



(43) International Publication Date
8 November 2012 (08.11.2012)

(10) International Publication Number
WO 2012/151464 A3

- (51) International Patent Classification:
A61C 5/00 (2006.01)
- (21) International Application Number:
PCT/US2012/036444
- (22) International Filing Date:
4 May 2012 (04.05.2012)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
61/482,825 5 May 2011 (05.05.2011) US
61/539,744 27 September 2011 (27.09.2011) US
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- (81) Designated States (unless otherwise indicated, for every
kind of national protection available): 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, JP, 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.

- (84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,
TM), European (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 (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
ML, MR, NE, SN, TD, TG).

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments (Rule 48.2(h))

- (88) Date of publication of the international search report:
27 December 2012

(54) Title: USE OF RADIOGRAPHIC CONTRAST AGENTS FOR DETECTING DENTAL CARIES

(57) Abstract: The present invention provides methods of imaging dental tissue. More particularly, the invention relates to a method of imaging dental caries by administering a topical intra-oral composition that provides enhanced radiographic imaging.



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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 12/36444

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - A61C 5/00 (2012.01)

USPC - 433/215

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)

USPC -- 433/215

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)

PubWEST (USPT,PGPB,JPAB,EPAB); Google

Search Terms: Dental tooth teeth paste cement composition gel kit container spray coat dip insert cavity fill filler x-ray radiographic image sodium iodide barium sulfate image carrier solvent water powder pure concentration molarity

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X -- Y	US 4,652,593 A (Kawahara et al.) 24 Mar 1987 (24.03.1987), entire document especially Abstract, col 4, ln 12-20, ln 46-50; col 2, ln 25-40 and col 5, ln 12-15	1-18, 28, 33-35, 43-56 and 64 ----- 19-22 and 29-32
Y	US 2009/0317772 A1 (Rusin et al.) 24 Dec 2009 (24.12.2009), entire document especially Abstract, para [0006] and [0019]-[0021]	19-22 and 29-32
A	US 6,054,400 A (Brink et al.) 25 Apr 2000 (25.04.2000) entire document	19-22 and 29-32

☐ Further documents are listed in the continuation of Box C.

* 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

27 Sep 2012 (27.09.2012)

Date of mailing of the international search report

16 OCT 2012

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450

Facsimile No. 571-273-3201

Authorized officer:

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PCT Helpdesk: 571-272-4300

PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 12/36444

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

----- See Extra Sheet -----

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-22, 28-35, 43-56 and 64

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US 12/36444

Box III: Observations where unity of invention is lacking:

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I: claims 1-22, 28-35, 43-56 and 64 directed to a method of imaging dental caries in a subject comprising the steps of: (a) administering a topical intra-oral composition comprising a contrast agent to one or more teeth of the subject; and (b) producing a radiographic image of the one or more teeth, wherein the radiographic image allows discrimination between cavitated and noncavitated dental caries.

Group II: claims 23-27 and 57-63 directed to a method of imaging dental caries in a human comprising the steps of: (a) administering a topical intra-oral composition comprising sodium iodide and distilled water to one or more teeth of the subject; and (b) producing a radiographic image of the one or more teeth, wherein the sodium iodide comprises a concentration ranging from about 0.5 molar to about 9 molar.

Group III: claims 36-42 directed to a method of imaging dental caries in a human comprising the steps of (a) administering a topical intra-oral composition comprising a combination of diatrizoate meglumine and diatrizoate sodium to one or more teeth of the subject, and (b) producing a radiographic image of the one or more teeth.

The inventions listed as Groups I-III do not relate to a single general inventive concept under PCT Rule 13.1 because under PCT Rule 13.2 they lack the same or corresponding technical features for the following reasons:

Groups I and III do not include sodium iodide and distilled water as required by Group II.

Groups I and II do not include combination of diatrizoate meglumine and diatrizoate sodium as required by Group III.

Groups II and III do not include radiographic image allows discrimination between cavitated and noncavitated dental caries as required by Group I.

Groups I-III share the technical feature of a method of imaging dental caries in a human comprising administering a topical intra-oral composition comprising an iodide and producing a radiographic image of the one or more teeth. Groups I and II share the technical feature of a method of imaging dental caries in a human comprising administering a topical intra-oral composition comprising sodium iodide and producing a radiographic image of the one or more teeth.

However, these shared technical features do not represent a contribution over the prior art of US 4,652,593 A to Kawahara et al. (24 Mar 1987), which teaches a method of imaging dental caries (col 1, ln 24 et seq. and col 2, ln 36-40) comprising administering a topical intra-oral composition comprising sodium iodide and producing a radiographic image of the one or more teeth. (see col 4, ln 12-20 and ln 46-50; col 2, ln 25-40, dental cement with x-ray contrasting agents). As the above imaging method was known at the time of invention, as evidenced by the teaching of Kawahara, this cannot be considered a special technical feature that would otherwise unify the groups.

Thus, the inventions listed as Groups I-III do not relate to a single general inventive concept under PCT Rule 13.1 because under PCT Rule 13.2 they lack the same or corresponding special technical feature. According to PCT Rule 13.2, unity of invention exists only when the same or corresponding technical feature is shared by all claimed inventions.