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(71) Applicant (for all designated States except US): GOVERN-MENT OF THE UNITED STATES as represented by THE SECRETARY DEPARTMENT OF HEALTH AND HUMAN SERVICES [US/US]; Washington, CD 20201 (US).

(72) Inventors; and

- (75) Inventors/Applicants (for US only): HANKINSON, John, L. [US/US]; 120 Poplar Drive, Morgantown, WV 26505 (US). VIOLA, Joseph, O. [US/US]; Route 1, Box 111, Masontown, WV 26542 (US). EBELING, Thomas, R. [US/US]; Route 12, Box 448B, Morgantown, WV 26505 (US).
- (74) Agent: PRICE, Robert, L.; Lowe, Price, LeBlanc & Becker, 99 Canal Center Plaza, Suite 300, Alexandria, VA 22314 (US).
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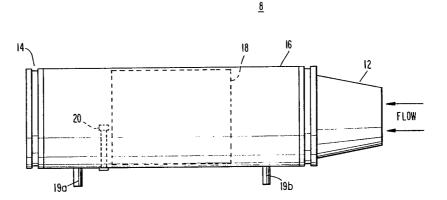
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With international search report.

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(54) Title: PORTABLE SPIROMETER WITH IMPROVED ACCURACY



(57) Abstract

A spirometric measurement device (10) includes an arrangement for computation of a dynamic BTPS correction factor, to compensate for temperature-related volume changes due to cooling of expired gas. The correction factor varies in time according to variation of temperature of a flow sensor (18). The temperature of the flow sensor (18) is accurately established by positioning a temperature sensor (20) downstream of the flow sensor (18). Autozeroing drift compensation is provided by addition of a PWM signal having an adjusted DC value. Resolution accuracy is increased beyond the capacity of an analog-to-digital converter used in the circuit by implementing a dithering procedure, wherein zero average noise is superimposed on the signal, or by implementing a modified dithering procedure wherein a sawtooth waveform is added to the flow signal, and oversampling the resultant signal.

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INTERNATIONAL SEARCH REPORT

International Application No PCT/US 93/03030

			International Application No PCT/	US 93/03030		
I. CLASSIFICAT	ION OF SUBJE	CT MATTER (if several classification sym	nbols apply, indicate all) ⁶			
According to Int. C1.5	ernational Patent	Classification (IPC) or to both National Clas A 61 B 5/087	ssification and IPC			
II. FIELDS SEA	RCHED					
		Minimum Documen	tation Searched ⁷			
Classification Sy	ystem	C	lassification Symbols			
Int.C1.5		A 61 B				
		Documentation Searched other the to the Extent that such Documents at	han Minimum Documentation re Included in the Fields Searched ⁸			
		TO DE DELEVANT				
		CD TO BE RELEVANT ⁹ ocument, ¹¹ with indication, where appropria	to of the relevant nassages 12	Relevant to Claim No.13		
Category °	Citation of D	ocument, ** with indication, where appropria	to or the reterant passages			
Х	US,A,5 August	038773 (NORLIEN ET AL.) 13	1,15		
A	see co	4,7,9, 17				
A	EP,A,0437055 (GLAXO AUSTRALIA PTY., LTD.) 17 July 1991 see column 3, line 7 - column 6, line 31 see figures 1-6B			1,6-8, 11-13, 15,17		
A	COMPAN	 0328415 (SHERWOOD MEDIC NY) 16 August 1989 age 3, line 1 - page 2, 		1,6,9, 12,15, 16		
		10	"T" later document published after the inte	ernational filing date		
"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			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 "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			
IV. CERTIFIC			Don of Mailing of this Transportant C	Search Depart		
Date of the Act	tual Completion o	f the International Search	Date of Mailing of this International S	веагси кероп		
29-07-1993 International Searching Authority EUROPEAN PATENT OFFICE			0 8. 12 Signature of Authorized Officer	0 8, 12, 93		
			Ms. Milena ๒๔๕๙เผกิชี			

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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)					
Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No			
A	WO,A,8912423 (ADX SYSTEMS PTY	1,7,8, 15,17			
	LIMITED) 28 December 1989	15,1/			
	see page 3, line 11 - page 16, line 37 see				
	figures				

INTERNATIONAL SEARCH REPORT

....ernational application No.

PCT/US 93/03030

Box I	Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)
This inte	rnational search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:
	Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:
	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 II	Observations where unity of invention is lacking (Continuation of item 2 of first sheet)
1.	rnational Searching Authority found multiple inventions in this international application, as follows: CLAIMS: 1-17 CLAIMS; 18-22
	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 searches 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. X	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 (The additional search fees were accompanied by the applicant's protest. No protest accompanied the payment of additional search fees.

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

US 9303030

SA 72280

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 15/11/93

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Patent document cited in search report	Publication date	Patent family member(s)		Publication date	
US-A- 50387°3	13-08-91	DE-A- GB-A- JP-A-	4118404 2246865 5111473	12-12-91 12-02-92 07-05-93	
EP-A- 04%7	17-07-91	US-A- AU-B- AU-A- JP-A-	5137026 636183 6799490 4028350	11-08-92 22-04-93 11-07-91 30-01-92	
EP-A- 0328	16-08-89	AU-A- JP-A- US-A- US-A-	2982789 1244736 5058601 5170798	10-08-89 29-09-89 22-10-91 15-12-92	
WO-A- 8912423	28-12-89	None			