



(51) International Patent Classification:
H01L 31/042 (2006.01)

MA 01642 (US). **KING, Zachary, Adam** [US/US]; 15
Turner Road, Townsend, MA 01469 (US).

(21) International Application Number:
PCT/US2009/044690

(74) Agent: **FOSTER, Scott, R.**; Pandiscio & Pandiscio, P.C.,
470 Totten Pond Road, Waltham, MA 02451 (US).

(22) International Filing Date:
20 May 2009 (20.05.2009)

(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, 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, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG,
SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA,
UG, US, UZ, VC, VN, ZA, ZM, ZW.

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/128,219 20 May 2008 (20.05.2008) US

(71) Applicant (*for all designated States except US*):
GREENRAY, INC. [US/US]; Suite E-1, 7 Littleton
Road, Westford, MA 01886 (US).

(72) Inventors; and

(75) Inventors/Applicants (*for US only*): **RUSSELL, Miles,**
Clayton [US/US]; Suite E-1, 7 Littleton Road, Westford,
MA 01886 (US). **KERN, Gregory, Allen** [US/US]; 442
South 112th Street, Lafayette, CO 80026 (US). **LITTLE,**
Ruel, Davenport [US/US]; 57 Monsen Road, Concord,

(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, HR, HU, IE, IS, IT, LT, LU, LV,
MC, MK, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR),

[Continued on next page]

(54) Title: AN AC PHOTOVOLTAIC MODULE AND INVERTER ASSEMBLY

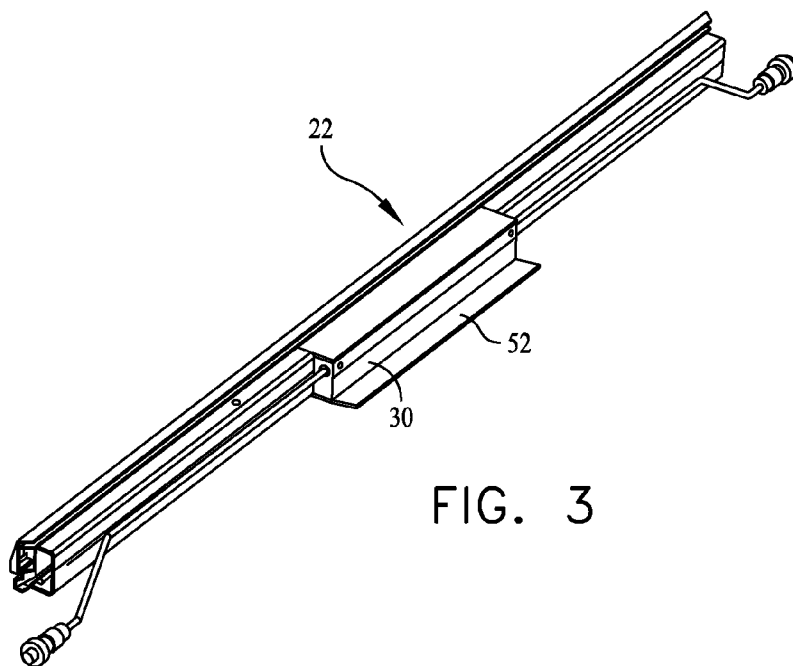


FIG. 3

(57) Abstract: An AC photovoltaic module includes a DC photovoltaic module for converting solar energy to DC electrical power, and an inverter for converting DC electrical power to AC electrical power, the inverter being adapted for connection to a frame portion of the module and being sized and configured, and provided with arrangements of electrical components thereof, to dispense heat from the inverter, whereby to prolong operational life and reliability of the inverter.

WO 2009/143253 A3



OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG). (88) Date of publication of the international search report:
14 January 2010

Published:

— *with international search report (Art. 21(3))*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2009/044690

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - H01L 31/042 (2009.01)

USPC - 136/244

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)

IPC(8) - H01L 31/04, 31/042, 31/048 (2009.01)

USPC - 136/243-265

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)

USPTO EAST System (US, USPG-PUB, EPO, DERWENT), PatBase, Google Patent

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6,750,391 B2 (BOWER et al) 15 June 2004 (15.06.2004) entire document	1-5, 19
X	DE 20012131 U1 (PATZ) 22 February 2001 (22.02.2001) entire document	1,6-10, 12, 18
---		---
Y		11, 13-17, 20-25, 28-19, 31
Y	US 6,791,024 B2 (TOYOMURA) 14 September 2004 (14.09.2004) entire document	11, 13-17, 22-25, 31
Y	US 6,804,127 B2 (ZHOU) 12 October 2004 (12.10.2004) entire document	20-30
Y	US 6,654,261 B2 (WELCHES et al) 25 November 2003 (25.11.2003) entire document	26-30
A	US 6,593,521 B2 (KOBAYASHI) 15 July 2003 (15.07.2003) see Fig. 2	1-30

☐ Further documents are listed in the continuation of Box C.


* 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

28 August 2009

Date of mailing of the international search report

04 SEP 2009

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

Authorized officer:

Blaine R. Copenheaver

PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2009/044690

Box No. 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 No. 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 extra 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 additional fees, this Authority did not invite payment of additional fees.
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.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☒ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2009/044690

Continuation of Box III.

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I – Claims 1-19 and 31 reciting an AC photovoltaic module including an inverter for DC/AC power conversion wherein the inverter comprises a narrow elongated body adapted to be mounted proximate an outer edge of a DC photovoltaic module such that an elongated side of the inverter is fixed in abutting relationship to the outer edge of the DC photovoltaic module.

Group II – Claims 20-30 reciting an inverter for DC/AC power conversion wherein the inverter includes film capacitor means or a set of at least one film capacitor.

The inventions listed as Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical feature of the Group I invention: a narrow elongated body adapted to be mounted proximate an outer edge of a DC photovoltaic module such that an elongated side of the inverter is fixed in abutting relationship to the outer edge of the DC photovoltaic module as claimed therein is not present in the invention of Group II. The special technical feature of the Group II invention: a film capacitor means or a set of at least one film capacitor as claimed therein is not present in the invention of Groups I.

Groups I and II lack unity of invention because even though the inventions of these groups require the technical feature of an inverter for DC/AC power conversion being mounted proximate to an edge of a DC photovoltaic module, this technical feature is not a special technical feature as it does not make a contribution over the prior art in view of US 6,593,521 B2 (KOBAYASHI) 15 July 2003, see Fig. 2 – inverter (20) mounted at edge of solar cells (15).

Since none of the special technical features of the Group I or II inventions are found in more than one of the inventions, unity of invention is lacking.