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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.
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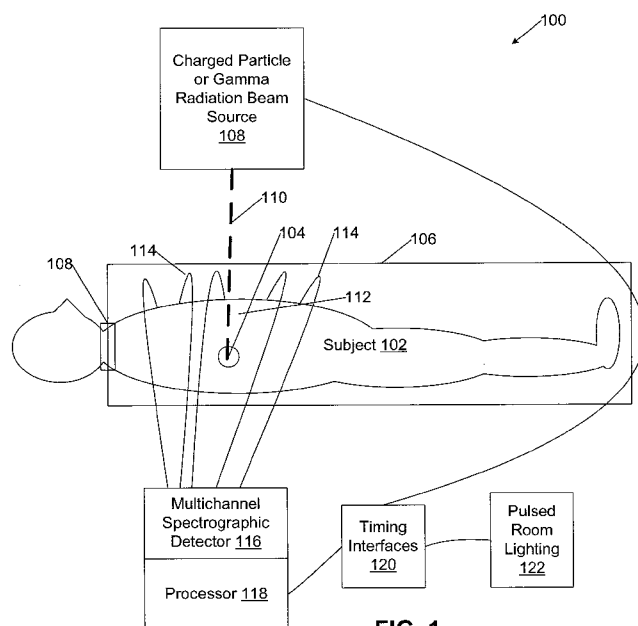
(54) **Title:** METHOD AND SYSTEM FOR USING CHERENKOV RADIATION TO MONITOR BEAM PROFILES AND RADIATION THERAPY

FIG. 1

(57) **Abstract:** A system for providing monitored radiation therapy has a high energy radiation source, apparatus for excluding uncontrolled ambient light, and apparatus for collecting light emitted from a subject. The system has apparatus for spectrally analyzing the collected light, and a processor for determining oxygenation or other metabolic function of tissue within the subject from spectral analysis of the collected light. The system monitors radiation therapy by providing a beam of high energy radiation; collecting Cherenkov and/or photoluminescent light from the subject, the light generated along the beam; spectrally analyzing the light; and determining oxygenation or metabolic function of tissue from the spectral analysis. Beam profile of the system is calibrated by imaging from multiple angles Cherenkov and/or photoluminescent light emitted by a phantom placed in the beam in lieu of a subject, captured images are analyzed to determine beam profile.

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24 January 2013

- *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))*

A. CLASSIFICATION OF SUBJECT MATTER*A61N 5/10(2006.01)i, A61B 18/00(2006.01)i*

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)

A61N 5/10; G01T 1/204; G01T 1/02; A61N 5/06; G01T 1/161; A61B 6/00; G01T 1/22; G01T 1/20

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) & Keywords: radiation therapy, monitoring, high energy, interference, detect, oxygenation, document, radiation beam profile, tissue phantom, transparent, refraction, Cherenkov radiation, camera, 3D, tomography.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2011-005862 A2 (THE BOARD OF REGENTS OF THE UNIVERSITY OF TEXAS SYSTEM) 13 January 2011 See paragraphs [0034], [0037], [0040], [0047], and [0066]; claims 1 and 3; and figures 1a-1b, 9, and 14-15.	1-12, 14-15, 22-25
A	US 2010-0331927 A1 (COTTRELL, WILLIAM J. et al.) 30 December 2010 See paragraphs [0022], [0025], [0031], [0035], and [0050]-[0051]; claims 1, 5, 9, and 11; and figures 2A, 3C, and 7.	1-12, 14-15
A	US 6,123,719 A (MASYSHEV, VICTOR) 26 September 2000 See col.4, lines 33-92; col.7, lines 52-55; col.9, lines 43-47; claims 1, 4, 7-8, and 11; and figures 1(a)-1(c) and 11-14(b).	1-12, 14-15
A	US 6,552,347 B1 (DIMCOVSKI, ZLATIMIR) 22 April 2003 See col.4, line 63 - col.5, line 9; col.5, line 51 - col.6, line 23; claims 3 and 6; and figures 1-2.	1-12, 14-15, 22-25
A	US 2011-0001049 A1 (SHIBUYA, KENGO et al.) 06 January 2011 See paragraph [0030], [0056], and [0061]; claims 8 and 15; and figures 2, 14, and 17;	1-12, 14-15, 22-25



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 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

30 NOVEMBER 2012 (30.11.2012)

Date of mailing of the international search report

03 DECEMBER 2012 (03.12.2012)

Name and mailing address of the ISA/KR

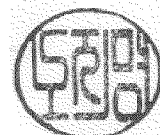
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2012/038609**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.: 16-21
because they relate to subject matter not required to be searched by this Authority, namely:
Claims 16-21 pertain to methods for treatment of the human body by therapy, as well as diagnostic methods and thus relate to a subject matter which this International Searching Authority is not required, under Article 17(2)(a)(i) of the PCT and Rule 39.1(iv) of the Regulations under the PCT, to search.
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.: 13
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:

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 an additional fee, this Authority did not invite payment of any additional fee.
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.:

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/US2012/038609

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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