United States Patent

Dull

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[45] Mar. 14, 1972

[54] HELICAL WIRE SHEARING AND TWISTING MECHANISM FOR SPRING MATTRESS UNITS

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

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[21] Appl. No.: 61,309

[52] U.S. Cl. ..... 140/92.7, 140/3 CA

[51] Int. Cl. B21f 27/14, B21f 27/16

[58] Field of Search ..... 140/1, 3 CA, 92.3, 92.4, 92.7, 140/92.9, 92.93, 92.94

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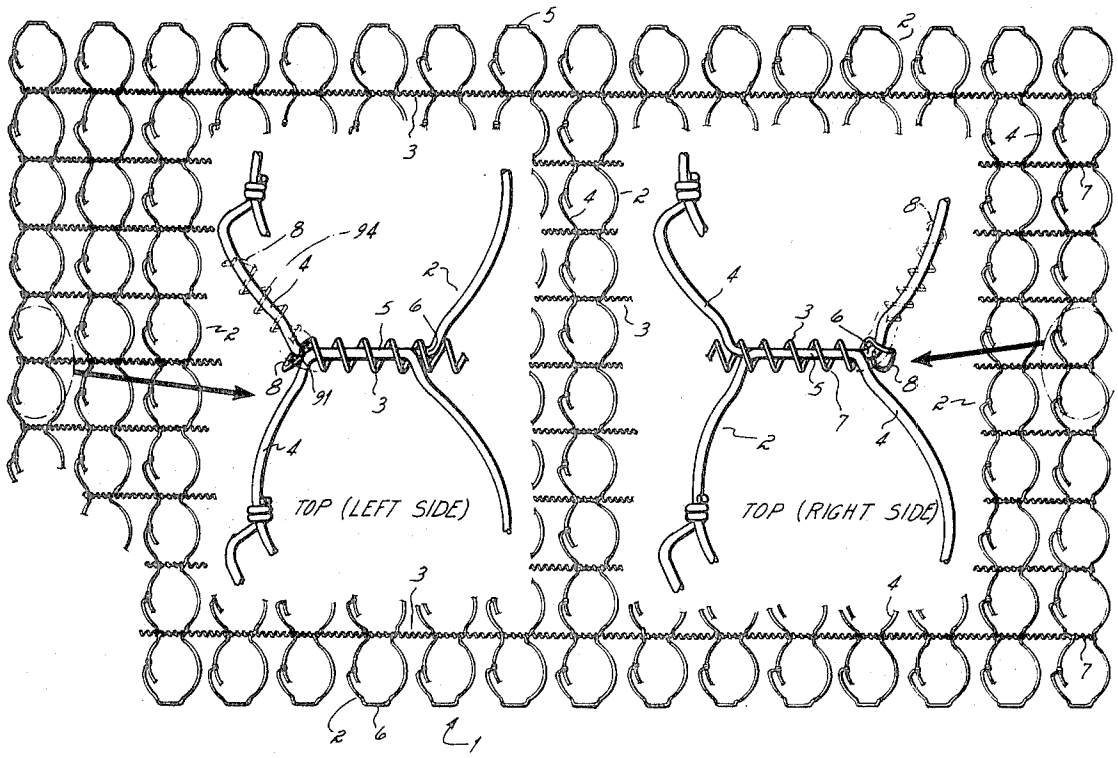
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[57] ABSTRACT

A shearing and twisting mechanism which acts upon the helical wires of a spring mattress of the type comprising transverse rows of coil springs having contiguous portions hingedly connected together by helical wires at top and bottom. The spring mattress is assembled by a machine and the shearing and twisting units of the invention are mounted in pairs at opposite ends of the assembly machine so as to act concurrently upon the leading and trailing ends of the upper and lower helicals after they are laced in position. Each shearing and twisting unit is self-contained, essentially comprising a shearing head arranged to rock in forward and reverse directions during a shearing and twisting cycle, combined with a coacting shearing knife and components driven by the rocking head for reciprocating the knife, such that, as rocking motion is imparted to the head, the end portion of the helical first is sheared by the knife and thereafter is twisted to a pigtail or loop formation encircling the terminal of the coil spring at the marginal edge portion of the mattress, whereby the terminal anchors the loop and locks the helical against endwise displacement to prevent the sheared end of the helical from penetrating or interfering with the ticking or other covering which encloses the spring mattress after it is assembled.

16 Claims, 13 Drawing Figures



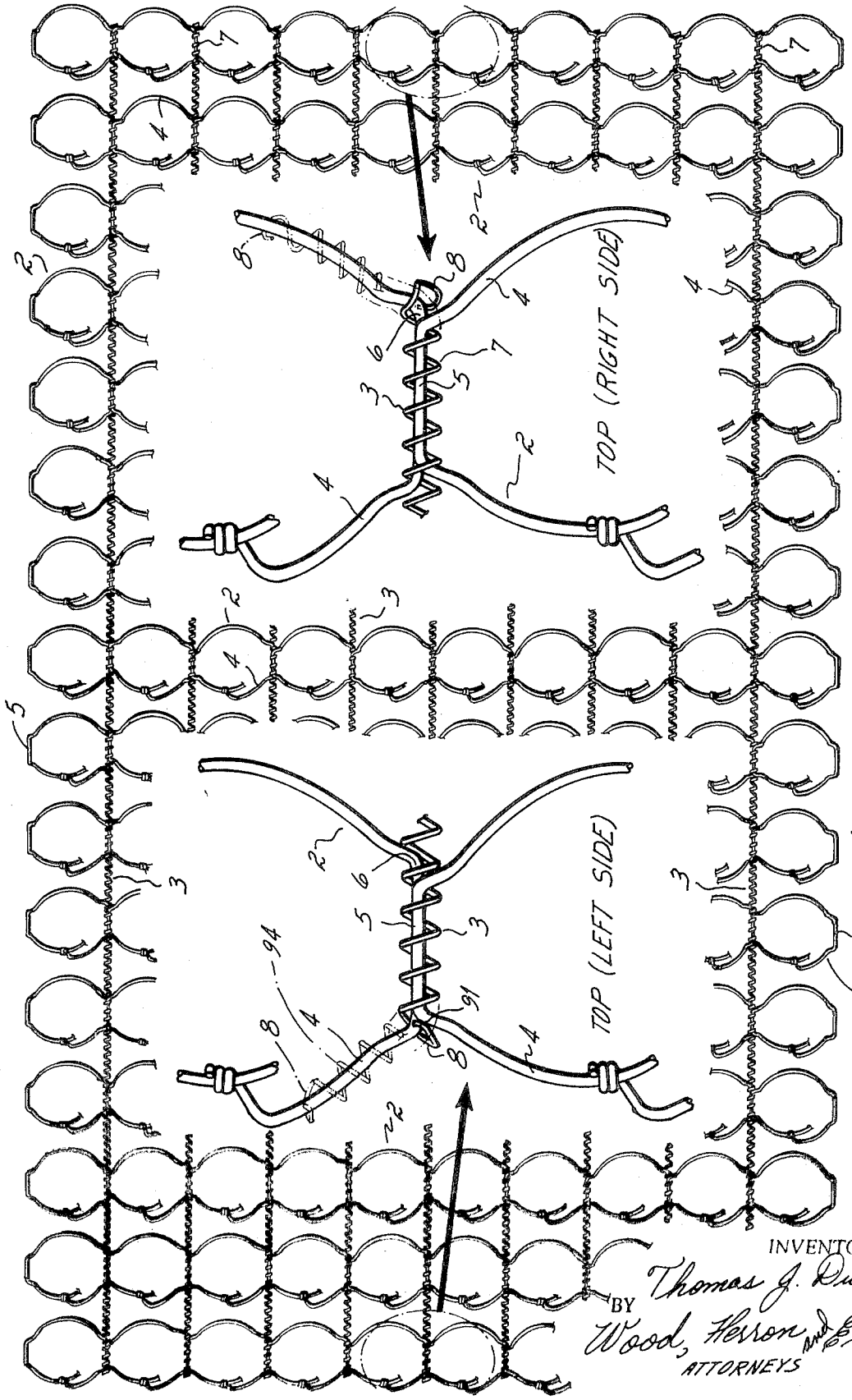


Fig. 1

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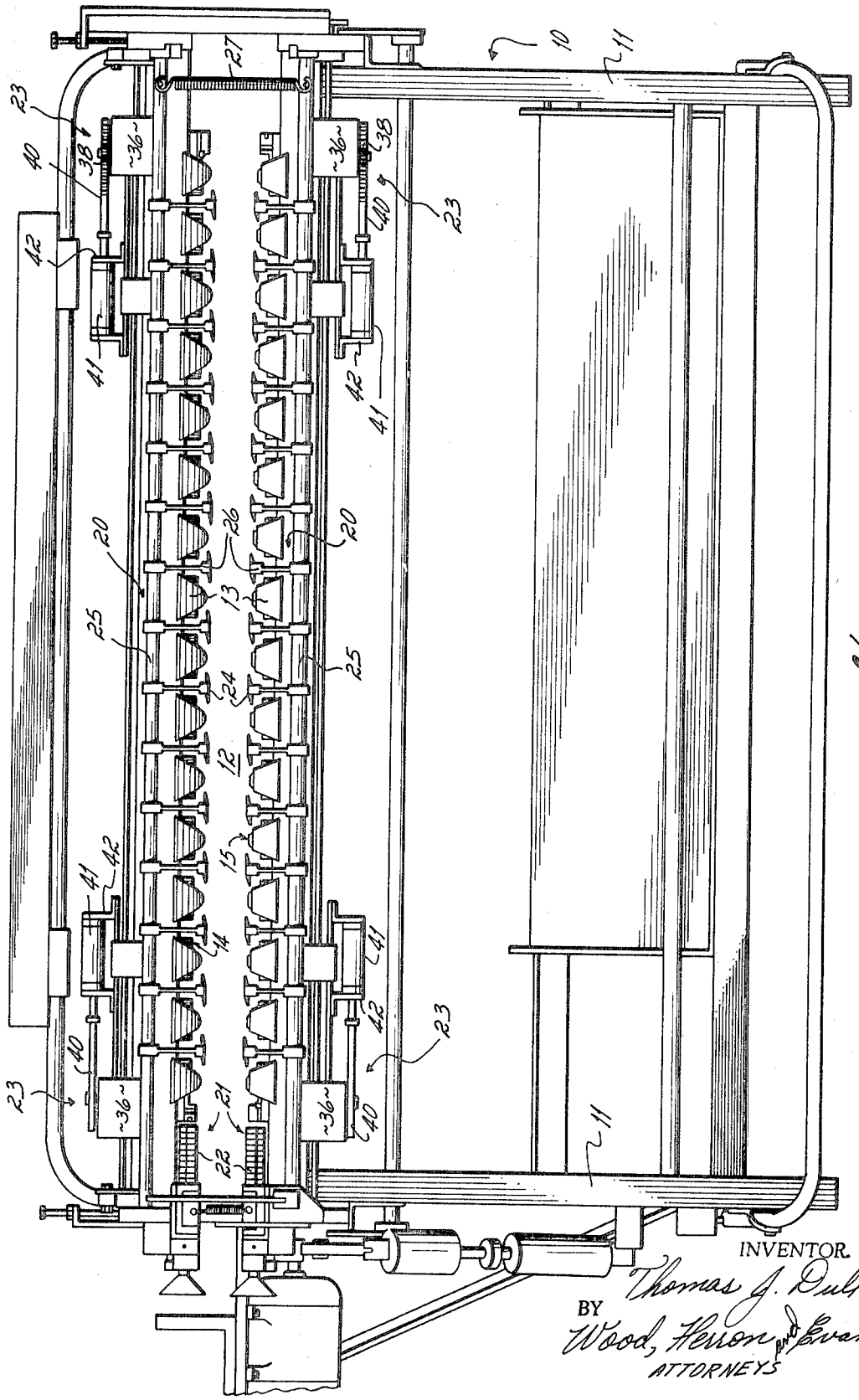


Fig. 2

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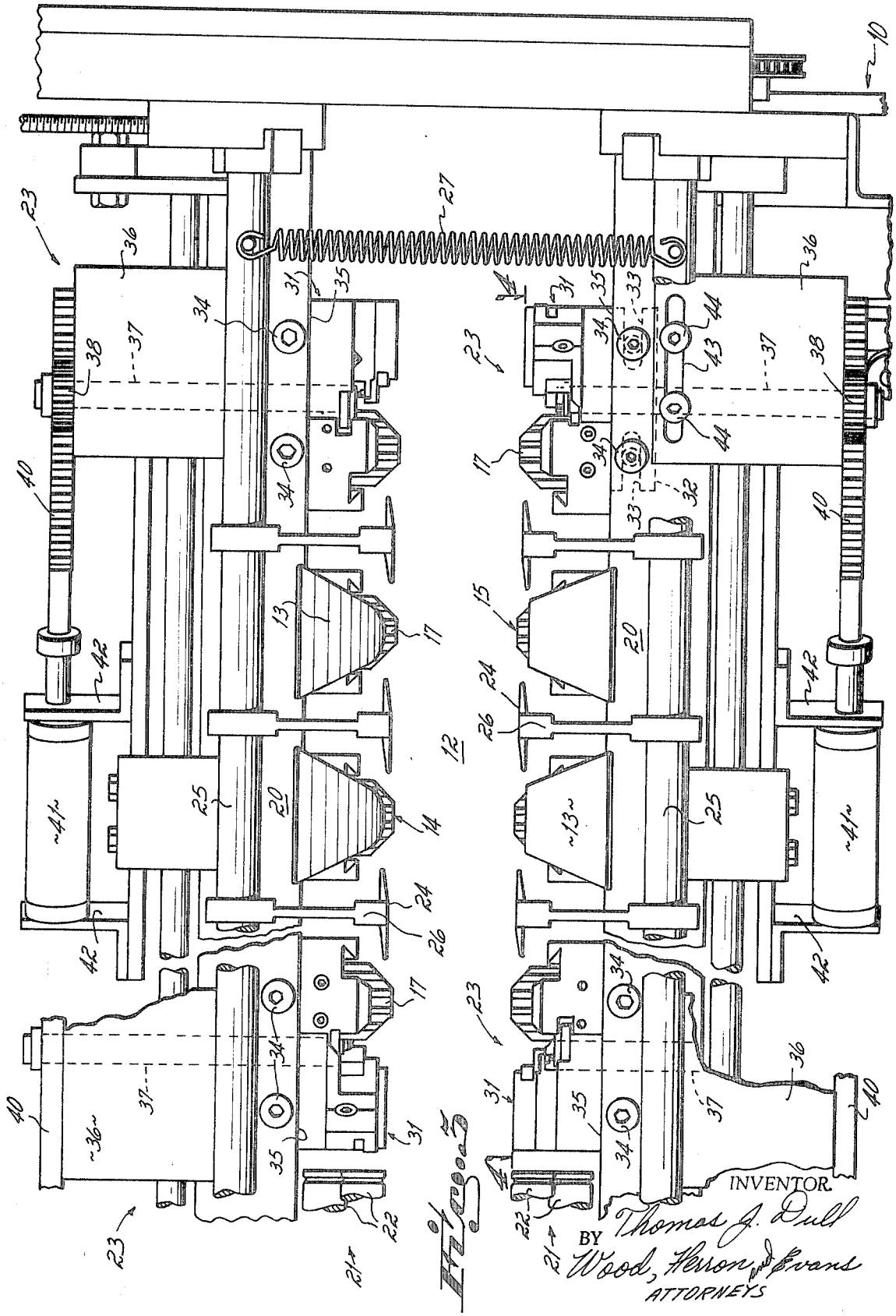


Fig. 3

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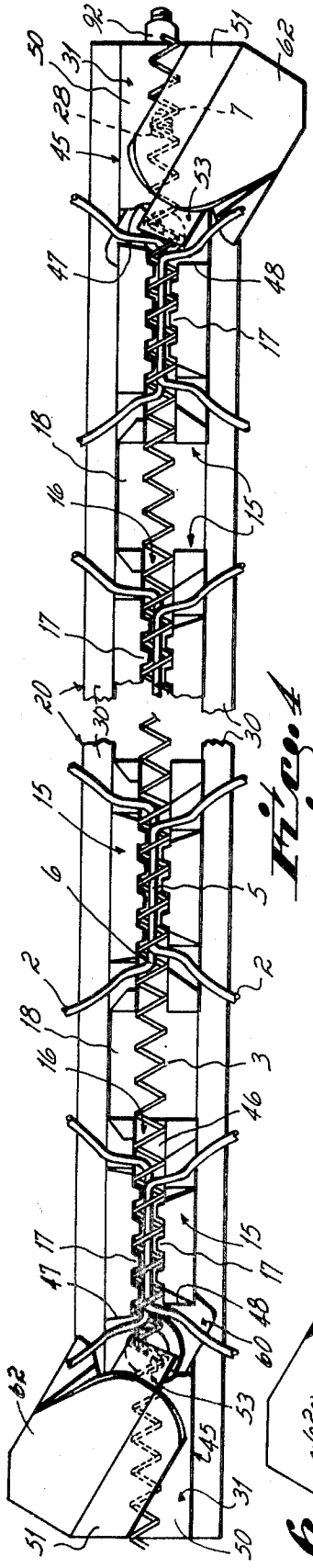


Fig. 4

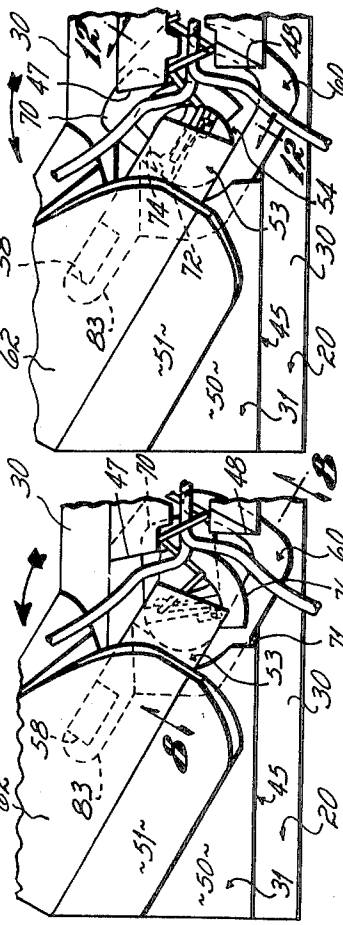


Fig. 1

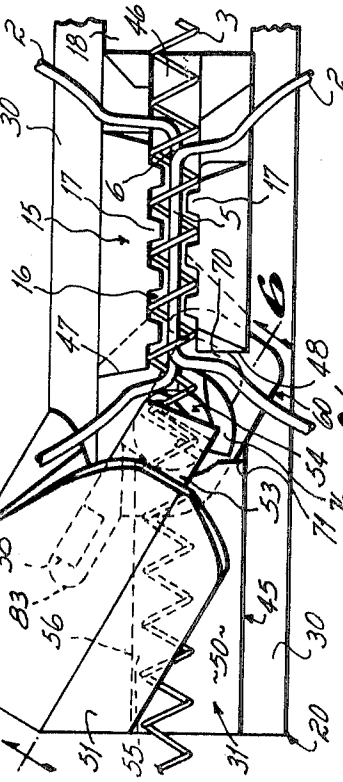


Fig. 5

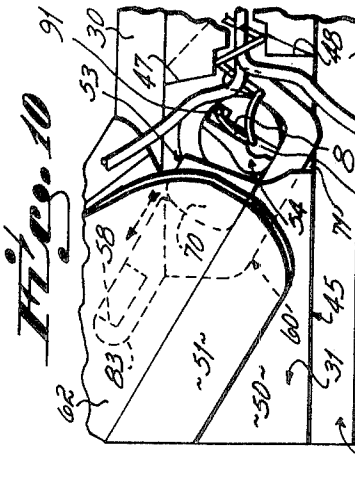


Fig. 10



Fig. 11

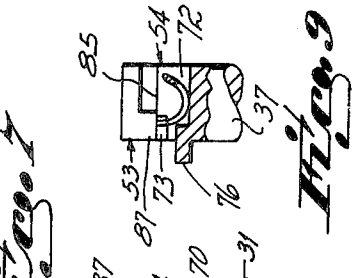


Fig. 9

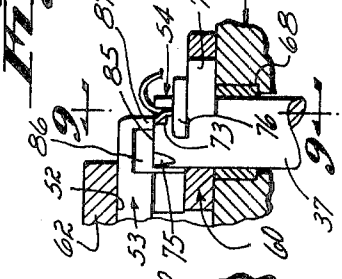


Fig. 8

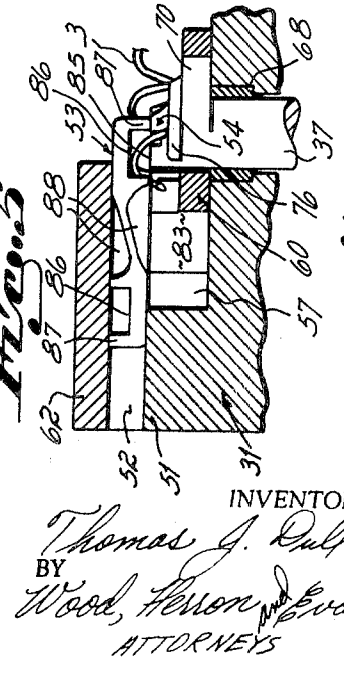


Fig. 6

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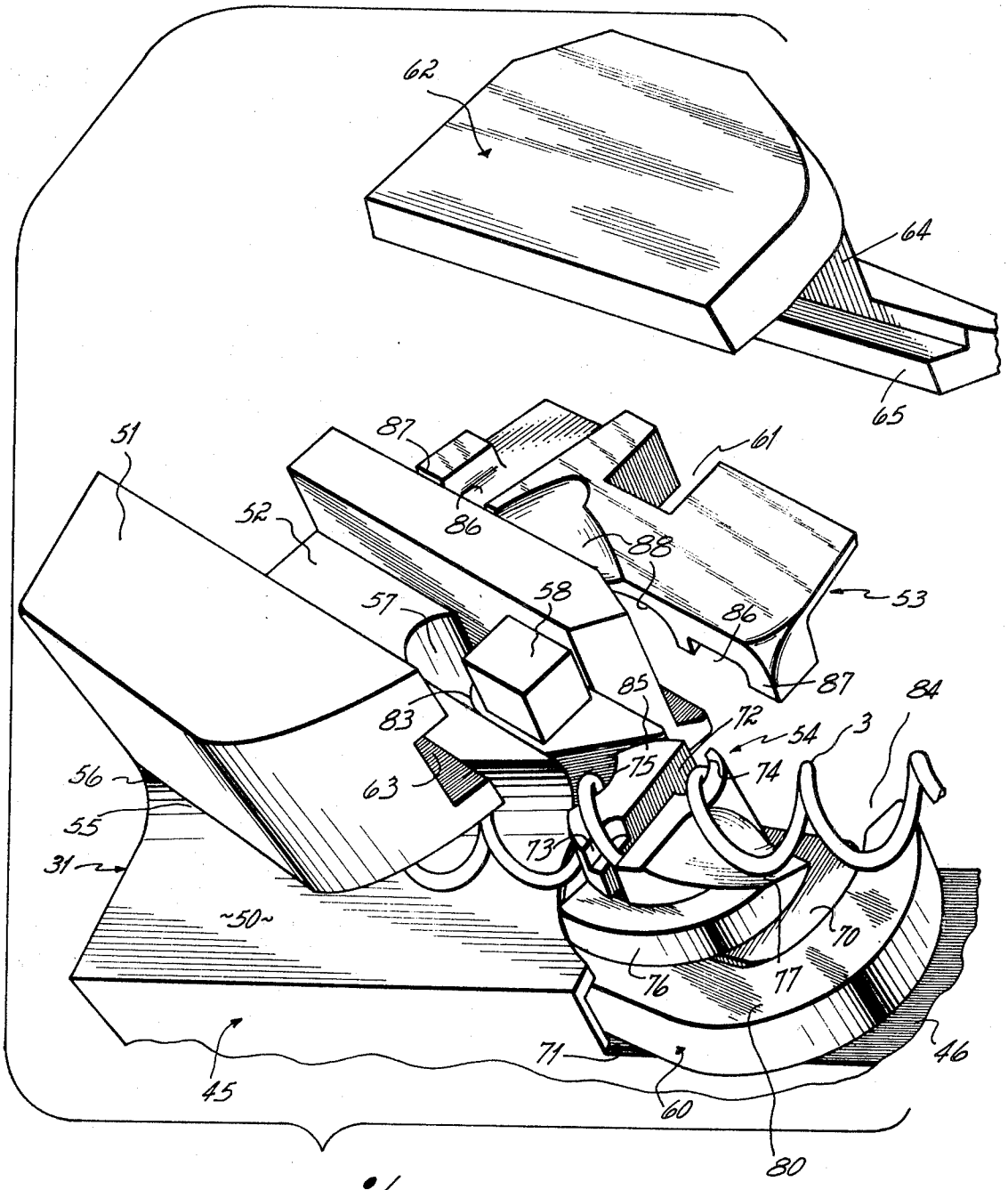


Fig. 13

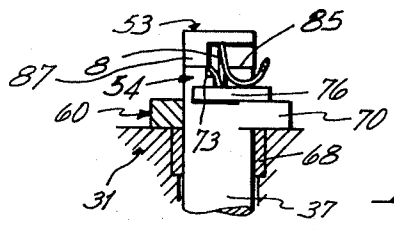


Fig. 12

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HELICAL WIRE SHEARING AND TWISTING MECHANISM FOR SPRING MATTRESS UNITS

BACKGROUND OF THE INVENTION

The concept of shearing and twisting the opposite ends of the helicals after they have been laced or threaded in position on the adjacent rows of coil springs is disclosed in U.S. Pat. No. 3,090,407, issued on May 21, 1963 to J. R. Greeno and the present inventor, Thomas J. Dull. This patent discloses a machine equipped with trimming and forming mechanisms which shear off the opposite end portions of the helical and twist the sheared end portions into loop formation so as to lock the helical longitudinally in place. The mechanism of the prior patent is commercially successful, however, the present shearing or twisting structure represents an improvement in that the mechanism anchors the opposite ends to the marginal terminals of the row of coil springs. Therefore, should the helical fail and break at an intermediate point after prolonged use, the separated end portions of the helical are locked to the terminals so that they cannot unthread themselves with respect to the coil springs and protrude or damage the ticking or covering which later is applied to the spring mattress.

Another U.S Pat No. 3,316,944, issued to Clifford Goldmeyer and Thomas J. Dull on May 2, 1967, to which attention is directed, discloses a mechanism for acting upon the ends of the helical to anchor the ends of the helical in another manner.

The shearing and twisting mechanism of the present invention is intended for installation upon spring assembly machines operated either automatically or manually. The machine selected to illustrate the principles of the present invention is of the type disclosed in the aforesaid U.S. Pat. 3,090,407 in which the assembly machine is operated by power cylinders under the control of an operator.

At the start of the operation, individual unattached coil springs are inserted into the receiving side of the machine where the upper and lower terminals of the coils reside in mating or contiguous relationship with portions of the previously assembled row of coil springs. The coil springs are held there while helical wires are rotated and caused to advance in sinuous or cork screw fashion upon the mating portions of the attached and unattached coil springs at top and bottom to hingedly connect them to one another and to the spring mattress. Thereafter, the leading and trailing end portions of the upper and lower helicals are sheared and twisted and the spring mattress is indexed rearwardly for the next cycle.

The shearing and twisting mechanism of the present invention, also referred to as a "loop forming unit," differs substantially in structure and function and represents an improvement over the mechanism disclosed in the aforesaid patents:

A primary objective of the invention has been to provide a self-contained, power-operated helical shearing and twisting mechanism which is arranged to shear and twist an end portion of the helical at a point contiguous to the mating portions of the coil spring terminals, thereby to cause the loop or pigtail thus formed to encircle the terminals so as to lock the helical to the terminals at a point inset from the margin of the spring mattress.

According to this concept, the loop forming units are substantially in duplicate at opposite ends of the assembly machine for the upper and lower helicals. The loops are formed concurrently at opposite ends of the helicals at points set inwardly from the margin of the spring mattress unit to protect the ticking or other covering against damage by the severed ends of the helical. Moreover, should the helical break at a point intermediate its length, it cannot be unscrewed to damage the ticking since its opposite ends encircle the terminals and simply advance about the terminal instead of protruding outwardly.

Another objective has been to provide a loop forming unit for forming the loop or pigtail formation, in which the forming mechanism is compatible with various types of spring assembly machines and wherein the operation of the forming units is initiated by the leading end of the helical wire at top and bottom.

In accordance with this concept, the loop forming units for the upper and lower helicals at the upstream and downstream ends of the machine are located closely adjacent sets of positioning jaws which guide the helical across and about the mating terminal portions of the coil springs. Accordingly, the helical feeds in a sinuous manner from the endwise pairs of positioning jaws through the forming unit and into engagement with an electrode or switch pole at the downstream end and at top and bottom, to complete an electrical control circuit which initiates the operation of the forming units.

The electrical circuit is arranged to energize the several forming devices concurrently, such that the opposite ends of both the upper and lower helicals are sheared and twisted before the next operating cycle of the spring assembly machine can be initiated. The forming units, thus may be applied either to a manually controlled assembly machine or it may coact with the control system of a completely automatic machine.

A further objective has been to provide a self-contained forming unit comprising a rotary shearing and twisting head, a coacting shearing knife reciprocated in time to rotary movements of the head for shearing and twisting the end portion of the helical, and a camming surface rocking with the head for ejecting the sheared and twisted end portion of the helical outwardly to a disengaged position for indexing the spring mattress for the next cycle.

In order to provide a self-contained unit, each forming mechanism comprises a mounting block in which the shearing knife is mounted for reciprocation. A shiftable yoke piece interconnects the rotary head and shearing knife, such that the knife is normally extended. The knife includes a cross slot overhanging a complementary cross slot of the head and delineating a shearing finger projecting into contact with the surface of the head to provide coacting shearing surfaces. This arrangement provides a closed guide passageway permitting the head to be positioned closely to the mating terminals of the coil springs so that the helical may be threaded directly relative to the mating terminals and guide passageway.

When the shearing and twisting cycle is initiated to cause rocking motion of the head (through an angle of approximately 180°), the convolution of the helical, confined between the complementary slots of the head and knife, is sheared. During continued rotary head motion, the sheared end is formed into a loop or pigtail and is twisted to reside about the terminal of the coil spring. The head is then rocked back to the starting position for the next cycle.

During the forward motion, a cam lobe, forming part of the head, shifts the yoke piece and shearing knife to a retracted dwell position so as to clear the cross slot of the head, permitting an outwardly inclined cam surface of the head to engage the end portion of the helical so as to force the loop or pigtail outwardly toward one of the mating terminals, whereby the loop encircles the terminal as the loop is twisted to closed position. At or about the same time, the positioning jaws of the assembly machine are retracted so as to release the helical and joined coil spring terminals from the machine for indexing the spring assembly for the next cycle operation.

The various advantages and structural details of the invention will be more clearly apparent to those skilled in the art from the following description in conjunction with the drawings.

DRAWINGS

FIG. 1 is a top plan view of a spring mattress with enlarged fragmentary views inserted to illustrate the loop or pigtail formation which is imparted to the opposite end portions of each helical by the shearing and twisting or forming unit of the invention.

FIG. 2 is a front elevation of a typical machine for assembling the coil springs and lacing the helicals thereon, the machine being equipped with the helical forming units which coact with the spring assembling machine.

FIG. 3 is an enlarged fragmentary front view taken from FIG. 2, showing in greater detail the spring guides which locate the coil springs in rows and also showing the location of the upper and lower helical forming units at opposite ends of the machine.

FIG. 4 is a fragmentary sectional view, taken along the line 4—4 of FIG. 3, showing the lower coil spring positioning devices in the coil locking position with the helical wire laced upon the coil springs, the helical wires being in position to be sheared and looped about the endwise terminals of the coil springs by the forming units.

FIG. 5 is an enlarged plan view of the lower left hand (upstream) forming unit in its normal helical-guiding position prior to the shearing and looping operation.

FIG. 6 is a sectional view taken along the line 6—6 of FIG. 5, further illustrating the structure of the shearing and twisting head of the forming unit.

FIG. 7 is a fragmentary view generally similar to FIG. 5, but showing the first stage of operation, as indicated by the arrow, in which the end portion of the helical wire is sheared prior to being twisted to its loop formation.

FIG. 8 is a fragmentary sectional view taken along the line 8—8 of FIG. 7, further detailing the movement of the parts during the helical shearing operation.

FIG. 9 is a fragmentary sectional view taken along the line 9—9 of FIG. 8, further detailing the components which carry out of the shearing operation.

FIG. 10 is a view similar to FIG. 7, showing the rotary trimmer head at an intermediate position during its rotary shearing motion.

FIG. 11 is a view similar to FIG. 10, showing the trimmer head rotated to its final position at which point the end portion of the helical wire is bent to its pigtail or loop formation.

FIG. 12 is a fragmentary view, taken along line 12—12 of FIG. 10, further detailing the rotary head and shearing knife.

FIG. 13 is an exploded perspective view showing the several components of the trimming and forming head in the position assumed at the start of a cycle, with the helical threaded in place ready to be sheared and formed to its loop or pigtail formation.

OPERATION GENERALLY

In order to best disclose the principles of the present invention, the wire shearing and forming mechanism is shown in relation to a spring assembly machine disclosed in the aforesaid U.S. Pat. No. 3,090,407, as noted earlier. This machine is of the semiautomatic type in which the unattached coil springs are fed into the machine manually, each cycle of operation also being controlled by the operator.

Referring to FIG. 1, the spring unit 1 constitutes a spring mattress comprising rows of coil springs 2 joined together at top and bottom by helical wires 3 at top and bottom. The spring mattress is bound on all four sides by upper and lower border wires (not shown). Each coil spring, as viewed in its upright position from the edge of the spring mattress (not shown) is generally of hour-glass shape with enlarged, generally circular terminals 4 at top and bottom which lie in common horizontal planes and delineate the top and bottom surface of the spring mattress.

Each terminal on diametrically opposite sides, includes complementary straight offset portions 5 and 6. As seen in FIGS. 1 and 4, the shorter offset portions 5 of one row of terminals overlie in contiguous relationship, the longer offset portions 6 of an adjoining row of assembled springs in order to facilitate lacing of the helical wire 3 upon the mating offsets to hingedly join the rows to one another.

The helicals are laced concurrently upon the mating offsets 5 and 6 at top and bottom transversely of the spring unit, each helical being applied by upper and lower feeder mechanism, as described later, which apply the helical by rotating it in corkscrew fashion upon the mating offsets 5 and 6 of the terminals 4 (FIG. 1). The helical 3 is applied to the mating offsets of the assembled spring unit after each row of unattached coil springs is fed into the receiving portion of the machine.

The spring mattress 1 is thus fabricated in stepwise progression, the assembled spring unit being indexed rearwardly after the application of each helical at top and bottom, followed by the introduction of the unattached row of coil springs into the receiving side of the machine. This operation is carried out successively until the full width of the spring unit is assembled.

After both helicals 3 are rotated and laced by corkscrew rotation, the opposite end portions 7 of the helical are severed adjacent the offsets 5 and 6 at opposite sides of the mattress, as indicated generally in FIG. 4. A loop or pigtail 8 (FIG. 1) is then formed in the helical at the offsets 5 and 6 of the terminals in a position inset with respect to the marginal confines of the spring mattress, as delineated by the terminals 4 at top and bottom. The loop 8 locks the helical longitudinally with respect to the coil springs to prevent displacement longitudinally. As noted earlier, the loop 8 being inset, lies within the confines of the spring mattress 1 so as to protect the ticking or other fabric covering which is applied to the spring mattress after assembly. Moreover, should the helical break after prolonged usage, the helical cannot back out since the loop 8 will simply advance partially about the terminal 4 which it encircles.

As explained later, the several operations of the assembly machine, such as introducing the unattached row of coil springs 2, lacing the upper and lower helicals 3 to join the unattached coil springs to the previously assembled row, and the indexing of the assembly rearwardly or carried out in sequence, either automatically or under the control of an operator. The operation of the helical wire shearing and twisting units 23 is controlled, in the present example, by means of electrodes 28 which are contacted by the leading end portion 7 of each helical as the threading or lacing operation is completed. The electrodes are interconnected with an electrical circuit which initiates the shearing and looping operations at the leading and trailing ends of both upper and lower helicals independently. The assembly machine thereafter is conditioned to repeat the cycle, whereby the next successive row of unattached coil springs is joined to the spring mattress assembly in the same manner.

Spring Assembly Machine (Structure and Operation)

The following brief description of a spring assembly machine U.S. Pat. No. 3,090,407) is presented herewith in order to facilitate an understanding of the shearing and twisting mechanisms, also referred to as "forming units."

Referring to FIGS. 2 and 3, the assembly machine comprises a frame 10 supported upon legs 11 at an elevation convenient to the operator. The forward portion of the machine, which is presented to the operator, comprises a spring-receiving section indicated generally at 12, constituting a series of converging throats for receiving the unattached row of coil springs 2 which are to be joined to the spring mattress by the helical wires 3 at top and bottom, as noted earlier. The spring-receiving section 12 includes respective pairs of inclined skid plates 13 for the reception of the upper and lower terminals 4 of the unattached coil springs. The skid plates 13 form inwardly converging throats leading to upper and lower pairs of positioning jaws or blocks 14 and 15, the skid plates and positioning jaws being mounted in pairs one above the other for vertical reciprocation. These components are also called "spring guides" in this specification.

In operating the machine, the spring guides are shifted to an intermediate loading position, in which position the individual unattached coil springs are forced by hand into the converging throats delineated by the inclined skid plates 13. The intermediate or loading position is shown in FIGS. 2 and 3 for insertion of the unattached coil springs.

In the machine illustrated generally in FIG. 2, the upper and lower composite mounting bars 20, which are mounted for vertical motion, are shifted to their several positions by power cylinders interconnected with the control system (not shown). The several components carried by the composite mounting bars, including the shearing and forming units 23, are thus

shifted in unison to the several positions assumed by the bars 20 during an operating cycle.

As the coil springs are fully inserted between the skid plates 13—13, the offset portions 5 of the terminals 4 snap into the open throats 16 delineated by the respective pairs of positioning jaws at top and bottom (FIG. 4,) and into registry with the offsets 6 of the assembled row.

After having been guided and compressed by the converging skid plates 13 and with the offsets 5 of the unattached coil springs in mating relationship with the offsets 6 of the mattress assembly, the upper and lower skid plates 13 and positioning jaws 14 and 15 are shifted from the loading positions (FIGS. 2 and 3) toward one another to a locking position thereby the guides and positioning jaws further compress the mating offsets of the coil springs.

As viewed in FIG. 4 and 5, the throats 16, delineated by the adjacent faces of the positioning jaws at top and bottom, are provided with vertical serrations or teeth 17 which are staggered with respect to one another to provide a sinuous path for guiding the helical wires 3—3. The spacing of the teeth 17 is equal to the lead of the helical so as to provide positive advancement in corkscrew fashion as the wires are rotated. As best shown in FIGS. 4 and 5, the opposed positioning jaws are clamped in a slot 18 delineated by respective upper and lower composite mounting bars 20—20. The converging skid plates 13 are also mounted in the space 18 provided by the mounting bars 20—20.

After the spring guides (skid plates and positioning jaws) are shifted from the intermediate or loading position to the locking position (not shown), the coil springs are compressed further. At this point, respective upper and lower helical feeders, indicated generally at 21, and which include sets of rollers 22, are energized to rotate and feed the helical wires transversely across the mating offsets 5 and 6 of the coil springs.

As each helical has been laced in position, its leading end projects beyond the newly joined row of coil springs at the right end of the spring mattress (FIG. 3), the end contacts and electrode 28 completes an electrical circuit, which in turn energizes the upper and lower shearing and forming mechanisms or forming units, indicated generally at 23, located at the right and left sides of the machine. The mechanisms 23 are operated upon completion of the circuit so as to shear and twist the loop 8 at both ends of the upper and lower helicals, as described later.

After completion of the trimming and forming operation with respect to the upper and lower helicals 3, the upper and lower mounting bars 20—20 are shifted outwardly with respect to one another to the retracted position to release the offsets 5 and 6, which are now joined by the helicals 3. Upon retraction, the springs guides are disengaged from the upper and lower helicals by operation of upper and lower stationary strippers 24—24 (FIG. 3).

The upper and lower strippers 24, as seen in FIG. 3, are located between the sets of skid plates 13 and positioning jaws 14 and 15, and are carried by stationary upper and lower strippers bars 25—25. The strippers 24 are designed to coact with the skid plates and positioning jaws to delineate a continuous helical passageway, the strippers including rearwardly facing yokes 26 in horizontal alignment with the skid plate and positioning jaws to guide the upper and lower helicals 3 in the loading position of the machine.

The upper and lower stripper bars 25 are held in their normal position by a tension spring 27 (FIG. 3) having opposite ends connected to the stripper bars. The arrangement is such that the strippers may be sprung to a disengaged position to prevent injury to an operator, and also to prevent breakage of parts in case the machine is jammed.

After the upper and lower positioning jaws have been shifted outwardly to the retracted position, the newly threaded helical wires 3 and mating portions of the coil springs are confined within the yokes 26 of the strippers, the yokes having open sides facing inwardly toward the machine. At this point an indexing mechanism (not shown) advances and engages the upper and lower helicals 3 then shifts the spring mattress assembly rearwardly across a support surface forming a part of the machine. This operation draws the newly joined row of coil springs through the spring-receiving section 12 to a position to be joined to a new row of unattached coil springs during the next cycle of operation.

During an operating cycle, the several components of the spring assembly machine are shifted by power, in the present example, under control of an operator, although the cycle may be carried out in an automatic manner in fully automatic machines.

In summary, the mounting bars 20 and spring-receiving section 12 reside in the first or intermediate loading position for receiving the unattached coil springs. Thereafter the mounting bars 20 are shifted toward one another to the second or locking position to further compress the adjoining coil springs and to hold the offsets 5 and 6 securely in mating position within the throats of the positioning jaws for the reception of the helicals. At this point, the feeders 21 rotate the upper and lower helicals 3 so as to advance and thread the helicals upon the mating offsets, as indicated in FIG. 4.

When the loading ends of the upper and lower helicals contact the electrode or switch poles 28—28 (FIG. 4) the electrical circuit (not shown) activates the shearing and forming mechanism 23, as noted earlier, to shear the opposite end portions of the helical to the proper length, and to form or twist the loops 8 about the terminals (FIG. 11).

After the shearing and forming operation has been carried out, the mounting bars 20—20 and their spring guides are shifted apart from one another to the third or retracted position, whereby the position jaws are disengaged from the helical, leaving the newly laced helicals 3—3 and offset portions 5 and 6 of the coil springs confined within the yokes 26—26 of the strippers 24.

With the spring guides thus retracted to the disengaged position, an indexing mechanism advances and engages the upper and lower helicals so as to shift the spring mattress unit 1 rearwardly of the machine, thus ending the cycle.

Helical Shearing and Twisting Mechanism Generally

As noted earlier, the shearing and twisting mechanism or forming units 23 of the invention are mounted in pairs at opposite end portions of the upper and lower composite mounting bars 20 for reciprocation with the components of the spring-receiving section 12 during operation of the machine. The forming units 23 are duplicates of one another except for their right and left hand relationship at the opposite ends of mounting bars 20.

As shown generally in FIG. 2, the left hand forming units 23, which act upon the trailing upstream ends of the helicals, are mounted in advance of the feeders 21—21 so as to act upon the end portion of the helicals 3 after they issue from the feeders. The forming units at the right hand end are both equipped with the electrodes 28. Thus the leading end portion 7 of the upper helical, upon contacting electrode 28, activates both upper units 23, while the electrode 28 of the lower right hand unit activates both lower units 23 upon being actuated by the leading end portion 7 of the lower helical.

Since the four shearing and forming units 23 are duplicates of one another except for the reversal of the positions, the detailed description (presented later) is confined to the left hand lower unit, as shown in FIGS. 5–13.

As shown in FIGS. 4 and 5, each composite mounting bar 20 comprises a pair of spaced parallel rails 30—30 between which the opposed pairs of lower positioning jaws 15 are confined and secured.

The upper jaws 14 are mounted on the upper bar 20 in the same manner. Each shearing and forming unit 23 comprises a mounting block, indicated generally at 31, having a foot portion 32 (FIG. 3) fitted between the spaced rails 30—30 (mounting bar 20) adjacent the endwise set of positioning

jaws at the left and right hand end portions of the mounting bars 20—20. The opposite ends of each foot portion 32 includes longitudinal slots 33—33 traversed by screws 34 which pass through the rails 30—30 and through the slots 33—33 to clamp the mounting block 31 of the unit 23 in an adjusted position. The mounting blocks 31 each includes a shoulder 35 at opposite sides resting upon the upper edges of the rails 30—30 to position the mounting block 31 vertically relative to the composite mounting bar 20.

Each mounting block 31 includes a bearing block 36 (FIGS. 2 and 3) secured to and projecting from the respective mounting blocks 31. Thus the mounting blocks for the lower shearing units 23 project downwardly from the mounting blocks 31 while the bearing blocks 36 of the upper units 32 project upwardly (FIG. 2). The bearing block 36 in each case, is attached to the composite mounting rail 20 and provides a bearing for the outwardly extended portion of a rock shaft 37. The opposite end portion of each rock shaft 37 is journaled in the mounting block 31 and is in driving connection with the operating parts of the shearing and forming units, as explained later. The lower end of rock shaft 37 projects outwardly beyond the bearing block 36.

To activate the forming units, each includes a pinion 38 keyed to the projecting portion of the rock shaft 37 and driven by a rack 40 (FIG. 3). The rack is connected to the reciprocating piston rod of a power cylinder 41. The power cylinder is connected to the frame of the machine by the brackets 42—42. The cylinder 41 is energized through the electrical circuit in which the electrodes 28 are interconnected.

In order to properly align the rock shaft 37 with the bearings of the mounting block 31 and bearing block 36, each bearing block 36 includes a longitudinal slot 43 traversed by bolts 44 which are threaded into the composite mounting block 20. This arrangement permits the bearing block 36 to be shifted longitudinally in accordance with the position of the mounting block 31, as provided by the slots 33 of foot portion 32.

The mounting block 31, including its foot portion 32, is of one-piece construction machined to provide an interchangeable unit, as noted earlier. Thus, the blocks are mounted on the left and right hand ends of the upper and lower mounting bars 20-20 simply by reversing their position end-for-end at opposite ends of the mounting bars. This relationship is best shown in FIG. 4. In addition to the reversal of positions, the relationship of the endwise sets of positioning jaws is reversed to adapt the forming units to right or left hand installation.

As noted earlier, the detailed description of the forming unit with reference to FIGS. 5–12 is limited to the lower left hand unit 23 and applies to all four of the units.

Shearing and Twisting Components

Described with reference to the lower left unit 23 (FIGS. 5–13), the head portion 45 of mounting block 31, which projects above the mounting bar 20, includes a relatively narrow tailpiece 46 (FIG. 5) rising from the foot portion 32 and delineated by the shoulders 47 and 48. The endwise positioning jaws 15 seat upon opposite sides of tailpiece 46 and against the shoulders 47 and 48, the outer sides of the jaws being substantially flush with the opposite sides of the head portion 45.

Rising upwardly from the upper surface 50 of the head portion 45 is a slide block 51 disposed at an angle to the throat 16 of positioning jaws 51 and having a slideway 52 (FIG. 13). A shearing knife, indicated generally at 53, is mounted for reciprocation within the slideway 52 relative to a rotary shearing and forming head 54 which is mounted upon the upper end of rock shaft 37, previously mentioned. The shearing end of the knife 53 resides immediately above the upper surface of rotary shearing head 54 (FIG. 6) to carry out the shearing operation, as explained later.

The side of the angular slide block 51, opposite slideway 52, overhangs the upper surface 50 of head 45, the overhang being delineated by a guide passageway 55 machined into the head 45. The innner surface of guide slot 55 is semicircular in cross section as at 56. The guide passageway 55 is delineated in part by the upper surface 50 of head 45 and the passageway 55 is aligned with the throat 16 of the positioning jaws 15.

The dimension of the passageway 55 is slightly greater than the diameter of the helical 3. Thus the helical threads its way in a straight line through the sinuous passageway of the throat 16 and through passageway 55. It will be noted that the rotary shearing head 54 and the coacting shearing blade 53 are located between the throat 16 and guide passageway 55 in a position to carry out the shearing and twisting operation in this area, as explained later.

As viewed in FIG. 13, slideway 52 comprises a longitudinal groove machined in the upper surface of slide block 51, The end portion of slideway 52 is slotted longitudinally as at 57 and a lug 58 projects upwardly from a yoke piece, indicated generally at 60. The yoke piece is reciprocated by a cam lug forming a part of the rotary shearing head 54, as described later.

The shearing knife 53 includes a lateral notch 61 (FIG. 13) interfitting the lug 58 of yoke piece 60. The arrangement is such that the lug 58 traverses the slot 57 in response to the rotary movements of the shearing head and cam lug to reciprocate the yoke piece 60 and shearing knife 53.

In assembly (FIGS. 5, 6 and 13) the open top of the slideway 52 is closed off by a detachable cover plate 62 to confine the shearing knife 53 within the slideway 52 for sliding motion in response to the reciprocation of lug 58 to which the knife is connected. The free edge portion of cover 62 interfits a longitudinal groove 63 (FIG. 13) formed in one side of slideway 52. The cover includes along its opposite edge portion, a right angular flange 64, the lower edge of which includes an inturned lip 65. Lip 65 interfits a groove (not shown) which is right angular in cross section, extending longitudinally along the slide block 51. The removable cover plate 62 is held in assembled position in the slide block 51 by a screw (not shown) passing through the right angular flange into the slide block.

Shearing Head

The rotary shearing head, indicated generally at 54, is mounted at the upper end of the rock shaft 37, as previously noted. The upper end of rock shaft 37 is journaled in a bushing 68 (FIG. 6) fitted within the head portion 45 of the mounting block 31. The lower end of rock shaft 37 immediately above pinion 38 (FIG. 3) is journaled in a similar bushing (not shown) carried by the bearing block 36.

The shearing and forming head 54 proper, includes a cam lobe 70 residing in a recess 71 formed in the upper surface of head portion 45 between the positioning jaws and the slide block 51 (FIGS. 3, 6 and 13). The yoke piece, previously indicated at 60, also resides within the recess 71. The shearing head 54 extends above the cam lobe 70 and is generally cylindrical as viewed from above FIGS. 5 and 13). The shearing head 54 includes a shearing slot 72 extending diametrically across its diameter.

The depth of slot 72 is equal to approximately one-half the diameter of helical 3. The rotary head 54, during the application of the helicals, resides in the staring position with the slot 72 disposed at the angle shown (FIG. 5), which is approximately equal to the lead of the helical. Therefore, as the rotating helical threads its way in corkscrew fashion through the throat 16 of the positioning jaws, it naturally threads its way through the slot. The opposite end portions of the slot 72 are provided with diagonally located recesses 73 and 74 extending vertically of the slot and receiving the convolution of the helical 3 as shown in FIG. 13. The outer edge of slot 73 provides a shearing edge coacting with the shearing knife 53 as explained later. The periphery of the shearing head at right angles to the slot, includes a third clearance recess 75 for the advancing helical 3.

The shearing head 54 includes an external flange 76 which is generally circular, extending upwardly from the surface of

cam lobe 70 and terminating approximately in alignment with the shearing recess 73 (FIG. 13). The upper surface of flange 76 includes an upwardly inclined camming surface 77, which in the normal position shown (FIGS. 5 and 13), provides clearance for the convolution of the helical passing through the slot.

During the rotary movement of head 54, the inclined camming surface 77 acts upon the helical to force it upwardly from the slot 72 for positioning the loop 8 relative to the offsets 5 an 6, as described later. After the loop 8 is formed at the opposite marginal sides of the spring mattress and released from the slot, the upper and lower mounting bars 20 are shifted from the locking position outwardly for the next cycle.

The arrangement of the components, as shown in FIGS. 5–13, represents the lower left hand unit, as noted. The helical shown, therefore issues from the helical feeder 21 at the upstream end of the machine, advancing from the lower feeder 21, through guide passageway 55, then through the slot 72 to the throat 16 of the positioning jaws. The teeth 17 of throat 16 thus advances the helical in a positive manner as it is rotated by the feeder.

The arrangement at the downstream or right hand end of the mounting bar 20 is similar, but as noted earlier, reversed in position. Therefore, the leading portion of the helical advances through the several throats delineated by the positioning jaws then naturally threads itself through the slot 72 of downstream head 54, then through the guide passageway 55 to contact the electrode 28 and signal the end of the feeding cycle for the lower helical.

It will be understood that after the shearing and twisting or forming cycle (loop 8), with the sheared loop disengaged from the slot 72 of the shearing head 54, the head 54 is rotated back to the starting position (power cylinder 41, rack 40 and pinion 38) for the next cycle of operation, as shown in FIG. 5.

Yoke Piece and Shearing Knife

As noted earlier, the yoke piece 60 is reciprocated in response to the rocking movements of the rock shaft 37 and shearing head 54 by operation of the cam lobe 70. The yoke piece 60, as noted, reciprocates the shearing knife 53 in time with the rotary movement of the shearing head so as to sever the end portion of the helical prior to the formation of the loop 8.

Described in detail (FIGS. 5–13), the yoke piece is of one-piece construction and normally dwells in the starting position (FIG. 5) in which the cross slot 72 of shearing head 54 is positioned to receive the advancing helical. The recess 71 (FIG. 3) within which the cam lobe 70 is confined, provides clearance for the reciprocating movements which are imparted to a U-shaped yoke 80 of yoke piece 60 during the rocking motion of the shearing head 54.

Yoke piece 60 includes a knife-actuating slide 83 rising from yoke 80, the slide being disposed in the longitudinal slot 57 of head portion 45, as described earlier (FIG. 13). The lug 58 rises above the slide 83 to engage the notch 61 of the shearing knife, the notch 61 having been previously described. The yoke 80 in the starting position (FIG. 13) embraces the cam lobe 70 on one side, while the opposite side of the yoke embraces the cylindrical shearing head 54.

During rotary motion of shearing head 54 through an angle of approximately 180°, cam lobe 70 rotates from the position of FIG. 5 to the position of FIG. 10, as indicated, at which point the lobe projects outwardly beyond the open throat 84 of U-shaped yoke 80. Thus, the yoke piece 60 and shearing knife 53 dwell in the stationary position. After clearing the open side or throat 84 of yoke 80, cam lobe 70 engages the opposite side of the yoke and cams the sliding yoke piece 60 in the direction indicated by the arrow in FIG. 11.

During the initial turning motion, with the knife stationary, the shearing and forming head first shears off the excess portion of helical 3 which extends beyond the shearing and forming unit 23. Thereafter, the yoke piece 60 is retracted (FIG. 11) to withdraw the shearing knife 53 while the sheared end portion of the helical is twisted to form the loop 8.

The shearing knife, previously indicated at 53, is generally rectangular and interfits the slot 52 of slide block 51 for reciprocating motion (FIG. 13). As viewed in FIGS. 6 and 8, in its normal position, the knife overlies the top surface 85 of the head 54. The forward portion of the shearing knife 53, which overlies the top surface 85 of head 54, includes a transverse slot 86 delineating a downwardly projecting shear finger 87, the surface of which contacts the top surface 85 so as to coact with the top surface during the shearing action.

In the normal position of the parts, the knife 53 occupies the position of FIGS. 5 and 6, with the shear finger 87 engaging the upper surface 85 of the head 54. As the convolution of the advancing helical passes through cross slot 72 of head 54, the transverse knife 86 coacts with the cross slot 72 to provide clearance for the helical (FIG. 6). As shown in this view, the knife 53 includes a chamfer 88 to permit the helical to pass beneath the knife and through the guide passageway 55 formed in the head portion 45 of mounting block 31. The knife 53 dwells in the extended guide position with respect to the helical until the electrode 28 is contacted to signal the end of the lacing cycle.

At the end of the helical feeding or lacing cycle, the shearing head 54 begins its rotary motion in the direction indicated by the arrow in FIG. 7. During the initial portion of the rotary motion, the shearing knife 53 dwells in stationary position overhanging the slot as shown in FIGS. 7 and 8, whereby the helical is sheared by the coaction between the shearing recess 73 (of slot 72) and the shearing edge of the extended finger 87.

It will be observed in FIGS. 6 and 8 that the shear finger 87 is located beyond the cross slot 72 in the shearing direction of rotation of head 54. Accordingly, the shearing force exerted by the shearing edge of recess 73 against the coacting shearing edge of finger 87 reacts outwardly, tending to pull the shearing knife 53 from its slideway 52. However, by virtue of the engagement of lug 58 of yoke piece 60 with the notch 61 of the knife, the yoke piece resists this force during the shearing operation.

After the shearing edges act upon the helical (FIGS. 7, 8 and 9) and with head 54 rotating in the direction indicated by the arrow in FIG. 7 (with knife 53 extended in its stationary dwell position) the cam lobe will have passed across the open throat 84 of yoke 80 so as to shift the yoke piece 60 and shearing blade or knife 53 to the retracted position shown in FIG. 11. During this portion of the rocking motion of head 54, the end portion of the sheared convolution (engaged in head cross slot 72) is twisted to from the loop 8 closely adjacent the offsets 5 and 6. The end portion 91 of the loop, at the same time, is slightly bent by recess 73 to cause its end to face the offset 6 of the terminal 4 at the end of the twisting operation (FIGS. 1 and 11).

During the formation of loop 8, the upwardly inclined camming surface 77 of head 54 is effective to act upon the helical 3 to force it about the offset 6 before completion of the twisting cycle. The camming surface 77 also tends to force the twisted loop from the cross slot 72 of head 54 for indexing rearwardly for the next cycle. It will be noted at this point (FIG. 1), that the offset 6 of the coil spring shields the free end 91 of loop 8 so as to prevent it from interfering with the ticking or fabric covering which is later applied about the spring unit.

As best shown in FIGS. 6 and 13, the shearing blade or knife 53 is reversible so as to provide shearing edges at opposite ends. In other words, if one end becomes worn, the cover plate 62 may be removed and the knife 53 turned end-for-end to present a new shearing edge.

For this purpose, the knife is of duplicate configuration at opposite ends, with a second shear finger 87 at the rearward end projecting upwardly relative to the slideway 52. The opposite ends are identical but are symmetrically opposite to one another. This arrangement permits convenient renewal of the

shearing edge. After both shear fingers **87** have become worn due to prolonged service, then the knife **53** may be sharpened or replaced by a new one.

OPERATION

In summary, each operating cycle of the spring assembly machine, in the present example, is initiated when the leading ends **7** of the upper and lower helicals **3** make contact with the electrodes **28** at the downstream end of the machine. The electrodes at this point, transmit a signal to the electrical control circuit to stop the operation of the feeders **21** and to energize the upper and lower forming units **23** so as to trim and twist the loop at opposite ends of the upper and lower helical.

The electrodes **28** are electrically insulated from the machine frame by the di-electric bushings **92** (FIG. **4**) mounted in the upper and lower mounting blocks **31** at the downstream or right hand end of the machine. Thus, as shown in FIG. **4**, the leading end **7** of the helical **3**, after it is laced upon the offsets, passes beyond the end of the spring mattress and contacts the electrode to complete a control circuit. As noted earlier, the same shearing and twisting action is carried out concurrently at opposite ends of a given helical. Since there may be a time differential between the rate of advancement of the upper and lower helicals, the upper and lower units **23** are both provided with electrodes **28** and are arranged to operate independently. When the units **23** have been thus activated, the control circuit causes the heads **54** to be rotated back to the starting position and the machine is conditioned for the next cycle of operation.

After the forming units **23** have been activated by the upper and lower electrodes **28**, the loops **8** have been urged upwardly relative to the cross slots **72** of the shearing head by the camming surface **77** (FIG. **13**) of the shearing heads **54**. At this point, the upper and lower composite mounting bars **20** shift outwardly from the locking position to the retracted position, whereby the positioning jaws are disengaged from the helicals and from the offsets of the coil springs for indexing the assembled spring mattress rearwardly for the application of the next row of helicals.

As noted earlier, the looped portion **8** of the helical at opposite ends partially encircle the longer offsets **6** of the coil springs at the juncture of the offset with the circular terminal **4** of the coil spring, whereby the severed end is twisted toward the coil spring to protect the ticking, padding or other material which may close the spring mattress assembly. It will be seen (FIG. **1**) that the looped ends **8** are inset with respect to the marginal coil springs of the mattress so that normally there is no interference with the mattress covering by the looped ends **8** of the helical **3**.

However, in the event that the helical **3** should break at some intermediate point along its length, then the separated end portions normally would be free to unthread themselves from the endwise coil springs of the mattress assembly. Since the loop **8** at opposite ends, in the present instance, encircles the offsets and terminals of the coil springs, the broken portions of the helical cannot be unthreaded. In other words, the looped end **8**, in such cases, simply threads its way about the terminal **4** as indicated at **94** in FIG. **1**, so as to lock the helical in place and prevent damage to the spring mattress covering.

Having described my invention, I claim:

1. A helical shearing and twisting mechanism for a spring assembly machine adapted to rotate and thread a helical wire proper about mating portions of coil springs in row formation, thereby to join the rows of coil springs to one another to form a spring mattress having marginal portions delineated by edgewise coil springs, said shearing and twisting mechanism comprising

a mounting member secured to the spring assembly machine adjacent the edgewise mating coil springs which delineate a marginal portion of the spring mattress;

a shearing head journaled in the mounting member for rotary motion in forward and reverse directions relative to the mounting member;

the said shearing head including an outer end surface having an open slot formed therein, said slot including a shearing edge;

said shearing head normally residing in a receiving position with said slot disposed at an angle corresponding to the lead of the helical wire and arranged to receive and confine an endwise portion of the helical wire projecting beyond the edgewise coil springs with a portion thereof projecting beyond the slot;

a reciprocating, normally extended, shearing knife slideably carried by the mounting member and having a shearing edge coacting with the shearing edge of the slot for shearing the end portion of the helical wire proper which projects beyond the slot;

means for rotating the shearing head in a direction to shear the helical wire between the edge of the shearing knife and shearing edge of the slot of the shearing head;

and means interconnecting the shearing knife and shearing head for shifting the outer end of the knife clear of the slot of the shearing head after the end portion of the helical wire proper is sheared;

said shearing head arranged to continue said rotary motion after the shearing knife is shifted clear of the slot, thereby to twist the sheared portion of the helical toward the helical proper in a direction to form a loop which encircles at least one of said mating portions of the edgewise coil springs, thereby to lock the helical wire to the edgewise coil springs.

2. A shearing and twisting mechanism as set forth in claim **1** in which the shearing head includes a camming surface located inwardly from the outer end surface of the shearing head, said camming surface rotatable with the shearing head and arranged to engage the helical wire proper adjacent the sheared end thereof to force the same outwardly of the slot of the shearing head as the loop is formed by the slot during continued rotary motion of the shearing head.

3. A shearing and twisting mechanism as set forth in claim **1** in which the slot of the shearing head has a depth extending inwardly from the outer end surface of the shearing head for a distance equal to at least one-half the diameter of the helical wire whereby the portion of the helical wire, which is confined in the slot after shearing, is twisted toward the helical wire proper to form the said loop.

4. A shearing and twisting mechanism as set forth in claim **1** in which the shearing head has a flat outer end surface disposed at right angles to the axis of rotary motion of the shearing head and in which the means interconnecting the shearing knife and shearing head provides a dwell period during which the shearing knife is shifted to a stationary position while said coacting shearing edges act upon the helical wire to shear the same and thereafter to shift the shearing knife to a position clear of the slot to provide clearance for forcing the helical wire from the slot as the said loop is formed by the slot during continued rotation of the shearing head.

5. A shearing and twisting mechanism as set forth in claim **1** in which the shearing head has a flat outer end surface disposed at right angles to the axis of rotary motion of the shearing head and in which the means interconnecting the shearing knife and shearing head provides a dwell period during which the shearing knife is shifted to a stationary position while said coacting shearing edges act upon the helical wire to shear the same and thereafter to shift the shearing knife to a position clear of the slot to provide clearance for forcing the helical wire from the slot as the said loop is formed by the slot during continued rotation of the shearing head, the shearing head including an outwardly inclined camming surface rotatable with the head and arranged to engage the helical wire proper adjacent the sheared end thereof to force the same outwardly from the slot of the head as the said loop is formed.

6. A shearing and twisting mechanism as set forth in claim **1** in which the shearing head has a flat outer end surface disposed at right angles to the axis of rotary motion of the shearing head and in which the shearing knife includes a portion spaced from the said outer end surface, said portion in-

cluding a shear finger contacting the flat outer end surface and having a shearing edge coacting with the shearing edge of the slot, the means interconnecting the shearing knife and shearing head providing a dwell period during which the shear finger resides in an extended stationary position overlying said slot of the shearing head during rotary motion of the head while said coacting shearing edges act upon the helical wire to shear the same, the interconnecting means thereafter shifting the shear finger to a retracted position relative to the slot to provide clearance for forcing the helical wire from the slot as the said loop is formed by the slot during continued rotation of the shearing head.

7. A shearing and twisting mechanism as set forth in claim 1 in which the shearing head has a flat outer end surface disposed at right angles to the axis of rotary motion of the shearing head and in which the shearing knife includes a portion spaced from the said outer end surface, said portion including a shear finger contacting the flat outer end surface and having a shearing edge coacting with the shearing edge of the slot, the means interconnecting the shearing knife and shearing head providing a dwell period during which the shear finger resides in an extended stationary position overlying said slot of the shearing head during rotary motion of the head while said coacting shearing edges act upon the helical wire to shear the same, the interconnecting means thereafter shifting the shear finger to a retracted position relative to the slot to provide clearance for forcing the helical wire from the slot as the said loop is formed by the slot during continued rotation of the shearing head, the shearing head including an outwardly inclined camming surface rotatable with the head and arranged to engage the helical wire proper adjacent the sheared end thereof to force the same outwardly from the slot of the head as the said loop is formed.

8. A shearing and twisting mechanism as set forth in claim 1 in which the shearing head includes a cam lobe rotatable there with and in which the means interconnecting the shearing knife and shearing head includes a shiftable yoke element associated with the cam lobe, said yoke element connected to the shearing knife for shifting the same, said cam lobe and yoke element providing a dwell period, whereby the knife remains in a stationary position while the end portion of the helical is sheared, the yoke element and cam lobe thereafter shifting the knife to a position clear of the slot of the shearing head during continued rotation of the shearing head.

9. A shearing and twisting mechanism as set forth in claim 1 in which the slot of the shearing head includes a recess formed at one side portion of the slot, said recess delineating the shearing edge which coacts with the shearing edge of the knife, whereby the sheared end portion of the helical is bent from the loop in a direction to cause the said sheared end to face the mating portion of the edgewise coil spring which is encircled by the loop.

10. A helical shearing and twisting mechanism for a spring assembly machine having guide means and being adapted to rotate and thread the convolutions of a helical wire proper about mating portions of the coil springs in row formation, thereby to join the coil spring together to form a spring mattress having marginal portions delineated by edgewise coil springs, said wire shearing and twisting mechanism comprising:

a mounting member secured upon an end portion of the assembly machine adjacent the edgewise mating coil springs which delineate a marginal portion of the spring mattress, the mating portions of said edgewise coil springs being confined in said guide means;

a shearing head journaled in the mounting member for rocking motion in forward and reverse direction;

said shearing head having a flat outer surface disposed at right angles to the axis of rotation of the head;

said flat outer surface including an open slot formed therein, the shearing head normally residing in a receiving position with the slot disposed at an angle corresponding to the lead of the helical wire, whereby the helical wire is threaded relative to the said guide means, the mating portions of the edgewise coil springs, and said slot;

said slot thereby adapted to confine a partial convolution of the helical wire proper, with the remainder rising above the flat outer surface of the head;

said slot having a shearing edge exposed at the flat outer surface of the shearing head;

a shearing knife having an end portion overlying the flat outer surface of he shearing head and mounted for reciprocation relative thereto;

the end portion of the knife which overhangs the end portion having a cross slot formed therein;

said cross slot of the shearing knife thereby providing clearance for the convolution of the helical confined in the slot of the shearing head and rising above the flat outer surface thereof;

the slot of the shearing knife delineating shear finger having an end in contact with the flat outer surface of the head at a point disposed between the cross slot and guide means and providing a shearing edge coacting with the shearing edge of the slot to sever the convolution of helical wire confined in said slot upon rotary movement of the shearing head;

means for rotating the shearing head in a direction to shear the end of said convolution between the coacting shearing edges of the head and shearing finger;

means interconnecting the head and shearing knife for shifting the knife toward a retracted position after the end portion of the helical is sheared, whereby the shear finger of the knife resides in a position displaced rearwardly of the slot of the shearing head;

said means arranged to continue the rotation of the head after retracting said knife, whereby the partial convolution confined in said slot is twisted during said continued rotation in said the same direction to form a closed loop;

said shearing and forming head being located in a position relative to the guide means to cause the said loop to encircle a portion of the edgewise coil spring at the marginal portion of the spring mattress, thereby to lock the helical against endwise displacement.

11. A shearing and twisting mechanism as set forth in claim 10 in which the guide means comprises a pair of spaced positioning jaws secured to the mounting member, said jaws delineating a throat for confining mating portions of the edgewise coil springs and providing a passageway for guiding the helical wire about said mating portions, said shearing and twisting head being journaled at a point adjacent the jaws, whereby the helical wire is threaded relative to the said throat, the mating portions of the edgewise coil springs, and the slot of the shearing head.

12. A shearing and twisting mechanism as set forth in claim 10 in which the guide means comprise a pair of spaced positioning jaws secured to the mounting member, said jaws delineating a throat having teeth forming a sinuous passageway for confining mating portions of the edgewise coil springs and for guiding the helical wire about said mating portions, said shearing and twisting head being journaled at a point adjacent the jaws, whereby the helical wire is threaded relative to the sinuous passageway delineated by said throat, the mating portions of the edgewise coil springs, and the slot of the shearing head.

13. A shearing and twisting mechanism as set forth in claim 10 in which the shearing head includes a cam lobe rotatable therewith and in which the means interconnecting the shearing knife and shearing head includes a shiftable yoke element associated with the cam lobe, said yoke element connected to the shearing knife for shifting the same, said cam lobe and yoke element providing a dwell period, whereby the knife remains in a stationary position with the end portion thereof overlying the flat outer surface of the head, while the end portion of the helical is sheared, the yoke element and cam lobe thereafter shifting the knife to a position clear of the slot of the shearing head during continued rotation of the shearing head.

14. A shearing and twisting mechanism as set forth in claim 10 in which the shearing head includes a cam lobe rotatable therewith and in which the means interconnecting the shearing knife and shearing head includes a shiftable yoke element associated with the cam lobe, said yoke element connected to the shearing knife for shifting the same, said cam lobe and yoke element providing a dwell period, whereby the knife remains in a stationary position with the end portion thereof overlying the flat outer surface of the head, while the end portion of the helical is sheared, the yoke element and cam lobe thereafter shifting the knife to a position clear of the slot of the shearing head during continued rotation of the shearing head, the shearing head including an outwardly inclined camming surface rotatable with the head and arranged to cam the helical wire upwardly toward a mating portion of the edgewise coil spring after the knife is shifted to said position clear of the slot.

15. A shearing and twisting mechanism as set forth in claim 10 in which the mounting member includes a slideway, the shearing knife being shiftably confined in the slideway for reciprocation, the shearing head including a cam lobe rotatable with the head, a yoke element associated with the cam lobe and connected to the shearing knife for reciprocation of the shearing knife, said cam lobe and yoke element providing a dwell period, whereby the knife remains in a stationary position with the end portion thereof overlying the flat outer surface of the head while the end portion of the helical is sheared, the yoke element and the cam lobe shifting the knife to a position clear of the slot during continued rotation of the shearing head.

16. A shearing and twisting mechanism as set forth in claim 10 in which the mounting member includes a slideway, a knife actuating slide member shiftably confined in the slideway for reciprocation, the shearing head including a cam lobe rotatable with the head, the slide member including a yoke element associated with the cam lobe for shifting the slide member in response to rotation of the shearing head and cam lobe, said shearing knife being confined in said slideway and connected to the slide for reciprocation with the slide, said cam lobe and yoke element providing a dwell period, whereby the knife remains in a stationary position with the end portion thereof overlying the flat outer surface of the head while the end portion of the helical is sheared the yoke element and cam lobe shifting the slide and knife to position clear of the slot during continued rotation of the shearing head.

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