



(51) International Patent Classification:

F24J 2/04 (2006.01) **F24J 3/06** (2006.01)
F24J2/34 (2006.01) **F25B 30/06** (2006.01)

(21) International Application Number:

PCT/US201 1/042968

(22) International Filing Date:

5 July 2011 (05.07.2011)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

61/361,506 5 July 2010 (05.07.2010) US

(71) Applicants (for all designated States except US):

GLASSPOINT SOLAR, INC. [US/US]; One Market St., Spear Tower, 36F, San Francisco, California 94105 (US). **THE BOARD OF TRUSTEES OF THE LELAND STANFORD JUNIOR UNIVERSITY** [US/US]; 1705 El Camino Real, Palo Alto, California 94306 (US).

(72) Inventors; and

(75) **Inventors/ Applicants (for US only): O'DONNELL, John Setel** [US/US]; 4015 Arbol Dr., Palo Alto, California 94306 (US). **KOVSEK, Anthony Robert** [US/US]; 1354 Central Ave, San Carlos, California 94070 (US).

(74) **Agent: VAN DYKE, Korbin S**; 3343 Little Valley Rd, Sunol, California 95686 (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, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

- 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))

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

10 May 2012

(54) **Title:** SUBSURFACE THERMAL ENERGY STORAGE OF HEAT GENERATED BY CONCENTRATING SOLAR POWER

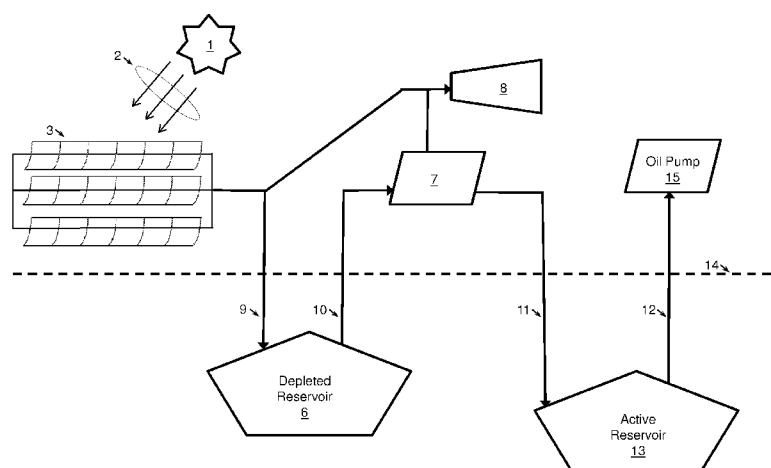


Fig. 1

(57) **Abstract:** Techniques for subsurface thermal energy storage of heat generated by concentrating solar power enable smoothing of available energy with respect to daily and/or seasonal variation. Solar thermal collectors produce saturated steam that is injected into a producing or wholly/partially depleted oil reservoir that operates as a heat storage reservoir. Some of the saturated steam generated by the collectors is optionally used to generate electricity. Heat is withdrawn from the reservoir as saturated steam and is used to operate an active thermal recovery project (such as a producing thermally enhanced oil reservoir) and/or to generate electricity. Withdrawn heat is optionally augmented by heat produced by firing natural gas. The reservoir is optionally one that has been used for thermally enhanced oil recovery and thus is already warm, minimizing heat losses.



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2011/042968**A. CLASSIFICATION OF SUBJECT MATTER****F24J 2/04(2006.01)i, F24J 2/34(2006.01)1, F24J 3/06(2006.01)1, F25B 30/06(2006.01)1**

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 2/04; F24J 2/34; E21B 43/24; F24J 3/02; F03G 7/02

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) & Keywords:solar, reservoir, oil, recovery

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2006-0048770 A1 (MEKSVANH et al.) 09 March 2006 See the abstract, paragraphs 0082-0096, 0100-0101 and FIGS. 1-2	1-10
A	US 03962873 A (DAVIS) 15 June 1976 See the abstract, column 2 and FIG.1	1-10
A	US 04174752 A (SLATER et al.) 20 November 1979 See the abstract, column 3 and FIG.1	1-10
A	US 2008-0066736 A1 (ZHU) 20 March 2008 See the abstract, paragraphs 0033-0035 and FIGS. 1-3	1-10

☐ 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

"&" document member of the same patent family

Date of the actual completion of the international search

29 FEBRUARY 2012 (29.02.2012)

Date of mailing of the international search report

09 MARCH 2012 (09.03.2012)

Name and mailing address of the ISA/KR

Korean Intellectual Property Office
Government Complex-Daejeon, 189 Cheongsu-ro,
Seo-gu, Daejeon 302-701, Republic of Korea

Facsimile No. 82-42-472-7140

Authorized officer

HAM, Joung Hyun

Telephone No. 82-42-481-5458



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2011/042968Patent document
cited in search reportPublication
datePatent family
member(s)Publication
date

US 2006-0048770 A1

09.03.2006

US 7472548 B2

06.01.2009

US 03962873A A

15.06.1976

JP 51-024435 A

27.02.1976

US 04174752A A

20.11.1979

US 04249605A A

10.02.1981

US 2008-0066736 A1

20.03.2008

None