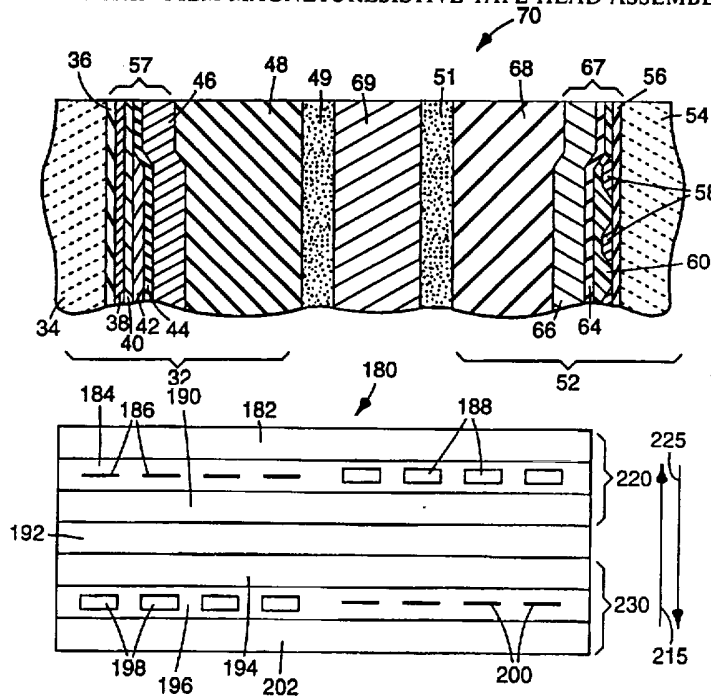




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁵ : G11B 5/48, 5/31, 5/39 G11B 5/584</p>	<p>A3</p>	<p>(11) International Publication Number: WO 94/05007 (43) International Publication Date: 3 March 1994 (03.03.94)</p>
<p>(21) International Application Number: PCT/US93/07458 (22) International Filing Date: 10 August 1993 (10.08.93) (30) Priority data: 07/933,383 21 August 1992 (21.08.92) US (71) Applicant: MINNESOTA MINING AND MANUFACTURING COMPANY [US/US]; 3M Center, Post Office Box 33427, Saint Paul, MN 55133-3427 (US). (72) Inventor: SCHWARZ, Theodore, A. ; Post Office Box 33427, Saint Paul, MN 55133-3427 (US). (74) Agents: LEVINSON, Eric, D. et al.; Office of Intellectual Property Counsel, Minnesota Mining and Manufacturing Company, Post Office Box 33427, Saint Paul, MN 55133-3427 (US).</p>		<p>(81) Designated States: JP, KR, NO, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i> (88) Date of publication of the international search report: 28 April 1994 (28.04.94)</p>

(54) Title: BIDIRECTIONAL THIN-FILM MAGNETORESISTIVE TAPE HEAD ASSEMBLY



(57) Abstract

A tape head assembly (180). Wear is minimized on the head assembly by: (1) minimizing the distance between the read elements (186, 200) and their respective write elements (198, 188), (2) forming the head assembly from hard materials, and (3) placing a hard block (69) between the read and write elements. The head assembly uses only a single pair of read and write elements per data track, but the pairs are reversed with respect to each other so that the head assembly is capable of reading-while-writing on the tape in both directions (215, 225).

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 93/07458

A. CLASSIFICATION OF SUBJECT MATTER IPC 5 G11B5/48 G11B5/31 G11B5/39 G11B5/584				
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 5 G11B				
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)				
C. DOCUMENTS CONSIDERED TO BE RELEVANT				
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
X	EP,A,0 131 727 (I. B. M. CORP.) 23 January 1985	1,2		
A	see page 1, paragraph 2 see page 5, paragraph 2 - paragraph 5 see page 6, paragraph 2; claims; figures 1,2	3-7		

X	US,A,5 027 245 (NAGATA ET AL.) 25 June 1991	2		
Y	see column 3, line 30 - line 33	4		
A	see column 4, line 7 - column 7, line 46; figures	1,3,5-7		

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<input checked="" type="checkbox"/> Further documents are listed in the continuation of box C. <input checked="" type="checkbox"/> Patent family members are listed in annex.				
* Special categories of cited documents : <table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> "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 "I" 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 </td> <td style="width: 50%; vertical-align: top;"> "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 </td> </tr> </table>			"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 "I" 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
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Date of the actual completion of the international search 8 March 1994		Date of mailing of the international search report 15.03.94		
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 cpo nl, Fax: (+ 31-70) 340-3016		Authorized officer Fux, J		

INTERNATIONAL SEARCH REPORT

Int: International Application No
PCT/US 93/07458

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 13, no. 263 (P-886)(3611) 19 June 1989 & JP,A,01 057 413 (MATSUSHITA ELECTRIC IND CO LTD) 3 March 1989	2
A	see abstract see figures	1,4-7
X	EP,A,0 348 169 (SHARP K. K.) 27 December 1989	2
A	see column 1, line 10 - line 42 see column 2, line 9 - column 3, line 6 see column 3, line 30 - column 4, line 29 see column 6, line 3 - line 17; claims 1,2; figures 1,2,8	1,4,5
X	PATENT ABSTRACTS OF JAPAN vol. 11, no. 029 (P-540)28 January 1987 & JP,A,61 198 411 (VICTOR CO OF JAPAN LTD) 2 September 1986	2
A	see abstract see figures 4,5	1,4,5
Y	IBM TECHNICAL DISCLOSURE BULLETIN vol. 14, no. 7 , December 1971 , ARMONK, N. Y., US page 2129 T. W. S. STENNING 'Interleaved multielement magnetic heads' see page 2129, paragraph 1 -paragraph 2; figures	4
A	IEEE TRANSACTIONS ON MAGNETICS vol. 26, no. 5 , September 1990 , NEW YORK US pages 2152 - 2156 XP000150505 W. D. DOYLE see page 2152, left column; figures 2,3	1,2,4,6
Y	US,A,4 639 808 (THORNLEY) 27 January 1987 see the whole document	6
Y	PATENT ABSTRACTS OF JAPAN vol. 8, no. 65 (P-263)(1502) 27 March 1984 & JP,A,58 212 614 (MITSUBISHI DENKI K. K.) 10 December 1983 see abstract	6

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INTERNATIONAL SEARCH REPORT

 Inter national Application No
 PCT/US 93/07458

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US,A,4 967 300 (REID ET AL.) 30 October 1990 see column 1, line 54 - column 2, line 18 see column 3, line 4 - line 66 see column 4, line 39 - column 6, line 10 see column 6, line 45 - line 58 see column 7, line 55 - line 61 see column 8, line 37 - line 47; figures 1,6-8,12 ---	2,3,5,6
A	PATENT ABSTRACTS OF JAPAN vol. 10, no. 198 (P-476)(2254) 11 July 1986 & JP,A,61 042 715 (FUJI PHOTO FILM CO LTD) 1 March 1986 see abstract ---	3,5
A	IBM TECHNICAL DISCLOSURE BULLETIN vol. 20, no. 9, February 1978, ARMONK, N. Y., US pages 3673 - 3674 'Read write servo magnetic head' see figures 3,4 ---	4
A	EP,A,0 383 957 (TANDBERG DATA A/S) 29 August 1990 see column 5, line 42 - column 6, line 2; figure 4 ---	4
A	PATENT ABSTRACTS OF JAPAN vol. 9, no. 79 (P-347)(1802) 9 April 1985 & JP,A,59 210 520 (Y. ICHINOSE) 29 November 1984 see abstract ---	9
A	PATENT ABSTRACTS OF JAPAN vol. 1, no. 138 (E-063)12 November 1977 & JP,A,52 075 421 (NIPPON DENKI K. K.) 24 June 1977 see abstract ---	
P,A L	EP,A,0 517 531 (MINNESOTA MINING AND MANUFACTURING COMPANY) 9 December 1992 see column 7, line 28 - line 39; figures 1,5A -----	4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 93/07458

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:

1. Claims 1-3,4,5-9; 2. Claims 10; 3. Claims 4 (partially)

For further information see form PCT/ISA/206 dated on 04/01/94

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.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 93/07458

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A-0131727	23-01-85	US-A- 4685005 JP-A- 60028010	04-08-87 13-02-85
US-A-5027245	25-06-91	JP-A- 1057413	03-03-89
EP-A-0348169	27-12-89	JP-A- 2005217 US-A- 5068760 US-A- 5153980	10-01-90 26-11-91 13-10-92
US-A-4639808	27-01-87	NONE	
US-A-4967300	30-10-90	NONE	
EP-A-0383957	29-08-90	NONE	
EP-A-0517531	09-12-92	US-A- 5229895 CN-A- 1067760 JP-A- 5182131	20-07-93 06-01-93 23-07-93