



- (51) **International Patent Classification:**
H01L 35/30 (2006.01) **F25B 21/02** (2006.01)
H01L 35/32 (2006.01)
- (21) **International Application Number:**
PCT/US2012/040949
- (22) **International Filing Date:**
5 June 2012 (05.06.2012)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
61/493,935 6 June 2011 (06.06.2011) US
61/493,926 6 June 2011 (06.06.2011) US
61/493,871 6 June 2011 (06.06.2011) US
61/566,194 2 December 2011 (02.12.2011) US
- (71) **Applicant:** GENTHERM INCORPORATED [US/US];
21680 Haggerty Road, Suite 101, Northville, MI 48167 (US).
- (72) **Inventors:** POLIQUIN, Eric; 37 W. Longden Avenue, Arcadia, California 91007 (US). CRANE, Douglas, T.; 1822 La Paz Road, Altadena, California 91101 (US). JOVOVIC, Vladimir; 1446 Bresee Avenue, Pasadena, California 91104 (US). DEAN, Joseph; 1507 Crestar Ct., Upland, California 91784 (US). KOSSAKOVSKI, Dmitri; 2042 Pine Street, South Pasadena, California 91030 (US). RANALLI, Marco; Leibnizstrasse 2, 86199 Augsburg (DE). ADLDINGER, Martin; Baarer Strasse 1,

86684 Holzheim (DE). LEU, Dumitru-Cristian; Lorenzstr. 5, D-86551 Griesbeckerzell (DE).

- (74) **Agents:** DELANEY, Karoline, A. et al.; Knobbe, Martens, Olson & Bear, LLP, 2040 Main Street, 14th Floor, Irvine, CA 92614 (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, 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, 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))

[Continued on next page]

- (54) **Title:** CARTRIDGE-BASED THERMOELECTRIC SYSTEMS

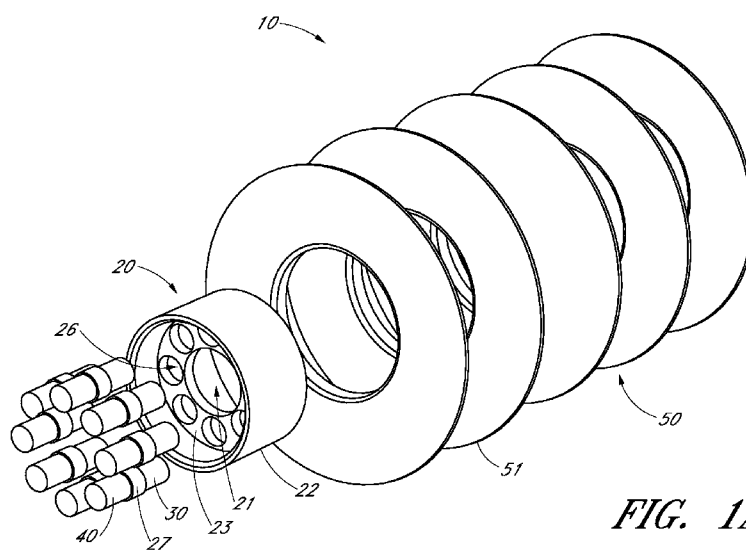


FIG. 1A

- (57) **Abstract:** Cartridge-based thermoelectric assemblies and systems are provided which include at least one shunt configured to extend around a conduit, a plurality of thermoelectric elements in thermal communication and in electrical communication with the at least one shunt with at least a portion of the at least one shunt sandwiched between the at least one first thermoelectric element and the at least one second thermoelectric element. The thermoelectric elements are electrically isolated from the conduit. The thermoelectric assemblies and systems further include at least one heat exchanger in thermal communication with the at least one shunt and configured to be in thermal communication with a second fluid.



— *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:**
23 January 2014

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2012/040949

A. CLASSIFICATION OF SUBJECT MATTER

INV. H01L35/30 H01L35/32 F25B21/02
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)

H01L F01N F25B

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.
Y	US 2011/067742 A1 (BELL LON E [US] ET AL) 24 March 2011 (2011-03-24) cited in the application abstract; figures 1,3,4,6,8,9,11 paragraphs [0056] - [0068] paragraphs [0077] - [0091] ----- -/-	1-5,17, 20-32, 36,45, 54-61, 63,67, 70,75, 83,85, 86,91, 100-113, 131-135, 140-142, 144



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 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

22 November 2013

Date of mailing of the international search report

29/11/2013

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

Deconinck, Eric

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2012/040949

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 095 998 A (HANSON CHARLES M) 20 June 1978 (1978-06-20)	128-130
Y	abstract; figures 1,2 column 2, line 10 - column 3, line 47	1-5,17, 20-32, 36,45, 54-61, 63,67, 70,75, 83,85, 86,91, 100-113, 131-135, 140-142, 144
A	----- WO 2008/091293 A2 (BSST LLC [US]) 31 July 2008 (2008-07-31) abstract; figures 32,27 paragraph [0189] paragraph [0234]	1-20,54, 100
A	----- US 2008/028769 A1 (GOENKA LAKHI NANDLAL [US]) 7 February 2008 (2008-02-07) abstract; figures 1,2 paragraphs [0018] - [0022] -----	1,21,54, 83,114

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2012/040949

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
US 2011067742	A1	24-03-2011	CN	102549789 A		04-07-2012
			EP	2457271 A2		30-05-2012
			JP	2013500590 A		07-01-2013
			KR	20120057619 A		05-06-2012
			US	2011067742 A1		24-03-2011
			WO	2011011795 A2		27-01-2011

US 4095998	A	20-06-1978	NONE			

WO 2008091293	A2	31-07-2008	CN	101611504 A		23-12-2009
			EP	2070129 A2		17-06-2009
			EP	2378577 A2		19-10-2011
			JP	5014427 B2		29-08-2012
			JP	2009545164 A		17-12-2009
			WO	2008091293 A2		31-07-2008

US 2008028769	A1	07-02-2008	US	2008028769 A1		07-02-2008
			US	2010326092 A1		30-12-2010
