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[Continued on next page]

(54) Title: USE OF MULTI-LAYER THIN FILMS AS STRESS SENSORS

Capping layer	460
Antiferromagnet layer	450
Ferromagnet layer	440-5
Ferromagnet layer	440-4
Spacer	440-3
Ferromagnet layer	440-2
Ferromagnet layer	440-1
Barrier layer	430
Ferromagnet layer	420-5
Ferromagnet layer	420-4
Spacer	420-3
Ferromagnet layer	420-2
Ferromagnet layer	420-1
Underlayer	410

(57) Abstract: The present invention provides a pressure sensing device that includes at least one TMR sensor, and preferably an array of TMR sensors, with each TMR sensor having an insulating spacer layer interposed between a pinned and a free ferromagnetic layer. In an unbiased state, the magnetization vector of each of the ferromagnetic layers is preferably parallel to each other. Upon application of a small woltage, the magnetization vectors remain unchanged. Upon application of stress, the magnetization vector of the free magnetic layer will rotate, thus causing a corresponding and proportionally related change in the resistance of the sensor. This change in resistance can be sensed and used to calculate the stress applied thereto.

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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.

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G01L1/12 G06K9/00

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 G01L G06K

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 394 773 A (RUELL HARTWIG) 19 July 1983 (1983-07-19) abstract; figure 1	1-100
A	EP 0 889 521 A (ST MICROELECTRONICS INC) 7 January 1999 (1999-01-07) abstract; figure 1	1-100

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

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"&" document member of the same patent family

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Name and mailing address of the ISA	Authorized officer
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INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4394773 A	19-07-1983	DE 3161635 D1	19-01-1984
		EP 0044489 A1	27-01-1982
EP 0889521 A	07-01-1999	US 6011859 A	04-01-2000
		EP 0889521 A2	07-01-1999
		JP 11123186 A	11-05-1999