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(54) Title: APPARATUS AND METHOD FOR ANALYTE EXTRACTION

(57) Abstract: Described is a matrix spot processing device comprising a tubular apparatus. An absorbent media is located either separate from, or attached to, the tubular apparatus. A sample is spotted on the absorbent media. A reservoir is in the tubular apparatus. A first region of the reservoir is constructed and arranged to have an extraction solvent. A second region of the reservoir, which may or may not be the same as the first region, is constructed and arranged to receive an extract generated from an interaction between the extraction solvent and the spotted sample at the absorbent media.



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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 13/61512

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - G01N 1/00, E03B 1/00, G01N 1/18, B01D 21/00 (2014.01)

USPC - 73/863

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)

USPC: 73/863

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC: 137/1, 436/178, 422/527.1(keyword limited; terms below)

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

PatBase, Google Patents/Scholar

Search Terms Used: Dried blood spot, tubular, extraction, reservoir, sample card, plunger, barrel, displacement, matrix, absorbent

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X -- Y	US 2012/0103421 A1 (GRENZ et al.) 03 May 2012 (03.05.2012) para [0006], [0027], [0029], [0036]-[0040], claim 1, Fig. 1-2, 5-8	1-5, 11-15, 17, 19-25 ----- 6-10, 16, 18
Y	WO 2012/067619 A1 (PEARCY et al.) 24 May 2012 (24.05.2012) abstract, pg 12, ln 10-33, pg 14, ln 24-25, Fig. 2A, 2B	6-10, 18
Y	WO 2011/076859 A1 (LAMARCA et al.) 30 June 2011 (30.06.2011) abstract	16
A,P	US 2013/0017545 A1 (YONG et al.) 17 January 2013 (17.01.2013) whole doc.	1-25
A,T	US 2014/0038172 A1 (DE LA ROSA et al.) 06 February 2014 (06.02.2014) whole doc.	1-25

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

* 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 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

"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

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 13/61512

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search 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 No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

Group I: claims 1-25, drawn to a matrix spot processing device, comprising: a tubular apparatus and a reservoir in the tubular apparatus; a first region of the reservoir constructed and arranged to have an extraction solvent, and a second region of the reservoir constructed and arranged to receive an extract generated from an interaction between the extraction solvent and the spotted sample at the absorbent media (see illustrated example in Fig. 3).

Group II: claims 26-43, drawn to a matrix spot processing device, comprising: a tubular apparatus, the tubular apparatus having a first end and a second end opposite the first end, each of the first end and the second end having an opening; a fluid path between the opening at the first end and the opening at the second end; a reservoir in the tubular apparatus between the first end and the second end (see illustrated example in Fig. 11).

- Please see extra sheet for continuation -

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 additional fees, this Authority did not invite payment of additional fees.
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. 1-25

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

Box NO III. Observations where unity of invention is lacking

Group III: claims 44-48, drawn to a matrix spot processing device, comprising: a tubular apparatus; an attachment mechanism at an inner sidewall at the tubular apparatus; and an absorbent media coupled to the attachment mechanism in the tubular apparatus, wherein a sample is spotted on the absorbent media, wherein the tubular apparatus is constructed and arranged to generate an extract from an interaction between an extraction solvent and the spotted sample at the absorbent media (see illustrated example in Fig. 8A).

Group IV: claims 49-53, drawn to a method for processing a matrix spot, comprising: positioning an absorbent media in a tubular apparatus; spotting a sample on the absorbent media; constructing and arranging a first region of the tubular apparatus to have an extraction solvent; and receiving, at a second region of the tubular apparatus, an extract generated from an interaction between the extraction solvent and the spotted sample at the absorbent media.

The inventions listed as Groups I through IV do not relate to a single general 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:

Special Technical Features

Group I include the special technical feature of a tubular apparatus comprising a reservoir in the tubular apparatus; wherein the reservoir comprises a first region of the reservoir and a second region of the reservoir, not required by Group II-IV.

Group II include the special technical feature of a tubular apparatus having a first end and a second end opposite the first end, each of the first end and the second end having an opening, not required by Group I, III and IV.

Group III include the special technical feature of a tubular apparatus; an attachment mechanism at an inner sidewall at the tubular apparatus, not required by Group I, II and IV.

Group IV include the special technical feature of a method for processing a matrix spot, not required by Group I-III.

Common Technical Features

The inventions of Groups I-IV share the technical feature of a tubular apparatus; an absorbent media positioned in the tubular apparatus, wherein a sample is spotted on the absorbent media; wherein an extract is generated from an interaction between the extraction solvent and the spotted sample at the absorbent media. The inventions of Groups I, II and IV further share the technical feature of a reservoir in the tubular apparatus, wherein the extraction solvent is transferred through the absorbent media to the reservoir to generate an extract. The inventions of Groups I and IV further share the technical feature of a reservoir in the tubular apparatus, wherein the reservoir comprises a first region of the reservoir constructed and arranged to have an extraction solvent, and a second region of the reservoir is constructed and arranged to receive an extract generated from an interaction between the extraction solvent and the spotted sample at the absorbent media.

However, these shared technical features do not represent a contribution over prior art as being anticipated by US 2012/0103421 A1 to Grenz et al. (hereinafter 'Grenz'). Grenz discloses (Claim 1), a matrix spot processing device (para [0006], a dried biological fluid spot punch device), comprising:
a tubular apparatus (Fig. 1, tube 100, claim 1);
an absorbent media positioned in the tubular apparatus, wherein a sample is spotted on the absorbent media (para [0036], Fig. 5 illustrates an example of utilizing the punch device 500. The punch device 500 is held over a substrate (or card, etc.) 560 in which one or more spots 564 of dried biological fluid have been formed. The substrate 560 may be composed of any composition suitable for use as a spotting card, non-limiting examples of which include various types of cellulosic filter papers; para [0037], Fig. 6 illustrates as the distal tube end 112 is pushed into the material of the substrate 560 and begins to cut the material, the as-forming sample unit 664 is bent upwards and into the distal section 124 of the tube 100. In this manner, a sample unit 664 of greater diameter (or other characteristic dimension) than the distal tube opening 116 eventually separates from the substrate 560 and fully passes through the distal tube opening 116 and into the distal section 124); and
a reservoir in the tubular apparatus, a first region of the reservoir constructed and arranged to have an extraction solvent (para [0038], Fig. 7 illustrates the selected well 772 is partially filled with a volume 776 of elution solvent), and a second region of the reservoir constructed and arranged to receive an extract generated from an interaction between the extraction solvent and the spotted sample at the absorbent media (para [0040], Fig. 8 illustrates while the tube 100 is being inserted into the well 772, the elution solvent is displaced and flows upward through the distal tube opening 116, passing through the dried biological fluid sample unit 664, the frit(s) and the filter of the frit/filter assembly 130, whereby a significant volume of the elution solvent is located above the frit/filter assembly 130. Thereby creates an analyte-inclusive liquid-phase sample matrix or supernatant 880 above the frit/filter assembly 130, wherein the region occupied by 880 in tube 100 corresponds to claimed second region of the reservoir). As said technical feature was known in the art at the time of the invention, this cannot be considered special technical feature that would otherwise unify the groups.

Groups I through IV therefore lack unity under PCT Rule 13 because they do not share a same or corresponding special technical feature.