

Description

Background of the Invention

Mattress innerspring units are generally formed of a plurality of spring coils arranged in side-by-side relation in parallel rows, with parallel columns also thereby being formed orthogonal to the rows. Border wires typically encircle both the upper and lower perimeters of the innerspring unit formed by the most outboard spring coils and are connected to terminal convolutions formed on the ends of the spring coils.

It is a common practice to form the terminal convolution with an enlarged diameter with respect to that of the spirals which are axially inward from the coil ends. This facilitates interengagement of the springs and makes the spring coil more stable in compression. Terminal convolutions of adjacent spring coils in a row are overlapped, and helical spring coils, referred to as cross-helicals, are then wound along columns to encircle the overlapped convolution portions. These cross-helicals ordinarily have an internal diameter which is slightly larger than the combined diameters of the overlapped terminal convolution portions. Larger diameter helical springs are also often used to attach a border wire to the terminal convolutions. Examples of some of such springs can be found in GB-A-386251, US-A-1887058 and US-3533114.

GB-A-386251 discloses a mattress comprising a plurality of connected coil springs. Each spring has upper and lowermost coils which are provided with two intermediate straight sections and straight free end sections arranged parallel with and opposite to one of the intermediate straight sections and at right angles to the other. In use the straight free end section is connected to the parallel intermediate section of a neighbouring coil by connecting transverse springs.

There are some general considerations of manufacture and comfort which underlie the design of any mattress innerspring. For example, considerable effort has been devoted in the industry to the development of terminal convolutions which facilitate the interengagement of the spring coils as well as their connection to the border wire. For example, terminal convolutions have been developed having offset portions formed thereon which include a straight part. This enables the spring ends to be secured along a substantial length of the straight part which will "catch" more helical spirals, and thereby provide more stability for the individual coils. Improved stability is always being sought, however.

These efforts have also been directed to find ways to prevent the spring coils from rotating relative to each other, and perhaps out of the upper or lower plane of the unit. A related problem in this area is that of hinging, where the overlapped portions of coils slip over one another and make noise. Hinging can further occur between coils overlapped with the border wire. Such hinging is obviously desired to be kept at a minimum in a mattress.

Another consideration in mattress design and manufacture is the ability to make innerspring units which have different firmness characteristics suited to an individual's personal preference. This may simply amount to providing several mattress lines having differing firmness, or, in more sophisticated mattresses, providing areas of different firmness in a particular mattress innerspring.

As may be readily recognised, producing mattresses with different firmness characteristics may be accomplished through the use of springs of differing compression for each mattress firmness, ordinarily achieved by making the various springs out of different wire stock or in different configurations. The overall layout or construction of the innerspring unit may also be changed from one mattress firmness to another, such as by changing the coil count and coil arrangement. Use of heavier wire stock, more springs, different springs or a different layout obviously adds expense to mattress production in terms of parts as well as labor. A primary consideration in making mattresses with different degrees of firmness is therefore to do so in the most efficient and economical manner while still achieving the desired results.

Field of the Invention

This invention relates to spring coils and spring coil assemblies, and particularly to those used in mattress innersprings.

Summary of the Invention

The present invention provides a number of innovations and improvements to spring coils and spring coil assemblies, particularly as adapted for use in a mattress innerspring unit. The general considerations outlined above take form in the present invention as a spring coil having a firmness that is readily adjusted in manufacture. The invention further includes spring coil and spring assembly features that assure that the spring coils have little or no rotation relative to each other or to a border wire surrounding an innerspring unit.

The invention also comprises various arrangements of spring coils and cross-helicals that yield innerspring assemblies of different firmness characteristics.

According to the invention there is provided a method of making a spiral spring coil having a firmness that is readily adjustable in manufacture for use in a mattress innerspring structure, comprising the steps of providing a spiral spring coil with a spiral coil body and a pair of terminal convolutions, at least one of said terminal convolutions having a free end, all portions of said at least one terminal convolution being in approximately the same plane, and characterised by the step of forming a connecting segment between said terminal convolution and said spiral coil body in the form of a gradient arm extending in the same plane as the terminal convolution, said gradient arm being integrally connected with said

spiral coil body at a shoulder, said gradient arm being adjustable in length in manufacture to vary the compression and thereby the firmness of the spring coil.

In a preferred embodiment of the invention at least one of the terminal convolutions is formed into c-shaped configuration, with a first and second offset portion which are opposed to each other and are joined together by a third offset portion. The second offset portion has a free end and all of the offset portions are approximately in the same plane, said first offset portion having one end joined to said third offset portion with the other end being joined to said spiral spring coil body by said connecting segment.

Preferably said first and second offset portions are generally straight segments that are parallel to each other, said connecting segment extending generally perpendicularly from said second offset portion.

Preferably both of said terminal convolutions are identical and said connecting segment has a length which is in a range of about 3 to about 9% of the active material length of said spring coil.

According to the invention there is also provided a spring assembly for a generally rectangular mattress innerspring unit comprising a plurality of spring coils made by a method according to one of the four preceding paragraphs said spring coils being disposed on substantially parallel axes with said terminal convolutions on respective coil ends being generally co-planar and arranged in side by side relation in a plurality of parallel rows and parallel columns, first and second offset portions of adjacent spring coils overlapped with each other in said rows, a plurality of cross-helical springs extending along said columns and coiled about said overlapped first and second offset portions, a border wire surrounding a perimeter formed by said spring coils, and offset portions of spring coils at the ends of said rows and columns being joined to said border wire.

Thus there can be provided a unique arrangements of spring coil rows using cross-helicals to interengage the coils. In this respect, the innerspring unit has a length and a width, with the length being longer than the width. The spring coils are arranged in rows extending across the width, with the spring coil columns thereby formed extending along the length. The cross-helicals joining adjacent overlapped spring coils in a row thus extend along the columns. It will be noted that the arrangement of rows across the width of the innerspring unit permits rows to be spaced closer together in certain areas of the unit form more firmness. These areas of increased firmness would accordingly be constant across the entire width of the mattress.

The foregoing features and advantages of the invention will be further understood upon consideration of the following detailed description of various embodiments of the invention taken in conjunction with the accompanying drawings, in which:

Brief Description of the Drawings

Fig. 1 is a plan view of an end portion of a mattress innerspring unit incorporating the spring coil of Fig. 2;

Fig. 2 is a perspective view of a spring coil embodying the gradient arm of this invention;

Fig. 3 is an enlarged plan view of a pair of overlapped offset portions encircled by a cross-helical as shown in Fig. 1;

Fig. 4 is a view similar to Fig. 1 illustrating three point engagement of the third offset portion with the border wire;

Fig. 5 is a view similar to Fig. 4 wherein the terminal convolutions of the spring coils have stepped segments on each offset portion;

Fig. 6 is a plan view of a portion of the middle third of a mattress innerspring unit showing orthogonally laced cross-helicals;

Fig. 7 is a view similar to Fig. 1 showing overlapped rows and orthogonally laced cross-helicals;

Fig. 8 is a graph of spring compression related to the length of the gradient arm;

Fig. 9 is a graph of various springs under load;

Figs. 10a, 11a and 12a are plan views of terminal convolutions of three spring coils; and

Figs. 10b, 11b and 12b are elevational views of the respective terminal convolutions of Figs. 10a, 11a and 12a.

Detailed Description of Presently Preferred Embodiments of the Invention

While the invention has found particular application for the innerspring unit of a mattress, and is so described in this environment hereafter, it will be understood that the invention is not limited to this application alone but may find utility in other employments.

Referring now to the drawings, Fig. 1 shows an innerspring unit or assembly 10 comprised of spring coils 11 arranged in a rectangular pattern of parallel rows. The rows are shown here extending from right to left as viewed in this drawing, with adjacent rows being spaced apart. These rows extend across the width of the innerspring unit 10. Columns of spring coils 11 (simply referred to as coils hereafter) are thereby formed which extend along the length (longitudinally) of the innerspring unit 10 and are orthogonal to the rows.

Extending the rows across the width of the unit permits making areas of increased firmness by simply moving rows closer together. The areas of increased firmness are thereby constant across the width of the unit.

With reference now to Fig. 2, the coil 11 has a spiral coil body 11a with terminal convolutions 11b and 11c formed at each end. The spiral body 11a of the illustrated coil has a fairly constant diameter of about 4.67 cm (1.843 in.) in this embodiment. The terminal convolutions 11b, 11c are identical in form, and have a larger diameter than the spiral body 11a. The coil has an overall axial length of about 12.7 cm (5.00 in.) in this embodiment.

The terminal convolutions 11b, 11c are each formed in an open end offset configuration comprised of three offset portions 12, 13 and 14 and an open end 15. The overall shape for the terminal convolution 11b, 11c is seen to be rectangular. The offset portions 12 and 14 have generally straight segments which are roughly parallel to each other and of approximately the same length. The third offset portion 13 extends between ends of the first and second offset portions 12, 14 and has a stepped segment which will be described in more detail hereafter. All portions of the terminal convolution are approximately in the same plane, which is perpendicular to the axis of the spring coil. These coils 11 are made from a single piece of wire stock, such as 15 gauge (1.8 mm or 0.072 in.) wire, which is first given a spiral body shape and then provided with the desired terminal convolutions.

The coils 11 are positioned so that the offset portions 12 and 14 of adjacent coils in a row overlap. The overlapped offset pairs are then secured together by spirally rotating a first set of helical coil springs 17 across the rows, i.e. along the columns, so as to interlace the overlapped offset portions. The cross-helicals 17 have an internal diameter which is just slightly greater than the diameter of the overlapped offset portions so that the overlapped relationship is maintained in use. The terminal convolutions 11b and 11c on both the upper and lower sides of the innerspring unit 10 are thus laced together in this fashion. Providing such long relatively straight segments to the offset portions 12 and 14 enables a significant number of cross-helical turns to be made thereabout, which yields a secure engagement of overlapped offset pairs and greater stability for the coils 11.

Offset portions 12-14 at the perimeter of the innerspring unit 10 are attached to a border wire 18 that extends around this perimeter. A border wire helical spring 19 is used to make this attachment and is spirally wound about the offset portions which are overlapped with the border wire. A border wire 18 is provided for both the upper and lower sides of the innerspring unit.

Second offset portion 14 has a free end 14a which is inwardly turned to extend generally perpendicularly to the straight segment of the second offset portion. First offset portion 12 extends into a connecting segment 20 which connects the terminal convolutions 11b, 11c to the spiral body 11a at a shoulder. The integral connection of the connecting segment 20 and the spiral body 11a is at an angle i.e. not a smooth transition. This connecting segment 20 extends generally perpendicularly from the end of offset portion 12, and is in the same plane as the terminal convolution.

The connecting segment 20 forms what will be referred to as a gradient arm for the coil 11. Figs. 10a and 10b, 11a and 11b and 12a and 12b illustrate three terminal convolutions with different gradient arm 20 lengths. The compression of

the coil 11, and thus the firmness of the coil, can be adjusted within limits by varying the length of this gradient arm 20. This will be seen with reference to the graph of Fig. 8.

As shown in this graph, a coil having a gradient arm of about 0.64 cm (1/4 in.) in length (measured from the end of the straight segment of the first offset portion 12 to the bend into the spiral body) had a spring gradient of 2.54 N/m (1.45 lbs./in.). A like coil 11 with a gradient arm of 1.59 cm (5/8 in.) in length had a spring gradient of 3.24 N/m (1.85 lbs./in.).

From the foregoing it will thus be seen that the compression or firmness of the individual coils can be varied by adjusting the length of the gradient arm 20. This is readily accomplished in manufacture through a relatively uncomplicated adjustment in the coil forming machinery. Spring coils of varying firmness can therefore now be manufactured on the same machine from the same wire stock in an efficient and cost effective manner.

A present estimate places the preferred range for the length of the gradient arm 20 at about 3 to 9% of the active material length of the spring coil. The active material length is considered to be that length of material which is free to deflect when a load is applied to the spring. The spiral portion of the coil, exclusive of the gradient arms and terminal convolutions, would thus constitute the active material length for the coils illustrated herein.

Also, while this firmness adjustment feature of the invention has been described in relation to an embodiment having particular offset portions, it is considered to have applications to other terminal convolution configurations.

The spring coil of this invention further provides a firmness that varies under load, i.e. as the coil is deflected. With reference to the graph of Fig. 9, an innerspring units formed with springs of a Bonnell type exhibited a fairly linear deflection in response to an increasing load (line B). An innerspring unit formed of springs of the type shown in Karpen, U.S. Patent No. 3,533,114 likewise exhibited a fairly linear response to load (line A).

An innerspring unit comprised of spring coils 11 of this invention exhibited a marked non-linear response to load (line C) in contrast to the foregoing innerspring units. The result is that in the initial stage of deflection, the innerspring assembly of this invention offers a first firmness that provides "surface comfort" to an individual. As increased load is imposed on the innerspring unit, the firmness increases to provide "depth" or "supportive" firmness. A more comfortable mattress is thereby produced.

Referring now to Fig. 3, another feature of this invention resides in matching the pitch of the cross helicals 17 to the length of the offset portions 12, 14 to lock the coils 11 against rotation relative to one another. To this end, each of the offset portions 12, 14 has a shoulder 25 formed at each end thereof. An inside shoulder 25a and an

outside shoulder 25b are thereby presented at each shoulder 25. The pitch (as indicated in Fig. 3) of the helical 17 is selected so that the cross-helical simultaneously engages the outside shoulders 25b of one of a pair of overlapped offset portions, such as the outside shoulders of offset portion 14 in Fig. 3. The offset portion 14, and thus its coil 11, is thereby firmly held against rotation by the cross-helical 17.

The pitch of the cross-helical 17 is also advantageously selected so that the cross-helical 17 catches the inside shoulders 25a of the other of the pair of overlapped offset portions. As shown in Fig. 3, the overlapped offset portions 12, 14 are coterminus, and the cross-helical 17 catches the inside shoulders 25a of offset portion 12. The coil 11 having the offset portion 12 is thereby further secured against rotation (it being understood that this same coil 11 will have its offset portion 14 held by the next adjacent cross-helical in the manner previously described).

Another feature of the invention relates to the three point attachment achieved between perimeter coils 11 and the border wire 18. Referring to Figs. 2 and 4 in particular, third offset portion 13 has a stepped segment formed thereon comprised of a major straight part 13a, angled parts 13b extending from the ends of the major straight part 13a, and minor straight parts 13c extending from the angled parts 13b. The major straight part 13a is spaced radially outwardly from the coil body 11a and is generally tangential thereto. The minor parts 13c are approximately in line with each other and generally parallel to the major straight part 13a.

A border wire helical 19 is wrapped around the overlapped border wire 18 and third offset portion 13 to catch the inboard sides of the minor straight parts 13c and the outboard side of the major straight part 13a. This yields a three point attachment of the offset portion 13 with the border wire which is very secure, and which substantially prevents any hinging of the offset portion with the border wire.

As shown in Fig. 5, the terminal convolution of a coil 11 could be provided with such stepped segments on all three of its offset portions 12-14. Three point attachments of the perimeter coils would thus be effected around the entire border wire (although for full effect the last row of coils may have to be reversed so that the third offset portions thereof are adjacent the border wire).

Another feature of the invention is the ability to adjust the firmness of the innerspring unit 10 through the addition of a second set of cross-helicals 28 which are orthogonal to the first set 17 to further interlace the coils. As seen in Fig. 6, the cross-helicals 28 extend along the coil rows, that is, they are across the width of the mattress. The cross-helicals 28 are substantially identical to the cross-helicals 17 and are wrapped about the short segments 14a and gradient arms 20 of the terminal convolutions. It will be noted that the cross-helicals 28 could

alternatively be wrapped around the third offset portions 13 in a row to the same effect.

The second set of cross-helicals 28 provide extra firmness, and can extend along the entire length of one or both sides of the innerspring unit 10, or can be located in selected segments of the innerspring unit 10 to "posturize" the unit, such as the middle third of the innerspring. Such posturizing is readily accomplished due to arranging the springs so that the primary cross-helicals 17 run along the length of the mattress.

Fig. 7 illustrates yet another aspect of the invention whereby a very firm innerspring unit is produced. Adjacent rows of coils 11 are overlapped so that the third offset portions 13 of one row extend into the open ends 15 of the coils 11 of an adjacent row. A second set of cross-helicals 28 are then wrapped about the "overlapped" major straight portions 13a of one row and the short segments 14a and gradient arms 20 of the other row. A very dense pattern of coils 11 is thereby produced with virtually no gaps existing between coils 11.

Thus, while the invention has been described in connection with certain presently preferred embodiments, those skilled in the art will recognise modifications of structure, arrangement, portions, elements, materials and components which can be used in the practice of the invention without departing from the principles of this invention as defined in the claims.

Claims

1. A method of making a spiral spring coil (11) having a firmness that is readily adjustable in manufacture for use in a mattress innerspring structure (10), comprising the steps of providing a spiral spring coil (11) with a spiral coil body (11a) and a pair of terminal convolutions (11b, 11c), at least one of said terminal convolutions having a free end (15), all portions (12, 13, 14, 15) of said at least one terminal convolutions being in approximately the same plane, and characterised by the step of forming a connecting segment (20) between said terminal convolution and said spiral coil body in the form of a gradient arm extending in the same plane as the terminal convolution, said gradient arm being integrally connected with said spiral coil body at a shoulder, said gradient arm being adjustable in length in manufacture to vary the compression and thereby the firmness of the spring coil.

2. A method of making a spiral spring coil (11) as claimed in claim 1 further comprising the step of forming at least one of said terminal convolutions (11b, 11c) into a C-shape with a first and a second offset portion (12, 14) which are opposed to each other, and a third offset portion (13) joining said first and second offset portions, said second offset portion having a free end (14a), all of said offset portions being approximately in the same plane, said first offset portion having one end joined to said third

outside shoulder 25b are thereby presented at each shoulder 25. The pitch (as indicated in Fig. 3) of the helical 17 is selected so that the cross-helical simultaneously engages the outside shoulders 25b of one of a pair of overlapped offset portions, such as the outside shoulders of offset portion 14 in Fig. 3. The offset portion 14, and thus its coil 11, is thereby firmly held against rotation by the cross-helical 17.

The pitch of the cross-helical 17 is also advantageously selected so that the cross-helical 17 catches the inside shoulders 25a of the other of the pair of overlapped offset portions. As shown in Fig. 3, the overlapped offset portions 12, 14 are coterminous, and the cross-helical 17 catches the inside shoulders 25a of offset portion 12. The coil 11 having the offset portion 12 is thereby further secured against rotation (it being understood that this same coil 11 will have its offset portion 14 held by the next adjacent cross-helical in the manner previously described).

Another feature of the invention relates to the three point attachment achieved between perimeter coils 11 and the border wire 18. Referring to Figs. 2 and 4 in particular, third offset portion 13 has a stepped segment formed thereon comprised of a major straight part 13a, angled parts 13b extending from the ends of the major straight part 13a, and minor straight parts 13c extending from the angled parts 13b. The major straight part 13a is spaced radially outwardly from the coil body 11a and is generally tangential thereto. The minor parts 13c are approximately in line with each other and generally parallel to the major straight part 13a.

A border wire helical 19 is wrapped around the overlapped border wire 18 and third offset portion 13 to catch the inboard sides of the minor straight parts 13c and the outboard side of the major straight part 13a. This yields a three point attachment of the offset portion 13 with the border wire which is very secure, and which substantially prevents any hinging of the offset portion with the border wire.

As shown in Fig. 5, the terminal convolution of a coil 11 could be provided with such stepped segments on all three of its offset portions 12-14. Three point attachments of the perimeter coils would thus be effected around the entire border wire (although for full effect the last row of coils may have to be reversed so that the third offset portions thereof are adjacent the border wire).

Another feature of the invention is the ability to adjust the firmness of the innerspring unit 10 through the addition of a second set of cross-helicals 28 which are orthogonal to the first set 17 to further interlace the coils. As seen in Fig. 6, the cross-helicals 28 extend along the coil rows, that is, they are across the width of the mattress. The cross-helicals 28 are substantially identical to the cross-helicals 17 and are wrapped about the short segments 14a and gradient arms 20 of the terminal convolutions. It will be noted that the cross-helicals 28 could

alternatively be wrapped around the third offset portions 13 in a row to the same effect.

The second set of cross-helicals 28 provide extra firmness, and can extend along the entire length of one or both sides of the innerspring unit 10, or can be located in selected segments of the innerspring unit 10 to "posturize" the unit, such as the middle third of the innerspring. Such posturizing is readily accomplished due to arranging the springs so that the primary cross-helicals 17 run along the length of the mattress.

Fig. 7 illustrates yet another aspect of the invention whereby a very firm innerspring unit is produced. Adjacent rows of coils 11 are overlapped so that the third offset portions 13 of one row extend into the open ends 15 of the coils 11 of an adjacent row. A second set of cross-helicals 28 are then wrapped about the "overlapped" major straight portions 13a of one row and the short segments 14a and gradient arms 20 of the other row. A very dense pattern of coils 11 is thereby produced with virtually no gaps existing between coils 11.

Thus, while the invention has been described in connection with certain presently preferred embodiments, those skilled in the art will recognise modifications of structure, arrangement, portions, elements, materials and components which can be used in the practice of the invention without departing from the principles of this invention as defined in the claims.

Claims

1. A method of making a spiral spring coil (11) having a firmness that is readily adjustable in manufacture for use in a mattress innerspring structure (10), comprising the steps of providing a spiral spring coil (11) with a spiral coil body (11a) and a pair of terminal convolutions (11b, 11c), at least one of said terminal convolutions having a free end (15), all portions (12, 13, 14, 15) of said at least one terminal convolutions being in approximately the same plane, and characterised by the step of forming a connecting segment (20) between said terminal convolution and said spiral coil body in the form of a gradient arm extending in the same plane as the terminal convolution, said gradient arm being integrally connected with said spiral coil body at a shoulder, said gradient arm being adjustable in length in manufacture to vary the compression and thereby the firmness of the spring coil.

2. A method of making a spiral spring coil (11) as claimed in claim 1 further comprising the step of forming at least one of said terminal convolutions (11b, 11c) into a C-shape with a first and a second offset portion (12, 14) which are opposed to each other, and a third offset portion (13) joining said first and second offset portions, said second offset portion having a free end (14a), all of said offset portions being approximately in the same plane, said first offset portion having one end joined to said third



offset portion with the other end being joined to said spiral spring coil body by said connecting segment (20).

3. A method of making a spiral spring coil (11) as claimed in claim 2 wherein said first and second offset portions (12, 14) are formed as generally straight segments that are parallel to each other, said connecting segment (20) extending generally perpendicularly from said second offset portion.

4. A method of making a spiral spring coil (11) as claimed in any one of the preceding claims wherein both of said terminal convolutions (11b, 11c) are identically formed.

5. A method of making a spiral spring coil (11) as claimed in any one of the preceding claims wherein said connecting segment is formed of a length which is in a range of about 3 to about 9% of the active material length of said spring coil.

6. A spring coil (11) made by the method of any one of the preceding claims.

7. A spring assembly (10) for a generally rectangular mattress innerspring unit comprising a plurality of spring coils (11) as claimed in claim 6 said spring coils being disposed on substantially parallel axes with said terminal convolutions (11b, 11c) on respective coil ends being generally co-planar and arranged in side by side relation in a plurality of parallel rows and parallel columns, first and second offset portions (12, 14) of adjacent spring coils overlapped with each other in said rows, a plurality of cross-helical springs (17) extending along said columns and coiled about said overlapped first and second offset portions, a border wire (18) surrounding a perimeter formed by said spring coils, and offset portions of spring coils at the ends of said rows and columns being joined to said border wire.

8. A spring assembly (10) as claimed in claim 7 wherein said innerspring unit has a length and a width, said length being longer than said width, said spring coils (11) arranged in rows extending across said width, said spring coil columns extending along said length, and further including a second plurality of cross-helical springs (28) extending along said rows and coiled about terminal convolution portions (11b, 11c) other than said first and second offset portions (12, 14).

9. A spring assembly (10) as claimed in claim 8 wherein said second plurality of cross-helical springs (28) is concentrated in the middle third of said innerspring unit.

10. A spring assembly (10) as claimed in claim 8 or claim 9 wherein said rows are immediately adjacent each other with said third offset portions (13) of the springs (11) in one row extending into the terminal convolutions (11b, 11c) of an adjacent row, said second plurality of cross-helicals (28) being coiled about said connecting segments of one row and said third offset portions (13) of an adjacent row.

11. A spring assembly (10) as claimed in claim 10 wherein said first plurality of cross-helicals (19) is orthogonal to said second plurality of cross-helicals (28), and said first and second pluralities

of cross-helicals extend across the entire length and width of the innerspring unit.

Patentansprüche

1. Verfahren zum Herstellen einer Spiralfeder (11) mit einer Festigkeit, die bei der Herstellung einfach einstellbar ist, zur Verwendung in der Innenfeder-Konstruktion (10) einer Matratze, das die Schritte aufweist, eine Spiralfeder (11) mit einem Spiralenhauptteil (11a) und zwei Endwindungen (11b, 11c) zu schaffen, wobei wenigstens eine der Endwindungen ein freies Ende (15) aufweist, wobei alle Bereiche (12, 13, 14, 15) der wenigstens einen der Endwindungen in ungefähr derselben Ebene angeordnet sind, und das durch den Schritt gekennzeichnet ist, einen Verbindungsabschnitt (20) zwischen der Endwindung und dem Spiralenhauptteil in Form eines Steigungs- oder Gradientenarms zu bilden, der sich in derselben Ebene wie die Endwindung erstreckt, wobei der Gradientenarm mit dem Spiralenhauptteil an einer Schulter verbunden ist, wobei der Gradientenarm in der Länge bei der Herstellung einstellbar ist, um die Zusammendrückung und damit die Festigkeit der Spirale zu verändern.

2. Verfahren zum Herstellen einer Spiralfeder (11) nach Anspruch 1, das weiter den Schritt aufweist, wenigstens eine der Endwindungen (11b, 11c) in eine C-Form mit einem ersten und einem zweiten versetzten Bereich (12, 14), die einander gegenüberstehen, und einem dritten versetzten Bereich (13) zu formen, der die ersten und zweiten versetzten Bereiche verbindet, wobei der zweite versetzte Bereich ein freies Ende (14a) aufweist, wobei alle dieser versetzten Bereiche ungefähr in derselben Ebene angeordnet sind, wobei der erste versetzte Bereich, der mit einem Ende mit dem dritten versetzten Bereich verbunden ist, mit dem anderen Ende durch den Verbindungsabschnitt (20) mit dem Spiralenhauptteil verbunden ist.

3. Verfahren zum Herstellen einer Spiralfeder (11) nach Anspruch 2, bei der die ersten und zweiten versetzten Bereiche (12, 14) als allgemein gerade Abschnitte ausgebildet sind, die zueinander parallel sind, wobei sich der Verbindungsabschnitt (20) allgemein rechtwinklig von dem zweiten versetzten Bereich erstreckt.

4. Verfahren zum Herstellen einer Spiralfeder (11) nach einem der vorangehenden Ansprüche, bei der beide der Endwindungen (11b, 11c) identisch ausgebildet sind.

5. Verfahren zum Herstellen einer Spiralfeder (11) nach einem der vorangehenden Ansprüche, bei der der Verbindungsabschnitt mit einer Länge ausgebildet ist, die im Bereich von ungefähr 3 bis ungefähr 9% der aktiven Materiallänge der Spiralfeder beträgt.

6. Spiralfeder (11), die nach dem Verfahren einer der vorangehenden Ansprüche hergestellt ist.

7. Federaufbau (10) für eine allgemein rechteckige Innenfedereinheit einer Matratze, die eine Vielzahl von Spiralfedern (11) nach Anspruch 6



aufweist, wobei die Spiralfedern auf im wesentlichen parallelen Achsen angeordnet sind, wobei die Endwindungen (11b, 11c) an entsprechenden Spiralenenden im allgemeinen in einer Ebene und in Seiten-Seite-Beziehung in einer Vielzahl von parallelen Reihen und parallelen Spalten angeordnet sind, wobei erste und zweite versetzte Bereiche (12, 14) benachbarter Spiralfedern miteinander in den Reihen überlappen, wobei sich eine Vielzahl von querspiralförmigen Federn (17) entlang den Spalten erstreckt und um die überlappenden ersten und zweiten versetzten Bereiche gewickelt ist, wobei ein Randdraht (18) einen Umfang, der durch die Spiralfedern gebildet ist, umgibt und versetzte Bereiche von Spiralfedern an den Enden der Reihen und Spalten mit dem Randdraht verbunden sind.

8. Federaufbau (10) nach Anspruch 7, bei dem die Innenfedereinheit eine Länge und eine Breite hat, wobei die Länge größer ist als die Breite, wobei die Spiralfedern (11) in Reihen angeordnet sind, die sich über die Breite erstrecken, wobei sich die Spalten der Spiralfedern entlang der Länge erstrecken, und der weiter eine zweite Vielzahl von querspiralförmigen Federn (28) aufweist, die sich entlang den Reihen erstrecken und um die Endwindungsbereiche (11b, 11c) gewickelt sind, die von den ersten und zweiten versetzten Bereichen (12, 14) verschieden sind.

9. Federaufbau (10) nach Anspruch 8, bei dem die zweite Vielzahl von querspiralförmigen Federn (28) in dem mittleren Drittel der Innenfedereinheit konzentriert ist.

10. Federaufbau (10) nach Anspruch 8 oder 9, bei dem die Reihen einander unmittelbar benachbart sind, wobei die dritten versetzten Bereiche (13) der Federn (11) in einer Reihe sich in die Endwindungen (11b, 11c) einer benachbarten Reihe erstrecken, wobei die zweite Vielzahl von Querspiralen (28) um die verbindenden Abschnitte der einen Reihe und die dritten versetzten Bereiche (13) einer benachbarten Reihe gewickelt sind.

11. Federaufbau (10) nach Anspruch 10, bei dem die erste Vielzahl von Querspiralen (19) senkrecht zur zweiten Vielzahl von Querspiralen (28) steht und die ersten und zweiten Vielzahlen von Querspiralen sich über die gesamte Länge und Breite der Innenfedereinheit erstrecken.

Revendications

1. Procédé pour la fabrication d'un ressort à boudin (11) ayant une fermeté facilement réglable dans la fabrication pour une utilisation dans une structure de ressorts intérieurs d'un matelas (10), comprenant les étapes de fourniture d'un ressort à boudin (11) avec un corps de ressort à spirale (11a) et une paire de spires terminales (11, 11c), au moins une desdites spires terminales ayant une extrémité libre (15), toutes les parties (12, 13, 14, 15) d'une au moins desdites spires terminales étant approximativement dans le même plan, et caractérisé en ce qu'il comporte l'étape de formation d'un segment de liaison (20) entre ladite spire

terminale et ledit corps de ressort à boudin sous la forme d'un bras de gradient s'étendant dans le même plan que la spire terminale, ledit bras de gradient étant relié intégralement audit corps de ressort à boudin à l'endroit d'un épaulement, ledit bras de gradient étant réglable en longueur lors de la fabrication pour modifier la compression et donc la fermeté du ressort à boudin.

2. Procédé pour fabriquer un ressort à boudin (11) selon la revendication 1, caractérisé en ce qu'il comprend en outre l'étape de formation en forme de C d'au moins une desdites spires terminales (11b, 11c) avec une première et une deuxième parties décalées (12, 14) opposées l'une à l'autre, et une troisième partie décalée (13) réunissant lesdites première et deuxième parties décalées, ladite deuxième partie décalée présentant une extrémité libre (14a), la totalité desdites parties décalées se trouvant approximativement dans le même plan, une des extrémités de ladite première partie décalée étant réunie à ladite troisième partie décalée, l'autre extrémité étant réunie audit corps de ressort en spirale par ledit segment de liaison.

3. Procédé pour fabriquer un ressort à boudin (11) selon la revendication 2, caractérisé en ce que lesdites première et deuxième parties décalées (12, 14) ont la forme de segments généralement droits parallèles entre eux, ledit segment de liaison (20) s'étendant généralement perpendiculairement à partir de ladite deuxième partie décalée.

4. Procédé pour fabriquer un ressort à boudin (11) selon l'une des revendications précédentes, caractérisé en ce que lesdites spires terminales (11b, 11c) sont faites de manière identique.

5. Procédé pour fabriquer un ressort à boudin (11) selon l'une des revendications précédentes, caractérisé en ce que ledit segment de liaison est fait d'une longueur comprise dans une plage allant d'environ 3% à environ 9% de la longueur du matériau actif dudit ressort à boudin.

6. Ressort à boudin (11) réalisé avec le procédé de l'une des revendications précédentes.

7. Ensemble de ressorts (10) pour une unité de ressorts intérieurs de matelas généralement rectangulaire comprenant une pluralité de ressorts à boudin (11) selon la revendication 6, lesdits ressorts à boudin étant disposés sur des axes sensiblement parallèles, lesdites spires terminales (11b, 11c) sur les extrémités de ressorts respectives étant généralement coplanaires et montées de manière à être côte à côte en une pluralité de rangées parallèles et de colonnes parallèles, des première et deuxième parties décalées (12, 14) de ressorts adjacents se recouvrant l'une l'autre dans lesdites rangées, une pluralité de ressorts hélicoïdaux transversaux (17) s'étendant le long desdites colonnes et s'enroulant autour desdites première et deuxième parties décalées se chevauchant, un fil de fer de bordure (18) entourant une périphérie formée par lesdits ressorts à boudin, et des parties décalées de ressorts à boudin aux extrémités desdites rangées et colonnes étant réunies audit fil de fer de bordure.



8. Ensemble de ressorts (10) selon la revendication 7, caractérisé en ce que ladite unité de ressorts intérieurs a une longueur et une largeur, ladite longueur étant supérieure à ladite largeur, lesdits ressorts à boudin (11) étant agencés en rangées s'étendant selon ladite largeur, lesdites colonnes de ressorts à boudin s'étendant le long de ladite longueur, et caractérisé en outre en ce qu'il comprend une deuxième pluralité de ressorts hélicoïdaux transversaux (28) s'étendant le long desdites rangées et entourant des parties de spires terminales (11b, 11c) autres que lesdites première et deuxième parties décalées (12, 14).

9. Ensemble de ressorts (10) selon la revendication 8, caractérisé en ce que ladite deuxième pluralité de ressorts hélicoïdaux transversaux (28) est concentrée dans le tiers du milieu de ladite unité de ressorts intérieurs.

10. Ensemble de ressorts (10) selon la revendi-

cation 8 ou la revendication 9, caractérisé en ce que lesdites rangées sont immédiatement adjacentes les unes aux autres, lesdites troisièmes parties décalées (13) des ressorts (11) dans une rangée s'étendant dans les spires terminales (11b, 11c) d'une rangée adjacente, ladite deuxième pluralité de ressorts hélicoïdaux transversaux (28) entourant lesdits segments de liaison d'une rangée et lesdites troisièmes parties décalées (13) d'une rangée adjacente.

11. Ensemble de ressorts (10) selon la revendication 10, caractérisé en ce que ladite première pluralité de ressorts hélicoïdaux transversaux (19) est orthogonale par rapport à ladite deuxième pluralité de ressorts hélicoïdaux transversaux (28), et en ce que lesdites première et deuxième pluralités de ressorts hélicoïdaux transversaux s'étendent sur toute la longueur et sur toute la largeur de l'unité de ressorts intérieurs.

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