



(51) International Patent Classification:

F03G 7/04 (2006.01) *F28F 3/00* (2006.01)
F03G 7/05 (2006.01) *F24J 3/06* (2006.01)

(21) International Application Number:

PCT/US2012/050941

(22) International Filing Date:

15 August 2012 (15.08.2012)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

13/209,944 15 August 2011 (15.08.2011) US

(71) Applicant (for all designated States except US): **THE ABELL FOUNDATION, INC.** [US/US]; 111 S. Calvert Street, Suite 2300, Baltimore, Maryland 21202-6174 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **HWANG, Yunho** [US/US]; 10257 Tuscany Road, Ellicott City, Maryland 21042 (US). **MUEHLBAUER, Jan** [DE/US]; 14009 Lake Meadows Drive, Bowie, Maryland 21042 (US). **LEE, Hos-**

cong [KR/US]; 6022 Westchester Park Drive, Apt. 201, College Park, Maryland 20740 (US). **SHAPIRO, Laurence Jay** [US/US]; 16-27 Radburn Road, Fair Lawn, New Jersey 07410 (US). **COLE, Barry R.** [US/US]; 35 Christopher Court, Mineral, Virginia 23117 (US).

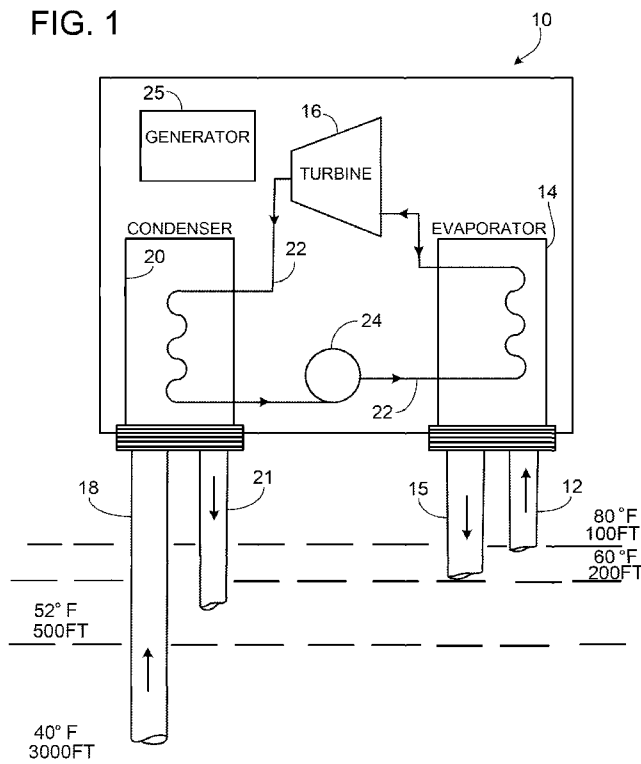
(74) Agents: **MCGLASHEN, Kelly** et al.; Fish & Richardson P.C., P.O. Box 1022, Minneapolis, Minnesota 55440-1022 (US).

(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, BN, 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.

[Continued on next page]

(54) Title: TRANSFERRING HEAT BETWEEN FLUIDS

FIG. 1



(57) Abstract: Heat exchangers can include heat exchange plates with: front and back exterior surfaces exposed to a non-working fluid; an interior working fluid flow channel between the front and back exterior surfaces, comprising a first plurality of parallel flow paths in a first direction and a second plurality of parallel flow paths in a second direction.



(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, 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).

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:

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

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

16 May 2013

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

A. CLASSIFICATION OF SUBJECT MATTER***F03G 7/04(2006.01)i, F03G 7/05(2006.01)i, F28F 3/00(2006.01)i, F24J 3/06(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)

F03G 7/04; F28F 3/08; F28F 3/02; A01K 61/00; F28D 1/00; B21D 53/04

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: heat exchanger, working fluid, flow, plate, ocean, cycle, energy, channel

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 4,823,867 A (POLLARD et al.) 25 April 1989 See column 1 line 22, column 5 lines 47-52, column 8 lines 41-44; figures 3-5.	1-3, 14, 15, 18, 20 4-13, 16, 17, 19
A	US 2009-0294110 A1 (FOUST, HARRY D.) 03 December 2009 See abstract, paragraph [0034]; figures 1-6 and 8-10.	1-20
A	US 2005-0155749 A1 (MEMORY et al.) 21 July 2005 See abstract and figures 1-21.	1-20
A	US 4,055,145 A (MAGER et al.) 25 October 1977 See abstract, column 8 lines 23-33; figures 1-3.	1-20



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

26 FEBRUARY 2013 (26.02.2013)

Date of mailing of the international search report

27 FEBRUARY 2013 (27.02.2013)

Name and mailing address of the ISA/KR

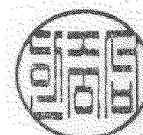


Facsimile No. 82-42-472-7140

Authorized officer

HAN, Joong Sub

Telephone No. 82-42-481-5606



INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2012/050941

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4823867 A	25.04.1989	None	
US 20090294110 A1	03.12.2009	US 8079508 B2	20.12.2011
US 20050155749 A1	21.07.2005	DE 112004002637 T5	30.11.2006
		GB 0610354 D0	05.07.2006
		GB 2423147 A	16.08.2006
		JP 2007-518955 A	12.07.2007
		KR 10-2006-0132645 A	21.12.2006
		US 7343965 B2	18.03.2008
		WO 2005-073658 A1	11.08.2005
US 4055145 A	25.10.1977	None	