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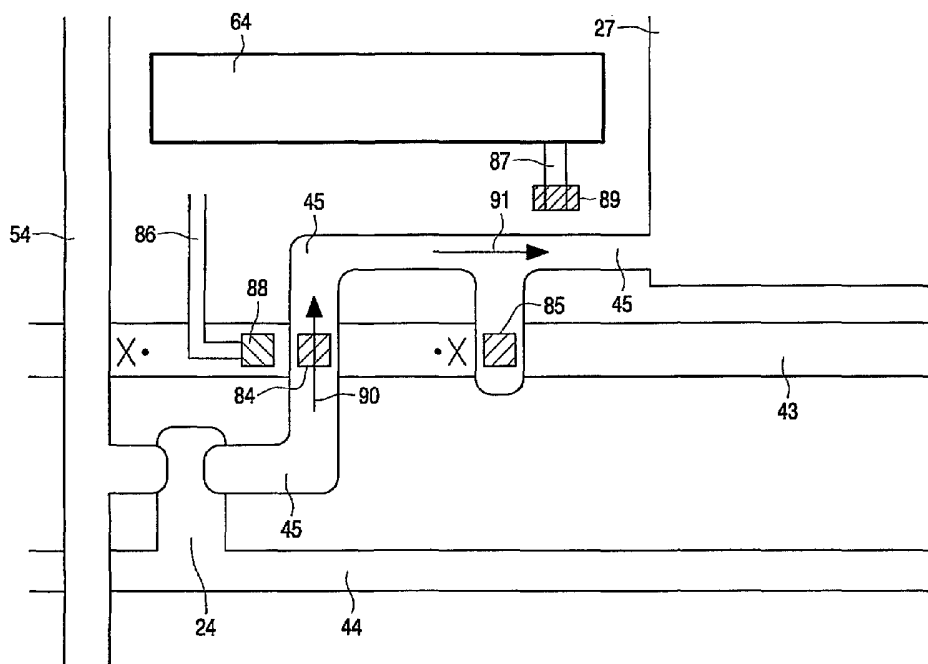
(72) Inventors; and

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[Continued on next page]

(54) Title: MEMORIES AND MEMORY CIRCUITS



(57) Abstract: Magnetoresistive random access memory (MRAM) is used to provide in-pixel memory circuits for display devices. A memory circuit (25) comprises two MRAMs (60, 62), each coupled to a respective input of a flip-flop circuit (64). A display device (1) is provided comprising a plurality of pixels (20) each associated with a memory circuit (25). One of the MRAMs is a switchable MRAM (60), the other MRAM is a reference MRAM (62) arranged to provide a reference by which the changed states of the switchable MRAM (60) may be readily observed and measured in the form of a differential.

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Previous Correction:

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/IB 03/01748

A. CLASSIFICATION OF SUBJECT MATTER IPC 7 G11C11/16				
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 G11C				
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, 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 6 191 972 B1 (MIURA SADAHIKO ET AL) 20 February 2001 (2001-02-20)	1,4,5		
Y	column 5, line 49 - column 5, line 56 column 6, line 47 - column 7, line 13 column 8, line 23 - column 8, line 59	2,3		
A	-----	17-20		
Y	PATENT ABSTRACTS OF JAPAN vol. 1997, no. 04, 30 April 1997 (1997-04-30) & JP 8 321016 A (SANYO ELECTRIC CO LTD), 3 December 1996 (1996-12-03) abstract	2,3		
A	----- EP 1 126 468 A (HEWLETT PACKARD CO) 22 August 2001 (2001-08-22) figures 3,4 -----	4,19,20		
-/--				
<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 style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; 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 "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 </td> <td style="width: 50%; border: none; 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 "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	"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
"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 "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	"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			
Date of the actual completion of the international search <p style="text-align: center;">30 November 2004</p>	Date of mailing of the international search report <p style="text-align: center;">27.01.2005</p>			
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;">Degraeve, L</p>			

INTERNATIONAL SEARCH REPORT

International Application No
PCT/IB 03/01748

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 2002/008987 A1 (TAKEDA KOICHI ET AL) 24 January 2002 (2002-01-24) column 4, paragraph 38 - column 5, paragraph 44 -----	1,3-5

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-6,17-20

MRAM sensing circuit comprising a reference MRAM cell and MRAM memory cell, the MRAM cell having an in plane magnetic easy axis, the reference cell having a plane perpendicular magnetic easy axis, and both the said cells being directly coupleable to the readout circuit. The sensing circuit is typical applicable to displays using in pixel memory cells.

2. claims: 7-16

Construction and layout of a display device using in pixel memory cells

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB 03/01748

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.:

1-6, 17-20

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

International Application No
PCT/JP 03/01748

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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			EP 1126468 A2 22-08-2001
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