

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
18 November 2004 (18.11.2004)

PCT

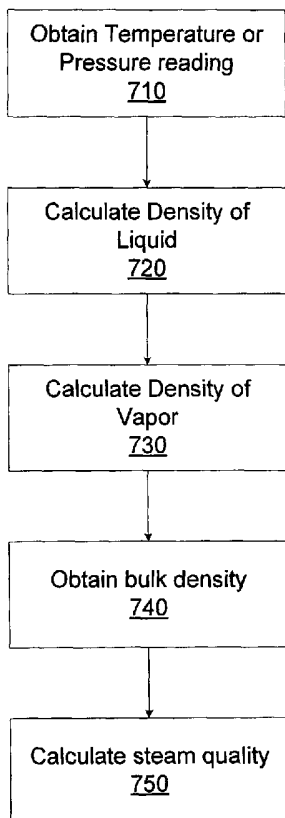
(10) International Publication Number  
**WO 2004/099731 A3**

- (51) International Patent Classification<sup>7</sup>: **G01F 1/84** US 10/737,856 (CON)  
Filed on 18 December 2003 (18.12.2003)
- (21) International Application Number: PCT/US2004/013800 US Not furnished (CIP)  
Filed on Not furnished
- (22) International Filing Date: 4 May 2004 (04.05.2004) (71) **Applicant** (for all designated States except US): **INVEN-SYS SYSTEMS, INC.** [US/US]; 33 Commercial St., Foxboro, MA 02035-2099 (US).
- (25) Filing Language: English (72) **Inventors; and**
- (26) Publication Language: English (75) **Inventors/Applicants** (for US only): **DUTTON, Robert, E.** [US/US]; 1027 Willow Place, Louisville, CO 80027 (US). **MATTAR, Wade, M.** [US/US]; 35 Blake Road, Wrentham, MA 02093 (US).
- (30) Priority Data:  
60/467,553 5 May 2003 (05.05.2003) US  
10/737,856 18 December 2003 (18.12.2003) US
- (74) **Agent:** **WALTERS, Gregory, A.**; Fish & Richardson P.C., 1425 K Street, N.W., 11th Floor, Washington, DC 20005-3500 (US).
- (63) Related by continuation (CON) or continuation-in-part (CIP) to earlier applications:  
US 60/467,553 (CON)  
Filed on 5 May 2003 (05.05.2003) (81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM,

[Continued on next page]

(54) Title: TWO-PHASE STEAM MEASUREMENT SYSTEM

700



(57) **Abstract:** A steam measurement system includes a Coriolis flowmeter (440, 540, 640) associated with a vibratable flowtube (410, 510, 610) to receive a flow of wet steam. A first sensor is associated with the flowtube to relay information about a motion of the flowtube by way of a first sensor signal. A second sensor determines a property of the flow and relays the property by way of a second sensor signal. A computing device (440, 540, 640) receives the first and second sensor signals and is configured to calculate a steam quality of the flow from the first and second sensor signals (700). The computing device also may calculate the total heat energy flow rate of the flow (800). Other implementations may include a full or partial separator (920) to separate the flow of wet steam into a substantially gas flow and a substantially liquid flow, and a second Coriolis meter (960a, 960b).

WO 2004/099731 A3



AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US (patent), UZ, VC, VN, YU, ZA, ZM, ZW.

SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**

- with international search report
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

**(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, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI,

**(88) Date of publication of the international search report:**  
21 April 2005

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

**INTERNATIONAL SEARCH REPORT**

International application No.

PCT/US04/13800

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(7) : G01F 1/84  
 US CL : 73/861.354

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)  
 U.S. : 73/861.354, 861.04, 861.06, 861.355, 861.356

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
 NONE

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
 EAST

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category *    | Citation of document, with indication, where appropriate, of the relevant passages   | Relevant to claim No.                 |
|---------------|--|---------------------------------------|
| X<br>---<br>Y | US 6,032,539 A (LIU et al) 07 March 2000 (07.03.2000), column 1, lines 12-15; column 5, lines 14-17, 40-50; column 10, lines 7-24. | 1-4, 6-8, 12, 13, 15-17<br>-----<br>5 |
| Y<br>---<br>A | US 5,359,881 A (KALOTAY et al) 01 November 1994 (01.11.1994), see entire document.   | 5<br>-----<br>1-4, 6-37               |

Further documents are listed in the continuation of Box C.

See patent family annex.

| * Special categories of cited documents:  | "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  |
|---|-----|--|
| "A" document defining the general state of the art which is not considered to be of particular relevance  | "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   |
| "E" earlier application or patent published on or after the international filing date   | "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 |
| "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) | "&" | document member of the same patent family  |
| "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  |     |  |

Date of the actual completion of the international search

Date of mailing of the international search report

18 February 2005 (18.02.2005)

**01 MAR 2005**

Name and mailing address of the ISA/US

Authorized officer

Mail Stop PCT, Attn: ISA/US  
 Commissioner for Patents  
 P.O. Box 1450  
 Alexandria, Virginia 22313-1450

JOSE G. DEES

Facsimile No. (703) 305-3230

Telephone No. (571) 272-1607

