(12) UK Patent Application (19) GB (11) 2 219 737 (13) A

(43) Date of A publication 20.12.1989

(21) Application No 8909430.4

(22) Date of filing 25.04.1989

(30) Priority data
(31) 63129710 (32) 27.05.1988 (33) JP

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(51) INT CL⁴
B68G 5/00, A47C 27/12, B68G 7/00 11/02, D04H 1/46

(52) UK CL (Edition J)
A4M M1DX M1D1 M1D2 M6
D1R R110 R201 R527
U1S S1213

(56) Documents cited
None

(58) Field of search
UK CL (Edition J) **A4M, D1R**
INT CL⁴ **A47C, B68G, D04H**

(54) Cushioning material for mattresses

(57) A cushioning material particularly suited for use in mattresses is formed by needling a pile of staple fibres to form a flat batt and folding the batt over in alternate directions to form a web of touching corrugations. The corrugations may be perpendicular to or at an angle to the plane of the web. The corrugated web may be held together by machine sewing, bonding or welding. The web may be quilted by sewing it together with a covering material 8. Suitable fibres are polyester, polyethylene and polypropylene fibres and they may be crimped.

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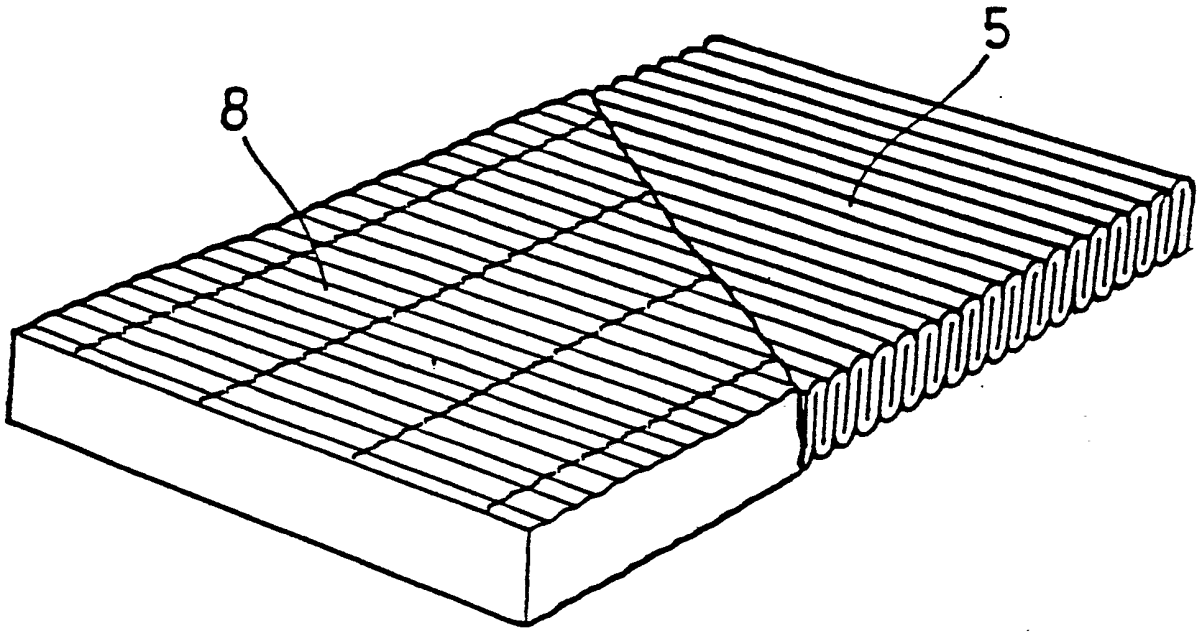

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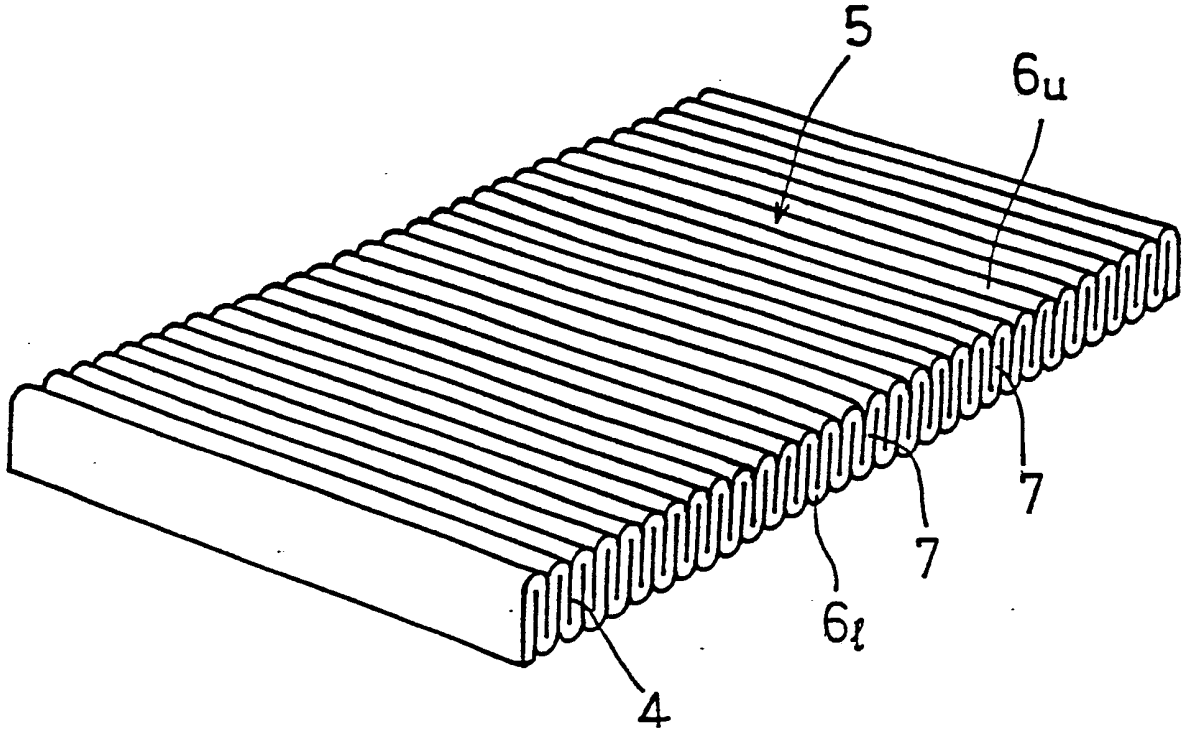

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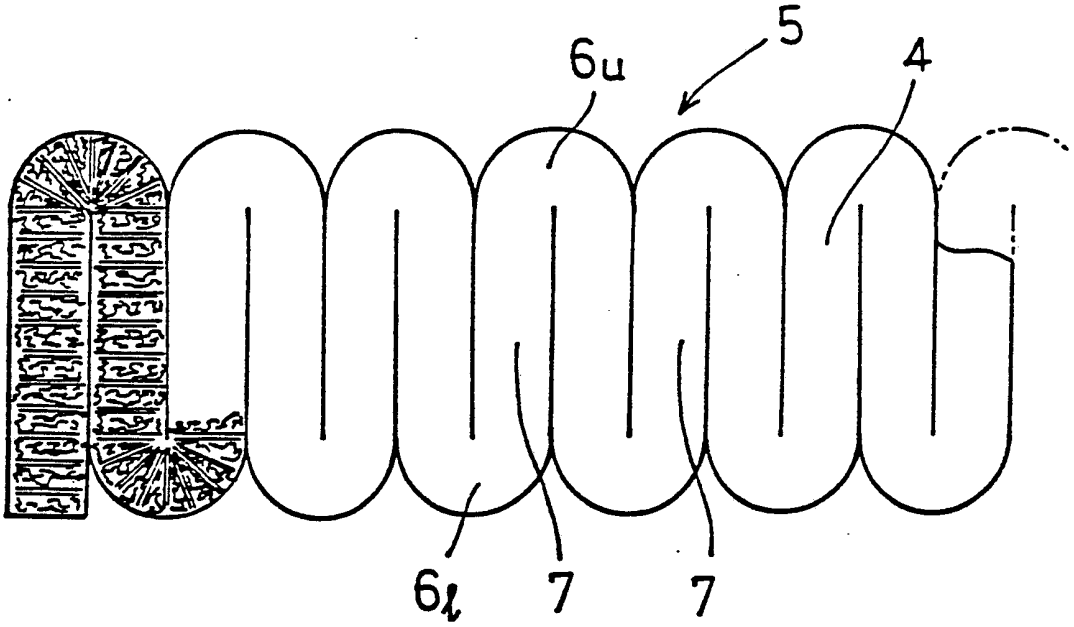

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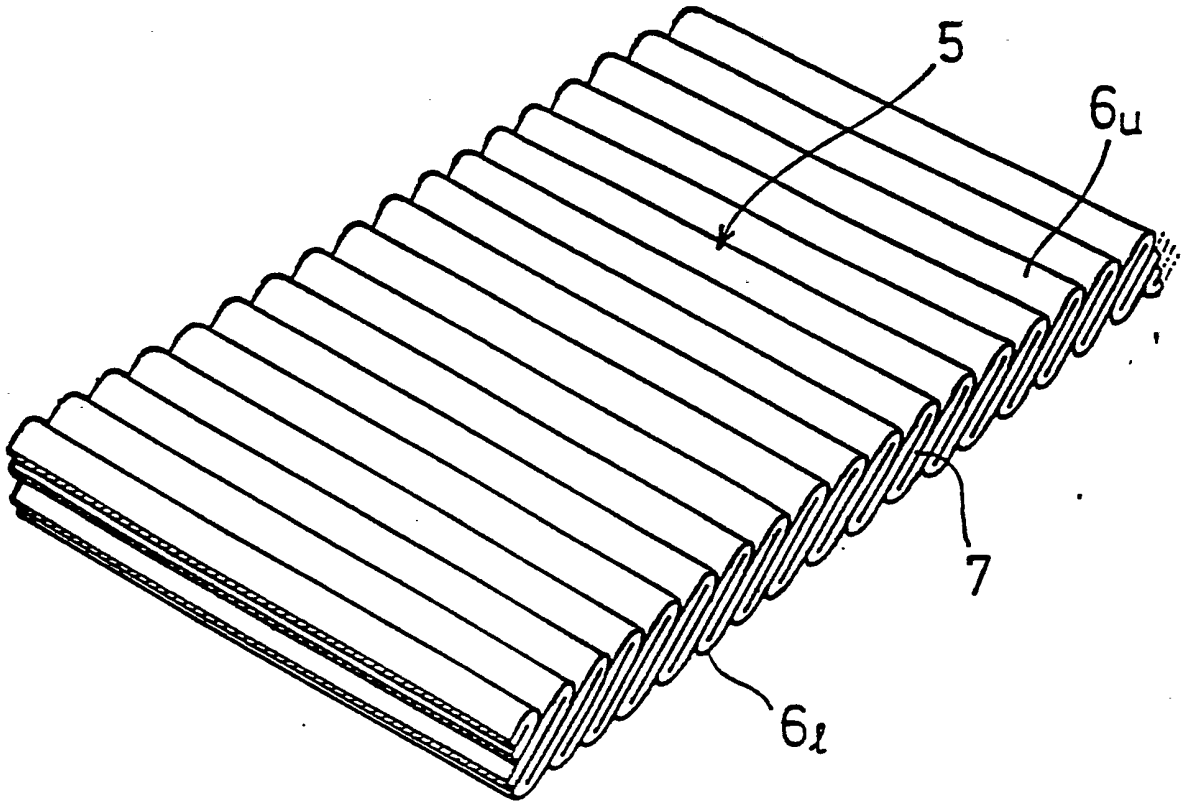

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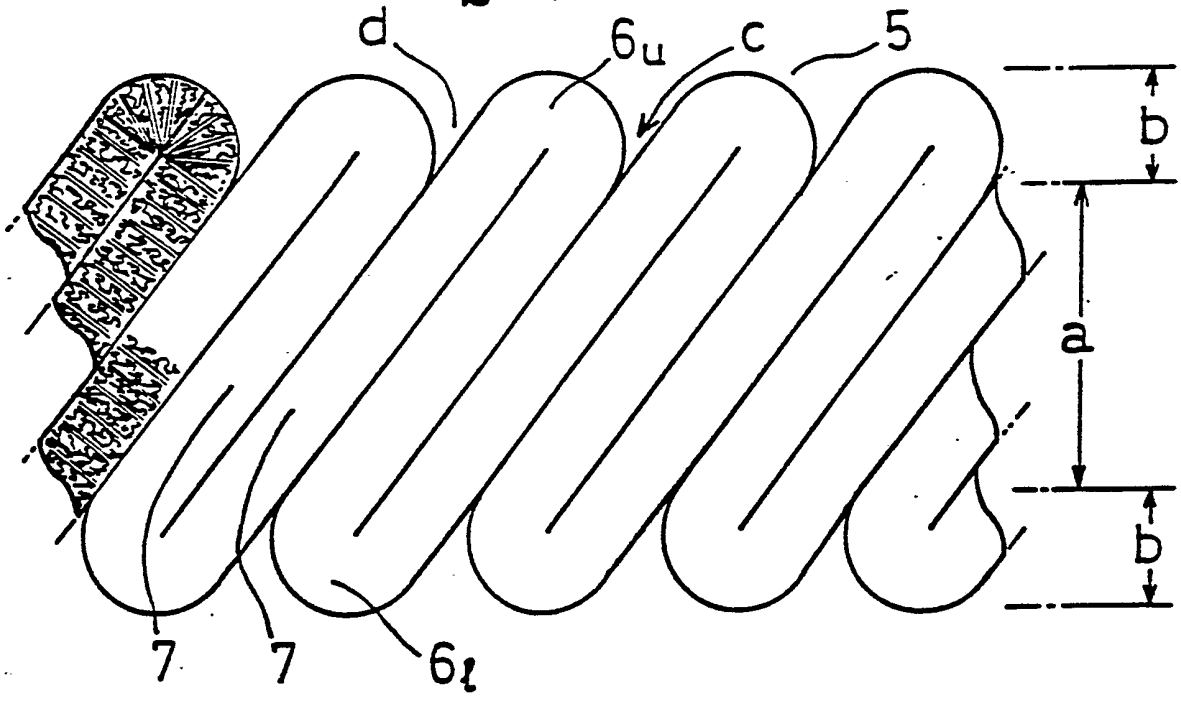

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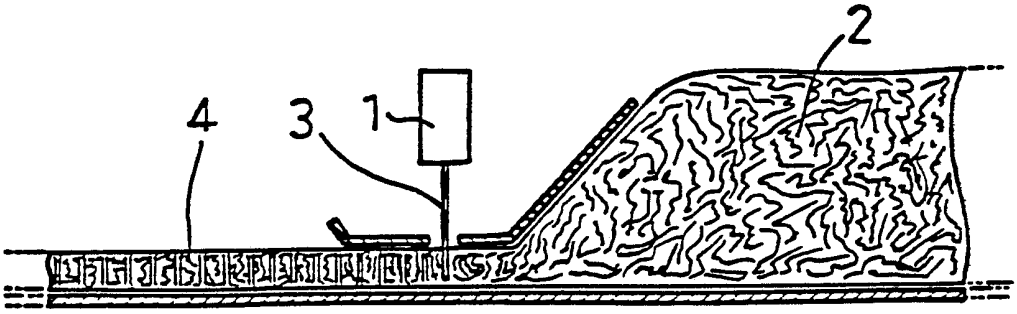

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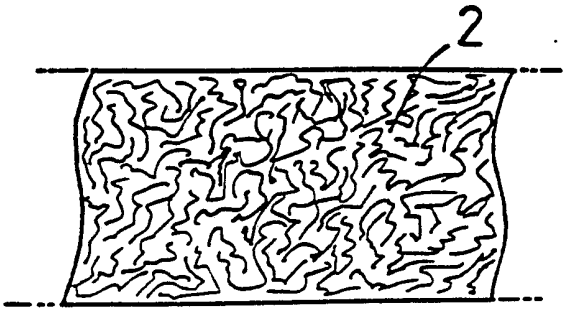

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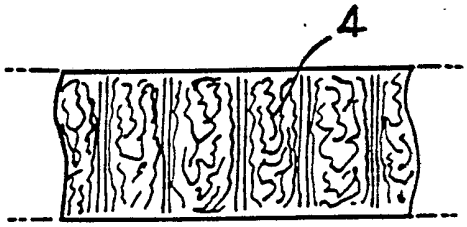

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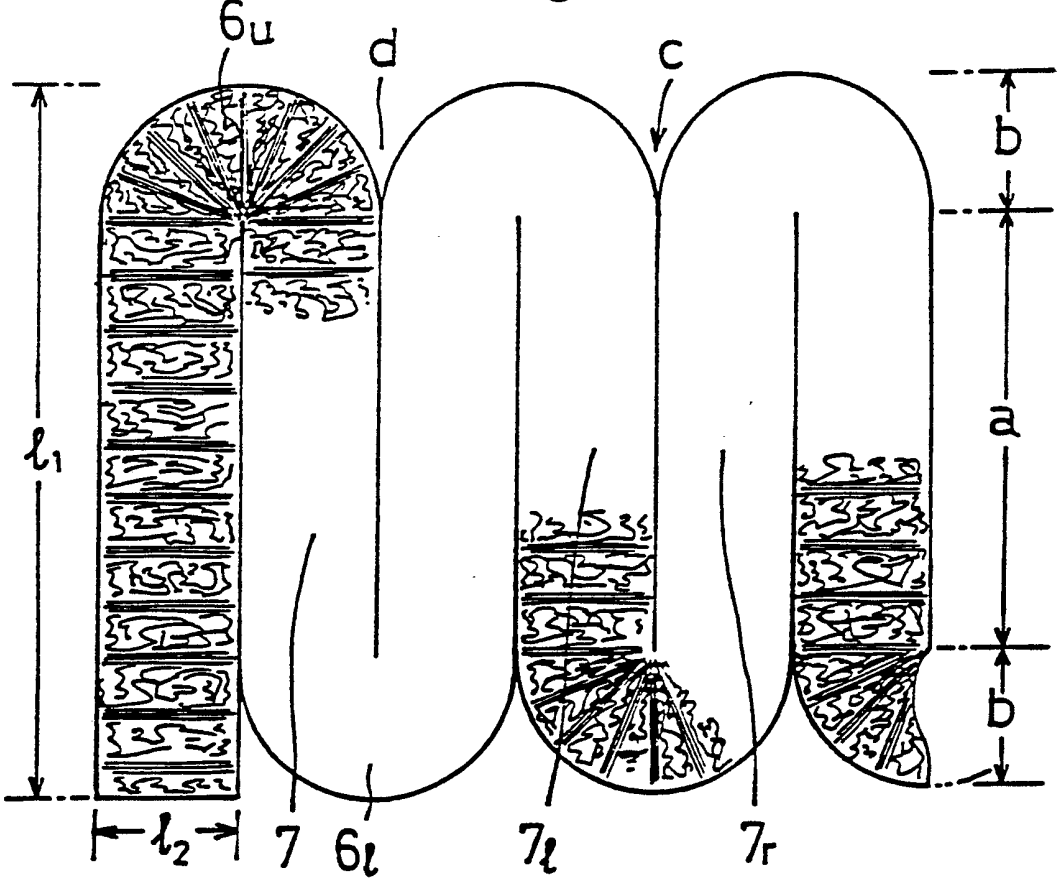

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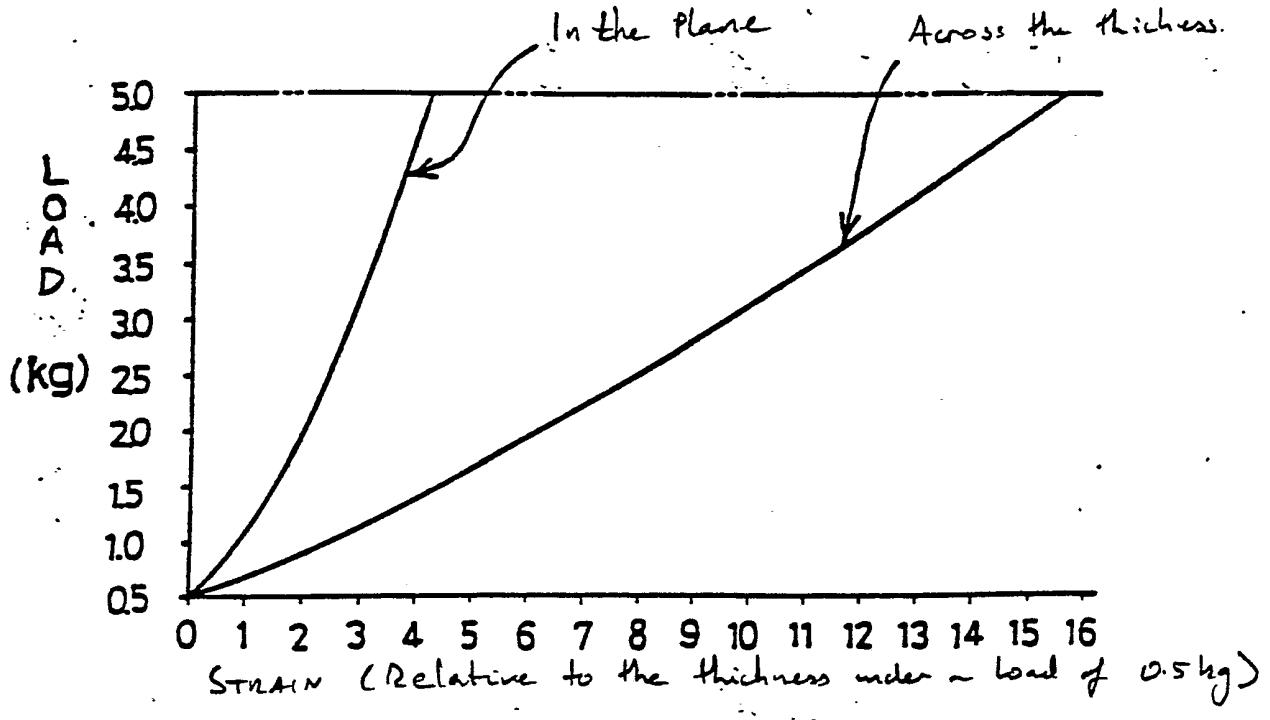

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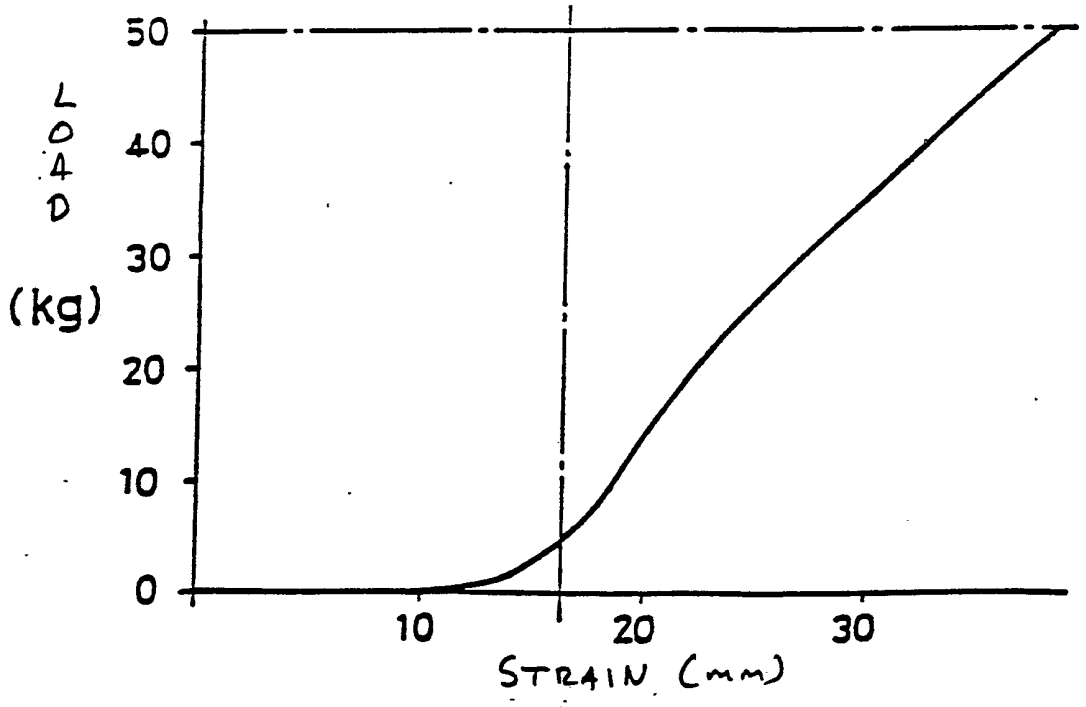

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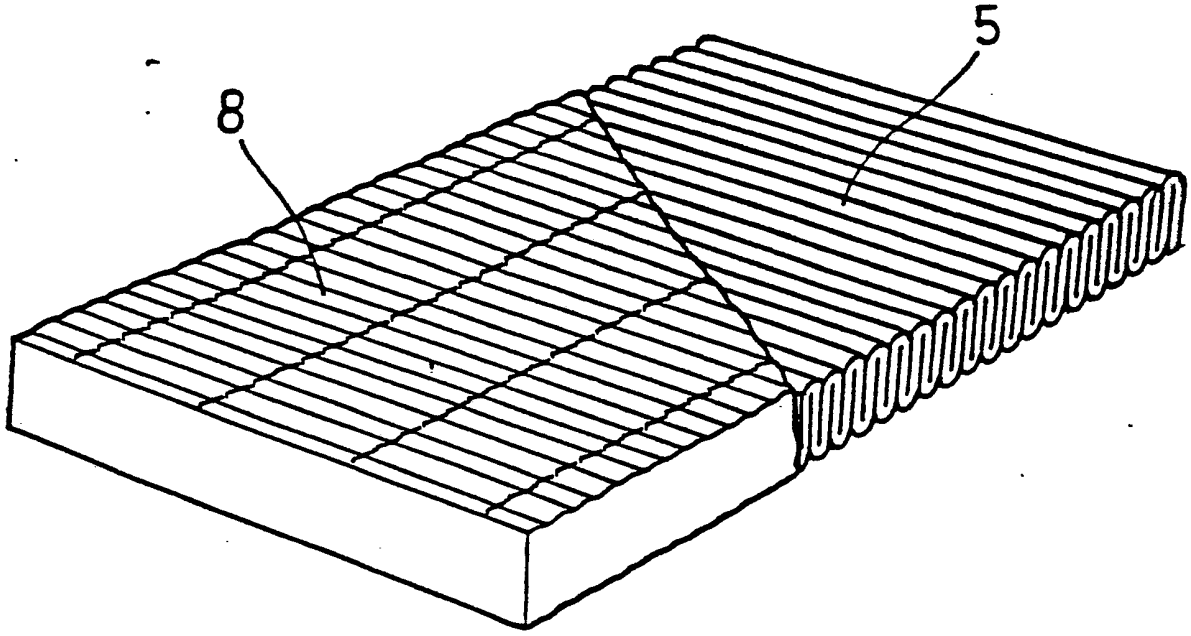

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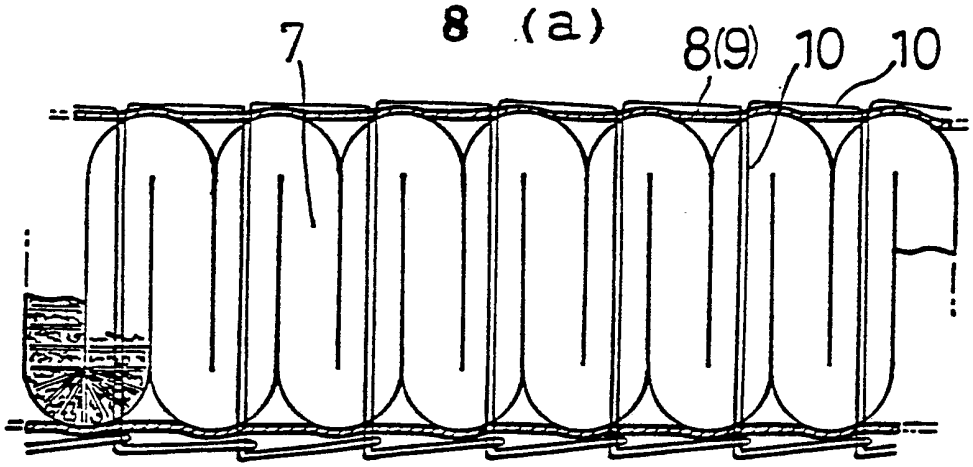

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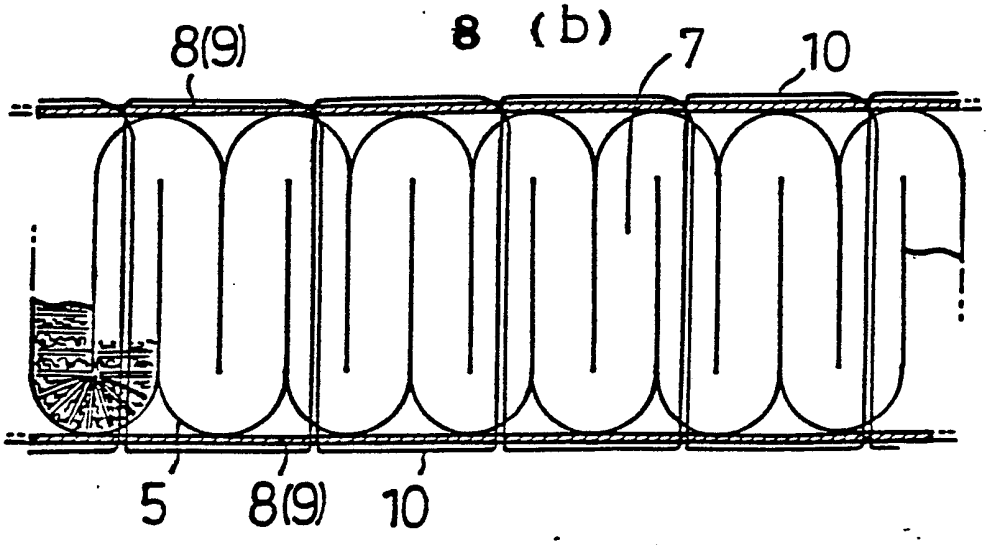

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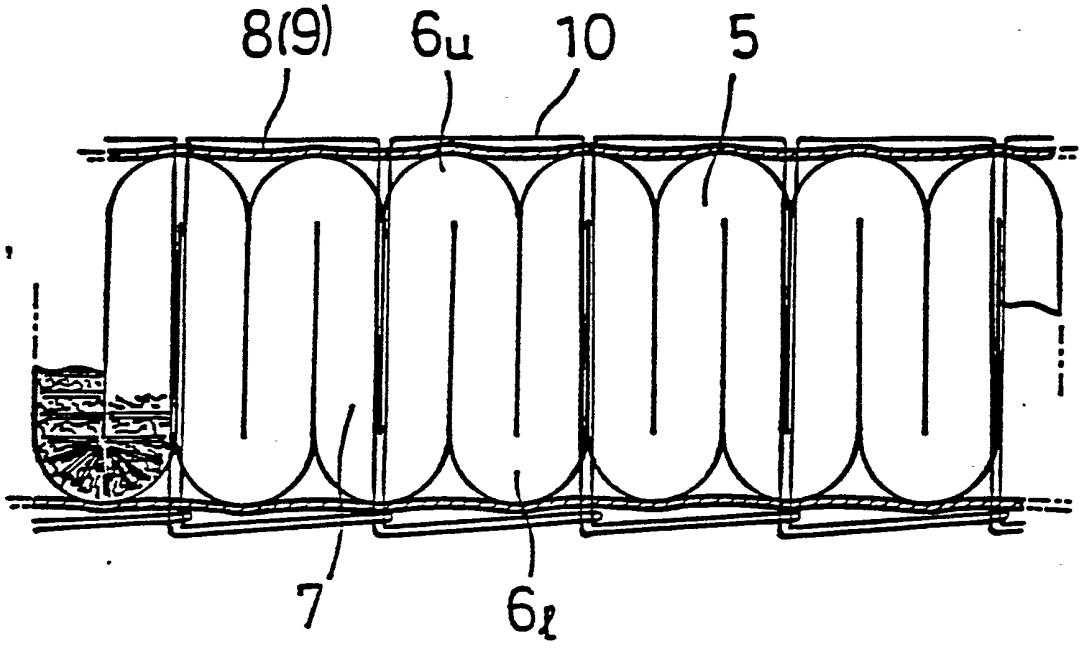

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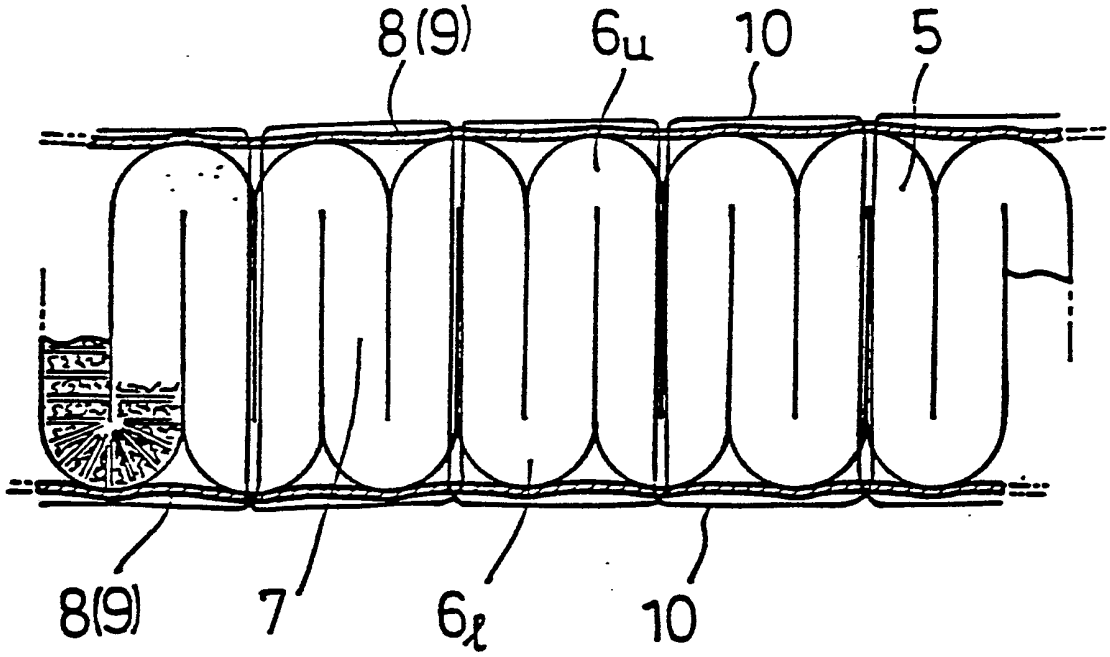

A cushioning material for mattresses

The present invention relates to a cushioning material particularly for use in mattresses.

Conditions generally required of a mattress are a moderate cushioning property and permeability.

For the cushioning property, the mattress must be soft at least on the side in contact with the human body. However, if the entire mattress is soft, the user sinks into the mattress too far due to his body weight, feels uncomfortable and furthermore gets tired because of the difficulty in turning over in bed. Therefore, to prevent too much sinking into the bed, the cushioning material must have moderate rigidity.

Conventional cushioning materials with moderate rigidity include hard synthetic resin foam board, spring structures with many coil springs installed in all directions, and structures with innumerable crimped staple fibres, formed by needling as required, bonded at the joints of the respective fibres by an adhesive for holding of the form described in Japanese Patent Publication No. 77-152573, Japanese Patent Publication No. 86-35954, etc. In general, the latter two cushioning materials are excellent also in permeability. To use any of the above mentioned cushioning materials, for instance, a soft cushioning material with a smaller spring constant is laminated on both sides of such cushioning materials, for use as padding of a mattress, to make the mattress soft in the portion near the surface in contact with the body and in the portion near the opposite surface.

On the other hand, most recent beds, particularly those used by patients in hospitals, etc. can be shaped, and mattresses used on such beds are required to bend according to the shape of the bed plate. However, the

cushioning materials with moderate rigidity mentioned above are hard to bend due to their rigidity. If a mattress using such a cushioning material as padding is laid on such a bed, such inconveniences as partial swelling, deformation and damage are liable to be caused by bending, and as a result, discomfort and durability degradation are caused.

The present invention has the aim of reducing the above problems.

According to present invention there is provided a cushioning material comprising a batt formed by needling a pile of staple fibres perpendicular to the plane of the batt, said batt being bent over in alternate directions to form a web of touching corrugations.

The present invention can provide a cushioning material which satisfies the conditions required for a cushioning material to be used in mattresses, i.e. moderate rigidity for preventing the sinking combined with softness in the portions near the surface, and moderate bendability.

The present invention will be further described hereinafter with reference to the following description of exemplary embodiments and the accompanying drawings, in which:

Figures 1(a) and (b) are, respectively, perspective and sectional views of a first embodiment of the present invention.

Figures 2(a) and (b) are, respectively, perspective and sectional views of a second embodiment of the present invention.

Figures 3, 4(a) and 4(b) are sectional views showing steps in the production of cushioning material according to the present invention.

Figure 5 is an enlarged sectional view of a cushioning material according to the present invention.

Figures 6(a) and (b) are diagrams showing the relationship between load and strain for a flat board and

cushioning material according to the present invention, respectively.

Figures 7 to 9(b) show various methods of holding the corrugated web together.

Figure 3 shows a needling machine, 1 and a pile of innumerable crimped staples or staple fibres 2. The material, fineness and length of the crimped staples 2 can be properly selected, for example, from the following:

Material:	Polyester fibres, polyethylene fibres, polypropylene fibres and their composite fibres
Fineness:	30 to 1000 denier
Length:	25 to 200 mm

In the needling machine 1, the pile 2 is pierced by needles 3 vertically thereby needling it to a form a flat board or batt 4. The innumerable crimped staples are randomly orientated and mutually intertwined, before needling, as shown in Figure 4(a).

After needling at and near the portions where needles 3 have passed large numbers of staples are orientated vertically, as shown in Figure 4(b). As a result, the cushioning properties of the flat board or batt 4 across its thickness are different from those in the plane orthogonal to the thickness. As shown in Figure 6(a), the spring constant in the thickness direction is smaller and that in the plane direction is larger.

The cushioning material 5 according to the present invention is obtained by bending the flat board 4 prepared as above in alternate directions, to form side-by-side contact portions which are ultimately held in a corrugated web. In the drawings, each symbol 6 stands for a bent portion, and 7, a side-by-side contact portion. In the structure shown in Figures 1(a) and (b), the side-by-side contact portions 7 are vertical in the

structure shown in Figures 2(a) and (b), the side-by-side contact portions 7 are inclined. The corrugated web may be held together by any appropriate method such as sewing, bonding, or welding as described below. The cushioning material 5 according to the present invention may be used on its own or with another cushioning material, as padding to be covered with a covering material 8, to form a mattress.

When a mattress composed as above is used, the weight of the user acts on the top bent portions 6u and is transmitted through the side-by-side contact portions 7 to the bottom bent portions 61. In this condition, the tops of the bent portions 6 receive the weight in the direction of the thickness of the flat board or batt 4, and as the batt turns into the side-by-side contact portions 7, the weight receiving direction gradually shifts toward the plane direction. Since the bent portions 6 have a small spring constant, and are therefore soft, the top bent portions 6u softly support the body of the user, while the bottom bent portions 61 ease the impact. Since the side-by side contact portions 7 take the load in a direction corresponding to the plane direction of the flat board 4, they have a large spring constant, and are therefore moderately rigid, preventing uncomfortable sinking of the body. As described, the cushioning material 5 according to the present invention has similar cushioning properties to a laminate of a soft cushioning material on both sides of a rigid cushioning material. Therefore, if the load on the cushioning material 5 of the present invention is gradually increased the strain changes greatly according to the change of load at first, since the spring constant is small, but if the strain exceeds a predetermined value, the change of strain in response to the change of load becomes small, since the spring constant is large as shown in

Figure 6(b). The strain up to the predetermined value can be considered as the strain of the bent portions 6, and thus it can be seen that the cushioning material 5 of the present invention has similar cushioning properties to a laminate with a soft cushioning material laminated on both sides of a rigid cushioning material.

A case where the mattress is used on a bed with a curved bed plate is described below. For instance, if a bed plate portion corresponding to the back of the user is raised by pivotal rotation, the mattress is bent upwards with the boundary between the bed plate portion and the adjacent bed plate portion as the bending line.

In Figure 5, C denotes the upward bending line, the side-by side contact portions 7l and 7r on both sides of the line C have compressive load acting at the top and tensile load acting at the bottom. The reaction to these loads acts to resist bending. However, the thickness a of the side-by side contact portions 7 on which these loads act is thinner than the total thickness l_1 (= a + 2b) of the cushioning material 5, and in addition, the direction of these loads corresponds to the thickness direction of the flat board 4 which has a spring constant. Therefore, the resisting force is small, allowing easy bending. Furthermore, since there are gaps d against adjacent bent portions 6, the swelling of the web in the bending direction can be prevented. The ratio of the thickness a of the side-by side contact portions 7 to the total thickness l_1 of the cushioning material of the cushioning material 5 can be decreased to allow easier bending, for example by inclining the side-by side contact portions 7 as shown in Figure 2, as opposed to keeping them upright as in Figures 1 and 5. The inclination of the side-by side contact portions 7 like this can also change the cushioning properties.

As described above, the cushioning material 5 of the present invention can provide sufficient rigidity to prevent unwanted sinking of the body while maintaining sufficient softness in the surface portions for comfort as well as moderate bendability.

Methods for holding the corrugated web together are described below. Figures 7 and 8 illustrate a corrugated web 4 held by machine sewing. In the illustrated method, the corrugated web 4 is quilted by sewing it together with cloth or sheet 9 on both sides using thread 10, but can be sewn by the thread 10 alone. The cloth or sheet 9 serves also as the covering material 8 of the mattress but the cushioning material 5 held by the cloth or sheet 9 can also be used as padding to be covered with another covering material 8. The precise method and positioning of the stitching is optional. For instance, Figures 8(a) and (b) show webs sewn with the thread 10 passed vertically at the portions between the side-by side contact portions 7, and Figures 9(a) and (b) show webs sewn with the thread 10 passed vertically at the side-by side contact portions 7. In the respective drawings, Figures (a) show cases of chain stitch using one thread, and Figures (b) show cases of lock stitch using needle thread and bobbin thread.

The corrugated web 4 can also be held together by bonding or welding. In this method, an adhesive can be applied or sprayed to the regions to be bonded, for bonding, or a thermally weldable material can be applied to approximate points, and heated at a predetermined step for welding. The above holding methods can also be used in combination.

For the pile 2 of innumerable crimped staples, after needling, as required, for instance as disclosed in Japanese Patent Publication No. 86-36954, the joints of the

respective staples can be bonded by an adhesive, or as another method, the respective staples can be coated around them with a thermally meltable resin which is then molten to bond said joints, to enhance the bonding strength. In this case, the bonding operation, i.e. adhesive spraying or melting of thermally meltable resin can be carried out after formation of said joints and the holding of the corrugated web simultaneously.

Moreover, as described before, it is of course allowed to use the cushioning material 5 of the present invention alone as padding, to form a mattress, or to use it together with another cushioning material, to form a mattress.

A pile 2 of polyester crimped staples of 100 denier in fineness and 50 mm in length was needled approximately once in every 18 mm^2, to form a 20 mm thick flat board 4. Four boards were layered together to form a 80 mm long x 80 mm wide x 80 mm high cube as a specimen. Two specimens were loaded in orthogonally different directions, to measure the strains. The relationships between the load and the strain thus obtained are shown in Figure 6(a). The flat board 4 was used, to form a cushioning material 5 of 90 mm in l_1 and 20 mm in l_2 in Figure 5, and the relationship between the load and the strain was measured. The result is shown in Figure 6(b).

CLAIMS

1. A cushioning material comprising a batt formed by needling a pile of staple fibers perpendicular to the plane of the batt, said batt being bent over in alternate directions to form a web of touching corrugations.

2. A cushioning material according to claim 1, wherein the touching portions of the corrugated web are at an angle other than perpendicular to the plane of the web.

3. A cushioning material according to claim 1 or 2, wherein the corrugated web is held together by machine sewing.

4. A cushioning material according to claim 3, wherein the machine sewing is quilting.

5. A cushioning material according to claim 1 or 2, wherein the corrugated web is held together by bonding or welding.

6. A cushioning material according to any preceding claim, wherein the fibres are crimped.

7. A cushioning material constructed and arranged to operate substantially as hereinbefore described with reference to, and as illustrated in, the accompanying drawings.

8. A mattress comprising cushioning material according to any preceding claim covered by covering material.

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