

TITLE

WIRE COIL AND INNERSPRING SYSTEM

FIELD OF THE INVENTION

5 The present invention relates generally to coil springs, and in particular although not exclusively to coil spring systems included in mattresses.

BACKGROUND TO THE INVENTION

10 As described in United States Patent No. 4,726,572 (the '572 patent), titled "Spring Coil and Spring Assembly", assigned to Sealy Technology LLC, mattress innerspring units are commonly formed of a plurality of spring coils arranged in side-by-side relation in parallel rows, with parallel columns formed orthogonal to the rows. Border wires sometimes surround both the upper and lower perimeters of the innerspring unit. The border wires when used, extend
15 from the most outboard spring coils and are connected to terminal convolutions formed on the ends of the spring coils.

 It is 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. That enables inter-engagement of the springs and can make the
20 spring coil more stable in compression.

 Terminal convolutions of adjacent spring coils in a column often overlap, and helical spring coils, referred to as cross-helicals, are then wound along rows to encircle the overlapped convolution portions. These cross-helicals ordinarily include an internal diameter that is slightly larger than the
25 combined diameters of the overlapped terminal convolution portions. Larger diameter helical springs are sometimes used to attach a border wire to the terminal convolutions.

The '572 patent disclosed various arrangements of spring coils and cross-helicals that yield innerspring assemblies of different firmness characteristics. However, the various arrangements generally resulted in a constant spring rate, which limits the ability to customize spring performance across different areas of a single mattress, and across different mattresses in a given mattress brand range.

United States Patent No. 7,404,223 (the '223 patent), titled "Innerspring Coils and Innersprings with Non-helical Segments", also assigned to Sealy Technology LLC, disclosed different types of helical springs which have one or more non-helical segments between ends of the coil and a helical body of the coil, and innersprings made with such coils. The non-helical segments define a different type of stepped coils, also referred to as "one-step" or "multi-step" coils, which are formed of wire made of steel or alloys. The coils include at least one non-helical segment in combination with or contiguous with a helical coil body and one or both of the coil ends. The "step" referred to the non-helical shaped segments of the described coils, which steps can be aligned or coaxial with a longitudinal axis of the coil, and provide height and length to a coil with less material than coils wherein the entire coil body is in the form of a helix. The non-helical configuration and orientation of the step or steps of the coils, when assembled in an innerspring, also can be used to form a relatively stiff base to the coil which supports a coil body with helical turns (i.e., a helical coil body), and which has a lower spring rate and softer feel for a support surface of the innerspring. However, the steps add additional overall length to the springs, which can limit associated mattress geometry options.

In addition to a need for various mattress geometry options, 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 inter-engagement 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.

5 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
10 innerspring.

As may be readily recognized, 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
15 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
20 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.

There is therefore a need for a further improved wire coil and innerspring system.

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OBJECT OF THE INVENTION

It is an object of the present invention to overcome and/or alleviate one or more of the above described disadvantages of the prior art or provide the consumer with a useful or commercial choice.

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SUMMARY OF THE INVENTION

According to one aspect, the invention is a wire coil for use in an innerspring, comprising:

10 a plurality of helical turns that form a helical coil body about a longitudinal axis of the coil, and which helical turns define a helical turn radius;

a first coil end extending from one end of the helical coil body; and

a second coil end extending from an opposite end of the helical coil body;

15 wherein at least one of the first coil end and the second coil end include one or more touch points defined by both a first portion extending a distance from the longitudinal axis of the coil that is greater than the helical turn radius, and a second portion extending a distance from the longitudinal axis of the coil that is less than the helical turn radius.

20 Preferably, the touch points are included on both the first coil end and the second coil end.

25 Preferably, the touch points are spaced apart around the full circumference of the helical coil body to provide uniform support around the full circumference of the helical coil body. Preferably, the first coil end lies approximately in a plane that is perpendicular to the longitudinal axis of the coil.

Preferably, the second coil end lies approximately in a plane that is perpendicular to the longitudinal axis of the coil.

Preferably, points on the longitudinal axis of the coil are centrally located within the profiles of the two coil ends.

Preferably, the first coil end includes two end segments that are approximately straight.

5 Preferably, the two end segments are approximately parallel to each other.

Preferably, the two end segments are spaced apart by approximately 180 degrees measured about the longitudinal axis of the coil and around the helical coil body.

10 Preferably, the first coil end includes two end segments, and the second coil end includes two end segments that overlap the two end segments of the first coil end in a direction parallel to the longitudinal axis of the coil.

15 Preferably, the coil is formed into an innerspring system using various possible methods including, but not limited to, helical lacing wires, pockets formed from textile material or another method of connecting the coils.

Preferably, an upper portion of the helical coil body includes more closely wound turns than a lower portion of the helical coil body.

20 Preferably, a spring rate of the wire coil during compression sequentially increases in six stages as each touch point of six different touch points contacts the coil body.

According to another aspect, the invention is an innerspring system, comprising a plurality of the wire coils described above.

25 Preferably, the longitudinal axis of each wire coil in the plurality of wire coils is centralized to prevent uneven coil spacing in alternating units of the wire coils.

Preferably, rows or columns of wire coils are turned 180 degrees around their longitudinal axis and relative to other wire coils to improve system stability.

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To assist in understanding the invention and to enable a person skilled in the art to put the invention into practical effect, preferred embodiments of the invention are described below by way of example only with reference to the accompanying drawings, in which:

5 FIG. 1 is a side perspective view of a wire coil for use in an innerspring system, according to an embodiment of the present invention;

 FIG. 2 is a top view of the wire coil of FIG. 1, showing only the first coil end and a first turn of the helical coil body;

 FIG. 3 is a bottom view of the wire coil of FIG. 1, showing only the
10 second coil end and a first turn of the helical coil body;

 FIG. 4 is a further top view of the wire coil of FIG. 1, showing the first coil end overlapping the second coil end and the helical coil body;

 FIG. 5 is a front side view of the wire coil of FIG. 1;

 FIG. 6 is a right side view of the wire coil of FIG. 1;

15 FIG. 7 is a side view of an innerspring system, according to an embodiment of the present invention; and

 FIG. 8 is a top view of the innerspring system of FIG. 7.

 Like reference symbols in the various drawings indicate like elements.

20 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

 The present invention relates to a wire coil and innerspring system. Elements of the invention are illustrated in concise outline form in the drawings, showing only those specific details that are necessary to understanding the embodiments of the present invention, but so as not to
25 clutter the disclosure with excessive detail that will be obvious to those of ordinary skill in the art in light of the present description.

 In this patent specification, adjectives such as first and second, left and right, top and bottom, up and down, upper and lower, rear, front and side, etc.,

are used solely to define one element or method step from another element or method step without necessarily requiring a specific relative position or sequence that is described by the adjectives. Words such as “comprises” or “includes” are not used to define an exclusive set of elements or method
5 steps. Rather, such words merely define a minimum set of elements or method steps included in a particular embodiment of the present invention.

According to one aspect, the present invention is defined as a wire coil for use in an innerspring, comprising: a plurality of helical turns that form a helical coil body about a longitudinal axis of the coil, and which helical turns
10 define a helical turn radius; a first coil end extending from one end of the helical coil body; and a second coil end extending from an opposite end of the helical coil body; wherein at least one of the first coil end and the second coil end include one or more touch points defined by both a first portion extending a distance from the longitudinal axis of the coil that is greater than the helical
15 turn radius, and a second portion extending a distance from the longitudinal axis of the coil that is less than the helical turn radius.

Advantages of some embodiments of the present invention include a wire coil having improved support and reduced distortion during compression, as the first active turn of the coil body contacts the coil ends at one or more
20 deliberate touch points. Further, the touch points progressively close off the end sections of the coil and provide the opportunity for a variable spring rate, where the spring rate increases and thus the coil becomes firmer as the coil is compressed, but without requiring additional springs. The touch points also assist in reducing noise from the wire coil. In addition, the end profile
25 increases the overlap of the coil body on the end profile, which prevents the coil body from pushing through the end profile under compression and becoming stuck when the coil is released. Further, when the wire coils are assembled into an innerspring system, the centralized longitudinal axis of the coils creates more uniform spaces between coil bodies in alternated coil unit
30 assemblies, which reduces the chances of adjacent wire coils clashing, regardless of coil orientation. Various coil assembly methods can be used, including, e.g., pocket coils, helical lacing, etc.

Those skilled in the art will appreciate that not all of the above advantages will be achieved by all possible embodiments of the present invention. The following illustrations depict a particular embodiment of the invention which provides three deliberate touch points at each end of the coil.

5 Those skilled in the art will understand that different embodiments of the invention may have different touch points formed by alternative coil end shapes and also may have different coil end profiles at each end of the coil. It is also possible to have the two end segments in different orientations with reference to each other.

10 FIG. 1 is a side perspective view of a wire coil 100 for use in an innerspring system, according to an embodiment of the present invention. The coil 100 includes a plurality of helical turns 105 which form a helical coil body 110 about a longitudinal axis 115 of the coil 100. The helical turns 105 define a helical turn radius 120.

15 A first coil end 125 extends from a first end 130 of the helical coil body 110. A second coil end 135 extends from an opposite end 140 of the helical coil body 110.

FIG. 2 is a top view of the wire coil 100, showing only the first coil end 125 and a first turn of the helical coil body 110. Touch points 200, 215, 220
20 are where portions of the first coil end 125 extend across the helical coil body 110 in an end view and thus where the first coil end 125 will contact the coil body 110 when the wire coil 100 is compressed. For example, a second touch point 215 is defined by both a first portion 202 of the first coil end 125 extending a distance 205 from the longitudinal axis 115 of the coil 100 that is
25 greater than the helical turn radius 120, and a second portion 207 extending a distance 210 from the longitudinal axis 115 of the coil 100 that is less than the helical turn radius 120. A first touch point 200 and a third touch point 220 are similarly defined.

The first coil end 125 thus crosses over the first turn of the helical coil
30 body 110 at each touch point 200, 215 and 220.

During compression of the wire coil 100, the first touch point 200 contacts the first turn of the helical coil body 110 at a point directly below (in a

direction parallel to the longitudinal axis 115) the first touch point 200. After the first touch point 200 contacts the first turn of the helical coil body 110, during further compression of the coil 100 the end section of the coil body 110 between the first touch point 200 and the first coil end 125 ceases to influence the spring rate of the coil 100. The spring rate of the coil 100 thus increases during such further compression.

Subsequently, during yet further compression of the coil 100, and after the second touch point 215 contacts the first turn of the helical coil body 110, the end section of the coil body 110 between the second touch point 215 and the first coil end 125 ceases to influence the spring rate of the coil 100. The spring rate of the coil 100 thus increases further. This progression continues through the second touch point 215 and on to the third touch point 220, which closes out a further section of the coil 100 between touch point 215 and touch point 220, thus further influencing the spring rate of the coil 100.

The touch points 200, 215 and 220 also provide improved support and stability for the coil body 110 and reduce lateral forces as the coil 100 is compressed.

According to some embodiments, the coil end profile and the touch points 200, 215, 220 allow for the top and bottom of the longitudinal axis 115 of the helical coil body 110 to be located as close as possible to the centre points of the coil end profiles, thus minimizing any lean or directional bias and maximizing stability as the coil 100 is compressed.

FIG. 3 is a bottom view of the wire coil 100, showing only the second coil end 135 and a first turn of the helical coil body 110. The second coil end 135 extends from the opposite end 140 of the helical coil body 110. Similar to the first coil end 125, the second coil end 135 also includes touch points 300, 310 and 315. Also, the second coil end 135 includes two end segments 320, 325 that are approximately straight, are approximately parallel to each other, and are spaced apart by approximately 180 degrees measured about the longitudinal axis 115 of the coil 100 and around the helical coil body 110.

FIG. 4 is a further top view of the wire coil 100, showing the first coil end 125 overlapping the second coil end 135 and the helical coil body 110.

End segments 420, 425 of the first coil end 125 are positioned directly over the end segments 320, 325 of the second coil end 135.

The two end segments 420, 425 are also approximately straight, are approximately parallel to each other, and are spaced apart by approximately 180 degrees measured about the longitudinal axis 115 of the coil 100 and around the helical coil body 110.

FIG. 5 is a front side view of the wire coil 100.

FIG. 6 is a right side view of the wire coil 100. As shown, an upper portion of the helical coil body 110 includes more closely wound turns than a lower portion of the helical coil body 110. That can result in a sequential contacting of the touch points 200, 215, 220, 300, 310 and 315 with the coil body 110 during compression of the coil 100. For example, touch point 200 may contact the coil body 110 first, followed by touch point 215, followed by touch points 200, 300, 310 and finally followed by touch point 315 contacting the coil body 110. Accordingly, a spring rate of the wire coil 100 during compression sequentially increases in six stages as each touch point 200, 215, 220, 300, 310, 315 contacts the coil body 110.

In light of the present disclosure, those skilled in the art will appreciate that alternative embodiments of the present invention may include different coil end profiles having, for example, different numbers and locations of touch points and different pitch and radiuses of the coil body turns forming different variable response rates as required.

FIG. 7 is a side view of an innerspring system 700, according to an embodiment of the present invention. Helical lacing 705 connects end segments 320, 420 to adjacent end segments 325, 425, respectively, of adjacent wire coils 100 to form the innerspring system 700.

Centralizing the longitudinal axis 115 of each wire coil 100 prevents uneven coil spacing in alternating units of the wire coils 100 in the innerspring system 700, where rows or columns of coils 100 can be turned 180 degrees to improve unit stability. This design also prevents the formation of larger and smaller spaces between rows or columns, thus reducing the possibility of adjacent coils 100 coming into contact with each other.

FIG. 8 is a top view of the innerspring system 700, and also illustrates the alternating units of the wire coils 100.

Those skilled in the art will appreciate that various embodiments of the present invention can be made of various materials, or a combination of
5 various materials, including steel, metal alloys or high strength plastics or composites.

Those skilled in the art will also appreciate that the alternating pattern of the coils may take on numerous different forms as required to achieve the desired final product. Coils may be turned about their longitudinal axis in
10 alternating patterns through columns, rows, checkerboard or any combination or multiple combinations of these in different angles of rotation throughout the spring unit, to achieve a desired effect, feel or stability in the unit.

The above description of various embodiments of the present invention is provided for purposes of description to one of ordinary skill in the related
15 art. It is not intended to be exhaustive or to limit the invention to a single disclosed embodiment. Numerous alternatives and variations to the present invention will be apparent to those skilled in the art of the above teaching. Accordingly, while some alternative embodiments have been discussed specifically, other embodiments will be apparent or relatively easily developed
20 by those of ordinary skill in the art. Accordingly, this patent specification is intended to embrace all alternatives, modifications and variations of the present invention that have been discussed herein, and other embodiments that fall within the spirit and scope of the above described invention.