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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
29 August 2013 (29.08.2013)

WIPO | PCT

(10) International Publication Number
WO 2013/126714 A3

(51) International Patent Classification:
B01L 3/00 (2006.01)

(21) International Application Number:
PCT/US2013/027341

(22) International Filing Date:
22 February 2013 (22.02.2013)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/601,937 22 February 2012 (22.02.2012) US

(72) Inventors; and

(71) Applicants : **EGAN, Michael** [US/US]; 508 Georgetown Road, Charlottesville, VA 22901 (US). **ROOT, Brian** [US/US]; 145 Woodgate Ct. Apt. 2A, Charlottesville, VA 22901 (US). **SCOTT, Orion, N.** [US/US]; 1113 East Jefferson St., Apt. 2, Charlottesville, VA 22902 (US). **SOUTH, Douglas, J.** [US/US]; 7320 Blanchard Drive, Rockville, MD 20855 (US). **BIENVENUE, Joan** [US/US]; 8801 General Griffins Ct., Fredericksburg, VA 22407 (US). **KINNON, Paul** [US/US]; Loma Larga Drive, Solana Beach, CA 92075 (US). **LANDERS, James** [US/US]; 633 Nettle Ct., Charlottesville, VA 22903 (US). **SAUL, David** [NL/NL]; 37 Hill Road, Palm Beach, Waiheke Island, NL-1081 Auckland (NL). **TSUEI, An-Chi** [US/US]; 2703 Brookmere Road, Charlottesville, VA 22901 (US). **HAYES, Jason** [AU/AU]; 53 Armstrong Road, Healthmont, Victoria, 3135 (AU). **SPRINGER, Matthew** [AU/AU]; 114 Railway Place, West Melbourne, Victoria, 3003 (AU). **SOLOMON, Matthew** [AU/AU]; 2 Dumblane Street, Hughesdale, Victoria, 3166 (AU). **VAN RUIJVEN, Peter** [AU/AU]; Unit 3, 5 Garrison Drive, Glen Waverley, Victoria, 3150 (AU).

(74) Agents: **KERN, John S.** et al.; Oblon, Spivak, McClelland, Maier & Neustadt, L.L.P, 1940 Duke Street, Alexandria, VA 22314 (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, 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,

[Continued on next page]

(54) Title: MICROFLUIDIC CARTRIDGE

(57) Abstract: A microfluidic cartridge can include at least one nucleic acid analysis portion. Each nucleic acid analysis portion can include a fluidic network being configured for micro-liter volumes or less, a sample input at the beginning of the fluidic network, a plurality of vent ports and fluidic channels in the fluidic network configured to effectuate hydrodynamic movement within the fluidic network, an extraction mixture reservoir in the fluidic network, a mixing chamber in the fluidic network, an amplification chamber in the fluidic network, and a separation channel in the fluidic network. A nucleic acid analyzer can be capable of performing nucleic acid analysis using the microfluidic cartridge. A nucleic acid analysis method can be performed using the microfluidic cartridge.

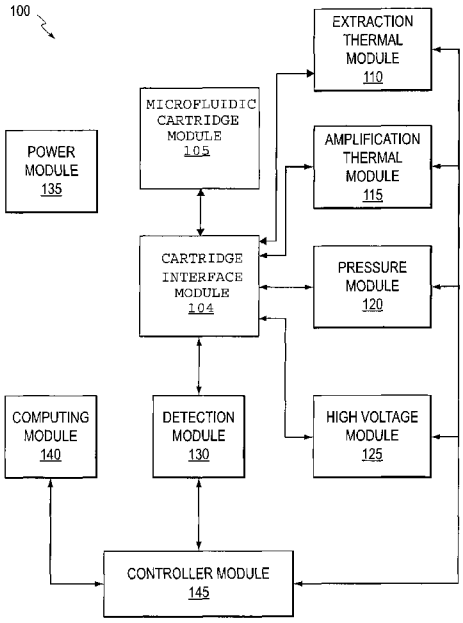


FIG. 1

WO 2013/126714 A3

NO, NZ, OM, PA, 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:
14 November 2013

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2013/027341

A. CLASSIFICATION OF SUBJECT MATTER
INV. B01L3/00
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)
B01L

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2008/055257 A2 (VECTRANT TECHNOLOGIES INC [US]; WITTY THOMAS R [US]; WOBKEN MARK E [US) 8 May 2008 (2008-05-08) abstract paragraphs [0034] - [0069]; figures 1,2	1,2,8,9, 11-13
A	US 5 922 591 A (ANDERSON ROLFE C [US] ET AL) 13 July 1999 (1999-07-13) the whole document	1,2,8,9, 11-13
A	WO 2008/101196 A1 (OSMETECH MOLECULAR DIAGNOSTICS [US]; CLEMENS CHARLES E [US]; FOSTER CL) 21 August 2008 (2008-08-21) the whole document	1,2,8,9, 11-13

☐ 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	Date of mailing of the international search report
12 June 2013	10/09/2013

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	Sinn, Cornelia

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2013/027341

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, 2, 8, 9, 11-13

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, 2, 8, 9, 11-13

   A microfluidic cartridge comprising at least one nucleic acid analysis portion, each nucleic acid analysis portion including: a fluidic network comprising a sample input configured to be mated to a sample acceptor, a plurality of vent ports and fluidic channels, an extraction mixture reservoir, a mixing chamber and an amplification chamber; with further details on a microfluidic cartridge sealing cover.

   ---

2. claims: 3, 19-25, 39-53

   A microfluidic cartridge and method for performing nucleic acid analysis, the microfluidic cartridge comprising a fluidic network comprising a sample input configured to be mated to a sample acceptor, a plurality of vent ports and fluidic channels, an extraction mixture reservoir, a mixing chamber, an amplification chamber and a separation channel.

   ---

3. claims: 4-6

   A microfluidic cartridge comprising a fluidic network comprising a sample input configured to be mated to a sample acceptor, a plurality of vent ports and fluidic channels, an extraction mixture reservoir, a mixing chamber, an amplification chamber and a plurality of frangible seals.

   ---

4. claims: 7, 26

   A microfluidic cartridge comprising a fluidic network comprising a sample input configured to be mated to a sample acceptor, a plurality of vent ports and fluidic channels, an extraction mixture reservoir, a mixing chamber, an amplification chamber; with further details on the sample input and sample acceptor.

   ---

5. claims: 16-18

   A microfluidic cartridge comprising a fluidic network comprising a sample input configured to be mated to a sample acceptor, a plurality of vent ports and fluidic channels, an extraction mixture reservoir, a mixing chamber, an amplification chamber; with further details on the mixing chamber.

   ---

6. claims: 27-38

A nucleic acid analyzer, comprising: a microfluidic cartridge module configured to accept at least one microfluidic cartridge of claim 1, a pressure module, an extraction thermal module, an amplification thermal module, a high voltage module, a power module, a detection module, and a controller module.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2013/027341

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2008055257 A2	08-05-2008	CN 101568636 A	28-10-2009
		US 2008153096 A1	26-06-2008
		WO 2008055257 A2	08-05-2008
US 5922591 A	13-07-1999	AT 235559 T	15-04-2003
		AT 386590 T	15-03-2008
		AU 6404996 A	05-02-1997
		DE 69626988 D1	30-04-2003
		DE 69626988 T2	04-03-2004
		DE 69637443 T2	12-06-2008
		EP 0843734 A1	27-05-1998
		EP 1304388 A2	23-04-2003
		JP H11509094 A	17-08-1999
		US 5856174 A	05-01-1999
		US 5922591 A	13-07-1999
		US 6043080 A	28-03-2000
		US 6197595 B1	06-03-2001
		US 6326211 B1	04-12-2001
		US 2001036672 A1	01-11-2001
		US 2005250199 A1	10-11-2005
		WO 9702357 A1	23-01-1997
WO 2008101196 A1	21-08-2008	US 2008200343 A1	21-08-2008
		US 2009291507 A1	26-11-2009
		US 2013137591 A1	30-05-2013
		WO 2008101196 A1	21-08-2008