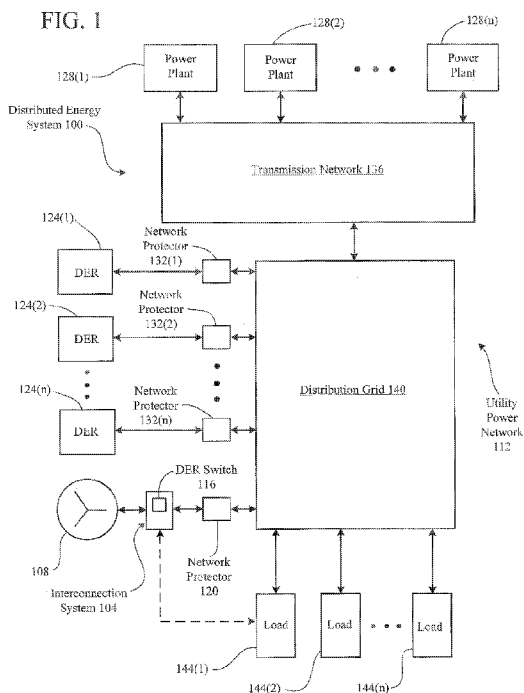




- (51) **International Patent Classification:**  
H02J 3/00 (2006.01) H02H 7/22 (2006.01)  
H02J 3/38 (2006.01)
- (21) **International Application Number:**  
PCT/US2010/037984
- (22) **International Filing Date:**  
9 June 2010 (09.06.2010)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**  
12/483,546 12 June 2009 (12.06.2009) US
- (71) **Applicant (for all designated States except US):**  
NORTHERN POWER SYSTEMS, INC. [US/US]; 29  
Pitman Road, Barre, VT 05641 (US).
- (72) **Inventors; and**
- (75) **Inventors/Applicants (for US only):** BENEDICT, Eric,  
L. [US/US]; 11 Upper Sunny Brook Road, Middlesex,  
VT 05602 (US). JOHN, Vinod [IN/IN]; #5 Nandi View  
Layout, Dinnur Main Road, R.T. Nagar, Bangalore  
560032 (IN).
- (74) **Agent:** HELLER II, Morgan, S.; Downs Rachlin Martin  
PLLC, 199 Main Street, P.O. Box 190, Burlington, VT  
05402-0190 (US).
- (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, 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, PE, PG, PH, PL, PT, RO, RS, RU, 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, SD, SL, SZ, TZ, UG,  
ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, 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, 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:** INTERCONNECTION SWITCHING SYSTEM AND METHOD FOR CONNECTING A DISTRIBUTED ENERGY RESOURCE TO AN ELECTRICAL POWER SYSTEM



(57) **Abstract:** A distributed energy resource (DER) switching system and method for connecting a DER to an electrical power system (EPS) protector, wherein the DER has a reactance-to-resistance ratio higher than the reactance-to-resistance ratio of the EPS protector. The DER switching system includes an input for receiving power from the DER, and an output for providing power from the DER to the EPS protector. The DER switching system is designed to effectively lower the higher reactance-to-resistance ratio of the DER during an over-current fault so that, during the fault, the effective reactance-to-resistance ratio at the output of the DER switching system is lower than the reactance-to-resistance ratio of the EPS protector. The method includes effectively lowering the reactance-to-resistance ratio of the DER by varying the operating state of a switching device in a controlled manner during the fault.

WO 2010/144584 A3



**Published:**

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

- *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))*

3 March 2011

## INTERNATIONAL SEARCH REPORT

International application No.  
**PCT/US2010/037984****A. CLASSIFICATION OF SUBJECT MATTER****H02J 3/00(2006.01)i, H02J 3/38(2006.01)i, H02H 7/22(2006.01)i**

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)

H02J 3/00; G06F 17/10; G06F 19/00; H02H 5/04; H02H 3/00; G05F 1/16; H02B 1/015

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKOMPASS(KIPO internal) &amp; Keywords: distributed energy resource, electrical power system, switch, reactance-to-resistance, X/R

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2007-0213956 A1 (NASLE ADIB et al.) 13 September 2007 See abstract; claims 1, 10-11, 14-15, 18-19; figures 11-13.	1-35
A	US 2008-0204961 A1 (O'LEARY RAYMOND P. et al.) 28 August 2008 See abstract; claims 1-2, 7, 9-10, 17; figures 1, 6.	1-35
A	US 5841618 A (DILKES; GRAHAM et al.) 24 November 1998 See abstract; claims 1-2, 4, 6; figure 2.	1-35
A	US 5604423 A (DEGENEFF; ROBERT C. et al.) 18 February 1997 See abstract; claims 1, 5-6, 15, 22, 39; figure 1.	1-35
A	US 2008-0203826 A1 (CHUNG WOON TAE) 28 August 2008 See abstract; claims 1, 7; figure 3.	1-35

 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 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 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

"&amp;" document member of the same patent family

Date of the actual completion of the international search

31 DECEMBER 2010 (31.12.2010)

Date of mailing of the international search report

**31 DECEMBER 2010 (31.12.2010)**

Name and mailing address of the ISA/KR

Korean Intellectual Property Office  
Government Complex-Daejeon, 139 Seonsa-ro, Seo-  
gu, Daejeon 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

WEE Jae Woo

Telephone No. 82-42-481-8540



**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/US2010/037984**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2007-0213956 A1	13.09.2007	AU 2007-225261 A1	20.09.2007
		AU 2007-238094 A1	25.10.2007
		AU 2007-264973 A1	03.01.2008
		AU 2007-264998 A1	03.01.2008
		AU 2007-269045 A1	10.01.2008
		AU 2007-269093 A1	10.01.2008
		AU 2007-275224 A1	24.01.2008
		AU 2007-275451 A1	24.01.2008
		AU 2007-308995 A1	02.05.2008
		AU 2008-251610 A1	20.11.2008
		AU 2008-284225 A1	12.02.2009
		AU 2008-304566 A1	02.04.2009
		AU 2008-310904 A1	16.04.2009
		CA 2646423-A1	20.09.2007
		CA 2648953-A1	25.10.2007
		CA 2653606-A1	03.01.2008
		CA 2653613-A1	03.01.2008
		CA 2655199-A1	10.01.2008
		CA 2655630-A1	10.01.2008
		CA 2657038-A1	24.01.2008
		CA 2657330-A1	24.01.2008
		CA 2668329-A1	02.05.2008
		CA 2684566-A1	20.11.2008
		CA 2684665-A1	12.02.2009
		CA 2698606-A1	02.04.2009
		CA 2699867-A1	16.04.2009
		EP 1991929 A2	19.11.2008
		EP 1991929 A4	03.03.2010
		EP 2005202 A2	24.12.2008
		EP 2033060 A2	11.03.2009
		EP 2033129 A2	11.03.2009
		EP 2038782 A2	25.03.2009
		EP 2041637 A2	01.04.2009
		EP 2044498 A2	08.04.2009
		EP 2047396 A2	15.04.2009
		EP 2076858 A2	08.07.2009
		EP 2147387 A1	27.01.2010
		EP 2147411 A1	27.01.2010
		EP 2193467 A1	09.06.2010
		EP 2201489 A1	30.06.2010
		N020084226A	10.12.2008
		US 2007-0192078 A1	16.08.2007
		US 2007-0239373 A1	11.10.2007
		US 2007-0285079 A1	13.12.2007
		US 2007-0286089 A1	13.12.2007
		US 2008-0004853 A1	03.01.2008
		US 2008-0049013 A1	28.02.2008
		US 2008-0077368 A1	27.03.2008
		US 2008-0120080 A1	22.05.2008

## INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

**PCT/US2010/037984**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		US 2008-0167844 A1	10.07.2008
		US 2008-0215302 A1	04.09.2008
		US 2008-0262820 A1	23.10.2008
		US 2008-0263469 A1	23.10.2008
		US 7693608 B2	06.04.2010
		US 7729808 B2	01.06.2010
		US 7826990 B2	02.11.2010
		US 7840395 B2	23.11.2010
		US 7840396 B2	23.11.2010
		US 7844439 B2	30.11.2010
		US 7844440 B2	30.11.2010
		WO 2007-106430 A2	20.09.2007
		WO 2007-106430 A3	20.09.2007
		WO 2007-121322 A2	25.10.2007
		WO 2007-121322 A3	25.10.2007
		WO 2008-003033 A2	03.01.2008
		WO 2008-003033 A3	03.01.2008
		WO 2008-003088 A2	03.01.2008
		WO 2008-003088 A3	03.01.2008
		WO 2008-006073 A2	10.01.2008
		WO 2008-006073 A3	10.01.2008
		WO 2008-006116 A2	10.01.2008
		WO 2008-006116 A3	10.01.2008
		WO 2008-011332 A2	24.01.2008
		WO 2008-011332 A3	24.01.2008
		WO 2008-011563 A2	24.01.2008
		WO 2008-011563 A3	24.01.2008
		WO 2008-052042 A2	02.05.2008
		WO 2008-052042 A3	02.05.2008
		WO 2008-141046 A1	20.11.2008
		WO 2009-020684 A1	12.02.2009
		WO 2009-042581 A1	02.04.2009
		WO 2009-048963 A1	16.04.2009
US 2008-0204961 A1	28.08.2008	None	
US 5841618 A	24.11.1998	AU 1996-65749 B2	01.06.2000
		GB 2305556 A	09.04.1997
US 5604423 A	18.02.1997	US 05604423A A	18.02.1997
US 2008-0203826 A1	28.08.2008	CN 101164211 A0	16.04.2008
		EP 1878099 A1	16.01.2008
		EP 1878099 A4	09.07.2008
		JP 2008-541681 A	20.11.2008
		KR 10-0740801 B1	19.07.2007
		KR 20-0428102 Y1	09.10.2006
		KR20060114640A	07.11.2006
		RU 2007143590 A	20.06.2009
		US 2008-203826 A1	28.08.2008

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International application No.

**PCT/US2010/037984**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		WO 2006-118419 A1	09.11.2006