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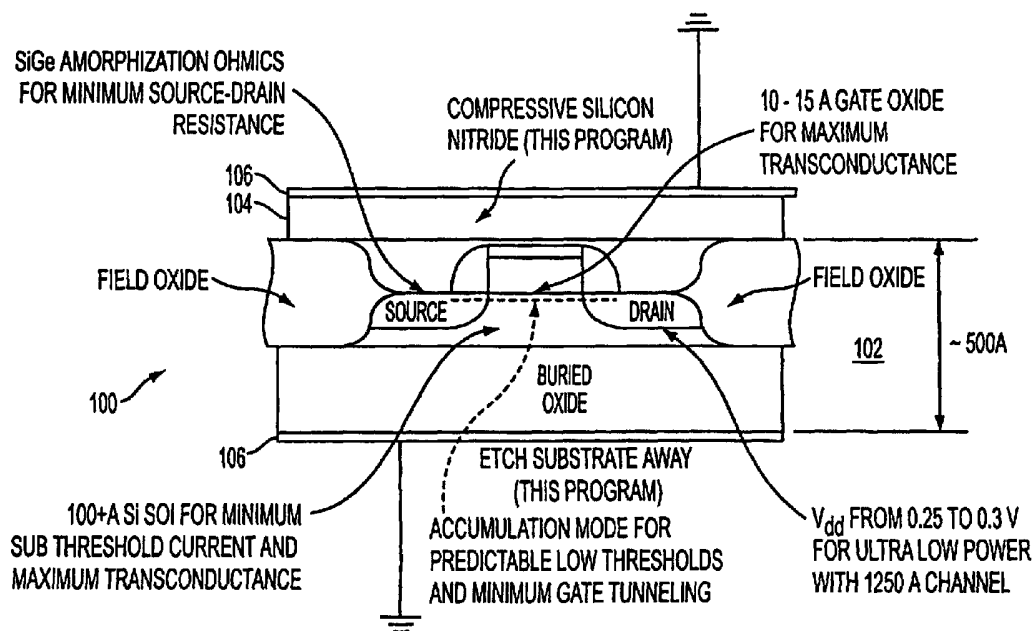
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- (74) Agents: **TOLLEFSON, Brian, A.** et al.; Rothwell, Figg, Ernst & Manbeck, P.C., 1425 K Street, N.W., Suite 800, Washington, DC 20005 (US).
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[Continued on next page]

(54) Title: COILED CIRCUIT DEVICE AND METHOD OF MAKING THE SAME



(57) Abstract: A coiled circuit device is produced by forming a circuit layer on a substrate. Optional insulator layers may be disposed above and below the circuit layer. The circuit layer, which may be memory, control, or other circuitry, is released from the substrate such that it coils into a dense, coiled device. A stressed coiling layer may be included which effects coiling when the circuit layer is released.

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Published:

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28 April 2005

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US2004/017952

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01L21/84 H01L27/12

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 B81B

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, INSPEC, IBM-TDB

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 01/88612 A (XEROX CORP) 22 November 2001 (2001-11-22)	1,9,10, 13,19, 23,31,35
Y	abstract; claims; figures 32,33	24-30, 37-42
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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 :

<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"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</p> <p>"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</p> <p>"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.</p> <p>"&" document member of the same patent family</p>
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Date of the actual completion of the international search 3 February 2005	Date of mailing of the international search report 22. 02. 2005
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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 <p style="text-align: center;">Wirner, C</p>
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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US2004/017952

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CA 2 305 069 A (NEW JERSEY TECH INST) 12 October 2001 (2001-10-12) abstract; claims; figures 2,3	1,2, 14-16, 18,19,31
Y		3-8,11, 12,17, 20-22, 32-34, 36, 43-45, 50, 53-57, 59-65
Y	US 2003/057525 A1 (GAKIS ANDREAS ET AL) 27 March 2003 (2003-03-27) abstract; claims; figures	3-8,11, 12,17, 20-22, 24-30, 32-34, 36-45, 50, 53-57, 59-65
X	US 2002/018334 A1 (HILL EDWARD A ET AL) 14 February 2002 (2002-02-14) abstract; figures 2,3,5,7-9 paragraph '0043!	67, 71-73, 75,76,79
X	US 6 464 687 B1 (ISHIKAWA AKIRA ET AL) 15 October 2002 (2002-10-15) abstract; figure 4 column 9, line 31 - line 50	80
X	EP 1 231 617 A (XEROX CORP) 14 August 2002 (2002-08-14) abstract; claims; figures 5,6	1,19,31
X	US 6 183 267 B1 (KADIJA IGOR V ET AL) 6 February 2001 (2001-02-06) abstract; claims; figures 8-10	1,19,31
X	GILL J J ET AL: "Manufacturing issues of thin film NiTi microwrapper" SENSORS AND ACTUATORS A, ELSEVIER SEQUOIA S.A., LAUSANNE, CH, vol. 93, no. 2, 30 September 2001 (2001-09-30), pages 148-156, XP004297608 ISSN: 0924-4247 abstract; figure 2	1,19,31
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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US2004/017952

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 241 507 A (FIAT RICERCHE) 18 September 2002 (2002-09-18) abstract; claims; figures	1, 19, 31
A	US 6 051 877 A (TASE TAKASHI ET AL) 18 April 2000 (2000-04-18) abstract; claims; figures	1-90
A	US 2002/125545 A1 (KANO SHIRO ET AL) 12 September 2002 (2002-09-12) abstract; claims; figures	1-90
A	WO 02/36486 A (MCNC; GOODWIN-JOHANSSON, SCOTT, H) 10 May 2002 (2002-05-10) abstract; claims; figures	1-90
A	WO 01/81173 A (STANDARD MEMS, INC; TRIMMER, WILLIAM) 1 November 2001 (2001-11-01) abstract; claims; figures	1-90

INTERNATIONAL SEARCH REPORT

national application No.
PCT/US2004/017952

Box 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 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 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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-42

Coiling of a sheet material and a circuit layer

2. claims: 43-66

A memory device coiled into a cylinder and manufacturing method

3. claims: 67-79

A device sheet comprising a nitride coiling layer

4. claims: 80-90

A plurality of interconnected coiled memory devices sharing a single bus

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US2004/017952

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 0188612	A	22-11-2001	AU 6132201 A EP 1301827 A1 JP 2003533897 T TW 501151 B WO 0188612 A1 US 2003027081 A1 US 2003179064 A1	26-11-2001 16-04-2003 11-11-2003 01-09-2002 22-11-2001 06-02-2003 25-09-2003
CA 2305069	A	12-10-2001	CA 2305069 A1	12-10-2001
US 2003057525	A1	27-03-2003	DE 10122324 A1 CN 1384543 A EP 1256983 A2 JP 2003069034 A	14-11-2002 11-12-2002 13-11-2002 07-03-2003
US 2002018334	A1	14-02-2002	US 6229684 B1 WO 02079076 A1 AU 2872401 A CA 2361511 A1 CN 1408120 T EP 1157396 A1 WO 0145120 A2	08-05-2001 10-10-2002 25-06-2001 21-06-2001 02-04-2003 28-11-2001 21-06-2001
US 6464687	B1	15-10-2002	US 6324904 B1 US 6366206 B1 US 6546268 B1 AU 3520900 A WO 0053243 A1	04-12-2001 02-04-2002 08-04-2003 28-09-2000 14-09-2000
EP 1231617	A	14-08-2002	US 2002110761 A1 EP 1231617 A1 JP 2002329632 A	15-08-2002 14-08-2002 15-11-2002
US 6183267	B1	06-02-2001	US 6484395 B1	26-11-2002
EP 1241507	A	18-09-2002	IT T020010250 A1 EP 1241507 A2	16-09-2002 18-09-2002
US 6051877	A	18-04-2000	US 6291877 B1 US 2002027274 A1 EP 0637841 A2 EP 0862134 A2 JP 2970411 B2 JP 7099267 A US 5689136 A	18-09-2001 07-03-2002 08-02-1995 02-09-1998 02-11-1999 11-04-1995 18-11-1997
US 2002125545	A1	12-09-2002	JP 2002170925 A	14-06-2002
WO 0236486	A	10-05-2002	US 6396620 B1 AU 1183602 A WO 0236486 A2	28-05-2002 15-05-2002 10-05-2002
WO 0181173	A	01-11-2001	AU 6294801 A WO 0181173 A1 US 2002056790 A1	07-11-2001 01-11-2001 16-05-2002