Dec. 5, 1967 H. H. NORMAN 3,355,747

SPRING ASSEMBLY

Filed Oct. 4, 1965 4 Sheets-Sheet 1

FIG. 1.

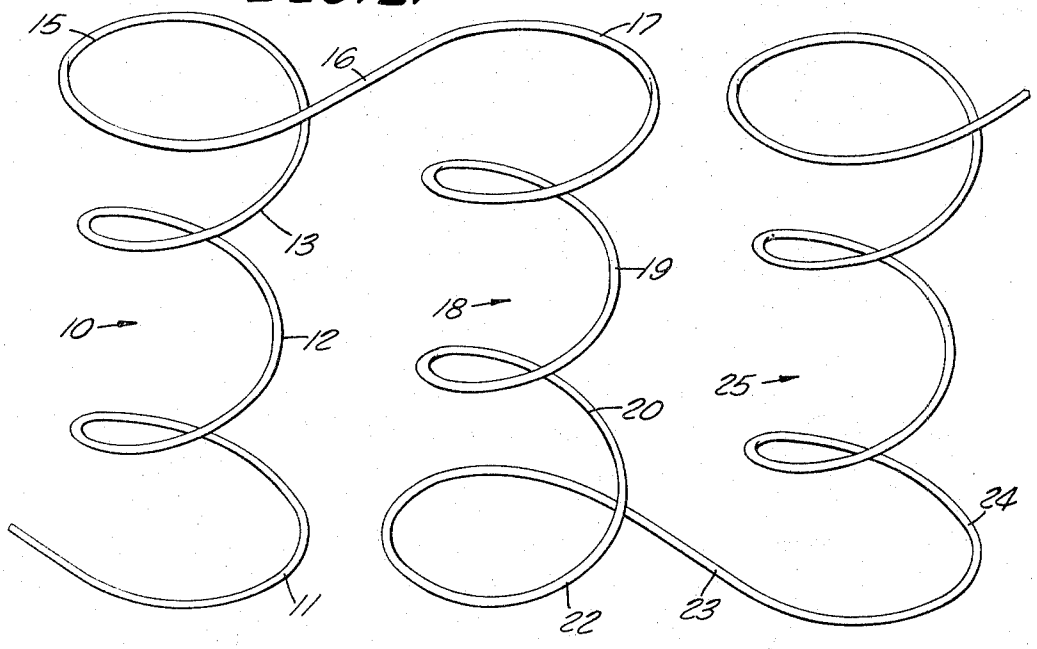
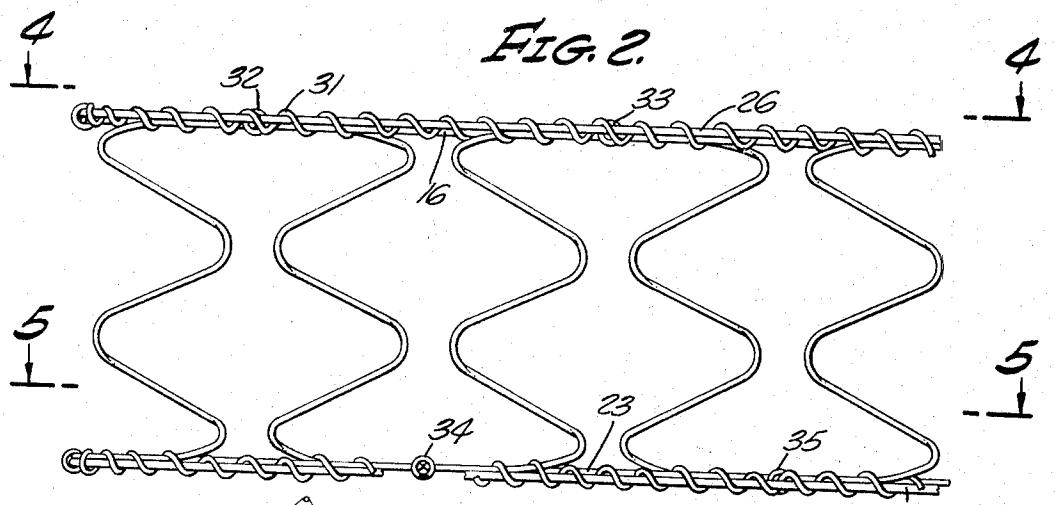


FIG. 2.



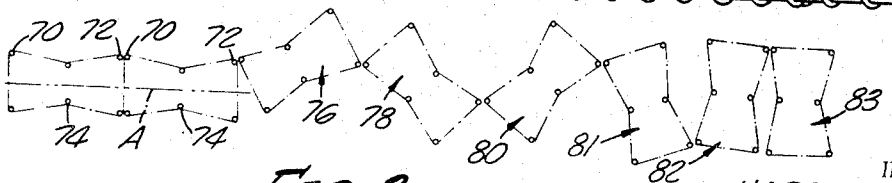


FIG. 3.

INVENTOR.
HARRY H. NORMAN

BY
Hazard & Miller
ATTORNEYS

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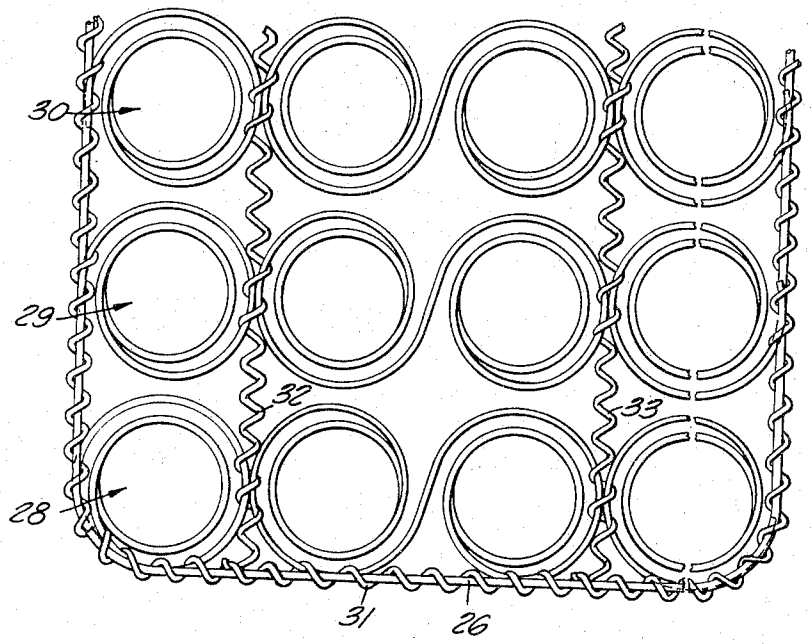


FIG. 4.

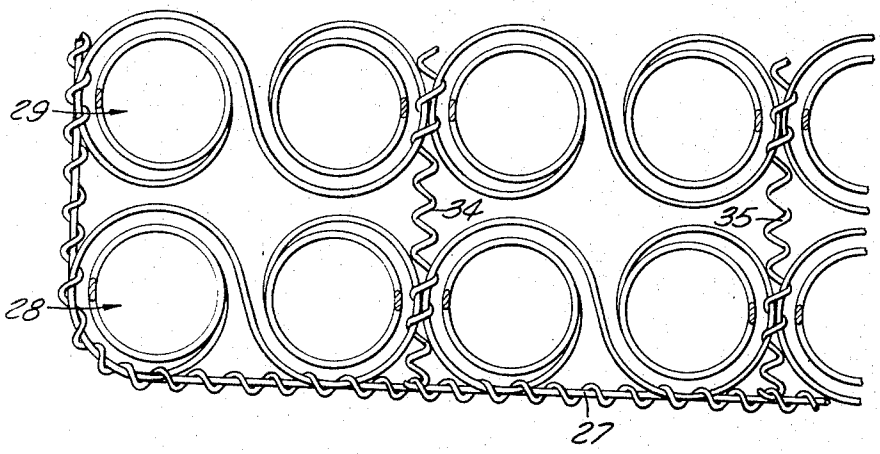


FIG. 5.

INVENTOR.
HARRY H. NORMAN
BY Hazard & Miller
ATTORNEYS

Dec. 5, 1967

H. H. NORMAN

3,355,747

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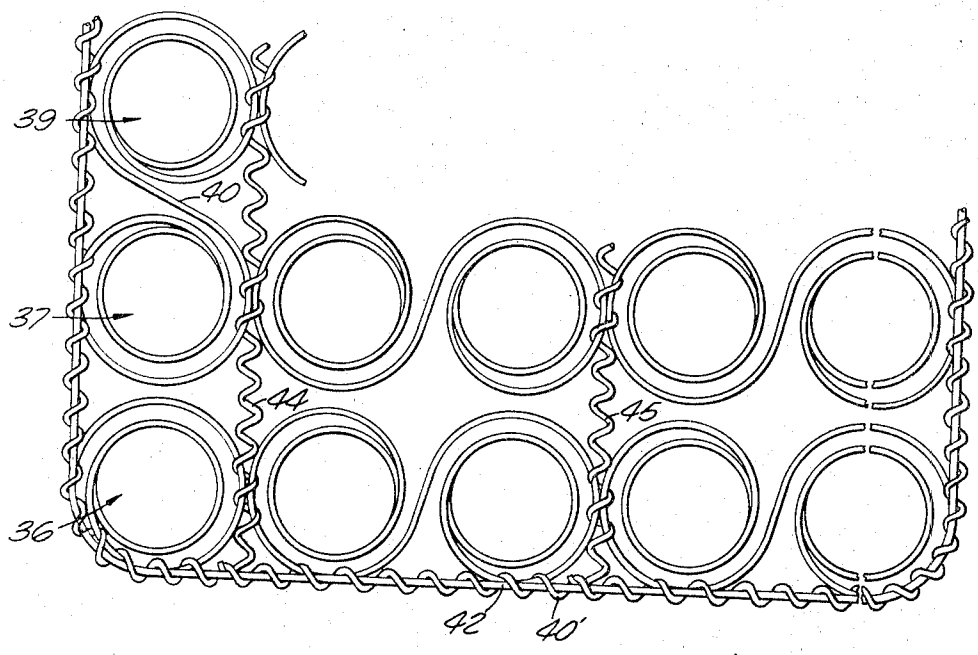


FIG. 6.

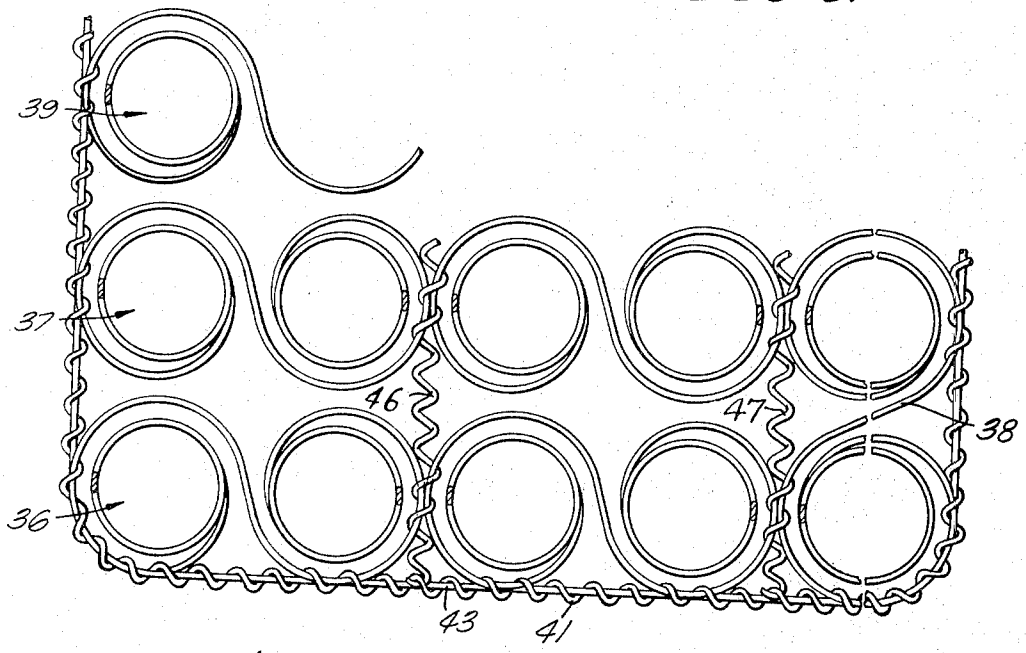


FIG. 7.

INVENTOR.
HARRY H. NORMAN

BY

Hazard & Miller

ATTORNEYS

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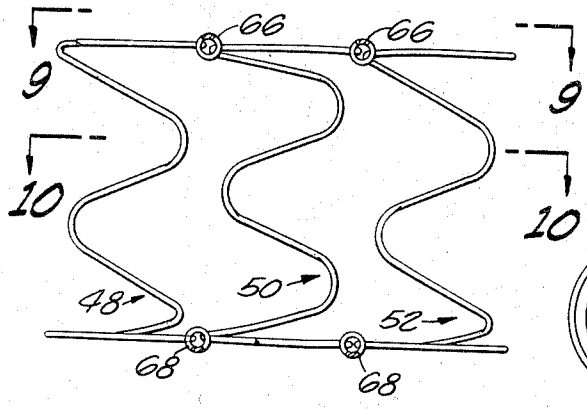


FIG. 8.

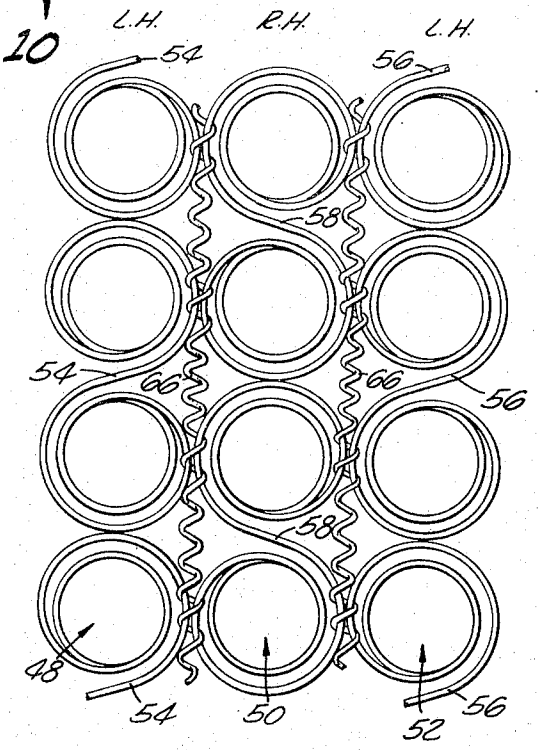


FIG. 9.

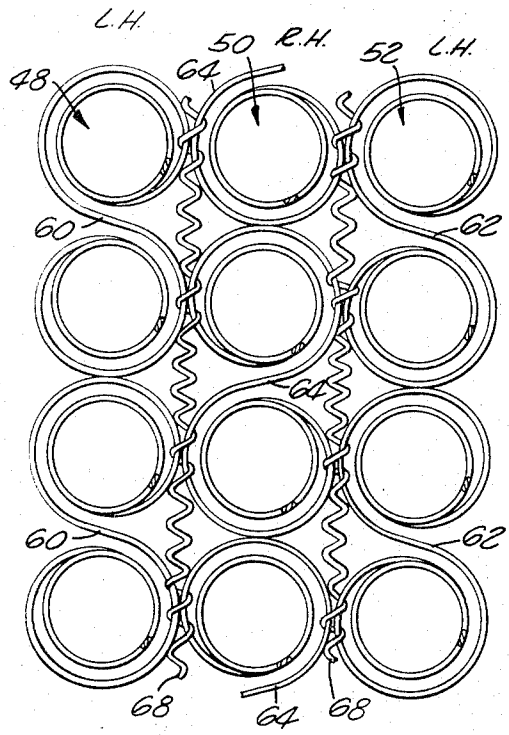


FIG. 10.

INVENTOR.
HARRY H. NORMAN
BY
Hazard & Miller
ATTORNEYS

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3,355,747

SPRING ASSEMBLY

Harry H. Norman, Manhattan Beach, Calif., assignor to Percy A. Ross, Los Angeles, Calif.

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8 Claims. (Cl. 5—252)

This invention relates to springs and spring assemblies, such as are frequently used in mattress and upholstery construction.

One object of the present invention is to provide as a novel article of manufacture an endless series of helical springs or coils, which series is formed from a single continuous length of wire resulting in coils being integrally connected to each other, and are so arranged that the wire may be regarded as progressing in a counter-clockwise direction from the bottom to the top of one coil and progressing in a clockwise direction from the top of the adjacent coil to the bottom thereof. The top convolutions of the two mentioned coils may be regarded as being connected together by a crossover comprising an integral continuation of the top convolution of the first coil. In a similar manner, the bottom convolution of the second coil may be regarded as being connected to the bottom convolution of a third coil by an integral continuation of the bottom convolution of the second coil.

Another object of the invention is to provide from a continuous coil of wire, an endless series of helical spring coils or units as in the preceding paragraph wherein the coils are of the same hand and the top and bottom ends of the coils opposite to the ends with the integral crossovers or connectors are connected by conventional pig tail wires alternately disposed or staggered from the tops of two adjacent coils to the bottoms of the second of said two coils and the next adjacent coil, etc.

A further object of the invention is to provide an endless series of helical coils having the above mentioned integral crossovers or connectors wherein the coils in a row are alternately of opposite hand and the ends of the coils opposite to those of the crossovers are connected by helical pig tail wires; in this arrangement the pig tails at the top and bottom being initially superimposed instead of staggered. This construction provides three points of connection at each end of each coil without individual separate ties, in a manner capable of accomplishment by machine and produces a minimum of void space in order to better support mattress padding or the like.

Because the coils are not tied at their ends by wire of the coil bent upon itself, it is possible to use high carbon spring steel of high tensile strength. Because of this it is also possible to use a shorter length of wire for each coil with such convolutions while still securing the same spring support and action.

Another object of the invention is to provide a method of forming an endless series of helical springs or coils between common upper and lower planes from a continuous elongated helical coil whose length is a multiple of the coils of the series.

Still a further object is to provide a product and method as outlined above which can be practiced and produced by machine, as distinguished from other methods and products involving continuous coils which are interlaced or otherwise connected in costly hand operation.

With the improved spring construction, a series of springs may be continuously formed with a suitably designed spring coiler, as will be appreciated by those skilled in the art.

Another object of the present invention is to provide a spring assembly suitable for use in mattress and upholstery construction employing the spring units abov described.

With the foregoing and other objects in view, whic will be made manifest in the following detailed descri tion and specifically pointed out in the appended claim reference is had to the accompanying drawings for a illustrative embodiment of the invention wherein:

FIG. 1 is a perspective view of three adjacent or con secutive springs embodying the present invention, two o which may be regarded as a unit which is repeated in definitely for an indefinite length of wire;

FIG. 2 is a partial view in side elevation of a sprin assembled with frame wires;

FIG. 3 is a diagrammatic view of the method of form ing the coils from a continuous elongated helical coil;

FIGS. 4 and 5 are horizontal sections taken substantially upon the lines 4—4 and 5—5 respectively, upor FIG. 2 in the direction indicated;

FIGS. 6 and 7 are views similar to FIGS. 4 and 5 but illustrating a slight modification;

FIG. 8 is a detail, in side elevation, of another form of the invention;

FIGS. 9 and 10 are horizontal sections taken substantially upon lines 9—9 and 10—10 upon FIG. 8.

Referring to the accompanying drawings, wherein similar reference characters designate similar parts throughout, the spring construction illustrated in FIG. 1 is formed of a single length or strand of high tensile strength, for example, of somewhere between 230,000 and 285,000 p.s.i.

A standard coil of low carbon, low tensile strength spring wire, tied upon itself at the top and bottom in the conventional manner, the coil is conventionally 5¼ inches high and comprises 5½ convolutions. By using high tensile strength wire as indicated, smaller wire of less length can be used. A 4¼ inch high coil can be made with approximately 3½ convolutions with comparable supporting and springing action. This strand of wire is bent so that in its relaxed or unstressed condition it forms a succession of integrally connected and endless helical coils. Thus, the first coil generally indicated at **10**, has a bottom convolution or half convolution **11** that is preferably of slightly greater size or diameter than the intermediate convolutions **12** and **13**. The latter convolutions are open or are spaced from each other and may or may not be of uniform size or diameter, because fewer convolutions are needed and the tensile strength is greater than formerly, the convolutions are more widely spaced than before. The top convolution **15** preferably is of the same size as the bottom convolution or half convolution **11**, and terminates in a continuation **16** of the top convolution which leads from said top convolution **15** to the top convolution **17** of the adjacent coil **18**. The top convolution **17**, like the convolutions **11** and **15**, is preferably slightly larger than the intermediate convolutions **19** and **20**, and the lowermost or bottom convolution **22** is likewise preferably larger than the intermediate convolutions. The bottom convolution **22** terminates in a crossover **23** that integrally connects the coil **18** with the bottom convolution **24** of the coil **25**. Coil **25** is a duplicate in its design and shape of the coil **10**.

In the preferred form of construction, the coils **10**, **18** and **25** have their axes parallel to each other, but such an arrangement is not essential. Also, said coils **10**, **18** and **25** are spaced from each other.

Considering the wire as commencing with the bottom convolution **11** of coil **10** and progressing toward the top convolution **15**, the wire may be regarded as progressing in one rotational direction or, in other words, when viewed from the top down, the turns or convolutions are of right hand, and having passed from the top

onvolution 15 to the top convolution 17 of the adjoining oil 18, the crossover 16 having been twisted 180°, the ire may be regarded as progressing downwardly in right and turns also toward the bottom convolution 20. In the oil 25, the wire may be regarded as again progressing upwardly in a counter-clockwise direction. However, it is een that in the three coils of FIG. 1, the turns are all of ie same hand, as when all are viewed from the top.

A succession of coils formed as illustrated in FIG. 1, nd as above described, may be advantageously used in number of different manners, such as have been illustrated in FIGS. 2, 4, 5 and 6, inclusive. Thus, in FIGS. , 4 and 5 inclusive, they may be assembled together vith top and bottom border wires 26 and 27, respectively. These border wires are usually rectangular in plan ind have rounded corners that usually have the same adius of curvature as the top and bottom convolutions on the coils. Thus, as illustrated in FIG. 4, a plurality of ows 28, 29 and 30 of aligned coils may be arranged beween the border wires 26 and 27 and within the outline hereof. Pig tail wiring 31 is applied to the top border wire 26 and will serve to connect the top convolutions of all of the coils of the row 28 to the border wire. This same pig tail wiring may serve also to connect the endmost coils of the rows 29 and 30 to the top border wire 26. Pig tail wiring, indicated at 32 and 33, may also be applied between adjacent coil units of the rows 28, 29 and 30 to connect the top convolutions of double coil units to the coils of adjacent units. As shown in FIG. 2, between the pig tail wires 32 and 33, the connecting crossovers or continuations similar to 16 of FIG. 1 form the sole connections between the adjacent helical spring coils at their tops.

By comparing FIG. 5 with FIG. 4, it will be appreciated that the continuations of the coils that connect the bottom convolutions of adjacent coils in the rows 28, 29 (and 30) are disposed vertically beneath the upper pig tail wires 32 and 33. Consequently, the lower pig tail wires 34 and 35 which connect bottom convolutions of adjacent coils to each other are disposed vertically beneath the crossovers or continuations of the coils that connect top convolutions of adjacent coils to each other.

In the constructions shown in FIGS. 4 and 5, the rows 28, 29 and 30 of the helical spring coils are separate or detached from each other, but are connected to each other and to the border wires 26 and 27 by the pig tail wires.

In the construction shown in FIGS. 6 and 7, it will be observed that the construction and the assembly is very much the same as the one previously described, with the exception that row 36 is integrally connected to row 37 at one end thereof by means of a crossover or continuation 38 of the coil wire which connects the bottom convolution of the endmost coil of row 36 with the bottom convolution of the endmost coil of row 37. Similarly, as viewed in FIG. 6, the row 37 is connected to the row 39 by an integral crossover or continuation 40 of the coil wire which connects the top convolution of the endmost coil of row 37 to the top convolution of the endmost coil of row 38. In this form of construction, pig tail wires 40 and 41 connect original coils of the assembly to the top and bottom border wires 42 and 43, respectively, and pig tail wires 44 and 45 which connect adjacent coils to each other by means of their top convolutions are staggered with respect to pig tail wires 46 and 47 which connect adjacent bottom convolutions of adjacent coils to each other.

FIGURES 8, 9 and 10 illustrate another form of the invention which comprises coils in three rows 48, 50 and 52. In this embodiment the coils of row 48 are of left hand as viewed from the top, the coils of row 50 are of right hand and the coils of row 52 are of left hand. Therefore, in a complete unit comprising a bed spring or the like successive rows of coils are of opposite hand. In FIG. 9 the integral crossovers or connectors 54 are parallel to each other and are also parallel to the connectors 56 at the tops of the coils in row 52. In row 50 the upper crossovers or conductors 58 are parallel to each other along lines transverse to lines forming continuations of the crossovers 54 and 56 of rows 48 and 52 respectively.

In FIG. 10, row 48 has lower integral crossovers or connectors 60 which are parallel to each other and parallel to the crossovers 62 of row 52. Row 50 has integral crossovers or connectors 64 which are parallel to each other but lie transversely to the crossovers 60 and 62 of rows 48 and 52.

The upper crossovers 54 of row 48 are on lines transverse to line forming continuations of the lower crossovers 60 of said row and in the same manner, the upper crossovers or rows 50 and 52 lie transversely to the lower crossovers of said rows 50 and 52.

In this embodiment, pig tail wires 66 and 68 connect respectively the upper and lower ends of adjacent coils in adjacent rows. Referring to row 50 of FIG. 9 by way of example, it will be seen that the upper end of each coil in such row is connected at its upper convolution of two pig tail wires and also connected to an adjacent coil in that row by an upper integral continuation or crossover 58. Likewise in FIG. 10 it is seen that the bottom convolution of each coil in row 50 is connected to two pig tail wires 68 and also to an adjacent coil in such row 50 by an integral crossover 64. Thus each coil in an assembly such as shown in FIGS. 8 through 10 is connected at three points at the top and three points at the bottom, in a method which can be carried by machine as distinguished from hand methods. It will also be noted that the pig tail wires 66 and 68 lie one above the other as distinguished from the staggered arrangement of pig tail wires shown in the embodiment in FIG. 2. This construction of FIGS. 8 through 10 not only provides a large number of connections of one coil with its adjacent coil but also results in a support for the mattress padding (not shown) which rests upon the tops of the coils as is understood in the art. In other words there is a minimum of voids and consequently a better support for the padding in a construction which can be made by machine. Furthermore, the provision of a considerable number of ties or connections between adjacent coils, of course, will stabilize the coils in the spring assembly. However, the flexibility and relative looseness of the pig tail ties and the integral crossovers provide ample flexibility and comfort.

The fact that the embodiment of FIGS. 8 through 10 utilizes a larger number of pig tail ties does not appreciably add to the material cost because the use of high carbon steel wire of high tensile strength in the coils themselves with the resulting reduction in the number of convolutions required considerably reduces the cost of the more expensive coil wire as compared to the wire used in the pig tails.

In FIG. 3 there is illustrated diagrammatically a method of forming individual coils from a continuous coil of wire. Initially there is formed a continuous coil on a single axis as indicated by the axis A which may be of any desired length. In forming the straight continuous coil on the axis A there are convolutions 70 and 72 which eventually become the end convolutions of a coil section such as coil sections 10, 18 and 25 of FIG. 1. Intermediate pairs of convolutions 70 and 72 are smaller diameter convolutions 74 which in the structure shown in FIG. 1 would compare with the smaller diameter convolutions 12 and 13. For the sake of simplicity in the diagram of FIG. 3 only one such smaller convolution 74 is indicated.

Reading from the left in FIG. 3 the third coil 76 has been bent out of axial alignment relative to the axis A. The next coil 78 has been bent to a greater angle relative to the axis A and succeeding coils 80, 81, 82 and 83 are in successive steps bent to even greater angles to the axis A until all of the coil sections so bent have their individual axes normal to the axis A. This bending of successive

portions of an elongated coil produces a 180° twist in the wire joining the coil sections to provide the integral crossovers **16** and **23** of FIG. 1 and the other integral crossovers in the succeeding embodiments illustrated. It produces coils which are all of the same hand in each row of coils in a mattress or cushion. This might not appear to be so in FIGS. 9 and 10, but it should be noted that in FIGS. 4, 5, 6 and 7, the pig tail wires of those figures run transversely to the rows of coils whereas in FIGS. 9 and 10 the pig tail wires run parallel to the rows of coils.

The method illustrated in FIG. 3 is not rapid and efficient but it differs considerably from previously known hand methods of interweaving adjacent coils in that the spools of wire used in hand methods must necessarily be limited in size and the length of wire on each hand spool is likewise limited. With my method it is possible to form a continuous coil of undeterminate length and from it to form individual but integrally connected coil units as illustrated in FIG. 3.

From the foregoing it will be seen that I have provided a spring construction and a method of forming the same wherein the spring is made up of a number of coils which are formed from a continuous length of wire. The wire can be made continuous throughout each row of coils in a mattress, for example, or it can be made continuous in the rows and from one row to the next so that an entire mattress coil assembly can be formed from a single, continuous piece of wire. Also, the wire utilized in the construction is preferably of high tensile strength which formerly could not be used in spring constructions where the wire of the coil is utilized to tie the ends of the coils and wherein the coils are separate. Furthermore, by using wire of high tensile strength, a standard height mattress coil can be formed from less convolutions and consequently a lesser length of wire. These coils of high tensile strength connected by integral continuations of the wire from one coil to the next can be connected by pig tail wire which is adaptable for making the additional connections aligned with or across rows of coils with machines, as compared to hand operations. The construction of FIGS. 1, 2, 4, 5 and 6 and its modification in FIG. 7 provide ample connections between the coils but utilize less pig tail connectors than in the embodiment of FIGS. 8 through 10. The advantage of the structure of FIGS. 8 through 10 is that there are less voids between adjacent coils for the mattress padding to sink into. Even in this construction, the additional pig tail wires are of such low cost that the saving in the wire of the coils through the use of high tensile strength wire offsets the additional pig tails.

It will, of course, be understood that various changes can be made in the form, detail, and arrangement and proportions of the various parts without departing from the spirit of the invention, and that likewise, the steps of the method can be varied.

I claim:

1. As a new article of manufacture, adjacent rows o helical spring wire coils, the consecutive coils of each rov having connections with each other integrally and alter nately at their tops and bottoms, said connections bein continuations of the wire of the coils, and pig tail wire connecting adjacent coils of adjacent rows at other point than at said integral connections.

2. The structure in claim **1**, and the coils of a row being of the same hand.

3. The structure in claim **1**, and there being a unit comprising a plurality of rows of coils lying beside each other, a border wire about the perimeter of the unit, means connecting the border wire to coils above said perimeter, and intermediate pig tail connectors extending between opposite points on said border wire and interconnected with adjacent coils along the longitudinal lines of said pig tail wires.

4. The structure in claim **3** and said pig tail wires extending parallel to said rows of coils.

5. The structure in claim **3**, and said pig tail wires extending transversely of said rows of coils.

6. The structure in claim **3**, and the coils of all said rows being of the same hand, the said pig tail wires being located alternately at the tops and bottoms of adjacent coils, and vertically opposite said integral connections.

7. The structure in claim **3**, and the coils of alternate rows being of opposite hand, and said pig tail wires being located at the tops and bottoms of said coils and lying between successive adjacent rows of coils.

8. The structure in claim **1**, and said integral connections of one row of coils being disposed along lines transversely of lines along which lie the integral connectors of adjacent rows.

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BOBBY R. GAY, *Primary Examiner.*

FRANK B. SHERRY, *Examiner.*

R. D. KRAUS, *Assistant Examiner.*