June 24, 1958 C. H. GAIL 2,840,118

WIRE CRIMPING AND CUTTING MECHANISM FOR BED SPRING MACHINES

Original Filed Oct. 26, 1948 4 Sheets-Sheet 1

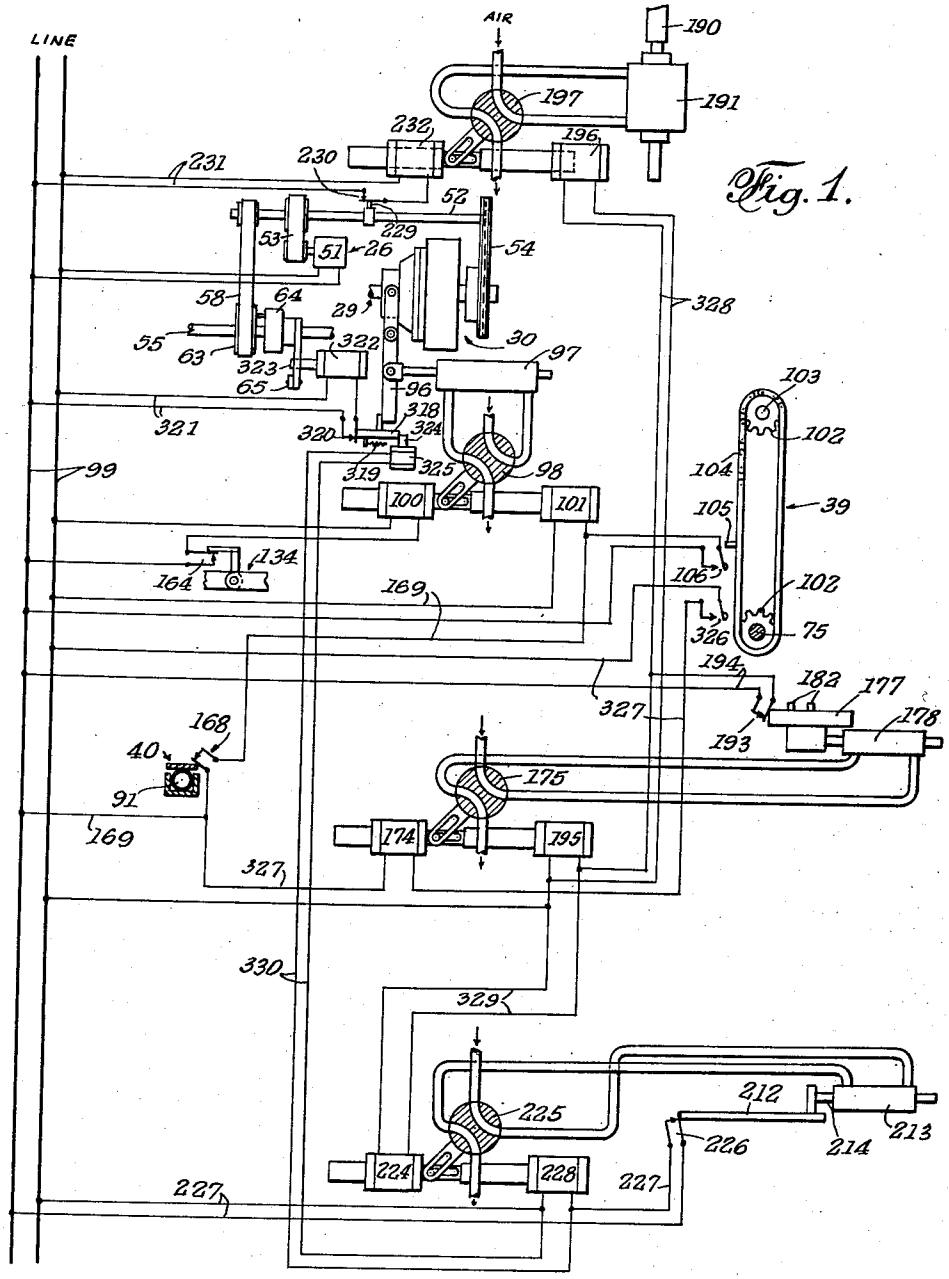


Fig. 1.

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Fig. 2.

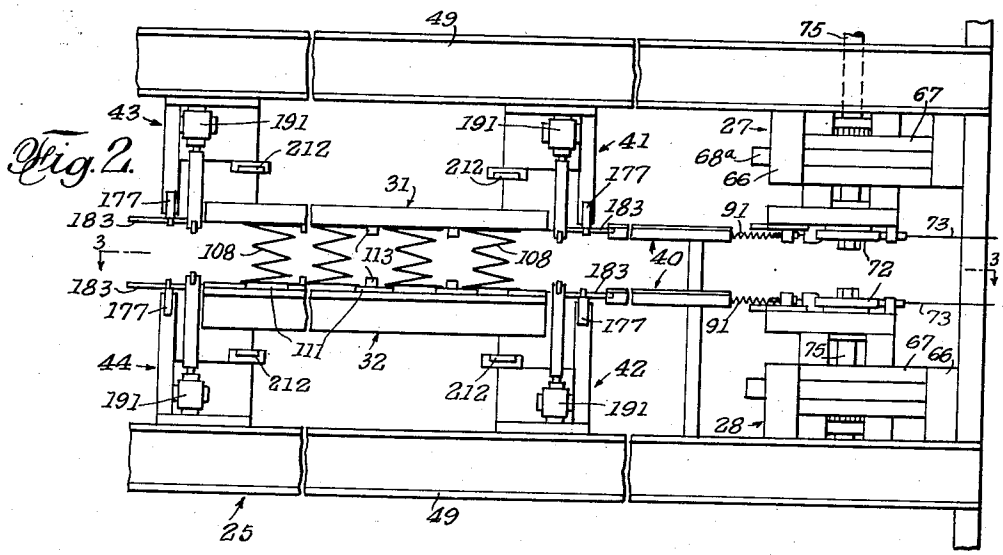
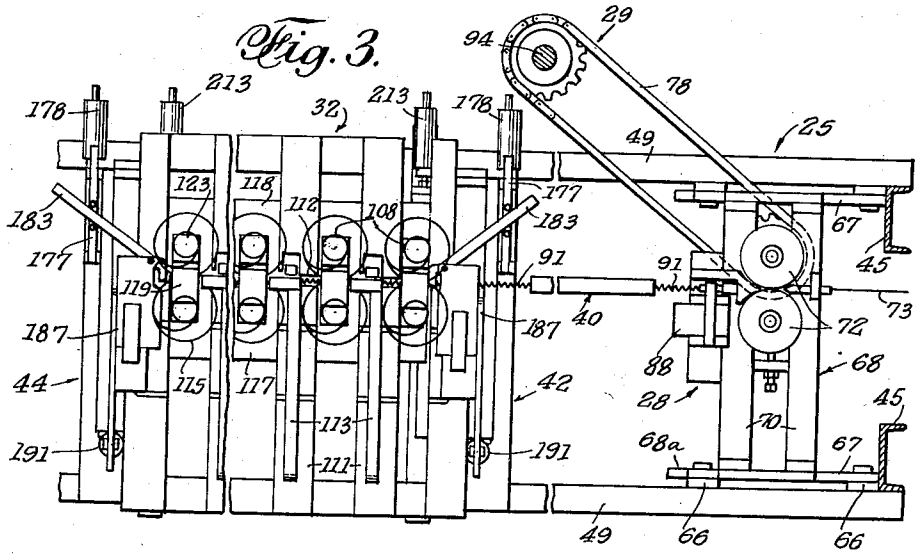


Fig. 3.



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Original Filed Oct. 26, 1948 4 Sheets-Sheet 3

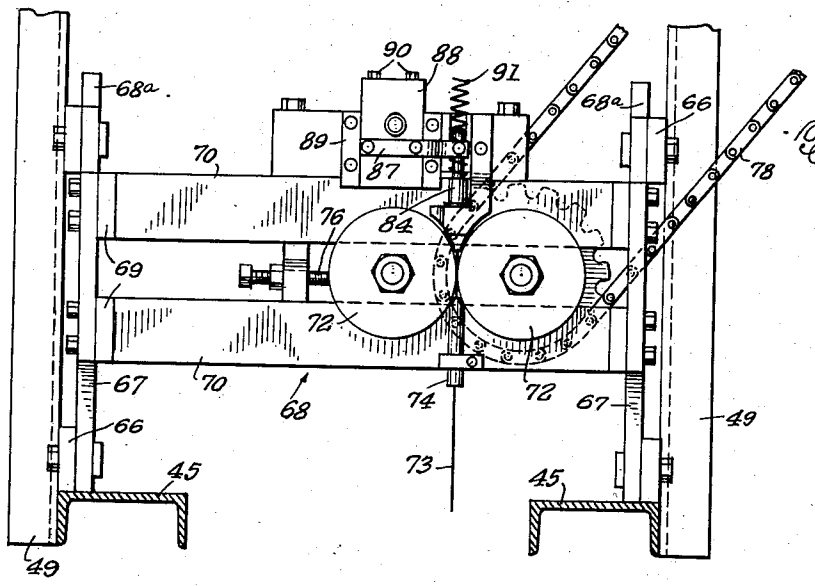


Fig. 4.

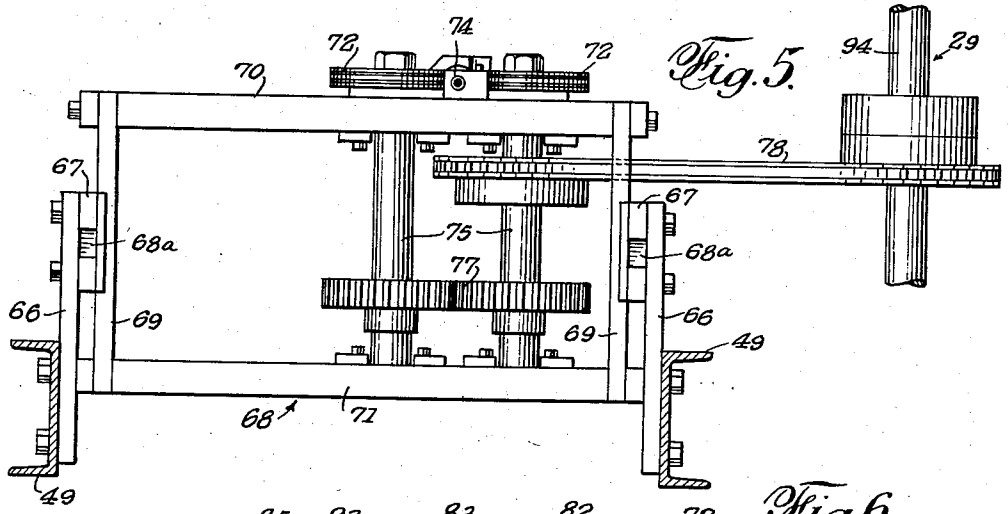


Fig. 5.

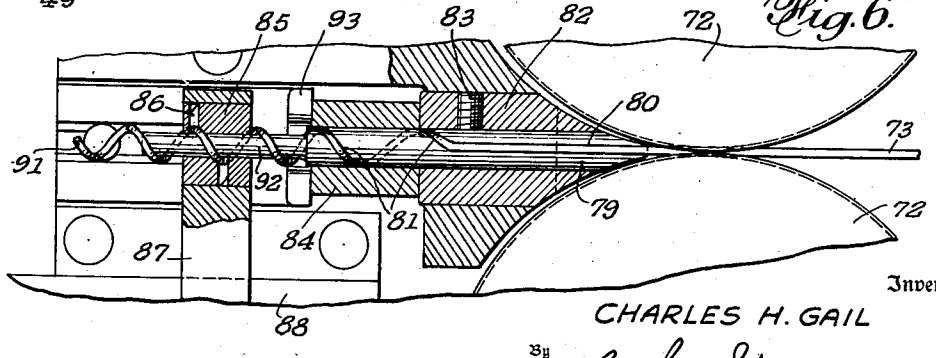


Fig. 6.

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WIRE CRIMPING AND CUTTING MECHANISM FOR BED SPRING MACHINES

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Fig. 9.

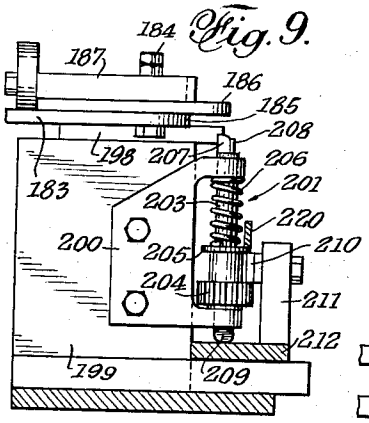


Fig. 10.

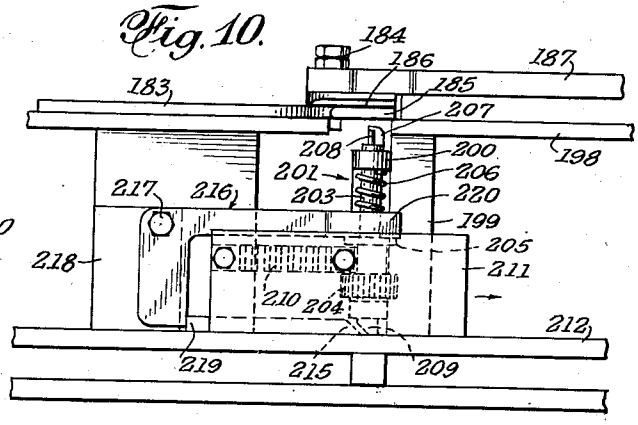


Fig. 7.

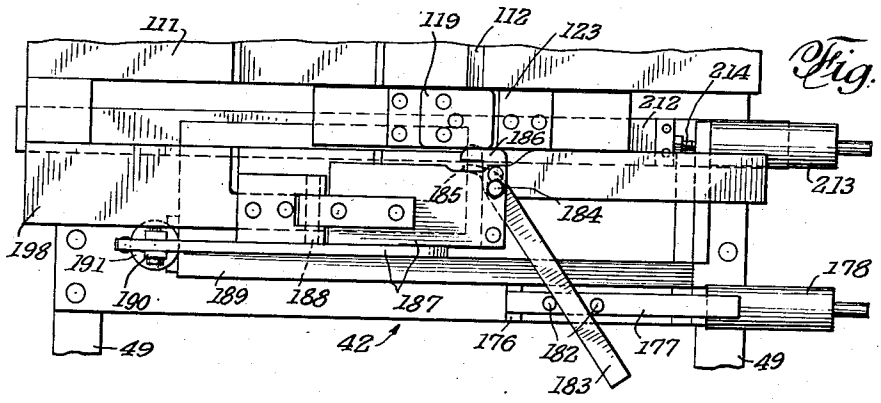


Fig. 8.

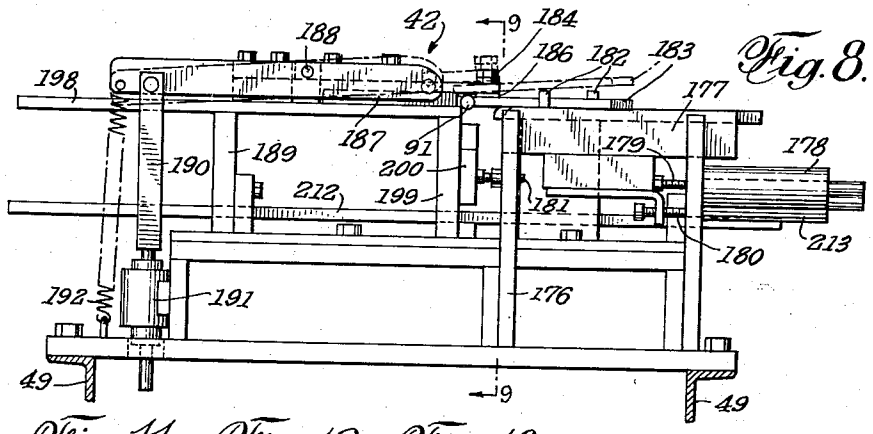


Fig. 11.

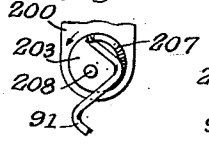


Fig. 12.

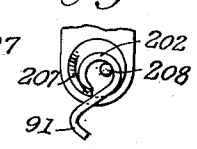
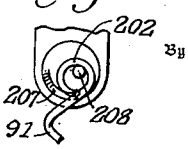


Fig. 13.



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2,840,118

WIRE CRIMPING AND CUTTING MECHANISM FOR BED SPRING MACHINES

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Original application October 26, 1948, Serial No. 56,635, now Patent No. 2,663,038, dated December 22, 1953. Divided and this application May 24, 1952, Serial No. 289,860

13 Claims. (Cl. 140—92.8)

This invention relates to mechanism for crimping wires to form helices, feed said helices to connect rows of spring coils, and cut and loop the ends of the helices. This application is a division of my pending application, Serial No. 56,635, filed October 26, 1948, now Patent No. 2,663,038, issued December 22, 1953.

The machine disclosed in said application depends on its efficient operation on the fact that any operative step performed thereby is instituted by means controlled by a step that has been properly completed. In other words, the machine sequentially performs a series of operative steps but each successive step is performed only if the step immediately preceding the same is completed.

An object of the present invention is to provide automatic means to form and feed helical connectors, to cut the ends of said connectors after they have connected side-by-side rows of spring coils, and to form closed loops on the ends of said connectors.

A further object of the invention is to provide means effective upon an abnormal condition in the feed of the helices to automatically stop their feed and thereby prevent undue fouling of the machine.

A further object of the invention is to provide a machine in which the feed of the helical connectors is controlled according to the length of the rows of spring coils connected thereby, said feed then automatically cutting off the helices, effecting release of the fixedly held rows and forming closed loops on the ends of the helices to obviate tearing of a fabric cover for the completed bed spring.

A still further object of the invention is to provide a machine of the character indicated in which the sequential operation is accomplished by mechanical means under the control of electro-pneumatic means, each operation, on completion, setting up the next operation to insure stoppage of the machine should any operation be improperly performed.

The invention also has for its objects to provide such means that are positive in operation, convenient in use, easily installed in a working position and easily disconnected therefrom, economical of manufacture, relatively simple, and of general superiority and serviceability.

The invention also comprises novel details of construction and novel combinations and arrangements of parts, which will more fully appear in the course of the following description. However, the drawings merely show and the following description merely describes one embodiment of the present invention, which is given by way of illustration or example only.

In the drawings, like reference characters designate similar parts in the several views.

Fig. 1 is a schematic view of the present wire crimping, feeding and cutting mechanism, arranged in diagram form to show the sequential performance of the successive operative steps.

Fig. 2 is a broken front elevational view of a bed spring machine embodying the present mechanism.

Fig. 3 is a plan sectional view as taken on line 3—3 of Fig. 2.

Fig. 4 is an enlarged plan view of the lower of two similar helix-forming and feeding units, the same being shown at the right hand end of Figs. 1 and 2.

Fig. 5 is an end elevational view of Fig. 4.

Fig. 6 is a further enlarged fragmentary plan sectional view of the helix-forming means.

Fig. 7 is a plan view of one of the four helix-cutting and loop-forming units used in the mechanism.

Fig. 8 is an end elevational view thereof.

Fig. 9 is an enlarged cross-sectional view as taken on line 9—9 of Fig. 8.

Fig. 10 is a broken side view as seen from the right of Fig. 9, the view also being the rear of Fig. 8.

Figs. 11, 12 and 13 are fragmentary plan views of an end loop-forming means embodied in the unit shown in Figs. 7 to 10, the views showing three stages of operation of said means.

The bed spring machine which embodies the present mechanism comprises generally, upper and lower means **31** and **32** cooperating to engage rows of spring coils **108** therebetween to hold said coils in fixed position in side-by-side rows whereby they are adapted to receive and be connected by upper and lower helical connectors **91**. The means **31** and **32** comprise the subject matter of the mentioned pending application and, therefore, will not be described in detail in this application.

A frame **25** (Fig. 2) mounts means **31** and **32** and comprises vertical end frame channels **45** (Fig. 3) and connecting longitudinal channels **49**.

Each means **31** and **32** comprises transverse spaced plates **111** (Fig. 3) mounting spacers **113**. The latter cooperate with said plates to form paths along which spring coils **108** are adapted to travel. Each plate **111**, in line with the path of helix **91**, is provided with a groove **112** through which said helix travels. Beneath plates **111** and on each side of grooves **112** therein there is provided a pair of side-by-side longitudinal bars **117** and **118** (Fig. 3). Although not shown in the present case, mechanism is provided to move said bars **117** and **118** toward and from each other and toward and from the plates **111** for the purpose of intermittently advancing rows of spring coils along the mentioned paths. Such mechanism is fully disclosed in the mentioned pending application.

Bars **117** are provided with means **119** (Fig. 3) for engaging the upper and lower turns **115** of the spring coils **108**, and bars **118** are provided with means **123** that cooperate with means **119** to locate the adjacent rows of spring coils in helix-receiving position and in alignment with grooves **112**.

The only portion of the mechanism that moves bars **117** and **118** that is here shown is a toggle **134** (Fig. 1), the mechanism embodying four such toggles one each for the upper and lower bars **117** and **118**. It will later be shown how said toggles are controlled and how only when straightened, to effect proper engagement of the means **119** (Fig. 3) and **120**, can the operative steps of forming and feeding helices, and cutting and looping the same, be instituted.

The machine is provided with drive means **26** (Fig. 1) which comprises an electric motor **51**, a shaft **52** driven by said motor by means of a belt drive **53**, and a shaft **55** driven from shaft **52** by a drive **58**. Shaft **55** represents one of four similar shafts that comprise the drive shafts of the mechanism that operates bars **117** and **118**. Pulley **63** of drive **58** is normally loose on shaft **55** and a one-revolution clutch **64**, controlled by a foot-operated pedal **65**, serves to couple said pulley and shaft to effect a drive of shaft **55** from motor **51**. Upon stepping on pedal **65**, said shaft will make one revolution and stop.

Upon each operation of the foot pedal, bars **117** and

118 are moved apart, the latter moving the helix-connected rows of coils rearward and the former moving forward to engage a row of coils fed into the front of the machine; and then moved toward each other to bring said latter row and the row adjacent thereto into position to be connected.

The mechanism constituting the subject-matter of the present invention comprises, generally, similar upper and lower helix-forming and -feeding units 27 and 28 (Fig. 2). respectively; a drive 29 (Fig. 3) for said units; clutch means 30 (Fig. 1) interconnecting drive 29 and motor 51; means 39 (see right central part of Fig. 1) to control the length of feed of the helices 91 formed by units 27 and 28; means 40 (see lower left part of Fig. 1 and Figs. 2 and 3) responsive to an obstruction to said feed to stop the same; upper and lower front units 41 (Fig. 2) and 42 (Figs. 2 and 3) and upper and lower rear units 43 (Fig. 2) and 44 (Figs. 2 and 3) for cutting both ends of both helices 91 and for forming said ends into closed loops; and electro-pneumatic controls for effecting a sequence of operations of the above means; whereby any one operation is performed only after a preceding operation has been completed.

The upper and lower helix-forming and helix-feeding units 27 and 28, located at the right of Fig. 2, are driven from shaft 52 (Fig. 1) through the medium of drive 54 (Fig. 1), clutch 30 and drive 29 (Figs. 1 and 3). These units are substantially alike. The lower unit 28 is shown in Figs. 4, 5 and 6, and the following description thereof also describes unit 27.

Referring to Figs. 4, 5 and 6 in particular, the longitudinal channels 49 support fixed side frame 66 (Figs. 4 and 5) in each of which is embodied a slide guide 67 (Fig. 5) for slide bars 68*a*, the latter being connected by a slidable frame 68 extending across the machine frame 25 (Fig. 2). Said frame is generally rectangular and is formed of side members 69 (Figs. 4 and 5) connected at the top by transverse members 70 (Figs. 4 and 5) and, at the bottom, by similar members 71 (Fig. 5). The units 27 and 28 are thus mounted for longitudinal adjustment of the machine frame.

Atop frame 68 there is provided a pair of wire feeding wheels 72, positioned side-by-side to feed a wire 73 between them in a direction toward the left, as seen in Fig. 2, and guided as by a guide tube 74 (Figs. 4 and 5). Each wheel 72 is mounted on a shaft 75 in upper and lower bearings carried by frame members 70 and 71. The wheels 72 are peripherally grooved for the wire 73 and, by an adjustment 76, one of the wheels can be adjusted with respect to the other to effect proper feeding of the wire. A pair of gears 77 (Fig. 5) connect shafts 75 and a chain and sprocket drive 78, from one of the shafts, is made to the drive 29 (Fig. 5). Thus the wheels 72 rotate in opposite directions to effect the mentioned wire feed.

A fixed mandrel 79 (Fig. 6) that is formed with a longitudinal groove 80 which, toward the end thereof away from wheels 72, gradually is formed as a helical groove 81, receives the wire from wheels 72. The mandrel resides in a hardened sleeve 82 and a set screw 83 fixedly holds said mandrel in the sleeve. A rear collar 84 is strung over the helically grooved portion of the mandrel. As the wire 73 is fed to the mandrel, the same follows along grooves 80 and 81 to be helically formed and emerges from between the mandrel and collar 84 as a helix of approximately the desired pitch. This pitch is approximate due to spring in the wire and the same must be given a "set" to insure accuracy of the pitch.

Accordingly, the helix is then directed to pass through a hardened die 85 which has a helical groove 86. Said die is mounted in a bracket 87 (Fig. 4) on a slide 88 that is adjustable in ways 89 (Fig. 4) by means of adjusting screws 90. By adjusting the die 85 with respect to the end of mandrel 79, an ironing relationship is set up between the helix and the walls of groove 86 to either slightly expand or contract the pitch of the helix, as the case may be, and thereby bring the same to the accurate pitch desired. In this manner, wear in the mandrel is compensated for. The helix, designated 91, is guided through the die by a reduced end 92 of the mandrel and the collar 84 is held in place by a suitable bracket 93.

In the above-described manner, an accurately pitched helix is obtained and it will be evident that, in order to orient the turns of the helix with the spring coil mechanism 31 and 32 (Fig. 2) so that the latter will properly threadedly engage and thereby connect adjacent spring coils, the units 27 and 28 are mounted for bodily adjustment on slides 67—68 (Figs. 4, 5, 2 and 3), as above described.

The drive 29 for the helical units 27 and 28 comprises a vertical shaft 94 (Figs. 5, 3) driven from clutch 30 (Fig. 1) to effect a drive, upon coupling of the clutch, from shaft 52 (Fig. 1) to the chain and sprocket drives 78 and to the wire-feeding wheels 72.

The clutch 30 (Fig. 1) has a clutch lever 96 (Fig. 1) that is movable through the medium of an air cylinder 97 to either couple or uncouple the drive between shaft 52 and shaft 94. Said air cylinder is controlled by a four-way valve 98 (Fig. 1), and said valve is actuated from an electric current line 99 by solenoids 100 and 101. The manner of operation of valve 98 to control clutch 30 will, hereinafter, be more fully described.

One of the units 27 or 28 (Fig. 2) has one of its shafts 75 (Figs. 2 and 5) extended to drive the means 39 (Fig. 1, right, center) for controlling the length of feed of the helices 91. This means 39 simply comprises a pair of sprockets 102, one on said extended shaft 75 and the other on a second shaft 103, and a chain 104 having a projection 105 thereon. The chain is of a length substantially equal to the length of feed of the helices and said projection 105 moves with the chain to encounter a switch 106 in series with solenoid 101 and across the line 99. It will be evident that, for each cycle of movement of projection 105, the same will close switch 106 to energize solenoid 101 and the latter will actuate valve 98 to direct air to that end of cylinder 97 which will cause clutch lever 96 to de-clutch clutch 30.

Toggles 134 (Fig. 1), when straightened to lock bars 117 and 118 (Fig. 3) in helix-guiding position, are used to close a switch 164 (Fig. 1) to energize solenoid 100 and, thereby, actuate valve 98 to direct air to cylinder 97 for moving clutch lever 96 in a direction to couple clutch 30. Thus, only upon straightening of the toggles, can valve 98 be operated to couple clutch 30. Consequently, the drive to the units 27 and 28 is connected only when said toggles are straight, the same being indicative of a normal operative alignment of the two rows of spring coils to be connected.

Should the end of a helix become snagged on any obstruction during the feed, the means 40 (Fig. 1) is provided for stopping the feed. In such an eventuality, the helix somewhere along its length, and more particularly at an unconfined point, will buckle in a direction off its straight line. This phenomenon is employed to close switch 168 in circuit 169 connected to solenoid 101, to energize said solenoid, actuate valve 98, and bring air into that end of cylinder 97 that will de-clutch clutch 30 and stop the units 27 and 28.

The clutch lever 96 (Fig. 1) is arranged to move a slide 318 against the pull of a spring 319 to close a switch 320. The latter is in a circuit 321 that includes a solenoid 322. The movable armature 323 of said solenoid is so interconnected with one-revolution clutch 64 that, upon energization of said solenoid, its armature will move to lock said clutch open. Consequently, should the operator step on pedal 65 during any intermediate stage of the cycle operation of the machine, the mechanical phase of the operation cannot be instituted.

When the slide 318 moves as described, the core 324 of a solenoid 325 or any part controlled thereby, moves

in behind said slide to hold switch 320 closed when clutch lever 96 of clutch 30 moves back to its initial position when said clutch 30 is uncoupled upon closing of switch 106.

The units 41, 42, 43 and 44 each have the like function of cutting one end of a helix and forming said end into a closed loop as shown in Fig. 13. The units 41 and 43 are located at the ends of the upper helix and units 42 and 44 at the ends of the lower one. Because of space conditions in the machine, these units, although similar in function, are somewhat differently constructed and proportioned. Figs. 7 to 10 show the lower unit 42 on the incoming side of the lower helix and said unit will be described, it being understood that said description will serve also for units 41, 43 and 44.

Channels 49 support a frame 176 on which is mounted a slide 177. Said slide is moved by an air cylinder 178 (Fig. 8) through the medium of a piston 179 connected to the slide. Stops 180 and 181 (Fig. 8) limit the movement of said slide in both directions. A pair of pins 182 on the slide engage a shearing cutter 183 that is pivoted at 184 to move the cutter end 185 of said cutting relative to a shear plate 186.

Said cutter and shear plate are mounted on an arm 187 that is pivoted at 188 on a frame 189 also fixedly mounted across channels 49. A link 190 connects arm 187 with the actuating piston of an air cylinder 191 for rocking said arm to bring the cutter and shear plate into position to cut a helix 91 fed past the unit. A spring 192 normally rocks said arm to hold the cutter and shear plate elevated to provide a path for the feeding movement of the helix.

The cylinder 178 (Figs. 1, 7 and 8) is controlled by valve 175 (Fig. 1) which, on the return of the clutch lever 96 (Fig. 1) to de-clutched position, is actuated to direct air into that end of cylinder 178 which will cause projection of piston 179 and movement of slide 177 in a direction to shear that turn of a helix which is caught between the cutter end 185 and shear plate 186. At the end of this movement of slide 177, the same, as seen in Fig. 1, will close a switch 193 in a circuit 194 that connects in series a solenoid 195 associated with valve 175 and a solenoid 196 associated with a valve 197. The slide 177 thus causes its own return since valve 175 will be actuated to direct air to that end of cylinder 178 which causes retraction of piston 179. The function of solenoid 196 will be later described.

The frame 189 (Fig. 7) includes a top plate 198 (Figs. 6, 7 and 8) that is similar to the plates 111 and, together with that one of the latter that is next adjacent, provides a guide and support for the first spring coil 108 (Figs. 2 and 3) of the row thereof that is manually fed to the machine.

One end of frame 189 is mounted on a vertical wall 199 to which is affixed a bracket 200 that mounts a twister unit 201 (Figs. 9 and 10) for forming the mentioned closed loop 202 on the cut end of the helix 91. Said unit comprises a shaft 203 having bearing in said bracket and which carries a gear pinion 204. An upper extension of said pinion is formed as a flange 205 and a compression spring 206 is coiled about shaft 203 and has end abutment on said flange and on the bracket 200, whereby said shaft is held in depressed position. The upper end of shaft 203 extends above the bracket and is formed with a partial upstanding peripheral wall 207 (Figs. 11, 12 and 13) and an eccentrically mounted pin 208 substantially coextensive therewith. The lower end of the shaft, below the bracket, is bevelled as at 209 (Fig. 10). The spring 206 normally depresses shaft 203 to hold the wall 207 and pin 208 below the path of movement of a helix.

Means are provided for oscillating shaft 203. Said means comprises a gear rack 210 (Fig. 10) mounted on a wall 211 comprising part of a slide 212 and normally out of mesh with pinion 204. Said slide is reciprocated by an air cylinder 213 (Fig. 1) but connected therewith through the cylinder piston 214 (Fig. 1). Said slide 212 also carries a wedge block 215 (Fig. 10) that engages the bevel 209 of shaft 203 to lift the shaft and cause enmeshing of pinion 204 with rack 210 and also raising of wall 207 and pin 208 to the position wherein said wall and pin flank the end turn of the helix 91. Thus, movement of slide 212 to the right in Fig. 10, will both lift shaft 203 and partially rotate the same in one direction. A movement of the slide to the left will rotate the shaft and allow spring 206 to depress the same to its initial position. To insure such depression of the shaft, a bellcrank lever 216, pivoted at 217 on a fixed wall 218 of frame 189, is engaged by an abutment 219 on slide 212 and rocked to cause its end 220 to bodily depress flange 205 on the pinion.

The movement to the left of the slide 212 is instituted by one or more of the toggles 134 (Fig. 1) to cause lateral separation of bars 117 and 118, when the cutter slide 177 (Fig. 7) is returned to its initial position to close switch 193 (Fig. 1) and energize solenoid 196 (Fig. 1). The latter is associated with four-way valve 197. This valve not only controls the admission of compressed air to cylinder 191 but also to a cylinder (not shown) that actuates toggles 134 (Fig. 1).

As shaft 203 (Figs. 9 and 10) is rotated, wall 207 and pin 208 cooperate, as seen in Figs. 12 and 13 to twist the end turn of the helix 91 to form the same into the closed loop 202. When the slide 212 reaches its end position to the left, it closes a switch 226 (Fig. 1) that closes an electric circuit 227 to a solenoid 228 and the latter actuates valve 225 to direct air to that end of cylinder 213 which will cause the same to return the slide to its initial position at the right—and thereby restore the twister unit 201 to its depressed position.

Toward the end of a full revolution of shaft 55 (Fig. 1), after rotation thereof has been instituted by depression of pedal 65, an arm or finger 229 (Fig. 1) on shaft 52 closes a switch 230 and a circuit 231. This circuit energizes a solenoid 232 to actuate valve 197 to direct air to that end of cylinder 191 which produces straightening of toggles 134. Simultaneously, valve 197 directs air to cylinder 191 to cause the same, through link 190, to rock arm 187 and move the cutter 185 and its shear plate 186 into position to cut through a helix.

A switch 326 (Fig. 1) is placed immediately adjacent to switch 106 and since there is a slight overtravel of chain 104, the projection 105 thereon after closing switch 106, moves by and closes switch 326. A circuit 327 is made by said latter switch to energize solenoid 174 and operate valve 175 to direct air to cylinders 178 in a direction to move slides 177 to cause operation of the cutters, thus cutting off the forward ends of the helices and also severing them from connection with units 27 and 28.

At the end of their movement, the slides 177 close switches 193 to simultaneously perform three steps of the cycle of operation. Closing of switch 193, through circuit 194, energizes solenoid 195 to actuate valve 175 and effect return of cutter slides 177. At the same time a circuit 328 is closed to solenoid 196 to actuate valve 197 to effect breaking of toggles 134 and lifting of cutters 183. Simultaneously, a circuit 329 is closed to solenoid 224 to operate valve 225 to direct air to cylinders 213 in a direction to operate twister slides 212 and twisters 201.

At the end of the operative movement of the twister slides 212, one or more of said slides close switches 226 and through circuit 227 to energize solenoid 228, operate valve 225 and, thereby, restore the slides 212 to their initial position. Simultaneously, a circuit 330 is closed through solenoid 325 to cause retraction of its armature 324 and permit spring 319 to retract slide 318. The switch 320 will then open and effect release of main clutch 64. Now, when the operator steps on pedal 65, the next cycle of operation is instituted.

It will be seen from the above, that only after the last operation—the twisting of the ends of the helices—can the cycle of operation be again started.

The means 40 is embodied in the machine as hereinbefore described.

While I have illustrated and described what I now regard as the preferred embodiments of my invention, the construction is, of course, subject to modifications without departing from the spirit and scope of my invention. I, therefore, do not wish to restrict myself to the particular forms of construction illustrated and described, but desire to avail myself of all modifications that may fall within the scope of the appended claims.

Having thus described the invention, what is claimed and desired to be secured by Letters Patent is:

1. In a machine for connecting spring coils by means of helices, said machine including, a helix-cutting device having a frame with a path therethrough for guiding said helix, a helix-cutting assembly mounted on said frame, said assembly including an oscillating arm having a shearing anvil and a cutter arm, said oscillating arm having means for holding said arm in spaced relationship with respect to said frame and said helix, first means to move said assembly toward said helix to bring said shearing anvil and said cutter arm into helix-cutting position, a slide operatively engaging said arm only when said helix-cutting assembly and said arm are moved into helix-cutting position, said slide moving said arm into the helix-cutting relationship with respect to said anvil upon engaging said arm.

2. In a machine for producing bed springs formed of rows of spring coils and helices connecting adjacent portions of the upper and lower turns of the spring coils of adjacent rows, said machine including two separate helix-forming and helix-feeding devices, a common drive for said devices to simultaneously form first and second helices from a straight wire stock, and to feed said helices along two parallel paths to connect first and second adjacent rows of spring coils, said drive including a normally open first clutch, first means for positioning and holding said adjacent rows of spring coils to receive said helices; second means controlled by said first means said second means closing said clutch for instituting the operation of said two helix-forming and helix-feeding devices, third means driven by one of said helix-forming devices, said third means opening said clutch after advancing said two helices into two respective positions in which said helices connect said first and second adjacent rows of spring coils, two pairs of pneumatically-operated cutters, one pair of cutters being aligned with said first helix, and the other pair being aligned with the second helix, fourth means for operating said cutters simultaneously and to cut off said first and second helices immediately adjacent to the ends of said rows of spring coils, said fourth means being initially actuated by said third means, and fifth means responsive to a deflection of either helix from their normal paths during feed thereof to open said clutch before said clutch normally is opened by said third means, said fifth means stopping the operation of both helix-forming and helix-feeding devices.

3. In a machine for producing bed springs formed of rows of spring coils and helices connecting the upper and lower turns of the spring coils of adjacent rows, said machine including two separate helix-forming and helix-feeding devices, a common drive for said devices to simultaneously form and synchronously feed two helices in two parallel paths to connect two adjacent rows of spring coils, said drive including a normally-open clutch, first means for positioning and holding said adjacent rows of spring coils in helix-receiving position, second means, controlled by said first means, to close said clutch to institute the operation of the two helix-forming and helix-feeding devices, third means driven by one of said helix-forming devices to open the clutch after advancing a predetermined length of each helix, said length being equal to the length required for connecting said two adjacent rows of spring coils, a pneumatically-operated cutter for each helix, and fourth means to operate the cutters simultaneously to sever each helix adjacent to the last pair of spring coils in said rows, said fourth means being operated by said third means.

4. In a machine for producing bed springs formed of rows of spring coils and helices connecting the upper and lower turns of the spring coils of adjacent rows, two separate helix-forming and helix-feeding devices to form and feed upper and lower helices to connect two adjacent rows of spring coils, first means to operate said devices including a common drive having a single clutch; second means, driven by one of said devices, to control the lengths of helices fed and to disconnect said clutch after a pre-determined length of helices has been fed, cutters immediately adjacent the upper and lower turns of the spring coils at the ends of said two adjacent rows, each cutter having a cutter operating slide; third means, actuated by said second means, for sequentially disconnecting said clutch and then shifting said slides, said slides engaging said cutters to cut off the outer ends of said helices and also simultaneously cut off said helices at the points adjacent to the spring coils first connected by the helices, and fourth means responsive to a deflection of either helix during feed thereof to disconnect said clutch and stop the feed of both helices, and means for positioning and holding adjacent rows of coil springs in alignment to receive said helices advanced by said forming and feeding means.

5. In a machine as defined in claim 4, in which each cutter is provided with loop-forming means for forming a loop on the end of the helix associated therewith, slide retracting means, and means operated by said cutter-operating slides at the end of their projecting movement to simultaneously operate said loop-forming means and said slide retracting means.

6. In a machine as defined in claim 1, in which said first means includes a piston-cylinder combination connected to a source of compressed fluid through a first valve, a first relay for actuating said first valve into a first position for actuating said first means into a position for moving said assembly into the helix-cutting position, a second relay for actuating said first valve into a second position for lifting said assembly away from said helix.

7. In a machine as defined in claim 6, in which said slide includes a slide-actuating piston-cylinder combination connected to said source of compressed fluid through a second valve, and a third relay for actuating said second valve first into the first position whereby said slide-actuating piston moves said cutter arm against said shearing anvil, and a fourth relay actuated by said slide, for returning said second valve into its original position for reversing the movement of said piston and returning said slide into its original position.

8. A machine for interlacing two, adjacent, parallel rows of coil springs with two helices, one helix interlacing said coil springs along an upper line of contact between said two rows, and the second helix interlacing said coil springs along a lower line of contact between said two rows, said machine including first means for positioning said coil springs into said two rows, second means operable simultaneously for shaping first and second straight-wire stock into first and second continuous helices and advancing said two helices along said upper and lower lines, respectively, for interlacing said two rows, said second means including a first relay and a first switch in series with the winding of said first relay, said switch normally being open and being closed by said first means after said first means completes the positioning of said coils into said two rows, whereby said second means becomes operative only after the completion of the operating cycle of said first means, said second means also including a second relay, a second normally open switch in series with said second relay and

a third means for closing said second switch after fixed lengths of helices are advanced by said second means, said fixed length being slightly in excess of the length of said rows, said second relay de-actuating said second means, fourth means actuated by said third means upon the completion of its cycle by said third means, said fourth means cutting off said first and second helices at each end of said rows, and fifth means actuated by said fourth means upon the completion of its cycle by said fourth means, said fifth means reshaping the four wire-ends of the two helices interconnecting said two rows into wire-ends having closed loops.

9. A machine as defined in claim 8, which also includes an additional means for de-activating said second means upon deviation of either one of said helices from the respective upper and lower lines of contact.

10. A machine as defined in claim 8, in which said first means includes a motor, a main shaft continuously driven by said motor, four auxiliary shafts driven by said main shaft and clutch means for each of said four shafts, said clutch means having means for disconnecting said four shafts from said main shaft upon completing one revolution.

11. A machine as defined in claim 10, in which said first means also includes a foot pedal for initially actuating said first means and means for locking out said pedal for one revolution of said four shafts and automatically unlocking said pedal upon completion of said one revolution.

12. A machine as defined in claim 11, in which said second means includes a motor, a main shaft connected

to and driven by said motor, an auxiliary shaft driven by said motor, a clutch included in said auxiliary shaft, and sixth means for automatically closing said clutch, said sixth means including said first switch closed by said first means upon completion of the normal operating cycle of said first means.

13. A machine as defined in claim 12, in which said third means includes wire-feeding wheels and a mechanical actuator for said second switch and a third switch, said actuator being driven by one of said wheels and said third switch being positioned in a lagging relationship with respect to the position of said second switch, whereby said actuator first operates said second switch and then said third switch, in sequence; said second switch, upon being closed, actuating said second relay, a valve operated by said second relay, and a pneumatic means connected to said valve for disconnecting said clutch, said third switch, upon being closed, initiating the operating cycle of said third means.

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