



(51) International Patent Classification:	61/074,799	23 June 2008 (23.06.2008)	US
<i>F28D 20/02</i> (2006.01)	61/074,889	23 June 2008 (23.06.2008)	US
(21) International Application Number:	61/090,084	19 August 2008 (19.08.2008)	US
	12/389,416	20 February 2009 (20.02.2009)	US
	PCT/US2009/034680		
(22) International Filing Date:	20 February 2009 (20.02.2009)		
(25) Filing Language:	English	(72) Inventors; and	
(26) Publication Language:	English	(75) Inventors/Applicants (for US only):	
(30) Priority Data:			
61/030,755	22 February 2008 (22.02.2008)	US	
61/061,908	16 June 2008 (16.06.2008)	US	
61/074,840	23 June 2008 (23.06.2008)	US	
61/074,869	23 June 2008 (23.06.2008)	US	

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[Continued on next page]

(54) Title: HEAT STORAGE DEVICES

(57) Abstract: Improved thermal energy storage materials (28), devices (80) and systems (60) employing the same and related methods. The thermal energy storage materials may include a phase change material that includes a metal-containing compound. This invention is directed at methods of encapsulating thermal energy storage materials, devices containing encapsulated thermal energy storage materials, and capsular structures (25) for encapsulating thermal energy storage materials.

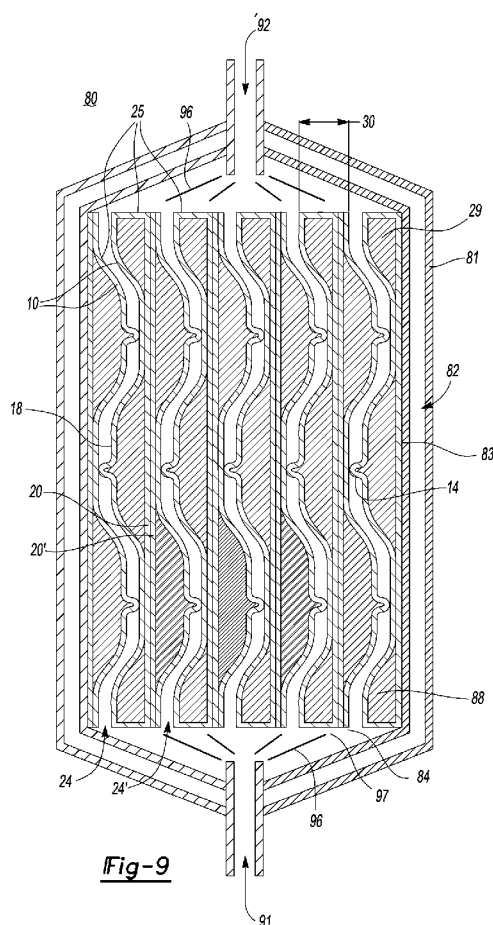


Fig-9



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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, 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.

(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), 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))

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

19 July 2012

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2009/034680

A. CLASSIFICATION OF SUBJECT MATTER

INV. F28D20/02

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)

F28D C09K

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 practical, 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.
X	DE 20 2005 017835 U1 (TROX GMBH GEB [DE]) 19 January 2006 (2006-01-19)	1-13, 16, 17
Y	paragraphs [0011], [0021], [0030] - [0044]; claim 1; figures 1-4	19-26
Y	GB 1 195 326 A (COMSTOCK & WESCOTT [US]) 17 June 1970 (1970-06-17) the whole document	19-26
Y	US 4 430 241 A (FIORUCCI LOUIS C [US]) 7 February 1984 (1984-02-07)	24, 25
A	the whole document	19
X	DE 32 45 027 A1 (SCHATZ OSKAR SCHATZ OSKAR [DE]) 7 June 1984 (1984-06-07) page 9, line 17 - page 10, line 8 page 16, lines 15-19; figure 1 page 17, lines 16-31; figures 4-6	1, 2, 4, 9, 14, 15, 18
	----- -/-	

☒ 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 document 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

1 October 2010

Date of mailing of the international search report

14/10/2010

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No

PCT/US2009/034680

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 90 15 510 U1 (HOERMANSDOERFER, GERD, 3167 BURG DORF, DE) 12 March 1992 (1992-03-12) the whole document -----	1-18
A	US 2004/194908 A1 (TOMOHIDE KUDO [JP] KUDO TOMOHIDE [JP]) 7 October 2004 (2004-10-07) paragraphs [0035] - [0067]; figures 1-9 -----	1-18
A	WO 01/92129 A (BRUCE HANS [SE]) 6 December 2001 (2001-12-06) * abstract; figures -----	3,21
A	WO 2008/050210 A (TOYOTA MOTOR CO LTD [JP]; T RAD CO LTD [JP]; T SUBONE KENJI [JP]; HASHI) 2 May 2008 (2008-05-02) the whole document -----	1-18
A	DE 20 2005 015393 U1 (MATINO GMBH [DE]) 26 October 2006 (2006-10-26) the whole document -----	1-18
A	DE 41 33 360 A1 (VOLKSWAGEN AG [DE]) 23 April 1992 (1992-04-23) the whole document -----	1-18

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2009/034680

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.:
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: 1-18

Device for storing and discharging heat having a specified average initial power density and a flow path defined by a specified gap thickness between first and second array components

2. claims: 19-26

Heating thermal energy storage material to free it from water

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2009/034680

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 202005017835 U1	19-01-2006	NONE	
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