United States Patent [19]

Higgins et al.

[11] **3,911,511**

[45] **Oct. 14, 1975**

[54] **SPRING ASSEMBLY**

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[73] Assignee: **Leggett & Platt, Incorporated,** Carthage, Mo.

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[52] **U.S. Cl.** **5/255;** 5/267; 5/351

[51] **Int. Cl.²** **A47C 23/04;** A47C 25/00

[58] **Field of Search** 5/246, 260, 266–269, 5/271, 351

[56] **References Cited**

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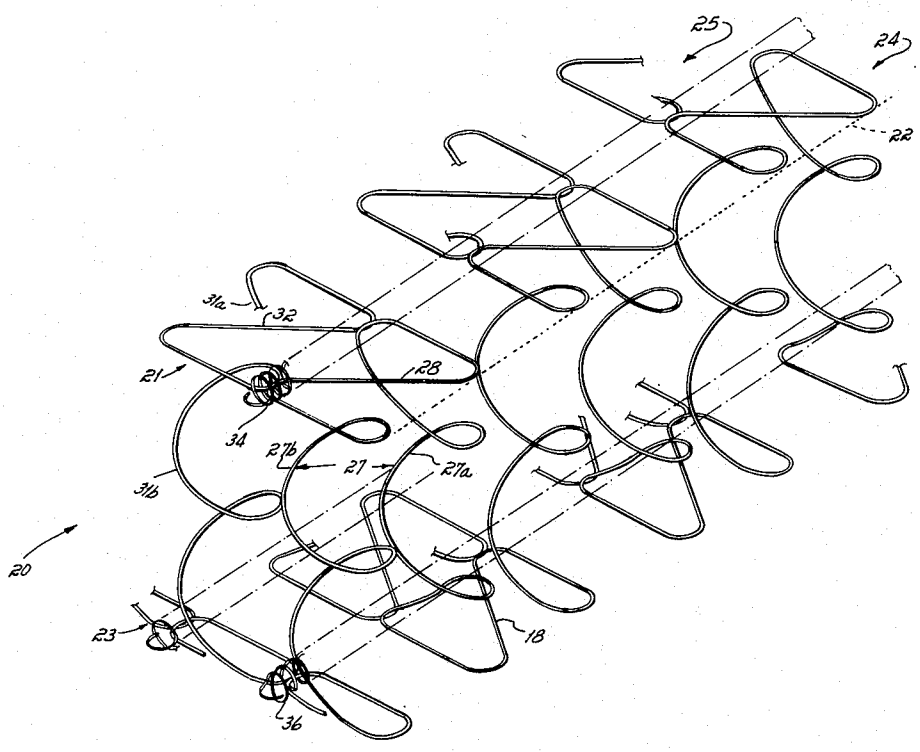
Primary Examiner—Casmir A. Nunberg

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[57] **ABSTRACT**

A spring assembly for mattresses, innersprings, and the like. The assembly comprises rows of coils, each row comprising a continuous length of wire formed into a plurality of like-handed coils interconnected by Z-shaped wire segments alternately disposed at the top and bottom of the coils. Adjacent rows of coils are of the same hand or twist and are coupled by a helical wire wound through overlapping Z-shaped wire segments.

13 Claims, 7 Drawing Figures



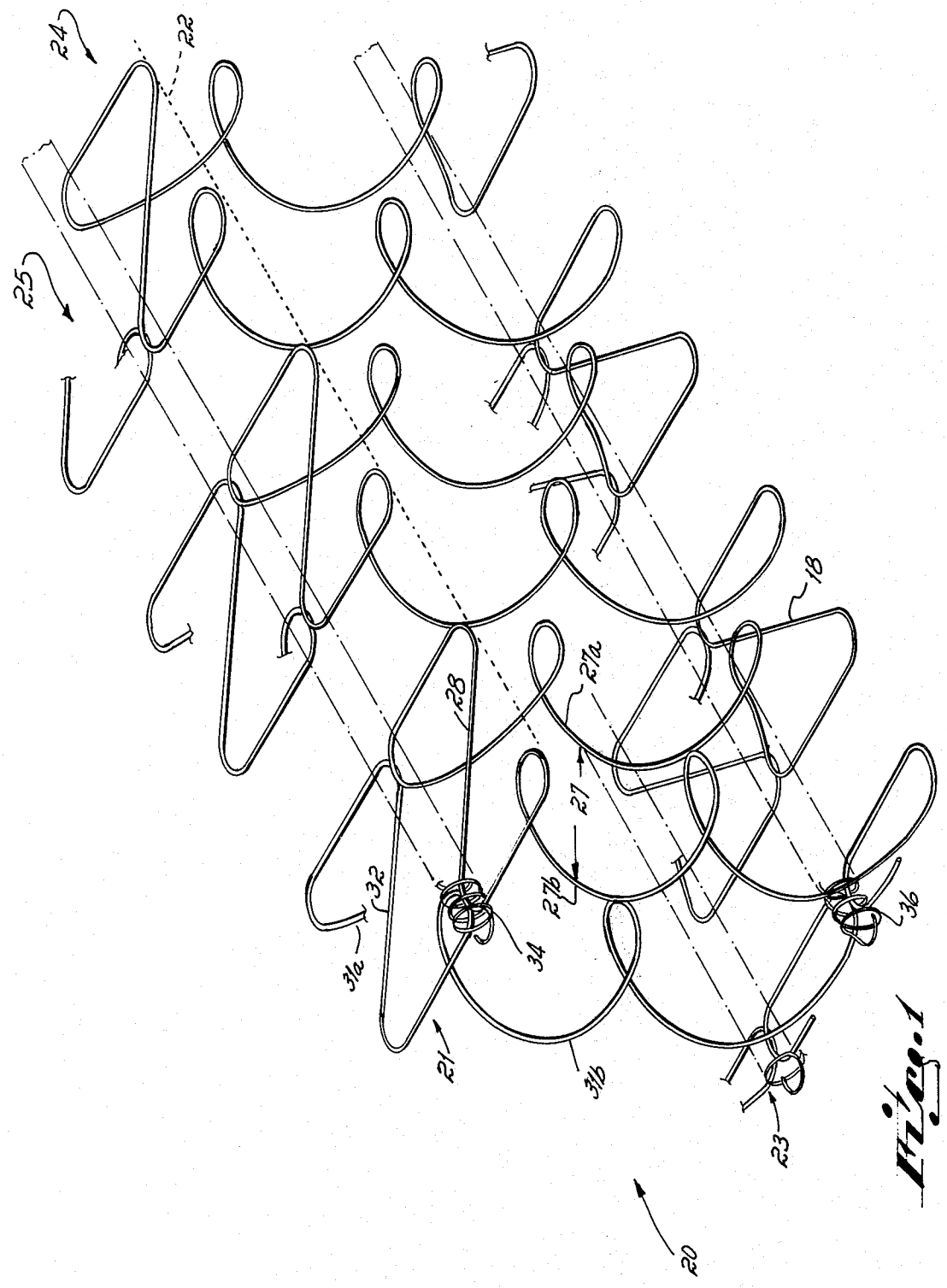


Fig. 1

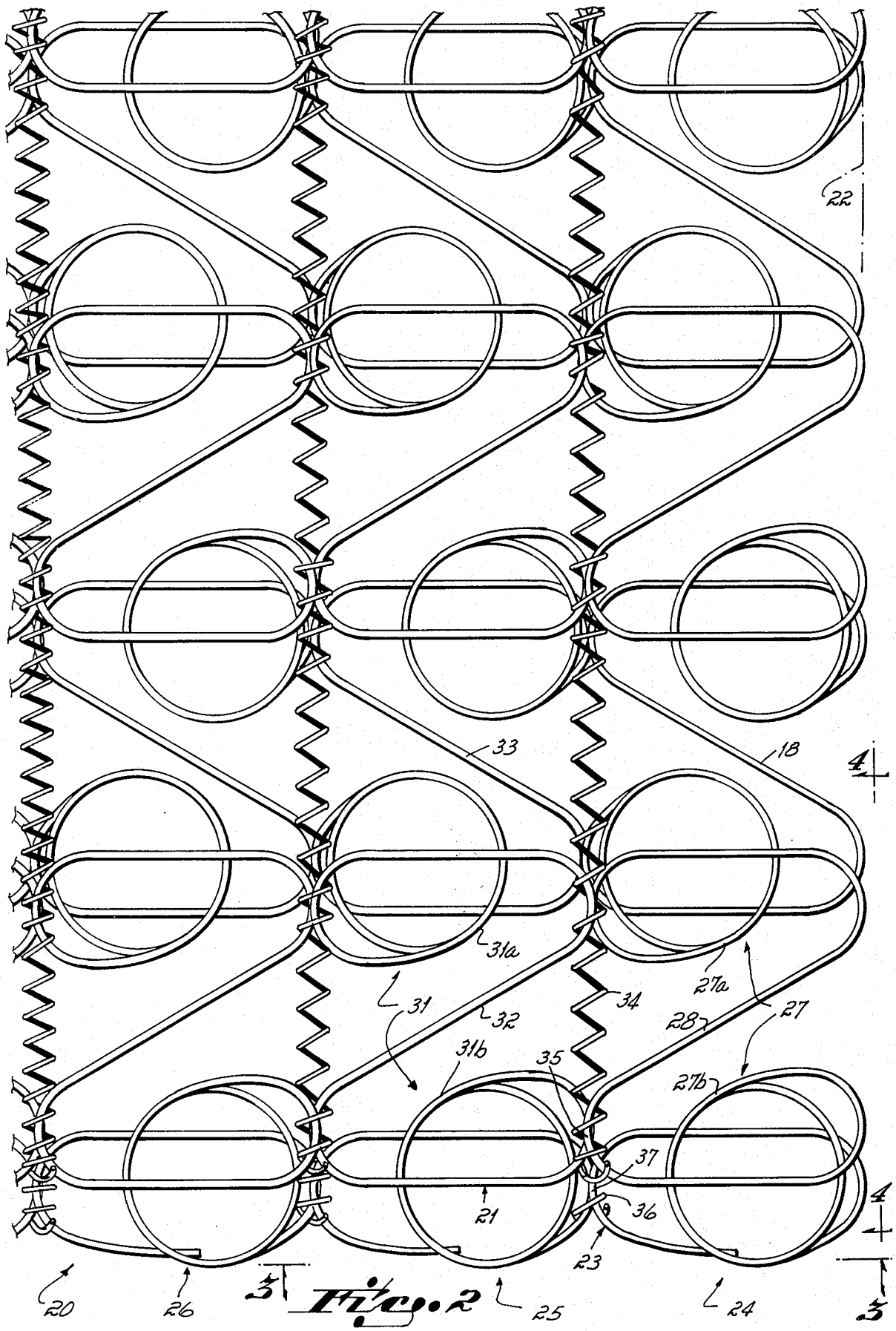

22
33
18
4
31a
27a
31
32
34
28
27
31b
35
27b
37
21
36
4
23
20
26
5
25
24
5

Fig. 2

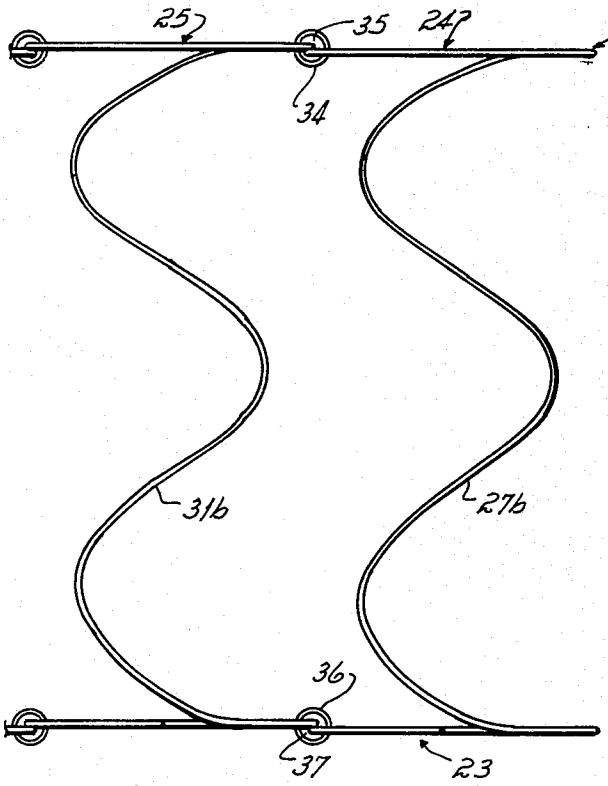


Fig. 3

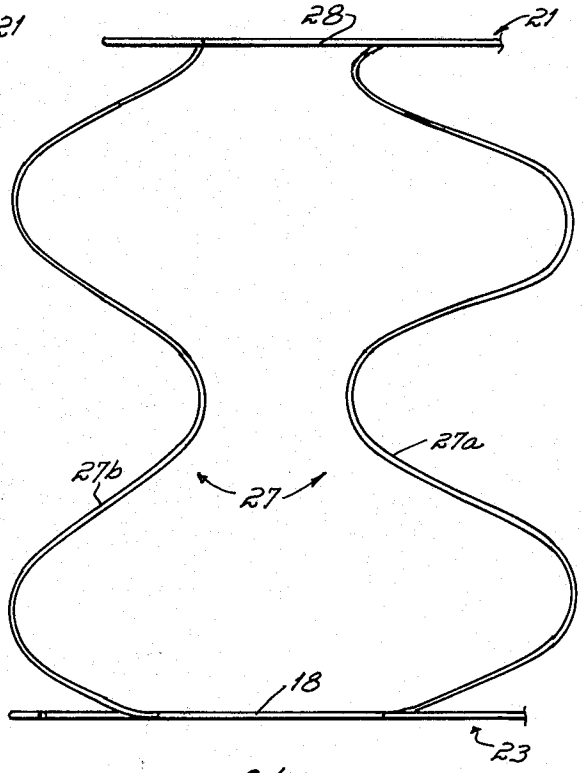


Fig. 4

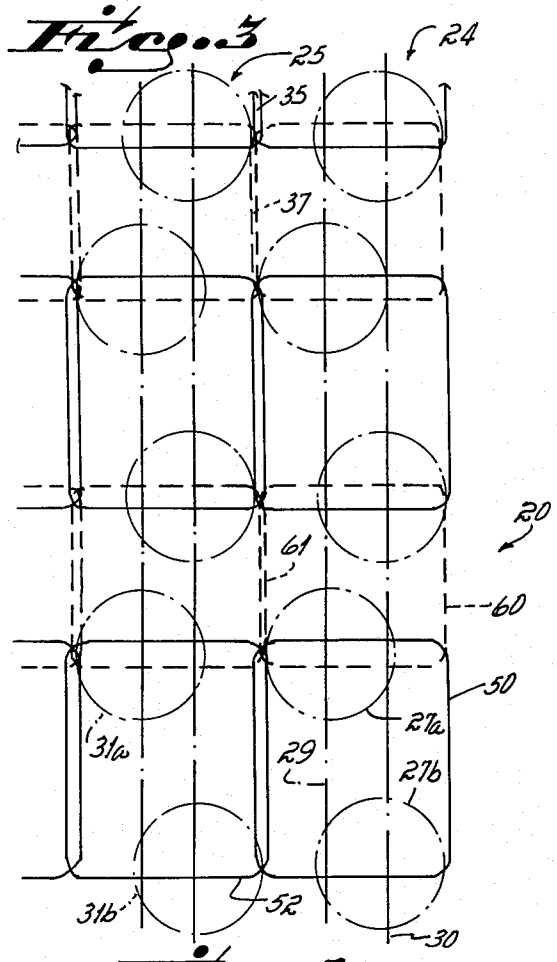


Fig. 5

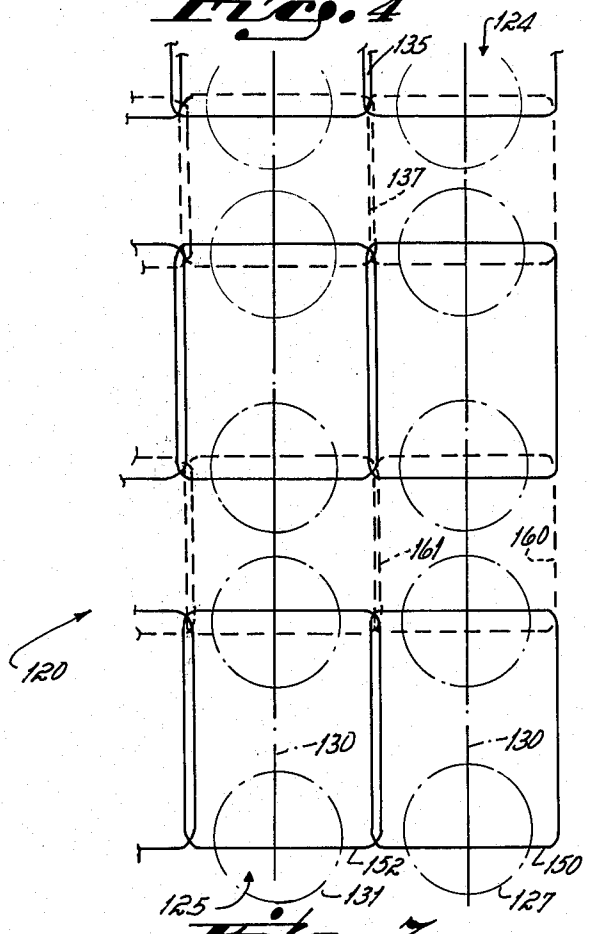


Fig. 7

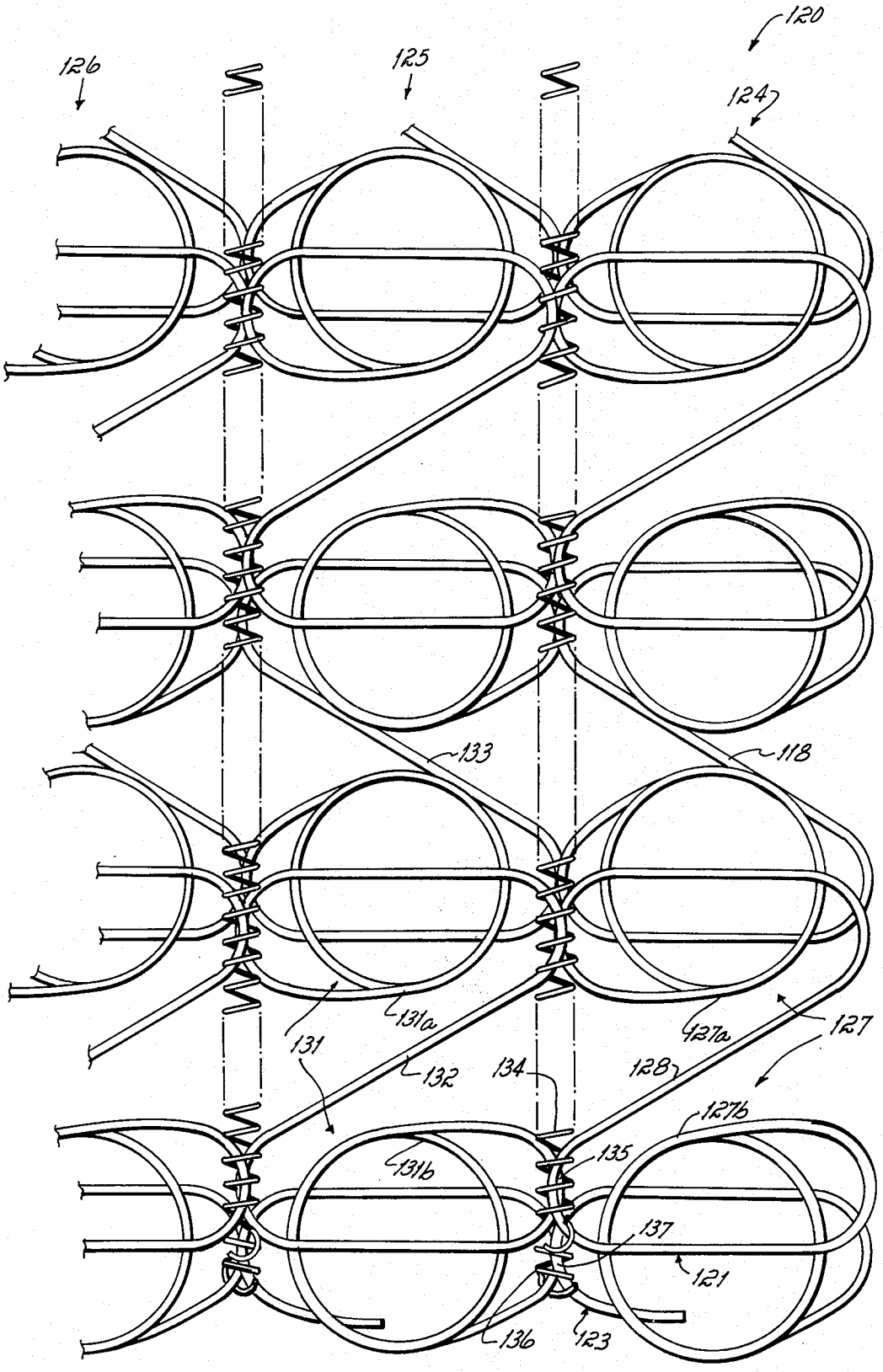

120
126
125
124
133
118
131a
127a
127
131
132
134
128
127b
131b
135
137
121
136
123

Fig. 6

SPRING ASSEMBLY

The present invention relates to spring assemblies of the type commonly used in the construction of innersprings, mattresses, upholstered furniture, and the like. More particularly, the present invention relates to a mattress spring core assembly in which each of the rows of coils is formed from a single continuous length of wire.

The prior art is replete with spring assemblies useful for mattresses, innersprings, and the like. While these are of various configurations, most of them employ rows of coils interconnected at the top and bottom by wire lacings. Such prior art spring assemblies, varied though they are in exact configuration, all are subject to some shortcomings. Primary among these shortcomings is the large amount of wire employed to make up the coil, as well as the complexity of the lacing schemes employed for the interconnection of the coils. Many of the configurations are subject to the requirement that they be hand assembled and consequently they are excessively expensive to manufacture.

Another typical problem in the manufacture of mattresses or innersprings is that of optimizing comfort by utilizing coil assemblies which are relatively firm yet resilient, with a minimum of lateral deflection, or so-called "water bed" effect. Optimally, when a person is lying on a mattress, the coils beneath him give sufficiently to accommodate the contour of the body but not so much so that proper orthopedic support of the body is lost. Moreover, the coils to either side of the person should be deflected by a minimal amount and help to carry the weight on the primary loaded spring coils. Then, too, the mattress or innerspring should be quiet, i.e., free from noise caused by scraping or slapping of adjacent coils or interconnections when deflected by the weight of a person sitting or reclining on the spring assembly.

One approach to overcoming the problems and shortcomings set forth hereinabove is disclosed in U.S. Pat. No. **3,657,749** in which rows of coils are formed from a continuous length of wire interconnected by Z-shaped connecting segments. The opposite rows of coils are of opposite hands, i.e., of alternately right hand and left hand twist, and the rows are interconnected by a zigzag connector wire. The primary advantage of the spring assembly disclosed in this patent is that it facilitates machine construction of the springs without any manual assistance and it substantially reduces the quantity of wire required to obtain a given degree of firmness.

While the spring core assembly disclosed in U.S. Pat. No. **3,657,749** has the advantages set forth hereinabove, it also suffers from several shortcomings. Specifically, that assembly has been found to be very noisy in that it allows wires to snap over each other and to come into contact with other wires during compression and relaxation of the individual spring coils. Additionally, there is a problem of the invididual coils shifting laterally in the course of compressing with the result that the complete assembly has the feel of a water bed, i.e., it allows the top surface to move laterally as well as to deflect in the course of compression.

Another problem or shortcoming encountered with the spring assembly disclosed in U.S. Pat. No. **3,657,749** is that it is possible when a corner is deflected severely as mattresses often are in the course of

placing a fitted sheet over the mattress, for the coils to become overlapped and locked in that overlapped condition. When that overlapping occurs the mattress either has a "hole" or unsupported area in it, or it is maintained in a deflected or bent condition.

The shortcomings of U.S. Pat. No. **3,657,749** have been overcome by this invention without sacrificing the advantages of their construction. According to the practice of this invention, a row of coils are all made of a single continuous strand of wire and all of the rows are of the same hand or twist. These rows are placed in juxtaposition with the Z-shaped interconnecting segments of adjacent rows in overlapping relation and the overlapping sections of the Z-shaped segments are laced or secured together by a helical wire connector.

This construction has numerous advantages over that of the above identified patent while it still retains the advantages of the spring assembly of U.S. Pat. No. **3,657,749.** Specifically, it maintains the advantages of being capable of being manufactured and assembled without any hand labor and it maintains the advantage of being capable of being manufactured of lightweight, inexpensive wire so that material cost is substantially reduced. Additionally, though, it overcomes the shortcomings of the mattress assembly disclosed in the above identified patent by eliminating the noise and the lateral shifting problem. It also is so constructed that it is impossible for the individual coils to become overlapped and interlocked.

Another advantage of the spring core assembly of this invention is that it is easily adaptable to the manufacture of varying size mattresses because the length may be varied without varying the width and vice versa. In the mattress core assemblies of the above identified patent, the variation in one dimension, i.e., length, required a corresponding change in the other direction, i.e., width. With the construction of this invention, either may be varied without affecting the other.

These and other advantages of this invention will be more readily apparent from the following description of the drawings, in which:

FIG. **1** is a perspective view of a corner of an innerspring embodying the invention of this application.

FIG. **2** is a top plan view of the innerspring of FIG. **1.**

FIG. **3** is an end elevational view taken on line **3—3** of FIG. **2.**

FIG. **4** is an end elevational view taken on line **4—4** of FIG. **2.**

FIG. **5** is a diagrammatic plan view in which each coil pair in each row is designated by block lines constituting continuations of the Z-shaped coil interconnection segments.

FIG. **6** is a top plan view of a second embodiment of the invention of this application.

FIG. **7** is a diagrammatic plan view of the embodiment of FIG. **6** in which each coil pair in each row is designated by block lines constituting continuations of the Z-shaped coil interconnection segments.

Referring now to the drawings and particularly to FIGS. **1** and **2,** there is shown an innerspring unit **20** utilizing a spring assembly made in accordance with the invention of this application. The upper surface **21** of innerspring **20** has a generally rectangular periphery **22** which may be enclosed by a border wire (not shown). Similarly, the lower surface **23** of innerspring **20** has a

rectangular periphery which also may be enclosed by a border wire (not shown).

Innerspring **20** includes a plurality of rows **24, 25, 26** of coils, all of the same twist, as, for example, all right handed twist or all left handed twist. As best illustrated in FIGS. **1** and **2**, each row **24, 25,** and **26** of coils is formed from a continuous length of wire. The wire is wound to form a plurality of spaced coil pairs **27** interconnected by substantially Z-shaped wire segments **28,** 18 disposed sequentially first in the plane of upper innerspring surface **21** and then within the plane of lower innerspring surface **23.**

As best illustrated in FIG. **2,** each coil pair **27** comprises a first right handed coil **27***a* offset from a second right handed coil **27***b*, having the same number of turns as coil **27***a*. As seen in FIG. **5,** the axes of coils **27***a* lie within a plane **29** which is parallel to, but spaced apart from, a second plane **30** within which lie the axes of offset coils **27***b*. It will be appreciated from FIG. **2** that the axes of adjacent coils **27***a* and adjacent coils **27***b* are equidistant, the axes being generally perpendicular to the upper and lower surfaces **21** and **23** of innersrping unit **20.**

While each of the coils **27***a* and **27***b* is illustrated as having approximately two full turns or revolutions, this number is not critical. Thus, a greater or lesser number of convolutions may be used, depending upon the tensile strength of the wire and the manner in which the coils are formed so as to provide a spring force appropriate to the particular application.

As will be appreciated from the following description, the coil interconnection technique utilized in innerspring mattress **20** prevents adjacent coils from binding when compressed even though they are not of hourglass configuration. Thus, a variety of shapes may be employed such as hourglass or potbellied, but the cylindrical shape illustrated is perferred.

Each row **24, 25,** and **26** is configured identical to each adjacent row and each coil within each row **24,** 25, 26 is identical to every other coil and of the same twist or hand.

In the preferred embodiment of the invention, the spacing between axes of adjacent coils within row **24** is the same as between axes spacing of adjacent coils and rows **25** and **26.** Further, should a coil pair in row **24** be interconnected in the plane of upper innerspring surface **21,** the adjacent coil pair in row **25** is interconnected in the same plane of upper innerspring surface **21.** This is best illustrated in FIGS. **1** and **2** where in row **24,** typical adjacent coils **27***a*, 27*b* are interconnected by Z-shaped wire segment **28** lying within upper innerspring surface **21.** The adjacent coil pair **32** in row **25,** coils **31***a* and **31***b*, are interconnected by a Z-shaped wire segment **32** lying in the same plane of the upper innerspring surface **21** and Z-shaped wire segment **33** lying in the same plane of the lower surface **23.** This pattern is repeated throughout the innerspring unit **20.** The result is Z-shaped segments in the plane of the upper surface **21** are aligned in columnar fashion and similarly the Z-shaped segments in the plane of the lower surface **23** are also aligned in columnar fashion in vertical planes which are located midway between the vertical plane of the Z-shaped segments in the plane of the upper surface **21.** Otherwise expressed, the Z-shaped segments which interconnect the pairs of coils are aligned both in rows and in columns in the planes of the upper and lower surfaces **21** and **23.**

In order to connect the adjacent rows of coils, the Z-shaped segments which interconnect adjacent pairs of coils within each row are positioned so that they overlap the Z-shaped segments of the adjacent row of coils. These overlapped portions or sections of the Z-shaped segments are then tied together by helical wire connectors. A first set of helical wire connectors, herein designated **34,** is disposed within the plane of upper innerspring surface **21** so as to join together overlapped portions **35** of upper Z-shaped interconnection segments **28, 32.** Similarly, a second set of helical wire connectors, herein designated **36,** lie within the plane of lower innerspring surface **23** and serve to join together overlapped portions **37** of lower Z-shaped interconnection segments **18** and **33.** As evident in the plan view of FIG. **2,** the length of each helical wire is the same as the length of the rows, and the helical wires **34, 36** extend parallel to the rows.

The assembly of the helical wires to the row of continuous coils may be easily accomplished on a completely automatic assembly machine. In such a machine, the adjacent rows of coils are positioned so that the sections **35** and **37** of the adjacent Z-shaped segments are positioned in overlapping relationship and a helical wire is then rotated or screwed onto the overlapping portions of the Z-shaped segments. After completion of the threading of the helical coil onto the Z-shaped segments, the helical coil is cut to length so that the now-connected adjacent rows of coils may be indexed forwardly and another pair of upper and lower helical wires threaded over the next row of coils. This process is repeated for the desired length of the mattress, after which the spring assembly is removed from the machine.

Referring now to FIG. **2,** it will be seen that the diameters of the helical wires **34** and **36** are approximately one-fourth the radius of the overlapped portions **35** and **37** of the Z-shaped segments. This relationship of having the radius of the Z-shaped segments over which the helical wire is threaded approximately eight times the radius of the helical wire has the effect of permitting two rotations of the helical wire to pass through and lock adjacent overlapped segments together. So locked or interconnected, the adjacent coils are free to pivot relative to each other but are locked against relative longitudinal or lateral movement. In other words, this relatively small diameter helical coil when used to lock the overlapped large radiused sections of the segments together, permits only relative pivotal movement between the adjacent interconnected coils.

Referring now to FIG. **5,** each block **50** represents the outline of a typical upper Z-shaped interconnection segment **28** in coil row **24.** Similarly, each block **52** represents the outline of a typical upper Z-shaped interconnection segment **32** in coil row **25.** Each block **60** represents the outline of typical lower Z-shaped interconnection segment **18** in coil row **24** and each block **61** represents the outline of a typical lower Z-shaped interconnection segment **33** in coil row **25.** As is apparent from the diagram in FIG. **5,** the blocks **50, 52,** and **60, 61** represent load supporting units. Each of these units **50, 52** and **60, 61** are overlapped so that the effect of the construction of coil assembly is one of a very densely packed innerspring assembly with a very high count of coils. This construction enables a very small gage wire to be utilized in the innerspring. It is a particularly advantageous structure for use in a foamed in

spring mattress such as the spring mattress disclosed in U.S. Pat. No. **3,660,876.**

Referring to FIG. **6,** there is illustrated a second embodiment of the invention of this application. This construction is illustrated diagrammatically in top plan view in FIG. **7.**

In general, the spring assembly of FIGS. **6** and **7** is identical to the spring assembly of FIGS. **1–5,** except that the rows of coils are positioned within the interconnecting Z-shaped segments so that the vertical axes of all of the coils of a single row are located in the same vertical plane **130,** rather than being alternately staggered in two different planes as in the embodiment in FIGS. **1–5.** The Z-shaped segments, rather than extending outwardly from one side only of each coil extend outwardly beyond both sides of each coil so that this construction has the same advantages of the embodiment of FIGS. **1–5** in that it minimizes or eliminates any tendency of the coils to overlap or contact adjacent convolutions of the same coil. Specifically, referring to FIG. **5,** it will be seen that in this embodiment each row of coils **124, 125, 126** is formed from a continuous length of wire and each wire is wound to form a plurality of spaced coil pairs **127** interconnected by substantially Z-shaped wire segments **128** disposed in the plane of upper innerspring surface **121.** The substantially Z-shaped wire segments **118** interconnect adjacent coil pairs **127** within the plane of lower innerspring surface **123.**

In this embodiment each coil pair **127** comprises a first right handed coil **127***a* offset from a second right hand coil **127***b* having the same number of turns as coil **127***a*. In this embodiment though the axes of coils **127***a* lie within the same plane **130** within which lie the axes of coils **127***b*. In this embodiment as in the embodiment of FIGS **1–5,** each row **124, 125, 126** is configured identically to each adjacent row and each coil within each row is of the same twist or hand.

In this embodiment, the corners of the interconnecting Z-shaped segments are both located outwardly from the circumference of the coils **127***a* and **127***b* within each pair of coils in both the planes of the upper and lower surfaces of the mattress. This outward spacing of the Z-shaped segments facilitates interconnection of the overlapped portions of Z-shaped segments by the helical springs **134.**

The primary advantage of both embodiments of the spring assembly described herein is that they both utilize continuous springs which extend for the length of each row of coils and because of this continuous row construction, the assembly may be easily machine manufactured and assembled. This construction also has the advantage of eliminating the knots conventionally formed in each coil. Additionally, this construction has the advantage of facilitating the manufacture of a very firm mattress or innerspring unit from a very thin gage wire and a gage which is much thinner than any which has heretofore been acceptable for manufacture of innerspring units. Additionally, the invention of this application eliminates side sway of "water bed" effect. It also eliminates noise problems encountered when adjacent coils move relative to each other or snap past each other in the course of flexure of the unit assembly.

While we have described only two embodiments of our invention, persons skilled in the arts to which this invention pertains will appreciate other changes and modifications which may be made without departing from the spirit of our invention. Therefore, we do not intend to be limited except by the scope of the following appended claims.

Having described our invention, we claim:

1. A spring assembly comprising,

a plurality of rows of coils, each of said rows of coils being formed from a continuous length of wire, segments of wire interconnecting adjacent coils in each of said rows, said segments each being substantially Z-shaped and disposed alternately in first and second planes generally perpendicular to the axis of said coils at the ends thereof, portions of said Z-shaped segments extending beyond the periphery of said coils, said Z-shaped interconnecting segments each generally defining a rectangle of width greater than the maximum diameter of said coils, adjacent coils within each of said rows being situated at diagonally opposite corners of said rectangles, the axes of coils in each of said rows thereby being disposed alternately in two offset parallel planes,

sections of each of said Z-shaped interconnecting segments of each row being overlapped relative to Z-shaped interconnecting segments of adjacent rows,

helical spring means extending parallel to said rows for the length of said rows, said helical spring means being wound through said overlapped sections of said Z-shaped interconnecting segments so as to secure said rows of coils in an assembled relation, and

said overlapped sections of said Z-shaped interconnecting segments being radiused, the radii of said overlapping sections being substantially greater than the radius of said helical wire so that said helical wire permits relative pivotal movement between said overlapped sections of said Z-shaped interconnecting segments of said rows but precludes all other relative movement.

2. The spring assembly as defined in claim **1** wherein the coils within each row are like-handed and the coils in adjacent rows are also like-handed.

3. The spring assembly of claim **1** in which said radius of said overlapped sections of said Z-shaped interconnecting segments is approximately eight times the radius of said helical wire.

4. A spring assembly comprising

a plurality of rows of coils, each of said rows being formed from a single continuous piece of wire and each of said rows containing a plurality of coils interconnected by Z-shaped interconnecting segments, alternate ones of said Z-shaped interconnecting segments being disposed in the planes of the upper and lower surfaces of said spring assembly, the axes of alternate ones of said coils in one of said rows being disposed in a first plane perpendicular to the upper and lower surfaces of said spring assembly, the axes of the other coils in said row being substantially parallel and disposed in a second plane parallel to, but displaced from said first plane,

sections of each of said Z-shaped interconnecting segments of each row being overlapped relative to Z-shaped interconnecting segments of an adjacent row,

helical spring means extending parallel to said rows for the length of said rows, said helical spring

means being wound through said overlapped sections of said Z-shaped interconnecting segments so as to secure said rows of coils in an assembled relation, and

said overlapped sections of said Z-shaped interconnecting segments being radiused, the radii of said overlapping sections being substantially greater than the radius of said helical wire so that said helical wire permits relative pivotal movement between said overlapped sections of said Z-shaped interconnecting segments of said rows but precludes all other relative movement.

5. The spring assembly of claim **4** in which said overlapped sections of said Z-shaped interconnecting segments are radiused, the radii of said overlapping sections being substantially greater than the radius of said helical wire so that said helical wire permits relative pivotal movement between said overlapped sections of said Z-shaped interconnecting segments of said rows but precludes all other relative movement.

6. The spring assembly of claim **4** in which said radius of said overlapped sections of said Z-shaped interconnecting segments is approximately eight times the radius of said helical wire.

7. A spring assembly comprising,

a plurality of rows of coils, each of said rows of coils being formed from a continuous length of wire, segments of wire interconnecting adjacent coils in each of said rows, said segments each being substantially Z-shaped and disposed alternately in first and second planes generally perpendicular to the axis of said coils at the ends thereof, portions of said Z-shaped segments extending beyond the periphery of said coils,

sections of each of said Z-shaped interconnecting segments of each row being overlapped relative to Z-shaped interconnecting segments of adjacent rows,

helical spring means extending parallel to said rows for the length of said rows, said helical spring means being wound through said overlapped sections of said Z-shaped interconnecting segments so as to secure said rows of coils in an assembled relation, and

said overlapped sections of said Z-shaped interconnecting segments being radiused, the radii of said overlapping sections being substantially greater than the radius of said helical wire so that said helical wire permits relative pivotal movement between said overlapped sections of said Z-shaped interconnecting segments of said rows but precludes all other relative movement.

8. The spring assembly of claim **7** in which said Z-shaped interconnecting segments each generally define a rectangle of width greater than the maximum diameter of said coils,

the coils within each row being like-handed and the coils in adjacent rows also being like-handed.

9. The spring assembly as defined in claim **7** wherein the coils within each row are like-handed and the coils in adjacent rows are also like-handed.

10. The spring assembly of claim **7** in which said radius of said overlapped sections of said Z-shaped interconnecting segments is approximately eight times the radius of said helical wire.

11. A spring assembly comprising

a plurality of rows of coils, each of said rows being formed from a single continuous piece of wire and each of said rows containing a plurality of coils interconnected by Z-shaped interconnecting segments, alternate ones of said Z-shaped interconnecting segments being disposed in the planes of the upper and lower surfaces of said spring assembly, the axes of said coils being disposed perpendicular to the upper and lower surfaces of said spring assembly,

sections of each of said Z-shaped interconnecting segments of each row being overlapped relative to Z-shaped interconnecting segments of an adjacent row,

helical spring means extending parallel to said rows for the length of said rows, said helical spring means being wound through said overlapped sections of said Z-shaped interconnecting segments so as to secure said rows of coils in an assembled relation, and

said overlapped sections of said Z-shaped interconnecting segments being radiused, the radii of said overlapping sections being substantially greater than the radius of said helical wire so that said helical wire permits relative pivotal movement between said overlapped sections of said Z-shaped interconnecting segments of said rows but precludes all other relative movement.

12. The spring assembly as defined in claim **11** wherein the coils within each row are like-handed and the coils in adjacent rows are also like-handed.

13. The spring assembly of claim **11** in which said radius of said overlapped sections of said Z-shaped interconnecting segments is approximately eight times the radius of said helical wire.

* * * * *