

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
29 January 2004 (29.01.2004)

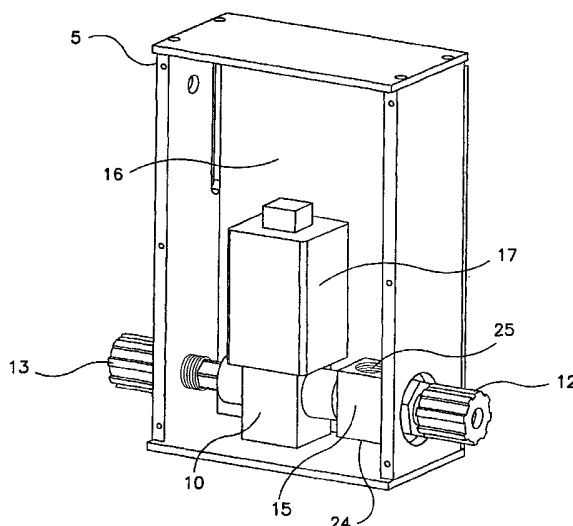
PCT

(10) International Publication Number
WO 2004/010086 A3

- (51) International Patent Classification⁷: **G06F 19/00**, G01F 17/00, 1/12, 1/50
- (21) International Application Number: PCT/US2003/022533
- (22) International Filing Date: 18 July 2003 (18.07.2003)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
60/397,162 19 July 2002 (19.07.2002) US
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- (81) Designated States (national): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, 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, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (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

[Continued on next page]

(54) Title: FLUID FLOW MEASURING AND PROPORTIONAL FLUID FLOW CONTROL DEVICE



(57) Abstract: A fluid flow measuring and control device for measuring a flow rate based on a pressure drop created by a restrictive flow element (15). The device includes a proportional flow valve (10) having a fluid inlet and a fluid outlet and an actuator (17) for modulating the proportional flow valve (10). The restrictive flow element (15) includes a fluid inlet and a fluid outlet in communication with the proportional flow valve (10) and creates a pressure drop between the restrictive flow element fluid inlet and outlet. The device also includes means (24, 25) for measuring the pressure drop, means (16) for calculating the flow rate based on the pressure drop, and control means (not shown) that communicates with the pressure drop measuring means (24, 25) and the actuator (17) for controlling the flow of fluid through a proportional flow valve (10) in response to the measured pressure drop.



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

7 October 2004

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/US03/22533

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G06F 19/00; G01F 17/00, 1/12, 1/50

US CL : 702/45, 47, 50, 85, 98

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. : 702/45, 47, 50, 85, 98; 73/861.42, 861.52

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,P --- Y,P	US 6,578,435 B2 (GOULD et al) 17 June 2003 (17.06.2003), column 5, line 21 - column 9, line 33.	1-3, 5-8, 10-11, 13, 17-20 ----- 4, 9, 12, 21-32
Y,P	US 6,564,824 B2 (LOWERY et al) 20 May 2003 (20.05.2003), column 2, line 57 - column 12, line 40.	4
Y,E	US 6,601,005 B1 (ERYUREK et al) 29 July 2003 (29.07.2003), column 3, line 35 - column 8, line 67.	9, 12, 21-32
A,E	US 6,662,140 B2 (MARTIS) 09 December 2003 (09.12.2003), column 5, line 59 - column 13, line 24).	9, 12, 21-32

☐ 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 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

12 May 2004 (12.05.2004)

Date of mailing of the international search report

23 JUL 2004

Name and mailing address of the ISA/US

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

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US03/22533

Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claim Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim 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. ☐ Claim Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
Please See Continuation 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 fee, this Authority did not invite payment of any additional fee.
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.

No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

PCT/US03/22533

BOX II. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

Group I, claims 1-13, drawn to a fluid flow control device.

Group II, claims 14-16, drawn to a fluid flow calibration method.

Group III, claims 17-23 drawn to computer readable memory features of a fluid flow device.

Group IV, claims 24-32 drawn to fuzzy logic features of a fluid flow device.

And it considers that the International Application does not comply with the requirements of unity of invention (Rules 13.1, 13.2, and 13.3) for the reasons indicated below:

The inventions listed as Groups I-IV do not relate to a single inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons: the special technical feature of the Group I invention is the fluid flow controller claimed therein; the special technical feature of the Group II invention is determining a calibration coefficient and relating it to fluid flow; the special technical feature of the Group III invention is the use of computer readable memories to calculate fluid flow; and, the special technical feature of the Group V invention is calculating a change in valve output based on fuzzy logic. Since the special technical feature of the different Groups I-IV claims is not present in the other Groups claims, unity of invention is lacking.