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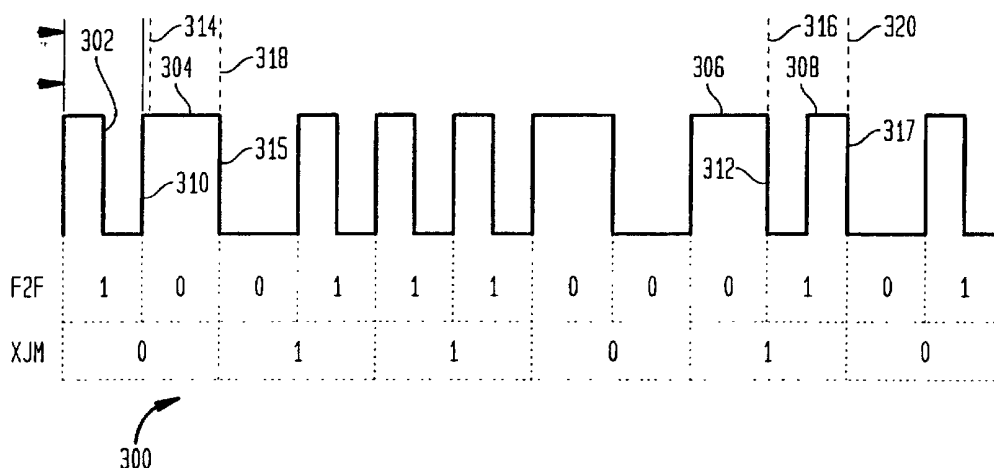
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHODS AND APPARATUS FOR INCREASED MAGNETIC CODING DENSITY BY PRECISE PLACEMENT OF MAGNETIC TRANSITIONS



(57) Abstract: Methods and apparatus for increasing the density of data storage on a magnetic medium by using variations in positioning of magnetic transitions to encode bits. Conventionally encoded bits are written to the medium as sequences of magnetic transitions according to an encoding standard. Additional bits are encoded on the medium as deviations from a nominal position of magnetic transitions separating conventionally encoded bits. The deviation from the nominal position is within an allowable range of tolerance for the standard followed in encoding the conventionally encoded bits. In order to prevent accumulation of error, additional bits are only encoded in transitions separating a pair of conventionally encoded bits. The first and last transitions of the pair do not have additional bits encoded as deviations of transition locations. This technique allows the encoding of one additional bit for every two conventionally encoded bits.



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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US01/13531

A. CLASSIFICATION OF SUBJECT MATTER				
IPC(7) : G06K 7/08, G06K 19/06, G11B 25/04, G11B 5/09				
US CL : 235/449, 235/493, 360/2, 360/40				
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. : 235/449, 235/493, 360/2, 360/40, 360/39, 360/43, 360/44, 235/380, 713/176, 341/71, 341/72				
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 practicable, search terms used) Please See Continuation Sheet				
C. DOCUMENTS CONSIDERED TO BE RELEVANT				
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
X	US 5,616,904 A (FERNANDEZ) 01 April 1997 (01.04.1997), Figs. 1B-A, 1B-B, 1C, 4A, col. 5, lines 6-33	1-11		
X	US 5,254,843 A (HYNES et al) 19 October 1993 (19.10.1993), column 4, line 63 - column 7, line 4.	1, 10-11		
X	US 6,031,671 A (AYRES) 29 February 2000 (29.02.2000), column 10, line 43 - column 11, line 46	1		
A	US 5,770,846 A (MOS et al) 23 June 1998 (23.06.1998), column 3, line 24 - column 4, line 25.	10-11		
A	US 5,625,689 A (INDECK et al) 29 April 1997 (29.04.1997), col. 3, line 31 - col. 4, line 9.	10-11		
A	US 5,546,462 A (INDECK et al) 13 August 1996 (13.08.1996), col. 4, line 41 - col. 5, line 18.	10-11		
A	US 4,114,029 A (LEE) 12 September 1978 (12.09.1978), col. 3, lines 23-40	10-11		
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.				
<table border="0"> <tr> <td> <p>* Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent 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> </td> <td> <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> </td> </tr> </table>			<p>* Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent 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>
<p>* Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent 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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Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703)305-3230		Authorized officer David R. Hudspeth Telephone No. (703)305-9000 <i>Kenneth Ward</i>		

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US01/13531

Continuation of B. FIELDS SEARCHED Item 3:

BRS: USPAT, US-PGPUB, EPO, JPO, DERWENT, IBM TDB

Search Terms: ((encod\$3 or writ\$3 or record\$3) NEAR10 (magnetic ADJ2 (medium or media or card or tape or disk or diskette or disc or platter or surface))) same ((bit or transition or pulse or cycle) NEAR10 (deviat\$3 or shorter or longer or less or greater or more or closer or farther or displac\$5 or offset\$3))