Title: MAGNETO-RESISTIVE BIT STRUCTURE AND METHOD OF MANUFACTURING THEREFOR

Abstract: Embodiments of the present invention provide a magnetic bit structure (2) that can be produced using conventional contact and/or via processing steps. This is preferably accomplished by providing a magnetic bit structure (2) that has bit ends (4a, 4b) that are sufficiently large to accommodate a minimum size contact or via hole (5a, 5b). As such, the contact or via holes (5a, 5b) may remain inside of the bit edges, thereby protecting the edges of the bit from later process steps that would otherwise cause oxidation or damage the bit structure.
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/US02/34914

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : G11C 11/00; H01L 31/119
US CL. : 365/158; 257/295
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. : 365/158; 257/295, 421; 438/3

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
Please See Continuation Sheet

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>US 4,897,288 A (JENSON) 30 January 1990 (30.01.1990), see entire document.</td>
<td>1-32</td>
</tr>
</tbody>
</table>

* Further documents are listed in the continuation of Box C. [ ]

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

*B* earlier application or patent published on or after the international filing date (not publication 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

<table>
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<th>Relevant to claim No.</th>
<th>Date of mailing of the international search report</th>
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<tbody>
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<td>1</td>
<td>28 Jul 2003</td>
</tr>
</tbody>
</table>

Date of the actual completion of the international search

Name and mailing address of the ISA/US
Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
Facsimile No. (703) 305-3230

Authorized officer
LONG TRAN
Telephone No. (703) 306-3329

Form PCT/ISA/210 (second sheet) (July 1998)
**INTERNATIONAL SEARCH REPORT**

**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:
Please See Continuation 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.

Form PCT/ISA/210 (continuation of first sheet(1)) (July 1998)
BOX II. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

Group I, claims 1-18, drawn to a semiconductor device, class 365/158 and 257/295.

The invention listed above do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, the species lack the same or corresponding special technical features for the following reasons: Inventions I and II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: The process as claimed can be used to make other and materially different product; or the product as claimed can be made by another and materially different process. For example, in claim 19, selectively forming a dielectric layer on the magneto-resistive bit structure instead of forming the entire magneto-resistive bit structure with dielectric layer then etching off unwanted portion of the dielectric to make a contact hole.

Continuation of B. FIELDS SEARCHED Item 3:

USPTO APS EAST
search terms: bit, contact, hole, via, pad, plug, structure, dimension, around, magneto-resistive, magneto?resistive, cover$3, extend$3, surround$3, magnet$9, silicon nitride, titanium tungsten, copper, aluminum