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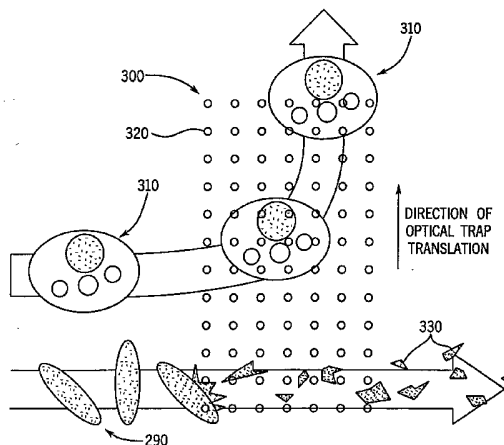
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[Continued on next page]

(54) Title: APPARATUS AND METHOD FOR FABRICATING, SORTING, AND INTEGRATING MATERIALS WITH HOLOGRAPHIC OPTICAL TRAPS



(57) Abstract: An apparatus and method for manipulating, effecting interaction of, photochemically transforming and/or sorting small dielectric particles or other materials are disclosed. The apparatus and method involves the use of one or more diffractive optical elements which each receive a laser beam and form a plurality of laser beams. These laser beams are operated on by a telescope lens system and then an objective lens element to create an array of optical traps for manipulating, effecting interaction of, photochemically transforming and/or small dielectric particles or other materials. One object of the invention is to provide an improved method and system for using optical traps to incorporate foreign matter into living cells. Another object of the invention is to provide an improved method and system to sort optically nonabsorbing particles from optically absorbing particles. Yet another object of the invention is to provide an improved method and system to implement the fabrication of heterogeneous structures using spatially resolved photochemistry.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 03/23991

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H05H3/04 G02B27/42 G02B21/32 G02B27/10 G21K1/06
C12N15/88

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)

IPC 7 H05H G02B G21K C12N

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 practical, search terms used)

EPO-Internal, WPI Data, PAJ, MEDLINE, BIOSIS, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 99/39223 A (ARCH DEV CORP) 5 August 1999 (1999-08-05) the whole document	1-7
A	MUNCE N. R. ET AL: "Optical micromanipulation and analysis of single cells on a microchip platform" PROCEEDINGS OF SPIE-THE INTERNATIONAL SOCIETY FOR OPTICAL ENGINEERING: OPTICAL DIAGNOSTICS OF LIVING CELLS V, vol. 4622, 2002, pages 176-182, XP002276074 the whole document	1-7



Further documents are listed in the continuation of box C.



Patent family members are listed in 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 document 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

5 April 2004

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 03/23991

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>STEUBING R. W. ET AL: "LASER INDUCED CELL FUSION IN COMBINATION WITH OPTICAL TWEEZERS THE LASER CELL FUSION TRAP" CYTOMETRY, vol. 12, no. 6, 1991, pages 505-510, XP009028745 ISSN: 0196-4763 the whole document, especially Fig.1-3 and 'Conclusions' the whole document</p>	1-7
A	<p>BERNS MICHAEL W: "Laser scissors and tweezers" SCIENTIFIC AMERICAN, vol. 278, no. 4, April 1998 (1998-04), pages 62-67, XP009028743 ISSN: 0036-8733 the whole document</p>	1-7
A	<p>DUFRESNE E. R. ET AL.: "OPTICAL TWEEZER ARRAYS AND OPTICAL SUBSTRATES CREATED WITH DIFFRACTIVE OPTICS" REVIEW OF SCIENTIFIC INSTRUMENTS, vol. 69, no. 5, May 1998 (1998-05), pages 1974-1977, XP000833479 ISSN: 0034-6748 abstract</p>	1-7
T	<p>GRIER DAVID G: "A revolution in optical manipulation." NATURE, vol. 424, no. 6950, 14 August 2003 (2003-08-14), pages 810-816, XP002276075 ISSN: 0028-0836 (ISSN print) the whole document</p>	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 03/23991

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 9939223	A	05-08-1999	US 6055106 A	25-04-2000
			AU 2494999 A	16-08-1999
			EP 1053492 A1	22-11-2000
			JP 2002502043 T	22-01-2002
			WO 9939223 A1	05-08-1999
			US 2003086175 A1	08-05-2003
			US 6624940 B1	23-09-2003
			US 2004105158 A1	03-06-2004

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 03/23991

Box I Observations where certain claims were found unsearchable (Continuation of item 1 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 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:

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 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.:

1-7

Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- 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: 1-7

Subject-matter relating to a method for incorporating foreign matter into living cells.

2. claim: 8

Subject-matter relating to a method for sorting nonabsorbing particles from absorbing particles.

3. claims: 9,10

Subject-matter relating to a method for simultaneously producing multiple spatially resolved structures through photochemistry.