

(12) STANDARD PATENT
(19) AUSTRALIAN PATENT OFFICE

(11) Application No. **AU 2017218566 B2**

(54) Title
Resilient unit and method of manufacture

(51) International Patent Classification(s)
A47C 27/06 (2006.01)

(21) Application No: **2017218566**

(22) Date of Filing: **2017.02.09**

(87) WIPO No: **WO17/137754**

(30) Priority Data

(31) Number
1602378.0

(32) Date
2016.02.10

(33) Country
GB

(43) Publication Date: **2017.08.17**

(44) Accepted Journal Date: **2022.11.24**

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(56) Related Art
US 5669093 A
US 2004/0025256 A1
US 7930783 B2
US 5815865 A



- (51) International Patent Classification:
A47C 27/06 (2006.01)
- (21) International Application Number:
PCT/GB2017/050331
- (22) International Filing Date:
9 February 2017 (09.02.2017)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
1602378.0 10 February 2016 (10.02.2016) GB
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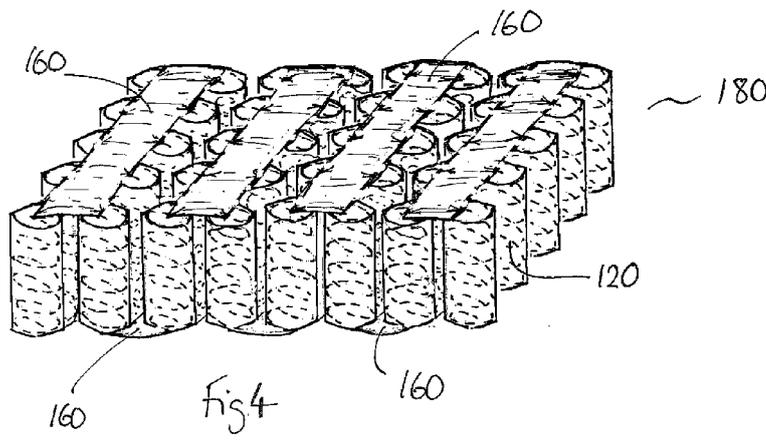
(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))

(54) Title: RESILIENT UNIT AND METHOD OF MANUFACTURE



(57) Abstract: A resilient unit (180), such as for a mattress, comprises a folded pad containing rows of resilient elements (120) in discrete pockets formed between superposed sheets of material joined at locations between adjacent resilient elements. Between at least some adjacent resilient elements the sheets form a gusset (160) which acts as a hinge when the pad is folded to form the resilient unit.



Resilient Unit and Method of Manufacture

The present invention relates to a resilient unit, and to a method of making a resilient unit, and is concerned particularly, but not exclusively, with a resilient unit
5 that can be used for example in an upholstered article such as a mattress or similar.

Pocketed springs, otherwise known as encased springs, are used in upholstered articles such as mattresses. Most
10 pocketed spring units comprise coil springs encased individually in pockets of fabric material formed by folding over a sheet of fabric to form two leaves that envelope the springs, and then attaching the leaves
15 together between the springs so as to form a string of springs. The strings are then joined to form an array of springs as a pocketed spring unit. The joining of the strings together to form an array is achieved either by gluing the strings together along the cylindrical surfaces
20 of the pocketed springs, one string to the next, and so on until the unit is formed, or else by arranging the strings beside each other in the manner of an array, and then gluing sheets of fabric to the cylindrical ends of the pocketed springs, above and below, so as to form the unit.

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In view of its relatively high cost, there is a desire to reduce the quantity of adhesive used in the manufacture of such units.

30 An alternative method of forming an array of pocketed springs is described in our European Patent No. EP 19939473 in which springs are introduced between axially superposed

sheets of material that are then joined at locations between the springs.

The present invention is defined in the attached independent claims, to which reference should now be made. Further, preferred features may be found in the sub-claims appended thereto.

Any discussion of documents, acts, materials, devices, articles or the like which has been included in the present specification is not to be taken as an admission that any or all of these matters form part of the prior art base or were common general knowledge in the field relevant to the present disclosure as it existed before the priority date of each of the appended claims.

Throughout this specification the word "comprise", or variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated element, integer or step, or group of elements, integers or steps, but not the exclusion of any other element, integer or step, or group of elements, integers or steps.

According to one aspect of the present invention, there is provided a resilient unit comprising a folded pad containing plural rows of springs arranged side by side in a longitudinal direction extending transverse to the extent of each row, wherein the springs are in discrete pockets formed by superposed continuous sheets of material joined between springs in adjacent rows, wherein for at least some of the rows, the continuous sheets are joined at two or more attachment points spaced longitudinally between

springs in adjacent successive rows of the unit, wherein in an unfolded configuration, the attachment points lie axially in line with the springs, and when the pad is folded to form the resilient unit the attachment points
5 form a gusset which acts as a hinge between the adjacent rows.

Preferably the pad comprises a plurality of gussets, each between adjacent pairs of resilient elements in a
10 longitudinal direction of the pad.

Preferably successive gussets are located on alternate sides of the folded pad.

15 Preferably at least some of the resilient elements have axes that extend between gussets in the folded pad. Preferably at least some of the resilient elements have axes that are aligned in a substantially parallel fashion in the folded pad.

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In a preferred arrangement, the sheets are joined at two or more spaced locations between adjacent resilient elements to form the gusset.

25 A single resilient element may be located between successive gussets. Alternatively, or in addition, a plurality of resilient elements may be located between successive gussets in the pad.

30 The resilient elements may comprise springs. Preferably the resilient elements comprise coil springs, which may be of metal wire.

The springs may be substantially cylindrical in shape. Preferably, the springs comprise plural coils and in at least some springs the coil at one end, more preferably the
5 coils at each end, is of a reduced diameter. The springs may be other than cylindrical, such as conical or barrel-shaped for example. This is so that, when the pad is in the folded configuration the free end or ends of the endmost coils of adjacent springs do not interfere with or catch
10 upon one another.

For at least some of the springs the axial length of the spring may exceed the maximum diameter of the spring. Alternatively or in addition, for at least some of the
15 springs the axial length of the spring may be substantially equal to, or may be less than, the maximum diameter of the spring.

In the folded pad at least some adjacent resilient elements
20 may be attached together. The adjacent elements may be attached together along an axially extending surface, more preferably a substantially cylindrical surface, of the resilient elements in the folded pad. Adjacent elements may be attached together for example by gluing or welding, such
25 as ultrasonic welding, of the sheet of material to itself.

Alternatively, or in addition, the folded pad may be held in its folded configuration by a retention member, which may comprise a frame or envelope. The retention member may
30 comprise a loop or band passing around the folded pad to prevent it from unfolding.

Alternatively or in addition, the folded pad may be held in its folded configuration by its attachment to a cover sheet or sheets. The cover sheet or sheets may cover one or both sides of the folded pad, and may be attached to the folded pad by adhesive or more preferably by welding, preferably to one or more positions which may comprise the gussets of the pad.

Alternatively, or in addition, the folded pad may be retained in a folded configuration by a case or bag. The case or bag may include padding or cushioning material and the folded pad inside the case may substantially comprise a mattress.

In a preferred arrangement the folded unit comprises a fan-folded, accordion-folded, concertina-folded or pleated pad. The pad may be folded upon itself first one way and then the other such that alternate gussets are located at first one side then the other side of the folded unit.

The sheets are preferably of a thermally weldable material, such as spun-bonded polyester.

In the folded unit at least some rows of resilient elements comprise a first plurality of springs and a second plurality of springs superposed on, and/or axially adjacent, the first plurality.

The first and second pluralities of springs may differ in one or more characteristics including, but not limited to: length, diameter, stiffness, shape, number of coils and gauge of spring material.

The resilient unit may comprise plural rows of resilient elements arranged in an array.

5 In the unfolded pad, adjacent rows of resilient elements may be offset from one another. This is so that, when folded, the springs are able to fit together more closely, for example to nest, which helps to form a more stable pad.

10 The sheets of material on opposed sides of the unit may differ from one another in respect of at least one characteristic from a group including optical, thermal, tactile, structural, chemical and physical.

15 The at least one characteristic may comprise the presence, absence or degree of at least one property from a group including, waterproof, probiotic, antibacterial, antistatic, flavour, fragrance, flame-retardance, elasticity, wear resistance and permeability.

20

The first and second sheets of material may differ from one another in thickness and/or weight.

In a preferred arrangement the first and second sheets may
25 differ from one another in one or more defined zones on one or both layers, such that the layers may have substantially identical characteristics in parts and may have different characteristics in other parts.

30 The sheets are preferably joined around the periphery of the unit.

According to a second aspect of the invention there is provided a resilient pad for forming a resilient unit, the pad comprising plural rows of resilient elements in discrete pockets formed between superposed sheets of material joined at locations between adjacent resilient elements, wherein between at least some adjacent resilient elements the sheets form a gusset which acts as a hinge between resilient elements either side of the gusset when the pad is folded to form a resilient unit.

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The resilient pad may be in accordance with any statement herein.

The invention also includes a method of making a resilient unit, the method comprising forming a resilient pad comprising plural rows of springs arranged side by side in a longitudinal direction extending transverse to the extent of each row, encasing a plurality of the springs in discrete pockets formed by continuous superposed sheets of material joined between springs in adjacent rows, wherein for at least some of the rows, joining the continuous sheets at two or more attachment points spaced longitudinally between springs in adjacent successive rows of the unit, so that in an unfolded configuration the attachment points lie axially in line with the springs to form gussets between the said rows, and fan-folding the pad upon itself using the gussets as hinges, such that alternate gussets become located on opposed sides of the folded unit and axes of at least some of the springs become substantially parallel.

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The invention also includes an article having at least one resilient unit according to any statement herein.

5 The invention also includes a mattress comprising a resilient unit according to any statement herein, or made according to a method according to any statement herein.

10 In accordance with the invention there is provided a seat comprising a resilient unit according to any statement herein.

The seat may be a seat for use in relation to a vehicle, such as a wheeled vehicle, an aircraft, spacecraft or a ship or boat, or a saddle for an animal. The seat may
15 comprise a chair, stool, bench, sofa or settee.

In accordance with another aspect there is provided a table comprising a resilient unit according to any statement herein. The table may be an operating table or massage
20 table, for example.

In accordance with a further aspect of the present invention there is provided an article of flooring comprising a resilient unit according to any statement
25 herein. The article of flooring may comprise a carpet, or carpet underlay, or a sport mat or exercise mat, or may be a leisure or sports surface either for indoor use or for outdoor use.

30 In accordance with a still further aspect of the invention there is provided a protective member, comprising a resilient unit according to any statement herein. The

protective member may comprise an article of clothing or headgear, or may be a protective shield to be worn on the body of a user, or for attachment to an article.

5 According to a still further aspect of the invention there is provided an article of packaging, comprising a resilient unit according to any statement herein.

The invention may include any combination of the features
10 or limitations referred to herein, except such a combination of features as are mutually exclusive, or mutually inconsistent.

A preferred embodiment of the present invention will now be
15 described. By way of example only, with reference to the accompanying diagrammatic drawings, in which:

Figure 1 is a side view of a first embodiment of resilient unit at a first stage of manufacture;
20

Figure 2 is a side view of the unit of Figure 1 at a second stage of manufacture,

Figure 3 is a side view of the unit at a third stage of
25 manufacture;

Figure 4 is a perspective view of the unit of Figure 3;

Figure 5 is a side view of an alternative embodiment of
30 resilient unit at a second stage;

Figure 6 is a side view of the unit of Figure 5 at a third stage of manufacture; and

Figure 7 shows a further alternative embodiment of resilient unit in accordance with the present invention.

Resilient units for various uses, in accordance with embodiments of the present invention, comprise pocketed coil springs, which are sometimes referred to as encased springs. The units typically comprise an array of metallic coil springs individually encased in pockets formed by bonding or otherwise joining together layers of material.

Turning to Figure 1, this shows, generally at 100, a pad for making into a resilient panel, in accordance with an embodiment of the present invention. The pad 110 is shown in side view, and only a single set of pocketed springs can be seen extending in a longitudinal direction indicated by arrow X, which is also the direction in which the newly formed pad is fed from the pocketing station (not shown). In fact the pocketed springs are formed in an array, made up of plural rows of springs side by side.

The pad comprises a number of springs 120 of coiled metallic wire (shown in broken lines) encased in individual pockets, one spring to a pocket in the example shown, formed between superposed sheets 140 or layers of material joined at positions P between the springs, preferably by welding. The sheets 140 are joined at least at two spaced apart positions P between each pair of adjacent springs 120, so that a gusset 160, or pleat, is formed between each pair of springs.

An example of an apparatus and a method for making the pad shown in Figure 1 can be seen in our European Patent No. EP 1 993 947 B1, the entire contents of which are incorporated
5 herein by reference.

Figure 2 shows a next step in the forming of the resilient unit. The springs 120 have been turned within their pockets, so that their axes A extend longitudinally,
10 between the weld points P. Turning the springs within their pockets is achieved readily, particularly with tall springs, as they have a tendency to turn in any case and need only be urged to do so, for example by vibrating the pad, or else by utilising a lip or ridge to catch an upper
15 leading edge of the spring, or a lower trailing edge, thereby causing it to flip.

The pad is then folded, or pleated, in the manner of a fan, concertina or accordion, so that alternate adjacent
20 pocketed springs are made to extend first one way, and then the other way, to form a resilient unit 180. During folding, the gussets act as hinges between rows of springs. When the pad has been folded in this way the axes of substantially all of the springs become aligned in a
25 direction that is generally transverse to the longitudinal extent L of the unit 180.

Before folding, adhesive is applied at positions G on the cylindrical surfaces of the pocketed springs. When the pad
30 has been folded into the configuration depicted in Figure 3 the pocketed springs can be urged together, causing the

adhesive to join adjacent springs, thereby retaining the pad in the folded configuration.

5 In one embodiment not shown, in the unfolded pad adjacent rows of springs are offset from one another in a direction across the pad, transverse to the axes of the springs, so that when the pad is folded the springs nest, each between two adjacent springs of a neighbouring row. This provides for a more stable pad.

10

The resultant unit is as shown in Figure 4, which is a perspective view in which the plural rows of springs can be seen. The gussets 160 extend across the width of the unit, alternately above and below adjacent springs.

15

The pad can initially be formed with other combinations of springs, and an example of an alternative embodiment is shown in Figures 5 and 6.

20 Figure 5 shows a pad in which two different types of spring are encased in individual pockets. The diagram shows the springs after they have been turned so that their axes extend longitudinally, along the length of the pad, between welding positions P. A set 120a of long springs is formed with a second set 120b of shorter springs. The springs are each located within their own pockets, created by joining the sheets 140 together at positions P. Between adjacent pairs of springs a gusset 160 is formed by spaced apart welds at positions P, and successive pairs are oriented
25
30 alternately so that when the pad is folded in the manner of a fan, and glued, all of the shorter springs 120b are

located above the longer springs 120a in an integrated stack.

The effect, in the finished unit 200, is of a layer of
5 short springs above a layer of long springs. Other combinations of springs can be employed in the pad.

The springs can be chosen for their characteristics such as stiffness and size and, as well as controlling the stacking
10 of different springs, the springs can be grouped into zones along the extent of the unit, and combined in such a way as to provide specifically desired performance characteristics. These characteristics can be determined by the intended use of the resilient unit.

15 This versatility comes from the way in which the initial pad is produced, in which the positions of the weld points can be programmed using computer-controlled means to produce whatever pattern is required.

20 Since the gusset 160 joins or connects pairs of adjacent springs at one end, they need only be joined at a minimum of one other place, which in the example (Figure 3) is the adhesive point G on the cylindrical surface of the pocketed
25 spring. This leads to a significant saving, possibly up to 50%, on adhesive.

In an alternative embodiment, shown in Figure 7, the folded pad may be held in its folded configuration by a retention
30 member in the form of a loop or band B passing around the folded pad to prevent it from unfolding. The band B may be of the same material as the sheets 140, but does not have

to be. As an alternative (not shown) the retention member may comprise a frame or envelope.

5 In another alternative embodiment (not shown), the folded pad may be held in its folded configuration by its attachment to a cover sheet or sheets. The cover sheet or sheets may cover one or both sides of the folded pad, and may be attached to the folded pad by adhesive or more preferably by welding, preferably to one or more positions
10 which may comprise the gussets of the pad.

In a further alternative embodiment, the folded pad may be retained in a folded configuration by a case or bag. The case or bag may include padding or cushioning material and
15 the folded pad together with the case may substantially comprise a mattress. The pad would be compressed axially with respect to the springs and possibly also transversely to this, between the edges, before being fed into the padded case to form a complete mattress.

20 Reducing or even eliminating the glue usage has a beneficial effect on the cost of production, and also makes recycling more feasible. The glueless resilient mattress can give up its steel springs easily and all of the pockets
25 remain joined together.

An additional substrate layer may be placed on top of the pocketed springs, or below them, to improve comfort and/or performance of the pad. The additional layer preferably
30 comprises natural materials such as hemp, cotton or wool, to assist in the recyclability of the pad.

At least some of the springs may have coils of different diameters at opposed ends. Such springs have a number of advantages over springs in which the coils at each end of the spring are of substantially the same diameter. Firstly,
5 the springs can be compressed to a substantially flat configuration, with the smaller diameter coils lying within the larger diameter coils. If the springs can be compressed entirely within themselves, such that no touching of adjacent coils takes place, this also provides a much
10 quieter panel than is the case when the coils repeatedly abut one another.

Furthermore, the stiffness of a wire spring can be increased by reducing coil diameter, for a given gauge of
15 wire. Therefore a narrower gauge spring can be made which uses less material to produce the same spring stiffness. A spring consisting of coils which reduce in diameter has a desirable characteristic, in that its stiffness increases progressively as it is compressed.

20 In an embodiment not shown, coils at one, or more preferably both, ends of the spring are of a reduced diameter. This can help to avoid interference between adjacent the free end coils of adjacent springs when the
25 pad is folded. The springs may be other than cylindrical, and may be, for example, conical, or barrel-shaped.

Various types of material are used in the manufacture of the above-described pocketed springs, and particularly
30 common is the use of non-woven, spun-bonded polyester, as this can readily be welded to itself using electrical welding apparatus.

Many other combinations of springs and spring types may be utilised in the resilient pad. These include, but are not limited to: spring-within-spring arrangements, superposed
5 springs in stacks of two, three, four or more high, multi-stage or multi-phase springs, such as hybrid springs of different coil types, and springs of different heights alternating along the top of the folded pad, in the manner of castellations (sometimes referred to in the bed-making
10 industry as a "Hi-Lo" unit). All of these combinations can also be combined with springs of different gauge, shape, height and with different degrees of pre-tensioning within the pockets.

15 The invention described above allows for an easy incorporation of large numbers of springs in a resilient unit. A higher spring count means that the desired characteristics of the unit can be achieved using springs of a lesser gauge and of a lesser diameter, which in turn
20 requires less filling material.

Whilst endeavouring in the foregoing specification to draw attention to those features of the invention believed to be of particular importance, it should be understood that the
25 applicant claims protection in respect of any patentable feature or combination of features referred to herein, and/or shown in the drawings, whether or not particular emphasis has been placed thereon.

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CLAIMS

1. A resilient unit comprising a folded pad containing plural rows of springs arranged side by side in a longitudinal direction extending transverse to the extent of each row, wherein the springs are in discrete pockets formed by superposed continuous sheets of material joined between springs in adjacent rows, wherein for at least some of the rows, the continuous sheets are joined at two or more attachment points spaced longitudinally between springs in adjacent successive rows of the unit, wherein in an unfolded configuration, the attachment points lie axially in line with the springs, and when the pad is folded to form the resilient unit the attachment points form a gusset which acts as a hinge between the adjacent rows.
2. A unit according to Claim 1, wherein the pad comprises a plurality of gussets, each between adjacent pairs of springs in the longitudinal direction of the pad.
3. A unit according to Claim 1 or 2, wherein successive gussets are located on alternate sides of the folded pad.
4. A unit according to any one of the preceding claims, wherein at least some of the springs have axes that extend between gussets.
5. A unit according to any one of the preceding claims, wherein at least some of the springs have axes that

are aligned in a substantially parallel fashion in the folded pad.

- 5 6. A unit according to any one of the preceding claims, wherein a single spring is located between successive gussets.
- 10 7. A unit according to any one of the preceding claims, wherein a plurality of springs are located between successive gussets in the pad.
- 15 8. A unit according to one any of the preceding claims wherein the springs comprise coil springs, which of metal wire.
- 20 9. A unit according to any one of the preceding claims, wherein for at least some of the springs the axial length of the spring exceeds the maximum diameter of the spring.
- 25 10. A unit according to any one of the preceding claims, wherein for at least some of the springs the axial length of the spring is substantially equal to, or less than, the maximum diameter of the spring.
- 30 11. A unit according to any one of the preceding claims, wherein in the folded pad at least some adjacent springs are attached together.
12. A unit according to Claim 11, wherein the adjacent springs are attached together along an axially extending surface of the springs in the folded pad.

13. A unit according to any one of the preceding claims, wherein the folded pad is held in its folded configuration by a retention member.
- 5 14. A unit according to Claim 13, wherein the retention member comprises a frame or envelope.
- 15 15. A unit according to Claim 13 or 14, wherein the retention member comprises a loop or band passing around the folded pad to prevent it from unfolding.
- 16 16. A unit according to any one of the preceding claims, wherein the folded pad is held in its folded configuration by its attachment to a cover sheet or sheets.
- 17 17. A unit according to Claim 16, wherein the cover sheet or sheets cover one or both sides of the folded pad.
- 20 18. A unit according to Claim 16 or 17, wherein the or each cover sheet is attached to the folded pad by adhesive or by welding to one or more positions.
- 25 19. A unit according to any one of Claims 16 to 18, wherein the or each cover sheet is attached to one or more gussets of the pad.
- 30 20. A unit according to any one of the preceding claims, wherein the folded pad is retained in a folded configuration by a case or bag.
21. A unit according to Claim 20, wherein the case or bag includes padding or cushioning material.

22. A unit according to any one of the preceding claims, wherein the unit comprises a fan-folded, accordion-folded, concertina-folded or pleated pad.
- 5 23. A unit according to any one of the preceding claims, wherein the pad is folded upon itself first one way and then the other such that alternate gussets are located at first one side then the other side of the folded unit.
- 10 24. A unit according to any one of the preceding claims, wherein in the folded pad at least some rows of springs comprise a first plurality of springs and a second plurality of springs superposed on, and/or axially adjacent, the first plurality.
- 15 25. A unit according to Claim 24, wherein the first and second pluralities of springs differ in one or more characteristics including, but not limited to: length, diameter, stiffness, shape, number of coils and gauge of spring material.
- 20 26. A unit according to any one of the preceding claims, wherein the sheets of material on opposed sides of the unit differ from one another in respect of at least one characteristic from a group including optical, thermal, tactile, structural, chemical and physical.
- 25 27. A method of making a resilient unit, the method comprising forming a resilient pad comprising plural rows of springs arranged side by side in a longitudinal direction extending transverse to the
- 30

5 extent of each row, encasing a plurality of the
springs in discrete pockets formed by continuous
superposed sheets of material joined between springs
in adjacent rows, wherein for at least some of the
10 rows, joining the continuous sheets at two or more
attachment points spaced longitudinally between
springs in adjacent successive rows of the unit, so
that in an unfolded configuration the attachment
points lie axially in line with the springs to form
gussets between the said rows, and fan-folding the pad
upon itself using the gussets as hinges, such that
alternate gussets become located on opposed sides of
the folded unit and axes of at least some of the
springs become substantially parallel.

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28. A mattress comprising a resilient unit according to
any of claims 1 to 26 or made by a method according to
Claim 27.

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