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[Continued on next page]

(54) Title: ACOUSTIC WAVES IN MICROFLUIDICS

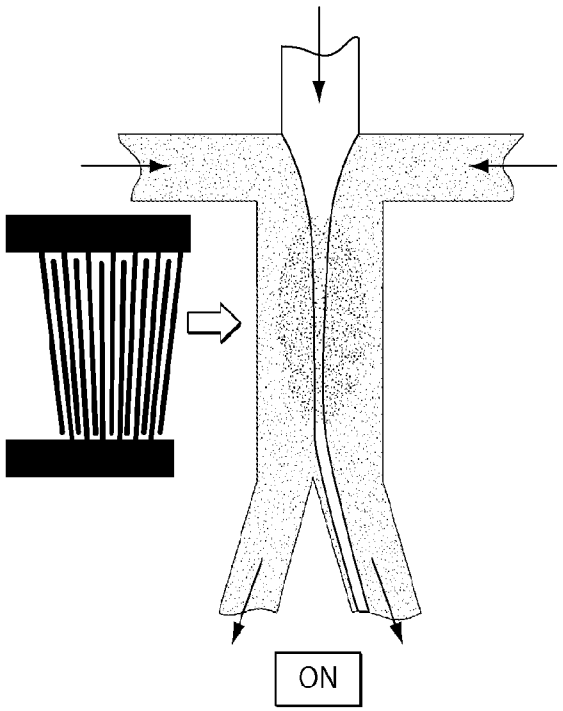

Fig. 1B

(57) Abstract: Various aspects of the present invention relate to the control and manipulation of fluidic species, for example, in microfluidic systems. In one set of embodiments, droplets may be sorted using surface acoustic waves. The droplets may contain cells or other species. In some cases, the surface acoustic waves may be created using a surface acoustic wave generator such as an interdigitated transducer, and/or a material such as a piezoelectric substrate. The piezoelectric substrate may be isolated from the microfluidic substrate except at or proximate the location where the droplets are sorted, e.g., into first or second microfluidic channels. At such locations, the microfluidic substrate may be coupled to the piezoelectric substrate (or other material) by one or more coupling regions. In some cases, relatively high sorting rates may be achieved, e.g., at rates of at least about 1,000 Hz, at least about 10,000 Hz, or at least about 100,000 Hz, and in some embodiments, with high cell viability after sorting.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2011/048804

A. CLASSIFICATION OF SUBJECT MATTER

B01J 19/10(2006.01)i, C12M 1/42(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)
B01J 19/10; G01N 15/06; G01N 33/48; B03C 1/30

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: microfluidic, surface acoustic wave, transducer, cell sorter

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2010-0139377 A1 (HUANG, TONY JUN et al.) 10 June 2010 See paragraphs 5-7, 9, 12-16, 28-32, 35-36, 46, 97-103; figure 2; and claims 1-20.	1-3,10-13,18-21 ,26-30,34-37,43-45
A	WOOD, C. D. et al. 'Formation and Manipulation of Two-dimensional Arrays of Micron-scale Particles in Microfluidic Systems by Surface Acoustic Waves.' Applied Physics Letters. 2009, Vol. 94, 054101. See the whole document.	1-3,10-13,18-21 ,26-30,34-37,43-45
A	TSUTSUI, HIDEAKI et al. 'Cell Separation by Non-inertial Force Fields in Microfluidic Systems.' Mechanics Research Communications. 2009, Vol. 36, pages 92-103. See abstract; pages 92,98-99; figures 3, 5; and table 2.	1-3,10-13,18-21 ,26-30,34-37,43-45
A	RAVULA, SURENDRA K. et al. 'A Microfluidic System Combining Acoustic and Dielectrophoretic Particle Preconcentration and Focusing.' Sensors and Actuators B. 2008, Vol. 130, pages 645-652. See abstract and introduction.	1-3,10-13,18-21 ,26-30,34-37,43-45

☐ 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	Date of mailing of the international search report
22 MARCH 2012 (22.03.2012)	**10 APRIL 2012 (10.04.2012)**

Name and mailing address of the ISA/KR
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2011/048804

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.: 5, 8, 24, 41-42
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:

Claims 5, 8, 24, and 41-42 refer to the multiple dependent claims which are not drafted in accordance with the third sentence of PCT Rule 6.4(a). Therefore, these claims do not meet the requirements of PCT Article 6 in that the matter for which protection is sought is not clearly defined.

3. ☒ Claims Nos.: 4, 6-7, 9, 14-17, 22-23, 25, 31-33, 38-40
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 addtional 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/US2011/048804

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2010-0139377 A1	10.06.2010	US 2010-0140185 A1	10.06.2010
		WO 2010-065868 A2	10.06.2010
		WO 2010-065868 A3	19.08.2010