

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
28 December 2006 (28.12.2006)

PCT

(10) International Publication Number
WO 2006/136801 A3

- (51) International Patent Classification:
H02M 7/17 (2006.01) H02M 7/23 (2006.01)
- (21) International Application Number:
PCT/GB2006/002239
- (22) International Filing Date: 20 June 2006 (20.06.2006)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
0512763.4 23 June 2005 (23.06.2005) GB
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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, RS, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, 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).

Declaration under Rule 4.17:

— as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))

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

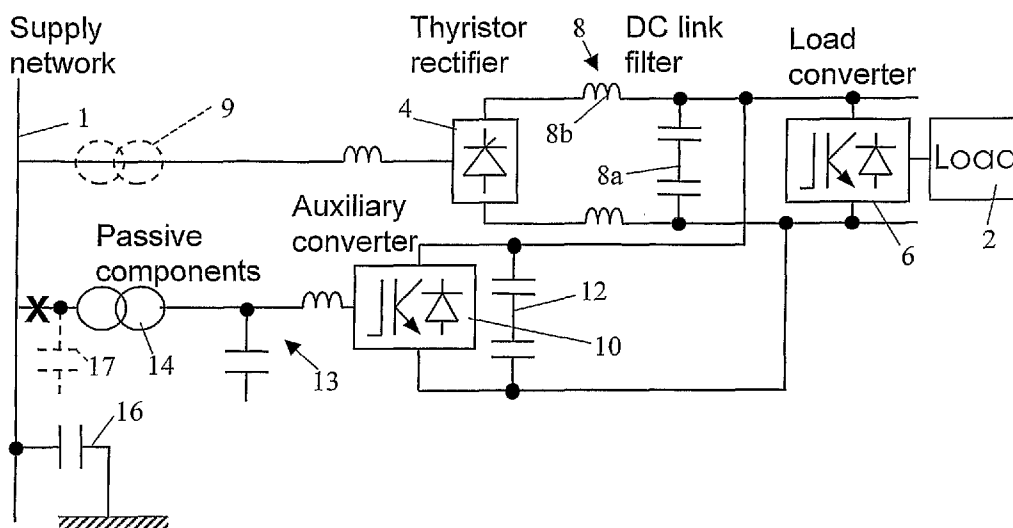
(88) Date of publication of the international search report:

13 December 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.

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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,

(54) Title: IMPROVEMENTS IN ELECTRICAL POWER CONVERTERS



(57) Abstract: An electric power converter combination converts AC power from a main AC supply network (1) to DC power to supply a DC load (2), the converter combination comprising a phase controlled thyristor supply bridge rectifier (4) and an auxiliary PWM converter (10) connected across a DC output filter (8) of the thyristor supply bridge (4), the auxiliary PWM converter (10) also being connected to a power supply comprising either the main AC supply network (1), an AC supply independent of the main AC supply network, or a low voltage DC supply.

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INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2006/002239

A. CLASSIFICATION OF SUBJECT MATTER
 INV. H02M7/17 H02M7/23

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)
 H02M H02J

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	SATO Y ET AL: "Hybrid pwm rectifiers to reduce electromagnetic interference" CONFERENCE RECORD OF THE 2002 IEEE INDUSTRY APPLICATIONS CONFERENCE. 37TH IAS ANNUAL MEETING . PITTSBURGH, PA, OCT. 13 - 18, 2002, CONFERENCE RECORD OF THE IEEE INDUSTRY APPLICATIONS CONFERENCE. IAS ANNUAL MEETING, NEW YORK, NY : IEEE, US, vol. 1 OF 4. CONF. 37, 13 October 2002 (2002-10-13), pages 2141-2146, XP010610171 ISBN: 0-7803-7420-7	1,2,4-9, 13, 19-24, 32-36, 41-45, 47,51
Y	page 1, paragraphs I,II	3,10-12, 14, 25-31, 46,48-50

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
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- *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
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- **&* document member of the same patent family

Date of the actual completion of the international search

Date of mailing of the international search report

30 May 2007

24/10/2007

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INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2006/002239

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	IN GYU PARK ET AL: "A Thyristor Phase-Controlled Voltage-Source Converter with Bidirectional Power Flow Capability" IEEE TRANSACTIONS ON INDUSTRY APPLICATIONS, IEEE SERVICE CENTER, PISCATAWAY, NJ, US, vol. 34, no. 5, October 1998 (1998-10), XP011022455 ISSN: 0093-9994 paragraph [000V]; figure 20	1,2,23, 24,45
Y	LOSIC N A ET AL: "Modeling and design of a vector-controlled PWM active rectifier" IECON'01. PROCEEDINGS OF THE 27TH. ANNUAL CONFERENCE OF THE IEEE INDUSTRIAL ELECTRONICS SOCIETY. DENVER, CO, NOV. 29 - DEC. 2, 2001, ANNUAL CONFERENCE OF THE IEEE INDUSTRIAL ELECTRONICS SOCIETY, NEW YORK, NY : IEEE, US, vol. VOL. 1 OF 3. CONF. 27, 29 November 2001 (2001-11-29), pages 1096-1101, XP010572931 ISBN: 0-7803-7108-9 paragraph [000I]; figure 1	46
A	BLASKO V: "Power conditions and control of a regenerative brake" INDUSTRY APPLICATIONS CONFERENCE, 1998. THIRTY-THIRD IAS ANNUAL MEETING. THE 1998 IEEE ST. LOUIS, MO, USA 12-15 OCT. 1998, NEW YORK, NY, USA, IEEE, US, vol. 2, 12 October 1998 (1998-10-12), pages 1504-1510, XP010313021 ISBN: 0-7803-4943-1 paragraphs [000I], [00II] - [000A]; figure 1	1,2,4,5, 47
Y	ZHIHONG YE ET AL: "Control of circulating current in parallel three-phase boost rectifiers" APPLIED POWER ELECTRONICS CONFERENCE AND EXPOSITION, 2000. APEC 2000. FIFTEENTH ANNUAL IEEE NEW ORLEANS, LA, USA 6-10 FEB. 2000, PISCATAWAY, NJ, USA, IEEE, US, vol. 1, 6 February 2000 (2000-02-06), pages 506-512, XP010371770 ISBN: 0-7803-5864-3 paragraphs [000I], [0III]; figures 1,10	48,49
A	ZHIHONG YE ET AL: "Control of circulating current in parallel three-phase boost rectifiers" APPLIED POWER ELECTRONICS CONFERENCE AND EXPOSITION, 2000. APEC 2000. FIFTEENTH ANNUAL IEEE NEW ORLEANS, LA, USA 6-10 FEB. 2000, PISCATAWAY, NJ, USA, IEEE, US, vol. 1, 6 February 2000 (2000-02-06), pages 506-512, XP010371770 ISBN: 0-7803-5864-3 paragraphs [000I], [0III]; figures 1,10	1,2,4,5
Y	ZHIHONG YE ET AL: "Control of circulating current in parallel three-phase boost rectifiers" APPLIED POWER ELECTRONICS CONFERENCE AND EXPOSITION, 2000. APEC 2000. FIFTEENTH ANNUAL IEEE NEW ORLEANS, LA, USA 6-10 FEB. 2000, PISCATAWAY, NJ, USA, IEEE, US, vol. 1, 6 February 2000 (2000-02-06), pages 506-512, XP010371770 ISBN: 0-7803-5864-3 paragraphs [000I], [0III]; figures 1,10	50
A	ZHIHONG YE ET AL: "Control of circulating current in parallel three-phase boost rectifiers" APPLIED POWER ELECTRONICS CONFERENCE AND EXPOSITION, 2000. APEC 2000. FIFTEENTH ANNUAL IEEE NEW ORLEANS, LA, USA 6-10 FEB. 2000, PISCATAWAY, NJ, USA, IEEE, US, vol. 1, 6 February 2000 (2000-02-06), pages 506-512, XP010371770 ISBN: 0-7803-5864-3 paragraphs [000I], [0III]; figures 1,10	1,2,4,5

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INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2006/002239

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>EJEA J B ET AL: "High - frequency bi-directional three - phase rectifier with power factor correction" 32ND.ANNUAL IEEE POWER ELECTRONICS SPECIALISTS CONFERENCE. PESC 2001. CONFERENCE PROCEEDINGS. VANCOUVER, CANADA, JUNE 17 - 21, 2001, ANNUAL POWER ELECTRONICS SPECIALISTS CONFERENCE, NEW YORK, NY : IEEE, US, vol. VOL. 1 OF 4. CONF. 32, 17 June 2001 (2001-06-17), pages 1303-1308, XP010559409 ISBN: 0-7803-7067-8 paragraph [000I]; figure 2</p>	<p>3,10-12, 14,25-31</p>
A	<p>YUKIHIKO SATO ET AL: "A Current-Type PWM Rectifier with Active Damping Function" IEEE TRANSACTIONS ON INDUSTRY APPLICATIONS, IEEE SERVICE CENTER, PISCATAWAY, NJ, US, vol. 32, no. 3, June 1996 (1996-06), XP011022020 ISSN: 0093-9994 paragraphs [00IV] - [000B]; figure 12</p>	<p>1,2,4,5, 47</p>
A	<p>FR 2 737 946 A1 (ELECTRICITE DE FRANCE [FR]) 21 February 1997 (1997-02-21) claim 1; figure 1</p>	<p>1,2,4,5, 48,49</p>

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2006/002239

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, 2-14, 19-36, 41-51

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: 1,2-14,19-36,41-51

Power system with an auxiliary converter having its supply means connected to the main Ac supply network and methods of operating such a power system

2. claims: 1,15-18,23,24,37,52

Power system with an auxiliary converter having its supply means connected to an AC supply separate from the main AC supply network and method of operating such a power system

3. claims: 1,16-18,23,24,38-40,53

Power system with an auxiliary converter having its supply means connected to a low voltage DC supply and method of operating such a power system

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2006/002239

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR 2737946	A1	NONE	