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(74) Agents: **SCHELLER, James, C., Jr.** et al.; Blakely,
Sokoloff, Taylor & Zafman LLP, 12400 Wilshire Boule-
vard, 7th Floor, Los Angeles, CA 90025 (US).

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(71) Applicant (*for all designated States except US*): **ALIEN
TECHNOLOGY CORPORATION** [US/US]; 18410
Butterfield Blvd., Suite 15, Morgan Hill, CA 95037 (US).

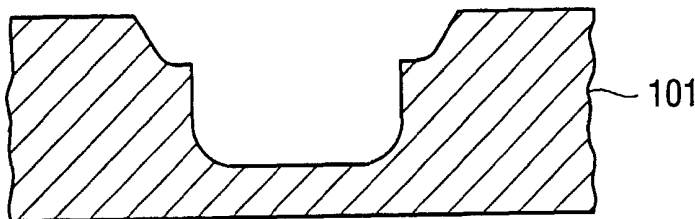
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(72) Inventors; and
(75) Inventors/Applicants (*for US only*): **SMITH, John,
Stephen** [US/US]; 1438 Oxford Street, Berkeley, CA
94709 (US). **HADLEY, Mark, A.** [US/US]; 39887 Cedar
Boulevard #353, Newark, CA 94560 (US). **CRAIG,
Gordon, S., W.** [US/US]; 1476 Dana Avenue, Palo Alto,
CA 93401 (US). **LOWE, Frank** [US/US]; 1438 Oxford
Street, Berkeley, CA 94709 (US).

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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.

(54) Title: METHODS FOR FORMING OPENINGS IN A SUBSTRATE AND METHODS FOR CREATING ASSEMBLIES



(57) Abstract: Methods for forming openings having predetermined shapes in a substrate and apparatuses with these openings. The methods may be used to form assemblies which include the substrate with its openings and elements which are disposed in the openings. In one example of a method, each of the elements include an electrical component and are assembled into one of the openings by a fluidic self assembly process. In an particular example of a

method to create such an opening, the substrate is etched through a first patterned mask and is later etched through a second patterned mask. Typically, the second patterned mask is aligned relative to the opening created by etching through the first patterned mask and has an area of exposure which is smaller than an area of exposure through the first patterned mask. In another example of a method, a photosensitive material is exposed through a patterned mask to oblique sources of light such that some of the light impinges into a first portion of the photosensitive material which is under the patterned mask, and the patterned mask and a second portion of the photosensitive material, which is under the patterned mask, is removed. In another example of a method, an opening in a first layer, which comprises silicon dioxide, is formed by depositing a second layer over the first layer and depositing a tungsten layer over the second layer. The tungsten and second layers are patterned to expose a portion of the first layer, and this portion is etched. Various apparatuses which may be made using these methods are also described.



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INTERNATIONAL SEARCH REPORT

International Application No

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A. CLASSIFICATION OF SUBJECT MATTER
 IPC 7 H01L21/308 H01L21/027 H01L21/311 H01L25/04 H01L21/98
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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 H01L G02F B81C

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 472 240 A (KAMEYAMA) 18 September 1994 (1994-09-18) figures	1,3,4, 6-8,10, 11,43,44
X	US 5 316 618 A (VAN LINTEL) 31 May 1994 (1994-05-31) figures	1,3-8, 10,43,44
X	US 4 496 418 A (HAM) 29 January 1985 (1985-01-29) figures	1,3-7, 43,44
X	US 5 389 198 A (KOIDE ET AL) 14 February 1995 (1995-02-14) figure 3	1,3,4,7, 43,44
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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
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- "O" document referring to an oral disclosure, use, exhibition or other means
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- "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

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Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
 NL - 2280 HV Rijswijk
 Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
 Fax: (+31-70) 340-3016

Authorized officer

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 714 038 A (KIM) 3 February 1998 (1998-02-03) figure 4 ---	1,3,7,8, 10,43,44
X	US 5 470 693 A (SACHDEV ET AL) 28 November 1995 (1995-11-28) figures ---	1-4,7-9, 43,44
A	YEH H -J J ET AL: "FLUIDIC SELF-ASSEMBLY OF MICROSTRUCTURES AND ITS APPLICATION TO THEINTEGRATION OF GAAS ON SI" PROCEEDING OF THE WORKSHOP ON MICRO ELECTRO MECHANICAL SYSTEMS (MEMS),US,NEW YORK, IEEE, vol. WORKSHOP 7, 25 January 1994 (1994-01-25), pages 279-284, XP000528430 ISBN: 0-7803-1834-X abstract ---	12-15
A	EP 0 607 808 A (MATSUSHITA) 27 July 1994 (1994-07-27) figures -----	5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 00/41003

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.:

1-15, 43, 44

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: 1-15, 43, 44

A method of forming openings having a predetermined cross sectional shape into a substrate; associated substrate.

2. Claims: 16-20

a method for etching using a mask.

3. Claims: 21-28

a method of forming an opening using oblique irradiation of a photosensitive layer.

4. Claims: 29-42

method of assembling a structure on a substrate, comprising etching openings with a plurality of masks and dispensing the structures in a slurry.

5. Claims: 45-51

process of etching using a selective ablation technique.

6. Claims: 52-56

process of etching glass.

7. Claims: 57-59

process of forming an opening into an organic layer.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 00/41003

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