(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
25 September 2014 (25.09.2014)

WIPO | PCT

(10) International Publication Number
WO 2014/149762 A3

(51) International Patent Classification:
A61M 1/14 (2006.01) *G01N 24/08* (2006.01)
A61M 1/16 (2006.01) *G01R 33/38* (2006.01)
A61M 1/34 (2006.01)

(21) International Application Number:
PCT/US2014/020742

(22) International Filing Date:
5 March 2014 (05.03.2014)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
13/836,514 15 March 2013 (15.03.2013) US

(71) Applicant: **FRESENIUS MEDICAL CARE HOLDINGS, INC.** [US/US]; 920 Winter Street, Waltham, Massachusetts 02451-1457 (US).

(72) Inventors: **JONES, Ross Peter**; 84 Wulfstan Way, Cambridge Cambridgeshire CB1 8 QH (GB). **GROVER, Simon Roderick**; 110 Cromwell Road, Cambridge Cambridgeshire CB1 3EG (GB). **TUCKWELL, Mark David**; 67 Wilbury Road, Letchworth Hertfordshire SG6 4JJ (GB).

(74) Agent: **HAMLIN, Michael R.**; Fish & Richardson P.C., P.O. Box 1022, Minneapolis, Minnesota 55440-1022 (US).

(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, BN, 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, IR, IS, JP, KE, KG, 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, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, 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, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

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))*

[Continued on next page]

(54) Title: MEDICAL FLUID SENSORS AND RELATED SYSTEMS AND METHODS

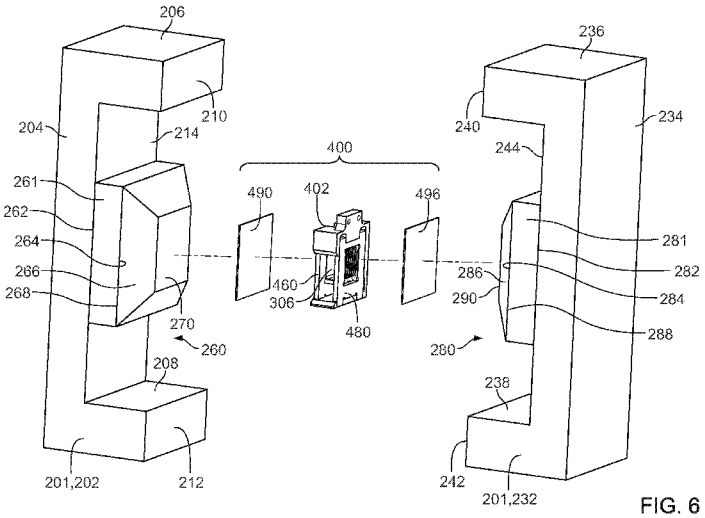

FIG. 6

(57) Abstract: This disclosure relates to medical fluid sensors and related systems and methods. In certain aspects, a nuclear magnetic resonance device includes a support frame, a first magnet connected to the support frame, a second magnet connected to the support frame in a manner such that the second magnet is disposed within the magnetic field of the first magnet and a magnetic attraction exists between the first magnet and the second magnet, and a spacer disposed between the first magnet and the second magnet. The spacer is configured to maintain a space between the first magnet and the second magnet.

WO 2014/149762 A3

WO 2014/149762 A3

(88) Date of publication of the international search report:
27 November 2014

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/020742

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61M1/14 A61M1/16 A61M1/34 G01N24/08 G01R33/38
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)
A61M G01N G01R

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, COMPENDEX, EMBASE, FSTA, INSPEC, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 01/47415 A1 (PINDI PRODUCTS INC [US]; FULLER MILTON E [US]) 5 July 2001 (2001-07-05) abstract figures 1-5 page 8, line 12 - page 9, line 24 page 6, line 9 - page 8, line 10	1-13
X	US 2009/167304 A1 (PRADO PABLO J [US] ET AL) 2 July 2009 (2009-07-02) abstract claim 1 figure 1	1-13

-/--

[X] Further documents are listed in the continuation of Box C.

[X] 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
23 September 2014	10/10/2014

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Jacques, Patrice

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/020742

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 887 655 B1 (PANACEA MEDICAL LAB [US]) 31 March 2004 (2004-03-31) abstract figure 1 claim 1 -----	1-13
A	WO 2010/114932 A1 (XCORPOREAL INC [US]) 7 October 2010 (2010-10-07) abstract page 2, line 25 - line 28 -----	14,15
A	PRICE ET AL: "Development of tissue-targeted metabonomics. Part 1. Analytical considerations", JOURNAL OF PHARMACEUTICAL AND BIOMEDICAL ANALYSIS, NEW YORK, NY, US, vol. 46, no. 4, 11 January 2008 (2008-01-11), pages 737-747, XP022473012, ISSN: 0731-7085, DOI: 10.1016/J.JPBA.2007.11.035 the whole document -----	14,15

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/020742

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 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.:

1-15

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: 1-15

A nuclear magnetic resonance device comprising:a support frame,a first magnet connected to the support frame,a second magnet connected to the support frame in a manner such that the second magnet is disposed within the magnetic field of the first magnet and a magnetic attraction exists between the first magnet and the second magnet, anda spacer disposed between the first magnet and the second magnet, the spacer configured to maintain a space between the first magnet and the second magnet, the spacer comprisinga first side that faces the first magnet, anda second side that is opposed to the first side and faces the second magnet,wherein the spacer has a shape that orients the first magnet relative to the second magnet in a manner such that a pole face of the first magnet is maintained substantially parallel to a pole face of the second magnet.A dialysis system comprising a device comprising all of the above mentioned technical features.

---

2. claims: 16-21

A device for measuring a concentration of a substance in a sample, the device comprising:a magnet support structure including a first frame member, and a second frame member,a first magnet supported on the first frame member, and a second magnet supported on the second frame member in such a way that a magnetic attraction exists between the first magnet and the second magnet, wherein the magnet support structure supports the first magnet in a spaced apart relationship relative to the second magnet such that the first frame member and the second frame member cooperate to substantially surround both the first magnet and the second magnet, a first air gap exists between the first magnet and the second magnet, a second air gap exists between the first frame member and the second frame member, and a third air gap exists between the first frame member and the second frame member at a location spaced apart from the first air gap and the second air gap.

---

3. claims: 22-33

A nuclear magnetic resonance device comprising a first magnet,a second magnet disposed adjacent to the first magnet in such a way that a first space exists between the first magnet and the second magnet and an attractive magnetic field exists in the space,a radio frequency coil assembly disposed in the space, the radio frequency coil assembly configured to transmit a radio frequency signal to, and receive a radio frequency signal from, a sample disposed in

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

the space, anda first non-magnetic, electrically-conductive member disposed between the radio frequency coil assembly and the first magnet, and a second non-magnetic, electrically-conductive member disposed between the radio frequency coil assembly and the second magnet.A dialysis ystem comprising a device comprising all of the above mentioned technical features.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2014/020742

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 0147415 A1	05-07-2001	AT 410114 T	15-10-2008
		AU 2606901 A	09-07-2001
		CA 2392935 A1	05-07-2001
		CN 1414839 A	30-04-2003
		EP 1241985 A1	25-09-2002
		ES 2315246 T3	01-04-2009
		HK 1047027 A1	08-05-2009
		US 2002193673 A1	19-12-2002
		US 2004193031 A1	30-09-2004
		WO 0147415 A1	05-07-2001
US 2009167304 A1	02-07-2009	NONE	
EP 0887655 B1	31-03-2004	AR 010921 A1	12-07-2000
		AU 746820 B2	02-05-2002
		AU 7392498 A	07-01-1999
		BR 9815758 A	28-11-2000
		CA 2239803 A1	27-12-1998
		DE 69822709 D1	06-05-2004
		DE 69822709 T2	10-03-2005
		EP 0887655 A2	30-12-1998
		JP 4050828 B2	20-02-2008
		JP H1199139 A	13-04-1999
		US 5935065 A	10-08-1999
WO 2010114932 A1	07-10-2010	US 2010252490 A1	07-10-2010
		WO 2010114932 A1	07-10-2010