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|------------|----------------------------|----|
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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).

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Declarations under Rule 4.17:

- *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))*

- (72) **Inventors; and**

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- *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))*

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- (15) **Information about Correction:**
Previous Correction:
see Notice of 22 March 2012



(54) **Title:** METHODS, DEVICES SYSTEMS FOR EXTRACTION OF THERMAL ENERGY FROM A HEAT CONDUCTING METAL CONDUIT

(57) **Abstract:** Provided are methods, devices and systems for controlled removal of thermal energy from a fluid within a thermally conducting metal conduit. The system allows for the in situ formation of a reversible plug that can stop the flow of fluid through the conduit, particularly without inducing thermally induced stress fractures or breaches in the conduit. The devices and systems include a thermal transfer device that can be adapted to be in thermal communication with a thermal conducting metal conduit containing a fluid, particularly a flowing fluid. The devices and systems allows for controlled re-heating of the conduit without inducing thermally induced stress fractures or breaches in the conduit to restore fluid flow through the conduit.

INTERNATIONAL SEARCH REPORT

International application No PCT/US2011/001083

A. CLASSIFICATION OF SUBJECT MATTER
 INV. F16L55/103 G05D23/19
 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)
 F16L

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.
X	US 4 267 699 A (BAHRENBURG HARRY H) 19 May 1981 (1981-05-19)	1-5, 7, 8, 10-18, 27-34, 36-42
Y	column 7, line 3 - line 11; figure 4	6, 26, 45-125
X	----- GB 1 584 189 A (BRISTER BERYLE DEAN) 11 February 1981 (1981-02-11) page 5, column 1, line 21 - line 36; figures 3-5	1-5, 7-25, 27-34, 36-44
X	----- DE 39 03 009 A1 (ROTHENBERGER WERKZEUGE MASCH [DE]) 9 August 1990 (1990-08-09) figures 3,4 ----- -/--	1-3, 17, 18, 35, 36

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

- | | |
|---|---|
| <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier application or patent but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> | <p>"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</p> <p>"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</p> <p>"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</p> <p>"&" document member of the same patent family</p> |
|---|---|

Date of the actual completion of the international search

24 May 2012

Date of mailing of the international search report

04/06/2012

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No PCT/US2011/001083

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6 141 972 A (EVANS DANIEL J [US]) 7 November 2000 (2000-11-07) the whole document -----	6, 45-102, 117-125
Y	US 5 836 167 A (CLOUSTON STUART D [GB] ET AL) 17 November 1998 (1998-11-17) the whole document -----	45-102, 117-125
Y A	US 3 041 850 A (NUNN ROBERT N) 3 July 1962 (1962-07-03) column 2, line 45 - line 48 -----	103-116 1,3,5
Y	WO 97/11326 A1 (NOWSCO WELL SERVICE INC) 27 March 1997 (1997-03-27) the whole document -----	26
A	US 4 441 328 A (BRISTER BERYLE D [US]) 10 April 1984 (1984-04-10) figure 3 -----	1,17,18, 36

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2011/001083

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, 17, 18, 36

relates to a thermal transfer device

2. claims: 2, 3, 35, 102

relates to further devices to refrigerate combined to the thermal transfer device

3. claims: 5, 13-16, 20, 25, 39, 52, 53, 67, 76, 79, 89, 91, 93-95

choice of materials

4. claims: 6, 37, 38, 40-42, 45-51, 54, 55, 61-66, 68-75, 77, 78, 80-88, 90, 92, 98, 107-110, 116-118, 123-125

cryogen injector and functions

5. claims: 7, 10, 12

Control system

6. claims: 8, 9, 11, 19, 21-24, 26-34, 43, 44, 56-60, 97, 104, 106, 111-115, 119-122

additional circuit components for diverse functions

7. claims: 96, 99, 101, 103, 105

dimensioning parameters

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2011/001083

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4267699	A	19-05-1981	NONE

GB 1584189	A	11-02-1981	BR 7706085 A 20-06-1978
			CA 1088332 A1 28-10-1980
			DE 2740975 A1 16-03-1978
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			WO 9711326 A1 27-03-1997

US 4441328	A	10-04-1984	NONE
