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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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**Published:**

— with international search report (Art. 21(3))

[Continued on next page]

(54) Title: THERAPEUTIC APPARATUS COMPRISING A RADIOTHERAPY APPARATUS, A MECHANICAL POSITIONING SYSTEM, AND A MAGNETIC RESONANCE IMAGING SYSTEM

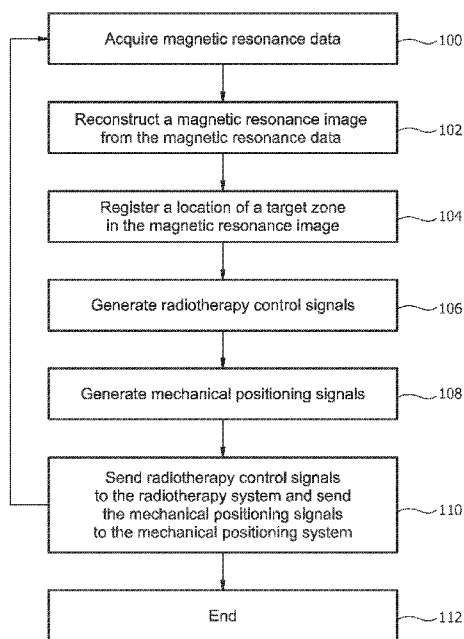


FIG. 1

(57) Abstract: A therapeutic apparatus (400, 500) comprising a radiotherapy apparatus (402), a mechanical positioning system, and a magnetic resonance imaging system (404). The radiotherapy apparatus comprises a radiotherapy source (408). The radiotherapy apparatus is adapted for rotating the radiotherapy source at least partially around a subject support. The therapeutic apparatus further comprises a memory containing machine executable instructions (468, 470, 472, 474, 476). Execution of the instructions causes a processor to repeatedly: acquire (100) the magnetic resonance data using the magnetic resonance imaging system; reconstruct (102) a magnetic resonance image (460) from the magnetic resonance data; register (104) a location (462) of the target zone in the magnetic resonance image; generate (106) radiotherapy control signals (464) in accordance with the location of the registered target zone; generate (108) mechanical positioning control signals (466) in accordance with the registered target zone and the radiotherapy control signals; and send (110) the radiotherapy control signals to the radiotherapy system and send (110) the mechanical positioning control signals to the mechanical positioning system.



**(88) Date of publication of the international search report:**  
11 October 2012

**INTERNATIONAL SEARCH REPORT**

International application No  
PCT/IB2011/055432

**A. CLASSIFICATION OF SUBJECT MATTER**  
INV. A61N5/10  
ADD.

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

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)  
EPO-Internal, WPI Data

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2007/045075 A1 (ALBERTA CANCER BOARD [CA]; FALLONE B GINO [CA]; CARLONE MARCO [CA]; MU) 26 April 2007 (2007-04-26) abstract page 5, line 9 - line 12 page 7, line 15 - page 9, line 6 -----	1,7-11, 14
Y	WO 99/35966 A1 (REIFFEL LEONARD [US]) 22 July 1999 (1999-07-22) abstract page 1, line 12 - page 2, line 4 page 5, line 20 - page 6, line 15 page 9, line 13 - page 10, line 15 -----	1,7-11, 14
A	US 2008/208036 A1 (AMIES CHRISTOPHER JUDE [US] ET AL) 28 August 2008 (2008-08-28) abstract paragraph [0030] - paragraph [0044] -----	1,7-11, 14

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  14 March 2012	Date of mailing of the international search report  20/07/2012
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer  Beck, Ewa

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/IB2011/055432

## 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.: 15  
because they relate to subject matter not required to be searched by this Authority, namely:  
**Rule 39.1(iv) PCT - Method for treatment of the human or animal body by therapy**
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 additional 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 an 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, 7-11, 14**

### 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.

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1, 7-11, 14

A therapeutic apparatus comprising a radiotherapy apparatus with a radiotherapy source, a mechanical positioning system for positioning a subject support, a magnetic resonance imaging system and a processor adapted to generate radiotherapy control signals in accordance with the location of the registered target zone, wherein the radiotherapy control signals cause the radiotherapy source to irradiate the target zone and to generate mechanical positioning control signals in accordance with the registered target zone and the radiotherapy control signals, wherein the mechanical positioning control signals cause the mechanical positioning system to position the subject.

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2. claims: 2-6, 12, 13

A therapeutic apparatus comprising a switchable radiotherapy source to generate therapeutic radiation and a collimator assembly to form a pencil beam from the therapeutic radiation; the collimator assembly including an aperture block having a radiation transparent window and a rotatable collimator member with several channels.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/IB2011/055432
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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