

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
25 June 2009 (25.06.2009)

(10) International Publication Number  
**WO 2009/079448 A3**

- (51) **International Patent Classification:**  
G11B 27/36 (2006.01) G11B 5/455 (2006.01)  
G11B 33/12 (2006.01)
- (21) **International Application Number:**  
PCT/US2008/086809
- (22) **International Filing Date:**  
15 December 2008 (15.12.2008)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**  
11/958,817 18 December 2007 (18.12.2007) US
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(81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

[Continued on next page]

(54) Title: DISK DRIVE TESTING

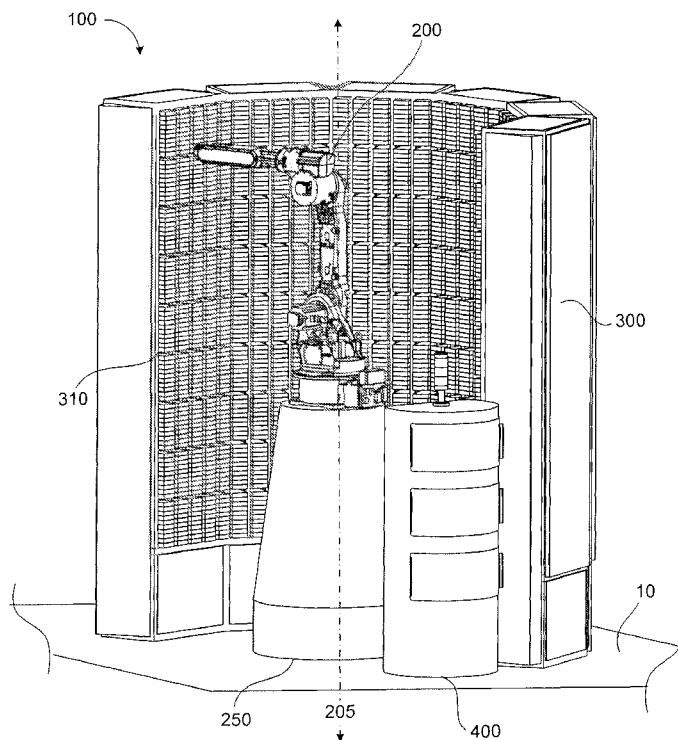


FIG. 3

(57) **Abstract:** A disk drive testing system (100) includes at least one robotic arm (200) defining a first axis (205) substantially normal to a floor surface (10). The robotic arm is operable to rotate through a predetermined arc about and extend radially from the first axis. Multiple racks (300) are arranged around the robotic arm for servicing by the robotic arm. Each rack houses multiple test slots (310) that are each configured to receive a disk drive transporter (550) configured to carry a disk drive (500) for testing. A transfer station (400) is arranged for servicing by the robotic arm. The transfer station includes multiple tote receptacles (420) that are each configured to receive a disk drive tote (450).

**(84) Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

**(88) Date of publication of the international search report:**  
5 November 2009

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2008/086809

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> INV. G11B5/455 G11B27/36 G11B33/12		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b>		
Minimum documentation searched (classification system followed by classification symbols) 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) EPO-Internal		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2007 220184 A (HITACHI GLOBAL STORAGE TECH) 30 August 2007 (2007-08-30) abstract; figures 2-4 -----	1-20, 22-30
Y	WO 03/067385 A (ASACA CORP [JP]; WILSON KIRK DONALD [US]; KUWAYAMA NORITADA [JP]) 14 August 2003 (2003-08-14) pages 8-9; figures 3-5 -----	1-20, 22-30
Y	US 5 999 356 A (DIMITRI KAMAL EMILE [US] ET AL) 7 December 1999 (1999-12-07) columns 1-4; figures 1,2,4A -----	1-20, 22-30
Y	US 5 426 581 A (KISHI GREGORY T [US] ET AL) 20 June 1995 (1995-06-20) column 3, lines 16-55; figure 2 -----	17, 30
-/--		
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.		
<input checked="" type="checkbox"/> 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 *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	Date of mailing of the international search report	
8 September 2009	17/09/2009	
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer  Poulsen, Martin	

## INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2008/086809

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 2002/161971 A1 (DIMITRI KAMAL E [US] ET AL) 31 October 2002 (2002-10-31) abstract; figures 2-4 -----	1-20, 22-30
A	GB 2 312 984 A (SAMSUNG ELECTRONICS CO LTD [KR]) 12 November 1997 (1997-11-12) abstract; figures 2-4 -----	1-20, 22-30
A	US 7 304 855 B1 (MILLIGAN CHARLES A [US] ET AL) 4 December 2007 (2007-12-04) abstract; figure 1 -----	1-20, 22-30
A	EP 1 760 722 A (HITACHI LTD [JP]) 7 March 2007 (2007-03-07) abstract; figure 1 -----	1-20, 22-30
A	US 2005/219809 A1 (MUNCASTER TIMOTHY J [GB] ET AL MUNCASTER TIMOTHY JOHN [GB] ET AL) 6 October 2005 (2005-10-06) abstract; figure 2 -----	1-20, 22-30
A	US 2005/010836 A1 (BAE MIN-WON [KR] ET AL) 13 January 2005 (2005-01-13) abstract -----	1-20, 22-30
A	US 5 851 143 A (HAMID LOTFIZADEH S [US]) 22 December 1998 (1998-12-22) abstract -----	1-20, 22-30
A	US 2004/236465 A1 (BUTKA DAVID JOHN [US] ET AL) 25 November 2004 (2004-11-25) paragraph [0047]; figure 15 -----	17,30
A	EP 1 045 301 A (HEWLETT PACKARD CO [US]) 18 October 2000 (2000-10-18) abstract -----	17,30

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US2008/086809

## Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 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 No. III Observations where unity of invention is lacking (Continuation of item 3 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 allsearchable claims.
  
2.  As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
  
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.:  
  
1-20, 22-30
  
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 and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

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

1. claims: 1-10,18-20,22-25

A disk drive testing system for multiple drives in multiple racks and a robot arm for moving the drives. A transfer station for servicing the robotic arm with disk drives.

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2. claims: 11-16,26-29

Details on testing such as varying power, temperature and vibration.

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3. claims: 17,30

A vision system for guiding the robot arm

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4. claim: 21

Depositing empty disk drive transporters in the slots of the racks.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2008/086809
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Patent document cited in search report	A	Publication date	Patent family member(s)	Publication date
JP 2007220184	A	30-08-2007	NONE	
WO 03067385	A	14-08-2003	AU 2003207839 A1 EP 1481325 A2 EP 1956475 A2 JP 2005517236 T	02-09-2003 01-12-2004 13-08-2008 09-06-2005
US 5999356	A	07-12-1999	NONE	
US 5426581	A	20-06-1995	NONE	
US 2002161971	A1	31-10-2002	JP 3683867 B2 JP 2003022601 A	17-08-2005 24-01-2003
GB 2312984	A	12-11-1997	CN 1177187 A JP 4027459 B2 JP 10064173 A US 6169413 B1	25-03-1998 26-12-2007 06-03-1998 02-01-2001
US 7304855	B1	04-12-2007	US 7400510 B1	15-07-2008
EP 1760722	A	07-03-2007	JP 2007066480 A US 2007053154 A1 US 2009091883 A1	15-03-2007 08-03-2007 09-04-2009
US 2005219809	A1	06-10-2005	AU 2003236935 A1 CN 1662991 A WO 2004006260 A1 JP 2005532643 T	23-01-2004 31-08-2005 15-01-2004 27-10-2005
US 2005010836	A1	13-01-2005	CN 1573708 A JP 2004342304 A KR 20040098684 A	02-02-2005 02-12-2004 26-11-2004
US 5851143	A	22-12-1998	NONE	
US 2004236465	A1	25-11-2004	NONE	
EP 1045301	A	18-10-2000	JP 3639177 B2 JP 2000314611 A US 6331714 B1	20-04-2005 14-11-2000 18-12-2001