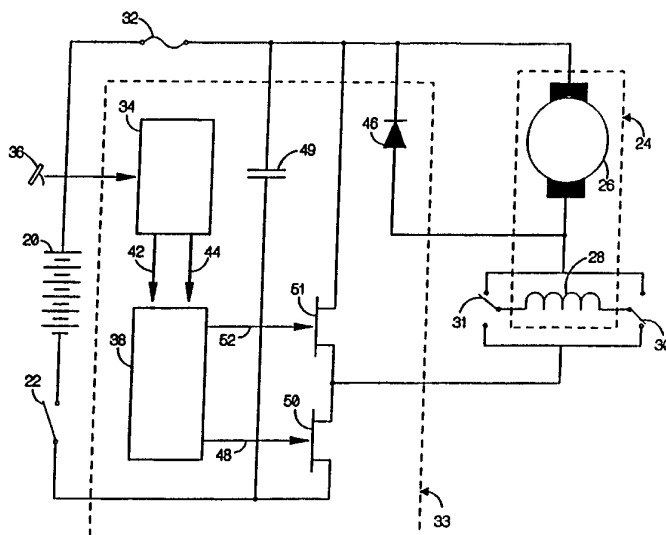




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁵ : H02P 5/17, 7/29</p>	<p>A3</p>	<p>(11) International Publication Number: WO 93/20611 (43) International Publication Date: 14 October 1993 (14.10.93)</p>
<p>(21) International Application Number: PCT/CA93/00131 (22) International Filing Date: 30 March 1993 (30.03.93) (30) Priority data: 07/859,226 30 March 1992 (30.03.92) US (71) Applicant: SOLARIA RESEARCH ENTERPRISES LTD. [CA/CA]; 440 Phillip Street, Unit 21, Waterloo, Ontario N2L 5R9 (CA). (72) Inventors: LANKIN, Robert ; 134 Keatsway Place, Waterloo, Ontario N2L 5H3 (CA). LANKIN, Andrew, E. ; 510 D, Albert Street, Waterloo, Ontario N2L 3V4 (CA). HELLINGA, Richard, J. ; 163 Margaret Avenue, Kitchener, Ontario N2H 4H8 (CA).</p>		<p>(74) Agent: WOOD, Max, R.; Scott & Ayles, 60 Queen Street, Ottawa, Ontario K1P 5Y7 (CA). (81) Designated States: AU, BB, BG, BR, CA, CZ, FI, HU, JP, KP, KR, LK, MG, MN, MW, NO, NZ, PL, RO, RU, SD, SK, UA, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i> (88) Date of publication of the international search report: 6 January 1994 (06.01.94)</p>

(54) Title: SYNCHRONOUS-RECTIFICATION TYPE CONTROL FOR DIRECT CURRENT MOTORS AND METHOD OF MAKING



(57) Abstract

A MOSFET (50, 51) control topology and a physical structure for a motor control which provide a more efficient and economic DC motor control are disclosed. The control topology introduces a synchronous-rectification technique wherein free-wheel diodes are replaced with MOSFET (50, 51) devices that are switched on and off by a logic circuit (38) so that they are conductive for commuting motor current during periods that the motor (24) current supply is switched off. The physical structure and method of assembling a DC motor control (33) eliminate time consuming assembly techniques while ensuring effective waste heat exchange between electronic components (46, 50, 51) and a heat sink (96) of the control (33) by providing quick-install spring retainers (110) for urging the components (46, 50, 51) into heat conducting contact with the heat sink (96). The physical structure also provides for high density packing of electronic components (46, 50, 51) in the control (33).

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	FR	France	MR	Mauritania
AU	Australia	GA	Gabon	MW	Malawi
BB	Barbados	GB	United Kingdom	NE	Niger
BE	Belgium	GN	Guinea	NL	Netherlands
BF	Burkina Faso	GR	Greece	NO	Norway
BG	Bulgaria	HU	Hungary	NZ	New Zealand
BJ	Benin	IE	Ireland	PL	Poland
BR	Brazil	IT	Italy	PT	Portugal
BY	Belarus	JP	Japan	RO	Romania
CA	Canada	KP	Democratic People's Republic of Korea	RU	Russian Federation
CF	Central African Republic	KR	Republic of Korea	SD	Sudan
CG	Congo	KZ	Kazakhstan	SE	Sweden
CH	Switzerland	LI	Liechtenstein	SI	Slovenia
CI	Côte d'Ivoire	LK	Sri Lanka	SK	Slovak Republic
CM	Cameroon	LU	Luxembourg	SN	Senegal
CN	China	LV	Latvia	TD	Chad
CS	Czechoslovakia	MC	Monaco	TG	Togo
CZ	Czech Republic	MG	Madagascar	UA	Ukraine
DE	Germany	ML	Mali	US	United States of America
DK	Denmark	MN	Mongolia	UZ	Uzbekistan
ES	Spain			VN	Viet Nam
FI	Finland				

INTERNATIONAL SEARCH REPORT

International Application No

PCT/CA 93/00131

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int.Cl.5	H 02 P 5/17	H 02 P 7/29
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
Int.Cl.5	H 02 P 5/00	H 02 P 7/00
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹		
Category ^o	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
X	US,A,4906906 LAUTZENHISER et al. 06 March 1990 06.03.90, fig. 9B,10,12; corresp. text. ---	1,7,8
Y	US,A,4626750 POST 02 December 1986 02.12.86, abstract; fig. 1,5. ---	1
Y	US,A,4859921 ARCHERI 22 August 1989 22.08.89, abstract; fig. 1-8. -----	1
<p>^o Special categories of cited documents : ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"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</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"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.</p> <p>"&" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
26-05-1993	01.12.93	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	KUTZELNIG	

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CA93/00131

Box I Observations where certain claims were found unsearchable (Continuation of item 1 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 II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. Claims 1-8
2. Claims 9-18

For further information please see form PCT/ISA/206 mailed 03.09.93.

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.:

1-8

Remark on Protest

- The additional search fees were accompanied by the applicant's protest.
- No protest accompanied the payment of additional search fees.

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.**

CA 9300131
SA 71874

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 15/11/93
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 4906906	06-03-90	AU-A- 8172587	01-06-88
		CA-A- 1292795	03-12-91
		CA-A- 1292796	03-12-91
		EP-A- 0328546	23-08-89
		WO-A- 8803400	19-05-88
		US-A- 4978899	18-12-90
		US-A- 5012165	30-04-91
US-A- 4626750	02-12-86	CN-A- 86105486	11-03-87
		DE-A- 3684841	21-05-92
		EP-A, B 0215325	25-03-87
		JP-C- 1685004	31-07-92
		JP-B- 3048752	25-07-91
		JP-A- 62060494	17-03-87
US-A- 4859921	22-08-89	CA-A- 1299646	28-04-92
		EP-A- 0365618	02-05-90
		JP-T- 2503500	18-10-90
		WO-A- 8908951	21-09-89