



- (51) **International Patent Classification:**
F24J 2/52 (2006.01) E04B 1/19 (2006.01)
F24J 2/14 (2006.01)
- (21) **International Application Number:**
PCT/US2012/034254
- (22) **International Filing Date:**
19 April 2012 (19.04.2012)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
61/476,964 19 April 2011 (19.04.2011) US
- (71) **Applicant (for all designated States except US):** ABENGOA SOLAR INC. [US/US]; 11500 W. 13th Avenue, Lakewood, CO 80215 (US).
- (72) **Inventors; and**
- (75) **Inventors/Applicants (for US only):** EISINGER, Joseph [US/US]; 11500 W. 13th Avenue, Lakewood, CO 80215 (US). MANNING, Kerry [US/US]; 11500 W. 13th Avenue, Lakewood, CO 80215 (US). MARCOTTE, Patrick [US/US]; 11500 W. 13th Avenue, Lakewood, CO 80215 (US). STEGALL, Nathan [US/US]; 11500 W. 13th Avenue, Lakewood, CO 80215 (US).
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- (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, 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, 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, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

- as to the identity of the inventor (Rule 4.17(i))
- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))

[Continued on next page]

(54) **Title:** STRUCTURAL FRAME AND SOLAR COLLECTOR MODULE

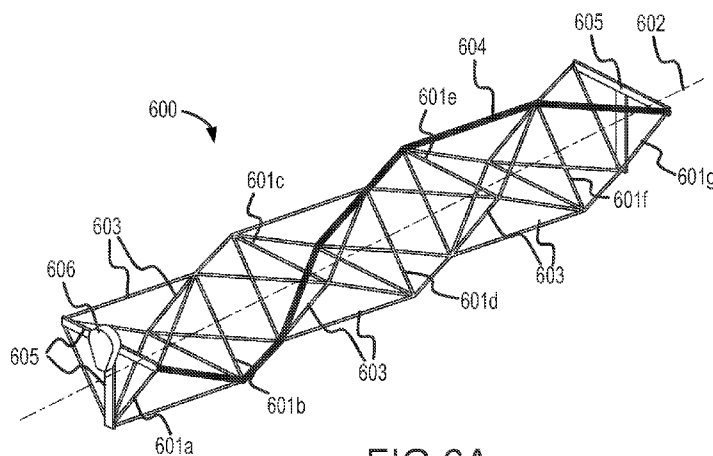


FIG. 6A

(57) **Abstract:** Solar collector modules and techniques for their construction are disclosed. In one aspect, a solar collector module includes a reflector and a three-dimensional structural frame that supports the reflector. The structural frame includes a set of primary structural shapes and a set of axial frame members connected between corners of the primary structural shapes forming helical paths for the transmission of torque from one end of the structural frame to the other. In another aspect, a method for assembling a solar collector module includes pre-assembling part of the module.

WO 2012/145513 A3



Published:

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

16 May 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 PCT/US2012/034254

A. CLASSIFICATION OF SUBJECT MATTER INV. F24J2/52 F24J2/14 E04B1/19 ADD.				
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) F24J				
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, WPI Data				
C. DOCUMENTS CONSIDERED TO BE RELEVANT				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
A	WO 2011/011728 A1 (ABENGOA SOLAR INC [US]; MARCOTTE PATRICK [US]; BIGGIO KENNETH [US]; MA) 27 January 2011 (2011-01-27) the whole document -----	1-32		
A	US 2010/252030 A1 (MARCOTTE PATRICK [US] ET AL) 7 October 2010 (2010-10-07) cited in the application the whole document -----	1-32		
A	WO 2010/024891 A1 (WERNER EXTRUSION SOLUTIONS LLC [US]; WERNER CRAIG ROY [US]; WERNER KUR) 4 March 2010 (2010-03-04) the whole document -----	1-32		
A	EP 1 903 155 A1 (GOSSAMER SPACE FRAMES [US]) 26 March 2008 (2008-03-26) the whole document -----	1-32		
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<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.				
* Special categories of cited documents : <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;"> "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 </td> <td style="width: 50%; border: none; vertical-align: top;"> "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 </td> </tr> </table>			"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
"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			
15 March 2013	26/03/2013			
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 Axters, Michael			

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2012/034254

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 103 01 883 B3 (DUERDOTH GEORG [CH]) 22 April 2004 (2004-04-22)	25-28
A	paragraphs [0030] - [0036]; figure 1 -----	29-32
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A	page 11, line 7 - page 12, line 15; figures 2, 8 -----	29-32
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A	column 1, line 50 - column 3, line 7 -----	29-32
Y	US 3 399 914 A (LANCELOT GRANT COLIN KAMET) 3 September 1968 (1968-09-03)	25-28
A	column 4, line 59 - column 5, line 41; figure 1 -----	29-32
X	US 2005/103326 A1 (CALLAHAN MICHAEL [US]) 19 May 2005 (2005-05-19)	29-32
A	paragraphs [0012] - [0017]; figures 1-5 -----	25-28
A	EP 1 310 605 A1 (LEGRAND ALAIN [FR]; LEGRAND MICHELE [FR]) 14 May 2003 (2003-05-14) the whole document -----	25-32

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2012/034254

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2012/034254

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 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 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.:

1-32
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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-24

A solar collector module comprising a three-dimensional structural frame including a set of primary structural shapes spaced apart along a longitudinal axis of the structural frame, and a set of axial frame members joining corners of adjacent primary structural shapes such that the axial frame members form helical paths.

2. claims: 25-28

A connection at a node comprising a bent plate having a concave side, a transverse plate fixed transverse to the concave side of the bent plate and transverse to the axis of a bend in the bent plate, the bent plate and the transverse plate including features for connecting members of a three-dimensional structural frame.

3. claims: 29-32

A connection at a node comprising at least two frame members having ends meeting at the connection, wherein each frame member end meeting at the connection is formed into a flange having connection features and the flanges are connected to each other without the use of a separate hub.

4. claims: 33-43

A method of assembling a solar collector module/ a subassembly for inclusion in a three-dimensional structural frame of a solar collector module wherein a plurality of frame members and one or more hubs are pre-assembled to form a subassembly wherein each connection of one of the frame members to one of the hubs uses only a single respective fastener that permits relative rotation of the respective frame member and hub about the respective fastener, and the frame members are arranged in a compact configuration that is more compact than an expanded configuration in which the subassembly is to be used in a solar collector module.
