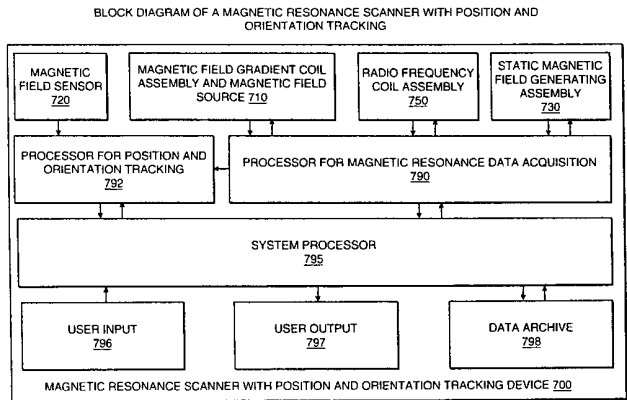
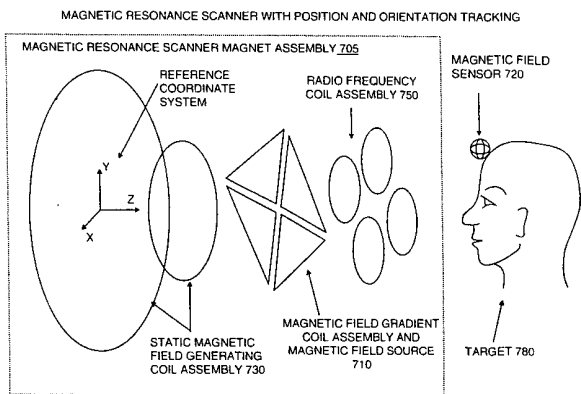




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁷ : G01R 33/28, 33/38</p>	<p>A3</p>	<p>(11) International Publication Number: WO 00/37955 (43) International Publication Date: 29 June 2000 (29.06.00)</p>
<p>(21) International Application Number: PCT/US99/30913 (22) International Filing Date: 22 December 1999 (22.12.99) (30) Priority Data: 60/113,782 23 December 1998 (23.12.98) US (71)(72) Applicant and Inventor: JAKAB, Peter, D. [US/US]; 40 Williams Street, Apt. 302, Brookline, MA 02146 (US). (74) Agents: SUNSTEIN, Bruce, D. et al.; Bromberg & Sunstein LLP, 125 Summer Street, Boston, MA 02110-1618 (US).</p>		<p>(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p>Published <i>With international search report.</i></p> <p>(88) Date of publication of the international search report: 16 November 2000 (16.11.00)</p>

(54) Title: MAGNETIC RESONANCE SCANNER WITH ELECTROMAGNETIC POSITION AND ORIENTATION TRACKING DEVICE



(57) Abstract

A system for combining electromagnetic position and orientation tracking with magnetic resonance scanner is provided. One embodiment includes a magnetic resonance scanner defining a reference coordinate system for scanning a target. Coupled to the magnetic resonance scanner is a magnetic field source which produces a magnetic field. The magnetic field is sensed by a magnetic field sensor which produces a signal proportional to the magnetic field. The magnetic field sensor has a location relative to the reference coordinate system. The location of the magnetic field sensor relative to the reference coordinate system of the magnetic resonance scanner is determined by a location tracking device using at least a line segment model of the magnetic field source and the signal from the magnetic field sensor.

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 99/30913

A. CLASSIFICATION OF SUBJECT MATTER IPC 7 G01R33/28 G01R33/38		
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 7 G01R A61B		
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C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 592 939 A (MARTINELLI MICHAEL A) 14 January 1997 (1997-01-14) column 4, line 51 -column 15, line 14; figures 1-9	1-4, 6-8, 30
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Y	US 5 211 165 A (DARROW ROBERT D ET AL) 18 May 1993 (1993-05-18) column 2, line 44 -column 7, line 38; figures 3-6	1-5, 7, 8, 30
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Date of the actual completion of the international search <div style="text-align: center; font-weight: bold;">1 August 2000</div>	Date of mailing of the international search report <div style="text-align: center; font-weight: bold;">14.08.00</div>	
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer <div style="text-align: center; font-weight: bold;">Lersch, W</div>	

INTERNATIONAL SEARCH REPORT

Int. l. Application No
PCT/US 99/30913

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	US 5 600 330 A (BLOOD ERNEST B) 4 February 1997 (1997-02-04) cited in the application column 5, line 8 -column 8, line 67; figures 3-7 ---	1-5,7,8, 30
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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 99/30913

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 689 591 A (MCDUGALL IAN L) 25 August 1987 (1987-08-25) column 1, line 10 -column 3, line 19 column 4, line 30 -column 4, line 49; figure 2 -----	18, 22-25, 28,29

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 99/30913

Box I Observations where certain claims were found unsearchable (Continuation of Item 1 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.: 11-17, 31-43, 59-66
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:
see FURTHER INFORMATION sheet PCT/ISA/210

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 II Observations where unity of invention is lacking (Continuation of Item 2 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 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.:
1-10, 18, 22-25, 28-30

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.
- 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: 1-17,30-43,59-66

Use of a line segment model of the source in the determination of the relative position of a magnetic field source and a magnetic field sensor.

2. Claims: 18,22-25,28,29

Coil arrangement for generating a homogeneous static magnetic field outside the arrangement.

3. Claim : 19

Coil arrangement for generating three mutually orthogonal gradient fields.

4. Claims: 20,21

Coil arrangement for generation or detection of quadrature magnetic rf fields.

5. Claims: 26,27

Magnetic resonance imaging system with tracking of the target location.

6. Claims: 44-58,67,68

MR scanner with a tracking system comprising three locators.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box I.2

Claims Nos.: 11-17,31-43,59-66

The first invention is defined in terms of 8 independent claims (7 apparatus claims + 1 method claim). Another 8 independent claims are used to define the remaining 5 inventions.

The large number of (independent) claims and also the wording of the claims presently on file render it difficult, if not impossible, to determine the matter for which protection is sought. Therefore, the present application fails to comply with the clarity and conciseness requirements of Article 6 PCT (see also Rule 6.1(a) PCT) to such an extent that a meaningful search is impossible. Consequently, the search has been carried out for those parts of the application which do appear to be clear and concise, namely claims 1-10 (= first set of apparatus claims) and claim 30 (= corresponding method claim). The remaining claims relating to the first invention, namely claims 11-17, 31-43 and 59-66, have not been searched.

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 99/30913

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