(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
5 November 2009 (05.11.2009)

PCT

(10) International Publication Number
WO 2009/134890 A3

(51) International Patent Classification:
G01F 25/00 (2006.01)

(21) International Application Number:
PCT/US2009/042116

(22) International Filing Date:
29 April 2009 (29.04.2009)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/049,110 30 April 2008 (30.04.2008) US

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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))*

— *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:
7 January 2010

(54) Title: APPARATUS AND METHOD FOR PROVING AT LOW TEMPERATURES

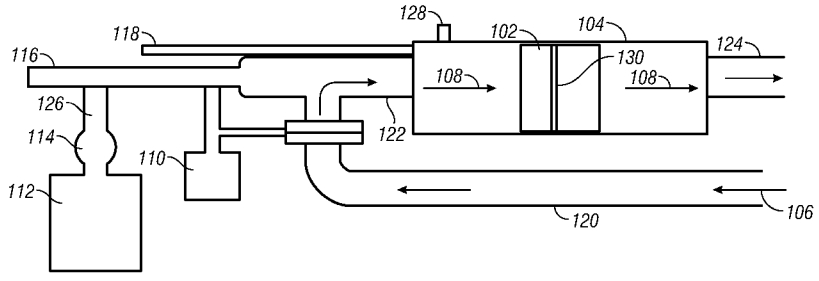

FIG. 3

(57) Abstract: Apparatus and methods for proving a flow meter at low temperatures. A flow meter measuring low temperature fluids (e.g., less than about -50 F, or less than about -220 F) must still be proved. Low temperature fluids can be destructive to piston or compact provers, or may require indirect proving methods. The apparatus disclosed is a low temperature prover directly coupled into the pipeline carrying the low temperature fluids. In some embodiments, a magnetic pickup coil (232) and a magnetic member (210) communicate between the displacer (202) and the flow tube (204). The magnetic target member (210) may be carbon-free. In some embodiments, a pair of ultrasonic transceivers (328, 330) coupled to the flow tube (304) communicate a signal (332) across the flow tube (304) and a displacer (302) is moveable to interrupt the signal (332). In some embodiments, the flow tube includes an inner surface having a microfinish for lubrication. The displacer may be a piston rotatable while being moved axially.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2009/042116

A. CLASSIFICATION OF SUBJECT MATTER

G01F 25/00(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)
IPC G01F

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 since 1975.
Japanese utility models and applications for utility models since 1975.

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & keywords: "flow meter", "temperature", "prove", "directly", "pipe", "tube", and similar terms.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2007-0234778 A1 (Dennis Jerome Swanek) 11 OCTOBER 2007 See abstract; figures 1-7; claims 1-10.	1-27
A	US 2007-0169536 A1 (Galen Cotton) 26 JULY 2007 See abstract; figures 1,2; claims 1-10.	1-27
A	WO 84/002185 A1 (SKELTONHALL LIMITED) 7 JUNE 1984 See abstract; figures 1-6; claims 1-6.	1-27
A	WO 93/015381 A1 (ENDRESS + HAUSER LIMITED) 5 AUGUST 1993 See abstract; figures 1-3; claims 1-7.	1-27
A	US 2006-0156828 A1 (Uwe Konzelmann et al.) 20 JULY 2006 See abstract; figures 1,2A,2B,3; claims 1-4.	1-27

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
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Date of the actual completion of the international search	Date of mailing of the international search report
17 NOVEMBER 2009 (17.11.2009)	**17 NOVEMBER 2009 (17.11.2009)**

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Form PCT/ISA/210 (second sheet) (July 2008)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/US2009/042116

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