

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
5 October 2006 (05.10.2006)

PCT

(10) International Publication Number
WO 2006/105293 A3

(51) International Patent Classification:
B23B 3/00 (2006.01)

(21) International Application Number:
PCT/US2006/011640

(22) International Filing Date: 30 March 2006 (30.03.2006)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/666,674 30 March 2005 (30.03.2005) US

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM,

AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(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, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

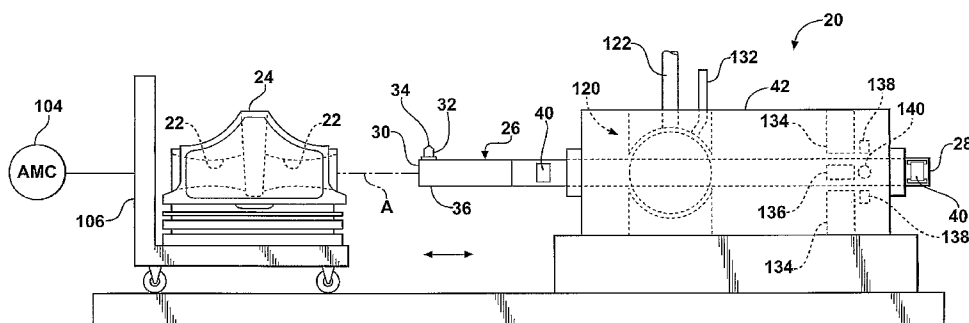
Published:

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

(88) Date of publication of the international search report:
15 November 2007

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: HYBRID ORBITING SPINDLE FOR SHAPING NON-CIRCULAR HOLES



(57) Abstract: A machine tool assembly includes a high speed rotating spindle for forming extremely precise surface contours on a work piece. The spindle is supported on a spherical air bearing about its center of gravity. The spindle can be rotated through an air turbine drive system incorporated into the spherical air bearing to eliminate any undesirable moments about an axis perpendicular to the long spindle axis. The spindle is adjustable in pitch and yaw directions through the influence of X-Y actuators. The X-Y actuation system is preferably electromagnetic and provides a non-contact method of displacing the spindle shaft in a controlled manner at any speed.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US06/11640

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - B23B 3/00 (2007.01)

USPC - 82/1.11, 1.3, 1.5; 409/200

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(8) - B23B 3/00 (2007.01)

USPC - 82/1.11, 1.2, 1.3, 1.5; 409/143, 200

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)

USPTO WEST System (US, USPG-PUB, EPO, DERWENT), MicroPatent, IP.com, DialogPro

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X — Y	US 4,180,946 A (HEIKENSKJOLD et al) 01 January 1980 (01.01.1980) entire document	1-5, 12, 14-17, 21 6-11, 13, 18-20
Y	US 4,884,899 A (SCHWARTZMAN) 05 December 1989 (05.12.1989) note Figure 20	6, 7, 18, 19
Y	US 4,681,492 A (HASEGAWA et al) 21 July 1987 (21.07.1987) note Figure 7	8-11, 13, 20
A	JP 61152304 A (TSUMAKI et al) 11 July 1986 (11.07.1986) entire document	1-21
A	US 6,036,413 A (CHANDRASEKAR) 14 March 2000 (14.03.2000) entire document	1-21
A	WO 03/071144 A1 (AMMANN) 28 August 2003 (28.08.2003) entire document	1-21
A	US 5,682,071 A (BUHLER et al) 28 October 1997 (28.10.1997) entire document	1-21

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Date of the actual completion of the international search

25 July 2007

Date of mailing of the international search report

13 SEP 2007

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P.O. Box 1450, Alexandria, Virginia 22313-1450

Facsimile No. 571-273-3201

Authorized officer:

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PCT OSP: 571-272-7774