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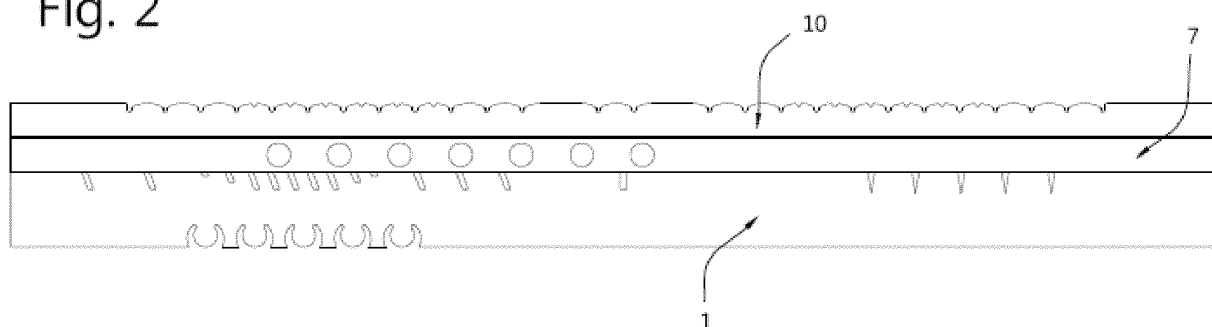
(54) **MATTRESS BASE, ASSEMBLY OF A MATTRESS BASE AND A MATTRESS AND A METHOD FOR PROVIDING THIS ASSEMBLY**

(57) A first aspect of the present invention relates to a mattress of mattress base, comprising a foam material with a basic hardness, wherein both the first and the second opposing surface are divided into zones at both sides of a fictive centre line, perpendicular to the longitudinal direction of the mattress or mattress base, wherein the first and the second surface each comprise at least one zone with a zonal hardness lower than said basic hard-

ness, which reduction in hardness is the result of one or more incisions and/or incision patterns in the surface layer at the level of said zones.

A second and third aspect respectively relate to a mattress base of a mattress base and a mattress, which mattress comprises a foam layer with one or more cavities provided with inserts, and a method for providing this mattress base.

Fig. 2



Description

TECHNICAL DOMAIN

[0001] The invention relates to personalized sleeping products. More in particular, the invention relates to the technical subdomain of personalized mattresses.

STATE OF THE ART

[0002] An incorrect position when sleeping can be the cause of many problems, in particular back problems. The use of a sleeping system that is not adapted to the personal needs and characteristics of a subject is often the cause. Important characteristics for sleeping products such as mattresses and cushions comprise providing support and lowering the pressure at particular body zones.

[0003] Today, personalized systems are known that try to deliver a product that is made according to the needs of the subject. Hereby, a "best fit" is often delivered from a range of standard products. In the most common cases, the optimal system is calculated based on the length of the user, wherein the support areas are defined based on the measured length.

[0004] Other systems in the state of the art are configured for offering a product that provides an optimal weight distribution instead of offering a pressure-reducing solution. Mattresses made from visco-elastic foam or memory foam are known to provide an optimal weight distribution. However, these products have disadvantages because they poorly ventilate and because the material literally encloses the body, hindering a smooth mobility of the subject.

[0005] A general problem that is moreover posed in said products is the permanent nature of these sleeping products. Indeed, they cannot be adapted to the subject for modifying the supporting characteristics or the comfort characteristics. Since a sleeping product such as a mattress usually has a long lifetime of as much as 15 years, such a product should be able to be adapted to respond to the changing body and/or the changing sleeping preferences of the subject.

[0006] WO 2014 105 045 describes a visco-elastic foam mattress with inserts in the longitudinal direction of the mattress, improving the mobility of the subject lying on the mattress. However, the mattress of WO '045 does not offer a personal tailor-made mattress providing support at the required points, and it also does not allow the subject to make any adjustments.

[0007] US 2014 059 776 describes a foam-based mattress protector with different layers of different densities. However, US '776 does not comprise a mattress or mattress base with different hardnesses or densities based on the body of a subject, wherein different supporting profiles can be realized.

[0008] US 2005 210 595 describes a foam mattress comprising different hardnesses and/or densities. The

mattress can moreover be turned in a longitudinal direction thanks to its symmetrical structure. Hereby, no different supporting and/or comfort profiles are however provided to the subject.

[0009] DE 20 212 460 describes a foam product with one or more incisions, lowering the hardness and/or density of the product. By inserting and removing the cut-out foam pieces, the hardness and/or density can be adjusted locally. The nature of the incisions does however not allow an accurate hardness adjustment and is practically very difficult to realize correctly by a subject. Also, the hardness is in no way correlated to the figure of the subject.

[0010] EP 2 322 060 describes a foam mattress which is, on both sides, provided with a surface layer with, preferably symmetrically positioned, incisions for obtaining a better deformation of the mattress at load, and for providing an adapted support in particular body zones. EP '060 does however not describe that different zones can be positioned on both sides of the mattress in such way that the subject can make a choice between different supporting and/or comfort profiles, simply by changing its orientation.

[0011] JP 2013 240479 describes a mattress provided with incisions providing adapted support to particular body zones. JP '479 describes the incisions only in a fixed configuration and does not allow that the subject can choose a comfort profile, purely by orientating the mattress as he/she wishes.

[0012] US 2005/115003 describes a mattress comprising one or more layers, each provided with specific contour incisions. In this way, a supporting profile is obtained which is suitable for, and which is found comfortable by, the average man or woman. The mattress according to US '003 can however only be used according to one single configuration and does not allow individual adjustments afterwards.

[0013] EP 3 023 034 describes the provision of a tailor-made mattress by measuring one or more body parameters of a subject, based on which a desired hardness profile is determined. The hardness profile is obtained in the tailor-made mattress by means of the use of visco-elastic inserts. Despite the fact that the inserts can be replaced, the subject cannot make the necessary or desired adjustments himself afterwards.

[0014] Consequently, there is a need for a personalized sleeping product, which is adjusted to the specific figure of a subject, wherein the supporting and comfort characteristics of the product can be adjusted to a changing figure and/or other changing circumstances by means of simply interventions.

[0015] The present invention aims to find at least a solution for some of the above-mentioned problems or disadvantages.

SUMMARY OF THE INVENTION

[0016] Thereto, the invention offers a mattress or mat-

tress base according to claim 1. The mattress or mattress base comprise two opposing surfaces, which are divided into zones with a zonal hardness which is lower than the basic hardness of the mattress or mattress base. These zones are situated at both sides of a fictive centre line, perpendicular to the longitudinal direction of the mattress or mattress base. The mattress or mattress base is characterized in that the first and the second surface each comprise at least one zone with a zonal hardness which is lower than the basic hardness, wherein the reduction in hardness is the result of one or more incisions and/or incision patterns in the surface layer at these zones.

[0017] The mattress or mattress base can thus be used according to two different orientations. Depending on the location of the different zones with reduced zonal hardness, the subject can thus choose to turn and/or rotate the mattress in the longitudinal direction so that said zones are situated at the desired body locations and/or body parts. In this way, merely by changing the orientation of the mattress or mattress base, another comfort feeling and/or comfort type can be provided to the subject.

[0018] Preferred embodiments of the mattress or mattress base are shown in the dependant claims 2 to 12.

[0019] A second aspect relates to a mattress base of claim 13. The mattress base comprises a mattress base according to the first aspect and a mattress comprising a foam layer and one or more inserts, which inserts are embedded into cavities of the foam layer.

[0020] The advantage of the base is the unique combination between a mattress base with zones with reduced zonal hardness and a mattress with inserts, locally increasing the hardness of the mattress. The mattress base and the mattress are separately movable with respect to each other in the base, as a result of which different orientations of the mattress base with respect to the mattress offer different support and comfort experiences to the subject.

[0021] Preferred embodiments of the mattress base are described in the dependant claims 14 to 19.

[0022] A specific embodiment relates to the mattress base of claim 15, wherein the inserts have a hardness between 1.5 and 6.0 kPa, and a density between 20 and 80 kg/m³.

[0023] A third aspect of the present invention relates to a method for providing a mattress base according to claim 20. The mattress base comprises a mattress base and a mattress, wherein, based on one or more body parameters associated with the subject, the method allows to determine a required position and a required hardness of inserts in the mattress, and a preferred position of the mattress base with respect to the mattress.

[0024] Preferred embodiments of the method are described in the dependant claims 21 to 24.

DESCRIPTION OF THE FIGURES

[0025]

Figure 1 shows a side view of a preferred embodiment of the mattress base according to the present invention.

Figure 2 shows a side view of a preferred embodiment of the base according to the present invention.

Figure 3a shows a perspective view of a preferred embodiment of the mattress base according to the present invention.

Figure 3b shows a perspective view of a preferred embodiment of the base base according to the present invention.

Figure 3c shows a perspective view of another preferred embodiment of the base according to the present invention.

DETAILED DESCRIPTION

[0026] A first aspect of the present invention related to a mattress or mattress base, comprising a foam material with a basic hardness, which mattress or mattress base comprises a first, flat surface and, opposing to said first surface, a second, flat surface. Both the first and the second surface comprise a surface layer and are suitable for supporting a subject. The surfaces are divided into zones with a zonal hardness, situated at both sides of a fictive centre line, perpendicular to the longitudinal direction of the mattress or mattress base. The present invention is characterized in that the first and the second surface each comprise at least one zone with a zonal hardness which is lower than the basic hardness of the mattress or mattress base. This reduction in hardness is the result of one or more incisions and/or incision patterns in the surface layer at said zones. The mattress or mattress base is thus suitable for supporting a subject on both the first and the second surface, wherein the zones offer a modified lying comfort to the subject.

[0027] The mattress or mattress base according to the present invention comprise at least one zone with a zonal hardness which is lower than the basic hardness on both the first surface and the second surface, as a result of which the mattress can be used at least according to two different orientations. Depending on the location of the different zones with reduced zonal hardness, the subject can thus choose to turn and/or rotate the mattress in the longitudinal direction so that said zones are situated at the desired body locations and/or body parts. Body locations or body parts typically requiring a large amount of sinking into a mattress or mattress base, for offering a sufficiently comfortable feeling to the subject, are amongst other things the shoulders and the hips. Such sinking respects the natural curvature of the vertebral column, wherein a well-balanced pressure distribution exists over the body of the subject. In this way, merely by changing the orientation of the mattress or mattress

base, another comfort feeling and/or comfort type can be provided to the subject. Zones with a reduced zonal hardness offer a zonally larger sinking into the mattress or mattress base.

[0028] Unless otherwise specified, all terms used in the description of the invention, including technical and scientific terms, shall have the meaning as they are generally understood by the worker in the technical field of the invention. For a better understanding of the description of the invention, the following terms are explained specifically.

[0029] "A", "an" and "the" refer in the document to both the singular and the plural form unless clearly understood differently in the context. "A segment" means for example one or more than one segment.

[0030] When "approximately" or "about" are used in the document together with a measurable quantity, a parameter, a period or moment, etc., variations of +/-20% or less, preferably +/-10% or less, more preferably +/-5% or less, still more preferably +/-1% or less, and even still more preferably +/-0.1% or less than and of the cited value are meant, as far as such variations apply to the invention that is described. It will however be clearly understood that the value of the quantity at which the term "approximately" or "about" is used, is itself specified.

[0031] The terms "include", "including", "consist", "consisting", "provide with", "contain", "containing", "comprise", "comprising" are synonyms and are inclusive of open terms that indicate the presence of what follows, and that do not exclude or prevent the presence of other components, characteristics, elements, members, steps, known from or described in the state of the art.

[0032] The citation of numeric intervals by means of end points includes all integers, fractions and/or real numbers between the end points, including these end points.

[0033] The terms "mattress" or "mattress base" indicate a large, mostly rectangular, cushion, which is suitable for supporting a lying body. A mattress or mattress base can be used as such, or it can be used as a part of a mattress base, a sofa, a sofa bed, a couch, a bed, or any equivalent device for lying, resting and/or sleeping. Mattress are usually placed onto a bed base which can be fixed, as is the case of a platform bed, or elastic, such as with a box spring or slats. A mattress or mattress base usually consists of a padded cover, mostly made of a reinforced tissue, which cover is filled with fibres, straw, cotton, foam rubber or any suitable filling materials. Mattress can also be filled with a framework of feathers, with air of water, or with a diversity of natural fibres. According to the present invention, the mattress or mattress base comprises a foam material.

[0034] A "foam material" means, in the framework of the present invention, any material from the group of latex foam, slow foam / memory foam, high-density foam or any combinations thereof. "Latex foam" in mattresses is normally a mixture of natural and synthetic latex. There are, however, mattresses only made of natural latex,

comprising no added chemicals. "Slow foam", also called "memory foam", is composed of a visco-elastic foam material, as well as a stronger polyurethane foam. Slow foam is typically influenced by the temperature of the body resting onto it. This aspect is revealed in the so-called memory effect, wherein the foam becomes soft and conforms to the body figure of the subject, this as a reaction to the body temperature and the body weight. High-density foam typically comprises polyurethane foam.

[0035] The term "basic hardness", or more generally "hardness" refers to the extent wherein a material offers resistance to permanent mechanical deformation. In this context, the terms "elastic deformation" and "plastic deformation" are relevant. When exerting a limited force onto a surface, elastic deformation occurs. This implies that, when the force is reduced, the surface takes its original shape again. When exerting a force onto a surface, a particular pressure arises causing a shearing stress in the material. When this shearing stress exceeds a particular threshold value, a permanent deformation arises, such as a dent, a scratch or a crack, in the material. In this case, we talk about plastic deformation. The pressure at which a permanent, plastic deformation arises, is characteristic for the hardness of a material. The term "zonal hardness" refers to a local hardness, which is not characteristic for a complete object or material, but only for a part thereof.

[0036] A method suitable for determining the hardness is described in the ISO standard 3386. This standard comprises the determination of the hardness of materials with a density of 250 kg/m³ and also provides for a method for calculating the so-called compression standard values of these materials. A compression stress and/or stretch characteristic is a degree for the load-bearing characteristics of a material.

[0037] In the context of the present invention, the "context layer" is the layer of the mattress or the mattress base which is visible from the outside, and extends from the inside of the mattress, where the surface layer changes to the "core" of the mattress or mattress base.

[0038] The term "centre line" indicated a fictive line, dividing the mattress transversally into the longitudinal direction into two halves.

[0039] The term "incision", or by extension "incision pattern", indicate an incision, indentation, opening of combinations thereof made deliberately, whether or not according to a predefined pattern, in the surface layer of the present mattress or mattress base. The incision and/or incision pattern is made for providing the surface layer at particular places with adapted material characteristics.

[0040] Preferably, the first and the second surface each comprise two zones, situated at both sides of the fictive centre line. The mattress or mattress base can, as a result, be used according to at least 4 different orientations. The orientation of the mattress base determines which zones are situated under specific body locations or body parts of the subject. Consequently, a single mat-

tress or mattress base according to the present invention offers at least four different types of comfort to a subject, as zones possibly dispose of modified material characteristics, comprising hardness, elasticity, density, resilience, tensile strength, thermal conductivity, moisture-resistance, colour, of combinations thereof.

[0041] More preferably, the zonal hardness of at least three of these zones is lower than the basic hardness of the foam material itself. Zones with a reduced hardness offer a certain sinking of the body parts or body locations of the subject lying onto these zones. According to this embodiment, the mattress or mattress base can thus be oriented in at least four ways, wherein sinking zones are positioned differently with respect to the subject. This offers the possibility to a subject to change the comfort feeling, simply by adjusting the orientation of the mattress or mattress base. According to an embodiment, four orientations can be defined. In this embodiment, a first orientation will provide a substantial support to the subject, a second orientation will provide a substantial support to the subject, with a zone with reduced hardness at the level of the shoulders of the subject, a third orientation will provide a moderate support to the subject with a one with reduced hardness at the level of the shoulders of the subject, and a fourth orientation will provide a soft support to the subject with a zone with reduced hardness at the level of the shoulders of the subject.

[0042] According to a further or other embodiment, the incisions and/or incision patterns extend in a direction towards the core of the mattress or mattress base, wherein this direction is oriented substantially perpendicular to the surface layer. Incisions deviating too much from this direction lead to an inferior lying comfort for the subject and offer a decreased reduction of the zonal hardness compared to when this incision is oriented in a perpendicular way to the surface layer. Incisions directed towards the core of the mattress or the mattress base thus require a more limited depth compared to incisions in a deviating angle, for cause the same reduction in hardness. Since deeper incisions negatively influence the mattress integrity, i.e. an increased risk of cracking and a potential reduction in the lifetime of the mattress or mattress base, undep incisions are more desired than deep incisions. For obtained a sufficient reduction in hardness by means of undep incisions, a perpendicular incision is preferred.

[0043] The incisions and/or the incision patterns have a depth between 0.5 and 5.0 cm according to a preferred embodiment. Within said range, an optimal balance is obtained between physical integrity of the mattress or mattress base and a comfortable reduction in hardness at the zones. More undep incisions guarantee a good integrity, but barely lead to a reduction in hardness, while deeper incisions induce a too large reduction in hardness. Hereby, a sinking is obtained which no longer contributes to an increased lying comfort for the subject, as the mattress or mattress base will offer little support in this case. Moreover, such dee incisions cause the mat-

tress to possible show cracks and/or deformation, considerably reducing the lifetime and/or causing a suboptimal lying comfort. Preferably, the depth of the incisions is comprised between 1.0 and 4.0 cm. The average width of the incisions and/or the incision patterns is usually comprised between 0.5 and 7.0 cm, more preferably between 1.0 and 6.0 cm.

[0044] According to a preferred embodiment, the three zones with a zonal hardness lower than the basic hardness respectively comprise incisions with a depth between 3.3 and 3.7 cm, incisions with a depth between 2.9 and 3.3 cm, and incisions with a depth between 1.0 and 3.0 cm. More preferably, the three zones respectively comprise incisions with a depth of approximately 3.5 cm, incisions with a depth of approximately 3.1 cm, and incisions with a depth between 1.0 and 3.0 cm.

[0045] The foam material of the mattress or mattress base has a basic hardness between 2.0 and 5.5 kPa. A mattress or mattress base with a hardness within this range offers an optimal support to a subject, and at the same time can offer a sufficient degree of comfort. Preferably, the basic hardness is comprised between 3.0 and 4.5 kPa. Within the framework of the present invention, wherein the mattress or mattress base is provided with zones with a reduced zonal hardness, the basic hardness can be chosen sufficiently high, i.e. higher than 3.0 kPa. As a result, a particularly good support is provided to the body of the subject. The zones with a reduced zonal hardness offer additional comfort to the mattress or mattress base, directed to specific body parts and/or body locations. The higher the basic hardness, the more zones are necessary and/or the larger the reduction in hardness, which is required at these zones, for creating an acceptable comfort for the subject. The lower the basic hardness, the less zones are necessary, however the more subtle the required differences in hardness are for continuing offering sufficient support. More preferably, the basic hardness of the foam material is comprised between 3.5 and 3.9 kPa. Within this range, an optimal support is realized and with only a small number of zones with a reduced hardness, an optimal lying comfort can be obtained. Most preferably, the basic hardness is 3.7 kPa.

[0046] The zonal hardness of said zones with a reduced zonal hardness is, according to an embodiment, comprised between 1.0 and 25.0% lower than the basic hardness of the foam material. A difference in hardness of 1.0 to 25.0% is desired as a smaller difference offers almost no additional comfort to the subject. Larger differences in hardness no longer offer an optimal support as the natural curvature of the body, and more in particular the vertebral column, of the subject are enlarged too much. Such large differences can lead to back problems after a while. Preferably, the zonal hardness of said zones is 2.5 to 10.0% lower than the basic hardness of the foam material. Within this range, the difference in hardness is found to be optimal, and a good balance was obtained between the support of the body and the offering of an

additional comfort.

[0047] A further or other embodiment related to the mattress or mattress base wherein the foam material has a density comprised between 25 and 65 kg/m³. The term "density" indicated how much mass of a material is present in a particular volume. The ISO standard 845 specifies a method for determining the apparent total density and the apparent core density of cellular plastics and rubbers. A density within this range guarantees the manoeuvrability of the mattress or mattress base. Since the purpose of the present invention is mainly based on the orientation of the mattress or mattress base, it is necessary that this mattress or mattress base can be easily moved, shifted, for turning en/of lifting it. Moreover, a mattress or mattress base wherein the foam material has a density lower than 25 kg/m³ can not sufficiently offer the necessary support to a subject. As from a density of 65 kg/m³, the comfort of the subject strongly decreases. Preferably, the density of the foam material is comprised between 50 and 60 kg/m³. Since the present invention comprises zones with a reduced zonal hardness, caused by means of the presence of incisions and/or an incision pattern, a rather high density for the foam material is preferred. The provision of the incisions and/or the incision pattern indeed also causes a reduction of the density in these zones. Most preferably, the density of the foam material is 53 kg/m³.

[0048] According to an embodiment, the zones with a reduced zonal density also have a reduced density, which is in average 1.0 to 25.0% lower than the density of the foam material. The reduction in density is inherently the consequence of the incisions and/or the incision pattern which has been made, but should be within said range, for offering an optimal lying comfort to the subject. Preferably, the density of said zones is 2.5 to 10.0% lower.

[0049] According to a further or another embodiment, the foam material has a maximum tensile strength which is at least 65 kPa and a resilience which is at least 45%. The tensile strength and the durability are crucial parameters mainly in the context of lifetime and durability of the mattress base or the mattress. A mattress base of mattress should indeed on average last ten to fifteen years. Within this period, it is of course supposed that the quality of the mattress or mattress base decreases a little as possible. With a maximum tensile strength of at least 65 kPa and a resilience of at least 45%, the lifetime of a mattress or mattress base according to the present invention is guaranteed.

[0050] The ultimate tensile strength (UTS), often abbreviated to "tensile strength" (TS), is the capability of a material or structure to resist to stresses stretching and/or extending the material. The ultimate tensile strength is measured by the maximum pressure a material can resist while it is stretched, before this material breaks. The ISO standard 1798 specifies a method for determining the strength and deformation characteristics of flexible cellular materials when a test piece is extended with a con-

stant speed until it breaks. Next to the maximum tensile strength, the ISO standard 1798 also provides for a method for determining the maximum stretch.

[0051] In the material sciences, the "resilience" is the capacity of a material to absorb energy when it is deformed elastically, which energy is released again when removing the deformation. Resilience is defined as the maximum energy which can be absorbed until the elastic limit, without creating a permanent deformation. The ISO standard 8307 specifies a testing method for determining the resilience through ball return of flexible cellular polymer materials.

[0052] Preferably, the maximum tensile strength of the foam material is at least 100 kPa and the resilience of the foam material is at least 55%. A higher tensile strength and a higher resilience imply a longer lifetime of the mattress or mattress base. Since incisions and/or an incision pattern is made in the mattress or mattress base, a material with a high tensile strength and a high resilience is a large advantage within the framework of the invention. Moreover, it is supposed that the orientation of the mattress or mattress base is changed regularly. Since this leads to a high pressure in use onto the mattress or mattress base, a high resilience and a high tensile strength of the foam material is desired. Most preferably, the maximum tensile strength of the foam material is at least 120 kPa and the resilience of the foam material is at least 60 %.

[0053] With the context of said high pressure in use, a high, maximum stretch of the foam material is also desired. According to an embodiment, the maximum stretch of the foam material is at least 60%. Preferably, the maximum stretch is at least 80%. Most preferably, the maximum stretch is at least 100%.

[0054] The mattress or mattress base according to any of the previous embodiments usually has a thickness which is comprised between 12.0 and 15.0 cm. Within these ranges, the mattress or mattress base offers a good lying comfort to the subject and it is possible to make sufficiently deep incisions in the mattress or mattress base without harming the integrity of the mattress or mattress base. Preferably, the thickness of the mattress of mattress base is comprised between 13.0 and 14.0 kg/m³.

[0055] According to an embodiment, the foam material comprises polyurethane foam. "Polyurethane" (PUR and/or PU) or "polyurethane foam" is an organic polymer which is usually thermohardening. Polyurethane can also be thermoplastic. Polyurethane polymers arise as a result of the reaction between a di- or tri-polyisocyanate with a polyol. Polyurethane is preferred since it has the desired material characteristics and it is moreover easy to process, which simplifies the making of incisions and/or incision patterns.

[0056] A second aspect of the present invention relates to a mattress base of a mattress base according to any one of the embodiments as described above and a mattress. The mattress base is suitable for supporting a sub-

ject. There mattress is hereby provided with a foam layer, which foam layer comprises one or more cavities. These cavities extend transversely to the longitudinal direction of the mattress and are suitable for comprising one or more inserts.

[0057] The inserts are possible elongated in the transverse direction of the mattress. For the purposes of the present invention, said transverse direction should be comprised as parallel to the width of the mattress. More in particular, transverse should also be comprised as a direction perpendicular to the longitudinal axis of the body of a user.

[0058] In an embodiment, the inserts comprise a foam with hardness comprised between 1.5 and 6.0 kPa, and a density comprised between 20 and 80 kg/m³. The foam material of the mattress is usually visco-elastic. It is known that visco-elastic foam materials have a pressure-reducing capacity. Mattresses and cushions of visco-elastic foam create a 'floating' experience wherein the body reaches a virtual state of weightlessness when sleeping. For a long time, it was said that this sleeping floatingly was the most optimal way to solve or prevent ergonomic problems. However, it remains necessary to keep on providing sufficient support on certain locations of the body. Thereto, the inserts preferably have a density between 25 and 65 kg/m³. By providing inserts with the same and/or a different hardness at different intervals in the mattress according to the present invention, supporting points are provided in the transverse direction of the mattress for the body of the user. These points improve the ergonomic nature of the mattress and offer an optimal sleeping experience. It seemed that the inserts offered insufficient support outside this range, or that the comfort for the subject decreased.

[0059] In particular, the base comprising a mattress base according to the first aspect of the present invention and the mattress as described here, provide an optimal support and an optimal lying comfort to a subject. The advantage of the base is the unique combination between a mattress base with zones with reduced zonal hardness and a mattress with transverse inserts, locally increasing the hardness of the mattress. The mattress base and the mattress are separately movable with respect to each other in the base, as a result of which different orientations of the mattress base with respect to the mattress offer different support and comfort experiences to the subject. This makes the present base ideal if a permanent adjustability of the lying characteristics is desired. The subject can indeed just at home, and at his/her own initiative, turn the mattress base over its different axes and thereby orient the position of the different zones with reduced zonal hardness differently with respect to the mattress.

[0060] In normal circumstances, a mattress or mattress base has a lifetime of approximately 10 to 15 years. During this period, the human body can undergo significant changes (for example weight loss or increase, pregnancy, etc.). The present invention allows to adjust the

foam article to the body changes of the subject. According to an embodiment, the inserts of the mattress can be removed and replaced, depending on changes in the body of the subject.

[0061] The foam layer of the mattress moreover has a density offering a relatively high degree of material durability. The density of the foam layer can also influence other characteristics of the foam, such as the way wherein the foam layer reacts to pressure and the feeling of the foam. In some embodiments, the foam layer has a density of not less than approximately 30 kg/m³ and not more than approximately 150 kg/m³. In other embodiments, the foam layer can have a density of at least approximately 40 kg/m³ and not more than approximately 135 kg/m³. In still other embodiments, the foam layer can have a density of at least approximately 50 kg/m³ and not more than approximately 120 kg/m³.

[0062] In an embodiment, said foam layer can be a non-reticulated network, namely with intact cells, or a reticulated foam, namely with skeleton-like cellular structure with open cells. The mattress in the base can possibly be provided with a top layer which is placed over the upper surface of the mattress and which is supported by this mattress. The top layer preferably comprises a non-visco-elastic material.

[0063] In an embodiment, the non-visco-elastic top layer rests on the mattress without being attached thereto. In another embodiment, the layers can be attached to each other by a cohesive binding material, and/or for example co-extrusion.

[0064] Both the upper surface and the lower surface of the different elements in the mattress base can be essentially flat. In other embodiments, at least one of these surfaces can be non-planar.

[0065] According to an embodiment, the top layer is preferably a soft polyurethane foam or a visco-elastic foam. The top layer will preferably improve the breathing capacity of the mattress. Visco-elastic foam material does not allow a better ventilation, as a result of which a non-visco-elastic top layer further improves the breathing capacity of the mattress base. This prevents sweating of a subject when sleeping.

[0066] According to a preferred embodiment, said top layer is a water-based (polyurethane) foam comprising polyols, preferably polyols of vegetative origin.

[0067] More preferably, said foam is alternated with gel parts, increasing the mechanical and physical characteristics as well as the breathing capacity of the foam, as a result of which the material is particularly suitable for use as a top layer in the present invention. Preferably, the gel parts have a size of 1 to 5 mm and they comprise 5 to 20% of the total volume of the foam matrix of the top layer. The top layer will preferably have a density between 40 and 70 kg/m³, more preferably between 50 and 60 kg/m³, such as approximately 55 kg/m³, measured according to the ISO standard 845. The hardness of the top layer is preferably between 0.5 and 1.5 kPa, more preferably between 0.6 and 1.6 kPa, such as 0.8 kPa, if

measured according to the ISO standard 3386. The tensile strength of the top layer will preferably be between 35 and 55 kPa, more preferably between 40 and 50 kPa, such as 45 kPa, measured according to the ISO standard 1798. The resilience through ball return of the top layer is preferably higher than 40%, more preferably between 50 and 80% measured according to the ISO standard 8307. The compression of the top layer is preferably lower than 5% (measured according to the ISO standard 1856). Each of these parameters contribute to an optimally ventilated and comfortable top layer. According to an embodiment, the inserts are spread over the mattress, wherein the position of the inserts corresponds to positions on the body of the subject, which positions require support. The unique adjusted combination of the mattress base and the mattress hereby offers an optimal support to a diversity of subjects with different body figure and/or characteristics, and at the same time a particularly good lying comfort. The relevant base allows to provide specific body locations and/or body zones with more or less support, as a result of which a supporting pattern is obtained which completely corresponds to the personal situation of each subject.

[0068] The hardness and/or the positions of the inserts are chosen based on one or more body parameters associated with the subject, thereby providing an optimal support. Parameters possibly comprise information about the body weight, weight, position of the shoulders, the hips, the thighs, the knees, the lower legs and/or the feet. These locations on the body seem to require additional support for offering an ergonomic way of sleeping.

[0069] According to a further or another embodiment, the mattress base can be configured in different ways, namely by choosing a position of the mattress base with respect to the mattress. This choice is made based on one or more body parameters associated with the subject. Depending on the desired support and/or the desired comfort, the orientation of the mattress base with respect to the mattress can be chosen. Based on particular body parameters of the subject, a mattress producer can also determine a preferred orientation of the mattress base with respect to the mattress.

[0070] In a further or separate embodiment, the inserts have a hardness comprised between 1.8 and 5.0 kPa.

[0071] In a more preferred embodiment, 5 classes of inserts can be used in the present invention, wherein the inserts are classified according to hardness. According to a preferred embodiment, class I (extra soft) has a hardness between 1.0 and 2.5 kPa, class II (soft) has a hardness between 2.5 and 3.5 kPa, class III (medium) has a hardness between 3.5 and 3.9 kPa, class IV (hard) has a hardness between 4.0 and 4.5 kPa and class V (extra hard) has a hardness of more than 4.5 kPa.

[0072] According to an embodiment, the inserts have a tensile strength which is higher than 50 kPa, preferably between 50 and 150 kPa.

[0073] In a still further or other embodiment, the maximum deformation of the inserts is higher than 50%, pref-

erably between 60 and 160%, measured according to the ISO standard 1798.

[0074] The resilience through ball return of the inserts is preferably higher than 40%, more preferably between 50 and 80%.

[0075] The compression of the inserts is preferably lower than 10 % (measured according to the ISO standard 1856). The wet compression measured according to the NFT standard 56 112 is preferably lower than 50%.

[0076] Principally, said inserts can be made of any suitable foam material with the characteristics as described above. Preferably, the inserts are made of a foam with a high resilience (HR foam) or a cold foam. Foam with a high resilience has a less uniform, more arbitrary cellular structure which is different from conventional products. The different cell structure helps adding support, comfort and resilience or bouncing. Foams with a high resilience have a high supportive factor and a larger surface resistance than conventional foams. The inventors found that the combination of visco-elastic foam with HR inserts provide a perfect combination of pressure-reducing characteristics and support.

[0077] In an embodiment, said HRfoam can be non-reticulated. In another embodiment, said HR foams can be cross-linked.

[0078] Suitable foams which can be used in an embodiment according to the present invention are amongst other things, but are not limited to, HR28, HR38, HR43, HR45, HR55M, HR60, and combinations thereof.

[0079] According to a most preferred embodiment, the inserts comprise a polyurethane foam.

[0080] According to a preferred embodiment, the inserts have a maximum diameter which is comprised between 3 and 6 cm, preferably approximately 4 cm. Diameters out of this range are not effective or affect the comfort of the user. Preferably, said inserts will have a circular, hexagonal, square or rectangular cross-section.

[0081] According to a preferred embodiment, said inserts are tubular. The inserts are hereby completely embedded in the visco-elastic foam layer. The inserts can be provided in a discontinuous pattern along a transverse line of the object. The insert can for example be an arrangement of balls at regular points of such a transverse line.

[0082] According to another embodiment, said insert can be a succession of separate cylinders, preferably cylinders with the same dimensions, at discrete distances along said transverse line.

[0083] According to another, most preferred embodiment, the inserts extend over the complete width of the mattress. The inserts can be applied in cavities, extending from the one side of the mattress to the other side and wherein the inserts span the complete width of the mattress. Alternatively, for example for a two-person mattress, inserts can be provided which cover only half of the width of the mattress. In such a case, a two-person mattress can be provided which is personalized for two subjects, wherein on a half, the inserts are positioned for

one subject and the other half is adapted to a second subject.

[0084] A third aspect of the present invention relates to a method for providing a tailor-made mattress base to a subject. This mattress base comprises a mattress base and a mattress, wherein the mattress base comprises two zones with a reduced zonal hardness, and the mattress comprises a foam layer provided with one or more cavities and one or more inserts. The inserts are hereby embedded in the cavities of the foam layer. The method according to the present invention includes the following steps: (a) obtaining one or more body parameters associated with the subject, (b) determining a required position and a required hardness of said inserts of the mattress based on the body parameters, (c) determining a preferred position of the mattress base with respect to the mattress based on the body parameters, (d) fabricating the mattress base, comprising the zones with reduced zonal hardness, (e) fabricating the mattress, comprising the inserts with the required hardness on the required positions, and (f) assembling the mattress base corresponding the preferred position of the mattress base with respect to the mattress.

[0085] The present invention allows to provide a tailor-made mattress base to a subject, which mattress base is adapted to the specific requirements of many body types and/or figures. The mattress base hereby provides zones with a reduced hardness, constituting so-called comfort zones and/or sinking zones, while the mattress itself provided for locations with a larger sturdiness. The unique combination between both layers guarantees a very subtle supportive profile of the mattress base corresponding to many requirements. The unique construction of the mattress base moreover allows that, after its fabrication, the mattress base can still be adapted to, whether or not temporary, circumstances, wherein the supportive profile can be modified by choosing another orientation of the mattress base with respect to the mattress, or possibly by changing and/or replacing inserts in the mattress.

[0086] Preferably, the zones with a reduced zonal hardness are obtained by means of the provision of one or more incisions and/or incision patterns in the mattress base in step d. The provision of incisions and/or incision patterns is an unambiguous way of adapting the hardness of the mattress base zonally and allows a large variety in obtained hardness. Moreover, the provision of incisions is a cost-effective way of causing a reduction in hardness.

[0087] According to an embodiment, the body parameters are chosen from the group of weight, length, shoulder width, hip width, or combinations thereof. Said parameters relate to body parts and/or body locations requiring an adjusted support. Based on these parameters, on the one hand, it can be determined by a mattress producer which inserts are required at which location for offering a correct support of the subject, on the other hand, the preferred orientation of the mattress base with

respect to the mattress can also be determined. The determined preference relates to indications and/or recommendations based on which the mattress base is fabricated and prided to the subject. The base does however allow to change the orientation and/or to choose for adjusted inserts afterwards.

[0088] According to an embodiment, the body parameters are obtained by means of asking questions to the subject in step a, in a way chosen from the group of a conversation, a telephone call, answering a questionnaire, answering an on-line questionnaire, answering a series of multiple-choice questions and/or text fields, or combinations thereof. Preferably, the collection of the parameters is made via one on-line questionnaire.

[0089] According to a further or other embodiment, body parameters are obtained by measuring the body of the subject and/or making a body scan by means of for example a 3D camera. Preferably, these body parameters will then be used for determining the required hardness and positions of inserts in the mattress.

[0090] According to a further or other embodiment, body parameters are obtained by making a depth image of the body of said subject by means of a depth camera or depth sensor system comprising one or more depth cameras or depth sensors. Based on the obtained depth image, body parameters of the individual are determined. These parameters form the basis for determining the position and/or hardness of the inserts as described above.

[0091] According to a further or another embodiment, the method provided for a mattress base according to the second aspect of the present invention.

[0092] In the following, the invention is described by means of non-limiting figures illustrating the invention, and which are not meant or cannot be interpreted as limiting the scope of the invention.

DETAILED DESCRIPTION OF THE FIGURES

[0093] The side view shown in **Fig. 1** of a preferred embodiment of the mattress base **1** according to the present invention comprises two surfaces **O**, **O'** and four zones **2**, **3**, **4** and **5** situated in these surfaces **O**, **O'**. **Fig. 3a** shows an equivalent perspective view of the mattress base **1**. The mattress base **1** has a height **H** (or thickness) of 13.5 cm. Three of these zones **3**, **4** and **5** have a zonal hardness which is lower than the basic hardness of the foam material of which the mattress base **1** is made. The reduced, zonal hardness is obtained by means of the incisions and/or incision patterns **6**, **6'** and **6''** which have been made in the surface layer of the surfaces **O** and **O'**. The incisions **6**, **6'** and **6''** extend over the complete width **B** of the mattress base **1**. As a result of the different incisions and/or incision patterns **6**, **6'** and **6''**, the four zones **2**, **3**, **4** and **5** have a different zonal hardness, as a result of which the mattress base **1** can be applied according to four different orientations. When a subject lies down with his shoulders at the level of zone **2**, also called a first orientation, the subject experiences a solid

support over the complete body. With the shoulders at the level of zone 3, or according to a second orientation, the subject experiences a solid support with a reduced hardness at the level of the shoulders. As a result, the shoulders slightly sink into the mattress base 1, improving the natural curvature of the back. When the subject lies down on the mattress base 1 with the shoulders at the level of zone 4, corresponding to a third orientation, the subject experiences a moderate support with a reduced hardness at the level of the shoulders. Finally, zone 5, corresponding to a fifth orientation, ensures a mild support with reduced hardness at the level of the shoulders. The different hardnesses are obtained by means of the incisions 6, having a depth of approximately 3.5 cm and a curved shape. The incisions 6 offer a slightly reduced zonal hardness at the level of zone 3. The incisions 6' ensure a moderate reduction of the zonal hardness at the level of zone 4, and have a depth of approximately 3.1 cm, oriented perpendicularly to the surface O. The largest reduction in zonal hardness is obtained by means of the incisions 6'' at the level of the zone 5, which have a depth comprised between approximately 1.0 cm and approximately 3.0 cm. The zones 4 and 5 moreover comprise one or more incisions in the longitudinal direction of the mattress base 1, with a depth of approximately 4.0 cm.

[0094] As shown in Fig. 2, the mattress base 1 according to the first aspect of the invention is used in a mattress base according to the second aspect. The mattress base 1 hereby supports a mattress 7. Possibly, the mattress is covered by a top layer 10.

[0095] Fig. 3b shows a perspective view of a preferred embodiment of the base base according to the present invention. The base comprises a mattress base 1 and a mattress 7, comprising a foam layer 8 and inserts 9 with a hardness comprised between 1.5 and 6.0 kPa, and a density comprised between 20 and 80 kg/m³.

[0096] As shown in Fig. 3C, the mattress base according to a preferred embodiment comprises a mattress base 1, a mattress 7 and a top layer 10.

[0097] List of the parts indicated in Figures 1 to 3c:

- 1 mattress base
- 2 zone with zonal hardness equal to the basic hardness
- 3 zone with zonal hardness slightly reduced with respect to the basic hardness
- 4 zone with zonal hardness moderately reduced with respect to the basic hardness
- 5 zone with zonal hardness strongly reduced with respect to the basic hardness
- 6 curved incisions with a depth of approximately 3.5 cm
- 6' straight incisions with a depth of approximately 3.1 cm
- 6'' incisions with a depth comprised between 1.0 cm and 3.0 cm
- 7 mattress in a mattress base

8 foam material of the mattress

9 inserts

10 top layer in a mattress base

O first surface of the mattress base

O' second surface of the mattress base

B width of the mattress base

H height (thickness) of the mattress base

10 Claims

1. A mattress or mattress base (1), comprising a foam material (8) with a basic hardness, which mattress or mattress base comprises a first, flat surface (O) and opposing to said first surface, a second, flat surface (O'), wherein both the first and the second surface comprise a surface layer and are suitable for supporting a subject, wherein the surfaces are divided into zones with a zonal hardness (2, 3, 4, 5), situated at both sides of a fictive centre line (MM'), perpendicular to the longitudinal direction (L) of the mattress or mattress base, **characterized in that** the first and the second surface each comprise at least one zone with a zonal hardness which is lower than the basic hardness of the mattress or mattress base, and wherein the reduction in hardness is the result of one or more incisions and/or incision patterns (6, 6', 6'') in the surface layer located in these zones.
2. The mattress or mattress base (1) of claim 1, **characterized in that** the first and the second surface (O, O') each comprise two zones (2, 3, 4, 5), situated at both sides of the fictive centre line (M').
3. The mattress or mattress base (1) of claim 2, **characterized in that** the zonal hardness of at least three of the zones (2, 3, 4, 5) is lower than the basic hardness of the mattress or mattress base.
4. The mattress or mattress base (1) of any one of the previous claims 1-3, **characterized in that** the incisions and/or incision patterns (6, 6', 6'') extend in a direction towards the core of the mattress or mattress base, and wherein the direction is oriented substantially perpendicular to the surface layer.
5. The mattress or mattress base (1) of any one of the previous claims 1-4, **characterized in that** the incisions and/or incision patterns (6, 6', 6, 6'') have a depth comprised between 0.5 and 5.0 cm, preferably between 1.0 and 4.0 cm.
6. The mattress or mattress base (1) of any one of the previous claims 1-5, **characterized in that** the foam material (8) has a basic hardness comprised between 2.0 and 5.5 kPa, preferably between 3.0 and 4.5 kPa.

7. The mattress or mattress base (1) of any one of the previous claims 1-6, **characterized in that** the zonal hardness of said zones (3, 4, 5) with reduced zonal hardness is between 1.0 and 25.0%, preferably between 2.5 and 10.0%, lower than the basic hardness of the foam material (8).
8. The mattress or mattress base (1) of any one of the previous claims 1-7, **characterized in that** the foam material (8) has a density which is comprised between 25 and 65 kg/m³, preferably between 50 and 60 kg/m³.
9. The mattress or mattress base (1) of any one of the previous claims 1-8, **characterized in that** the zones with a reduced zonal hardness (3, 4, 5) have a density which is between 1.0 and 25.0% lower, preferably between 2.5 and 10.0% lower, than the density of the foam material (8).
10. The mattress or mattress base (1) of any one of the previous claims 1-9, **characterized in that** the foam material (8) has a maximum tensile strength of at least 65 kPa and has a resilience of at least 45%.
11. The mattress or mattress base (1) of any one of the previous claims 1-10, **characterized in that** the mattress or mattress base has a thickness (H) which is comprised between 12.0 and 15.0 cm, preferably between 13.0 and 14.0 cm.
12. The mattress or mattress base (1) of any one of the previous claims 1-11, **characterized in that** the mattress or mattress base comprises cold foam.
13. A mattress base of a mattress base (1) of any one of the previous claims 1-12 and a mattress (7), suitable for supporting a subject, which mattress comprises a foam layer provided with one or more cavities, which cavities extend transversely to the longitudinal direction of the mattress, **characterized in that** the mattress comprises one or more inserts (9), which inserts are embedded into the cavities of the foam layer.
14. The mattress base of claim 13, **characterized in that** the inserts comprise a foam with hardness comprised between 1.5 and 6.0 kPa, and a density comprised between 20 and 80 kg/m³.
15. The mattress base of claim 14, **characterized in that** the hardness and/or density of the inserts (9) is different, wherein the hardness corresponds to the required support of the subject.
16. The mattress base of claim 14 or 15, **characterized in that** the inserts (9) are spread over the mattress, wherein the position of the inserts corresponds to positions on the body of the subject, which positions require support.
17. The mattress base of any one of the previous claims 14 or 16, **characterized in that** the hardness and/or positions of the inserts (9) is chosen based on one or more body parameters associated with the subject.
18. The mattress base of any one of the previous claims 14-17, **characterized in that** the position of the mattress base (1) with respect to the mattress (7) is chosen based on one or more body parameters associated with the subject.
19. The mattress base of any one of the previous claims 14-18, **characterised in that** the inserts (9) comprise polyurethane foam.
20. A method for providing a tailor-made mattress base to a subject, the mattress base comprising a mattress base and a mattress, the mattress base comprising at least two zones with a reduced zonal hardness, and the mattress comprising a foam layer provided with one or more cavities, and one or more inserts, which inserts are embedded into the cavities of the foam layer, comprising the steps:
- obtaining one or more body parameters associated with the subject,
 - determining a required position and a required hardness of said inserts of the mattress based on the body parameters,
 - determining a preferred position of the mattress base with respect to the mattress based on the body parameters,
 - fabricating the mattress base, comprising the zones with reduced zonal hardness,
 - fabricating the mattress, comprising the inserts with the required hardness at the required positions, and
 - assembling the mattress base corresponding to the preferred position of the mattress base with respect to the mattress.
21. The method of claim 20, **characterized in that** the zones with a reduced zonal hardness are obtained by means of the provision of one or more incisions and/or incision patterns in the mattress base in step d.
22. The method of claim 20 or 21, **characterized in that** the body parameters are chosen from the group of weight, length, shoulder width, hip width, or combinations thereof.
23. The method of any one of the previous claims 20-22, **characterized in that** the body parameters are ob-

tained by means of questioning the subject in step a, in a way chosen from the group of a conversation, a telephone call, answering a questionnaire, answering an on-line questionnaire, answering a series of multiple-choice lists and/or text fields, or combinations thereof. 5

- 24.** The method of any one of the previous claims 20-23, wherein a mattress base of claim 13-19 is provided. 10

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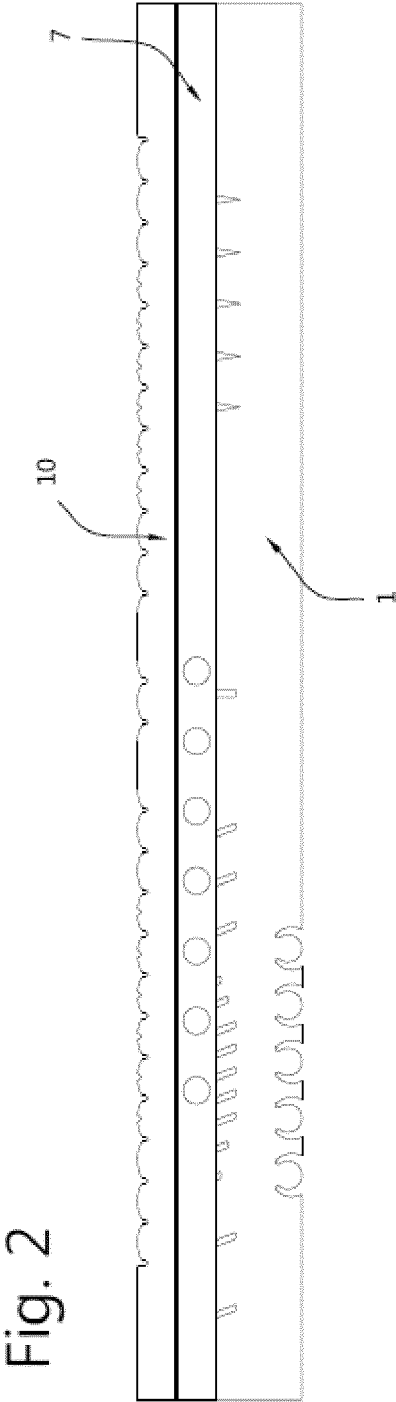
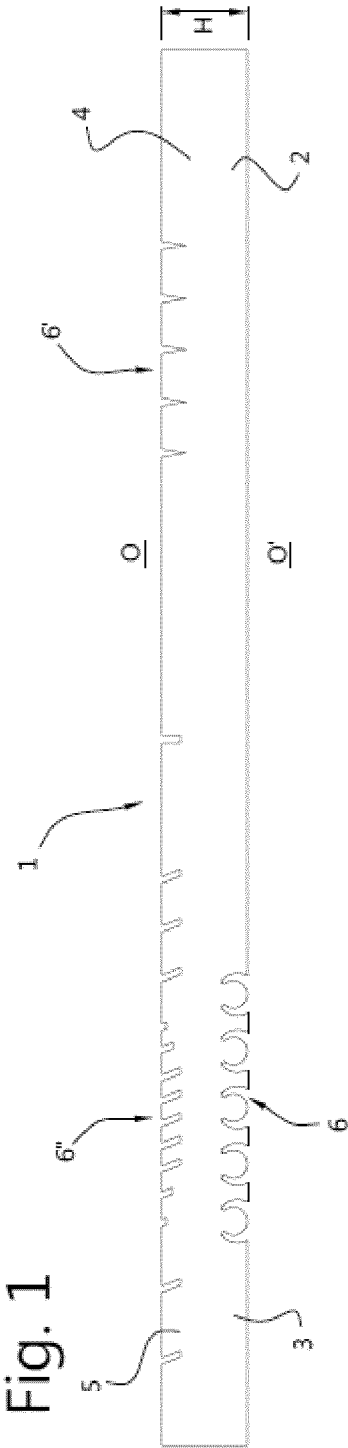
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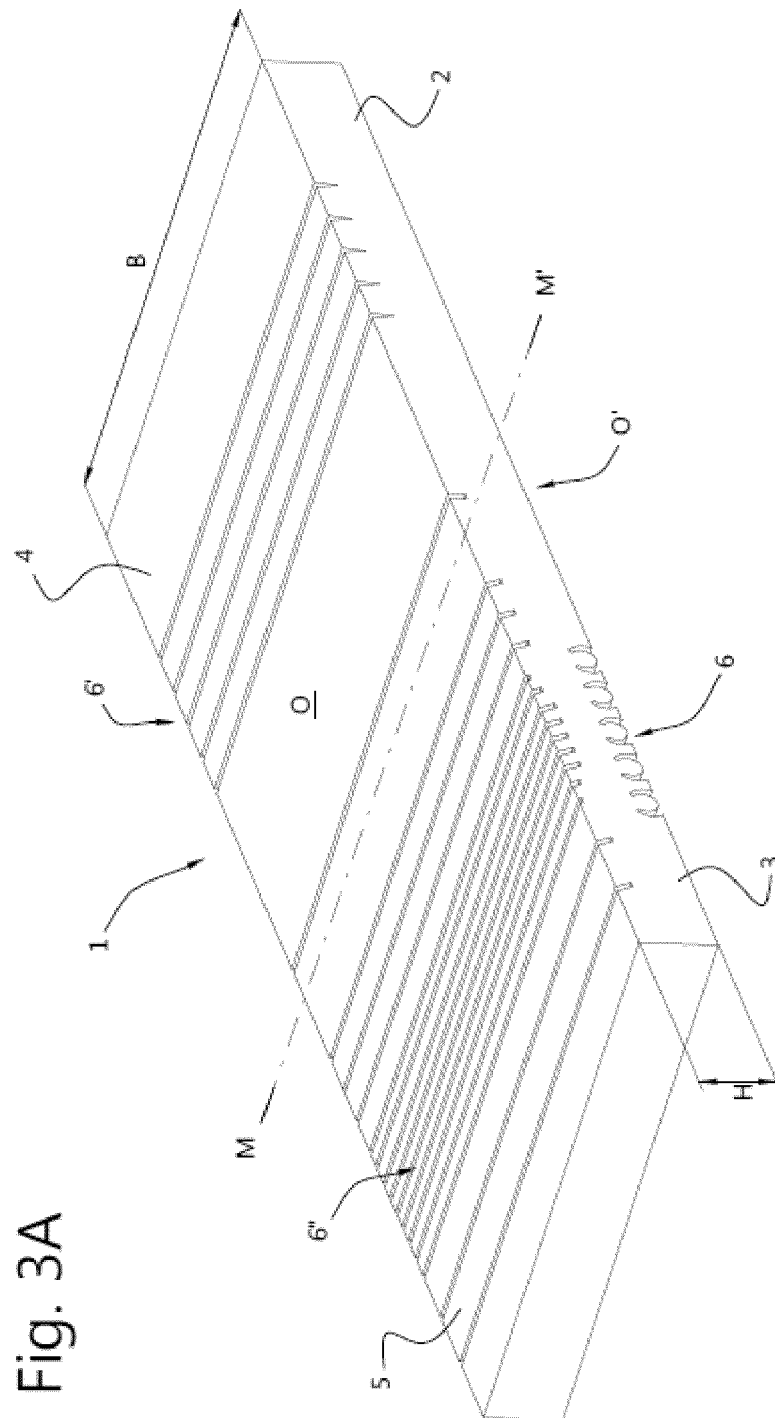
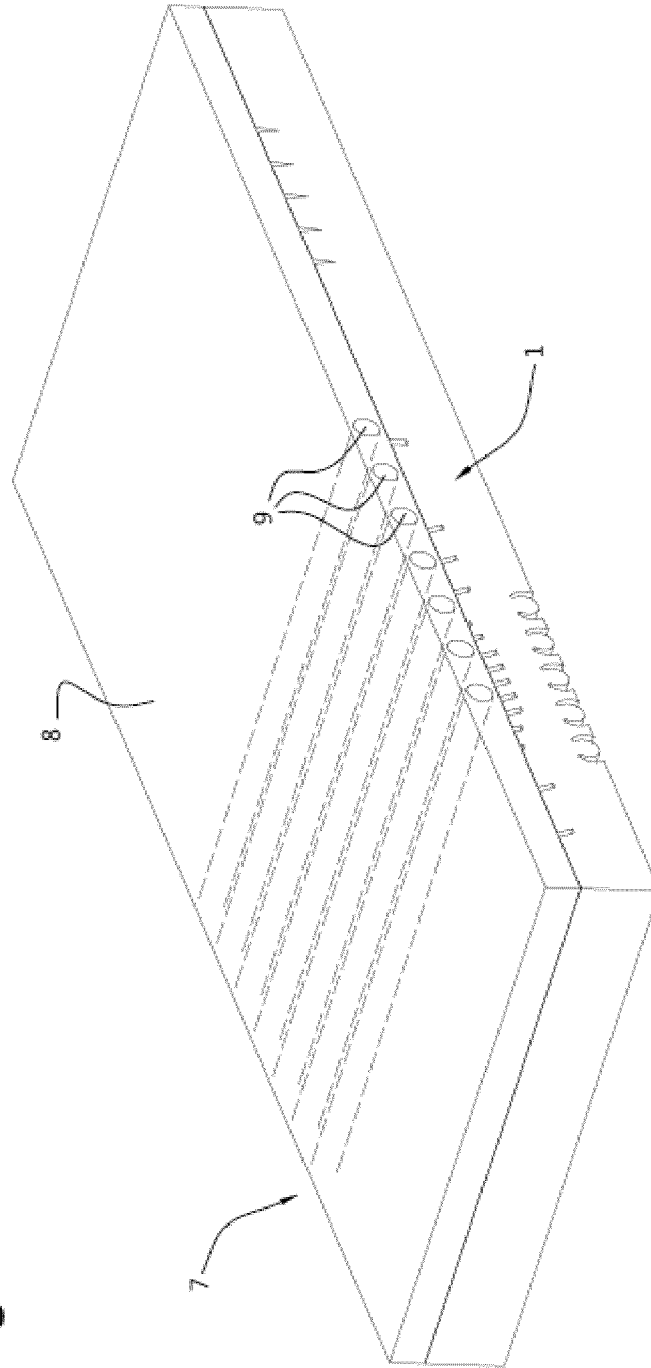


Fig. 3A

Fig. 3B



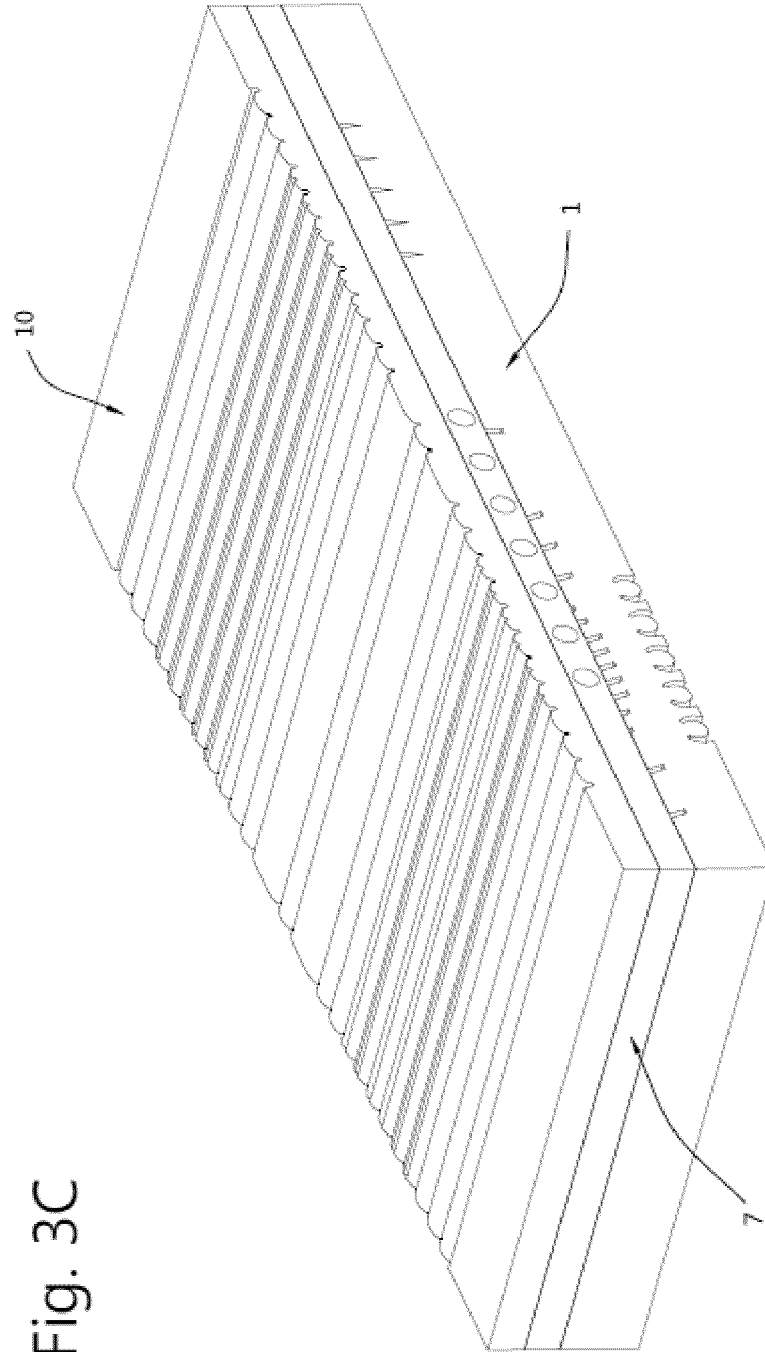


Fig. 3C



EUROPEAN SEARCH REPORT

 Application Number
 EP 19 20 2719

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 21 July 2020	Examiner Kus, Slawomir
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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