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(71) Applicant(s):
Sandwell and West Birmingham Hospials NHS Trust (Incorporated in the United Kingdom)
City Hospital, Dudley Road, BIRMINGHAM, B18 7QH, United Kingdom

(72) Inventor(s):
Jonathon Berg

(74) Agent and/or Address for Service:
Appleyard Lees
15 Clare Road, HALIFAX, West Yorkshire, HX1 2HY, United Kingdom

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(56) Documents Cited:
WO 2002/089723 A1 **US 20080299010 A1**
US 20040092001 A1

(58) Field of Search:
INT CL **G01N**
Other: **EPODOC, WPI**

(54) Title of the Invention: **Sample collection**
Abstract Title: **Folding sample collection device with drying facility**

(57) A sample collection method useful with a sample collection apparatus that comprises a sample collection area 2 coupled to a support member 3 for the sample collection area. The method comprises the steps of arranging the support member to lie beneath the sample collection area by folding along lines of weakness 7 and extracting, from the sample collection apparatus, a portion of the sample collection area by bringing an extraction tool into contact with the sample collection area. When folded the enclosure formed from part 4 assists in drying the sample by provision of dessicant or absorbent 6.

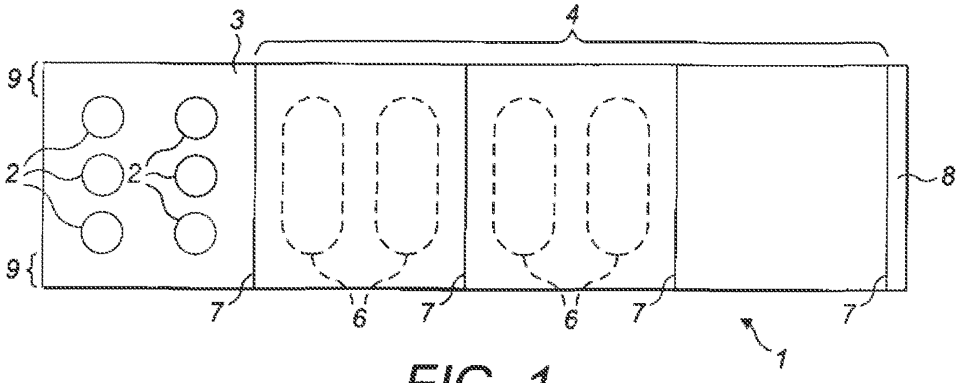

FIG. 1

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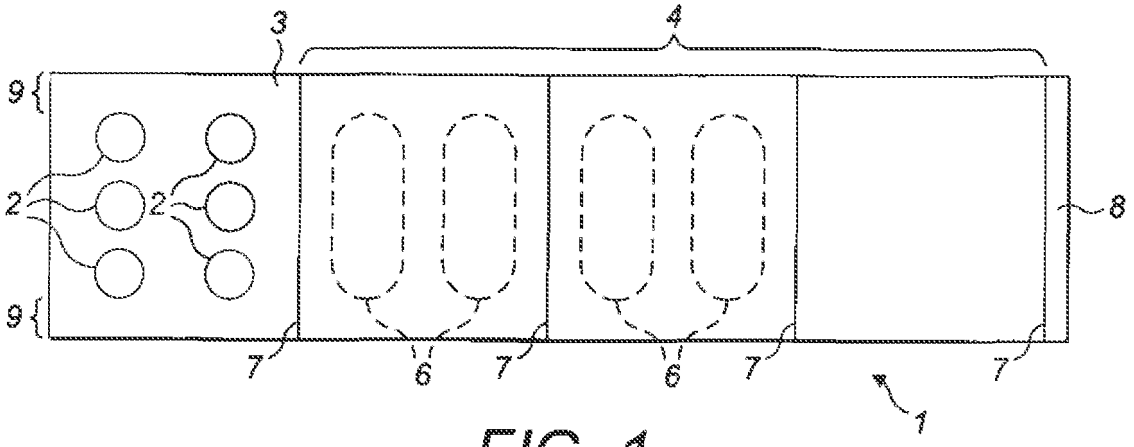

FIG. 1

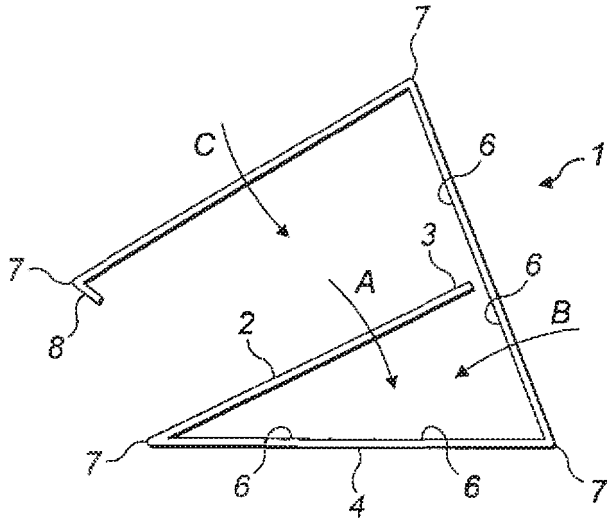

FIG. 2

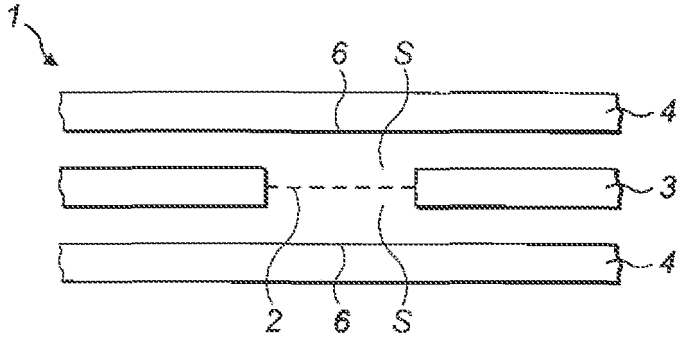

FIG. 3

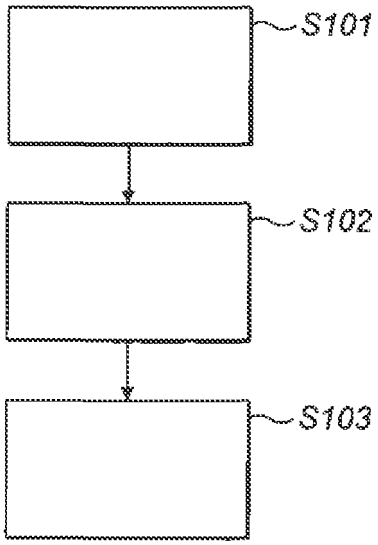

FIG. 4

Sample Collection

Field of the Invention

The present invention relates to sample collection apparatus and related methods.

Background to the Invention

Collecting samples of wet materials e.g. biological samples can be accomplished in a number of ways. One approach involves applying a spot of the wet sample onto an absorbent medium such as blotting paper. The sample is in part drawn into the absorbent material, and is then dried before being processed. However, the period where the sample is drying is inconvenient in many situations because it enables cross contamination to occur. A further problem with this approach arises in subsequently extracting material of dried sample of interest for processing.

It is an aim of example of embodiments of the present invention to address at least one disadvantage associated with related art techniques.

Summary of the Invention

In one aspect the present invention provides a sample collection method, the method comprising steps of:

(a) collecting a sample on a sample collection apparatus comprising a sample collection area coupled to a support member for the sample collection area,

(b) arranging the support member to lie beneath the sample collection area; and

(c) extracting, from the sample collection apparatus, a portion of the sample collection area that carries a portion of the sample by bringing an extraction tool into contact with the sample collection area from above.

Suitably, the support member comprises part of an enclosing member arrangeable with the sample collection area to absorb moisture evaporated from a sample collected on the sample collection area to thereby dry the sample.

Suitably, the sample collection area comprises a moisture absorbent area. Suitably, the sample collection area comprises an area of sheet material. Suitably, the sample collection area comprises an area of paper, cardboard or textile-based material, preferably blotting paper-based material.

Suitably, the sample collection area is mounted in a carrier. Suitably, the sample collection area is mounted in an aperture in a carrier. Suitably, the sample collection area obstructs an aperture in a carrier, preferably completely fills an aperture in the carrier. Suitably, the carrier is a sheet. Suitably, the sample collection area is bounded by the carrier. Suitably, the sample collection area is generally planar. Suitably, the carrier is generally planar. Suitably, the carrier is of greater thickness than the sample collection area. Suitably, a portion of the carrier adjacent to the sample collection area is of greater thickness than the sample collection area. Suitably, the sample collection area lies within the thickness of the carrier in which the sample collection area is mounted. Suitably, the sample collection area comprises an area of reduced thickness compared to the thickness of the carrier, preferably at least compared to the thickness of the carrier adjacent to the sample collection area. Suitably, the sample collection area is recessed compared to one side of the carrier, or a portion thereof. Suitably, the sample collection area is recessed compared to two sides of the carrier, or portions thereof. Suitably, the carrier comprises an area of paper, cardboard or textile-based material, preferably cardboard-based material.

Suitably, the enclosing member and the carrier are integral with one another. Suitably, the enclosing member comprises an extension from the carrier. Suitably, the enclosing member is moveable between a first position and a second position. Suitably, the enclosing member is moveable from a first position away from the sample collection area and in which the sample collection area is available to receive a sample. Suitably, the enclosing member is moveable to a second position relatively nearer to the sample collection area than the first position. Suitably, in the second position an air space is formed adjacent to the sample collection area into which moisture from the sample may evaporate. Suitably, in the second position an air space is formed adjacent to two sides of the sample collection area. Suitably, in the second position the enclosing member comprises a portion that lies parallel to the carrier. Suitably, in the second position the enclosing member comprises a portion that lies parallel to the carrier on a first side of the carrier, and a further portion that lies parallel to the carrier on a second side of the carrier. Suitably, in the second position an air space is formed between the enclosing member and one or two sides of the sample collection area. Suitably, the enclosing member comprises an absorbent material across its whole extent. Suitably, the enclosing member comprises an absorbent portion localised at the portion or portions thereof that are proximate to the sample collection area when the enclosing member is in the second position. Suitably, the enclosing member is generally absorbent on a first side thereof. Suitably, the enclosing member is generally impermeable to moisture on a second side thereof. Suitably, the enclosing member comprises a moisture-absorbent material applied or carried thereon, preferably a silica gel material. Suitably, the enclosing member comprises a semi-permeable membrane applied across a surface portion thereof, enabling moisture to evaporate into and be retained in the enclosing member.

Suitably, the enclosing member is a foldable member. Suitably, the enclosing member comprises one or more predetermined lines of weakness to facilitate folding thereof. Suitably, the enclosing member comprises one or more sheet sections, preferably generally planar sheet sections. Suitably, the enclosing member comprises one or more predetermined lines of weakness to facilitate formation of folds between planar sections of the enclosing member. Suitably, the lines of weakness are generally parallel to one another. Suitably, the enclosing member comprises an area of paper, cardboard or textile based material, preferably cardboard-based material.

Suitably, the enclosing member comprises a retaining member arranged to hold the enclosing member in the second position. Suitably, the enclosing member is arranged to seal the carrier member from the atmosphere when arranged in the second position. Suitably, the enclosing member comprises an adhesive portion arranged to hold and the enclosing member in the second position. Suitably, the enclosing member provides a breathable seal around the carrier portion when arranged in the second position.

Suitably, the sample collection comprises a plurality of discrete sample collection areas. Suitably, the sample collection areas are arranged in an array, preferably a two-dimensional array. Suitably, each sample collection area is of generally identical construction to the others.

Suitably, the method comprises carrying out the steps (a),(b) and (c) in sequence. Suitably, the method comprises carrying out the step (b) before the step (a).

Suitably, step (c) comprises bringing an extraction tool in the form of a coring tool into contact with the sample collection area.

Suitably, the method further comprises arranging the enclosing member around the sample collection area, allowing the sample to dry out, then removing part of the enclosing member from above the sample collection area to enable access to the sample collection area.

Suitably, the method comprises: applying a sample to a sample collection area, and then with an enclosing member enclosing the sample collection area such that the enclosing member absorbs moisture evaporated from the sample collection area to thereby dry the sample applied to the sample collection area.

Suitably, the method comprises moving the enclosing member from a first position in which it is away from the sample collection area and in which the sample collection area is available to receive a sample, to a second position relatively nearer to the sample collection area.

Suitably, in the second position an air space is formed adjacent to the sample collection area into which moisture from the sample may evaporate. Suitably, in the second position an air space is formed adjacent to two sides of the sample collection area.

Suitably, the method comprises sealing the sample collection area from the atmosphere using the enclosing member arranged in the second position.

Suitably, the method comprises moving the enclosing member into the second position before the sample applied to the sample collection area is dried. Suitably, the method comprises moving the enclosing member into the second position directly after the sample is applied to the sample collection area. Suitably, the method comprises moving the enclosing member into the second position immediately on application of the sample to the sample collection area.

Suitably, the sample comprises liquid containing suspended solids. Suitably, the sample comprises a solution containing dissolved solutes. Suitably, the sample comprises a biological sample. Suitably, the sample comprises a tissue sample, preferably a blood sample.

Suitably, the method comprises extracting a portion of the sample collection area that carries a portion of the sample without de-coupling the support member from the sample collection apparatus. Suitably, the method comprise extracting a portion of the sample collection area while the support remember remains in situ in the sample collection apparatus. Suitably, the method comprises extracting a portion of the sample collection area together with a portion of the support member.

Brief Introduction to the Figures

Figure 1 shows a plan view of a sample collection apparatus for use in an example embodiment;

Figure 2 shows a side view of the sample collection apparatus of Figure 1, illustrating how the sample collection apparatus is folded;

Figure 3 shows a side sectional view of a portion of the folded sample collection apparatus, the section passing through a sample collection area; and

Figure 4 illustrates steps of an example embodiment.

Description of Example Embodiments

Referring now to Figures 1-3 there is shown a sample collection apparatus 1.

The sample collection apparatus 1 comprises a two by three array of sample collection areas 2. The sample collection areas 2 are provided at circular apertures through a carrier 3. The sample collection apparatus 1 further comprise an enclosing member 4 that serves to provide support member for the sample collection area 2. The sample collection apparatus 1 is an example of a blood spot collection apparatus.

To use the sample collection apparatus 1, a sample is applied to a sample collection area 2. Then, the enclosing member 4 is used to enclose the sample collection area 2. The sample collection apparatus 1 is arranged such that the enclosing member 4 absorbs moisture evaporated from the sample collection area 2 to thereby dry the sample applied to the sample collection area 2. In this way the sample is easily and quickly isolated from the environment to reduce the risk of cross contamination, and thereafter drying within the enclosing member 4 takes place to facilitate later processing of the sample.

To hold the sample initially on the sample collection apparatus 1 the sample collection area 2 comprises a moisture absorbent area made of a blotting paper-based material. The sample collection area 2 is recessed from the faces of the carrier 3 to thereby provide an air space into which moisture from the sample can evaporate before being absorbed by the enclosing member 4. This air space is labelled as area S in Figure 3 on two sides of the sample collection area 2.

In the sample collection apparatus 1, the enclosing member 4 and the carrier 3 are integral with one another, with the enclosing member 4 comprising an extension from the carrier 3. The enclosing member 4 is moveable between a first position, as shown in Figure 1 and a second position. Figure 2 shows three folding operations A, B and C that bring the enclosing member from the first position to the second position. In the second position the enclosing member 3 comprises portions that lie parallel to the carrier 3, as shown in Figure 3.

The enclosing member 4 comprises absorbent portions 6 proximate to the sample collection area when the enclosing member is in the second position. In some embodiments the enclosing member 4 is generally absorbent across its whole extent whereas in other embodiment the enclosing member may comprise specific localised absorbent portions thereon.

To aid folding of the enclosing member 4, the enclosing member 4 comprises predetermined lines of weakness 7 arranged between generally planar sheet sections. The enclosing member 4 further comprises a retaining member 8 arranged to hold the enclosing member in the second position, for example by folding around the enclosing member 4 and sticking thereto. To seal the carrier member 3 from the atmosphere when the enclosing member 4 is arranged in the second position an adhesive or other seal may be provided, for example running along regions 9 along the edge of the enclosing member 4 and/or carrier member 3.

In this way a user, for example a clinician, nurse or patient may collect a sample, immediately protect the sample against cross contamination, while at the same time enabling the sample to be provided to a pathology lab or other test centre at a later time in a suitably dried form.

On receipt of the sample at a pathology lab or other test centre the enclosing member 4 is removed from its position on one side of the sample collection area 2 so that part of the sample collection area 2 is accessible from above while being supported from beneath by the support member formed by the remaining part of the enclosing member 4. This enables a sample extraction tool to be used to extract, from the sample collection apparatus, a portion of the sample collection area that carries a portion of the sample by bringing an extraction tool into contact with the sample collection area from above. The support member prevents the sample collection area from coming into contact with any external, potentially contaminated surfaces, and serves as a built in, disposable barrier preventing the sample extraction tool from picking up material from outside the sample collection apparatus. A further separate support is not needed, and therefore the sample collection method described if well suited to automation, for example in a machine capable of extracting sample cores from the sample collection area as described.

These step of the example embodiment shown in Figure 4 are, firstly, at step S101 collecting a sample on a sample collection apparatus comprising a sample collection area coupled to a support member for the sample collection area. Then at step S102 the support member is arranged to lie beneath the sample collection area. In other embodiments the support member may be provided beneath the sample collection area before the sample is collected. Furthermore, it is to be understood that "beneath" and "above" herein are used not in relation to absolute directions relative to gravity, but relative to one another. At step S103 a portion of the sample collection area that carries a portion of the sample is extracted by bringing an extraction tool (not shown) into contact with the sample collection area from above.

Attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection

with this specification, and the contents of all such papers and documents are incorporated herein by reference.

All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

Each feature disclosed in this specification (including any accompanying claims, abstract and drawings) may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

CLAIMS

1. A sample collection method comprising the steps of:
(a) collecting a sample on a sample collection apparatus comprising a sample collection area coupled to a support member for the sample collection area,
(b) arranging the support member to lie beneath the sample collection area; and
(c) extracting, from the sample collection apparatus, a portion of the sample collection area that carries a portion of the sample by bringing an extraction tool into contact with the sample collection area from above.

2. The sample collection method of claim 1, wherein the steps are performed in order as (a) first, then (b), then (c).

3. The sample collection method of claim 1, wherein the steps are performed with step (b) before step (a).

4. The sample collection method of claim 1 or 2, wherein the step (c) comprises brining an extraction tool in the form of a coring tool into contact with the sample collection area.

5. The sample collection method of any preceding claim, comprising extracting a portion of the sample collection area that carries a portion of the sample without de-coupling the support member from the sample collection apparatus.

6. The sample collection method of any preceding claim, wherein the method comprises extracting a portion of the sample collection area while the support member remains in situ in the sample collection apparatus.

7. The sample collection method of any preceding claim, wherein the method comprises extracting a portion of the sample collection area together with a portion of the support member.

8. The sample collection method of any preceding claim, wherein the support member comprises part of an enclosing member arrangeable with the sample collection area to absorb moisture evaporated from a sample collected on the sample collection area to thereby dry the sample, and the method comprises the steps of: applying a sample to a sample collection area, and then, with the enclosing member; enclosing the sample collection area such that the enclosing member absorbs moisture evaporated from the sample collection area to thereby

dry the sample applied to the sample collection area; then removing part of the enclosing member from above the sample collection area to enable access to the sample collection area.

9. The sample collection method of claim 8, comprising moving the enclosing member from a first position in which it is away from the sample collection area and in which the sample collection area is available to receive a sample, to a second position relatively nearer to the sample collection area.

10. The sample collection method of claim 9, wherein in the second position an air space is formed adjacent to the sample collection area into which moisture from the sample may evaporate.

11. The sample collection method of claim 10, wherein in the second position an air space is formed adjacent to two sides of the sample collection area.

12. The sample collection method of any one of claims 8 to 11, wherein the method comprises sealing the sample collection area from the atmosphere using the enclosing member arranged in the second position.

13. The sample collection method of any one of claims 8 to 12, wherein the enclosing member is moved into the second position before the sample applied to the sample collection area is dried.

14. The sample collection method of any one of claims 8 to 13, wherein the enclosing member is moved into the second position directly after the sample is applied to the sample collection area.

15. The sample collection method of any one of claims 8 to 14, wherein the enclosing member is moved into the second position immediately on application of the sample to the sample collection area.

16. The sample collection method of any preceding claim, wherein the enclosing member is a foldable member or comprises one or more predetermined lines of weakness to facilitate folding thereof.

17. The sample collection method of any preceding claim, comprising collecting a sample comprising a liquid containing suspended solids.

18. The sample collection method of any preceding claim, comprising collecting a sample comprising a solution containing dissolved solutes.

19. The sample collection method of any preceding claim, comprising collecting a biological sample.

20. The sample collection method of any preceding claim, comprising collecting a blood sample.

21. A sample collection method substantially as described herein, with reference to the accompanying drawings.

Application No:	GB1121545.6	**Examiner:**	Dr J.P. Bellia
Claims searched:	1-21	**Date of search:**	4 April 2012

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1, 3-7, 16-20	US2008/299010 A1 (SHIVIJI) See Figures
X	1, 3, 5, 6, 19	US2004/092001 A1 (BEDINGHAM et al) See paragraphs 34-41, 55, 56 and Figures
X	1, 3-7, 16-20	WO02/089723 A1 (BIOSAFE MEDICAL TECHNOLOGIES) See page 7 line 17-page 8 line 3; page 14 line 5-page 16 line 4 and Figures

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC[X] :

Worldwide search of patent documents classified in the following areas of the IPC

G01N

The following online and other databases have been used in the preparation of this search report

EPODOC, WPI

International Classification:

Subclass	Subgroup	Valid From
G01N	0001/28	01/01/2006
G01N	0033/52	01/01/2006