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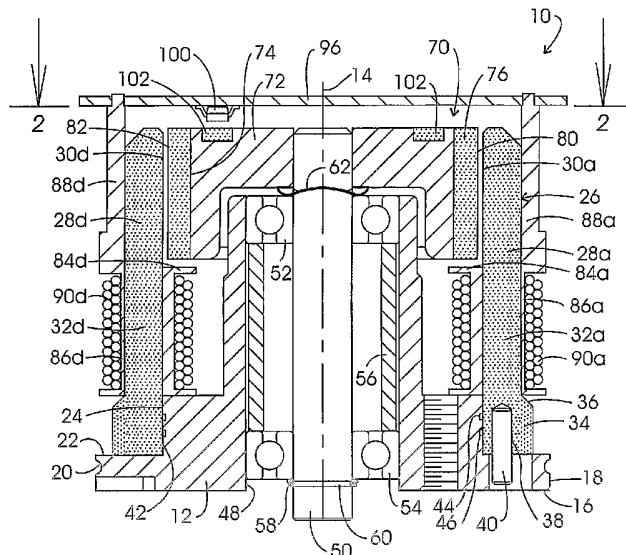
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4 May 2006

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: MULTIPHASE MOTORS WITH SINGLE POINT SENSING BASED COMMUTATION



(57) Abstract: System, method and apparatus for commutating a multiphase motor utilizing a single sensor. Commutation is carried out by employing a sensible system which incorporates phase commutating transition attributes. A motor is started by assigning a starting phase for a given direction of motor direction. An aligning phase initially is energized to orient the rotor so as to provide adequate starting phase start-up torque. Following such alignment and start-up, the motor is operated in response to transitions of the sensible system. In one aspect, a reference phase attribute may be incorporated in the sensible system to provide a mandated reference phase energization when the rotor is oriented for reference phase activation. Further described is a sensible system magnetic region configuration which is combined with a single package Hall effect sensor to provide three-phase unipolar and four-phase commutation with absolute phase defining information.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/06454

A. CLASSIFICATION OF SUBJECT MATTER IPC(7) : H02P 1/18 US CL : 254 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) U.S. : 318/138,254 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) EAST																														
C. DOCUMENTS CONSIDERED TO BE RELEVANT																														
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">Category *</th> <th style="width: 70%;">Citation of document, with indication, where appropriate, of the relevant passages</th> <th style="width: 20%;">Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">A</td> <td>US 5,859,519 A (ARCHER) 12 January 1999 (12.01.1999), see entire document</td> <td style="text-align: center;">1-118</td> </tr> <tr> <td style="text-align: center;">A</td> <td>US 5,821,708 A (WILLIAMS et al) 13 October 1998 (13.10.1998), see entire document</td> <td style="text-align: center;">1-19</td> </tr> <tr> <td style="text-align: center;">A</td> <td>US 5,231,338 A (BECERRA et al) 07 October 1997 (07.10.1997), see entire document</td> <td style="text-align: center;">1-19</td> </tr> <tr> <td style="text-align: center;">A</td> <td>US 4,814,677 A (PLUNKETT) 21 March 1989 (21.03.1989), see entire document</td> <td style="text-align: center;">1-19</td> </tr> <tr> <td style="text-align: center;">A</td> <td>US 5,963,706 (BAIK) 05 October 1999 (05.10.1999), see entire document</td> <td style="text-align: center;">1-19</td> </tr> </tbody> </table>	Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	A	US 5,859,519 A (ARCHER) 12 January 1999 (12.01.1999), see entire document	1-118	A	US 5,821,708 A (WILLIAMS et al) 13 October 1998 (13.10.1998), see entire document	1-19	A	US 5,231,338 A (BECERRA et al) 07 October 1997 (07.10.1997), see entire document	1-19	A	US 4,814,677 A (PLUNKETT) 21 March 1989 (21.03.1989), see entire document	1-19	A	US 5,963,706 (BAIK) 05 October 1999 (05.10.1999), see entire document	1-19	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; padding: 5px;"> <input type="checkbox"/> Further documents are listed in the continuation of Box C. </td> <td style="width: 50%; padding: 5px;"> <input type="checkbox"/> See patent family annex. </td> </tr> <tr> <td style="padding: 5px;"> * 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 application or patent 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 </td> <td style="padding: 5px;"> "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 </td> </tr> <tr> <td style="padding: 5px;"> Date of the actual completion of the international search 27 December 2005 (27.12.2005) </td> <td colspan="2" style="padding: 5px;"> Date of mailing of the international search report <div style="text-align: center; font-size: 1.2em; font-weight: bold;">09 MAR 2006</div> </td> </tr> <tr> <td style="padding: 5px;"> Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201 </td> <td colspan="2" style="padding: 5px;"> Authorized officer <div style="text-align: center; font-size: 1.2em; font-family: cursive;">Lydia Duda For</div> Rina Duda Telephone No. 571-272-2062 </td> </tr> </table>		<input type="checkbox"/> Further documents are listed in the continuation of Box C.	<input 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 application or patent 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 27 December 2005 (27.12.2005)	Date of mailing of the international search report <div style="text-align: center; font-size: 1.2em; font-weight: bold;">09 MAR 2006</div>		Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. 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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/06454

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:
Please See Continuation 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 additional fees, this Authority did not invite payment of any 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.:

- 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.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/06454

BOX III. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claim(s) 1-11, 28-44, and 67-108, drawn to multiphase motor.

Group II, claim(s) 12-27, 45-66, and 109-118, drawn to a commutation control circuit.

The inventions listed as Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: Inventions I and II are related as combination and subcombination. Inventions in this relationship are distinct if it can be shown that (1) the combination as claimed does not require the particulars of the subcombination as claimed for patentability, and (2) that the subcombination has utility by itself or in other combinations (MPEP § 806.05(c)). In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed because the multiphase motor is not directed to a specific type of motor, it could very well be an induction, series, synchronous, stepper, asynchronous, DC brushless, DC brush motor, the subcombination is specifically directed to electronically commutated motors. The subcombination has separate utility such as refrigerators and compressor pumps.