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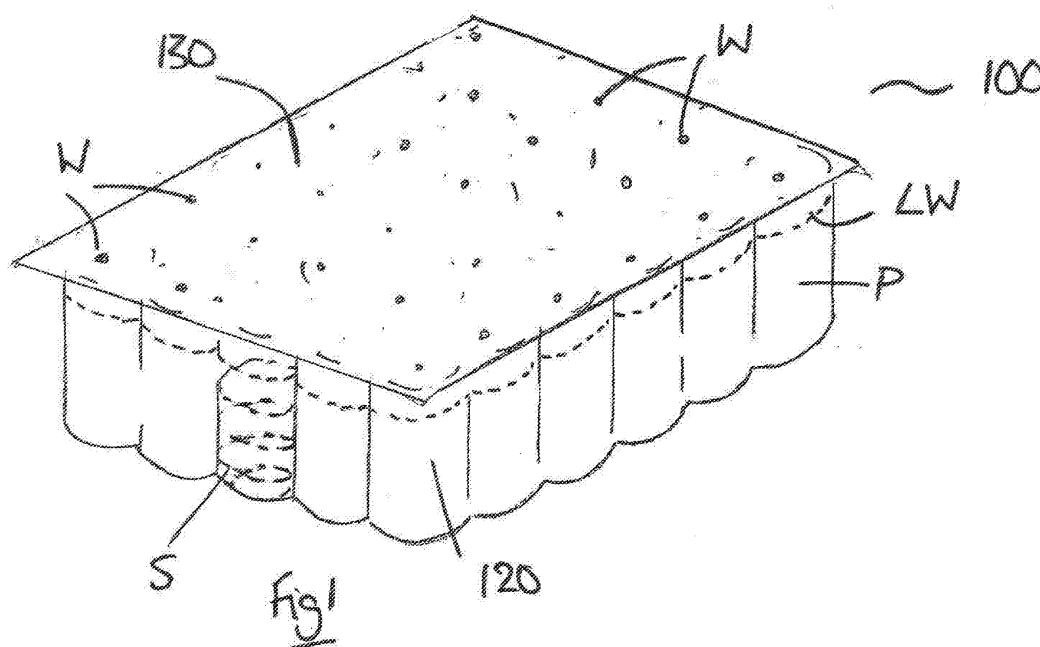
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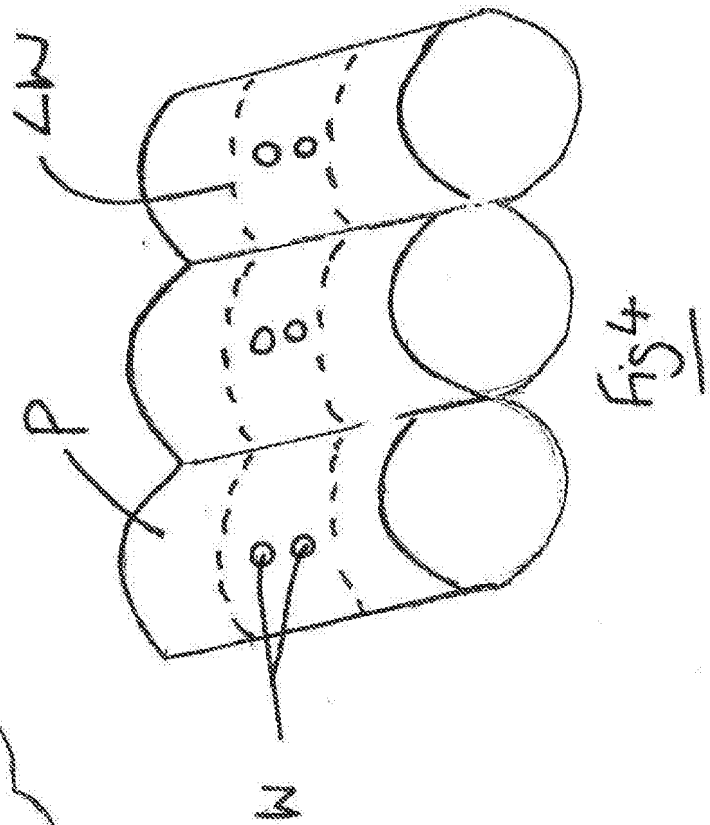
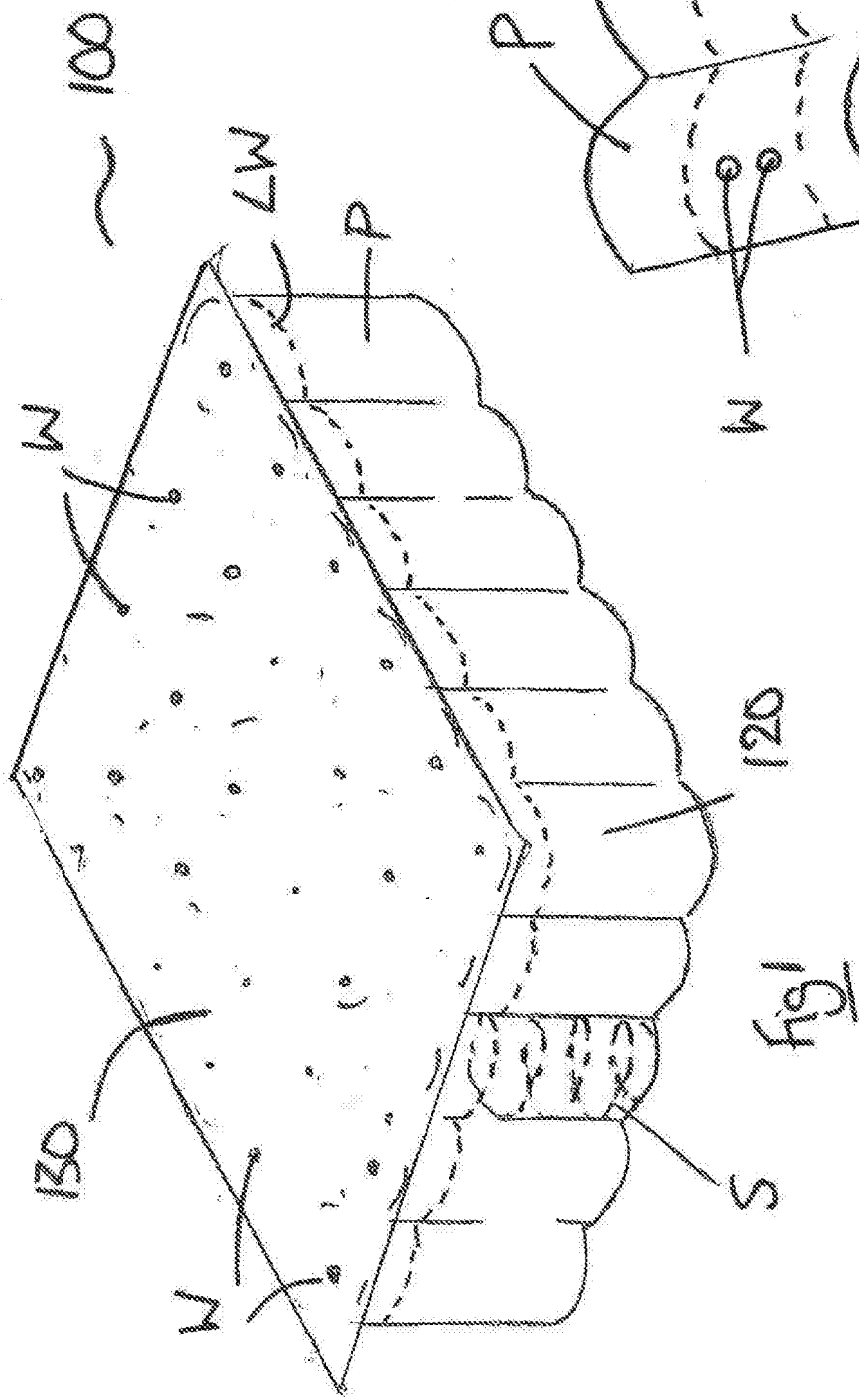
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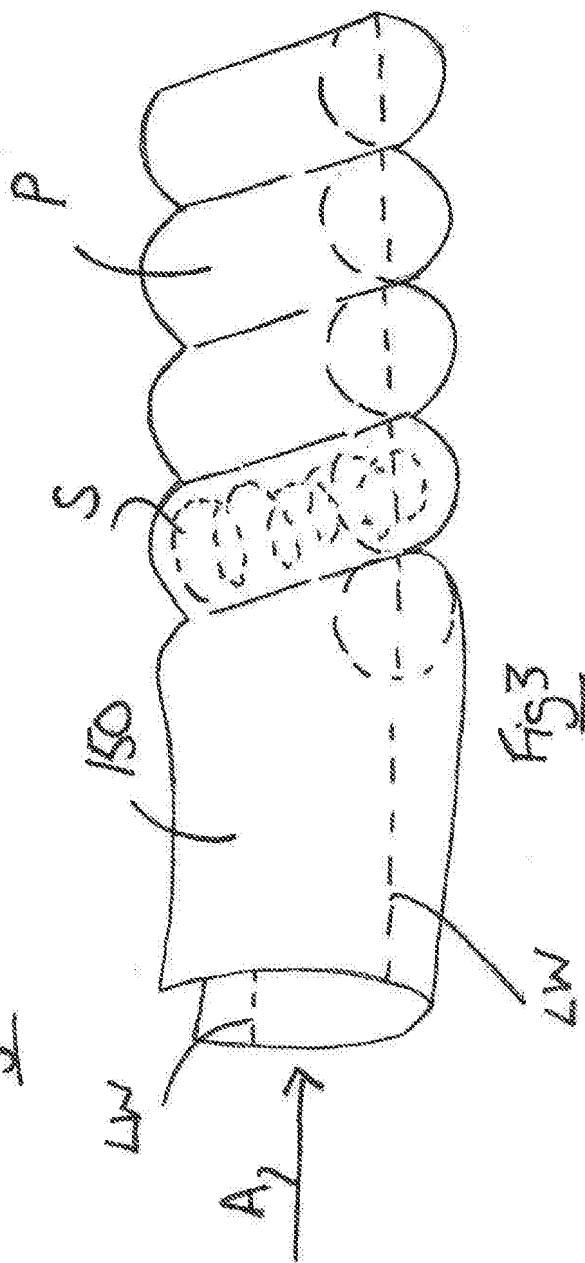
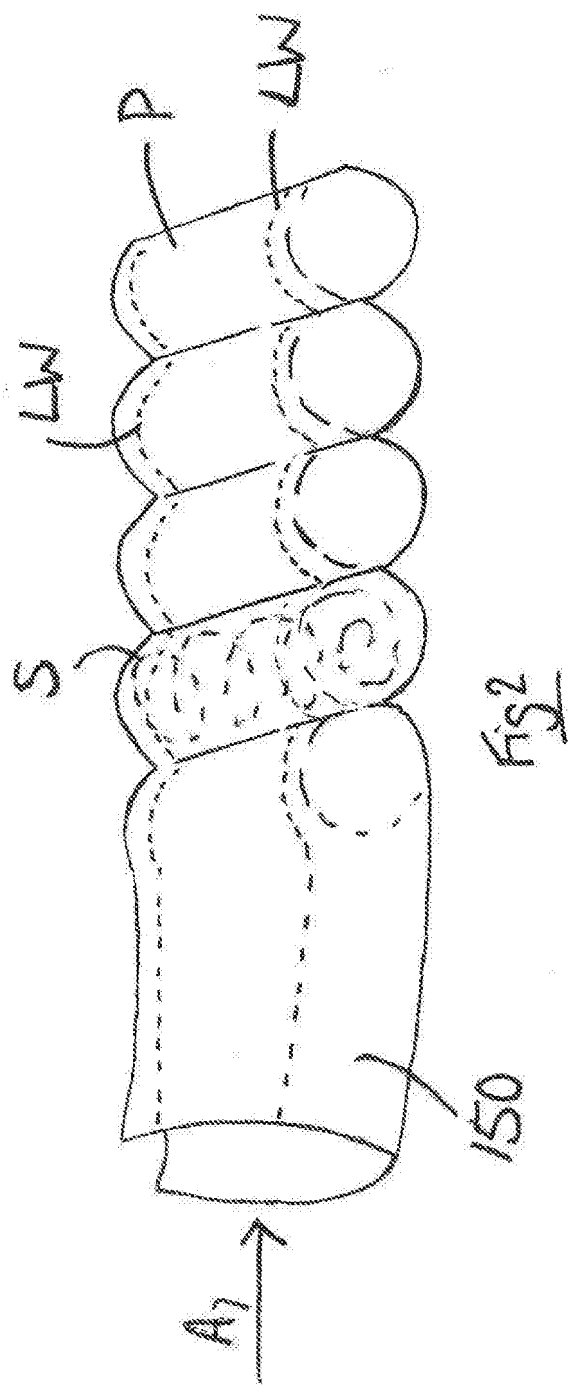
(58) Field of Search:
INT CL **A47C, B68G**
Other: **EPODOC, WPI, Patent Fulltext**

(54) Title of the Invention: **Recycling of resilient units**
Abstract Title: **Mattress with tearable pockets**

(57) A resilient unit comprises pockets P housing resilient elements S. One pocket P has a line of weakness LW so that a tearing force rips the pocket P at a predetermined location. This may allow the unit, e.g. a mattress, to be readily disassembled with the springs removable for recycling. The line of weakness LW may be located towards an axial end region, end face or cylindrical face of the pocket P and may be an intermittent or unbroken line of perforations or welds. The unit may include strings of pocketed resilient members 120, where a string may have a common cover sheet 130 of pocketing material. The line of weakness LW may extend along a string or throughout the sheet 130. Pockets P may be joined to the sheet 130 by welds or adhesive. Also disclosed are methods of producing the resilient unit and of releasing the resilient elements S from the pockets P.







The present invention relates to a resilient unit, such as a mattress, that is designed to be readily recyclable, and to a method of manufacturing such a resilient unit.

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Pocketed springs, otherwise known as encased springs, are used in upholstered articles such as mattresses. Most pocketed spring units comprise coil springs of wire encased individually in pockets of fabric or other material formed by folding over a sheet of fabric to create two leaves that envelope the springs, and then attaching the leaves together between the springs so as to form a string of springs. The strings are then joined together 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 or welding the strings together along the cylindrical surfaces 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 a cover sheet of fabric to one or both of the axially spaced ends of the pocketed springs, above and below.

When such a unit reaches the end of its useful life there is a need to recycle as much as possible of its material. The coil springs of wire, typically steel, inside the pockets are recyclable, but with previously considered units it can be labour intensive and therefore expensive to remove them from their pockets. Another problem lies in the fact that the glue itself is not recyclable, and so any of the pocketing material that has glue on it is not suitable for recycling.

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Embodiments of the present invention aim to provide a resilient unit, and a method of manufacturing a resilient unit, in which problems of the prior art are at least partly addressed.

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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.

15

According to one aspect of the present invention, there is provided a resilient unit comprising a plurality of resilient elements located in pockets of material, wherein one or more of the pockets includes a line of weakness configured to cause the pocket to tear at a predetermined location when a tearing force is applied to the pocket.

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The line of weakness may be located at or towards an axial end region of the pocket.

25

In a preferred arrangement the resilient element is generally cylindrical. The line of weakness may be located on an end face of the pocket, which end face may be substantially circular.

30

Alternatively, or in addition, the line of weakness may be located on a cylindrical face of the pocket and may extend substantially around the pocket.

5 The line of weakness may comprise a line of perforations in the material of the pocket. Alternatively, or in addition, the line of weakness may comprise a line of welds or a line of welding.

10 The line of weakness may be substantially unbroken. Alternatively, the line of weakness may be substantially intermittent.

The line of weakness may include one or more portions that
15 are substantially unbroken and may include one or more portions that are substantially intermittent.

The resilient unit may comprise one or more strings of
20 pocketed resilient members.

The line of weakness may extend along the string of resilient
units. In a preferred arrangement at least some of the
pockets of the resilient elements in the same string may
comprise a common sheet of pocketing material. Preferably
25 the line of weakness extends throughout the common sheet.

The resilient unit may comprise a plurality of strings of
pocketed resilient elements joined to a common cover sheet.
The pockets may be joined to the common cover sheet by welds
30 or by adhesive.

Where the resilient units are in pockets formed from separate
portions of pocketing material the separate pockets may be
joined by welds or adhesive.

35

5 The pockets may be formed from separate, superposed, axially spaced sheets of material, which are then joined at positions between the springs. In this case there may be at least one line of weakness in each of the two sheets and the lines of weakness preferably lie in registration.

10

Adjacent strings of resilient units may be joined together by welds or by adhesive.

At least some of the resilient elements may comprise springs,
15 more preferably coil springs, particularly of metal wire such as steel wire.

According to another aspect of the present invention, there is provided a method of producing a resilient unit, the
20 method comprising encapsulating a plurality of resilient elements in pockets formed from pocketing material having at least one line of weakness configured to cause the pockets to tear at a predetermined location when a tearing force is applied to the pocketing material.

25

The method may include placing resilient elements between leaves of pocketing material at an insertion stage.

The method may include providing pocketing material without
30 a line of weakness to the insertion stage and forming a line of weakness in the pocketing material immediately prior to insertion of the resilient elements in the pockets.

5 Alternatively, or additionally, the method may comprise preforming a line of weakness in the pocketing material prior to introducing the pocketing material to the insertion stage.

According to a further aspect of the present invention, there
10 is provided a method of releasing resilient elements from pockets in a resilient unit, the method comprising applying a tearing force to material forming the pockets to cause the pocketing material to tear at one or more predetermined locations along at least one line of weakness.

15 The method may include applying the tearing force to a common cover sheet of the resilient unit. Alternatively, or additionally, the method may include applying the tearing force directly to one or more pockets

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

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

30 Figure 1 shows a resilient unit according to a first embodiment of the present invention;

Figure 2 shows a portion of the resilient unit of Figure 1;

5 Figure 3 shows a portion of a resilient unit according to a second embodiment of the present invention; and

Figure 4 shows a portion of a resilient unit according to a third embodiment of the present invention.

10

Turning to Figure 1, this shows generally at 100, a resilient unit comprising pocketed springs 120 attached to a common cover sheet 130 by welds W. The pocketed springs 120 each comprise a coil spring of wire S (only one is shown) located
15 inside a fabric pocket P. The pocketed springs are formed in lines, or strings, by folding a sheet of pocketing material over the springs and ultrasonically welding the sheet together around and between the springs to create the individual pockets. The string is then ultrasonically welded
20 to the cover sheet alongside other strings of springs to form a two-dimensional array. The welding preferably joins the axial end of the pocket with the cover sheet. The example shown is for illustrating the structure and is narrower and shorter than most real-life examples, which would typically
25 form the basis of a mattress.

The pockets each have a line of weakness LW which in this case is a line of perforations in the pocketing material. For each pocket the line of weakness extends substantially
30 around the cylindrical surface and is located towards the same axial end of each spring. The purpose of the line of weakness is to allow the springs to be released from their pockets easily at the end of the working life of the unit
100 - so that the springs at least, and possibly the
35 pocketing material, can be recycled. To do this it is

5 necessary only to pull on the cover sheet 130. This in turn then applies a tearing force to the pocket material so as to cause the pocket to tear apart at the line of weakness.

10 In another example (not shown) the strings of springs may also be attached to a second cover sheet at their axially opposite ends, so that the springs are sandwiched between two sheets. In this case there could be a second line of weakness along the pocketed springs, for example towards the opposed axial ends of the springs, to allow the pockets to
15 be torn open by pulling either cover sheet (or both).

Figure 2 shows a part of a single string of pocketed springs as it is being formed. The springs S travel down a chute (not shown) in the direction of arrow A, where they become
20 enveloped in a folded sheet 140 of pocketing material. The leaves of the sheet 140 become welded ultrasonically by being pressed between a welding horn and an anvil (neither shown) at a series of indexed steps, to encapsulate the springs in individual pockets. Immediately prior to welding, lines of
25 weakness LW are made in the pocketing material, for example by perforating the material using a perforating device (not shown) such as a wheel with perforating projections.

Figure 3 shows an alternative embodiment in which the lines
30 of weakness LW are formed on the pocketing material so as to be positioned on the substantially circular, axial end walls of the pocketed springs.

Alternatively, or in addition, the strings may also be welded
35 to each other along the substantially cylindrical surfaces

5 of the springs of adjacent strings. In examples with no cover
sheet, these welds may comprise the only points where the
strings are joined and thus the only thing that holds the
resilient unit together. Figure 4 shows an embodiment in
which a string of springs is arranged to be joined to an
10 adjacent string by welds W located along the substantially
cylindrical walls of the pocketed springs. In this case the
lines of weakness LW are located closer to the axial mid-
points of the springs and either side of the welds W.

15 Although in the embodiments described above the strings are
joined to each other and/or to the cover sheets (if any) by
welding, such as ultrasonic welding, it will be apparent to
the skilled person that the joins may be made by adhesive.
The adhesive may constitute a significant cost in the
20 production of such units and so welding is often preferred.
Also, material with glue on it may not be suitable for
recycling. However, the metal springs would still ordinarily
be recyclable.

25 The lines of weakness are shown in the examples as
perforations. However, the lines of weakness could be formed
by welds either as substantially continuous lines or else
intermittent. One or more welding horns (sonotrodes) and
anvils (not shown) may be used for this purpose.

30

In general, the lines of weakness can be positioned and
shaped so as to control the places where the pocketing
material will tear.

5 In the examples given above, the lines of weakness are formed immediately prior to the formation of the pockets around the springs. This is useful as it allows precise positioning of the lines with respect to the intended pockets. However, as an alternative, or additionally, the lines of weakness may
10 be pre-formed on the pocketing material prior to its use in the pocketing process. With such an approach the lines may be positioned on the pocketing material web prior to it being wound in a roll.

15 Although the above examples describe springs encapsulated in pockets by folding a sheet of pocketing material over the springs and then joining the material around and between the springs to form the pockets, other types of pocketed spring may also benefit from the inclusion of lines of weakness as
20 discussed above.

Notably, lines of weakness may also be applied to pocketed springs formed by placing springs between separate, superposed, axially spaced sheets of material, which are
25 then joined at positions between the springs, for example in the manner described in our European Patent No. EP 1 993 947B.

Our co-pending PCT Application No. WO 2017137754 describes
30 another method of manufacturing a resilient unit comprising pocketed springs, in which the above-described lines of weakness may be similarly employed to aid in the recycling process.

35

5 In some of these examples more tears, and therefore more
lines of weakness, may be necessary to facilitate easy
removal of the springs from their pockets.

Whilst endeavouring in the foregoing specification to draw
10 attention to those features of the invention believed to be
of particular importance, it should be understood that the
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
15 has been placed thereon.

5 CLAIMS

1. A resilient unit comprising a plurality of resilient elements located in pockets of material, wherein one or more of the pockets includes a line of weakness configured to cause the pocket to tear at a predetermined location when a tearing force is applied to the pocket.
10
2. A unit according to Claim 1, wherein the line of weakness is located at or towards an axial end region of the pocket.
15
3. A unit according to Claim 1 or 2, wherein the resilient element is generally cylindrical.
20
4. A unit according to any of the preceding claims, wherein the line of weakness is located on an end face of the pocket.
25
5. A unit according to any of the preceding claims, wherein the line of weakness is located on a cylindrical face of the pocket and extends substantially around the pocket.
30
6. A unit according to any of the preceding claims, wherein the line of weakness comprises a line of perforations in the material of the pocket.
35
7. A unit according to any of the preceding claims, wherein the line of weakness comprises a line of welds or a line of welding.

5

8. A unit according to any of the preceding claims, wherein the line of weakness is substantially unbroken.

9. A unit according to any of the preceding claims, wherein
10 the line of weakness is substantially intermittent.

10. A unit according to any of the preceding claims, wherein the line of weakness includes one or more portions that are substantially unbroken and one or more portions
15 that are substantially intermittent.

11. A unit according to any of the preceding claims, wherein the unit comprises one or more strings of pocketed resilient members.
20

12. A unit according to Claim 11, wherein the line of weakness extends along the string of resilient units.

13. A unit according to Claim 11 or 12, wherein at least
25 some of the pockets of the resilient elements in the same string comprise a common sheet of pocketing material.

14. A unit according to Claim 13, wherein the line of
30 weakness extends throughout the common sheet.

15. A unit according to any of the preceding claims, wherein the resilient unit comprises a plurality of strings of pocketed resilient elements joined to a common cover
35 sheet.

- 5 16. A unit according to Claim 15, wherein the pockets are
 joined to the common cover sheet by welds or by
 adhesive.
- 10 17. A method of producing a resilient unit, the method
 comprising encapsulating a plurality of resilient
 elements in pockets formed from pocketing material
 having at least one line of weakness configured to cause
 the pockets to tear at a predetermined location when a
 tearing force is applied to the pocketing material.
- 15 18. A method according to Claim 17, wherein the method
 includes placing resilient elements between leaves of
 pocketing material at an insertion stage.
- 20 19. A method according to Claim 17 or 18, wherein the method
 includes providing pocketing material without a line of
 weakness to the insertion stage and forming a line of
 weakness in the pocketing material immediately prior to
 insertion of the resilient elements in the pockets.
- 25 20. A method according to Claim 17 or 18, wherein the method
 comprises preforming a line of weakness in the pocketing
 material prior to introducing the pocketing material to
 the insertion stage.
- 30 21. A method of releasing resilient elements from pockets
 in a resilient unit, the method comprising applying a
 tearing force to material forming the pockets to cause
 the pocketing material to tear at one or more

5 predetermined locations along at least one line of
 weakness.

22. A method according to Claim 21, wherein the method
 includes applying the tearing force to a common cover
10 sheet of the resilient unit.

23. A method according to Claim 21 or 22, wherein the method
 includes applying the tearing force directly to one or
 more pockets
15



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Examiner: Dr Niall Deakin

Claims searched: 1-23

Date of search: 4 February 2019

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1-23	JP 2005065726 A (AISIN SEIKI) See figures; EPODOC Abstract
X	1-23	JP 2012095785 A (UNION BED SEIZO et al.) See figures; EPODOC Abstract; paragraph 17
X	1-23	JP 2005065727 A (AISIN SEIKI) See figures; EPODOC Abstract; paragraphs 41 and 42

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^X :

Worldwide search of patent documents classified in the following areas of the IPC

The following online and other databases have been used in the preparation of this search report

International Classification:

Subclass	Subgroup	Valid From
A47C	0027/04	01/01/2006