(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 626 152 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
25.03.2020 Bulletin 2020/13

(51) Int Cl.:
A47L 17/08 *(2006.01)*

(21) Application number: **19198944.1**

(22) Date of filing: **23.09.2019**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **23.09.2018 EP 18196128**

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(54) **SPONGE WITH AN IMPROVED SUDS GENERATION**

(57) The present invention relates to a sponge having at least one porous layer and at least one scouring layer, wherein the sponge has at least one cavity distinct from the pores of the sponge and emerging on a surface of the scouring layer forming an opening, and wherein at least one layer among the porous layer and the scouring layer has a high foam generating speed.

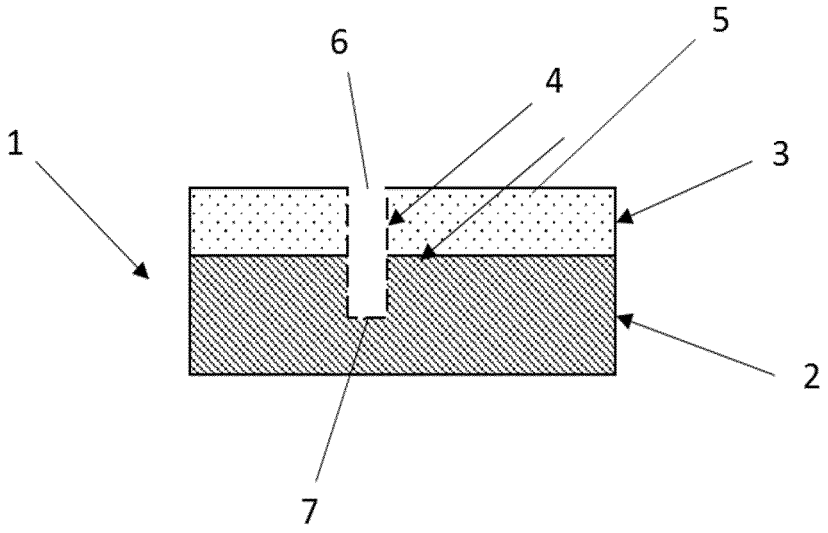

Fig. 1

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to the field of cleaning surfaces, and more particularly sponges. The sponges according to the present invention have the advantage of optimizing the performance and quantity of cleaning liquid used during cleaning methods.

TECHNOLOGICAL BACKGROUND OF THE INVENTION

[0002] It is known to use a sponge associated with a cleaning product to clean surfaces, such as floors, windows, or kitchen items and dishes.

[0003] In the case of cleaning dishes in particular, the cleaning may be done in a basin, or more commonly under running water. In fact, given that standing water containing the dishwashing liquid becomes dirty quickly and hinders cleaning, many users prefer washing dishes under running water.

[0004] This method for cleaning has the drawback of losing a large part of the cleaning liquid applied on the sponge when said sponge is passed under running water.

[0005] At the beginning of the cleaning operation the user deposits a quantity of dishwashing liquid on the sponge and presses the sponge to generate active foam. At each cleaning operations of a piece of dish, the user presses again the sponge in order to generate cleaning foam. The amount of generated foam at each pressure is, for the user, an indicator of the efficiency of the cleaning liquid. When the foam generated by the sponge is not sufficient, it is the signal for the user to add cleaning liquid onto the sponge.

[0006] The inventors discovered that among commercially available sponges, sponges either have a relatively quick suds (or foam) generation and a short-lasting suds generation or have a relatively slow suds (or foam) generation and a long-lasting suds generation. Dish-washing sponges with a long lasting suds generation will allow to clean more dishes with a given quantity of active liquid before to add again cleaning liquid onto the sponge.

[0007] However dish-washing sponges with a slow suds generation will oblige the consumer to press many times the sponge before to get enough foam to start the dishwashing, which will be deceptive.

[0008] There is therefore a need for a sponge to have a quick suds generation power and a long-lasting suds generation.

[0009] Up to now, professionals wanting to improve the foam generation, worked on the composition of the cleaning liquid. Few works have been done on the sponge itself.

[0010] WO2013/167304 discloses an interesting solution to provide a sponge having a long-lasting foaming power. The sponge of WO2013/167304 comprises a cavity allowing a long-lasting suds generation but the sponge of this document has a relatively slow suds generation.

[0011] The present invention aims at providing a sponge having simultaneously a quick suds generation and a long-lasting suds generation.

BRIEF DESCRIPTION OF THE FIGURES

[0012]

Fig. 1 to 4 shows a cross-section of sponges according to the present invention.
Fig. 5 corresponds to a cross-section of a sponge according to the present invention.
Fig. 6 corresponds to the device used to measure the softness (suppleness) of the scouring layer.
Fig. 7 corresponds to the assembly used to measure the foam generating speed of a sponge or of the porous layer.

BRIEF DESCRIPTION OF THE INVENTION

[0013] A first aspect of the invention relates to a sponge 1 having at least one porous layer 2 and at least one scouring layer 3, wherein the sponge has at least one cavity 4 distinct from the pores of the sponge and emerging on a surface 5 of the scouring layer forming an opening 6, and wherein at least one layer among the porous layer and the scouring layer has a foam generating speed of less than 12 pressures,
the foam generating speed being measured by the following method:

- Providing a test sample of 90mm*40mm*40mm of material,
- Pre-treating the sample:
    - Squeezing sample under water having a hardness of about 29°fH 3 times and letting it in water for 3 minutes,

- Taking the sample out of water and wringing it manually,
- Drying the sponge,

- Impregnating the pre-treated test sample uniformly with 14.5g of water.
- Putting 0.5g of detergent in the centre of one side of the test sample (90x40mm), the detergent having a Brookfield viscosity ranging from 900 to 1000 mPa.s measured with a spindle L1 at 1,5 rpm at a temperature of 20°C and a foam capacity ranging from 140 to 170 mL according to standard ISO 696:1975,
- Letting the detergent impregnate the test sample for 30 seconds,
- Placing the test sample into a holding and compression device on its 90 x 40 mm side (see Fig. 7), the side used for the detergent impregnation is set perpendicularly to the base,
- Placing a graduated collector under the bottom plate to collect the foam ejected at each compression,
- Compressing sample several times at a speed of 220 mm/s, stopping compression when the applied strength reaches 3.5 kg and respecting a stop time between each compression of 7 seconds. After each compression the foam present under the sponge is collected by scrapping it into a collector, and measuring cumulated foam volume collected (excluding water present in the bottom of collector) after each compression,
- Stop process when cumulated foam volume collected (excluding water collected at the bottom of the collector) has reached or exceeded 25ml,

the foam generation speed being expressed by the number of compressions performed till collection of 25 ml foam, the final result being the average of 5 measures.

[0014] Preferably, the layer having a foam generating speed of less than 12 pressures is the porous layer.

[0015] According to an embodiment, the porous layer has one or several of the following features:

- a density of less than 24 kg/m^3,
- a compressive strength of less than 30kPa,
- an absorption of less than 50g/100cm^3, more preferably less than 30g/100cm^3.

[0016] According to an embodiment, the scouring layer has a flexibility of less than 3.5N, more preferably less than 2.5N, even more preferably less than 2N.

[0017] According to an embodiment, the sponge has a cleaning surface with a circularity index of more than 0.70, more preferably more than 0.75, even more preferably more than 0.80.

[0018] According to an embodiment, the cavity has a bottom 7 inside the sponge, preferably inside the porous layer of the sponge. Preferably, the cavity is perpendicular to at least one of the main faces of the sponge.

[0019] According to an embodiment of the invention, the maximum distance between two points of the contour of the opening 6 is comprised between 3 and 25 mm, preferably between 5 and 20 mm, still more preferably between 8 and 15 mm.

[0020] According to an embodiment, the porous layer is a foam, and preferably a polyurethane foam.

[0021] According to an embodiment, the scouring layer is glued on at least part of the upper surface of the porous layer.

[0022] According to an embodiment of the invention, the sponge includes a third layer 8 glued on at least part of the lower surface of the sponge, the upper surface of the sponge being the surface with the opening of the cavity, the scouring layer, the porous layer and third layers characterizing a "sandwich" structure.

[0023] According to an embodiment, the sponge has two slots 9 along two parallel sides of the sponge, the slots being preferably drilled in the porous layer.

[0024] A second aspect of the invention relates to a cleaning method comprising a step of applying a cleaning liquid into the cavity or onto a surface, preferably in the cavity, of the sponge according to the invention, followed by a step of compressing the sponge in order to release a foam of the cleaning liquid.

[0025] The cleaning method of the invention is preferably performed under running water.

[0026] A third aspect of the invention relates to the use of the sponge of the invention to clean dish items.

[0027] The sponge according to the invention shows improved performances since it allows simultaneously a quick suds (or foam) generation and a long-lasting suds (or foam) generation.

[0028] The sponge according to the invention allows optimizing the consumption of cleaning liquid.

DETAILED DESCRIPTION OF THE INVENTION

[0029] In order to achieve the aforementioned aim, the present invention proposes a sponge comprising at least one porous layer and at least one scouring layer, and including at least one cavity, distinct from the pores of the sponge, making it possible to introduce a given quantity of cleaning liquid inside the sponge to impregnate it, the cavity preferably having a bottom inside the sponge, and emerging on the other hand on a surface of the scouring layer of the sponge,

the porous layer having a foam generating speed of less than 12 pressures.

[0030] According to the present invention, the term "cleaning liquid" designates any cleaning liquids or gels that may be used in household cleaning or upkeep. These are for example degreasing liquids, detergents, dishwashing liquids, liquids containing enzymes, antibacterials or antiseptics. The term also refers to gels which, not being completely solid, are fluid enough to fill a cavity, be absorbed by the sponge and be released during the cleaning phase, for example using simple compression of the sponge by the user.

[0031] These types of liquids/gels generally correspond to products concentrated in a detergent agent; they generally have viscosities typically comprised between 10 and 10,000 centipoises, for example between 200 and 3,000 centipoises or between 300 and 2,000 centipoises at 25°C. Thus, the sponges according to the present invention are usable with different types of liquids currently marketed. One type of standard reference liquid soap is the dishwashing soap marketed under the Fairy® brand or Paic® brand.

[0032] According to the present invention, the term "sponge" refers to an absorbing, porous and/or fibrous, natural or synthetic, material used to clean surfaces or dishes. A sponge generally assumes the form of a rectangle having two main cleaning faces and four side surfaces. The so-called "main" faces offer the largest contact surfaces of all of the faces of the sponge. The term "sponge" designates an item capable of being directly handled by the user. Generally, the dimensions of the sponge are such that the user can hold the sponge completely in his hand. Such a sponge may also have an ergonomic shape, or a thin profile in the center thereof so as to be easier to grip, or may have side reinforcements or prehension shape capable of facilitating grasping of the sponge by the user. In particular, according to one preferred embodiment of the invention, the sponges exclude the presence of a reservoir sleeve, capable of containing a cleaning liquid reservoir. According to an embodiment, the sponge of the invention is profiled with a prehension shape, the prehension shape being preferably formed in the porous layer.

[0033] The sponge according to the invention makes it possible to introduce detergent liquid inside the sponge. Furthermore, the sponge according to the invention can be impregnated by the introduced liquid, i.e., it allows a substantial quantity of the liquid introduced into the cavity to directly penetrate the inside of the structure of the sponge, i.e., to be absorbed. "Substantial" means at least 90% of the volume of the liquid introduced into the cavity after the sponge has beforehand been moistened. Thus, the liquid is contained in the very structure of the sponge and comes out in the form of foam preferably from all of the available surfaces of the sponge during cleaning. According to a specific embodiment, the entire structure of the sponge generates and then favors the formation of foam.

[0034] The sponge according to the invention in fact makes it possible to be able to be impregnated by the liquid before the latter leaves the cavity under pressure from the user. Advantageously, the sponge according to the invention makes it possible to be impregnated with liquid introduced into the cavity fairly quickly so that it does not come out during conventional handling of the sponge, i.e., in several minutes, for example in 5, 3 or 2 minutes.

[0035] According to the present invention, the term "cavity" refers to any space created within the sponge that can be manufactured by removing material, such as a notch or hole. For example, the removal of material may be done by drilling, boring, incision or milling. Particularly, the cavity is made directly in the mass of the sponge and not by assembling elements where part of the material has previously been removed. Thus, the cavities are prepared according to methods that are easy to implement and that simplify the industrial production of the sponges relative to more complex cavity shapes and make it possible to decrease the production costs and therefore prices. The sponges according to the invention comprise one or more cavities. Preferably, the sponge according to the invention comprises only one cavity.

[0036] The cavities may also have a bottom, in particular in the case where one of the cavities is vertical relative to one of the main cleaning surfaces of the sponge, such that the detergent liquid can be absorbed in the heart of the sponge by the sponge and not directly released on the surface to be cleaned, through the sponge. The bottom is not, however, necessary when a through cavity is inclined relative to the vertical axis or parallel to one of the main cleaning surfaces. In fact, the liquid then has the possibility of being absorbed in the heart of the sponge by flowing along the wall of the cavity before exiting.

[0037] Advantageously, the cavity of the sponges according to the invention comprises a bottom, the bottom being preferably located within the porous layer.

[0038] Typically, the inner volume of the cavity, or, if applicable, the cumulative inner volume of the cavities, is comprised between 1 and 6 cm^3, preferably between 1.2 and 4 cm^3, or between 1.2 and 2 cm^3. In the case of an application for dishwashing, this volume typically corresponds to the half-dose necessary for standard dishwashing, which makes it possible to perform a cleaning cycle with a single refill. In filling the cavity, the user has a visual indicator that makes it possible to fill the sponge systematically with a consistent volume of liquid soap and to dose the product economically during each refill. Furthermore, the cavity makes it possible to introduce the liquid soap directly into the heart of the sponge, which allows longer lasting and more regular suds generation for a given quantity of active liquid. This was not the case with the sponges of the prior art, in particular when they were used under running water.

[0039] It is also possible to consider providing a specific cavity volume according to the properties of a particular type of cleaning liquid, for example depending on the concentration of cleaning liquid or its cleaning power for a given application.

[0040] The cavity opens on at least one of the surfaces of the scouring layer of the sponge. Typically, the size and shape of the opening correspond to the cross-section of the through cavity so as to facilitate the production of the sponges according to the invention. The opening comprises a surface area typically comprised between 5 and 200 mm^2, preferably comprised between 20 and 120 mm^2, and still more preferably between 50 and 120 mm^2 or between 50 and 100 mm^2 so as to be able to directly receive the tip of liquid soap bottles.

[0041] The contour of the opening on the free surface of the scouring layer is such that the maximum distance between two points of the contour of the opening is comprised between 3, preferably 5, still more preferably 8, and 20 mm, preferably 15 mm, still more preferably 12 mm. In other words, on all of the points of the contour, the maximum distance between two points of that contour is comprised between 3 and 20 mm. Advantageously, this opening size prevents the liquid introduced into the cavity by the user from leaving before it has impregnated the inside of the sponge.

[0042] Preferably, the opening has a surface slightly smaller than the size of the tip of the liquid soap bottle and deforms when the bottle is inserted into the opening so as to ensure hermetic contact with the tip of said bottle. This tightness may also be obtained by pressing the head of the bottle on the surface of the sponge situated around the opening. This alternative of the invention thus prevents any loss of detergent product during the refill. The user fills the cavity by pressing on the bottle and knows that the cavity has been filled when slight resistance on the bottle is felt.

[0043] Depending on the flexibility of the sponge, the opening, as well as the cavity, may also be a notch or incision which, by deforming, makes it possible to insert the tip of the liquid bottle in the heart of the sponge, the deformation of the mass of the sponge creating a cavity in that case.

[0044] Depending on the number of cavities considered for the sponge, the cavity or cavities may emerge on one or more surfaces of the sponge.

[0045] Additionally, the shape of the contour of the opening can vary from one sponge to the next. It is preferably circular, but may also have an oval or rectangular shape. It may also be a notch or incision.

[0046] According to the invention, the sponge comprises at least one porous layer and at least one scouring layer.

[0047] Preferably, the material forming the scouring layer is selected from woven, non-woven, knitted or resin coated materials having scrubbing or abrasive properties.

[0048] The abrasive layer can also be obtained by coating directly the porous layer with a coating material (for instance a resin or a polyurethane composition) containing abrasive material.

[0049] According to an embodiment, the scouring layer has a thickness of less than 10 mm, preferably ranging from 6 to 8 mm.

[0050] According to an embodiment, and in order to contribute to higher foam generation speed, the scouring layer has a softness of less than 3.5N, more preferably less than 2.5N, even more preferably less than 2N. The softness may be measured according to the following method:

- A piece of a scouring layer of 90 x 40 mm is placed in a device comprising a fixed bottom guide rail 1 and a mobile upper guide rail 2 (moving vertically at a speed of 100mm/min), the piece of scouring layer having a thickness of less than 10 mm, typically ranging from 6 to 8 mm.
- The sample stands on one of its small side (long side aligned with vertical axis), and is submitted to compression, as illustrated in Fig. 6.
- The result is the average strength recorded between position -5mm and -25mm of the upper guide.

[0051] Preferably, the cavity has a bottom inside the sponge, and preferably within the porous layer of the sponge.

[0052] The porous layer of the sponge has a foam generating speed of less than 12 pressures, preferably less than 10 pressures, even more preferably less than 8 pressures, measured by the following method:

- Providing a test sample of 90mm*40mm*40mm of material,
- Pre-treating the sample:
    - Squeezing sample under water having a hardness of about 29°fH 3 times and letting it in water for 3 minutes,
    - Taking the sample out of water and wringing it manually,
    - Drying the sponge,
- Impregnating the pre-treated test sample uniformly with 14.5g of water.
- Putting 0.5g of detergent in the centre of one side of the test sample (90x40mm), the detergent having a Brookfield viscosity ranging from 900 to 1000 mPa.s measured with a spindle L1 at 1,5 rpm at a temperature of 20°C and a foam capacity ranging from 140 to 170 mL according to standard ISO 696:1975,
- Letting the detergent impregnate the test sample for 30 seconds,
- Placing the test sample into a holding and compression device on its 90 x 40 mm side (see Fig. 7), the side used for the detergent impregnation is set perpendicularly to the base,

- Placing a graduated collector under the bottom plate to collect the foam ejected at each compression,
- Compressing sample several times at a speed of 220 mm/s, stopping compression when the applied strength reaches 3.5 kg and respecting a stop time between each compression of 7 seconds. After each compression the foam present under the sponge is collected by scrapping it into a collector, and measuring cumulated foam volume collected (excluding water present in the bottom of collector) after each compression,
- Stop process when cumulated foam volume collected (excluding water collected at the bottom of the collector) has reached or exceeded 25ml,

the foam generation speed being expressed by the number of compressions performed till collection of 25 ml foam. The final result is the average of 5 measures.

[0053] A porous layer having the foam generating speed defined in the present invention can be Vitapol VPPT1830 from Vita Polymers Poland SP Z O.O.

[0054] Fig. 7 illustrates a holding and compression device 1 used to measure the foam generating speed. The device can be characterized by the followings:

- Base 2 of the device 1 has an open window 3 measuring 85x35mm and is preferably made in a rigid material,
- Sample is covering and overlapping the window 3 and is placed between four vertical bars 4 guiding it and maintaining it centred during compression,
- Top 5 of the device comprises a mobile plate 6 that allows to compress and depress alternatively the sample,
- The sample side used for detergent impregnation is set perpendicularly to the base,
- The open window 3 of bottom plate 6 contains at least two tensed cables 7 in order to hold the bottom side of the sample during compression.

[0055] The detergent used to measure the foam generating speed has a viscosity, measured with the Brookfield method with a spindle L1 and a speed of 1.5 rpm ranging from 900 to 1000 mPa.s, at a temperature of 20°C.

[0056] The detergent used to measure the foam generating speed has a foam capacity measured with the Ross-miles method according to standard ISO 696:1975, ranging from 140 to 170 ml.

[0057] If one porous layer material is smaller than the prescribed 90mm*40mm*40mm dimensions, it is possible to superpose several sample of the same material to arrive to the dimensions 90mm*40mm*40mm for the test sample in order to measure the foam generating speed of the material.

[0058] A typical detergent used in the method of the invention can have a Brookfield viscosity of about 964 mPa.s at 20°C (spindle L1 and speed of 1.5 rpm) and foam capacity Ross-miles of about 152 ml.

[0059] According to an embodiment, and in order to contribute to higher foam generation speed, the porous layer has a density of less than 24 kg/m^3, preferably less 23 kg/m^3. The density may be measured by the method described in the experimental part of the present invention.

[0060] According to an embodiment, and in order to contribute to higher foam generation speed, the porous layer has a compressive strength of less than 30 kPa, preferably less than 28 kPa. The compressive strength may be measured according to the following method:
A parallelepipedal sample is placed in a device comprising a fixed bottom plate and a mobile upper plate, moving vertically at a speed of 100mm/min.

[0061] The sample stands on one of its highest surface side and is submitted to successive compression and release steps (the sample is totally covered by the plates during compression):

- Initial cycle: the sample is compressed by 70% (i.e. the sample height is reduced to 30% of its initial height), then it is released. This cycle is executed 3 times.
- Last cycle: sample is compressed by 40% (i.e. the sample height is reduced to 60% of its initial height). The force necessary to reach this level of compression is recorded and corresponding pressure expresses compressive strength.

[0062] According to an embodiment, and in order to contribute to higher foam generation speed, the porous layer has an absorption of less than 50g/100cm^3, preferably less than 30 g/100cm^3. The absorption may be measured by the method described in the experimental part of the present invention.

[0063] The porous material may include closed pores, or partially closed pores, preferably between 2 and 20% and still more preferably between 3 and 5% closed pores. In fact, a completely open porous structure-i.e., whereof the pores are open-facilitates the absorption of the dishwashing product, but does not enable the retention thereof. On the contrary, a completely closed pore structure-i.e., whereof all of the pores are closed-is sealed and rigid. Thus, a layer whereof only a portion includes closed pores or partially closed pores allows satisfactory impregnation and retention of the dishwashing product for economical consumption of the dishwashing product.

[0064] Furthermore, such a porous structure including only a portion of closed or partially closed pores makes it possible to increase foam generation

[0065] The porous material forming the porous layer is preferably a foam, more preferably a polyurethane foam.

[0066] An example of a suitable porous layer is a polyurethane foam with a density of 18 kg/m^3, an absorption capacity of 26.1 g/100cm^3, a compressive strength of 25kPa, and a foam generating speed of 7.4 pressures.

[0067] According to an embodiment, the sponge according to the invention further comprises a third layer, being understood that the opening of the cavity is on the outer surface of the sponge, wherein the third layer is optionally made from a different material from the porous or the scouring layers.

[0068] It is thus possible to multiply the functionalities of the final sponge, for example by adding a face capable of wiping surfaces or having high cleaning power like microfiber material.

[0069] This additional layer may be added by gluing said layer to the porous or scouring layer, being understood that the opening of the cavity remains on the outer surface of the sponge. As an example, the third layer may be the inner layer between the scouring layer and the porous layer or the third layer may be the outer layer glued on the porous layer.

[0070] According to an embodiment, the sponge according to the present invention comprises one or more additional layers, said layer(s) being glued on the outer surface of the porous layer or being glued on the inner surface of the porous layer, being understood that the opening of the cavity on the surface of the scouring layer is left available, i.e. remains on the outer surface of the sponge, for example for a filing by a cleaning liquid.

[0071] According to one preferred embodiment of the invention, the sponge comprises one additional layer covering the main outer surface of the porous layer of the sponge.

[0072] Typically, the material of the additional layer(s) can be selected from cellulosic materials, cellulosic cloth, polyurethane foams, open cell honeycomb materials, hydrophilic honeycomb materials, honeycomb materials with a base of a vinyl acetate polymer, microfiber-based or melamine materials. Such materials are known by those skilled in the art and directly applicable to the present invention.

[0073] One particularly embodiment of the invention relates to a three-layer sponge, i.e., comprising only one additional layer on the main outer surface of the porous layer of the sponge, which can have a different function, for example absorbent or degreasing properties. A layer made from a microfiber-based material is in particular advantageous for its absorbing and degreasing and/or wiping properties. This type of structure is particularly effective to complete the anti-grease performance of a liquid detergent and help eliminate certain stains on dishes, such as traces of lipstick on glasses.

[0074] Fig. 1 illustrates a sponge 1 according to the invention, comprising a porous layer 2, a scouring layer 3 and a cavity 4. The outer surface of the scouring layer 5 comprises the opening 6 of the cavity 4. According to an embodiment illustrated in Fig. 1, the cavity 4 has a bottom 7 located inside the porous layer 2.

[0075] Fig. 2, 3 and 4 illustrate a sponge according to other embodiments of the invention, wherein the sponge further comprise a third layer.

[0076] Fig. 2 illustrates a sponge 1 comprising a porous layer 2, a scouring layer 3, a third layer 8 and a cavity 4. The outer surface of the scouring layer 5 comprises the opening 6 of the cavity 4. According to an embodiment illustrated in Fig. 2, the cavity 4 has a bottom 7 located inside the porous layer 2 and the third layer 8 is an outer layer.

[0077] Fig. 3 illustrates a sponge 1 comprising a porous layer 2, a scouring layer 3, a third layer 8 and a cavity 4. The outer surface of the scouring layer 5 comprises the opening 6 of the cavity 4. According to an embodiment illustrated in Fig. 3, the cavity 4 has a bottom 7 located inside the third layer 8 and the third layer 8 is an inner layer.

[0078] Fig. 4 illustrates a sponge 1 comprising a porous layer 2, a scouring layer 3, a third layer 8 and a cavity 4. The outer surface of the scouring layer 5 comprises the opening 6 of the cavity 4. According to an embodiment illustrated in Fig. 3, the cavity 4 has a bottom 7 located inside the porous layer 2 and the third layer 8 is an inner layer.

[0079] Fig. 5 illustrates a sponge 1 according to the invention, comprising a porous layer 2, a scouring layer 3 and a cavity 4. The outer surface of the scouring layer 5 comprises the opening 6 of the cavity 4. According to an embodiment illustrated in Fig. 5, the sponge has two slots 9 along two parallel sides of the sponge, the slots being preferably formed in the porous layer.

[0080] The two slots are preferably through slots extending along the preferred direction of the sponge, which is the highest direction. The thickness of the slots allows the introduction of the fingers of the user in order to facilitate the gripping of the sponge. As an example, the slots can have a thickness of about 5-20 mm. The slots can be of a concave form (illustrated in Fig. 5).

[0081] The porous layer according to the invention offer a high active liquid detergent absorption capacity and speed. For example, the absorption capacity is such that at least 90% of a volume of 2 ml of liquid having a Brookfield viscosity of about 964 mPa.s^{-1} at a temperature of 20°C, deposited on the surface of the previously-moistened sponge (2 cm thick and 70 cm^2 surface area), is absorbed in less than 5 minutes, preferably less than 3 minutes and still more preferably less than 2 minutes.

[0082] Owing to the sponges according to the invention, the user henceforth has the possibility of refilling the sponge with the right quantity of liquid soap to clean dishes without any waste or overconsumption. The use of the sponge to clean several surfaces or dishes between refills makes it possible to avoid continuously saturating the sponge and offers

considerable dishwashing liquid savings.

[0083] Advantageously, and in order to contribute to higher foam generation speed, the shape of the sponge according to the invention has a high "circularity index" in order to generate more foam when the user squeezes the sponge. Circularity index is defined as the following ratio: $4\pi S/P^2$, where S and P are respectively the surface and the perimeter of a main cleaning face of the sponge.

Preferably the main cleaning surface has a circularity index higher than 0.70, more preferably higher than 0.75. The main cleaning surface is generally one of the highest surface and is generally the surface which will be in contact with the surface to be cleaned.

[0084] Furthermore, the sponge according to the invention generates quickly suds when it has been reloaded with liquid soap. This allows to continue the cleaning without the need to press the sponge many times after each reload.

[0085] Furthermore, the sponge according to the invention generates considerable foam, distributed over all of the available surfaces of the sponge, and not in a localized manner, which allows the user to verify visually whether detergent liquid remains that is capable of cleaning the surface or items to be washed. Thus, the user is not encouraged to refill the sponge regularly or to add liquid in the wash medium (i.e. in the cavity of the sponge or on the surface of the sponge).

[0086] The user henceforth has a visual indicator that makes it possible to refill the sponge with a consistent quantity of dishwashing liquid. It is also possible for the user to insert the tip of the cleaning liquid bottle directly into one of the openings and to fill it using simple pressure on the bottle.

[0087] These advantages are particularly useful when the dishwashing is done under running water and makes it possible to reduce liquid soap consumption and, at the same time, to optimize the properties of the product used relative to the use of the sponges of the prior art.

[0088] Another object of the invention is directed to a cleaning method comprising a step of applying a cleaning liquid onto a surface or into the cavity of the sponge according to the invention, followed by a step of compressing the sponge in order to release a foam of the cleaning liquid. According to a preferred embodiment, the cleaning method is performed under running water.

[0089] The cleaning liquid can be selected from any known cleaning liquid.

[0090] Another objet of the invention relates to the use of the sponge of the invention to clean dish items.

EXAMPLES

Example 1: Description of the tested sponges

[0091] Sponge 1: A sponge according to the invention has been obtained by the following method:

- Providing a porous layer made of polyurethane and having a thickness of 30 mm and having a foam generating speed of 7.4 pressures (Vitapol VPPT1830 from Vita Polymers Poland SP Z O.O).
- Providing a scouring layer.
- Gluing the porous layer and the scouring layer by a polyurethane based glue.
- Drilling a cavity in the scouring layer, the cavity having a volume of 1.6 cm^3, the bottom of the cavity being in the porous layer.

[0092] Different comparative sponges have been tested:

- Sponge 2: Commercial sponge Vileda PUR ACTIV® having a porous layer made of polyurethane and a scouring layer, without cavity.
- Sponge 3: Commercial sponge Delhaize® "eponge à recurer" having a porous layer made of polyurethane and a scouring layer, without cavity.

[0093] The foam generating speed of the porous layer material used in the sponges 2 and 3 has been measured according to the method defined in the invention. The detergent used in the method of the examples has a Brookfield viscosity of about 964 mPa.s at 20°C (spindle L1 and speed of 1.5 rpm) and foam capacity Ross-miles of about 152 ml.

[0094] Results of the foam generating speed of sponges 1, 2 and 3 are indicates in the table 1 below.

Table 1: Foam generating speed of the porous layer of the sponges

	Polyurethane foam of sponge 1	Porous layer of Sponge 2	Porous layer of Sponge 3
Number of pressures	7.4	15.2	13.6

[0095] As can be seen from table 1, porous layers of commercial sponges 2 and 3 have a lower foam generating speed than the porous layer of the sponge 1 according to the invention.

Example 2: Measure of the foam generating speed of the sponge

[0096] The foam generating speed of the different sponges defined in example 1 has been measured according to the method described in the invention. The detergent used in the method of the examples has a Brookfield viscosity of about 964 mPa.s at 20°C (spindle L1 and speed of 1.5 rpm) and foam capacity Ross-miles of about 152 ml.

[0097] Results of the foam generating speed are indicates in the table 2 below.

Table 2: Foam generating speed of the sponges

	Sponge 1	Sponge 2	Sponge 3
Number of pressures	9.2	23.0	43.0

[0098] It can be noted that the foam generation speed of the final sponge can be measured according to the same test as the one described in the invention, being understood that if a cavity is present (it is the case of sponge 1 only), the detergent is introduced into the cavity and if a cavity is not present, the detergent is introduced onto the surface of the scouring layer.

[0099] As can be seen from table 2, the sponge of the invention provides a much higher foam generating speed than commercial sponges currently on the market.

Example 3: Measure of the characteristics of the porous layers of the sponges of example 1

[0100] The density and the absorption of the materiel, for example of the porous layer material, is measured according to the following method comprising the successive steps:

- Pre-treatment:
    - Squeeze sample under water 3 times and let it in water for 3 minutes.
    - Take the sample out of water wring it manually.
        - Measure wet volume of the sample.
        - Dry the sample, measure the dry weight. Density (kg/m^3) = dry weight (kg) / wet volume (m^3).
        - Squeeze sample under water until evacuation of air contained.
        - Take the sample out of the water and let it drain for 1 min on an openwork grid inclined at 45°.
        - Measure the final weight
        - Absorption (water retention) expressed in g/100 cm^3 is equal to (Final weight - dry weight) (g) / wet volume (100cm^3).

[0101] The density, absorption and compressive strength of porous layers of sponges 1, 2 and 3 described in example 1 have been measured and indicated in table 3 below. The compressive strength has been measured according to the method described above.

Table 3: density, absorption and compressive strength

	Polyurethane foam of sponge 1	Porous layer of Sponge 2	Porous layer of Sponge 3
Density (kg/m^3)	18	18	32
Absorption (g/100cm^3)	26.1	73.0	75.0
Compressive strength (kPa)	25	35	33

Example 4: effect of the circularity index of the sponge

[0102] The effect of the circularity index has been evaluated by measuring the foam generation speed as detailed in the present invention. The results are indicated in table 4 wherein the results are expressed in relation to the cylinder

form used as a reference normalized to 100.

Table 4: effect of the circularity index

Geometric form	Circularity index	Normalized foam generation speed
Cylinder	1	100
drop	0.84	66
butterfly	0.51	49

[0103] The best result is obtained for the cylinder form with a circularity index of 1. We can see that increasing the circularity index has a positive effect on the foam generation speed.

Claims

1. A sponge (1) having at least one porous layer (2) and at least one scouring layer (3), wherein the sponge has at least one cavity (4) distinct from the pores of the sponge and emerging on a surface (5) of the scouring layer forming an opening (6), and wherein at least one layer among the porous layer and the scouring layer has a foam generating speed of less than 12 pressures,
the foam generating speed being measured by the following method:

   - Providing a test sample of 90mm*40mm*40mm of material,
   - Pre-treating the sample:

     - Squeezing sample under water having a hardness of about 29°fH 3 times and letting it in water for 3 minutes,
     - Taking the sample out of water and wringing it manually,
     - Drying the sponge,

   - Impregnating the pre-treated test sample uniformly with 14.5g of water,
   - Putting 0.5g of detergent in the centre of one side of the test sample (90x40mm), the detergent having a Brookfield viscosity ranging from 900 to 1000 mPa.s measured with a spindle L1 at 1.5 rpm at a temperature of 20°C and a foam capacity ranging from 140 to 170 mL according to standard ISO 696:1975,
   - Letting the detergent impregnate the test sample for 30 seconds,
   - Placing the test sample into a holding and compression device on its 90 x 40 mm side, the side used for the detergent impregnation is set perpendicularly to the base,
   - Placing a graduated collector under the bottom plate to collect the foam ejected at each compression,
   - Compressing sample several times at a speed of 220 mm/s, stopping compression when the applied strength reaches 3.5 kg and respecting a stop time between each compression of 7 seconds; after each compression the foam present under the sponge is collected by scrapping it into a collector, and measuring cumulated foam volume collected (excluding water present in the bottom of collector) after each compression,
   - Stop process when cumulated foam volume collected (excluding water collected at the bottom of the collector) has reached or exceeded 25ml, the foam generation speed being expressed by the number of compressions performed till collection of 25 ml foam, the final result being the average of 5 measures.

2. The sponge according to claim 1, wherein the porous layer has a density of less than 24 kg/m^3, and/or a compressive strength of less than 30kPa.

3. The sponge according to any one of claims 1 to 2, wherein the porous layer has an absorption of less than 50g/100cm^3, more preferably less than 30g/100cm^3.

4. The sponge according to any one of claims 1 to 3, wherein the scouring layer has a flexibility of less than 3.5N, more preferably less than 2.5N, even more preferably less than 2N.

5. The sponge according to any one of claims 1 to 4, having a cleaning surface with a circularity index of more than 0.70, more preferably more than 0.75, even more preferably more than 0.80.

6. The sponge according to any one of claims 1 to 5, wherein the cavity has a bottom (7) inside the sponge, preferably inside the porous layer of the sponge.

7. The sponge according to claim 6, wherein the cavity is perpendicular to at least one of the main faces of the sponge.

8. The sponge according to any one of claims 1 to 7, wherein the maximum distance between two points of the contour of the opening (6) is comprised between 3 and 25 mm, preferably between 5 and 20 mm, still more preferably between 8 and 15 mm.

9. The sponge according to any one of claims 1 to 8, wherein the porous layer is a foam, and preferably a polyurethane foam.

10. The sponge according to any one of claims 1 to 9, wherein the scouring layer is glued on at least part of the upper surface of the porous layer.

11. The sponge according to any one of claims 1 to 10, including a third layer (8) glued on at least part of the lower surface of the sponge, the upper surface of the sponge being the surface with the opening of the cavity, the scouring layer, the porous layer and third layers characterizing a "sandwich" structure.

12. The sponge according to any one of claims 1 to 11, having two slots (9) along two parallel sides of the sponge, the slots being preferably drilled in the porous layer.

13. A cleaning method comprising a step of applying a cleaning liquid into the cavity or onto a surface, preferably in the cavity, of the sponge according to any one of claims 1 to 12, followed by a step of compressing the sponge in order to release a foam of the cleaning liquid.

14. The method according to claim 13, performed under running water.

15. The use of the sponge according to one of claims 1 to 12, to clean dish items.

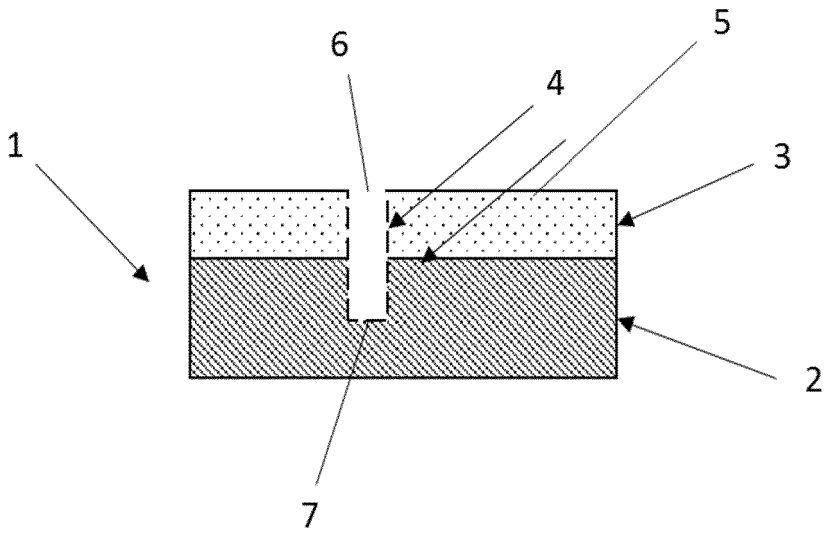

Fig. 1

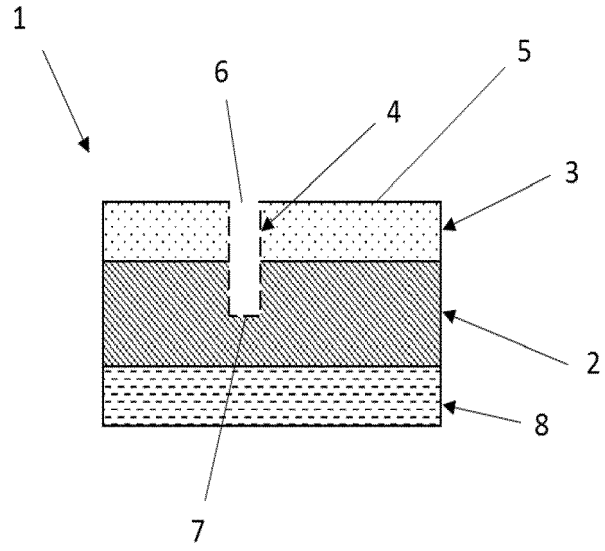

Fig. 2

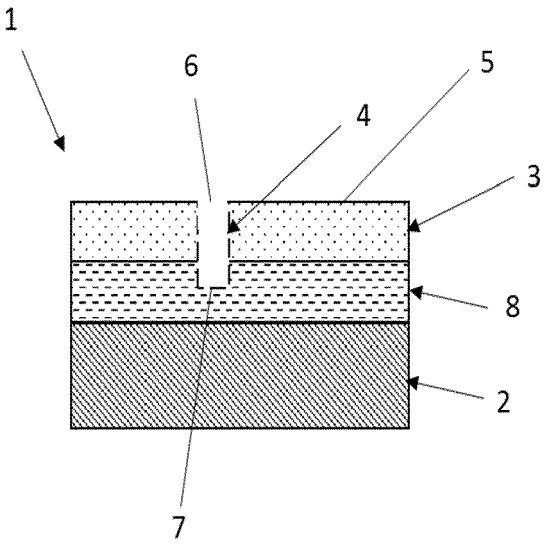

Fig. 3

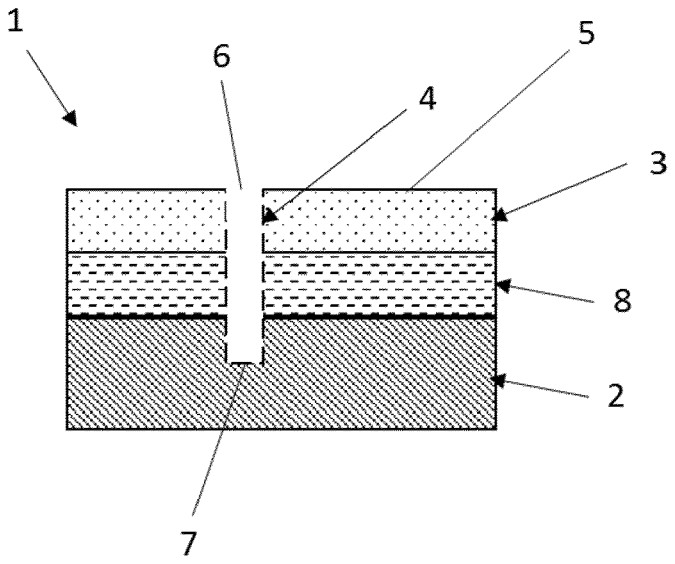

Fig. 4

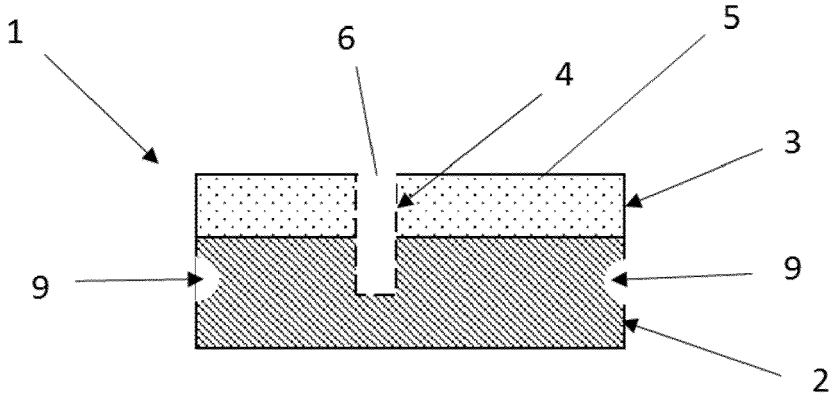

Fig. 5

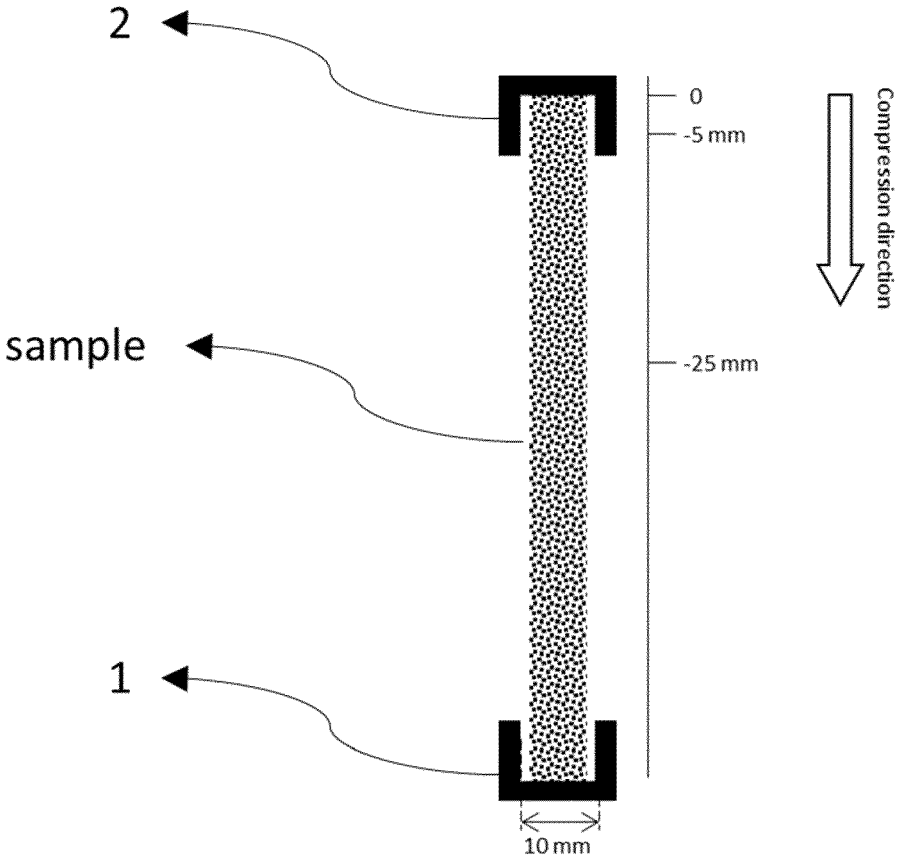

Fig. 6

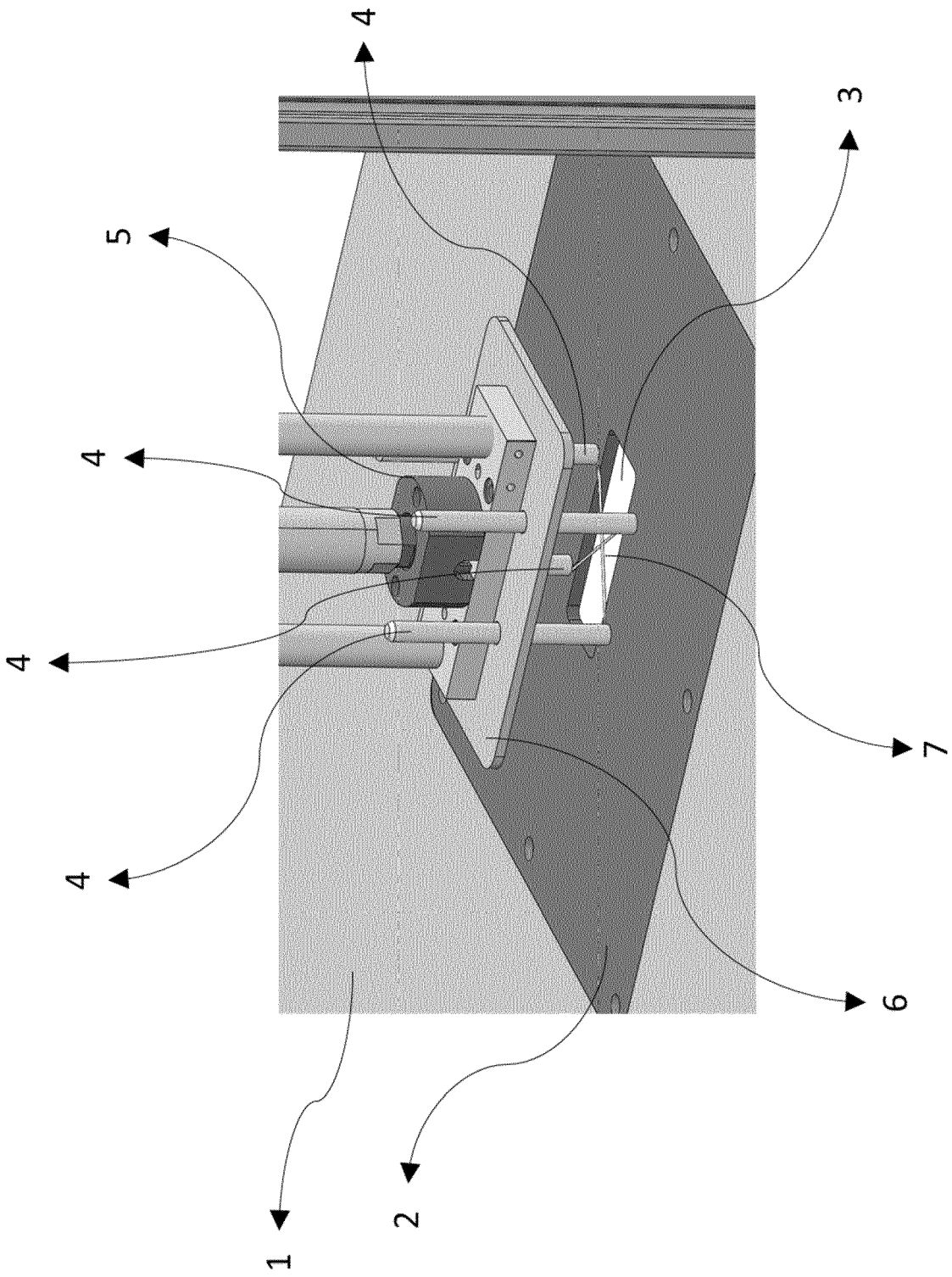

Fig. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 19 19 8944

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	WO 2013/167304 A2 (EURVEST [BE]) 14 November 2013 (2013-11-14) * page 4, line 14 - page 10, line 5 * * page 12, line 17 - page 17, line 13 * * figure 4 * -----	1-15	INV. A47L17/08
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TECHNICAL FIELDS SEARCHED (IPC)

A47L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	4 November 2019	Maisonnier, Claire

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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