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(71) Applicant: **Universidade de Évora**
7000-803 Évora (PT)

(72) Inventors:
- **MADUREIRA PIMENTA NOGUEIRA, PEDRO MIGUEL**
  7005-389 ÉVORA (PT)
- **CARDOSO MAIA, MIGUEL**
  7005-413 ÉVORA (PT)
- **FONTES MOREIRA, NOEL ALEXANDRE**
  7000-957 ÉVORA (PT)
- **CHARNECA MENDES, PEDRO MIGUEL**
  7005-145 ÉVORA (PT)
- **PITA VICENTE, SANDRO DO ROSÁRIO**
  9350-254 RIBEIRA BRAVA (PT)
- **DE SOUSA MATOS, JOÃO FILIPE**
  7000-376 ÉVORA (PT)

(74) Representative: **Patentree**
Edificio Net
Rua de Salazares, 842
4149-002 Porto (PT)

(54) PROTECTIVE SUPPORT FOR THIN SECTIONS, METHODS AND USES THEREOF

(57) The present disclosure relates to a protective support for microscope analysis of a geological, biological or archaeological sample comprising an elastic frame, wherein the frame is able to surround a thin section or a support glass slide with a fixed thin section, through a cavity or recess in the inner side frame. The upper face of three walls comprises each other at least a protrusion mark and/or a symbol. Another aspect of the present disclosure relates to the usage of an optical equipment, preferably a microscope or a binocular loupe, to observe the thin section in which the protective support is applied.

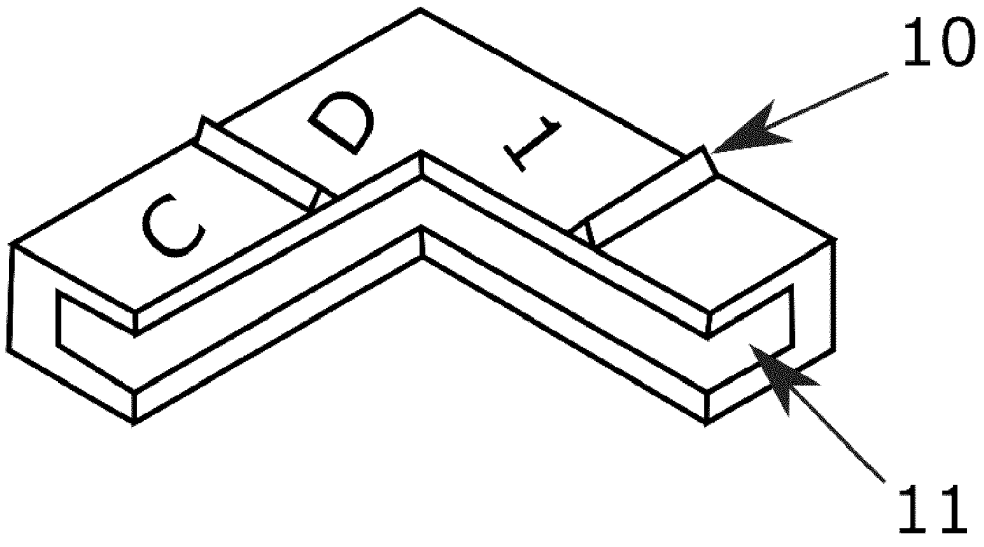

Fig. 5

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to a protective support for microscopy slides, more specifically, an elastic protective support for microscopy slides containing geological, biological or archaeological materials. The protective support is designed to protect the thin sections from breaking, particularly during their handing or analysis by microscopic techniques.

BACKGROUND

[0002] Thin sections are used for observation and characterization through microscopic techniques of geological, archaeological, geotechnical and biological materials, based on their optical properties. Its preparation is time consuming, requiring a set of laboratory procedures until reaching its final form. The most common geological thin section consists of a slice of rock sample cut and grinded to a thickness of 0.03 mm assembled on a microscope glass slide, with a thickness around 1mm (variable according to the laboratory specifications used). The thin section of the sample of geological (e.g. rocks, minerals, soils), archaeological (e.g. mortars, ceramics) or biological (e.g. teeth, bones) material is fixed to the glass using a mixture of resin like EpoThin 2 Resin - Buehler, EpoFix Resin - Streuers or others, and hardener, selected from EpoThin 2 Hardener - Buehler, EpoFix Hardener - Streuers, among others. The preparation of thin sections allows the observation of materials using transmitted or reflected light, enabling the characterization of the materials through their optical properties.

[0003] Particularly, geologic thin sections used for microscopic studies are assembled in a microscope glass slide in which a rock slice is bonded through EPOXY resin and grinded to 0.03 mm thick, becoming very brittle and susceptible to breakage.

[0004] The thin sections are therefore objects of extreme brittleness, and their laboratory preparation is time consuming, so their protection and storage are essential premises. The brittleness of the materials is even more evident when they are observed and handled, and some potential fall can result in their fragmentation and consequently loss of information of great importance, that often has a unique character, not allowing its replication.

[0005] The storage of glass slides for microscopy has already been addressed by a number of solutions, such as carton or plastic boxes or common individual carton files that are widely used. However, while useful, these materials do not provide protection to the thin section during its handling and observation under the microscope, having only the purpose of storage.

[0006] In addition, petrographic studies of these thin sections (0.03 mm) of geological, archaeological and even biological materials, presupposes identification and detailed description of the materials under study, being important to refer several points within thin sections in such way to easily identify zones on which a certain mineral or texture was found on the thin section. Currently, usual procedures use a photographic camera coupled to the optical microscope and connected to a computer, which allows to collect microscopic images of the minerals present on the observed sample. However, it should be noted that the thin section (0.03 mm) is glued to a glass with a thickness of around 1.00 mm, which makes it difficult to mark on the thin section the position in which the observation was made.

[0007] Some solutions related with generic microscope slides were already developed.

[0008] The document CN201965301 relates to a support for biological slides that intends to protect the slide when is in use in the microscope stage, during its utilization. This solution intends to help the utilization of the slide in a manner to avoid the hinder of the slide when is being used. The support is made of a material that is not moldable to the slide and has a "T" shape. The fact that the support is T shaped does not promote the correct protection of the slide which may break when is in use or when it falls.

[0009] The document US5225266 describes a specimen slide in the form of a strip-shaped glass plate. This slide is made of rigid material without any elasticity. Since this solution is made of a rigid material and is made of two separate parts, one of which removable, demonstrates that it is not a suitable solution for the purpose of the present disclosure.

[0010] Due to the extreme fragility of thin sections, the present subject matter was developed to confer protection to the thin section during their use, namely during the observation and handling, as well as providing an easy way to identify the information that is being analysed under the microscope.

[0011] These facts are disclosed in order to illustrate the technical problem addressed by the present disclosure.

GENERAL DESCRIPTION

[0012] In an embodiment, the present subject matter relates to a protective support for microscopic analysis that simultaneously provides solutions for storage, protection, handling, transport, identification, referencing and observation of thin sections of solid geological, archaeological or biological samples. The device is made of a malleable material which can absorb, cushion and minimize impacts in cases of fall, shock or application of certain stresses/pressures in situations of handling, transport and/or storage, preventing the breaking of the samples where this support is applied, and also avoid user injuries from cutting in the sharp edges of the glass.

[0013] For the purpose of this disclosure, thin section is defined as a thin, flat piece of material prepared for examination with a microscope, in particular a piece of rock about 0.03 mm thick (12). For microscope observa-

tion, thin sections are fixed to microscope glass slides (13), using a mixture of resins (14).

[0014] In an embodiment, the present disclosure may confer even better identification and organization capacity, given by the use of colours in the material composing the device; by the possibility of directly writing on its surface; as well as rapid identification and referencing of the elements in the quadrants of the thin sections.

[0015] In another embodiment, the protective support allows the observation of thin sections on appropriate microscopes or other similar equipment (e.g. binocular loupes) without having to remove the protective support/frame. Due to the adhesion features of the silicon from which the protective support is made, the risk of falling and breaking decreases, with complementary functionalities of protection, identification and organization/reference of information.

[0016] The device of the present disclosure is particularly useful for geological fields of investigation, since it enables safer and more efficient observation of thin sections under the microscope, avoiding unnecessary losses of material and unnecessary expenses to different geological laboratories. The production of thin sections involves a significant investment in laboratory materials and laboratorial time, or alternatively, placing an order to prepare thin sections on laboratories that provide this kind of services.

[0017] In an aspect of the disclosure, the device minimizes the risk of damage of the thin sections, and the injury of the operator, thus helping to conserve these scientific assets (thin section), which are expensive to replace and often irreplaceable because of the unique character of the rock sample.

[0018] The protective support of the present disclosure allows any operator to observe the thin section under the microscope without having to detach the protective support from the microscope slide itself, implying that the studied thin section, is always protected even when it rests on the microscope stage.

[0019] An aspect of the present disclosure relates to a protective support for microscope analysis of a geological/biological/archaeological sample comprising an elastic frame, made of a transparent addition curing two-component silicone moulding compound. The elastic frame is able to surround the sample and/or a sample support glass through a cavity or recess in the inner side.

[0020] In an embodiment, the protective support may comprise four side walls that embed all the edges of the slide and/or thin section, wherein at least one of the side walls is larger than the other sides. Preferably, the width of each three lateral side walls is at least 0.3 cm and the larger side has at least 0.5 cm. Also, the upper face of the larger side wall is flat.

[0021] In an embodiment, the protective support has a recess that embeds at least 0.2 cm of the sample or sample support on three lateral sides (c') and at least 0.35 cm on the larger lateral side (c).

[0022] An aspect of the present disclosure is that at least one of the upper faces of the side walls comprises at least a protrusion mark and/or a symbol, wherein the symbol is an alphanumeric character or a pictogram.

[0023] In an embodiment, each upper face of the three smaller side walls comprises at least one protrusion mark and one symbol. Preferably, the two oposite side walls have three protusions and the third side wall has one protrusion. Each protusion is separated no more than 10 mm from each other. If there are more than three protrusions per side wall, the distance between them is less than 10 mm. The shape of the protrusions can be selected from triangular or quadrangular prism, or half cylinder, preferably a triangular prism.

[0024] In another embodiment, the color of the protective support is modified by the addition of a color additive to the silicone mixture, selected from a variety of pigments.

[0025] In an embodiment, the elastic frame is made of a transparent addition curing two-component silicone moulding compound comprising a first component related to silicon and a second component comprising the hardener, wherein the first part is ten times more than the second part.

[0026] The present disclosure relates to a protective support that can be used with a geological, archeological or biological sample, wherein the geological sample is selected from rock, mineral or soil; the archeological sample is selected from mortar or ceramic; and the biological sample is selected from teeth or bones.

[0027] Another aspect of the present disclosure relates to an optical equipment to observe the thin section in which the protective support is applied, preferably a microscope or a binocular loupe.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] The following figures provide preferred embodiments for illustrating the disclosure and should not be seen as limiting the scope of invention.

Figure 1: Schematic representation of a side view section of the rectangular support where (1) is the support wrapped around a microscope slide and (2) is the microscope slide with the thin sample section.

Figure 2: Schematic drawing of an embodiment of the rectangular protective support where (3) represents part of the thin section fixed to a microscope slide, that is covered by the rectangular protective support for writing, (4) corresponds to the observable area/exposure area of the thin section; (5) represents the thickness of the outer wall of the support showing limits where the slide stays; (6) and (7) are the alphanumeric markings used for quadrant visualization.

Figure 3: Schematic representation of the layout of the rectangular protective support where (5) repre-

sents the thickness of the outer part of the support showing limits where the slide stays; (8) represents the larger side of the support where it is possible to reference the sample by writing on it; (9) shows a virtual quadrant division of the observable area; and (10) represents the protrusions existent on the sidewalls.

Figure 4: Schematic representation of the side view section of the rectangular support where (a) corresponds to the total width of one of the sides of the rectangular protective support (1) and (a') corresponds to the total width of three of the sides of the rectangular protective support; (b) corresponds to the total height of the rectangular support and (b') corresponds to the superior and inferior heights of each limit of the recess/cavity; (c) corresponds to the width of one side of the rectangular frame that incorporates the slide wider than the three other sides, so that writing of the sample reference is made possible; (c') represents three of the sides of the rectangular support, and (d) corresponds to the thickness of the rectangular frame limits where the slide is not incorporated.

Figure 5: Schematic image with the detail of the rectangular support from a corner perspective, where the division between the numbers and letters is made by a protrusion (10) in the upper part of the rectangular support. The recess/cavity is represented as 11.

Figure 6: Schematic representation of a thin section (12) fixed in a microscope glass slide (13) using a mixture of resins (14).

DETAILED DESCRIPTION

[0029] The present disclosure relates to a protective support for microscope analysis of a geological, biological or archaeological sample comprising an elastic frame, wherein the frame is able to surround a thin section or a support glass slide with a fixed thin section, through a cavity or recess in the inner side frame. The upper face of three walls comprises each other at least a protrusion mark and/or a symbol. Another aspect of the present disclosure relates to the usage of an optical equipment, preferably a microscope or a binocular loupe, to observe the thin section in which the protective support is applied.

[0030] In an embodiment, the protective support relates to a single elastic rectangular holder for securing microscope glass slides with a fixed thin section. The rectangular frame (1) comprises four side walls, that cover all the edges of the thin section, presenting a central opening (4), also with a rectangular form, creating a useful area of observation that is almost identical to the total area of the microscope slide.

[0031] In an embodiment, the rectangular frame (1) is made of a transparent addition curing two-component silicone moulding compound. The method used in the production of the protective support herein described, is widely used in other knowledge fields and prototype production. This production method uses a transparent addition curing two-moulding compound, with a wide variety of brands available. The production here described was achieved using the Köraform A42 moulding system from Alpina Technische Produkt GmbH. This moulding system is based on the mixing of two components, one of the components (A) corresponds to Köraform A42 silicone that must be mixed with a second component (B), which corresponds to Köraform A42B hardener. This mixture has to be achieved by a mixture of 10 parts of component A by 1 part of component B. The used silicon mixture has a viscosity of 35000 mPas, hardness shore A of 42, tensile strength of 6 N/mm^2, elongation at break of 300 %, tear resistance of 25 N/mm and a linear shrinkage of 0.1 %. Therefore, this material was selected because not only is malleable and facilitates the allocation of the microscope slide in the frame (1), but also avoids injuries on the user while operating the samples.

[0032] An aspect of the present disclosure comprises the physical properties of silicone used in the present subject matter. In an embodiment, the elastic nature of the silicone mixture permits the absorption of impact forces in case of fall, giving it a protective character.

[0033] In another embodiment, silicone malleability permits an easy handling of the device as well as an effortless detachment from the microscope slide. Since it is a "single piece" material, the assembly is achieved by sliding and adjusting the protective support to the four sides of the thin section.

[0034] In another embodiment, the adherent properties of silicone prevent unintentional moving of the microscope slide when observed under a microscope or loupe, while allowing its perfect manipulation during observations.

[0035] In embodiment, the physical properties of the silicone were tested by the brand under standard norms ASTM D 624 Form B, year 2012, for tear resistance; DIN 53 505 with the Shore Durometer for hardness and DIN 53 504 S 3 A from year 2017 for elongation at break and tensile strength. Viscosity was measured using the 2018 standard DIN 50 014-23/50-2 at 20 °C.

[0036] The rectangular frame (1) involves all the perimeter of the microscope glass slide (2) through a recess or cavity (11) in the inner side wherein the slide (2) will be embedded. This recess or cavity (11), which has a height of 0.13 cm embeds at least 0.35 cm of the microscope slide with the fixed thin section on three lateral sides (c') and at least 0.2 cm on the fourth lateral side (8) and (c). These dimensions are to ensure that the thin section and slide do not get accidently detached from the rectangular frame (1), so that the slide gets some coverage, without covering a significant part of the observation field. The total width of each three lateral sides is at least 0.3 cm and the fourth side has at least 0.5 cm.

[0037] The dimensions of the rectangular frames will vary consonantly with the size of the glass slide from which the thin section will be produced. Sometimes a wider area of observation is required for certain studies, hence it is mandatory to use bigger glass slides to produce the thin section. For this, the production of this protective support can be made with a moulding cast that respects the features and the proportions of the thin section.

[0038] In an embodiment, the dimensions of the rectangular frame (1) must be, at least 27 mm height, 46 mm length and 1.13 mm thickness. The thickness of the walls of the rectangular frame (1) make it resistant but at the same time they are thin enough to ensure the flexibility needed.

[0039] In another embodiment, the rectangular frame can be produced using dimensions similar to the standard dimensions of microscope slides available on the market. Table 1, below, provides examples of the most common dimensions (width × height) of microscope glass slides.

Table 1 shows the most common dimensions (width × height) of microscope glass slides

Model	width (mm)	height (mm)
1	27	46
2	24	32
3	51	76

[0040] In an embodiment, the upper faces of three sides (walls), marked as a dashed circle in Figure 4, contain protruding markings (10), letters (6) and/or numbers (7), that virtually divide the microscope slide into quadrants (9), marked as dashed lines in Figures 3, These markings allow the referencing and identification of zones where particular observations were made (e.g. mineral: "biotite - quadrant A1").

[0041] In another embodiment, the protrusions (10) may be in any form selected from half triangular or quadrangular prism or half cylinder, preferably, half triangular prisms. Between each protrusion there can be some protruding letters (6) and numbers (7), for example A, B, C, 1, 2, among others, to identify the virtual quadrants (9).

[0042] The minimum number of protrusions (10) on the two opposite sides is one. The number of protrusions is dependent on the dimension of the microscope slide to be protected with the rectangular frame. Preferably, there are three protrusions on each opposite side, and one on the third side, with each protrusion being separated by 10 mm. For rectangular frames with more than 3 protrusion per side, the distance between them must be inferior than 10 mm.

[0043] In another embodiment, the back side of the rectangular frame (1), the one that is in contact with the microscope stage, is smooth, without any protrusion or markings, allowing handling on the microscope or loupe stage. Additionally, it serves as a contact surface, increasing adhesion and avoiding slippery of the microscope slide, which is increased by the physical characteristics of the silicone used to produce the rectangular protective support.

[0044] In an embodiment, an aspect of the protective support is the possibility to clearly identify the thin section that is being protected by the rectangular frame. The surface of the fourth side (8) of the present device, identified by a solid circle in Figure 4, is flat, meaning that does not have any protrusions (10), letters (6) or numbers (7). Additionally, this side is wider than the three other sides and has an unmarked area (a) for insertion of a handwritten or sticker information of the thin section being observed (e.g. thin section reference, rock name). This side has a minimum width of 5 mm.

[0045] In an embodiment, a further feature of the protective support is the possibility to change the color of the frame, through the addition of a color additive to the silicone, usual from the state of the art. The aim of this color option is that the user can reference its samples by different groups, using a color code. Such identification will help the organization and rapid identification of a certain type of sample, for example, blue for thin section of schist; red for thin sections of granite; grey for thin sections of skarns, among others. The proportions of the coloring agent added to the silicone will vary consonantly to the final color required for the rectangular protective support. The composition of the material itself also allows for the addition of written notes on the elastomer itself (for example, thin section reference), which can then be deleted, if necessary, with a suitable diluent (e.g. alcohol or acetone).

[0046] In an embodiment, a standard measurement of the microscope glass slides used to fix a thin section is: 27 mm (height) x 46 mm (length) x 1.10 mm (thickness). To this glass, a rock sample is embedded and latter grinded to achieve a 0.03 mm thickness, so that the final measurements of the glass slide with thin section will be 27 mm (height) x 46 mm (length) x 1.13 mm (thickness).

[0047] In an embodiment, according to Figure 4, the rectangular frame (1) is prepared using the following dimensions: a = 0.5cm; a' = 0.3cm; b = 0.3cm; b' = 0.085cm; c = 0.35cm; c' = 0.2cm; d = 0.1cm.

[0048] In an embodiment, the production method involves a 3D design of the casting material from which the protective support will be produced. This casting piece is produced by 3D printing of the design previously created, following the measurements needed for the piece.

[0049] In an embodiment, the production of the rectangular frame (1) is achieved by using firstly, transparent addition curing two-component silicone moulding system where component A (silicone) is mixed with component B (hardener) at a proportion of 10:1. At this stage, a colorant can be added to the mixture, whereas its proportions will vary consonantly to the color wanted for the

rectangular protective support. When perfect mixture of component A and B is achieved, the resulting viscous liquid-like material (silicone) is then injected into the 3D printed casting. After injection of the mixture into the casting piece, the silicone rests for at least 12h (curing time). This allows the silicone to cure, forming a rubber material ideal for the rectangular protective support being produced.

[0050] In an embodiment, after the curing time the casting is unmounted and the rubber (rectangular protective support/frame (1)) material is simply pealed from the cast.

[0051] The term "comprising" whenever used in this document is intended to indicate the presence of stated features, integers, steps, components, but not to preclude the presence or addition of one or more other features, integers, steps, components or groups thereof.

[0052] The disclosure should not be seen in any way restricted to the embodiments described and a person with ordinary skill in the art will foresee many possibilities to modifications thereof. The above described embodiments are combinable.

[0053] The following claims further set out particular embodiments of the disclosure.

Claims

1. A protective support for microscope analysis of a geological/biological/archaeological samples comprising an elastic frame, wherein the frame is able to surround a thin section or a support glass slide with a fixed thin section, through a cavity or recess in the inner side frame, leaving the central part available for microscope observation.

2. The protective support according to the previous claim 1, comprising four side walls that embed all the edges of the glass slide with thin section.

3. The protective support according to any of the previous claims, wherein at least one of the side walls is larger than the other sides.

4. The protective support, according to previous claim 3, wherein the width of each three lateral side walls is at least 0.3 cm and the larger side wall has at least 0.5 cm.

5. The protective support, according to previous claim 3-4, wherein the upper face of the larger side wall is flat.

6. The protective support, according to any of previous claims, wherein the recess embeds at least 0.2 cm of the sample or sample support on three lateral sides (c') and at least 0.35 cm on the larger lateral side (c).

7. The protective support according to previous claim 2 wherein at least one of the upper faces of the side walls comprises at least a protrusion mark and/or a symbol wherein the symbol is an alphanumeric character or a pictogram.

8. The protective support, according to the previous claims 3 and 7, wherein each upper face of the three smaller side walls comprises at least one protrusion mark and one symbol.

9. The protective support, according to previous claim 9, wherein the two oposite side walls have three protusions and the third side wall has one protrusion.

10. The protective support according to previous claim 10 wherein each protusion is separated no more than 10 mm from each other.

11. The protective support, according to previous claim 9 wherein if there are more than three protrusions per side wall, the distance between them is less than 10 mm.

12. The protective support, according to the previous claim, wherein the elastic frame is made of a transparent addition curing two-component silicone moulding compound comprising
a first component, related to silicone;
a second component, comprising the hardener;
wherein the first part is ten times more than the second part.

13. The protective support, according to the previous claim 15, wherein the resulting silicone has:

a viscosity between 30000 and 40000 mPas at 20 °C, preferably 35000 mPas at 20 °C;
a hardness shore A between 35 and 60, preferably 42;
a tensile strength between 5 and 10 N/mm^2, preferably 6 N/mm^2;
an elongation at break between 250% and 350%, preferably 270 - 300%;
a tear resistance between 20 and 30 N/mm, preferably 25 N/mm; and
a linear shrinkage of 0.1 %.

14. The protective support, according to any of the previous claims, wherein:

the geological sample is selected from rock, mineral or soil;
the archaeological sample is selected from mortar or ceramic.
the biological sample is selected from teeth or bone.

15. An optical equipment comprising the protective support according to any of the previous claims, preferably a microscope or binocular loupes.

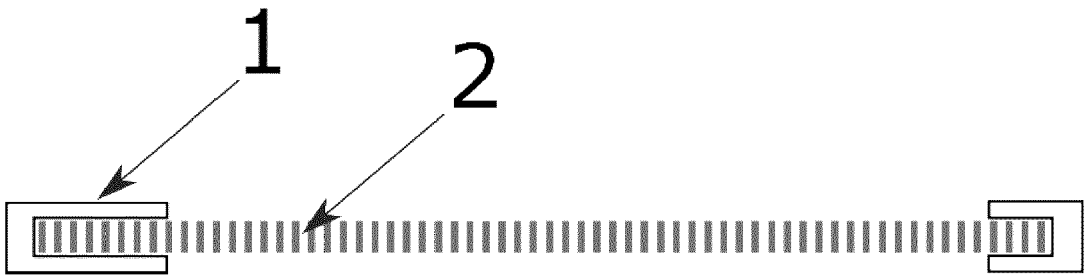

Fig. 1

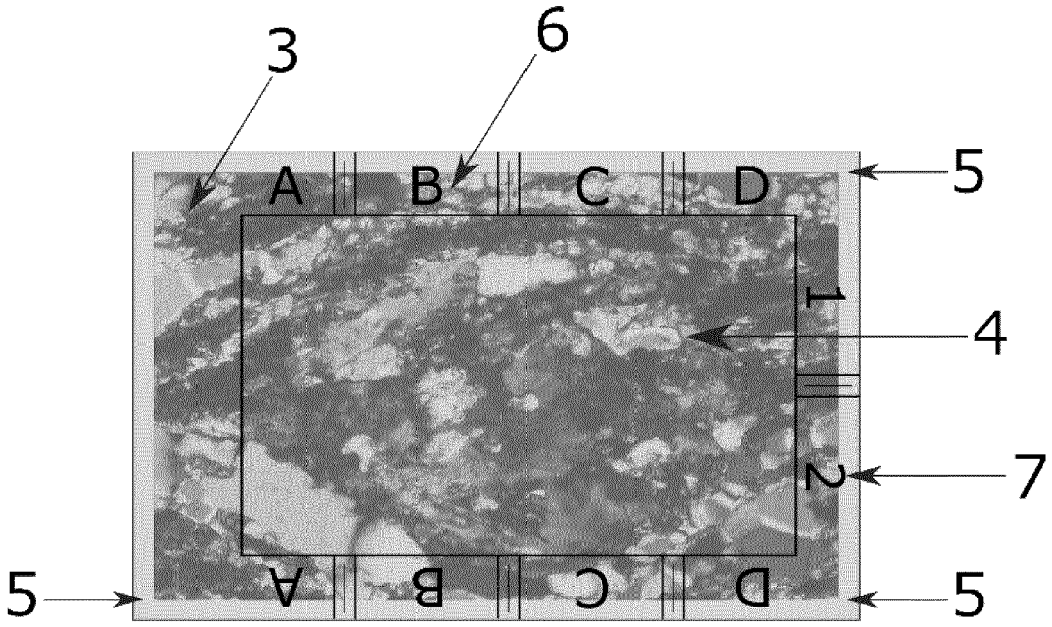

Fig. 2

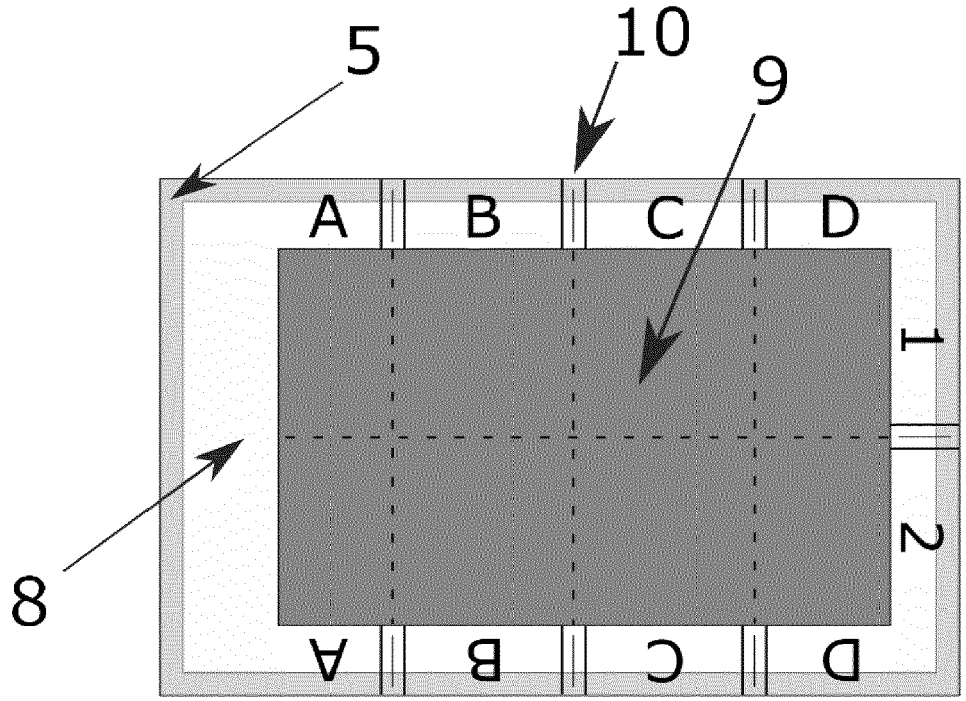

Fig. 3

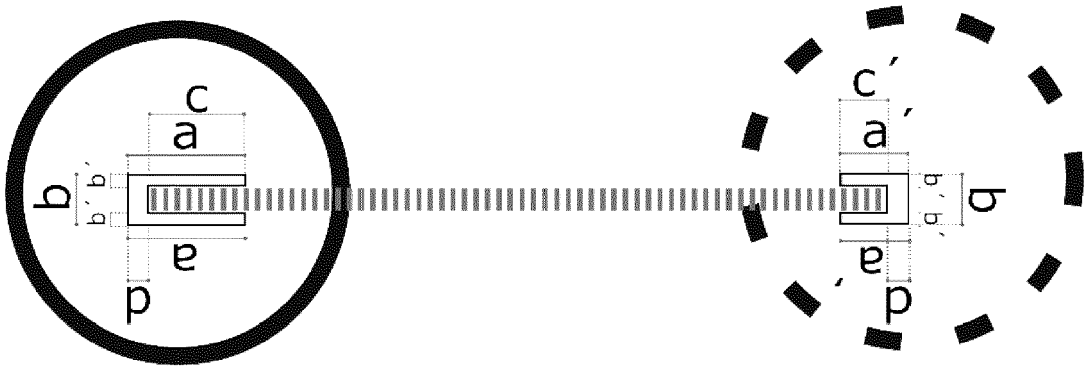

Fig. 4

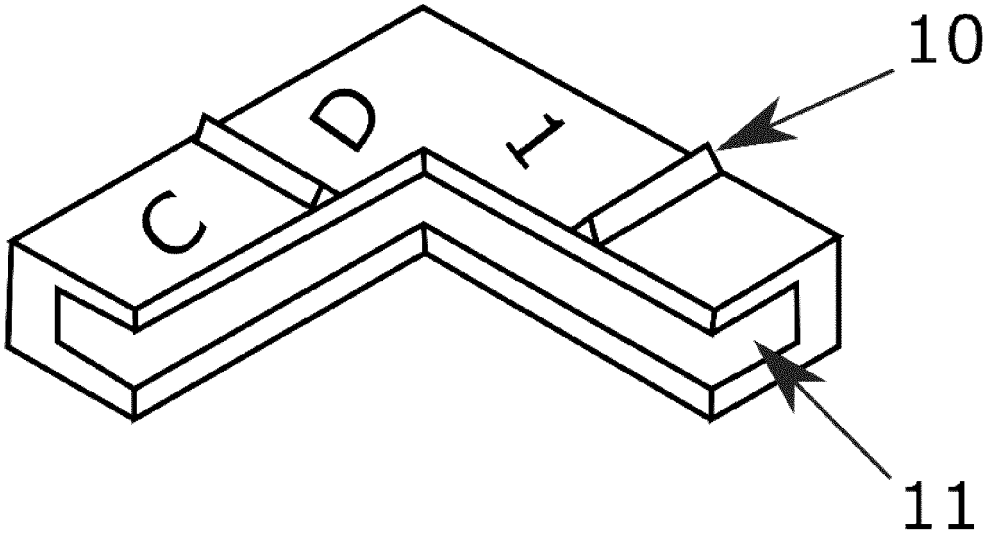

Fig. 5

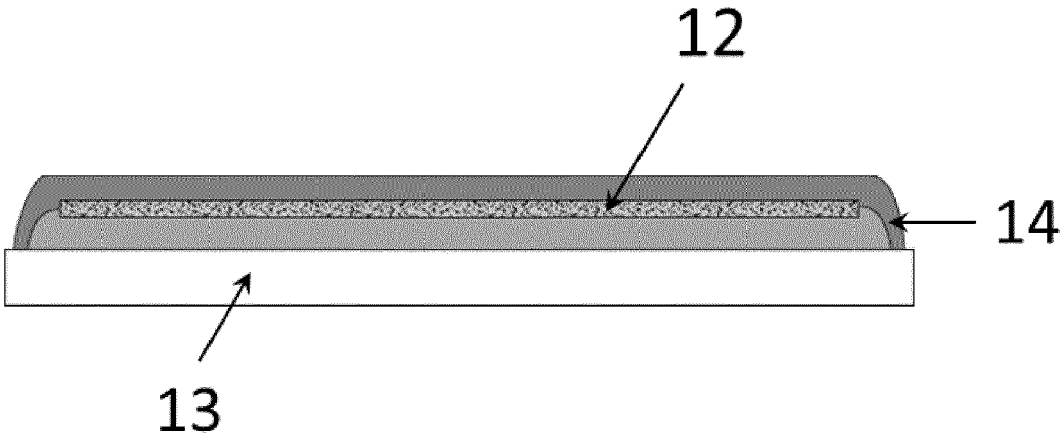

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 19 21 7747

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	US 2009/225309 A1 (DEMOU ZOE N [US]) 10 September 2009 (2009-09-10) * paragraphs [0030] - [0037], [0057]; claims 1-19; figures 1-4 *	1-6, 12-15 7-11	INV. B01L9/00
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A	DE 38 30 721 A1 (MENTON MICHAEL DR [DE]) 22 March 1990 (1990-03-22) * column 3, lines 8-31; figures 5-9 *	1-15	
A	EP 0 515 725 A1 (MENZEL G) 2 December 1992 (1992-12-02) * claims 1-19; figures 1-2 *	1-15	
A	WO 2014/009067 A1 (EUROIMMUN MEDIZINISCHE LABORDIAGNOSTIKA AG [DE]) 16 January 2014 (2014-01-16) * page 14, line 23 - page 15, line 27; figure 4 *	1-15	TECHNICAL FIELDS SEARCHED (IPC) B01L
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	23 June 2020	Pessenda García, P

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 19 21 7747

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