# United States Patent

**Norman**

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[45] **Apr. 25, 1972**


## [54] SPRING ASSEMBLY


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[73] Assignee: **Stephen Baliski,** Gardena, Calif. a part interest



[22] Filed: **June 22, 1970**

[21] Appl. No.: **48,047**

**Related U.S. Application Data**

[63] Continuation-in-part of Ser. No. 795,303, Jan. 30, 1969, abandoned.

[52] **U.S. Cl.** ..... **5/271,** 5/248, 5/351, 267/91

[51] **Int. Cl.** ..... **A47c 23/04**

[58] **Field of Search** ..... 5/247, 246, 260, 266, 248, 5/351, 271; 267/91



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 277,322 | 5/1883 | Mills | 5/260 X |
| 593,279 | 11/1897 | Murray | 5/260 X |
| 701,461 | 6/1902 | Bates | 5/266 |
| 2,058,462 | 10/1936 | Karr | 5/246 |
| 2,096,767 | 10/1937 | Sklar | 5/260 |
| 2,610,334 | 9/1952 | Piliero | 5/351 |
| 258,249 | 5/1882 | Ober et al. | 5/271 |

FOREIGN PATENTS OR APPLICATIONS

| | | | |
|---|---|---|---|
| 266,912 | 1/1964 | Australia | 5/256 |



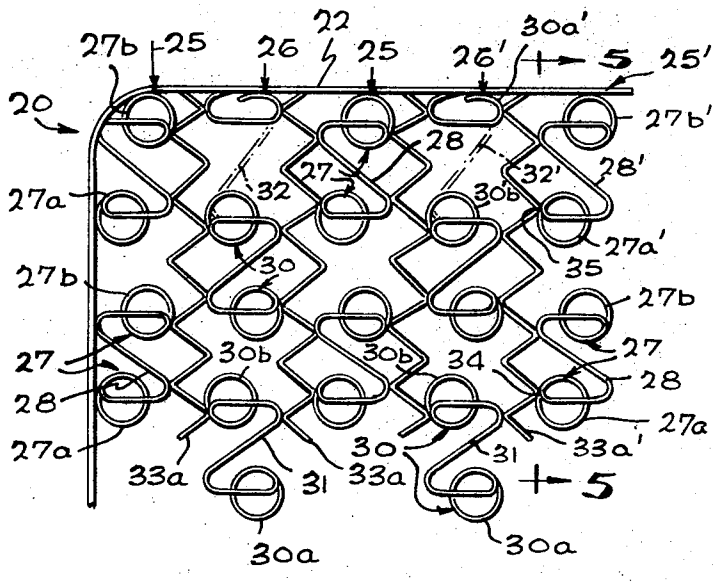
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[57] **ABSTRACT**

A spring assembly for mattresses, innersprings, upholstered furniture and the like. The assembly utilizes 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 coupled by zig-zag connectors. The bends of the zig-zag connectors are looped over portions of the Z-shaped coil interconnection segments, providing an assembly allowing relatively independent coil compression with minimal lateral deflection, and having a maximized surface platen for the support of padding and fabric. A unitary double border wire assembly or alternatively, a rail-type construction may be used as a border for the spring assembly.


**17 Claims, 20 Drawing Figures**



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SHEET 1 OF 6

Fig. 1

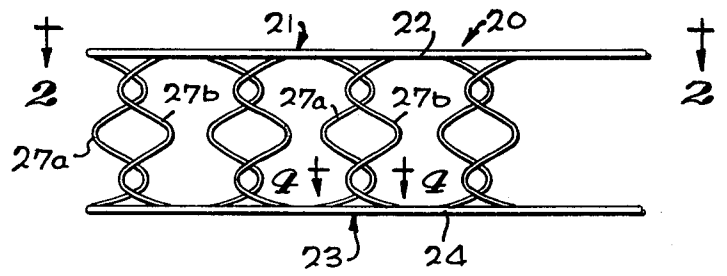



Fig. 2

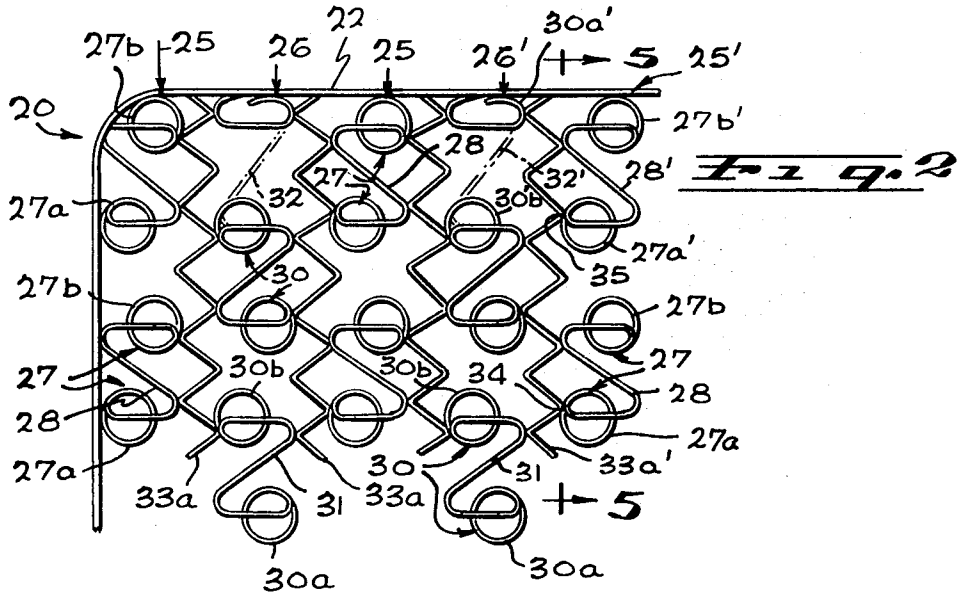
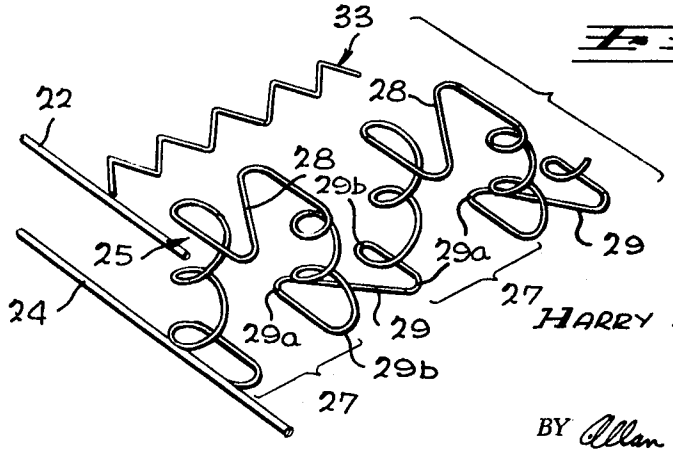



Fig. 3




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Fig. 4

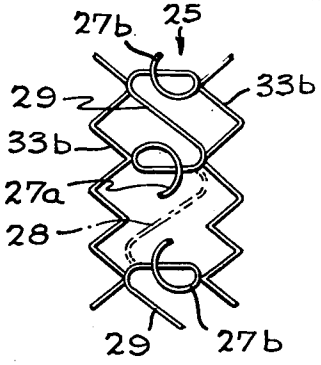



Fig. 5

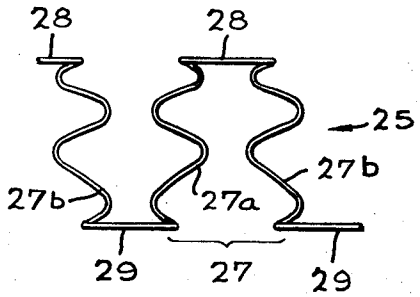
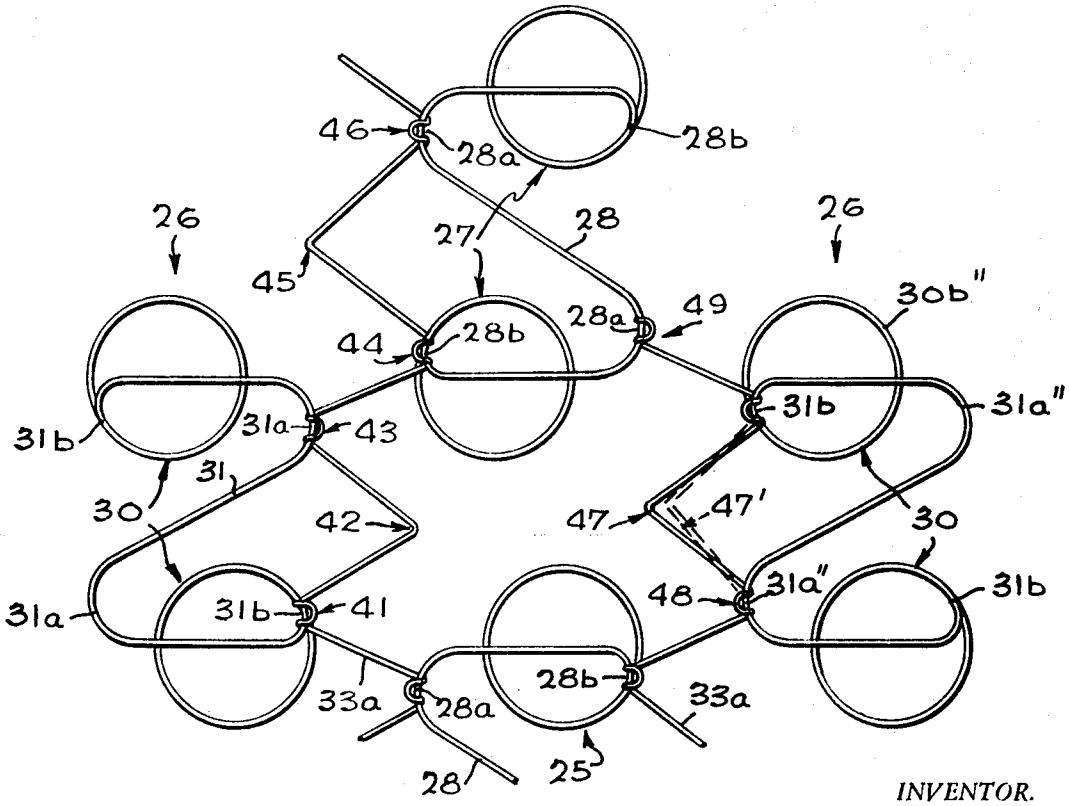



Fig. 6




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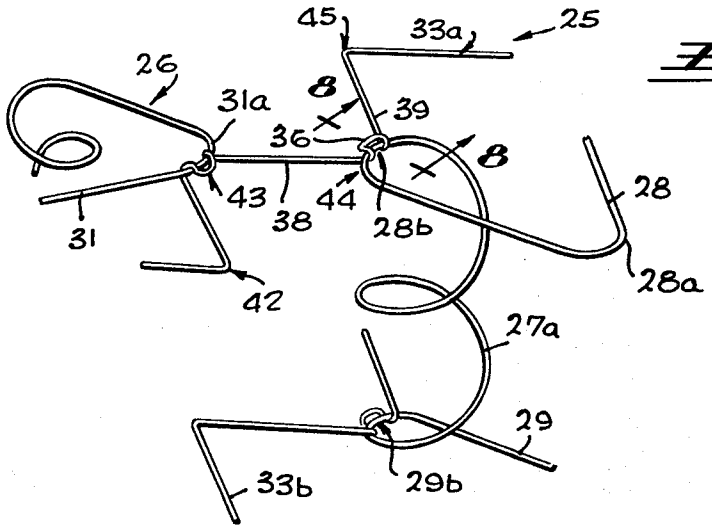



Fig. 7

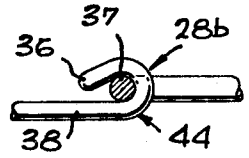



Fig. 8

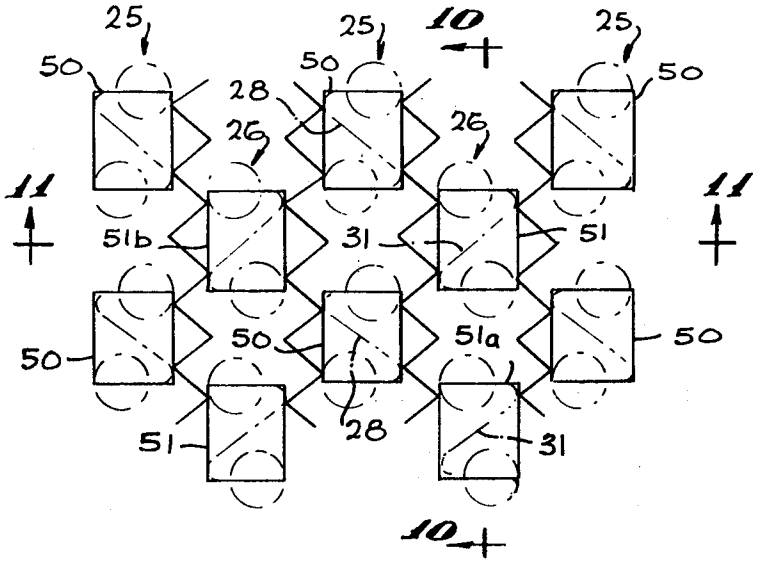



Fig. 9

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Fig. 10

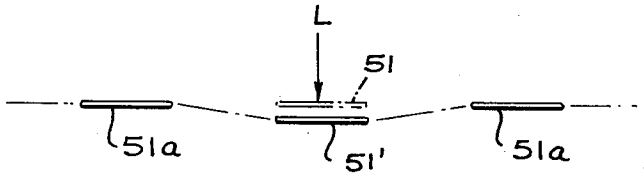



Fig. 11

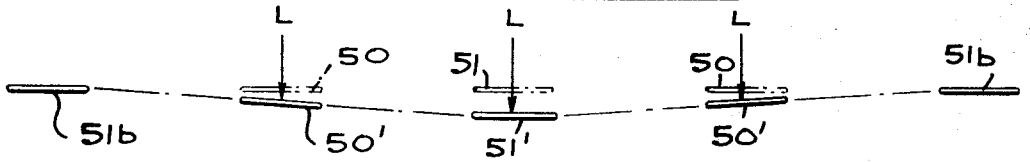



Fig. 12

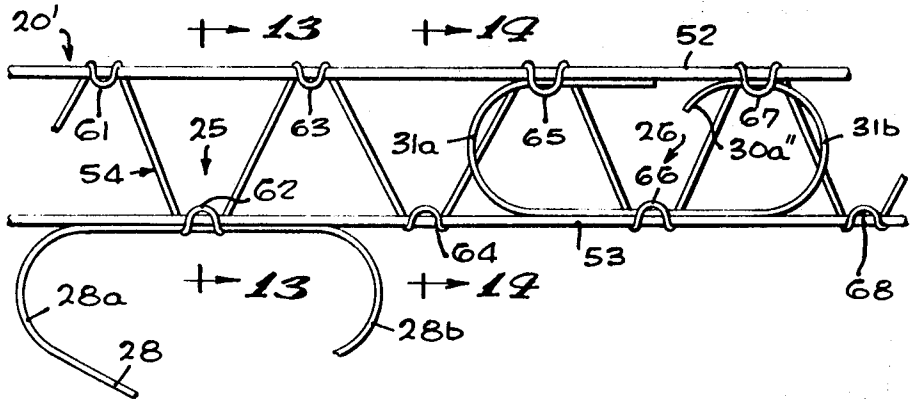



Fig. 13

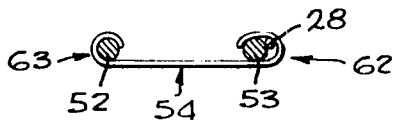
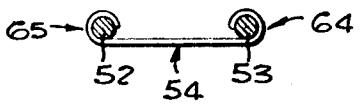



Fig. 14




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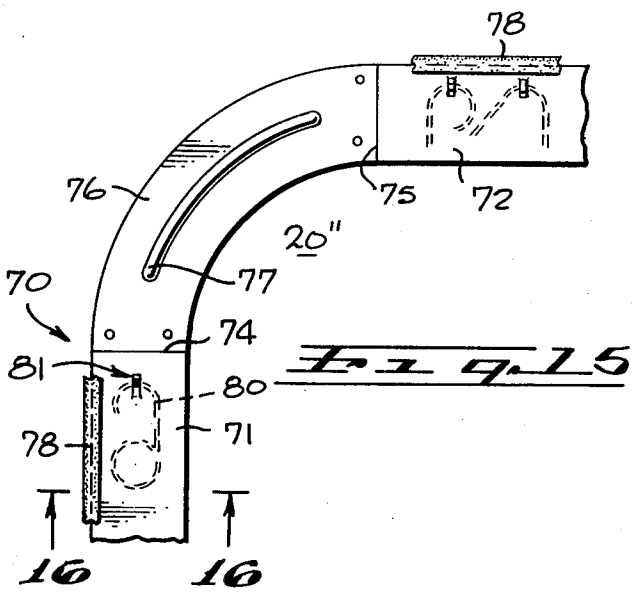



Fig. 15

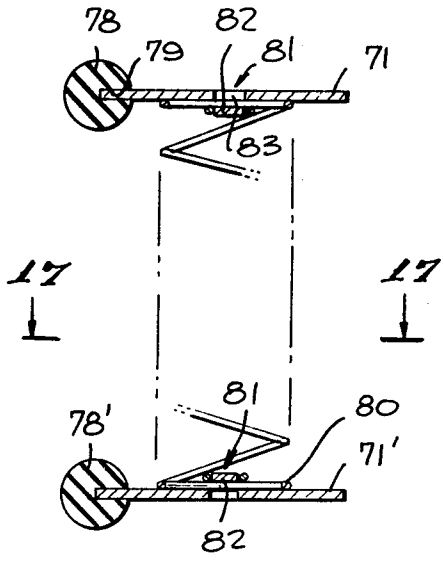



Fig. 16

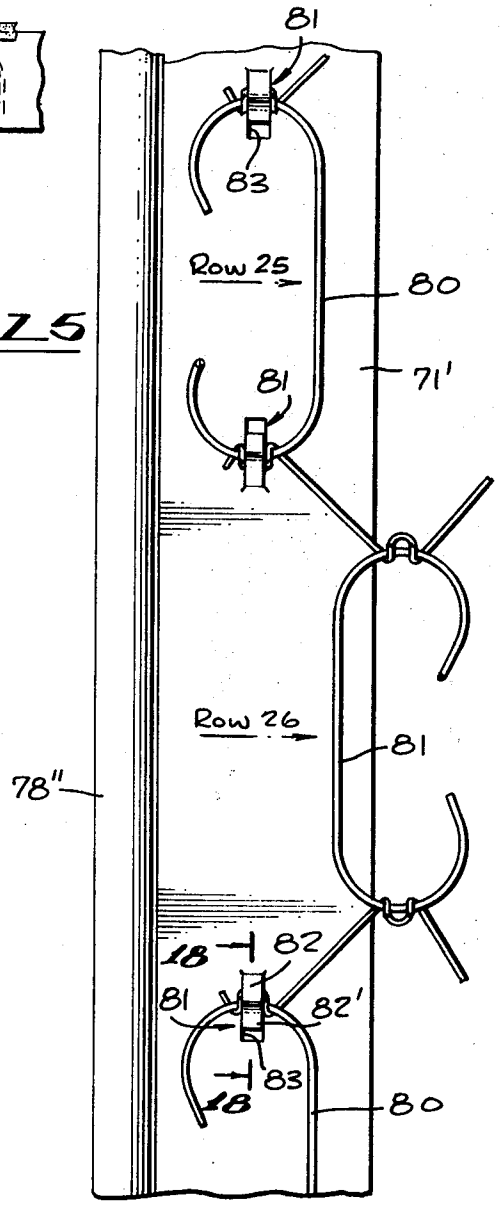



Fig. 17

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Fig. 18

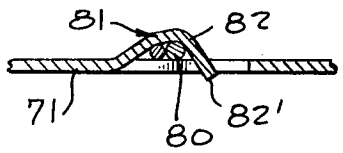



Fig. 19

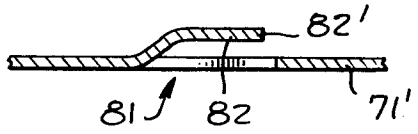
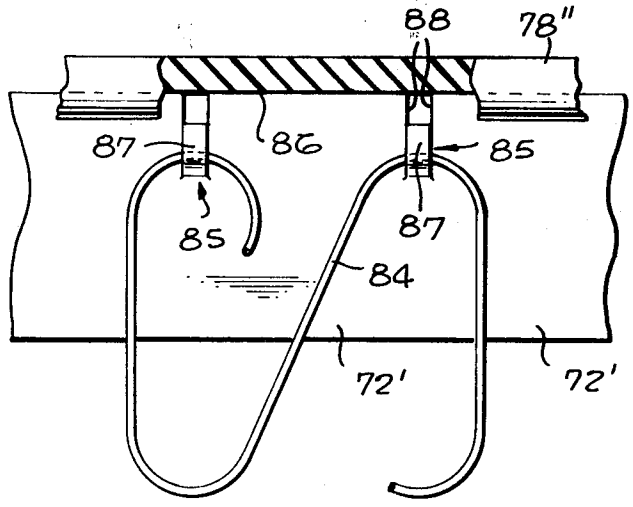



Fig. 20




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# SPRING ASSEMBLY

## RELATED APPLICATIONS

This application is a continuation-in-part of copending application Ser. No. 795,303, filed Jan. 30, 1969, now abandoned.

## FIELD OF THE INVENTION

The present invention relates to spring assemblies such as frequently used in the construction of innersprings, mattresses, upholstered furniture and the like. More particularly, the present invention relates to an interconnected spring assembly comprising coils disposed in rows each formed of a continuous length of wire, adjacent rows being attached by zig-zag connectors.

## DESCRIPTION OF THE PRIOR ART

The prior art is replete with spring assemblies useful for mattresses, innersprings, upholstered furniture and the like. While these are of various configurations, they all employ in common rows of coils, often hourglass in shape, interconnected at top and bottom by complex wire interlacing.

Such prior art spring assemblies, varied though they may be in exact configuration, all suffer similar shortcomings. Primary among these are the large amount of wire used to interconnect the coils, and the complexity of the lacing schemes employed for the interconnections. Both problems significantly add to the cost of the assembly, the former by requiring additional material to be used, the latter by making it virtually impossible to use machine assembly techniques.

Another shortcoming typical of prior art spring assemblies is the lack of sufficient surface platen to prevent the padding, fabric and other materials surrounding the coil assembly in an innerspring or mattress from pressing through. Typically, this problem has been attacked by increasing the number of coils in the assembly, or the complexity of the intercoil wire lacing. Of course, these attempted solutions only add to the cost and complexity of manufacturing the assembly.

Prior art spring assemblies also are typified by another problem, somewhat interrelated with those already mentioned. To provide innersprings or mattresses of optimum comfort requires coil assemblies which are rigid yet resilient, with a minimum of lateral deflection. Thus, when a person is lying on a mattress in the longitudinal or "body resting" direction, the coils beneath him should give sufficiently to accommodate the contour of the body, but not so much so that proper orthopedic support for the body is lost. Moreover, the coils to either side of the person should be deflected by a minimal amount, lest the mattress sink into a concave shape not conducive to proper rest or support. Then too, the mattress or innerspring should be quiet, i.e., free from noise caused by the scraping of adjacent coils or interconnections when deflected by the weight of a person sitting or reclining on the spring assembly.

To provide these desired characteristics of rigidity with resiliency, minimal lateral deflection and quiet operation, prior art spring assemblies have resorted to the use of large numbers of coils or complicated interlacing schemes. The coils typically are formed in hourglass or spool shapes with relatively larger diameter convolutions at the top and bottom, in an attempt to avoid body contact of adjacent coils, and thus reduce the noise problem, as well as to reduce the quantity of wire metal employed in the assembly.

The above described shortcomings of the prior art are overcome by using the inventive spring assembly, in which rows of coils are flexibly interrelated by zig-zag connectors. The inventive spring assembly provides maximum efficiency of wire utilization, typically employing 50 percent less wire than spring assemblies of the prior art. Moreover, the spring assembly provides improved performance characteristics, including minimal lateral deflection, an absence of noise associated with body contact between adjacent coils, and a large surface platen for supporting the fabric, padding or other



material of a mattress or innerspring. Moreover, the inventive spring assembly readily lends itself to assembly by automated techniques, thus permitting machine assembly with a concomitant minimization of cost.

## SUMMARY OF THE INVENTION

In accordance with the present invention, there is provided a novel spring assembly comprising a plurality of rows of helical coils or springs, each row formed from a single, continuous length of wire. Within a row, the coils may be said to be of like convolution, all being either righthanded or lefthanded when viewed from one of the above or below aspects. The coils are all aligned with their axes substantially perpendicular to the upper and lower surfaces of the assembly.

Within a row, adjacent coils are connected by planar, substantially Z-shaped interconnection segments, alternate segments being located at opposite ends of the coils. That is, if the Z-shaped wire segment interconnecting the first and second coil in a row is disposed in the plane of the upper assembly surface, the Z-shaped wire segment interconnecting the second and third coils in the row will lie in the plane of the lower assembly surface. Further, alternate coils in each row are offset. That is, the axes of alternate coils lie in a first plane perpendicular to the upper and lower assembly surfaces, while the axes of the intervening coils lie in a second plane parallel to, but displaced or offset from, the first plane.

In the spring assembly, adjacent rows of coils of the novel configuration just described are interconnected by means of novel zig-zag connectors. These connectors each comprise a single continuous length of wire bent into zig-zag shape. Bends of the zig-zag connector are looped about portions of the Z-shaped coil interconnection segments so as to provide novel pivotal couplings therebetween. Such zig-zag connectors are provided in the planes of both the upper and lower spring assembly surfaces, the zig-zag connectors and the Z-shaped segments together providing maximum surface platen for the support of padding, fabric and the like.

In a preferred embodiment, the coils in adjacent rows are of the opposite hand. That is, all of the coils in alternate rows are righthanded, while all of the coils in the intervening rows are lefthanded.

In one embodiment, single or double border wires define the outer periphery of the upper and lower spring assembly surfaces. Alternatively, a rail-type construction including die punched hooks may be used as a border for the spring assembly.

Thus, it is an object of the present invention to provide an improved spring assembly.

Another object of the present invention is to provide as a novel article of manufacture, a row of interconnected coils formed of a single continuous length of wire, the wire segments interconnecting adjacent coils being substantially Z-shaped.

It is another object of the present invention to provide a simplified interconnection arrangement for the coils of a spring assembly.

Yet another object of the present invention is to provide a spring assembly comprising rows of lefthanded coils alternating with rows of righthanded coils, the rows being simply interconnected by zig-zag connectors.

A further object of the present invention is to provide a spring assembly wherein adjacent rows of coils are connected by crossover elements providing pivotal couplings at each point of connection.

It is a further object of the present invention to provide a spring assembly having maximum efficiency of wire utilization and utilizing a novel row configuration wherein adjacent coils are coupled by Z-shaped crossover elements effectively providing four point connections between the coils.

Yet a further object of the present invention is to provide a spring assembly having improved load characteristics, including a minimum of lateral deflection due to the presence of lateral flexure provided by zig-zag intercoil connectors.

Still a further object of the present invention is to provide an improved spring assembly of optimum quietness achieved by spacing adjacent coils in a row by means of integral Z-shaped wire interconnection segments, and by providing pivotal coupling between coils of adjacent rows.

It is yet a further object of the present invention to provide a spring assembly capable of manufacture by automation techniques yet using a minimum of wire and providing a maximum of surface platen for the support of padding, fabric and other materials.

Still a further object of the present invention is to provide novel double wire or rail-type border constructions for a spring assembly of the type described.

Still other objects, features and attendant advantages of the present invention, together with various modifications, will become apparent to those skilled in the art from a reading of the following detailed description of the preferred embodiments constructed in accordance therewith, taken in conjunction with the accompanying drawings wherein like numerals designate like parts in the several figures.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation view of an innerspring unit in accordance with the present invention, illustrating the staggered or offset relationship of successive coils in each row;

FIG. 2 is a top plan view, as seen in the direction of arrows 2—2 in FIG. 1, further illustrating the staggered relationship of the coils in each row as well as the Z-shaped wire segments interconnecting each coil pair and the zig-zag connectors coupling adjacent rows of coils;

FIG. 3 is an exploded perspective view of a portion of one row of coils and a zig-zag connector;

FIG. 4 is a fragmentary plan view, similar in aspect to FIG. 2, but enlarged therefrom and taken in partial section in the direction of arrows 4—4 in FIG. 1, illustrating the bottom Z-shaped interconnection segments and the zig-zag connectors, with the top Z-shaped interconnection segments being shown in phantom to illustrate their offset relationship;

FIG. 5 is an end elevation view, taken in the direction of arrows 5—5 in FIG. 2 and enlarged therefrom, illustrating the paired coil relationship;

FIG. 6 is an enlarged fragmentary plan view in the same aspect as FIG. 2;

FIG. 7 is an enlarged fragmentary perspective view illustrating the zig-zag interconnections;

FIG. 8 is an enlarged sectional view taken along line 8—8 in FIG. 7;

FIG. 9 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. 10 is a diagrammatic elevational view as though taken along line 10—10 in FIG. 9, illustrating unitary load effects in the lateral direction within each row;

FIG. 11 is a diagrammatic elevational view as though taken along line 11—11 in FIG. 9, illustrating the distributed load effects in the longitudinal direction;

FIG. 12 is a fragmentary plan view of a double border wire embodiment of the inventive spring assembly;

FIG. 13 is an enlarged sectional view taken along line 13—13 in FIG. 12;

FIG. 14 is an enlarged sectional view taken along line 14—14 in FIG. 12;

FIG 15 is a fragmentary plan view of a rail-type border embodiment of the inventive spring assembly;

FIG. 16 is a side elevation view as taken along line 16—16 in FIG. 15, showing an end coil of a typical row situated between upper and lower side rails of the border;

FIG 17 is a fragmentary top plan view as taken along line 17—17 in FIG. 16, illustrating the manner in which coils are attached to the lower side rail;

FIG. 18 is an enlarged fragmentary sectional view as taken along line 18—18 in FIG. 17, illustrating a typical die punched hook used to connect a coil to a border rail;

FIG. 19 is an enlarged fragmentary sectional view of the die punched hook also shown in FIG 18, but prior to attachment to a coil; and

FIG. 20 is a fragmentary top plan view illustrating the manner in which coils of the inventive spring assembly may be attached to an end rail of the type shown in FIG. 15.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, and particularly to FIGS. 1 and 2 thereof, there is shown an innerspring unit 20 utilizing a spring assembly in accordance with the present invention. The upper surface 21 of innerspring 20 has a generally rectangular periphery defined by border wire 22, while the lower surface 23 of innerspring 20 has a similarly rectangular periphery defined by border wire 24.

Innerspring 20 includes a plurality of rows 25 of righthanded coils alternating with a plurality of rows 26 of lefthanded coils. As best illustrated in FIGS. 2, 3 and 5, each row 25 of righthanded 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 disposed in the plane of upper innerspring surface 21. The wire segments 29 interconnecting adjacent coil pairs 27 also are substantially Z-shaped, and lie within the plane of lower innerspring surface 23.

As evident in FIGS. 1, 2 and 3, each coil pair 27 comprises a first righthanded coil 27*a* offset from a second righthanded coil 27*b* having the same number of turns as coil 27*a*. Thus, the axes of coils 27*a* lie within a plane which is parallel to, but spaced apart from a second plane within which lie the axes of offset coils 27*b*. It will be appreciated from FIGS. 2 and 5 that the axes of adjacent coils 27*a* and 27*b* are equidistant, the axes being generally perpendicular to the upper and lower surfaces 21 and 23 of innerspring unit 20.

While each of coils 27*a* and 27*b* is illustrated as having approximately two turns or convolutions, this number is not critical. Thus, a greater or lesser number of convolutions may be used, depending on 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 inventive 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 an hourglass or even its converse potbellied shape, but the basically cylindrical shape illustrated is preferred for ease and economy of manufacture and assembly.

Each alternate row 26 is configured identically to that of an adjacent row 25; however, each coil within row 26 is lefthanded. Thus, a typical row 26 is formed of a continuous length of wire wound into coil pairs 30, each comprising coils 30*a* and 30*b* interconnected by a substantially Z-shaped wire segment 31 lying within the plane of upper innerspring surface 21. Adjacent coil pairs 30 are interconnected by substantially Z-shaped segments of wire 32 (shown in phantom in FIG. 2) generally disposed within the plane of lower innerspring surface 23.

In a preferred embodiment of the invention, the spacing between axes of adjacent coils within row 25 is substantially the same as the between-axis spacing of adjacent coils in row 26. Further, should a coil pair in row 25 be interconnected in the plane of upper innerspring surface 21, in a preferred embodiment, the adjacent coil pair in row 26 will be interconnected in the plane of lower innerspring surface 23. This is well illustrated in FIG. 2, where, in row 25', typical adjacent coils 27*a*' and 27*b*' are interconnected by a Z-shaped wire segment 28' lying within upper innerspring surface 21. In the adjacent coil pair in row 26', coils 30*a*' and 30*b*' are interconnected by a Z-shaped wire segment 32' lying in the plane of lower innerspring surface 23. This alternating pattern is repeated throughout innerspring unit 20. It is also apparent in FIG 2 that, in the preferred embodiment shown, the axes of all

coils in the same column lie within a common plane perpendicular to the direction of rows 25 and 26.

It is also apparent in FIG. 2 that the top and bottom portions of each Z-shaped interconnection segment 28, 29, 30 and 31 lie within the columnar planes defined by the axes of adjacent coils within the same column. Thus, the "height" of each Z-shaped interconnection segment corresponds to the between-column spacing of the coils in innerspring unit 20.

Each row 25 of righthanded coils is connected to the adjacent row or rows 26 of lefthanded coils by means of zig-zag connectors 33 (see FIG. 3). A first set of zig-zag connectors, herein designated 33*a*, are disposed within the plane of upper innerspring surface 21 (see FIGS. 2 and 7) so as to join together portions of upper Z-shaped interconnection segments 28 and 31. A second set of zig-zag connectors, herein designated 33*b* (see FIG. 4), lie within the plane of lower innerspring surface 23 and serve to join together portions of lower Z-shaped interconnection segments 29 and 32. As evident in the plan view of FIG. 2, the length of each leg of zig-zag connector 33 and the angles between these legs are selected so that the distance between every sixth point or bend equals twice the between-column spacing of innerspring unit 20. Thus, the distance between bends 34 and 35 of typical zig-zag connector 33*a'* corresponds to twice the height of typical Z-shaped interconnection segment 31.

The manner in which zig-zag connectors 33 are attached to coil rows 25 and 26 is best illustrated in FIGS. 6, 7 and 8. Referring first to FIG. 6, it is apparent that, when viewed in plan, each Z-shaped interconnection segment 28 defines a generally rectangular area having a first pair of free diagonally opposite corners 28*a*, and a second pair of diagonally opposite corners 28*b* where joined to coil pair 27. Similarly, each Z-shaped interconnection segment 31 defines a generally rectangular area having a first pair of diagonally opposite, free corners 31*a* and a second pair of diagonally opposite corners 31*b* where joined to coil pair 30. Similarly, lower Z-shaped interconnection segments 29 each have a first pair of diagonally opposite free corners 29*a* and a second pair of diagonally opposite corners 29*b* where joined to coil pair 27. While not specifically shown, each of lower Z-shaped interconnection segments 32 define a similar rectangular region.

Referring to FIG. 6, it will be appreciated that the interconnection pattern is repeated every six bends of zig-zag connector 33. Thus, first bend 41 is connected to corner 31*b* of a typical Z-shaped interconnection segment 31 lying within row 26. Second bend 42 is free standing, not being connected to any coil pair. Third bend 43 is connected to free corner 31*a* of the same Z-shaped interconnection segment 31 to which bend 41 is attached. Fourth bend 44 is connected to corner 28*b* of the Z-shaped interconnection segment 28 in row 25. Note that bends 43 and 44 thus are associated with coils lying in adjacent rows but in the same column. Fifth bend 45 of zig-zag connector 33 also is free standing, not being connected to any coil pair. Sixth bend 46 is connected to free standing end 28*a* of the same Z-shaped interconnection segment 28 to which bend 44 is attached. Of course, this interconnection scheme is repeated for each zig-zag connector 33*a* lying within the plane of upper innerspring surface 21, as well as for each zig-zag connector 33*b* (see FIG. 7) lying within the plane of lower innerspring surface 23.

The manner in which each bend of zig-zag connector 33 is attached to a portion of coil row 25 or 26 is best illustrated in FIGS. 7 and 8. As evident therein, bend 44 of zig-zag connector 33*a* is attached to corner 28*b* of Z-shaped interconnection segment 28 merely by looping the apex 36 of the wire forming bend 44 around the wire segment 37 forming corner 28*b*. Such a connection is simple to manufacture, requiring no actual twisting of the interconnection wire about the wire forming the coils. Moreover, such an interconnection permits rotation of coil wire section 37 within loop 36. Thus, should coil 27*a* be compressed, legs 38 and 39 of zig-zag connector 33 will be angled downward, but will not cause disorientation of coil 27*a* since coil wire 37 is free to rotate within the looped connection at bend 44.

The rotational freedom permitted at the interconnections between the bends of zig-zag connectors 33 and the corners of Z-shaped interconnection segments 28, 29, 31 and 32 is only one of the features of the present invention, permitting relatively independent compression of individual coils. Referring to FIG. 6, additional freedom is provided by the fact that, when a typical coil 30*b''* is compressed, the adjacent unconnected bend 47 of zig-zag connector 33 is free to be displaced, as to the position shown at 47' in FIG. 6. In addition to this displacement, the zig-zag connector is free to twist or flex adjacent bend 47, as well as to rotate about adjacent connected bends 48 and 49. Then, too, when coil 30*b''* is compressed, Z-shaped interconnection segment 31 itself is free to flex, bend, or twist, particularly at corners 31*a''*, so as to displace the plane of the Z to an angle with respect to the plane of upper innerspring surface 21.

It should be apparent that each free standing or unconnected bend of zig-zag connector 33*a* or 33*b*, of which bends 42, 45 and 47 are representative (see FIG. 6), may have a different configuration than the preferred shape of a single acute bend illustrated, such as a plurality of short reversing bends adjacent each other, a wiggly shape, and so forth, as long as a free standing portion is provided for its deflection characteristics as previously described.

From the foregoing description, it should be apparent that the unitary load effects in the lateral direction within each row 25 or 26 of innerspring unit 20 differ somewhat from the distributed load effects in the longitudinal or columnar direction. These load effects are illustrated diagrammatically in FIGS. 9, 10 and 11 wherein each coil pair of a continuous row of coils is designated by rectangular block lines (completing the lines of the Z-shaped interconnection segments). In considering FIGS. 9, 10 and 11, it should be borne in mind that the body resting direction of a person reclining on innerspring 10 normally is in the longitudinal or columnar direction.

Referring now to FIG. 9, each block 50 represents the outline of typical upper Z-shaped interconnection segment 28 in coil row 25. Similarly, each block 51 represents the outline of a typical upper Z-shaped interconnection segment 31 in coil row 26.

As apparent from the diagram of FIG. 10, when a typical coil pair shown in phantom at 51 is loaded from above, as indicated by the arrow marked L, the loaded coils are compressed, Z-shaped interconnection element 31 being depressed downward to the position shown in FIG. 10 at 51'. Note, however, that adjacent coil pairs within the same row 26, represented by blocks 51*a* in FIG. 10, remain substantially undisplaced. Thus, in the lateral direction, the coil pairs making up a typical row of innerspring units 20 are substantially independently compressible, little or no displacement of adjacent coil pairs occurring when a unitary coil pair is loaded.

As evident from the diagram of FIG. 11, a distributed loading effect occurs in the longitudinal or "body resting" direction of innerspring unit 20. Thus, when a typical coil pair in row 26 is loaded from above, as indicated by the arrow marked L in FIG. 11, the corresponding upper Z-shaped interconnection segment is displaced from the position shown in phantom at 51 to the position shown at 51'. This displacement, acting through the adjacent legs of zig-zag connectors 33*a*, tends to slightly angularly displace adjacent coils in the same column, as from the positions shown in phantom at 50 in FIG. 11 to the angularly displaced positions shown and designated 50'. Note that this distributed load effect in the longitudinal direction is minimal, and that the coils two rows away from the loaded pair are substantially undisturbed, as indicated by the blocks marked 51*b* in FIG. 11.

Thus, the lateral and longitudinal load effects characteristic of the inventive spring assembly provide an innerspring of outstanding comfort. Moreover, the simple configuration of the inventive spring assembly is one which can be readily mechanized, thereby permitting fabrication of spring assemblies with a minimum of hand operations. Moreover, since each row of coils is formed from a single, continuous wire, the rows can be entirely fabricated by machine on a continuous

basis. In this respect, a pair of rows, one righthanded, the other lefthanded, normally would be fashioned simultaneously on cross-compensated machines to provide adjacent coil sets having like compression characteristics but oppositely convoluted. Further, the Z-shaped coil interconnection segments and the zig-zag connectors together provide maximum surface platen at both top and bottom of the inventive spring assembly, thereby minimizing the likelihood of padding, fabric or like material from passing through into the interior of the innerspring unit.

An alternative embodiment of the inventive spring assembly is shown in FIGS 12, 13 and 14. This embodiment utilizes a double border wire configuration which substantially increases the rectangular structural integrity of the border assembly and simplifies attachment of the coil row ends to the innerspring border.

As shown in FIG 2, the upper surface of innerspring unit 20' is surrounded by an outer border wire 52, typically defining a rectangular shape for the spring assembly. An inner border wire 53 parallels outer border wire 52 and also lies within the upper surface of innerspring unit 20'. The spacing between border wires 52 and 53 is approximately one-half of the maximum coil diameter of a typical coil utilized in innerspring 20'. A zig-zag connector 54, formed of a continuous piece of wire, serves to maintain border wires 52 and 53 in fixed parallel relationship to each other, i.e., provides a truss-like rigid framework between the border wires for securing them together, while also serving to attach the ends of coil rows 25 and 26 to the border wires.

Referring back to FIG. 2, it may be seen that the last Z-shaped interconnection segment in each row 25 lies within the plane of upper innerspring surface 21, while the last Z-shaped interconnection segment 32 of each row 26 lies within the plane of lower innerspring surface 23. The double border wire embodiment of FIG. 12 takes advantage of this alternating coil configuration. Thus, each end Z-shaped interconnection segment 28 in row 25 is attached to inner border wire 53. The termination of the end coil 30a'' end of row 26 then is connected between border wires 52 and 53, as shown in FIG. 12. Note that this termination corresponds to the wire segment from which a Z-shaped interconnection 31 would be fashioned were row 26 longer.

The manner in which the coils are attached to border wires 52 and 53 is well illustrated in FIGS. 12, 13 and 14. Note that a first bend 61 of zig-zag connector 54 is looped over outer border wire 52. Second bend 62 of zig-zag connector 54 is looped over both inner border wire 53 and a portion of Z-shaped interconnection segment 28 approximately midway between corners 28a and 28b thereof. Third bend 63 is looped over outer border wire 52, while fourth bend 64 is looped over inner border wire 53.

Fifth, sixth and seventh bends 65, 66 and 67 of zig-zag connector 54 are used to attach the end of row 26 to border wires 52 and 53. As evident in FIG. 12, bend 66 is looped over inner border wire 53, as well as over wire segment 31 approximately midway between corners 31a and 31b. Bends 65 and 67 each are looped both over outer border wire 52 and over wire segment 31 adjacent respective corners 31a and 31b. Finally, eighth bend 68 of zig-zag connector 54 is looped about inner border wire 53. Of course, this interconnection pattern is repeated for consecutive coil rows 25 and 26.

While not illustrated in FIG. 12, the lower surface of innerspring unit 20' similarly is provided with a pair of spaced parallel border wires. Of course, Z-shaped interconnection segments 32 of rows 26 are connected to the inner border wire at the lower surface of innerspring unit 20'.

Thus, it is seen that double border wires 52 and 53 are secured to each other in a unitary manner and it will be understood by those skilled in the art that improved structural integrity is provided whereby the usual border or edge non-uniform sag problem is substantially eliminated, particularly in connection with the border beam or wire deflection effect commonly occurring when the padding or fabric is tightly wrapped and drawn about the innerspring border.

An alternative border arrangement for the inventive spring assembly is shown in FIGS. 15 through 20. Referring first to FIG 15, spring assembly 20'' includes an upper, generally rectangular border 70 of rail-type construction. Border 70 comprises a pair of spaced parallel side rails 71 aligned generally perpendicular to a pair of spaced parallel end rails 72. Each of rails 71 and 72 is substantially planar, typically being fabricated of a strip of metal.

The end 74 of rail 71 may be connected to the adjacent end 75 of rail 72 by means of a planar, arcuate corner member 76 also shown in FIG. 15. Typically, corner member 76 may be fabricated of metal, and may be rivoted or spot welded to rails 71 and 72. For added stiffness, corner member 76 may be provided with an elongate central arcuate boss or raised portion 77. Of course, upper border 70 includes four such corner members 76.

Although hidden in FIG. 15, spring assembly 20'' also includes a lower rail-type border comprising a pair of side rails 71' evident in FIGS. 16 and 17, and a pair of end rails 72' evident in FIG. 20. The adjacent ends of rails 71' and 72' are connected by corner members (not shown) similar to member 76 of FIG. 15.

The outer edges of rails 71, 71', 72 and 72' each may be provided with a protective trim 78 to prevent the sharp edges of the rails from cutting the padding or fabric used to cover spring assembly 20''. Typically, protective trim 78 may comprise a flexible, cylindrical plastic rod which is slit longitudinally and inserted about the outer edge of the rail to be protected. Thus in FIGS. 16, the outer edge of rail 71' is inserted into slit 79 of flexible plastic rod 78'. An epoxy or other adhesive may be used to retain protective trim 78 in place.

Referring to FIGS. 16 and 17, the end coil 80 of each row 25 of spring assembly 20'' is situated between upper side rail 71 and lower side rail 71'. Similarly, the end coil 81 (FIG. 17) of each row 26 of spring assembly 20'' is situated between side rails 71 and 71', but offset toward the center of the spring assembly with respect to end coils 80.

Each end coil 80 is fastened to side rails 71 and 71' by means of a plurality of die punched hook means 81, shown in detail in FIGS. 17, 18 and 19. Each hook means 81 may include a tongue 82 defined by a generally U-shaped cut 83 through rail 71 or 71'. When formed, tongue 82 preferably is offset from rail 71 or 72' by a distance equal to or slightly greater than the diameter of the wire used to form coil 80. Coil 80 then may be fastened to rail 71 or 71' simply by bending the end 82' of tongue 82 around the wire of coil 80 and back toward rail 71, as clearly shown in FIG. 18.

The Z-shaped interconnection segments 84 associated with the end coils in adjacent columns of spring assembly 20'' may be connected to end rails 72 and 72' in the manner shown in FIG. 20. Referring thereto, hook means 85' are similar to hook means 81 described above, and also may be formed by die punching. However, to facilitate attachment of segments 84 as close as possible to the outer edge 86 of end rail 72', the tongue 87 of each hook means 85 may be defined by a pair of parallel cuts 88 extending perpendicularly inward from the rail edge 86. Each tongue 87 is offset from rail 72' and folded back over interconnection segment 84 in a manner similar to that shown in FIG. 18 above.

Protective trim 78'' may be applied to rail 72' subsequent to attachment thereto of interconnection segments 84. Trim 78'' thus will prevent the sharp corners between edges 86 and 88 from cutting the padding or fabric used to cover spring assembly 20''.

The rail-type border 70 described in conjunction with FIGS. 15 through 20 incorporates a minimum of components, lends itself readily to automatic fabrication techniques and, by the use of die punched hooks, permits rapid, simple attachment to a spring assembly of the novel type described. Despite its simplicity, border 70 provides firm support and prevents edge sagging of the innerspring, mattress, or other cushion utilizing the inventive spring assembly.

While the invention has been described with respect to several physical embodiments constructed in accordance

therewith, it will be apparent to those skilled in the art that various modifications and improvements may be made without departing from the scope and spirit of the invention.

I claim:

1. A row of coils formed from a continuous length of wire, the segments of wire interconnecting adjacent coils in said row each being substantially Z-shaped and disposed alternately in first and second planes generally perpendicular to said coils at the ends thereof, portions of said Z-shaped segments extending beyond the periphery of said coils to facilitate spaced attachment to an adjacent row of coils, and wherein said Z-shaped interconnecting segments generally define a rectangle of width greater than the maximum diameter of said coils, adjacent coils being situated at diagonally opposite corners of said rectangle, the axes of coils in said rows thereby being disposed alternately in two offset parallel planes.

2. A spring assembly comprising in combination, a plurality of spaced parallel rows of coils each as defined in claim 1, adjacent rows being connected by means comprising a zig-zag shaped continuous length or wire, bends of said zig-zag connector wire being pivotally attached to corners of said Z-shaped segments.

3. Means as defined in claim 2 wherein the distance between every sixth bend of said zig-zag wire is approximately equal to the between-axis spacing of alternate coils in one of said rows.

4. A spring assembly as defined in claim 2 wherein the coils within each row are like-handed, coils in alternate rows being of opposite hand.

5. A spring assembly as defined in claim 2 further comprising first and second border wires peripherally surrounding said spring assembly, and respectively disposed in said first and second planes at the upper and lower surfaces of said spring assembly.

6. A spring assembly as defined in claim 2 wherein a first set of said zig-zag connectors are disposed in said first plane at the upper spring assembly surface, and a second set of said zig-zag connectors are disposed in said second plane at the lower spring assembly surface.

7. A spring assembly as defined in claim 6 wherein bends of said zig-zag connectors are looped about portions of said Z-shaped interconnection segments to form pivotal couplings.

8. A spring assembly comprising:

a plurality of rows of coils, each of said rows being formed from a single continuous piece of wire and containing a plurality of coils interconnected by Z-shaped wire segments, alternate ones of said Z-shaped interconnection segments being disposed relatively 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,

the coils of each row being connected to the adjacent row of coils by means of first and second sets of said zig-zag shaped connectors each formed of a continuous length of wire, said sets being disposed respectively in the planes of said upper and lower surfaces of said spring assembly, the bends of said zig-zag connectors being pivotally attached to said Z-shaped interconnection segments.

9. A spring assembly as defined in claim 15 wherein the distance between every sixth bend of one of said zig-zag connectors is substantially equal to the between-axis spacing of alternate coils in one of said rows.

10. A spring assembly as defined in claim 8 wherein, when viewed in a columnar direction perpendicular to said rows, alternate Z-shaped interconnection segments are disposed in the plane of said upper surface of said spring assembly, the other Z-shaped interconnection segments in said column being disposed in the plane of said bottom surface of said spring assembly.

11. A spring assembly as defined in claim 10 wherein the axes of coils in adjacent rows lie in planes disposed in the columnar direction and of equidistant spacing as measured in the row direction.

12. A spring assembly according to claim 8 further comprising:

first and second generally planar border members disposed respectively in the planes of said upper and lower surfaces of said spring assembly, each border member comprising a pair of end rails, a pair of side rails, and corner means connecting adjacent ends of said rails, each rail having a plurality of hook means integrally formed therein for fastening said coils to said border members.

13. A spring assembly comprising:

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

first and second pairs of border wires disposed respectively in the planes of the upper and lower surfaces of said spring assembly, each of said pairs comprising an outer border wire peripherally surrounding said spring assembly, and an inner border wire parallel to said outer border wire and spaced therefrom by a distance approximately equal to half the diameter of the coils in one of said rows.

14. A spring assembly as defined in claim 13 further comprising a zig-zag connector formed of a continuous length of wire, adjacent bends of said zig-zag connector being looped respectively about said outer and said inner border wires to provide mutually pivotable spaced interconnection therebetween.

15. A spring assembly as defined in claim 14 wherein the end coils in alternate rows are attached to said outer border wire, the end coils in the other rows being connected to said inner border wire.

16. A spring assembly as defined in claim 15 wherein said end coils are pivotally attached to said border wire by means of said zig-zag connector.

17. A spring assembly comprising:

a plurality of rows of coils having upper and lower surfaces disposed in common respective upper and lower planes;

first and second pairs of border wires disposed respectively in said upper and lower planes, each of said pairs comprising an outer border wire peripherally surrounding said spring assembly and an inner border wire parallel to said outer border wire and spaced inwardly therefrom, said border wires being attached to said coil rows; and

a zig-zag connector formed of a continuous length of wire, adjacent bends of said zig-zag connector being looped respectively about said outer and inner border wires to provide mutually spaced interconnection therebetween.

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