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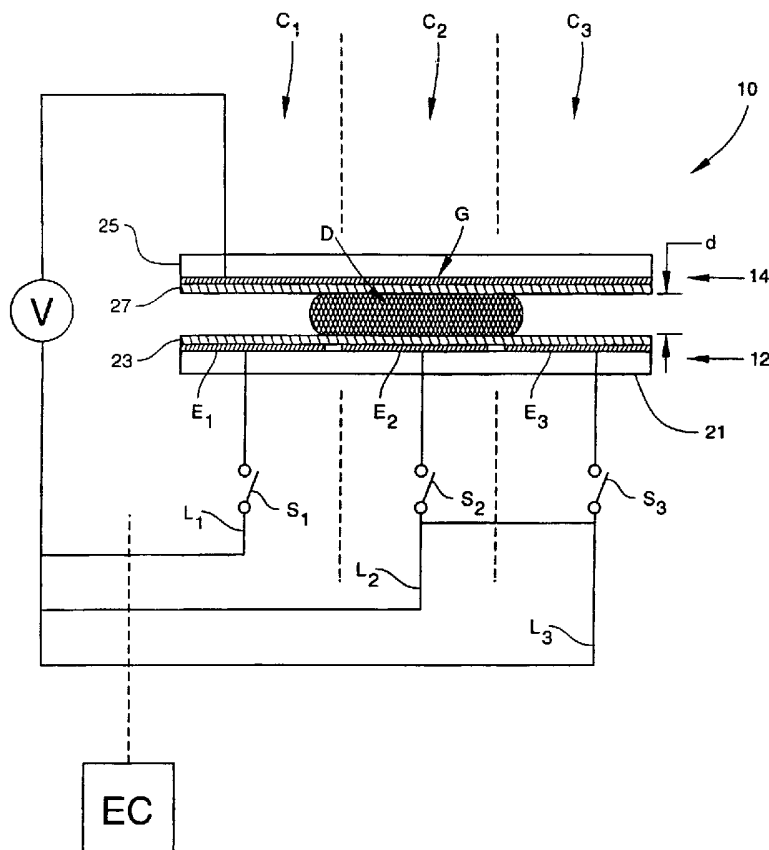
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[Continued on next page]

(54) Title: METHODS AND APPARATUS FOR MANIPULATING DROPLETS BY ELECTROWETTING-BASED TECHNIQUES



(57) Abstract: An apparatus is provided for manipulating droplets. The apparatus is a single-sided electrode design in which all conductive elements are contained on one surface on which droplets are manipulated. An additional surface can be provided parallel with the first surface for the purpose of containing the droplets to be manipulated. Droplets are manipulated by performing electrowetting-based techniques in which electrodes contained on or embedded in the first surface are sequentially energized and de-energized in a controlled manner. The apparatus enables a number of droplet manipulation processes, including merging and mixing two droplets together, splitting a droplet into two or more droplets, sampling a continuous liquid flow by forming from the flow individually controllable droplets, and iterative binary or digital mixing of droplets to obtain a desired mixing ratio.

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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*

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**INTERNATIONAL SEARCH REPORT**

International application No.

PCT/US03/12754

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(7) : G01N 27/403  
 US CL : 204/600,660,663,666

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)  
 U.S. : 204/600,660,663,666

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)  
 IEEE, EAST: droplet, electrowet\$, electrode

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6,294,063 B1 (BECKER et al) 25 September 2001 (25.09.2001), columns 7-15; and column 21, line 41 to column 22, line 18; and column 26, lines 12-37.	1,2,4-40,42-94
X	POLLACK et al., "Electrowetting-based actuation of liquid droplets for microfluidic applications," Appl. Phys. Letters, 11 September 2000, Vol. 77, No. 1, pages 1725-1726.	1-6,8-16,39-42,45-52

Further documents are listed in the continuation of Box C.

See patent family annex.

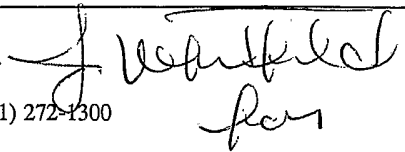
* Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"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
"E" earlier application or patent published on or after the international filing date	"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
"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)	"&"	document member of the same patent family
"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		

Date of the actual completion of the international search  
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# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US03/12754

## Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1.  Claim Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
  
2.  Claim 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.  Claim 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:

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.:
  
  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.