

(19) **DANMARK**

(10) **DK/EP 2672862 T3**



Patent- og
Varemærkestyrelsen

(12) Oversættelse af
europæisk patentskrift

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- (51) Int.Cl.: **A 47 C 27/06 (2006.01)**
- (45) Oversættelsen bekendtgjort den: **2015-02-23**
- (80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2014-11-19**
- (86) Europæisk ansøgning nr.: **12710112.9**
- (86) Europæisk indleveringsdag: **2012-02-09**
- (87) Den europæiske ansøgnings publiceringsdag: **2013-12-18**
- (86) International ansøgning nr.: **GB2012050285**
- (87) Internationalt publikationsnr.: **WO2012107767**
- (30) Prioritet: **2011-02-09 GB 201102187**
- (84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
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- (54) Benævnelse: **Elastisk indretning**
- (56) Fremdragne publikationer:
EP-A1- 2 105 069
WO-A1-2006/043862
FR-A1- 2 932 658
US-A1- 2005 055 778

Description

[0001] The present invention relates to a multi-purpose resilient unit in which the resilience is provided at least in part by a plurality of pocketed springs.

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[0002] The unit may typically be in the form of a pad or panel and may be used in various applications, in particular where resilience is needed for comfort, convenience, support or protection.

10 **[0003]** Resilient pads are used in many applications to provide comfort, convenience, support and/or protection, for example to a person or object resting on, or wearing or using an article. Such pads are used, for example, in seats such as chairs or vehicle seats, in beds or tables, in mats such as exercise mats, and in special packaging. In many cases resilient pads include foam components to
15 provide the resilience. In particular, high-density, man-made foams, such as polyurethane foams, are useful as they become deformed under pressure, but regain their shape after use.

[0004] The ability to deform can provide comfort, for example in a seat, or can
20 absorb energy from an impact, to provide protection, for example in a helmet or other article of clothing, or in packaging.

[0005] Whilst, on the one hand, man-made foam is inexpensive and versatile, there is a long-recognised problem with its use, which is that it cannot be recycled cost effectively. Also man-made foams are typically very slow to degrade
25 naturally.

[0006] Accordingly, various industries are actively seeking replacements for man-made foams, for use in various types of resilient pad.

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[0007] Embodiments of the present invention aim at least partly to address this problem.

[0008] US 2005/0055778 A1 describes a one-sided mattress construction including a spring assembly with asymmetric spring coils. Only the bottom portion of each spring coil is attached, either to adjacent spring coils or to a bottom surface of the mattress. The top portion of each spring may have a narrowing taper that permits the top to move independent of other adjacent springs.

[0009] FR 2 932 658 describes a helical spring chain for making spring suspension of bed mattress, having a transversal heat welding line divided into oblique heat welding lines defining a v-shape opened towards edges of a band to reduce a width of the pocket. The chain has a conical shaped helicoidal spring with an end part having small diameter lower than the width of retaining pockets. A longitudinal heat welding line extends parallel to an edge of a band opposite to another edge of the band. A transversal heat welding line situated at one of the ends of the chain is divided into oblique heat welding lines defining a v-shape opened towards the edges of the band so as to reduce the width of each pocket from the spring to an area where the end part of the spring is housed.

[0010] EP 2 105 069 A1 describes coil spring assemblies comprising a plurality of coil springs enclosed in a fabric. The coil springs at a first end have a greater diameter than at a second end. In an embodiment, all the coil springs are orientated substantially in the same direction, and connections along slanted connection lines with respect to the longitudinal axes of the coil springs are provided to enclose the coil springs in individual pockets. In another embodiment, adjacent coil springs are orientated in an antiparallel manner to form an "up and down effect".

[0011] 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.

[0012] According to the present invention there is provided a resilient unit suitable for providing comfort, convenience, support or protection, the unit compris-

ing a plurality of pocketed coil springs arranged in an array, each spring being substantially encased in an individual pocket, and the unit being compressible in the axial direction of the springs, wherein each spring comprises a number of coils, and in respect of at least some springs the coils at opposed ends are of
5 different diameter.

[0013] The unit is preferably in the form of a resilient pad or panel. The array may comprise a single row of springs or may comprise a plurality of rows of
10 springs.

[0014] In respect of at least some of the springs, the diameter of at least one of the coils is greater than the axial length of the spring in the pocket.

[0015] The pockets are formed from layers of material that are joined together
15 at least at locations between the springs. for at least some of the springs the layers are joined together at a position that is closer to one end of the spring than the other.

[0016] The layers may be welded together, for example ultrasonically or ther-
20 mally. The weld may form a join that may be wider than it is tall, and is preferably substantially flat. In a preferred arrangement the pockets are formed from only two layers.

[0017] For at least some springs the layers of material may be joined at a posi-
25 tion that is closer to an end of the spring having a coil of larger diameter.

[0018] Preferably substantially the same quantity of material is arranged to cover each end of the spring.

[0019] In a preferred arrangement the unit is also at least partly compressible in
30 at least one direction transverse to the axis of the springs.

[0020] Preferably at least some of the springs are held under compression in their pockets.

- 5 **[0021]** The two layers of material are preferably bonded, welded or otherwise attached together at least at locations between the springs.

[0022] The springs are preferably wire and are more preferably of steel, aluminium or titanium, or of an alloy thereof. Preferably the unit is flexible in at least
10 one lateral direction, generally perpendicular to the axis of the springs.

[0023] The unit may include a plurality of zones in which springs from different zones have at least one different characteristic. The characteristic may be the height of the spring. Alternatively or in addition the characteristic may be the
15 stiffness or shape of the spring.

[0024] The unit may comprise more than one layer of pocketed springs.

[0025] In a preferred arrangement the unit includes at least one additional substrate layer above or below a layer of springs and/or between layers of springs.
20 The additional substrate layer may comprise natural material and preferably comprises one or more of: leather, hemp, wool, silk, cotton, mohair, cashmere, feather, down, and alpaca.

25 **[0026]** The invention also includes an article having at least one resilient unit according to any statement herein.

[0027] In accordance with the invention there is provided a seat comprising a resilient unit in the form of a pad according to any statement herein.

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[0028] 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 comprise a chair, stool, bench, sofa or settee.

[0029] In accordance with another aspect there is provided a table comprising a resilient unit in the form of a pad according to any statement herein. The table may be an operating table or massage table, for example.

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[0030] In accordance with a further aspect of the present invention there is provided an article of flooring comprising a resilient unit in the form of a pad according to any statement 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.

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[0031] 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.

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[0032] According to a still further aspect of the invention there is provided an article of packaging, comprising a resilient unit in the form of a pad according to any statement herein.

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[0033] The invention also provides a method of producing a resilient unit suitable for providing comfort, convenience, support or protection, the method comprising arranging a plurality of pocketed coil springs in an array, each spring being substantially encased in an individual pocket, and the unit being compressible in the axial direction of the springs, wherein each spring comprises a number of coils, and in respect of at least some springs the coils at opposed ends are of different diameter, the method further comprising forming the pockets from layers of material that are joined together at least at locations between the springs, wherein for at least some of the springs the layers are joined together at a position that is closer to one end of the spring than the other.

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[0034] The present invention may comprise any combination of the features or limitations referred to herein, except such a combination of features as are mutually exclusive.

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[0035] Preferred embodiments of the present invention will now be described by way of example only with reference to the accompanying diagrammatic drawings in which:

Figure 1 shows, in schematic sectional view, a portion of a resilient unit in the form of a pad, according to an embodiment of the present invention;

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Figure 2 shows, in schematic cutaway view, a chair base, incorporating a resilient unit in the form of a panel according to an embodiment of the present invention; and

Figure 3, shows, in schematic part-sectional view, a portion of a floor including a resilient unit in the form of a pad according to an embodiment of the present invention.

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[0036] Resilient pads for various uses, in accordance with embodiments of the present invention, comprise pocketed coil springs, which are sometimes referred to as encased springs. The panels typically comprise an array of metallic coil springs individually encased in pockets formed by bonding or otherwise joining together layers of material. A convenient process for manufacturing such a panel is described in our own co-pending European patent application number

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[0037] The springs are typically wider than they are tall, i.e. the diameter of at least one coil is greater than the height of the spring when in the pocket. However, in some embodiments, due to the coils at opposed ends being of different diameters and the position of the weld closer to one end of the spring than the other, the individual springs are stable and can be at least as tall as the diameter of the largest coil, and possibly taller. The pad is stable, resilient and workable. Its plan shape can be cut to suit the desired shape of the article in which it

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is to be used, and because of its construction it is generally flexible, both in-plane and out-of plane.

5 **[0038]** The springs can be chosen for their stiffness and size, and can be grouped into zones 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 pad.

10 **[0039]** An additional substrate layer may be placed on top of the pocketed springs, or below them, or in between adjacent layers of springs to improve comfort and/or performance of the pad. The additional layer preferably comprises natural materials such as hemp, cotton or wool, to assist in the recyclability of the pad.

15 **[0040]** At least some of the springs 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, 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
20 compressed entirely within themselves, such that no touching of adjacent coils takes place, this also provides a much quieter panel than is the case when the coils repeatedly abut one another.

25 **[0041]** Furthermore, the stiffness of a wire spring can be increased by reducing coil diameter, for a given gauge of wire. Therefore a narrower gauge spring can be made which uses less material to produce the same spring stiffness. It is necessary for the spring to have at least one coil of appropriate diameter to ensure stability within the pocket, and in particular to resist any tendency for the coil to invert within the pocket, but the other coils can be made narrower. Fur-
30 thermore, a spring consisting of coils which reduce in diameter has a desirable characteristic, in that its stiffness increases progressively as it is compressed.

[0042] Another, preferred feature of the invention lies in the positions where the

material layers are joined, in relation to the axial height of the spring. In previously considered pocketed springs the layers of material forming the pocket were welded or otherwise bonded together either at a position half way along the axial height of the spring, or else at one end of the spring. In accordance
5 with preferred embodiments of the present invention the joining of the layers takes place at a position closer to one end of the spring, but not at the end. More preferably, the joining takes place closer to the end of the spring having the coil of greater diameter. The quantity of material required to cover each end of the spring may be arranged to be substantially the same.

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[0043] The inventors have found that this arrangement optimises stability of the spring within the pocket.

[0044] Furthermore, when the force compressing the spring acts on the end of
15 the spring with the greater diameter coil, the pocket of one spring affects neighbouring springs more significantly, and also at an earlier point in the compression, as compared with the situation in which the join is at a halfway position, for example.

[0045] Turning to Figure 1, there is shown, in schematic sectional view, generally at 10 a portion of a resilient pad according to an embodiment of the present invention. The pad comprises a number of wire coil springs 12, each of which is located within its own discrete pocket 14 formed by upper and lower layers 14a and 14b of material, preferably of non-woven material. The two layers 14a and
25 14b have been thermally, or ultrasonically, welded together at points 16 between the adjacent springs to create the pockets.

[0046] The coil springs 12 have a generally frusto-conical shape, with, in each case, the uppermost coil 12a being of the greatest diameter, and the spring tapering to its lowermost coil 12b which is of the smallest diameter.
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[0047] The position of the welds 16 is a distance d from the top of the pad, and

a distance D from the bottom of the pad, with D being greater than d, and preferably the ratio $d/(d+D)$ being in the range 0.25-0.3.

5 [0048] Whilst the springs in Figure 1 are of generally frustoconical shape they could be of other shapes, such as hour glass or barrel shape, providing that one end coil is of greater diameter than the other end coil. Of course, depending upon the application, the pad 10 may be arranged to receive a compressive force in the direction of arrow A or of arrow B, i.e. the pad 10 may be in the orientation shown in Figure 1 or else may be inverted.

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[0049] Turning to Figure 2, this shows generally at 20 a chair having a chair base 20a comprising a resilient pad 10 as shown in Figure 1. An additional layer (not shown) of fabric or other material forms the seating surface, and the resilient pad provides comfort to the user.

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[0050] Figure 3 shows in schematic sectional view a portion of a domestic floor, generally at 30, incorporating a resilient pad as shown in Figure 3. Above the resilient pad 10 is a layer of thermal insulation material 32, and above that are tongue and groove floorboards 34. For different types of floor, such as sports surfaces and exercise mats, the layers 32 and 34 may comprise different materials. Also, the stiffness of the springs 12 can be chosen to suit the intended use.

25 [0051] In both cases the resilient pad provides comfort and support without using foam and with a substantial saving on the amount of metal needed to provide the wire for the springs. The use of springs which have end coils of different diameters enables the unit to be thicker - ie the height of the springs to be greater - as compared with cylindrical springs using the same quantity of material, such as wire. The pad is also free from the noise which often accompanies an array of previously considered springs.

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[0052] The above examples of resilient pad have a consistent type of pocketed spring throughout. However, the pad need not have pocketed springs that are

all the same. The pad can have springs that are arranged in zones, with some areas having springs with one characteristic and others having different springs, for example so that the overall pad has areas with different resilience, where this is useful.

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[0053] As mentioned above, seat bases and articles of flooring are only two of the possible uses of a resilient pad according to the present invention. Others include, but are not are not limited to: protective clothing or headgear, where a thin pad possibly of different zones of stiffness could be used, tables, beds and

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[0054] 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 applicant claims protection in respect of the appended

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Patentkrav

1. Elastisk indretning, som er egnet til at tilvejebringe komfort, bekvemmelighed, støtte eller beskyttelse, og som omfatter en flerhed af lommespiralfjedre
5 (12), der er anbragt på en række, hvor hver fjeder er i alt væsentligt indkapslet i en individuel lomme (14), og hvor indretningen kan presses sammen i fjedrenes aksiale retning, hvor hver fjeder omfatter et antal spiraler, og hvor - hvad angår i det mindste nogle fjedre - spiralerne ved modstående ender har forskellig diameter, og kendetegnet ved, at lommerne er dannet af aksialt adskilte lag (14a,
10 14b) af materiale, der er sammenføjet i det mindste på steder (16) mellem fjedrene, og hvor - hvad angår i det mindste nogle af fjedrene - sammenføjningen er ved en position, der er tættere på, men ikke ved, den ene ende af fjederen end den anden.
- 15 2. Elastisk indretning ifølge krav 1, hvor - hvad angår i det mindste nogle fjedre - diameteren af mindst én af spiralerne er større end den aksiale længde af fjederen i lommen.
3. Elastisk indretning ifølge krav 1 eller 2, hvor - hvad angår i det mindste
20 nogle fjedre - materialelagene er sammenføjet ved en position, som er tættere på en ende af den fjeder, som har en spiral med større diameter.
4. Elastisk indretning ifølge et af kravene 1 til 3, hvor der er anbragt i alt væsentligt den samme mængde materiale for at dække hver ende af fjederen.
25
5. Elastisk indretning ifølge et af de foregående krav, hvor indretningen også kan presses sammen i mindst én retning på tværs af fjedrenes akseretning.
6. Elastisk indretning ifølge et af de foregående krav, hvor mindst nogle af
30 fjedrene holdes under sammenpresning i deres lommer.

7. Elastisk indretning ifølge et af kravene 1 til 6, hvor de to materialelag er forbundet, svejset eller på anden måde sammenføjet i det mindste på steder mellem fjedrene.
- 5
8. Elastisk indretning ifølge et af de foregående krav, hvor fjedrene er af rustfri stål- eller titaniumtråd.
9. Elastisk indretning ifølge et af de foregående krav, hvor puden er fjedrende.
- 10
10. Elastisk indretning ifølge et af de foregående krav, hvor indretningen indbefatter en flerhed af zoner, hvor fjedre fra forskellige zoner har mindst én anden egenskab.
- 15
11. Elastisk indretning ifølge krav 10, hvor egenskaben omfatter fjederens højde og/eller stivhed.
12. Elastisk indretning ifølge et af de foregående krav, hvor indretningen omfatter en flerhed af lag af lommefjedre.
- 20
13. Elastisk indretning ifølge et af de foregående krav, hvor indretningen indbefatter mindst et yderligere substratlag over eller under et lag af fjedre og/eller mellem lag af fjedre.
- 25
14. Elastisk indretning ifølge krav 13, hvor det ekstra substratlag omfatter naturligt materiale herunder et eller flere af: læder, hamp, uld, silke, bomuld, mohair, kashmir, fjer, dun og alpaka.
15. Sæde, som omfatter en elastisk indretning ifølge et af kravene 1 til 14.
- 30
16. Bord, som omfatter en elastisk indretning ifølge et af kravene 1 til 14.
 17. Gulvbelægningsartikel, som omfatter en elastisk indretning ifølge et af kravene 1 til 14.

18. Beskyttelseselement, som omfatter en elastisk indretning ifølge et af kravene 1 til 14.
19. Emballageartikel, som omfatter en elastisk indretning ifølge et af kravene 1
5 til 14.
20. Fremgangsmåde til fremstilling af en elastisk indretning, som er egnet til at tilvejebringe komfort, bekvemmelighed, støtte eller beskyttelse, hvilken fremgangsmåde omfatter anbringelse af en flerhed af lommespiralfjedre på en række,
10 ke, hvor hver fjeder er i alt væsentligt indkapslet i en individuel lomme, og hvor indretningen kan presses sammen i fjedrenes aksiale retning, hvor hver fjeder omfatter et antal spiraler, og hvor - hvad angår i det mindste nogle fjedre - spiralerne ved modstående ender har forskellig diameter, kendetegnet ved, at fremgangsmåden endvidere omfatter dannelse af lommerne af aksialt adskilte lag af
15 materiale, der er sammenføjet i det mindste på steder mellem fjedrene, og hvor - hvad angår i det mindste nogle af fjedrene - lagene er sammenføjet ved en position, der er tættere på, men ikke ved, den ene ende af fjederen end den anden.

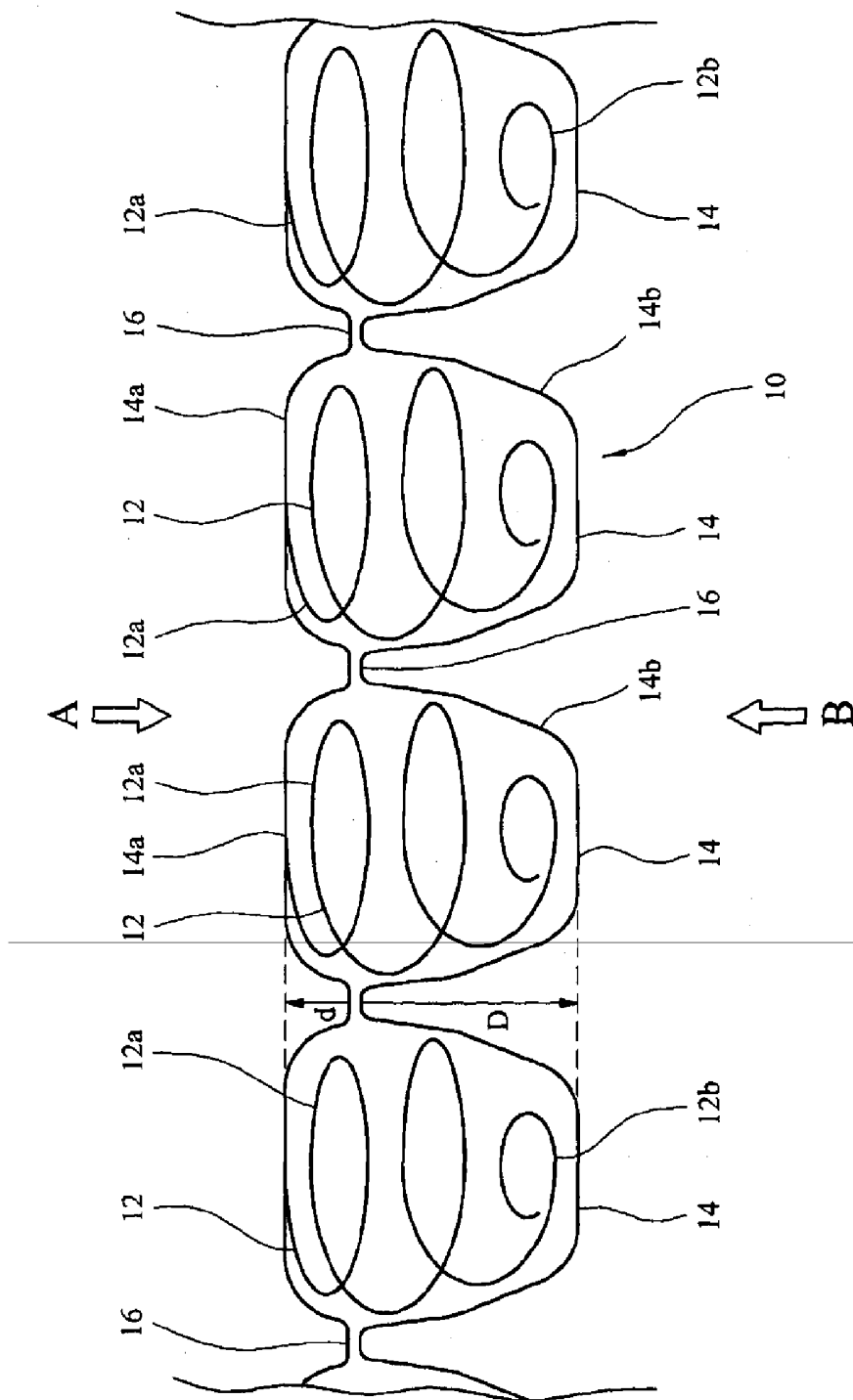


FIG. 1

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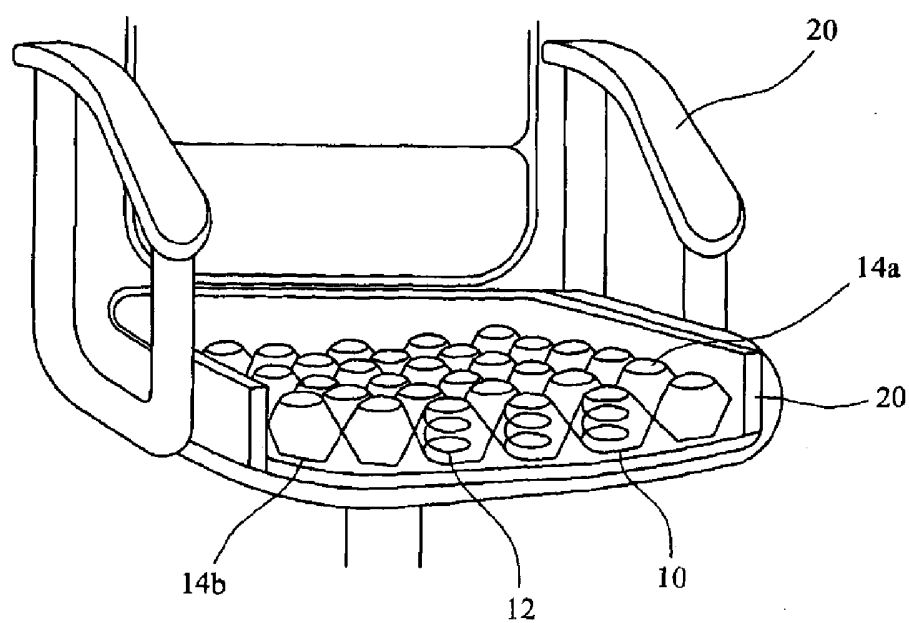


FIG. 2

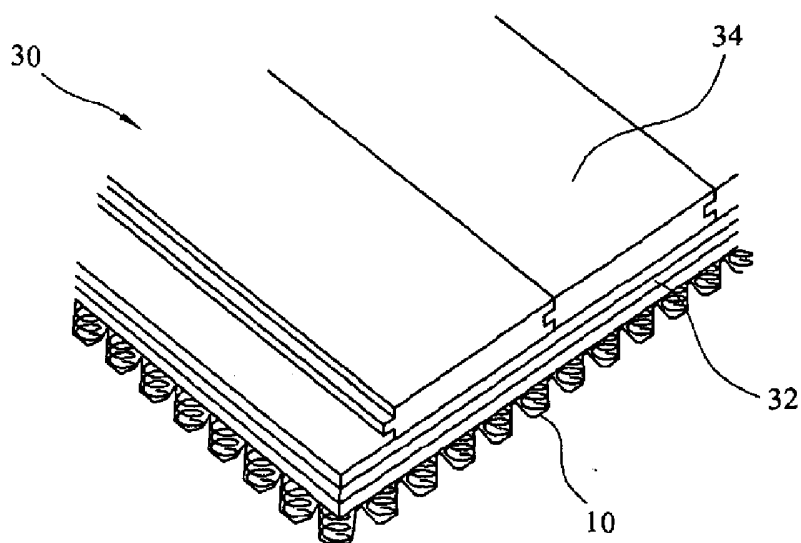


FIG. 3