

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
9 November 2006 (09.11.2006)

PCT

(10) International Publication Number
WO 2006/119210 A3

(51) International Patent Classification:
F01L 1/344 (2006.01)

(21) International Application Number:
PCT/US2006/016666

(22) International Filing Date: 2 May 2006 (02.05.2006)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/676,822 2 May 2005 (02.05.2005) US

(71) Applicant (for all designated States except US): **BORG-WARNER INC** [US/US]; 3850 Hamlin Road, Auburn Hills, Michigan 48326 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **SMITH, Franklin R.** [US/US]; 3736 Hedgemoor Drive, Cortland, New York 13045 (US). **CHAPMAN, Peter** [GB/IT]; Strada Provinciale Per Imbersago, 39, Arlate Di Calco (Ic), I-23885 Lecco (IT).

(74) Agent: **DZIEGIELEWSKI, Greg;** BorgWarner Inc., 3850 Hamlin Road, Auburn Hills, MI 48326, (US).

(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.

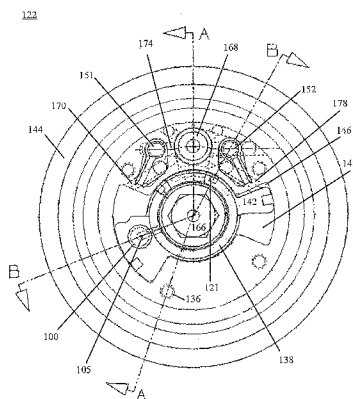
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, 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

(88) Date of publication of the international search report:
11 January 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: TIMING PHASER WITH OFFSET SPOOL VALVE



(57) Abstract: A variable cam timing phaser for an internal combustion engine with at least one camshaft includes a housing (144), a rotor (138), and a phaser control valve (168). The phase control valve is offset from a center axis of rotation through the camshaft of the phaser and may also be parallel to the center axis of rotation. The phaser control valve directs fluid flow to shift the relative angular position of the rotor relative to the housing. The phaser may be cam torque actuated, oil pressure actuated, or torsion assist.



WO 2006/119210 A3

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2006/016666

A. CLASSIFICATION OF SUBJECT MATTER

INV. F01L1/344

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)

F01L

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 111 200 A2 (HONDA MOTOR CO LTD [JP]) 27 June 2001 (2001-06-27) abstract figures 1,2,4	1,2,5, 7-9,14
X	JP 09 264110 A (AISIN SEIKI) 7 October 1997 (1997-10-07) abstract; figures	1,2,5, 7-9,14
X	EP 1 081 340 A2 (HONDA MOTOR CO LTD [JP]) 7 March 2001 (2001-03-07) abstract figures 1,2,6	1,2,5, 7-9,14
	----- -/--	

☒ Further documents are listed in the continuation of Box C.

☒ 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

13 October 2006

Date of mailing of the international search report

25/10/2006

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

Paulson, Bo

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2006/016666

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 924 393 A2 (PORSCHE AG [DE]; HYDRAULIK RING GMBH [DE] PORSCHE AG; HYDRAULIK RING G) 23 June 1999 (1999-06-23) abstract figures 1,2	1,5, 7-10,14
X	DE 100 02 352 A1 (MITSUBISHI ELECTRIC CORP [JP]) 17 August 2000 (2000-08-17) abstract figure 2	1,5,7-9, 14
X	EP 0 829 621 A2 (TOYOTA MOTOR CO LTD [JP] TOYOTA MOTOR CO LTD) 18 March 1998 (1998-03-18) abstract figures 1,2,4-6	1,5,7-9, 14
X	EP 1 113 152 A2 (BORG WARNER INC [US]) 4 July 2001 (2001-07-04) abstract figures	1,11,12, 14
X	DE 43 07 010 A1 (BORG WARNER AUTOMOTIVE [US]) 7 October 1993 (1993-10-07) abstract figures	1,11,12, 14

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2006/016666

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 1111200	A2	27-06-2001	CA 2316448 A1 CN 1299919 A DE 60018891 D1 DE 60018891 T2 JP 3355165 B2 JP 2001164989 A TW 446793 B US 6260526 B1	13-06-2001 20-06-2001 28-04-2005 13-04-2006 09-12-2002 19-06-2001 21-07-2001 17-07-2001
JP 9264110	A	07-10-1997	JP 3365199 B2	08-01-2003
EP 1081340	A2	07-03-2001	CA 2316147 A1 CN 1287212 A DE 60009998 D1 DE 60009998 T2 JP 3546994 B2 JP 2001073725 A TW 444098 B US 6302071 B1	03-03-2001 14-03-2001 27-05-2004 02-09-2004 28-07-2004 21-03-2001 01-07-2001 16-10-2001
EP 0924393	A2	23-06-1999	CN 1223332 A DE 19756016 A1 ES 2155277 T3 JP 11247626 A US 6085708 A	21-07-1999 24-06-1999 01-05-2001 14-09-1999 11-07-2000
DE 10002352	A1	17-08-2000	JP 3730809 B2 JP 2000282903 A KR 2000053558 A US 6196174 B1	05-01-2006 10-10-2000 25-08-2000 06-03-2001
EP 0829621	A2	18-03-1998	DE 69708801 D1 DE 69708801 T2 JP 10089024 A US 5797363 A	17-01-2002 20-06-2002 07-04-1998 25-08-1998
EP 1113152	A2	04-07-2001	DE 60027259 T2 JP 2001214718 A US 6263846 B1	31-08-2006 10-08-2001 24-07-2001
DE 4307010	A1	07-10-1993	JP 3767634 B2 JP 6042317 A US 5289805 A	19-04-2006 15-02-1994 01-03-1994