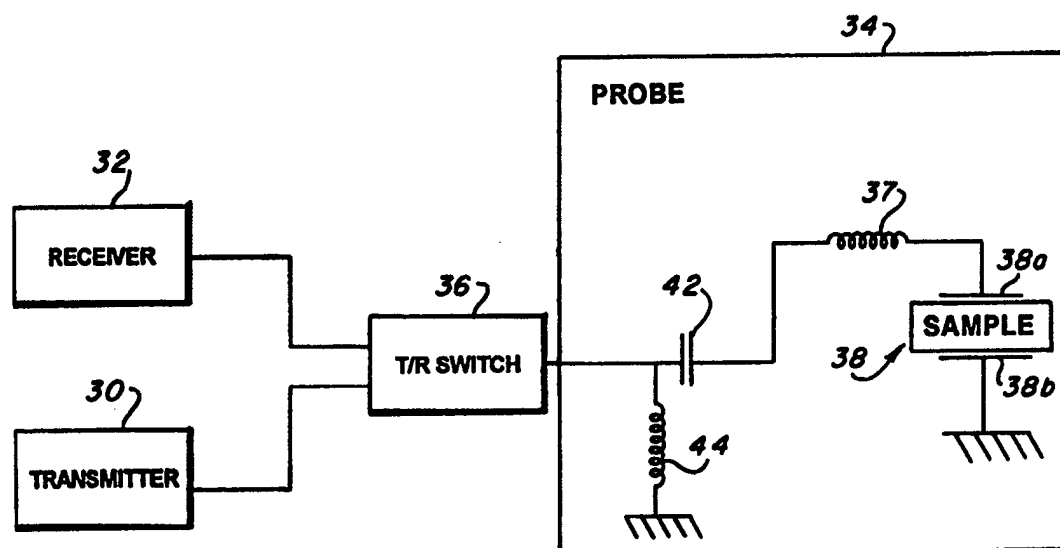


INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification ⁶ : G08B 21/00</p>	<p>A3</p>	<p>(11) International Publication Number: WO 98/55974</p>
<p>(21) International Application Number: PCT/US98/11664</p>		<p>(43) International Publication Date: 10 December 1998 (10.12.98)</p>
<p>(22) International Filing Date: 5 June 1998 (05.06.98)</p>		
<p>(30) Priority Data: 08/869,934 5 June 1997 (05.06.97)</p>	<p>US</p>	<p>(81) Designated States: AU, CA, CN, IL, JP, KP, MX, NZ, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).</p>
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(54) Title: METHOD AND APPARATUS FOR DETECTING A TARGET MATERIAL BY PRE-SCREENING A SAMPLE FOR PIEZOELECTRIC RESONANCE



(57) Abstract

A method and apparatus for screening samples (38) to determine which samples include a target material. Generally, the samples are pre-screened (S400) to determine which of the samples have a piezoelectric resonance when irradiated in a probe (34) with an electric field, to thereby indicate the possible presence of the target material. The samples that have the piezoelectric resonance are then further screened by a different process (S510) to confirm the presence of the target material. For example, samples that have the piezoelectric resonance are further screened for a specific nuclear quadrupole resonance (NQR), a specific nuclear magnetic resonance (NMR) or a specific visual characteristic, to confirm the presence of the target material in the sample. The apparatus and method can be used, for example, to search luggage at ports of entry for the presence of cocaine hydrochloride.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US98/11664

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : G08B 21/00

US CL : 340/540

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. : 340/540, 572; 324/300, 307, 318, 655; 310/311, 312

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)

APS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,595,908 A (FAWCETT et al) 21 January 1997, col. 6, lines 3-11	1-23
Y	US 5,233,300 A (BUSS et al) 03 August 1993, col. 4, lines 31-38	2-20
Y	US 5,430,441 A (BICKLEY et al) 04 July 1995, abstract, lines 1-5	21-23
X	US 5,243,282 A (MILLER, III et al) 07 September 1993, Figure 1, No. 11	24
Y		25-27
Y	US 5,594,338 A (MAGNUSON) 14 January 1997, Figure 2, No. 34	25-27
A	US 4,232,239 A (DWORSKY et al) 04 November 1980	1-27

☒ 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
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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)	*A* 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

08 SEPTEMBER 1998

Date of mailing of the international search report

11 DEC 1998

Name and mailing address of the ISA/US
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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US98/11664

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4,785,232 A (BALLATO et al) 15 November 1988	1-27
A	US 5,365,171 A (BUESS et al) 15 November 1994	1-27
A	US 5,494,550 A (BENGE) 27 February 1996	1-27
A	US 5,608,321 A (GARROWAY et al) 04 March 1997	1-27

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US98/11664

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. ☐ 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 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 Extra 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

International application No.
PCT/US98/11664

BOX II. OBSERVATIONS WHERE UNITY OF INVENTION WAS LACKING

This ISA found multiple inventions as follows:

This application contains the following inventions or groups of inventions which are not so linked as to form a single inventive concept under PCT Rule 13.1. In order for all inventions to be searched, the appropriate additional search fees must be paid.

Group I, claim(s) 1-23, drawn to piezoelectric resonance.

Group II, claim(s) 24-27, drawn to a probe having capacitive plates.

The inventions listed as Groups I and II 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 piezoelectric resonance of a target material while the special technical feature of the Group II invention is the probe having parallel capacitive plates. Since the special technical feature of the Group I invention is not present in the Group II invention being claimed and the special technical feature of the Group II invention is not present in the Group I invention being claimed, unity of invention is lacking.