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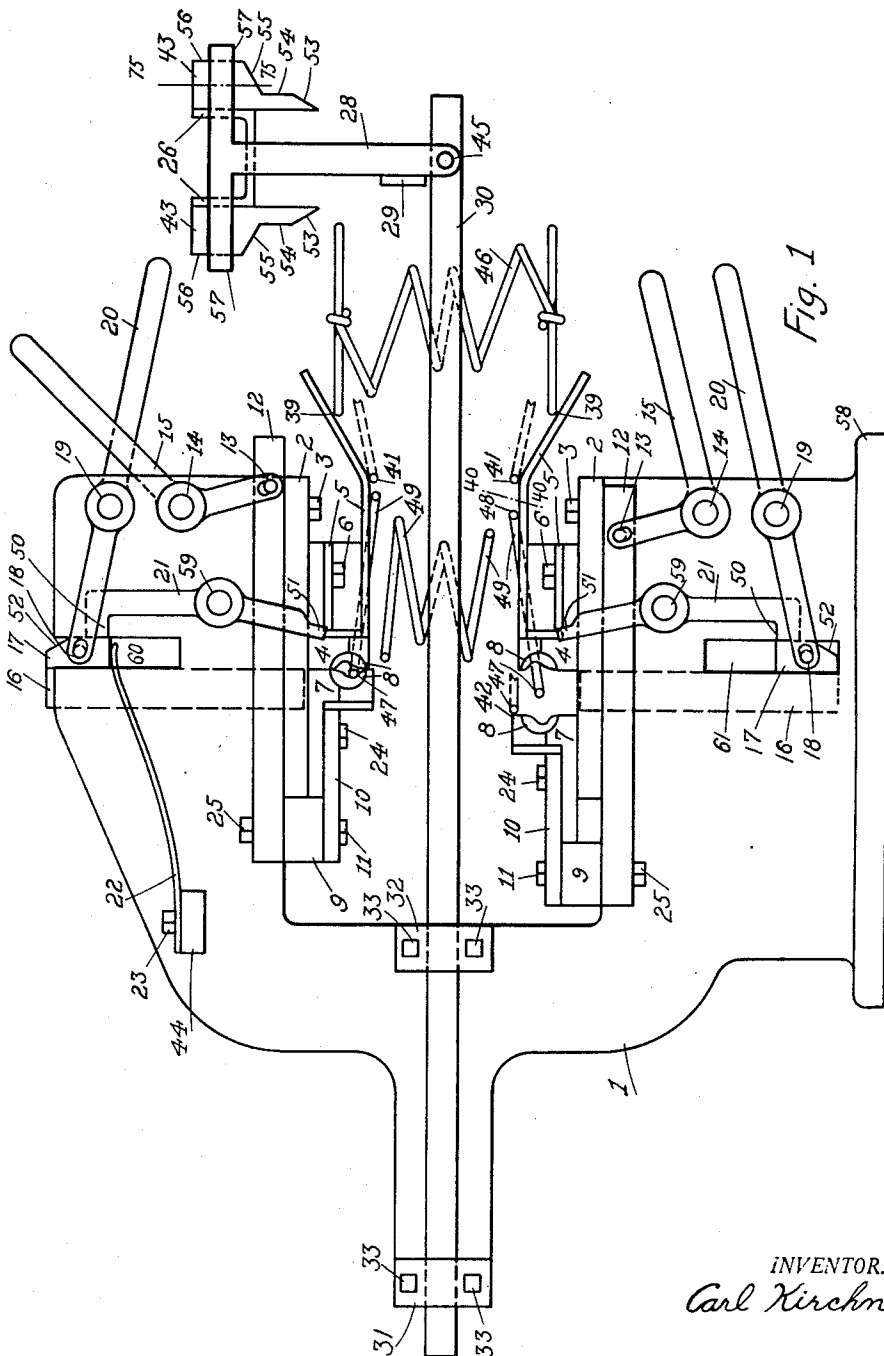
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2,176,262

METHOD AND APPARATUS IN MAKING SPRING STRUCTURES

Filed Oct. 3, 1938

4 Sheets-Sheet 1



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METHOD AND APPARATUS IN MAKING SPRING STRUCTURES

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4 Sheets-Sheet 2

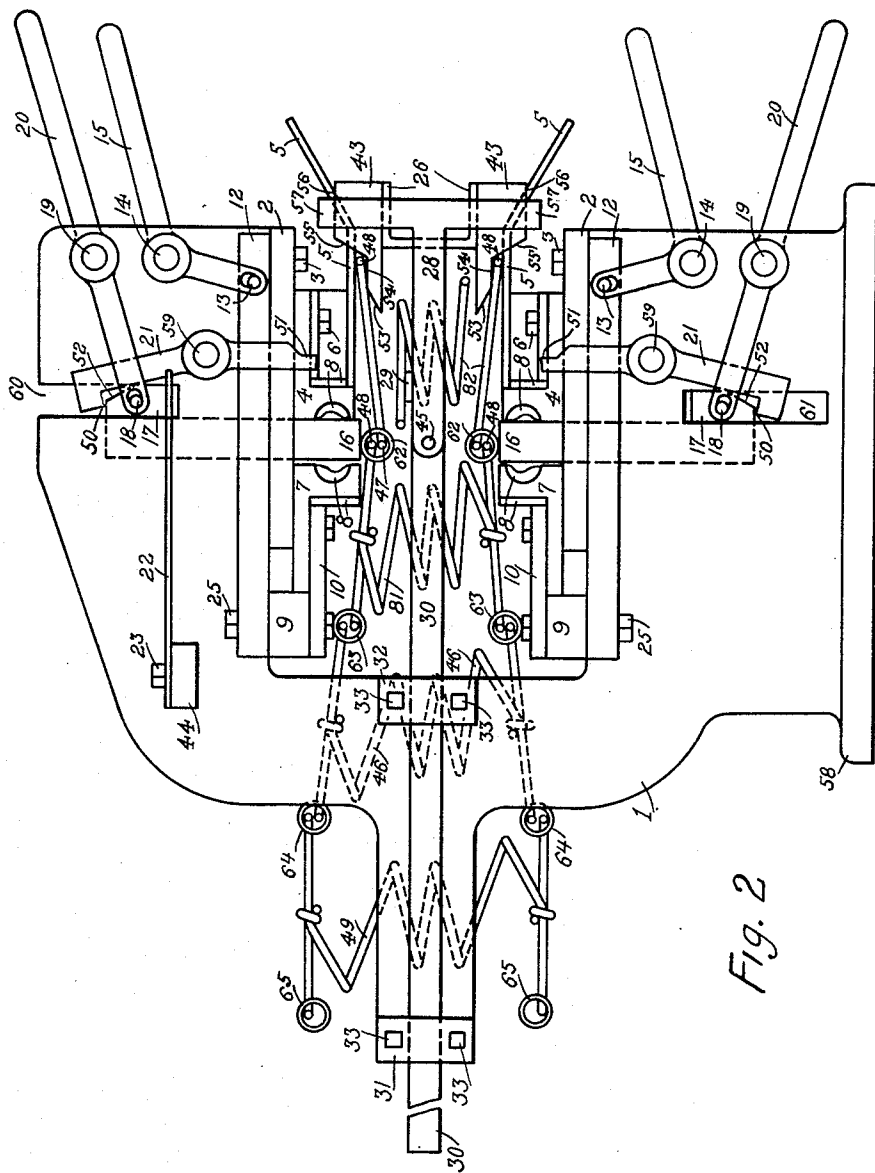


Fig. 2

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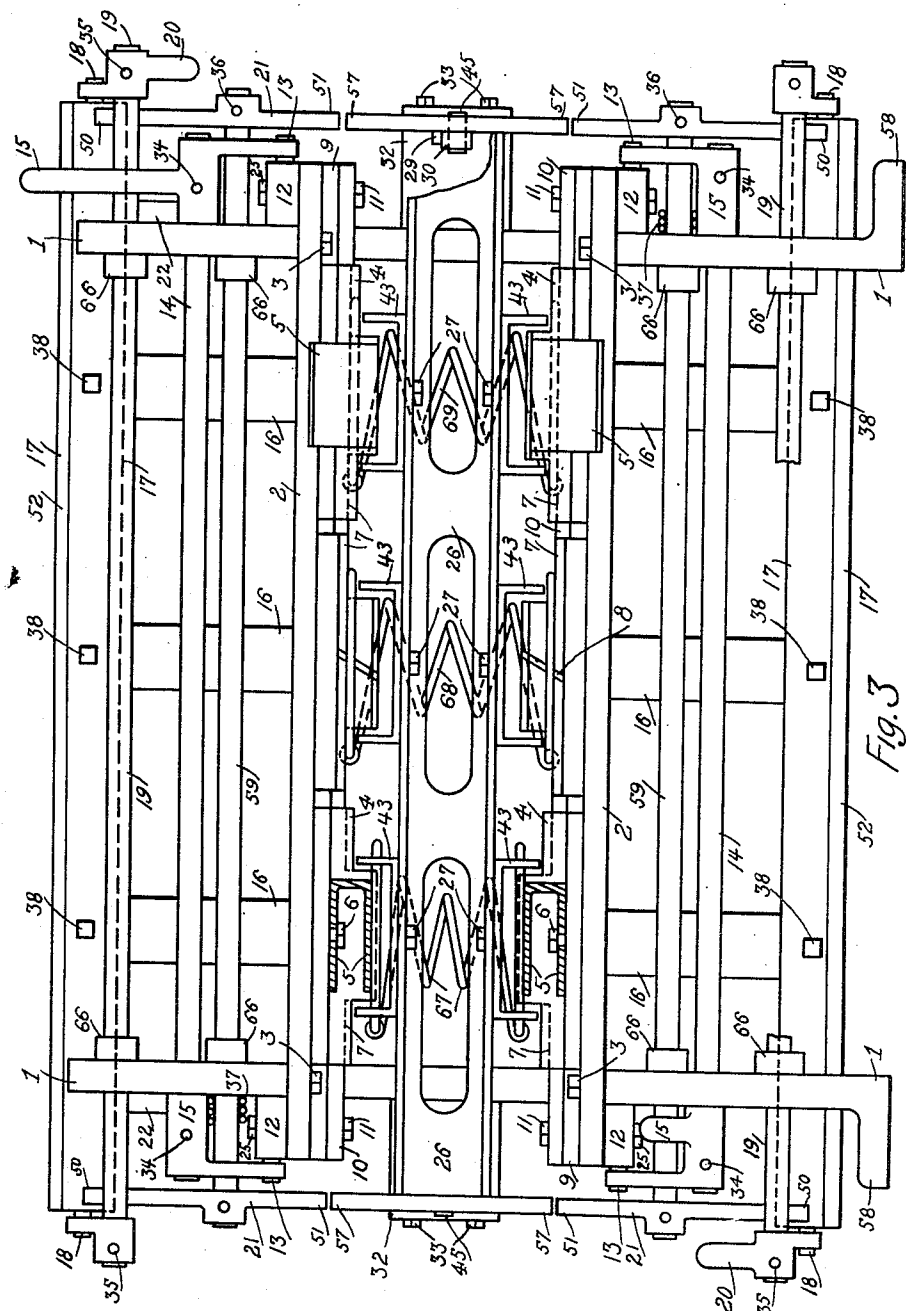
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METHOD AND APPARATUS IN MAKING SPRING STRUCTURES

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4 Sheets-Sheet 3



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METHOD AND APPARATUS IN MAKING SPRING STRUCTURES

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4 Sheets-Sheet 4

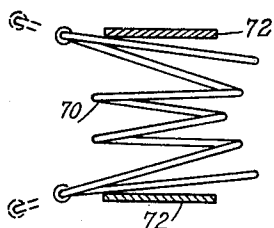


Fig. 4

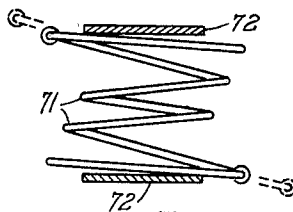


Fig. 5

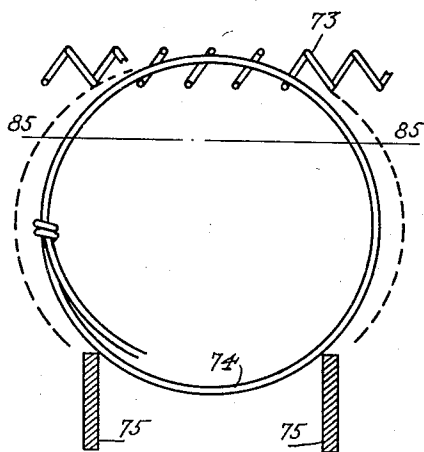


Fig. 6

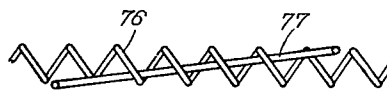


Fig. 7

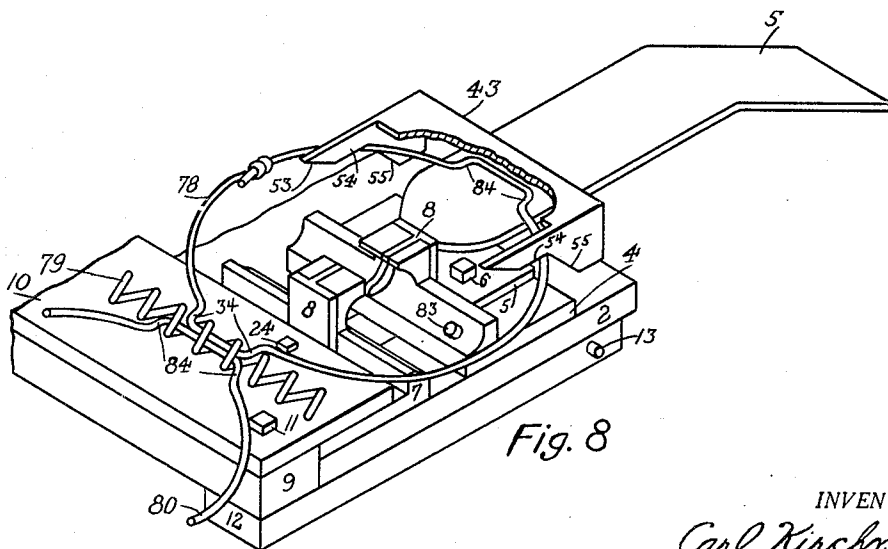


Fig. 8

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UNITED STATES PATENT OFFICE

2,176,262.

METHOD AND APPARATUS IN MAKING
SPRING STRUCTURES

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Application October 3, 1938, Serial No. 232,960

14 Claims. (Cl. 140-3)

My invention relates to improvements in methods and apparatus for making spring structures.

It particularly relates to a new method and apparatus for assembling spring structures which consist of spiral springs held together by helical springs.

One of the objects of my invention is to provide a novel method and apparatus for rapidly and accurately locating the spiral springs in order to receive the encircling helical and to rapidly and accurately shift and relocate the spiral springs in order to receive a second encircling helical spring which may also encircle one or a series of additional spiral springs.

Another object of my invention is to provide a novel apparatus of the kind described, which is simple, cheap, strong, durable, not likely to get out of order, and efficient in operation which will assemble spring structure of any desired width, length, and height.

The novel features of my invention are herein-after fully described and claimed.

In the accompanying drawings, which illustrate a preferred embodiment of my novel apparatus adapted to carry into effect my novel method.

Fig. 1 is an end elevation of my novel apparatus with one spiral spring located in the proper position for receiving the encircling helical and a second spiral spring located in a loading position.

Fig. 2 is an end elevation of the apparatus with an assembled spring structure in the apparatus.

Fig. 3 is a front elevation of the apparatus with three spiral springs in various positions and parts of the apparatus cut away or shown in section for clearness.

Fig. 4 is an elevation view of a spiral spring positioned between two sections of the spiral spring guides.

Fig. 5 is a front elevation of a spiral spring with opposite knots positioned between two sections of the spiral spring guides.

Fig. 6 is a plan view of one knotted end convolution of a spiral spring encircled by a helical spring at one point and pushed by two sections of a shift device at two nearly opposite points.

Fig. 7 is a view of a portion of an end convolution of a spiral spring 74, Fig. 6 above section line 85-85 encircled by a helical spring.

Fig. 8 is a perspective view of one knotted end convolution of a spiral spring encircled by a portion of a helical spring which also encircles a portion of a convolution of a second spiral spring.

The portion of spring structure rests upon portions of the assembling apparatus and is embraced by a shift device.

Similar reference characters designate similar parts in the different views.

One of the most common of methods and apparatuses for assembling spring structures consists of an ordinary table, the top of which is provided with a plurality of pegs. A spiral spring is placed over each peg so that one end convolution of the spiral spring rests on the table with the peg extending through the center of the upright body of the spiral spring to prevent the spiral spring from shifting from position. The pegs are usually located in rows and close enough together for the end convolutions of the spiral springs to touch or overlap the end convolution of the spiral spring around each successive peg in a row. The rows of pegs are spaced at such a distance as will not allow the end convolutions to overlap. The overlapping portion of the end convolutions of two adjacent spiral springs are then held in one hand and a spiral spring screwed around the overlapping portions by means of the other hand.

The helical spring as screwed across the space between the rows of spiral springs and around the overlapping portions of the similarly positioned spiral springs in each successive row until the helical spring encircles the overlapping portions of two spiral springs which are located on two adjacent pegs in each row of pegs. This process is repeated until all the overlapping portions are encircled by a plurality of helical coils. Usually both end convolutions of the spiral springs are encircled in the same manner. The main trouble with the above method and apparatus is that it is slow, the spiral springs lean away from their correct position and are not likely to be accurately spaced in the completed spring structure, and the overlapping portions are not always encircled by the desired number of convolutions of the encircling helical spring.

A number of methods and apparatuses, including the method and apparatus described in Kirchner Patent Number 1,907,323, have been invented to properly locate the spiral spring end convolutions in order for the same to be encircled by a correct number of convolutions of the helical springs and also to be accurately spaced in the complete spring structure. Usually only one side of a spring structure is assembled after which the structure is turned over and the other side assembled in order to allow the use of a

minimum of apparatus parts. This class of methods is also considered slow mainly because the last ends of the spiral springs to be assembled are difficult to place in the assembling apparatus due to variations in the length of the various spiral springs and also because the free end convolutions usually incline relative to adjacent end convolutions. This latter trouble is avoided to some extent by assembling one end of one or two rows of spiral springs and before releasing the same moving a second assembling apparatus onto the free end convolutions, locating the same in the apparatus, and assembling by screwing an encircling helical spring through the apparatus and around all overlapping spiral spring portions. This last described method is also slow and troublesome due to the difficulty of moving approximately one half of the apparatus onto the free ends of the spiral springs and due to the difficulty of locating the free end convolutions in the apparatus.

My novel apparatus provides two vertical parallel columns to which are fastened by screws 3 two parallel relatively long main transverse plates 2, Figs. 1, 2, 3, and 8 between which and to the adjacent faces of the plates are respectively secured two rows of stationary clamps 4, Figs. 1, 2, 3, and 8 by means of screws 6. Two rows of slideable clamps 7, Figs. 1, 2, 3, and 8 are mounted to match each of the clamp halves 4 and are respectively secured to two rows of clamp plates 10, Figs. 1, 2, 3, and 8 by screws 24. The clamp plates 10 are secured by screws 11 to two transverse beams 9 each secured to two clamp slides 12 by screws 25. The ends of plates 2 project outward from the columns as shown in Fig. 3. The assembly of parts 7, 10, 9, and 12 form a U shape structure at each end of clamp plates 10, which embrace the outwardly extending ends of main plates 2 and also bear against the outer faces of columns 1 as shown in Figs. 1, 2, and 3 which prevents all motion of the slideable clamps 7 on main plate 2 except directly toward or away from the stationary clamps 4. To open and close clamps 4 and 7 the rods 14 Figs. 1, 2, and 3 are passed through bearings in columns 1 and fitted at each end with a hub 15 which is provided with a lever to engage pins 13 extending from the clamp slides 12. Hubs 15 are secured to the shaft or rod 14 by pins 34 and an operating lever is provided integral with one or both hubs 15 on each rod 14 as shown.

When rods 14 Figs. 1, 2, and 3 are rotated both ends of each of the clamp plates 12 are moved at the same time, and same amount. The faces of the clamps which clamp together are shaped to provide an annular opening between the clamps 4 and 7 through which a helical may be screwed. The upwardly extending portion of the clamps are also shortened lengthwise to embrace a portion of the end convolution of a spiral spring and locate the same in the annular opening in a position to be encircled by a helical spring when the latter is screwed through the annular opening. Each clamp is fitted with a holding plate 8 Figs. 1, 2, 3, and 8 which extends into the annular opening to aid in properly positioning the portions of spiral springs without obstructing the helical spring. Each of the clamps 4 is provided with a spiral spring guide 5 which is secured by screws 6 Figs. 1, 2, 3, and 8. Each guide 5 is bent near its outer end to diverge away from the space between the clamps 4 Figs. 1, 2, 3, and 8.

To operate this apparatus a spiral spring is held by its center turns and brought into contact with the diverging portions of the guides 5 as shown in Fig. 1 by the spiral spring 46 making contact with the two opposite guides 5 at points 39. As the spring 46 is moved farther into the apparatus the diverging portions of the guides 5 compress the spiral spring until the end convolutions reach the parallel portions of the guides as indicated by the dotted outline of a portion of an end convolution at points 41 Fig. 1. The spiral spring is stopped at the proper position by striking the projecting face of the clamps 7 as shown in the lower set of clamps of Fig. 1 where the dotted spring portion is shown making contact with clamp 7 at point 42. After, or just before, the spring portion strikes the clamp 7, its end convolution swings down into the opening between the clamps due to the tendency of the spiral spring to expand to its original length as shown by the section 47 of the lower convolution of spiral spring 49. After the end convolutions have entered the opening between the clamps 4 and 7, rod 14 is rotated to close the clamps and embrace a portion of an end convolution in each annular opening as shown in the upper set of clamps in Fig. 1. While so held, a helical spring is located in the annular opening by the pin 33 in clamp 4 Fig. 8 and screwed so as to pass through the annular opening between all the clamps in each set and encircle all portions of the spiral springs positioned in the clamps.

The clamps are then opened by rotating the rods 14, Figs. 1, 2 and 3, and the helical springs ejected from the openings between the clamps and into the space between the upper and lower sets of clamps, in which position the helical springs with the encircled portions of the end convolutions, are free to be shoved between the clamps 4 and 7 to allow the opposite portions of the end convolutions to expand into the opening between the clamps. This movement is accomplished by a shift mechanism composed of a shift beam 26, Figs. 1, 2, and 3 to which shift devices 43 are secured by screws 27, Fig. 3. Each end of the shift beam 26 is provided with a T shaped member 28, the longest ends of which are pivoted to the two shift slides 30 by means of two pins 45. The longest ends are also provided with lugs 29 adapted to rest on the slides 30 to prevent the member 28 from swinging below a position in line with the shift slides 30 as shown in Figs. 2 and 3. The shift slides 30 are supported in guides 31 and 32 secured to the outer surfaces of the columns 1, Figs. 1, 2, and 3 by screws 33. After the shift beam has been lowered from the position shown in Fig. 1 the beam 26 guided by the shift slides 30 is moved manually inward into the space between the spiral spring guides 5, Fig. 2. A shift device 43 Figs. 1, 2, 3, and 8 straddles each spring guide 5 upon which the portion of each spiral spring end convolution, which is most distant from the opening between the clamps, rests as shown by the positions of the spring sections 48 in Figs. 1 and 2. The shift device has an inclined face 53, Figs. 1 and 2 which draws the spring portion toward the guide 5 if it is not pressing against the guide. As the beam 26 is moved farther inward the portion 54 of shift device 43 passes over the spring portion until the inclined face 55 of shift device 43 contacts the spring portion as shown at point 48, Fig. 2 after which the spring portion is held close to

the guide 5 and effectually prevented from tipping on or leaving the guide 5 while the beam 26 and shift device 43 shift the end convolutions of the spiral springs to the position where they will expand into the openings between the clamps. The helical spring ejectors 16 for the lower clamps are secured to ejector beam 17 which passes through the guides 61 in columns 1 and extends a distance outwardly from both columns. The ejectors for the upper clamps are likewise secured to ejector beam 17 in guide slots 60 by means of screws 38, Fig. 3. The lower ejector beam 17 is held in rest position by gravity and the top ejector beam is held in rest position by a spring 22 secured by screws 23 to lugs 44 on the outer face of both columns 1, Figs. 1 and 2. Ejector beams 17 are operated by means of shafts 19 which have hubs 20 secured by pins 35. The hubs are provided with levers to engage pins 18 projecting from each end of the ejector beams 17 and also with a convenient hand lever for rotating the shaft. When the ejector beams 17 are moved to the helical spring ejecting position they are held in said ejecting position by means of the latch lever 21, lugs 50, Figs. 1, and 2, swinging into latch position. The latch levers 21 are secured to shafts 59 by pins 36 and are rotated by springs 37, Fig. 3. The projecting ends 51 of the latch levers are moved by the lugs 57 on the ends of the shift beam 26, Figs. 1, 2, and 3 before the portion of the spiral springs which are in contact with the shift devices 43, Fig. 2 are in position to expand into the opening between the clamps. The movement of the end 51 of the latch lever 21 swings the latch lug 50 to a position where the inclined faces 52 on the ejector beams 17 will swing the latch lever an additional amount, as the ejector beams are returned to rest position, in order to swing the latch lever ends 51 to a position where they will not touch the lugs 57 as the shift beam 26 is moved to its extreme inward position and withdrawn. When the shift devices 43 force portions of the spiral springs against the point 42 of clamps 7, Fig. 1, the inclined face 55 of the shift devices 43 force the portions to expand into the opening between the clamps and the faces 56 on the shift devices permit a considerable overtravel of the shift device. This amount of overtravel is important due to the fact that the operator or operators of the apparatus are assured that all the spring end convolutions are properly located between the clamps without taking the time necessary to make a visual inspection of each spring. Should one of the spiral springs, that is being pushed by a shift device 43 to the first position, catch high on the adjacent clamp 7, as indicated by 42 and in dotted lines in Fig. 1, and not descend between the clamps 7 and 4 to a position to be encircled by the helical that is to connect the springs, the improperly positioned spring would hold the shift device 43, and thereby the beam 26, so that the beam would not travel the full length of its inner stroke. The operator being thus notified would properly position the spring before connecting the springs of the row with the helical.

Successive rows of springs are placed in the apparatus in the same manner as the first row. The second and successive pairs of helical springs will encircle the overlapping portions of two rows of spiral springs thus forming the spring structure which is shown in end elevation passing through the apparatus in Fig. 2.

It will be understood from the above description that this assembly method is very rapid and convenient and that the apparatus is novel and entirely successful in operation.

Spiral spring 67, Fig. 3 is shown in the same position as spring 49, Fig. 1 with both end convolutions in the dotted outline position 47 with portions of guide 5 removed for clearness.

Spring 68, Fig. 3 is shown in the position of spring 81, Fig. 2 except expanded into the space occupied by ejectors 16, Fig. 2. The clamps 4 and guide 5 are removed in Fig. 3 to clearly show spring 68. Spring 69 is shown in the same position as spring 68 but with clamp 4 and guide 5 in place. The apparatus is usually built long enough to assemble the widest or longest spring structure desired and as many clamps and parts provided for the greatest number of springs desired in one row. The columns 1, Figs. 1, 2, and 3 are made with substantial feet 58.

The helical springs encircling the first row of spiral springs will appear in elevation as the helical springs 65, Fig. 2 after the same is ejected and the spiral springs shifted. The successive helical springs will appear in elevation like helical springs 64, 63, and 62, Fig. 2. Helical springs 62 are shown in ejected position, resting on the ends of ejectors 16, and free to be shifted over clamps 7, Fig. 2.

The spiral spring end surfaces of the assembled spring structure appear similar to the two spiral spring convolutions shown joined together, Fig. 8, by an encircling helical spring but there will be a plurality of such helical springs with each encircling a number of spiral spring end convolutions. The end convolutions may be round or be provided with bent portions 84 as shown in Fig. 8.

The spiral springs 70 and 71, Figs. 4 and 5, illustrate the tendency of the spiral springs to slide on the section 72 taken on the parallel portions of spiral spring guides 5 Fig. 1, section 40-40 to the undesirable positions shown by dotted outlines.

The sections 75 of the shift devices 43, Fig. 1 illustrate how the surfaces 55 tend to properly locate the spiral spring 74 although it tends to swing in helical spring 73 to the dotted positions.

The portion of spring 77 encircled in helical spring 76 illustrates the tendency of the spiral spring end convolutions to assume an angular position in Fig. 7.

When preferred, the motion of the shift beam 26 from the position shown in Fig. 1 to the position shown in Fig. 2 may be utilized through suitable mechanism to operate ejector beams 17 and ejectors 16 to the position shown in Fig. 2 in order to avoid the separate manual operation of levers 20 in Figs. 1, 2, and 3. The stationary clamps 4 constitute, with the front portions of the clamps 7, a first row of positioning means, and occupy the first position into which the spiral springs are moved. The slidable clamps 7, with the rear portions of the clamps 4, constitute a second row of positioning means, and occupy the second position into which the spiral springs are moved.

The guide plates 5, which lead to the first row of positioning means, and which diverge outwardly at their outer portions, constitute means for compressing and guiding the spiral springs to their first position between the plates 2 which form fixed supports for the springs and between which the spiral springs are held com-

pressed from the time of their insertion until they have been coupled together by the helicals or connecting members. For holding the spiral springs compressed while in their two positions between the supports, the first and second rows of positioning means are spaced apart a distance substantially less than the normal lengths of the springs when not compressed.

By means of the construction, shown and described, the spiral springs are inserted, compressed and disposed upon the first row of positioning means in one movement and in one operation, and they are coupled together by the helicals and shifted with a mechanism having a minimum of parts, and with a minimum of operations.

Various modifications of my invention, within the scope of the appended claims, may be made without departing from the spirit of my invention.

What I claim is:

1. The method of assembling spring structures, comprising compressing, and placing a row of spiral springs between two supports with portions of the springs positioned by a first row positioning means located on each support, screwing helical springs into encircling engagement with portions of the spiral springs, disengaging the positioning means from the spiral springs and shifting the spiral springs with the connecting helical springs between the two supports to a second row of positioning means located on each support, compressing and positioning a second row of spiral springs by the first row of positioning means, screwing a second series of helical springs between the two rows of spiral springs and into encircling engagement with portions of the spiral springs, disengaging the spiral springs from both the first and second rows of positioning means on each support and shifting the springs with the helical springs between the two supports.

2. In a spring structure assembling apparatus, two spaced mechanisms each including a support having means for positioning two rows of spiral springs placed between the two mechanisms and means for guiding helical springs between the two rows of springs and into encircling engagement with portions of the two rows of springs, means for ejecting said spiral springs and helical springs from said locating and guiding means, consisting of a plurality of ejectors operative through the said supports and through the positioning means to force the helical springs and encircled spring portions free of the spring positioning and helical spring guide means, and means for shifting said spiral springs and helical springs over said positioning and guide means consisting of a beam operative to contact all springs in one row and shift the same across and between the means for positioning said spiral springs and means for guiding said helical springs.

3. In a spring structure assembling apparatus, two spaced mechanisms each including a support having means for positioning two rows of spiral springs placed between the two mechanisms and means for guiding helical springs between the two rows of spiral springs, means for disengaging said springs and helical springs from said positioning and guiding means, and means for shifting said spiral springs and helical springs over said positioning and guiding means including a beam mounted to travel between said mechanisms and fitted with a plurality of shift devices

positioned on said beam and formed to embrace each spiral spring in one row.

4. In a spring structure assembling apparatus, two spaced mechanisms each including a support having means for positioning two rows of spiral springs placed between the two mechanisms and means for guiding helical springs between and into encircling engagement with portions of the two rows of springs, means for disengaging said spiral springs and helical springs from said positioning and guiding means, and means for shifting said spiral springs and helical springs including a beam operative between the mechanisms, and fitted with a plurality of shift devices so formed as to contact each end convolution of each spiral spring of a row at substantially spaced apart points on the periphery of the convolution and upon the side of the convolution which is between the ends of the spiral spring.

5. The method of assembling a spring structure of the kind described, consisting in inserting, and compressing while inserting, a row of spiral springs into a first position between two supports by which they are held compressed, engaging the springs while in said first position with a connecting member, and shifting the springs, with said connecting member, while it is being held compressed into a second position ahead between said supports.

6. The method of assembling a spring structure of the kind described, consisting in inserting, and compressing while inserting, a row of spiral springs into a first position between two supports by which they are held compressed, engaging the springs while in said first position with a connecting member, shifting the springs, with said connecting member, into a second position between said supports, similarly compressing and inserting into said first position a second row of spiral springs, and engaging a second connecting member with the springs of said two rows while they are respectively disposed in said two positions.

7. The method of assembling a spring structure of the kind described, consisting in inserting, and compressing while inserting, a row of spiral springs into a first position between two supports by which they are held compressed, engaging the springs while in said first position with a connecting member, shifting the springs, with said connecting member, into a second position between said supports, similarly compressing and inserting into said first position, a second row of spiral springs, engaging a connecting member with the springs of said two rows while they are respectively in said two positions, and shifting said two rows, with said connecting members, to move the first row of springs from said second position and to move said second row of springs from said first position into said second position.

8. The method of assembling a spring structure of the kind described, consisting in inserting, and compressing while inserting, a row of spiral springs into a first position between two supports by which they are held compressed, engaging the springs while in said first position with a connecting member, shifting the springs, with said connecting member, into a second position between said supports, similarly compressing and inserting into said first position a second row of spiral springs, engaging a connecting member with the springs of said two rows while they are respectively in said two positions, shifting said two rows, with said connecting members, to move said first row of springs from said sec-

ond position and to move said second row of springs from said first position into said second position, and similarly successively compressing, positioning, and connecting with connecting members, additional rows of spiral springs with said second row and with each other until rows of springs of a desired number have been assembled.

9. In an apparatus of the kind described, in combination, means for consecutively holding compressed in two positions one ahead of the other a row of spiral springs, converging means for compressing and guiding said springs while they are being inserted into the first of said two positions, means for engaging a connecting member with said springs while they are in said first position, and means for shifting the springs while compressed, with the connecting member, from the first into the second of said two positions.

10. In an apparatus of the kind described, in combination, means for consecutively holding compressed in two positions one ahead of the other a row of spiral springs, means including two opposed sets of members which converge inwardly at their outer end portions and are adapted to engage respectively the opposite ends of said springs for compressing and guiding the springs while they are being inserted into the first of said positions, means for engaging a connecting member with said springs while they are in said first position, and means for shifting the springs while compressed, with said connecting member, from the first into the second of said two positions.

11. In an apparatus of the kind described, in combination, means for consecutively holding in two positions one ahead of the other a row of spiral springs, means for guiding the springs into the first of said two positions, means for engaging a connecting member with the springs while they are in said first position, and means for shifting the springs, with said connecting member, from said first into the second of said two positions, said shifting means including shift devices adapted to bear against the peripheries

and upon the inner sides of the end convolutions of the springs.

12. In an apparatus of the kind described, in combination, means for consecutively holding compressed in two positions one ahead of the other a row of spiral springs, converging means for compressing and guiding said springs while they are being inserted into the first of said two positions, means for engaging a connecting member with said springs while they are in said first position, and means for shifting the springs, with said connecting member from said first into the second of said two positions, said shifting means including shift devices adapted to bear against the peripheries and upon the inner sides of the end convolutions of the springs.

13. In an apparatus of the kind described, in combination, means for consecutively holding compressed in two positions one ahead of the other a row of spiral springs, means including two opposed sets of members which converge inwardly at their outer end portions and are adapted to engage respectively the opposite ends of the springs for compressing and guiding the springs while they are being inserted into the first of said positions, means engaging a connecting member with said springs while they are in said first position, and means for shifting the springs, with said connecting member, from said first into the second of said two positions, said shifting means including shift devices adapted to bear against the peripheries and upon the inner sides of the end convolutions of the springs.

14. In an apparatus of the kind described, in combination, means for consecutively holding in two positions one ahead of the other a row of spiral springs, means for guiding said springs into the first of said two positions, and means including a member reciprocative toward and from said first position and provided with shift devices adapted to be disposed between the opposite end convolutions of said springs and to bear against the peripheries and upon the inner sides of said end convolutions for shifting the springs from said first into the second of said two positions.

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