



- (51) International Patent Classification:  
*H02M 7/217* (2006.01)
- (21) International Application Number:  
PCT/EP2012/071673
- (22) International Filing Date:  
2 November 2012 (02.11.2012)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
11187884.9 4 November 2011 (04.11.2011) EP  
12176840.2 18 July 2012 (18.07.2012) EP
- (71) Applicant: **ALSTOM TECHNOLOGY LTD.** [CH/CH];  
Brown Boveri Strasse 7, CH-5400 Baden (CH).
- (72) Inventors: **SOEIRO, Thiago Batista**; Grosswiesenstrasse  
42, CH-8051 Zürich (CH). **KOLAR, Johann Walter**;  
Zürichbergstrasse 124, CH-8044 Zürich (CH). **RAN-  
STAD, Per**; Bergundavägen 34, S-352 35 Växjö (SE).  
**LINNER, Jörgen**; Södergatan 12, S-352 35 Växjö (SE).
- (74) Agent: **SIMONSSON, Erik**; Awapatent AB, P.O. Box 99,  
S-351 04 Växjö (SE).
- (81) Designated States (unless otherwise indicated, for every  
kind of national protection available): AE, AG, AL, AM,  
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,  
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,  
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,  
HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP,  
KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD,  
ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI,  
NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU,  
RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, 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, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,  
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,  
TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,  
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,  
MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,  
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,  
ML, MR, NE, SN, TD, TG).

[Continued on next page]

- (54) Title: HYBRID RECTIFIER AND METHOD FOR OPERATING SUCH HYBRID RECTIFIER

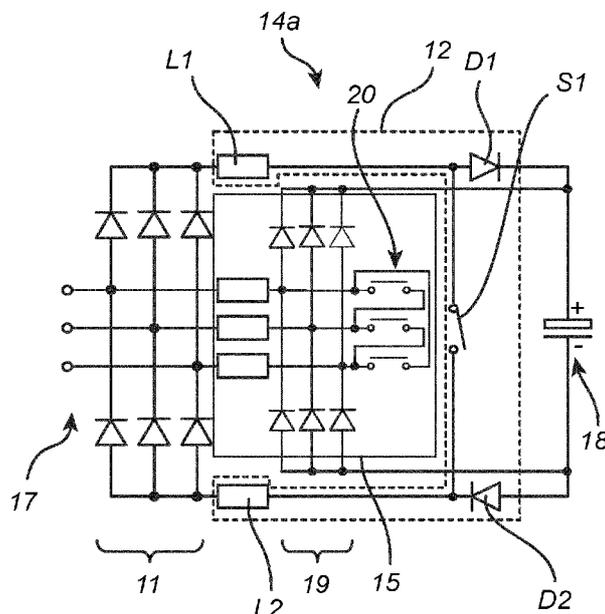


Fig. 4

(57) Abstract: A hybrid rectifier (14a) comprises a line-commutated rectifier (11) and a self-commutated rectifier (15) working in parallel between a 3-phase AC input (17) and a DC output (18). The efficiency of the rectifier is improved by choosing said self-commutated rectifier (15) to be a 2-level unidirectional delta-switch rectifier.



**Published:**

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

17 October 2013

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

# INTERNATIONAL SEARCH REPORT

International application No <b>PCT/EP2012/071673</b>
--

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> INV. H02M7/217 ADD.		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b>		
Minimum documentation searched (classification system followed by classification symbols) H02M		
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) EPO-Internal		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	ALVES ET AL: "A Novel Unidirectional Hybrid Three-Phase Rectifier System Employing Boost Topology", POWER ELECTRONICS SPECIALISTS CONFERENCE, 2005. PESC '05. IEEE 36TH, IEEE, PISCATAWAY, NJ, USA, 1 January 2005 (2005-01-01), pages 487-493, XP031000213, DOI: 10.1109/PESC.2005.1581669 ISBN: 978-0-7803-9033-1 the whole document ----- -/--	1-9
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <span style="margin-left: 200px;"><input type="checkbox"/> See patent family annex.</span>		
* 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 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	Date of mailing of the international search report	
23 August 2013	03/09/2013	
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer  Jansen, Helma	

**INTERNATIONAL SEARCH REPORT**

International application No PCT/EP2012/071673
---

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>SALMON J C: "Circuit topologies for PWM boost rectifiers operated from 1-phase and 3-phase AC supplies and using either single or split DC rail voltage outputs", APPLIED POWER ELECTRONICS CONFERENCE AND EXPOSITION, 1995. APEC '95. C ONFERENCE PROCEEDINGS 1995., TENTH ANNUAL DALLAS, TX, USA 5-9 MARCH 1995, NEW YORK, NY, USA, IEEE, US, 5 March 1995 (1995-03-05), pages 473-479, XP010147626, DOI: 10.1109/APEC.1995.468990 ISBN: 978-0-7803-2482-4 the whole document -----</p>	1-9