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(71) Applicant (for all designated States except US): KAY-MOR, L.L.C. [US/US]; 807 Airport Road, Jackson, MI 49202 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): MORETZ, Dale, R. [US/US]; 3612 Whispering Woods Drive, Jackson, MI 49201 (US). KAYWOOD, Roy [US/US]; 1342 Kathmar Drive, Jackson, MI 49203 (US).

(74) Agents: MITCHELL, Christopher, A. et al.; YOUNG & BASILE, P.C., 3001 W. Big Beaver Road, Suite 624, Troy, MI 48084-3107 (US).

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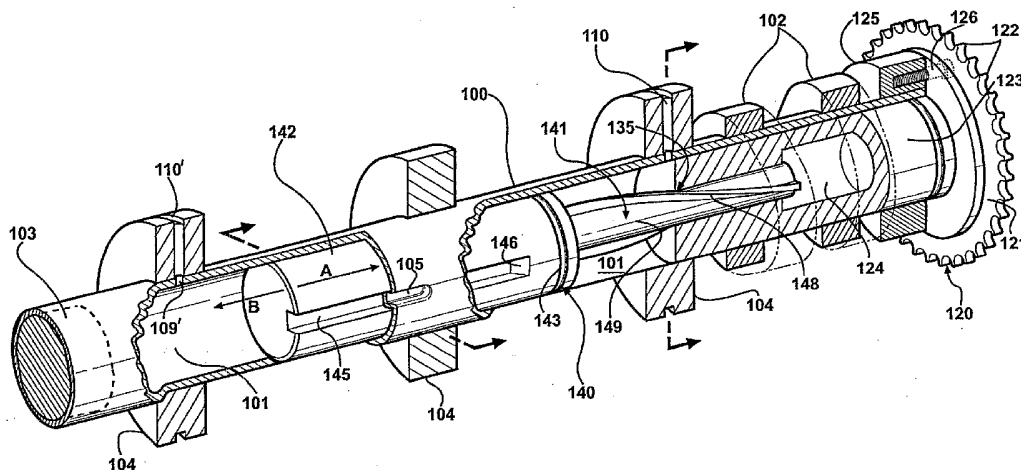
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2 November 2006

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: DYNAMIC VALVE TIMING ADJUSTMENT MECHANISM FOR INTERNAL COMBUSTION ENGINES



(57) Abstract: A cam phaser is disclosed for adjusting the angular position of a camshaft (100) relative to a crankshaft. In a first embodiment, a rotatable camshaft (100) has an interior passageway (124) and at least one cam (102) operative to effect actuation of an engine valve. A piston member (140) is axially moveably disposed within the camshaft (100) interior passageway (101) and associated with the camshaft (100) for rotation therewith. The piston member (140) is further associated with the first drive member (120) for rotation therewith and axial movement relative thereto. Axial movement of the piston member (140) effects a change in the angular position of the first drive member (120). In a second embodiment, a rotatable tubular member (100) has an interior passageway.

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**INTERNATIONAL SEARCH REPORT**

Interr application No  
PCT/US2005/033449

**A. CLASSIFICATION OF SUBJECT MATTER**  
INV. F01L1/344 F01L1/053

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, PAJ

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	DE 198 25 814 A1 (THE TORRINGTON CO., TORRINGTON, CONN., US) 10 December 1998 (1998-12-10) column 1, lines 3,4 column 1, line 66 - column 2, line 65 figures	1,2,7-10 3-6,11
X A	DE 42 40 631 A1 (BAYERISCHE MOTOREN WERKE AG, 80809 MUENCHEN) 9 June 1994 (1994-06-09) column 1, lines 3-7 column 6, lines 25-36 column 7, lines 4-12 column 9, lines 38-60 figures 3,4	1,2,7-10 3,4
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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

14 February 2006

Date of mailing of the international search report

18 AUG 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

Paquay, J

## INTERNATIONAL SEARCH REPORT

Intern: application No  
PCT/US2005/033449

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 013, no. 545 (M-902), 6 December 1989 (1989-12-06) & JP 01 224407 A (KICHISABURO KOMORITANI), 7 September 1989 (1989-09-07)	1,2,7-10
A	abstract; figure 1	3,4,11
A	----- US 6 199 522 B1 (REGUEIRO JOSE F) 13 March 2001 (2001-03-13) column 1, lines 5-9 column 5, lines 3-59 figure 3	1-6
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A	----- DE 195 31 616 A1 (UNISIA JECS CORP., ATSUGI, KANAGAWA, JP) 7 March 1996 (1996-03-07) column 1, lines 3-7 column 3, lines 16,17 column 6, lines 4-14 column 10, lines 6-12 column 11, lines 47-62	1,7-10
A	----- US 5 588 404 A (LICHTI ET AL) 31 December 1996 (1996-12-31) cited in the application column 1, lines 6-8 column 1, lines 54-58 column 3, line 62 - column 4, line 13 figure 1	1,7-10
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# INTERNATIONAL SEARCH REPORT

Int. application No.  
PCT/US2005/033449

## Box 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 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 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.:

1-16

Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- 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: 1-16

This first group of claims contains a camshaft phaser situated within an interior camshaft passageway

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2. claims: 17-31

This second group of claims contains a camshaft phaser that enables the change in the angular position of the first drive member relative to the second drive member

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## INTERNATIONAL SEARCH REPORT

Intern application No  
PCT/US2005/033449

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