

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
23 February 2006 (23.02.2006)

PCT

(10) International Publication Number  
**WO 2006/020587 A3**

(51) International Patent Classification:

*H02P 1/54* (2006.01)      *H02P 5/46* (2006.01)  
*H02P 5/00* (2006.01)      *H02P 3/00* (2006.01)

North East, PA (US). TARNOW, Andrew, C. [US/US];  
Rockdale, PA (US).

(21) International Application Number:

PCT/US2005/028178

(74) Agents: SWARTZ, Douglas, W. et al.; Sheridan Ross  
P.C., 1560 Broadway, Suite 1200, Denver, CO 80202-5141  
(US).

(22) International Filing Date: 9 August 2005 (09.08.2005)

(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,  
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,  
KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA,  
MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ,  
OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL,  
SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC,  
VN, YU, ZA, ZM, ZW.

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

60/600,330      9 August 2004 (09.08.2004)      US  
60/616,173      4 October 2004 (04.10.2004)      US  
60/618,631      13 October 2004 (13.10.2004)      US

(71) Applicant (for all designated States except US):  
RAILPOWER TECHNOLOGIES CORP. [CA/CA];  
Suite 202, 50 Fell Avenue, North Vancouver, B.C. V7P  
3S2 (CA).

(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).

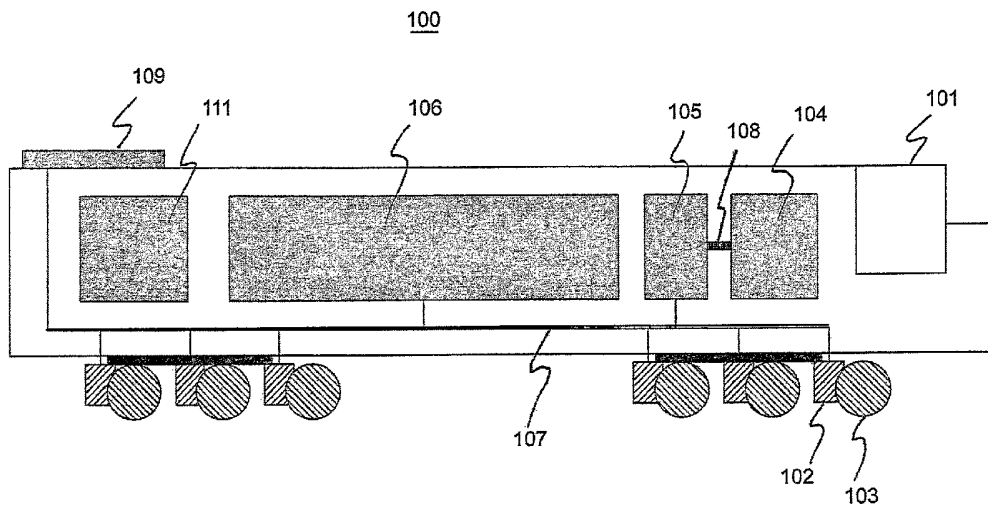
(72) Inventors; and

(75) Inventors/Applicants (for US only): DONNELLY,  
Franck, Wegner [CA/CA]; 509 East 6th Street, North  
Vancouver, British Columbia V7L 1R2 (CA). WATSON,  
John, David [US/US]; 34804 West Meadow Road, Ever-  
green, CO 80439 (US). BAILEY, Ronald, B. [US/US];

Published:  
— with international search report

[Continued on next page]

(54) Title: REGENERATIVE BRAKING METHODS FOR A HYBRID LOCOMOTIVE



(57) Abstract: The present invention relates generally to regenerative braking methods for a hybrid vehicle such as a hybrid loco-  
motive, which are compatible with optimum management of a large battery pack energy storage system. Four methods for recovering  
energy from regenerative braking and for transferring this energy to an energy storage systems are disclosed. These methods may  
also be used with battery operated vehicles.

WO 2006/020587 A3



— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

*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.*

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

7 December 2006

**INTERNATIONAL SEARCH REPORT**

International application No.

PCT/US05/28178

<p><b>A. CLASSIFICATION OF SUBJECT MATTER</b></p> <p>IPC: H02P 1/54( 2006.01),H02P 5/00 H02P 5/46 H02P 3/00( 2006.01)</p> <p>USPC: 318/34</p> <p>According to International Patent Classification (IPC) or to both national classification and IPC</p>												
<p><b>B. FIELDS SEARCHED</b></p> <p>Minimum documentation searched (classification system followed by classification symbols) U.S. : 318/34, 318/362</p> <p>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched</p> <p>Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EAST</p>												
<p><b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b></p> <table border="1"> <thead> <tr> <th>Category *</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>US 5629596 (Iijima et al 13 May 1997 (13.05.1997), Fig. 1, Entire document</td> <td>1-56</td> </tr> <tr> <td>A</td> <td>US 5710699 (king et al) 20 January 1998 (20.01.1998), fig. 1, entire document.</td> <td>1-56</td> </tr> </tbody> </table>			Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	US 5629596 (Iijima et al 13 May 1997 (13.05.1997), Fig. 1, Entire document	1-56	A	US 5710699 (king et al) 20 January 1998 (20.01.1998), fig. 1, entire document.	1-56	
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.										
X	US 5629596 (Iijima et al 13 May 1997 (13.05.1997), Fig. 1, Entire document	1-56										
A	US 5710699 (king et al) 20 January 1998 (20.01.1998), fig. 1, entire document.	1-56										
<p><input type="checkbox"/> Further documents are listed in the continuation of Box C.      <input type="checkbox"/> See patent family annex.</p>												
<p>* Special categories of cited documents:</p> <table border="0"> <tr> <td>"A" document defining the general state of the art which is not considered to be of particular relevance</td> <td>"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</td> </tr> <tr> <td>"E" earlier application or patent published on or after the international filing date</td> <td>"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</td> </tr> <tr> <td>"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)</td> <td>"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</td> </tr> <tr> <td>"O" document referring to an oral disclosure, use, exhibition or other means</td> <td>"&amp;" document member of the same patent family</td> </tr> <tr> <td>"P" document published prior to the international filing date but later than the priority date claimed</td> <td></td> </tr> </table>			"A" document defining the general state of the art which is not considered to be of particular relevance	"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	"E" earlier application or patent published on or after the international filing date	"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	"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)	"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	"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family	"P" document published prior to the international filing date but later than the priority date claimed	
"A" document defining the general state of the art which is not considered to be of particular relevance	"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											
"E" earlier application or patent published on or after the international filing date	"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											
"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)	"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											
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family											
"P" document published prior to the international filing date but later than the priority date claimed												
<p>Date of the actual completion of the international search 03 September 2006 (03.09.2006)</p>		<p>Date of mailing of the international search report <b>10 OCT 2006</b></p>										
<p>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</p>		<p>Authorized officer <i>Ronnda for Bell</i> Lincoln Donovan Telephone No. (571) 272-2800</p>										