identifier etc. are linked|related with a patient's information and it unit-picture-izes (refer FIG.7(c)).
The display column 704 for entering a medical-examination order|rank etc. in the unit picture 74 as the tooth|gear image 701 is published.
At the unit picture 75, the tooth|gear image 703 and the display column 706 are published at the tooth|gear image 702, and the display column 705 and the unit picture 76, respectively.
These unit pictures are recorded on the preset patient database, and form a patient's up-and-down intraoral data list.

By the medical-examination image selection means 54, visual observation or automatic extract the unit picture 77 which shows the tooth image used as medical examination or the improvement object out of an unit picture (refer FIG.7(d)).

It is the medical-examination order|rank setting means 55 which has the structure similar to FIG. 1 and performs the same operation|movement, and the medical-examination description formation means 56, and he is respectively dentist itself.
or
The medical-examination order|rank etc. are filled in looking at the unit tooth|gear image preferably reflected to the monitor of the computer with the patient.

And a medical-examination order|rank determines,
You may display in the state edited in the step where the medical-examination start date etc. were written in further including a wide range image as it showed in the display output means 57 in the arrangement|sequence of an unit picture by which it was indicated by the order as shown in FIG.7(e) to the monitor 78 of a computer, or FIG.7(f),
Recognition of medical examination and the condition where consent is obtained by continuous medical examination can be formed in a patient.

It is preferable that the unit pictures 707, 708, 709, and 710 are located in a line in order of a treatment start.
FIG.7(f) is the screen display which contains all the tooth|gear image data 711, for example, or the printed-matter-ized tooth|gear data 79 which a patient carries.

The recording means 58 records these unit pictures on a database, and is suitably utilized for adjustment of another patient's schedule.

Moreover, in the case of wide image acquisition, this invention may move along a dentition|gear_row the method using the convex mirror shown in FIG. 3, or a reflective mirror, may merge the method of couple|bonding and obtaining a still image, and may form the image of 1 sheet.
That is, only a dentition|gear_row is used as a still image, the site|part of a tongue is image|photographed using a convex surface reflective mirror, and the intraoral wide image equipped with the dentition|gear_row without distortion by carrying out an image synthesis is acquired.

Furthermore, an example of the panorama dentition|gear_row image formation method which synthesize|combines and forms a panorama-like dentition|gear_row in clarity in the state which clenched its tooth|gear is shown to FIGS. 8-12.

As shown in FIG. 8, the image image|photographed from left back|inner is image|photographed to a central region with a camera,
Direction of an intraoral camera is changed,
The method of carrying out continuous shooting imaging|photography even of the central region from right back|inner is taken,
However,
In this case, an imaging|photography state is interrupted in order to change the direction of a camera once,
The synthesis|combination of a dentition|gear_row image on either side is not made correctly, but shifts|deviates from this in many cases.

Moreover, in imaging|photography of a molar, the action shot of the camera by manual control is arrange|positioned between cheek flesh of an intraoral inner surface, and a tooth|gear side surface, for example,
Since an intraoral camera is moved in a state which pushes away this cheek flesh or a contact state with a tooth|gear side surface is formed, cheek flesh and a tooth|gear side surface will be in the state supporting the reflective mirror of an intraoral camera, and the imaging|photography site|part of a camera,
However,
When an intraoral camera is moved to an anterior-teeth direction, it will be released from compression by cheek flesh, etc.,
It will be in a hand-held state and the position of the camera to image|photograph becomes unstable,
An image is disturb|confused easily.
Distance with the tooth|gear side surface which is especially a camera and a to-be-photographed object

is fluctuate|varied, or a blurring comes out for imaging|photography, the tooth|gear magnitude|size which is a to-be-photographed object may be fluctuate|varied, or distortion may arise in an image.

The intraoral camera 901 using the reflective mirror shown in FIG. 8 is the structure which the structure shown in FIG. 3 was illustrated and put LED for light sources in multiple arrangement|array|sequence around the module-like CCD camera and the C-MOS camera,
Comprising:
While performing illumination by LED for light sources to an intraoral area through a reflective mirror, images, such as an intraoral dentition|gear_row, are acquired in continuous shooting,
It can image|photograph stably from a molar,
The camera for [instead of what is restricted to this] the radiograph which does not use a reflective mirror is used.

The intraoral camera 901 used here the reflective-mirror unit 903 (302 of FIG. 3) provided with the planar reflective mirror 902 (303 of FIG. 3),
A CCD camera,
What provided the structure which carries out mounting|wearing use as replacement|exchange with the front-end|tip of the main body 904 (301 of FIG. 3) equipped with the imaging|photography unit 905 (309 of FIG. 3) which combined imaging devices, such as a C-MOS camera, and the illuminator which has arrange|positioned the light emitting diode around [about 4-8] an imaging device at the front-end|tip being possible is illustrated.

What outputs a still image digital image using the continuous shooting method in which the imaging|photography unit 905 image|photographs a still image so that an image may be acquired in per second 10 to 30 sheets is illustrated.

The mark ML which attaches|subjects the mark ML to the central region of the dentition|gear_row 900a of the state which clenched its up-and-down tooth|gear beforehand by the time it began continuous shooting imaging|photography,
What can be vividly displayed on an image by camera imaging|photography, such as description with the coloring pen which can drop|remove temporary adhesion of the colored seal|sticker and a color, is preferable.
Center vicinity at the time of attaching|subjecting the mark ML to center vicinity of a dentition|gear_row shows the place used as the reference|standard at the time of synthesize|combining, after carrying out continuous shooting imaging|photography of the dentition|gear_row on either side,
Comprising:
In addition, the site|part used as the image process top characteristics may be detected, and the site|part may be set on a mark image in the central region of the image|photographed image.
It is preferable that the mark ML arrange|positions so that an upper tooth and a lower tooth may be started.

It is a position of a molar about this continuous shooting operation|movement,
Comprising:
For example, a tooth-surface is met like 906b and 906c from the state of 906a,
Preferably only the same distance is released|separated from a dentition|gear_row side, and it has the main body 904 by hand, and moves and image|photographs the reflective mirror 902.

IG is a display part for correction|amendment and they are the parallel crosses for image correction, a square|rectangle|intersection, the triangle, grid_pattern|squares, and another figure at the sticking member to which it adheres in the state which can peel on the tooth|gear surface,
Comprising:
What is necessary is just the display based on the distance between distortion, camera, and tooth|gear side surface of an image which can correct|amend the magnitude of an image, etc.
Moreover, if the color of the display part IG for correction|amendment also attaches|subjects discriminable color in green and other image processes, it will not restrict green.

This sticking member is the tooth|gear center, for example, as shown in FIG.8 and FIG.10,
Comprising:
The tooth|gear which may be affixed on the tooth|gear surface which attached|subjected the mark ML, and is affixed may affix and image|photograph a sticking member not only for one tooth|gear but for a several tooth|gear, and it is another tooth|gear,
Comprising:

By an intraoral area, there is no other support and you attach|subject to the site|part which image|photographs a tooth|gear manually.

The method similar to the mark ML should just be used for the means which attaches|subjects the display part IG for correction|amendment to the tooth|gear surface,
A display correct|amends both image distortion and a magnitude|size based on the display part IG for correction|amendment which using the thing which does not melt or spread was illustrated and was image|photographed in common with both with the saliva etc. in the left dentition|gear_row one part panorama image and the right dentition|gear_row one part panorama image,
It is suitable when couple|bonding together.
In addition, when [at which it divided|segmented into the left dentition|gear_row, a center dentition|gear_row and the right dentition|gear_row, and three] couple|bonding a panorama image in part, you may provide the display part IG for auxiliary|assistant in the common tooth|gear of each partial panorama image rows.

The correction|amendment in each image|photographed still image is also due to the display part IG for auxiliary|assistant used as a reference|standard within the image obtained by continuously shooting, for example, or
Or in the image|photographed image group, one of those [the] by which the display part IG for correction|amendment is image|photographed is detected with a block matching method, a template matching method, etc., and it is based on this,
The display part IG for auxiliary|assistant image|photographed by the other image was detected,
Then, compared with a reference|standard image, the difference of distortion, inclination, and a magnitude|size, etc. may be detected and expansion, shrinking|reduction, rotation, and correction|amendment using the affine transformation which carries out adjustment by movement may be performed.
In the case of the imaging|photography by which rocking|fluctuation by manual control is not avoided, it becomes compoundable [for the stable panorama dentition|gear_row image formation] by attaching|subjecting the display part IG for auxiliary|assistant to a tooth|gear.

Correction|amendment of the image using the above display parts IG for correction|amendment may use the method used by the calibration of camera images, such as the method (IEEE.Transactions on pattern Analysis and Machine Intelligence,22(11);1330-1334,2000) of Zhang, for example.
Moreover, the display part IG for correction|amendment may not be essential by the process of an imaging|photography state, an affine transformation, etc.

FIG.8(b) actually shows 1 time of the imaging|photography range at the time of continuously shooting from a molar in schematic drawing.
The continuous shooting image by a still image is acquired moving the reflective-mirror part of an intraoral camera sequentially like 906a->906b->906c->906d->906e->906f->906g.

Since the intraoral camera 901 consists of a structure provided with the reflective mirror 902 which had a predetermined angle at the front-end|tip, supposing it image|photographs the dentition|gear_row side from the left back|inner tooth|gear in the figure, it will be a central region and will change direction of the main body 904,
It image|photographs sequentially from a right back|inner tooth|gear in the figure,
A 906-g surface was image|photographed from 906e shown in FIG. 8 from this,
Then, the intraoral camera 901 is reversed,
The imaging|photography from a right back|inner tooth|gear starts.

In order that the speed of continuous shooting may move the main body 904 manually, it considers the influence of rocking|fluctuation, such as camera shaking, and image|photographs it more mostly as about 30 sheets from per second 20 sheets,
The thing with allowances to delete the image which camera-shook and was out of focus to do for continuous shooting imaging|photography is preferable.

Although it is preferable to image|photograph until the mark ML comes in the center of a imaging|photography screen or a reflective mirror, this continuous shooting is performed to the site|part which went through it to some extent or more, and selects the image|photographed image after that.

It may be more preferable to have affine-transformed based on the common site|part of each image, and to prepare the state of an image before a synthesis|combination, for camera operation by manual control.

For example, a several point [with respect to a comparison image / matching method / block / on the basis of the image which becomes the center in the synthetic|combination beginning] is detected.
The following image is affine-transformed based on this common several point.
For example, two or more pixel coordinates (xb, yb) of the following image corresponding to the pixel coordinate (xa, ya) of the reference|standard image in a common part are chosen, and it substitutes in following Formula, and acquires the value of coefficient value a-f.
You may perform a panorama synthesis|combination, preparing an image, after affine-transforming the following image and arranging|tidying_up an image in the state which substituted coefficient value in following Formula.

[EQUATION 1]
[MAT_IMAGE "JPOXMLDOC01-appb-M000001.tif"]

Thus, a part of image obtained by continuously shooting from left back|inner to front vicinity in the figure of the dentition|gear_row 900a is shown in FIG. 9, and it uses together with FIG. 8 and demonstrates the imaging operation of an intraoral camera based on the said Example.

It is an example of the picked-up image data sequence at the time of FIG.9(e) carrying out continuous shooting imaging|photography of center vicinity 907c in the picked-up image data of the dentition|gear_row shown in FIG.8(b) to 907e vicinity from Fig.9 (a).
In addition, since the intraoral camera had acquired the dentition|gear_row image using the reflective mirror 902, the picked-up image was shown in FIG.9 and FIG.11 in the state which has not been inverted, in order to make it intelligible, although right and left were reversed.

Fig.9 (a) image|photographs 906c vicinity of FIG.8(b),
FIG.9(b) image|photographs 906d vicinity,
FIG.9(c) image|photographs 906e vicinity,
FIG.9(d) image|photographs 906f vicinity,
And FIG.9(e) is the image which image|photographed 906g vicinity.
In addition, since it image|photographs manually, it cannot image|photograph in the state with always same picked-up image in many cases.
Therefore, when the image is slanting, it is a part which overlaps another tooth|gear state, for example, and it is preferable to carry out correction|amendment prepared using an affine transformation, and FIG. 9 has shown the figure after correction|amendment.
In the case of correction|amendment, you may use the perpendicular|vertical center line CL beforehand set to the reflective-mirror surface where the reflective mirror 902 other than the mark ML was image|photographed, and the horizontal center line HL as a site|part used as one reference|standard.

The grade which puts marks, such as a processus|protrusion, on the site|part which is not necessarily displayed on an image and corresponds to the edge of a reflective mirror at the starting point and the end point of a perpendicular|vertical center line and a horizontal center line, respectively may be sufficient as the perpendicular|vertical center line CL and the horizontal center line HL,
Based on this mark, it may display hypothetically|virtually.

Moreover, in accordance with the process correct|amended by a software, you may perform distortion with the lens of the CCD camera for imaging|photography.

RM was an outline of the mirror, and although the image|photographed actual image turned into a circular shaped image within the outline RM, in order to make range description easy to carry out, it was displayed as the image of the square|rectangle|intersection.

Since the image image|photographed is hand-holding, the distance between a tooth|gear and a camera may differ.
However,
In this case, you may correct|amend the magnitude|size of another picked-up image on the basis of the image which the mark ML and the vertical center line CL substantially corresponded|coincided.
In addition, the image acquired may be stabilized by performing continuous shooting imaging|photography, making the front-end|tip part of the reflective mirror 902 contact a tooth|gear surface lightly.

As shown in FIG. 8, the reflective mirror 902 of the main body 904 is arrange|positioned in the molar of the left side from a front, and it is made to move to a front direction after that, and continuously shoots, for example, acquires the image of Fig.9 (a) - FIG.9(e).
In this case, the image which carried out imaging|photography acquisition at the timing to which the

mark ML corresponded is employ|adopted as the vertical center line (CL) of the reflective mirror 902 as an image for synthetic|combination (to FIG.9(c)).
It is more preferable not to use it for a synthesis|combination, since it may become a cause of a shift|offset|difference at the time of a synthesis|combination when FIG.9(d) or subsequent ones is used.

On the basis of the mark ML, the inclination of an image, etc. are correct|amended if needed that the image shown in FIG.9(c) should be made the image of a reference|standard.
That is, it is good also as a reference|standard image to correct|amend an image on the basis of the long side and short side of the mark ML.
The example of 1 synthetic|combination operation is demonstrated below.

The image employ|adopted as a synthesis|combination was shown after FIG.9(f).
It corresponds in the image which FIG.9(f) shows in FIG.9(c), FIG.9(g) is corresponded in FIG.9(b), and FIG.9(e) is corresponded to Fig.9 (a).

The image 906e shown in FIG.9(f) and 906 d of images shown in FIG.9(g) are overlap|superposed and combined based on the common part which the shape of the image of 906 d of images corresponds or approximates on the basis of the image 906e.

When it overlap|superposes on the basis of FIG.9(f), the part protruded to the left surface of FIG.9(g) is shown by 1001a.
1001a becomes an image of a molar direction.

Next, the synthesized image shown in FIG.9(g) and the image 906c shown by Fig.9 (a) are overlap|superposed with visual observation or an image processing technique in the part into which a shape etc. are common on the basis of the synthesized image of FIG.9(g).
It is the overlap|superposed image,
Comprising:
The part protruded into left direction from FIG.9(g) was shown by 1001b.
1001b becomes an image of a molar direction.

By overlaying|stacking in the image to which said operation|movement is carried out between the images adjacent to the next and also which the next adjoins, and a common part, a mark synthesize|combines from the image in a predetermined position in panorama image to a molar direction, and forms a left side dentition|gear_row.

In addition, the method of connecting partial 1001a, 1001b.... protruded into the center image shown in FIG.9(f), and forming the panorama image of a left half can be illustrated.

Moreover, the detection of the overflowing part extracts the part overflowing among 906 d of 906e and FIG.9(b) of FIG.9(c), for example,
Furthermore, the part overflowing between 906c of 906 d and Fig.9 (a) of FIG.9(b) is extracted,
Furthermore, the parts overflowing between the images which the next adjoins may be collected, this overflowing part may be connected as an image which finally showed the reference|standard image in FIG.9(f), and a panorama image may be formed.
It may be preferable that the image of the overflowing part overlap|superposes the image which adjoins from it on the basis of the image from the center.

In addition, even if it is a case where overlap|superpose completely, and it does not correspond or approximate, when a marker part exists in common, the part may be overlap|superposed and the same synthesis|combination may be performed.
In addition, since it is manual, depth perception and inclination may be different for every still image obtained.
In this case, it correct|amends automatically using an affine transformation etc., or what is zoom-scaled arbitrarily and adjusted is preferable.

The synthetic|combination state is shown to Fig.12 (a).
As shown by Fig.12 (a), the panorama dentition|gear_row image of a left half can be formed.

next, as shown by Fig.10 (a), continuous shooting imaging|photography by a still image is performed in the direction which approximates 1101a->1101b->1101c and the center in the dentition|gear_row 900a surface while maintaining fixed a distance as possible in the upper and lower sides or the state which has arrange|positioned the reflective mirror 104 of the main body 103d to the seen right back|inner of the dentition|gear_row 900a of a state.

The positional relationship of the still image and the dentition|gear_row 900a which are image|photographed by FIG.10(b) was shown in schematic drawing.

Having the intraoral camera 901 by hand, a user makes it move to the direction of 1102a->1102b->1102c->1102d->1102e->1102f, image|photographs, and acquires a still image in continuous shooting.
Since this example is a hand-held type|mold, a picked-up image inclines in right and left and a depth direction, or shifts|deviates,
However,
An affine transformation is utilized,
It may rotate based on the common part which exists between the adjoining images obtained by continuously shooting, and may provide the process of moving and adjusting an image.

Since the thing of FIG. 8 was being used for the intraoral camera 901 shown by Fig.10 (a) as it is, it attached|subjected the same number and abbreviate|omitted description.

In Fig.11 (a) to FIG.11(e), the typical image was shown in 1102 f from 1102a of FIG.10(b).
About the structure which is common between FIG. 11 and FIG. 9, the code|symbol same as the code|symbol shown in FIG. 9 was attached|subjected.

In FIG. 11, Fig.11 (a) shows 1102-d image vicinity of FIG.10(b),
FIG.11(b) shows image vicinity of 1102e of FIG.10(b),
FIG.11(c) shows 1102-f image vicinity of FIG.10(b).
Moreover, FIG.11(d) shows 1102-g image vicinity of FIG.10(b), and FIG.11(e) shows 1102-h image vicinity of FIG.10(b).

In addition, FIG. 11(d) and 11(e) is a photograph image at the time of moving the reflective mirror 104 to left direction, after the vertical center line CL and the mark ML correspond,
Since the part of the stacking|superposition of the image image|photographed from the left-right direction will increase and the shift|offset|difference of an image will arise when these images are employ|adopted, this is not employ|adopted but FIG.11(c) is employ|adopted from Fig.11 (a).

In said image, the thing on the basis of the image (1102f of FIG.11(c)) to which the mark ML and the vertical center line CL corresponded is shown in FIG.11(f).
Next, an images [which are shown in FIG.11(b) / 1102e and 1102f] common site|part is overlap|superposed.

The part which protruded the image 1102e from on the on the basis of 1102 f of images in the state overlap|superposed in the range which a shape corresponds or approximates is 1201a.

Next, it overlap|superposes by the site|part which uses the pattern matching method etc. on the basis of the image which overlap|superposed this overlap|superposed image and the image 1201b shown in FIG.11(b), and a shape corresponds or substantially corresponds|coincides from on that.

The part overflowing in the overlap|superposed state is 1201b.
The image which adjoins in this way is overlap|superposed, and it goes, and forms the dentition|gear_row of the right side.
What is synthesize|combined as another synthesis|combining method as the reference|standard image 906e and the images 1201a and 1201b are shown in FIG.12(b) is used.
In addition, when the image of back and front is overlap|superposed and there exist some shift|offset|differences, any one of the overlap|superposed locations is deleted.

1102 f of center images at the time of combining the center image 906e at the time of synthesize|combining the continuous shooting still image and combining the image of the left dentition|gear_row in the above procedure, and the image of the right dentition|gear_row are overlaid|stacked,
The panorama dentition|gear_row shown in FIG.12(c) is formed by making it correspond or substantially correspond|coincide.

It is preferable that a stacking|superposition carries out the connection synthesis|combination of the panorama dentition|gear_row on either side, for example based on the boundary part (KL) of a center tooth|gear and a tooth|gear.
In addition, the boundary of a tooth|gear and a tooth|gear is used bordering on the tooth|gear boundary part of the upper jaw or the lower jaw, in order to respond|correspond, when it differs by the upper jaw

and the lower jaw,
You may synthesize|combine,
The synthesis|combination in that case synthesize|combines the panorama dentition|gear_row of only the upper jaw, and the panorama dentition|gear_row of the lower jaw, respectively,
Finally the upper jaw and the lower jaw are synthesize|combined.
When there exist some shift|offset|differences between center images, also in that case, it is the overlapping range, and it may erase|eliminate any one image.

Moreover, it is not necessary to necessarily overlap|superpose the center image 906e and 1102 f of center images, and they just employ|adopt one of the center images 1301 beforehand.
In that case, when some when the center image 906e is employ|adopted, it is a magnitude|size of 1201a, 1201b etc. may be corrected, for example and 1102 f of center images are employ|adopted, the magnitude|size of 1001a, 1001b may be corrected.
Thus, when not extracting the overflowing part other than the method of join|connecting the overflowing part between each image but overlap|superposing in the common part as it is, a stacking|superposition may be carried out, adjusting a magnitude|size for center images.

Thus, from a center image, a dentition|gear_row on either side is synthesize|combined, it is set as a left side synthetic|combination dentition|gear_row and a right side synthetic|combination dentition|gear_row, and formation of the panorama dentition|gear_row which restrained the shift|offset|difference is enabled by synthesize|combining these based on each center image.

It is preferable for the synthesis|combination based on a center image to make a characteristic part the contact line (edge) of a center tooth|gear and a tooth|gear, for example, and to synthesize|combine a left side synthetic|combination dentition|gear_row and a right side synthetic|combination dentition|gear_row.
In addition, it may be a tooth|gear site|part etc. which a mark does not necessarily have the need that a center tooth|gear is attached|subjected, and are image|photographed at the timing which changes the direction of a camera in the case of imaging|photography.
The position of a mark is suitably selected for the other objective etc.

Like a mark, a characteristic part is a site|part which can be aligned at the time of an image synthesis, and it is not specifically limited.
Moreover, a more exact synthesis|combination is attained by setting the site|part which attaches|subjects a mark to the dentition|gear_row which is a to-be-photographed object beforehand, or it corresponds from an image to a mark.

In addition, the above operation|movement description uses graphics software,
The copy paste according the several image displayed on the computer monitor to visual observation and mouse|mouth operation,
When it carries out based on operation of the reduction/enlargement of drag and drop and an image, deskew, etc., the well-known software for automatic panoramic photograph synthetic|combination, for example, Photoshop Elements 7 (a trademark, the Adobe make), Photo Stitch (a trademark, Canon company make) etc., may be able to be utilized.

[Creation of a three-dimensional panorama dentition|gear_row image]
A dentition|gear_row is the shape in an arch shape curved with respect to the occlusal plane,
When grasping|ascertaining the whole actually, each tooth|gear mode is known in the panorama display by two-dimensions,
However,
Since it displays on planar shape in the state with which the tooth|gear is located in a line, 3-dimensional grasping|ascertainment is inadequate,
The method which can be displayed three-dimensionally from this is preferable.

The method of acquiring a panorama image with an intraoral actual image image|photographs the whole dentition|gear_row by what formed the flame|frame which has the shape approximated to the dentition|gear_row arch home|platform rough form similar virtual type curve, for example in international publication (WO) 2007th / 063980 No. pamphlet, and has arrange|positioned the imaging device on the side surface,
Acquiring the panorama image of three-dimensional three-dimensions by making this into a stereo format is described.
Surely, although the image of a dentition|gear_row can be image|photographed in three-dimensional shape, there exists a surface which is hard to be called measurement method simple at the point which

requires formation of the flame|frame provided with the arch home|platform ◆T◆Y similar virtual type curve.

Next, the Example which forms the three-dimensional panorama image by an actual image is shown and described to FIG. 13.
FIG. 13 is a block diagram for demonstrating a three-dimensional panorama dentition|gear_row image formation means.

The reference number 1401 is an imaging|photography data entry means,
The camera provided with two or more cameras for stereo image photography as shown in FIG. 14 is connected,
It is a means to form simultaneously the image of the same number of sheets as the number of objects of a camera.

The imaging|photography data entry means 1401 is equipped with the pattern which pushes a shutter for every sheet, and the structure which image|photographs a several photograph by pushing a shutter once and whose imaging|photography was enabled in continuous shooting,
A pair of several still image may be output continuously.

1402 is a calibration means,
It is a means for performing correction|amendment of distortion by a lens shape, camera shaking, etc., correction|amendment of a far and near distance, etc.,
The well-known method what is called of a calibration means is used, and it is comprised.

A calibration is performed to each of the image image|photographed simultaneously, and the calibration means 1402 may delete a periphery part with large distortion.

1403 is a common point detection means, for example, is a means for detecting the common feature of a pair of image.
The common point detection means 1403 makes the luminance value of one pixel of a one side's image, or a mass of pixel the luminance value for references|standards,
The luminance value of one pixel of another image or a mass of pixel is used,
For example, the part estimated by the part or the sub pixel estimation which takes total (SAD) of a brightness|luminance difference and the sum-of-squares (SSD) value of a brightness|luminance difference, and corresponds with the minimum value or maximum value is output as a common feature.

More specifically, you may utilize the structure and the other well-known method which are shown by the optimization of the correlation function in the block matching of an image other than the Gen Arai group, and a sub pixel designation|designated system, the Information Processing Society of Japan report of research, 2004, and P33-40, for example.

1404 is a world coordinate conversion means and is a means to convert the coordinate of each image of the acquired common feature into an entirely common three-dimensional coordinate.

The world coordinate conversion means 1404 is performed by computer processing by the arithmetic methods, such as trigonometry, the 8 point|piece algorithm method, a triangulation, for example,
The formation output of a parallax value and the characteristic (The position of two cameras which are a focal distance of the lens which is an internal parameter, an image center, pixel size, and an external parameter, and an attitude|position) of a camera to world coordinate (X, Y, Z) is carried out from the coordinate value of each photograph image of the common feature acquired by the said common point detection means 1403.

For example,
Based on following Formula (1) generally known, world coordinate (X, Y, Z) is calculated|required from the local coordinate (u1, v1) of the common feature M of the perspective-projection matrices P1 and P2 which consist of the internal parameter different, respectively and external parameter of a camera, and the image image|photographed, respectively, and (u2, v2).

[EQUATION 2]
[MAT_IMAGE "JPOXMLDOC01-appb-M000002.tif"]

A perspective-projection matrix is calculated|required using the internal parameter of a camera, and an external parameter, or
The perspective-projection matrix P_1, P_2, and (omega)1 and (omega)2 are calculated|required from the

local coordinate etc. of the several common feature acquired from each still image,
Regarding the method of acquiring a world coordinate based on the above Formula(1) etc., the well-known methods, such as the Journal of the Institute of Electronics, Information and Communication Engineers and a method described in Vol.92, No.6, 2009, 463-468, are used suitably, for example.

In addition, as the method of acquiring a three-dimensional coordinate, although it describes in for example, the dental material and an instrument, Vol.19, No.3, 333-338(2000), etc. with the close-up photography method, not only this but a method general in addition to this can be taken.

The reference number 1405 is a three-dimensional image formation means,
For example, the said world coordinate data are displayed on the three-dimensional coordinate space hypothetically|virtually formed on the computer,
You may form the wire frame model which ties this coordinate data with a straight line or a curve, and displays it,
Furthermore, more realistic panorama three-dimensional data are obtained by affixing virtual surface data on the part enclosed by the line|wire.
You may carry out three-dimensional panorama-like dentition|gear_row data as [display / a curved-shape dentition|gear_row] by making stereoscopic on a three-dimensional coordinate.

1406 is a display means,
It may form with the monitor for computers, a printer, etc., and you may display as a virtual three-dimensional image on a normal computer monitor,
Furthermore, you may project and display the curved panorama-like dentition|gear_row image on two-dimensions.

FIG. 14 shows an example of the probe 1500 for three-dimensional measurement of the shape of a probe equipped with two cameras at the front-end|tip.
1501 is the imaging part A, and the lens 1501a is arrange|positioned at the center and it has what is called a camera module form.
1502 is the imaging part B, and the lens 1502a is arrange|positioned at the center and it has what is called a camera module form.

1503 is an illumination light irradiation part,
Preferably it is provided in the circumference|surroundings of imaging part A1501 and imaging part B1502,
It is a part which irradiates the tooth|gear surface which is a to-be-photographed object from the illumination light irradiation part 1503 through the optical leading path 1504 about the light which the light-emitting means 1505 formed in the inside of the supporting member 1506 emitted.
The illumination light irradiation part 1503 is not identified as the shape which it was preferable that it is a shape where more uniform illumination is performed, and was shown by FIG. 14.

1503a is a light source for an instruction|indication, and it is a thing for showing a photographing face,
Comprising:
It is a part which performs the output like a spotlight, and LED, such as the red, blue, white which covered the periphery by black cylindrical body, is used.
Since it is the light like a spotlight, a probe 1500 can be moved from the areas of an irradiation surface differing according to distance, keeping it constant.

1504 is an optical leading path and it is preferable that form in supporting member 1506 inside and the surface is coat|covered with light reflection members, such as thin films, such as aluminum and silver.
The optical leading path 1504 has connected with the illumination light irradiation part 1503.

1505 is a light-emitting means, it mounts|wears in the supporting member 1506 and white LED and another light source are illustrated.
In a present Example, an intermittent flash drive like electronic flash, a continuous illumination drive, etc. may be performed.

It is a supporting member, for example, shape|molds by a lightweight and hard plastics material, and an imaging part etc. are arrange|positioned at a front-end|tip, and 1506 is cylindrical and has a shape which is easy to insert to the intraoral back.

1507 is a switch for operation and performs shutter operation etc.
The number should just be arbitrary structures that what is necessary is to just be set according to the operation specification or the objective.

When using it as a shutter, while pushing, a specification which performs a shutter drive continuously by predetermined spacing can also be taken.

1508 is a holding part, it is comprised integrally with the supporting member 1506, and shape|molding by a lightweight and strong plastics material etc. is preferable.

1509 is an electric lead wire for making the connection of an external power supply, a connection, an external data processing apparatus, etc., etc., and the cable using a USB connection connector may be utilized.
In addition, a light source is electronic flash light emission,
Comprising:
In the case where continuous shooting data can be temporarily memorize|stored inside a camera, and the case where it wirelessly connects using Zigbee (trademark) and the front end circuit for radio|wireless communication, a connection means may become unnecessary.

Subsequently, the operation|movement of a present Example shown in FIG.13 and FIG.14 is demonstrated.

In the imaging|photography data entry means 1401 of FIG. 13, a user,
Have the holding part 1508 shown in FIG. 14, and as shown in FIG. 8, an up-and-down tooth|gear closely approaches imaging part A1501 and imaging part B1502 at a front-end|tip of the supporting member 1506 to a to-be-photographed object site|part in the state by which the biting bubble was carried out,
Looking at the magnitude|size of the spotlight which the light source 1503a for an instruction|indication instruct|indicates, and a position, switch 1507 for operation is pushed and continuous shooting operation|movement is started.

The continuous shooting which decreases the operation|movement pushed in order to prevent camera shaking etc., although switch 1507 for operation for shutters is pushed not for continuous shooting operation|movement but for every imaging|photography is preferable.
In this pushed state, it image|photographs to the same position as Fig.8 (a), and then image|photographs to the same position by the state similar to Fig.10 (a).

The image which becomes FIG. 15 with a pair in the image group obtained by one continuous shooting imaging|photography is shown.
In addition, when measuring a tooth|gear surface shape more accurately, imaging|photography in the state which adjoined is preferable and it is preferable to set in the state which can also photograph the focal distance of a camera close at an intraoral area.
The distortion which arises by the curved surface of a lens by the calibration means 1402 of FIG. 13, inclination, etc. are calibrated (calibration), and the these-image|photographed image is output to the common point detection means 1403.

When performing a three-dimensional process, as shown in FIG.9 and FIG.11, it is preferable to consider to synthesize|combine from center vicinity to the left-right direction, and to carry out from the center, but it is not limited to this method in particular, either.

Fig.15 (a) is a tooth|gear front,
Comprising:
It is the image which carried out the ◆B system of the place close|similar to a center, and they are also the data obtained by image|photographing by the imaging|photography data entry means 1401 which uses the probe 1500 of FIG. 14 as an element|module.

1701a is an image of imaging part B1502, and 1701b is an image of imaging part A1501.
The coordinate which used the central point as the same part, respectively is provided to this image,
For example, point A'(x2, y2) which sets arbitrary point A(x1, y1) of the image 1701a of Fig.15 (a) which imaging part B1502 image|photographed, and shows the same position as this is looked for.
An average luminance value is calculated|required for the point A as a block of one pixel.
While moving calculating|requiring the pixel block of the same size as the point A, taking total or the sum of squares of the difference both luminance value, and performing the same calculation to a point A' direction gradually from the vicinity of the position assumed to be point A' of the image data 1702a of Fig.15 (a).
A correspondence degree evaluation curve is formed.

Especially if it is the method of acquiring a common feature although the sub pixel estimation method which sets the part to which total of this difference value or the sum of squares of the difference became the smallest, or the part which became the largest as point A' on a correspondence degree evaluation curve is preferable, it does not identify as this.

Next, the operation same about the pixel block of the next door of the point A of 1701a is performed, and a common point is detected from on the image 1702a.
This operation is repeated and it is a deed.
The coordinate of a common feature is calculated|required in the common range 1703a except the range of the occlusion of the images 1701a and 1702a.
Forming a common feature coordinate centering on the position of the mark ML newly added also in this case makes it possible to acquire a high-precision common feature.
Moreover, since processing time will become long in a higher-precision state although a common feature is detectable when this block is made small, the magnitude|size of a block is selected suitably.

Next, in the world coordinate conversion means 1404 of FIG. 13, it converts into a three-dimensional world coordinate from the coordinate value which measured the above-mentioned common feature as several points based on a parameter and 1 type|set intrinsic|native to an imaging|photography device, such as parallax and a focal distance.
The normal method shown by the literature etc. which this concrete method mentioned above is employ|adopted suitably.

After calculating|requiring a common feature from a pair of image of Fig.15 (a), the common range 1703b except the range of an occlusion is converted into three-dimensional world coordinate A(X, Y, Z) using the image shown in following FIG.15(b) versus 1701b, 1702b.
It is a state used as a three-dimensional world coordinate, and creates what was shape|molded in the shape of [which is shown, for example in FIG.15(d)] a wire frame.

Furthermore, the three-dimensional world coordinate of each common feature of the common range 1703c except the occlusion range of the image pairs 1701c and 1702c shown in FIG.15(c) is calculated|required.

Next, in the three-dimensional image formation means 1405 shown in FIG. 13, it is not a planar stacking|superposition and overlays|stacks the three-dimensional coordinate and FIG.15(b) which were calculated|required from Fig.15 (a) converted into the world coordinate by a virtual three-dimensional coordinate space.
The three-dimensional world coordinate further shown in FIG.15(c) in this overlap|superposed image is overlap|superposed.
If this stacking|superposition is a stacking|superposition in three-demensional space of imagination, it will display hypothetically|virtually the dentition|gear_row of the shape of a wire frame as shown in FIG.15(d) on a computer monitor based on these data formed into the three-dimensional world coordinate, respectively,
It can carry out by [as operating computer interfaces, such as a mouse|mouth, visually and overlaying|stacking each],
However,
When raising the precision of a stacking|superposition, a synthesis|combination which will be in a state with the smallest difference by difference comparison etc. on the basis of one of the three-dimensional numerical values to compare may be preferable.
By the sub pixel estimation method by block matching, you may acquire a common feature.

Although FIG.15(c) formed the dentition|gear_row based on the data which the dentition|gear_row of the right side formed into the three-dimensional world coordinate toward the front from Fig.15 (a), three-dimensional world coordinate-ization of the dentition|gear_row of the left side is performed next.
After the world coordinate-ization should just use the well-known method mentioned above, for example, acquires the three-dimensional coordinate based on two images, what performed conversion to the world coordinate which is a common coordinate may be used for it.

What is necessary is just to couple|bond together by the approximate equivalence|correspondence by the three-dimensional virtual display of a computer, or the numerical stacking|superposition of a coordinate value, after acquiring the three-dimensional world coordinate of a dentition|gear_row on either side.
In that case, it is preferable to accumulate on the basis of the three-dimensional coordinate data of a mark part, and according to the said method, the panorama dentition|gear_row display which does not

have a shift|offset|difference with a three-dimensional coordinate failing in two-dimensional only, either will be possible by the display means 1406 shown in FIG. 13.

A stacking|superposition is a stacking|superposition in the data numerical value of the same shape part, Comprising:
When it does not correspond, it is the manual method of drag and drop about an image on the method overlap|superposed while taking the average of both coordinate value, and a screen, and after overlap|superposing operating a computer mouse|mouth, the method of calculating|requiring a coordinate value, etc. are illustrated.

In addition, even if it is an image with the site|part which was mutually common, in the case of the image where overlap condition has a bad relation, after a calibration should just select from an imaging|photography condition in which among common images,
The image at the side of the part required in order to create a panorama image not overlapping is used.

The synthesis|combination by three-dimensioning based on a world coordinate enables all the dentition|gear_rows to display what is called in the shape of dentures.

The two-dimensional panorama digital image display of a tooth|gear side surface and the three-dimensional panorama digital image display of a tooth|gear side surface can understand the dentition|gear_row state of whole oneself now easily for a patient,
The image of the state which performed the correction simulation process and the virtual whitening process, and formed the virtual dentition|gear_row from this about each of two-dimensional panorama dentition|gear_row data and three-dimensional panorama dentition|gear_row data, for example is put side by side on a computer monitor,
You may form the aspect which makes a patient realize the effect of a treatment, etc.

If the correction simulation process is a two-dimensional panorama dentition|gear_row image, for example, the database of various shapes of one tooth|gear will be beforehand created according to a site|part,
With respect to each tooth|gear image on a two-dimensional panorama dentition|gear_row image, a computer mouse|mouth is operated on graphics software, and the orthodontist performs a copy paste and shows a means to form the formed virtual correction panorama dentition|gear_row.

In the case of the panorama three-dimensional dentition|gear_row image, the three-dimensional coordinate is already set,
From this, on the existing CAD software, the orthodontist etc. perform three-dimensional coordinate adjustment of a panorama three-dimensional dentition|gear_row image, and a means to form a virtual correction three-dimensional panorama dentition|gear_row is illustrated.
These correction panorama display methods are illustrations,
You may take in the other method.

Dentist may write together that to which their two-dimensional panorama and the virtual display after the virtual whitening process with respect to a three-dimensional dentition|gear_row image also adjusted color data with respect to these images on graphics software.
Thus, a patient becomes possible [deepening an understanding of a treatment] by putting side by side on a screen what performed virtual correction and a virtual coloring process to the patient's himself panorama dentition|gear_row.

[Aim|sight light irradiation means]
FIG. 16 is a figure which shows one Example of this invention.
A10 is a reflective-mirror unit in the figure,
It forms by hard plastics etc., and reflective-mirror A10K installed at the front-end|tip a predetermined angle (for example, 45 degree|times) is provided, and cylindrical mounting part A10S in which the outer periphery of imaging|photography unit A14 and a connection are possible is formed in a rear end,
In the meantime, it is the open|released shape.

The connection of mounting part A10S and imaging|photography unit A14 is formed in the form to push in, and the grade made possible only by pulling away may be sufficient as it, for rotation prevention, an unevenness|corrugation may be provided for both or it may also make detachment|leave asymmetrical shapes, such as an ellipse.

A11 is a housing|casing,
It forms by a plastics and resin and an aperture diameter comprises the shape which is easy to have by

hand by a cylindrical form like a large ball-point pen,
It arrange|positions so that imaging|photography unit A14 may protrude at a front-end|tip,
Cable A15 for connecting with an external processing apparatus connects with a rear end.

A12 is an observation direction at the time of dentist, dental hygienist, etc. observing it at it, seeing directly reflective-mirror A10K arrange|positioned by a predetermined angle at the front-end|tip of reflective-mirror unit A10.

A13 is an aim|sight light irradiation surface and is an example of the irradiation surface of the aim|sight light at the time of the aim|sight light output from light source A142 for aim|sight reflecting by reflective-mirror A10K, and beginning to illuminate a tooth-surface.

The position of light source A142 for aim|sight (refer FIG.16(c)) may be arbitrary, as long as it is a position which can determine the range of a picked-up image, another position may be used, and the site|part is a front-end|tip part of reflective-mirror unit A10, for example,
Comprising:
The site|part which illuminates an imaging|photography range is also good.
In this case, since an optical path becomes short, even if an angle-of-beam-spread degree is somewhat large, the range of a picked-up image may be able to be illuminated.

The state which expanded imaging|photography unit A14 to FIG.16(c) was shown.
In the figure, A141 is a light source for illumination and the combination with a wide angle-of-beam-spread degree of LED, or a lens and LED is illustrated.
Light source A141 for illumination is multiply arranged around imaging|photography member A143.

A142 is a light source for aim|sight and what performs the output which can have a predetermined breadth in an irradiation surface is illustrated by the combination of LED with a small angle-of-beam-spread degree, and a lens and LED.
Moreover, when it is a light source with a small angle-of-beam-spread degree, it is preferable to open two or more predetermined spacing and to arrange|position.

A143 is an imaging|photography member, it forms with the camera of CCD and CMOS and a thing with more pixel counts is preferable.

When it returns to Fig.16 (a) again, A15 is a cable for connecting with an external image display apparatus, and may be formed by a cable for exclusive use other than a general purpose cable like a USB cable.

A16a and A16b are respectively the button|peonies A and B for operation,
It is comprised by a push type, a pull type|formula, or a rotary type etc.,
In each button|peony, when button|peony A16a for operation is pushed, light source A142 for aim|sight will light-emit for the predetermined time,
Only fixed time illuminates the principal part through reflective-mirror A10K.
Fixed time is the time when a user can recognize the aim|sight light which illuminates the intraoral principal part at least,
Comprising:
Preferably, it is until the timing of imaging|photography, for example, button|peony A16for operation a etc., is pushed.

At the time of imaging|photography, since the illumination part of a color scheme which is different in a still image is formed, it is unpreferable at the point of becoming the hindrance of observation.
However,
Especially when not becoming the hindrance of observation, it is not necessary to extinguish the light for aim|sight, and makes it blink.
You may make a user recognize.

Next, operation|movement of the Example shown in FIG. 16 is demonstrated.

The illumination output of light source A141 for illumination with which it mounted|wore around imaging|photography member A143 of imaging|photography unit A14 illuminates intraoral tooth|gear AH1 through reflective-mirror A10K.
A14L is an aim|sight light optical path.
In addition, the light source for illumination is also irradiated through reflective-mirror A10K, and a part

of illumination light surface inside has become the state in which aim|sight light irradiation surface A13 was formed.

Imaging|photography member A143 inputs the intraoral site|part which began to be illuminated through reflective-mirror A10K, and displays it with an external monitor apparatus through cable A15.

Users, such as a dentist, are the images displayed with an external monitor apparatus, and can grasp|ascertain an imaging|photography position,
However,
When shortening consultation hours, or when a treatment is included, the use similar to a dental mirror will be made|formed in many cases, and it may be in the state which differs from a picked-up image as an observation direction shows by A12.
However,
In that case, button|peony A16a for operation is pushed, for example.
When button|peony A16a for operation is pushed, light source A142 for aim|sight light-emits, and light emission is predetermined time,
Preferably it is carried out before an imaging|photography start and an observer light-emits by the grade which confirms an observation position and an imaging|photography position.
An observer moves reflective-mirror A10K in order to make an imaging|photography position and an observation position correspond, is pushing button|peony A16a for operation again, and performs adjustment of an imaging|photography position and an observation position.

Completion|finish of positioning will perform recording of a still image or a moving image by pushing button|peony A16for operation a, or button|peony B16b for operation again.
The operation content of button|peony A16a for operation mentioned above and button|peony B16b for operation is an illustration, and is selected suitably possibly.
The example was shown in FIG.16(b).

A17 is an example of an image and tooth|gear AH1 made into the imaging|photography objective is image|photographed.
The irradiation range of aim|sight light is the range of a circle|round|yen shown by a dotted line by aim|sight light irradiation surface A13, and almost all of the principal part which carries out the objective of the imaging|photography is contained.

The range of aim|sight light irradiation surface A13 changes, when the combination of housing|casing A11 and reflective-mirror unit A10 moves up and down with respect to the tooth|gear H1,
A user makes housing|casing A11 and reflective-mirror unit A10 go up and down from this.
It may adjust,
It becomes larger than an imaging|photography range, or becomes small,
However,
It does not shift|deviate from the principal part of an imaging|photography range, and fully shows the principal part of an imaging|photography range rather than a point light source.

By the above operation, a photographing face and viewing side are adjusted and recording of an exact still image or a moving image is performed.

It has housing|casing A11 shown by Fig.16 (a), and with respect to an intraoral observation part, it is made to move in every direction, and observes and image|photographs so that the site|part aiming at reflective-mirror A10K may be caught.

An intraoral camera is inserted in the narrow deep site|part of the intraoral upper jaw or the lower jaw, etc., and while the imaging|photography range of a reflective mirror reaches far and wide, an intraoral area is image|photographed in a state with a reverse reflective mirror, or a diagonal state and sideways are image|photographed,
A picked-up image also inclines or becomes reverse from this.
Then, this invention detected the imaging|photography state with the position sensor, and implement|achieved that an image provided an image compensation means to rectify this horizontally with respect to an up-down opposite state and a diagonal state.

[Picked-up image correction means]
FIG. 17 is an example of the intraoral camera used in order to describe one Example of this invention, and showed one part as sectional drawing.
A21 is a housing|casing for a holding|grip in the figure,
It has the column shape equipped with interior space,

Imaging|photography unit A23 of an elliptical cylinder shape which consists of a light source for illumination formed around the camera and the camera connects at a front-end|tip in the state protruded from housing|casing A21,
Cable A26 of the sake connecting with an external display apparatus connects with a rear end.

An example of the lighting unit was shown in FIG. 17.
A22 is a reflective-mirror unit in the figure,
It mounts|wears with reflective-mirror A22H arrange|positioned with a predetermined angle at a front-end|tip,
Cylindrical mounting part A22S with which it can mount|wear is formed in a rear end so that the periphery of imaging|photography unit A23 may be covered,
Others are the open|released states.

A24 is a circuit board, the inside of housing|casing A21 is mounted|worn and the image processing IC etc. are mounted.
A25a and A25b are position sensors and have the IC chip etc. which were mounted in the circuit board.
The number of objects of a position sensor and the mounting site|part are examples, and may not be mounted depending on the kind of sensor.

The sensor device from which position sensor A25a and A25b will not be in an immeasurable state with an angle since a movement state with wide range intraoral cameras, such as an acceleration sensor and an angular velocity sensor, can be taken is employ|adopted.
It is an illustration although the number of objects of the position sensor was shown as two,
Comprising:
It may be one, if the number of chip|tips changes or there exists a unit for three axes according to the number of axis|shafts.
A triaxial sensor may be illustrated and, as for the number of objects of a position sensor, an acceleration sensor and an angular velocity sensor may be adjusted with the number of axis|shafts, etc.
The axis|shaft which shows the x-axis of position sensor A25a and A25b..., a y-axis, and a z axis, for example in FIG. 19 is illustrated.

When position sensor A25a and A25b are made into an angular velocity sensor (gyro sensor), an angular velocity sensor outputs the variation|change_quantity of the angle by the movement of the surroundings of an x-axis, the variation|change_quantity of the angle by the movement of the surroundings of a y-axis, and the variation|change_quantity of the angle by the movement of the surroundings of a z axis, respectively, for example.
It is the state which set arbitrarily the initial state of the x-axis, the y-axis, and the z axis, and in the case of the angular velocity sensor, the variation|change_quantity of each axis|shaft is added, and it detects the imaging|photography state of a camera.

On the other hand, an acceleration sensor outputs the acceleration component of each x-axis direction, the acceleration component of a y-axis direction, and the acceleration component of z axial direction.
Furthermore, when the synthetic|combination vector of these acceleration components outputs an attitude|position vector and exists in a repose|standstill state, a gravitational-acceleration vector is shown, respectively.
The imaging|photography state of a camera is acquired from this attitude|position vector.

For example, since an acceleration sensor outputs the state of gravitational-acceleration vector A451 as an attitude|position vector at the time of rest,
The method of calculating addition etc., etc. can utilize the amount of rotational variations of each axis|shaft using that posterior-horn speed sensor by making the vector of the x-axis direction in this state, a y-axis direction, and z axial direction into a reference|standard attitude|position,
Therefore,

By combining both an acceleration sensor and an angular velocity sensor, you may detect various states of a camera.

FIG. 18 is a block diagram which shows an example of a means to rectify an image display state using a position sensor.
As long as the structure shown with the said block diagram is computer processing, it may have a part performed by a program.
In the figure, A31 is an imaging|photography means and shows a means to image|photograph a moving

image and a still image with the camera arrange|positioned at the center of imaging|photography unit A23 of FIG. 17.

A32 is an image compensation means,
Temporal|temporary recording of the image which was comprised with image recording memory, CPU, etc. and was acquired by imaging|photography means A31 is carried out,
Based on the camera angle information of position detection means A34, an image is rotated and the image data of a clear state is formed.

For example, when imaging|photography unit A23 image|photographed, the reference|standard attitude|position of the image project|reflected on a monitor was defined and a reference|standard attitude|position image rotates by moving a housing|casing with respect to the reference|standard attitude|position
WHEREIN:
For example, formation of a clear image is attained by only the angle at which the angular velocity sensor etc. detected the variation|change_quantity of the rotation angle, and pulled a part for the rotation angle variation|change_quantity from the angular velocity in each axis|shaft rotating an image, and displaying it.

In addition, compensation of an image may be possible only at rotation of the surroundings of the y-axis shown in FIG. 19.
Since the camera of imaging|photography unit A23 has always faced the reflective-mirror direction when image|photographing the intraoral image reflected with the reflective mirror, the rotation accompanying rotation of the housing|casing centering on y axis coordinate which shows in FIG. 19 that an image rotates is for being primary.
Therefore, it may be preferable that the state which faces a fixed direction rectifies at least the image project|reflected on xz plane in an image display part in the state from which housing|casing A11 and reflective-mirror unit A10 changed to the x-axis, the y-axis, and z axial direction.

33 is an image display means, the monitor of a computer and other monitors for exclusive use are shown, and the output image of image compensation means A32 should just be displayed.

34 is a position detection means,
It is comprised by position sensor A25a of FIG. 17, A25b, etc., and, specifically, acceleration sensors, such as a MEMS sensor angular velocity sensors, such as the rate gyro which outputs an angular velocity, the rate integral gyro which outputs an angle, an attitude gyro, a MEMS type, other machine types, an optical type, a piezoresistance type, an electrostatic capacitance type, and heat|fever detection type, can be utilized.

Next, operation|movement of FIG. 18 is demonstrated with reference to FIG.17 and FIG.19.

When the coordinate axis shown in FIG. 19 shows the case where one position sensor respond|corresponds to three axes and a position sensor respond|corresponds by 1 axis|shaft, two axes|shafts, etc., respectively, a coordinate axis corresponding for every site|part of a position sensor is set.

It has housing|casing A21 shown in FIG. 17, and reflective-mirror A22H is inserted in an intraoral area, and the target site|part is image|photographed.
In that case, initial stage attitude state is recorded by operating the switch attached on housing|casing A21.
An example of the coordinate in expectation attitude state was shown by A410 of FIG. 19.

A coordinate axis is formed by installation of a position sensor.
In the present Example, A431 set it as the y-axis by A421 having set it as the x-axis, and A441 set it as the z axis.
In addition, A451 is a gravitational-acceleration vector and is an example of the attitude|position vector which synthesize|combined at the time of rest of an acceleration sensor.
Therefore, a gravitational-acceleration vector may be unable to be utilized when not using an acceleration sensor.

In order that an intraoral camera may image|photograph the side surface of a molar, the coordinate in the state close|similar to erection is shown.
A422 is an x-axis,
A432 is a y-axis,

A442 is a z axis, and when an acceleration sensor is used, A452 can show a gravitational-acceleration vector.

The reflective mirror 22H is moved to the site|part made into the intraoral objective.
An example of how to move is shown in FIG. 19.
The intraoral camera comprised with the reflective mirror 22H and a housing|casing moves in all directions [as shown by A411, A412, A413],
Imaging|photography means A31 image|photographs the intraoral image in each state by the still image and a moving image, and outputs it to image compensation means A32.

Position detection means A34 outputs initial stage position information to image compensation means A32 with respect to each of a x, y, z direction, for example.
In addition, since the camera has faced the reflective-mirror direction like a present Example in the structure which displays the image of a reflective mirror, that it will be in the state a camera image inverts or it is hard to look at has be [many] factors in rotation of the surroundings of a y-axis,
Only a 1 axis|shaft type position sensor is utilized from this.
Image compensation means A32 matches this initial stage position information and image, and it makes it output and display them on image display means A33.

When moving an intraoral camera like A411, A412, A413 as shown in FIG. 19, and image|photographing an intraoral area, imaging|photography means A31 outputs the image according to each attitude|position.
When a camera rotates focusing on a y-axis, an image will be image|photographed by reverse and the image corresponding to an imaging|photography state will be output.

Position detection means A34 respectively detects the angular velocity in the surroundings of an x-axis, a y-axis, and a z axis from position sensor A25a and A25b (in for example, the case of a gyro sensor),
The variation|change_quantity ((DELTA)(theta)yz) of the angle of the surroundings of an x-axis, the variation|change_quantity ((DELTA)(theta)xz) of the angle of the surroundings of a y-axis, and the variation|change_quantity ((DELTA)(theta)xy) of the angle of the surroundings of a z axis are detected from this angular velocity.

Such variation|change_quantity is output to image compensation means A32.
Image compensation means A32 rotates an image based on the variation|change_quantity of an angle based on the image data input from imaging|photography means A31, and the positional infomation output from the position detection means 34,
It returns to the state of the first image.

Therefore, even if image display means A33 rotates a camera and image|photographs the same intraoral target object with a moving image and a still image, the image can give the display from which a display content image always changes in the first setting state.

In addition, when image|photographing all the teeth|gears of the upper jaw and the lower jaw using a convex mirror, you may apply the fish-eye lens correction|amendment means by the method described in literature (Design Wave Magazine, 2008 December, P113-115).

[Imaging operation timing adjustment means]
This invention is the frequency|count of pushing a method to push the switch operated when obtaining an actual image on fixed time like the double-clicking method performed, for example at the time of computer operation, and adjusts time until it actually image|photographs,
It makes it possible to attain stabilization of camera operation at the time of a medical examination and patient description at the time of dentist's treatment.
Moreover, the icon display (it continuously shot for several times for 2 second after that by 2 times) which shows the timing which operates the switch of a camera on a monitor image and is displayed in an imaging operation timing is designated,
You may determine the timing.

Moreover, when performing indicating functions, such as a coordinate, on a screen and demonstrating by the frequency|count of an operation button of pushing, and adjusting the timing of a display with how to push etc., while inserting a camera in an intraoral area,
It is also possible to adjust the timing of an image display.
The specification of a concrete timing may carry out input adjustment from the screen of a portable terminal.

An example of a timing adjustment means is demonstrated in detail with reference to FIG. 20.
In FIG. 20, B7001 is an input means, for example, has shown the pushbuttons 101d and 101e which comprise the interface for operation of FIG. 1.

B7002 is a frequency|count detection means of input, is comprised with a counter, a flip flop, etc. and counts the frequency|count that the pushbutton pushed.
It is preferable to count this count within a predetermined-time-interval.

B7003 is a delay means and is a thing for multiplying delay time each time it pushes once with the frequency|count of pushing a pushbutton, and setting delay time.
One pulse is output after delay time progress.

B7004 is an imaging|photography output setting means and outputs the signal which starts imaging|photography to imaging|photography means B7005 at the time of fall of the delayed pulse of delay means B7003.

Imaging|photography means B7005 performs continuous shooting of the still image of a several dozen sheet, or video recording from several sheets based on the signal of an imaging|photography start.
The image acquired by this imaging|photography is input into image input means B7006,
Furthermore, an image with a focus is classify|selected by image selection means B7007,
It displays on a preservation|save or the display 104 shown in FIG. 1 by preservation|save display means B7008.

Image input means B7006 is a thing for outputting to taking image selection means B7007 by using as digital data the image acquired by imaging|photography means B7005.
Moreover, image selection means B7007 is a means for classify|selecting only the image which had a focus, for example.

B7009 is a display means, and after pushing the button|peony of input means B7001, the structure etc. which change the position of blink of even execution and it notifies visually are shown.
Display means B7009 displays whether to start operation|movement in how many second from after, after a dentist is installed in the place which stands out in the case of a treatment and pushes an operation button,
It may display on the monitor of the computer which is one of the display means B7009.

Moreover, a color is red during delay time,
It becomes possible for after delay time is complete|finished, during delay time are [LED which changes to white and] continuous light emission and a light source to flashing-light-emit etc. to button|peony operate [which is generous by providing the indicator with which a user can recognize that it is during delay time],
It becomes possible to expand the width|variety of an intraoral operation|work.

[X-ray imaging means]
Fig.21 (a) is a block diagram which shows the Example of this invention.
In the figure, B8011 is an X-ray imaging means and a X-ray output device, the combination of a X-ray CCD sensor, and a combination with X election force apparatus, a X-ray fluorescent screen and CMOS, or a CCD camera are illustrated.
Specifically, an example was shown in FIG.21(b).

The existing panorama roentgen imaging device, a X-ray CT, a dental roentgen apparatus etc. are contained in X-ray imaging means B8011, and it is good for it if a display is possible as data on a computer monitor at least.
When the X-ray-image data opened directly cannot be acquired,
You may acquire as X-ray-image data of the data obtained by image|photographing the X-ray image on a monitor with the data which accompany a computer and which were formed into the X-ray-image viewer, the hard-copy data of a screen, the data in a monitoring screen share state, and an intraoral camera, etc.
Furthermore, the structure of FIG.21(b) may be included.

B8012 is an actual image imaging|photography means, for example, a reflection type intraoral camera is used suitably.
Actual image imaging|photography means B8012 may include the structure further shown in FIG.21(c).

B8013 is a comparison site|part extraction means,
In order to extract the image which was formed by the block matching method and the sub pixel estimation method, and was image|photographed by X-ray imaging means B8011, and the corresponding part,
Outline extraction of the image which is a thing for extracting a comparison site|part, for example, was image|photographed, and extraction of a several pixel value are performed, and X-ray-image extraction data are output.

B8014 is a comparison site|part extraction means,
In order to extract the image which was formed by the block matching method, the sub pixel estimation method, etc., and was image|photographed by actual image imaging|photography means B8012, and the corresponding part,
Outline extraction of the image which is a thing for extracting a comparison site|part, for example, was image|photographed, and extraction of a several pixel value are performed, and actual image extraction data are output.

B8015 is a comparison means, compares the extraction data output from each comparison site|part extraction means, and outputs an equivalence|correspondence and the site|part which substantially-corresponds and carries out a presumed equivalence|correspondence as an equivalence|correspondence part.
When comparing, an image may be expanded and shrunk|reduced, but it is sufficient for it, if this is converted as versatile formats, such as they are BMP, JPEG, and GIF about an actual image and X-ray-image data, and a scaling|zooming process is carried out by general purpose graphics software for example.

B8016 is an equivalence|correspondence part recording means, and it transmits to display means B8017 while it records the site|part which corresponded, the site|part substantially corresponded|coincided, or a presumed equivalence|correspondence site|part.

As for display means B8017, the monitor (display) apparatus of a computer, a mobile telephone display part, etc. are illustrated,
However,
There should just exist resolution|decomposability whose X-ray image is a grade displayed vividly by the magnitude|size which is a grade which juxtaposition-displays [of X-ray image and an actual image], and can perform the repeated display at least.

A present Example may be formed of hardware, although computer software is implement|achieved.

X-ray imaging means,
Although a separate device may be sufficient as an actual image imaging|photography means,
Preferably, the state which one device carried out [the state] partial replacement|exchange and was shared is more preferable.

Subsequently, operation|movement of a present Example is demonstrated.

By X-ray imaging means B8011, a measured region is image|photographed with a moving image or a still image.
The site|part which X-ray imaging means B8011 measures is performed by selection of all the teeth|gears of one tooth|gear, a several tooth|gear or the upper jaw, and the lower jaw, etc.

Next, the site|part which X-ray imaging means B8011 image|photographed by actual image imaging|photography means B8012 is image|photographed with a moving image or a still image.
Although the same site|part may be positioned correctly and may be image|photographed in imaging|photography, you may image|photograph on a standard.

Distortion of the image acquired from both is correct|amended.
The calibration method may be sufficient as the method of correction|amendment, for example, and it computes a distortion value with a lens by image|photographing the grid_pattern|squares which becomes a reference|standard previously, and correct|amends data.

Next, a characteristic part is computed by comparison site|part extraction means B8013 and B8014.
A characteristic part is an outline, for example,
Comprising:

One part or all part of the tooth|gear outline in the case of a X-ray and the tooth|gear outline of an actual image is extracted, respectively.

Next, both outline is compared.
in that case, it comes out about and X-ray image and an actual image take out the site|part with which both images overlapped in the state which corresponded with a part of outline, or the state which corresponded.

Comparison means B8015 outputs both the above-mentioned duplicate images to equivalence|correspondence part recording means B8016, and equivalence|correspondence part recording means B8016 records both images.
According to a user's selection, both images are displayed, and display means B8017 accumulates or puts them side by side in a permeation|transmission state.

FIG. 23 shows an example of the image image|photographed by the X-ray imaging means and the actual image imaging|photography means.
Fig.23 (a) is X-ray image and the X-rayed tooth|gear b101 is shown.
FIG.23(b) has shown the tooth|gear b102 of the actual image image|photographed by Fig.23 (a) and the site|part.
FIG.23(c) shows the duplication image b103 which accumulated and displayed these.
By contrast of X-ray image and an actual image, X-ray image can understand easily.
Since the presence or absence of the color of a gum, a swelling, and inflammation can be displayed especially by actual image display, a periodontal disease, and the advancement degree of a caries and its presence or absence can be displayed intelligibly for a patient by response|compatibility with X-ray image.

Next, the concrete example of an X-ray imaging means is shown in FIG. 22, and it demonstrates to a detail.
In FIG. 22, B9101 is a housing|casing for a holding|grip,
Preferably, it forms by the plastics material etc. which contain lead in radiopaque.

B9102 is a X-ray output device,
A ready-made article common portable type [dental] is preferable,
However,
If it is not the thing restricted especially but a X-ray output device used with dentistry medical examination, utilization can be done sufficiently functionally,
However,
The home medical examination of a portable type is also effective,
It is suitable for utilization of the X-ray image used together with the actual image.
Even if it is a portable type, mounting|wearing and using for a stand is also possible.

B9103 is an electric lead wire, and a general purpose USB cable is used, and also it can utilize a cable for exclusive use etc.

B9104 is the fluorescent substance for X-rays, and what crystal-grew the fluorescence material CsI, CaWO, $Gd_2O_2S:Tb^{3+}$, 549nm(f-f), (Zn, Cd)s:Ag on the glass substrate, the apply|coated thing, etc. are used.

B9105 is the visible light permeation|transmission member,
Comprising:
It is a thing for forming by the translucent member containing lead and permeate|transmitting only visible light.

B9106 is an imaging|photography unit,
Comprising:
In this case, it is preferable that a thing good [a camera] and high-resolutioner is used.

B9107 is a supporting member for X-ray imaging,
Forming by the radiopaque member containing lead, it mounts|wears with reflective-mirror B9108, fluorescent substance B9104 for X-rays, etc. at a front-end|tip, and the other end forms the cylinder shape open|released since it insert-fixed around imaging|photography unit B9106.

Reflective-mirror B9108 is a thing for forming in the state leaning to 45 degree|times, for example, forming in a planar mirror, reflecting the visualized image after X-ray dropping, and making it transmit to imaging|photography unit B9106.

In Fig.22 (a), the X-ray output from the X-ray output device is converted into visible light by X-ray fluorescent substance B9104,
Then, after a X-ray component is removed and reflecting by reflective-mirror B9108, it inputs into an imaging|photography unit.
B9109 is intraoral dentition|gear_row schematic drawing of an imaging|photography site|part.

FIG.22(b) is the Example which combined the X-ray-photograph image by a X-ray sensor, and the actual image by a reflective mirror.
B9110 is a supporting member for X-ray imaging, and is formed by the radiopaque member similarly to supporting member B9107 for X-ray imaging shown by Fig.2 (a).

B9111 is the visible light permeation|transmission member and is a filter for forming by a lead containing translucent member, removing a X-ray, and transmitting visible light to imaging|photography unit B9106.

B9112 is a reflective mirror, and it is a planar mirror, and B9113 is a X-ray sensor and is formed by the existing X-ray CCD (CMOS) sensor and the imaging plate.
B9114 is a lead wire which transmits the sensor signal of a X-ray sensor to the exterior, and it is preferable that this is also coat|covered with lead containing resin.

A present Example has the structure for outputting a X-ray visible image and an actual image at the same timing by the combined use of a combination with a reflective-mirror unit and imaging|photography unit B9106 other than X-ray sensor B9113.

In the structure which combined reflective-mirror B9112 and X-ray sensor B9113, an actual image displays a tooth|gear back side,
However,
The image and collation which were separately image|photographed from the tooth|gear table|surface become easy,
It is preferable at the point obtained easily, without giving the image process which calculates|requires an equivalence|correspondence range, since an actual image and X-ray image are [the same site|part] simultaneously acquirable.

Intraoral X-ray image is an image difficult to a patient,
However,
About the actual image of the same imaging|photography site|part, by juxtaposition or transparently overlap|superposing and displaying, X-ray image becomes more intelligible and the description to a patient becomes easy at a computer monitor, a paper surface, etc.

In the case of a dental roentgen, X-ray image image|photographs several teeth|gears as 1 sheet or 1 data by one imaging|photography.
In this case, shifting a X-ray sensor and a X-ray output device, continuous shooting imaging|photography is carried out, and after [several] X-ray-image-izing, outline extraction is performed for an entire jaw as digital data, for example.
And the common part of few images at each adjacent X-ray image is detected, the block matching method and the point which overlap|superposes and carries out [correspond and] a presumed equivalence|correspondence are detected, and a panoptic image may be formed.
Furthermore, an actual image forms a panoptic image similarly.
The data which can perform an intelligible comparison can be formed by printing these images on a monitoring screen or a paper.

An example of data was shown in FIG. 23(d) and 23(e).
FIG.23(d) shows the state which carried out the digital process and connected actual image data, b104 is upper-jaw data and b105 is lower-jaw data.
With the intraoral camera which shows the upper-jaw data b104 in FIG. 1, the position is image|photographed, for example in [with a shifting] continuous shooting little by little, the common part of each image is overlap|superposed, and it creates with connection.
Although the lower-jaw data b105 are created similarly and the method of making it into the image of 1 sheet is shown, the upper-jaw lower jaw is image|photographed simultaneously, and you may connect, overlap|superposing a common part.

Since the structure displayed as an image is continuing and continuous shooting is continuing also in size, the site|part to connect finds it, it is cheap and there is also little size adjustment.

When obtaining such a panoptic actual image, you may use methods, such as an intermediate|middle luminance value method, a block matching method, and the optical flow method.

FIG.23(e) shows the upper-jaw X-ray data b106 and the lower-jaw X-ray data b107 which connected X-ray image similarly and created it,
Furthermore, in the lower jaw, it is the state which piled up the lower-jaw data b108 based on an actual image, and makes it clear also to a patient.

A present Example so that an intraoral actual image, X-ray-imageY, a virtual correction panorama dentition|gear_row image, the panorama dentition|gear_row image by a virtual color scheme, etc. can be compared.
The improvement of the own expense rate by a continuous treatment, effective prevention, and a positive treatment, etc. can be demanded from a patient by "rendering visible" one's intraoral area visible by the printing|printed_character to a computer monitor and a paper, and printing.

Moreover, replenishment displays a required site|part with a X-ray and an actual image by the gum and a jaw bone,
The synthesis|combination of the state of the jaw bone as setting|planting conditions for an artificial dental root and the state of a hypothetical|virtual prosthetic|repair with an actual image, etc. can carry out based on X-ray image,
The reproduction|regeneration area by an osteoanagenesis means can also be displayed.

As a many-sided image list|wrist, an actual image, X-ray image, and a microscope image can be put together clear, are an image display and printing out about the edited result, and can show intelligibly for a patient the procedure of treatment and prevention based on an intraoral condition.

Imaging|photography of the actual image performed dental-plaque coloring, such as phloxine, and enabled observation of a dental-plaque adhesion condition visually, for example,
Then, the image shown in FIG.23(d) is formed, and it records on a recording device, and makes observable the adhesion condition of a dental plaque, and the condition of a gum.
Furthermore, a dental plaque is extract|collected based on the condition of a gum, a periodontal-bacteria image is formed using a microscope, and image edit is carried out in the condition relevant to the extraction|collection site|part.

Furthermore, it makes it possible to form the intraoral map which displays the condition of a periodontal disease clear in about five steps as image data and printed data, and to perform periodontal disease prevention and dental-caries prevention to qualification by combined use with X-ray image.

The image data as which the dental plaque was displayed by actual image formation means to acquire the photograph image of all the teeth|gears by the panorama specification mentioned above or a one part tooth|gear, using the red stain|dyestuff is obtained.

For example, it depends the degree of red lightness and darkness of this image data on software, a detection means to detect using the luminance value detection method detects a light/dark value.
When a fixed value, for example, the value which converted the value of the thickness based on the thickness of the state accumulate|stored to such an extent that periodontal bacteria bred easily with the luminance value, is exceeded with this light/dark value,
By providing the means which attaches|subjects care marks (symbol synthesize|combined on the screen) to the site|part of image data, when the image after intraoral dyeing|staining is output with a computer monitor or a printer, a part with many adhesion amounts of a dental plaque will be displayed automatically.
This output display and the condition of a gum can be seen from an image, and a discovery of a periodontal disease, prevention, and a treatment are performed efficiently.

[An intraoral hypothetical|virtual prosthetic|repair treatment display]
this invention can form an intelligible image by the juxtaposition synthesis|combination of X-ray image and an actual image,
However,
Furthermore, the virtual shape and color information of prosthesis are overlap|superposed on top of the said image, and are synthesize|combined,
It makes it possible to display the hypothetical|virtual state after a treatment intelligibly.

The means for indicating by synthetic|combination the virtual shape shown in FIG.21(b) as an example to X-ray imaging means B8011 shown by Fig.21 (a) is added to a back|latter stage,
The structure which adds the means which indicates by synthetic|combination the virtual shape shown in FIG.21(c) to actual image imaging|photography means B8012 shown by Fig.21 (a) to a back|latter stage is shown.

Furthermore, a virtual shape is stored beforehand and it is preferable in the case of a virtual synthetic|combination display to provide memory|storage means B8022, such as a virtual shape used calling.
As a virtual shape etc.,
In dentures, bridge|bridging, a clasp, a non clasp, an implant, an inlay, a crown, other prosthesis, and orthodontic instrument shape information and a virtual shape,
What accumulate|stored the color information etc. of what data-formed previously the shade guide which consists of a color sample equipped with many shape of a tooth profile used when color information is also contained, for example, color tone is determined, or was data-formed at the time of use, and was accumulate|stored, all the teeth|gears, or one tooth|gear may be contained.
When accumulation|storage of the said data image|photographs a patient's intraoral X-ray image and an actual image, it may memorize|store the image one by one by attaching|subjecting the data for correction|amendment and arrangement|tidiness if needed.

In FIG.21(b), B8018 is a virtual shape adjustment means for X-ray image,
In image|photographed X-ray imaging means B8011, in the image|photographed X-ray imaging image,
The size is marked, or though easy recognition is possible on X-ray image, the virtual shape which was designated by the user from memory|storage means B8022, such as a virtual shape, or was called automatically is adjusted to comfortable color, and is adjusted to a compoundable state.
B8019 is a synthetic|combination display means with respect to X-ray image, and is a means to synthesize|combine and display X-ray image and a virtual shape on a monitoring screen.

Although the virtual synthetic|combination display means was added as a thing respectively subordinate for an imaging|photography means, not only according to a subordinate thing but according to the objective, you may set FIGS. 21(b) and 21(c) as a main structure.
Moreover, the structure which performs the stacking|superposition of the actual image of FIG. 21 and X-ray image is not required,
You may synthesize|combine a virtual display by independent [of an actual image and X-ray image / each].
This synthesis|combination makes an image general purpose formats, such as BMP, JPEG, and GIF,
The superimpose method may be used like a grid display etc., or the permeation|transmission method used by general purpose graphics software and the stacking|superposition method may be used.

In FIG.21(c), B8020 is a virtual shape adjustment means for actual images, and has the same structure as the virtual shape adjustment means for X-ray image.
B8021 is a synthetic|combination display means and this also has a function similar to the synthetic|combination display means for X-ray image, and a structure.

Subsequently, the synthetic|combination structure of the virtual display shown in FIG. 21 is demonstrated in detail with reference to FIG. 28.

All the teeth|gears shown by Fig.28 (a) by X-ray imaging means B8011 in Fig.21 (a)
X-ray image b201 is image|photographed and formed.
This X-rayed all the teeth|gears several [every / the panorama image acquired, for example from the existing X-ray panoramic-exposure apparatus, and], and acquired the image, and it converted this into the digital image,
Then, a common part is detected for example, after outline extraction with respect to each image.

It may connect in a common part for each image of every, and may form the panoptic image of all the teeth|gears.
The panoptic actual image b202 of all the teeth|gears shown in FIG.28(b) is similarly formed by actual image imaging|photography means B8012.
In addition, these tooth|gear images of all the may not be restricted to this method, may carry out continuous shooting imaging|photography, and the method of selecting and connecting a suitable image, etc. may be used for them.

A treatment part is found from an image.
For example, in the image b201, the panoptic actual image b202 which are the molar defect|deletion part b219a, the molar defect|deletion part b219b, the defect|deletion part b219c of the anterior teeth, and the clearance gap b219d between anterior teeth is also the same.

It is respectively a defect|deletion part,
Comprising:
It examines what kind of prosthetic|repair is required, for example, if it is anterior-teeth prosthesis, memory|storage means B8022, such as a virtual shape, will be searched with virtual shape adjustment means B8018, and the candidate of the anterior teeth of the shape which can be patched up will be selected.
After selecting, reading a selection image and selecting size and a color on a screen, it synthesize|combines by synthetic|combination display means B8019, and displays by a display monitor.
FIG.28(c) is the image b203 which synthesize|combined the virtual structure, for example.
In the synthetic|combination image b203, to the molar defect|deletion part b219a of the lower jaw, and b219b,
selecting the implant b212 and the bridge|bridging superstructure b214 for bridge|bridging from memory|storage means B8022, such as a virtual shape, when it can be considered that an artificial dental root is suitable, and it is in|by multiple pieces alike and crosses, the artificial dental root b213, the superstructure b215, and
Size and a color are adjusted by virtual shape adjustment means B8018,
It synthesize|combines by synthetic|combination display means B8019,
It displays on a monitoring screen and the monitoring screen of a portable terminal.

The prosthetic|repair tooth|gear for actual images, inlay data, etc. are called from memory|storage means B8022, such as a virtual shape, also like the panoptic actual image b202 obtained by the actual image imaging|photography means,
Size and a color are adjusted by virtual shape adjustment means B8020,
It displays by synthetic|combination display means B8021.

In FIG. 28, b216 shows the superstructure b214 for bridge|bridging of FIG.28(c), and b219 shows the superstructure b215 of FIG.28(c).
b217 is a crown for anterior teeth, and it corresponds it to b210 of FIG.28(c).
b218 shows the clearance gap prosthetic|repair part b211 of FIG.28(c).

Formation of the clearance gap prosthetic|repair part b211 may be formed by enlarging the magnitude|size of a crown and making both crowns into a contact state, for example, as long as a mutual tooth|gear is a crown.
In the case of a natural tooth, the method of scraping off and patching up teeth|gears [both of] somewhat is shown.

Prosthesis was shown with the oblique line to each of the synthetic|combination images b203 and b204.
For example, in the synthetic|combination implant b212 for bridge|bridging and the superstructure b214 for bridge|bridging in the image b203, when [, such as an intensity|strength,] unpreferable, three artificial dental roots and superstructure similar to the lower-jaw right side are read from memory|storage means B8022, such as a virtual shape,
It substitutes and displays,
The condition of the bone|frame of a defect|deletion part and the range in which an implant is possible are adjusted looking at an image.

Moreover, you may determine, calling tooth-color data and carrying out comparison adjustment of the relationship of a color with an adjacent tooth|gear by a monitor from memory|storage means, such as a virtual shape.
For example, the anterior-teeth prosthetic|repair b210 may adjust, synthesize|combine and determine an adjacent tooth|gear, a shape, and a color, comparing a general purpose model.

The method of a clearance gap [b219d] treatment also selects prosthetic|repair patterns which are used, such as an inlay and a crown, from memory|storage means B8022, such as a virtual shape,
It adjusts by virtual shape adjustment means B8018, inserting in an image,
You may examine another virtual shape, looking at a synthetic|combination condition by synthetic|combination display means B8019.
When this virtual shape is formed three-dimensionally, on a screen, a virtual shape is rotated, and even if it is a plane|planar intraoral image, a more realistic synthesized image can be obtained.

It is sufficient information in which the image of FIG.28(c) and FIG.28(d) was acquired to inquire even to a state,
However,
Furthermore, it is a site|part before [the synthesized image shown in FIG.28(c) by comparison site|part detection means B8013 of Fig.21 (a) to] a synthesis|combination,
Comprising:
It is a site|part before [the image which designates the site|part used as the characteristics and it shows in FIG.28(d) by comparison site|part extraction means B8014 to] a synthesis|combination,
Comprising:
The site|part used as the characteristics is designated, and the state which compared both comparison site|part and corresponded by comparison means B8015 is recorded temporarily, and also it displays.

The image which shows this displayed state is shown in FIG.28(e).
The synthesized image b205 overlap|superposes an actual image and X-ray image.
A number is a prosthetic|repair state shown by the synthetic|combination images b203 and b204.
X-ray image is hard to see, and especially a gum site|part is hard to see,
However,
The gum part of X-ray image is intelligibly displayed by such synthesized image, and also it is intelligible and enables the display of a superstructure or a tooth|gear, and the balance of a tooth root part.

It is going to implement|achieve the prosthetic|repair suitable for a patient rather than it can give a patient the intraoral display which can imagine the result of an actual treatment and being based on virtual exhibition of teeth|gears, such as the suitable coloring or silver tooth for an individual|principal, and ceramics, by performing hypothetical|virtual mounting|wearing on a screen.
In the case of a treatment, the hypothetical|virtual mounting|wearing to X-ray image is consulted also for a dentist at a treatment.
The existing data marketed are used for virtual data as it is,
It converts into prosthetic|repair data from an actual distance after a synthesis|combination other than in the case of zoom-scaling and synthesize|combining,
It becomes possible to also obtain a whitening and the correction data with color information.

Since a part of size of actual prosthesis can be calculated|required, virtual-shaped data may be used as they are as data for prosthesis manufacture by the synthesis|combination of the virtual shape to a prosthetic|repair site|part.

Moreover, a part of magnitude|size of rapidly actual prosthesis may understand this method by carrying out by computer, and it may also become possible to use it as manufacture data of prosthesis as it is.

[Portable terminal type|mold information input-output means]
Subsequently, the Example of this invention is described in detail with reference to FIG. 24.
In the figure, it is a small battery, and batteries, such as a button type, cylindrical shape, sheet|seat type, and a pin type, are illustrated, and one a01 can use both a primary battery and a secondary battery.
One a02 is a pressure|voltage rise means,
Comprising:
They are a DC-DC converter, a chopper type|mold, and another switching regulator,
Comprising:
For example, what has a function which pressure|voltage-rises 1.5V to 3 V more-or-less is used.
One a03 is a control means,
Comprising:
Control chips, such as a one chip|tip type computer and ASIC, are illustrated.
One a04 is a display means,
Comprising:
The thing which is formed with a liquid crystal panel etc. and which can be displayed two-dimensional is illustrated.

One a05 is the terminal side communication means,
Comprising:
If the kind of one a0 C of radio|wireless media adjusts suitably and it is an electromagnetic wave, it is a carrier power output means up to several gigahertz,
Modulation means, such as FM, AM, and PCM,
The circuit containing a transmission-and-reception antenna etc. is used, and if it is light, the combination of LED, a laser, and light receiving elements, such as CDS, will be used,

However,
Also in this, the Zigbee module (brand name) etc. which used the electromagnetic wave can be utilized suitably.
In addition, the communication means by wire communications, such as general purpose cables, such as a USB connection, and an exclusive cable, is sufficient.

One a06 is an input means and a keypad, a touchpad, and the other things to push and that convert into an electric signal the site|part made into a user's objective by the ability to touch are illustrated.
The display means one a04, such as using the liquid crystal panel which has a touch-panel function, and the input means one a06 may be combined with the same device.

One a07 is a memory|storage means, and a program is recorded in order to edit and display patient data on a display part.
Since it mainly records by the host device side, a temporary memory|storage may be sufficient as patient data, and it should just be memorize|stored according to a capacity|capacitance.
One a08 is an electric circuit|line which connects directly the input means one a06 and the terminal side communication means one a05,
However,
This push of a key will show the function transmitted through the terminal side communication means one a05 as it is,
Comprising:
You may show the structure similar to the circuit circuit|line between a keyboard and a computer.
It may become unnecessary when the control means one a03 executes by proxy.

1a0B is a host device,
The dental-personnel related data of patient data, patient intraoral data, patient health data, an attendance etc., dentistry medical-examination data,
The combination structure of the recording means one a11, the host computer one a10, and the communication means one a09 which memorize|stores all the data of dentist business ��, such as a database which stored the patient medical sheet data converted to electronic form, patient reservation data, etc., is shown.

One a09 is a communication means at the side of a host,
Comprising:
The structure used as the terminal side communication means one a05 at the side of a portable terminal and one pair is shown.
Since it is not new that a several portable terminal is utilized with respect to a several patient, a multichannel setting is possible for a portable terminal or the communication means one a09,
It is preferable to receive only the input from a specific portable terminal.

One a10 is a host computer,
Comprising:
A combination structure with peripheral devices, such as a display apparatus for a display, a keyboard, a mouse|mouth, and a printer, is shown.
One a11 is a recording means,
Comprising:
They are recording media, such as a hard disk, SD, DVD and a USB memory,
Comprising:
You may accommodate in the host computer one a10.
As for the communication means one a09, the others in external connection may be incorporated similarly.
One a12 is a communication network,
Comprising:
The internet, in-house LAN, an intranet, etc. are illustrated.
One a13 is another host device,
Comprising:
It may have the structure similar to the host computer one a10 of host device 1a0B, and may memorize|store the patient data etc. which host device 1a0B does not own.
For example, it also becomes possible from a remote place to assist a dentist's medical examination treatment to operate by sending treatment data to a portable terminal.

Next, operation|movement of the Example shown in FIG. 24 is demonstrated.

The voltage of the battery one a01 is pressure|voltage-risen by the pressure|voltage rise means one a02, and each means is supplied.
By this pressure|voltage rise means one a02, a C-MOS control element etc. can be driven by pressure|voltage-rising the battery voltage 1.5v to 3V or the voltage beyond it, for example.

The control means one a03 may call, run and display the program for medical examination data processings at the time of dentistry medical examination on the display means one a04 from the memory|storage means one a07.
Otherwise, you may display the data transmitted from the host computer one a10 by the display means one a04 as it is.

Since the wireless|radio communication means is used, in the middle of the beginning or operation, a communication state is test|inspected and a communication condition is confirmed.
In addition, even if wireless connection is interrupted|blocked on the way, the input-output [the control means one a03 interrupts|blocks] of a between may be good also as a structure performed temporarily.

According to the display of the display means one a04, an operator can be touched [which pushes the input button of the input means one a06], and operates.
In this case, when the key of "1" of the input means one a06 is pressed, for example, while indicating "1" by an output through the control means one a03 at the display means one a04, it transmits to the host computer one a10 through the terminal side communication means one a05, one a0 C of radio|wireless media, and the communication means one a09.
When the execution button|peony signal reached|attained the host computer one a10, for example a patient name is transmitted to the host computer one a10 from the input means one a06, it searches to the database in the received host computer one a10,
Data are transmitted to one a0 A of portable terminals.
Through the terminal side communication means one a05, the transmitted data are the control means one a03, are adjusted to a display, and are displayed by the display means one a04.

Moreover, the structure displayed on the display means one a04 of one a0 A of portable terminals as it is may be sufficient as the data transmitted to the portable terminal from the host computer one a10,
Moreover, the control means one a03 calls and runs a program from the memory|storage means one a07,
Program manipulation of the data transmitted from the host computer one a10 is carried out,
You may display on the display means one a04.

The data transmitted/received by a wireless|radio communication means transmit code|symbol data, numerical data, symbol data, other text data, and image data.
When there is no content required for the host computer one a10, the acquisition of data may be aimed at through the communication network one a12 to the other host device one a13.

The input from the input means one a06 is further recorded on the recording means one a11 at the side of a host device.
For example, when a periodontal pocket depth value is acquired and it inputs manually from the input means one a06, it records on the recording means one a11 through the host computer one a10 as it is,
However,
In order to confirm the input value, you may provide the circuit for giving the display also to the display means one a04.

Next, operation|movement of the Example of this invention is demonstrated in detail with reference to FIG.24 and FIG.25.

As shown at step one b01 shown in FIG. 25 in the case of the beginning of using, an automatic communication test is performed,
An automatic communication test is done at (NO) in which a communication test fails, (step one b02 shown in FIG. 25), and step one b01 which an error message is displayed (step one b03 shown in FIG. 25), and is again shown in FIG. 25.

When an automatic communication test is successful (YES), the host computer one a10 shown in FIG. 24 will output a patient and selection menu display data to the control means one a03 through the communication means one a09, one a0 C of radio|wireless media, and the terminal side communication means one a05,
The control means one a03 which input this data outputs this to the display means one a04.
In this case, it is display data which the host computer one a10 outputs,

Comprising:
When displaying these display data by the display means one a04, the control means one a03 running the program for a display read from the memory|storage means one a07, and forming is illustrated.

In addition, the patient and the selection menu may be recorded on the memory|storage means one a07 of the portable terminal as a program.
Moreover, data may be displayed on the direct presentation means one a04 without the control means one a03.

The display means one a04 shown in FIG. 24 displays a patient and a user selection menu (step one b04 shown in FIG. 25).

At step one b05 shown in FIG. 25, a patient selection menu number is demonstrated about (yes), when a keypad is pushed and input,
Other selection (NO) is performed by moving to terminal 1b05a,
However,
Since it becomes a repetition of the same operation, illustration and description are abbreviate|omitted.

While patient selection (for example, 1 of a keypad is pushed) and the signal of 1 are transmitted to the host computer one a10 through a wireless|radio communication means as it is, the program which displays a patient name input box on the display means one a04 act|operates.
When a keypad is pushed and a patient name or a patient code|cord|chord is input in step one b06 shown in FIG. 25,
Whenever it pushes, when the symbol corresponding to the pushed keypad and character data are transmitted to the host computer one a10 and the enter key is pressed, it will search with respect to the stored data within the recording means one a11 of the host computer one a10.

Since the said search can utilize the truncation of a full name etc. which all input and search only lastname or firstname other than an equivalence|correspondence search, the patient list obtained when it was the search of match partial is displayed.

When a selective display of whether a patient candidate is is carried out and it is, the key which shows the case where it is is pressed,
The pushed information is transmitted to the host computer one a10 as it is, and the host computer one a10 calls patient data from a database,
It transmits to one a0 A of portable terminals.

Although this patient data is displayed on the display means one a04, the control means one a03 may indicate by listing for every line feed code as it is in this case.

Furthermore, in a patient data display, the control means one a03 reads and runs the program for a display from the memory|storage means one a07,
The display which has the arrangement|sequence according to a program may be given to the display means one a04.

When a patient candidate is at step one b07 shown in FIG. 25 (YES), the host computer one a10 shown in FIG. 24 transmits patient data to one a0 A of portable terminals (step one b08 shown in FIG. 25).
When a patient candidate is not, (NO) may perform novel registration of patient, or may search it with step one b07 shown in FIG. 25 again.
However,
The routine display of a search is abbreviate|omitted again,
Only the step (step one b09 shown in FIG. 25) which performs novel registration of patient was shown.

In the case of novel registration of patient, the keypad of the input means one a06 is operated,
When inputting data, keypad input is transmitted to the host computer one a10 as it is, and is registered into the database of the recording means one a11.
In addition, in a novel patient's registration, the input from the host computer one a10 other than the input from the input means one a06 may be used,
Also in ones of input, the patient information currently recorded on the recording means one a11 of the host computer one a10 newly adds (step one b09 shown in FIG. 25).

When a patient is identified and recording is displayed, the menu display of a test|inspection at step one b10 shown in FIG. 25 next will be performed by the display means one a04 which is one a0A of portable terminals.

What the display means one a04 displayed this menu display as by the control means one a03 which performed the data in which the host computer one a10 indicated by the output, or the program which called this data from the memory|storage means one a07 is illustrated.

When test|inspection menu relation is displayed as a text text, this,
In the display which was displayed as it was through one a0 C of radio|wireless media, and the control means one a03, and had a sequence pattern intrinsic|native in a database from host device 1a0B,
From the memory|storage means one a07, an application program may be read and this may be performed (step one b10 shown in FIG. 25).

In FIG. 25, it shows designating a plaque test|inspection and is abbreviate|omitting other than that selection (1b11a).
When a plaque test|inspection is designated at step one b11 shown in FIG. 25, the signal which pushed the input means one a06 and carried out input designation|designated will be directly transmitted to the host computer one a10, and a host computer will output the past plaque data.

The past plaque data which the host computer one a10 calls from the recording means one a11, and outputs to one a0 A of portable terminals are data of a numerical value, a symbol, a character, a moving image, a still image, etc.
The control means one a03 runs the plaque display program called from the memory|storage means one a07, and displays it based on the data output from the host computer one a10.

The data of on what side surface of which tooth number to have carried out additional description of the plaque of which step by keypad operation at the side of a portable terminal are transmitted to the host computer one a10 shown in FIG. 24.
The host computer one a10 records data to that effect on the recording means one a11.

In step one b12 shown in FIG. 25, when a patient's plaque display is made|formed, it will move to step one b13 shown in FIG. 25 of whether to carry out correction and an addition,
When correcting and adding, above correction and additions (step one b14 shown in FIG. 25) are performed.

When correction and an addition are completed, and it will be judged at step one b15 shown [whether another test|inspection is conducted and] in FIG. 25 and will conduct another test|inspection,
When the display of whether to return to an initial menu when the test|inspection menu display of step one b10 shown in FIG. 25 is given and it does not conduct another test|inspection is given (step one b16 shown in FIG. 25) and it returns to an initial menu, the patient of step one b04 shown in FIG. 25 and a user selection menu display are performed,
A process continues.
When not returning to an initial menu, either, you may complete|finish, for example.

In addition, the above structure is an example to the last,
For example, a smart phone and a mobile telephone are used as a portable terminal for dentistry information management as it is.
At least, dental personnel carry,
Operation of input, a display, registration, etc. can do intraoral information, dentistry office information, dentistry worker information, and other related information, and it reads information from a host terminal as needed,
It can register, and covalently, required information is displayed and dentistry workers just input it,
The structure according to the objective can be taken.

It is data of a code|cord|chord and numerical value of a keypad, a character, a code|symbol, a symbol, text data, an image, a moving image, etc. that radio|wireless communication is performed by the above operation,
A display is possible in real time,
Even if it uses a terminal simultaneously with medical examination from this, it can be used without a stress.
Moreover, when mounting|wearing a waist|lumbus|elasticity and the back with a host device, or when convenient even if it connects between portable terminals with a host device with a wire communication, radio|wireless communication is not used but a wire communication is used.

this invention can also implement|achieve centralized management of dentistry information with the above-mentioned portable terminal.
As information used as a management object, input of dentistry office information, patient information,

patient medical sheet information, accounting information, medical treatment fee information, etc. which are handled by the recall management system regarding the receipt computer system and old case who create receipt data from the reservation management system, the electronic medical chart system, the accounting information, and medical-examination information of dentistry medical examination etc. is enabled, for example,
For example, test|inspection information, such as the dentistry office information handled with the business management system provided with the function which creates and displays the report|record formed a graphical representation, digital roentgen information, dental microscope information, dental CT information, an intraoral camera, dental unit information for a treatment,
Dental-personnel information, such as an attendance of employees, such as the data information of the chair for patients, etc., a periodontal pocket inspection probe, the intraoral information from another apparatus, a dentist, dental hygienist, dentistry stuff|staff, reception office stuff|staff, and a dental technician, is shown,
However,
In addition, dentifrice|toothbrushing information, a plaque relevant information,
Although not restricted to an intraoral area like prevention information, such as periodontal-bacteria information, and a life-style related disease relevant information,
For example, it is related with indirect diseases, such as a disease relevant to a periodontal disease, blood pressure, blood information, etc. may be contained.

Moreover, if it is useful information in the hospital, patient useful information, inquiry information, management information, etc. at least, it will become the object of centralized management,
However,
Centralized management may be good also as object of not only management of all the related dentist business information but centralized management of one part required information.

For example, the case where data are obtained only by the analog photograph and an image like [in the case of an analog X-ray imaging apparatus], and in the case of handwritten data, it is made into a digital signal through digital conversion means, such as a hard copy of an image scanner, a digital camera, and a computer screen,
Managing may be preferable.

Although centralized management of data may be performed by the above-mentioned portable terminal, centralized management by dental computers, such as a tablet type, notebook type, and a desk-top type|mold, may be sufficient as it.
Utilization of the terminal of the netbook specification especially centering on the internet and a portable terminal may be performed, and the portable terminal accessed via Internet by wireless LAN may be utilized.

Moreover, this invention may perform provision of the information unified using the cloud computing method, information processing provision, etc.
For example, a portable terminal or a host terminal may input-output data for the application software which the one thru|or several center engine|system|organization which exists through the internet provides with the exclusive use at the side of a terminal, or general purpose browser software.
The terminal side does not install the application software for centralized management,
Browser soft only, such as Internet Explorer (trademark) and a fire fox (trademark), is installed, and data can be input-output by performing software for dentistry information centralized management of a center through these browser soft(ware),
It does not care about the capacity|capacitance of the recording device at the side of a terminal, but it is small and can become the thing provided with simplicity.

In addition, you may use not a general purpose browser but the soft(ware) only for [for dentistry information centralized management] software starting.
Moreover, in part, information has the terminal side, also when [which requires the case where information is all accumulate|stored, and the safe management of personal information etc. for the resource at the side of a cloud] accumulate|storing in the terminal side.

The system which was constructed|assembled as a private cloud only in the dentistry group in which only a center engine|system|organization participates only in the company as for the range whose leakage of information, as for the aspect of a cloud, poses a problem is preferable,
However,
If the security is reliable, it may be comprised by the public cloud constructed|assembled by the

information provision service establishment by an external computer, etc., and is good also considering all as a private cloud or a public cloud depending on the case.

Depending on the dental hygienist, dentistry reception office stuff|staff, a dental technician, other related persons, and a case other than a dentist, a patient may do carrying use of the said portable terminal, respectively.
You may share other stuff|staff and data.
Moreover, it can also be used by turns by providing the exchange function of the support|carrier which identifies individuals, such as an IC card, respectively, carrying out exclusive use of the 1 unit|set.

It is preferable that centralized management of data has a compatibility between the data currently handled by each system,
However,
What is necessary is for a compatibility to be unnecessary, for example, to display it on a portable terminal and just to be always able to operate it at least, when using the hard-copy data of a screen.

In a present Example, it is preferable to be used in real time in the server which set the external database, and the state with which a portable terminal can communicate,
However,
When not only this but operation is temporarily recorded on a portable terminal and communication with a server is attained, the data recorded temporarily may use the batch method automatically transferred to a database.

For example, when operating a patient's reservation system on a portable terminal, and determining the hospital visit schedule for a patient's treatment and prevention, and the reservation day used as a candidate is input from on a terminal, from a database, reservation status data are read and it compares,
The overlapping scheduled day is displayed on the screen of a portable terminal,
You may accelerate|urge|promote a change,
A schedule is entered in several treatment / prevention screen at the input display column of a portable terminal screen,
By performing a print instruction from a portable terminal, printing|printed_character printing of the treatment / prevention calendar is carried out with a related printer,
It is also possible to supply a patient widely.

It connects with a host device with a radio|wireless and a wire communication, and also the tooth|gear and the periodontal imaging|photography positioning which may connect by the intraoral camera, the wire communication, or a radio|wireless, and have the necessity for a treatment and prevention in this case are made as for a portable terminal to qualification.

If it not only achieves unification of the information between a portable terminal and a host terminal, but a host terminal is used as a server when a terminal is set as a dental computer for what is called every chair for dentistry medical examination, centralized management of the information between a host terminal and the computer for every chair can be aimed at.

The force piston, sliding type|mold with which the input of the data to a portable terminal was attached as mentioned above,
When peripheral devices, such as a virtual button|peony on a screen other than the type|mold operation button which makes a finger|toe and a pen other thing contact a screen, and operates them, and a rotary dial, a virtual keyboard, and an intraoral camera, connect, the said button|peony on a peripheral device and a dial are illustrated,
In addition, free input becomes easy by providing audio|voice input recording with the microphone installed integrally, and a scanning recording function with the camera installed integrally or in different body.
In addition, a scanning recording function is good also as a photograph image recording by a dental camera.

When performing input of the character and handwritten image based on utilization of electromagnetic induction type pens in the case of screen input, such as a tablet type computer and a portable terminal, and a resistance film-type pen, you may make it take in handwriting input data.
For example, when it is appropriate to display on a screen in handwritten in addition to this when demonstrating to a patient, and demonstrating the treatment method to the dental hygienist,
You may give description to a patient, and explanation to another worker by it being displayed as it is

that a screen is input in handwritten from a portable terminal, or displaying synchronizing with the monitoring screen of a host terminal,
It records then,
You may be used later.
When it inputs especially into an intraoral image in handwritten, it can be used as a patient's data as it is.

Furthermore, as audio|speech data can also be input, it is good also as possible in exact grasping|ascertainment of an intraoral condition.
For example on a portable terminal screen, when talking with another portable terminal user, audio|speech data is designating a window and may display an audio|voice and an image simultaneously.
Moreover, audio|speech data is making it convert into character data as it is, or also converting a handwritten character into character data, and can reduce recording capacity.
When performing especially an intraoral diagnosis, previously special terms, such as a state of a caries, are registered as audio|speech data, and the data written down by converting into character data until now by comparison collation with the audio|voice input through a portable terminal can be automatically used as electronic data.

The audio|voice sample of technical terms and the table of text data which are registered previously are recorded on a recording device,
Input audio|voice data are compared with audio|voice sample data,
Exact dentistry information recording is enabled by converting into the text data corresponding to the audio|voice sample data at the time of corresponding or substantially corresponding|coinciding.

The present Example can also input-output the information regarding dentistry office work, such as input of patient information, such as an electronic medical chart, and input of medical treatment fee information, under centralized management.
However,
In this case, a host terminal and a portable terminal may synchronize in an input state at least.
That is, when it inputs from a host terminal, the input is displayed on a portable terminal, and an output display will synchronize similarly and will be performed.
Screen synchronous software can be performed by utilization of commercially available software Sync+ (brand name), etc., when a portable terminal contains a general purpose computer.
Moreover, the thing etc. of the state which the portable terminal was incorporated previously, or connects the USB terminal provided with the LAN function, and enables utilization of wireless LAN are shown.
This can also aim at the share between other portable terminals, or a share direct between host terminals not only through between a host terminal and a portable terminal but through a host terminal.
A thing may be used for a direct share via a relay terminal other than the thing using radio|wireless media, such as electromagnetic waves and infrared rays.

Case [like home dentistry], the memory capacity of a portable terminal and processing capacity are low, and when data cannot be memorize|stored, a separate memory|storage device or a mail arranges|tidies_up to data a part|minute to be unable to memorize|store,
You may transmit to a host terminal for every serial|sequential or fixed amount of memory|storages using exclusive use or a public line.

When dentistry medical examination is performed in common room|chamber interior, for example, performing complicated input from a portable terminal such a synchronization of the display between terminals,
Since time is taken, rapid input is attained by enabling input from the host terminal which equipped input interfaces, such as a keyboard and a mouse|mouth.

Moreover, in centralized management of the dentistry information using a portable terminal and another terminal, you may automatically process time-sequential data.
For example, date-time at the time of the completion of a treatment of the patient after a treatment and a treatment rest is read from a database,
It compares with present date-time,
After a treatment, when a predetermined equivalent period passes, that is displayed on a portable terminal or a host terminal.
Or you may perform automatically carrying out printing|printed_character creation of the direct mail as it is.

A host terminal may be automatically notified to a portable terminal that the stage of medical treatment fee creation comes, also about an attendance, may notify a day without a report, etc. automatically and may adjust them.

A portable terminal is connecting through a peripheral-devices [, such as an X-ray imaging apparatus, an intraoral camera, and a microscope,], direct, or host terminal, and it displays the imaging|photography output by these peripheral devices on a portable terminal in real time, for example,
The structure recorded on the data folder for patients identified by the patient name etc. can also be taken.
You may control operation|movement of these peripheral devices, a dental chair, a lighting fixture, etc., etc. from a portable terminal.
In that case, you may record on patient charts by making recording of control operation into a log.

The data folder for patients is a state which does not overlap centering on a host terminal, and it is preferable to record and to make read-out possible by the search from each terminal.
Although it may exist that the data folder for patients exists [two or more] for every terminal in temporary use etc., when registering continuously, existing in one storage area is preferable.
This storage area is located not only via a host terminal but via a network in a remote place.

Further, the said portable terminal becomes possible [a patient or also carrying the said portable terminal], when it is good also as possible and especially wide use of a portable terminal is attained in the information exchange in an audio|voice with a patient, an image, and a character.
When a patient carries, it is preferable to enable browsing only of information required for a patient.
This may become possible only by getting a patient to install an application for exclusive use, for example, when [which mentioned above the application software of the smart phone and the other mobile telephone] forming a dental management terminal.

[Dental description means]
About dentistry medical examination, while displaying a patient's panorama-like all dentition|gear_row image and a treatment part image on the monitor (display) screen of a computer, for example, a present Example,
Intelligible description is enabled when by making it couple|bond together [for the purpose of the moving image formed by subdividing], and reproducing|regenerating as a joint moving image demonstrates a treatment for every patient.
Although a dentist may use the existing moving image row|line|column which couple|bonded the subdivided moving image previously, it may select in advance and he may do an edit coupling|bonding.

The moving image row|line|column which was couple|bonded [semi custom] with existing as for the method of a dentist doing selection edit in advance can be selectively used,
Furthermore, the Example which makes at least 1 moving image row|line|column combining all the description data is described in detail with reference to FIG. 26.

FIG. 26 is a figure for demonstrating operation|movement in case a dentist sets as one combination moving image in advance.
1c01 is the display of the first menu in the figure.
The list|wrist which shows an existing moving image row|line|column, the list|wrist in which joint edit is possible in semi custom, and the list|wrist of each subdivided moving image are displayed, and it selects according to the objective.

1c02 is a step which selects either from the first menu display.

It is a step to which an execution step branches by which 1c03 selected, and, in NO, moves to other joint moving image selection (not shown) through terminal 1c03a.
In YES, it moves to the step (1c04) which judges whether it has already registered with this joint moving image with methods attached|subjected by a moving image name search and subdivision dynamic image data, such as a search of the combination of an intrinsic|native code|symbol,
When registered temporarily (YES), it transfers to other joint moving image selection through terminal 1c03a.

When not registered, a list of subdivision data is displayed and also an editing region is displayed.
As for the list of subdivision data, the division may be carried out by purpose-oriented and systematization and formation of the tree may be carried out.

In the selection 1c05 of subdivision dynamic image data, from the list, paste [copy] on an editing region, it is made to move to it by drag and drop, and time-sequential description data are edited.

In FIG. 26, when subdivision moving image selection is completed (1c06), reproduction|regeneration of the moving image row|line|column selected and couple|bonded is performed in a tentative way (1c07).

FIG. 27 shows the example of a combination of a joint moving image.
As for the recovery|restoration moving image of the gum after a tooth extraction, and 1d02, the inclination movement drawing of an adjacent tooth and 1d03 is
[01]
a stretching moving image of an antagonistic tooth, and a moving image to which 04 shows the formation moving image of an abutment tooth, the description moving image of the processed material which showed 05 [1d] in FIG. 1, and set mounting|wearing of a processed material in the figure. [of 1d] [of 1d]
As for the moving image of these each, it may be more preferable for not one but the several moving image to exist.

1d of joint moving images set 1d of a series of moving images [1d of] of 05 to 00 from 01, it was named, and it recorded on the recording device and the recording device recorded the symbol string previously attached|subjected to each subdivision dynamic image data,
Then, as for 1d of joint moving images, 00 may be displayed as one icon on a computer screen.

1d of joint moving images combine 00 in order, and it creates one reproducible moving image continuously,
Each moving image is subdivided,
It is preferable that the constant for patients and the constant for doctors are set to each.
The formats of each moving image are WMV, AVI, and an MPEG format, for example,
Comprising:
What is necessary is to select by existing moving image edit software, and just to make it couple|bond together in order.

Furthermore, at step 1c08, the doctor side data and the patient side data are displayed, and the time cost is indicated,
Preferably, it is the other method,
Comprising:
You may be carried out by distinguishing the display of low cost and description [high profit for a short time] more.

In step 1c09, even if it is the state by which the joint moving image was already created, it is a step made to transfer to selection of subdivision dynamic image data to re-select,
It is a step which selects whether 1c10 preserve|saves this menu list,
When preserve|saving (YES), at step 1c11, a joint moving image name is input and a registration preservation|save is carried out.
When not preserve|saving, it returns at a completion|finish step and it is selected whether it edits or it complete|finishes as it is (1c12).

FIG. 26 demonstrates the operation|movement at the time of a doctor creating a joint moving image,
Since a large number [the actually subdivided data], the case where it takes time with the data to select arises,
From this, you may form a sample in the style of an edit box for every kind of description previously.
The said Example may register a patient's own intraoral image into a subdivision moving image further, and may be utilized as a part of description, such as a treatment peculiar to a patient, and prevention.

A present Example is mainly utilized for informed consent,
However,
If it carries out from shortening of the treatment time for a patient, and the efficiency improvement of description, it is preferable that more efficient viewing and listening is performed,
However,
In that case, it subdivides,
Time becomes description intelligible for a patient by performing by explanatory and auxiliary screen display of the term which a doctor uses, while a doctor demonstrates the moving image for several minutes to a patient from several second.

For example, the list|wrist of subdivided data is displayed by icon, a table|surface, etc. on a computer screen, and a plain title respectively intelligible for a patient is attached|subjected.
Edit of this list|wrist is displayed on the portable terminal mentioned above, and a dentist selects it.
The selected state is displayed on the screen which a patient looks at.

Moreover, the instant formation which creates the combination moving image row|line|column selected for patients, and displays this for patients on a simple portable terminal is also possible, talking about a treatment to a patient.
Namely, the display part which a dentistry worker mainly carries and the portable terminal equipped with the input interface,
And it consists of a terminal equipped with the monitor for a display to which a patient and a prevention candidate (it is set as a patient etc.) can view and listen, and a dentistry worker searches and edits a moving image including the content transmitted to a patient etc., the subdivided moving image, or its combination moving image on a portable terminal.
In the state which edit complete|finished, it transmits to the terminal for patient viewing and listening.
In addition, you may transmit dynamic image data in this case,
However,
The identification data attached|subjected to dynamic image data are transmitted,
The terminal for patient viewing and listening receives this identification data,
You may carry out the real-time process which displays the moving image based on this identification data sequence on a screen.

Furthermore, in the state in which the dentist etc. carried the portable terminal, you may perform remote operation, such as reproduction|regeneration of the moving image on a screen display of the terminal to which a patient etc. view and listen, a stop, a display of patient data, and non-display.

Moreover, you may synchronously display the image to which the patient is viewing and listening, and data on the portable terminal which a dentistry worker carries.
Especially when the intraoral camera shown in FIG. 1 displays and demonstrates a patient's intraoral area, description and a case correspond and it becomes more intelligible.

Furthermore, in a present Example, you may carry out the output display of the image which edited dynamic image data and was edited into the computer monitor which a patient can see with the portable terminal shown in FIG. 24.

Moreover, it is good also as possible in operation of the moving image display to the monitor connected to the dental computer which a patient can see with the said portable terminal.
[The boundary detection means of a gum and a tooth|gear]
This invention includes the structure for enabling the setting detection of the boundary of a tooth|gear and a gum clearly.

Since the image of an intraoral camera has many locations which image|photograph dark narrow space while hitting|applying illumination,
For example, as a means to form the panorama image by the computer image processing shown in FIG.8 and FIG.10, when detecting the common part between images, or when demonstrating the dental treatment to a patient, identification may be difficult because of approximate tone, such as a boundary of a gum and a tooth|gear, the influence of a saliva, etc.

Then, an outline extraction means to extract the tooth|gear outline of an actual image,
An actual image is converted into a component color,
The color component image conversion means which clarifies the shape of a tooth|gear and a gum,
Extraction of the outline of a tooth|gear and a gum was enabled also at tooth|gear stain|pollution|contamination and the place whose illumination is not enough by the combination structure which consists of a synthesized image formation means which combined the image converted by the color component image conversion means, and the outline extraction image.

An outline extraction means is a means to perform a two-dimensional Fourier-transform, for example with respect to an image,
It is comprised after the said Fourier-transform by a means to detect only the phase signal in the frequency domain which shows the change of the lightness and darkness of an image, and to perform an inverse Fourier transform.
In addition, utilization of a Z-transform type|system|group and a Laplace-transform type|system|group may also be possible.

A color component image conversion means forms the image decomposed|disassembled into the component color shown by colorimetric systems, such as a RGB colorimetric system, a La*b* colorimetric system, an HSV colorimetric system, an XYZ system, a xyY colorimetric system, a L*u*v* colorimetric system, a Munsell color system, an Ostwald color system, a NCS (Natural Color System), DIN colorimetric system, for example,
The component color where a shape looks clearly is selected from this inside,
A means to form the image based on the component color,
Or the component color is synthesize|combined regardless of a colorimetric system,
It is a means to form the component color where a shape looks clearly more, and to form the image based on the said component color.
It is preferable that the said selection measures and determines the component color which was so much suitable for the intraoral image previously,
For example, a La*b* colorimetric system,
Any one of these L component images, a* component image, or the b* component images, H (hue (Hue)) component image of an HSV colorimetric system, S (chroma-saturation (Saturation*Chroma)) component image, V (brightness (Brightness*Lightness*Value)) component image,
The synthesis|combination of the component colors of a colorimetric system which synthesize|combining combining any these one is shown and is different may be preferable.
Selection or the combination synthesis|combination of a component color should just perform conversion in the component color where a shape looks clearly, or the synthesis|combination of two or more ingredient color.
In addition, a component image contains the thing obtained by adjusting the numerical value which shows the component value for example, on a program for the image which emphasizes a component, etc.

Moreover, it colors using the combination of the color a shape selects clearly the component image which can be recognized, and also a person can recognize the boundary to be more.
For example, applying R (red) component image to a gum, and applying G (green) component image to a tooth|gear is shown.

Moreover, with the component color shown here, you newly color using the color which clarifies what [not only] was detected from the image but a boundary.

And a synthesized image formation means makes the outline image obtained by the said outline extraction means, and the image acquired by the color component image conversion means a same color type|system|group, for example like the chroma key method except the outline part of an outline image, and permeate|transmits and combines a color component image.
Moreover, a person discolors a gum part red-type, or makes it emphasize deeply after the said synthesis|combination, in order to further emphasize a color component image so that a boundary may be distinguished visually or mechanical more more.
You may use discoloration or the means emphasized deeply for a tooth|gear green.
In addition, as long as there exist some which convert a tooth-color into red green depending on a color component, you may convert a gum color into the color component image.
It is preferable that these means are implement|achieved by computer software in each case,
However,
It may be comprised by custom, such as a gate array and PLD (Programmable Logic Device), and a semi custom IC.

Next, the Example shown in FIG. 29 is described.
In the figure, 2901 is an image input means, for example, is a means to input the still image image|photographed with the intraoral camera.
The still image image input by the image input means is output to the filter means 2902.
Although the filter means 2902 is shown by edge emphasis filters, such as an unsharp filter, the filter which emphasizes the lightness and darkness of an image is used for it.

The image to which the filter process was carried out by the filter means 2902 is output to the outline extraction means 2903 and the component color image conversion means 2904.
The outline extraction means 2903 is a two-dimensional Fourier-transform means,
Phase signal detection means,
And it consists of an inverse-Fourier-transform means,
However,
What is performed combining the program module which has these means in a software library like open-CV (made by an Intel company) is illustrated.

2904 is a means to form the image converted into a* component color of a La*b* colorimetric system and an HSV colorimetric system, b* component color, and the H component color S component color V component color, as it is a component color image conversion means and being mentioned above,
Although it consists of a component color combining means to synthesize|combine these component colors and a hue|tone changes, an image with a clear shape of a tooth|gear and a gum is formed.
Furthermore, tooth|gear stain|pollution|contamination and a discovery of a dental caries may also be attained by the change of this hue|tone.

The outline image obtained by the outline extraction means 2903 and the image converted into the component color image by the component color image conversion means 2904 are output to the synthetic|combination display means 2905.
The synthetic|combination display means 2905 synthesize|combines the outline image which the outline extraction means 2903 output, and the output component color image of a component color image conversion means.
For example this synthesis|combination similar-colors-izes except the outline of an outline image, transparentizes these similar colors, and synthesize|combines with the component color image used as a background image|video.
The combined image is displayed on a computer monitor.

An image with a clear boundary of a gum and a tooth|gear may be able to be acquired by the compositing process of these series.
Moreover, a present Example is used suitably when detecting the center boundary KL of two teeth|gears as a standard at the time of combining the images (for example, the image 906e and 1102f of images) by which the mark ML comes about the dentition|gear_row on either side shown in FIG. 12 to the center of an image.
Moreover, you may synthesize|combine the outline image obtained by a Fourier-transform detecting a phase signal, and an actual image as it is.
Moreover, since the image to which a shape becomes clear is acquired even if it uses only a component color image, the image to which the boundary of an image gum and a tooth|gear obtained by the component color image detection means becomes clear is acquired.
The image to which the boundary of such a tooth|gear and a gum became clear can be utilized as a mark for various synthetic|combination operation|works, or can be used for the object for the description to a patient, and dental treatments.

INDUSTRIAL APPLICATION

The dentistry system which can renew a patient's intraoral information by providing a patient with intraoral information in a clear format so that this invention may attain improvement in dentistry medical examination in intraoral health is proposed,
In a dental field|area, it utilizes effectively.

Description of Symbols

11 Intraoral image input means
12 Medical-examination site|part detection means
13 Unit picture formation means
14 Medical-examination order|rank setting means
15 Medical-examination description formation means
16 Display output means
17 Recording means

(Translation from Thomson Reuters)

Citations

Citation *Record level*

Expand Citing Patents (2)

Expand Cited Patents (22)

Expand Cited Non-patents (7)

DPCI Citation *Patent family level*

Expand DPCI Citing Patents (11)

Expand DPCI Cited Patents (22)

Expand DPCI Cited Non-patents (6)

Expand DPCI Citation Counts

DPCI Field of Search

-

DPCI Citing Patents Country

WO; JP; US; CN

DPCI Cited Patents Country

WO; EP; JP; US; CN

Other

Attorney / Agent

AOKI Atsushi et al., SEIWA PATENT & LAW, Toranomon 37 Mori Bldg., 5-1, Toranomon 3-chome, Minato-ku, Tokyo, 1058423, JP

Designated States

AE AG AL AM AO AT AU AZ BA BB BG BH BR BW BY BZ CA CH CL CN CO CR CU CZ DE DK DM DO DZ EC EE EG ES FI GB GD GE GH GM GT HN HR HU ID IL IN IS KE KG KM KN KP KR KZ LA LC LK LR LS LT LU LY MA MD ME MG MK MN MW MX MY MZ NA NG NI NO NZ OM PE PG PH PL PT QA RO RS RU RW SC SD SE SG SK SL SM ST SV SY TH TJ TM TN TR TT TZ UA UG US UZ VC VN ZA ZM ZW , **European patent:** AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR , **OAPI patent:** BF BJ CF CG CI CM GA GN GQ GW ML MR NE SN TD TG , **ARIPO patent:** BW GH GM KE LR LS MW MZ NA RW SD SL SZ TZ UG ZM ZW , **Eurasian patent:** AM AZ BY KG KZ MD RU TJ TM

DWPI Title Terms

IMAGE DISPLAY SYSTEM DENTIST FIELD SIDE SURFACE COMBINATION UNIT FORMING FORMATION OBTAIN ARCH

DWPI Related Accession Numbers

Type	DWPI Update	Accession Number	DWPI Title
R	-	2013-A92165	System for managing dentistry information of patient in dentistry clinic using network e.g. internet

Custom Fields

Class

-

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Electronic Acknowledgement Receipt

EFS ID:	27631096
Application Number:	14770177
International Application Number:	
Confirmation Number:	8357
Title of Invention:	METHOD AND SYSTEM FOR BITE REGISTRATION
First Named Inventor/Applicant Name:	Yannick Glinec
Customer Number:	70523
Filer:	Carl R. Wesolowski/Karen Tyler
Filer Authorized By:	Carl R. Wesolowski
Attorney Docket Number:	95480
Receipt Date:	29-NOV-2016
Filing Date:	25-AUG-2015
Time Stamp:	09:47:34
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	95480_IDS_2.pdf	139912 14363fb71b5ee81eabb8e16855df7d2e0b2e9235	no	3

Warnings:

Information:					
This is not an USPTO supplied IDS fillable form					
2	Foreign Reference	EP2428764.pdf	305799 16f581c36c61830904d3f0b178d4a1685f7f7c18	no	21
Warnings:					
Information:					
3	Foreign Reference	DE102010040096.pdf	457992 4058e0011416115a23665ea45df56da3d51026ec	no	16
Warnings:					
Information:					
4	Foreign Reference	WO2012096312.pdf	1694574 bb008366653d03bc42d737ff4a1ed5c88dcc1107	no	61
Warnings:					
Information:					
5	Non Patent Literature	95480_EP_Search_Report_3_pages.pdf	109149 a9788a9300aad39a982d9f7fffc7d641c6e5735f	no	3
Warnings:					
Information:					
			Total Files Size (in bytes):	2707426	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/770,177	08/25/2015	Yannick Glinec	95480

CONFIRMATION NO. 8357

70523
Carestream Health, Inc.
ATTN: Patent Legal Staff
150 Verona Street
Rochester, NY 14608

PUBLICATION NOTICE

OC000000079916478

Title:METHOD AND SYSTEM FOR BITE REGISTRATION

Publication No.US-2016-0008116-A1
Publication Date:01/14/2016

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
14/770,177	08/25/2015		1620	95480	20	3

CONFIRMATION NO. 8357

FILING RECEIPT

70523
Carestream Health, Inc.
ATTN: Patent Legal Staff
150 Verona Street
Rochester, NY 14608

OC000000077883415

Date Mailed: 10/06/2015

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

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Qinran Chen, Shanghai, CHINA;
Mo Yufeng, Shanghai, CHINA;

Applicant(s)

CARESTREAM HEALTH, INC., Rochester, NY

Power of Attorney: The patent practitioners associated with Customer Number 70523

Domestic Priority data as claimed by applicant

This application is a 371 of PCT/CN13/72420 03/11/2013

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

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If Required, Foreign Filing License Granted: 10/05/2015
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/770,177**
Projected Publication Date: 01/14/2016
Non-Publication Request: No
Early Publication Request: No

Title

METHOD AND SYSTEM FOR BITE REGISTRATION

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

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Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

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Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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U.S. APPLICATION NUMBER NO.	FIRST NAMED INVENTOR	ATTY. DOCKET NO.
14/770,177	Yannick Glinec	95480

70523
Carestream Health, Inc.
ATTN: Patent Legal Staff
150 Verona Street
Rochester, NY 14608

INTERNATIONAL APPLICATION NO.	
PCT/CN13/72420	
I.A. FILING DATE	PRIORITY DATE
03/11/2013	

CONFIRMATION NO. 8357
371 ACCEPTANCE LETTER

OC000000077863416

Date Mailed: 10/06/2015

NOTICE OF ACCEPTANCE OF APPLICATION UNDER 35 U.S.C 371 AND 37 CFR 1.495

The applicant is hereby advised that the United States Patent and Trademark Office, in its capacity as a Designated / Elected Office (37 CFR 1.495), has ACCEPTED the above identified international application for national patentability examination in the United States Patent and Trademark Office.

The United States Application Number assigned to the application is shown above. A Filing Receipt will be issued for the present application in due course. **THE DATE APPEARING ON THE FILING RECEIPT AS THE "FILING DATE or 371(c) DATE" IS THE DATE ON WHICH THE LAST OF THE 35 U.S.C. 371 (c)(1) and (c)(2) REQUIREMENTS HAS BEEN RECEIVED IN THE OFFICE. THIS DATE IS SHOWN BELOW.** The filing date of the above identified application is the international filing date of the international application (Article 11(3) and 35 U.S.C. 363)

08/25/2015
DATE OF RECEIPT OF 35 U.S.C.
371(c)(1) and (c)(2) REQUIREMENTS

The following items have been received:

- Copy of the International Application filed on 08/25/2015
- Copy of the International Search Report filed on 08/25/2015
- Preliminary Amendments filed on 08/25/2015
- Information Disclosure Statements filed on 08/25/2015
- Inventor's Oath or Declaration filed on 09/01/2015
- U.S. Basic National Fees filed on 08/25/2015
- Assignee Statement for PGPUB filed on 08/25/2015
- Power of Attorney filed on 08/25/2015
- Authorization to Permit Access filed on 08/25/2015
- Application Data Sheet (37 CFR 1.76) filed on 08/25/2015

Applicant is reminded that any communications to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5)

JOHN L ANDERSON

Telephone: (571) 272-0385

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 14/770,177

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	280
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	480
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	720
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	*			OR	x 80 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*				x 420 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1480

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

MULTIPLE DEPENDENT CLAIM FEE CALCULATION SHEET

Substitute for Form PTO-1360
(For use with Form PTO/SB/06)

Application Number	Filing Date
14770177	

Applicant(s) Yannick Glinec

* May be used for additional claims or amendments

CLAIMS	AS FILED		AFTER FIRST AMENDMENT		AFTER SECOND AMENDMENT	
	Indep	Depend	Indep	Depend	Indep	Depend
1	1		1			
2		1		1		
3		1		1		
4		1		1		
5		1		1		
6		1		1		
7		2	---	---		
8		1		1		
9		1		1		
10		2	---	---		
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16	1		1			
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Total Indep	3		3		0	
Total Depend	21	↵	17	↵	0	↵
Total Claims	24		20		0	

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	Indep	Depend	Indep	Depend	Indep	Depend
51						
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Document code: WFEE

United States Patent and Trademark Office
Sales Receipt for Accounting Date: 10/05/2015

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DECLARATION (37 C.F.R. 1.63) FOR UTILITY PATENT APPLICATION (USING AN APPLICATION DATA SHEET (37 C.F.R. 1.76))	ATTORNEY DOCKET 95480

As a below named and undersigned inventor, I hereby declare that:
This declaration is directed to the application entitled:

METHOD AND SYSTEM FOR BITE REGISTRATION

The specification of which (check only one box below):

[ ] is attached hereto.

[ ] was filed as United States Application Number _____ on _____
and (if applicable) was amended on _____

[X] was filed as PCT International Application Number PCT/CN2013/072420 on 03/11/2013
and (if applicable) was amended under PCT Article 19 on _____ .

- The above-identified application was made or authorized to be made by me.
- I believe that I am the original inventor or an original joint inventor of a claimed invention in the application.
- I have reviewed and understand the contents of the application, including the claims.
- I am aware of and acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations §1.56.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the attorney(s) and/or agent(s) associated with Carestream Health, Inc. **Customer No. 70523** to prosecute this application and transact all business in the U.S. Patent and Trademark Office connected therewith.

Send correspondence to the address associated with: **Customer No. 70523**	**Direct Telephone Calls to:** Carestream Health, Inc. c/o Patent Legal Staff 585/627-6740 or 585/627-6687. Facsimile: (585) 627-8919

Full Legal Name of Inventor – as listed on the Application Data Sheet:

	FAMILY NAME	FIRST GIVEN NAME	MIDDLE INITIAL
101	GLINEC	Yannick	
102	CHEN	Qinran	
103	MO	Yufeng	

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

101- SIGNATURE OF INVENTOR	102 - SIGNATURE OF INVENTOR	103 - SIGNATURE OF INVENTOR
	Chen Qinran	Mo Yufeng
DATE 2015.08.26	DATE 2015.8.26	DATE 2015.8.26

Electronic Patent Application Fee Transmittal

Application Number:	14770177
Filing Date:	
Title of Invention:	METHOD AND SYSTEM FOR BITE REGISTRATION
First Named Inventor/Applicant Name:	Yannick Glinec
Filer:	Carl R. Wesolowski/Karen Tyler
Attorney Docket Number:	95480

Filed as Large Entity

Filing Fees for U.S. National Stage under 35 USC 371

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Oath/Decl > 30 Mos From 371 commencement	1617	1	140	140
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**140**

Electronic Acknowledgement Receipt

EFS ID:	23364899
Application Number:	14770177
International Application Number:	
Confirmation Number:	8357
Title of Invention:	METHOD AND SYSTEM FOR BITE REGISTRATION
First Named Inventor/Applicant Name:	Yannick Glinec
Customer Number:	70523
Filer:	Carl R. Wesolowski/Karen Tyler
Filer Authorized By:	Carl R. Wesolowski
Attorney Docket Number:	95480
Receipt Date:	01-SEP-2015
Filing Date:	
Time Stamp:	07:41:52
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$140
RAM confirmation Number	7805
Deposit Account	504233
Authorized User	TYLER, KAREN

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. 1.492 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Oath or Declaration filed	95480_DEC.pdf	53179 8319247f5fa43d11dca492b32f5dc25c613f9b00	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30488 67e0af3a1b5b27b6fb50e115e14b7a9effbc0bed	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	83667		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO-1390 (06-13)
Approved for use through 6/30/2013. OMB 0651-0021
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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.

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A SUBMISSION UNDER 35 U.S.C. 371

Attorney Docket No.	U.S. Application No. (if known, see 37 CFR 1.5)
95480	

International Application No.	International Filing Date	Priority Date Claimed
PCT/CN2013/072420	March 11, 2013	March 11, 2013

Title of Invention
METHOD AND SYSTEM FOR BITE REGISTRATION

First Named Inventor
Yannick Glinec

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information.

1. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). NOTE: The express request under 35 U.S.C. 371(f) will not be effective unless the requirements under 35 U.S.C. 371(c)(1), (2), and (4) for payment of the basic national fee, copy of the International Application and English translation thereof (if required), and the oath or declaration of the inventor(s) have been received.
2. ☑ A copy of the International Application (35 U.S.C. 371(c)(2)) is attached hereto (not required if the International Application was previously communicated by the International Bureau or was filed in the United States Receiving Office (RO/US)).
3. An English language translation of the International Application (35 U.S.C. 371(c)(2))
   a. ☐ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
4. An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4))
   a. ☐ is attached.
   b. ☐ was previously filed in the international phase under PCT Rule 4.17(iv).

Items 5 to 8 below concern amendments made in the international phase.

PCT Article 19 and 34 amendments

5. ☐ Amendments to the claims under PCT Article 19 are attached (not required if communicated by the International Bureau) (35 U.S.C. 371(c)(3)).
6. ☐ English translation of the PCT Article 19 amendment is attached (35 U.S.C. 371(c)(3)).
7. ☐ English translation of annexes (Article 19 and/or 34 amendments only) of the International Preliminary Examination Report is attached (35 U.S.C. 371(c)(5)).

Cancellation of amendments made in the international phase

8a. ☐ Do not enter the amendment made in the international phase under PCT Article 19.

8b. ☐ Do not enter the amendment made in the international phase under PCT Article 34.

NOTE: A proper amendment made in English under Article 19 or 34 will be entered in the U.S. national phase application absent a clear instruction from applicant not to enter the amendment(s).

The following items 9 to 17 concern a document(s) or information included.

9. ☑ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
10. ☑ A preliminary amendment.
11. ☑ An Application Data Sheet under 37 CFR 1.76.
12. ☐ A substitute specification. NOTE: A substitute specification cannot include claims. See 37 CFR 1.125(b).
13. ☑ A power of attorney and/or change of address letter.
14. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13*ter*.3 and 37 CFR 1.821-1.825.
15. ☐ Assignment papers *(cover sheet and document(s))*. Name of Assignee: _____
16. ☐ 37 CFR 3.73(c) Statement *(when there is an Assignee)*.

This collection of information is required by 37 CFR 1.414 and 1.491-1.492. 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 1.11 and 1.14. This collection is estimated to take 15 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, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

U.S. APPLN. No. (if known – see 37 CFR 1.5)	INTERNATIONAL APPLICATION No.	ATTORNEY DOCKET No.
	PCT/CN/2013/072420	95480

17. ☐ Other items or information:

The following fees have been submitted.	CALCULATIONS	PTO USE ONLY
18. ☑ Basic national fee (37 CFR 1.492(a)) **$280**	$ 280	
19. ☑ Examination fee (37 CFR 1.492(c)) If the written opinion prepared by ISA/US or the international preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4) ..... **$0** All other situations **$720**	$ 720	
20. ☑ Search fee (37 CFR 1.492(b)) If the written opinion prepared by ISA/US or the international preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4) ..... **$0** Search fee (37 CFR 1.445(a)(2)) has been paid on the international application to the USPTO as an International Searching Authority .....**$120** International Search Report prepared by an ISA other than the US and provided to the Office or previously communicated to the US by the IB .....**$480** All other situations **$600**	$ 600	
TOTAL OF 18, 19, and 20 =	$ 1600	
☐ Additional fee for specification and drawings filed in paper over 100 sheets (excluding sequence listing in compliance with 37 CFR 1.821(c) or (e) in an electronic medium or computer program listing in an electronic medium) (37 CFR 1.492(j)). Fee for each additional 50 sheets of paper or fraction thereof **$400**		

Total Sheets	Extra Sheets	Number of each addition 50 or fraction thereof (round **up** to a whole number)	RATE	
- 100 =	/ 50 =		x **$400**	$

Surcharge of **$140.00** for furnishing any of the search fee, examination fee, or the oath or declaration after the date of commencement of the national stage (37 CFR 1.492(h)).	$	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	- 20 =		x **$80**	$	
Independent claims	- 3 =		x **$420**	$	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			**+ $780**	$	
Processing fee of **$140.00** for furnishing the English translation later than 30 months from the earliest claimed priority date (37 CFR 1.492(i)). **+**				$	
TOTAL OF ABOVE CALCULATIONS =				$	
☐ **Applicant asserts small entity status.** See 37 CFR 1.27. Fees above are reduced by ½.					
☐ **Applicant certifies micro entity status.** See 37 CFR 1.29. Fees above are reduced by ¾. Applicant must attach form PTO/SB/15A or B or equivalent.					
TOTAL NATIONAL FEE =				$	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property. **+**				$	
TOTAL FEES ENCLOSED =				$ 1600	
				Amount to be refunded:	$
				Amount to be charged:	$

a. ☐ A check in the amount of $_____ to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of $_____ to cover the above fees.

c. ☑ The Director is hereby authorized to charge additional fees which may be required, or credit any overpayment, to Deposit Account No. 50-4233 as follows:

i. ☐ any required fee.

ii. ☐ any required fee except for excess claims fees required under 37 CFR 1.492(d) and (e) and multiple dependent claim fee required under 37 CFR 1.492(f).

d. ☑ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038. The PTO-2038 should only be mailed or faxed to the USPTO. However, when paying the basic national fee, the PTO-2038 may NOT be faxed to the USPTO.

ADVISORY: If filing by EFS-Web, do **NOT** attach the PTO-2038 form as a PDF along with your EFS-Web submission. Please be advised that this is **not** recommended and by doing so your **credit card information may be displayed via PAIR**. To protect your information, it is recommended to pay fees online by using the electronic payment method.

NOTE: Where an appropriate time limit under 37 CFR 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the International Application to pending status.

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File)Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013, and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.

NOTE 1: By providing this statement under 37 CFR 1.55 or 1.78, **this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA**.

NOTE 2: A U.S. national stage application may not claim priority to the international application of which it is the national phase. The filing date of a U.S. national stage application is the international filing date. See 35 U.S.C. 363.

Correspondence Address

☑ The address associated with Customer Number: 70523 **OR** ☐ Correspondence address below

Name					
Address					
City		State		Zip Code	
Country		Telephone			
Email					

Signature	/Carl R. WESOLOWSKI/	Date	August 25, 2015
Name (Print/Type)	Carl R. Wesolowski	Registration No. (Attorney/Agent)	40,372

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.

PTO/AIA/14 (07-14)
Approved for use through 04/30/2017. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	95480
	Application Number	
Title of Invention	METHOD AND SYSTEM FOR BITE REGISTRATION	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Yannick		Glinec	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Shanghai	Country of Residence [i]	CN

Mailing Address of Inventor:

Address 1	Carestream Health, Inc. - c/o Patent Legal Staff
Address 2	150 Verona Street

City	Rochester	State/Province	NY
Postal Code	14608	**Country** [i]	US

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
	Qinran		Chen	

Residence Information (Select One) ○ US Residency ◉ Non US Residency ○ Active US Military Service

City	Shanghai	Country of Residence [i]	CN

Mailing Address of Inventor:

Address 1	Carestream Health, Inc. - c/o Patent Legal Staff
Address 2	150 Verona Street

City	Rochester	State/Province	NY
Postal Code	14608	**Country** [i]	US

Inventor 3 Remove

Legal Name

PTO/AIA/14 (07-14)
Approved for use through 04/30/2017. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	95480
	Application Number	
Title of Invention	METHOD AND SYSTEM FOR BITE REGISTRATION	

Prefix	Given Name	Middle Name	Family Name	Suffix
	Mo		Yufeng	

Residence Information (Select One) ◯ US Residency ◉ Non US Residency ◯ Active US Military Service

City	Shanghai	Country of Residence i	CN

Mailing Address of Inventor:

Address 1	Carestream Health, Inc. - c/o Patent Legal Staff		
Address 2	150 Verona Street		
City	Rochester	**State/Province**	NY
Postal Code	14608	**Country** i	US

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	70523		
Email Address	patent@carestream.com	Add Email	Remove Email

Application Information:

Title of the Invention	METHOD AND SYSTEM FOR BITE REGISTRATION		
Attorney Docket Number	95480	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Total Number of Drawing Sheets (if any)	8	**Suggested Figure for Publication (if any)**	

Filing By Reference :

Only complete this section when filing an application by reference under 35 U.S.C. 111(c) and 37 CFR 1.57(a). Do not complete this section if application papers including a specification and any drawings are being filed. Any domestic benefit or foreign priority information must be provided in the appropriate section(s) below (i.e., "Domestic Benefit/National Stage Information" and "Foreign Priority Information").

For the purposes of a filing date under 37 CFR 1.53(b), the description and any drawings of the present application are replaced by this reference to the previously filed application, subject to conditions and requirements of 37 CFR 1.57(a).

Application number of the previously filed application	Filing date (YYYY-MM-DD)	Intellectual Property Authority or Country i

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	95480
	Application Number	
Title of Invention	METHOD AND SYSTEM FOR BITE REGISTRATION	

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)
☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	70523		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, 365(c), or 386(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.
When referring to the current application, please leave the application number blank.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	a 371 of international	PCT/CN13/072420	2013-03-11

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

Foreign Priority Information:

This section allows for the applicant to claim priority to a foreign application. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55. When priority is claimed to a foreign application that is eligible for retrieval under the priority document exchange program (PDX) the information will be used by the Office to automatically attempt retrieval pursuant to 37 CFR 1.55(i)(1) and (2). Under the PDX program, applicant bears the ultimate responsibility for ensuring that a copy of the foreign application is received by the Office from the participating foreign intellectual property office, or a certified copy of the foreign priority application is filed, within the time period specified in 37 CFR 1.55(g)(1).

Remove

Application Number	Country	Filing Date (YYYY-MM-DD)	Access Code (if applicable)

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	95480
	Application Number	
Title of Invention	METHOD AND SYSTEM FOR BITE REGISTRATION	

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button. Add

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.
NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Authorization to Permit Access:

☒ Authorization to Permit Access to the Instant Application by the Participating Offices

If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the instant patent application is filed access to the instant patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the instant patent application is filed to have access to the instant patent application.

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date o f filing this Authorization.

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	95480
	Application Number	
Title of Invention	METHOD AND SYSTEM FOR BITE REGISTRATION	

Applicant 1 Remove

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Clear

○ Assignee	○ Legal Representative under 35 U.S.C. 117	○ Joint Inventor
◉ Person to whom the inventor is obligated to assign.	○ Person who shows sufficient proprietary interest	

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor :

If the Applicant is an Organization check here. ☒

Organization Name	Carestream Health, Inc.

Mailing Address Information For Applicant:

Address 1	Carestream Health, Inc. - c/o Patent Legal Staff		
Address 2	150 Verona Street		
City	Rochester	**State/Province**	NY
Country i	US	Postal Code	14608
Phone Number		Fax Number	
Email Address			

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Complete this section if assignee information, including non-applicant assignee information, is desired to be included on the patent application publication . An assignee-applicant identified in the "Applicant Information" section will appear on the patent application publication as an applicant. For an assignee-applicant, complete this section only if identification as an assignee is also desired on the patent application publication.

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PTO/AIA/14 (07-14)
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	95480
	Application Number	
Title of Invention	METHOD AND SYSTEM FOR BITE REGISTRATION	

Prefix	**Given Name**	Middle Name	**Family Name**	Suffix

Mailing Address Information For Assignee including Non-Applicant Assignee:

Address 1			
Address 2			
City		**State/Province**	
Country i		Postal Code	
Phone Number		Fax Number	
Email Address			

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Signature:

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

Signature	/Carl R. WESOLOWSKI/			Date (YYYY-MM-DD)	2015-08-25
First Name	Carl	Last Name	Wesolowski	Registration Number	40372

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This collection of information is required by 37 CFR 1.76. 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 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet 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, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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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 inspections 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.

Docket No. 95480
Customer No. 70523
Confirmation No.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Yannick GLINEC, et al.

METHOD AND SYSTEM FOR BITE REGISTRATION

Serial No. UNKNOWN

Filed: Herewith

Group Art Unit: Unknown

Examiner: Unknown

CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being filed using the USPTO's electronic filing system EFS-Web, and is addressed to: Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on this 25 day of August 2015.

Signature: Karen J Tyler

Name: Karen Tyler

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

Sir/Madam:

PRELIMINARY AMENDMENT

Please preliminarily amend the above-identified application as set forth below:

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Claims are reflected in the listing of claims, which begins on page 3 of this paper.

Remarks/Arguments begin on page 8 of this paper.

Amendments to the Specification:

Please add the following new paragraph on page 1, after line 1.

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of and is a U.S. National Phase filing of PCT Application PCT/CN2013/072420 filed March 11, 2013 entitled "METHOD AND SYSTEM FOR BITE REGISTRATION", in the name of Glinec et al.

Amendments to the Claims:

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

1. (Original) A method of bite registration, characterized by comprising the steps of:

a. generating 3-dimensional (3D) teeth models of the upper jaw and the lower jaw;

b. acquiring a bite surface containing a portion of upper and lower jaws simultaneously;

c. attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface;

d. displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful;

e. repeating step b to step d so as to obtain at least two successful bite registrations corresponding to different displayed bite surfaces;

f. selecting one or more successful bite registrations by evaluating at least two successful bite registrations; and

g. computing a final bite registration using selected one or more successful bite registrations.

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

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

4. (Original) The method of bite registration according to claim 3, wherein said one or more interpolations contain steps of:

decomposing each matrix into an equivalent set of values;

interpolating corresponding values from each set of values; and

recomposing a matrix from the interpolated set of values.

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

a1) capturing 3D teeth surface on the upper jaw or lower jaw by a scanner;

a2) judging whether the captured 3D teeth surface is the first one or not during the scan;

a3) if the captured portion is the first one, accepting the captured 3D teeth surface; and if further succeeding to accept, combining the captured 3D teeth surface with the 3D teeth model; and

a4) if the captured portion is not the first one, attempting to stitch the captured 3D teeth surface onto the existing 3D teeth model; if succeeding to stitch, combining the captured 3D teeth surface with the existing 3D teeth model.

6. (Currently Amended) The method of bite registration according to claim 1, wherein step d including step of:

if the alignment is not successful, the bite surface is discarded and the user receives a notification of failing to align or to register the bite surface, wherein if the alignment is not successful, automatically returning back to step b until the alignment is successful.

7. Canceled

8. (Original) The method of bite registration according to claim 1, wherein the alignment is completed at least by stitching of a portion of 3D teeth surface of the bite surface with the 3D teeth models of the upper jaw and the lower jaw.

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

generating candidate 3D rigid transformations to place the 3D teeth surface relative to the 3D teeth model;

evaluating a metric of the candidate 3D rigid transformations using the relative placement of the 3D teeth surface relative to the 3D teeth model;

choosing the best 3D rigid transformation which corresponds to a best metric; and

if the best metric goes below a predetermined threshold, accepting the corresponding 3D rigid transformation; if the best metric exceeds a predetermined threshold, rejecting the stitching.

10. Canceled

11. (Original) The method of bite registration according to claim 1, wherein in step e, when repeating to perform step b, the location of the acquired bite surface is changed.

12. (Original) The method of bite registration according to claim 11, wherein the teeth contained in the bite surface are selected from incisors, premolar or molars.

13. (Original) The method of bite registration according to claim 1, wherein the bite surface is acquired based on one or more bite views captured by a scanner.

14. (Original) The method of bite registration according to claim 1, wherein the alignment is completed in a manual way, a semi-automatic way or automatic way.

15. (Original) The method of bite registration according to claim 1, wherein the final bite registration is used to construct a global 3D teeth model.

16. (Original) A system for bite registration, characterized by including:

means for generating 3D teeth models of the upper jaw and the lower jaw;

means for acquiring a bite surface containing a portion of upper and lower jaws simultaneously;

means for attempting to align the 3D teeth models of the upper jaw and the

lower jaw with the bite surface;

means for displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful;

means for obtaining at least two successful bite registrations corresponding to different displayed bite surface by repeating;

means for selecting one or more successful bite registrations by evaluating at least two successful bite registrations; and

means for computing a final bite registration using selected one or more successful bite registrations.

17. (Original) The system for bite registration according to claim 16, wherein the computation of the final bite registration involves the optimization of a cost function depending on the selected successful bite registrations.

18. (Original) The system for bite registration according to claim 16, wherein means for computing the final bite registration involves device for one or more matrix interpolations of the selected successful bite registrations.

19. (Original) The system for bite registration according to claim 18, wherein device for one or more matrix interpolations includes:

module for decomposing each matrix into an equivalent set of values;

module for interpolating corresponding values from each set of values; and

module for recomposing a matrix from the interpolated set of values.

20. (Original) The system for bite registration according to claim 16, wherein means for attempting to align the 3D teeth models includes:

module for, if the alignment is not successful, discarding the bite surface and sending a notification of failing to align to the user.

21. (Original) A system for bite registration, including a scanner and a computerized workstation, wherein the workstation is configured as:

generating 3D teeth models of the upper jaw and the lower jaw;

acquiring a bite surface containing a portion of upper and lower jaws simultaneously;

attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface;

displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful;

repeating steps acquiring to step of displaying so as to obtain at least two successful bite registrations corresponding to different displayed bite surfaces;

selecting one or more successful bite registrations by evaluating at least two successful bite registrations; and

computing a final bite registration using selected one or more successful bite registrations.

22. (Original) The system for bite registration according to claim 21, wherein the system is used to construct a global 3D teeth model.

REMARKS

This Preliminary Amendment is made to clarify the priority claim and amend claims 6 and 9. Claims 7 and 10 are canceled without prejudice or disclaimer.

It is believed that the application is in condition for allowance. Accordingly, consideration and favorable action are respectfully solicited.

Respectfully submitted,



Attorney for Applicants
Registration No. 40372

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If unable to reach the Applicant(s) Attorney at the telephone number provided, please communicate with Carestream Health, Inc. at (585) 627-6740 or (585) 627-6687.

POWER OF ATTORNEY BY APPLICANT Carestream Health, Inc.	ATTORNEY DOCKET 95480

• I hereby revoke all previous powers of attorney given in the application referenced below.

• I hereby appoint the patent practitioner(s) associated with the following Customer Number as our attorney(s) or agent(s), and to transact all business in the U.S. Patent and Trademark Office connected therewith for the application referenced below: **Customer Number 70523**

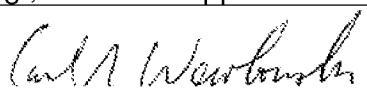
• Please recognize the correspondence address associated with the above-mentioned Customer Number.

Application Number	UNKNOWN
Filing Date	HEREWITH
First Name Inventor	Yannick GLINEC
Title	METHOD AND SYSTEM FOR BITE REGISTRATION
Art Unit	Unknown
Examiner Name	Unknown
Attorney Docket Number	95480

I am the Applicant (Applicant is a juristic entity):

Carestream Health, Inc.

Assignee or Person to Whom the Inventor is Under an Obligation to Assign.

Signature of Applicant for Patent The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).	
Signature	
Name	Carl R. Wesolowski
Registration Number	40372
Title and Company	Patent Counsel, Carestream Health, Inc.
Date	August 25, 2015
Direct Telephone Calls to: 585/627-6740 or 585/627-6687 Facsimile: (585) 627-8919	Carestream Health, Inc. Patent Legal Staff 150 Verona Street Rochester, NY 14608

Docket No.: 95480
Customer No. 70523
Confirmation No.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of
Yannick GLINEC, et al.

METHOD AND SYSTEM FOR BITE REGISTRATION

Serial No. UNKNOWN

Filed: HEREWITH

Group Art: Unknown

Examiner: Unknown

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Signature Karen J Tyler

Name: Karen Tyler

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

Madam:

INFORMATION DISCLOSURE STATEMENT FOR CONSIDERATION BY THE OFFICE UNDER 37 C.F.R. 1.97-1.99

Enclosed herewith are patents and/or publications for consideration by the Patent and Trademark Office in regard to the invention claimed in the above-described application. In compliance with §1.56, such documents are listed in the enclosed Form CSH-1449.

Applicants request that the Patent and Trademark Office make of record the above-identified documents. A full text copy of each document is attached, except for copies of U.S. patents and U.S. patent application publications. For documents not in English, an English translation or an equivalent English language patent or publication may be attached. Where a translation is not available, a concise explanation of the relevance of each document not in English is included either here or in the specification.

This Information Disclosure Statement is submitted according to the following selected paragraph:

I. [X] This Statement is being filed under §1.97(b) within three months of the filing date of the application (other than a CPA), or before the first Office action on the merits or before mailing of a first Office action after the filing of a request for continued examination.

II. [ ] This Statement is being filed under §1.97(c), with fee, **prior** to either a final action, a notice of allowance or an action that otherwise closes prosecution in the application. Please charge any additional fees required by §1.17(p) to Carestream Health, Inc. Deposit Order Account Number 50-4233.

III. ☐ This Statement is being filed under §1.97(c), with a statement under, §1.97(e) **prior** to either a final action, a notice of allowance or an action that otherwise closes prosecution in the application. The undersigned hereby states that (check one):

☐ each item of information contained in this Statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this Statement.

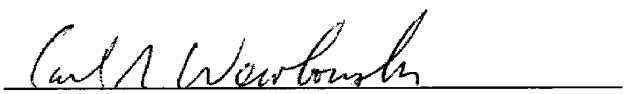
☐ no item of information in this Statement was cited in a communication from a foreign patent office in a counterpart foreign application and, to the knowledge of the person signing this certification statement under §1.97(e) after making reasonable inquiry, no item of information contained in this Statement was known to any individual designated in §1.56(c) more than three months prior to the filing of this Statement.

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Respectfully submitted,



Attorney for Applicants
Registration No. 40372

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Enclosures

FORM CSH-1449 US DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	Atty. Docket No. 95480 Customer No. 70523	Serial No. UNKNOWN
If AFTER the later date of the first Office Action or 3 months from filing, use only with Rule 97(E) Certificate or Fee	Applicant: Yannick GLINEC, et al.	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date HEREWITH	Group Unknown

U.S. PATENT DOCUMENTS

Examiner Initial*	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	2002/0094509	07/08/2002	Durbin et al.			11/30/2000
	7,118,375	10/10/2006	Durbin et al.			01/08/2004

FOREIGN PATENT DOCUMENTS

Examiner Initial*	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES | NO
	101228556	07/23/2008	CN			**Yes**

OTHER ART *(Including Author, Title, Date, Pertinent Pages, Etc.)*

	International Search Report, dated December 19, 2013 International Application No. PCT/CN2013/;072420, 5 pages.

EXAMINER	DATE CONSIDERED

***EXAMINER:** *Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.*

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Registration of 3D imaging of 3D objects

CN 101228556 A

Publication number	CN101228556 A
Publication type	Application
Application number	CN 200680026432
PCT number	PCT/US2006/027774
Publication date	Jul 23, 2008
Filing date	Jul 18, 2006
Priority date	Jul 18, 2005
Also published as	CA2615482A1, 9 More »
Inventors	A·亚马科维克, B·格兰特, R·S·沙莱克
Applicant	阿特兰蒂斯组件公司
Export Citation	BiBTeX, EndNote, RefMan

Referenced by (2), Classifications (15), Legal Events (3)

External Links: SIPO, Espacenet

ABSTRACT translated from Chinese

The present invention discloses a method and system based on the application of a design used in the dental and related medical (and appropriate non-medical) three-dimensional modeling. Data capture device generates representative objects (such as arch) point cloud of the three-dimensional surface. A three-dimensional object recognition in particular those provided in the area of the image field of the low resolution images, and in particular disposed in at least two images appear overlapping portion of these areas in order to provide adequate location for the three-dimensional image processing software, angle and orientation information to achieve highly accurate combination of adjacent and overlapping images (or "stitched"). This is conducive to the formation or model-related objects (such as the maxillary arch and the mandibular arch) alignment and post-alignment of objects or models.

DESCRIPTION translated from Chinese

Registration of three-dimensional imaging technology in the field of three-dimensional object of the present invention relates to determining the object and wherein the plurality of scanned images in the relative positions of the methods and systems, particularly to medical and dental applications, including the requirements of the surgical and prosthetic devices designed and manufactured to able to adapt to individual anatomical structure of the patient as determined by those applications where precise anatomical structure dimensions. More specifically, it aims precisely registration as mandibular and maxillary digital three-dimensional scanning, or equivalent to their mold or stamp issue. Many surgical procedures involved will be very high precision and accuracy required to fit the patient's anatomy structure of prosthetic devices and other artificial means for temporarily or permanently inserted into the patient soft tissue or bone tissue. One such application relates to oral implantology, implant procedures in one or more (usually metallic) anchors the implant is surgically placed in the jaw bone of a patient to receive and support designed to ^^ Mo It intends to replace the prosthetic components and the loss of one or more teeth in patients natural teeth. As we all know, in order to fully successful implantation of the program must comply with the existing bone structure and dentition determined very strict position, orientation and size requirements and thus be fitted to the type of surgical implant positioning an anchor of prosthetic components must be perfectly designed, shaped and sized so that it fits the exact construction geometry patient, including the adjacent tooth position, shape and size, and must be moved to support high precision implant anchored objects precise orientation of the spindle. In addition, many trends of products and services and repairing orthodontic field of dentistry is to seek to provide computer-aided design (CAD) and computer-aided manufacturing (CAM) use. For example, in dentistry, stone or plastic mold (stone cast) stamp formed by the mouth of the patient is typically used to provide the desired product or service, and whether the patient dentition or indicate mold patient dentition The three-dimensional (3-D) can be used to scan a dental CAD system 4 is for showing the relevant geometry data. However, for such applications, dental CAD Mo needs to build only the maxillary (upper part of the mold or replica) and mandible (lower part of the mold or replica) is very accurate image alignment. Conventional methods to meet these demanding requirements of the patients jaw and dentition model for forming the fan models produced include the malleable material is placed on and includes the entire arch of teeth (dental arch) of patients within and around the mouth to produce patient dentition so-called "Indian only mo." In implants and prosthetic components are placed is a factor, this impression is generally anchored implant inserted after surgery was made. Under normal circumstances, we are called to deal with India 4 mo (impression coping) reference assembly is attached to the outer ends of the inserted implant anchors and an anchor for the reference position and angular.

CLAIMS (14) translated from Chinese

A method for constructing a three-dimensional model of the three-dimensional model of the image data are combined and aligned maxillary arch and the mandibular arch of the relative three-dimensional scanning, the method comprising: (a) setting the maxillary Bow and mandibular arch adjacent surface, sufficient to allow the appropriate location and determine the orientation of the plurality of identifying characteristics of those arch; (b) a single to three-dimensional scanning of the arch to obtain the dental contain and represent dimensional image data bow morphology and capture the arch of each identifying characteristics associated; (c) to set up the maxillary occlusal relationship and the mandibular arch, and on the arch three-dimensional scanning data to obtain a three-dimensional image, the three-dimensional image data comprising the identifying characteristics of each of the dental arch can be captured in the single scan; and (d) processing the three-dimensional image data and build three-dimensional model, which corresponds to the maxillary dental arch represented with a corresponding mandibular dental arch representation accurately aligned.

L The method according to claim 2, wherein the fan is formed in the maxillary arch mandibular arch bow and Indian patients only Mo or mold.

3. The method according to claim 1 or claim 2, characterized in that the at least one identification feature is located outside of the at least one bow.

4. A method as claimed in claim 1 or claim 2, characterized in that the at least one identification Laid ^ n located inside at least one of the bow.

5. 1 or 2 fans method of claim wherein the surface is set with the maxillary arch and the mandibular arch adjacent, sufficient to allow determining a plurality of identification features corresponding to those of the dental arch position and orientation includes a plurality of identification features, these features when used in conjunction with the one or more dental arch characteristics, sufficient to allow to achieve at least one of the position and orientation of the dental arch is determined.

6. The method according to claim 1 or claim 2, characterized in that at least one of the dental arch is edentulous.

7. The method according to claim 1 or claim 2, characterized in that the two bows are not missing teeth.

Subsequently, the model is based on the formation of the mold stamp fans will combine the so-called "analog" anchors in order to patient jaw anchoring built only Mo, and the anchoring prosthetic devices will be based on a given matter as the model geometry form design and manufacturing. In practice, the above conventional program has many difficulties and shortcomings. Dentist can not make the space and location sustained error-free dental impression and model, which has been confirmed; due to the geometry of this type of application requirements so harsh, so even sub-millimeter dimension error or 1 or 2 Orientation degree of error will lead to the replacement position unacceptable stress and conditions. In recent years, people have been trying to preclude the use of image-based technology built before Mo to address conventional dental implants in these well-known problems. In these attempts, through the use of so -called three-dimensional image processing technology and software to obtain images of the patient's mouth, and reconstructed the relevant area of only Mo Bee type. Roots in the field of photogrammetry since the thirties of the nineteenth century, the invention of photography decade is "by recording, measuring and interpreting photographic images and patterns of electromagnetic radiation energy and other phenomena related to the physical object is obtained and the environment Art of reliable information, science and technology. " (American Society for Photogrammetry and Remote Sensing Project, 1980 photogrammetric Manual 4th Edition.) In particular, having appeared with the emergence of fast processing speed and large memory capacity of computers and low-cost digital cameras and other image capture device for a variety of ready-made applications, virtual modeling three-dimensional image processing software can be easily obtained. After the use of such software, by using the available commercial products and reconstructed the imaged body region (subject field) Mo was fairly accurate 3D model. However, the special requirements of high accuracy and physical constraints on the body imaging in the dental field so far has been the lack of an acceptable three-dimensional imaging technique. A specific issue is necessary in order to form an accurate virtual model reconstruction imaging scene. In general, from more than one location on the object is imaged, thus providing a more complete three-dimensional model. December 22, 1998 release, granted to Carlsson et al U.S. Patent No. 5, 851, 115 describes a method for imaging the mouth to create a virtual patient's mouth before Mo type, which can be designed and fabricated tooth photogrammetric method and system parts. In the Carlsson et al system uses a special camera, including a set of mirrors to allow a single exposure include two different angles of three-dimensional photographic images. Carlsson proposed system also requires accurate know the relative geometry of the virtual mirror system created "lens" of. To help locate the imaging software features and orientation, Carlsson teaches the use of applications such as circles within the imaging area to the plane of reference marks. L December 1999 release, granted vanNifteric et al U.S. Patent No. 5, 857, 853 discloses a method of photogrammetry-based capture for use in the manufacture of dental implants for tooth replacement part needed spatial data and orientation data. In order to obtain at least two views triangulation photogrammetry software engine (triangulation engine) desired, van Nifteric et al., Methods with precisely known relative positions of a plurality of cameras, or mounted on a rotary support, in separate but accurate single camera moves between defined location. van Nifteric, who also teaches the use of object recognition and act as a point of photogrammetry software localization within the coordinate system used in the imaging scene feature reference point. vanNifteric et al discloses the use of thus include indexing tags rods and bolts installed on the two spheres as object recognition. Although the method of Carlsson et al and van Nefteric et al., Discloses constitutes a significant advance, these methods are still several serious shortcomings and defects, making them most implant dentist is not practical. Two of the methods require the use of highly specialized and therefore expensive camera equipment, and both require such precise alignment of the camera device to capture multiple images from a fully known relative lens position. Two methods are not suitable for large functionally accurate image projection area, especially in having very low feature definition includes a large area of the projection region especially, this missing teeth (without teeth) and jaw are typical Therefore, in implant dentistry practice very common condition. The present invention addresses these deficiencies in the prior art, and it provides a three-dimensional virtual model based approach, which especially for medical and dental applications, it costs very low, and especially in the need to use a combination of three-dimensional image applications feature provides higher accuracy Reconstruction. Specifically, with respect to the issue of the maxillary and mandibular provide relative positions for the dental CAD system, the prior art method relies on the sharing of a common characteristic of two ways: The first method relies on a single image capturing both maxillary and mandibular facial the surface of the three-dimensional image. Maxillary and mandibular single scan is then separated and both maxillary and mandibular facial surface of the image provided by the public template matching. A second prior art method relies capture both the maxillary and mandibular occlusal surfaces of teeth "bite registration" or stamp. After you capture the geometry of the lower jaw, the lower jaw bite registration placed on the surface, and also be scanned. Then scan and maxillary occlusal surface maps recorded match <image to match. Both prior art methods described in the previous paragraph there are two basic problems. One problem is the complexity of the calculations and the need for an operator by the relative position of the image of a good match for the initial determination to an even greater computational complexity to a minimum. In the case of partial or complete absence of teeth, lack the necessary information to match the three-dimensional scans of patients with maxillary and mandibular, there has been a second greater difficulties. In

8. The method according to claim 7, characterized in that at least one of said arch area having a missing tooth.

9. A method for constructing a three-dimensional image only Mo-based method, the three-dimensional model of the image data are combined and aligned with the upper teeth model components and the relative three-dimensional scan of the lower part of tooth model assembly, the method comprising: (a) use three-dimensional scanner only the upper teeth and lower teeth Mo type component model component for each three-dimensional scanning, wherein at least one component has a planar features, and during the scan, so that the assembly is pressed against the flat feature in the plane of the three-dimensional scanner, the assembly also having an additional identifying feature, the additional identification features and the planar bottom when combinations of features, sufficient to determine the respective position and orientation axes components;. (b) In occlusion and placing the upper teeth and the lower teeth model assembly model components into abutting the scanner; (c) a tooth on the upper and lower teeth Mo type component model component three-dimensional scanning to obtain In operation of the upper teeth comprising (a) are scanned before a sufficient number of Mo-type assembly and said lower dental model component identification features of the three-dimensional image data, the image is aligned to allow the assembly; and (d) processing the three-dimensional image data and the "three-dimensional image constructed red smell type, wherein said upper dental model component and said lower dental representation showing the model assembly is properly aligned.

10. The method according to claim 9, characterized in that said at least one additional identification feature is a feature plane, and in the operation (a), the features are pressed against the fan registration mark scanner.

11 The method according to claim 9, characterized in that said alignment mark with a planar area perpendicular to the scanner.

12. The method according to claim 9 or claim 10, characterized in that at least one of the dental arch is edentulous.

13 The method according to claim 9 or IO claims, characterized in that the two bows are missing teeth.

14. The method according to claim 13, characterized in that at least one of said arch area having a missing tooth.

addition, the record is difficult to obtain from the engagement geometry of anterior teeth. In a prior art, it can be captured using any suitable scanning method represented by a cloud of three-dimensional features of the scanned area data point to scan the object. Such scanning general need to take multiple overlapping images, which together cover the image field to including the desired target. Various methods are generally used to reconstruct from these individual scans only Mo entire 3D model. One such prior art method using precise information about the model with respect to the position of the camera, the positioning and orientation of the plurality of images. In addition, commercial three-dimensional image processing software products are also available through the overlap region matching images and combine into a single model of discrete scan tool. Examples of suitable image processing software known include Raindrop Geomagic, Inc. in the Studio on the market specifically due to pieces. SUMMARY Disclosed herein is a three-dimensional modeling method and system design for dental and related medical (and appropriate non-medical) applications. One aspect of the method and system is needed to dispense a particular camera, and in turn allows the use of any data that may generate three-dimensional surface representation of the point cloud capture device. Such data capture devices such as handheld or frame can be fixed, three-dimensional laser scanner, an ordinary digital camera or the practical application of any other agency specific medical imaging applications. Another aspect of the disclosure is a three-dimensional object recognition using the three-dimensional image processing software to allow automatic positioning and accurately determine the image position and orientation of the object field. On the other hand in those areas like the field of low image resolution, and in particular objects having a specific location identification topography disclosure appeared in the region of at least two such overlapping portion of the image, so that a three-dimensional confining image processing software provides adequate position, angle measurement and orientation information, in order to achieve highly accurate image combination is connected to and superimposed (or "stitched"). Other aspects of the disclosure include for accurately capturing the spatial relationship of the maxillary and mandibular, the method does not depend on the presence of dentition, so completely used to obtain accurate data from CAD to build only Mo partially or even totally edentulous patient's . In the disclosed method, the non-physiological identify objects or geometry is added to the upper and lower jaws, or that the patient's upper and lower jaws of the mold in order to provide accurate child how accurate reference. On the other hand, an alternative method of tooth models capture the relative positions of the upper and lower components of the present invention utilize these model components of the non-planar three-dimensional geometry of the tooth. In this alternative method, the software only with accurate set of geometric characteristics of Mo-type position from 3D scan data, and to adopt the geometric characteristics of the known characteristics of precision and accurate positioning and includes all anatomical structure and dental characteristics All topographical features (topographical feature) is associated with the model. Determining the geometric characteristics of such a location may be at least three cross on each side until Mo type module; Such features can turn comprise a combination of flat and / or components, such as the model plane, the sphere is placed or finishing disc and other features, or the like will provide 4 Mo paste location data (6 degrees of freedom for each object) of any other non-dental objects. In these methods, including having clear features in accurate relative position is known or can be determined on the known geometry of the object recognition is fixedly positioned as the venue, and especially in a low-resolution features area image block. Examples include the identification of objects having one or more spheres of known radius, and known geometry and dimensions of one or more flat object, such as a cone. Subsequently, the object field scanning, such scanning effectively "panorama shooting (panning)" as the field to cover the image field, provide the required geometry. Preferably included in this specification forth a three-dimensional image processing software algorithm is then used a combination of three-dimensional image data obtained by scanning parts and determine with high accuracy the virtual three-dimensional model reconstructed net branch scanning the image field geometry. Known geometric characteristics of each image in the overlapping or non-overlapping coverage of interest together by physical connection is used to identify the object, which can determine the relative position and orientation of the image. This aspect of the invention is used to eliminate the source of the inaccuracy of known "sew" method produces, these methods lead to bias when alignment scan, distorted and / or other distortions. Yet another aspect of the present invention is a method for constructing a three-dimensional approach was Mo type, the model merge and alignment of the three dimensional image data relative to the maxillary arch and the mandibular arch. The fans method comprising: providing the upper and lower jaws arch surface adjacent to the plurality of identification features, making enough to allow the determination of those arch corresponding position and orientation; each of the arch to obtain three-dimensional scanning package Scotia and representing the dimensional image data of said arch morphology and capture identifying characteristics associated with each of the arch; and to set the occlusion of the maxillary arch and the mandibular arch and the arch of the three-dimensional scanning to obtain three-dimensional image data comprising the fans are captured in a single scan each of the identifying characteristics of said arch; and processing three-dimensional image data was lost and construct three-dimensional Mo type, which corresponds to the maxillary dental arch showing the corresponding mandibular arch represent accurately aligned. Maxillary dental arch may be formed in India and mandibular arch ^^ or mold. At least one identification feature may be located at least one of the Yi bow outside. In addition, at least one identification feature is located inside the at least one of the bow. _ 〖Shu opposed adjacent surfaces of the maxillary and mandibular dental arch, is sufficient to allow the determination of the respective position and orientation of the plurality of identification features may include those dental arch, wherein a plurality of identification, with the bow in one or more When used with a tooth characteristics sufficient to allow at least one dental arch to achieve the position and orientation of the fan OK. At least one of the fans may edentulous arch, or no arch may be missing teeth, or at least one of the arch region may have a missing tooth. The other is a method for constructing a three-dimensional image model, the model fit and alignment of the upper teeth only three-dimensional scan image data MO type components and relatively lower teeth model components. The method involves the use of three-dimensional scanner three-dimensional scanning of the upper and lower teeth of each model component, wherein at least one of the fan assembly has a planar features, and during the scan, so that the assembly plane characteristic pressure leaning against (. bear upon) the fan plane features three-dimensional scanner, the fan assembly may also have additional identifying characteristics, in combination with the flat bottom of the feature sufficient to determine the position and orientation of each component; relative to the occlusion Scanner Settings fan assembly of the upper and the lower teeth model teeth of a Mo-type module; on the upper and lower teeth model components three-dimensional scanning to obtain the upper and lower teeth model components included in

the scanning operation in (a) three-dimensional image data of the identifying characteristics sufficient dental model components, allowing the alignment of the fan assembly of the image; and processing the three-dimensional image data and three-dimensional image constructed from only Mo type, wherein said upper tooth punch assembly type Mo represents said lower dental model component represents - wave accurately aligned. At least one of said additional recognition features may be flat characteristic, and scanning, the characteristic net is pressed against the support of the registration mark scanner. In some cases, the registration mark perpendicular to the plane of the scanner area. At least one of the dental arch may be missing teeth, or two dental arches may be missing teeth, or at least one of the dental arch may have missing teeth area. Figure 1 attached storm is a perspective view of the disclosed methods and systems for the first identification of objects based. 2 is a perspective view of a second object recognition for the disclosed methods and systems used. Figure 3 is a perspective view of a third for object recognition disclosed methods and systems. Figure 4 is a perspective view including the younger brother of three arch of object recognition. Figure 5 is a perspective view of a fourth arch object recognition. Figure 6 is a perspective view of the maxillary and mandibular mold identify objects located outside representation. Figure 7 is a lower jaw mold include three internal settings of a view object recognition. Figure 8 is a view of the upper jaw mold, the mold shown in FIG. 7 by the identification of three objects produced stamper. Figure 9 is a view of the mold shown in FIG. 8, FIG. 8 now includes a visual impression of the ball. FIG. 10 is a characteristic plane (characteristic planar surface) of the assembly through a tooth model shown in Figure. FIG. 11 is only 10 tooth Model with lower assembly through - see Fig. 12 is a perspective view of IO-type upper tooth punch Mo component. Referring now to the various aspects of the above-described methods and systems. Introducing Yat some aspects, embodiments will be used to describe characteristics ^ dagger class methods and systems. It should be understood that these embodiments are only shown as an example, and the purpose of limitation. The present invention is capable of these and many other forms. Although these embodiments illustrate various components and operations of elements, it should be appreciated that in the case with or without some other elements or operations, some or all of such elements or actions may be assembled or otherwise and still practice The present invention may be practiced. . As used herein, certain terms or expressions unless the context clearly indicates the use of, or should be understood to have the following meanings: "adjacent to the surface of the bow ,, including direct on the bow or in connection with a slight gap." Internal ,, and "External" were involved in internal or external mouth; internal or external relative to the bow area were involved in the U-shaped bow inside or along the outside of the U-shaped bow area. Edentulous arch is toothless bow. Bow edentulous area has some missing one or more teeth and one or tooth. One aspect of the invention is an overlapping capture images "stitched" in the reference point by using the body as a non-physiological, and further characterized by having a low-resolution field of view (field of view) in order to enhance the positioning of such object recognition Such regional dimensional accuracy Mo was built to create a method and system by scanning the field of view of a virtual three-dimensional model. Yet another aspect of the present invention is a method for obtaining the CAD and CAM applications available, particularly when a single scan must be noted in the number three from each of the components involved in a single component such as a patient's jaw and maxillary dental and other relative positions The method and system of three -dimensional data. The system and method is particularly suitable and intended for use in medical and dental applications, and is particularly suitable for use in implant dentistry and related applications. Dental implants to support the missing tooth repair. The implant retention device surgically implanted by a dentist. The dental implant abutments and generally will crown "fix"; that is,; fci into the body after successfully implanted in a patient retention jaw, including abutments and supplementary components will be attached to the crown straight into the Si retention device, in order to provide patients with a patient's natural tooth repair. 'In one aspect, the present invention is a method and system of some embodiments allows dental restoration component manufacturers to accurately measure implant position and orientation relative to the surrounding environment of the oral cavity and thereby design and processing with extremely high precision and accuracy custom prosthetic components for construction and existing patient anatomy dentition. Involving dental applications and related medical applications, such a method and system eliminates the need for dedicated camera and camera mount. Instead, they are allowed to produce any data representing three-dimensional surface of point cloud capture devices. Such number noted capture means may be hand-held or fixed frame 3D laser scanner, an ordinary digital phase ^ i or actually apply to any other institution specific medical imaging applications. Image data can be used in conjunction with the present invention can easily capture device obtained from commercial sources, and for example, will include a three-dimensional laser scanner, such as Minolta Corporation marketed the VIVID 900 scanner type. Another aspect of the present invention is the use of object recognition 1-7 in FIG. 12-26 shown, three-dimensional image processing software to assist in automatically and accurately positioned as the inside of the object to determine the position and orientation. Yet another aspect of the present invention is in the field of image sharpness FIG ^^ ^ (Di within those regions, and specifically positioned in at least two images appear overlapping Gao points in these areas have such a clear recognition morphology object to provide a full software I like the location and orientation information, enabling connected and highly accurate combination of overlapping images (or "stitched"). The presence of such a low-resolution characteristic region of missing teeth is a typical situation, and thus creating a serious problem edentulous jaw imaging, and the first successful winter invention solves this problem. In practice the teachings herein scenario, you have to know exactly including in defining feature or may be determined relative positions of known geometry Object recognition is fixedly included in the image field, and especially in areas with low-resolution images characteristic block in. implementing some identify objects used in conjunction with this technique include ^ For example shown in Figure 1 object 12 and other objects , including a precisely known radius, are fixed angled pile 13-A, precisely known location 13-B and 13-C on the three links ball 12-A, 12-B, 12-C. Another useful form of identification of the object using a plurality of plane surfaces as shown in Figure 3 the object 16-A and 16-B in FIG. 16, FIG. 3 shows an example of a polygonal funnel of known dimensions. Still other object recognition Useful form is shown in Figure 4, 18, having a rod fixed at the end of a rectangular object, as shown in Figure 5, 22, the wire having spaced apart arcuate accurate identification features and 5 (which is characterized by a sphere) -7 and shown in FIG. 9, the radius of the sphere is known simple Figure 8 shows a spherical object attached to the upper jaw and after the formation of the stamp print making. Figure 4 and Figure 5 shows on the maxillary or mandibular arch Bow mold 40 nearby object recognition. In Figure 6, the identification of objects is located 42 maxillary and mandibular impression outside the sphere 44 in practice methods taught herein, as 1-7, object recognition shown in Figure 9 ^ L as incorporated

in the floor. on implant dentistry concerned, identifying one or more objects have been implanted in a patient may be secured to the jaw by a dental implant surgery. Such preferred that each identification object comprising Supplementary dental implant interface features body attachment feature. identify objects by engaging fixing, the engaging member having a threaded shaft along implant retention device for spindle orientation hole pluggable object recognition in the field include maxillary and place the mold jaw hinge, object recognition can be fixed to use. screw pile mold fixed or otherwise secured to. As noted in another aspect, the present invention includes a method for dental restoration areas form a virtual three-dimensional model and systems. In one aspect, the present invention provides methods for determining object recognition and object recognition feature of the relative position of one or more scanned images obtained by three-dimensional scanning means and detecting objects in three-dimensional scanning feature known position and orientation components. In another aspect, the present invention includes a use of positioning or fixed to the entity (ie, the upper and lower jaws or to represent upper and lower jaws of the mold or printed only Mo) identification of objects, such as dental accurately capture maxillary and mandibular systems and methods for the spatial relationship between the two as a single entity. 'Identification object may be the original object (or objects set), but non-anatomical structure inherent characteristics, it can be added to the original field of human creation. In either case, the identification of objects having a known geometry. The use of the known geometry of the object recognition information, the software allows the scanned data with respect to the identification of the object to determine the precise location and orientation. Moreover, given the multiple scans the field of view can be "registration", and its relative position and / or orientation are precisely aligned, without any human intervention. Similarly, in particular, including the upper and lower jaws or a representation thereof, such as two or more fields of view of the relative position and orientation of objects in a single scan both mold and other components can be used several times by scanning each field of view The obtained high spatial accuracy and precision of the alignment accuracy, wherein at least one scan comprises identifying each object from the view. Field to be scanned must include one or more identifying characteristics with known geometry and dimensions of the at least one object, sufficient to fully define the feature position and / or orientation. Figure 1-7 shows a non-limiting examples of these types of objects. A three-dimensional scanner to scan identification (location) object, and often will net skin disorder scanned data collected as ASCII text format; however, three-dimensional point data (three-dimensional point) are applicable to any collection. Determining (using its known geometry) also allows to determine the data captured in the scanned all other objects and features of the position detecting and imaging software data scanned from the identification object, and each object position identification and / or orientation orientation. This process can be quickly performed automated process using effective computer code. For example, in the example for defining the position and orientation of the three spherical (see Figure I), the software detects three spheres (diameter are known and are also known mutual distance) in the center. Subsequently, the calculation geometry origin (origin), and generally the origin of the three-phase output position data points (& y, z). The software also can direct the identification of objects is calculated as the unit vector can also be expressed as a three-phase data points. Similar methods for determining the subject field (subject field) from the known geometry of the other objects defined position and orientation, spherical, planar, polygonal, cylindrical, and other shapes as shown in FIG. 1-7 Other objects. Thus, the availability of fully qualified each identified object position and orientation of a set of data. In the three-dimensional scanning; ^ measure known geometry of the object has many possible applications. The present invention relates generally to medical and dental applications involving organic surface composition and manufacturing objects, and in these applications, high accuracy position location and the ability to detect the orientation of the anatomical structure of the field of view of an object of known geometry, the ability to cause the anatomical structure designed for this field of topography and custom component parts. Specifically, the dental implant is concerned, for example, by mounting one of the objects shown in Figures 1-3 identify the existing manufacturing part (i.e., the implant itself), the patient can be determined in this portion of the inner arch 4 relative to the other identifying the exact position and orientation of the object of legislation. This determination has allowed virtual assembly, the assembly will combine to replace and complement the proposed partial scan images and to select and then just supplement replace and complement the manufacturing part of the patient's anatomy geometric configuration status requirements. In addition, placing identify shortcomings allow accurate scanning with prospective contains object recognition in the area of missing teeth or anatomical structure does not have a significant characteristic of other areas. Nie was shot multiple three-dimensional images of objects (for example, due to the size or only broken Figure Mo paste the reason), it must define each image relative position and orientation in order to re-align the captured image data into the original field of view complete and accurate representation. To do this, you must capture the image in each image in the group is also next image appears in the group, known geometry identify objects (those objects as shown in Figure 1-7). Each map "as the location of a known object and / or orientation can then be used to locate the position of the image relative to each other in order to reconstruct the original field of view. This method can also be combined and complement current practice "stitching" or "registration" method. These methods are aligned with a plurality of scan without using known geometric shape, but for many applications, it is not accurate enough. Add as shown in Figure 1-6, according to the present invention, one or more object recognition field, which greatly enhances the accuracy of contiguous image stitching. Furthermore, in addition to use as a reference point relative to each include a given object recognition between adjacent images, the positioning in any area of the field of view with low resolution features such object recognition will greatly enhance these areas three-dimensional modeling. In particular, the way to achieve the maxillary and mandibular dental patients independent digitally scanned (or, respectively, in patients with maxillary and mandibular mold scan) the precise connection and registration. Forming a three-dimensional model from these methods achieve a maxillary and mandibular accurate position and orientation. Limited, including determining the accurate determination of the occlusal morphology characteristic aspects. Such three-dimensional model can then be used only Mo form the best position to solve the occlusal contacts and correct surface / orientation of dental restoration. The first way to achieve the relative position of the maxillary and mandibular accurate registration of the use of pattern recognition module shown in Figure 6. As shown in Figure 6, a group of three known radius ^ seeking body 24 are attached to the maxillary and mandibular mold outside the mold. After digitizing scanning maxillary and mandibular single implementation, as shown in all spheres capture the maxillary and mandibular 6 shows the positioning of such a scan or a group of scan can be used to construct a three-dimensional model that can accurately represent and maxillary and mandibular corresponding position of the

corresponding feature, orientation and size. It was articulated in a three-dimensional relationship between the maxillary and mandibular Mo Zi type II method according to the present invention for, only use a single set of (preferably) three spheres. 7, the group J seek 26 positioned within a patient maxillary or mandibular arch 44, or 7, provided in the representation of such a mold the bow, and the resulting set of objects located opposite the soft material inside the imprint jaw element "impression." Then scan the corresponding jaw, and "Stamp" surface remains (Figure 8) to dent 46 formed on object recognition imaging, or 9 to put a dent in the same size as an additional Stephen J reflector body 48 after better lighting. By covering with a single field of view of interest, overlapping or non-overlapping images, known geometric features as recognition physically connected to the object, it is possible to determine the relative position and orientation of the image. This aspect of the invention is used to eliminate the source of the inaccuracy of known "sew" method of producing these "stitching" approach would lead to bias when alignment scan, distorted and / or other distortions. Figure 4 shows an example of this solution: In this case, you want to scan arch. Known geometry in two dimensions is also known and by a link rod having a known size and is introduced in the form of a polygon scanner, which allows the detection of the tooth portions of the scanning position and / or orientation. Intraoral scanning is necessary to use a small scanner to allow only capture a portion of each scan arch. In the practice of the present invention, by using the spatial information may be obtained directly scanning the oral cavity, and then processing as described above. As described above, however, the present invention can be combined with M ^ practice often used, whereby the teeth of patients: stamp system, and a master stamper mold form produced by the replication of the dentition. In the implantation, the primary mold containing the dental implant similar body. According to the present invention, by using object recognition, it allows for the repair of the component parts designed to support the implant body and determine the accuracy of these implants similar body (implant analog) position and orientation can be improved. Alternative aspect of the invention, the relative position of the teeth to capture only Mo-type upper and lower components and thus for the "point" of the model components in the use of three-dimensional geometry of the non-planar tooth components of these models . In this alternative method, the software from the scan data with precise geometric characteristics of a given model position and the use of the geometric characteristics of known characteristics to precisely and accurately locate all topographical features, which included all the anatomical features tooth structure and characteristics associated only Mo type. Determining the geometric characteristics of such a location may be at least three cross on the face of each of the model components; such features may instead include flat-screen combination and / or model plane assembly, place the sphere or disk, and other features such as finishing in, or such as a vague position will provide data (6 degrees of freedom for each object) of any other non-dental objects. Referring to FIG. 10, 11 and 12, there is shown a typical 50-tooth 4 Mo, including lower unit 52 (shown separately in FIG. 11) and the upper assembly 62 (shown separately in FIG. 12). As shown in Figure 10-12, tooth ^^ Mo type generally has a plurality of planar surfaces due to its production and produced. (Or such surfaces can easily be added), and these surfaces provide a rich source of data to determine the location, These data can be obtained from the red scanning in Mozambique, to be used as the basis for all location, location and topographical features associated with the model. Referring to Figure 11, which shows only Mo-type lower assembly 50 52. The lower assembly 52 includes a plurality of planes as a modeling artifact, or subsequently created to model making and clearly identified as a position reference feature. The plane includes a bottom surface 54 (not visible in FIG. 11, but with a relatively lower portion of the arch 55), a back plane 56, a first (e.g., right) and the second side surface 58 (e.g., left) side (not shown) . Similarly, the upper portion of FIG. 12 shows a separate model component 62 includes a bottom surface 64 (not visible in FIG. 12, but relative to the upper dental arch 65), a back plane 66, a first side 68A and second side 68B. Specifically, the formation of each model component "may be used as a reference plane wherein the bottom ,, 0 type component Mo" bottom "surface of the component to the opposing dental arch plane). In the following example, a lower portion, only Mo type组件52的底面54(在图11中单独示出)用作参考面；然而，实际上，任一才莫型組件的另一平面都可用作参考。类似地，为此示例选择了三个平面，但也可选择三个或更多个面或面与其它非牙体特征的组合。（一些情况下，一个或多个牙体特征甚至可用作由平面和/或其它非牙体特征增强的识别特征，。）下部模型组件与上部才莫型组件的对准在此示例中通过使用每个模型组件的三个面而实现。应注意的是，在用于实现对准的这些相应模型組件的特定图像中，来.自上部和下部模型的选定面不必为形成上部和下部模型组件的准确对准而以任何特定方式对准。（如果在感兴趣的面上或附近存在非平面特征，这些特征可以且一般应通过使询'本领域中已知的适合处理技术而去除。）装配的模型（图IO)提供了分别装配下部模型组件(图II)和上部模型组件(图12)的单个三维图像所需的面的相对位置。从每个才莫型选择三个面。装配的模型在图10中示出，并且下部模型组件52在图11 中示出时，下部模型52的底面54是看不到的；类似地，在图12中，上部模型组件62的底面64是看不到的。然而，每个^f莫型组件的底面在扫描时靠在三维扫描器的参考面上，优选为与一个或多个参考标记对准，因此，在扫描中这些底面的几何定向是已知的。由于三个图像(装配的、下部的和上部的图像)的每个图像中的底面是已知的，因此，对于上部和下部组件中的每个组件而言，只有两个附加面需要由软件来确定以便精确地确定该组件的几何形状，每个附加面在组件的单个图像和装配图像中都是可见的。类似地，为确定完全装配^f型的几何形状及因此而对准上部和下部组件，必须从图10所示的图像中确定选自各冲莫型组件的两个面，加上上部^f型组件62的唯一的在前不可见、但"已知，，的底面64。例如，从下部模型组件底面54(图11中看不到）的认识和下部组件背平面56和下部组件侧面58的确定中，可确定下部才莫型组件52的几何形状。类似地，从上部模型组件的底面64(图12中看不到）的认识和上部组件背平面66和上部组件侧面68A或68B的确定中，可确定上部模型组件62的几何形状。假设给定上述面的位置，则可装配单个图像以匹配装配中的面的位置。因此，要从图10所示的装配模型的图像中实现模型50的上部和下部组件的对准，则在此图像中只需确定上述四个面(每个模型组件两个面)的定向（即，上部组件的背平面56和侧面58及下部组件的背平面66和侧面68)，并且另外如图10中所示而确定上部组件底面64的定向。也可使用不止三个面及过约束模型组件位置的解的其它物体(虽然过约束时一般可优选至少均方或类似解)。可选的，附加的参考特征可连接到才莫型组件表面的平面，也用作位置确定参考特征。例如，颜色与模型表面颜色差异明显的小圆盘可涂饰在任何表面上或以其它方式附到任何表面。也可在精确测量的间隔位置，将两个或多个的此类圆盘设置在同一平面上，并由此提供标量测量。

REFERENCED BY

Citing Patent	Filing date	Publication date	Applicant	Title
WO2014139070A1 *	Mar 11, 2013	Sep 18, 2014	Carestream Health, Inc.	Method and system for automatically aligning models of an upper jaw and a lower jaw

Citing Patent	Filing date	Publication date	Applicant	Title
WO2014139078A1 *	Mar 11, 2013	Sep 18, 2014	Carestream Health, Inc.	Method and system for bite registration

* Cited by examiner

CLASSIFICATIONS

International Classification	G06T17/00, A61C13/00
Cooperative Classification	G06T2207/30004, G06T17/00, G06K9/00214, G06K9/00, A61C9/0053, A61C13/0004, G06K2209/05, G06T7/0028
European Classification	G06K9/00, G06T17/00, A61C13/00C1, G06T7/00D1F, G06K9/00D3

LEGAL EVENTS

Date	Code	Event	Description
Jul 23, 2008	C06	Publication	
Sep 17, 2008	C10	Request of examination as to substance	
Jun 6, 2012	C14	Granted	

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PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION**	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
FPEL12150362		
International application No.	International filing date *(day/month/year)*	(Earliest)Priority date *(day/month/year)*
PCT/CN2013/072420	11 Mar. 2013(11.03.2013)	
Applicant		
CARESTREAM HEALTH, INC. et al.		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 5 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

a. With regard to the **language**, the international search was carried out on the basis of:

☒ the international application in the language in which it was filed

☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6bis(a)).

c. ☐ With regard to any **nucleotide and /or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (see Box No. II)

3. ☐ **Unity of invention is lacking** (see Box No. III)

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☐ the text is approved as submitted by the applicant.

☒ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

a. The figure of the **drawings** to be published with the abstract is Figure No. 2

☒ as suggested by the applicant

☐ as selected by this Authority, because the applicant failed to suggest a figure

☐ as selected by this Authority, because this figure better characterizes the invention

b. ☐ none of the figures is to be published with the abstract

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Form PCT/ISA/210(first sheet)(July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2013/072420

Box No. IV Text of the abstract (Continuation of item 5 of the first sheet)

Method and system for bite registration using multiple bite registrations. In this method or system, when both the 3D teeth model of the upper jaw and the 3D teeth model of the lower jaw are successfully aligned with the bite surface, the bite surface with the 3D teeth models of the upper jaw and the lower jaw is displayed for further evaluation; the bite surfaces selected by the user are combined to generate a final bite registration. Using multiple bite surfaces for registration improves the accuracy.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2013/072420

A. CLASSIFICATION OF SUBJECT MATTER

See the extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: A61C19/-; G06T17/-

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNPAT,CNKI,WPI,EPODOC: carestream w health, dental, jaw, bite, arch, occlusal, 3d, 3?demension, three?dimension, registrat+, match+, align+, surface

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 7118375 B2 (DURBIN, Duane Milford et al.) 10 October 2006 (10.10.2006) figures 1, 8 and 9	1-22
A	US 2002/0094509 A1 (DURBIN, Duane et al.) 18 July 2002 (18.07.2002) the whole document	1-22
A	CN 101228556 A (ATLANTIS COMPONENTS, INC.) 23 Jul 2008 (23.07.2008) the whole document	1-22

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim (S) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&"document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 November 2013 (21.11.2013)	**19 Dec. 2013 (19.12.2013)**
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer LI, Yincen Telephone No. (86-10)61648460

Form PCT/ISA /210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2013/072420

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
US 7118375 B2	10.10.2006	US 2005/153257 A1	14.07.2005
		EP 1845889 A1	24.10.2007
		WO 2006085851 A1	17.08.2006
US 2002/0094509 A1	18.07.2002	NONE	
CN 101228556 A	23.07.2008	WO 2007/011909 A1	25.01.2007
		EP 1904978 A1	02.04.2008
		EP 1904978 B1	28.12.2011
		US 2006/0072810 A1	06.04.2006
		US 7362890 B2	22.04.2008
		KR 1020080034472 A	21.04.2008
		JP 2009501616 A	22.01.2009
		JP 5011292 B2	29.08.2012
		EP 2431944 A1	21.03.2012
		BR PI0613627 A2	18.01.2011
		AU 2006269977 A1	25.01.2007
		AU 2006269977 B2	22.10.2009
		US 2008/0002869 A1	03.01.2008
		US 7551760 B2	23.06.2009
		CN 101228556 B	06.06.2012
		CA 2615482 A1	25.01.2007
		AT 539418 T	15.01.2012
		ES 2380547 T3	16.05.2012

Form PCT/ISA /210 (patent family annex) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2013/072420

Continuation of A. CLASSIFICATION OF SUBJECT MATTER

A61C 19/04 (2006.01) i

G06T 17/00 (2006.01) i

Form PCT/ISA /210 (extra sheet) (July 2009)

METHOD AND SYSTEM FOR BITE REGISTRATION

FIELD OF THE INVENTION

[0001] The present invention relates to the technical field of dental 3-dimensional (3D) imaging, and in particular to a method and computerized system for bite registration using at least two bite surfaces.

BACKGROUND

[0002] In dental field, it is one of key points to obtain an accurate 3D teeth model corresponding to clenched state during the course of treatment (for example, orthodontics). 3D camera system is used to create a 3D model of the teeth directly with the patient, which avoids the need to cast impressions and send them to the lab for restoration. This reduces cost and simplifies the workflow of dental restoration.

[0003] For the process of constructing global 3D teeth model, the step of bite registration is one of necessary and crucial steps. Bite registration is the process of registering the upper jaw with the lower jaw, which could establish a 3D spatial positioning relationship between an upper jaw and its corresponding lower jaw in clenched state.

[0004] In an existing 3D camera system, during bite registration, only one bite surface is required for constructing a global 3D teeth model. In this method, the single bite surface is captured from one certain location (such as right side of molars) of the clenched teeth by a scanner, then the 3D teeth models of the upper jaw and the lower jaw captured independently are stitched onto the bite surface in a semi-automatic way so as to complete bite registering. However, when the global teeth contains a plurality of teeth (such as more than 5 teeth), the bite registration obtained from only one location of the bite surface may lead to significant mismatch in another location. For example, when only one bite surface corresponding to right side of molars is used, there are several hundreds microns of mismatch in the bite registration corresponding to the distant end (such as incisors or left side of molars). Thus, it is difficult to ensure the overall accuracy of bite registration, which results that a great difference may exist between the ultimate virtual global 3D teeth

model constructed by this single bite registration and the actual global teeth in unique clenched state.

[0005] U.S. Pub. No.: US 2005/0196724A1 to Ross J. Miller et al. discloses a device for bite registration, which uses block (200) filled with impression material to record bite configurations. Evidently, it can not provide digital visual bite surface, and thus is not adaptable to digital 3D camera system.

[0006] Further, U.S. Pat. No.: US 8121718 B2 to Rüdger Rubbert et al. discloses an interactive orthodontic care system based on intra-oral scanning of teeth. In this system, when stitching both the upper jaw and the lower jaw onto the bite surface, it is completed in a manual way. Moreover, only one bite surface is used for obtaining a 3D virtual model of the teeth either.

SUMMARY OF THE INVENTION

[0007] In view of above problems, the object of the present invention is to improve the accuracy of bite registration at least.

[0008] In order to realize the above object or other objects, the invention provides the following technical solutions.

[0009] According to one aspect of the invention, a method of bite registration is provided, this method comprises the steps of:

a. generating 3-dimensional (3D) teeth models of the upper jaw and the lower jaw;

b. acquiring a bite surface containing a portion of upper and lower jaws simultaneously;

c. attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface;

d. displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful;

e. repeating step b to step d so as to obtain at least two successful bite registrations corresponding to different displayed bite surfaces;

f. selecting one or more successful bite registrations by evaluating at least two successful bite registrations; and

g. computing a final bite registration using selected one or more successful bite registrations.

[0010] According to another aspect of this invention, a system for bite registration is provided which includes:

means for generating 3D teeth models of the upper jaw and the lower jaw;

means for acquiring a bite surface containing a portion of upper and lower jaws simultaneously;

means for attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface;

means for displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful;

means for obtaining at least two successful bite registrations corresponding to different displayed bite surface by repeating;

means for selecting one or more successful bite registrations by evaluating at least two successful bite registrations; and

means for computing a final bite registration using selected one or more successful bite registrations.

[0011] According to yet another aspect of this invention, a system for bite registration is provided which includes a scanner and a computerized workstation, wherein the workstation is configured as:

generating 3D teeth models of the upper jaw and the lower jaw;

acquiring a bite surface containing a portion of upper and lower jaws simultaneously;

attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface;

displaying the bite surface together with the 3D teeth models of the upper jaw and the

lower jaw aligned with the bite surface if alignment is successful;

repeating steps acquiring to step of displaying so as to obtain at least two successful bite registrations corresponding to different displayed bite surfaces;

selecting one or more successful bite registrations by evaluating at least two successful bite registrations; and

computing a final bite registration using selected one or more successful bite registrations.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The above and other objects and advantages of the invention will become fully understood from the following detailed description with reference to drawings, in which identical or similar elements are denoted by identical reference signs.

[0013] Fig. 1 is a is a schematic structural view of a system for bite registration in accordance with an embodiment of the invention;

[0014] Fig. 2 is a workflow of a method of bite registration in accordance with an embodiment of the invention;

[0015] Fig. 3 is a schematic workflow of bite registration in accordance with an embodiment of the invention;

[0016] Fig. 4(a) is a 3D teeth models of the upper jaw;

[0017] Fig. 4(b) is a 3D teeth models of the lower jaw;

[0018] Fig. 5 is a schematic view of bite surface displayed in the monitor;

[0019] Fig. 6 is a schematic workflow of aligning the 3D teeth models with the bite surface in accordance with an embodiment of the invention;

[0020] Fig. 7 shows a display of the user interface when succeeding to stitch in accordance with an embodiment of the invention;

[0021] Fig. 8 shows a display of the user interface when not succeeding to stitch in accordance with another embodiment of the invention;

[0022] Fig. 9 shows a schematic workflow of multiple matrix interpolations;

[0023] Fig. 10 shows a part of acquired 3D surface with the bite surface.

DETAILED DESCRIPTION OF THE INVENTION

[0024] Some of the many possible embodiments of the invention will be described below in order to provide a basic understanding of the invention and not to identify crucial or decisive elements of the invention or define the scope of protection. It can be easily understood that according to the technical solutions of the invention, those with ordinary skills in the art can propose other alternative implementations without departing from the true spirit of the invention. Therefore, the following embodiments and accompanying drawings are illustrative description of technical solutions of the invention, and should not be construed as constituting the whole of the invention or as limiting or defining technical solutions of the invention.

[0025] Fig. 1 is a schematic structural view of a system for bite registration in accordance with an embodiment of the invention. The system 10 is used to bite registration at least. As simply illustrated in Fig. 1, in this embodiment, the system 10 includes a scanner 13 and a computerized workstation 11. The scanner 13 is handheld by the dentist, and it can be partly put into the mouth of patient 90. When put into the mouth, the scanner 13 can capture image(s) of the teeth or other 3D views as necessary. The scanner 13 and the workstation 11 can be connected in a wireless or wired way so that the images or views captured by the scanner 13 can be transmitted to the workstation for data processing or real-time displaying. Of course, some instructions generated by the workstation 11 can also be transmitted to the scanner 13 so as to control its action.

[0026] The workstation 11 comprises a monitor 19 at least which can display all sorts of 2D/3D images or windows under the control of the workstation 11. Software of bite registration can be installed in the workstation 11. When running the software, the workstation 11 functions as an image processing device which can complete the bite registration step at least in the process of constructing the global 3D teeth model. Of course,

it can be understood that the software may not be limited to perform bite registration step but can be used to realize global 3D teeth model in time. Thus, if necessary, the system 10, mainly constituting a 3D camera system adapted for teeth, can also function as constructing the global 3D teeth model of the patient.

[0027] The software's function of bite registration is carefully described hereinafter in conjunction with the following figures. Certainly, a method of bite registration can further be applied to construct the global 3D teeth model.

[0028] Fig. 2 is a workflow of a method of bite registration in accordance with an embodiment of the invention. In this embodiment, the method in Fig. 2 can obtain at least two successful bite registrations corresponding to different bite surfaces. The following description, conjunction with Figs. 1-10, describes the workflow of bite registration which obtains at least two successful bite registrations and selects at least one bite registration by user.

[0029] Firstly, in step of S110, the dentist operates the scanner 13 in the mouth of the patient 90, thus multiple 2D images of the upper jaw and lower jaw can be respectively captured from different viewpoints. The multiple 2D images are transmitted to the workstation 11, and then are processed so as to generate 3D teeth models of the upper and lower jaws.

[0030] In a preferred embodiment, as shown in Fig.3, S110 includes the following steps: S111, 3D teeth surface on the upper jaw or lower jaw is captured by the handheld scanner 13; S112, judging whether the captured portion is the first one or not for a certain patient in the workstation 91; S114, if the captured portion is the first one during the scan, the captured portion is accepted; if succeeding to be accepted in S116, entering into S117 of combining the captured 3D teeth surface with the 3D teeth model; S113, if the captured portion is not the first one, attempting to stitch the captured portion onto the existing 3D teeth model; S115 judging whether the captured portion is successfully stitched not; if succeeding to stitch in S115, entering into S117 of combining the captured portion with the existing 3D teeth model. Thus, the captured portion combine with the existing 3D teeth model would make the ultimately formed 3D teeth model of the upper or lower jaw more accurate.

[0031] In another embodiment, the method of generation of the 3D teeth model in step of S110 can refer to two filed patents of Application No. US13/293,308 and Application No. 13/525,590, both with name of "3D INTRAORAL MEASUREMENTS USING OPTICAL MULTILINE METHOD". Those entire contents of these patent applications are incorporated by reference herein.

[0032] Further, in step of S120, a bite surface containing a portion of the upper jaw and a portion of the lower jaw simultaneously is acquired. In this embodiment, the scanner 13 is set in a location so as to capture one or more bite views (or surfaces) corresponding to some teeth. The bite view(s) captured by the scanner 13 is (are) obtained in a unique clenched state where the upper jaw is static in relation to the lower jaw. Thus, one or more bite views can form a bite surface containing a portion of upper and lowers jaws simultaneously. In particular, the bite view is a 3D surface containing upper and lowers jaws, and in one embodiment, several bite views corresponding to different teeth respectively can be combined into one view so as to form a bigger bite surface. In one example, the bite surface 191 can be displayed on the monitor in-time as shown in Fig. 5.

[0033] It can be understood that the bite surface 191 is a 3D surface, and can be obtained by a method of image processing applied to one or more bite views. In an embodiment, this method is similar with that used in steps of S110. It can also be understood that, since captured in the clenched state, the scanner 13 is convenient to image the outside of the teeth. Thus, the bite surface 191 is a 3D surface usually representing 3D shape characteristic of outside, and it can not substitute the function of the global 3D teeth model obtained ultimately. However, this bite surface can be further used in the process of global matching so as to improve the accuracy of the global 3D teeth model. As the bite surface 191 is also used to align with the 3D teeth models, the bite surface 191 must contain a part of the upper jaw and the lower jaw simultaneously in the unique clenched state.

[0034] In a preferred embodiment, the portion of the upper and lower jaws observed in the bite surface can be changed. For example, when repeating to perform step of S120, the bite surface can be obtained from different portions of the clenched upper and lower jaws; thus, the location of the acquired bite surface can be changed. In a selectable embodiment, the obtained bite surface may include, but is not limited to, portions from incisors,

premolar, molars.

[0035] Further, in step of S130, attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface. In an embodiment, the alignment can be completed at least by stitching of a portion of 3D teeth surface of the bite surface with the 3D teeth models of the upper jaw and the lower jaw. In another embodiment, the alignment can be completed at least by stitching of a portion of 3D teeth surface of the acquired bite surface with either the lower or the upper arch.

[0036] Fig.6 is a schematic workflow of aligning the 3D teeth models with the bite surface in accordance with an embodiment of the invention. The stitching of a portion of 3D teeth surface of the bite surface with the 3D teeth models includes steps of S131 to S136. In S131, generating candidate 3D rigid transformations to place the 3D teeth surface of the bite surface relative to the 3D teeth model. In S132, evaluating a metric of the candidate 3D rigid transformations using the relative placement of the 3D teeth surface relative to the 3D teeth model. In S133, choosing the best 3D rigid transformation which corresponds to a best metric. In S134, judging whether the best metric exceeds a predetermined threshold or not; if the best metric goes below a predetermined threshold, entering into S136 of accepting the corresponding 3D rigid transformation; if the best metric exceeds a predetermined threshold, entering into S137 of rejecting the stitching, which means a failure of stitching.

[0037] It is noted that the stitching process can be completed in a manual way, a semi-automatic way or automatic way. In case of using a semi-automatic way, the particular method of stitching can refer to U.S. Pat. No.: US 8121718 B2. In other preferred embodiment, the stitching process can be performed automatically based on an algorithm. The entire content of US 8121718 B2 is incorporated by reference herein. It can be understood that the automatic way used in aligning process could greatly save valuable time for user. Thus, not only the speed for bite registration but also the user experience is improved.

[0038] Further, in step of S140, judging whether the alignment in S130 is successful or not. If the alignment is successful, coming into step of S150, i.e., the bite surface is displayed together with the 3D teeth models of the upper jaw and the lower jaw; if

alignment is not successful, returning back to step of S120 so as to acquire another bite surface until the alignment is successful.

[0039] Fig. 7 shows a display of the user interface when the alignment is successful in accordance with another embodiment of the invention. In an embodiment, as shown in Fig. 7, 106 denotes the bite surface together with the 3D teeth models of the upper/lower jaws stitched onto the bite surface, which represents one successful bite registration. Moreover, in particular, 101 denotes application window; 102 denotes application menu bar; 103 denotes application workspace; 104 denotes the 3D teeth model of the upper jaw in the initial placement; and 105 denotes the 3D teeth model of the lower jaw in the initial placement. The arrows represent a moving direction of the 3D teeth models of the upper/lower jaws in the process of alignment. When the alignment is successful, a transformation corresponding to the successful bite registration can be obtained and stored, and the user can employ it in the next step of computation of the final bite registration.

[0040] Fig. 8 shows a display of the user interface when the alignment is not successful in accordance with another embodiment of the invention. In case that the alignment is not successful, as shown in the user interface of Fig.8, the user would receive a notification 109 of notification of failing to align or to register the bite surface. Moreover, the bite surface may be discarded automatically. Thus, the user only gets results which satisfy the algorithm quality criterion of alignment, which helps for improving the accuracy of bite registration. Meanwhile, it is necessary to return back to S120 so as to repeat anther circulated process of bite registration.

[0041] Further, in step of S160, the user can repeat to perform steps of S120 to S150 so as to obtain another successful bite registration. The time of repeating steps of S120 to S150 is not limited by this embodiment. The user can subjectively determine the time of repeating so as to obtain at least two successful bite registrations. A plurality of successful bite registrations can be stored and freely displayed by the user. Thus, it is very convenient to valuate all of successful bite registrations for the user, and the user can further select the ones with preferred transformation from successful bite registrations in the next step. As shown in Fig. 7 and Figs. 8, each button 107 represents a process of repeating. In an example, button 107 can be set as green color in case that the successful bite registration is

selected.

[0042] Further, in step of S170, selecting at least one successful bite registration by evaluating at least two successful bite registrations. In this step, the bite surface with 3D models of the upper and lower jaws 106 can be displayed from different viewpoints; thus, this bite surface and the registered lower and upper arches may be observed from different viewpoints by the user, which greatly contributes to a full observation of the mismatch in different locations. When evaluating, the respective location of 3D teeth models of the upper jaw and the lower jaw can be evaluated by the user so as to judge whether the bite surface is suitable or not. If the mismatch corresponding to the distant end of the bite surface exceeds desired value, the bite surface and its corresponding bite registration are not suitable to be used in the next steps of computation of the final bite registration. For example, when the bite surface is selected from right side of molars, the user can observe the mismatch in the location of the left side of molars. Further by comparatively evaluating at least two successful bite registrations, one or more successful bite registrations and its corresponding bite surfaces with better evaluation results can be easily selected out by the user. Therefore, the user can select the bite registrations with optimized transformation in an intuitive way, which can further greatly improve the accuracy of the global 3D teeth model ultimately formed.

[0043] In particular, as shown in Fig. 7 and Fig. 8, the user can double-click any of the buttons 107 to enable and store desired successful bite registration and its corresponding bite surface, and the unselected one is disabled in the next steps of computation of the final bite registration. In one embodiment, when the successful bite registration is selected by the user, the button 107 turns green; when the successful bite registration is unselected the button 107 turns red. Thus, the user can easily distinguish the selected from the unselected successful bite registration. In another embodiment, the selection of the successful bite registration can be completed in an automatic way. In another embodiment, Step 170 automatically selects all successful bite registration without user interaction. When further clicking button 108, going to step of S180.

[0044] Further, in step of S180, computing the final bite registration(s) using selected one or more successful bite registrations.

[0045] In one embodiment, the computation of the final bite registration employs multiple matrix interpolation of the selected successful bite registrations. If at least two successful bite registrations are selected in step S170, combining all transformations corresponding to different selected successful bite registrations respectively into a single transformation. In particular, as shown in Fig. 9, a 4x4 matrix interpolation may contain the steps of decomposing each matrix into an equivalent set of values (S211), interpolating corresponding values from each set of values (S212) and recomposing a matrix from the interpolated set of values (S213). The set of equivalent values may consist in translation, scale, skew all represented as a vector with 3 components and perspective, quaternion both represented as a vector with 4 components. For detail, the abovementioned multiple matrix interpolations are also described in http://dev.w3.org/csswg/css3-transforms/#matrix-interpolation, and its disclosure can be incorporated by reference herein.

[0046] Therefore, in the embodiment of multiple matrix interpolation, S180 provides the user with a way to merge information from all selected bite registration together, and it can be seen as a process of averaging transformations (i.e. averaging the stitching noise) while keeping the upper and lower arches rigid.

[0047] It is noted that, if only one successful bite registration is selected in step S170, the transformation of the selected bite registration can be processed by a method of prior art.

[0048] In another embodiment, the computation employs the optimization of a cost function depending on the selected successful bite registrations, i.e., employs global matching of 3D views to simultaneously optimize relative placement of all views which have some overlay. The bite surface reused in this process is the bite surface corresponding to the selected bite registration. That is to say, the bite surface selected in the S170 is further used for optimizing the placement of each 3D surface.

[0049] To be specific, global matching refers to the placement optimization of each 3D surface so as to optimize a cost function. In an embodiment of global matching, 3D surfaces from the upper jaw, the lower jaw and selected successful bite registrations might be used altogether in the cost function to be optimized. In another embodiment of the global matching, a subset of 3D surfaces from the lower jaw, a subset of surfaces from the

upper and a subset of selected successful bite registrations are used in the cost function to be optimized. In one embodiment, the cost function is computed from the distance between pairs of 3D surfaces. The distance between pairs of 3D surfaces might be computed from the distance between corresponding closest points on the surfaces. If the surfaces use a discrete representation, the corresponding points may be obtained using interpolation of the discrete coordinates. The distances between corresponding closest points on the surface may be weighted, and the weight might depend on a predetermined threshold. The predetermined threshold might represent a threshold distance above which influence of corresponding closest points decreases.

[0050] The cost function for a single pair of 3D surfaces S1 and S2 might be written:

[0051] $$f(S_1, S_2) = \sum_{i \in S_1} w_i d_i^2(S_1, S_2)$$

[0052] Where index i is a point on the surface S_1 and $d_i(S_1,S_2)$ the distance of that point to the other surface, and w_i is a weight, which may depend on the initial distance between the two surfaces and also on a pre-determined threshold

[0053] The cost function for all pairs of 3D surfaces may be written:

[0054] $$F = \sum_k \sum_{l \neq k} f(T_k(S_k), T_l(S_l))$$

[0055] Where (k,l) represents any pair of distinct surfaces and T_k, T_l represent surfaces transformations to be optimized.

[0056] Global matching corresponds here to the minimization of a least square sum function where the unknows are transforms T_k, T_l.

[0057] There exist other variations of a cost function which provide similar final transforms, which will be considered having the same role to those skilled in the art.

[0058] The optimization of a transform which uses the one or more selected bite registrations may refer to the placement optimization of the upper arch relative to the lower arch, using the one or more selected bite registrations by optimizing a cost function. In one embodiment, the cost function is computed from the distance between pairs of 3D surfaces. The distance between pairs of 3D surfaces might be computed from the distance between corresponding closest points on the surfaces. The distance between corresponding closest

points on the surface may be weighted, and the weight might depend on a predetermined threshold. The predetermined threshold might represent a threshold distance above which influence of corresponding closest points decreases.

[0059] The cost function for optimization of the transform may be written:

[0060] $$G = \sum_{b \in B} \sum_{l \in L} f(T_b(S_b), T(S_l)) + \sum_{b \in B} \sum_{u \in U} f(T_b(S_b), S_u)$$

[0061] Where b represents the index of a selected bite surface, B the pool of selected bite surface indices, L the pool of surfaces from the lower jaw, U the pool of surfaces from the upper jaw, T_b the transform of each bite surface with index b, T the transform of the lower jaw relative to the upper jaw. The upper jaw is considered static in this representation, but there exist variations of this cost function which provide similar final transformations. The unknowns to be optimized are the individual transformations of bite surfaces T_b and the global transformation of the lower jaw T.

[0062] Fig. 10 shows a part of acquired 3D surface with the bite surface. Wherein, 201 denotes the upper jaw, 203 denotes the lower jaw, and 202 denotes the bite surface 202. The accumulated placement error from the upper and lower jaws is reduced by optimizing the placement of all meshes simultaneously. Thus, the relationship between upper and lower jaws is maintained and the placement of the meshes gets optimized.

[0063] After S220, the method for constructing a global 3D teeth model can further comprise other steps such as S230 of merging of meshes in lower jaw and in upper jaw separately to generate a global surface by interpolating surfaces in overlapping region, and S240 of meshing post-processing which combines mesh operations like hole-filling, smoothing, and cleaning. Other steps are known those skilled in the art, thus they are not carefully described herein.

[0064] Lastly, the global 3D teeth model is formed and displayed in the monitor. As using the accurate bite registration and steps of S210 and S220, the accuracy of the global 3D teeth model is greatly improved.

[0065] It can be understood that the system for bite registration can be seen as a sub-module of the system for constructing a global 3D teeth model.

[0066] In this context, a surface corresponds to surface acquired in one acquisition (also

named one view) and may actually contain several disconnected surfaces.

[0067] The above examples mainly discuss the method and system for bite registration and the method and system for constructing a global 3D teeth model. While only some of the embodiments of the invention have been described, it is understood by those skilled in the art that the invention can be implemented in many other forms without departing from the spirit and scope thereof. Therefore, the illustrated examples and embodiments should be construed as exemplary rather than limiting. The invention may cover various modifications and replacements without departing from the spirit and scope of the invention as defined by appended claims.

CLAIMS

1. A method of bite registration, characterized by comprising the steps of:

a. generating 3-dimensional (3D) teeth models of the upper jaw and the lower jaw;

b. acquiring a bite surface containing a portion of upper and lower jaws simultaneously;

c. attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface;

d. displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful;

e. repeating step b to step d so as to obtain at least two successful bite registrations corresponding to different displayed bite surfaces;

f. selecting one or more successful bite registrations by evaluating at least two successful bite registrations; and

g. computing a final bite registration using selected one or more successful bite registrations.

2. The method of bite registration according to claim 1, wherein

the computation of the final bite registration involves the optimization of a cost function depending on the selected successful bite registrations.

3. The method of bite registration according to claim 1, wherein

the computation of the final bite registration involves one or more matrix interpolations of the selected successful bite registrations.

4. The method of bite registration according to claim 3, wherein said one or more interpolations contain steps of:

decomposing each matrix into an equivalent set of values;

interpolating corresponding values from each set of values; and

recomposing a matrix from the interpolated set of values.

5. The method of bite registration according to claim 1, wherein step a includes the steps of :

a1) capturing 3D teeth surface on the upper jaw or lower jaw by a scanner;

a2) judging whether the captured 3D teeth surface is the first one or not during the scan;

a3) if the captured portion is the first one, accepting the captured 3D teeth surface; and if further succeeding to accept, combining the captured 3D teeth surface with the 3D teeth model; and

a4) if the captured portion is not the first one, attempting to stitch the captured 3D teeth surface onto the existing 3D teeth model; if succeeding to stitch, combining the captured 3D teeth surface with the existing 3D teeth model.

6. The method of bite registration according to claim 1, wherein step d including step of:

if the alignment is not successful, the bite surface is discarded and the user receives a notification of failing to align or to register the bite surface.

7. The method of bite registration according to claim 1 or 6, wherein if the alignment is not successful, automatically returning back to step b until the alignment is successful.

8. The method of bite registration according to claim 1, wherein the alignment is completed at least by stitching of a portion of 3D teeth surface of the bite surface with the

3D teeth models of the upper jaw and the lower jaw.

9. The method of bite registration according to claim 1, wherein the alignment can be completed at least by stitching of a portion of 3D teeth surface of the acquired bite surface with either the lower or the upper arch.

10. The method of bite registration according to claim 8 or 9, wherein the stitching process includes the steps of:

generating candidate 3D rigid transformations to place the 3D teeth surface relative to the 3D teeth model;

evaluating a metric of the candidate 3D rigid transformations using the relative placement of the 3D teeth surface relative to the 3D teeth model;

choosing the best 3D rigid transformation which corresponds to a best metric; and

if the best metric goes below a predetermined threshold, accepting the corresponding 3D rigid transformation; if the best metric exceeds a predetermined threshold, rejecting the stitching.

11. The method of bite registration according to claim 1, wherein in step e, when repeating to perform step b, the location of the acquired bite surface is changed.

12. The method of bite registration according to claim 11, wherein the teeth contained in the bite surface are selected from incisors, premolar or molars.

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

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

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

16. A system for bite registration, characterized by including:

means for generating 3D teeth models of the upper jaw and the lower jaw;

means for acquiring a bite surface containing a portion of upper and lower jaws simultaneously;

means for attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface;

means for displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful;

means for obtaining at least two successful bite registrations corresponding to different displayed bite surface by repeating;

means for selecting one or more successful bite registrations by evaluating at least two successful bite registrations; and

means for computing a final bite registration using selected one or more successful bite registrations.

17. The system for bite registration according to claim 16, wherein the computation of the final bite registration involves the optimization of a cost function depending on the selected successful bite registrations.

18. The system for bite registration according to claim 16, wherein means for computing the final bite registration involves device for one or more matrix interpolations

of the selected successful bite registrations.

19. The system for bite registration according to claim 18, wherein device for one or more matrix interpolations includes:

module for decomposing each matrix into an equivalent set of values;

module for interpolating corresponding values from each set of values; and

module for recomposing a matrix from the interpolated set of values.

20. The system for bite registration according to claim 16, wherein means for attempting to align the 3D teeth models includes:

module for, if the alignment is not successful, discarding the bite surface and sending a notification of failing to align to the user.

21. A system for bite registration, including a scanner and a computerized workstation, wherein the workstation is configured as:

generating 3D teeth models of the upper jaw and the lower jaw;

acquiring a bite surface containing a portion of upper and lower jaws simultaneously;

attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface;

displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful;

repeating steps acquiring to step of displaying so as to obtain at least two successful bite registrations corresponding to different displayed bite surfaces;

selecting one or more successful bite registrations by evaluating at least two successful bite registrations; and

computing a final bite registration using selected one or more successful bite

registrations.

22. The system for bite registration according to claim 21, wherein the system is used to construct a global 3D teeth model.

ABSTRACT

The present invention relates to method and system for bite registration using multiple bite registrations. In this method or system, when both the 3D teeth model of the upper jaw and the 3D teeth model of the lower jaw are successfully aligned with the bite surface, the bite surface with the 3D teeth models of the upper jaw and the lower jaw is displayed for further evaluation; the bite surfaces selected by the user are combined to generate a final bite registration. Using multiple bite surfaces for registration improves the accuracy.

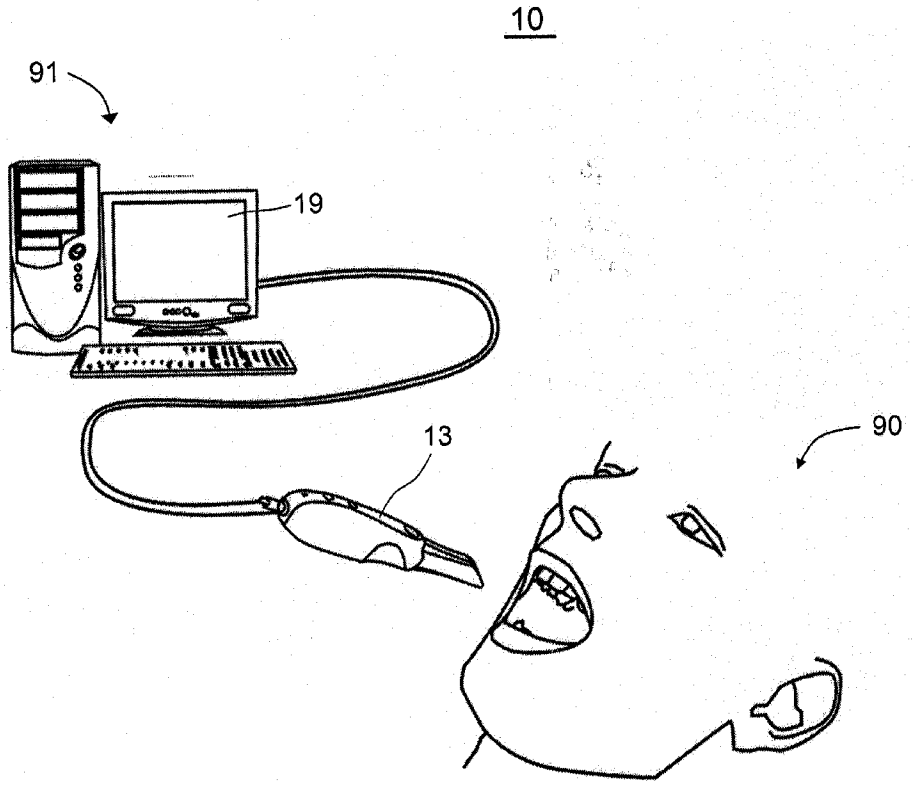


Fig. 1

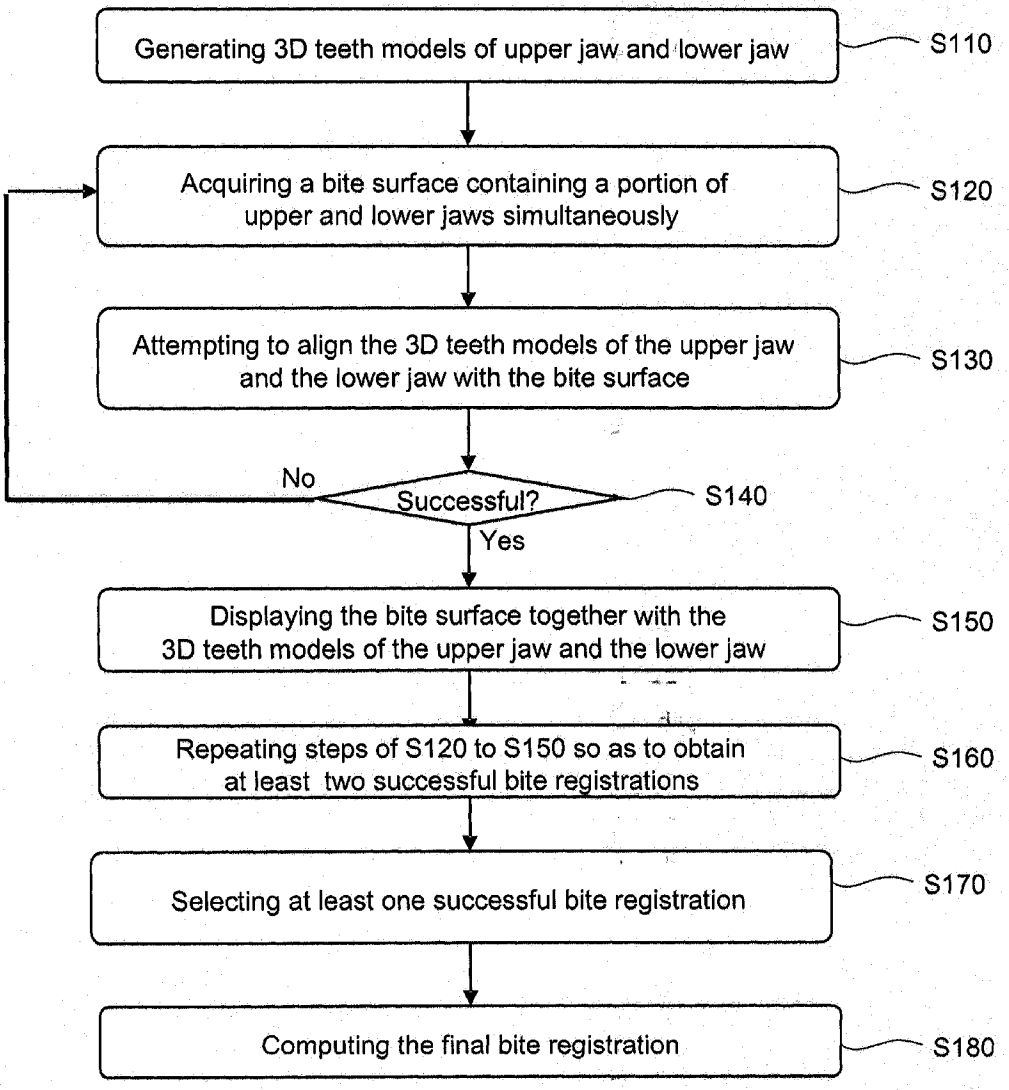

Generating 3D teeth models of upper jaw and lower jaw
S110
Acquiring a bite surface containing a portion of upper and lower jaws simultaneously
S120
Attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface
S130
No
Successful?
S140
Yes
Displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw
S150
Repeating steps of S120 to S150 so as to obtain at least two successful bite registrations
S160
Selecting at least one successful bite registration
S170
Computing the final bite registration
S180

Fig. 2

5

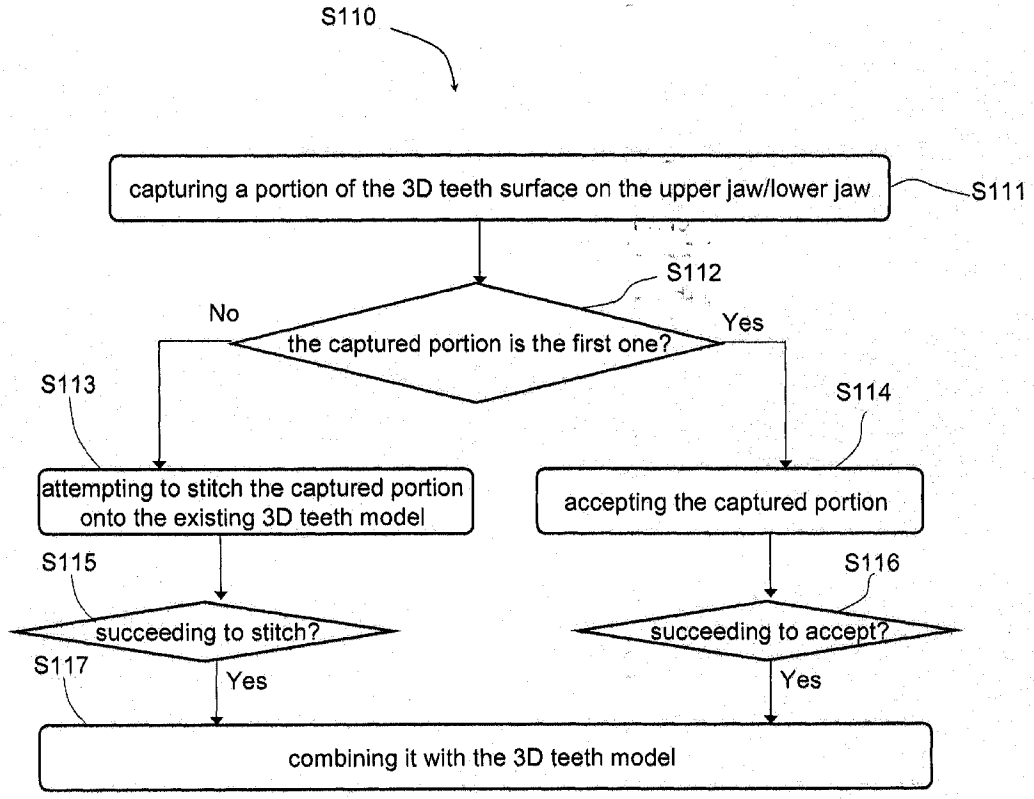

S110
capturing a portion of the 3D teeth surface on the upper jaw/lower jaw
S111
S112
No
the captured portion is the first one?
Yes
S113
S114
attempting to stitch the captured portion onto the existing 3D teeth model
accepting the captured portion
S115
S116
succeeding to stitch?
succeeding to accept?
S117
Yes
Yes
combining it with the 3D teeth model

Fig.3

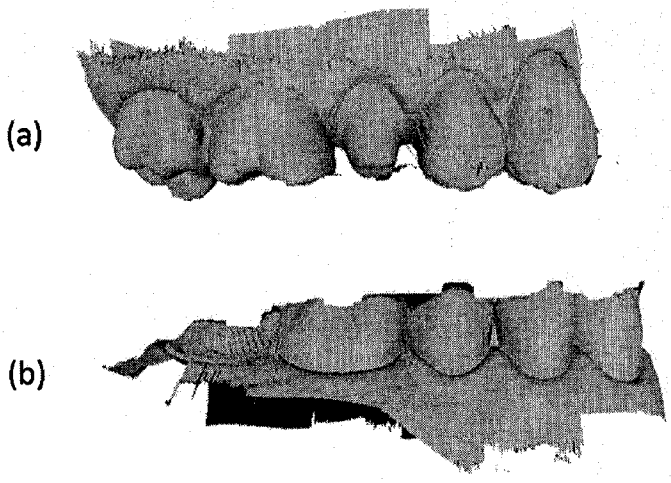


Fig.4

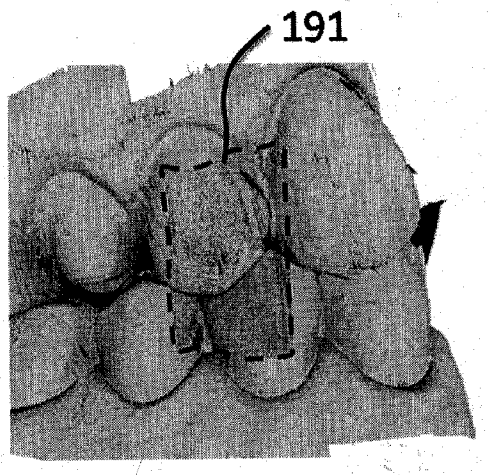


Fig.5

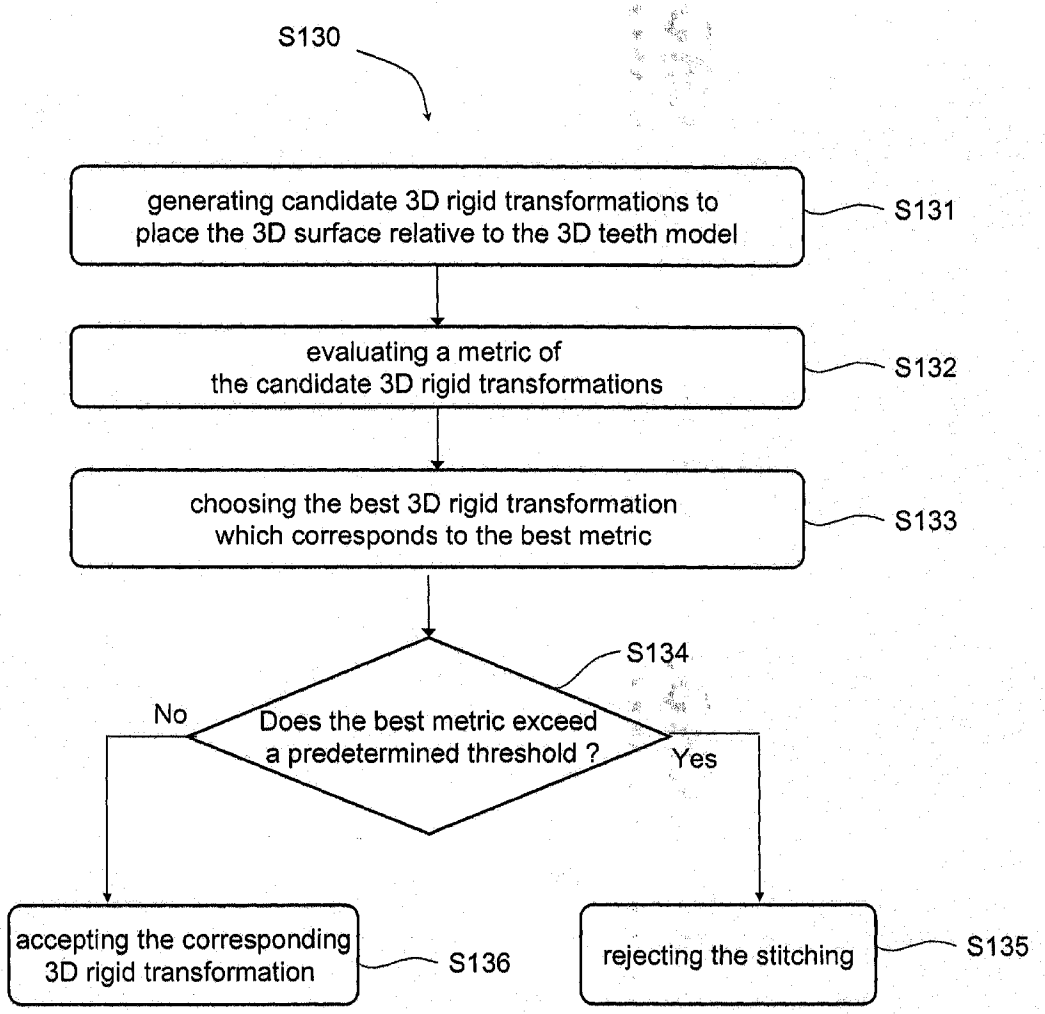

S130
generating candidate 3D rigid transformations to place the 3D surface relative to the 3D teeth model
S131
evaluating a metric of the candidate 3D rigid transformations
S132
choosing the best 3D rigid transformation which corresponds to the best metric
S133
S134
Does the best metric exceed a predetermined threshold ?
No
Yes
accepting the corresponding 3D rigid transformation
S136
rejecting the stitching
S135

Fig.6

5

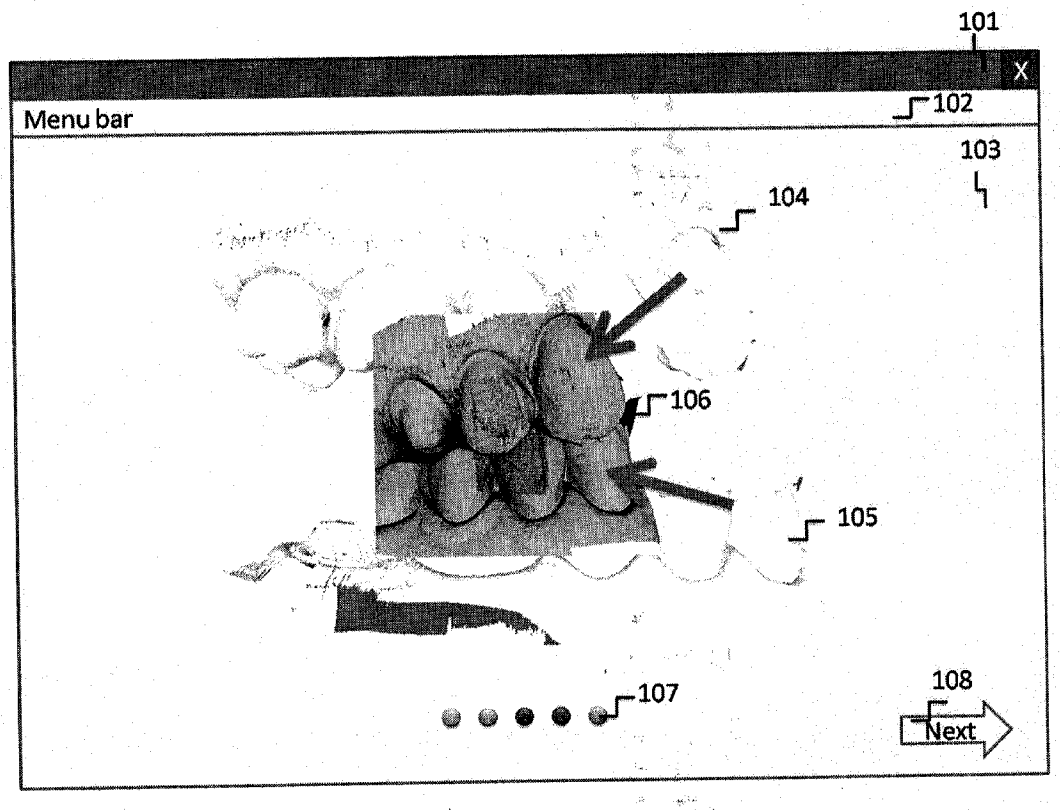


Fig.7

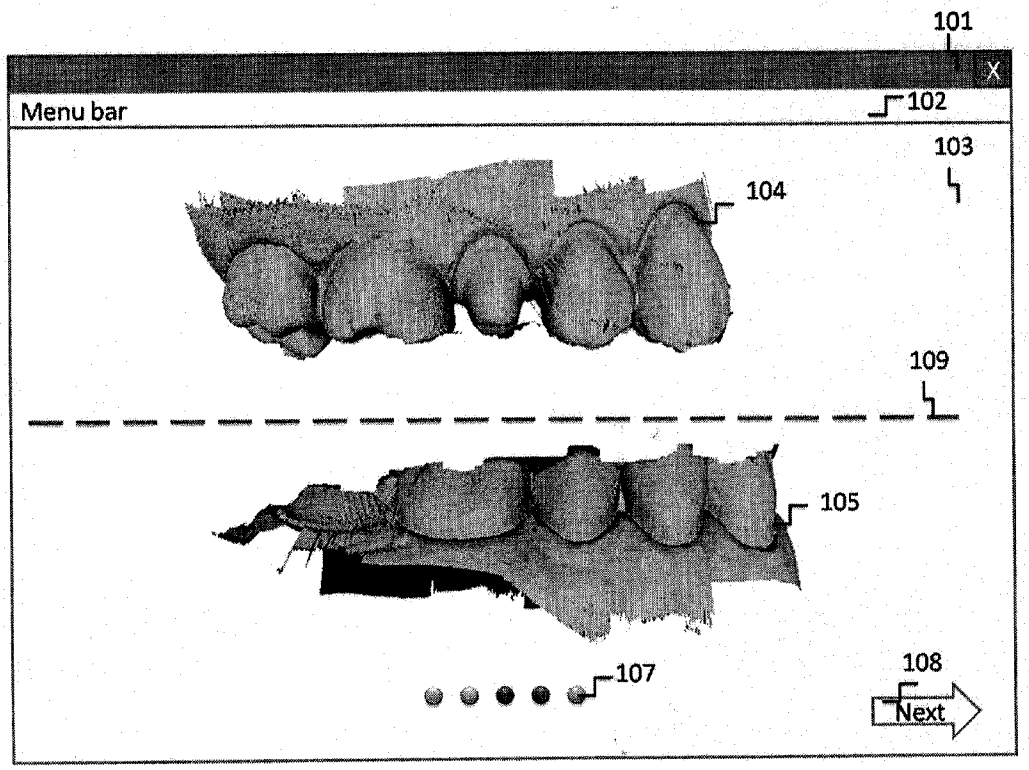

101
X
Menu bar
102
103
104
109
105
107
108
Next

Fig.8

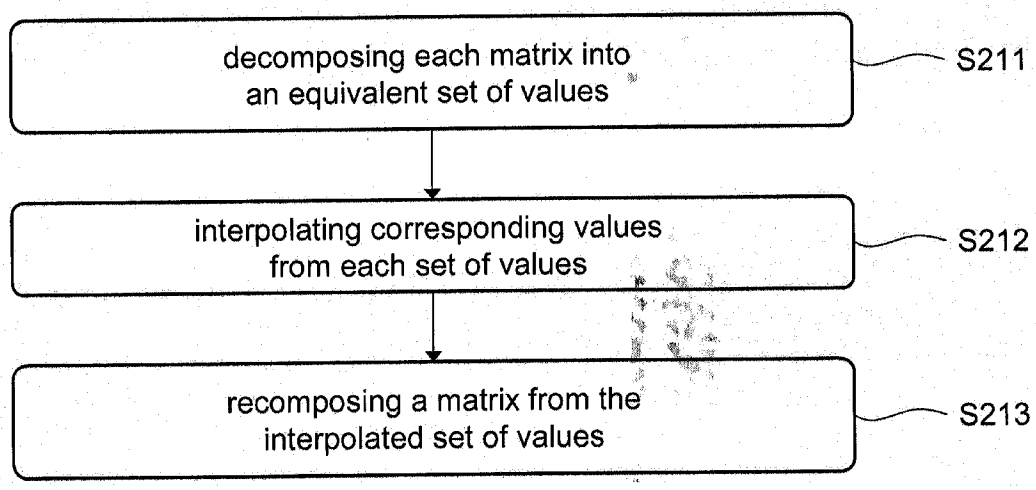

decomposing each matrix into an equivalent set of values
S211
interpolating corresponding values from each set of values
S212
recomposing a matrix from the interpolated set of values
S213

Fig.9

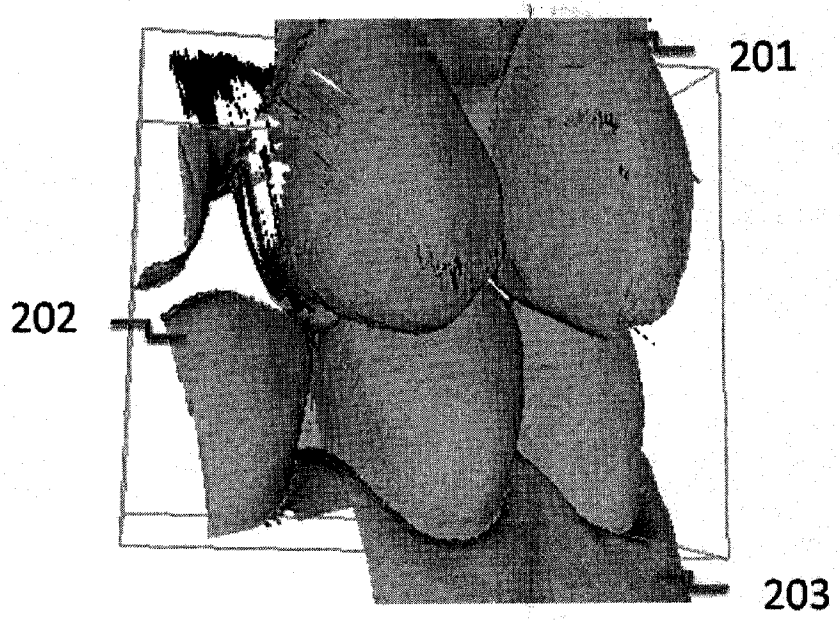


Fig.10

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	METHOD AND SYSTEM FOR BITE REGISTRATION
First Named Inventor/Applicant Name:	Yannick Glinec
Filer:	Carl R. Wesolowski/Karen Tyler
Attorney Docket Number:	95480

Filed as Large Entity

Filing Fees for U.S. National Stage under 35 USC 371

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
National Stage Fee	1631	1	280	280
National Stage Search - all other cases	1632	1	600	600
National Stage Exam - all other cases	1633	1	720	720
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**1600**

Electronic Acknowledgement Receipt

EFS ID:	23303079
Application Number:	14770177
International Application Number:	PCT/CN13/72420
Confirmation Number:	8357
Title of Invention:	METHOD AND SYSTEM FOR BITE REGISTRATION
First Named Inventor/Applicant Name:	Yannick Glinec
Customer Number:	70523
Filer:	Carl R. Wesolowski/Karen Tyler
Filer Authorized By:	Carl R. Wesolowski
Attorney Docket Number:	95480
Receipt Date:	25-AUG-2015
Filing Date:	
Time Stamp:	13:24:58
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$1600
RAM confirmation Number	11852
Deposit Account	504233
Authorized User	TYLER, KAREN

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal of New Application	pto-1390CRW.pdf	216727 9a21f4aaa3eddc7b293ce996ca0b161446a51028	no	4
Warnings:					
Information:					
2	Application Data Sheet	aia0014CRW.pdf	1819187 38aeab3bb88a652d419715d31cc8dd1d7380d787	no	7
Warnings:					
Information:					
3		95480_Prelim_Amend.pdf	241071 b15bb6a5a6305615 1f09b3bf196a4c4d2d2f6953	yes	8

Multipart Description/PDF files in .zip description

Document Description	Start	End
Preliminary Amendment	1	1
Specification	2	2
Claims	3	7
Applicant Arguments/Remarks Made in an Amendment	8	8

Warnings:					
Information:					
4	Power of Attorney	95480_POA.pdf	20075 ec383047c2d02424b3c799c6817e44ea9c2e0bbd	no	1
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Information:					
5	Information Disclosure Statement (IDS) Form (SB08)	95480_IDS_1.pdf	136682 c6ea764a48b7f62d35312280f2ee82fad98f8a8f	no	3
Warnings:					
Information:					
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6	Foreign Reference	CN101228556.pdf	792728 5ab6e35672f461bcd40118a6cf7ed06f16b01055	no	7
Warnings:					
Information:					
7	Non Patent Literature	95480_Search_Report_5_pages.pdf	152091 77695cd729167916558193512557e9be6cfd43b7	no	5
Warnings:					
Information:					
8		95480WO_Application.pdf	9525575 4f382bff55c6d2339699ad2f2a21b5bc22b1e8ef	yes	29

Multipart Description/PDF files in .zip description

Document Description	Start	End
Specification	1	14
Claims	15	20
Abstract	21	21
Drawings-only black and white line drawings	22	29

Warnings:					
Information:					
9	Fee Worksheet (SB06)	fee-info.pdf	35341 3e85de5d6b36d9ea78b4082a0bbc12bb177bf56d	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	12939477	

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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PCT REQUEST

Print Out (Original in Electronic Form)

0	**For receiving Office use only**	
0-1	International Application No.	PCT/CN2013/072420
0-2	International Filing Date	11 March 2013 (11.03.2013)
0-3	Name of receiving Office and "PCT International Application"	RO/CN

0-4	**Form PCT/RO/101 PCT Request**	
0-4-1	Prepared Using	PCT-SAFE Version 3.51.056.232 MT/FOP 20121001/0.20.5.19
0-5	**Petition** The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	**Receiving Office (specified by the applicant)**	State Intellectual Property Office of the People's Republic of China (RO/CN)
0-7	**Applicant's or agent's file reference**	FPEL12150362
I	**Title of Invention**	METHOD AND SYSTEM FOR BITE REGISTRATION
II	**Applicant**	
II-1	This person is	Applicant only
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IV-1-6	Agent's registration No.	72001

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V	**DESIGNATIONS**		
V-1	**The filing of this request constitutes under Rule 4.9(a), the designation of all Contracting States bound by the PCT on the international filing date, for the grant of every kind of protection available and, where applicable, for the grant of both regional and national patents.**		
VI-1	**Priority Claim**	NONE	
VII-1	**International Searching Authority Chosen**	State Intellectual Property Office of the People's Republic of China (ISA/CN)	
VIII	**Declarations**	Number of declarations	
VIII-1	Declaration as to the identity of the inventor	-	
VIII-2	Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent	-	
VIII-3	Declaration as to the applicant's entitlement, as at the international filing date, to claim the priority of the earlier application	-	
VIII-4	Declaration of inventorship (only for the purposes of the designation of the United States of America)	-	
VIII-5	Declaration as to non-prejudicial disclosures or exceptions to lack of novelty	-	
IX	**Check list**	Number of sheets	Electronic file(s) attached
IX-1	Request (including declaration sheets)	4	✓
IX-2	Description	14	✓
IX-3	Claims	6	✓
IX-4	Abstract	1	✓
IX-5	Drawings	8	✓
IX-7	TOTAL	33	
	Accompanying Items	Paper document(s) attached	Electronic file(s) attached
IX-8	Fee calculation sheet	-	✓
IX-11	Copy of general power of attorney	-	✓
IX-18	PCT-SAFE physical media	-	-
IX-20	**Figure of the drawings which should accompany the abstract**	Fig.2	
IX-21	**Language of filing of the international application**	English	
X-1	**Signature of applicant, agent or common representative**	/China Patent Agent (HK)Ltd./	
X-1-1	Name	CHINA PATENT AGENT (H.K.) LTD.	
X-1-2	Name of signatory	China Patent Agent (HK)Ltd.	
X-1-3	Capacity (if such capacity is not obvious from reading the request)	Agent	

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10-1	**Date of actual receipt of the purported international application**	11 March 2013 (11.03.2013)
10-2	**Drawings:**	
10-2-1	Received	
10-2-2	Not received	
10-3	**Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application**	
10-4	**Date of timely receipt of the required corrections under PCT Article 11(2)**	
10-5	**International Searching Authority**	ISA/CN
10-6	**Transmittal of search copy delayed until search fee is paid**	

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NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92*bis*.1 and Administrative Instructions, Section 422)

To:

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Wanchai
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Date of mailing *(day/month/year)*
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IMPORTANT NOTIFICATION

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1. The following indications appeared on record concerning:

☒ the applicant ☒ the inventor ☐ the agent ☐ the common representative

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	Facsimile No.	
	E-mail address	

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☐ the person ☐ the name ☐ the address ☐ the nationality ☐ the residence

Name and Address	State of Nationality	State of Residence
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3. Further observations, if necessary:
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4. A copy of this notification has been sent to:

☒ the receiving Office
☒ the International Searching Authority
☐ the Authority(ies) specified for supplementary search
☐ the International Preliminary Examining Authority
☐ the designated Offices concerned
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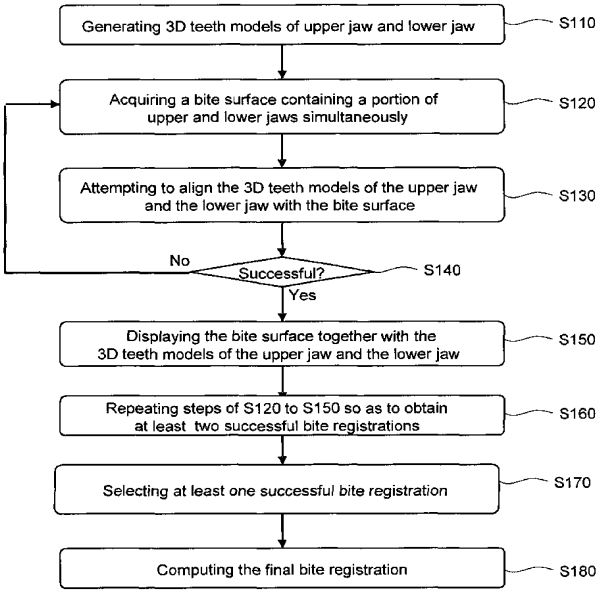


Fig. 2

(57) **Abstract**: Method and system for bite registration using multiple bite registrations. In this method or system, when both the 3D teeth model of the upper jaw and the 3D teeth model of the lower jaw are successfully aligned with the bite surface, the bite surface with the 3D teeth models of the upper jaw and the lower jaw is displayed for further evaluation; the bite surfaces selected by the user are combined to generate a final bite registration. Using multiple bite surfaces for registration improves the accuracy.

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METHOD AND SYSTEM FOR BITE REGISTRATION

FIELD OF THE INVENTION

[0001] The present invention relates to the technical field of dental 3-dimensional (3D) imaging, and in particular to a method and computerized system for bite registration using at least two bite surfaces.

BACKGROUND

[0002] In dental field, it is one of key points to obtain an accurate 3D teeth model corresponding to clenched state during the course of treatment (for example, orthodontics). 3D camera system is used to create a 3D model of the teeth directly with the patient, which avoids the need to cast impressions and send them to the lab for restoration. This reduces cost and simplifies the workflow of dental restoration.

[0003] For the process of constructing global 3D teeth model, the step of bite registration is one of necessary and crucial steps. Bite registration is the process of registering the upper jaw with the lower jaw, which could establish a 3D spatial positioning relationship between an upper jaw and its corresponding lower jaw in clenched state.

[0004] In an existing 3D camera system, during bite registration, only one bite surface is required for constructing a global 3D teeth model. In this method, the single bite surface is captured from one certain location (such as right side of molars) of the clenched teeth by a scanner, then the 3D teeth models of the upper jaw and the lower jaw captured independently are stitched onto the bite surface in a semi-automatic way so as to complete bite registering. However, when the global teeth contains a plurality of teeth (such as more than 5 teeth), the bite registration obtained from only one location of the bite surface may lead to significant mismatch in another location. For example, when only one bite surface corresponding to right side of molars is used, there are several hundreds microns of mismatch in the bite registration corresponding to the distant end (such as incisors or left side of molars). Thus, it is difficult to ensure the overall accuracy of bite registration, which results that a great difference may exist between the ultimate virtual global 3D teeth

model constructed by this single bite registration and the actual global teeth in unique clenched state.

[0005] U.S. Pub. No.: US 2005/0196724A1 to Ross J. Miller et al. discloses a device for bite registration, which uses block (200) filled with impression material to record bite configurations. Evidently, it can not provide digital visual bite surface, and thus is not adaptable to digital 3D camera system.

[0006] Further, U.S. Pat. No.: US 8121718 B2 to Rüdger Rubbert et al. discloses an interactive orthodontic care system based on intra-oral scanning of teeth. In this system, when stitching both the upper jaw and the lower jaw onto the bite surface, it is completed in a manual way. Moreover, only one bite surface is used for obtaining a 3D virtual model of the teeth either.

SUMMARY OF THE INVENTION

[0007] In view of above problems, the object of the present invention is to improve the accuracy of bite registration at least.

[0008] In order to realize the above object or other objects, the invention provides the following technical solutions.

[0009] According to one aspect of the invention, a method of bite registration is provided, this method comprises the steps of:

a. generating 3-dimensional (3D) teeth models of the upper jaw and the lower jaw;

b. acquiring a bite surface containing a portion of upper and lower jaws simultaneously;

c. attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface;

d. displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful;

e. repeating step b to step d so as to obtain at least two successful bite registrations corresponding to different displayed bite surfaces;

f. selecting one or more successful bite registrations by evaluating at least two successful bite registrations; and

g. computing a final bite registration using selected one or more successful bite registrations.

[0010] According to another aspect of this invention, a system for bite registration is provided which includes:

means for generating 3D teeth models of the upper jaw and the lower jaw;

means for acquiring a bite surface containing a portion of upper and lower jaws simultaneously;

means for attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface;

means for displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful;

means for obtaining at least two successful bite registrations corresponding to different displayed bite surface by repeating;

means for selecting one or more successful bite registrations by evaluating at least two successful bite registrations; and

means for computing a final bite registration using selected one or more successful bite registrations.

[0011] According to yet another aspect of this invention, a system for bite registration is provided which includes a scanner and a computerized workstation, wherein the workstation is configured as:

generating 3D teeth models of the upper jaw and the lower jaw;

acquiring a bite surface containing a portion of upper and lower jaws simultaneously;

attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface;

displaying the bite surface together with the 3D teeth models of the upper jaw and the

lower jaw aligned with the bite surface if alignment is successful;

repeating steps acquiring to step of displaying so as to obtain at least two successful bite registrations corresponding to different displayed bite surfaces;

selecting one or more successful bite registrations by evaluating at least two successful bite registrations; and

computing a final bite registration using selected one or more successful bite registrations.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The above and other objects and advantages of the invention will become fully understood from the following detailed description with reference to drawings, in which identical or similar elements are denoted by identical reference signs.

[0013] Fig. 1 is a is a schematic structural view of a system for bite registration in accordance with an embodiment of the invention;

[0014] Fig. 2 is a workflow of a method of bite registration in accordance with an embodiment of the invention;

[0015] Fig. 3 is a schematic workflow of bite registration in accordance with an embodiment of the invention;

[0016] Fig. 4(a) is a 3D teeth models of the upper jaw,

[0017] Fig. 4(b) is a 3D teeth models of the lower jaw;

[0018] Fig. 5 is a schematic view of bite surface displayed in the monitor;

[0019] Fig. 6 is a schematic workflow of aligning the 3D teeth models with the bite surface in accordance with an embodiment of the invention;

[0020] Fig. 7 shows a display of the user interface when succeeding to stitch in accordance with an embodiment of the invention;

[0021] Fig. 8 shows a display of the user interface when not succeeding to stitch in accordance with another embodiment of the invention;

[0022] Fig. 9 shows a schematic workflow of multiple matrix interpolations;

[0023] Fig. 10 shows a part of acquired 3D surface with the bite surface.

DETAILED DESCRIPTION OF THE INVENTION

[0024] Some of the many possible embodiments of the invention will be described below in order to provide a basic understanding of the invention and not to identify crucial or decisive elements of the invention or define the scope of protection. It can be easily understood that according to the technical solutions of the invention, those with ordinary skills in the art can propose other alternative implementations without departing from the true spirit of the invention. Therefore, the following embodiments and accompanying drawings are illustrative description of technical solutions of the invention, and should not be construed as constituting the whole of the invention or as limiting or defining technical solutions of the invention.

[0025] Fig. 1 is a schematic structural view of a system for bite registration in accordance with an embodiment of the invention. The system 10 is used to bite registration at least. As simply illustrated in Fig. 1, in this embodiment, the system 10 includes a scanner 13 and a computerized workstation 11. The scanner 13 is handheld by the dentist, and it can be partly put into the mouth of patient 90. When put into the mouth, the scanner 13 can capture image(s) of the teeth or other 3D views as necessary. The scanner 13 and the workstation 11 can be connected in a wireless or wired way so that the images or views captured by the scanner 13 can be transmitted to the workstation for data processing or real-time displaying. Of course, some instructions generated by the workstation 11 can also be transmitted to the scanner 13 so as to control its action.

[0026] The workstation 11 comprises a monitor 19 at least which can display all sorts of 2D/3D images or windows under the control of the workstation 11. Software of bite registration can be installed in the workstation 11. When running the software, the workstation 11 functions as an image processing device which can complete the bite registration step at least in the process of constructing the global 3D teeth model. Of course,

it can be understood that the software may not be limited to perform bite registration step but can be used to realize global 3D teeth model in time. Thus, if necessary, the system 10, mainly constituting a 3D camera system adapted for teeth, can also function as constructing the global 3D teeth model of the patient.

[0027] The software's function of bite registration is carefully described hereinafter in conjunction with the following figures. Certainly, a method of bite registration can further be applied to construct the global 3D teeth model.

[0028] Fig. 2 is a workflow of a method of bite registration in accordance with an embodiment of the invention. In this embodiment, the method in Fig. 2 can obtain at least two successful bite registrations corresponding to different bite surfaces. The following description, conjunction with Figs. 1-10, describes the workflow of bite registration which obtains at least two successful bite registrations and selects at least one bite registration by user.

[0029] Firstly, in step of S110, the dentist operates the scanner 13 in the mouth of the patient 90, thus multiple 2D images of the upper jaw and lower jaw can be respectively captured from different viewpoints. The multiple 2D images are transmitted to the workstation 11, and then are processed so as to generate 3D teeth models of the upper and lower jaws.

[0030] In a preferred embodiment, as shown in Fig.3, S110 includes the following steps: S111, 3D teeth surface on the upper jaw or lower jaw is captured by the handheld scanner 13; S112, judging whether the captured portion is the first one or not for a certain patient in the workstation 91; S114, if the captured portion is the first one during the scan, the captured portion is accepted; if succeeding to be accepted in S116, entering into S117 of combining the captured 3D teeth surface with the 3D teeth model; S113, if the captured portion is not the first one, attempting to stitch the captured portion onto the existing 3D teeth model; S115 judging whether the captured portion is successfully stitched not; if succeeding to stitch in S115, entering into S117 of combining the captured portion with the existing 3D teeth model. Thus, the captured portion combine with the existing 3D teeth model would make the ultimately formed 3D teeth model of the upper or lower jaw more accurate.

[0031] In another embodiment, the method of generation of the 3D teeth model in step of S110 can refer to two filed patents of Application No. US13/293,308 and Application No. 13/525,590, both with name of "3D INTRAORAL MEASUREMENTS USING OPTICAL MULTILINE METHOD". Those entire contents of these patent applications are incorporated by reference herein.

[0032] Further, in step of S120, a bite surface containing a portion of the upper jaw and a portion of the lower jaw simultaneously is acquired. In this embodiment, the scanner 13 is set in a location so as to capture one or more bite views (or surfaces) corresponding to some teeth. The bite view(s) captured by the scanner 13 is (are) obtained in a unique clenched state where the upper jaw is static in relation to the lower jaw. Thus, one or more bite views can form a bite surface containing a portion of upper and lowers jaws simultaneously. In particular, the bite view is a 3D surface containing upper and lowers jaws, and in one embodiment, several bite views corresponding to different teeth respectively can be combined into one view so as to form a bigger bite surface. In one example, the bite surface 191 can be displayed on the monitor in-time as shown in Fig. 5.

[0033] It can be understood that the bite surface 191 is a 3D surface, and can be obtained by a method of image processing applied to one or more bite views. In an embodiment, this method is similar with that used in steps of S110. It can also be understood that, since captured in the clenched state, the scanner 13 is convenient to image the outside of the teeth. Thus, the bite surface 191 is a 3D surface usually representing 3D shape characteristic of outside, and it can not substitute the function of the global 3D teeth model obtained ultimately. However, this bite surface can be further used in the process of global matching so as to improve the accuracy of the global 3D teeth model. As the bite surface 191 is also used to align with the 3D teeth models, the bite surface 191 must contain a part of the upper jaw and the lower jaw simultaneously in the unique clenched state.

[0034] In a preferred embodiment, the portion of the upper and lower jaws observed in the bite surface can be changed. For example, when repeating to perform step of S120, the bite surface can be obtained from different portions of the clenched upper and lower jaws; thus, the location of the acquired bite surface can be changed. In a selectable embodiment, the obtained bite surface may include, but is not limited to, portions from incisors,

premolar, molars.

[0035] Further, in step of S130, attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface. In an embodiment, the alignment can be completed at least by stitching of a portion of 3D teeth surface of the bite surface with the 3D teeth models of the upper jaw and the lower jaw. In another embodiment, the alignment can be completed at least by stitching of a portion of 3D teeth surface of the acquired bite surface with either the lower or the upper arch.

[0036] Fig.6 is a schematic workflow of aligning the 3D teeth models with the bite surface in accordance with an embodiment of the invention. The stitching of a portion of 3D teeth surface of the bite surface with the 3D teeth models includes steps of S131 to S136. In S131, generating candidate 3D rigid transformations to place the 3D teeth surface of the bite surface relative to the 3D teeth model. In S132, evaluating a metric of the candidate 3D rigid transformations using the relative placement of the 3D teeth surface relative to the 3D teeth model. In S133, choosing the best 3D rigid transformation which corresponds to a best metric. In S134, judging whether the best metric exceeds a predetermined threshold or not; if the best metric goes below a predetermined threshold, entering into S136 of accepting the corresponding 3D rigid transformation; if the best metric exceeds a predetermined threshold, entering into S137 of rejecting the stitching, which means a failure of stitching.

[0037] It is noted that the stitching process can be completed in a manual way, a semi-automatic way or automatic way. In case of using a semi-automatic way, the particular method of stitching can refer to U.S. Pat. No.: US 8121718 B2. In other preferred embodiment, the stitching process can be performed automatically based on an algorithm. The entire content of US 8121718 B2 is incorporated by reference herein. It can be understood that the automatic way used in aligning process could greatly save valuable time for user. Thus, not only the speed for bite registration but also the user experience is improved.

[0038] Further, in step of S140, judging whether the alignment in S130 is successful or not. If the alignment is successful, coming into step of S150, i.e., the bite surface is displayed together with the 3D teeth models of the upper jaw and the lower jaw; if

alignment is not successful, returning back to step of S120 so as to acquire another bite surface until the alignment is successful.

[0039] Fig. 7 shows a display of the user interface when the alignment is successful in accordance with another embodiment of the invention. In an embodiment, as shown in Fig. 7, 106 denotes the bite surface together with the 3D teeth models of the upper/lower jaws stitched onto the bite surface, which represents one successful bite registration. Moreover, in particular, 101 denotes application window; 102 denotes application menu bar; 103 denotes application workspace; 104 denotes the 3D teeth model of the upper jaw in the initial placement; and 105 denotes the 3D teeth model of the lower jaw in the initial placement. The arrows represent a moving direction of the 3D teeth models of the upper/lower jaws in the process of alignment. When the alignment is successful, a transformation corresponding to the successful bite registration can be obtained and stored, and the user can employ it in the next step of computation of the final bite registration.

[0040] Fig. 8 shows a display of the user interface when the alignment is not successful in accordance with another embodiment of the invention. In case that the alignment is not successful, as shown in the user interface of Fig.8, the user would receive a notification 109 of notification of failing to align or to register the bite surface. Moreover, the bite surface may be discarded automatically. Thus, the user only gets results which satisfy the algorithm quality criterion of alignment, which helps for improving the accuracy of bite registration. Meanwhile, it is necessary to return back to S120 so as to repeat anther circulated process of bite registration.

[0041] Further, in step of S160, the user can repeat to perform steps of S120 to S150 so as to obtain another successful bite registration. The time of repeating steps of S120 to S150 is not limited by this embodiment. The user can subjectively determine the time of repeating so as to obtain at least two successful bite registrations. A plurality of successful bite registrations can be stored and freely displayed by the user. Thus, it is very convenient to valuate all of successful bite registrations for the user, and the user can further select the ones with preferred transformation from successful bite registrations in the next step. As shown in Fig. 7 and Figs. 8, each button 107 represents a process of repeating. In an example, button 107 can be set as green color in case that the successful bite registration is

selected.

[0042] Further, in step of S170, selecting at least one successful bite registration by evaluating at least two successful bite registrations. In this step, the bite surface with 3D models of the upper and lower jaws 106 can be displayed from different viewpoints; thus, this bite surface and the registered lower and upper arches may be observed from different viewpoints by the user, which greatly contributes to a full observation of the mismatch in different locations. When evaluating, the respective location of 3D teeth models of the upper jaw and the lower jaw can be evaluated by the user so as to judge whether the bite surface is suitable or not. If the mismatch corresponding to the distant end of the bite surface exceeds desired value, the bite surface and its corresponding bite registration are not suitable to be used in the next steps of computation of the final bite registration. For example, when the bite surface is selected from right side of molars, the user can observe the mismatch in the location of the left side of molars. Further by comparatively evaluating at least two successful bite registrations, one or more successful bite registrations and its corresponding bite surfaces with better evaluation results can be easily selected out by the user. Therefore, the user can select the bite registrations with optimized transformation in an intuitive way, which can further greatly improve the accuracy of the global 3D teeth model ultimately formed.

[0043] In particular, as shown in Fig. 7 and Fig. 8, the user can double-click any of the buttons 107 to enable and store desired successful bite registration and its corresponding bite surface, and the unselected one is disabled in the next steps of computation of the final bite registration. In one embodiment, when the successful bite registration is selected by the user, the button 107 turns green; when the successful bite registration is unselected the button 107 turns red. Thus, the user can easily distinguish the selected from the unselected successful bite registration. In another embodiment, the selection of the successful bite registration can be completed in an automatic way. In another embodiment, Step 170 automatically selects all successful bite registration without user interaction. When further clicking button 108, going to step of S180.

[0044] Further, in step of S180, computing the final bite registration(s) using selected one or more successful bite registrations.

[0045] In one embodiment, the computation of the final bite registration employs multiple matrix interpolation of the selected successful bite registrations. If at least two successful bite registrations are selected in step S170, combining all transformations corresponding to different selected successful bite registrations respectively into a single transformation. In particular, as shown in Fig. 9, a 4x4 matrix interpolation may contain the steps of decomposing each matrix into an equivalent set of values (S211), interpolating corresponding values from each set of values (S212) and recomposing a matrix from the interpolated set of values (S213). The set of equivalent values may consist in translation, scale, skew all represented as a vector with 3 components and perspective, quaternion both represented as a vector with 4 components. For detail, the abovementioned multiple matrix interpolations are also described in http://dev.w3.org/csswg/css3-transforms/#matrix-interpolation, and its disclosure can be incorporated by reference herein.

[0046] Therefore, in the embodiment of multiple matrix interpolation, S180 provides the user with a way to merge information from all selected bite registration together, and it can be seen as a process of averaging transformations (i.e. averaging the stitching noise) while keeping the upper and lower arches rigid.

[0047] It is noted that, if only one successful bite registration is selected in step S170, the transformation of the selected bite registration can be processed by a method of prior art.

[0048] In another embodiment, the computation employs the optimization of a cost function depending on the selected successful bite registrations, i.e., employs global matching of 3D views to simultaneously optimize relative placement of all views which have some overlay. The bite surface reused in this process is the bite surface corresponding to the selected bite registration. That is to say, the bite surface selected in the S170 is further used for optimizing the placement of each 3D surface.

[0049] To be specific, global matching refers to the placement optimization of each 3D surface so as to optimize a cost function. In an embodiment of global matching, 3D surfaces from the upper jaw, the lower jaw and selected successful bite registrations might be used altogether in the cost function to be optimized. In another embodiment of the global matching, a subset of 3D surfaces from the lower jaw, a subset of surfaces from the

upper and a subset of selected successful bite registrations are used in the cost function to be optimized. In one embodiment, the cost function is computed from the distance between pairs of 3D surfaces. The distance between pairs of 3D surfaces might be computed from the distance between corresponding closest points on the surfaces. If the surfaces use a discrete representation, the corresponding points may be obtained using interpolation of the discrete coordinates. The distances between corresponding closest points on the surface may be weighted, and the weight might depend on a predetermined threshold. The predetermined threshold might represent a threshold distance above which influence of corresponding closest points decreases.

[0050] The cost function for a single pair of 3D surfaces S1 and S2 might be written:

[0051] $$f(S_1, S_2) = \sum_{i \in S_1} w_i d_i^2 (S_1, S_2)$$

[0052] Where index i is a point on the surface S_1 and $d_i(S_1,S_2)$ the distance of that point to the other surface, and w_i is a weight, which may depend on the initial distance between the two surfaces and also on a pre-determined threshold

[0053] The cost function for all pairs of 3D surfaces may be written:

[0054] $$F = \sum_k \sum_{l \neq k} f(T_k(S_k), T_l(S_l))$$

[0055] Where (k,l) represents any pair of distinct surfaces and T_k, T_l represent surfaces transformations to be optimized.

[0056] Global matching corresponds here to the minimization of a least square sum function where the unknows are transforms T_k, T_l.

[0057] There exist other variations of a cost function which provide similar final transforms, which will be considered having the same role to those skilled in the art.

[0058] The optimization of a transform which uses the one or more selected bite registrations may refer to the placement optimization of the upper arch relative to the lower arch, using the one or more selected bite registrations by optimizing a cost function. In one embodiment, the cost function is computed from the distance between pairs of 3D surfaces. The distance between pairs of 3D surfaces might be computed from the distance between corresponding closest points on the surfaces. The distance between corresponding closest

points on the surface may be weighted, and the weight might depend on a predetermined threshold. The predetermined threshold might represent a threshold distance above which influence of corresponding closest points decreases.

[0059] The cost function for optimization of the transform may be written:

[0060] $$G = \sum_{b \in B} \sum_{l \in L} f(T_b(S_b), T(S_l)) + \sum_{b \in B} \sum_{u \in U} f(T_b(S_b), S_u)$$

[0061] Where b represents the index of a selected bite surface, B the pool of selected bite surface indices, L the pool of surfaces from the lower jaw, U the pool of surfaces from the upper jaw, T_b the transform of each bite surface with index b, T the transform of the lower jaw relative to the upper jaw. The upper jaw is considered static in this representation, but there exist variations of this cost function which provide similar final transformations. The unknowns to be optimized are the individual transformations of bite surfaces T_b and the global transformation of the lower jaw T.

[0062] Fig. 10 shows a part of acquired 3D surface with the bite surface. Wherein, 201 denotes the upper jaw, 203 denotes the lower jaw, and 202 denotes the bite surface 202. The accumulated placement error from the upper and lower jaws is reduced by optimizing the placement of all meshes simultaneously. Thus, the relationship between upper and lower jaws is maintained and the placement of the meshes gets optimized.

[0063] After S220, the method for constructing a global 3D teeth model can further comprise other steps such as S230 of merging of meshes in lower jaw and in upper jaw separately to generate a global surface by interpolating surfaces in overlapping region, and S240 of meshing post-processing which combines mesh operations like hole-filling, smoothing, and cleaning. Other steps are known those skilled in the art, thus they are not carefully described herein.

[0064] Lastly, the global 3D teeth model is formed and displayed in the monitor. As using the accurate bite registration and steps of S210 and S220, the accuracy of the global 3D teeth model is greatly improved.

[0065] It can be understood that the system for bite registration can be seen as a sub-module of the system for constructing a global 3D teeth model.

[0066] In this context, a surface corresponds to surface acquired in one acquisition (also

named one view) and may actually contain several disconnected surfaces.

[0067] The above examples mainly discuss the method and system for bite registration and the method and system for constructing a global 3D teeth model. While only some of the embodiments of the invention have been described, it is understood by those skilled in the art that the invention can be implemented in many other forms without departing from the spirit and scope thereof. Therefore, the illustrated examples and embodiments should be construed as exemplary rather than limiting. The invention may cover various modifications and replacements without departing from the spirit and scope of the invention as defined by appended claims.

CLAIMS

1. A method of bite registration, characterized by comprising the steps of:

a. generating 3-dimensional (3D) teeth models of the upper jaw and the lower jaw;

b. acquiring a bite surface containing a portion of upper and lower jaws simultaneously;

c. attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface;

d. displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful;

e. repeating step b to step d so as to obtain at least two successful bite registrations corresponding to different displayed bite surfaces;

f. selecting one or more successful bite registrations by evaluating at least two successful bite registrations; and

g. computing a final bite registration using selected one or more successful bite registrations.

2. The method of bite registration according to claim 1, wherein

the computation of the final bite registration involves the optimization of a cost function depending on the selected successful bite registrations.

3. The method of bite registration according to claim 1, wherein

the computation of the final bite registration involves one or more matrix interpolations of the selected successful bite registrations.

4. The method of bite registration according to claim 3, wherein said one or more interpolations contain steps of:

decomposing each matrix into an equivalent set of values;

interpolating corresponding values from each set of values; and

recomposing a matrix from the interpolated set of values.

5. The method of bite registration according to claim 1, wherein step a includes the steps of:

a1) capturing 3D teeth surface on the upper jaw or lower jaw by a scanner;

a2) judging whether the captured 3D teeth surface is the first one or not during the scan;

a3) if the captured portion is the first one, accepting the captured 3D teeth surface; and if further succeeding to accept, combining the captured 3D teeth surface with the 3D teeth model; and

a4) if the captured portion is not the first one, attempting to stitch the captured 3D teeth surface onto the existing 3D teeth model; if succeeding to stitch, combining the captured 3D teeth surface with the existing 3D teeth model.

6. The method of bite registration according to claim 1, wherein step d including step of:

if the alignment is not successful, the bite surface is discarded and the user receives a notification of failing to align or to register the bite surface.

7. The method of bite registration according to claim 1 or 6, wherein if the alignment is not successful, automatically returning back to step b until the alignment is successful.

8. The method of bite registration according to claim 1, wherein the alignment is completed at least by stitching of a portion of 3D teeth surface of the bite surface with the

3D teeth models of the upper jaw and the lower jaw.

9. The method of bite registration according to claim 1, wherein the alignment can be completed at least by stitching of a portion of 3D teeth surface of the acquired bite surface with either the lower or the upper arch.

10. The method of bite registration according to claim 8 or 9, wherein the stitching process includes the steps of:

generating candidate 3D rigid transformations to place the 3D teeth surface relative to the 3D teeth model;

evaluating a metric of the candidate 3D rigid transformations using the relative placement of the 3D teeth surface relative to the 3D teeth model;

choosing the best 3D rigid transformation which corresponds to a best metric; and

if the best metric goes below a predetermined threshold, accepting the corresponding 3D rigid transformation; if the best metric exceeds a predetermined threshold, rejecting the stitching.

11. The method of bite registration according to claim 1, wherein in step e, when repeating to perform step b, the location of the acquired bite surface is changed.

12. The method of bite registration according to claim 11, wherein the teeth contained in the bite surface are selected from incisors, premolar or molars.

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

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

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

16. A system for bite registration, characterized by including:

means for generating 3D teeth models of the upper jaw and the lower jaw;

means for acquiring a bite surface containing a portion of upper and lower jaws simultaneously;

means for attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface;

means for displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful;

means for obtaining at least two successful bite registrations corresponding to different displayed bite surface by repeating;

means for selecting one or more successful bite registrations by evaluating at least two successful bite registrations; and

means for computing a final bite registration using selected one or more successful bite registrations.

17. The system for bite registration according to claim 16, wherein the computation of the final bite registration involves the optimization of a cost function depending on the selected successful bite registrations.

18. The system for bite registration according to claim 16, wherein means for computing the final bite registration involves device for one or more matrix interpolations

of the selected successful bite registrations.

19. The system for bite registration according to claim 18, wherein device for one or more matrix interpolations includes:

module for decomposing each matrix into an equivalent set of values;

module for interpolating corresponding values from each set of values; and

module for recomposing a matrix from the interpolated set of values.

20. The system for bite registration according to claim 16, wherein means for attempting to align the 3D teeth models includes:

module for, if the alignment is not successful, discarding the bite surface and sending a notification of failing to align to the user.

21. A system for bite registration, including a scanner and a computerized workstation, wherein the workstation is configured as:

generating 3D teeth models of the upper jaw and the lower jaw;

acquiring a bite surface containing a portion of upper and lower jaws simultaneously;

attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface;

displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw aligned with the bite surface if alignment is successful;

repeating steps acquiring to step of displaying so as to obtain at least two successful bite registrations corresponding to different displayed bite surfaces;

selecting one or more successful bite registrations by evaluating at least two successful bite registrations; and

computing a final bite registration using selected one or more successful bite

registrations.

22. The system for bite registration according to claim 21, wherein the system is used to construct a global 3D teeth model.

5

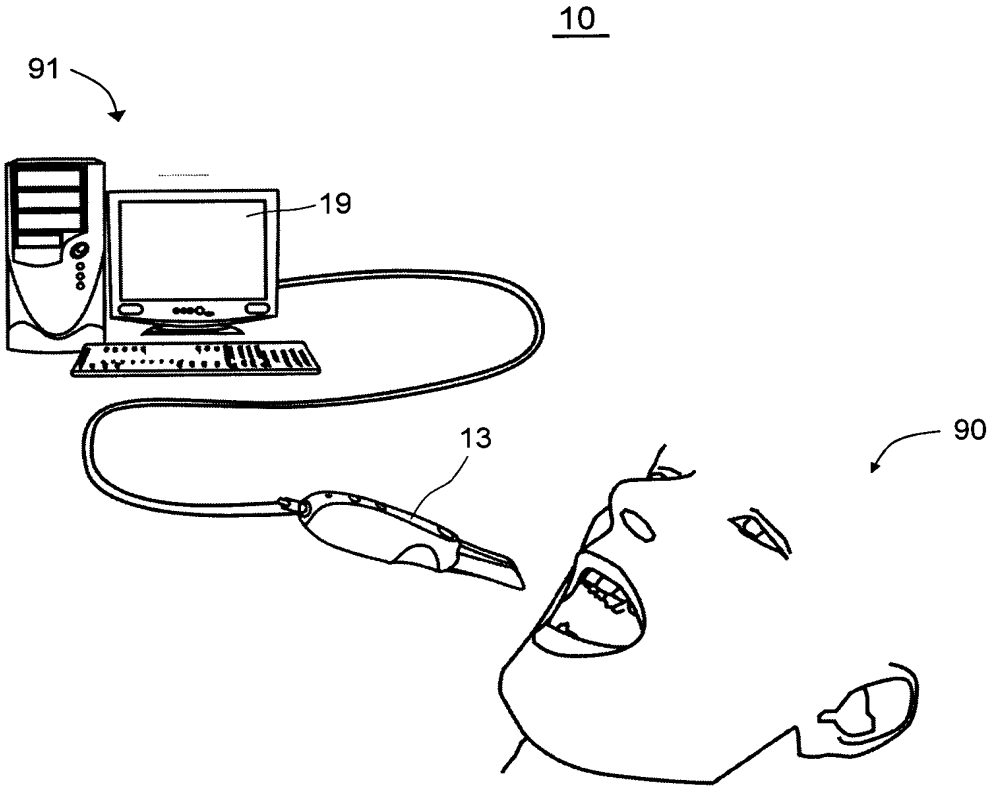


Fig. 1

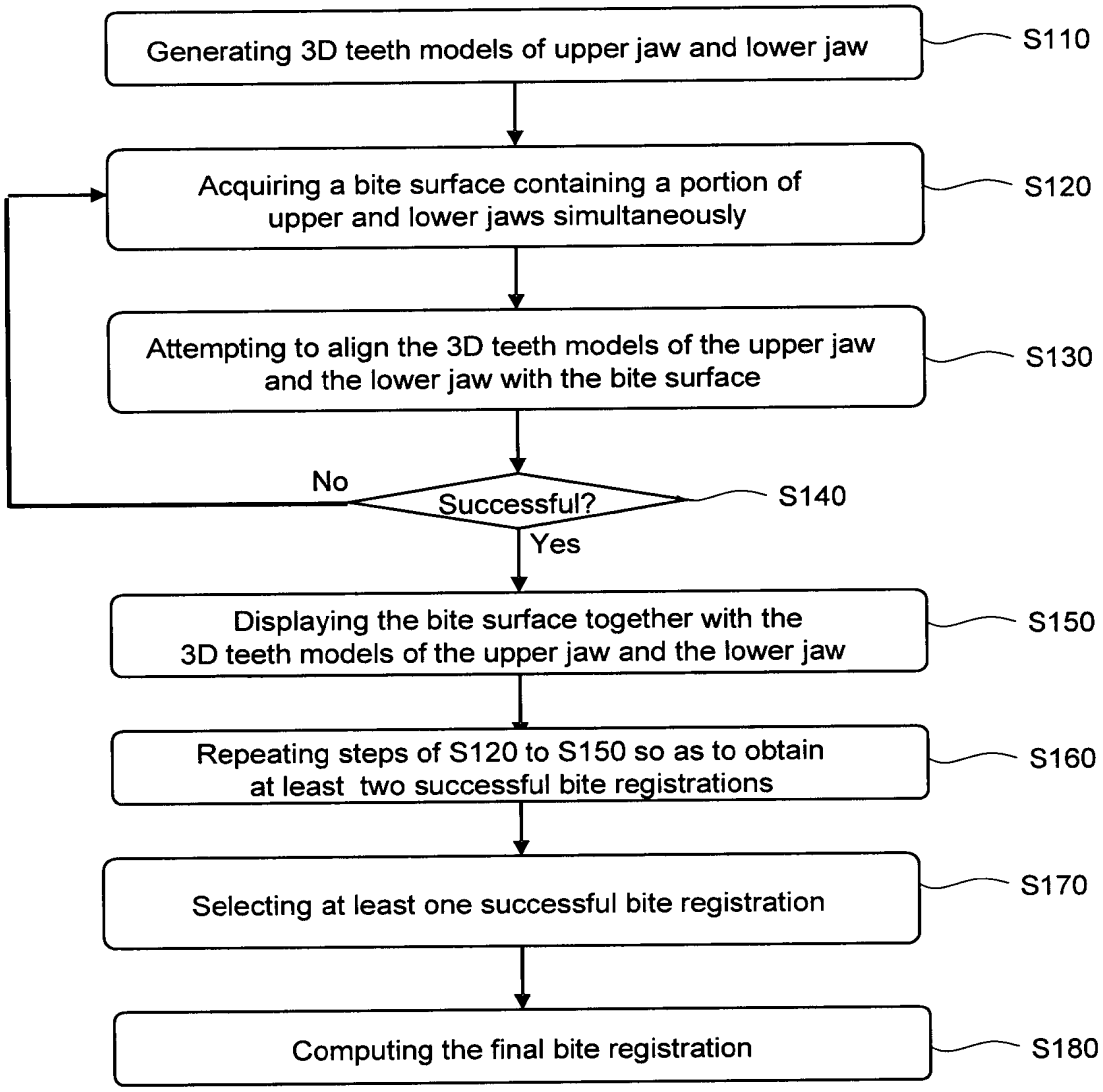

Generating 3D teeth models of upper jaw and lower jaw
S110
Acquiring a bite surface containing a portion of upper and lower jaws simultaneously
S120
Attempting to align the 3D teeth models of the upper jaw and the lower jaw with the bite surface
S130
No
Successful?
S140
Yes
Displaying the bite surface together with the 3D teeth models of the upper jaw and the lower jaw
S150
Repeating steps of S120 to S150 so as to obtain at least two successful bite registrations
S160
Selecting at least one successful bite registration
S170
Computing the final bite registration
S180

Fig. 2

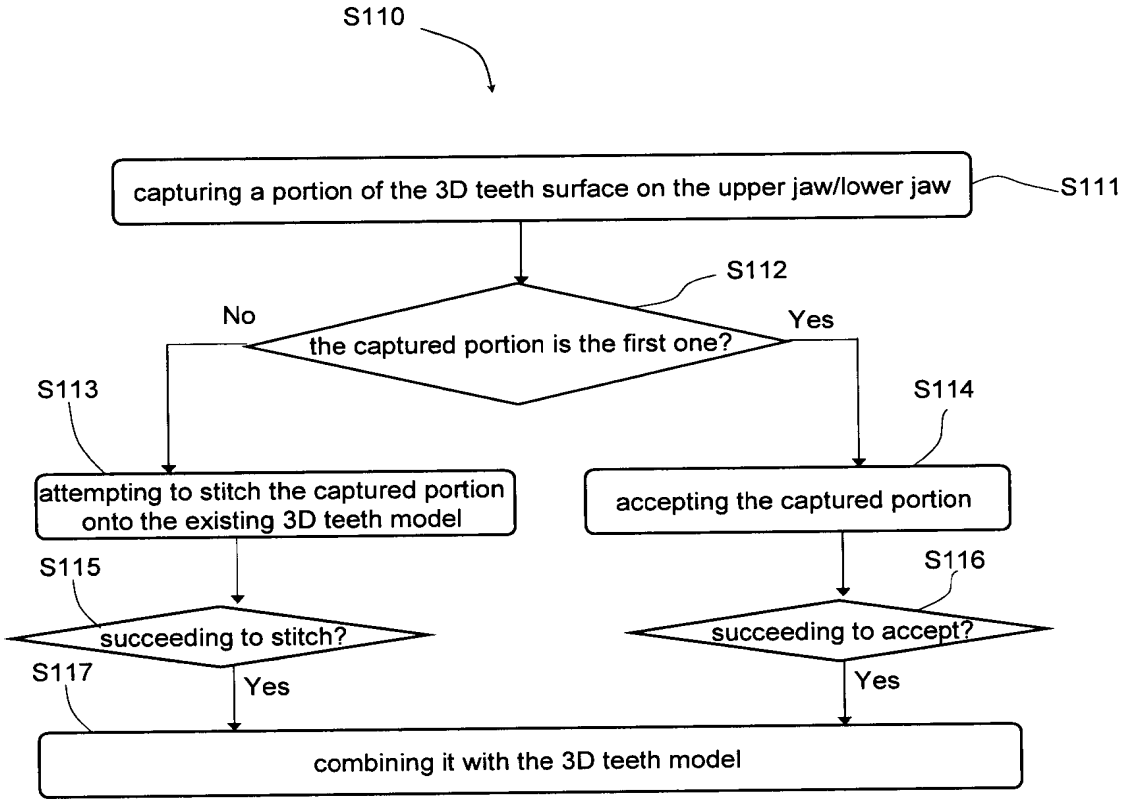

S110
capturing a portion of the 3D teeth surface on the upper jaw/lower jaw
S111
S112
No
the captured portion is the first one?
Yes
S113
S114
attempting to stitch the captured portion onto the existing 3D teeth model
accepting the captured portion
S115
S116
succeeding to stitch?
succeeding to accept?
S117
Yes
Yes
combining it with the 3D teeth model

Fig.3

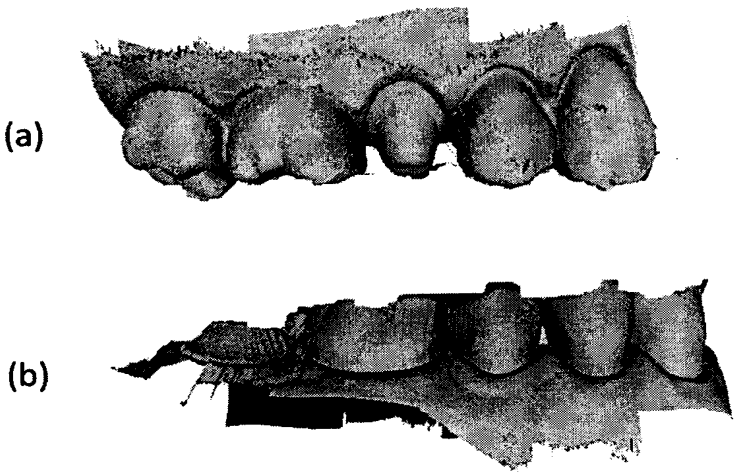


Fig.4

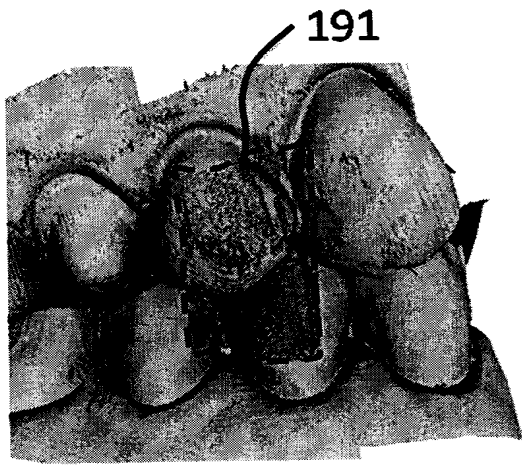


Fig.5

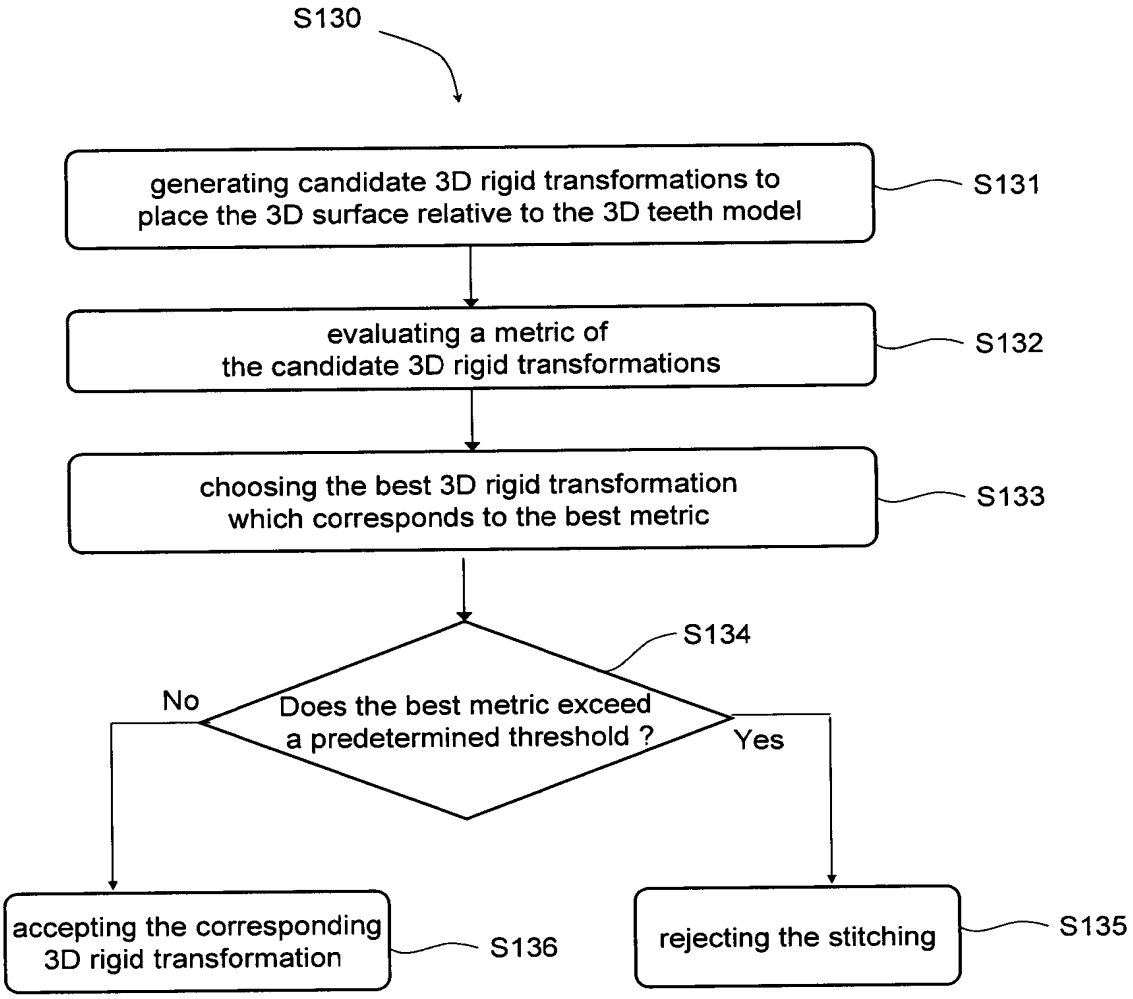

S130
generating candidate 3D rigid transformations to place the 3D surface relative to the 3D teeth model
S131
evaluating a metric of the candidate 3D rigid transformations
S132
choosing the best 3D rigid transformation which corresponds to the best metric
S133
S134
Does the best metric exceed a predetermined threshold ?
No
Yes
accepting the corresponding 3D rigid transformation
S136
rejecting the stitching
S135

Fig.6

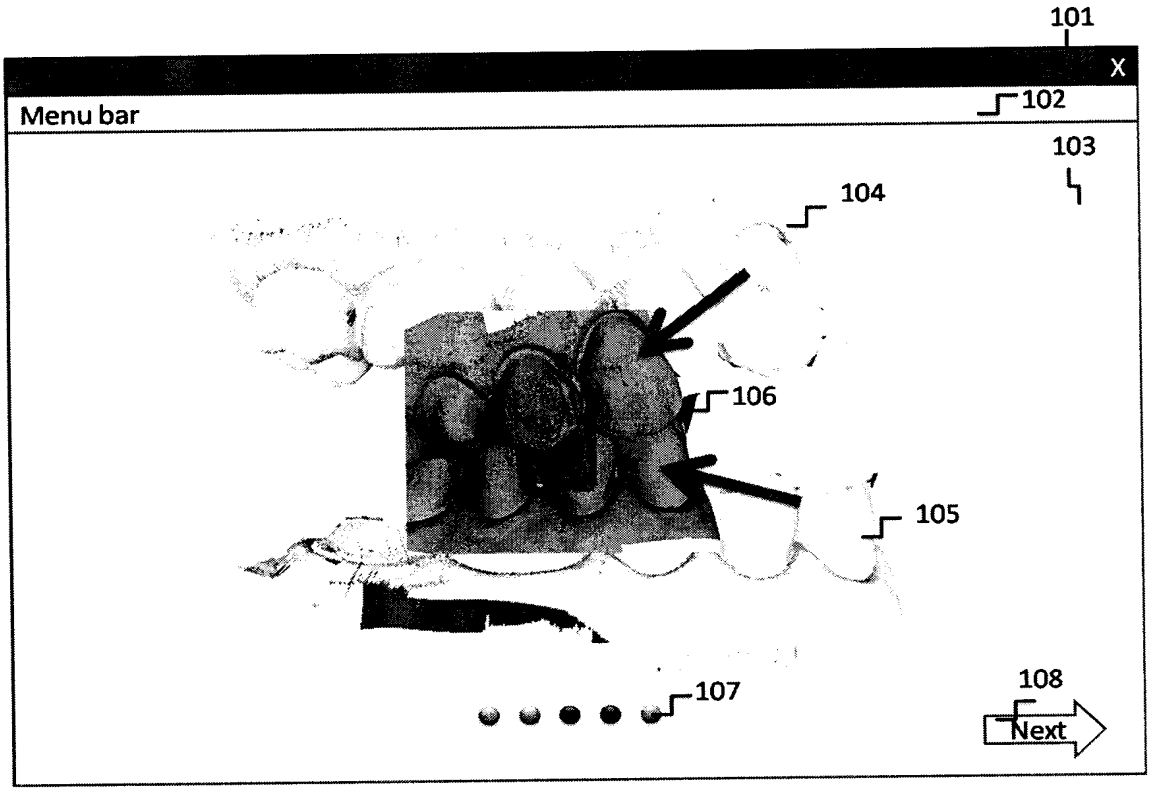


Fig.7

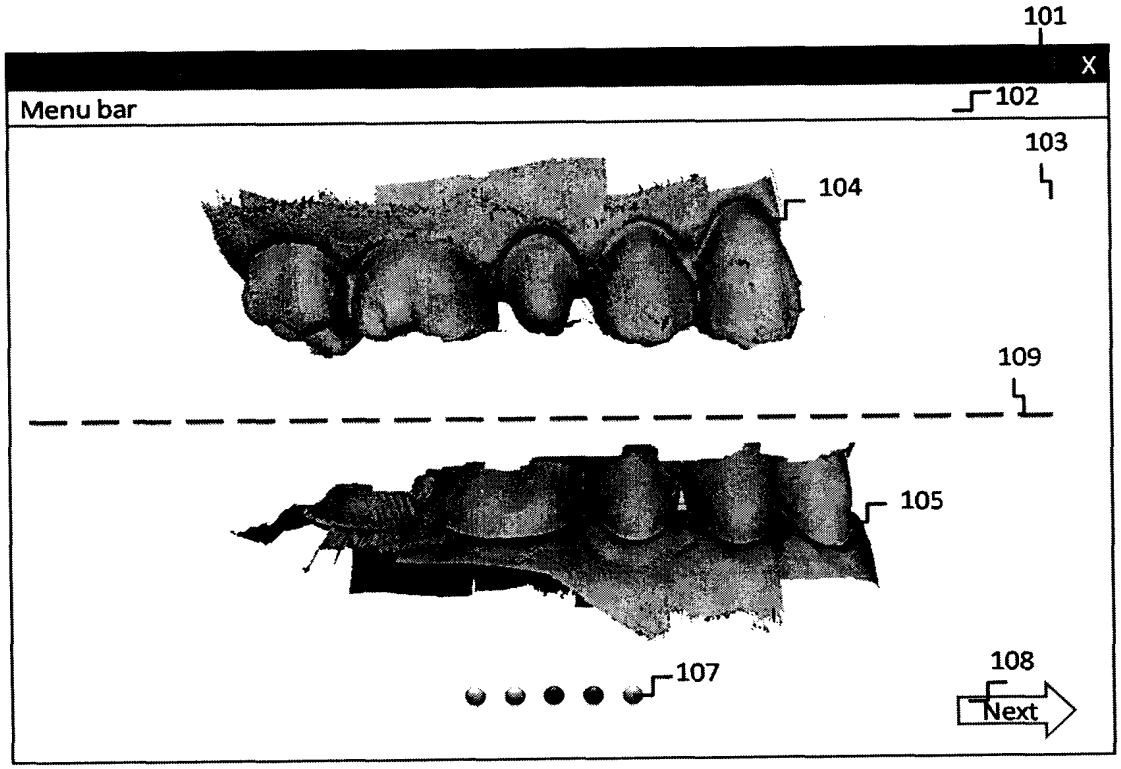

101
X
Menu bar
102
103
104
109
105
107
108
Next

Fig.8

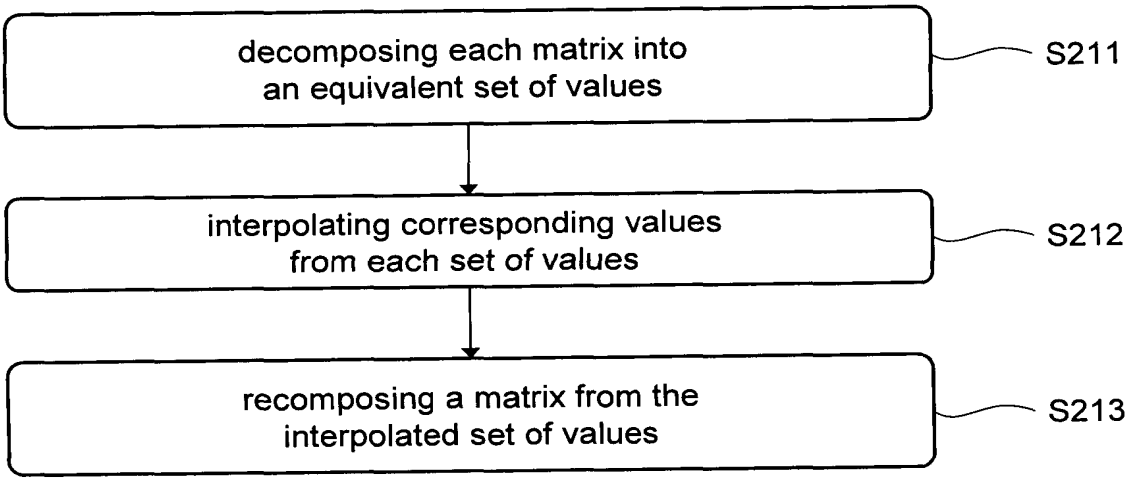

decomposing each matrix into an equivalent set of values
S211
interpolating corresponding values from each set of values
S212
recomposing a matrix from the interpolated set of values
S213

Fig.9

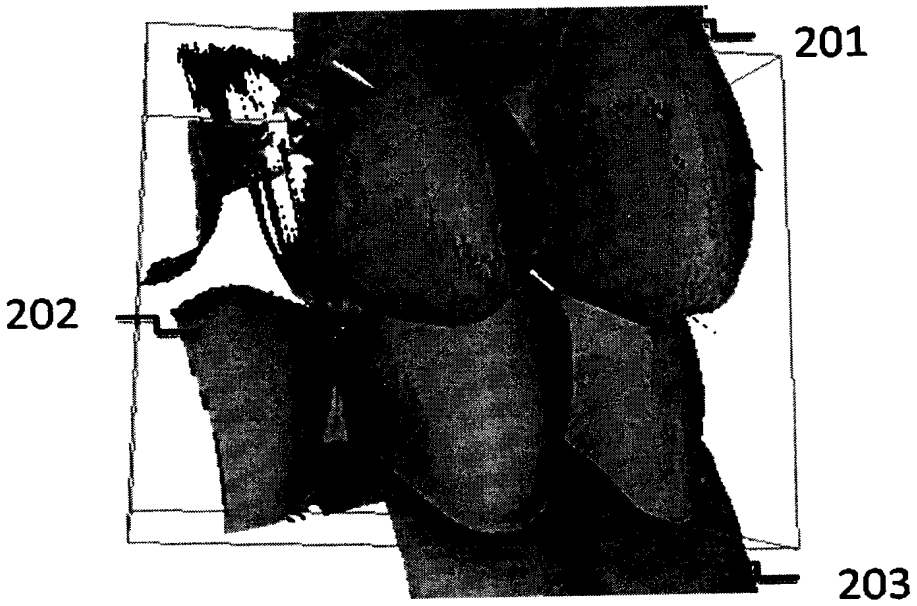


Fig.10

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 14/770,177	Filing Date 08/25/2015	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT

08/25/2015	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	X $80 =	0
Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $420 =	0
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	0

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/JULIET MCMILLAN/

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