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

(11) **EP 3 199 064 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
02.08.2017 Bulletin 2017/31

(51) Int Cl.:
A47C 27/12 *(2006.01)* ***A47C 31/00*** *(2006.01)*
B68G 7/10 *(2006.01)*

(21) Application number: **17152947.2**

(22) Date of filing: **25.01.2017**

(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:
MA MD

(30) Priority: **27.01.2016 PL 41592116**

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(54) **A METHOD FOR PROCESSING A SPACER FABRIC MAT AND A SPACER FABRIC MAT**

(57) A method for processing of a spacer fabric mat made of a spacer fabric, comprising a top layer (110), a bottom layer (120) and an elastic spacer layer (130), characterized by pressing the spacer fabric mat along at least a section of at least one side edge, wherein during the pressing the spacer fabric is compressed in a pressing area (141) to a thickness (h) less than a thickness (H) of the spacer fabric in a non-pressed area (142) adjacent to the pressed area (141) and the yarns (131) of the spacer layer (130) are heated at least to a temperature at which the material of the yarns (131) becomes plastic.

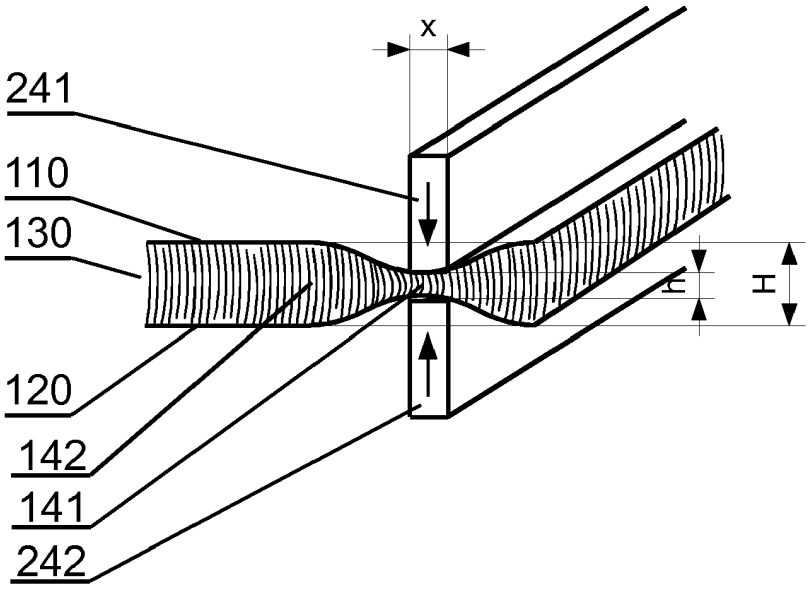

Fig. 3

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Description

[0001] The present invention relates to processing a spacer fabric mat and a spacer fabric mat, in particular for use as a mattress or a cushion on hard furniture, such as beds, chairs, pool furniture or garden furniture.

[0002] Common types of mattresses include foam or interior-sprung mattresses, which are covered by slipcovers. However, mattresses of this type are prone to collect dust and mites. After a few months of use, they may become unsuitable for people suffering from allergies, and after a few years, their use is not advisable even for healthy people. Effective removal of mites from this type of mattresses is hardly possible.

[0003] There are known spacer fabrics having a top layer and a bottom layer having yarns extending in a direction substantially parallel to their main plane, and a spacer layer, which is a knitted fabric joining the top layer and the bottom layer by yarns extending substantially in a direction perpendicular to the top layer and the bottom layer. These spacer fabrics may have a thickness between a few millimeters and a few centimeters. The spacer fabrics are elastic, and their elasticity depends on the density of the spacer layer and the thickness of its filling yarn. These spacer fabrics, in particular highdistance spacer fabrics, may be used as an alternative to foam mattresses, in particular for cushions for hard furniture.

[0004] This type of fabric is disclosed for example in a Polish patent application PL405689 related to an elastic mat having a top layer, a bottom layer and at least two spacer layers.

[0005] One problem related to elastic mats made of spacer fabrics is the finishing of the side edges. If the mat is cut out from a large spacer fabric sheet with traditional methods, the filling yarn is cut loose and results in prickly needles at each side of the fabric. Such mat is not comfortable to be used as a standalone product, and should be placed into a slipcover to protect a user from the sharp edges. However, the edges of the mat may cause damage to the inside of the slipcover.

[0006] A Polish utility model PL122468 discloses a mattress made of spacer fabric and having a top layer, a bottom layer and a spacer layer, wherein the top layer and the bottom layer extend over the spacer layer and are joined with each other at the edges of the mattress by knitting. However, this type of mattress must be manufactured as a standalone product and may not be cut out from a large sheet or a long roll.

[0007] Therefore, there is a need to provide an alternative method for processing an a spacer mat in to obtain a spacer fabric mat devoid of sharp edges with prickly needles.

[0008] There is disclosed a method for processing of a spacer fabric mat comprising a top layer, a bottom layer and an elastic spacer layer, characterized by pressing the spacer fabric mat along at least a section of at least one side edge, wherein during the pressing the spacer fabric is compressed in a pressing area to a thickness (h) less than a thickness (H) of the spacer fabric in a non-pressed area adjacent to the pressed area and the yarns of the spacer layer are heated at least to a temperature at which the material of the yarns becomes plastic.

[0009] The method may comprise pressing the spacer fabric by heated clamping heads having a form corresponding to a desired pressing line.

[0010] The method may comprise pressing the spacer fabric with clamping heads, each being displaced by the same distance in opposite directions towards the middle of the spacer fabric.

[0011] The method may comprise pressing the spacer fabric at a distance from the edge of the spacer fabric.

[0012] The method may comprise pressing the spacer at an area adjacent to the edge of the spacer fabric.

[0013] The method may comprise cutting the outer section of the pressed area by a hot cutter having a temperature higher than the flow temperature the yarns of the spacer layer.

[0014] The method may comprise finishing the edge of the pressed area by an overlock type stitch.

[0015] The method may comprise finishing the edge of the pressed area by a bias binding.

[0016] There is also disclosed a spacer fabric mat made of a spacer fabric, comprising a top layer, a bottom layer and an elastic spacer layer, characterized in that along at least a section of at least one side edge the spacer fabric mat has a pressed area with a thickness (h) less than a thickness (H) of the knitted fabric in a non-pressed area adjacent to the pressed area, wherein yarns of the spacer layer in the pressed area are permanently deformed with respect to the yarns of the spacer layer in the non-pressed area.

[0017] The length of the yarns of the spacer layer in the pressed area can be the same as in the non-pressed area adjacent to the pressed area.

[0018] The edge of the pressed area can be finished with an overlock type stitch. The edge of the pressed area can be finished with a bias binding.

[0019] The mat may comprise more than one spacer layer.

[0020] The present invention is shown by means of example embodiment in a drawing, wherein:

- Fig. 1 presents an overview of a spacer fabric sheet before processing;
- Fig. 2 presents an example of a process line for use in the method;
- Fig. 3 presents a method for pressing the spacer fabric away from its edge;
- Fig. 4 presents a method for pressing the spacer fabric at its edge;
- Fig. 5 presents a pressed spacer fabric;
- Fig. 6 presents a top plan view of the spacer fabric mat with finished edges.

[0021] Fig. 1 presents an overview of a spacer fabric sheet from which the spacer fabric mat can be produced.

A top layer 110 and a bottom layer 120 are knitted fabrics with yarns extending in a direction substantially parallel to their main plane. A spacer layer 130 is arranged between and joins the top layer 110 and the bottom layer 120, wherein its yarns 131 extend substantially in a direction perpendicular to the top layer and the bottom layer.

, wherein yarns go substantially in a parallel direction to a main spacer fabric plane. Between the top layer 110 and the bottom layer 120 lies a spacer layer 130, which is a knitted fabric, wherein yarns 131 joining flat layers go substantially in a perpendicular direction to the main mat plane, wherein yarns 131 point out a slight distortion in a perpendicular cutting plane parallel to a distortion direction. The yarns, including the spacer fabric yarns 131, are typically monofilament plastic yarns. If the large sheet is cut into smaller pieces, such as 50x50cm cushions, some yarns 131A may tend attached only to the top layer 110, and other yarns 131 B may tend attached only to the bottom layer 120, as shown in Fig. 1. Thus, some filling yarns are cut loose and result in prickly needles at the side of the fabric, so the mat is frayed at the edges.

[0022] It is known to finish frayed edges by an overlock sewing machine. However, this method is hard to use for spacer fabrics, since during overlock processing the top layer may shift with respect to the bottom layer, which may lead to irregularities of the stitch and creases on the stitched edges. Spacer fabric treated this way may be unaesthetic, and the edges may be prone to damage. This problem increases with the increase of the thickness of the knitted fabric, which may be up to a few centimeters. This problem needs to be solved by providing an alternative method for edge processing.

[0023] The method according to the invention can be employed using a process line as shown in Fig. 2.

[0024] A Raschel machine 210 can be used to manufacture a sheet or a roll of spacer fabric having a desired thickness, for example from 3mm to 100mm. In case multilayer elastic mats are desired, a plurality of Raschel machines 210 can be used. The knitted spacer fabric can be finished on a stabilizer 220. A finished spacer fabric is then cut to desired dimensions of the spacer fabric mat in a cutting station 230. For example, a 2,5 meter wide sheet or roll of spacer fabric can be made and then cut to a shape of 80cm x 200cm mattresses, or slightly larger (for example about 1cm at each dimension). Next, the edges of the cut spacer fabric are pressed in a pressing station 240, as explained in details with respect to Fig. 3. The pressed edges are then finished in a finishing station 250, for example by stitching with an overlock sewing machine by binding.

[0025] Fig. 3 presents schematically a pressing process performed in the pressing station 240. The pressing station 240 is equipped in a clamping press comprising a clamping top head 241 and a clamping bottom head 242, between which the spacer fabric is arranged. The clamping heads 241, 242 have a shape that is to be imprinted on the pressed spacer fabric. Fig. 3 shows in a cross-section only a fragment of the pressed knitted fabric and a portion of the clamping heads 241, 242. An example of a full heads shape and the knitted fabric is shown in Fig. 5. The clamping heads have a pressing width x, for example from 2 mm to 20 mm, preferably 1 cm.

[0026] In the initial pressing process phase in the station 240, the heads 241, 242 are moved away from each other. The spacer fabric is positioned on the bottom head 242. Then, the heads 241, 242 are closed to clamp the spacer fabric in an area 141 (a point of contact area with the heads 241, 242) to a distance h being smaller than a spacer fabric thickness H in an area 142 neighboring the heads, such that the spacer fabric at the location between heads 241, 242 is pressed. The relationship between the values of h and H is determined individually for a particular spacer fabric mat according to parameters of the spacer fabric, from which it is made, such as the thickness H of the knitted fabric, the density of the yarns 131 of the spacer layer 130, the thickness of the yarns 131, the material from which the yarns 131 are made etc. For example, a spacer fabric with a thickness H of 1cm may be pressed between the clamping heads 241, 242 to a thickness of 2 mm. As a result, the density of the spacer fabric in the clamped area at the width x of the clamping heads 241, 242 is increased.

[0027] If the spacer fabric is to be pressed evenly from the top and from the bottom, after the clamping heads 241, 242 contact the outer layers 110, 120 of the spacer fabric, a further clamp should be carried out in such a way that both heads 241, 242 move evenly in the compression direction toward the center of the knitted fabric thickness i.e. such as to move each clamping head 241, 242 by the same distance (equal to a half of a difference between the height H of the knitted fabric and the target thickness h after the pressing) towards the middle of the spacer fabric, in opposite directions.

[0028] The pressing area may be positioned away from the edges of the spacer fabric, as shown in Fig. 3. In such a case, a thin spacer fabric portion between the pressing line and the edge may be considered as a waste product to be cut out at a further processing stages. This may be useful in a high-volume processing processes, to allow an error margin for pressing.

[0029] The presented method may be used in an equivalent manner for multilayer spacer fabrics, i.e. spacer fabrics having more than one spacer layer, for example two spacer layers, as shown in Fig. 4.

[0030] Regardless of the type of the knitted fabric, the pressing may be carried out adjacently to the edge of the knitted fabric, as also shown in Fig. 4.

[0031] The clamping heads 241, 242 are heated to a temperature, at which the material of the yarns 131 loses its elastic properties and becomes plastic, i.e. devoid of tensions, such that it undergoes non-reversible changes of shape in response to applied forces. In other words, the heated yarns 131 deform permanently under the influence of the clamping heads and after the pressing

force is removed, they remain deformed. Depending on the material of the yarns 131, they may be heated to a temperature of at least the glass transition temperature or a flow temperature. On the other hand, the material should not be heated above a temperature wherein the material passes into a liquid state or degrades, for example it should not exceed a melting temperature or a breakdown temperature.

[0032] In other words, the clamp of heads 241, 242 causes a bending of the spacer layer yarns 131, which under influence of the transferred heat energy are not deformed elastically to the initial position, but remain in the deformed position.

[0033] For example, if yarns 131 of the spacer layer 130 are made of polyester, at the pressing stage they can be heated to a temperature in a range from 150 to 170°C, preferably 150°C.

[0034] It is also possible to heat the yarns 131 in another or an additional way, for example by a hot air stream blown between the clamping heads 241, 242, infrared radiation, microwave radiation or the like.

[0035] After the pressing, the outer section of the knitted fabric may be cut with a hot cutter, i.e. a cutter heated to a temperature above a flow temperature of the plastic of the yarns 131 or even above its breakdown temperature. It allows to remove the spacer fabric excess before its final processing stage, and a high temperature of the cutter may cause that some yarns 131 of the spacer layer that may possibly extend beyond the knitted fabric are fused with the top and the bottom layer or with other spacer layer yarns.

[0036] Fig. 5 presents a top view of the pressed knitted fabric after its removal from the press between the heads 241, 242, for example to be used as a cushion for furniture, wherein the area 141 is pressed to the height h and the non-pressed area 142 with the high H nearby the pressed area 141. For example, if the end product (the cushion) is to have a shape of a rectangle (with rounded corners) of 50x50cm dimensions, the spacer fabric may be cut to dimensions of a rectangle of 51x51cm, then the spacer fabric may be inserted between the heads 241, 242, which form the pressed area 141 with rounded inner corners between the pressed area 141 and the non-pressed area 142. The outer edges of the pressed area 141, indicated by a dashed line, may be cut with a hot cutter or at a final finishing stage (it will be easier to precisely cut into a rounded shape than the spacer fabric before the pressing). The 1 cm surplus on the perimeter of the spacer fabric may be removed at a further finishing stage as a waste product. It facilitates manufacturing tolerance. If waste product is not desired, the pressing may be also performed precisely to the end product dimension.

[0037] In presented embodiment, the pressed area 141 extends along all spacer fabric edges, but there are possible other applications, wherein only a section of the spacer fabric edges is finished, for example an edge of only one side. An elastic mat may have a variable thickness at its main area, for example it may be quilted (by a pressing and/or stitching in an analogic way as for edges finishing). However, in the pressed area 141 the length of yarns 131 of the spacer layer 130 is substantially the same as in the adjacent non-pressed area 142, and consequently the pressed area is much denser and stiffer.

[0038] Thus, in general, in the pressing station 240, the spacer fabric is subject to a pressure, preferably from both sides, along lines parallel to the knitted fabric edges, heating yarns 131 material of the spacer layer 130 to a temperature equal at least a plastifying temperature of this material.

[0039] The knitted fabric pressed in such a way remains permanently in a pressed state after leaving the pressing station 240. The knitted fabric in the pressed area is characterized by a much higher density and stiffness than in the non-pressed area. Therefore, it is much easier to be further processed at the finishing station 250.

[0040] At the finishing station 250, the pressed knitted fabric edge can be finished (after earlier cutting off a possible waste material, mentioned in connection with Fig. 3). For finishing may be used various types of known sartorial methods of edge finishing, such as binding with an overlock type stitch, or applying a bias binding (bias tape).

[0041] Fig. 6 presents an elastic mat top view, for example in a form of a cushion for a hard furniture, with finished edge 141.

[0042] The method according to the invention enables to obtain an elastic mat, wherein the edges are pressed and have permanently thermally deformed spacer layer yarns, thus they may be easily finished by known edge finishing methods. The elastic mat has, therefore, appropriately treated and protected edges and as such it may be used as a stand-alone product or may be put into slipcovers with a highly reduced risk of damage to the internal surface of the slipcover at the edges.

Claims

1. A method for processing of a spacer fabric mat comprising a top layer (110), a bottom layer (120) and an elastic spacer layer (130), **characterized by** pressing the spacer fabric mat along at least a section of at least one side edge, wherein during the pressing the spacer fabric is compressed in a pressing area (141) to a thickness (h) less than a thickness (H) of the spacer fabric in a non-pressed area (142) adjacent to the pressed area (141) and the yarns (131) of the spacer layer (130) are heated at least to a temperature at which the material of the yarns (131) becomes plastic.

2. The method according to claim 1, **characterized by** pressing the spacer fabric by heated clamping heads (241, 242) having a form corresponding to a desired pressing line.

3. The method according to any of previous claims, **characterized by** pressing the spacer fabric with clamping heads (241, 242), each being displaced by the same distance in opposite directions towards the middle of the spacer fabric.

4. The method according to any of previous claims, **characterized by** pressing the spacer fabric at a distance from the edge of the spacer fabric.

5. The method according to any of claims 1-3, **characterized by** pressing the spacer at an area adjacent to the edge of the spacer fabric.

6. The method according to any of previous claims, **characterized by** cutting the outer section of the pressed area (141) by a hot cutter having a temperature higher than the flow temperature the yarns (131) of the spacer layer (130).

7. The method according to any of previous claims, **characterized by** finishing the edge of the pressed area (141) by an overlock type stitch.

8. The method according to any of previous claims, **characterized by** finishing the edge of the pressed area (141) by a bias binding.

9. A spacer fabric mat comprising a top layer (110), a bottom layer (120) and an elastic spacer layer (130), **characterized in that** along at least a section of at least one side edge the spacer fabric mat has a pressed area (141) with a thickness (h) less than a thickness (H) of the knitted fabric in a non-pressed area (142) adjacent to the pressed area (141), wherein yarns (131) of the spacer layer (130) in the pressed area (141) are permanently deformed with respect to the yarns (131) of the spacer layer (130) in the non-pressed area (142).

10. The mat according to claim 9, **characterized in that** the length of the yarns (131) of the spacer layer (130) in the pressed area (141) is the same as in the non-pressed area (142) adjacent to the pressed area (141).

11. The mat according to any of claims 9-10, **characterized in that** the edge of the pressed area (141) is finished with an overlock type stitch.

12. The mat according to any of claims 9-11, **characterized in that** the edge of the pressed area (141) is finished with a bias binding.

13. The mat according to any of claims 9-12, **characterized in that** it comprises more than one spacer layer (130A, 130B).

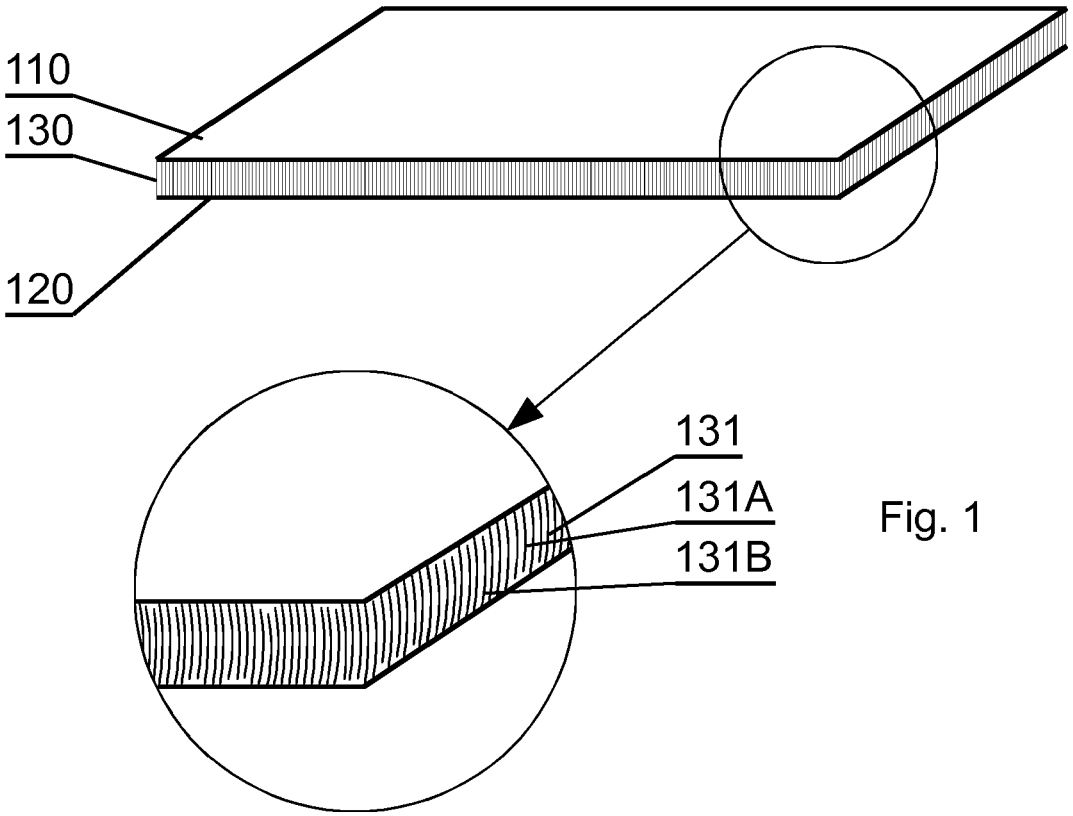

Fig. 1

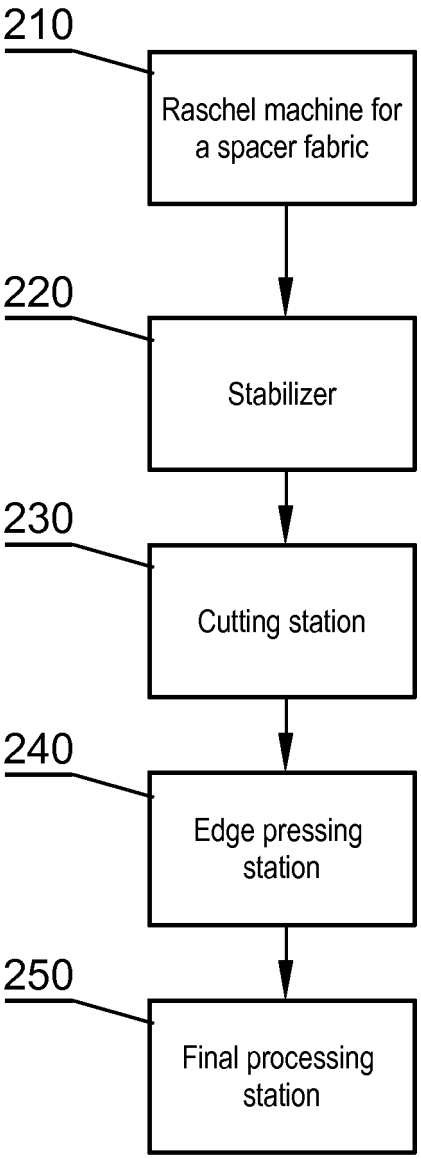
210
Raschel machine for a spacer fabric
220
Stabilizer
230
Cutting station
240
Edge pressing station
250
Final processing station

Fig. 2

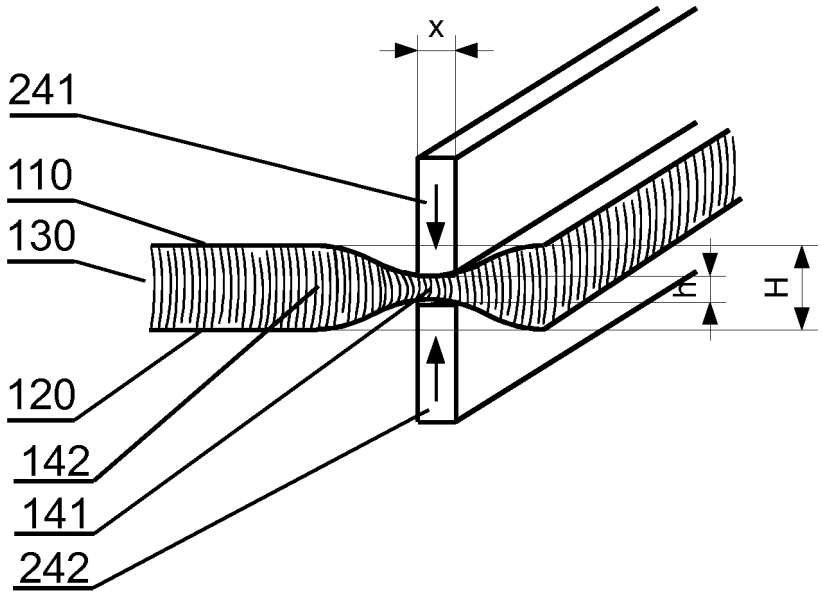
x
241
110
130
120
142
141
242
h
H

Fig. 3

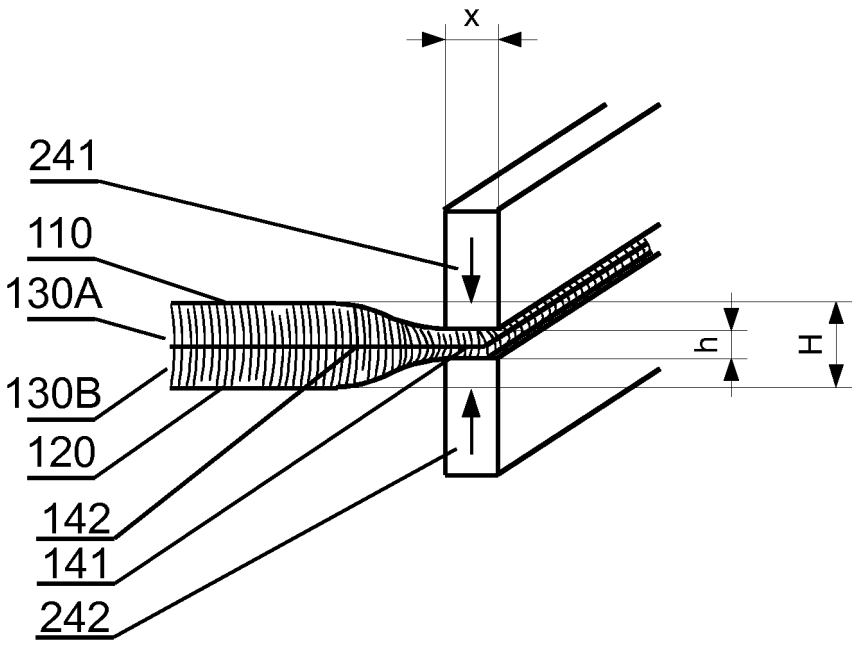
x
241
110
130A
130B
120
142
141
242
h
H

Fig. 4

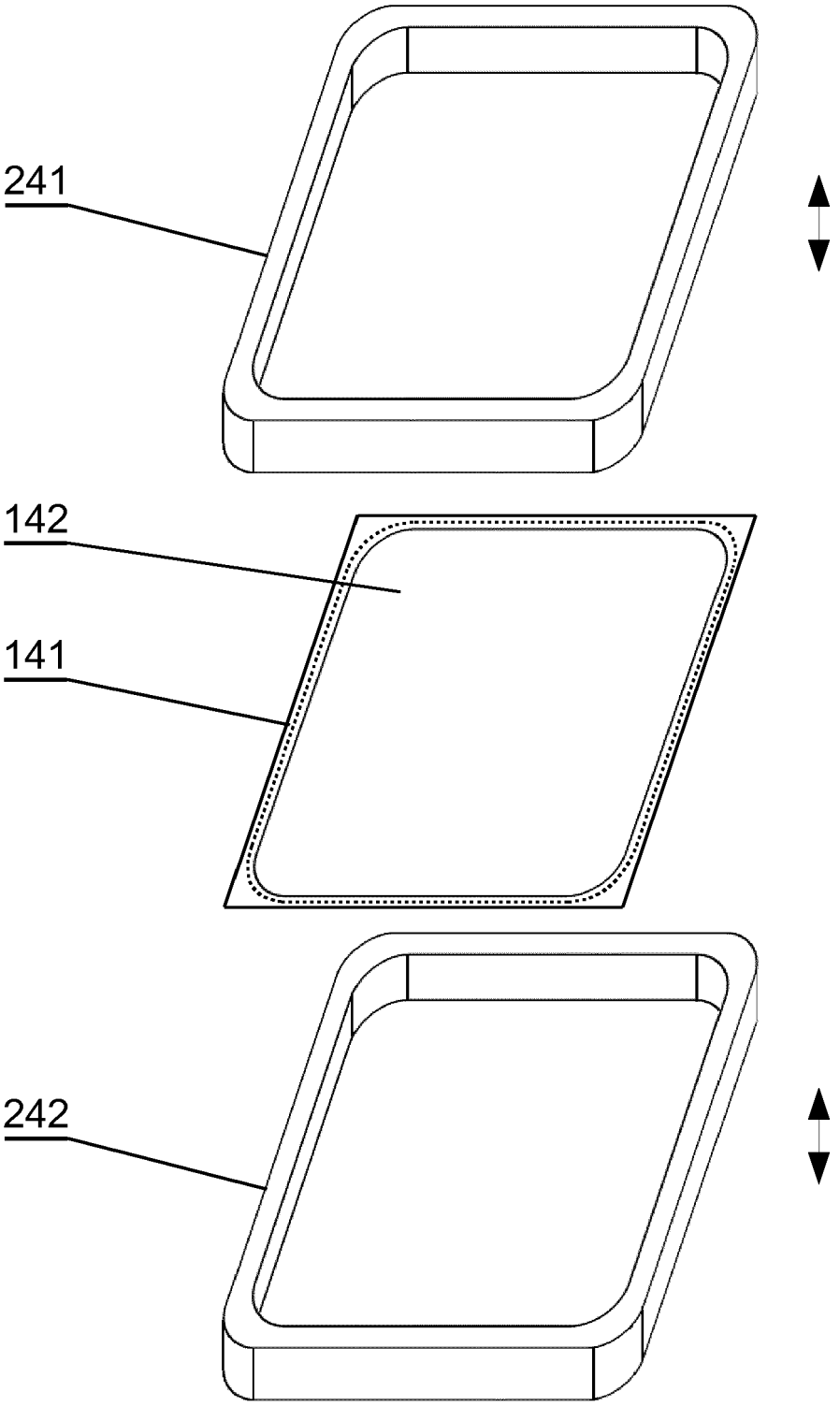

Fig. 5

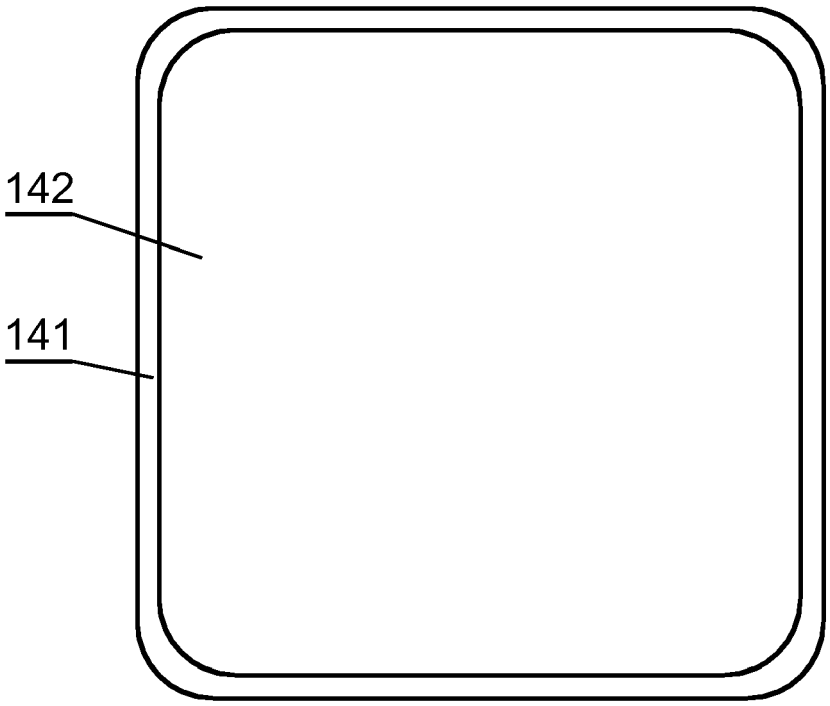

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 17 15 2947

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	US 2009/068910 A1 (FREDRICK KEVIN [US] ET AL) 12 March 2009 (2009-03-12) * paragraphs [0032], [0034]; claims; figures * -----	1-13	INV. A47C27/12 A47C31/00 B68G7/10
X	GB 2 468 905 A (BRIGHTWAKE LTD [GB]) 29 September 2010 (2010-09-29) * page 7, line 26 - page 8, line 10; figures * -----	1,6,9,10	

TECHNICAL FIELDS SEARCHED (IPC)

A47C
B68G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	1 June 2017	Kis, Pál

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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01-06-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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Patent documents cited in the description

- PL 405689 **[0004]**
- PL 122468 **[0006]**