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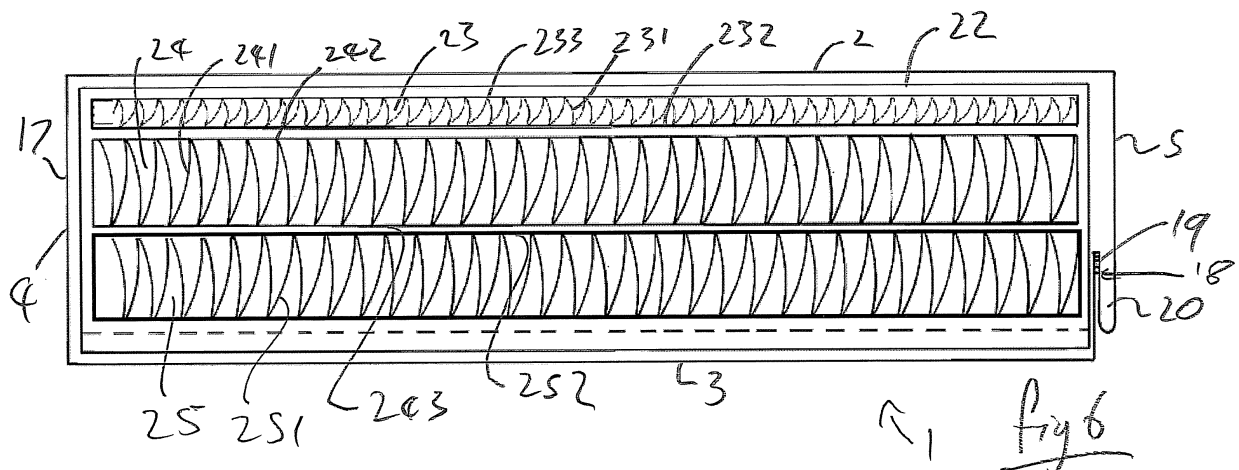
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(54) **MATTRESS OR MATTRESS OVERLAY**

(57) A mattress or mattress overlay is provided, which is formed from several layers of spacer fabric. At least two layers of the spacer fabric are arranged such that the microfilaments in the layers curve in the same direction, towards the foot of the bed. Another layer can be provided, with layers which curve in the same, or a

different direction, e.g. orthogonal. The top layer is more compressible than the bottom layer and the surface of the top layer of spacer fabric is provided with cuts in the heel region to reduce pressure at this high-risk bony prominence.



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DescriptionTechnical Field of the Invention

5 **[0001]** The present invention relates to mattresses and mattress overlays including at least one layer of spacer fabric.

Background to the Invention

10 **[0002]** Spacer fabric has already found use in mattresses and mattress overlays and US2011/0283459 proposes a mattress formed of a plurality of layers; a bottom layer of foam and an upper layer of spacer fabric. One example in US2011/0283459 proposes a plurality of layers of spacer fabric one on top of the other, in order to produce a greater overall height. In another embodiment of US2011/0283459 use of a ventilation device in the form of a pump/suction device is proposed to pump air into the upper (spacer) layer. Simple overlays formed of one layer of spacer fabric to be placed over a mattress are also known.

15 **[0003]** Warp knitted spacer fabric has an inherent directionality in the monofilaments that separate the two textile faces due to the action of a knitting machine. As this stiff yarn is thrown from the needles forming one face to those forming the other, it forms an arc as there is a small displacement between the two layers. Figure 1 shows schematically a spacer fabric in which the microfilaments curve in a first direction (to the left in the drawing), which is the direction of travel as the spacer fabric is manufactured. Figure 2 shows the view from the other side of the spacer fabric of figure 1, in which the microfilaments curve in a second direction (to the right in the drawing), which again is the direction of travel as the spacer fabric is manufactured. Figure 3 shows the view orthogonal to the views in figures 1 and 2, looking down the spacer fabric. In this view, the mono filaments can be seen to go from left to right and vice versa, crisscrossing in the weft direction.

20 **[0004]** The present invention seeks to provide improved mattresses and overlays.

Summary of the Invention

25 **[0005]** According to a first aspect of the invention, there is provided a mattress or mattress overlay having a head end to be located at the head of a bed and a foot end to be located at the foot end of the bed, and comprising a layer of spacer fabric, wherein the spacer fabric comprises monofilaments which curve towards the foot end of the mattress or mattress overlay.

30 **[0006]** Monofilaments which curve towards the foot of the bed are more easily compressed by a diagonal force downwards and towards the end of the bed, and the top face of such spacer material moves towards the foot of the bed in response to a diagonal force downwards and towards the foot of the bed, such as occurs when a bed is "profiled" to raise the head of a patient on the bed. This movement of the fabric, offsets a shear strain which would otherwise occur internally in the patient's body potentially damaging tissue integrity, which may contribute to pressure ulcers etc.

35 **[0007]** The expression a layer of spacer fabric comprising monofilaments which curve towards the foot end of the mattress or mattress overlay preferably means a layer of fabric in which more monofilaments curve towards the foot end of the mattress or mattress overlay than curve towards the head end, preferably the majority of the monofilaments in the specified layer curve towards the foot end of the mattress or mattress overlay and more preferably substantially all of the monofilaments curve towards the foot end of the mattress or mattress overlay.

40 **[0008]** According to second aspect of the invention, there is provided a mattress or a mattress overlay (preferably as set out in the first aspect) comprising at least two layers of spacer fabric, wherein the first layer of spacer fabric has monofilaments which curve in a first direction and the second layer of spacer fabric has monofilaments which curve the same first direction.

45 **[0009]** It has been found that when two layers of spacer fabric have monofilaments which curve in the same direction, the effect of the curve is reinforced, and it is therefore desirable to be able to reinforce this effect.

[0010] Preferably the first direction is towards the foot of the mattress or mattress overlay, thus the ease of compressibility of two layers of spacer fabric which both curve in that direction is exaggerated further. This is especially desirable for pressure area care in beds which "profile", raising the head of the patient for eating and suchlike.

50 **[0011]** In such cases there is force down the bed due to the distribution of the patient's weight. *Effect of head elevation on sacral and ischial tuberosities pressure in infirmity patients*, CHK Chung et al, Asian J. Gerontol. Geriatr:2012;7:101-106 shows an average 150mm movement of the patient with respect to the bed frame when the head is raised to 45 degrees.

55 **[0012]** This movement can be reduced by raising the knees at the same time as the head but there is still residual movement down the bed. This movement increases the pressure at the sacral and ischial tuberosities, and thus increases the risk of pressure ulcer development.

[0013] With the spacers orientated in multiple layers so that the curve of the monofilament in the layers is towards the

foot end of the bed there is a reduction in force resisting that parallel to the textile layers due to the higher relative movement of the top and bottom faces of the layers themselves. This is believed to reduce the opposing force within the tissues of the patient.

[0014] Preferably the first layer of spacer fabric and the second layer of spacer fabric are adjacent. Separation of the layers, especially by a further spacer layer having a different orientation disconnects the reinforcement of effects by the two layers, (although the disconnection would be negligible for thin layers, such as ordinary cloth) so it is preferred that the two layers of spacer are adjacent.

[0015] A third aspect of the invention provides a mattress or a mattress overlay (preferably having the features set out above in relation to the first and/or second aspect of the invention) comprising a plurality of layers of spacer fabric, wherein a first layer of spacer fabric has a greater compressibility than a second layer of spacer fabric.

[0016] By a greater compressibility, it is meant that the first layer is more compressible, i.e. it has a lower value of compressibility measured in kPa.

[0017] Preferably the first layer has a compressibility of between 6 and 18kPa, more preferably the first layer has a compressibility of between 7 and 11 kPa and most preferably the first layer has a compressibility of between 8 and 10 kPa.

[0018] Preferably the second layer has a compressibility of between 6 and 20 kPa, more preferably the second layer has a compressibility of between 8 and 14 kPa and most preferably the second layer has a compressibility of between 10 and 12 kPa.

[0019] Preferably the arrangement of layers is such that in use, the first layer of spacer fabric forms an upper layer and the second layer forms a lower layer.

[0020] Preferably the first layer has a first thickness and the second layer has a second thickness and the first thickness is less than the second thickness.

[0021] More preferably the mattress or mattress overlay further comprises a third layer of spacer fabric, which in use forms a lowest layer, beneath the second layer.

[0022] Preferably the third layer of spacer fabric also has a lower compressibility than the first layer of spacer fabric.

[0023] Preferably the third layer of spacer fabric has a third thickness which is more than the first thickness.

[0024] Preferably the third layer of spacer fabric has a different compressibility to the first layer of spacer fabric and the second layer of spacer fabric. Alternatively, the third layer of spacer fabric has the same compressibility as the second layer of spacer fabric.

[0025] Preferably the third layer has a compressibility of between 10 and 25 kPa, more preferably the third layer has a compressibility of between 12 and 18 kPa and most preferably the third layer has a compressibility of between 14 and 16 kPa.

[0026] Compression resistance measurements are carried out at 40% CV (compression stress value) according to European Standard EN ISO 3386-1:1997.

[0027] In one preferred embodiment, the third layer of spacer fabric has monofilaments which curve in the same first direction as the first and/or the second layer of spacer fabric

[0028] In another embodiment the third layer of spacer fabric has monofilaments which curve in a second direction which is not the same as the first direction, and which is preferably orthogonal (i.e. generally substantially orthogonal) to the first direction.

[0029] Preferably the mattress or mattress overlay comprises a cover, covering the plurality of layers of spacer fabric.

[0030] Preferably the cover is formed from a liquid impermeable material. Preferably the cover is formed from a moisture vapour permeable material. Suitably, the cover is formed from stretch coated textile, such as polyurethane coated knitted textile. Ideally vapour should be able to exit the cover material, but liquid, e.g. bodily fluids, should be prevented from entering the cover.

[0031] Preferably the cover has an air inlet for introducing air into the mattress or mattress overlay to reduce humidity.

[0032] Preferably the air inlet is at the foot end of the mattress or mattress overlay.

[0033] Preferably the cover has an air outlet for allowing humid air to exit the mattress or mattress overlay.

[0034] Preferably the air outlet is at the head end of the mattress or mattress overlay.

[0035] Preferably the mattress or mattress overlay is provided with apparatus for securing it to a mattress or bed below.

[0036] In the case of a mattress overlay, the means for securing the overlay to a mattress below may comprise a fastener in a cover of the mattress overlay for fastening to a fastener provided in a cover of the mattress below.

[0037] Preferably the fastener in the cover comprises a set of teeth of a zipper for fastening to a corresponding set of teeth associated with the mattress cover.

[0038] Preferably the mattress overlay further comprises a flap to cover the fastener.

[0039] Alternatively, the securing apparatus may comprise a strap, preferably including a buckle to adjust the length of the strap.

[0040] In addition to this it is preferable if the base of the mattress/ overlay cover is made from an anti slip coated textile to prevent relative movement to the mattress below.

[0041] Preferably the cover comprises an opening, and preferably the opening comprises a slit along the side of the

mattress or mattress overlay. More preferably still, the opening is closable, for example by means of a zip, and most preferably the opening is covered by an overlap which extends over the opening, from the upper surface of the mattress or mattress overlay towards the lower surface of the mattress or mattress overlay. This overlap is primarily to prevent any liquid from wicking into the core of the mattress through the zip where it may represent an infection risk.

[0042] Preferably the mattress or mattress overlay comprises an interlayer surrounding the plurality of layers of spacer fabric and surrounded by the cover. Preferably the interlayer is fire retardant, and preferably it is formed of an inherently fire retardant yarn such as modified viscose, or a treated cellulosic material.

[0043] Preferably the layers of spacer fabric are connected at anchor points spaced around the periphery of the mattress or mattress overlay.

[0044] Preferably the mattress or mattress overlay comprises a layer of spacer fabric formed by a head end layer of spacer fabric alongside a foot end layer of spacer fabric, wherein the head end layer of spacer fabric comprises monofilaments which curve towards the head end of the mattress or mattress overlay and the foot end layer of spacer fabric comprises monofilaments which curve towards the foot end of the mattress or mattress overlay.

[0045] Preferably the head end layer of spacer fabric and the foot end layer of spacer fabric meet about a third of the way along the length of the mattress.

[0046] Preferably the head end layer of spacer fabric and the foot end layer of spacer fabric meet in the region where, in use on a profiling bed, the mattress or overlay will fold when the bed is profiled. More preferably the head end layer of spacer fabric and the foot end layer of spacer fabric meet proximate the fold line where the mattress or overlay will fold when the bed is profiled, but towards the head end. Preferably in the region of a user's waist when sitting on a profiled bed, e.g. about 10 cm away from the fold line, towards the head end.

[0047] Preferably the layer of spacer fabric formed by a head end layer of spacer fabric alongside a foot end layer of spacer fabric is the first layer of spacer fabric.

[0048] According to a fourth aspect of the invention there is provided a mattress or mattress overlay having a head end to be located at the head of a bed and a foot end to be located at the foot end of the bed, and comprising a layer of spacer fabric, wherein a cut heel region is provided in the spacer fabric, in which cuts are provided in one face of the spacer fabric.

[0049] Preferably the mattress or mattress overlay in which a cut heel region is provided in the spacer fabric, is a mattress or mattress overlay according to any of the first to third aspects of the invention, preferably including the preferred features thereof.

[0050] Preferably the cut heel region is in the foot end half of the mattress or mattress overlay.

[0051] Preferably the cuts are provided in the top face of the spacer fabric.

[0052] Preferably the cuts are provided as a grid, forming cut-sections which are able to move independently of each other.

[0053] Preferably the spacer fabric having a cut heel region therein is the second layer of spacer fabric.

Detailed Description of the Invention

[0054] In order that the invention may be more clearly understood an embodiments thereof will now be described, by way of example only, with reference to the accompanying drawings, of which:

Figure 1 shows schematically a cross section through a layer of spacer fabric, with the monofilaments curving in a first direction;

Figure 2 shows schematically a cross section through a layer of spacer fabric with the monofilaments curving in a second direction;

Figure 3 shows schematically a cross section orthogonal to the cross sections of figures 1 and 2;

Figure 4 shows a perspective view of a mattress overlay according to the invention;

Figure 5 shows a perspective view of the inlet of the mattress overlay of figure 4;

Figure 6 shows a cross section through the mattress overlay according to a first embodiment of the invention;

Figure 7 shows a cross section through the first layer of spacer fabric in the mattress overlay according to figures 4 to 6;

Figure 8 shows a cross section through the first layer of spacer fabric shown in figure 7 with a load applied thereto;

Figure 9 shows a cross section through the first layer of spacer shown in figure 8 with a load applied in a different direction;

Figure 10 shows a cross section through a combined mattress and overlay according to the second embodiment of the invention;

Figure 11 shows schematically a cross section through the mattress overlay according to the second embodiment of the invention; and

Figure 12 shows a plan view of the second layer of spacer fabric in the mattress overlay of figures 10 and 11.

[0055] Referring to figure 4, a mattress overlay 1 is formed in a typical rectangular shape, with an upper surface 2, a lower surface 3, a head end 4, a foot end 5 and two long sides 6, 7. A strap 8 with an adjustment buckle 9 is connected to the head end 4 of the mattress overlay 1, to attach it to a mattress beneath. An inlet 10 is situated on the first side 6 of the mattress overlay 1 in the foot region. An outlet 11 is situated at the head of the mattress overlay 1 on the second side 7.

[0056] The mattress overlay 1 is suitably about 2'7½" x 6'3" (80cm x 190cm) and about 2" (about 5cm) thick. The inlet 10 shown in more detail in figure 5 comprises an air delivery unit 12, including a fan 13, which is held within a sleeve 14 formed from air impermeable coated textile. When connected to a power source (not shown) via connectors 16, it serves to deliver air into the mattress overlay 1, inside its cover 17. With reference to figures 4 and 6, The cover 17 of the mattress overlay 1 covers the entire outer surface (apart from the inlet 10 and the outlet 11) and is provided with a closure 18 in the form of a zip 19 situated beneath an overlap 20 and extending along the first side 6 and the foot end 5 of the mattress overlay. The cover is formed of stretch coated textile, such as polyurethane, with moisture vapour permeability properties, to allow moisture vapour to pass through it, but prevent ingress of bodily fluids.

[0057] In the first embodiment of the invention, shown in figure 6, a fire retardant proban cotton interliner 22 is provided immediately inside the cover 17 to contain the core, formed of layers of spacer fabric which provide depth to the mattress overlay 1.

[0058] Inside the interliner 22, at the top, closest to the upper surface 2 of the mattress overlay, is a first layer of spacer fabric 23, which in this embodiment is formed of Baltex A1301-235 spacer material, the details of which are set out below:

QUALITY REF	A1301-235
FABRIC DESCRIPTION:	6MM PES SPACER
COURSES PER INCH	58
WALES PER INCH	27
COLOUR	Pure
WIDTH	235 CM
TENSILE STRENGTH BS EN ISO 13934-1	50KGS Warp; 46KGS Weft
WEIGHT	320 GM/M2
THICKNESS BS EN ISO 5084 (BS 2544)	4.5 MM
FR FINISH	ISO 1021 PARTS 1 AND 2
DIMENSIONAL STABILITY "@ 60oC	2.5% WARP AND WEFT
COMPRESSION STRENGTH "@ 40% COMPR.,	
ISO 3386-1	11KPA

[0059] As can be seen, the first layer of spacer fabric 23 is arranged such that the monofilaments 231 of the first layer of spacer fabric 23 curve towards the foot end 5 of the mattress overlay. Directly beneath the first layer of spacer fabric 23, a second layer of spacer fabric 24 is provided (adjacent to the first layer of spacer fabric 23). The second, lower, layer of spacer fabric 24 in this embodiment has a higher compression strength than the first layer of spacer fabric 23 and is made from Baltex M3550 Spacer material, the details of which are set out below:

QUALITY REF	M3550
FABRIC DESCRIPTION	POLYESTER SPACER
	XD
COMPOSITION	100 % POLYESTER
COLOUR	WHITE
WIDTH	200 CM

(continued)

WEIGHT	1000 GM/M2
THICKNESS BS EN ISO 5084	20 MM
COMPRESSION STRENGTH "@ 40% COMPR.. ISO 3386-1	15 KPA

[0060] The second layer of spacer fabric 24 is also arranged such that its monofilaments 241 curve towards the foot end 5 of the mattress overlay 1.

[0061] Beneath the second, lower, layer of spacer fabric 24, immediately adjacent thereto, is a third layer of spacer fabric 25, formed from the same material as the first layer of spacer fabric 24, Baltex M3550. This third, lowest, layer of spacer fabric 25 therefore is also thicker than the first layer of spacer fabric 23 and has a higher compressibility than the first layer of spacer fabric 23.

[0062] Like the first layer of spacer fabric 23 and the second layer of spacer fabric 24, in which the warp of the fabric runs longitudinally down the mattress overlay 1, between the head end 4 and the foot end 5; the warp of the third layer of spacer fabric 25 also runs longitudinally down the mattress overlay 1 between the head end 4 and the foot end 5, with the weft running between the sides, this can be seen in the figure 6 by the monofilaments 251 of the third layer of spacer fabric 25 curving towards the foot end 5. The second layer of spacer fabric 24 is attached to the first layer of spacer fabric 23 above it and to the third layer of spacer fabric 25 below it, by means of spaced anchor points around the periphery of the spacer layers. For example, four corner-anchor points (not shown), are provided, one at each corner of the mattress overlay, formed by sewing the bottom face 232 of the first spacer fabric 23 to the top face 242 of the second spacer fabric 24 with an elastic substance such as elasticated yarn. The bottom face 243 of the second layer of spacer fabric 24 is similarly attached by four anchor points at its corners.

[0063] Further anchor points are provided along the sides, connecting the first layer of spacer fabric 23 to the second layer of spacer fabric 24, with additional side-anchor points connecting the second layer of spacer fabric 24 to the third layer of spacer fabric 25. Typically there will be between 4 and 12 anchor points on each long edge and 2 to 6 anchor points on each short edge. In use, the mattress overlay 1 is placed on a bed (not shown), especially a bed capable of profiling, such as a hospital bed, with the foot end 5 at the base of the bed. The overlay is attached to the bed using the strap 8 (which is sized to be capable of extending round a king-sized bed, although typically, a hospital bed is a single bed) which is adjusted to the correct size using the buckle 9.

[0064] The air delivery unit 12 is connected to a power source to blow air through the mattress overlay 1. Air is easily blown through the overlay because the monofilaments in spacer fabrics present little obstacle to airflow. Of course, airflow, may be adjusted by a manually operated adjuster, or on the basis of a sensor system on the basis of temperature and/or humidity in the overlay.

[0065] When a patient lies on the mattress overlay 1 (with the top 2, and hence the first layer of spacer fabric 23, uppermost), the relatively low compression strength of the first layer 23, just 11kPa, provides a soft and comfortable surface, whilst the lower second layer 24 and third layer 25 provide a springiness that offers a high level of support to the patient. Although some of the monofilaments 231 of the first layer 23 will be crushed substantially flat, reducing the amount of airflow through that layer, the monofilaments 241, 251 of the higher compression strength layers below 24, 25 will remain more upright, allowing airflow through the mattress overlay 1 beneath the patient, to transfer saturated air maintain a gradient in humidity which promotes effective moisture transfer.

[0066] The fact that the microfilaments 231, 241 of the first spacer layer 23 and second spacer layer 24 both curve in the same direction, towards the foot of the bed, has beneficial results when a non-orthogonal force is applied to the upper surface 2, as occurs when a bed is "profiled", i.e. when the head end of the bed frame is raised to raise the head of the patient to assist him/her in eating etc. As set out above, when profiling is carried out, there is force down the bed, i.e. towards the foot end 5, due to the distribution of the patient's weight.

[0067] Figure 7 shows how such a load (downwards and towards the foot of the bed) applied to the first spacer fabric 23 can be resolved into a downward vector and a vector in the direction from the head end 4 to the foot end 5 of the bed. And figure 8 shows how when such a force is applied, the spacer fabric is easily crushed in the direction of the force, and the direction of the curve of the monofilaments 231, with the top face 233 of the first spacer fabric 23 moving downwards, towards the foot end 5 of the mattress overlay.

[0068] The second spacer fabric 24 and third spacer fabric 25, which also have monofilaments 241, 251 which curve towards the foot of the bed are easily crushed in the same manner, such that the top face 242 of the second spacer fabric 24 moves towards the foot of the bed.

[0069] Simply for comparison, figure 9 shows how the spacer fabric 23 reacts to a force applied downwards, but towards the head end 4. In this case, it can be seen that the monofilaments 231 resist crushing to a greater extent and the top face 233 of the first spacer fabric 23 does not move towards either the head end 4 or the foot end 5 of the bed.

[0070] As set out above, when, as in this embodiment, two adjacent layers of spacer fabric 23,24 have the same directionality of the curve of the monofilaments 231,241, the effect of movement in the direction of the curve is reinforced and occurs to an even greater extent. Accordingly there is a substantial movement of the top face 233 of the first spacer fabric 23 relative to its bottom face 232 and a like movement of the top face 242 of the second spacer fabric 24 relative to its bottom face 243, in the direction of the foot of the bed. This lessens the force applied to the body of the patient when the bed is profiled, reducing the amount of distortion in the tissue of the body and decreasing the risk of development of pressure ulcers. This is considered to be of particular benefit in reducing the development of deep tissue injuries at the internal bone/tissue interface.

[0071] The provision of a third layer 25 which also has the same directionality of the curve of its monofilaments 251 further enhances this effect.

[0072] Turning to the second embodiment of the invention, as shown in figure 10, a combined mattress and overlay 27 is provided. The combined mattress and overlay 27 comprises a foam core 28, which is an antidecubitus mattress, and sits beneath an overlay 29. The overlay 29 comprises an overlay cover 30, which surrounds the core of the overlay 29 and is provided at its lower edge with a set of teeth 31 for a zip. For its part, the foam core 28 is also surrounded by a cover 32, which also includes one set of teeth 33 of a zip. The zip formed by the teeth 31, 33 is closed by a puller (not shown) associated with one of the sets of teeth, to attach the overlay cover 30 to the mattress cover 32. This allows the overlay 29 to be removed easily for cleaning/replacement. A flap 34 formed in the overlay cover 30 covers the zip 31,33 in the same way as the overlap 20 covers the zip 19 of the first embodiment.

[0073] With reference to figure 11, which is a schematic drawing showing only the monofilaments in the spacer fabric, the overlay 29 of the second embodiment also comprises three layers of spacer fabric.

[0074] A fire retardant proban cotton interliner (not shown) is provided immediately inside the cover 30 to contain the core, formed of layers of spacer fabric which provide depth to the mattress overlay 29.

[0075] Inside the interliner, at the top, closest to the upper surface of the mattress overlay, is a first layer of spacer fabric 35, which is formed of spacer material with a compression in the region of 7-11KPa, e.g. 7KPa.

[0076] As can be seen in figure 11, the first layer of soft spacer fabric 35 is formed by two separate layers located alongside one another; a foot end first layer 36 extends along about two thirds of the length of the mattress overlay 29, and a head end first layer 37 extends from the head end, along about one third of the length of the mattress overlay 29 to meet the foot end first layer 36. The head end first layer 37 and the foot end first layer 36 are arranged to meet near the point in the mattress where the overlay 29 will fold when a bed is profiled around the waist level of a patient, slightly closer to the head end (e.g. 10 cm up from the fold-point). As in the first embodiment, in the foot end first layer 36, the monofilaments 361 curve towards the foot end of the mattress overlay 29. On the other hand, the monofilaments 371 of the head end first layer 37 curve towards the head end of the mattress overlay 29.

[0077] Directly beneath the first layer of soft spacer fabric 35, a second layer of medium spacer fabric 38 is provided (adjacent to the first layer of spacer fabric 23). The second, lower, layer of spacer fabric 38 in this embodiment has a higher compression strength than the first layer of spacer fabric 35 of about 8-14KPa, e.g. 10KPa.

[0078] The second layer of spacer fabric 38 is formed of a single piece of spacer material arranged such that its monofilaments 381 curve towards the foot end of the mattress overlay 29.

[0079] Beneath the second, lower, layer of spacer fabric 38, immediately adjacent thereto, is a third, hard, layer of spacer fabric 39, formed from a harder spacer material than the first two layers, with a compression of about 12-18KPa, e.g. 15KPa.

[0080] This third, lowest, layer of spacer fabric 39 is also thicker than the first layer of spacer fabric 35 and has a higher compressibility than both the first layer of spacer fabric 35 and the second layer of spacer fabric 38. Like the second layer of spacer fabric 38, the monofilaments 391 of the third layer of spacer fabric 39 curve towards the foot end of the mattress overlay.

[0081] The layers of spacer material 35, 38, 39 are connected to one another at anchor points, in the same way as in the first embodiment. However, additional anchor points may be required between the head end first layer 37 and the second layer 38 beneath it, in the region adjacent the foot end first layer 36. Similarly, additional anchor points may be required between the foot end first layer 36 and the second layer 38 beneath it, in the same region.

[0082] In a further modification, shown in figure 12, the second layer of spacer fabric 38 includes a cut-heel region 40 at the foot end of the overlay 29. The cut heel region 40 in this embodiment is provided 150mm inwards of the foot end and the two sides of the mattress and is formed as a square of 500mm x 500mm within this region, cuts 42 are provided through the top face of the spacer fabric 38, but not through the bottom face of the spacer fabric, so as to separate small sections 41 of the top face of the spacer fabric from the regions around them. The cuts 42 are made from end to end and from side to side of the square cut heel region 40, to define a grid of small cut-sections 41 which readily conform. The cut sections may be of 30mm x 30mm, and in order to fit a square of 500mm x 500mm, the outer ring of cut sections may be 40mm x 40mm. The top faces of the cut sections 41 are able to move independently of the sections 41 around them, and of the main body of the top face of the second layer of spacer fabric 38, thereby making them less rigid and providing a region of greater compressibility. The provision of this cut-heel region in the second layer 38 of the overlay,

rather than the top layer or the bottom layer, is considered optimal in terms of reducing the firmness in the sensitive heel region, without having a detrimental effect on the overall structure of the mattress overlay 29.

[0083] In use, the combined mattress and overlay 27 of the second embodiment is placed on a bed (not shown), especially a bed capable of profiling, and oriented such that the foot end of the combined mattress and overlay 27 is at the base of the bed and the head end first layer is located over the part of the bed which will profile to raise the head of the user. The combined mattress and overlay 27 may be attached to the bed and may be provided with air delivery means which would be connected to a power source in use.

[0084] When a patient lies on the mattress overlay 29, (with the first layer 35 of spacer fabric uppermost), the relatively low compression strength of the first layer 35 provides a soft and comfortable surface, with the lower, second layer 38 providing a degree of softness and support, and the lowest, firmest, third layer 39 mainly providing support.

[0085] The patient's feet and lower leg are likely to lie in the cut-heel region, which as discussed above will be more compressible and hence more comfortable in this sensitive region reducing the interface pressure at this high risk bony prominence.

[0086] The microfilaments 361, 381, 391 of the three spacer layers in the lower two thirds of the bed are all curved towards the foot of the bed. This is the area where a force acts in the direction towards the foot of the bed during profiling. Accordingly, when profiling is carried out, the change in distribution of the patient's weight down the bed is ameliorated, reducing internal distortion at the bone-tissue interface. On the other hand, the fact that one layer (the upper layer 37) has monofilaments 371 curved in the opposite direction, towards the head end of the bed, in the region which is profiled, means that there is a resistance to crushing of the monofilaments in this area, reducing the prospect of "shoulder shear" in patients who may be susceptible to tissue adjacent bones in the upper portion of the body being distorted by a movement down the bed.

[0087] The above embodiments are described by way of example only. Many variations are possible without departing from the scope of the invention as defined in the appended claims.

Claims

1. A mattress or a mattress overlay comprising at least two layers of spacer fabric, wherein the first layer of spacer fabric has monofilaments which curve in a first direction and the second layer of spacer fabric has monofilaments which curve the same first direction.
2. A mattress according to claim 1 wherein the first direction is towards the foot of the mattress or mattress overlay.
3. A mattress or a mattress overlay according to any of the preceding claims wherein the first layer of spacer fabric has a greater compressibility than the second layer of spacer fabric.
4. A mattress or mattress overlay according to any preceding claim wherein the first layer has a compressibility of between 6 and 18 kPa, preferably between 7 and 11 kPa and more preferably between 8 and 10 kPa.
5. A mattress or mattress overlay according to any of the preceding claim wherein the second layer has a compressibility of between 6 and 20 kPa, preferably between 8 and 14 kPa and more preferably between 10 and 12 kPa.
6. A mattress or mattress overlay according to any of the preceding claims further comprising a third layer of spacer fabric, which optionally, in use, forms the lowest layer, beneath the second layer.
7. A mattress or mattress overlay according to claim 6 wherein the third layer of spacer fabric has a different compressibility to the first layer of spacer fabric and the second layer of spacer fabric, which compressibility is optionally between 10 and 25 kPa, between 12 and 18 kPa, or between 14 and 16 kPa.
8. A mattress or mattress overlay according to claim 6 or 7 wherein the third layer of spacer fabric has monofilaments which curve in a second direction which is not the same as the first direction and is optionally orthogonal to the first direction.
9. A mattress or mattress overlay according to claim 6 or 7 wherein the third layer of spacer fabric has monofilaments which curve in the same first direction as the first and/or the second layer of spacer fabric
10. A mattress or mattress overlay according to any of the preceding claims further comprising a cover, covering the layers of spacer fabric, the cover optionally formed from a liquid impermeable and/or moisture vapour permeable

material, preferably stretched textile coated with polyurethane.

5 **11.** A mattress or mattress overlay according to claim 10 wherein the cover has an air inlet for introducing air into the mattress or mattress overlay which is optionally at the foot end and/or has an air outlet which is optionally at the head end.

12. A mattress or mattress overlay according to claim 10 or 11 further comprising an interlayer surrounding the plurality of layers of spacer fabric and surrounded by the cover, the interlayer optionally being fire retardant.

10 **13.** A mattress or mattress overlay according to any of claims 1 to 12 wherein the layers of spacer fabric are connected at anchor points spaced around the periphery of the mattress or mattress overlay.

15 **14.** A mattress or mattress overlay according to any of claims 1 to 13 wherein a cut heel region is provided in the spacer fabric, in which cuts are provided in one face of the spacer fabric, the cut heel region optionally being in the foot end half of the mattress or mattress overlay, and the cuts optionally being provided in the top face of the spacer fabric and/or provided as a grid, forming cut-sections which are able to move independently of each other.

20 **15.** A bed, optionally a hospital bed capable of profiling, comprising a mattress or mattress overlay according to any of the preceding claims.

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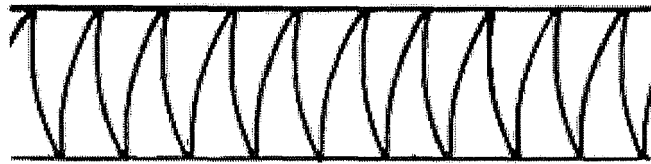


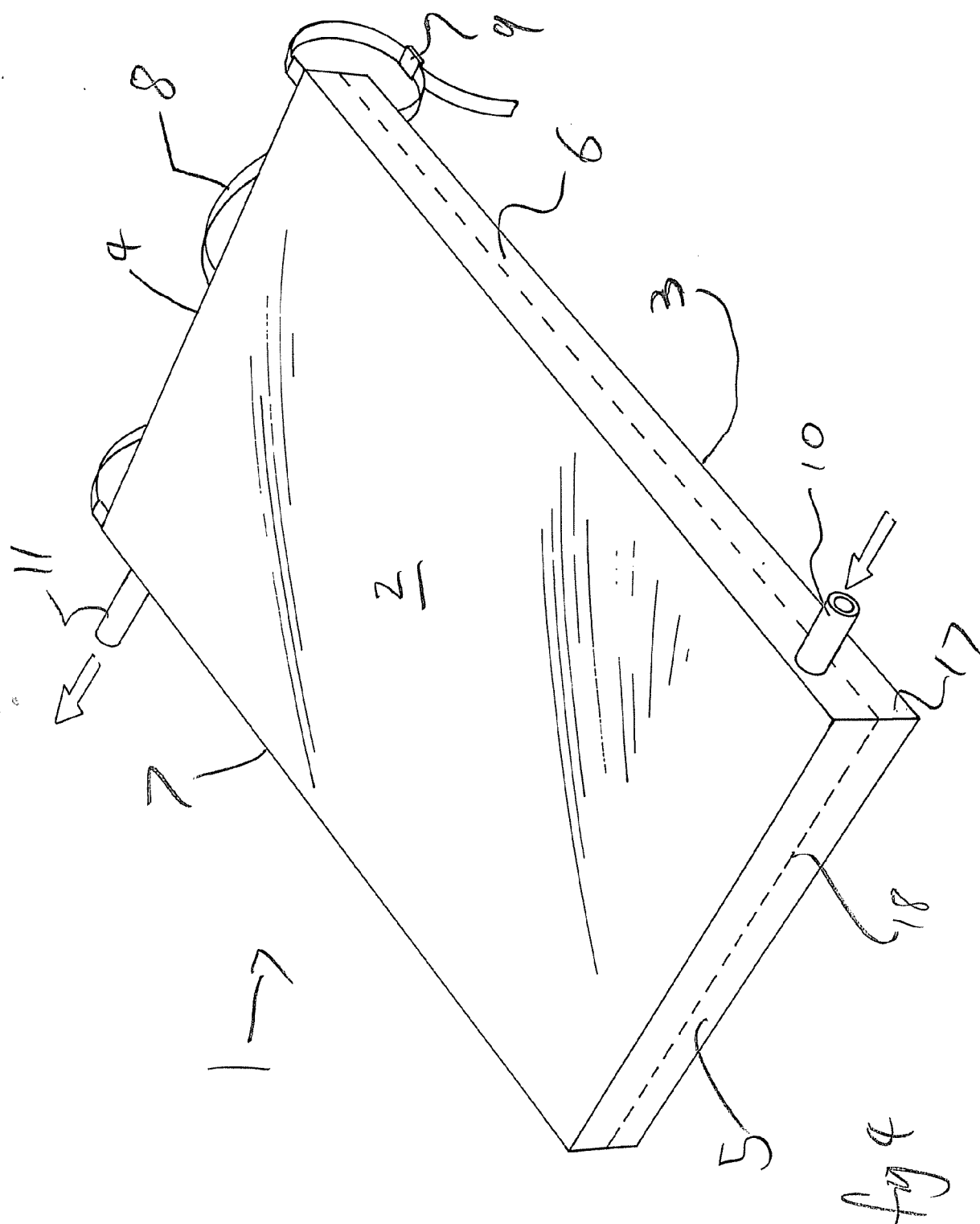
Fig 1 – Prior Art

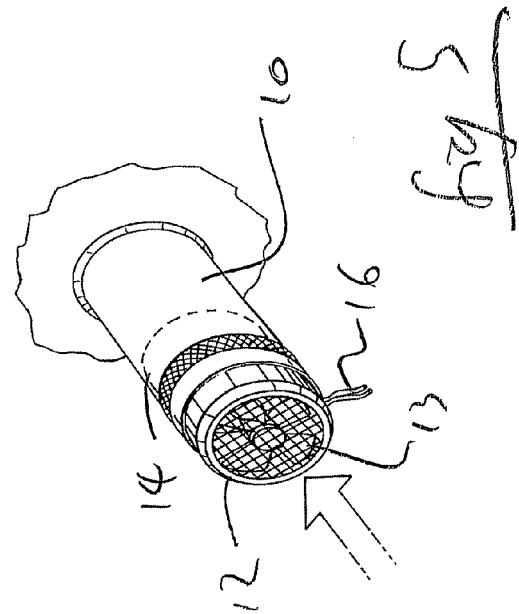
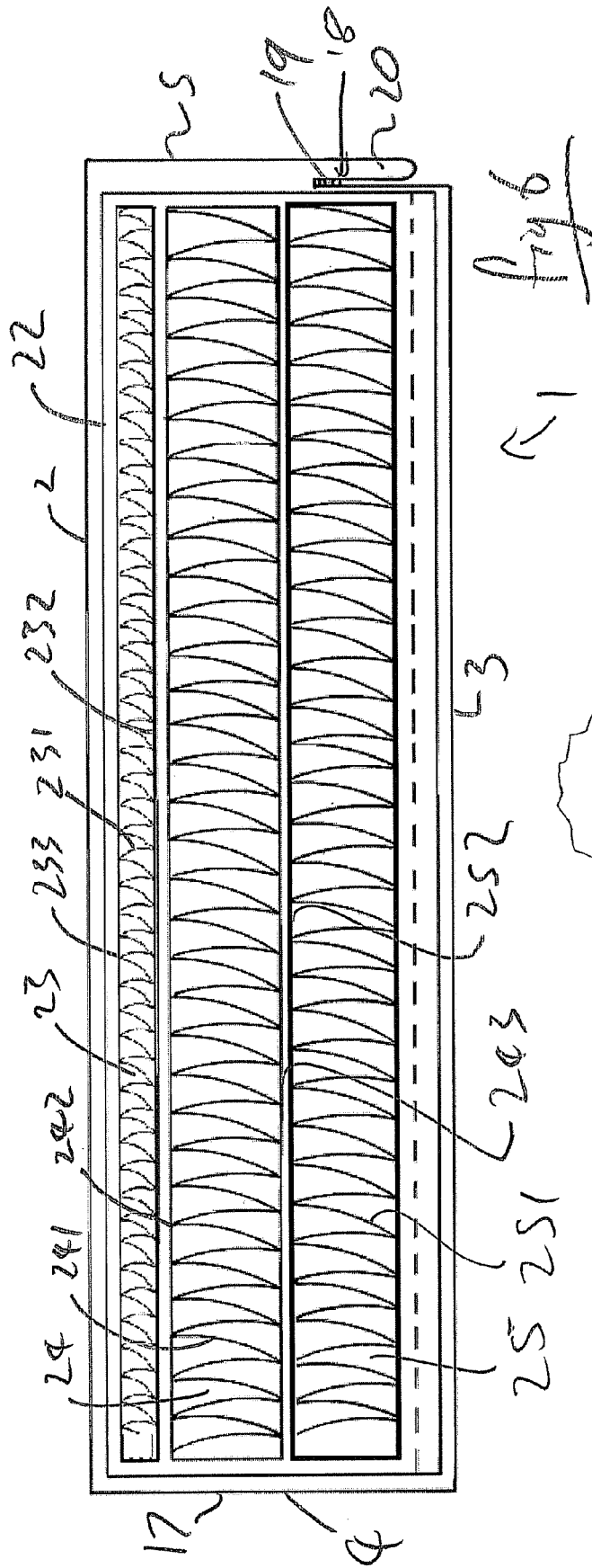


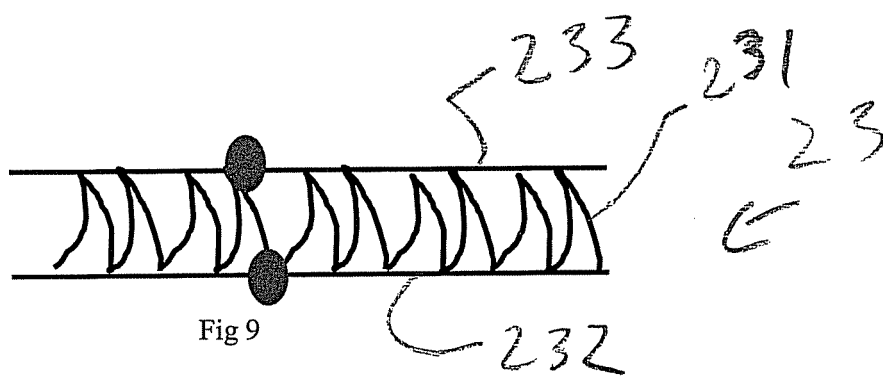
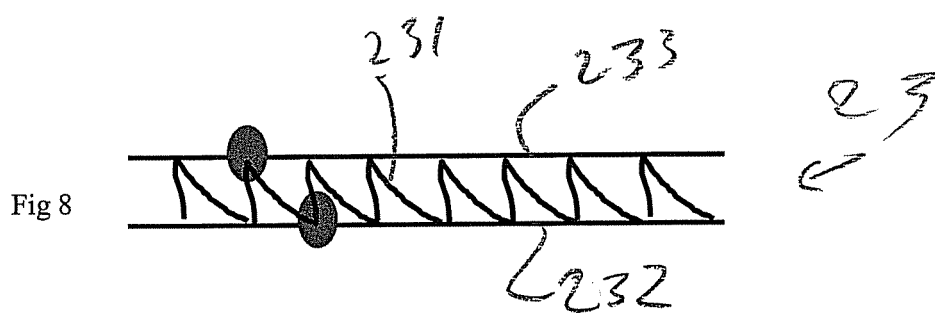
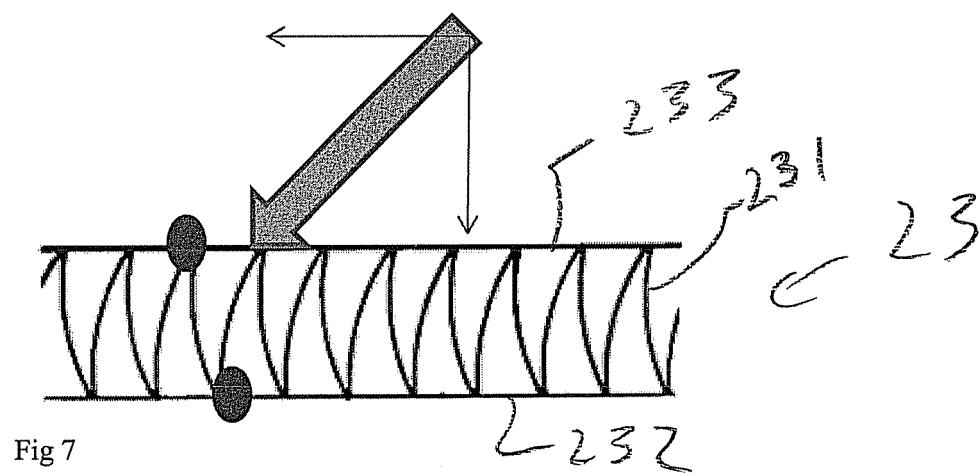
Fig 2 – Prior art



Fig 3 – Prior art







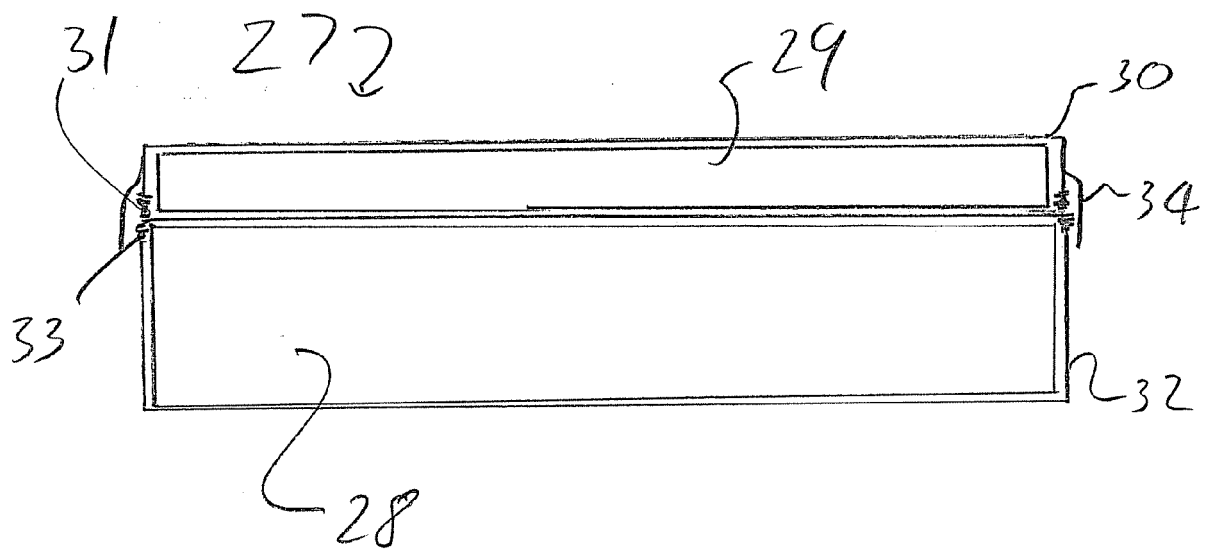
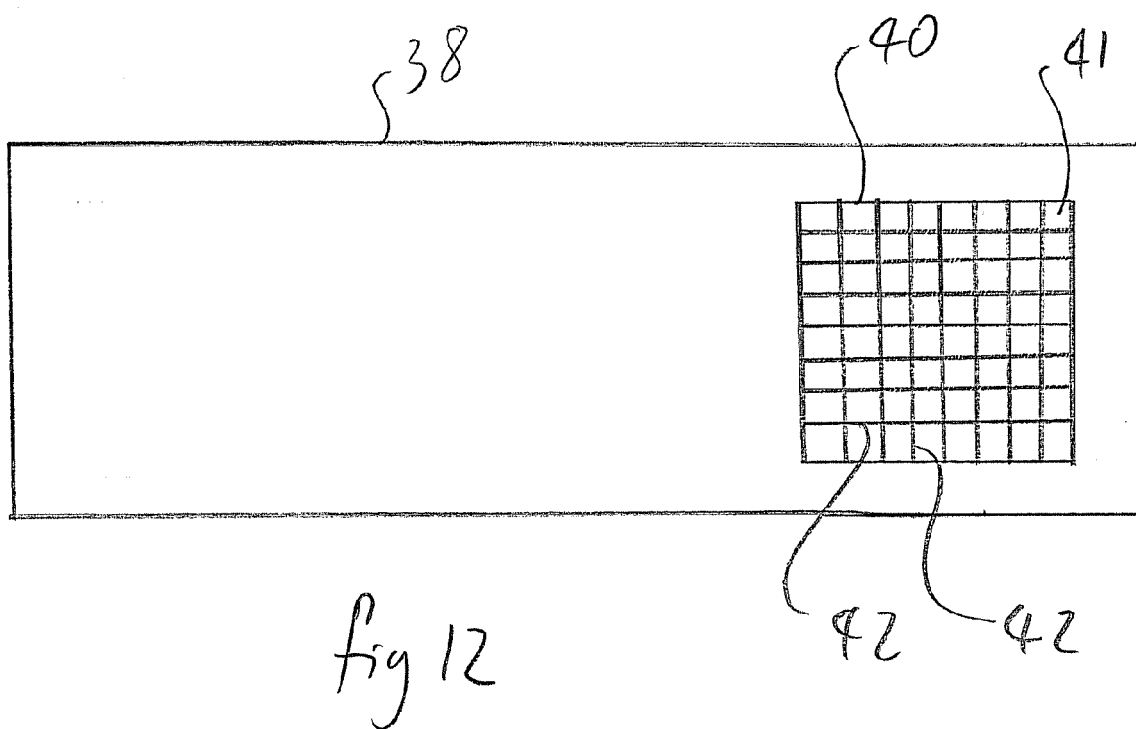
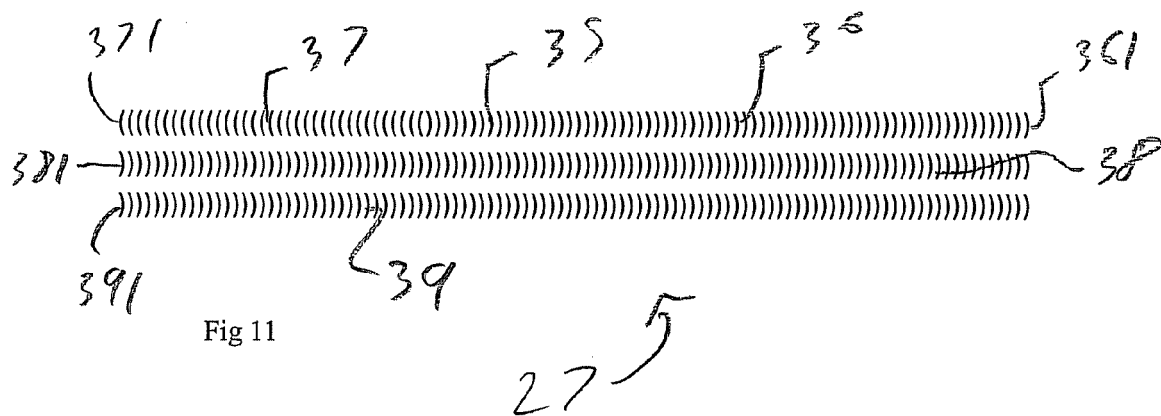


fig 10





EUROPEAN SEARCH REPORT

Application Number
EP 15 27 5255

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			A61G A47C
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 19 April 2016	Examiner Mammeri, Damya
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			

EPO FORM 1503 03/82 (P04C01)

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The members are as contained in the European Patent Office EDP file on
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19-04-2016

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