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Published:

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

[Continued on next page]

(54) **Title**: CONTROL OF EMULSIONS, INCLUDING MULTIPLE EMULSIONS

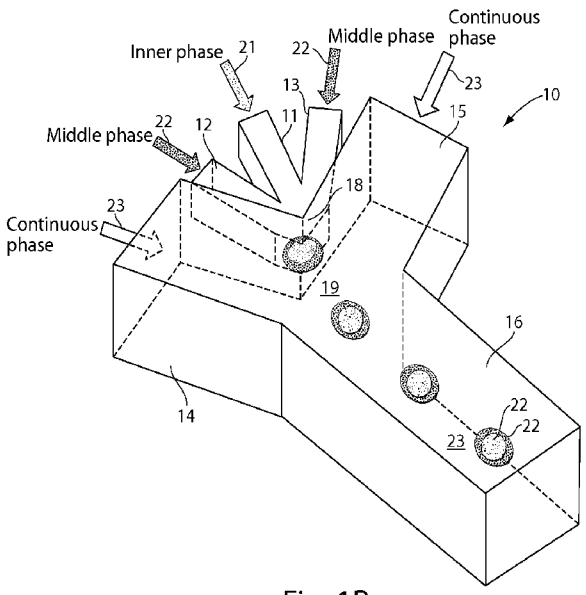

Fig. 1B

(57) **Abstract**: The present invention generally relates to emulsions, and more particularly, to double and other multiple emulsions. Certain aspects of the present invention are generally directed to the creation of double emulsions and other multiple emulsions at a common junction of microfluidic channels. In some cases, the microfluidic channels at the common junction may have substantially the same hydrophobicity. In one set of embodiments, a device may include a common junction of six or more channels (11, 12, 13, 14, 15, 16), where a first fluid (21) flows through one channel (11), a second fluid (22) flows through two channels (12, 13), and a third or carrying fluid (23) flows through two more channels (14, 15), such that a double emulsion of a first droplet of the first fluid, contained in a second droplet of the second fluid, contained by the carrying fluid, flows away from the common junction through a sixth channel (16). Other aspects of the invention are generally directed to methods of making and using such systems, kits involving such systems, emulsions created using such systems, or the like.

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— *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))*

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/038957

A. CLASSIFICATION OF SUBJECT MATTER
INV. B01F13/00 B01F3/08
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)
B01F

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2010/104604 A1 (HARVARD COLLEGE [US]; WEITZ DAVID A [US]; ABATE ADAM R [US]) 16 September 2010 (2010-09-16) cited in the application figure 1A abstract page 5, line 28 - page 6, line 26	1-44
A	EP 1 362 634 A1 (JAPAN SCIENCE & TECH CORP [JP] JAPAN SCIENCE & TECH AGENCY [JP]) 19 November 2003 (2003-11-19) abstract figures 7,8 paragraph [0020] - paragraph [0024]	1-44

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[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
28 August 2012	03/01/2013

Name and mailing address of the ISA/	Authorized officer
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2

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

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2012/038957

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 2 289 613 A2 (HITACHI PLANT TECHNOLOGIES LTD [JP]) 2 March 2011 (2011-03-02) abstract page 8; figure 8 paragraph [0074]	1-44
A	MELIN ET AL: "A liquid-triggered liquid microvalve for on-chip flow control", SENSORS AND ACTUATORS B: CHEMICAL: INTERNATIONAL JOURNAL DEVOTED TO RESEARCH AND DEVELOPMENT OF PHYSICAL AND CHEMICAL TRANSDUCERS, ELSEVIER S.A, SWITZERLAND, vol. 100, no. 3, 15 May 2004 (2004-05-15), pages 463-468, XP005135415, ISSN: 0925-4005, DOI: 10.1016/J.SNB.2004.03.010 figure 8 abstract page 467	1-44
A	US 2003/124509 A1 (KENIS PAUL J A [US] ET AL) 3 July 2003 (2003-07-03) figures 6C, 7A, 7C abstract	1-44
A	EP 2 283 918 A2 (UNIV CHICAGO [US]) 16 February 2011 (2011-02-16) figures 4, 5, 6, 17, 19, 37 abstract paragraph [0087]	1-44

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/038957

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.:

1-44

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: 1-44

microfluidic device comprising at least six channels, a first junction, an interface and a second junction and certain realtionships regarding the cross-sectional areas of the channels

1.1. claims: 28-35

microfluidic device comprising a junction with at least six channels and certain relationships regarding the cross-sectional areas of the channels

1.2. claims: 36-44

method of creating a double emulsion comprising fluids passing through an interface between a first junction and a second junction

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2. claim: 45

method of creating a double emulsion comprising channels having the same hydrophobicity

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2012/038957

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