SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO	
RAD: 13-204222- -4	**FECHA:** 2015-05-19 18:25:43
DEP: 2020 DIRECCION DE NUEVAS CREACIONES	**EVE:** 1 REGISTRO/DEPOSITO/CONCESION/DEPOSITO
TRA: 3 PATENTES DE MODELO DE UTILIDAD	**FOLIOS:** 7
ACT: 430 REQUERSOLICITA	

DIRECCIÓN DE NUEVAS CREACIONES

2020
Bogotá, D.C.,

Abogado(a)/Señor(a)
CAROLINA VERA MATIZ

Asunto: Radicación: 13-204222- -4
Trámite: 3
Evento: 1
Actuación: 430
Oficio: 5460
Folios: 7

Patente de Invención				Patente de Modelo de Utilidad	X
Vía Nacional	**X**				
Vía PCT (Fase Nacional)		Capítulo I		Capítulo II	
No. Solicitud Internacional					
Fecha de Presentación Internacional					

Como resultado del Examen de Fondo realizado, con fundamento en el artículo 85 y en concordancia con el artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se le comunica:

1. Documentos estudiados

Descripción:	Rad. N° 13-204222-00000-0000	28/Agosto/2013
Reivindicaciones:	Rad. N° 13-204222-00000-0000	28/Agosto/2013
Dibujos:	Rad. N° 13-204222-00000-0000	28/Agosto/2013
Oposición	Rad. N° 13-204222-00002-0000	The Mattress Warehouse 10/Octubre/2014

2. Objeto de la invención

En el presente documento se aplicará lo establecido en la Circular Única en su Título X, con respecto a que cuando la solicitud contenga más de diez (10) reivindicaciones y no se haya pagado la tasa complementaria, sólo se estudiarán las cubiertas por la tasa pagada al momento de realizar el examen de patentabilidad consagrado en el artículo 45 de la Decisión 486.

Título de la solicitud: “Unidad resortada con dureza zonificada” (modificado en el folio 145).

El problema planteado en esta solicitud consiste en lograr una unidad resortada que provea al usuario una relajación muscular diferente en cada una de las zonas de su cuerpo.

Para resolver este problema técnico la solicitud en estudio propone una unidad resortada que consta de un cuerpo rectangular que encierra una pluralidad de resortes helicoidales, alineados mediante unos elementos tensores, dichos resortes agrupados en zonas de diferente amortiguación.

El objeto de la presente Solicitud se relaciona con la Clasificación Internacional de Patentes (CIP): A 47 C 27/00.

3. Análisis de las Oposiciones

Argumentaciones de The Mattress Warehouse S.A.S.

En resumen, la sociedad The Mattress Warehouse, en su calidad de opositora, señala que la Unidad Resortada reclamada en la solicitud actualmente estudiada es: *"…un producto que ya es conocido, que se encuentra en el estado de la técnica, que presenta solamente* ***diferencias secundarias no relevantes*** *con respecto a realizaciones anteriores y* ***es carente de nivel inventivo****."* –negrita y subrayado originales del texto-.

Como sustento del argumento anteriormente transcrito, la sociedad añade que *"…desde antes del 12 de octubre de 2011, ha producido y comercializado ampliamente Colchones en los que usa resortes helicoidales alineados a lo largo y ancho dentro del contorno de la base bajo la marca* ***PULLMAN****…"* –negrita y subrayado originales del texto-. De acuerdo con lo anterior, realiza una comparación de las características del colchón mencionado con las reclamadas en la presente solicitud y adjunta una factura de venta de dicho colchón, junto con sus especificaciones técnicas.

De igual manera, compara el colchón ofertado en la página web: http://colchonesnaturals.blogspot.com/ , alegando que es elaborado con resortes agrupados y alineados en todo el marco, lo que también afectaría la novedad de la Unidad Resortada reivindicada.

Adicional a lo anterior, menciona que: *"…en el mercado se encuentra amplia oferta de colchones elaborados con resortes helicoides a lo largo y ancho de la base…",* tal y como puede observarse en las siguientes páginas web:

- http://sites.amarillasinternet.com/colchonesestelar/resortados.html
- http://sites.amarillasinternet.com/colchonesconfortplus/nuestros_productos.html

Finalmente, concluye que por todo lo anterior, la patente de Modelo de Utilidad denominada "Unidad Resortada con Dureza Zonificada" incumple con el requisito de Novedad y, en consecuencia, es procedente negar la solicitud en estudio.

Respuestas del Solicitante

Como respuesta a los argumentos de la sociedad opositora, la solicitante afirma que: *"…la presente solicitud reclama una unidad resortada con unas variantes y alternativas en la distribución de zonas o áreas en la base de los colchones para proveer diferentes grados de amortiguación o dureza zonificada en la unidad a través de los resortes de diferente diámetro o calibre en cada zona."* –subrayado original del texto-.

Ahora bien, haciendo referencia a los antecedentes allegados por la opositora, la solicitante manifiesta que no muestran prueba clara de que las zonas mencionadas anteriormente estén incluidas en el colchón de la página web: http://colchonesnaturals.bloqspot.com/, o en otros colchones existentes en el mercado.

En específico, el colchón de la página web anteriormente citada *"….muestra una estructura con disposición uniforme de los resortes dentro del colchón, pero no muestra la presencia de elementos tensores ni la variabilidad de diámetros o calibre de los resortes…".*

Finalmente, concluye que la unidad resortada de la solicitud no se encuentra divulgada en los antecedentes presentados por la Oposición.

Respuesta del Examinador Técnico

Revisados los argumentos de las partes, este Despacho concluye que ninguno de los documentos presentados por la opositora contiene integralmente las características técnicas reclamadas en la reivindicación 1, para la cual se solicita protección.

Al hacer una comparación entre los documentos de la oposición y la solicitud actualmente estudiada, se puede concluir que la diferencia radica en los resortes agrupados en zonas a áreas (A) y (B) de diferente dureza o amortiguación con base en el diámetro o calibre de los resortes en cada zona. Lo anterior, debido a que los colchones de los antecedentes presentados, no contienen estas características técnicas.

En consecuencia, los documentos presentados en la Oposición no desvirtúan la Novedad del objeto de esta solicitud.

4. Determinación del Estado de la Técnica

El estado de la técnica se determinó con base en la fecha de presentación de la solicitud de patente nacional: Agosto 28 de 2013 y se encontraron los siguientes documentos que anticipan el objeto de esta solicitud:

Ítem	Documento	Título	Fecha de Publicación
D1	US 7'992.242	'Mattress having a zoned spring unit with firmness indicating zones formed by a multiple colored top panel'	09/Agosto/2011
D2	US 4'679.266	'Varying firmness mattress'	14/Julio/1987
D3	US 5'868.383	'Multiple rate coil spring assembly'	9/Febrero/1999
D4	WO 2011/150080	'Independent mattress units with transition zone'	1/Diciembre/2011

El documento D1[1] divulga un colchón zonificado cubierto por una tela tejita de por lo menos 2 colores diferentes, indicando tres zonas de firmeza diferentes (resumen).

El documento D2[2] divulga un colchón de tamaño estándar conformado por 4 regiones longitudinales, por ejemplo, una de cabeza, una de torso superior, una de torso inferior y una de soporte de piernas. Cada una de estas regiones es de una constante firmeza, que difiere de la de las regiones adyacentes (resumen).

1 https://www.google.ca/patents/US7992242?dq=7992242&hl=es&sa=X&ei=bZIUVf7jA_PjsATq1ILYBw&ved=0CB0Q6AEwAA
2 https://www.google.ca/patents/US4679266?dq=4679266&hl=es&sa=X&ei=KxgYVYH5Ce3jsASOxIDABw&ved=0CBwQ6AEwAA

El documento D3[3] divulga ensambles de resortes y colchones en general, en específico, pero no en manera de limitación, de múltiples tipos de resortes (Col. 1, líneas 5 a 7).

El documento D4[4] divulga un colchón que incluye una primera unidad de resortes con un primer grado de firmeza y una segunda unidad de resorte con un segundo grado de firmeza, que difiere del primer grado de firmeza (resumen).

5. **Examen de Patentabilidad** (Art 14 D486)

Novedad (Art 16 D486)

La reivindicación 1 consiste en: *"Unidad resortada (1) con dureza zonificada para utilización en camas y colchones que comprende unas zonas o áreas con diferente dureza…"* (ver página 7 incluida en el radicado bajo No. 13-204222-00000-0000).

Comparación de las características técnicas **esenciales**, con las del Estado de la Técnica:

Características **esenciales**	**D1**	**D2**	**D3**	**D4**
Unidad resortada caracterizada por:	Una unidad de resorte (12) caracterizada por:	Colchón caracterizado por:	Colchón caracterizado por:	Colchón caracterizado por:
Un cuerpo o volumen rectangular que encierra una pluralidad de resortes helicoidales alineados a lo largo y ancho dentro del contorno de la base.	Una alojamiento (111) que encapsula todos los resortes (116). Los cuales están alineados a lo largo y ancho del contorno de la base (111) (Figs. 1 y 2; Col. 5, líneas 3 a 51).	Un cuerpo o volumen rectangular que encierra una pluralidad de resortes helicoidales alineados a lo largo y ancho dentro del contorno de la base (Fig. 2).	Un cuerpo o volumen rectangular que encierra una pluralidad de resortes helicoidales alineados a lo largo y ancho dentro del contorno de la base (Figs. 12 y 13).	Un cuerpo o volumen rectangular que encierra una pluralidad de resortes helicoidales alineados a lo largo y ancho dentro del contorno de la base.
Dichos resortes agrupados en zonas o áreas de diferente dureza o amortiguación con base en el diámetro o calibre de los resortes en cada zona.	Los Resortes (116) definen al menos tres zonas de firmeza incluyendo al menos una zona de firmeza de cabeza (141), una zona de firmeza de torso o lumbar (142), una zona de firmeza de pie o de pierna (143). La diferencia en la firmeza puede ser resultado de alambres de diferente calibre utilizado para conformar los resortes (Col. 6, líneas 64 a 67; Col. 7, líneas 6 a 10).	El colchón está formado por numerosas filas de resortes (25) que conforman la región de soporte de cabeza (H), numerosas filas de resortes (26) y (27) que, respectivamente, conforman la región de soporte de torso superior (Tu) y (Tl) y filas de resortes (28) que conforman la región de soporte de pierna (L). Los resortes pueden ser de más gruesos o más delgados calibres. (Col. 5, líneas 37 a 55).	Un colchón puede tener más de tres zonas de firmeza, que corresponden a las porciones de cabeza, cuerpo medio y pies, de los lados izquierdo y derecho (H1), (M1), (F1), (H2), (M2), (F2), respectivamente. El colchón puede tener, por ejemplo, una zona izquierda (L) y una zona derecha (R). El diámetro del resorte del medio puede ser más grande que cualquier de los diámetros de la primera pluralidad de resortes. El diámetro del resorte del medio puede ser	Las diferentes firmezas de los resortes están referenciadas por un color determinado. Por ejemplo, la unidad de resorte hechos con alambre de calibre 14 puede ser referenciado con el color rojo (R). Unidades de resortes realizados con alambre de calibre 14.5 puede ser referenciado con el color azul (B). Unidades de resortes realizados con alambre de calibre 15 pueden ser referenciados con el color verde (G). Unidades de resorte realizados con

3 https://www.google.ca/patents/US5868383?dq=5868383&hl=es&sa=X&ei=UhgYVdmdFpPisASX5YGACA&ved=0CB0Q6AEwAA

4 https://www.google.ca/patents/WO2011150080A1?cl=en&dq=WO+2011/150080&hl=es&sa=X&ei=dBgYVdDvGtLjsATQ1oKIDw&ved=0CB0Q6AEwAA

			más pequeño que el diámetro de la primera pluralidad de resortes (Col. 14, líneas 65 a 67; Col. 15, líneas 1 a 7; Col. 16, líneas 32 a 39).	alambre de calibre (16) estará referenciado con color café pálido (T) (Pág. 5, Párr. 2).

Las características **esenciales** de la unidad resortada de la reivindicación 1 habían sido divulgadas previamente en D1 a D4. En consecuencia, la reivindicación 1 no es nueva.

Por su parte, los elementos tensores reclamados en la reivindicación 1 son ampliamente conocidos en campo técnico de la solicitud y, por lo tanto, se consideran elementos implícitos de los colchones que pueden encontrarse en el mercado[5] [6]. Asimismo, el documento D1 también enseña estos tensores al mencionar que: la porción superior de los resortes (41) y la porción inferior de los resortes (42) están enlazados con los tensores superiores e inferiores (56) y (57) (Col. 5, líneas 40 a 46). De acuerdo con lo anterior, los tensores no pueden dar novedad a la unidad resortada reclamada en la presente solicitud.

Con relación con la reivindicación 2, cabe aclarar que al especificar que los resortes son de diámetro de 2.30mm y 2.10mm, está refiriéndose a las características o especificaciones con las cuales se encuentran dichos alambres comercialmente. Por lo tanto, se considera que son características intrínsecas del material con el cual se fabrican los resortes[7 8 9]. Cabe aclarar, que vía modelo de utilidad los materiales, sus propiedades o especificaciones, no pueden ser objeto de protección. En este tipo de patente, solo se protegen las características constructivas de la creación reclamada. De acuerdo con lo expuesto, la reivindicación citada no contiene materia patentable.

6. Conclusión

Los requisitos de Patentabilidad de la presente Solicitud están afectados así:

Ítem	Documento	Reivindicaciones afectadas	Requisito que afecta
D1	US 7'992.242	1	Novedad
D2	US 4'679.266	1	Novedad
D3	US 5'868.383	1	Novedad
D4	WO 2011/150080	1	Novedad

5 http://sites.amarillasinternet.com/colchonesconfortplus/nuestros_productos.html
6 http://sites.amarillasinternet.com/colchonesestelar/resortados.html
7 http://ausin.com.uy/index.php/productos/alambres
8 https://www.epm.com.co/site/Portals/0/RA7-228.pdf
9 http://www.mallasjuliotorres.com/web/wp-content/uploads/2015/02/alambre-puas-pvc.pdf

En cumplimiento del artículo 45 de la Decisión 486 de la Comisión de la Comunidad Andina, se le indica que debe dar respuesta dentro del término de treinta (30) días contados a partir del día siguiente de la fecha de notificación de la presente comunicación. En caso de no dar respuesta al presente requerimiento, o si a pesar de la respuesta subsistieran los impedimentos para la concesión, se denegará la patente.

Se invita al solicitante se sirva indicar, si así lo considera, su renuncia al término faltante de treinta (30) días para dar respuesta a este requerimiento y presentarla por escrito.

Finalmente, se le recuerda al solicitante que si como respuesta a este requerimiento llegara a modificar el capítulo reivindicatorio y éste contenga más de diez (10) reivindicaciones, no pagará la tasa de modificación voluntaria pero sí la correspondiente al pago por reivindicación adicional.

Notifíquese el presente oficio conforme a lo dispuesto en el numeral 5.2, literal e), del capítulo quinto del título primero de la Circular Única No. 10 de 2001.

JOSÉ LUIS SALAZAR LÓPEZ
Director de Nuevas Creaciones (c)

El anterior requerimiento fue notificado por fijación en lista, de fecha 2015-05-26

Elaboró: Monica Andrea Gutierrez Almonacid
Revisó: Sonia Andrea Diaz Pirazan

Superintendencia de Industria y Comercio: Cra 13 No. 27- 00 pisos 1, 3, 4, 5, 6, 7 y 10 - PBX: (571) 5870000
E-mail: contactenos@sic.gov.co - Bogotá D.C., Colombia.
Señor ciudadano la entidad le ofrece los siguientes canales para hacer seguimiento a su solicitud así:
Página web: www.sic.gov.co | Línea gratuita a nivel nacional: 018000 910165
Centro de atención telefónica en Bogotá: 5920400 | Kiosco Informático Centro Comercial Gran Estación en Bogotá
MINCOMERCIO INDUSTRIA Y TURISMO

US007992242B2

(12) **United States Patent**
Antinori

(10) **Patent No.: US 7,992,242 B2**
(45) **Date of Patent: Aug. 9, 2011**

(54) MATTRESS HAVING A ZONED SPRING UNIT WITH FIRMNESS INDICATING ZONES FORMED BY A MULTIPLE COLORED TOP PANEL

(75) Inventor: **Steven J. Antinori**, Tampa, FL (US)

(73) Assignee: **American Bedding Industries**, Tampa, FL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1209 days.

(21) Appl. No.: **11/528,604**

(22) Filed: **Sep. 28, 2006**

(65) **Prior Publication Data**

US 2007/0017033 A1 Jan. 25, 2007

Related U.S. Application Data

(63) Continuation-in-part of application No. 10/446,729, filed on May 29, 2003, now Pat. No. 7,870,626.

(51) **Int. Cl.**
A47C 23/05 (2006.01)
A47C 17/86 (2006.01)

(52) **U.S. Cl.** **5/727**; 5/717; 5/737

(58) **Field of Classification Search** 5/716, 717, 5/721, 727, 737, 739
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,469,084	A		5/1949	Schenker
2,836,228	A		6/1956	Dahle
3,210,781	A		10/1965	Pollock
4,086,675	A		5/1978	Talbert et al.
4,405,681	A		9/1983	McEvoy
4,679,266	A	*	7/1987	Kraft 5/716
4,794,658	A	*	1/1989	Goodale 5/737
5,065,485	A		11/1991	Zocco
5,105,488	A		4/1992	Hutchinson et al.
5,107,559	A		4/1992	Lueck
5,136,740	A	*	8/1992	Kraft 5/730
5,430,901	A		7/1995	Farley
5,475,881	A		12/1995	Higgins et al.
5,568,659	A		10/1996	Fogel
5,579,549	A		12/1996	Selman et al.
5,701,623	A		12/1997	May
5,960,496	A		10/1999	Boyd
5,987,678	A	*	11/1999	Ayers 5/720
6,122,787	A	*	9/2000	Kao 5/723
6,151,739	A		11/2000	Meyer et al.
6,256,821	B1		7/2001	Boyd
6,351,863	B1		3/2002	Meyer et al.
6,779,369	B2	*	8/2004	Shepherd 66/196
2005/0223667	A1		10/2005	McCann et al.
2005/0229318	A1		10/2005	Peng

* cited by examiner

Primary Examiner — Michael Safavi
(74) *Attorney, Agent, or Firm* — Reed Smith LLP

(57) **ABSTRACT**

A zoned mattress including at least a head firmness zone, a leg firmness zone between the head and leg firmness zones overlaid by a knit top fabric knit from threads of at least two different colors to define three different firmness indicating areas corresponding to the three firmness zones of the mattress. At least one of the firmness indicating areas is defined by threads differing in color as compared to the color of the threads defining at least one of the two remaining firmness indicating areas.

15 Claims, 6 Drawing Sheets

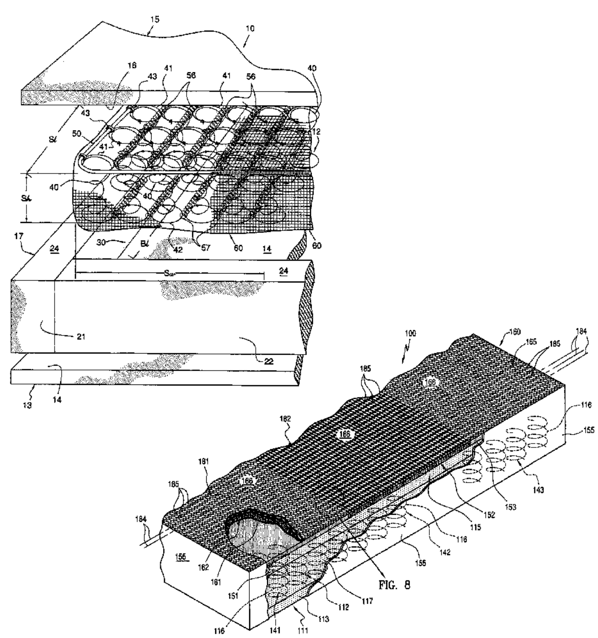


FIG. 8

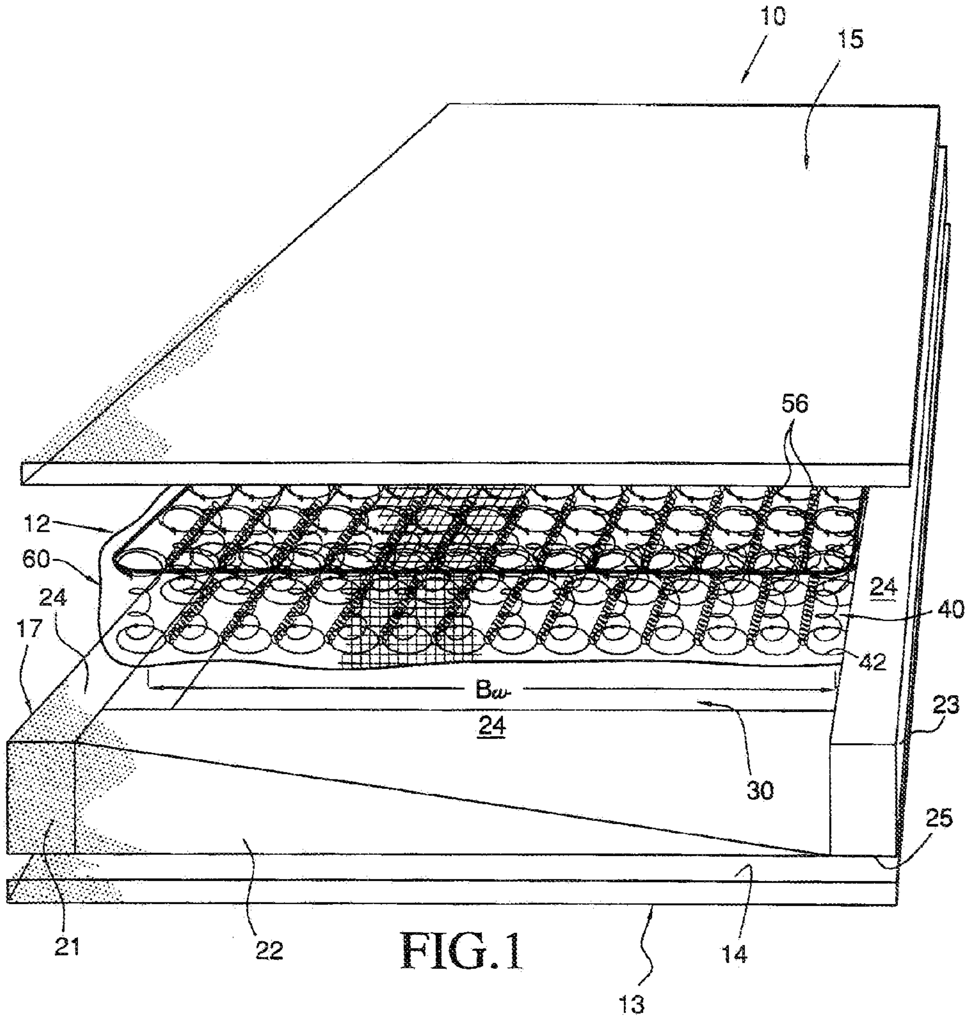


FIG.1

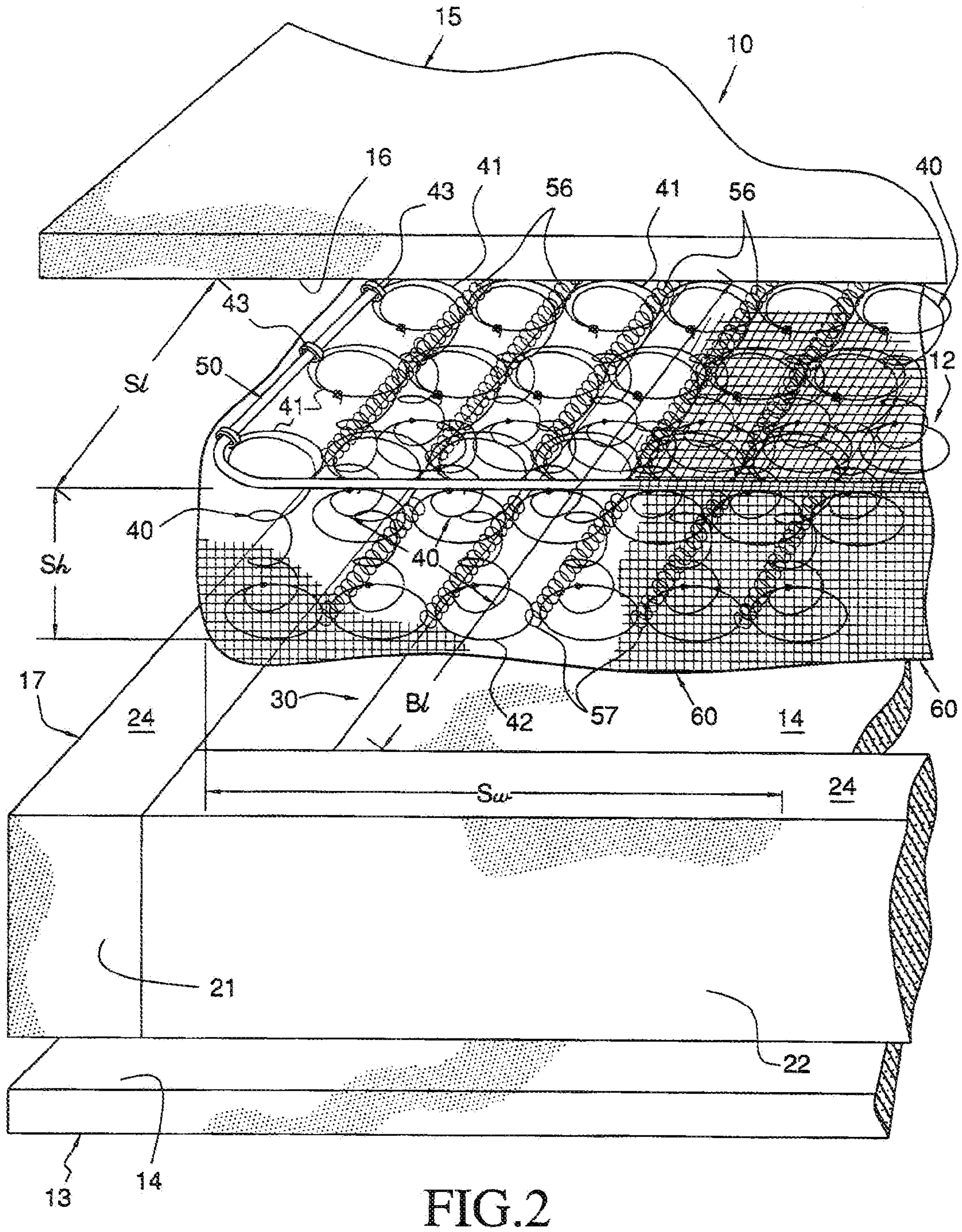

15
10
16
43
41
56
41
56
40
43
50
Sl
41
12
40
Sh
40
17
24
30
Bl
42
57
60
14
60
24
Sw
21
22
13
14

FIG.2

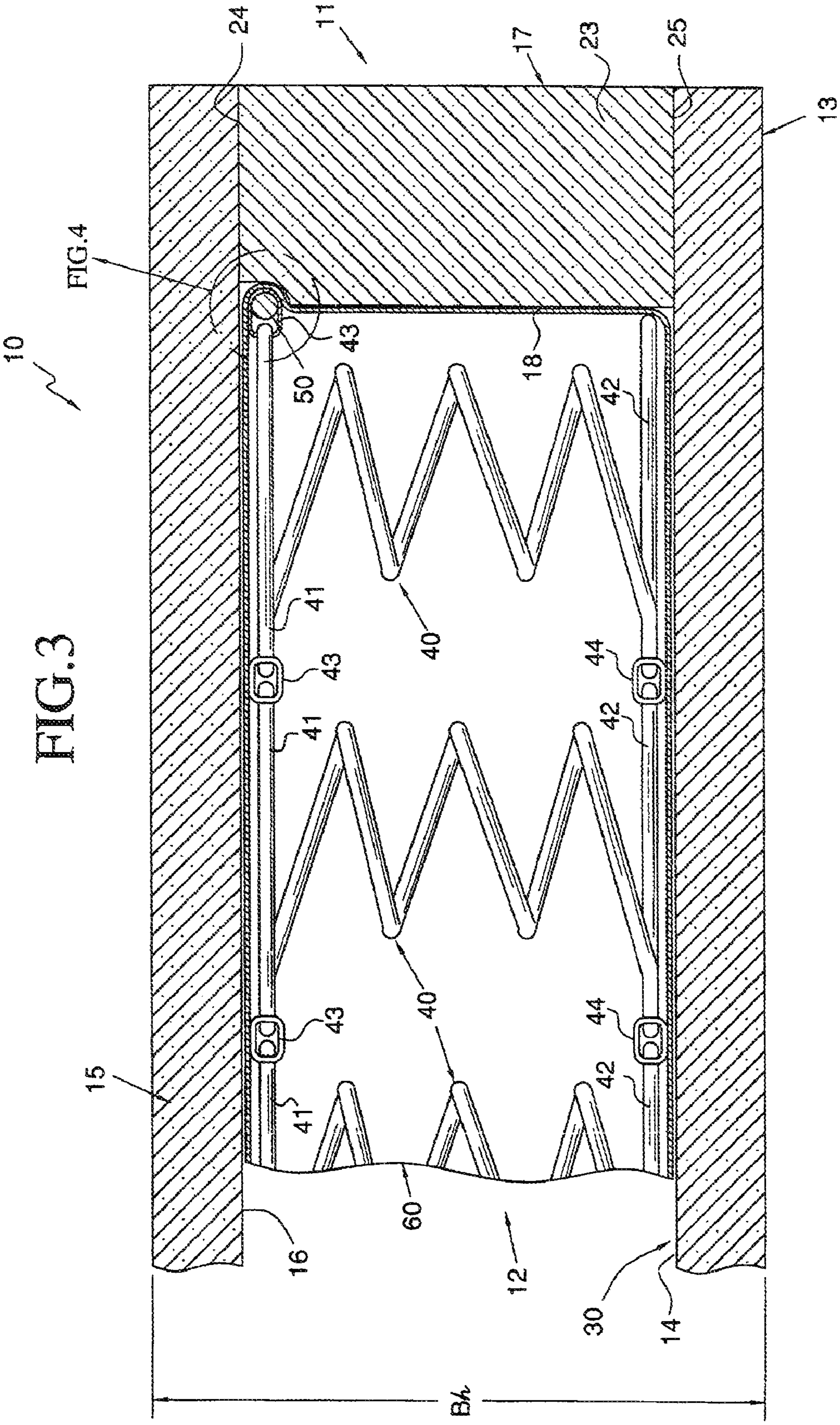

24
11
17
23
25
13
FIG.4
10
43
50
18
42
41
40
43
44
41
42
43
44
15
41
42
16
60
12
30
14
Bh

FIG.3

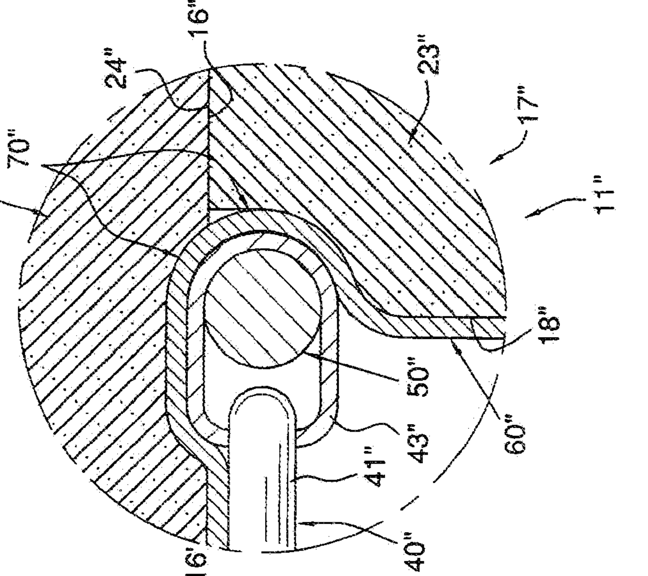


FIG.6

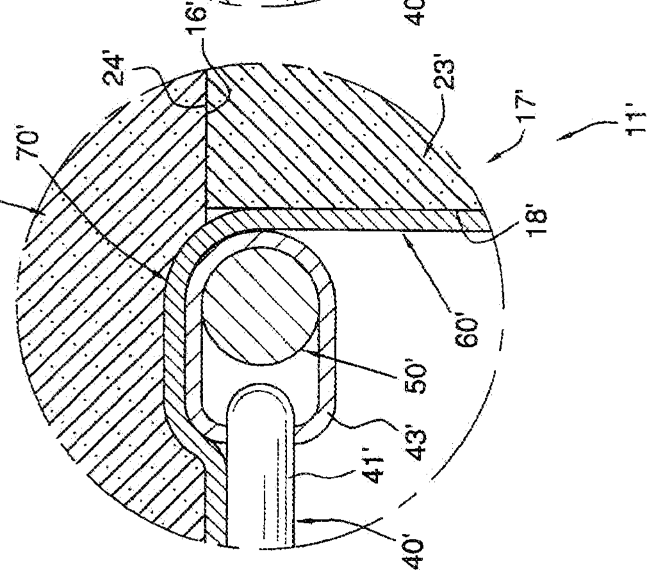


FIG.5

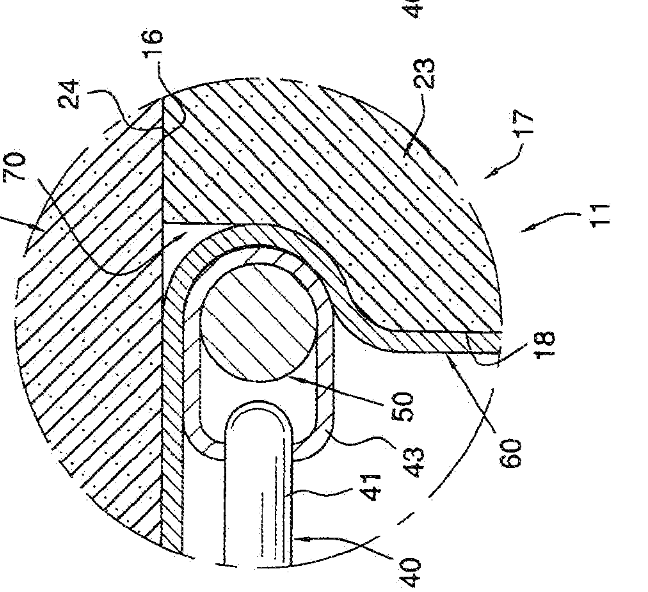


FIG.4

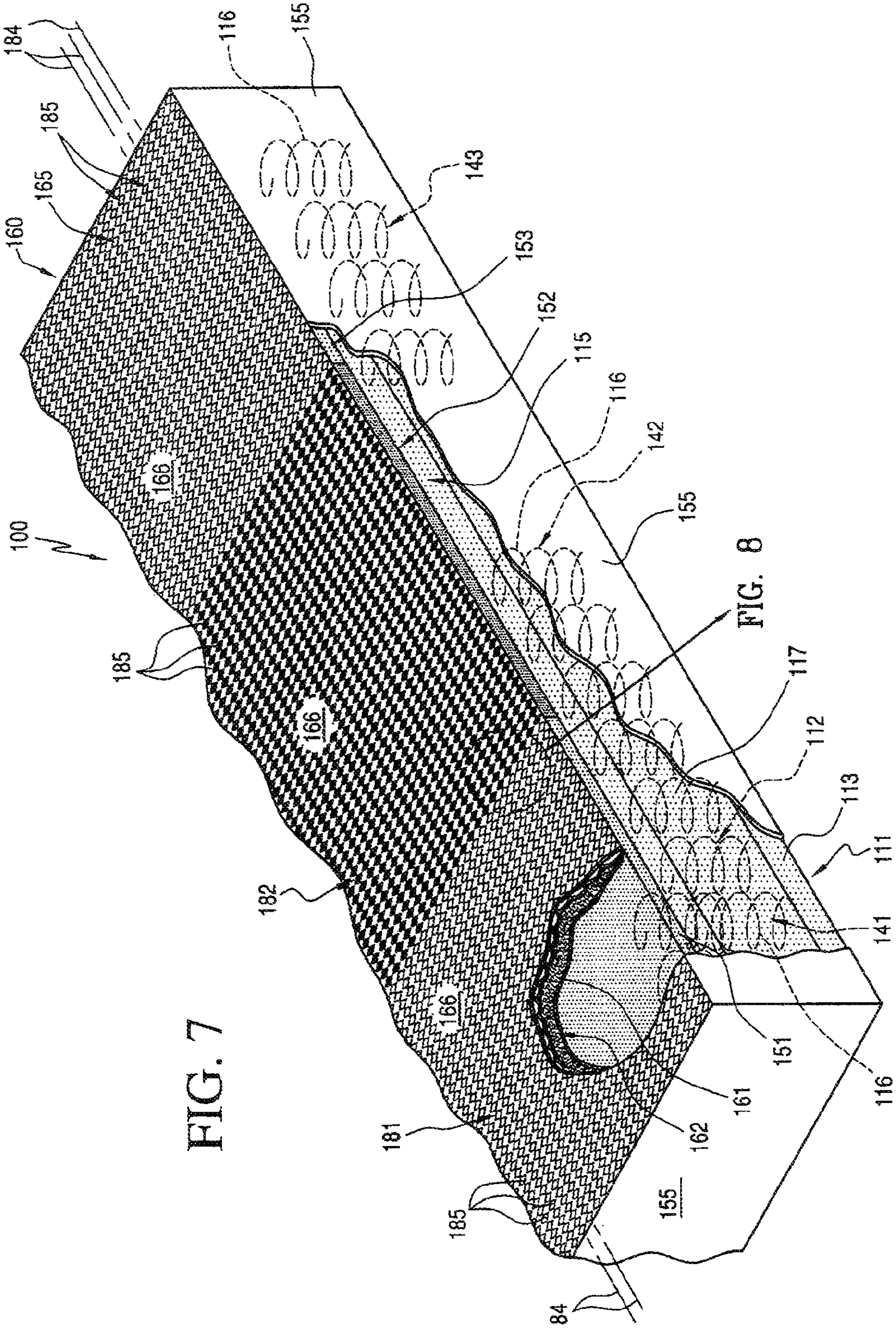

184
185
165
160
116
155
143
153
152
115
116
142
155
100
FIG. 8
185
166
166
117
112
113
111
141
116
151
161
162
182
166
181
185
155
184

FIG. 7

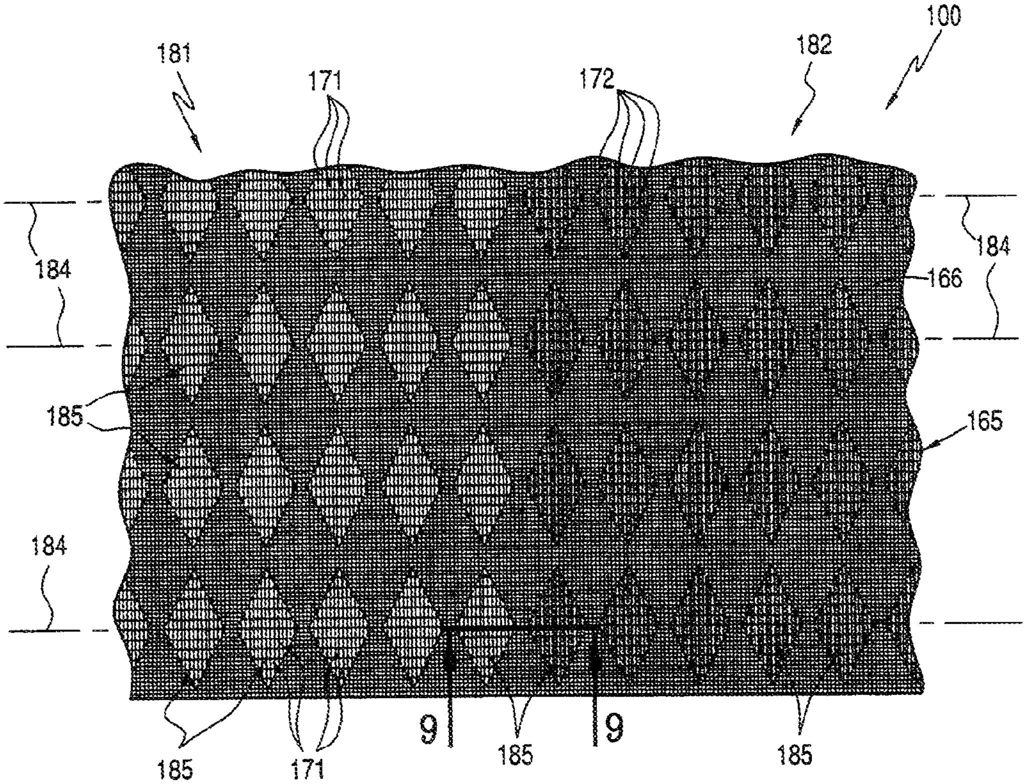

100
181
171
172
182
184
184
166
185
165
184
185
171
9
185
9
185

FIG. 8

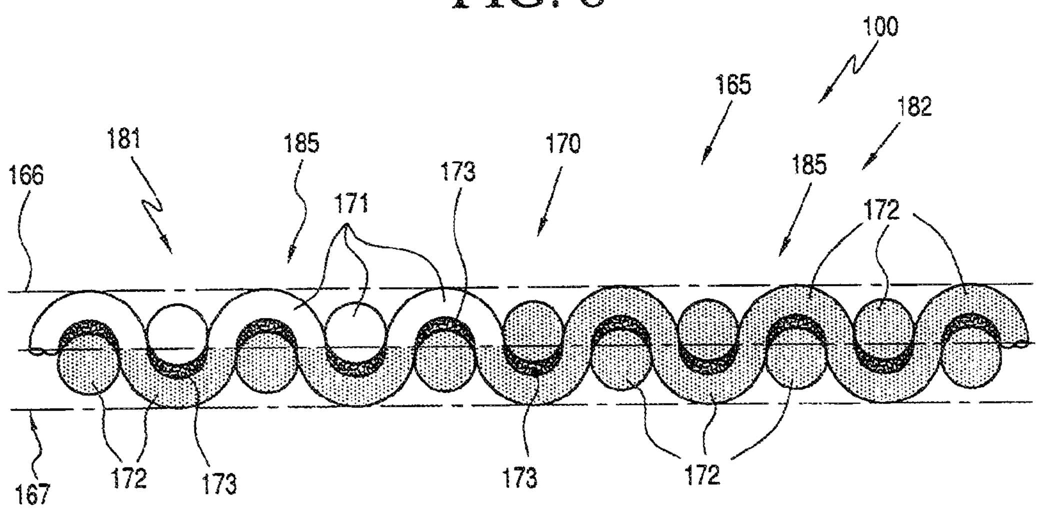

100
165
182
166
181
185
170
185
171
173
172
172
167
172
173
173
172

FIG. 9

MATTRESS HAVING A ZONED SPRING UNIT WITH FIRMNESS INDICATING ZONES FORMED BY A MULTIPLE COLORED TOP PANEL

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part application of Applicant's commonly assigned application in Ser. No. 10/446,729 filed on May 29, 2003 entitled "A Mattress Having a Spring Unit with a Single Upper Peripheral Border Rod Locked Within a Chamber of a Synthetic Foam Plastic Material Housing," and now U.S. Pat. No. 7,870,626.

BACKGROUND OF THE INVENTION

Conventional mattresses are constructed in many different ways to provide uniform or varied firmness along their lengths, such as conventional coil spring mattresses or synthetic foam mattresses. Other mattresses include housings made of synthetic polymeric/copolymeric plastic material generally formed by upper and lower layers or panels and a peripheral border therebetween. In one type of mattress one or more synthetic plastic material panels are housed within the chamber of the mattress housing. In another type mattress a spring unit or a series of springs or inflatable units or conventional natural fibers are similarly housed within the chamber of such mattress housings. A further mattress includes both one or more panels of synthetic plastic material and coil springs housed within a chamber of a mattress housing.

All such mattresses are said to have a variety of different advantages, and typical of mattresses defined by a synthetic plastic material mattress housing defining a chamber in which are housed one or more layers of polymeric/copolymeric plastic material, including foam, are McEvoy, U.S. Pat. No. 4,405,681 issued on Sep. 20, 1983; Dahle, U.S. Pat. No. 2,836,228 issued on Jun. 15, 1956; Luck, U.S. Pat. No. 5,107,559 issued on Apr. 28, 1992; Talbert et al., U.S. Pat. No. 4,086,675 issued on May 2, 1978 and May, U.S. Pat. No. 5,701,623 issued on Dec. 30, 1997. Such mattresses are said to advantageously provide desired support, differential hardnesses, extremely high resistance to compression, resilience to return from a compressed condition substantially to the original uncompressed form, differential firmness, edge firmness and softer centers, etc.

Much the same advantages are claimed for mattresses in which a spring unit or individual spring coils are housed within a chamber of a synthetic plastic material mattress housing with or without synthetic plastic panels also being housed within the chamber. Typical of the latter mattresses can be found in Zocco, U.S. Pat. No. 5,065,485 issued on Nov. 19, 1991; Pollock, U.S. Pat. No. 3,210,781 issued on Oct. 12, 1965; Schenker, U.S. Pat. No. 2,469,084 issued on May 3, 1949; Kraft, U.S. Pat. No. 5,136,740 issued on Aug. 11, 1992 and Hutchinson et al., U.S. Pat. No. 5,105,488 issued on Apr. 21, 1992. Though the latter type mattresses exhibit numerous advantages, a major disadvantage is the "swimming pool" effect of the coil spring unit and the synthetic polymeric/copolymeric synthetic plastic material housing. Heretofore such spring units continuously floated or shifted within the associated chamber of the plastic mattress housing ("swimming pool" effect) which created excessive wear and increased the return rate of such mattresses which quickly deteriorated over a short period of time as the inner surfaces or walls defining the mattress housing deteriorated under continuous rubbing and grinding of the spring unit as it continuously shifted when in use. Normally such coil spring units are defined by a number of coils and upper and lower heavier peripherally extending border rods which are attached to the coils by clips. When such coil spring units are loosely dropped into and are housed loosely within the chamber of an associated plastic mattress the clips and the upper and lower border rods rub and grind away at the inner surfaces or walls of the peripheral border and/or the upper and/or lower panels of the plastic mattress housing.

Such conventional mattresses utilizing spring units formed by both upper and lower relatively rigid peripheral border rods clipped to upper and lower coil loops of coils are also extremely rigid and are not susceptible to bending either transversely or longitudinally, as is oft times desired when mattresses are transported, removed, installed, flipped, etc. Such rigidity in conventional coil spring/foam housing mattresses also creates a transition area between the upper border rod and the spaced peripheral border of the mattress housing which creates an undesired peripheral gap and/or lump between the two which is noticeable when a person sits upon an edge of the mattress.

Conventional mattresses utilizing sprint units or innersprings can also be zoned to provide varying firmness or resistance to vertical deflection in response to a person lying upon or shifting relative to the mattress. Typically, a conventional mattress is divided into at least three longitudinal zones of differing firmness or resistance to vertical deflection in order for the body of a person lying atop the mattress to be supported with minimum pressure at high pressure points on the body. One such zone mattress is disclosed in U.S. Pat. No. 5,475,881 granted to Larry Higgins et al. on Dec. 19, 1995 and includes in conjunction with the mattress zoning a top, pad or panel which has a quilting pattern divided into four longitudinal zones reflecting and identifying the location and position of four underlying longitudinal firmness zones of the core mattress/innerspring located beneath the cover. The quilting pattern thereby enables a person sleeping atop the mattress to identify where the head, hips, legs and feet should be located on the top of the mattress so as to maximize the comfort imparted by the underlying mattress firmness zones. The quilting pattern also varies in size in different zones such that the closer the quilting pattern, the greater is the restriction to fabric movement and thus more firmness is imparted to that particular section of the mattress by the top or cover. Stated otherwise, a close or tight quilting pattern of quilted seams is located over the more firm section of the mattress and a looser pattern is located over the less firm section of the mattress.

SUMMARY OF THE INVENTION

The invention herein provides a mattress formed of synthetic polymeric/copolymeric plastic material, preferably foam plastic, which forms a mattress housing defined by a lower foam panel, an upper foam panel and a peripheral foam border formed of one, two or more pieces of material collectively defining a spring unit chamber. A spring unit of the mattress of this invention includes a plurality of coil springs having upper and lower loops to the upper loops of which is connected by clips a peripheral border rod. The coil spring unit includes only one peripheral border rod and the latter is located only at the upper side of the coil spring unit. The overall length and width of the border rod is exactly equal to, slightly larger than or somewhat larger than the corresponding dimensions of the inner walls or surfaces of the peripheral border of the housing. Accordingly, with the bottom panel adhesively bonded to the peripheral border, the coil spring unit is dropped-in a chamber of the mattress housing from above with the lower coil loop of each coil spring resting upon an innermost surface of the lower panel. The border rod must be forced down into the chamber and if the peripheral dimensions thereof correspond substantially identically to the peripheral dimensions of the housing border, the upper border rod and its clips are in frictional locking relatively immobilized relationship to the inner wall or surface of the peripheral border of the housing. However, the dimensions of the inner walls or surfaces of the border are preferably foreshortened ¼-½ inch relative to the same dimensions of the upper border rod which during assembly causes the synthetic foam plastic material along an innermost upper edge of the border to compress and essentially lockingly grip the peripheral border rod along the upper edge of the plastic material border when the coil spring unit is fully seated within the mattress chamber. The latter locking avoids the "swimming pool" effect earlier described while the absence of any further peripheral border rods and particularly a lower peripheral border rod permits the mattress to be bent as earlier described.

Instead of oversizing the length and width of the upper peripheral border rod relative to the respective length and width of the mattress chamber dimensions, the height of the coil spring unit can be ¼-½ inch higher than the distance between the inner opposing surfaces of the upper and lower panels which would be the same as the height of the mattress border as defined between upper and lower surfaces thereof. After the lower panel has been adhesively bonded to the mattress border and the coil spring unit has been placed therein, the upper peripheral border rod would project the ¼-½ inch above the upper surfaces of the mattress border. However, as the upper panel is placed atop the coil spring unit and is pushed downwardly, the upper peripheral border rod and its clips embed into the inner surface of the upper panel creating a peripherally extending downwardly opening locking channel which prevents the "swimming pool" effect after the mattress has been completed by adhesively uniting the upper panel to the upper surface of the mattress peripheral border.

In further keeping with the present invention, the overall peripheral size and height of the coil spring unit can be ¼-½ inch greater than the corresponding dimensions of the chamber of the mattress housing. When finally assembled, the upper peripheral border rod will lock both with the upper interior surface of the housing border and the inner surface of the upper panel in respectively peripherally extending inwardly opening and downwardly opening locking grooves or channels.

In further accordance with the present invention, in lieu of the utilization of a quilted top or pad having unique quilting patterns applied thereto of different sizes and firmness, the top panel or pad of the present invention includes an outermost exterior exposed knit fabric formed from threads of two different colors with the threads at the exterior surface of the top fabric being knitted to define at least three different firmness indicating areas corresponding to three firmness zones of the innerspring, and at least one of the firmness indicating areas of the knit top fabric is defined by threads differing in color as compared to the color of the threads defining at least one of the two remaining firmness indicating areas. By this construction of the knit top fabric, which is also preferably defined by an inner surface of but a single color of knit threads, the correct fabrication of the overall top, pad or panel is assured and irrespective of any particular knitted design evident in the exterior top fabric, it is the color of the threads at the exterior of the top fabric which delineates or indicates the underlying firmness zones of the coil spring units/innerspring.

DESCRIPTION OF THE DRAWINGS

FIG. **1** is an exploded perspective view of a novel mattress constructed in accordance with this invention, and illustrates upper and lower panels and a polygonal border constructed from synthetic plastic material defining a chamber in which is housed a spring unit including only a single upper peripheral border rod united by clips to upper loops of a plurality of coil springs.

FIG. **2** is a fragmentary exploded perspective view of the mattress of FIG. **1**, and illustrates details of the coil spring unit including upper and lower bonnell lacings uniting upper and lower loops of coil springs from head end to foot end of the mattress to prevent roll together.

FIG. **3** is a fragmentary vertical cross-sectional view taken through the assembled mattress and illustrates the upper and lower panels adhesively bonded to the housing border and the upper peripheral border rod locked in an inwardly opening peripheral extending groove of the housing border formed during the force-fit assembly of the coil spring unit into the mattress housing chamber.

FIG. **4** is a fragmentary enlarged cross-sectional view of the encircled portion of FIG. **3**, and more clearly illustrates the manner in which the upper peripherally extending border rod and one of the clips is locked in the locking channel formed by deformation of the mattress housing border during assembly.

FIG. **5** is an enlarged fragmentary view of another mattress taken in the same area as that of FIG. **4**, but illustrates the manner in which the upper peripheral border rod is locked in a downwardly opening peripherally extending channel of the upper panel of the mattress housing caused by the compression of the plastic material during assembly.

FIG. **6** is an enlarged fragmentary cross-sectional view of another mattress taken through the same area as FIG. **4**, and illustrates the manner in which both the peripheral border and the upper panel are deformed or distorted during assembly to form a locking channel in each for locking the upper peripheral border rod and its clips therein.

FIG. **7** is a fragmentary perspective view of a mattress having three zones of firmness defined by an innerspring or coil spring unit, and illustrates in association therewith a top, pad or panel defined by an outermost top fabric knit from threads of at least two different colors with the two different colors defining three firmness zones visually apparent from the exterior of the mattress which are indicative of the underlying firmness zones of the spring unit.

FIG. **8** is an enlarged fragmentary view of the encircled portion of the knit top fabric of the top panel of FIG. **7**, and illustrates the manner in which two different colors of the threads associated with two different areas reflect the corresponding firmness of the underlying firmness zones of the spring unit or innerspring.

FIG. **9** is an enlarged cross-sectional view taken through the knit fabric along line **9-9** of FIG. **8**, and illustrates the two different colored threads of the two different firmness indicating areas of the top knit fabric.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A novel mattress constructed in accordance with this invention is illustrated in FIGS. **1** through **3** of the drawings and is generally designated by the reference numeral **10**.

The mattress **10** is defined by a synthetic foam plastic mattress housing **11** and a coil spring unit **12** (FIG. **3**).

The mattress housing **11** is defined by a substantially rectangular or polygonal lower or bottom panel **13** having an innermost surface or wall **14**, and an upper substantially polygonal or rectangular panel **15** having an innermost surface or wall **16** and a border **17** having an inner peripheral surface or wall **18**. The border **17** can be a single molded component or can be a single piece of material bent at three corners and glued at a fourth corner or can be made of a plurality of individual border members, such as three of four border members illustrated in FIG. **1** and individually identified by reference numerals **21**, **22** and **23**. The border **17** includes an upper surface **24** and a lower surface **25** which defines a border height Bh. The inner peripheral surface or wall **18** of the border **17** also defines an inner border width Bw and an inner border length Bl (FIGS. **1** and **2**). The dimensions Bh, Bw and Bl define the overall dimensions of a chamber **30** in which is housed the coil spring unit **12**.

The coil spring unit **12** includes a plurality of identical bonnell coils or coil springs each being designated by the reference numeral **40** and each having respective upper and lower opposite loop portions **41**, **42** positioned respectively adjacent the inner surfaces **16**, **14** of the respective upper and lower panels **15**, **13** in the completely assembled mattress **10**, as is shown in FIG. **3**. A selected plurality or all of the upper loop portions **41** are connected to each other by conventional metallic clips **43** as are the lower loop portions **42** by similar conventional metallic clips **44**. A relatively rigid metallic peripheral border rod **50** is located in exterior surrounding relationship to the upper loop portions **41** of the peripherally outermost coil springs **40**. The metallic clips **43** connect the peripheral border rod **50** to the upper loop portions **41** of the coil springs **40** extending along the long sides of the border **17** but need not necessarily be united to the uppermost loops in the row adjacent each of the short sides or width of the border **17**, as is readily apparent from FIG. **2** of the drawings. However, the clips **43** can also be used to connect the peripheral border rod **50** to the upper loop portions **41** of the coil springs **40** in the row of coil springs most adjacent the short sides (head and foot ends) of the mattress. However, head end to foot end bonnell lacings are "laced" longitudinally to connect the upper loop portions **41** and the lower loop portions **42** of all longitudinally extending rows of coil springs **40** with the upper and lower lacings being respectively identified by reference characters **56** and **57** in FIG. **2** of the drawings. The springs **40** are also preferably spaced closer together toward the middle of the mattress **10** than at the head and foot ends to provide better support where a supine body needs it most. A plastic netting or mesh **60** encases all of the coil springs **40** and the peripheral border rod **50**.

The coil spring unit **12** has a height Sh (FIG. **2**), a length Sl and a width Sw. The dimensions Sh, Sl and Sw of the coil spring unit **12** correspond to the respective dimensions Bh, Bl and Bw of the chamber **30**. In accordance with this invention, one or more relative dimensions Sh, Sl and/or Sw define at a minimum a frictional fit relationship, more preferably a force-fit relationship, and still more preferably an oversize fit of between ¼-½ inch relative to the corresponding dimensions Bh, Bl and/or Bw. In this manner at least one dimension, length, width or height of the coil spring unit **12** is greater than at least one dimension, length, width or height of the chamber **30** which assures that the coil spring unit **12** is virtually immovably interlocked within the chamber **30**. More specifically, in keeping with the mattress **10** thus far described, both the spring unit length Sl and the spring unit width Sw which are measurements of the respective length and width of the peripheral border rod **50** are ¼-½ inch greater in size than the respective dimensions Bl and Bw defining the interior length and width of the chamber **30** of the mattress housing **10**. Therefore, as the spring unit **12** is lowered into the chamber **30**, after the surfaces **14**, **25** of the respective lower panel **13** and border **17** have been adhesively bonded to each other, the peripheral border rod **50** and the clips thereof contact the upper surface **24** of the border **17** because of the oversized peripheral dimension of the upper border rod **50** as compared to the peripheral dimension of the inner surface **18** of the border **17**. As the spring unit **12** is forced downwardly into the chamber **30** the upper edge of the inner peripheral surface **18** becomes distorted and, in a preferred embodiment of the invention in which the border **17** is constructed from foam material, the foam is crushed to form interlocking means **70** (FIG. **4**) in the form of an inwardly opening peripherally extending channel **70** which immobilizes the coil spring unit **12** within the chamber **30**. The lower interior surface **16** of the upper panel **15** is then bonded to the upper peripheral surface **24** of the border **17**. As is most evident from FIG. **3**, the lower loop portions **42** are unconstrained relative to the inner peripheral surface **18** of the border **17** because of the absence thereat of a peripheral border rod corresponding to the upper peripheral border rod **50**. Thus the interlocking means **70** assures the "swimming pool" effect is eliminated while at the same time providing a mattress **10** of superior characteristics which can be bent considerably about its length or width, again because of the absence of any peripheral border rods beyond the border rod **50**.

In further accordance with the present invention, a mattress **10'** is illustrated in FIG. **5** which is identical in construction to the mattress **10** except the dimensions Bl, Sl and Bw, Sw are substantially the same but the height Sh of the coil spring unit **12** as measured from the top of the peripheral border rod **50** and the lowest loop portions **42** of the coil springs **40** is ¼-½ inch greater than the distance or height Bh (FIG. **3**) of the chamber or compartment **30**. Thus, peripheral locking means **70'** is formed in the inner surface **16** of the upper panel **15** when the latter is forced downwardly upon the coil spring unit **12'**. In this case the locking or interlocking means **70'** is effected between only the upper panel **15'** and the spring unit **12'** whereas the border **17'** includes its normal undeformed inner peripheral surface **18'**.

A mattress **10"** of FIG. **6** includes interlocking means **70"** which is defined by both of the interlocking means **70**, **70'** of respective FIGS. **4** and **5** heretofore described. In other words, the locking or interlocking means **70"** is achieved by dimensioning all three dimensions Sh, Sl and Sw of the coil spring unit **12** greater than the respective dimensions Bh, Bl and Bw of the chamber **30**. The locking or interlocking means **70"** is thereby effected between the coil spring unit **12"** and both the inner surface **16"** of the upper panel **15"** and the inner peripheral surface **18"** of the border **17"**.

Another novel mattress constructed in accordance with this invention is illustrated in FIGS. **7** through **9** of the drawings and is generally designated by the reference numeral **100**.

The mattress **100** is defined by a synthetic foam plastic mattress housing **111** and a coil spring unit **112**.

The mattress housing **111** corresponds substantially to the mattress housing **11** of the mattress **10** and includes a substantially rectangular or polygonal lower or bottom panel **113**, an upper substantially polygonal or rectangular panel **115** and a peripheral border **117**.

The coil spring unit or innerspring **112** includes a plurality of bonnell coils or coil springs **116** which set-off or define at least three zones of firmness including at least a head firmness zone **141**, a torso or lumbar firmness zone **142** and a foot or leg firmness zone **143**. Mattresses having such firmness zones are conventional and one such mattress having four different zones of firmness is disclosed in U.S. Pat. No. 5,475,881 in the name of Larry Higgins et al. granted on Dec. 19, 1995. As disclosed in the latter patent, in the case of a mattress coil spring unit or core formed of coil springs, such as the coil springs **146**, the differing firmness of the differing zones **141**-**143** result from springs of different characteristics within each of the zones. The differing firmness may be the result of differing gauge wire utilized to manufacture the springs **116** in each zone or of different styles of coils or springs of differing metal compositions, or combinations thereof. The mattress **100** is preferably firmest in the center zone **142** and of lesser firmness at the firmness zones **141**, **143** to either side thereof. Overlying the firmness zones **141**-**143** and adhesively bonded to an upper surface (unnumbered) of the upper polygonal panel **115** are respective variable firmness panels **151**, **152** and **153** with the center or torso firmness panel **152** being more firm and less compressible than the head or foot firmness panels **151**, **152**, respectively. The panels **151**-**153** also provide variable firmness irrespective of the particular material from which each is made with the center panel **152** being made of firmer less compressible material than the material of the firmness panels **151** and **153**. A fabric covering **155** covers the entirety of the components of the mattress **100** thus far described.

In further accordance with the present invention, the mattress **100** includes a top panel or topper **160** defined by a polygonal or rectangular piece of fabric material **161** (FIG. **7**) which is peripherally sewn to a knit top fabric **165** and defines therewith a chamber **162** filled with relatively soft cushioning material such as non-woven fabric batting material and/or a thin ply or pieces of urethane foam material which assures that a person lying atop the mattress **100** will distribute his or her weight as evenly as possible over the maximum surface area possible to create increased comfort.

The invention is particularly directed to the knit top fabric **165** of the topper or top panel **160** which is best illustrated in FIGS. **8** and **9** of the drawings. The knit top fabric **165** includes a top surface **166** and a bottom surface **167** set off by threads **170** of at least two different colors which, for purposes of description, are a plurality of white threads **171** and colored threads **172**, such as tan or gold, and circularly knitted therebetween and therewith are polyester inlay threads or yarn **173** (FIG. **9**) generally of a neutral or opaque color which are indiscernible when the knit top fabric **165** is viewed from above the top surface **166** or from below the bottom surface **167** thereof. The plurality of threads **170** of FIG. **9** are diagrammatically illustrated for the purpose of reflecting different color characteristics of the overall top panel **165** and particularly the appearance of the top surface **166** thereof. However, the fabric **165** is preferably knitted upon a circular knitting machine, such as the OVJA 1.6 E 511 manufactured and sold by Mayer & Cie of Germany which through positive needle guidance, diagonal stitch-forming and electronic individual needle selection in conjunction with electronic pattern resetting in externally resettable cams offers reliable pattern repetition in bulk tip-top jacquard qualities. Depending upon the particular control of the conventional circular knitting machine, virtually any particular pattern desired can be knitted using virtually any number of different colored threads **170** to form the knitted top fabric panel **165**. In the present case the pattern selected is such that the threads **171**, **172** exposed at the top surface **166** when viewed from above define three different firmness indicating areas or firmness indicating zones **181**, **182** and **183** (FIG. **7**) corresponding in size and profile and overlying the respective head firmness zone **141**, the torso firmness zone **142** and the foot firmness zone **143**. The specific pattern of the knit fabric **165** both at the top surface **166** and at the bottom surface **167** is a plurality of longitudinally extending substantially parallel spaced rows **184** of knitted diamond areas **185** which from row-to-row are also in spaced aligned tip-to-tip opposing relationship, as is most readily apparent from FIG. **8** of the drawings. As is best indicated in FIG. **8** and in the diagrammatic cross-sectional view of FIG. **9**, the individual diamond shaped areas **185** are formed by white threads **171** circularly knit into the top surface **166** of the firmness indicating zones **181**, **183**, but in the center firmness indicating zone **182** the diamond shaped circularly knitted areas **185** are formed by the colored threads **172** (gold or tan) which clearly distinguishes the firmness indicating zone **182** from the firmness indicating zones **181**, **183** (FIG. **7**). The bottom surface **167** of the knitted top fabric **165** is formed only by colored threads **172**. Therefore, when viewed from below, the interior or bottom surface **167** is formed of threads **172** of a single color, such as gold or tan, but lacks white or similar threads **171** which provide the marked contrast obvious in FIG. **7** in which the exposed colored/darker threads **172** at the top surface **166** clearly delineate or define the torso firmness indicating zone **182**, as opposed to the lighter firmness indicating zones **181**, **183** effected by the exposed white threads **171** at the top or upper surface **166** thereof. Therefore, though the pattern of the entire circular knit top fabric or top panel **165** is identical when viewed from the top surface **166** and the bottom surface **167**, the bottom surface **167** is defined throughout its entire area only by the colored threads **172**, whereas the colored threads **172** at the top surface **166** define or delimit the torso indicating firmness zone **182**. The latter relationship assures that during manufacture, fabrication of the mattress **100** cannot be done incorrectly because workers can simply look at the knit top fabric panel **165** and know that the "all-dark" side goes down (dark side down), whereas the definitively differently colored firmness indicating zones **181**-**183** go up, resulting in the appearance readily apparent in the mattress **100** of FIG. **7**.

Though also apparent from the drawings, it should be noted that the firmness indicating zones **181**, **182** and **183** are coextensive in size and shape to the respective variable firmness panels **151**, **152**, **153** and the respective firmness zones **141**, **142**, **143**. Therefore, when in use, equally obvious to a user are the firmness zone because of the relative firmness thereof evident by the firmness indicating zones **181**, **182** and **183**.

Although a preferred embodiment of the invention has been specifically illustrated and described herein, it is to be understood that minor variations may be made in the apparatus without departing from the spirit and scope of the invention, as defined by the appended claims.

What is claimed is:

1. A mattress comprising a polygonal border defined between upper and lower terminal peripheral edge portions and upper and lower panels collectively defining a substantially closed chamber, said border and panels being constructed from synthetic plastic material, means for bonding said upper panel to said border upper terminal peripheral edge portion, means for bonding said lower panel to said border lower terminal peripheral edge portion, a spring unit housed substantially in said chamber, said spring unit including a plurality of springs each having opposite upper and lower loop portions positioned substantially adjacent the respective upper and lower panels, an upper peripheral border rod located substantially adjacent said upper panel, means for securing at least selective ones of said springs to said upper peripheral border rod along the periphery of said upper peripheral border rod, said spring unit being devoid of a lower peripheral border rod at said springs lower loop portions, means for peripherally interlocking said upper peripheral border rod substantially against movement relative to said border and upper panel, said upper peripheral border rod being substantially interlocked against lateral and longitudinal movement by an upper inner peripherally extending distorted corner of said chamber defined by said upper panel and said polygonal border in interlocking relationship with said upper peripheral border rod, said spring unit being devoid of fabric pockets adapted to house springs, said plurality of springs setting-off at least three firmness zones including at least a head firmness zone, a leg firmness zone and a torso firmness zone between the head and leg firmness zones; a top fabric substantially covering said firmness zones, said top fabric being knit from threads of at least two different colors, said top fabric having interior and exterior surfaces, the threads at the exterior surface of said top fabric being knit to define three different firmness indicating areas corresponding to the three firmness zones, and at least one of said firmness indicating areas being defined by threads differing in color as compared to the color of the threads defining at least one of the two remaining firmness indicating areas.

2. The zoned mattress as defined in claim **1** wherein the threads of the two remaining firmness indicating areas are of substantially the same color.

3. The zoned mattress as defined in claim **1** wherein the threads of the two remaining firmness indicating areas are of substantially the same color, and said last-mentioned thread color is lighter than the thread color of the at least one firmness indicating area.

4. The zoned mattress as defined in claim **1** wherein the top fabric is circular knit.

5. The zoned mattress as defined in claim **1** including an inlay between the top fabric interior and exterior surfaces.

6. The zoned mattress as defined in claim **1** including an inlay of polymeric/copolymeric yarn between the top fabric interior and exterior surfaces.

7. The zoned mattress as defined in claim **1** wherein the three different firmness indicating areas each include a plurality of substantially identical repetitive pattern-defining areas, wherein two of the three different firmness indicating areas differ from the remaining one of the three different firmness indicating areas in color alone.

8. The zoned mattress as defined in claim **1** wherein the interior surface of the top fabric is substantially one color.

9. The zoned mattress as defined in claim **2** wherein the top fabric is circular knit.

10. The zoned mattress as defined in claim **2** including an inlay between the top fabric interior and exterior surfaces.

11. The zoned mattress as defined in claim **2** including an inlay of polymeric/copolymeric yarn between the top fabric interior and exterior surfaces.

12. The zoned mattress as defined in claim **2** wherein the three different firmness indicating areas each include a plurality of substantially identical repetitive pattern-defining areas, wherein two of the three different firmness indicating areas differ from the remaining one of the three different firmness indicating areas color alone.

13. The zoned mattress as defined in claim **3** including an inlay between the top fabric interior and exterior surfaces.

14. The zoned mattress as defined in claim **5** wherein the three different firmness indicating areas each include a plurality of substantially identical repetitive pattern-defining areas, wherein two of the three different firmness indicating areas differ from the remaining one of the three different firmness indicating areas in color alone.

15. The zoned mattress as defined in claim **5** wherein the interior surface of the top fabric is substantially one color.

* * * * *

United States Patent [19]

Kraft

[11] **Patent Number: 4,679,266**

[45] **Date of Patent: Jul. 14, 1987**

[54] **VARYING FIRMNESS MATTRESS**

[76] Inventor: **Eugene Kraft,** 2760 W. Warren Ave., Detroit, Mich. 48208

[21] Appl. No.: **830,091**

[22] Filed: **Feb. 18, 1986**

[51] **Int. Cl.**[4] **A47C 27/00**

[52] **U.S. Cl.** **5/464**; 5/474

[58] **Field of Search** 5/446, 447, 464, 474

[56] **References Cited**

U.S. PATENT DOCUMENTS

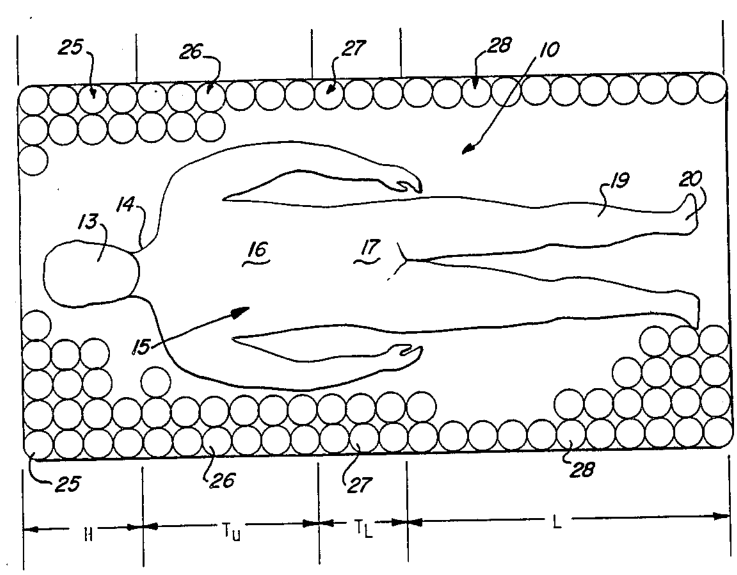
3,551,924	1/1971	Frye, Sr.	5/447
3,828,378	8/1974	Flam	5/464
3,885,258	5/1975	Regan	5/464
3,999,234	12/1976	Regan	5/464
4,042,987	8/1977	Rogers	5/464
4,053,957	10/1977	Regan	5/464
4,161,045	7/1979	Regan	5/447
4,161,046	7/1979	Golembeck	5/464
4,222,137	9/1980	Usami	5/446

Primary Examiner—Gary L. Smith
Assistant Examiner—Michael F. Trettel
Attorney, Agent, or Firm—Cullen, Sloman, Cantor, Grauer, Scott and Rutherford

[57] **ABSTRACT**

A standard size mattress is formed with four longitudinally arranged regions, i.e., a head, an upper torso, a lower torso and a leg support region, for supporting a person comfortably and substantially level. The length of the head support region is equal to the approximate height of a person's head and neck. The length of the combined torso support regions is equal to the approximate height of a person's torso from the crotch to the juncture with the neck, with the upper torso region being roughly two-thirds and the lower torso region being roughly one-third of the length of the combined torso support regions. The length of the leg portion is equal to approximately the height of the legs from the crotch to the bottom of the feet. Thus, the lengths of the four regions are roughly in the ranges of 18%, 23%, 14% and 45%, respectively, of the length of a typical standard mattress. Each of the head, leg support and the two torso regions are of a single, constant support firmness, which differ from their adjacent regions. The upper torso region is the most firm, the head and lower torso regions are of about the sâme mid-firmness, and the leg support region is least firm. The lengths of the torso and leg regions vary for different length standard mattresses while the head region remains approximately the same length for different length mattresses.

7 Claims, 2 Drawing Figures



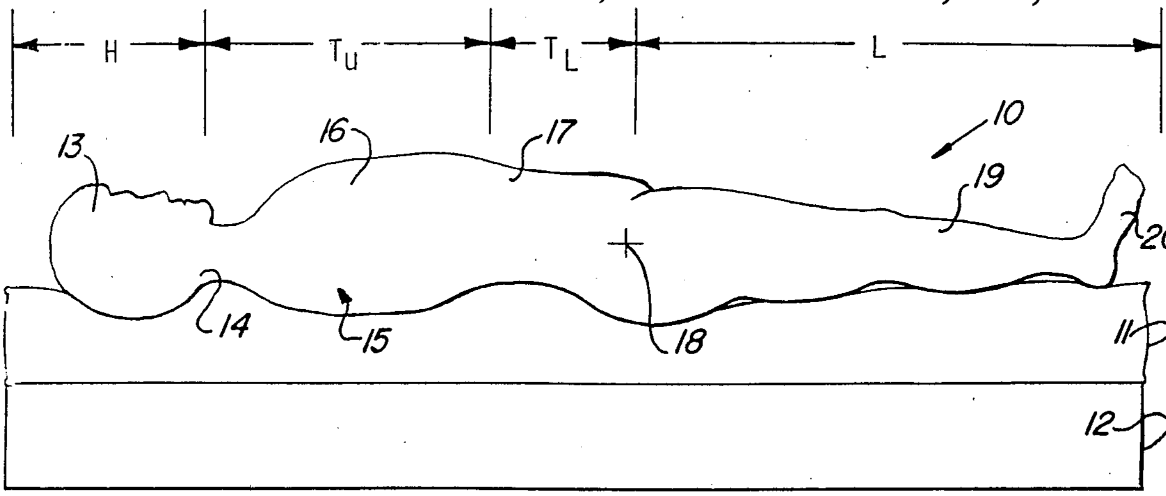

H
T_U
T_L
L
10
13
16
17
19
20
14
15
18
11
12

Fig-1

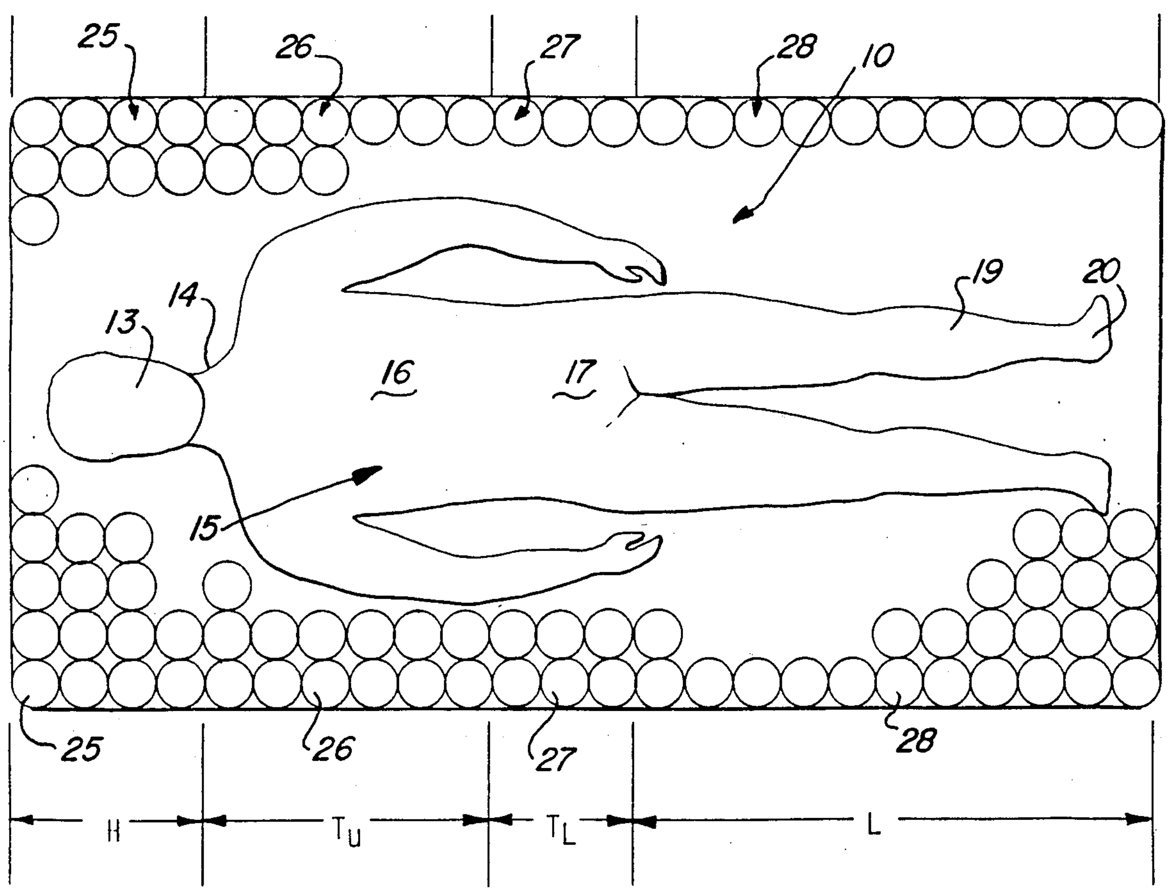

25
26
27
28
10
19
20
14
13
16
17
15
25
26
27
28
H
T_U
T_L
L

Fig-2

VARYING FIRMNESS MATTRESS

BACKGROUND OF INVENTION

Conventional mattresses and box springs or foundations are of uniform firmness along their entire lengths and widths. A conventional mattress, whether of the coil spring construction or water-bed or foam or air constructions, is so soft that the upper torso of the person resting upon it tends to sag down relative to the legs. Thus, the legs are ordinarily elevated slightly relative to the lower part of the torso. This results in the lower part of the torso not being properly supported when the individual is lying in a straight line either on his back or side.

As is well known, individuals vary considerably in size, weight and proportions. However, commercially available mattresses which are made in mass production, are typically made in certain predetermined, standard sizes, such as in 75 inch, 80 inch, or 84 inch lengths and the like. Since a mattress cannot be economically made to individually fit each person who rests upon it, the mattress industry has produced mattresses which are of, pre-selected standard uniform firmnesses. That is, a particular mattress may be of a soft or a hard or a medium firmness. Hence, the individuals resting upon a mattress do not get the optimum or, in many cases, even a reasonably comfortable support for their backs, that is, the lumbar regions and adjacent portions of the body. Frequently, the lumbar region is not in full contact with the mattress so that it is not supported.

Mattresses have been made with a denser, or firmer central one-third, as compared with the upper and lower thirds, taken along their length directions. This provided a symetrical construction, wherein the upper and lower third were of the same density to provide the same support firmness, and the central one-third had a greater firmness. But this has not given adequate back support because of the wide variation in anatomy of people. Thus, it has not bee thought to be commercially feasible to adequately vary the firmness of support given by a single mattress. The invention herein relates to producing a single mattress having regions of different firmnesses proportional to the average linear weight distribution. Such assymetrical construction provides a reasonably comfortable and level support for the maximum number of people, notwithstanding some variations in their sizes and weights.

SUMMARY OF INVENTION

The invention herein relates to a mattress, such as a conventionally constructed coil spring mattress, or a water-bed, or air or foam type mattress or box spring, which is divided along its length into four major regions, of different firmnesses. The uppermost or head region corresponds in length to roughly the height of an average individual's neck and head. The middle or combined torso region corresponds in length to roughly the height of the average individual's torso between the juncture of the neck to the shoulders to the crotch, and is divided into an upper two-thirds torso region and a lower one-third torso region. The lowermost or leg region corresponds in length to the height of the average person's feet and legs up to approximately the crotch.

Each of the regions or zones is of a uniform firmness. However, the adjacent firmnesses differ from each other. The upper torso region is the most firm, the head region is of mid-firmness and the leg region is least firm. The lower torso region is about as firm as the head region. By relating the lengths and firmnesses of each region roughly to the approximate average heights and weights of the corresponding portions of the human body, a mattress, or a box spring, is provided which is a substantial improvement in support comfort and in providing level support for the user. Thus, even though the mattresses are mass produced to standard lengths and widths, and even though the individual users may vary in size and weight and the matresses may support both males and females, whose bodies generally are substantially different in weight and proportions, the overall results produced by the relationships of the four support regions are a substantial improvement for most people.

In providing mattresses of different standard lengths, such as a standard 75 inch mattress or a standrd 80 inch mattress, it is contemplated that the head support regions will be about the same length on all such mattresses, but the torso regions and the leg regions will be varied in length for different length mattresses. This simplifies the mass production of mattress, while producing the improved effect.

In this construction, the transitions between the regions of a mattress are at points that correspond to where the average individual's body transitions occur. That is, the mattress region transitions are located at the places where major weight and size changes occur in the average individual's body. These are at the junction between the neck and shoulders, at about the waist, and at the connection of the legs to the torso, i.e., at about the crotch. As mentioned, the head region may be of a generally fixed length since there are little variations in the weights and heights of most adult human heads and necks. Thus, the mattress is constructed with its several regions roughly matching the lengths between the natural transition points of the average body and with the firmnesses of the mattress regions roughly matching the weights of average body portions between the natural transition points. This provides economically feasible, commercially producable, standard mattresses which are able to give reasonably comfortable and level support to a wide range of individuals lying either on their backs or sides.

One of the objects of the present invention is to produce a varying firmness mattress which can be manufactured with approximately the same ease as a standard, uniform firmness mattress and can be made using conventional mattress construction materials and manufacturing techniques. Thus, the invention permits the use of uniform size and shape springs in each of the three body support regions. Changes in firmness from one region to another can be accomplished, for example, by varying the wire gauge of the springs in the different sections or by varying the barrel of the springs. This permits use of conventional assembly equipment and production steps, by making sub-assemblies of different gauge springs for each region or zone and then joining the sub-assemblies end-to-end.

Another object is to provide a mattress with the lower torso support area softer than the upper torso support area so that the lower torso gets well into the mattress to permit good mattress support for the lower back regions of the upper torso.

These and other objects and advantages will become apparent upon reading the following description of which the attached drawings form a part.

DESCRIPTION OF DRAWINGS

FIG. **1** is a schematic, elevational view of a human figure resting upon a mattress;

FIG. **2** is a schematic, plan view showing the human figure resting upon the mattress with coil springs schematically shown.

DETAILED DESCRIPTION

FIG. **1** schematically shows a human figure **10** resting upon a mattress **11** which is supported upon a box spring **12**. The human figure includes a head **13** and a neck **14** joined to a torso **15**. The torso comprises an upper torso **16** and a lower torso **17**. At the crotch area, i.e., below the joint **18** between the femur or thigh bone and pelvis, there is a natural transition point at the connection between the torso and the legs **19**. The feet **20** are schematically shown at the foot or lower end of the mattress.

An object of this invention is to support the person using a mattress in a substantially level position with a good support for the lower back. Ideally, the mattress should yield a varying amount at each place on the mattress in response to the varying weight of the different parts of the human body resting upon it. That is, ideally, every square inch of the mattress should be made with the appropriate firmness or springiness to correspond to the precise portion of the human body resting upon it. Obviously, that is not feasible, not only because of the commercial need for mass production of mattresses of standard sizes and firmnesses, but also because of the varying sizes and weights and proportions of persons using a particular mattress, and because individuals frequently move their positions on the mattresses. Hence, it is not feasible to precisely support the human body upon a mattress at all times or even at any particular time.

The invention herein is concerned with a mattress which is feasible to construct in mass production, and which will provide a reasonable solution to the problem of providing good support despite such wide variances in people, positions, etc.

Anatomical studies of large numbers of people have produced data concerning averages of heights and weights. For example, an average height male is about 5' 10". Comparisons between average male and female weights and heights are useful in understanding the lengths and firmnesses of the regions comtemplated in the present mattress. These are as follows:

	Distance from top of head to:		
	Shoulders	Crotch or Leg Juncture	Bottom Of Feet
Average Male	12.9"	37.8"	69.9"
Average Female	11.9"	35.2"	63.5"

Averages of Body Weight for General Population in U.S.		
Body Size	Male	Female
Large	227.8 lbs.	204.7 lbs.
Average	172.8 lbs.	139.8 lbs.
Small	126.1 lbs.	105.4 lbs.

The weights of various major segments of the human body, in terms of averages, can be expressed as a percentage of total body weight as follows:

Body Segment	Male	Female
Head and Neck	6.7%	6.7%
Chest	30.2%	26.3%
Abdomen	2.9%	4.1%
Pelvis Region	22.6%	25.6%
Right Upper Arm	2.4%	2.2%
Left Upper Arm	2.4%	2.2%
Right Forearm & Hand	2.4%	1.9%
Left Forearm & Hand	2.4%	1.9%
Right Thigh	8.0%	9.1%
Left Thigh	8.0%	9.1%
Right Calf & Foot	6.0%	5.5%
Left Calf & Foot	6.0%	5.5%

Considering the roughly average lengths of the four major body sections, (1) the head section (i.e., head plus neck up to junction with shoulder), (2) the upper torso section (i.e., between shoulders and waist), (3) the lower torso section (between the waist and crotch or juncture with legs), and (4) leg section (i.e., from crotch to the bottom of feet), a mattress can be divided into four main regions as follows: a head, an upper torso, a lower torso and a leg support region. The upper torso region generally includes the chest and abdomen, etc., and the lower torso region comprises the pelvic area, etc.

The linear divisions and weight distribution along the height of an average male is roughly as follows:

Area	% of Length of Body	Weight Distribution
Head/neck	18.7%	6.7%
Upper Torso	25%	42.7% (including weight of arms)
Lower Torso	12.5%	22.6% (excluding weight of arms)
Legs/Feet	43.75%	28%

Corresponding linear divisions can be approximated on standard length mattress, as for example, a 75 inch long and an 80 inch long mattress, as follows:

For a standard 75 inch long mattress:		
Region	Approximate Percentage of Length	Length - Inches
Head Region	18.7%	14
Mid or Torso Region	37.3%	38
Upper Torso Zone	24.0%	18
Lower Torso Zone	13.3%	10
Leg Region	44.0%	33

For a standard 80 inch long mattress:		
Region	Approximate Percentage of Length	Length - Inches
Head Region	17.5%	14
Mid or Torso Region	37.5%	30
Upper Torso Zone	22.5%	18
Lower Torso Zone	15.0%	12
Leg Region	45.0%	36

In constucting a conventional coil spring mattress, using approximations of this data, with springs which generally are about three inches or slightly more in diameter (as for example, roughly 3.125 inches in diameter), it can be seen that the same number of rows of springs, in the lengthwise direction, can be used for the head support region for both length mattresses. However, the toso support regions, which use more rows of springs than the head region, will vary a little in the number of springs in accordance with the varying length of the mattress. The same spring row variance takes place in the case of the foot or leg support region. Examples of a practical number of springs are as follows:

For a standard 75 inch long coil spring mattress:		
Head Region	4 rows	16.7% of length
Torso Region combined	9 rows	37.5% of length
Upper Torso Zone	(6 rows)	25% of length
Lower Torso Zone	(3 rows)	12.5% of length
Leg Region	11 rows	45.8% of length
Total	24 rows	
For a standard 80 inch long coil spring mattress:		
Head Region	4 rows	15.4% of length
Torso Region combined	10 rows	38.4% of length
Upper Torso Zone	(6 rows)	25% of length
Lower Torso Zone	(4 rows)	15.4% of length
Leg Region	12 rows	46.2% of length
Total	26 rows	

The calculations of approximate percentages of lengths of the springs in each region are based upon the number of rows of springs for the region divided by the total number of rows of springs along the length of the mattress. For this purpose the spring diameters are assumed to be the same size. It can be seen that the percentage of springs in the four regions are close for both the longer and shorter mattress and for the average human body.

Thus, it can be seen that using rough figures, the four regions handle most people. The springs can be made of different firmnesses to accommodate different weights and weight distributions.

Turning to FIG. 2, the human body, schematically shown as **10**, is rested upon a coil spring mattress (schematically shown) formed of numerous rows of coils **25** which make up the head support region H, numerous rows of coil springs **26** and **27** which, respectively, make up the upper torso support region T_u and T_L and rows of coil springs **28** which make up the leg support region L.

The two springs may be of any suitable conventional type. For example, conventional hour glass form or cylindrical form or continuous, integral wire, springs or variations of these may be used. These various types of springs are commercially available and well known. By using springs that are made of thicker or thinner gauges of wire, or more or less resilient wire, or of differing barrels or hour glass sizes, etc., the stiffnesses of the springs can be adjusted. Examples of varying the spring gauge in standard 75 inch and 80 inch length coil spring mattress are:

Region	Approx. Length	Number of Rows of Coils	Gauge of Coil Wire
Example of 75 inch long coil spring mattress			
Head	14"	4	13
Upper torso	18"	6	12.5
Lower torso	10"	3	13
Legs/feet	33"	11	13.5
Example of 80 inch long coil spring mattress			
Head	14"	4	13
Upper torso	18"	6	12.5
Lower torso	12"	4	13
Legs/feet	36"	12	13.5

The stiffer, heavier gauge, i.e., 12½ gauge, wire in the upper torso region provides a relatively firmer or stiffer body support than the 13 gauge springs of the adjacent head support and lower torso regions. The 13½ gauge springs of leg support region are considerably less firm.

The firmness of the mattress or box spring can also be varied by varying the density of the support. For example, more or less springs can be used to control firmness. In the case of a foam mattress, for example, denser or less dense foam material can be used.

To summarize, a standard length mattress, e.g., 75 inch or extra long 80 inch length, is divided into four regions, namely the head region which comprises roughly 18% of the mattress length, the torso support region comprising roughly 73% of the mattress length and which is subdivided into an upper zone of roughly 25% and a lower zone of roughly 14% and the leg support region comprising roughly 45% of the mattress length. The firmness of the springs in each one of the head and leg regions and the two torso regions is constant. But firmness varies in an assymetrical fashion along the length of the bed. The width of the bed can vary either as a single bed, a queen size or king size, etc. by varying the number of springs in each row. For example, a double width bed may have 14 springs in a transverse row, and queen and king size widths may have 15 and 19 springs, respectively. The firmness is uniform from side to side at any particular location on the mattress. However, in some mattresses the springs along the outer edges may be of a stiffer gauge (e.g., 12½ gauge) to form a stiff border to maintain the shape of the mattress.

The same sort of firmness variations can be applied to a box spring used to support a mattress or with other types of matresses such as a water, air or foam mattress, etc.

Thus, the term mattress as used herein also encompasses foundations, such as box springs.

By way of examples of 75 inch and 80 inch long spring box springs, using larger diameter springs:

Region	Number of Rows Of Coils	Gauge of Coils
For a standard 75 inch long box spring:		
Head	2	10
Upper torso	2	9.5
Lower torso	1	10
Legs/feet	4	10.5
For a standard 80 inch long box spring:		
Head	2	10
Upper torso	2	9.5
Lower torso	1	10
Legs/feet	5	10.5

Although, not precise, the firmness variances described above will accommodate a substantial portion of the population in the United States and provide a substantial improvement in comfort, better support of the lumbar region of the body, and level support of the body.

Having fully described an operative embodiment of this invention, I now claim:

1. A standard type mattress formed with varying firmnesses for supporting a predetermined, generally average height and weight person comfortably and substantial level, comprising:

the mattress being divided into four major body support regions along its length, namely, a head support region, an upper torso support region, a lower torso support region and a leg support region;

the head support region extends from the mattress upper end towards the lower end a distance equal to roughly the height of an average head and neck beginning about at the juncture of the neck to the shoulders to the top of the head;

the upper torso support region extends a distance roughly equal to the average distance between about the neck and shoulder juncture to the waist, and the lower torso support region extends a distance roughly equal to the average distance between about the waist to the crotch so that the upper torso region is roughly two-thirds and the lower torso region is roughly one-third the length of an average person's torso;

and the leg support region extends from the lower torso support region to the lower end of the mattress a distance roughly equal to between about the height of the legs of an average person from the crotch to the bottom of feet;

and with each of the head and leg support regions and the upper and lower torso regions being constructed so that it has its own uniform springy firmness, with the upper torso region being the most firm, the head region being of lesser firmness than the upper torso region, the leg region being of considerably lesser firmness than the head region, and the lower torso region being of the firmness of roughly about that of the head region;

and with the several firmnesses being pre-selected to provide a substantially level body support lengthwise upon the mattress.

2. A mattress as defined in claim 1, and with the length of said head region being roughly 18% of the mattress length;

the length of the combined torso region being roughly 37% of the mattress length and with the upper torso region formed of roughly the upper two-thirds of the combined torso region length, with remainder forming the lower torso zone;

and the length of the leg support region being roughly 45% of the mattress.

3. A mattress as defined in claim 1, and with the firmnesses of the lower torso region being the same as that of the head region.

4. A mattress as defined in claim 1, and said mattress being formed of a conventional coil spring construction, and wherein the number of coil springs measured in a row along the mattress length in the head support region is a predetermined number regardless of the length of the mattress, but the number of the springs in the torso support region and in the leg support region vary in number depending upon the overall length of the mattress.

5. A mattress as defined in claim 4, and wherein the springs in each one of the head and leg support regions and the upper and lower torso zones are made with the same springy firmness, but with the springs of each region being of a different firmness than the springs in the next adjacent region.

6. A mattress as defined in claim 5, and wherein the sizes of the springs in each of the regions are the same and the gauge of the spring wire of all of the springs in any one region is the same, but with the gauges varying in the springs in one region relative to the other regions, so that the springs in the upper torso region are of the heaviest, stiffest gauge, whereas the springs in the head support region are of thinner, less stiff gauge than that of the springs in the upper torso support region, and the springs in the leg support region are of an even thinner and less stiff gauge than that of the springs of the head support region, and the springs in the lower torso region are about the same gauge as the springs in the head region.

7. A mattress as defined in claim 6 and including a row of stiff springs, i.e., springs made of stiffer gauge wire than the gauges used for the head and leg regions, arranged around the periphery of the mattress to form a stiffer border around the edges of the mattresses.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 4,679,266

DATED : July 14, 1987

INVENTOR(S) : Eugene Kraft

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In claim 1, line 4, change "substantial" to --substantially--

In claim 1, line 5, after "four", add --adjacent-- and in line 6, after "regions", add --sequentially--

Signed and Sealed this

Thirteenth Day of October, 1987

Attest:

DONALD J. QUIGG

Attesting Officer

Commissioner of Patents and Trademarks

US005868383A

United States Patent [19]
Codos

[11] Patent Number: 5,868,383
[45] Date of Patent: Feb. 9, 1999

[54] **MULTIPLE RATE COIL SPRING ASSEMBLY**

[75] Inventor: **Richard N. Codos**, Warren, N.J.

[73] Assignee: **L&P Property Management Company**, South Gate, Calif.

[21] Appl. No.: **827,198**

[22] Filed: **Mar. 27, 1997**

[51] **Int. Cl.**[6] **F16F 3/10**; B65B 9/00; B65B 63/00

[52] **U.S. Cl.** **267/80**; 5/655.8; 5/720; 53/114; 53/450; 29/91.1; 367/166.1; 367/91

[58] **Field of Search** .... 267/80, 81, 91–101, 267/288, 166, 166.1, 168, 180, 142, 144, 33, 152, 153; 5/720, 655.8, 248, 256; 29/91.1, 91; 53/114, 550, 450, 526, 127, 438; 156/70; 140/3 CA, 92.4

[56] **References Cited**

U.S. PATENT DOCUMENTS

182,924	10/1876	Hansell	267/288
333,983	1/1886	Vose	267/288
394,007	12/1888	Pfeil	267/166.1
1,466,617	8/1923	Foster .	
2,359,003	9/1944	Sawyer .	
2,430,098	11/1947	Rinch .	
2,616,684	11/1952	Richter	267/166.1
3,462,779	8/1969	Thompson .	
3,751,025	8/1973	Beery et al.	267/166.1
4,120,489	10/1978	Borlinghaus	267/166.1
4,234,983	11/1980	Stumpf .	
4,401,501	8/1983	Stumpf .	
4,439,977	4/1984	Stumpf .	
4,451,946	6/1984	Stumpf .	
4,485,506	12/1984	Stumpf et al. .	
4,566,926	1/1986	Stumpf .	
4,578,834	4/1986	Stumpf .	
4,679,266	7/1987	Kraft .	
4,854,023	8/1989	Stumpf .	
4,867,423	9/1989	Marsh .	
4,918,773	4/1990	Scott .	
4,972,536	11/1990	Scott .	
4,986,518	1/1991	Stumpf .	
5,054,178	10/1991	Zuger	29/91.1
5,099,757	3/1992	Jennings	267/168
5,105,488	4/1992	Hutchinson et al. .	
5,126,004	6/1992	Suenens et al. .	
5,136,740	8/1992	Kraft .	
5,325,553	7/1994	Ripley et al. .	
5,507,476	4/1996	Lin	267/166.1
5,572,853	11/1996	Clair et al.	53/114

FOREIGN PATENT DOCUMENTS

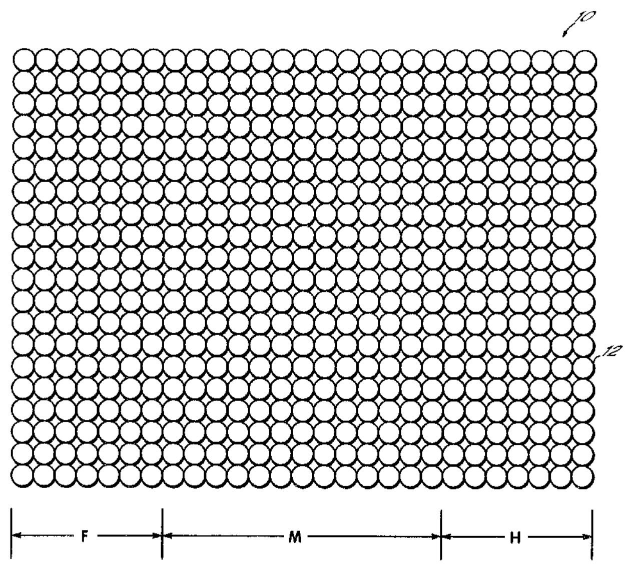
WO 94/18116 8/1994 WIPO .

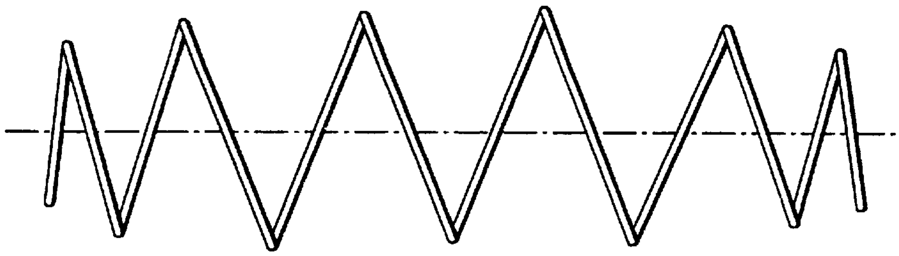
Primary Examiner—Douglas C. Butler
Attorney, Agent, or Firm—Wood, Herron & Evans, LLP

[57] **ABSTRACT**

An automated method for the manufacture of a coil spring assembly including inserting coil springs having predetermined multiple spring rates into respective individual pockets of a continuous pocket strip in a predetermined order. The predetermined multiple spring rates of at least one coil spring may differ from that of the other coil springs, and each of the multi-rate coils has at least two different spring rates. One or more wires having a substantially uniform thickness are coiled to form the multiple rate coil springs before insertion into the continuous pocket strip. The wire is preferably coiled to produce a coil spring having at least two different diameters and at least two different pitches. The method also includes cutting the spring-filled strip into one or more desired lengths, placing at least two spring-filled lengths adjacent to each other; and attaching adjacent lengths together. A coil spring assembly may thus be provided with one or more firmness zones. Perimeter coil springs may also be inserted into pockets corresponding to the outer perimeter of the coil spring assembly, and border wire may be added for stiffness.

48 Claims, 8 Drawing Sheets





PRIOR ART
FIG. 2

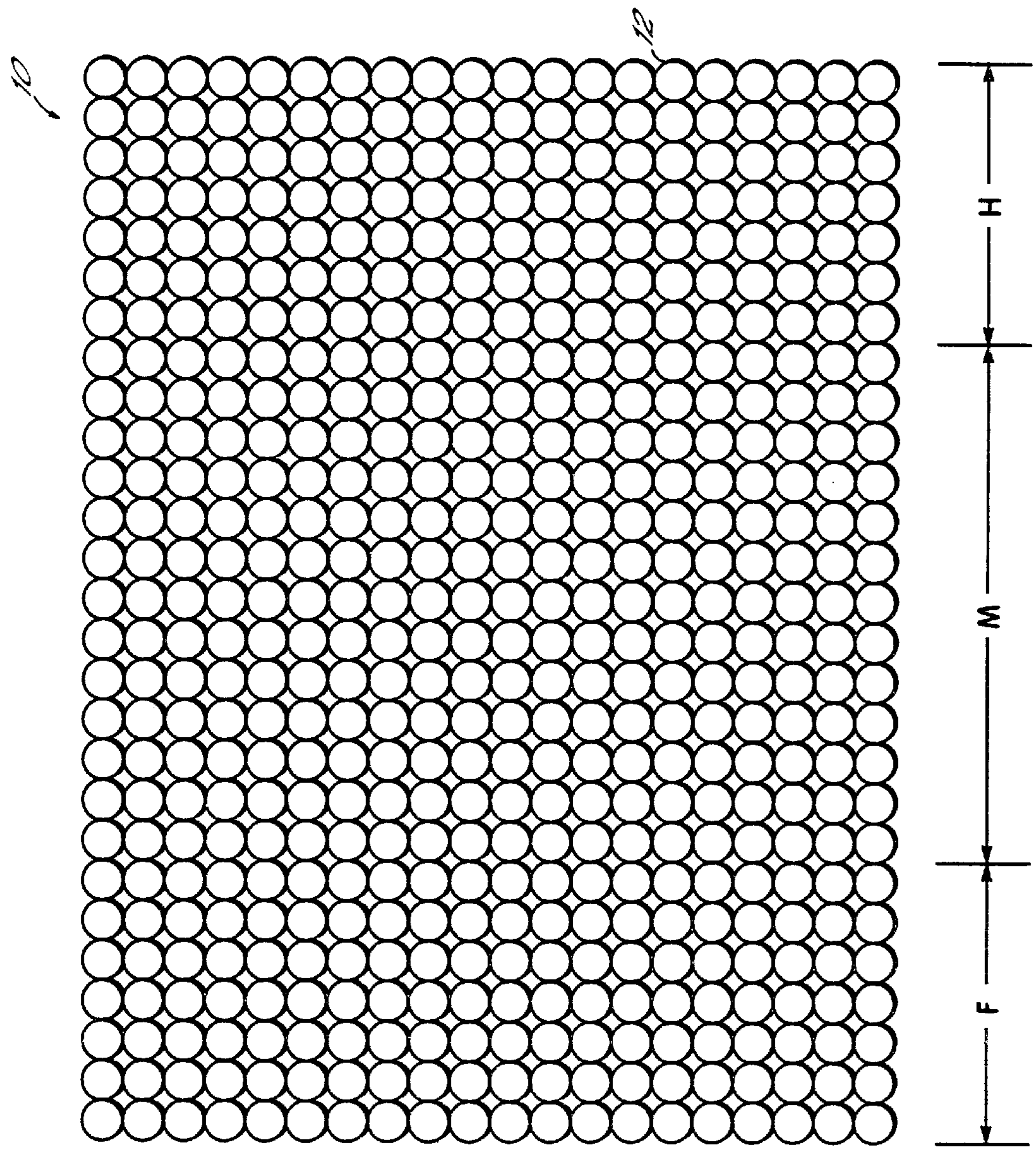


FIG. 1

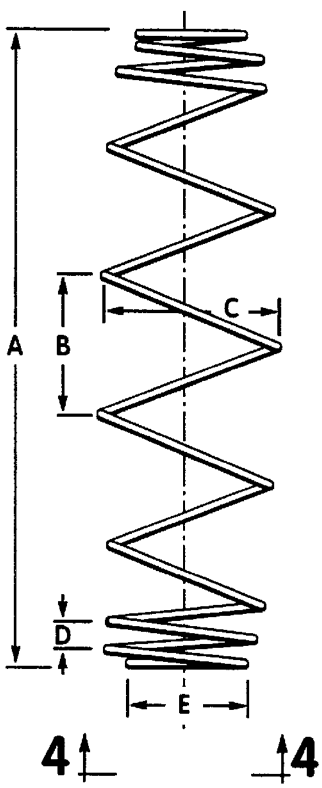


FIG. 3

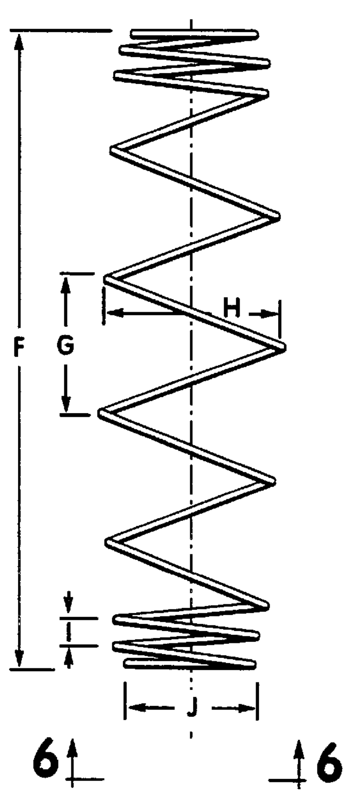


FIG. 5

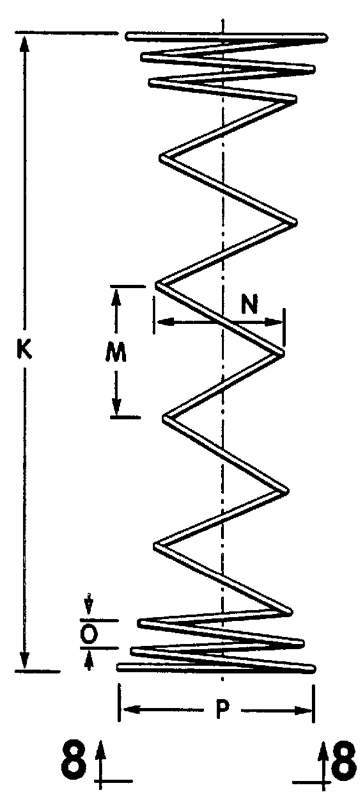


FIG. 7

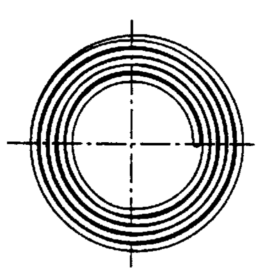


FIG. 4

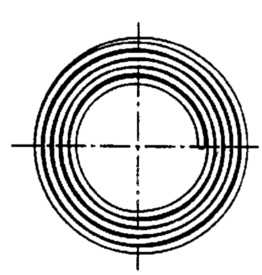


FIG. 6

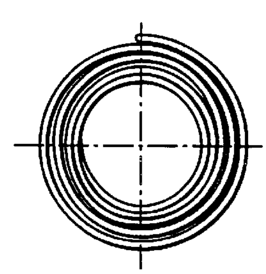


FIG. 8

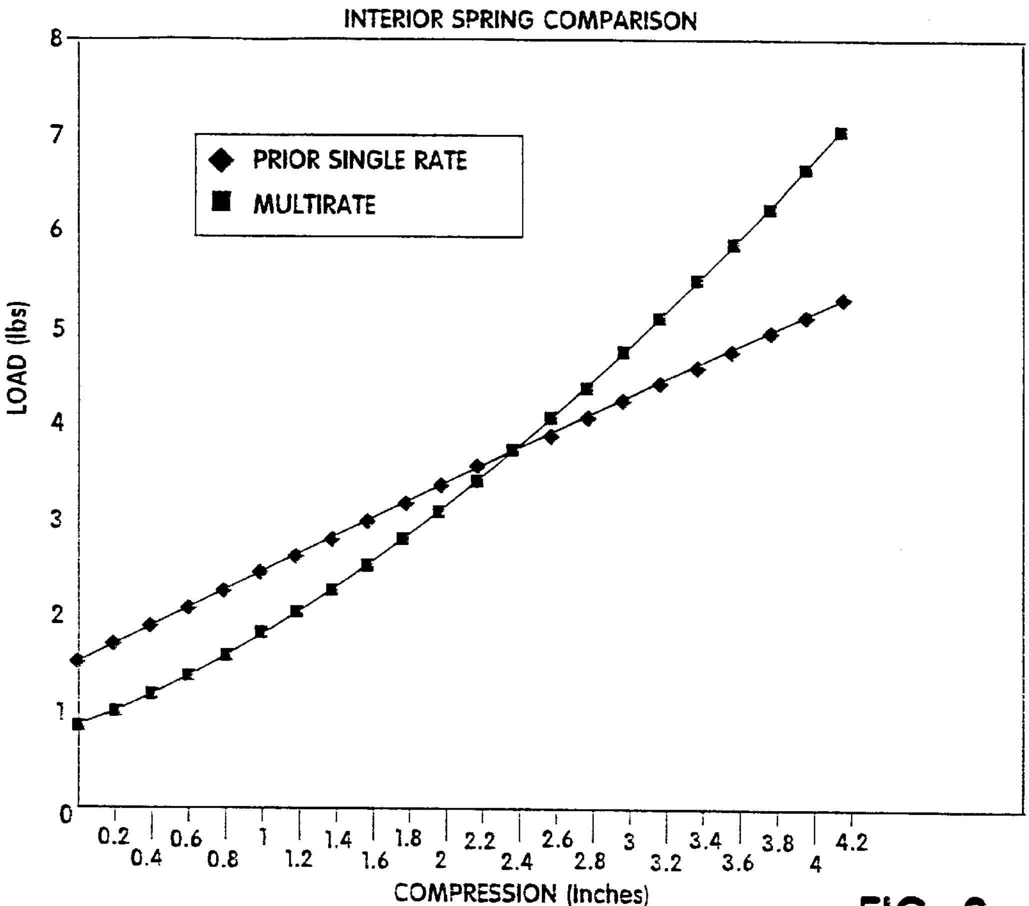


FIG. 9

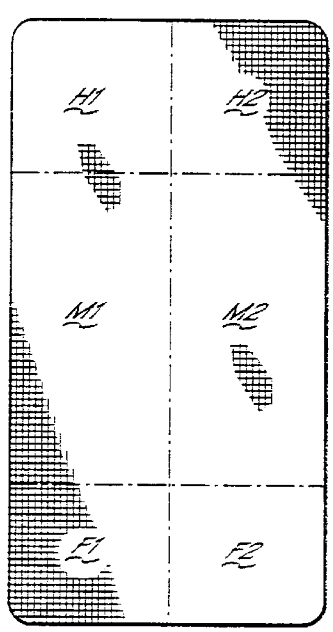


FIG. 10

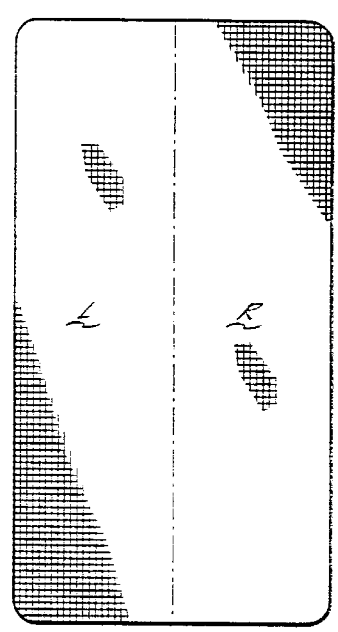


FIG. 11

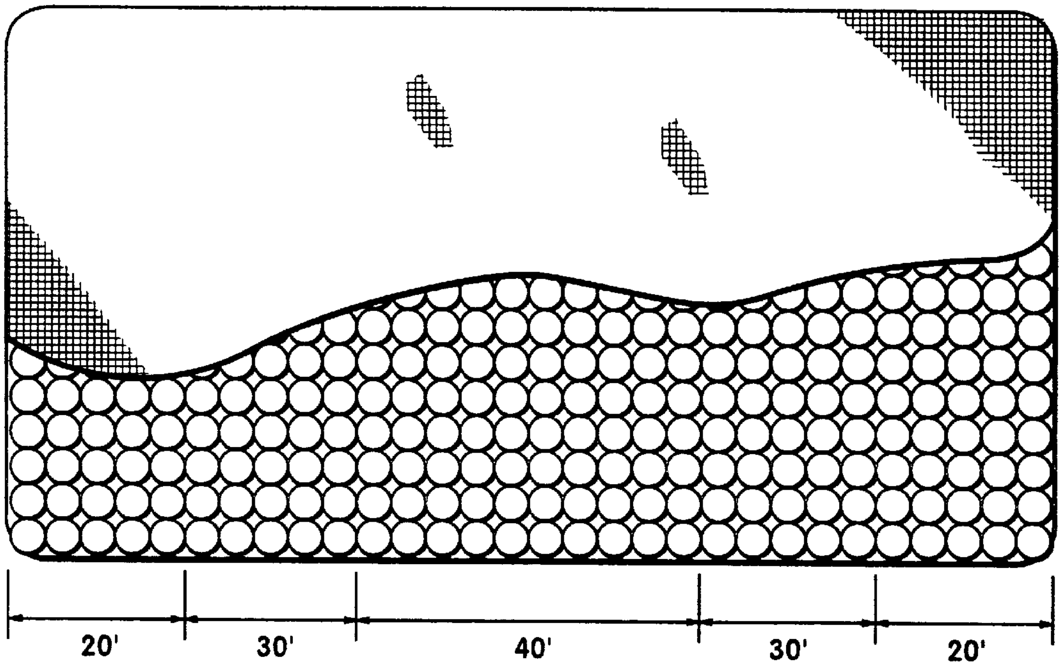


FIG. 12

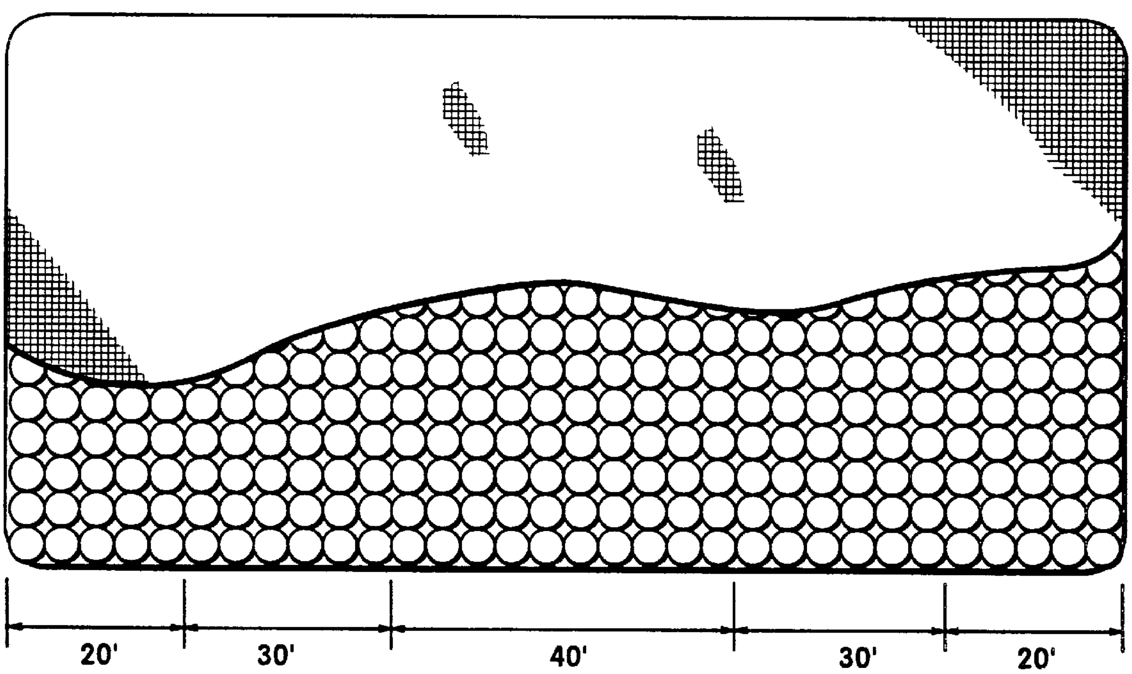


FIG. 13

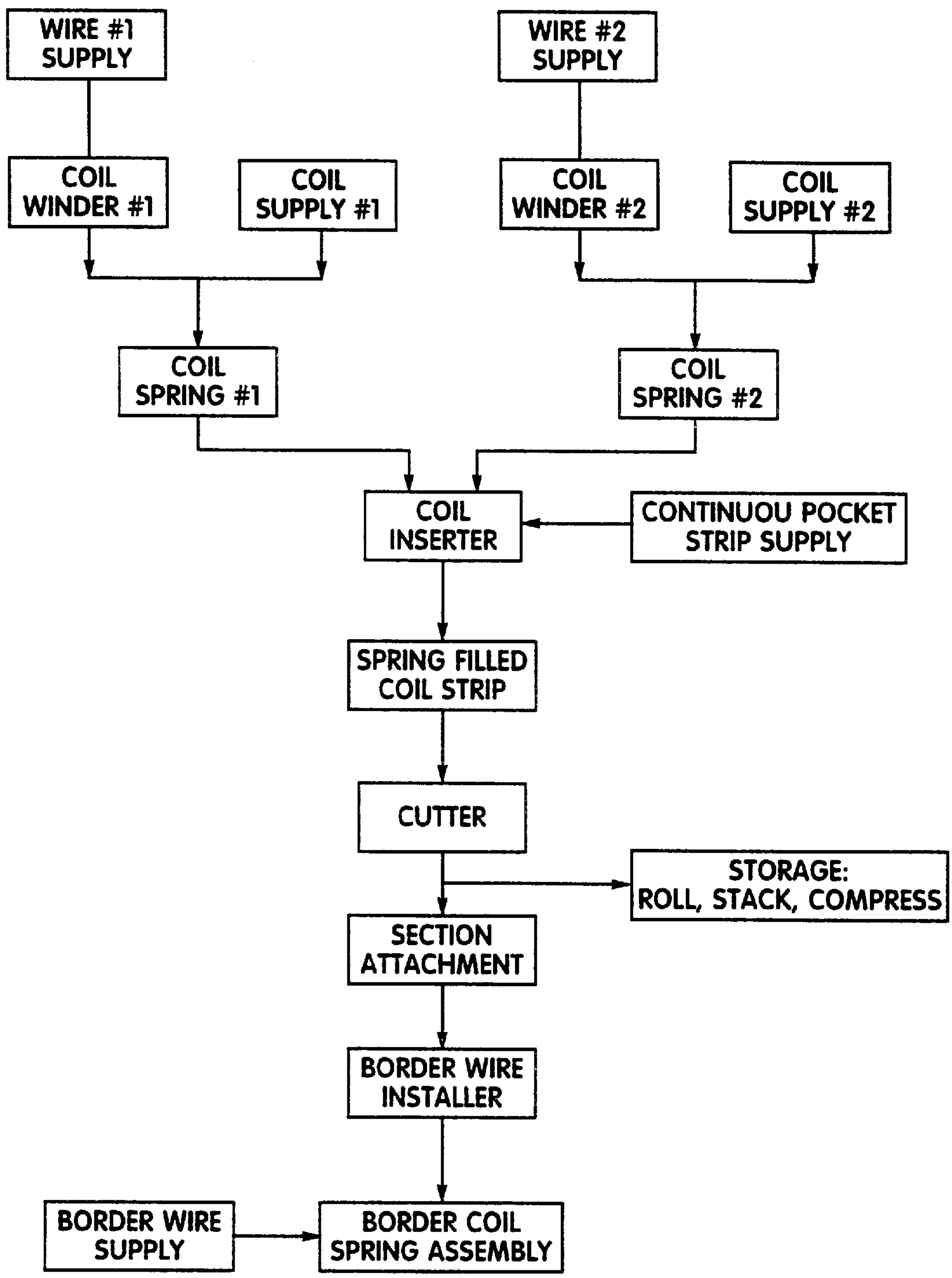

WIRE #1 SUPPLY
WIRE #2 SUPPLY
COIL WINDER #1
COIL SUPPLY #1
COIL WINDER #2
COIL SUPPLY #2
COIL SPRING #1
COIL SPRING #2
COIL INSERTER
CONTINUOU POCKET STRIP SUPPLY
SPRING FILLED COIL STRIP
CUTTER
STORAGE: ROLL, STACK, COMPRESS
SECTION ATTACHMENT
BORDER WIRE INSTALLER
BORDER WIRE SUPPLY
BORDER COIL SPRING ASSEMBLY

FIG. 14

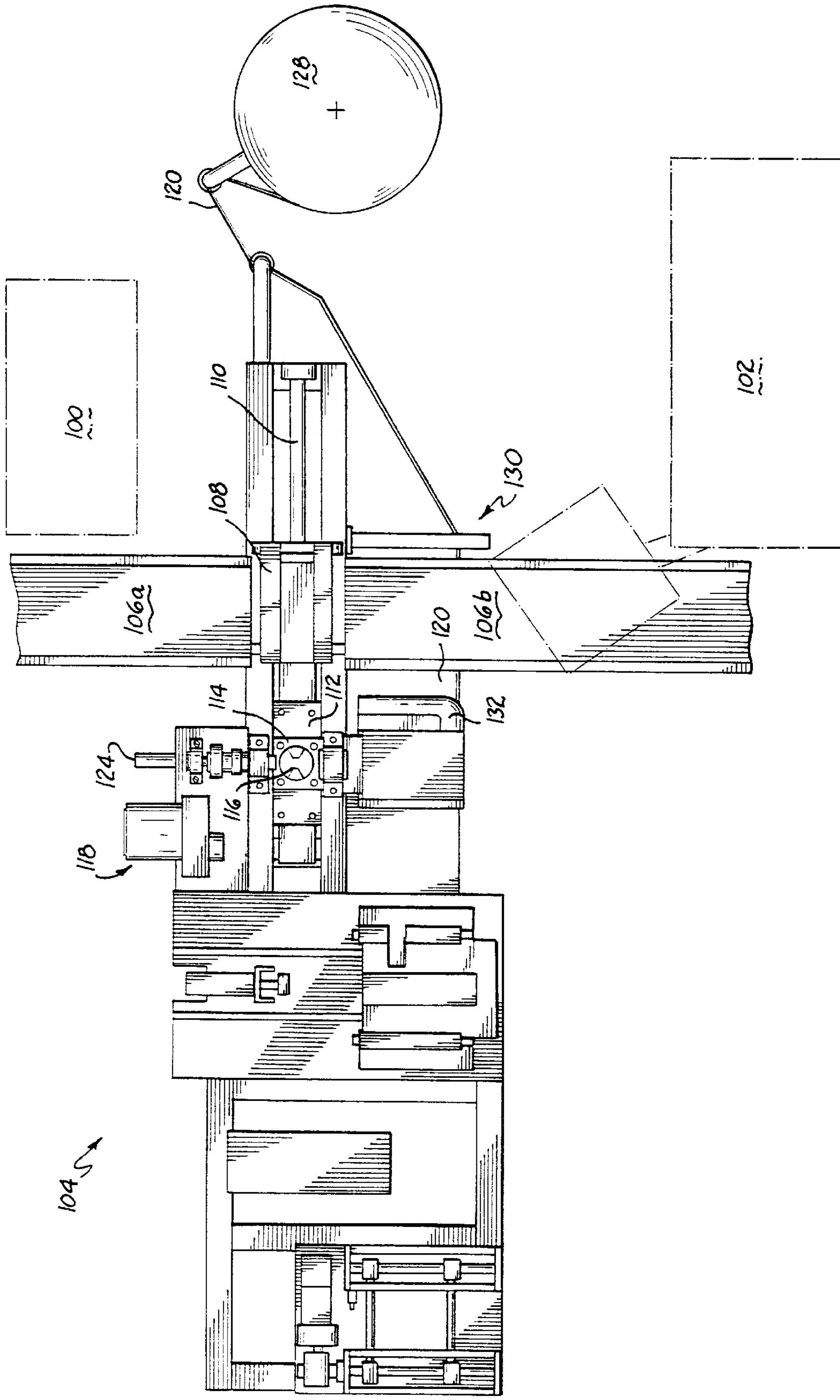

128
120
110
100
108
130
102
106a
106b
120
114
112
132
124
116
118
104

FIG.15

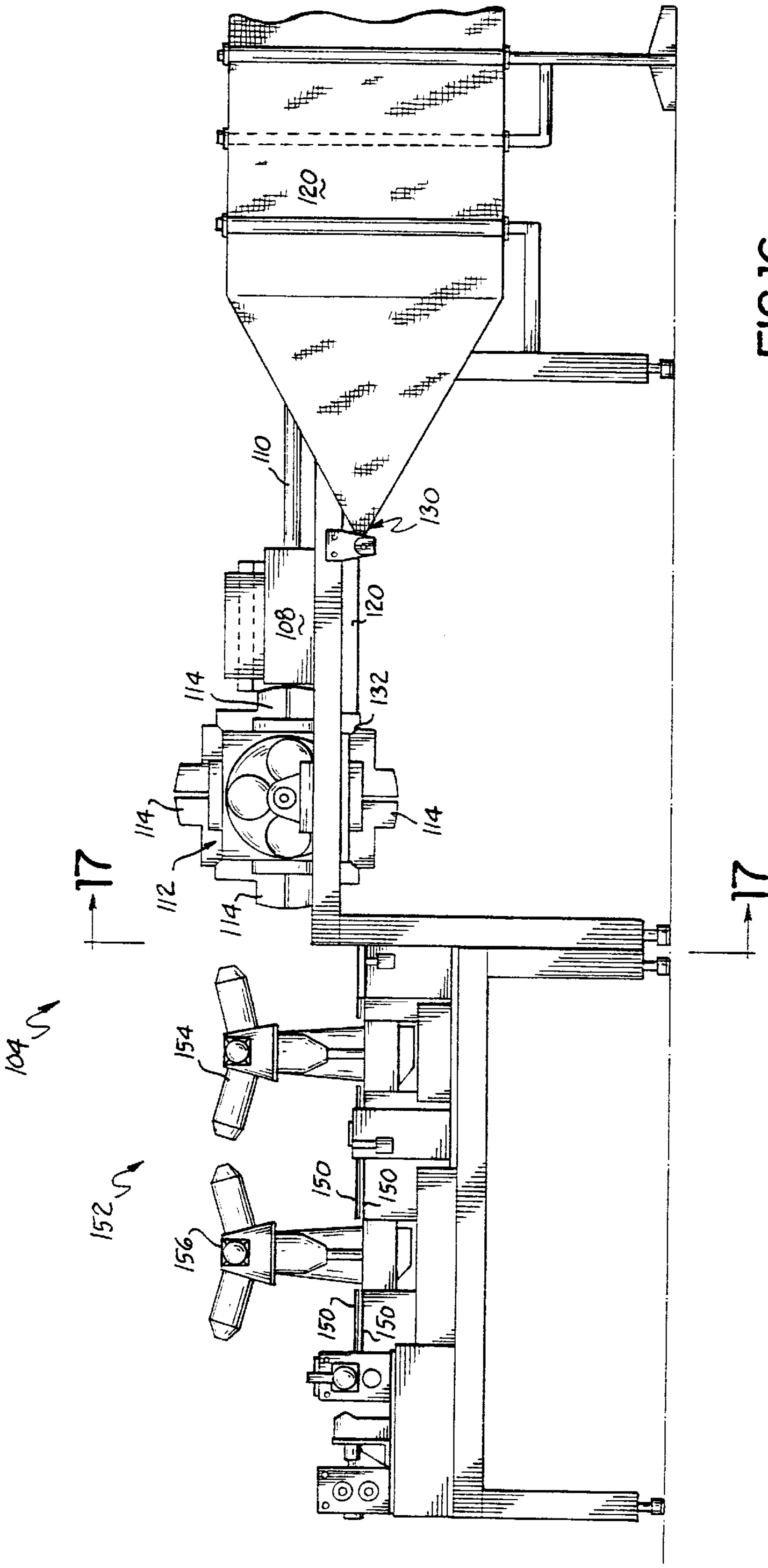

120
110
130
108
120
132
114
114
114
112
114
17
17
104
154
152
150
150
156
150
150

FIG.16

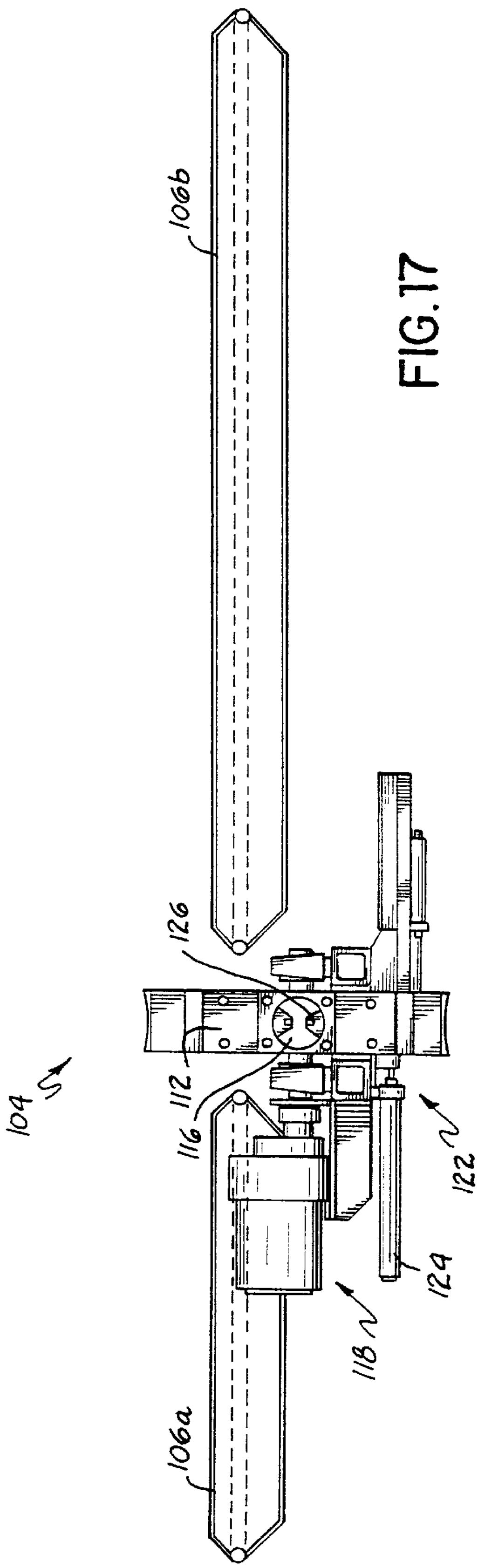


FIG. 17

MULTIPLE RATE COIL SPRING ASSEMBLY

BACKGROUND OF THE INVENTION

The present invention relates to coil spring assemblies and mattresses generally and, more particularly, but not by way of limitation, to a novel multiple rate coil spring assembly.

DESCRIPTION OF THE RELATED ART

Pocketed coil spring assemblies may be assembled by inserting coil springs into respective pockets of a continuous pocket coil strip, sealing each coil spring in its pocket, cutting a section of the strip to a length which corresponds to a width or a length of the desired assembly, and attaching the cut lengths together to form the final assembly.

Most mattresses or innersprings utilizing a pocketed coil construction typically contain coil springs having uniform spring rates, and all the coil springs generally have identical compression features. Thus, in an automated production run, coil springs having identical uniform spring rates are inserted into a continuous pocket coil strip, wherein a number of coil spring assemblies are assembled from a single pocket coil strip, and wherein cut lengths of spring-filled pockets correspond to consecutive rows of consecutive coil assemblies.

Other mattress units include one or more levels of foam and/or polyester layers which are disposed over a pocket coil matrix. However, foam and polyester are typically less responsive than springs to a change in user position, and further become lumpy and uncomfortable. Moreover, foam, polyester and the like usually deteriorate substantially over time, and eventually assume a contorted body imprint corresponding to the most frequent positions taken by the user. A user is then compelled to turn or rotate the mattress in an attempt to even out or avoid the imprints.

The desirability of providing a coil spring assembly with different firmness zones or sections has been recognized in the art. For example, it may be desirable for the center section of a mattress to support a greater load than the head and foot sections, so that a center zone providing a relatively firmer support area to bear the majority of the weight of the user would be desirable.

Known methods of assembling a variable firmness mattress relies on construction on a zone by zone basis for a single horizontal layer, or on a layer by layer basis, for example for a horizontal layer mattress. Each pocket of a single coil strip is filled with a respective coil spring, and each coil spring has a uniform spring rate equal to the spring rate of the other springs in that particular strip. Another known continuous pocket strip is similarly filled with a row of coil springs of uniform spring rate, but with a different spring rate than that of the springs in another row. The different spring rate is achieved by utilizing coil springs of different construction or with a different thickness or gauge.

Another known method for producing a variable firmness mattress includes inserting coil springs having uniform spring rates into first and second pocket coil strips in which the spacing between pockets differs for each of the strips. The assembly of differently spaced coil strips into various zones produces a mattress having more than one overall firmness zone.

U.S. Pat. No. 4,679,266 issued to Kraft discloses a varying firmness mattress having four longitudinally arranged regions for supporting a person with rows of coil springs. Changes in firmness are provided by varying the wire gauge of the springs in the different sections or by varying the barrel or diameter of the springs, although each zone is composed of a subassembly having uniform size and shape springs. The stiffness of the springs can also be adjusted by using more or less resilient wire, or using differing barrel or hourglass sizes. Furthermore, the firmness of the mattress can also be varied by varying the density of the support, such as using more or less springs or denser or less dense foam material. Nevertheless, the firmness of the springs in each of the four regions is constant and is uniform from side to side at any particular location of the mattress, although the outer edges may be provided for a stiffer gauge wire.

U.S. Pat. Nos. 4,972,536 and 4,918,773 issued to Scott disclose a mattress having springs of different firmness provided either by the use of wire having different characteristics, or by coil springs of different heights. Assembly of the mattress is accomplished by providing individual bands of springs uncoiled from rolls of interlaced coil springs, as opposed to direct feeding of the stock through an assembly machine from a coil forming machine. Bands of firmer springs are provided at the ends of the mattress. The patents also provide an alternative to the center and end portions having springs of differing gauge or diameter by providing same diameter springs but differing tensile strength or relaxed height of the individual coils. However, coil firmness are uniform within a band of coil springs.

U.S. Pat. No. 4,986,518 issued to Stumpf discloses a continuous strip of pocketed coil springs which may be adapted to accommodate springs having various shapes and sizes, but does not provide a means for placing adjacent springs having differing spring rates in a coil strip.

U.S. Pat. No. 5,325,553 issued to Ripley et al. discloses a mattress spring with a reinforcing frame in the lumbar area which encircles coil springs. The coil springs all have the same diameter. The patent also discloses varying the total number of springs, spring size, compression, and coiled spring alignment. Furthermore, the number of transverse rows of coiled springs can be varied depending on spring size. However, this patent does not disclose varying these factors on an individual spring basis.

U.S. Pat. No. 5,136,740 issued to Kraft discloses a varying firmness mattress having four different rubber-like foam densities and firmnesses which may be joined together edge to edge with a suitable adhesive. The foam pad is provided with numerous depressions or indentations, and the firmness varies with the depths, widths and shapes of the indentations. Each region is of a uniform firmness, but adjacent sections may have a differing firmness. Furthermore, this patent provides a mattress as also being made of a conventional coil spring construction wherein the coil springs may vary in diameter, height or configuration, e.g., the coil springs may have the shape of a cylinder, barrel, hourglass, or the like. However, variations are limited to those between zones.

U.S. Pat. No. 5,105,488 issued to Hutchinson discloses a bedding configuration having variable support characteristics, wherein various air chambers, cylinders, and tubes provide support in the lumbar portion of the mattress which may be selectively inflated or deflated in order to provide corresponding firmness levels. Furthermore, the patent discloses the use of such air chambers with pocketed coils, and in particular, half-size pocketed coils which may be placed adjacent the air chamber. Moreover, inflatable tubes may be positioned in the gaps formed by the top and bottom portions of barrel-shaped pocket coils.

As discussed above, prior methods of producing such a mattress may involve producing two or more runs of two or more continuous spring filled coil strips wherein each strip has uniform coil springs of substantially the same characteristics, although different coil strips may have different type springs, then cutting the strips and assembling the cut lengths in desired combinations. Furthermore, prior methods do not provide for the insertion of various coil springs having different characteristics in a single continuous pocket strip or a section thereof, whether each individual spring has a uniform or variable spring rate, into the strip on a pocket by pocket basis. Moreover, none of the prior methods facilitates automated customization of a mattress which is selectable on a pocket by pocket basis.

Therefore, there is a need for providing a mattress or coil spring assembly which offers multiple spring rate support, and which can be economically fabricated on an automated basis. According to the present invention, great flexibility in providing such a mattress can be achieved by inserting coil springs, which preferably include coils springs having multiple spring rates, into respective individual pockets of a pocket coil strip, wherein the spring rate characteristics of each coil spring may be selectively the same as, or different from, any other coil spring in the same assembly.

In the past, pocketed coil or continuous coil innersprings having individual coil springs with differing compression features within a single pocketed coil row could not be economically manufactured on a production basis.

One object of the invention is to provide a new and novel means for creating a pocketed coil spring assembly or innerspring mattress unit wherein one or more coil springs have a spring rate differing from other coil springs in the unit, and wherein each coil is automatically placed in a desired pocket. At least one of the coil springs preferably has a multiple spring rate. Another object is to provide a method of manufacturing or assembling the pocketed coil spring assembly which can be both automated and continuous, at least on a batch basis. Thus, the pocketed coil spring assembly preferably includes multiple spring rate coils wherein each coil spring has been individually coiled so as to have multiple spring rates, and wherein each coil spring is inserted into a predetermined pocket of a continuous pocket strip.

It is another object of the invention to provide a means for manufacturing a mattress with different firmness levels or zones which is not laborious and difficult to implement.

It is yet another object of the invention to provide mattresses with a customizable arrangement of multiple rate coil springs within a pocket coil framework.

Other objects of the present invention, as well as particular features, elements, and advantages thereof, will be elucidated in, or be apparent from, the following description and the accompanying drawing figures.

SUMMARY OF THE INVENTION

The present invention achieves the above objects, among others, by providing, in a particular embodiment, an automated method for the manufacture of a coil spring assembly comprising inserting coil springs, preferably having predetermined multiple spring rates into respective individual pockets of a continuous pocket strip in a predetermined order. One or more coil springs may have spring rates which differ from one or more other coil springs. The predetermined multiple spring rates of at least one coil spring may differ from that of the other coil springs, and each of the coils may have at least two different spring rates.

The automated method may further include the step of sealing each coil spring inside its respective pocket. The method may also include coiling one or more wires having a substantially uniform thickness into the coil springs before insertion into the continuous pocket strip.

The method may further comprise cutting the spring-filled strip into one or more desired sections or lengths, placing at least two spring-filled sections adjacent to each other, and attaching adjacent sections together. The adjacent strips may be joined by hot melt adhesive or by glue.

The individual pockets in the coil strip may be uniformly spaced. Moreover, the pockets in each length of the coil strip may be uniformly spaced by a first distance, and the adjacent sections or lengths may be uniformly spaced apart by a second distance.

The spring filled pocket coil strip may be rolled into one or more rolls. The attached adjacent sections may be also rolled into one or more rolls. The spring filled pocket coil strip or attached adjacent sections may be compressed in either the rolled or unrolled states. The attached adjacent lengths may also be simultaneously compressed and rolled.

The wire may be coiled to produce a coil having at least two different diameters, at least two different pitches, or at least two different diameters and at least two different pitches.

The multiple spring rate coil springs may be inserted into the pocket strip in a predetermined order to form at least two firmness zones upon attaching adjacent lengths or sections together. The firmness zones may comprise a head zone, a foot zone, and a middle zone.

Furthermore, the automated method may comprise inserting a plurality of perimeter coil springs in respective perimeter pockets corresponding to the outer perimeter of the coil spring assembly. The perimeter coil springs may be formed by coiling a wire, such as a wire having a second substantially uniform thickness before insertion into the continuous pocket strip, wherein the second thickness differs from the thickness of the other coil springs. The perimeter coil springs may also be preformed and supplied by hopper, or the thicker gauge wire may be coiled into multiple rate perimeter coil springs before insertion into the continuous pocket strip.

The automated method may further comprise installing one or more border wires around the outer perimeter of the coil spring assembly.

In another embodiment, the present invention concerns an automated method of manufacturing a coil spring assembly from a continuous pocket coil strip having a plurality of open pockets disposed along a longitudinal axis, wherein each pocket has a central axis which is substantially orthogonal to the longitudinal axis of the coil strip, and from a plurality of coil springs, each coil spring have a plurality of coils, and wherein at least one coil spring has a different spring characteristic than at least one other coil spring and wherein each spring has an axis of compression, wherein the method includes inserting each spring into a respective open pocket of the continuous pocket coil in a predetermined order, and then closing the pockets. The automated method may also include detaching, at respective predetermined lengths, at least two sections of the continuous pocket coil strip containing the springs. The method may also include aligning the axis of compression of each spring perpendicularly to the central axis of a respective pocket before insertion therein.

The automated method may further include rotating each spring within its respective pocket, thereby aligning the axis of compression of each spring with the axis of its respective pocket. The automated method may further include attaching at least two sections in side-by-side relationship, wherein the longitudinal axes of the sections are substantially parallel to each other and the axes of compression of the coil springs are parallel to each other. The sections may be cut into equal lengths, or into various lengths.

Attached portions of pocket coil may form a pocket coil assembly having at least two zones of coil springs, wherein the coil springs in each zone have substantially similar spring rate characteristics, and wherein the spring rate characteristics of at least two of the zones differ. At least one of the coil springs may have at least two spring rates. The method may further involve at least one coil spring which has a first end portion having a first pitch, a second end portion having substantially similar or equal pitch and a middle having a second pitch and integrally disposed between the first and second end portions. The second pitch may be greater than the first pitch. Furthermore, at least one coil of at least one of the end portions of at least one of the coil springs may decrease in diameter in an endward direction.

In practicing the method of the present invention, a particular embodiment of a coil spring assembly may be manufactured wherein the coil spring assembly comprises a plurality of multiple spring rate coil springs, each spring having at least two spring rates, and a connective matrix means for maintaining the coil springs in a spaced apart relationship and for allowing the coil springs to compress and expand. Each multiple spring rate coil spring further preferably comprises a plurality of coils of substantially uniform thickness. At least one of the multiple rate springs has at least two coils of different diameters or different pitches, or at least one of the multiple rate springs has at least two coils having different diameters and pitches.

A firmness zone may be formed where at least two adjacent coil springs have substantially similar spring rates. At least one multiple firmness zone may be formed where at least two adjacent multiple rate springs have substantially similar multiple spring rates.

The coil spring assembly may further comprise a plurality of perimeter springs generally disposed at the outer perimeter of the mattress. wherein each of the perimeter springs preferably includes a plurality of coils of substantially uniform thickness which is greater than the thickness of the coils of the multiple rate springs. For example, for a connective matrix means which includes a plurality of pockets, a plurality of perimeter springs may be inserted into respective pockets corresponding to the outer perimeter of the mattress.

In practicing the method of the present invention, a particular embodiment of a mattress of pocket coil construction may be manufactured or assembled, the mattress comprising a plurality of pockets and a plurality of multiple spring rate coil springs, each spring having at least two spring rates. Each spring further preferably comprises a plurality of coils of substantially uniform thickness, and the springs are disposed in respective selected pockets. The plurality of springs preferably has a substantially uniform height. At least one of the multiple rate springs has at least two coils of different diameters or pitches, or at least one of the multiple rate springs has at least two coils having different diameters and pitches. At least one multiple firmness zone can be created wherein at least two adjacent multiple rate springs have substantially similar multiple spring rates. The mattress may further comprise at least two multiple firmness zones, wherein the multiple spring rates of at least two zones differ.

A particular embodiment of the mattress may contain multiple rate springs which are substantially uniformly spaced. Thus, the multiple rate springs may be substantially uniformly spaced in a first direction, and the multiple rate springs may also be substantially uniformly spaced in a second direction which is substantially perpendicular to the first direction. The uniform spacing in the first and second directions may be the same or may differ.

The mattress may further comprise a plurality of perimeter springs disposed in respective perimeter pockets corresponding to the outer perimeter of the mattress, wherein each of the perimeter springs includes a plurality of coils of substantially uniform thickness, the thickness being greater than the thickness of the coils of the multiple rate springs. The perimeter springs may in addition be multiple rate perimeter springs. One or more border wires may be disposed around the outer perimeter of the mattress. The mattress may lie in a substantially flat plane in an unloaded state.

In another particular embodiment, at least one of the multiple rate coil springs of the mattress has at least four coils, wherein one to three coils have a different diameter and pitch than the remainder of the coils within that multiple rate coil spring, so that two coils may have a substantially similar diameter and pitch, or three coils may have a substantially similar diameter and pitch, and so forth.

In another embodiment, at least one of the multiple rate coil springs has first and second portions having respective first and second spring rates, wherein the first spring rate is lower than the second spring rate, and wherein the first portion of the coil spring is adapted to compress at least partially by an initial displacement before the second portion compresses. The coils of the first portion may have a smaller pitch and diameter than the coils of the second portion. The first portion is adapted to substantially completely compress before the second portion compresses beyond a minimal displacement or while the second portion remains substantially uncompressed.

In yet another embodiment, the first portion of the multiple rate coil spring is adapted to compress by approximately one to two inches before the second portion compresses beyond a minimal displacement, or while the second portion remains substantially uncompressed.

In still another particular embodiment, the multiple rate coil springs are fabricated from a wire having a substantially uniform diameter, in the range of 0.070 to 0.100 inch, and multiple rate perimeter springs may be fabricated from a wire having a substantially uniform diameter in the range of 0.05 to 0.12 inch. For example, the internal coil springs may have a diameter of approximately 0.09 inch and perimeter springs may have a diameter of approximately 0.11 inch. Other suitable wire sizes may be used.

The mattress may contain two or more multiple firmness zones. For instance, the mattress could have a first plurality of multiple spring rate coil springs, a second plurality of multiple spring rate coil springs, and a third plurality of multiple spring rate coil springs, wherein the multiple spring rates of at least one of the plurality of multiple spring rate coil springs differs from at least one of the other springs.

The first plurality of multiple rate coil springs may further comprise first and second portions having respective first and second spring rates wherein the first spring rate is lower than the second spring rate, and wherein the first portion of the coil spring is adapted to compress at least partially by an initial displacement before the second portion compresses. The coils of the first portion may have a smaller pitch and diameter than the coils of the second portion. Furthermore, the first and third pluralities of multiple rate coil springs may have substantially similar spring rates which differ from the second plurality of multiple rate coil springs.

For example, the first portion of the first and third pluralities of multiple rate coil springs can be adapted to compress by approximately one-half to one inch before the second portion compresses beyond a minimal displacement. Moreover, the first portion of the second plurality of multiple rate coil springs can be adapted to compress by approximately one to two inches before the second portion compresses beyond a minimal displacement.

The first plurality of multiple spring rate coil springs can be disposed in the plurality of pockets to form a head zone at one end of the coil spring assembly. The third plurality of multiple spring rate coil springs can be arranged to form a foot zone at an opposite end of the coil spring assembly. The second plurality of multiple spring rate coil springs can be arranged to form a middle zone disposed between the head and foot zones.

Thus, it is an object of the present invention to provide a method for manufacturing or assembling a coil spring assembly or mattress from coil springs inserted into selected pockets of a pocket strip material, wherein at least one coil spring may have a different spring rate characteristic from one or more other coil springs, and wherein at least one of the coils may have a multiple or varying spring rate.

It is a further object of the invention to provide multiple rate coil springs disposed in a pocket coil matrix.

It is another object of the invention to produce an innerspring unit by inserting springs into predetermined pockets in a single continuous pocket coil strip, wherein at least one of the coils has a spring characteristic which differs from at least one other coil in the strip.

It is yet another object of the invention to have the capability to provide multiple or varying rate coil springs and/or firmness zones, with little or no reliance on using different gauge spring wires or different pocket coil spacing.

It is still another object the invention to provide an automated way to produce such coil spring assemblies or mattresses which is quick, economical, and highly customizable.

It is yet another object to provide a method for assembling a pocket coil inner unit which has customized spring ratios.

It is still another object to provide a method which requires minimal operator intervention, especially regarding determination of the individual location of each multiple rate spring in the assembly matrix.

The above, and other objects, features and advantages will become apparent from the following description and the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Understanding of the present invention and the various aspects thereof will be facilitated by reference to the accompanying drawing figures, submitted for purposes of illustration only and not intended to limit the scope of the invention, in which:

FIG. 1 is a plan view representation of one embodiment comprising a mattress in accordance with the present invention, partially showing the spring filled pockets and showing head, foot and middle zones;

FIG. 2 is a schematic view of a known conventional single rate spring;

FIG. **3** is a schematic representation of a first preferred embodiment of a coil spring in an unloaded state according to the present invention.

FIG. **4** is a view of the coil spring of FIG. **3** as seen from view **4—4**.

FIG. **5** is a schematic representation of a second preferred embodiment of a coil spring in an unloaded state according to the present invention.

FIG. **6** is the second embodiment of the coil spring of FIG. **5** taken from view **6—6**.

FIG. **7** is a schematic representation of a third embodiment of a coil spring in an unloaded state according to the present invention.

FIG. **8** is the third embodiment of the coil spring of FIG. **7** taken from view **8—8**.

FIG. **9** is a graphical comparison of the load-deflection characteristics of a prior art single rate spring and one embodiment of a multi-rate spring according to the present invention.

FIG. **10** is a schematic plan view of a mattress according to the present invention showing six zones corresponding to head, foot and middle zones for left and right sides, wherein individual coils or pockets are not shown;

FIG. **11** is a schematic plan view of a mattress according to the present invention showing two zones corresponding to left and right zones without showing individual coils or pockets;

FIG. **12** is a plan view of a mattress component according to the present invention showing five longitudinally spaced zones formed from adjacent longitudinal strips of 30 pocketed springs;

FIG. **13** is a plan view of a mattress component according to the present invention showing five longitudinally spaced zones formed from adjacent longitudinal strips of 32 pocketed springs;

FIG. **14** is a schematic representation of a means of manufacturing a coil spring assembly according to the present invention;

FIG. **15** is a top view of an automated coil insertion apparatus in cooperation with two coiler apparatuses, which are shown in phantom.

FIG. **16** is a side elevational view of the apparatus of FIG. **15**.

FIG. **17** is a partial end view of the apparatus of FIG. **14** as seen from view **17—17**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference should now be made to the drawing figures, on which similar or identical elements are given consistent identifying numerals throughout the various figures thereof, and on which parenthetical references to figure numbers direct the reader to the view(s) on which the element(s) being described is (are) best seen, although the element(s) may also be seen on other views.

One aspect of the present invention is a coil spring assembly generally comprising a plurality of coil springs, including at least one multiple spring rate coil spring, each multiple spring rate coil spring having at least two spring rates, and a connective matrix means for maintaining the coil springs in a spaced apart relationship. The connective matrix also allows the coil springs to compress and expand within the matrix. Preferably, the coil spring assembly is adapted to allow each said coil spring to compress and expand substantially independently.

In one embodiment, the connective matrix comprises a pocket coil arrangement, where each coil spring is disposed in a respective pocket. The pockets may be preformed with an open or openable end or side, or the pockets may be formed around the springs as the springs are placed in contact with the connective matrix material. Thus, the connective matrix means may comprise a plurality of attached pocket coil strip segments, or the connective matrix means may be of the interwoven type. Each multiple spring rate coil spring consists of a plurality of coils, and each coil of all the springs is preferably fabricated of a wire having substantially uniform thickness.

As used herein, a connective matrix means may include interconnected pockets, or pocket strip material, or segments or sections of pocket strips. The connective matrix means may also comprise an interwoven wire type matrix, such as provided by interconnecting the coil springs with helically shaped wire. Thus, the connective matrix means may include helical coils, or spiral lacing wire, or spiral-shaped connecting elements, or spiral helical coils, or a wire connecting matrix, or a plurality of spiral-shaped connecting elements.

In a particular embodiment, coil springs are disposed within a connective matrix means in a plurality of rows, wherein each said row contains a plurality of coil springs and wherein the spring rate of at least one of the coil springs in at least one of the rows differs from the spring rate of at least one other coil spring in that row. Preferably, the connective matrix means comprises a plurality of attached pocket coil strips, wherein the spring rate of at least one of the coil springs in at least one of the rows of spring filled strip differs from the spring rate of at least one other coil spring in that row.

In another particular embodiment, coil springs are disposed within a connective matrix means in a plurality of rows, wherein each row contains a plurality of coil springs, wherein at least one of the rows contains at least two multiple spring rate coil springs, and wherein the multiple spring rate of at least one of the multiple spring rate coil springs in at least one of the rows differs from the multiple spring rate of at least one other multiple spring rate coil spring in at least one of the rows. The connective matrix means may comprise a plurality of attached pocket coil strip segments, wherein each row is made from at least one coil strip segment.

In yet another particular embodiment includes at least one of the multiple rate springs having at least two coils of different diameters. Another particular embodiment includes at least one of the multiple rate springs having at least two coils of different pitches. Yet another particular embodiment includes at least one of the multiple rate springs with at least two coils having different diameters and pitches.

In another particular embodiment, the present invention comprises a coil spring assembly comprising a plurality of coil springs and a connective matrix means for maintaining the coil springs in a spaced apart relationship and for allowing the coil springs to compress and expand. The coil springs are disposed within the connective matrix means in a plurality of rows, wherein each row contains a plurality of coil springs, and wherein the spring rate of at least one of the coil springs in at least one of the rows differs from the spring rate of at least one other coil spring in that row. The connective matrix means may include a plurality of attached pocket coil strip segments, wherein each row is made from at least one coil strip segment. The coil spring assembly may be adapted to allow each coil spring to compress and expand substantially independently or individually. The plurality of coil springs may further comprise a plurality of perimeter springs generally disposed at the outer perimeter of the coil spring assembly, wherein each of the perimeter springs has a plurality of coils of substantially uniform thickness which is greater than the thickness of the coils of the multiple spring rate coil springs.

A multiple firmness zone may occur wherever at least two adjacent multiple rate springs having substantially similar multiple spring rates are disposed adjacent each other. Thus, two or more springs having substantially similar spring characteristics may be disposed in some adjacent relationship, forming a firmness zone. A zone may be formed by springs which are lengthwise or longitudinally spaced, horizontally or transversely spaced, diagonally spaced, or some combination thereof. A zone may also be formed by placing springs having different spring characteristics in alternating relationship. For example, a spring having a first multiple rate characteristic is placed adjacent a spring having a second multiple rate characteristic, followed by another spring having a first multiple rate characteristic, and so forth. By way of another example, two adjacent springs having a first multiple rate characteristic are placed adjacent two other adjacent springs having a second multiple rate characteristic, followed by another two springs having the first multiple rate characteristic, and so on.

The coil spring assembly may further include a plurality of perimeter springs generally disposed at the outer perimeter of the mattress, for example, a plurality of perimeter springs may be inserted in respective pockets corresponding to the outer perimeter of a mattress having a connective matrix which is provided with a plurality of pockets. Typically, the perimeter springs are stiffer than the internal springs. Thus, each of the perimeter springs may include a plurality of coils of substantially uniform thickness which is greater than the thickness of the coils of the remainder of the multiple rate springs disposed in the internal section of the assembly, i.e. the internal coil springs. Alternatively, the perimeter springs may be constructed of substantially the same wire as the internal coils but wound differently to provide a stiffer spring characteristic.

In another embodiment, the present invention contemplates a coil spring assembly comprising a plurality of coil springs and a connective matrix means for maintaining the coil springs in a spaced apart relationship and for allowing the coil springs to compress and expand, wherein the coil springs are disposed within the connective matrix means in a plurality of rows, wherein each row contains a plurality of coil springs, and wherein the spring rate of at least one of the coil springs in at least one of the rows differs from the spring rate of at least one other coil spring in the row. The connective matrix means may comprises a plurality of attached pocket coil strip segments, wherein each row is made from at least one coil strip segment. The coil spring assembly may be adapted to allow each coil spring to compress and expand substantially independently of each other. The plurality of coil springs may further comprise a plurality of perimeter springs generally disposed at the outer perimeter of the coil spring assembly, wherein each of the perimeter springs has a plurality of coils of substantially uniform thickness which is greater than the thickness of the coils of the multiple spring rate coil springs.

FIG. **1** illustrates a first embodiment of the present invention in the form of a mattress **10**. The mattress has a selectable length corresponding to a longitudinal direction, a width corresponding to a transverse direction, and a height corresponding to a vertical direction. Mattresses may be constructed of various shapes and sizes so that, for example, the length could be 78 inches and the width could be 54, 60, 78 or 80 inches, thereby corresponding to dimensions for full, queen or king size mattresses, respectively.

Typically, the mattress lies in a substantially flat plane in an unloaded state. However, the mattress could be constructed to have more than one level, or be disposed in more than one plane, for a particular application. A mattress or cushion may further be formed with one or more concave areas, such as concave regions formed by springs of different heights or by varying the spatial orientation of the connective matrix, or both.

The mattress is preferably formed from a pocket coil matrix having a plurality of pockets for containing a plurality of multiple spring rate coil springs, wherein each spring is disposed in a respective pocket. Each spring has at least two different spring rates, and each spring further preferably comprises a plurality of coils of substantially uniform thickness. Preferably, each of the plurality of springs has a substantially uniform height, although springs of different heights may also be used. Each of the springs is "vertically" oriented in a respective pocket. FIG. **1** shows a matrix representing twenty coils disposed widthwise or transversely, and twenty-seven coils disposed lengthwise or longitudinally, for a total of 540 coil springs which are arranged so that the axis of compression of each spring and the central axis of each pocket are aligned substantially parallel to one another and substantially perpendicular to the weight bearing surfaces which are bordered by the length and width of the mattress.

The spring-filled pockets **12** are shown in FIG. **1** as being substantially uniformly spaced. The spacing shown is similar in both the lengthwise and widthwise directions. However, the pockets and springs may be uniformly spaced in a first direction by a first distance, and further may be substantially uniformly spaced in a second direction, which may be substantially perpendicular to the first direction, by a second distance. The pockets and springs may also be substantially uniformly spaced in only a first direction. Furthermore, nonuniformly spaced pockets and/or springs are also contemplated by the present invention.

The springs may be pre-compressed during insertion into the pockets. After insertion into the pockets and sealing of the pockets is complete, the springs may be rotated or slipped or adjusted into a suitable alignment within the pocket. Preferably, the coil springs reside in the pockets in a preloaded state.

The mattress may have a plurality of perimeter springs disposed in respective perimeter pockets corresponding to the outer perimeter of the mattress. Preferably, each of the perimeter springs includes a plurality of coils of substantially uniform thickness which is greater than the thickness of the coils of the multiple rate springs, as it may be desired to provide the perimeter of the mattress with a stiffer set of springs derived from a thicker gauge wire. Each of the perimeter springs may possess one or more spring rates, as further described below.

The mattress may also include one or more border wires disposed around the outer perimeter of the mattress for further stiffening the perimeter. The border wire may be attached to the mattress after shipping of the mattress occurs to facilitate compression of the mattress during transport.

As the internal coil springs are all preferably fabricated from substantially similar thickness wire, multiple spring rates are achieved by selectively coiling each coil of each coil spring according to one or more predetermined pitches and/or diameters. Preferably, the multiple rate coil springs have both different diameters and different pitches. One example of a multiple rate coil spring may include a first coil having a first diameter and first pitch, and a second coil having a second diameter and second pitch. The coil springs have at least two coils, although many more coils within each spring may also be provided.

The multiple rate coil springs may have at least two coils of different diameters, or at least two coils of different pitches.

In a particular embodiment, at least one of the multiple rate coil springs comprises at least four coils, wherein between one to three coils have a different diameter and pitch than the remainder of the coils within that multiple rate coil spring. In a further particular embodiment, two or three coils may have a substantially similar diameter and pitch, differing from the remainder of the coils within that multiple rate coil spring.

FIG. **2** shows a known conventional coil spring typically used in coil spring assemblies. Such coil springs exhibit an overall singular spring rate to provide a single linear load deflection response and to provide uniform spring characteristics in a coil assembly.

FIGS. **3–4** show a first preferred embodiment of a multi-rate coil spring according to the present invention. The pitch on the ends or end portions is smaller than the pitch in middle or middle portion of the spring. The larger pitch provides a greater spring rate, while the smaller pitch provides a lower spring rate. Additionally the diameter of the spring at the ends is smaller than the middle, where the diameter of the spring gradually increases towards the middle. The larger diameter provides a lower spring rate, while the smaller diameters provide a greater spring rate. Preferably, the diameter and pitch are selected to allow the combination of end sections to compress or collapse first, but in a controlled gradual manner, i.e. the diameters and pitches are preferably matched to provide smooth transitions between regions of stiffness in the coil spring. Because of the variable diameter of the spring, the spring collapses inside itself, i.e. the turns of the spring nest within each other, preferably without contact, or with minimal contact, as best seen in FIG. **4**, thereby minimizing metal on metal noise. This embodiment of the spring also avoids tangling of one or more coils within a given spring.

Preferably the middle portion of the spring has a sufficiently "small" diameter and/or sufficiently "large" pitch to prevent premature large scale deflection of the middle portion, thereby preventing self-entanglement or distortion of the coil spring.

Furthermore, each end portion of the multi-ratc coil spring is provided with an enhanced softness level or softness zone due to its propensity to compress in preference to the middle portion. Thus each coil can provide a localized softness zone which can deflect under a localized load.

The particular embodiment shown in FIG. **3** is provided with a length of 8¾ inches in an unloaded state. The diameter in the middle section is 2½ inches, and the diameter at the ends is 1½ inches. The pitch in the middle in an unloaded state is 1⅞ inches.

FIGS. **5–6** show a second preferred embodiment of a multi-rate coil spring according to the present invention. The length of the second embodiment of the coil spring is 8¼ inches, the diameter in the middle section is 2½ inches, and the diameter at the ends is 1½ inches. The pitch in the middle portion in an unloaded state is 1¾ inches.

FIGS. **7–8** show a third embodiment of a multi-rate coil spring according to the present invention. The overall length, fully expanded, is 8¾ inches, the diameter in the middle section is 1½ inches, and the diameter at the ends 2½ inches. The pitch in the middle portion in the unloaded state is 1⅞ inches. Preferably the smaller pitch and larger diameter at end portions, as well as the larger pitch and smaller diameter of the middle portion, are adapted so that the end portions compress or collapse, preferably fully, before the middle portion begins to compress. As seen in FIG. **8**, the coils of the end portions may be adapted to nest within each other, preferably without touching, to minimize noise and/or entanglement created by contact with adjacent coils.

FIG. **9** shows a comparison of load-deflection characteristics of a known single rate spring and a multiple spring rate coil spring according to the present invention. It can be seen from FIG. **9** that the particular multi-rate spring tested generally has two distinct firmness levels. In comparison to the known single rate coil spring, the multiple rate coil is initially softer, i.e. requires a lighter load to achieve a given deflection, while the multiple rate spring offers firmness support at deeper deflections.

Other combinations of multiple diameter and/or pitch that yield multiple spring rates within a single coil spring may also be provided.

According to the particular embodiments shown in FIGS. **3–8**, the multiple rate coil spring preferably includes two end portions, each end portion having a first spring rate, and a middle portion having a second spring rate, wherein the second spring rate is greater than the first spring rate, so that the end portions of the coil spring are adapted to compress at least partially by an initial displacement before the middle portion compresses.

In another embodiment, a multiple rate coil spring may have a first portion with a first diameter and a second portion with a second diameter. Under increasing amounts of load, the spring may be adapted so that the first portion is partially compressed, while the second portion remains largely uncompressed, or so that the first portion is substantially completely compressed before the second portion compresses beyond a minimal displacement, i.e. the second portion is substantially uncompressed. Under an even greater load, the first portion then becomes substantially completely compressed, and the second portion is first partially, then fully, compressed.

Thus, effective firmness levels within a multiple rate coil spring may be achieved, such that a given load compresses one portion of the spring through a first displacement, that portion having a predetermined spring rate or firmness rating or softness, and an increased or heavier load compresses another portion of the spring through a second displacement, wherein that second portion has another predetermined spring rate or firmness rating. It should be understood that one spring may include more than one portion, and at least one portion has a different spring rate characteristic than the other portion or portions. The spring rate characteristic may be defined by a different diameter or pitch, or both. For example, the coils of the first portion could have a smaller pitch and diameter than the coils of the second portion.

In one particular embodiment, the first portion of the multiple rate coil spring is adapted to compress by a finite deflection such as by approximately one to two inches while the second portion remains substantially uncompressed, or before the second portion compresses beyond a minimal displacement.

In another particular embodiment, the multiple rate coil springs are fabricated from a wire having a substantially uniform diameter of approximately 0.09 inch, and the perimeter springs are multiple rate perimeter springs fabricated from a wire having a substantially uniform diameter of approximately 0.11 inch.

A mattress or a coil spring assembly may be assembled to include two or more firmness zones. For example, the mattress shown in FIG. **1** may have three firmness zones, corresponding to the head "H", foot "F", and middle "M" sections of the mattress, wherein each zone is a multiple firmness zone. In each zone. at least two adjacent multiple rate springs have substantially similar multiple spring rates, thereby forming a multiple firmness zone. The multiple spring rates of one of the zones and at least one other zone preferably differ. For example, the head and foot zones may have similar multiple rate spring characteristics which differ from the middle zone. Other embodiments may include a mixture of multiple rate springs and substantially single rate springs, and may include both multiple firmness zones and single firmness zones.

Thus, the mattress may comprise a first plurality of multiple spring rate coil springs, a second plurality of multiple spring rate coil springs, and a third plurality of multiple spring rate coil springs, wherein the multiple spring rates of at least one of the pluralities of multiple spring rate coil springs differ from at least one of the other plurality of springs.

The first plurality of multiple rate coil springs may further comprise first and second portions having respective first and second spring rates, wherein the first spring rate is lower than the second spring rate, and the first portion of the coil spring is adapted to compress at least partially by an initial displacement before the second portion compresses, or while the second portion remains substantially uncompressed. The coils of the first portion have a smaller pitch and diameter than the coils of the second portion. The first and third pluralities of multiple rate coil springs may be substantially similar. Furthermore, the coils of the first portion may have a smaller pitch and diameter than the coils of the second portion, so that, in a particular embodiment, the first portions of the first and third pluralities of multiple rate coil springs are adapted to compress by a finite deflection, such as by approximately one-half to one inch, before the second portion compresses beyond a minimal displacement, and the first portion of the second plurality of multiple rate coil springs is adapted to compress by a finite deflection, such as by approximately one to two inches, before the second portion compresses beyond a minimal displacement.

In another embodiment, a mattress according to the present invention comprises a first plurality of multiple spring rate coil springs, a second plurality of multiple spring rate coil springs, and a third plurality of multiple spring rate coil springs, wherein the multiple spring rates of at least one of the plurality of multiple spring rate coil springs differs from at least one of the other coil springs.

In yet another embodiment, a mattress according to the present invention comprises a first plurality of multiple spring rate coil springs, each coil spring having a first multiple spring rate, a second plurality of multiple spring rate coil springs, each coil spring having a second multiple spring rate, and a third plurality of multiple spring rate coil springs, each coil spring having a third multiple spring rate, wherein at least one of the multiple spring rates differs from at least one of the other multiple spring rates.

A mattress may have more than three multiple firmness zones, such as the six zones shown in FIG. **10** which correspond to head, middle and foot sections for left and right sides ("H1", "M1", "F1", "H2", "M2", "F2", respectively). Thus, the mattress may be customizable on a zone-by-zone, or on a spring-by-spring basis, to suit the needs of one or more users per mattress.

FIG. **11** shows an example of a mattress having two zones, one left side zone "L" and one right side zone "R".

FIGS. **12** and **13** illustrate a particular embodiment of a coil spring mattress assembly or portion thereof having five longitudinally arranged firmness or softness zones.

FIG. **12** shows a symmetric arrangement having two end portions **20'**, **20'**, two intermediate portions **30'**, **30'**, and a middle portion **40'**. The five longitudinally spaced zones are formed from adjacent longitudinal strips of thirty pocketed springs interconnected to form a matrix. The middle portion **40'** contains the firmest springs, the end portions **20'**, **20'** contain the second firmest, and the intermediate portions **30'**, **30'**, the least firm. For example, if the springs of the middle portion **40'** were formed to have a certain load-displacement characteristic or load capacity which is rated at 100%, then the springs of the end **20'**, **20'** and intermediate portions **30'**, **30'** may be formed to exhibit load capacities of approximately 81% and 79%, respectively.

Similarly, FIG. **13** shows a symmetric arrangement having two end portions **20'**, **20'**, two intermediate portions **30'**, **30'**, and a middle portion **40'**, wherein the five longitudinally spaced zones are formed from adjacent longitudinal strips of thirty-two pocketed springs.

In another embodiment of the present invention, a coil spring assembly comprises a plurality of tubular pockets, each pocket having a tubular sidewall disposed around a central axis and a pair of endwalls disposed at opposite ends of the tubular sidewall, wherein the pockets are interconnected to form a side-by-side matrix, and a plurality of coil springs, including a plurality of multiple rate coil springs, each coil spring having a plurality of coils, wherein at least one coil spring has a different spring characteristic than at least one other coil spring, wherein each spring has an axis of compression substantially aligned with the central axis of its respective pocket, and wherein the axes of compression and the central axes are substantially perpendicular to the matrix. Preferably, each spring occupies a respective selected pocket. The coil assembly may further comprise at least two zones of coil springs, wherein the coil springs within each respective zone have substantially similar spring rate characteristics, and wherein the spring rate characteristics of at least two of the zones differ. At least one of the coil springs may have at least two spring rates. Furthermore, at least one of the coil springs may comprise a first end portion having a first pitch, a second end portion having the first pitch, and a middle portion having a second pitch and integrally disposed between the first and second end portions. The second pitch may be greater than the first pitch. Moreover, at least one coil of at least one of the end portions of at least one of the coil springs may decrease in diameter in an endward direction.

In another aspect, the present invention comprises, in a particular embodiment, a multiple rate coil spring comprising a plurality of helically wound coils including a first coil, a second coil, and a plurality of intermediate coils disposed therebetween, wherein the pitch of the first coil is smaller than the pitch of the second coil, and wherein the diameter of the first coil is smaller than the diameter of the second coil. The pitch of the intermediate coils may successively increase from the first coil to the second coil. Alternately, or additionally, the diameter of the intermediate coils may successively increase from the first coil to the second coil. Furthermore, the diameter of the intermediate coils may increase from the first coil to the second coil, and wherein the coils are formed to allow the coils, upon compression, to nest within an adjacent coil having a larger diameter. The coils may be are formed to allow adjacent coils to nest within one another without touching. The first coil may be disposed at an end of the coil spring, and the second coil may be disposed in the middle of the coil spring.

In another particular embodiment, the present invention comprises a multiple rate coil spring comprising a first end portion having a first plurality of helically wound coils and a middle portion having a second plurality of helically wound coils, the middle portion being integrally formed with the first end portion, wherein the first plurality of coils includes a first coil and a second coil, wherein the second coil is disposed between the first coil and the middle portion, wherein the first and second coils have substantially similar pitches, wherein the second plurality of coils includes at least one middle coil, wherein the pitch of the middle coil is greater than the pitch of any of the first plurality of coils, and wherein the first end portion and the middle portion are adapted to permit the first end portion to substantially fully compress substantially before the middle portion compresses. The first plurality of coils may be adapted to spirally nest within one another. Furthermore, the first plurality of coils may be adapted to lie substantially in a plane when fully compressed. Moreover, the first plurality of coils may be adapted to spirally nest within one another without having the exterior surfaces of said coils touching one another. Alternately, the first plurality of coils may be adapted to spirally nest on top of one another.

The diameter of the middle coil may be greater than any of the diameters of the first plurality of coils. Furthermore, the diameter of the second coil may be greater than the diameter of the first coil. The diameter of the first coil may be greater than the diameter of the second coil. The diameter of said middle coil may be smaller than the diameters of the first plurality of coils.

The end portion may further include at least part of at least one substantially planar coil.

The multiple rate coil spring may further comprise a second end portion integrally formed with the middle portion, wherein the second portion is symmetric with the first portion about the middle portion. The pitches and the diameters of the middle portion and the end portions are preferably adapted to yield a middle portion which is stiffer than the end portions. The end portions may substantially fully compress substantially before the middle portion compresses.

According to the present invention, a coil spring assembly, or mattress. or cushion is preferably fabricated by an automated method. The manufacture of the coil spring assembly preferably comprises inserting coil springs having predetermined spring rates into respective individual pockets of a continuous pocket strip in a predetermined order. Preferably, the coil springs have predetermined multiple spring rates, and the predetermined multiple spring rates of at least one coil spring in the coil spring assembly may differ from that of the other coil springs. Preferably, each of the coils has at least two different spring rates. The present invention also contemplates inserting coil springs having predetermined single spring rates into respective individual pockets. For example, a multiple spring rate coil spring may be inserted into a first pocket while a single rate spring may be inserted into an adjacent pocket.

The automated method may further include the step of sealing each coil spring inside its respective pocket.

One or more wires, preferably having a substantially uniform thickness, are coiled into springs, preferably having multiple spring rate characteristics, before insertion into the continuous pocket strip.

The spring filled pocket coil strip may be rolled into one or more rolls for storage or shipment. The coil strip may be compressed before, during, or after rolling, to conserve space.

The automated method may further include the steps of cutting the spring-filled strip into one or more desired sections or lengths, placing at least two spring-filled sections adjacent to each other, and attaching adjacent sections together. As with the strip, the attached adjacent sections may be rolled into one or more rolls, and the attached lengths or rolls may be compressed for case of storage or transport. The attached adjacent lengths may also be simultaneously compressed and rolled into one or more rolls.

Wire may be wound to produce a coil having at least two different diameters, or at least two different pitches, or at least two different diameters and at least two different pitches.

The automated method may further include the step of inserting coil springs, preferably including multiple spring rate coil springs, into the pocket strip in a predetermined order to form at least two firmness zones upon attaching adjacent lengths together. The two firmness zones may further comprise a head zone, a foot zone and a middle zone.

The method may further include the step of inserting a plurality of perimeter coil springs in respective perimeter pockets corresponding to the outer perimeter of the coil spring assembly.

Perimeter coil springs may be formed by coiling a wire, preferably having a second substantially uniform thickness, before insertion of the perimeter springs into the continuous pocket strip, wherein the second thickness differs from the thickness of the other coil springs which are disposed in pockets corresponding to the internal or non-perimeter portions of the final assembly. Furthermore, the wire may be coiled into multiple rate perimeter coil springs before insertion into the continuous pocket strip.

The method may further comprise installing one or more border wires around the outer perimeter of the coil spring assembly.

The adjacent strips may be attached by hot melt adhesive, glue or other suitable attachment means.

The springs may be inserted into a coil strip having individual pockets which are uniformly spaced, or the springs may be placed adjacent the pocket strip material wherein the pockets are formed around each spring. The pockets in each length of the coil strip may be uniformly spaced by a first distance, and the adjacent lengths uniformly spaced apart by a second distance.

One method of manufacturing a coil spring assembly is described below. First, input parameters related to the design of the coil spring assembly are input, computed, or otherwise registered. Such input parameters could include, for example: the width and/or length of the final coil assembly; the number, location and/or characteristics of desired firmness zones; the diameter and spacing of the pockets in the pocket strip. Output control signals may be derived or computed from input parameters or feedback signals from other points in the process. At least a first wire, preferably having a substantially uniform thickness, and preferably a second wire, preferably having a second substantially uniform thickness, and a length of continuous pocket strip may be supplied.

Preferably, the pocket strip has a length at least long enough to accommodate all of the coil springs corresponding to an entire final coil spring assembly, although pocket strips having a length corresponding to a portion of the entire final spring assembly may also be used.

Internal coil springs and perimeter coil springs may be coiled from the first and second wires, respectively, according to predetermined multiple rates which are delivered by the control signals that dictate winding. Alternatively, the coil springs or perimeter springs, or both, may be supplied in a pre-formed or pre-coiled state, obviating the need to supply and coil the wire, so that selected springs may be delivered to the strip from one or more hoppers or the like.

Coils are then inserted into the continuous pocket strip. If desired, for example if the coils are not to be immediately cut into lengths, the filled strip may be delineated or marked so as to indicate locations corresponding to the beginning or end of a coil spring assembly, a length, a width, or some other portion thereof. The spring-filled strip may be rolled or stacked, and the strip may be compressed before, during or after rolling or stacking for subsequent storage or transport. Otherwise, the spring-filled strip is cut into sections or lengths, preferably corresponding at least roughly to the desired length or width of the resulting coil spring assembly. The sections or lengths of spring-filled strip may be rolled or stacked, and the lengths may be compressed before, during or after rolling or stacking for subsequent storage or transport. Otherwise the lengths may be attached to one another, for example by hot melt adhesive or glue. The attached sections may be rolled or stacked, and the unbordered assembly may be compressed before, during or after rolling or stacking for subsequent storage or transport. Border wire may be added around the outer periphery or outer perimeter of the coil spring assembly for added stiffness.

Thus, the sections or lengths of spring-filled strip may correspond to a row within the coil spring assembly, wherein the row may be longitudinal, transverse or oriented at an angle with respect to an overall dimension. Furthermore, the sections or lengths may comprise at least part of a coil assembly having a specified overall outline or shape, such as circular, oval, oblong, triangular, hexagonal, square, or other desired configuration.

FIG. **14** is a schematic representation of the means by which the coil spring assembly may be manufactured. Input parameters are supplied by the user to a control means or preset into the control means. The control means may receive feedback control signals from various points in the apparatus during the assembly process. The control means computes or derives output control signals and sends the output signals to appropriate points in the process. A first wire having a first diameter, or thickness, or gauge, may be provided by a first wire supply, which may cut the wire into a desired length or supply a continuous feed of wire. The first wire is fed into a first coil winder which winds the wire into a plurality of coils according to the output signals or output parameters from the control means. The coil winder may be adapted to wind the wire into a coil spring having a specified or selectable number of coils, wherein the winder is capable of providing each coil with a diameter and/or pitch different than other coils in the same spring. If the first wire that was fed into the first coil winder was not already cut, the coil spring is then cut, preferably automatically, from the remainder of the first wire, thereby preferably producing a single coil spring having a multiple spring rate characteristic. The coil spring is then fed into a coil inserter.

Similarly, a second wire having a second diameter, or thickness, or gauge, may be provided by a second wire supply, which may cut the wire into desired lengths or which may supply a continuous feed of wire. The second wire is fed into a second coil winder which winds the wire into a plurality of coils according to the output parameters from the control means. The coil winder is capable of winding the wire into a perimeter coil spring having a number of coils, wherein each coil may have a different diameter and/or pitch than other coils in the spring. If the second wire that was fed into the second coil winder was not already cut, the perimeter coil spring is cut, preferably automatically, from the remainder of the second wire, thereby preferably producing a single coil spring which may have a multiple spring rate characteristic. The perimeter coil spring is then fed into the coil inserter.

Optionally, pre-formed or pre-coiled springs having either the first or second thickness, or springs having a different thickness wire, may be supplied to the coil inserter.

A length of continuous pocket strip or pocket strip material is also fed into the coil inserter.

The coil inserter then inserts the internal coil springs or perimeter coil springs into the pocket strip according to the predetermined order communicated from the control means in response to user input or according to a preset pattern.

The spring-filled coil strip may then either be rolled, stacked, or compressed, or fed into the pocket coiler mattress assembly machine. The assembly machine cuts lengths of the spring-filled pocket strip according to the output control signals. A cut length may then either be rolled, stacked, or compressed, or attached to other cut lengths, for example by gluing or hot melt adhesive, into an unbordered spring-filled pocket coil assembly. Border wire may be added to the outside perimeter of the coil assembly for added stiffness.

Input parameters could include overall length and row width of the final coil assembly matrix and the number, characteristics, and location of individual springs or firmness zones.

Output control signals could include, for example, the number of pockets or coil springs per row or per cut length, the location of each pocket within the matrix, and the particular spring rate characteristics of a coil spring or perimeter spring corresponding to a particular pocket or location.

Coil spring characteristics may also be characterized or computed according to other parameters, such as the number of spring rate portions per coil per zone based on desired load weight and displacement characteristics, diameter and pitch per spring rate portion, spring wire gauge or thickness, and/or height.

Thus, the means for manufacturing the coil spring assembly may include the following: means for inputting desired coil spring assembly characteristics; means for inputting desired coil characteristics or patterns; means for selecting a coil spring coiling pattern; means for cutting a wire into a desired length; means for coiling a length of wire into a coil spring having the selected coil spring coiling pattern or characteristics; means for cutting the coil spring to a desired height; means for inserting a coil spring into a pocket or area corresponding to its preselected matrix location, preferably in a pre-compressed or pre-loaded state; and means for securing the coil spring in its respective pocket. The means for manufacturing the coil spring assembly may also include means for winding the spring filled strip or matrix for storage. The means for manufacturing the coil spring assembly may further include means for reorienting, or flipping, or impacting a coil spring in its respective pocket. Furthermore, the means for manufacturing the coil spring assembly may include means for cutting a specified length of the spring filled continuous pocket strip into one or more sections; and means for assembling lengths of spring filled strips or strip segments together, such as means for placing the sections into adjacent relationship corresponding to a desired overall matrix location and means for fixedly attaching the adjacent sections together to form the desired spring filled matrix. The manufacture may further be accomplished with means for inserting perimeter springs into the continuous pocket strip in locations corresponding to the outer perimeter of the coil spring assembly prior to cutting into sections, and means for inserting border wire around the periphery of the coil spring assembly.

By way of example, various coil springs may be placed in a continuous pocket coil strip used to form a mattress which has twenty pockets disposed along an edge, wherein adjacent sections of spring filled product strip are attached to one another in a side by side relationship parallel to the edge. The beginning of the continuous pocket strip, wherein the first twenty pockets correspond to the first row, are filled with perimeter springs. The first row could correspond to the first row of coils located at the head or foot or side of a mattress. The twenty-first and forty-first pockets contain perimeter springs, while the intervening twenty-second through fortieth pockets contain internal coil springs, wherein the twenty-first through forty-first pockets correspond to the second column of the coil spring assembly. Similarly, a perimeter spring is disposed in the forty-second pocket, followed by internal coil springs, and so on.

Thus, production of a coil spring assembly having a plurality of multiple spring rate coil springs, wherein the spring characteristics of each spring coil may differ from other coil springs, may be accomplished in an automated fashion on a continuous basis. Production may also be performed on a batch basis, where a part of a mattress, a single mattress, or a number of mattresses are fabricated in a single run, as may be used when constructing highly customized mattresses, or when it is desired to change one or more wire thicknesses from mattress to mattress.

Different gauge wire may be used in a single mattress. For example, head, foot, and middle sections may each contain springs of different diameters. Furthermore, different gauge wires may be fed sequentially into a single coiler. However, it is usually preferable to have one coiler for each different wire gauge in order to speed the process of manufacture. If only one coiler is available, it may be preferable to coil one set of springs in advance and feed those coil springs from a hopper.

It should be noted that every spring in a final coil spring assembly may comprise springs wherein each has a different multiple spring rate characteristic from any other spring in the assembly, and wherein each spring is selectively placed in a particular matrix location in relation to the other springs in the assembly.

Furthermore, all the springs may have the same multiple spring rate characteristics.

Moreover, a final coil spring assembly may include perimeter springs or border wire. On the other hand, perimeter or border springs may be omitted altogether.

A coil spring assembly, or a portion thereof, may thus form a single horizontal layer, or may be stacked and interconnected to form a multiple horizontal layer assembly. The coil spring assembly may be substantially planar, or may be formed or adapted to a variety of shapes and configurations. For example, the spring assembly may have concave or convex surfaces, or may have a square, circular, rectangular, triangular shape. Other shapes and configurations. whether two- or three-dimensional, may be constructed according to the present invention.

FIGS. **15–17** illustrate a first coiler apparatus **100**, a second coiler apparatus **102**, and a coil insertion apparatus **104**. One or both coiler apparatuses **100**, **102** may be replaced by a coil hopper if appropriate coils are made in advance. A first conveyor **106***a* transports coils from the first coiler **100** toward the insertion apparatus **104**. Similarly, coils from the second coiler apparatus **102** are transported toward the insertion apparatus **104** by a second conveyor **106***b*. The coils are preferably aligned transversely with respect to the direction of travel of first and second conveyors **106***a–b*, whereupon the coils are placed or fall by gravity into the hopper **108**. The hopper **108** preferably has a wedge shape so that the coil falls by gravity into the bottom of the wedge. The hopper or chute **108** facilitates the delivery of each coil in a longitudinal alignment with the line of travel of the insertion apparatus **104**.

The insertion apparatus **104** further comprises a compression plunger **110**, a rotatable turret **112** having at least one outer portion **114** having a recess **116** adapted to receive and retain a compressed coil, a means **118** for rotating the turret **112** to place a respective recess **116** into alignment with coil strip material **120** which is fed into the insertion apparatus **104**, and a means **122** for inserting the compressed spring into contact with the coil strip material **120**. FIG. **15** shows four outer portions **114** equally separated by 90°. Each outer portion **114** defines a radial opening through which a coil may be inserted into the turret **112**, a first transverse opening through which the distal end of a coil insertion plunger **124** contacts the compressed coil spring, and a second transverse opening opposite the first opening, from which the coil may be ejected. The outer portion **114** further includes a means **126** for temporarily retaining the coil within the cavity in a compressed state, and in particular prevents the coil spring from radially exiting the turret **112**. The coil may be retained by a hinged mechanism, such as a one-way cam locking device.

As best seen in FIG. **15**, the coil strip material **120** may be supplied from a roll **128** of coil strip material **120** which may be unrolled as it is fed into the insertion apparatus **104**. In the particular embodiment shown in FIGS. **15–17**, a sheet of coil strip material is drawn from the roll **128** and folded in half by a folding means **130**, whereby the open end faces inwardly towards the insertion apparatus **104** and the folded crease is disposed outwardly. The folded coil strip material **120** is then advanced adjacent the insertion apparatus **104** in order to be filled with coil springs.

The insertion apparatus **104** further comprises a spreading wedge **132** which spreads the top and bottom layers of coil strip material **120** in advance of the coil insertion area of the insertion apparatus **104** as the material travels alongside. The insertion apparatus **104** also includes a top plate and a bottom plate disposed above the top layer and below the bottom layer of strip material. respectively. After the turret **112**, which contains a compressed spring in one of its recesses **116**, is rotated into position so the spring is aligned with the coil insertion plunger **124**. The coil insertion plunger **124** is then actuated toward the turret **112** and the coil spring retention means **126** is released, thereby displacing the coiled spring from the recess of the outer portion **114** of the turret **112**. The compressed coil spring is further advanced by the coil insertion plunger **124** between two intermediate telescoping plates which are disposed between the turret **112** and the top and bottom plates. The intermediate plates extend partially between the two top and bottom plates, wherein the top layer of folded coil strip material passes between a gap between the top outer plate and the top intermediate plate, and the bottom layer of the folded coil strip material passes through the gap between the bottom intermediate plate and the bottom outer plate.

At the fullest extent of the coil insertion plunger **124**, the spring is displaced beyond the intermediate plates to rest between the top and bottom layers of folded strip material **120**. The spring is substantially prevented from expanding within the coil strip material **120** by the top and bottom outer plates. As best seen in FIG. **16**, the insertion apparatus **104** further comprises a plurality of guiding plates **150** which maintain the coil filled strip material in a compressed state as the spring-filled material is longitudinally advanced through the insertion apparatus **104**.

The apparatus **104** further includes a sealing means for enclosing the coil spring within pockets of coil strip material. First and second sewing mechanisms **154**, **156** are best seen in FIG. **16**, wherein the first sewing mechanism **154** traverses and sews or seals the coil filled strip material transversely in a back and forth fashion, while the second sewing mechanism **156** applies a longitudinal seal or seam to the material. Preferably, the system is adapted so that the second sewing mechanism **156** seals only one longitudinal edge of the material, as the other longitudinal edge has a folded crease. Thus, the coil spring is entrapped inside its respective pocket in a compressed state with its axis of compression lying generally perpendicular to the central axis of the pocket. With respect to the apparatus shown in FIGS. **15–16**, the pockets are formed transverse to the direction of strip material fed through the apparatus, where the strip material exits the apparatus in a generally horizontal orientation, and the axis of compression of each inserted coil spring is generally vertical. The coil filled strip material may at this juncture be rolled, or stacked, while preferably maintaining the compressed coil spring in such a perpendicular orientation, if desired. The coil filled strip may instead be fed or inserted into a device which reorients or flips each coil spring within its respective pocket. Thus, the insertion apparatus **104** may further comprise an impact mechanism for imparting a transverse force to the compressed coil within its pocket of the coil strip. The impact mechanism is adapted to impact the spring in an appropriate direction and with sufficient force to cause the spring to reorient itself within its pocket, e.g. by 90°, whereupon the spring at least partially expands to fill the pocket in a proper orientation. Preferably, the spring finally situates itself within the pocket in a preloaded or partially compressed state. Thus, the reoriented spring may have a lesser degree of compression than its initially inserted state.

Thus, the insertion apparatus **104** is adapted to insert springs coiled by various types of coilers. The first and second coiler apparatus, **100** and **102**, may be any suitable known spring coiling devices capable of producing the desired springs.

The coil filled strip material may be cut into sections or lengths. The sections or lengths may be attached to one another, for example by hot melt adhesive or glue in a manner which allows each spring to compress and expand generally independently or individually. Preferably the pockets of adjacent sections are attached by application of adhesive or melt near the middle of the pocket while leaving the ends of the pocket of adjacent sections unattached.

It will thus be seen that the objects set forth above, among those elucidated in, or made apparent from, the preceding description, are efficiently attained and, since certain changes may be made in the above construction without departing from the scope of the invention, it is intended that all matter contained in the above description or shown on the accompanying drawing figures shall be interpreted as illustrative only and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

I claim:

1. An automated method for the manufacture of a coil spring assembly comprising inserting coil springs into respective individual pockets of a continuous pocket strip in a predetermined order wherein at least one of said coil springs has predetermined multiple spring rates.

2. The automated method according to claim **1** further comprising at least two predetermined multiple spring rate coil springs, wherein said predetermined multiple spring rates of at least one of said predetermined multiple spring rate coil springs differs from that of the other predetermined multiple spring rate coil springs.

3. The automated method according to claim **1** further comprising sealing each said coil spring inside its respective pocket.

4. The automated method according to claim **1** further comprising coiling one or more wires having a substantially uniform thickness into said multiple rate coil springs before insertion into said continuous pocket strip.

5. The automated method according to claim **1** wherein said continuous spring-filled strip is cut into sections, wherein said predetermined multiple spring rates of at least one of said predetermined multiple spring rate coil springs in a first cut spring-filled strip differs from that of the other coil springs in said first strip.

6. The automated method according to claim **1** further comprising:

cutting the spring-filled strip into one or more desired lengths;

placing at least two spring-filled lengths adjacent to each other; and

attaching adjacent lengths together.

7. The automated method according to claim **6** further comprising inserting said coil springs into said pocket strip in a predetermined order to form at least two firmness zones upon attaching said adjacent lengths together.

8. The automated method according to claim **6** further comprising installing one or more border wires around the outer perimeter of said coil spring assembly.

9. The automated method according to claim **1** further comprising inserting a plurality of perimeter coil springs in respective perimeter pockets corresponding to the outer perimeter of said coil spring assembly.

10. The automated method according to claim **9** where said perimeter coil springs are formed by coiling a wire having a second substantially uniform thickness before insertion into said continuous pocket strip, wherein said second thickness differs from the thickness of at least one other said coil spring.

11. An automated method of manufacturing a coil spring assembly from a continuous pocket coil strip having a plurality of open pockets disposed along a longitudinal axis, wherein each said pocket has a central axis which is substantially orthogonal to said longitudinal axis of said coil strip, and from a plurality of coil springs, each said coil spring having a plurality of coils, and wherein at least one coil spring has a predetermined multiple spring rate and has a different spring rate characteristic than at least one other coil spring and wherein each spring has an axis of compression, the method comprising:

inserting each said spring into a respective open pocket of said continuous pocket coil in a predetermined order; and

closing said pockets.

12. The automated method according to claim **11** further comprising detaching, at respective predetermined lengths, at least two sections of said continuous pocket coil strip containing said springs.

13. The automated method according to claim **12** further comprising attaching said at least two sections in side-by-side relationship, wherein the longitudinal axes of said sections are substantially parallel to each other and the axes of compression of said coil springs are parallel to each other.

14. The method according to claim **13** wherein said attached portions of pocket coil form a pocket coil assembly having at least two zones of coil springs wherein said coil springs of each said zone have substantially similar spring rate characteristics, and wherein the spring rate characteristics of at least two of said zones differ.

15. The automated method according to claim **11** further comprising aligning the axis of compression of each said spring perpendicular to the central axis of a respective said pocket before insertion.

16. The automated method according to claim **15** further comprising rotating each said spring within its respective said pocket thereby aligning the axis of compression of each said spring with the axis of its respective said pocket.

17. The method according to claim **11** wherein said one other coil spring has at least two spring rates.

18. The method according to claim **11** wherein said at least one of said coil springs comprises:

a first end portion having a first pitch;

a second end portion having the first pitch; and

a middle portion having a second pitch and integrally disposed between said first and second end portions.

19. The method according to claim **18** wherein said second pitch is greater than said first pitch.

20. The method according to claim **18** wherein at least one coil of at least one of said end portions of at least one of said coil springs decreases in diameter in an endward direction.

21. A coil spring assembly comprising:

a plurality of coil springs, including at least one multiple spring rate coil spring, each said multiple spring rate coil spring having at least two spring rates;

a connective matrix means for maintaining said coil springs in a spaced apart relationship and for allowing said coil springs to compress and expand; and

wherein said connective matrix means comprises a plurality of attached pocket coil strip segments.

22. The coil spring assembly according to claim **21** wherein said coil spring assembly is adapted to allow each said coil spring to compress and expand substantially independently.

23. The coil spring assembly of claim **21** wherein said at least one multiple spring rate coil spring comprises:

a plurality of helically wound coils including a first coil, a second coil, and a plurality of intermediate coils disposed therebetween, wherein the pitch of said first coil is smaller than the pitch of said second coil, and wherein the diameter of said first coil is smaller than the diameter of said second coil.

24. The coil spring assembly according to claim **23** wherein the pitch of said intermediate coils successively increases from said first coil to said second coil.

25. The coil spring assembly according to claim **23** wherein the diameter of said intermediate coils successively increases from said first coil to said second coil.

26. The coil spring assembly according to claim **23** wherein the diameter of said intermediate coils increases from said first coil to said second coil, and wherein said coils are formed to allow said coils, upon compression, to nest within an adjacent coil having a larger diameter.

27. The coil spring assembly according to claim **23** wherein said coils are formed to allow adjacent said coils to nest within one another without touching.

28. A coil spring assembly comprising:

a plurality of coil springs, including at least one multiple spring rate coil spring, each said multiple spring rate coil spring having at least two spring rates;

a connective matrix means for maintaining said coil springs in a spaced apart relationship and for allowing said coil springs to compress and expand; and

wherein said coil springs are disposed within said connective matrix means in a plurality of rows, wherein each said row contains a plurality of said coil springs, and wherein the spring rate of at least one of said coil springs in at least one of said rows differs from the spring rate of at least one other coil spring in said row.

29. The coil spring assembly of claim **28** wherein said at least one multiple spring rate coil spring comprises:

a first end portion having a first plurality of helically wound coils; and

a middle portion having a second plurality of helically wound coils, said middle portion being integrally formed with said first end portion;

wherein said first plurality of coils includes a first coil and a second coil;

wherein said second coil is disposed between said first coil and said middle portion;

wherein said first and second coils having substantially similar pitches;

wherein said second plurality of coils includes at least one middle coil;

wherein the pitch of said middle coil is greater than the pitch of any of said first plurality of coils; and

wherein said first end portion and said middle portion are adapted to permit said first end portion to substantially fully compress substantially before said middle portion compresses.

30. The coil spring according to claim **29** wherein said first plurality of coils is adapted to spirally nest within one another.

31. The coil spring according to claim **30** wherein said first plurality of coils is adapted to lie substantially in a plane when fully compressed.

32. The coil spring according to claim **30** wherein said first plurality of coils is adapted to spirally nest within one another without having the exterior surfaces of said coils touching one another.

33. A coil spring assembly comprising:

a plurality of coil springs, including at least one multiple spring rate coil spring, each said multiple spring rate coil spring having at least two spring rates;

a connective matrix means for maintaining said coil springs in a spaced apart relationship and for allowing said coil springs to compress and expand; and

wherein said coil springs are disposed within said connective matrix means in a plurality of rows, wherein each said row contains a plurality of said coil springs, wherein at least one of said rows contains at least two multiple spring rate coil springs, and wherein the multiple spring rate of at least one of said multiple spring rate coil springs in said at least one of said rows differs from the multiple spring rate of at least one other multiple spring rate coil spring in said at least one of said rows.

34. A coil spring assembly comprising:

a plurality of coil springs; and

a connective matrix means for maintaining said coil springs in a spaced apart relationship and for allowing said coil springs to compress and expand;

wherein said coil springs are disposed within said connective matrix means in a plurality of rows, wherein each said row contains a plurality of said coil springs, and wherein the spring rate of at least one of said coil springs in at least one of said rows has predetermined multiple spring rates and differs from the spring rate of at least one other coil spring in said row.

35. The coil spring assembly according to claim **34** wherein said coil spring assembly is adapted to allow each said coil spring to compress and expand substantially independently.

36. The coil spring assembly according to claim **34** wherein said plurality of coil springs further comprises a plurality of perimeter springs generally disposed at the outer perimeter of said coil spring assembly, wherein each of said perimeter springs has a plurality of coils of substantially uniform thickness which is greater than the thickness of said coils of said multiple spring rate coil springs.

37. A mattress of pocket coil construction comprising:

a plurality of pockets; and

a plurality of coil springs, including at least one multiple spring rate coil spring, each said multiple spring rate coil spring having at least two spring rates;

wherein each said spring further comprises a plurality of coils; and

wherein said springs are disposed in respective said pockets.

38. The mattress according to claim **37** wherein at least two adjacent said multiple rate springs have substantially similar multiple spring rates, thereby forming at least one multiple firmness zone.

39. The mattress according to claim **37** wherein at least one of said multiple rate coil springs further comprises first and second portions having respective first and second spring rates, respectively;

wherein said first spring rate is lower than said second spring rate; and

wherein said first portion of said coil spring is adapted to compress at least partially by an initial displacement before said second portion compresses.

40. The mattress according to claim **37** further comprising:

a first plurality of multiple spring rate coil springs;

a second plurality of multiple spring rate coil springs; and

a third plurality of multiple spring rate coil springs;

wherein the multiple spring rates of at least one of said plurality of multiple spring rate coil springs differs from at least one of the other said coil springs.

41. The mattress according to claim **37** further comprising:

a first plurality of multiple spring rate coil springs, each said coil spring having a first multiple spring rate;

a second plurality of multiple spring rate coil springs, each said coil spring having a second multiple spring rate; and a third plurality of multiple spring rate coil springs, each said coil spring having a third multiple spring rate;

wherein at least one of said multiple spring rates differs from at least one of the other said multiple spring rates.

42. A coil spring assembly comprising:

a plurality of tubular pockets, each said pocket having a tubular sidewall disposed around a central axis and a pair of endwalls disposed at opposite ends of said tubular sidewall, wherein said pockets are interconnected to form a side-by-side matrix; and

a plurality of coil springs, including a plurality of multiple rate coil springs, each said coil spring having a plurality of coils, wherein at least one coil spring has a different spring characteristic than at least one other coil spring, wherein each spring has an axis of compression substantially aligned with the central axis of its respective pocket, and wherein the axes of compression and the central axes are substantially perpendicular to said matrix.

43. The coil assembly according to claim **42** wherein each said spring occupies a respective selected pocket.

44. The coil assembly according to claim **42** further comprising at least two zones of coil springs, wherein said coil springs within each respective said zone have substantially similar spring rate characteristics, and wherein the spring rate characteristics of at least two of said zones differ.

45. The coil assembly according to claim **42** wherein at least one of said coil springs has at least two spring rates.

46. The coil assembly according to claim **42** wherein at least one of said coil springs comprises:

a first end portion having a first pitch;

a second end portion having said first pitch; and

a middle portion having a second pitch and integrally disposed between said first and second end portions.

47. The coil assembly according to claim **46** wherein said second pitch is greater than said first pitch.

48. The coil assembly according to claim **46** wherein at least one coil of at least one of said end portions of at least one of said coil springs decreases in diameter in an endward direction.

* * * * *

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
1 December 2011 (01.12.2011)

PCT

(10) International Publication Number
WO 2011/150080 A1

(51) International Patent Classification: *A47C 23/00* (2006.01)

(21) International Application Number: PCT/US2011/037935

(22) International Filing Date: 25 May 2011 (25.05.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/348,233 25 May 2010 (25.05.2010) US

(71) Applicant *(for all designated States except US)*: **KINGSDOWN, INC.** [US/US]; 126 West Holt Street, Mebane, North Carolina 27302 (US).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: **HINSHAW, Lee** [US/US]; c/o Kingsdown, INC., 126 West Holt Street, Mebane, North Carolina 27302 (US).

(74) Agents: **LYTLE, J. Warren** et al.; Sughrue Mion, PLLC, 2100 Pennsylvania Avenue, NW, Suite 800, Washington, District of Columbia 20037-3213 (US).

(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, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, 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, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, 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,

[Continued on next page]

(54) **Title**: INDEPENDENT MATTRESS UNITS WITH TRANSITION ZONE

(57) Abstract: A mattress includes a first spring unit having a first degree of firmness, a second spring unit having a second degree of firmness different from the first degree of firmness, and a transition zone that is disposed between the first and second spring units. A foam perimeter surrounds the first and second spring units and the transition zone. The transition zone has a first row of springs adjacent to the first spring unit and has a degree of firmness between the first and second degrees of firmness that is closer to the first degree of firmness than the second degree of firmness. The transition zone also has a second row of springs adjacent to the second spring unit and has a degree of firmness between the first and second degrees of firmness that is closer to the second degree of firmness than the first degree of firmness.

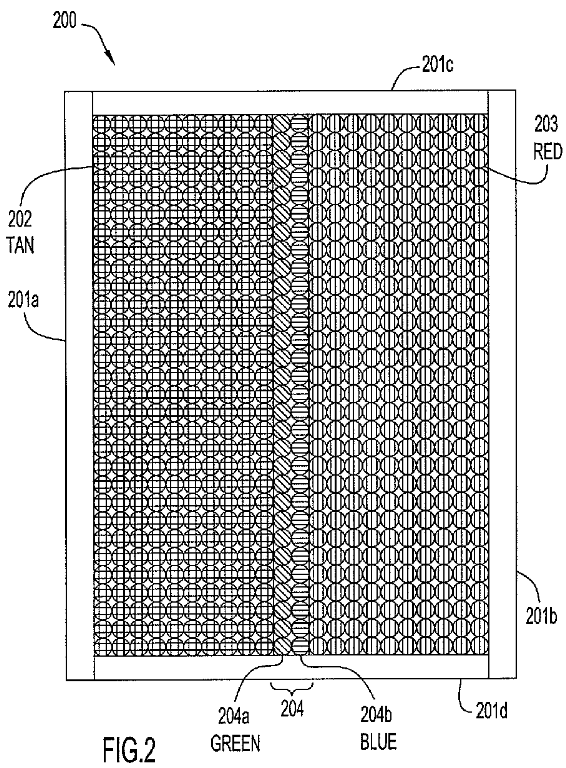


FIG.2

WO 2011/150080 A1

SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

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

— *with amended claims and statement (Art. 19(1))*

INDEPENDENT MATTRESS UNITS WITH TRANSITION ZONE

Cross-reference to Related Applications

This application claims the benefit of U.S. Provisional Application No. 61/348,233, filed May 25, 2010.

Field of the Invention

The invention relates to mattress systems having separate mattress support units of the same or varying firmnesses and a transition zone that provides an area of transitional support between the mattress support units.

BACKGROUND OF THE INVENTION

Spring coil mattresses have been known in the art for many years. A variety of attempts have been made to provide mattresses that have different firmness zones within the same mattress. An example of such a mattress is described in U.S. Patent Publication No. 2008/0072382 to James. This patent application describes a mattress that has a foam perimeter surrounding two sections with a flexible spacer placed between the two sections, the flexible spacer being constructed of foam. Arrays of springs are placed in the two sections and the foam flexible spacer is described as restricting translation of movement between the adjacent sections of the mattress. This flexible spacer is also described as being rather small, generally significantly less than the width of the perimeter rail.

Another attempt at providing a mattress with varying firmness is a hybrid mattress having portions with different support characteristics, as described in U.S. Patent No. 5,740,574 to Piraino. This hybrid mattress is described as having two individual support means with differential deflection coefficients, such as two inner spring supports, and a comfort means which is a unitary casing of foam rubber having two pouches sized to snugly receive the individual support means. This casing structure of the comfort means is described as also having an internal interface member. The internal interface member is described as a piece of rigid foam connecting the top and bottom surface members and creating the two pouches in which the individual support means fit. The interface member is further described as being part of the unitary comfort means that allows the hybrid mattress to act as a single unit without coming apart or shifting during use. This foam interface member which is part of the casing structure is stated to alleviate problems in the prior art of traversing the change in support rating from one unit to the other.

These prior attempts at creating a mattress rely on a piece of foam that acts as a flexible spacer or interface member to separate the two support units.

SUMMARY OF THE INVENTION

An embodiment of the present invention are directed to a mattress that has two independent mattress units with support characteristics that differ from one another, and that has a transition zone disposed between the two mattress units. Each of the independent mattress units can be an array of springs that has a degree of firmness that is different from the degree of firmness of the other independent mattress unit. The transition zone is formed by one or more rows of compression of springs having a degree of firmness that is between the degrees of firmness of the two mattress units.

BRIEF DESCRIPTION OF THE FIGURES

Embodiments of the present invention will now be described by reference with the following figures, in which:

FIG. 1 is a diagram of a conventional multi-firmness mattress having two coil units of different firmness, with a thin foam separator rail.

FIG. 2 shows an embodiment of the invention in which a mattress has two independent mattress units of different firmnesses with a transition zone of two rows of springs each with a different firmness between the firmness of the two independent mattress units.

FIGS. 3(A)-3(D) illustrate a plurality of mattress units with different firmnesses.

FIGS. 4(A)-4(F) show various transition zone spring units having more than one row of springs with each row having either the same or a different firmness than the firmness of the other row.

FIGS. 5(A)-5(J) show various configurations of a mattress having independent mattress units of the same or differing firmnesses with a transition zone of springs disposed therebetween.

FIG. 6 is a flowchart illustrating the steps in a method to make a mattress that has two independent mattress units of different firmnesses with a transition zone disposed therebetween, according to an embodiment of the invention.

DETAILED DESCRIPTION

FIG. 1 shows a conventional mattress 100 in the related art that has a foam casing made up of side rails 101a and 101b, head rail 101c, and foot rail 101d, and two spring units 102 and 103 of different firmnesses, which are support units for supporting a person during sleep. Disposed between the spring units is a thin foam rail 104.

A well known type of bedding employs a spring assembly that includes a number of discrete coil springs, each of which is enclosed in a fabric pocket in a length of folded fabric material. Longitudinal axes of the coil springs are generally parallel with one another so that the top and bottom end turns of the coil springs define top and bottom faces of the spring assembly. A row of such pocketed springs is known in the industry as a string of pocketed springs. A bedding product can be fabricated from such strings of pocketed springs by binding or adhering the individual rows or strings of pocketed springs together to form a spring assembly which may be padded and encased in an upholstered covering. This type of spring assembly is commonly referred to as a pocketed spring assembly due to the fact that each spring is contained within an individual pocket of fabric material. The construction of strings of pocketed coil springs in each pocket is well known in the art and, for example, is disclosed in U.S. Pat. No. 4,439,977, which is hereby incorporated by reference in its entirety. The system disclosed in that patent includes a spring coiler which forms a coil spring which is subsequently compressed and inserted between the plies of folded pocketing fabric material.

For ease of description, and without limitation, different firmnesses of the springs are assigned the name of a color and will be referred to by that color. For example, spring units made of 14 gauge wire will be referred to by the color red (R). Spring units made of 14.5 gauge wire will be referred to by the color blue (B). Spring units made of 15 gauge wire will be referred to by the color green (G). Spring units made of 16 gauge wire will be referred to by the color tan (T). Generally, the larger the gauge of wire from which a spring is constructed, the firmer the spring and more support is will provide. It will be understood that the gauges of wire described here are merely examples and other gauges can be used.

FIG. 2 shows a mattress 200 according to an embodiment of the present invention which has two independent mattress units of different firmnesses with a transition zone having two rows of springs. The mattress 200 is formed by a foam perimeter made up of side rails 201a and 201b, a head rail 201c, and a foot rail 201d. A first spring unit 202 is a support unit that has a first firmness made of a plurality of strings of pocketed springs with coils of 16 gauge wire and is referred to as a tan spring unit. A second spring unit 203 is a support unit that is formed of a plurality of strings of pocketed springs with coils made from a heavier gauge wire, namely 14 gauge wire, and therefore is firmer than spring unit 202, and is referred to as a red spring unit. A transition zone of springs 204 is formed from two transition strips 204a and 204b which, according to the present embodiment, are strings of pocketed springs, each string of pocketed springs also being referred to as a row of springs, with firmnesses that transition from a firmer spring (blue) to a softer spring (green). Together the two transition spring rows 204a and 204b form the transition zone. The firmer row of springs in the transition zone, in this case the blue row of springs 204b, is disposed adjacent to the firmer spring unit, namely the red spring unit 203. The less firm, or softer row of springs in the transition zone, in this case the row of green springs 204a, is disposed adjacent to the softer spring unit, namely the tan spring unit 202.

The transition zone springs 204 can be attached to either one or both of the spring units 202, 203 by conventional methods, such as by gluing or hog-ringing. The transition zone is attached to at least one of the spring units prior to the spring units being inserted into the space formed by the foam perimeter 201a-201d. The foam perimeter surrounds the spring units 202, 203 and the transition zone 204. The mattress 200 is then covered by suitable top covering materials to form a mattress suitable for use by two people. Accordingly, the resulting mattress with independent spring units is suitable for a person desiring a relatively firm mattress, corresponding to the spring unit made of heavier gauge wire such as red spring unit 203, and by a person desiring a less firm, or softer mattress corresponding to the spring unit made of lighter gauge wire such as tan spring unit 202. And the mattress has a transition zone 204 that has a firmness that transitions in a relatively continuous manner from the firmer spring unit (red) to the softer spring unit (tan), making the change in firmness between the spring units less noticeable than in conventional mattresses.

The mattress can be a suitable size for comfortable sleeping by two people, such as a king or queen size mattress. However, the techniques described here can be used with other size mattresses.

Selection of the appropriate spring units can be made in conjunction with automatic mattress recommendation systems such as those described in U.S. Patent Nos. 6,571,192, 6,741,950, and 6,990,425 to Hinshaw, et al., which are incorporated herein by reference. Based on customers' selection or recommendation of the appropriate firmness for each side of the mattress, a suitable mattress can be built using the appropriate spring units with the selected or recommended firmness for each person. Based on the spring units to be used in the mattress, a transition zone is determined that appropriately blends the firmness from one side of the mattress to the other. The transition zone, according to the present embodiment, has two rows of springs with the firmness of the springs in each row selected based on the firmness of the different mattress units. The firmness of the coils making up the transition zone are selected to provide a gradual transition from the firmness of one mattress unit to the firmness of the other mattress unit. In the following embodiment, the firmnesses ranges from the most firm, being a 14 gauge red

(R) spring coil, to a 14.5 gauge blue (B) spring coil, to a 15 gauge green (G) spring coil, to the softest spring coil, tan (T), made of a 16 gauge wire. As illustrated in FIGS. 3(A)-3(D), mattress units, or support units, are made of a plurality of strings of pocketed springs in which the springs are coils of the same firmness. For example, FIG. 3(A) shows a spring unit made of ten strings of pocketed springs connected together as a spring unit. Each of the springs in the spring unit shown in FIG. 3(A) is a tan (T) type spring of 16 gauge wire making the spring unit shown in FIG. 3(A) the softest spring unit of the present embodiment. FIG. 3(B) shows a somewhat firmer spring unit made of a plurality of strings of pocketed springs in which the springs are made of green (G) springs of 15 gauge wire. FIG. 3(C) shows an even firmer spring unit made of a plurality of strings of pocketed springs in which the springs are made of blue (B) springs of 14.5 gauge wire. And FIG. 3(C) shows an the firmest spring unit made of a plurality of strings of pocketed springs in which the springs are made of red (R) springs of 14 gauge wire.

The spring coils used to make the transition zone rows are selected to have a firmness that transitions from the firmness of one of the mattress units to the firmness of the other mattress unit. For example, the mattress shown in FIG. 2 has a relatively soft tan (T) mattress unit 202 made of 16 gauge wire. Red (R) mattress unit 203 is made of 14 gauge spring coils. The transition zone is formed by a row of blue (B) springs 204b of 14.5 gauge wire and a row of green (G) springs 204a of 15 gauge wire. The row of blue springs is disposed next to the firmer mattress unit, the red (R) unit 203, and the row of green springs is disposed next to the softer mattress unit, the tan (T) unit 202. This provides an gradual easing of the firmness of coils going from the firmer side of the mattress to the softer side of the mattress, that is, going from the red (R) mattress unit to the tan (T) mattress unit. This results in a more subtle transition from the firm mattress unit to the softer mattress unit, and is more pleasing and desirable to the users than in conventional mattress support structures having differing firmnesses. In the mattress shown in FIG. 2, the blue and green rows of springs in the transition zone have a firmness that is between the firmness of the red and tan spring units and therefore provides for a continuous transition in firmness in the transition zone 204.

The different firmnesses of the spring units, described here as red, blue, green and tan, can be considered degrees of firmness. A red spring unit and a blue spring unit differ by one degree of firmness. Similarly, a red spring unit and a green spring unit differ by two degrees of firmness. And a red spring unit and a tan spring unit differ by three degrees of firmness. Likewise, a blue spring unit and a green spring unit differ by one degree of firmness, and a blue spring unit and a tan spring unit differ by two degrees of firmness. And a green spring unit and a tan spring unit differ by one degree of firmness. Similarly, rows of springs for the transition zone differ in degrees of firmness in the same manner.

In general, the degrees of firmness of the springs used in the rows of the transition zone are chosen to provide a gradual change in firmness that is as continuous as possible, going from one spring unit to another. There are some configurations where either one of two degrees of firmness can be chosen to provide this gradual or near-continuous transition. In certain embodiments of the invention, when such a choice is to be made, the firmer degree of spring is chosen. The firmer row of springs is chosen because the person desiring firmer support often will be the larger of the two partners using the mattress and may require more mattress area.

FIGS. 4(A)-4(F) show various configurations of rows of springs for a transition zone. For example, six different transition zones are shown in these figures: two rows of tan springs shown in FIG. 4(A), two rows of green springs shown in FIG. 4(B), two rows of blue springs shown in FIG. 4(C), two rows of red springs shown in FIG. 4(D), one row of green springs with one row of blue springs shown in FIG. 4(E), and one row of blue springs with one row of red springs shown in FIG. 4(F).

Various combinations of mattress units and transition zones are shown in FIGS. 5A-J.

FIG. 5A shows a configuration with two green mattress units which have no difference in firmness and therefore the transition zone is formed from two rows of green springs. FIG. 5B shows the configuration shown in FIG. 2, in which the mattress units differ by three degrees of firmness. Accordingly, the transition zone is formed by a row of blue springs positioned adjacent to the red spring unit, and a row of green springs positioned adjacent to the tan spring unit. FIG. 5C shows a configuration with a blue mattress unit and a tan mattress unit, which differ by two degrees of firmness. Because only one type of spring has a firmness between the firmness of the blue and the tan spring units, namely a green spring unit, the row of coils in the transition zone disposed closest to the firmer mattress unit, namely the blue mattress unit, is chosen to be the same as the firmer mattress unit. So in this case, a blue row of springs is selected for the transition zone to be positioned next to the blue mattress unit. This is because the firmer mattress unit is likely to support a larger size person who may need more area on the mattress for firm support. A green coil is selected for the second row of the transition zone and it is positioned next to the tan unit to provide a transition from blue to tan. In FIG. 5D, green and tan mattress units are selected. Since those two mattress units are adjacent in degrees of firmness, both rows of springs of the transition zone are selected to be the same firmness as the more firmer mattress unit, namely green springs. This provides more area for the person desiring the firmer coil mattress.

The remaining mattresses shown in FIGS. 5(E)-(J) show various combinations and configurations of spring units and transition zones.

A method of making a mattress with a plurality of support zones of different firmnesses and a transition zone between the support zones, is illustrated in FIG. 6. In this method, a mattress is made with two support zones suitable for supporting two people, in which each support zone supports one of the two people according to that person's physical and sleep characteristics. In step 601, the first person's physical and sleep characteristics are analyzed. For example, the techniques described in U.S.

Patent Nos. 6,571,192, 6,741,950, and 6,990,425 to Hinshaw, et al., can be used to analyze the person's physical and sleep characteristics. In the present embodiment, a computer programmed with an algorithm as described in those patents, and incorporated herein by reference, performs the analysis. In step 602, a similar analysis is performed for the second person. In step 603, a first support unit, having a first firmness, is selected according to the analysis of the first person's physical and sleep characteristics. In step 604, a second support unit, having a second firmness, is selected according to the analysis of the second person's physical and sleep characteristics. In step 605, a transition zone, having two transition strips, is selected based on the selected first and second support units. The firmness of the transition strips is selected according to the guidance described above. The transition strips can be connected to one another to form the transition zone. Each transition strips can be a string of pocketed springs.

The transition zone is then connected to at least one of the support units, such as the first support unit, as shown in step 606. In step 607, the components of the mattress are arranged such that the selected transition zone is disposed between the first and second support units with the firmer transition strip of the transition zone being placed adjacent to the firmer support unit In step 608, a foam perimeter is placed around the arranged first support unit, transition zone, and second support unit. The assembly is covered with one or more layers of mattress covering materials.

The present invention is not restricted to spring coil type support members but can use other types of members as well such as foam mattress units, etc. For example, the support units can be made of foam rubber having the appropriate firmness and the transition strips also can be formed of foam rubber having the appropriate firmness. In embodiments using coils, the coils can be made from any type of suitable inner spring type coil conventionally used for sleep products such as pocketed coils, a Bonnell coil or other continuous wire units, although the invention is not limited to these type of coils. Combinations of types of support units and transition strips can be used depending on the application.

While the invention has been particularly shown and described with reference to certain embodiments thereof, it would be understood by those skilled in the art that various changes in form and detail may be made without departing from the spirit and scope of the invention.

WHAT IS CLAIMED IS:

1. A mattress comprising:

a first spring unit having a first degree of firmness;

a second spring unit having a second degree of firmness different from the first degree of firmness;

a transition zone disposed between the first and second spring units;

a foam perimeter surrounding the first and second spring units and the transition zone;

the transition zone comprising:

a first row of springs adjacent to the first spring unit and having a degree of firmness between the first and second degrees of firmness and closer to the first degree of firmness than the second degree of firmness; and

a second row of springs adjacent to the second spring unit and having a degree of firmness between the first and second degrees of firmness, and closer to the second degree of firmness than the first degree of firmness.

2. The mattress according to claim 1, wherein the first and second rows are each a string of pocketed springs.

3. A bedding product, comprising:

a first support unit having a first degree of firmness;

a second support unit have a second degree of firmness different from the first degree of firmness;

a transition zone disposed between the first and second support units;

a perimeter zone surrounding the first and second support units and the transition zone;

the transition zone comprising:

a first transition strip adjacent to the first support unit and having a degree of firmness between the first and second degrees of firmness and closer to the first degree of firmness than the second degree of firmness; and

a second transition strip adjacent to the second support unit and having a degree of firmness between the first and second degrees of firmness, and closer to the second degree of firmness than the first degree of firmness.

4. The bedding product according to claim 3, wherein at least one of the first and second support units is a spring unit comprised of springs.

5. The bedding product according to claim 4, wherein at least one of the spring units is comprised of a string of pocketed springs.

6. The bedding product according to claim 5 wherein at least one of the first and second transition strips is comprised of a string of pocketed springs.

7. The bedding product according to claim 3, wherein at least one of the first and second transition strips is comprised of a string of pocketed springs.

8. A method of making a bedding product, comprising:

selecting a first support unit having a first degree of firmness;

selecting a second support unit have a second degree of firmness different from the first degree of firmness;

making a transition zone by selecting a first transition strip having a degree of firmness between the first and second degrees of firmness and closer to the first degree of firmness than the second degree of firmness, by selecting a second transition strip having a degree of firmness between the first and second degrees of firmness, and closer to the second degree of firmness than the first degree of firmness, and by disposing the first and second transition strips adjacent to one another; and

disposing the transition zone between the first and second support units wherein the first transition strip is disposed adjacent to the first support unit and the second transition strip is disposed adjacent to the second support unit.

9. The method according to claim 8, wherein at least one of the first and second support units is a spring unit comprised of springs.

10. The method according to claim 9, wherein at least one of the spring units is comprised of a string of pocketed springs.

11. The method according to claim 10, wherein at least one of the first and second transition strips is comprised of a string of pocketed springs.

12. The method according to claim 8, wherein at least one of the first and second transition strips is comprised of a string of pocketed springs.

WHAT IS CLAIMED IS:

1. A mattress comprising:

a first spring unit having a first degree of firmness;

a second spring unit having a second degree of firmness different from the first degree of firmness;

a transition zone disposed between the first and second spring units;

a foam perimeter surrounding the first and second spring units and the transition zone;

the transition zone comprising:

a first row of springs adjacent to the first spring unit and having a degree of firmness between the first and second degrees of firmness and closer to the first degree of firmness than the second degree of firmness; and

a second row of springs adjacent to the second spring unit and having a degree of firmness between the first and second degrees of firmness, and closer to the second degree of firmness than the first degree of firmness.

2. The mattress according to claim 1, wherein the first and second rows are each a string of pocketed springs.

3. A bedding product, comprising:

a first support unit having a first degree of firmness;

a second support unit have a second degree of firmness different from the first degree of firmness;

a transition zone disposed between the first and second support units;

a perimeter zone surrounding the first and second support units and the transition zone;

the transition zone comprising:

a first transition strip adjacent to the first support unit and having a degree of firmness between the first and second degrees of firmness and closer to the first degree of firmness than the second degree of firmness; and

a second transition strip adjacent to the second support unit and having a degree of firmness between the first and second degrees of firmness, and closer to the second degree of firmness than the first degree of firmness.

4. The bedding product according to claim 3, wherein at least one of the first and second support units is a spring unit comprised of springs.

5. The bedding product according to claim 4, wherein at least one of the spring units is comprised of a string of pocketed springs.

6. The bedding product according to claim 5 wherein at least one of the first and second transition strips is comprised of a string of pocketed springs.

7. The bedding product according to claim 3, wherein at least one of the first and second transition strips is comprised of a string of pocketed springs.

8. A method of making a bedding product, comprising:

selecting a first support unit having a first degree of firmness;

selecting a second support unit have a second degree of firmness different from the first degree of firmness;

making a transition zone by selecting a first transition strip having a degree of firmness between the first and second degrees of firmness and closer to the first degree of firmness than the second degree of firmness, by selecting a second transition strip having a degree of firmness between the first and second degrees of firmness, and closer to the second degree of firmness than the first degree of firmness, and by disposing the first and second transition strips adjacent to one another; and

disposing the transition zone between the first and second support units wherein the first transition strip is disposed adjacent to the first support unit and the second transition strip is disposed adjacent to the second support unit.

9. The method according to claim 8, wherein at least one of the first and second support units is a spring unit comprised of springs.

10. The method according to claim 9, wherein at least one of the spring units is comprised of a string of pocketed springs.

11. The method according to claim 10, wherein at least one of the first and second transition strips is comprised of a string of pocketed springs.

12. The method according to claim 8, wherein at least one of the first and second transition strips is comprised of a string of pocketed springs.

13. The mattress according to claim 1, wherein the degree of firmness of the first row of springs is noticeably different from the first degree of firmness, and

wherein the degree of firmness of the second row of springs is noticeably different from the second degree of firmness.

14. The mattress according to claim 1, wherein the first row of springs is adjacent to the second row of springs, with no rows of springs between the first row of springs and the second row of springs.

15. The mattress according to claim 1, wherein the degree of firmness of the first row of springs is approximately halfway between the first degree of firmness and the degree of firmness of the second row of springs.

16. The mattress according to claim 15, wherein the degree of firmness of the second row of springs is approximately halfway between the second degree of firmness and the degree of firmness of the first row of springs.

STATEMENT UNDER ARTICLE 19(1)

New claims 13-16 have been added to describe the invention more particularly. No new matter has been added.

Respectfully submitted,

/ Andrew J. Taska /

Andrew J. Taska
Reg. No. 54,666

Encls. (Pages 14-17)

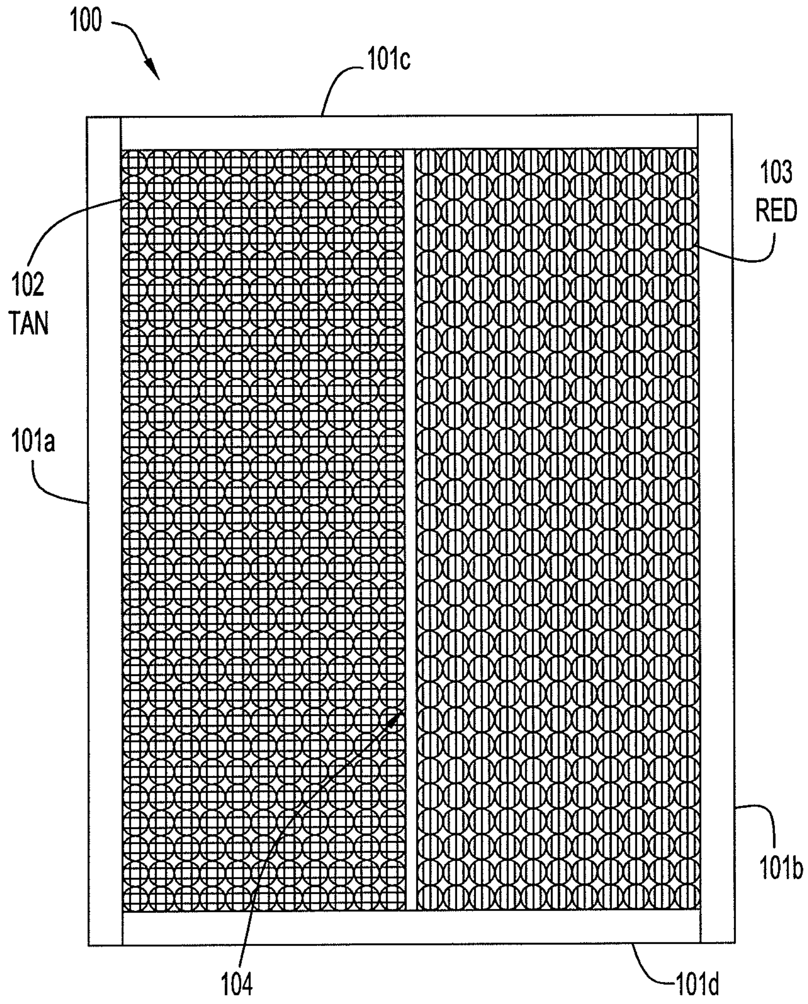

100
101c
103
RED
102
TAN
101a
101b
104
101d

FIG.1

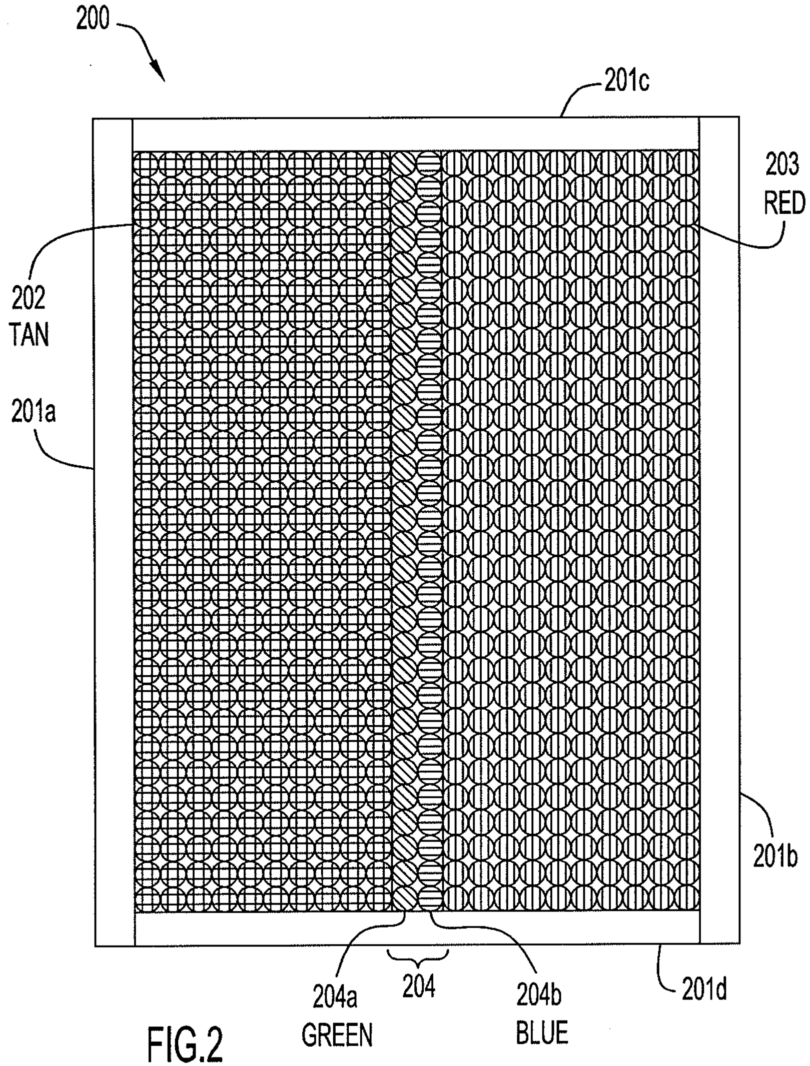

200
201c
203
RED
202
TAN
201a
201b
204a
GREEN
204
204b
BLUE
201d

FIG.2

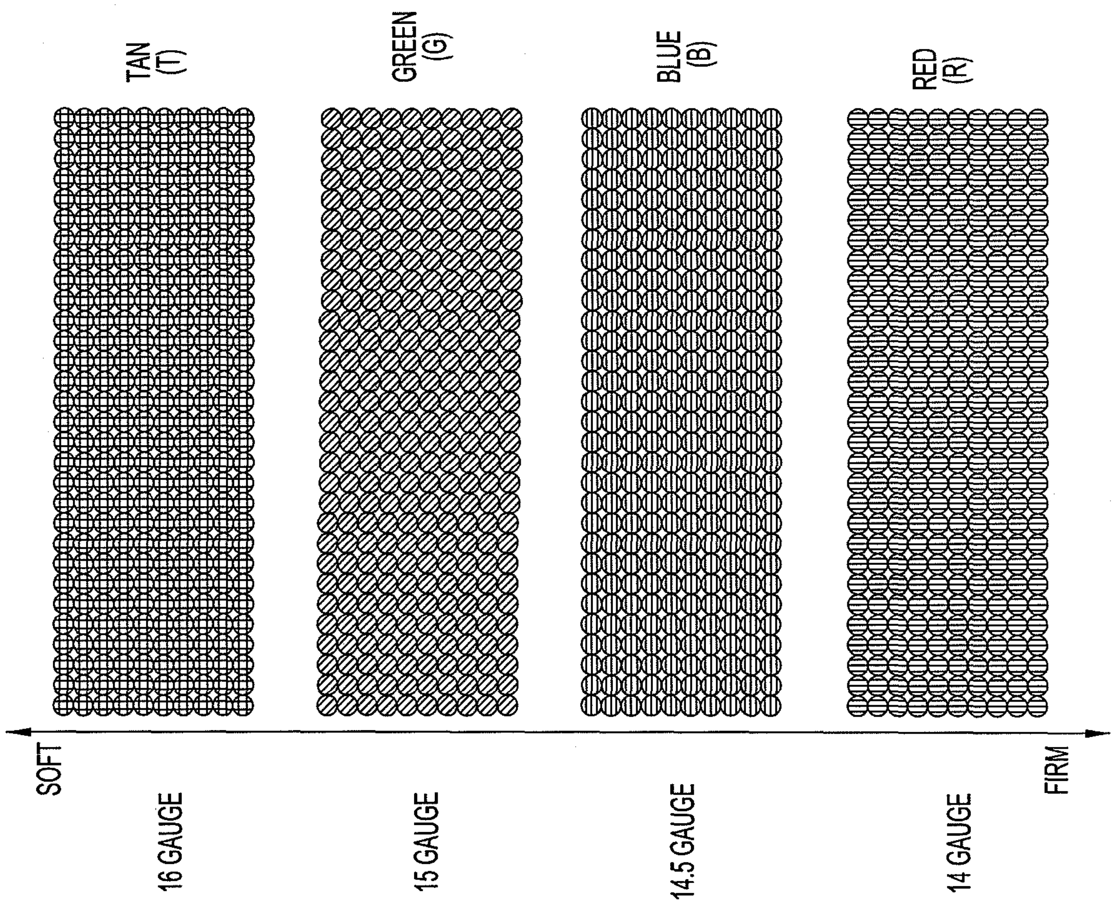


FIG.3A

FIG.3B

FIG.3C

FIG.3D

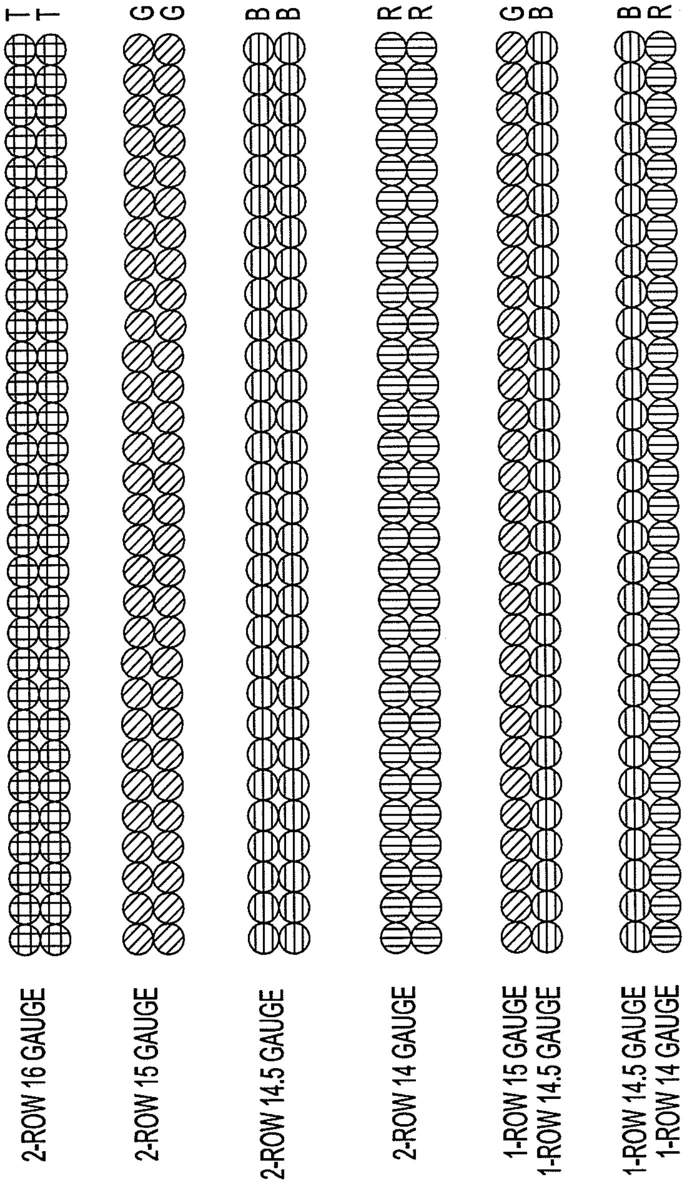


FIG.4A FIG.4B FIG.4C FIG.4D FIG.4E FIG.4F

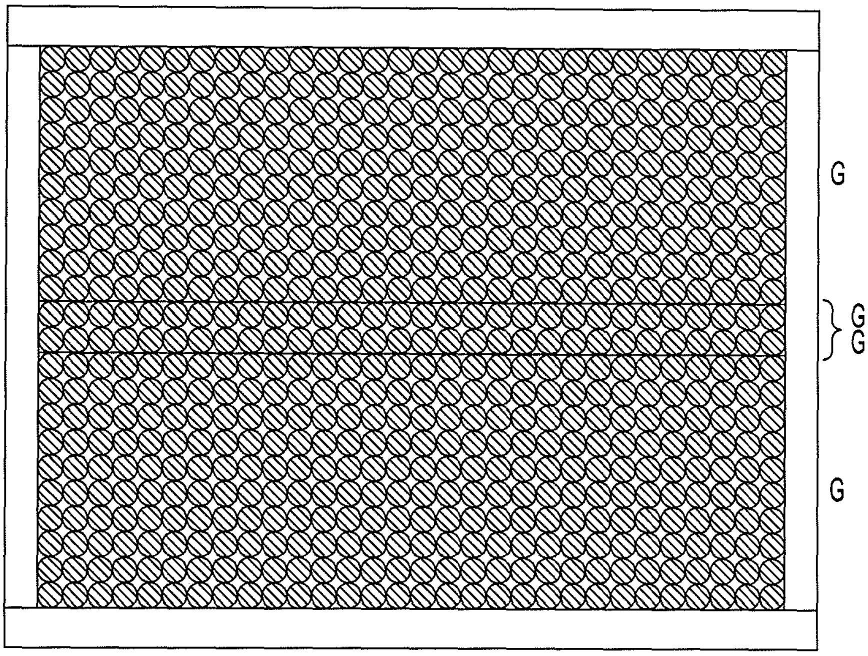


FIG.5A

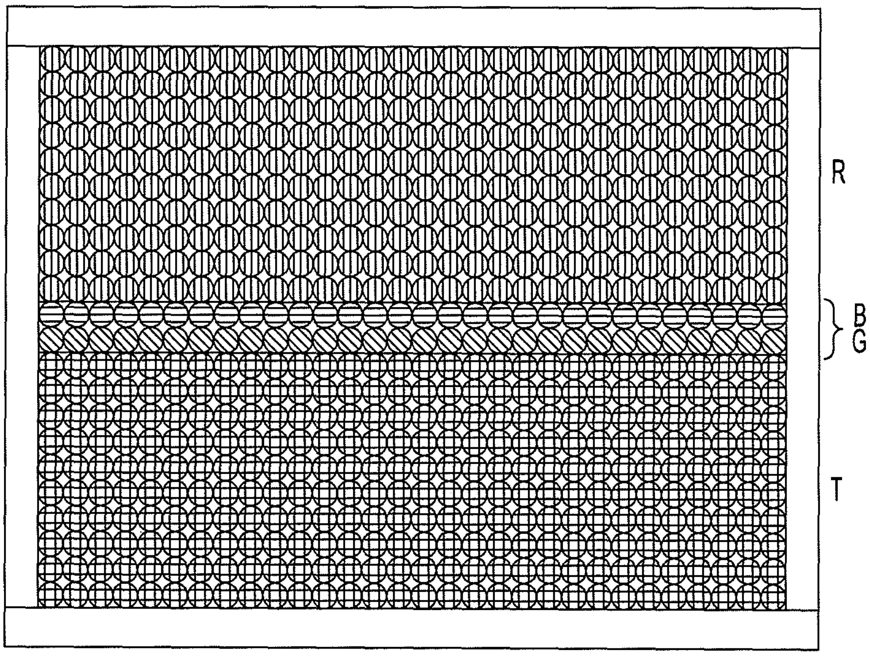


FIG.5B

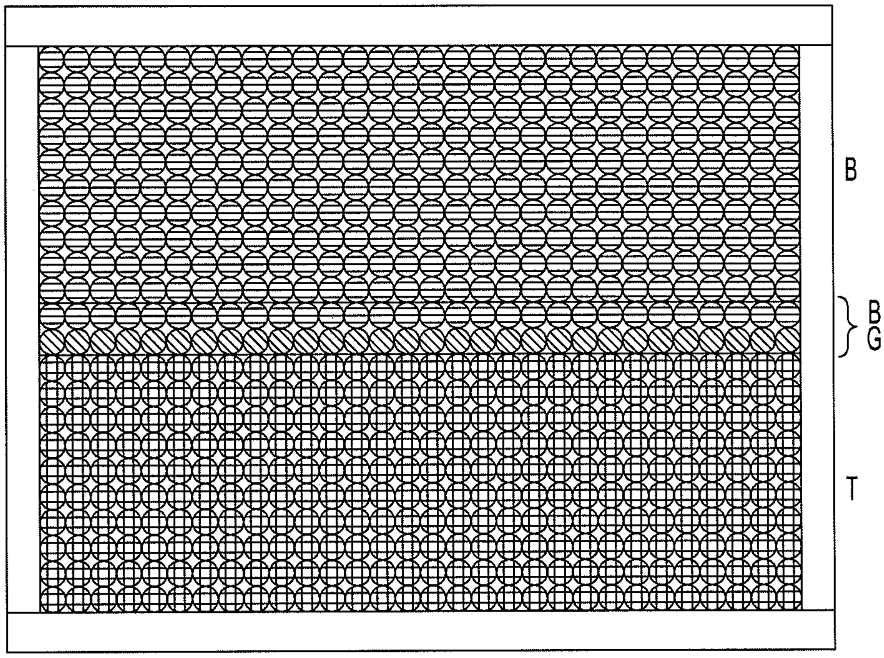


FIG.5C

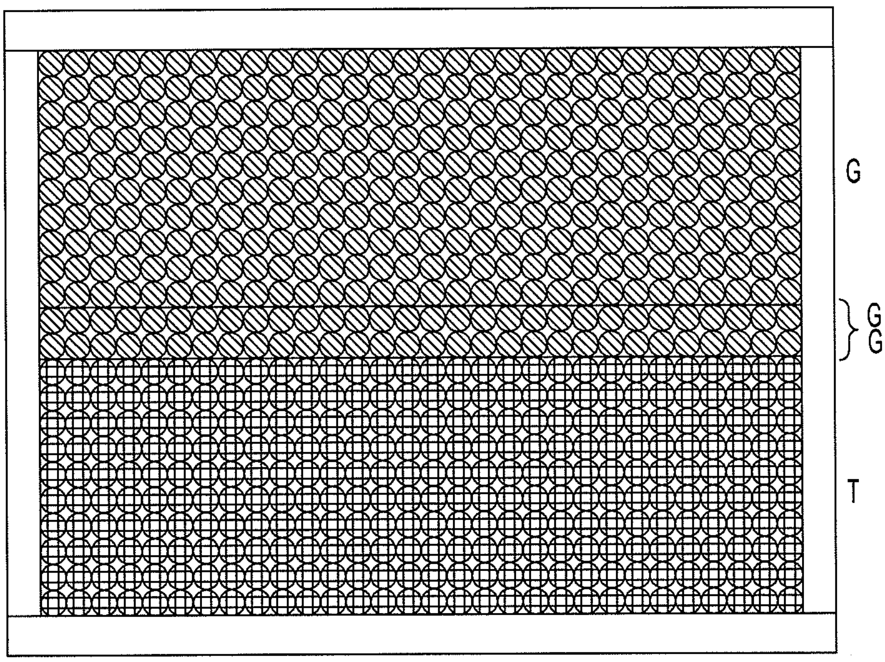


FIG.5D

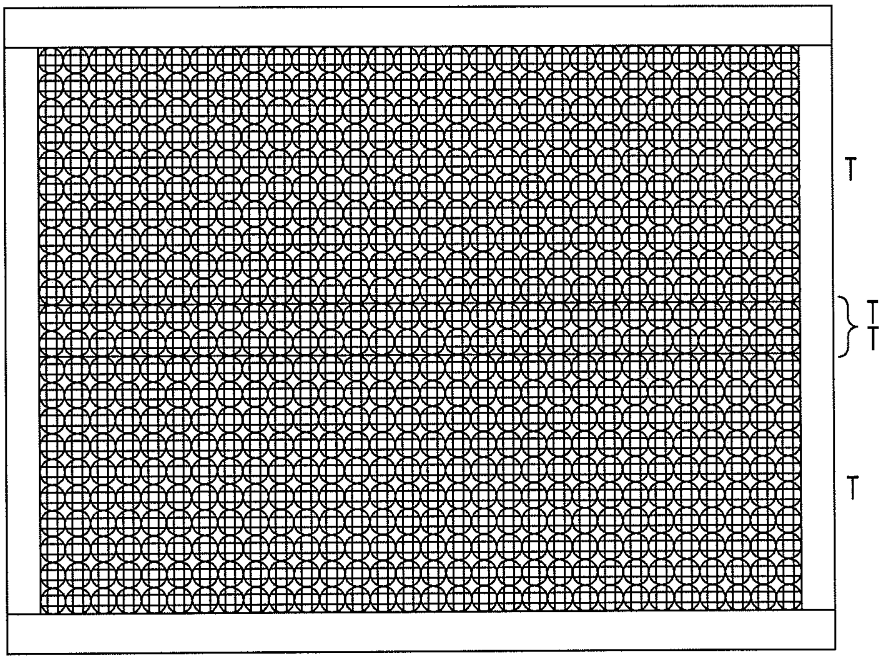


FIG.5E

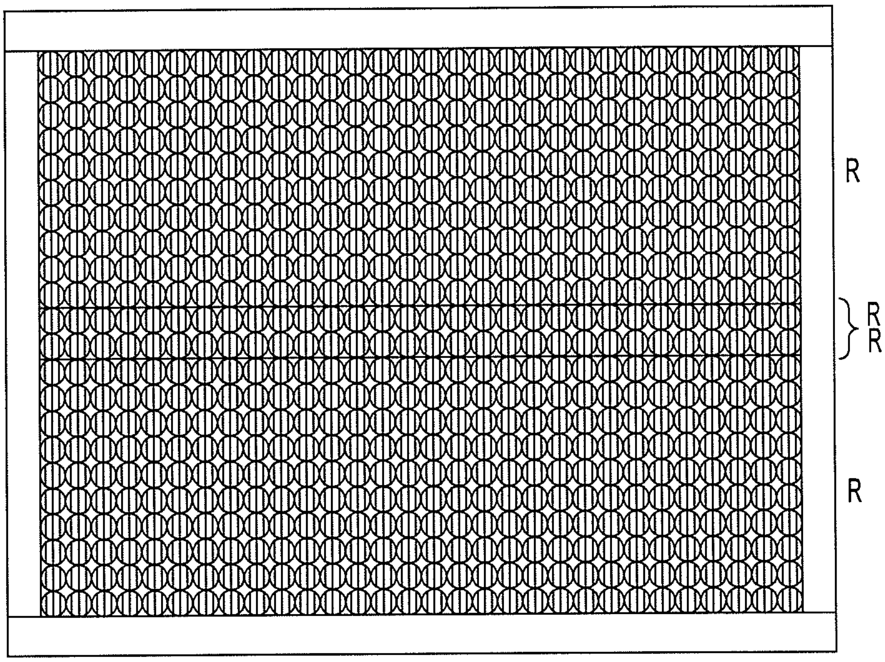


FIG.5F

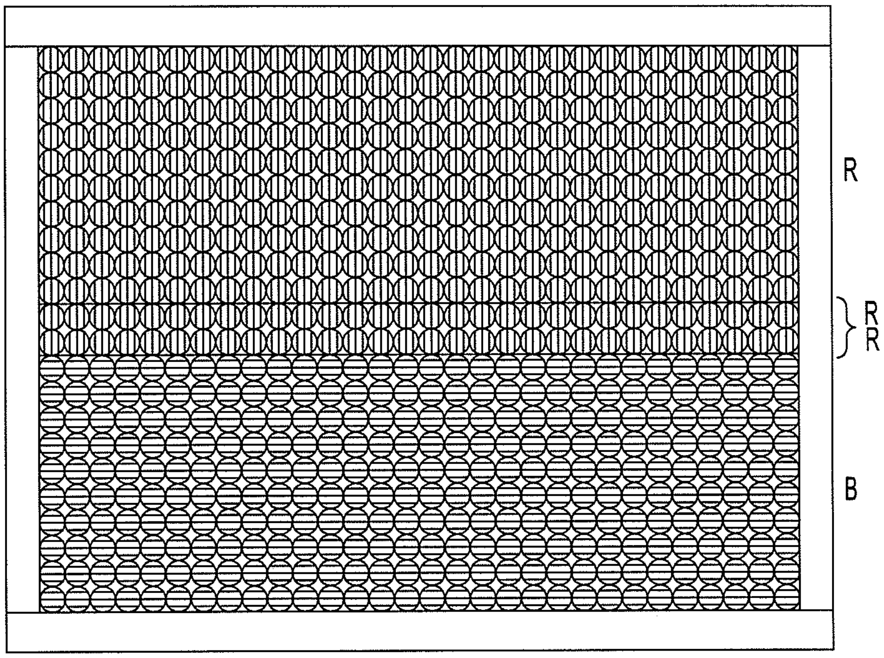


FIG.5G

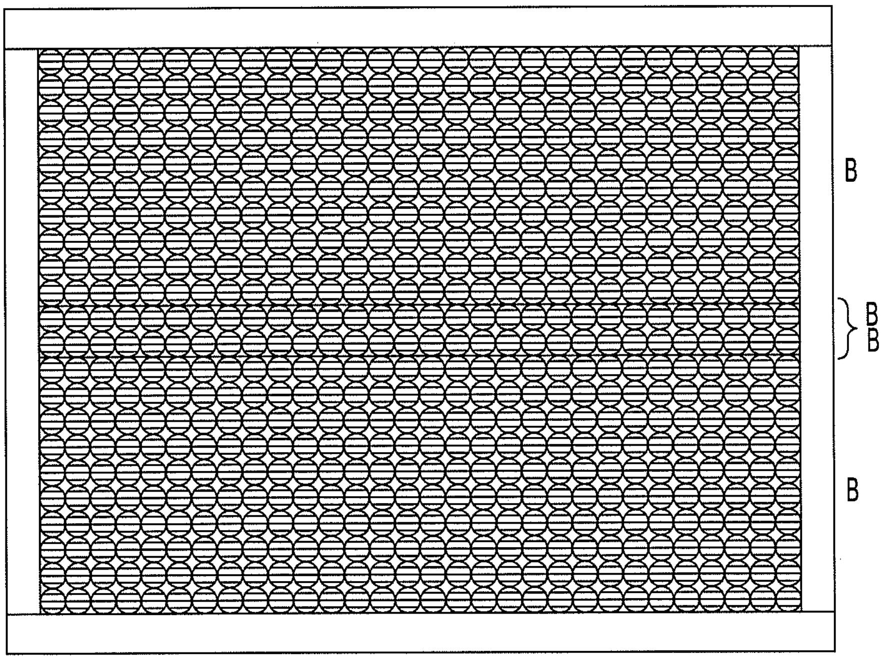


FIG.5H

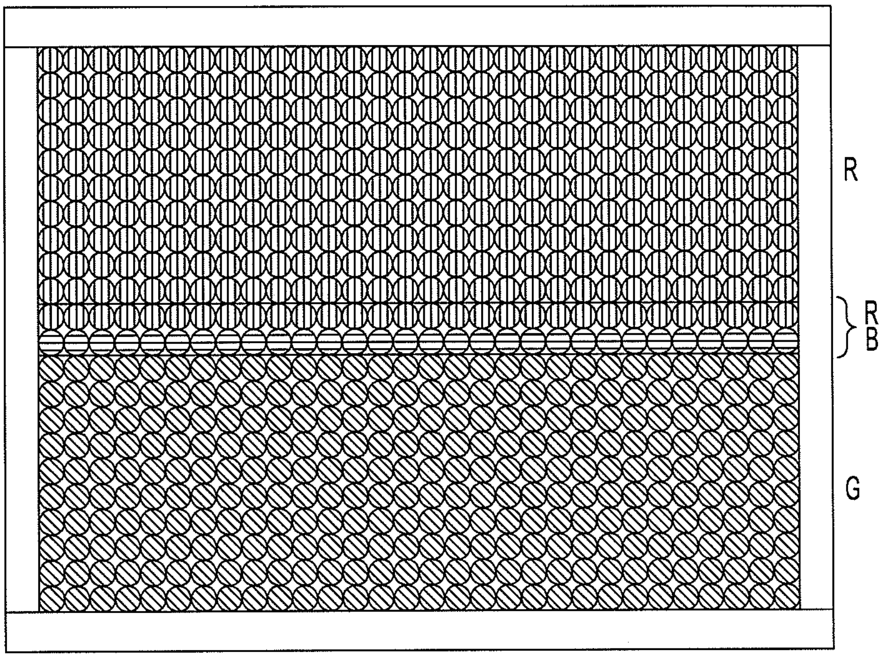


FIG.5I

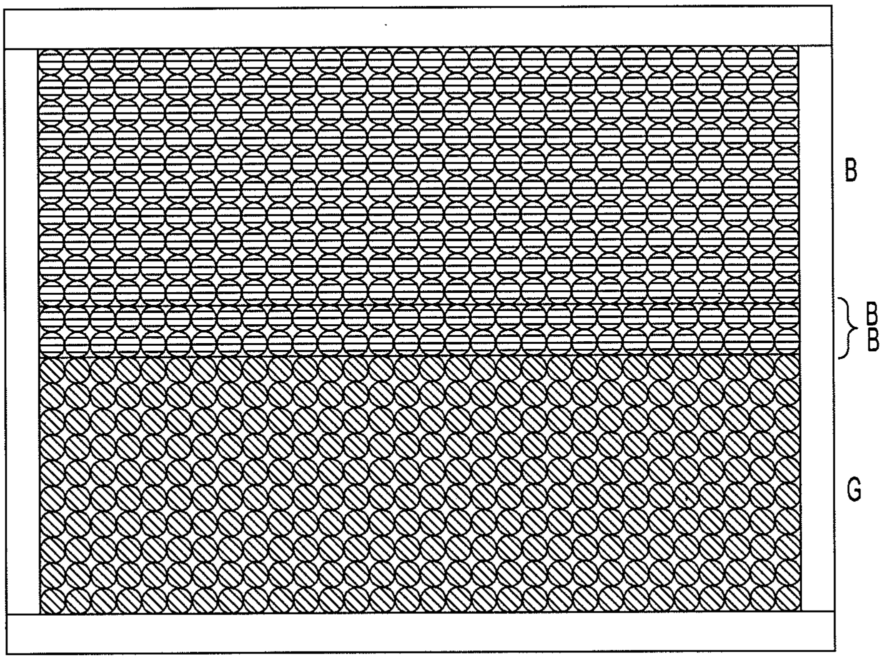


FIG.5J

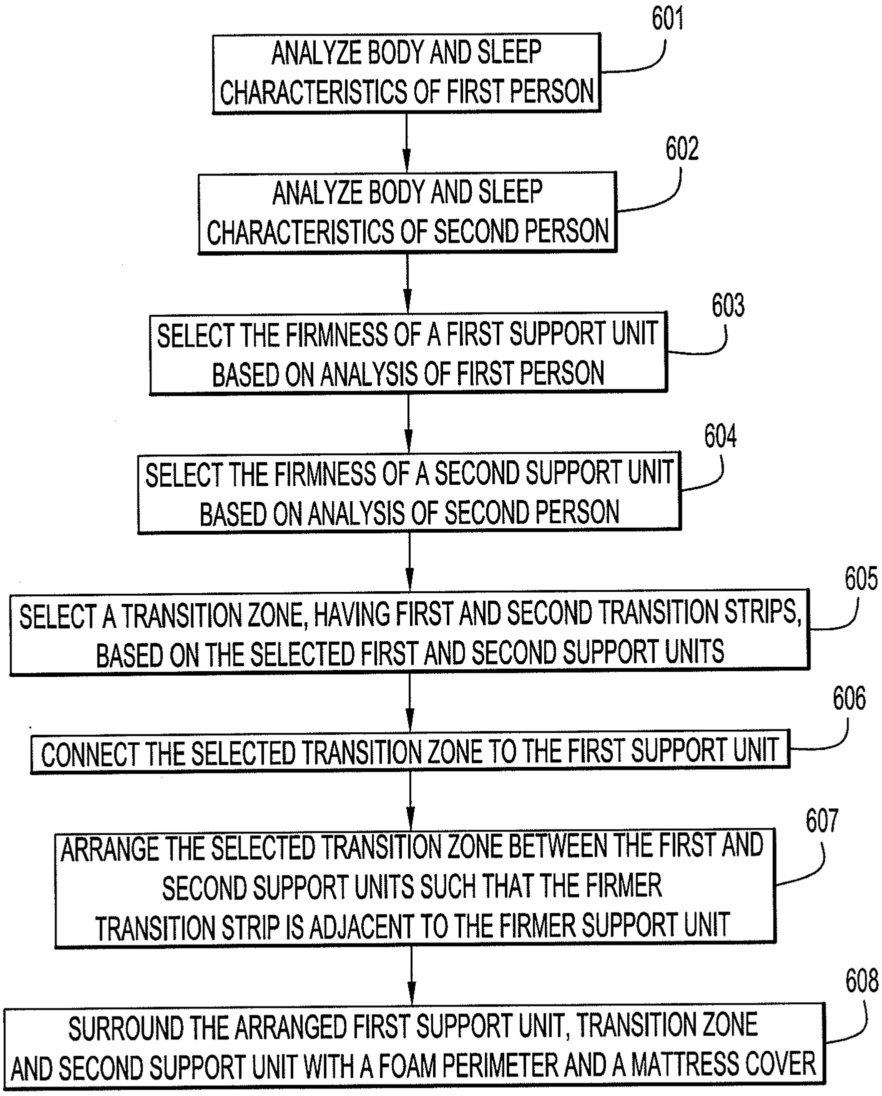

601
ANALYZE BODY AND SLEEP CHARACTERISTICS OF FIRST PERSON
602
ANALYZE BODY AND SLEEP CHARACTERISTICS OF SECOND PERSON
603
SELECT THE FIRMNESS OF A FIRST SUPPORT UNIT BASED ON ANALYSIS OF FIRST PERSON
604
SELECT THE FIRMNESS OF A SECOND SUPPORT UNIT BASED ON ANALYSIS OF SECOND PERSON
605
SELECT A TRANSITION ZONE, HAVING FIRST AND SECOND TRANSITION STRIPS, BASED ON THE SELECTED FIRST AND SECOND SUPPORT UNITS
606
CONNECT THE SELECTED TRANSITION ZONE TO THE FIRST SUPPORT UNIT
607
ARRANGE THE SELECTED TRANSITION ZONE BETWEEN THE FIRST AND SECOND SUPPORT UNITS SUCH THAT THE FIRMER TRANSITION STRIP IS ADJACENT TO THE FIRMER SUPPORT UNIT
608
SURROUND THE ARRANGED FIRST SUPPORT UNIT, TRANSITION ZONE AND SECOND SUPPORT UNIT WITH A FOAM PERIMETER AND A MATTRESS COVER

FIG.6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2011/037935

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A47C 23/00 (2011.01)
USPC - 5/727
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - A47C 23/00, 23/04 (2011.01)
USPC - 5/716, 717, 718, 720, 727, 728, 729, 730; 267/142, 143, 249

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
USPTO EAST System (US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT), PatBase

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4,213,214 A (GILHOOLY) 22 July 1980 (22.07.1980) entire document	3, 4, 8, 9
Y		1, 2, 5-7, 10-12
Y	US 7,287,291 B2 (CARLITZ) 30 October 2007 (30.10.2007) entire document	1, 2
Y	US 5,987,678 A (AYERS) 23 November 1999 (23:11.1999) entire document	2, 5-7, 10-12
A	US 2008/0072382 A1 (JAMES) 27 March 2008 (27.03.2008) entire document	1-12
A	US 6,684,435 B1 (WELLS) 03 February 2004 (03.02.2004) entire document	1-12
A	US 2008/0093784 A1 (RAWLS-MEEHAN) 24 April 2008 (24.04.2008) entire document	1-12

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 August 2011	08 SEP 2011

Name and mailing address of the ISA/US	Authorized officer:
Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774