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(54) **EVIDENCE PRESERVATION**

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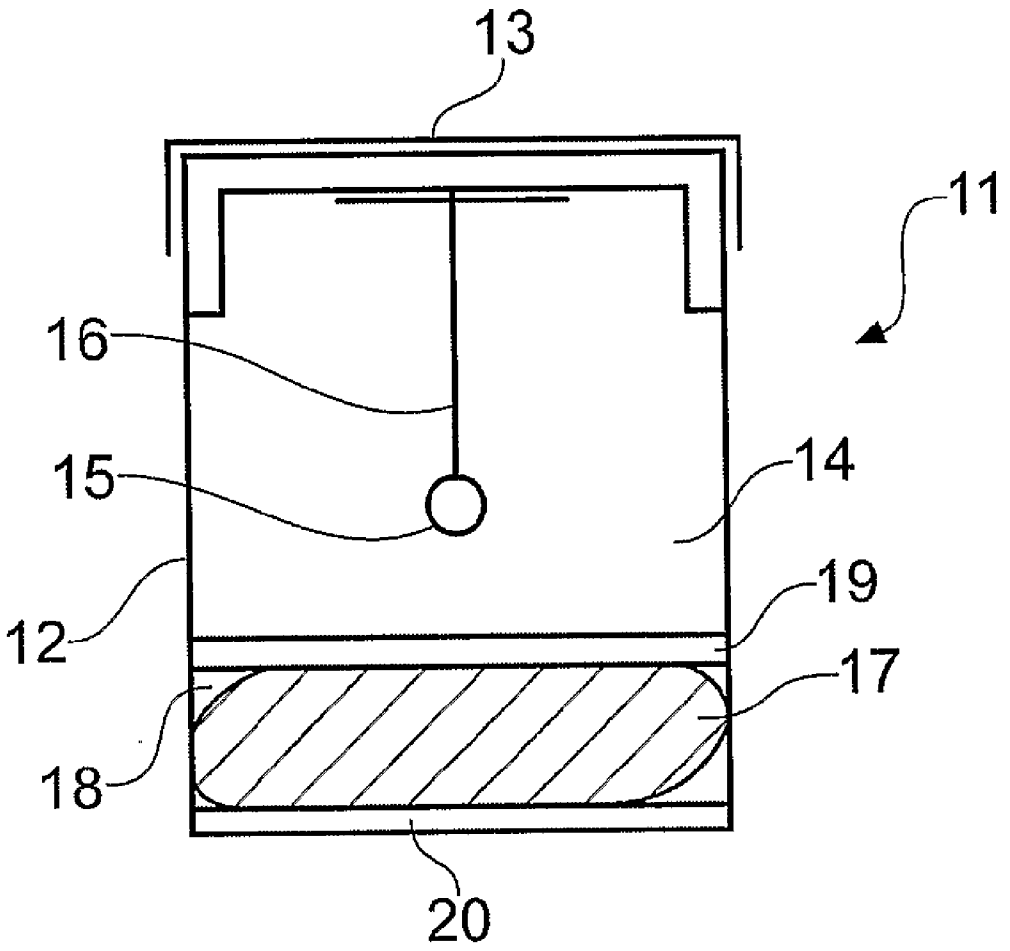
(57) **ABSTRACT**

A preservation apparatus for evidence samples comprising a hermetically sealable container having means to suspend samples in humidity exchange with air held within the container and a drying agent to dehumidify the air held within the container in order to act as a sink for humidity exchange in order to markedly dry the samples.



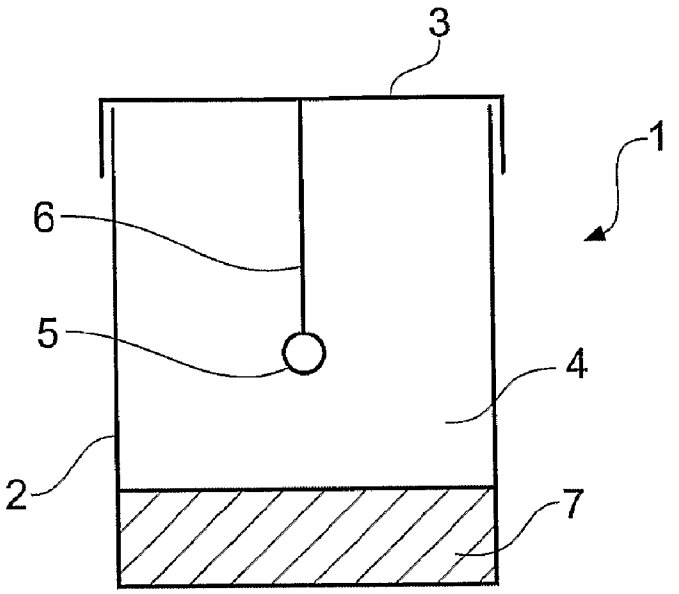


Fig. 1

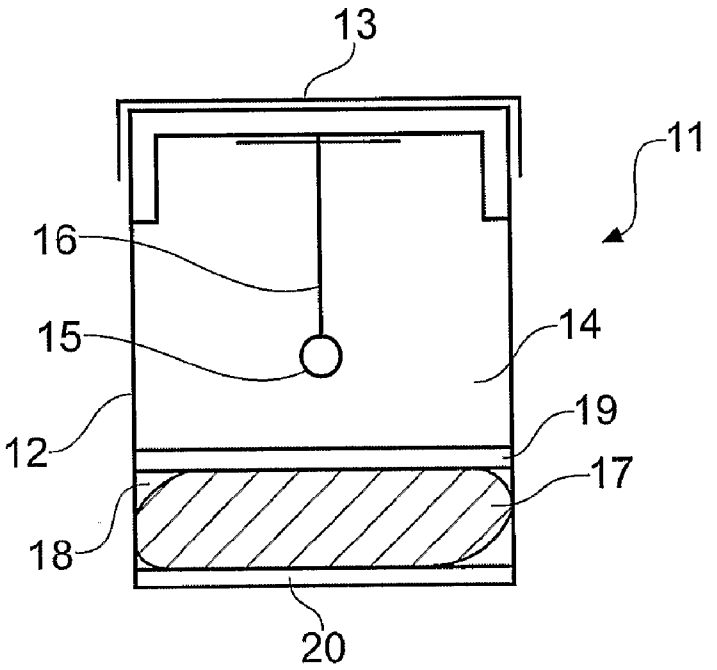


Fig. 2

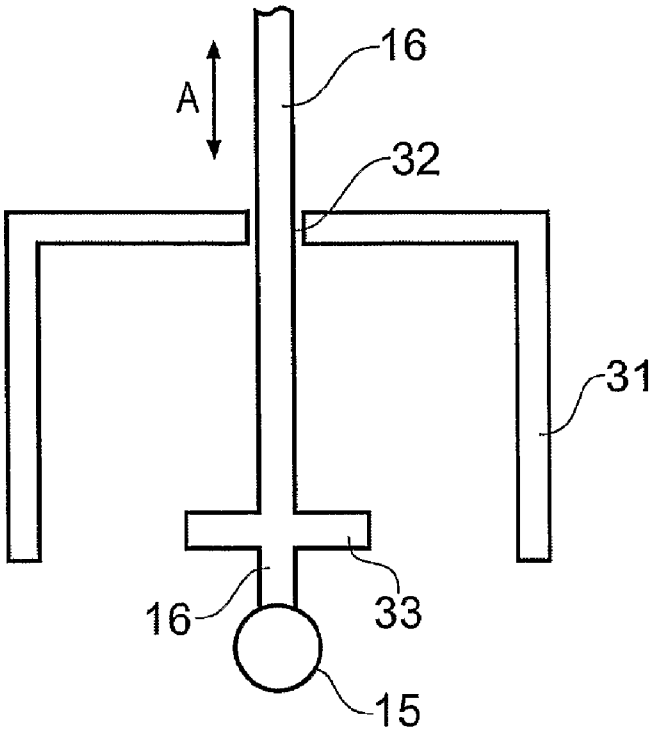


Fig. 3a

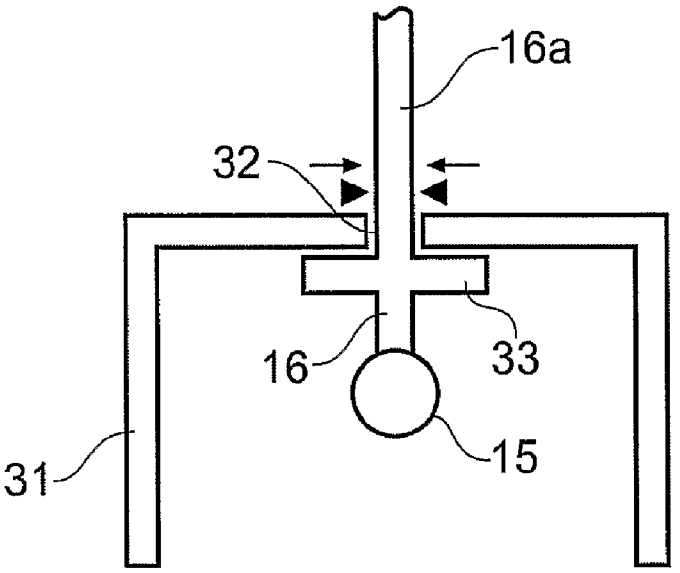


Fig. 3b

EVIDENCE PRESERVATION

[0001] The present invention relates to evidence preservation and more particularly, but not exclusively to swab drying with respect to forensic evidence preservation taken from crime scenes.

[0002] Swabs in the form of typically cotton buds presented on a stick are used for forensic evidence collection. The cotton bud is used to absorb a fluid or sample material for later investigation in a laboratory. Clearly, most samples taken with cotton bud swabs will deteriorate with time. In such circumstances, it is necessary to preserve the sample at least until it reaches a test laboratory. Similarly, samples of fabrics or woven materials or non-woven materials or otherwise may be collected and held by a clip, but these materials or the evidence they carry may deteriorate.

[0003] Previously swabs and in particular the samples taken with those swabs have been preserved through freezing or forced air drying. Both these processes inherently introduce the potential for corruption with respect to the evidence sample taken. Freezing of a sample may itself cause degradation as a result of the freezing process or the potential for moisture condensation or milder during the thawing process. Forced air typically with hot air itself can contaminate the sample with particulate matter in the forced air used to dry the sample and may even "cook" the sample creating degradation.

[0004] The above problems are further exacerbated by the "first at scene" mentality to take a large number of samples requiring preservation. Some of these samples may be duplicates such that careful preservation of all the samples may be time consuming and expensive particularly when potentially only some samples will require long term storage. In such circumstances relatively low level retardation with respect to any potential degradation in the sample will be adequate.

[0005] In accordance with the present invention there is provided a preservation apparatus for evidence samples, the apparatus comprising a hermetically sealable container having means to suspend a sample in humidity exchange with air held within the container and a drying agent to dehumidify the air held within the container in order to act as a sink for humidity exchange in order to markedly dry the sample.

[0006] Typically, the means to suspend the sample comprises a closure for the container. Generally, that closure is a lid for the container.

[0007] Preferably, the drying agent is a pre-dried silica gel. Possibly, the drying agent is held in a separate compartment of the container with a diffusion barrier between that compartment and the remainder of the apparatus in which the sample is suspended. Advantageously, the drying agent is replaceable in order to achieve acceptable drying of the sample. Advantageously, the drying agent changes colour to indicate its water content and therefore extent of humidity exchange within the container.

[0008] Possibly, the container includes means to ensure that the sample does not contact the walls of the container when suspended.

[0009] Embodiments of the present invention will now be described by way of example and with reference to the accompanying drawings in which:

[0010] FIG. **1** is a schematic cross-section of a first embodiment of a preservation apparatus in accordance with the present invention;

[0011] FIG. **2** is a schematic cross-section of a second embodiment of a preservation apparatus in accordance with the present invention; and,

[0012] FIG. **3** is a schematic illustration of a closure lid in accordance with the second embodiment of the invention depicted in FIG. **2**.

[0013] One of the principal causes of degradation with respect to samples taken by swab is as a result of liquid levels within the sample. In such circumstances, drying of the sample will essentially delay degradation and so extend the time period for analysis to an acceptable level. Nevertheless, appropriate drying techniques previously were not available at the remote locations typical of crime scenes where forensic samples must be taken for obvious reasons. The present apparatus provides a means by which swab or other samples can be preserved through in situ drying when in their storage device.

[0014] Referring to FIG. **1** illustrating a preservation apparatus **1** comprising a hermetically sealable container formed by a jar **2** and a closure lid **3**. In such circumstances within the container a volume of air **4** is hermetically isolated from its surroundings and therefore defines a closed environment. Within this closed environment a swab **5** is suspended upon a stork **6** in the volume of air **4**. The swab **5** is not in contact with any part of the container and so is generally in humidity exchange with the volume of air **4**. The stork **6** is typically formed from a rigid material such as wood or plastic and provides the manipulative handle by which the swab **5** can be used to wipe up a sample in forensic evidence gathering. The stork **6** cannot transmit, leach or leak fluid from the swab and in particular the sample taken by that swab **5**.

[0015] Within the container, and in particular the jar **2**, a drying agent **7** is provided. For illustrative purposes this drying agent **7** is shown as a block of material at one end of the jar **2** but it will be appreciated that the drying agent **7** may be placed as a coating on all or some of the inside walls of the jar **2**. In any event, the drying agent **7** acts to disturb the balance in the nacent humidity exchange between the swab **5** and the volume of air **4**. In short, the drying agent **7** acts as a sink for vapour and therefore reduces the humidity of the volume of air **4** such that in order to achieve equilibrium vapour is thereby drawn from the sample in the swab **5** in turn drying that sample. The effect of the drying agent **7** should be relatively massive in order to disturb the equilibrium humidity exchange between the swab **5** sample and the volume of air **4** sufficiently to cause the drying process to occur in an acceptable period of time. However, it will be understood that the samples will be taken and gathered at the site and therefore the swab sample will be exposed to the drying agent **7** for a significant period of time before being analysed. In such circumstances the drying process may be slow over that period of time but sufficient to avoid degradation in the swab sample.

[0016] It is possible if the swab sample is sufficiently dried that further drying through the drying agent **7** may be superfluous or even potentially damaging. In such circumstances, the drying agent **7** may be removed, but in the embodiment depicted in FIG. **1** this may be difficult so a shutter may be provided to allow isolation of the agent **7** from the remainder of the container in order to stop further drying.

[0017] In accordance with the preferred feature of the present invention the swab **5** and its stork **6** will be integral with the closure lid **3**. In such circumstances a sample will be gathered through the swab **5** with the lid **3** attached. Once the sample is collected, care will be taken in suspending the swab

5 within the jar 2 such that the swab 5 does not touch the surfaces of the container as this may create spurious results. The apparatus 1 will be specified in relation to the humidity exchange relationship between the swab 5 and the drying agent 7 such that any liquid sample smeared onto the jar 2 may distort this humidity exchange relationship.

[0018] As indicated above, typically the swab 5 and its stork 6 will be, integral with the closure lid 3. As an alternative, the stork 6 may be placed into piercing engagement with a corking material in the closure lid 3, but in any event the lid 3 once secured upon the jar 2 will create the hermetically sealed container as described above such that there is a closed environment within that container within which the humidity exchange processes between the swab sample 5 and the air 4 and then the air 4 with the drying agent 7 can act. Previously, it has been known to include drying agents in packaging for products sensitive to moisture in order to ensure any moisture ingress is preferentially collected by the drying agent. The present container is hermetically sealed so ingress is not possible so moisture is drawn from the sample by the massive de-humidifying bias of the drying agent indirectly through the intermediate volume of air 4.

[0019] Being an indirect drying process, that is to say swab sample to air 4 and then air 4 to drying agent 7 it will be appreciated that any rapid drying of the swab sample will generally be avoided by the indirect drying process in terms of limits with respect to possible vapour exchange.

[0020] The drying agent 7 will normally be a pre-dried silica gel which is chemically inert but other drying agents may be used.

[0021] FIGS. 2 and 3 illustrate a second potential embodiment of the present invention. Thus, again an hermetically sealed container 11 is formed by a jar 12 and a closure lid 13 with a volume of air 4 contained within that hermetically sealed container 11 provides a closed environment. Thus, a swab 15 on a stork 16 is suspended within the volume of air 14 such that there is a humidity exchange relationship between that swab sample and the volume of air 14 and then that volume of air 14 is in humidity exchange with a drying agent 17.

[0022] The embodiment in FIG. 2 has two particular features in comparison with the first embodiment depicted in FIG. 1. Thus, the drying agent 17 is in the form of a closed pack secured within a separate compartment 18 with a diffusion barrier 19 between that compartment 18 and the remainder of the jar 12. Humidity exchange between the volume of air 14 and the drying agent 17 occurs through this diffusion layer 19 in normal operation and this diffusion layer 19 acts as a regulator to allow the drying agent 17, as a pack, to be removed from the compartment 17 if required in order to maintain humidity within the volume of air 14 and so prevent further drying of the swab sample. Alternatively, it will be appreciated that the humidity exchange is dependent upon the humidity differential between the air 14 and the drying agent 17. Thus, as the drying agent 17 absorbs more and more moisture that gradient or differential may narrow significantly altering the drying rate and profile. As indicated above generally the drying agent 17 will act as a relatively massive humidity sink but nevertheless a narrowing of the driving humidity differentials between the air 14 and the drying agent 17 may disturb the drying procedure such that it is desirable to replace the drying agent 17. The point at which the drying agent 17 is replaced may be a simple fixed time period for each drying agent 17 pack or the drying agent 17 may be arranged to change colour when sufficiently saturated that it will be of less effect with respect to the humidity exchange for drying of the swab sample. The drying agent pack 17 will simply be removed by removal of a lid 20 to gain access to the compartment 18 and a replacement pack 17 then inserted and the lid 20 replaced.

[0023] It will also be understood as indicated above that once the humidity and the volume of air 14 has reached an acceptable level and therefore the drawing effect upon the swab sample has been achieved further drying would be detrimental or superfluous. In such circumstances the compartment 18 may be arranged to receive an appropriate seal or shutter in order to create a hermetic barrier closing the container with respect to further exchange with its drying agent. In such circumstances the humidity exchange balance within the container, that is to say between the volume of air 14 and the swab 15 will then purely be dependent upon temperature within the container 11. Therefore, if retained in a stable temperature environment the container will maintain the swab 15 at that particular dried status.

[0024] A further feature of the embodiment depicted in FIG. 2 is provision of a swab gauntlet in order to diminish or eliminate the possibility of the swab 15 contacting the sides of the jar 12. FIG. 3 provides a more detailed illustration of the swab gauntlet during a collection phase (FIG. 3*a*) and drying phase (FIG. 3*b*). As can be seen the swab 15 is secured upon the stork 16 which passes through the gauntlet 31 in an aperture 32. The swab 16 is arranged such that it can be displaced in the direction of arrowheads A extending or retreating as required to expose the swab 15 to allow collection of a sample (FIG. 3*a*). The stork 16 and the aperture 32 are arranged to be in a tight interference fit in order to retain stork 16 position once a displacement force is removed and more importantly provide a seal to facilitate hermetical isolation of the container in use.

[0025] Once the sample has been taken by the swab 15, the stork 16 will be pulled upwards until a scabbard 33 engages an underside of the gauntlet 31. In such situations as depicted in FIG. 3*b* the swab 15 is then located within the cavity formed by the gauntlet 31. In this position a significant length of the stork 16 depicted as 16*a* extends beyond the gauntlet 31 out of the aperture 32. This portion 61*a* will be removed by a lateral cleaving action 35 breaking the stork 16 or through any other process such as use of a knife, etc. With the swab 15 within the cavity formed by the gauntlet 31 the whole will then be presented to the jar 12 as depicted in FIG. 2 and slid down into position. Typically, there will be an interlock relationship between parts of the jar 12 and the gauntlet 31 to ensure the gauntlet 31 with swab 15 does not fall too much into the jar 12 and so ensures that the swab 15 is appropriately suspended within the volume of air 14 for the drying process as described above. Once the gauntlet 31 is in position the closure lid 13 will be placed upon the jar 12 in order to create the hermetically sealed container as described previously. The scabbard 33 may be coated with a sealant or otherwise used in association with the gauntlet 31 in order to facilitate this hermetic seal.

[0026] With a gauntlet 31 and scabbard arrangement it will be understood that when the stork portion 16*a* is removed, and if the scabbard is arranged to adhere in the same way with an upper part of gauntlet 31, then a "protected" unit is provided. These units can be "stacked" in a tube which is closed for evidence preservations. The tube will include the drying agent as required.

[0027] The closure lids **3**, **13** will generally be secured to the jars through a screw thread seal, although other processes may be provided to ensure hermetic isolation of the container for the humidity exchange relationships as described above.

[0028] Generally, each preservation apparatus will incorporate an appropriate identifier for the particular swab sample contained there within. This identifier may take the form of a label with a bar code or otherwise such that the location at which the sample was taken as well as possibly the time of retrieval, etc can be recorded and appropriately catalogued.

[0029] In terms of the procedure for retrieval of a swab sample it will be understood that if the swab and stork are integral with the closure lid **3**, **13** then the period of time when this closure lid **3**, **13** is removed must be minimised. The swabs **5**, **15** can be used such that the moisture naturally occurring within a sample, e.g. fresh blood is utilised or the swab itself may be pre-moistened with distilled water in order to retrieve less fluid samples such as the saliva on a drinks can, etc. In either event as described above the time when the closure lid **3**, **13** is removed should be minimised in order to reduce the exposure to atmosphere to as short a time period as possible so that there is less contamination and moistening of the drying agent **7**, **17**.

[0030] As the present invention is based upon the humidity exchange relationships between the swab and the volume of air and then the volume of air in the drying agent it will be understood that the particular dimensions of the container formed by the jar **2**, **12** as well as the volume of drying agent can be adjusted dependent upon particular requirements with respect to drying of the swab sample. If a less aggressive drying agent is provided such that the humidity differential is not so great then clearly the rate of drying will be reduced whilst more aggressive and therefore absorbent drying agents will greatly increase the rate of drying to the possible detriment of the swab sample. In such circumstances care must be taken with respect to the drying agent used.

[0031] Although both embodiments above describe suspension of the swab **5**, **15** from a stork associated with the closure lid **3**, **13** it will be understood that a swab in accordance with the present invention could also be suspended through a hanger not associated with the closure lid and possibly acting through association with the jar **2**, **12** if required.

[0032] It will be appreciated that the present preservation apparatus for swabs allows the drying of swabs, such as DNA swabs and sample swabs at crime scenes independently of the environmental conditions and without the necessity of using potential contaminating drying apparatus whilst ensuring acceptable drying of the swab sample in high humidity conditions. Each preservation apparatus is self contained and hermetically sealed removing the requirement for specialist drying equipment and so avoiding any potential further contamination of the swab sample until opened at the laboratory for analysis. Generally, the preservation apparatus will be transported prior to use in its hermetically sealed condition such that the apparatus is sterile and so not contaminated. As indicated, preferably the swab is integral with the apparatus and so again avoids any potential problems with respect to contamination. Similarly, the drying agent is retained within the preservation apparatus without contamination in a sterile form.

[0033] Although described with respect to swabs it will be appreciated that the swab could be replaced with means for attaching a fabric sample or other absorbent material such as tissue or plant materials which are then dried in accordance with the preservation apparatus as described above. Furthermore, although not essential it will be appreciated that the preservation apparatus in total could be frozen for further preservation although care will then be required with respect to re-humidifying equally upon the thawing of the apparatus.

[0034] Whilst endeavouring in the foregoing specification to draw attention to those features of the invention believed to be of particular importance it should be understood that the Applicant claims protection in respect of any patentable feature or combination of features hereinbefore referred to and/or shown in the drawings whether or not particular emphasis has been placed thereon.

1-14. (canceled)

15. A preservation apparatus for evidence samples, the apparatus comprising a hermetically sealable container having means to suspend a sample in humidity exchange with air held within the container and a drying agent to dehumidify the air held within the container in order to act as a sink for humidity exchange in order to markedly dry the sample.

16. An apparatus as claimed in claim **15** wherein the means to suspend the sample comprises a closure for the container.

17. An apparatus as claimed in claim **16** wherein that closure is a lid for the container.

18. An apparatus as claimed in claim **15** wherein the drying agent is a pre-dried silica gel.

19. An apparatus as claimed in claim **15** wherein the drying agent is held in a separate compartment of the container with a diffusion barrier between that compartment and the remainder of the apparatus in which the sample is suspended.

20. An apparatus as claimed in claim **15** wherein the drying agent is replaceable in order to achieve acceptable drying of the sample.

21. An apparatus as claimed in claim **15** wherein the drying agent changes color to indicate its water content and therefore extent of humidity exchange within the container.

22. An apparatus as claimed in claim **15** wherein the container includes means to ensure that the sample does not contact the walls of the container when suspended.

23. An apparatus as claimed in claim **15** wherein the means to suspend a sample in the container comprises a stork.

24. An apparatus as claimed in claim **23** wherein the stork is surrounded by a gauntlet.

25. An apparatus as claimed in claim **24** wherein the gauntlet is displaceable about the sample in use.

26. An apparatus as claimed in claim **23** wherein a plurality of gauntlets are locatable within or from the hermetically sealable container.

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